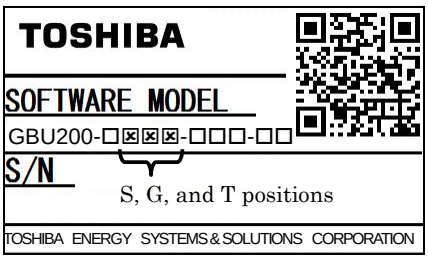
TOSHIBA

Instruction manual

Bay Control Unit with/without Protection

GR200 series (GBU200)

TOSHIBA ENERGY SYSTEMS & SOLUTIONS CORPORATION



Notice: This GBU200 manual is issued for '011, 013, 01F(BCU)', '02N, 02C(BCPU)', or '019(IFU)' software code, which you can identify at the 'S, G, and T positions' in Software nameplate.

Safety Precautions

Before using this equipment, please read this chapter carefully.

This chapter describes the safety precautions recommended when using the GR equipment. Before installing and using the equipment, this chapter must be thoroughly read and understood.

Explanation of symbols used

Signal words such as DANGER, WARNING, and CAUTION, will be followed by important safety information that must be carefully reviewed.

⚠ DANGER	Indicates an imminently hazardous situation which will result in death or serious injury if you do not follow the instructions.
⚠WARNING	Indicates a potentially hazardous situation which could result in death or serious injury if you do not follow the instructions.
⚠CAUTION	Indicates a potentially hazardous situation which if not avoided, may result in minor injury or moderate injury or property damage.

⚠ DANGER

•Current transformer circuit

Never allow the current transformer (CT) secondary circuit connected to this equipment to be opened while the primary system is live. Opening the CT circuit will produce a dangerously high voltage.

⚠WARNING

•Exposed terminals

Do not touch the terminals of this equipment while the power is on, as the high voltage generated is dangerous.

•Residual voltage

Hazardous voltage can be present in the DC circuit just after switching off the DC power supply. It takes approximately 30 seconds for the voltage to discharge.

•Fiber optic

CLASS 1 LASER PRODUCT.

⚠CAUTION

•Earth

The earthing terminal of the equipment must be securely earthed.

⚠CAUTION

•Operating environment

The equipment must only be used within the range of ambient temperature, humidity and dust detailed in the specification and in an environment free of abnormal vibration.

•Ratings

Before applying AC voltage and current or the DC power supply to the equipment, check that they conform to the equipment ratings.

•Printed circuit board

Do not attach and remove printed circuit boards when the DC power to the equipment is on, as this may cause the equipment to malfunction.

•External circuit

When connecting the output contacts of the equipment to an external circuit, carefully check the supply voltage used in order to prevent the connected circuit from overheating.

•Connection cable

Carefully handle the connection cable without applying excessive force.

•Modification

Do not modify this equipment, as this may cause the equipment to malfunction.

•Short-wire (Short-bar)

Do not remove the short-wire/short-bar(s) connected to the frame earth (FG) at the terminal block on the rear of cases.

•Electric wire between #35 - #37 on the power-supply terminal block

Make sure the wire is connected.

(Exception: This wire needs to be detached for performing the dielectric voltage test.)

•Disposal

This equipment contains neither expendable supplies nor parts that can be recycled. When disposing of this equipment, the customer must contact an operator responsible for industrial waste disposal, and request that the operator dispose of this equipment in accordance with the local waste disposal regulations; otherwise the person who disposes of this equipment may be punished under local regulations. When disposing of this equipment is practiced by the customer acting on their own behalf, it must be done so in a safe manner according to local regulations. For further information in terms of the disposal, the customer shall contact to a local dealer and sales staff at Toshiba Energy Systems & Solutions Corporation (Toshiba ESS, Japan).

This equipment contains neither expendable supplies nor recyclables.

•Plastics material

This equipment contains the following plastics material.

- ABS, Polycarbonate, Acrylic resins, Nylon 66, and others.

Equipment installation and operation

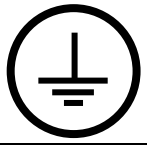
•Equipment installation

Never remove cables at frame ground terminals (FGs) while the AC/DC power supplies.

•Equipment operation

The user shall have responsibilities to use and install the equipment where the specifications are designated by the manufacture. Never operate the equipment on the condition where the manufacture cannot intend. Otherwise, the safety function furnished into the equipment may not be operated properly.

•Symbols

Symbol	Description
	**Protective conductor terminal**
	**Caution, risk of electric shock**

Liability, copyright and others

•Disclaimer of liability

We have checked the description of this manual against the hardware and software described, but we cannot guarantee that all deviations have been eliminated from the description completely; hence, no liability can be accepted for any errors or omissions contained in the information given. We review the information in this manual regularly and there will be some corrections in subsequent editions. We reserve the right to make technical improvements without notice.

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1 Introduction

The GBU200 bay controller (BCU) is designed to provide control applications for transmission lines and distribution feeders.

- Control and monitoring of switchgear, transformers and other equipment or devices in EHV, HV, MV and LV substations
- Built-in feeder protection functions in BCU with protection (BCPU)
- Applicable to single, double and one- and a half breaker arrangements and to both GIS and AIS switchgear
- Various models and hardware options for flexible application depending on system requirement and controlled object
- Communications within substation automation system or to a remote control center
- IEC 61850 interface for binary input and output signals (IFU)

1.1 Control

The control functions are provided for circuit breakers and isolators, other switchgear and transformers. The user can operate the functions using the human machine interface; the functions are able to operate together with such as automatic sequence control, interlocking safeguard function and manual overridden function.

[SPOS] Single position device function

The SPOS function is used to operate a device including a single-position switch. The SPOS function consists of (1) status detection, (2) control, (3) event detection, and (4) response check.

[DPOS] Double position device function

The DPOS function is used operate a device including a double-position switch. The DPOS function is the same as the SPOS one; the DPOS function also has contact inconsistency detection, which the SPOS function does not include.

[DPSY] Double position device with synchronism function

The DPSY function is similar to the DPOS one; the DPSY function can operate with synchronization check function.

[TPOS] Triple position device function

The TPOS function is the same as the DPOS one, which is used to operate a device including three-position switch.

[TAP-BCD] Tap device function

The BCD function has control feature and monitoring feature for a tap positon of the transformer.

[LRST] LED reset function

The LRST function can turn off a LED when the LED is lit by tripping.

[ASEQ] Automatic sequence control function

The ASEQ function is used together with a logic that is programmed by the user using PLC function.

[ILK] Software interlock function

The ILK function is provided to latch the operation of control function that is connected to a primary device.

[SOFTSW] Software switch function

The SOFTSW function can provide scheme switches created by the software.

1.2 Protection functions

Protection functions are available when the BCPU model is selected in the GBU200 series.

[OC] Directional/non-directional phase over current protection

The OC function provides some relay elements. The OC function includes inverse time and definite time characteristics.

[EF] Directional/Non-directional phase earth fault protection

The EF function provides some relay elements. The choice of characteristic is selectable between inverse time, and definite time.

[OCN] Negative-sequence phase over-current protection

The OCN function is used to monitor negative sequence currents. The OCN characteristic is similar to that of the OC characteristic.

[UC] Under-current protection

The UC function provides two relay elements.

[THM] Thermal overload protection

The THM function can generate an alert signal upon occurrence of the thermal overload conditions.

[CBF] Circuit breaker failure protection

The CBF function is provided to clear the fault when an original circuit-breaker fails to operate.

[OVN] Negative-sequence over-voltage protection

The OVN function operates for a voltage of negative-sequence.

[OVG] Zero-sequence phase over-voltage protection

The OVG function operates for a voltage of zero-sequence.

[UV] Under-voltage protection

The UV function provides two relay elements. The sensitivity of drop-off voltage and pick-up voltage is programmable by using ratio settings.

[UVS] Phase-to-phase under-voltage protection

The UVS function provides two relay elements; the sensitivity of drop-off voltage and pick-up voltage is programmable by using ratio settings.

[VTF] VT failure detection function

When a fault occurs in the secondary circuit of a voltage transformer (VT), voltage dependent measuring elements may operate incorrectly. Thereby when the VTF function detects a failure in the VT, the VTF function blocks the voltage dependent relay.

[CTF] CT failure detection function

When a fault occurs in the secondary circuit of a current transformer (CT), current dependent measuring elements may operate incorrectly. Thereby when the CTF function detects a failure in the CT, the CTF function blocks the current dependent relay.

[ARC] Auto-re-close function

After tripping a circuit breaker (CB), the automatic re-close function can restore the service by closing the CB again.

[VCHK] Voltage check for auto-re-close

The VCHK function senses the absence/existence of the voltage so that the auto-re-close function (ARC) can operate properly.

1.3 Monitoring and metering functions

Using the HMI, the monitoring and metering functions can display status, settings, data and others. The user can also see information using "GR-series Toshiba IED Engineering and Monitoring Software (GR-TIEMS)" both at local and remote end.

Event record function:

The function provides recording feature that memorizes any event occurred in the IED.

1.4 Hardware overview

The IED has human machine interface (HMI), which is made of LCD screen, indication lights, operation and function keys, monitoring jacks, and a USB connector. Voltage, current input terminals, and binary input and output circuits are provided on the rear..

HMI features:

- Menu-driven human interfaces for settings or viewing of stored data.
- A standard LCD or a large LCD (MIMIC) screen, LEDs, function keys and operation keys

Communication features:

- USB for GR-TIEMS
- 100BASE-TX or FX for SAS with IEC61850 protocol
- IRIG-B000 for Clock

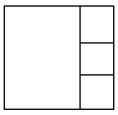
Module circuits and others:

- Binary input circuits and binary output circuits with configurable features
- AC inputs
- Programmable logic for I/O configuration, alarms, indications, recording and others
- Automatic supervision

1.5 Symbols used in logical diagrams

Symbols used in the scheme logic and their meanings are as follows:

(i) Relay element, signal-monitoring point, PLC connection point, and Mapping point

1. **Marked with**  : Relay elements

2. **Marked with**  : Signal-monitoring point designated by Element ID number

Note that the symbol can be connected with what follows:

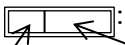
A binary output (BO) circuit

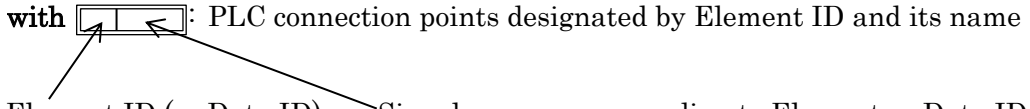
A LED circuit

Like in the BO and LED circuits, it can also be connected or mapped to what follows:

A PLC connection point

The IEC 61850 logical node (LN) to send a signal for the SAS

3. **Marked with**  : PLC connection points designated by Element ID and its name

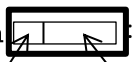


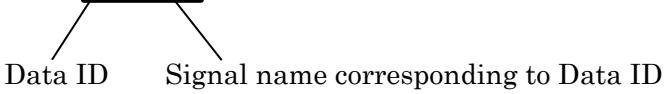
Note that the symbol can be used for the reception point coming from the output of PLC logics.

Note that the user does not apply a PLC connection point straightforward when functions (relays/control and monitoring) are operated on sub-CPU rather than main-CPU. Thereby, an alternative connection point (PLC driver[1]/Input dummy[2]) is provided in place of the PLC connection point. The user shall notice that the provision of the alternative connection point is dependent upon the selection of the model.

[1]PLC driver is discussed in Chapter *PLC function*.

[2]Input dummy can be discussed in Appendix *Input dummy for relay application*.

4. **Marked with**  : Mapping points designated by Data ID and its name

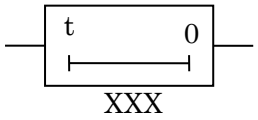


[1]Note that the symbol can be used as a signal reception-point coming from the SAS. The reception point is mapped to the LN of the IEC61850.

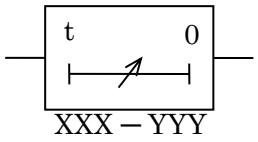
(ii) Timer symbol

- Delay timer

Delayed pick-up timer

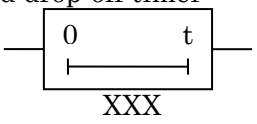


Fixed timer (XXX: Set time)

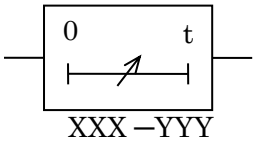


Variable timer (XXX ─ YYY: Setting range)

Delayed drop-off timer

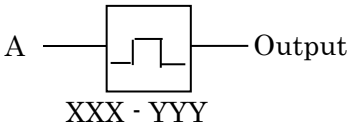


Fixed timer (XXX: Set time)

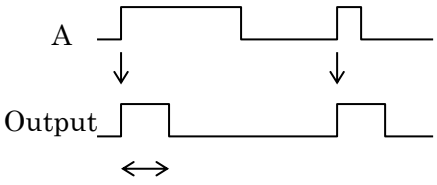


Variable timer (XXX ─ YYY: Setting range)

- One-shot timer

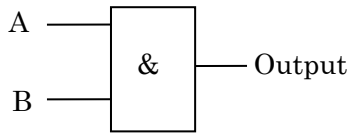


XXX - YYY: Setting range



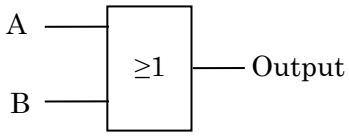
(iii) Logic symbol

- AND gate



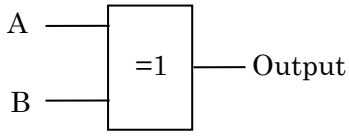
A	B	Output
1	1	1
1	0	0
0	1	0
0	0	0

- OR gate



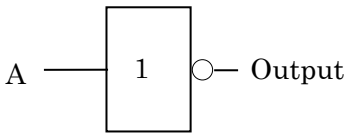
A	B	Output
1	1	1
1	0	1
0	1	1
0	0	0

- XOR gate



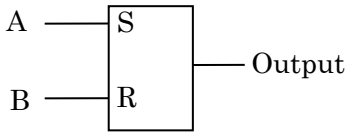
A	B	Output
1	1	0
1	0	1
0	1	1
0	0	0

- Signal inversion



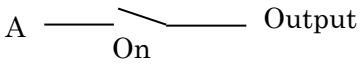
A	Output
0	1
1	0

(iv) Flip-flop symbol

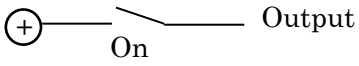


A	B	Output
0	0	No change
1	0	1
0	1	0
1	1	0

(v) Scheme switch



A	Switch	Output
1	On	1
1	Off	0



Switch	Output
On	1
Off	0

1.6 Abbreviation

Abbreviation	Description
ADC	Analog to digital converter
BCU	Bay Control Unit
BCPU	Bay Control and Protection Unit
BI	Binary Input module or circuit
BO	Binary Output module or circuit
BIO	Binary Input and Output module or circuit
CB	Circuit Breaker
CPU	Signal processing and communication module
CT	Current Transformer
DS	Disconnecting Switch
EF	Earth Fault
ES	Earthing Switch
EWS	Engineering Workstation in the substation
GPS	Global Positioning System
GR-TIEMS	GR-series Toshiba IED Engineering and Monitoring Software
GUI	Graphical User Interface
HMI	Human Machine Interface
IED	Intelligent Electronic Device
IDMT	Inverse Definite Minimum Time
LCD	Liquid Crystal Display for IED screen (standard LCD screen)
LCP	Local Panel for Controlling
LED	Light Emitting Diode
MIMIC	Touchscreen operation configured by user's program to operate control application
NA	Not Applicable
NGR	Neutral Grounding Resistance
N/C	Normally Closed
N/O	Normally Open
OWS	Operator Workstation in the substation
PC	Personal Computer for maintenance
PCB	Printed circuit board
PLC	Programmable Logic Controller
RCC	Remote Control Centre
SAS	Substation Automation System
SC	Station Computer
SCMS	Substation Control and Monitoring System
TCP/IP	Transmission Control Protocol/ Internet Protocol

Abbreviation	Description
UTC	Coordinated Universal Time
SyncSrc	Synchronization Source
VT	Voltage Transformer
VCT	Transformer module including VTs and CTs
43	Selector device or selector switch

1.7 Function Block (FB), Function ID, Signal number (Data ID)

(i) Signal symbols

Function Block (FB) is the software module and GR-series IED implements FBs for protections, controls and communications. The function ID is unique ID described by six digits in hexadecimal; each function ID represents each FB. Signal number (or Data ID) is the logical address of the input and output data of the FB. The signal number (Data ID) consists of a function ID and an element ID. The function ID is common within the FB; accordingly the element ID will be shown to make description simple. The element ID is 10 hexadecimal and it has the element ID name for easy to read. Figure 1.7-1 exemplifies the symbols, the function ID, and the element ID. The table below shows the structure of the signal.

	Function ID	Element ID	Note
Format (Hex)	FFFFFF	XXXXXXXXXX	Content
Signal example	123456	80000xxxx0	XX relay in phase-A is operated.

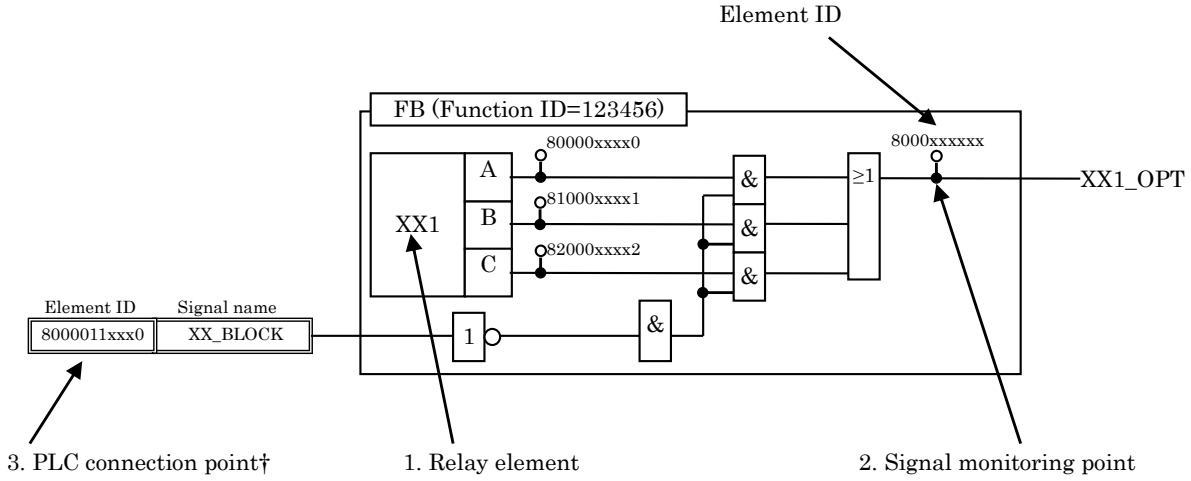


Figure 1.7-1 Example of symbols and others

†Note that a PLC connection point can be shown with the function ID (123456) plus element ID (8000011xxx0) expressed in 16 delights in hexadecimal, in some scheme logics. The 'PLC connection point' could be found to search the letter '**E**' of element ID (i.e., '8000011**E**xx0').

(ii) Data length (bit length of Data ID)

The user can read data length of a Data ID by seeing the seventh and eighth number of the Data ID. Table 1.7-1 shows examples of 1~32-bits data.

Table 1.7-1 How to identify a Data length by seeing Element ID

Data length	Example Function ID	Example Element ID	Identifier texts	Note
1-bit	400001	**8**000001B6F	**8** (the beginning # of Element ID)	
8-bits	400001	**20**00001B6F	**20** (First and second # of Element ID)	
8-bits	400001	**30**00001B6F	**30** (First and second # of Element ID)	
16-bits	400001	**21**00001B6F	**21** (First and second # of Element ID)	

Data length	Example Function ID	Example Element ID	Identifier texts	Note
16-bits	400001	**31**00001B6F	**31** (First and second # of Element ID)	
32-bits	400001	**22**00001B6F	**22** (First and second # of Element ID)	
32-bits	400001	**32**00001B6F	**32** (First and second # of Element ID)	
32-bits	400001	**42**00001B6F	**42** (First and second # of Element ID)	Float 32
64-bits	400001	**23**00001B6F	**23** (First and second # of Element ID)	
64-bits	400001	**33**00001B6F	**33** (First and second # of Element ID)	
64-bits	400001	**43**00001B6F	**43** (First and second # of Element ID)	Float 64

2 Control and monitoring application

2.1 Overview

The control and monitoring functions provided as applications within the IED have several control types; the choice of control type depends on the object device that is to be controlled and the control sequence logic. The control types and the maximum number supported is dependent upon the respective model. For example, it is possible to cater for up to ten devices in the SPOS function depending upon the respective model whereas it is possible to support either one or two devices in the DPSY function. Accordingly, the user should take note that particular features and their availability depend upon the selection of the IED model, these are described later under each respective function.

2.2 Control scheme

Figure 2.2-1 shows the control overview for the control function; there are two control stages: "Wait for a command" and "Receiving commands". The function will wait for a command from the server in the first stage. During the receiving stage, the function will respond to "Select", "Cancel", and "Operate" commands. Specific logic is provided for each command for each receiving stage. A decision is required from each logic block to move to the next step (i.e., 'Failed' or 'Success'). When a 'success' decision is determined in the operate logic, the respective command is issued to the relevant device; the device commences with its operation (for example, a 43-switch is changed to "On" from "Off"). The waiting and receiving stages loop around at the receipt of every command.

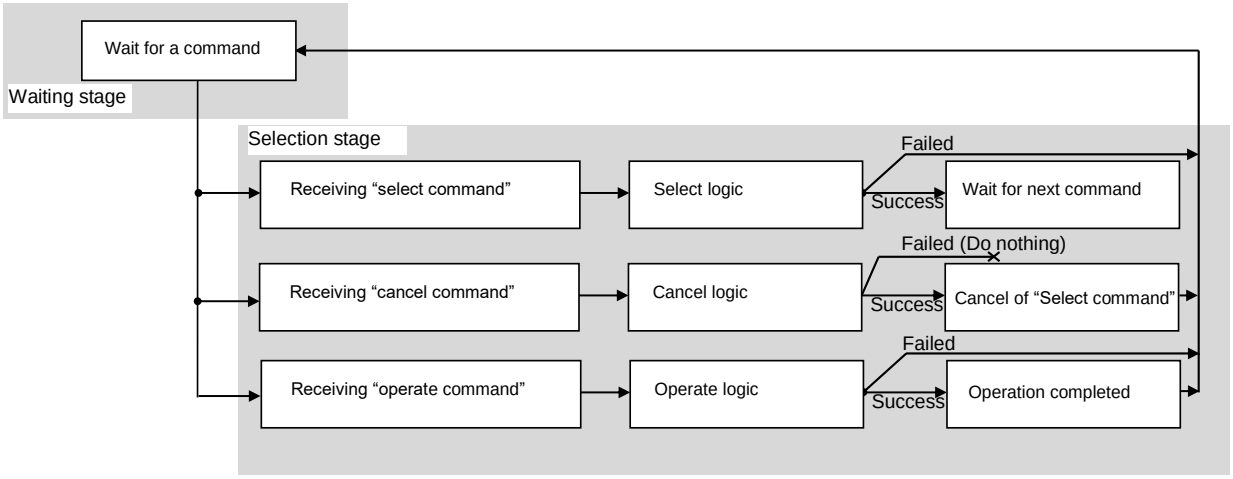


Figure 2.2-1 Stages in control function

The type of control can be categorized in accordance with its origin, (Remote/Local/PLC) and modes (SBO/DIR). That is, the respective control scheme should respond to the respective origin and mode. The user should be aware of the context of the control action, "On (or Closing) control" and "Off (or Open) control" in relationship to its origin and mode†.

†Note:The "On control" and "Off control" can be found in the SPOS, DPSY and other functions; when a device has a triple-position switch, control of the device is executed by the instructions "Position 1 (P1)", "Position 2 (P2)", and "Position 3 (P3)". Controlling the triple-position switch is discussed in the TPOS function. For more information on these functions, see the explanations provided for each respective function.

(i) Command reception in SBO mode

In the SBO receiving stage shown in Figure 2.2-1 we can find three processes: select, cancel, and operate command flows.

(i)-1 Reception of "select command"

Figure 2.2-2 shows a schematic process flow diagram when receiving a "select command" following the "Wait for a command". The receipt "select command" is divided into "select command 'On' (Closing)" and "select command 'Off' (Open)". The select command is carried out based on its origin: "Remote", "Local", and "PLC". If the "select command" is successful, the process will wait for the receipt of the next command.

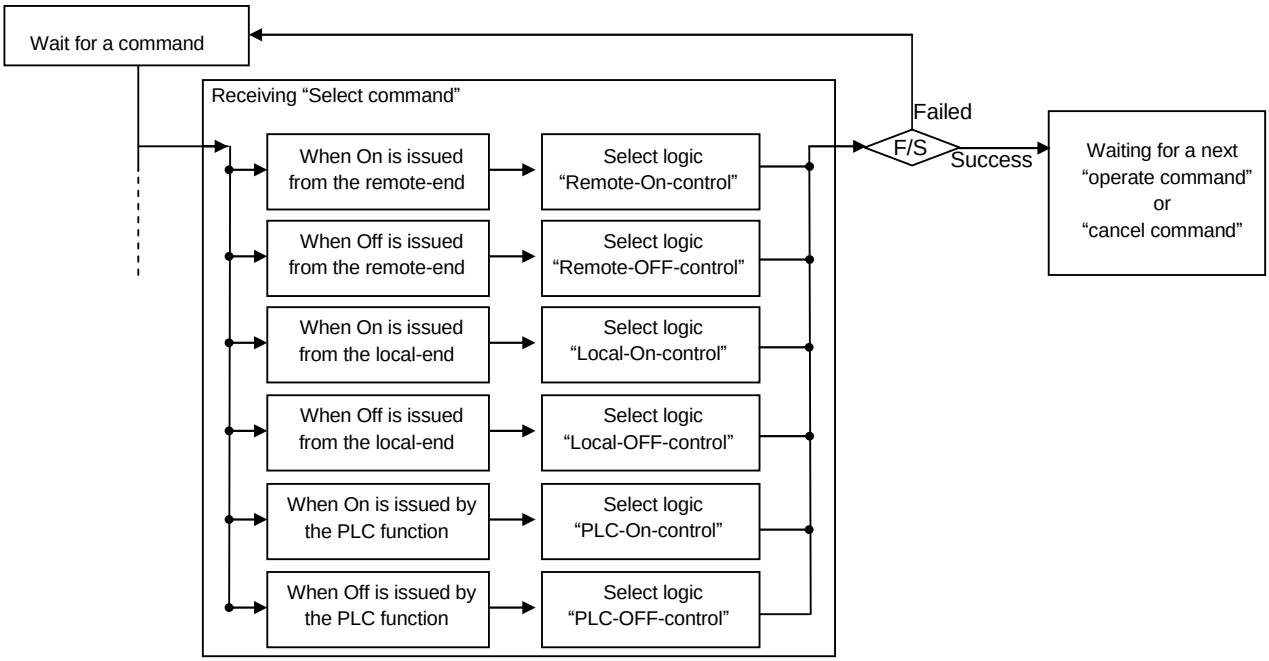


Figure 2.2-2 Schemes for "Select command"

(i)-2 Reception of "cancel command"

If the "select command" proceeds successfully following the receiving stage, the function can subsequently receive a "cancel command". Figure 2.2-3 shows the reception of a "cancel command". If the "cancel command" is successful, the "select command" is discarded and the function returns to the "Wait for a command" stage (i.e., the initial stage). In other words, the function waits for a new "select command" so that the other control functions can receive a command.

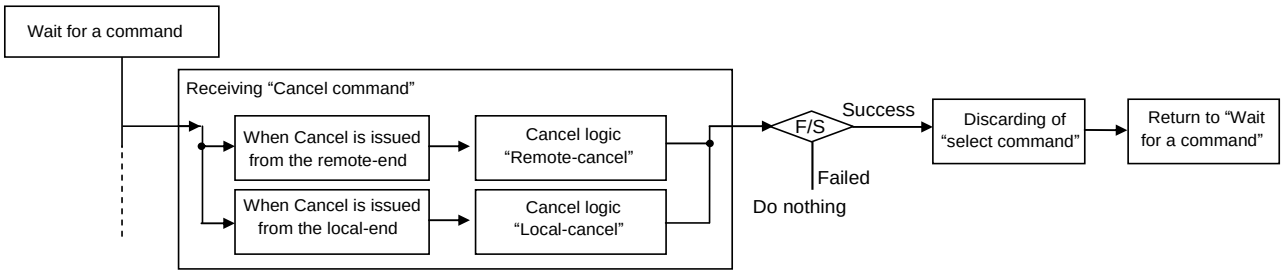


Figure 2.2-3 Scheme "Cancel command"

(i)-3 Reception of "operate command"

Following successful completion of the "select command", the control function is ready to receive an "operate command" in order to control a device. The receipt of "operate command" is divided into "Operate command 'On' (Closing)" and "Control command 'Off' (Open)"; each of the two commands is carried out based upon its origin i.e. "Remote", "Local", and "PLC". If the "operate command" is completed, the "select command" can be released; then a new "Wait for a command" stage can commence for receipt of a new "select command".

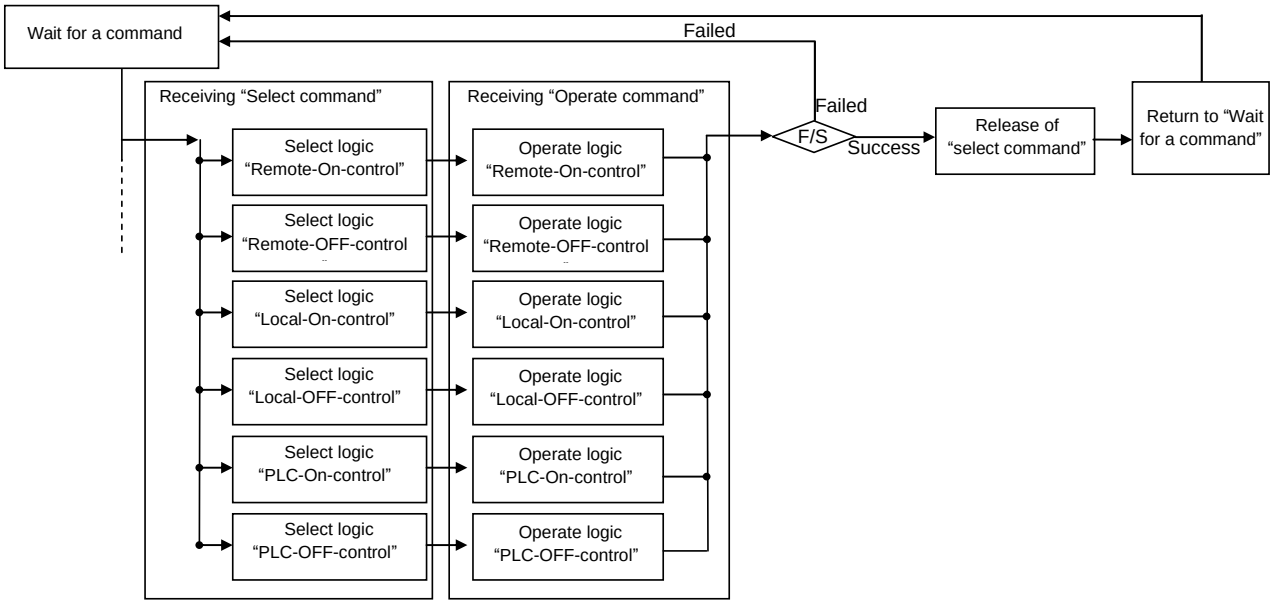


Figure 2.2-4 Scheme "Operate command"

(ii) Command reception in DIR mode

In DIR mode, issuing an "operate command" is possible without the reception of the "select command". Thus, the reception of an "operation command" only features in the control scheme†. We shall see the DIR mode later.

†Note: We can encompass the operation of the "select command" being performed internally in the control scheme. Thus, the user is not required to take account of the reception of the "select command".

2.3 Control mode

Either Select-Before-operation (SBO) or Direct-Operate-control (DIR) is provided as a control mode for the device. The user can select the preferred control mode.

2.3.1 Select-before-operation mode (SBO)

The user should be aware that in the SBO mode a signal is returned from the target device in the form of a response signal, (answer). When the target device sends a response to the IED after receiving a command, the server (and the IED) can send another command to the target device if the criterion of the response (answer) is satisfied. A safe SBO operation (**SBOns**) is normally utilized; however, the user can opt to select an enhanced-security SBO operation (**SBOes**), if additional safety is deemed necessary.

(i) SBO with enhanced security (SBOes)

In the SBOes, an operation process (Oper) commences after the completion of a selection process (SBOw). Figure 2.3-1 exemplifies the exchange of commands and responses; the server receives a response (answer#1) from the IED with regard to a SBOw command. Then, provided that the response, (answer#1) received from the IED is satisfied, the server can send an Oper request to the IED to control the device. If the target device completes the operation successfully, the server will receive an operation result. Figure 2.3-1shows the communication flow between the server (remote-end) and the IED, note that the user will also see the same process flow when using the IED-front-panel key-operations. That is, the IED-front-panel (local-end) takes the place of the server (remote-end).

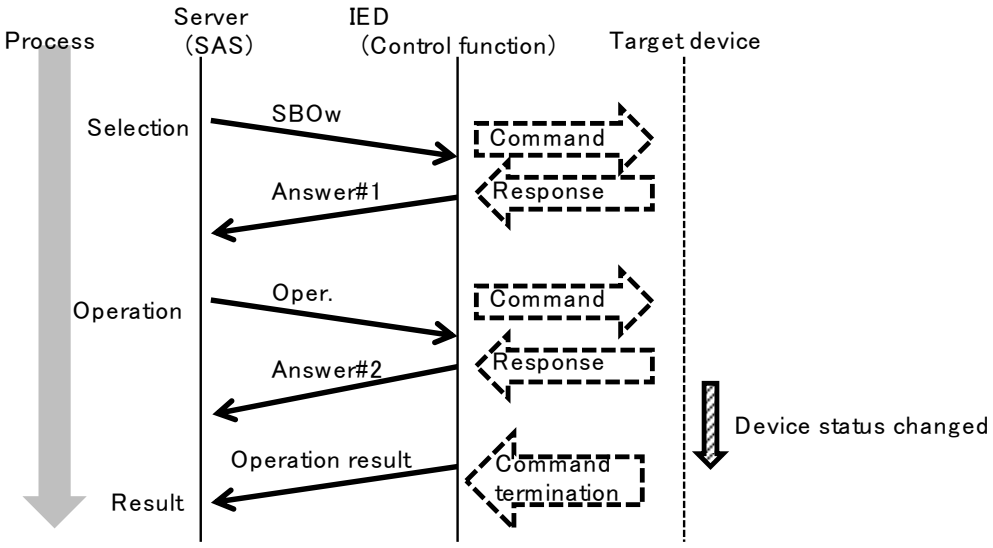


Figure 2.3-1 SBO with enhanced security

(ii) SBO with normal security (SBOns)

Figure 2.3-2 shows normal SBOns control. The difference between the SBOes and the SBOns is that the IED does not send an operation result in response to the request Oper.

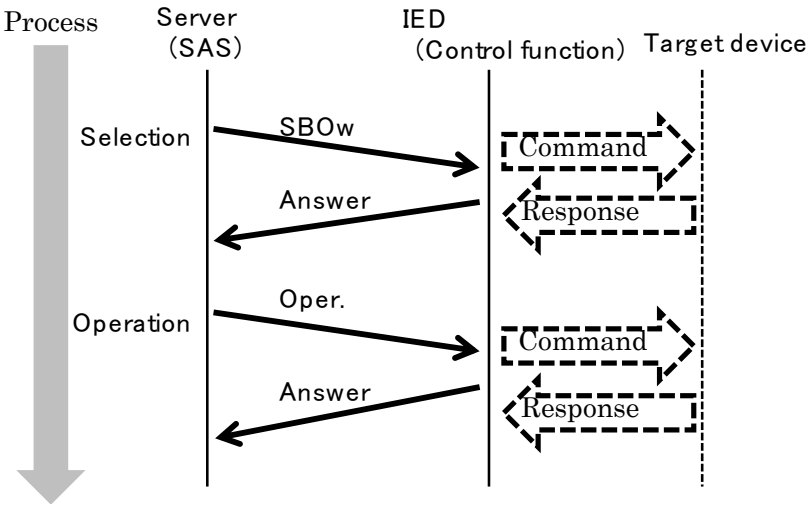


Figure 2.3-2 SBO with normal security

2.3.2 Direct-operation mode (DIR)

In the DIR mode, a target device is controlled without the reception of the select command. An enhanced security mode (**DOes**) is also provided when the user wishes to control a device with additional security rather than the normal level of security experienced with mode (**DOns**) .

(i) DIR with enhanced security (DOes)

Figure 2.3-3illustrates the server sending the Oper request to the IED; the server receives a response, (answer#1) from the IED. The result is notified when the operation of the target device is complete. The result includes status information; it informs whether the target device has operated normally or not. Note that the control start of the target device is initiated regardless of the state of the target device.

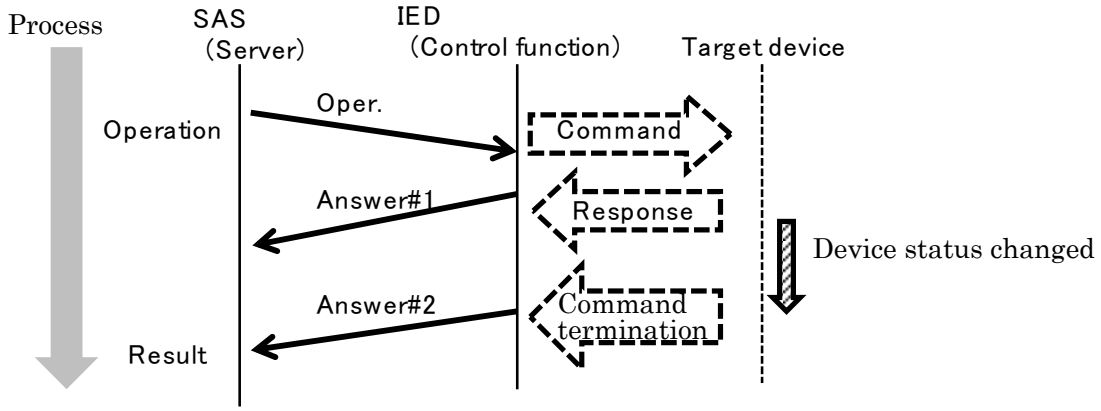


Figure 2.3-3 Direct control with enhanced security

(ii) DIR with normal security (DOns)

A response (answer#2) from the target device is not sent to the SAS in DOns, as shown inFigure 2.3-4

.

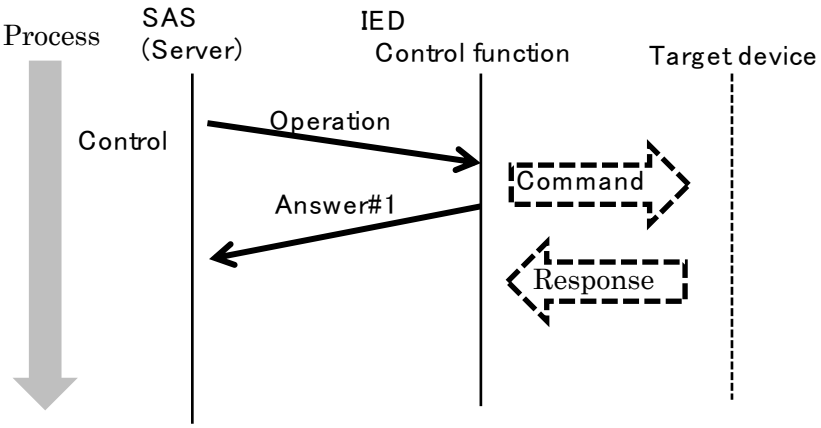


Figure 2.3-4 Direct control with normal security

2.4 Control hierarchy

It is important that the user understand the meaning of the terms 'control-right' and 'control-hierarchy' in connection with the functioning of the control and monitoring applications in the sub-station automation system (SAS) and the sub-station control and monitoring system (SCMS). For instance, if we consider an example where we have a system in which there is an IED, such as a bay control unit (BCU) used to enable the operation of a device (such as a piece of switchgear or others), the device is forbidden to operate if the system cannot give a 'control-right' for the device using the 'control-hierarchy'. Figure 2.4-1 depicts the control-hierarchy; the control-hierarchy is made of three control-levels, three selector-switches, and four control-points. Only a control-point is permitted to issue a control command; the system discards the command from a control-point if the control-hierarchy does not work correctly. On this account, no collision of control-points exists within the system.

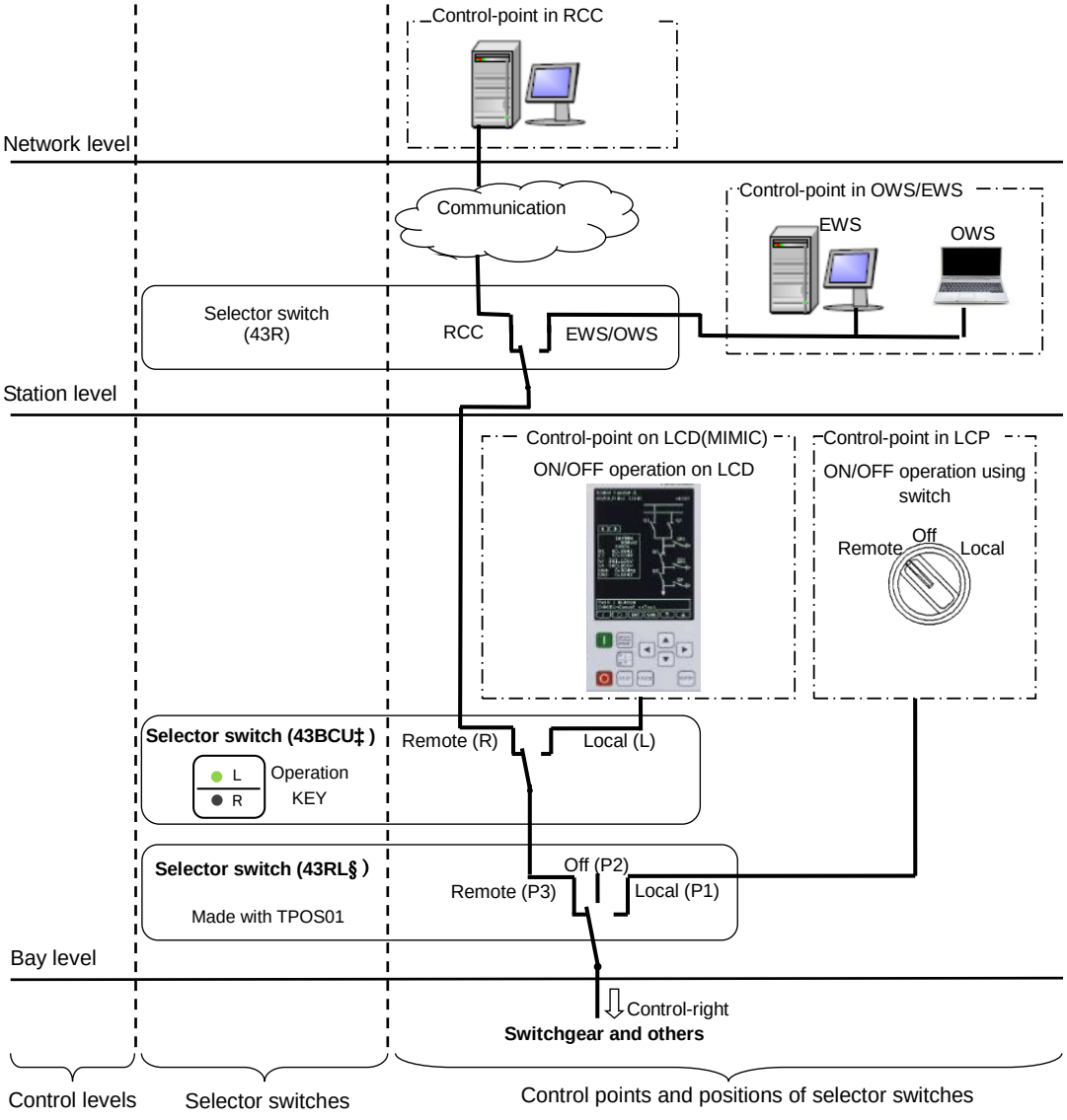


Figure 2.4-1 Control hierarchy and selector switches

‡Note: The L|R key on the IED is used for the 43BCU switch. The L|R key is already programmed during manufacture using the PLC function before

shipment, but it can also be programmed by the user.

§Note: If a 43RL triple-position switch is used, it is possible to provide a three-position device function (TPOS) in the IED for the 43RL switch. Incidentally, the 43RL switch furnished in the IED is already programmed for the TPOS01 function prior to shipment. See chapter *Control and monitoring application: Three-position device function (TPOS)*. We shall see how the 43RL switch is implemented within the TPOS01 function using PLC programming. Of course, the user can implement their own version of a 43RL switch by programming the PLC. For more details, see Chapter *PLC function*.

Note: The implementation of particular features is dependent upon the selection of hardware and the configuration of functions. Several IED models do not support certain features. To determine whether a particular feature has been implemented within an IED, identify the IED ordering number; and check the order number for the "G&T position" referring to the comparison table below. For more information, see *Appendix: Ordering*.

Table 2.4-1 Comparative table in respective ordering numbers

Sec.	Feature	Ordering No. at "G&T"					
		BCU			BCPU		IFU
		11	13	1F	2N	2C	19
–	Main features	NA	✓	NA	✓	✓	NA

✓: Applicable NA: Not applicable

2.4.1 Control level and control point

As shown in Figure 2.4-1, the control hierarchy is distributed across three levels; the network level having a remote-control center (RCC); the station level having operator and engineering work stations (OWS/EWS); and the bay level† having an IED equipped with an LCD screen. One of the three control-points (RCC, OWS/EWS, and LCD) is available to issue a control-command; the local control panel (LCP) is used locally for device operation rather than the SAS and the SCMS.

†Note: We, hereafter, discuss only the operations at the bay level; that is, we focus only on operations made from the bay level. The scope of this discussion does not include operations from either the remote control center or the network levels.

2.4.2 Selector switches and bay operations

At the bay level, two selector switches are provided: 43BCU and 43RL switches. Both switches open a path to permit the flow of the control-right.

(i) LCD operation

Suppose that the position "**Remote** (**P3**)" is selected at the 43RL switch. When the user sets the 43BCU switch to "**Local** (**L**)", the issuing of a control-command from the LCD is possible for the device.

(ii) LCP operation

When the user wishes to operate the device at the LCP, the user should set the "**Local** (**P1**)" position at the 43RL switch. In this case, the LCP has the prime right for the operation regardless of the operating position of the 43BCU switch.

(iii) RCC, EWS, or OWS operation

Alternatively, suppose that the position "**Remote** (**R**)" is selected at the 43BCU switch. In this case, the issuing of the control-command from the LCD is not possible.

2.4.3 Programming of control-right distributions

Figure 2.4-2 illustrates that the PLC function provides the means to distribute the control-right for the control functions.

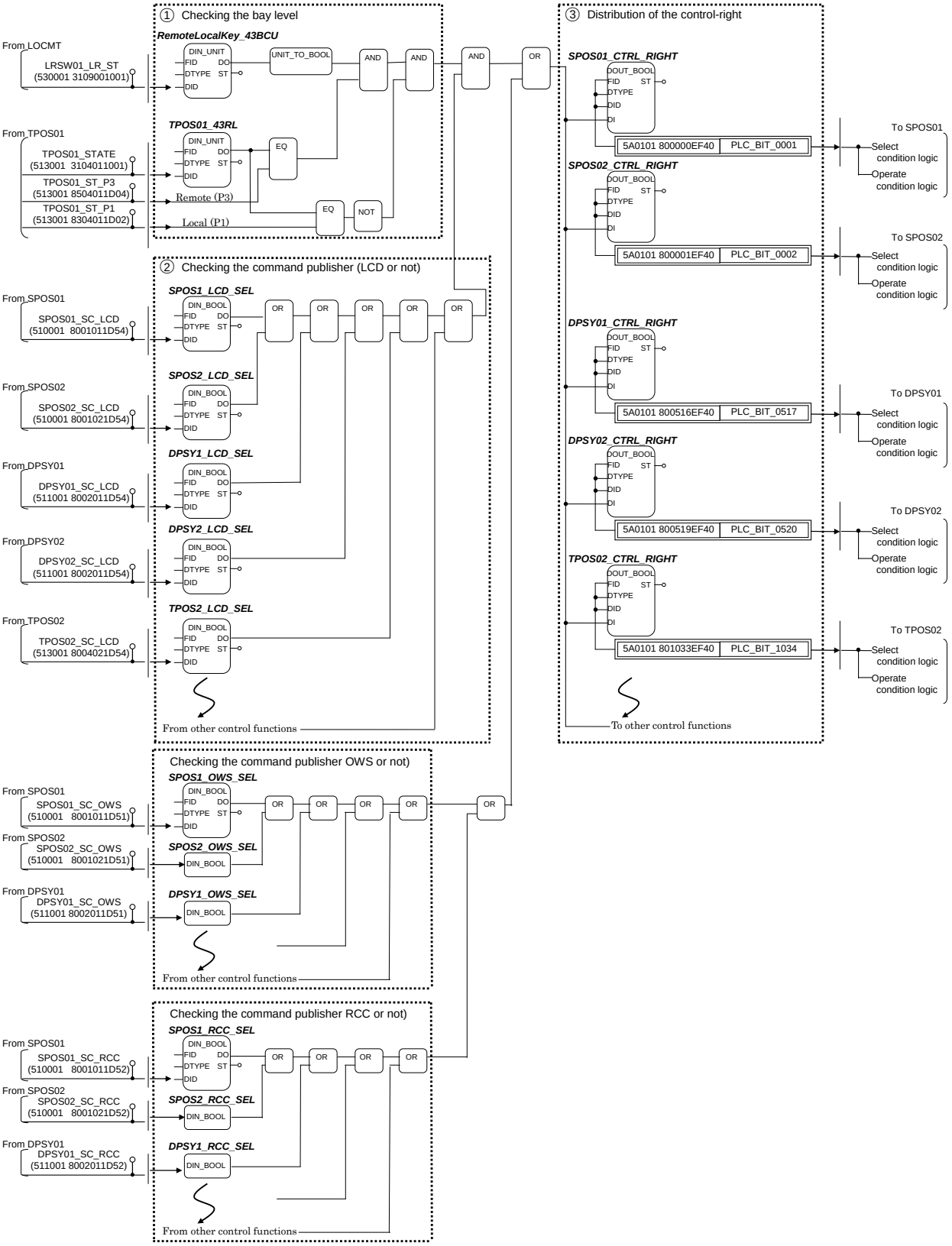


Figure 2.4-2 Programmed 43RL and Control-right on the bay level (Default setting)

Suppose that the 43RL switch is set in the position of "**Remote** (**P3**)". When the 43BCU switch is set to the "**Local** (**L**)" position, the user can control a device from the LCD. This is

because the signal for the control-right is generated in the LCD within the control-hierarchy. Figure 2.4-2 shows that the logic is programmed so that the control-right is generated from the LCD; the logic consists of three parts: ① checking the operation-point is from the bay level, ② checking that the operation is coming from the IED front panel, and ③ distributing the control-right to the corresponding functions.

(i) Checking the bay level

The part① logic is programmed so that, the control-right signal can be issued from the bay level when the 43RL and 43BCU switches are set to "**Remote** (**P3**)" and "**Local** (**L**)" respectively. The LOCMT function, denoted by *RemoteLocalKey_43BCU* applies a signal to the part① logic; denoting the TPOS01 function by *TPOS01_43RL* checks the operation conditions of the LCD. If the 43RL switch is set to "**Local** (**P1**)", control from the LCD is blocked by the final AND operation by introducing the condition signal "TPOS01_ST_P1".

(ii) Checking the LCD operation

The part② logic is programmed to check whether the LCD can issue a control-right signal or not. An LCD-operation-selected signal, which is denoted *DPSY1_LCD_SEL* by signal "DPSY01_SC_LCD", is injected into the part② logic. The *DPSY1_LCD_SEL* signal confirms that the operation of the DPSY01 function is from the LCD and the select-before-operation (SBO) mode is called-up in the DPSY01 function. If the output signal from the part② logic is true, the issuing of a control-right signal from the LCD is allowed†. The remaining signals, such as *SPOS1_LCD_SEL* and others, are also processed in a similar way (as per *DPSY1_LCD_SEL*).

If the user wishes to control the device using the direct-operation (DIR) mode, they can substitute the SBO signal for the DIR signal i.e. the user is required to change the *DPSY1_LCD_SEL* to *DPSY1_LCD_EC*‡ using the DIN_BOOL§ feature. Consequently, the DIR mode is called-up by the DPSY01 function.

†Note: The actual permission for LCD control is provided after ANDing the part① and part② signals.

‡Note:The *DPSY1_LCD_EC* signal is provided by the operation of DIN_BOOL injecting the signal "DPSY01_EC_LCD (511001 8002011D58)". As in"DPSY01_EC_LCD, the other functions have similar signals to change the mode. To search for user-preferred signals, find the key-word "SC_LCD" or "EC_LCD" in the Data IDs lists for the respective functions; the user can also find the signal through the operation of GR-TIEMS (Figure 2.4-3). Table 2.4-2 shows a Data ID (i.e. function ID plus element ID) signal derived by using the key-words "SC_LCD" or "EC_LCD".

§Note:The PLC function provides firmware libraries such as DIN_BOOL and other

features.

Table 2.4-2 SC_LCD or EC_LCD signals in the DPSY01 function

DPSY(Function ID: 511001)

Element ID	Name	Description
8002011D58	DPSY01_EC_LCD	DPSY01 execute command coming from LCD
8002011D55	DPSY01_EC_OWS	DPSY01 execute command coming from OWS(MIMIC)
8002011D59	DPSY01_EC_PLC	DPSY01 execute command coming from PLC
8002011D56	DPSY01_EC_RCC	DPSY01 execute command coming from RCC
8002011D57	DPSY01_EC_RMT	DPSY01 execute command coming from OWS or RCC
8002011D54	DPSY01_SC_LCD	DPSY01 select command by LCD
8002011D51	DPSY01_SC_OWS	DPSY01 select command by OWS(MIMIC)
8002011D52	DPSY01_SC_RCC	DPSY01 select command by RCC
8002011D53	DPSY01_SC_RMT	DPSY01 select command by OWS or RCC

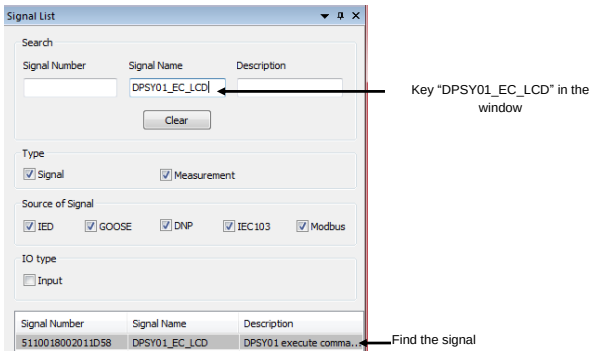


Figure 2.4-3 Search of "SC_LCD" or "EC_LCD" signal using GR-TIMES

(iii) Distribution of the control-right

The part③ logic is programmed so that, the control-right signal can be distributed to the respective control applications. With regard to the DPSY01 function, PLC connection point "PLC_BIT_0517†" has been programmed using DOUT_BOOL feature (for example). Therefore, the control-right signal is transferred to the select and operate-condition logic‡ when the user connects the control-hierarchy with the DPSY01 function using "PLC_BIT_0517".

†Note:It is feasible to use the PLC_BIT signal for mutual connections between control functions; for more information, see chapter *Control and monitoring application: Common controls(CMNCTRL)*.

‡Note:The select-condition and operate-condition logic are used to decide upon the execution of a select command or an operate command in the DPSY01 function. For more detail, see chapter *Control and monitoring application: DPSY function: Operate condition* and *Select condition*. As per the DPSY function, other functions, such as SPOS, DPOS, and TOPS, have the same logic; the user is required to do the connection.

2.4.4 43RL control-right on TPOS01

In Figure 2.4-1 when the 43RL switch is used should to operate a device, the control-right signal should be passed to the bay level, because the TPOS01 function is used especially for the 43RL switch scheme. That is, the TPOS01 function shall work unconditionally. Figure 2.4-4 shows the execution of the TPOS01 function. A constant (CONST_1) signal is applied forcibly at *TPOS1_CTRL_RIGHT* in the DOUT_BOOL feature. Hence, the TPOS01 function works unconditionally for the 43RL switch. The 43RL switch logic is implemented with the TPOS01 function during manufacture, as a default configuration.

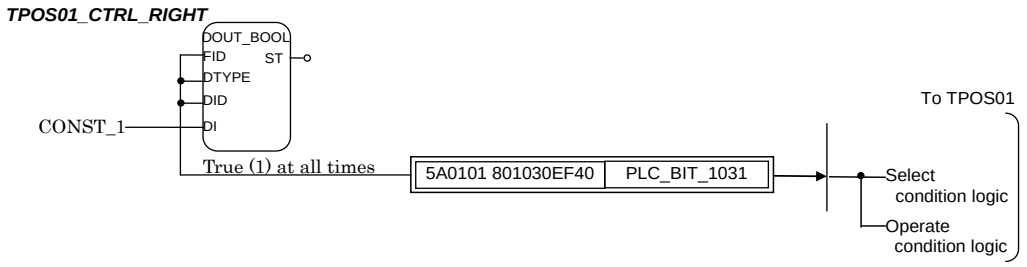


Figure 2.4-4 Distribution of the control-right for 43RL (TPOS01)

2.5 Common controls (CMNCTRL)

The CMNCTRL function consists of two parts. The former part (CMNCTRL1) is used to prevent double-commands, which are forbidden, by the use of select-states for the respective control functions. The latter part (CMNCTRL2) acts as a mediator to provide a bridge between the control functions.

Note: The implementation of such features depends on the selection of hardware and the configuration of functions. Several IED models do not support certain features. To determine whether a particular feature is implemented within an IED, identify the IED ordering number; and check the order number for the "G&T position" referring to the comparison table below. For more information, see *Appendix: Ordering*.

Table 2.5-1 Comparative table in respective ordering numbers

Sec.	Feature	Ordering No. at "G&T"					
		BCU			BCPU		IFU
		11	13	1F	2N	2C	19
–	Main features	✓	✓	✓	✓	✓	✓

✓: Applicable NA: Not applicable

2.5.1 Double command blocking (DCB)

For control functions, the operating principle is that priority is given to the first command received and shall be executed first. In other words, successive commands received do not have the right to run until the first command received has failed to complete its operation (that is, the principle of double command blocking (DCB) is established). The principle is significant for protection and control devices in the sub-station†. Figure 2.5-1 illustrates how each control function generates a SLD_RPT signal; the aggregation of SLD_RPT signals is performed in the CMNCTRL1 function. The resultant signal is output at PLC connection point "DCB SND OR". The resultant signal is returned to the respective control function as feedback.

†Note: Let us assume that the control function in IED-1 controls CB1, as shown in Figure 2.5-2. IEDs -2 to -10 are forbidden to operate their CBs throughout the period that IED-1 is in operation. Control functions are also forbidden to operate CB1 when the automatic sequence controlling function (ASEQ) is in operation. We discuss the ASEQ function later. (See Chapter *Control and monitoring application: Automatic sequence controlling function*)

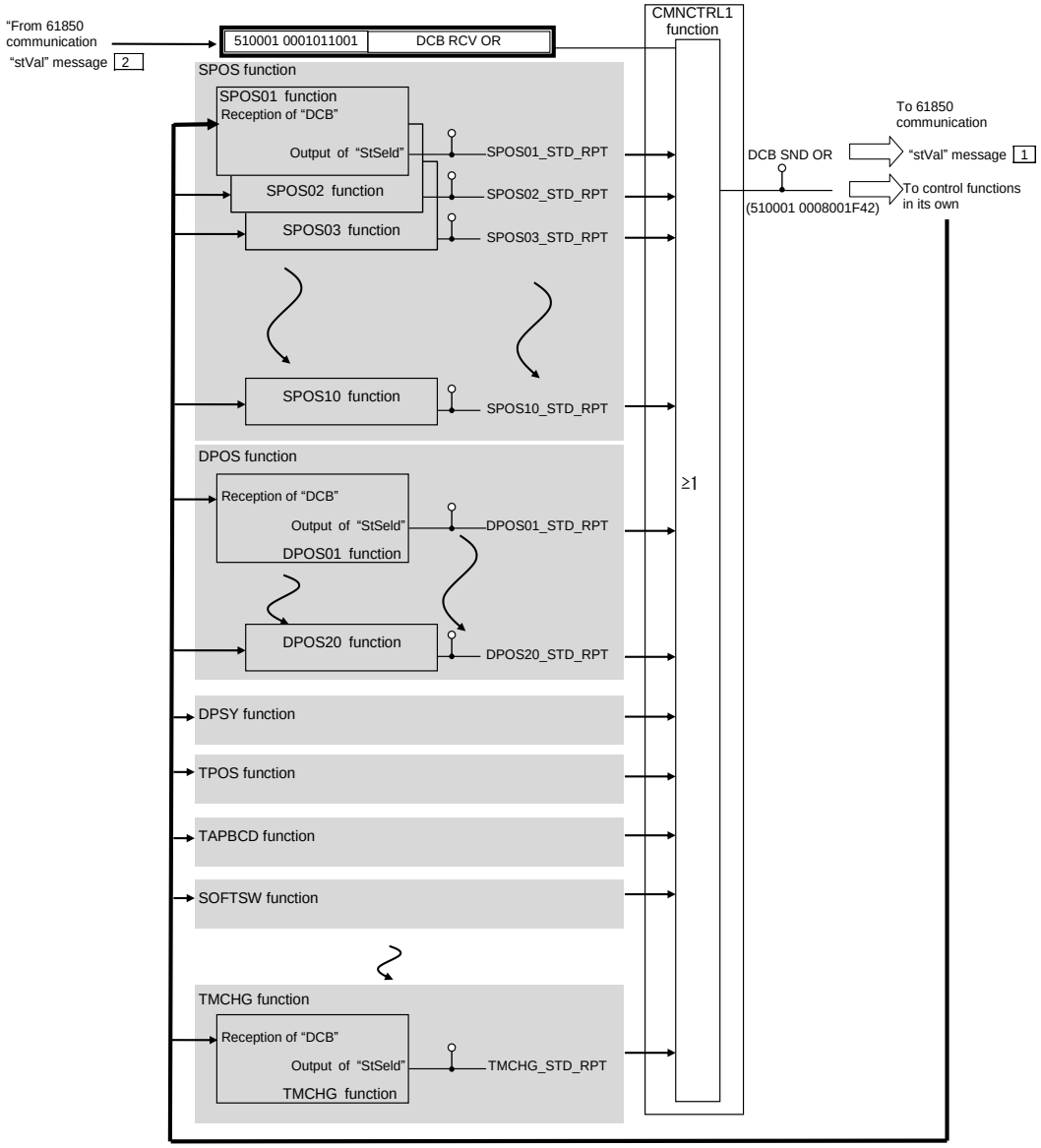


Figure 2.5-1 DCB operation in CMNCTRL1 function

In Figure 2.5-1, the CMNCTRL1 function generates a message denoted with the number 1; Figure 2.5-2 exemplifies that the IED-1 generates the "stVal" message 1. In addition, IEDs-2 to -10 are also required to receive message 1, this is denoted with the number 2. For IEC61850 communication, the "stVal" messages 1 and 2 are carried by GOOSE publish and GOOSE subscribe. Thus, for all IEDs (i.e., IED-1 to IED-10 of Figure 2.5-2), it is required to set the GOOSE publish destination corresponding to the message.

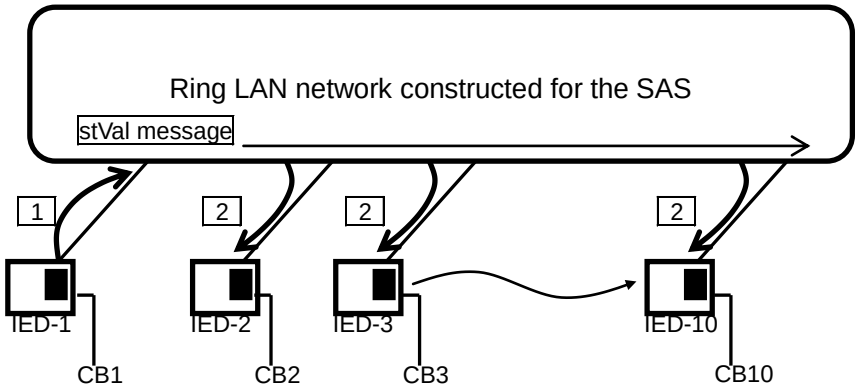


Figure 2.5-2 Sending and reception of stVal message

Figure 2.5-3 demonstrates how the GOOSE publish destination is set with regard to the DCB message. The user is required to set the destination for each respective IED by selecting the signal “DCB SND OR”, corresponding to the GOOSE publish, this must be performed at the respective screens in GR-TIEMS†. That is, the user should select the “stVal” item for each IED. After setting, the user should write the setting date for each respective IED.

†Note:For more operation information on GR-TIEMS, see Chapter *Engineering tool*.

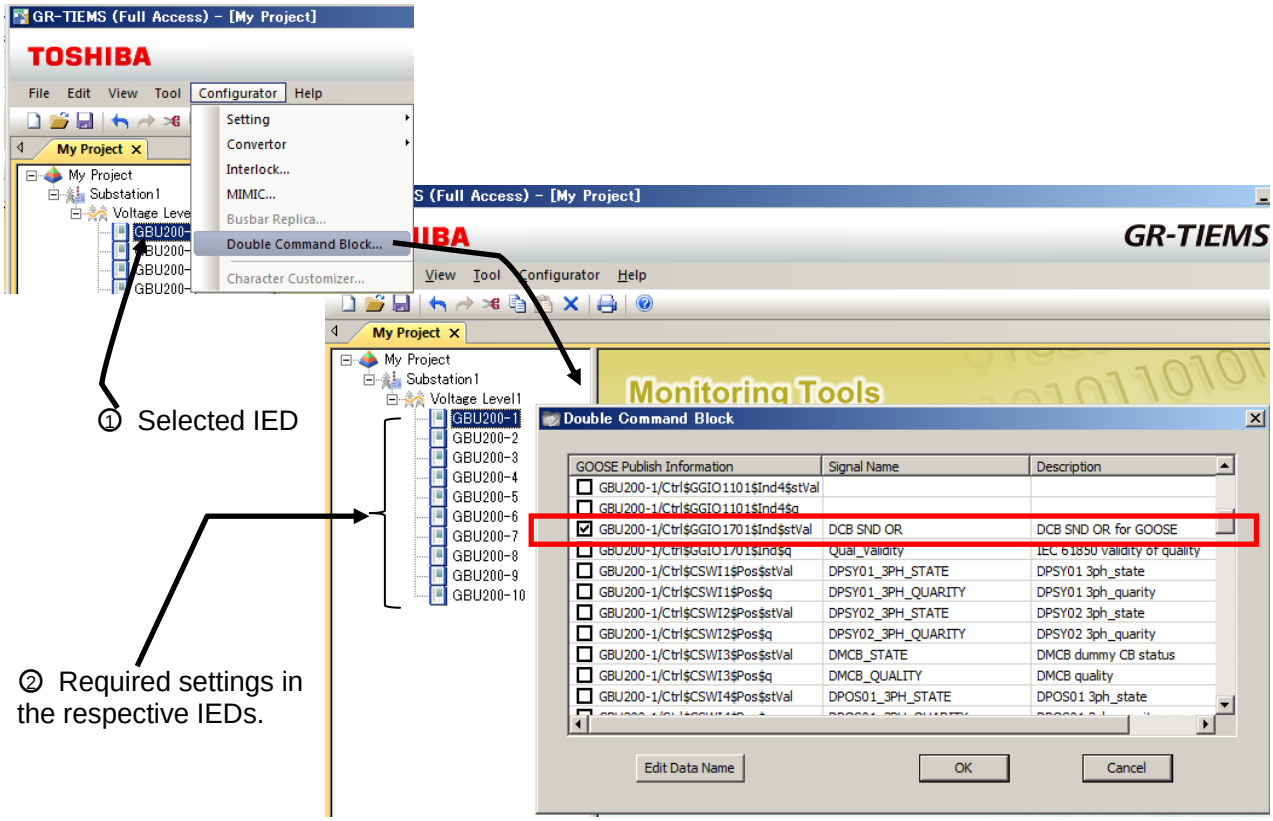


Figure 2.5-3 Example of DCB setting for IED-1 using GR-TIEMS

2.5.2 PLC_BIT/UNIT/BOOL signal

The control and monitoring functions are mutually interconnected within the IED; hence, cascading features are provided to transfer information between them so that the user does not need to check the interconnections. Approximately 1500 signals are included to facilitate the internal connection of the control and monitoring functions; their signals are distributed into BIT, UNIT, BOOLEAN types. Amongst these signals†, approximately 130 are available to the user and can be applied to program an event operation or another function‡. Figure 2.5-4 exemplifies the "PLC_BIT_0201" signal, which can be used for recording events and other purposes.

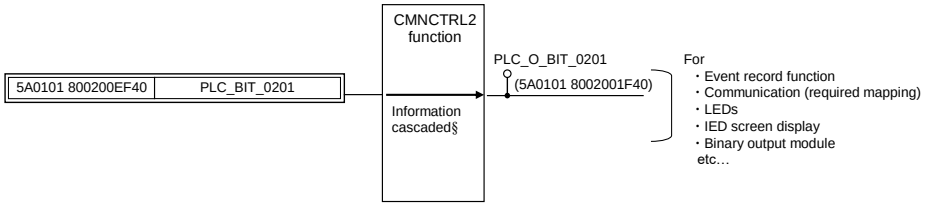


Figure 2.5-4 Cascading information using signal "PLC_BIT_0201"

†Note:The PLC connection points and monitoring points are listed later.

‡Note:Although 130 signals are available for user programming, nonetheless, the PLC function also provides the user with other signals for the same purpose. It is recommended that the user selects the PLC signals provided (i.e., PLC drivers; see chapter *PLC function* for more information).

§Note:The CMNCTRL2 function is used to cascade information between signal processing modules. For more details on the processing module, see chapter *Technical description: Signal processing and communication module.*

Figure 2.5-5 shows the input-points and the output-points. During manufacture several CMNCTRL2 output-points are connected to the respective control functions. Hence, the user will find that control functions (such as SPOS, DPOS, and other control functions) use the PLC_BIT to import external signals, as shown in Figure 2.5-5.

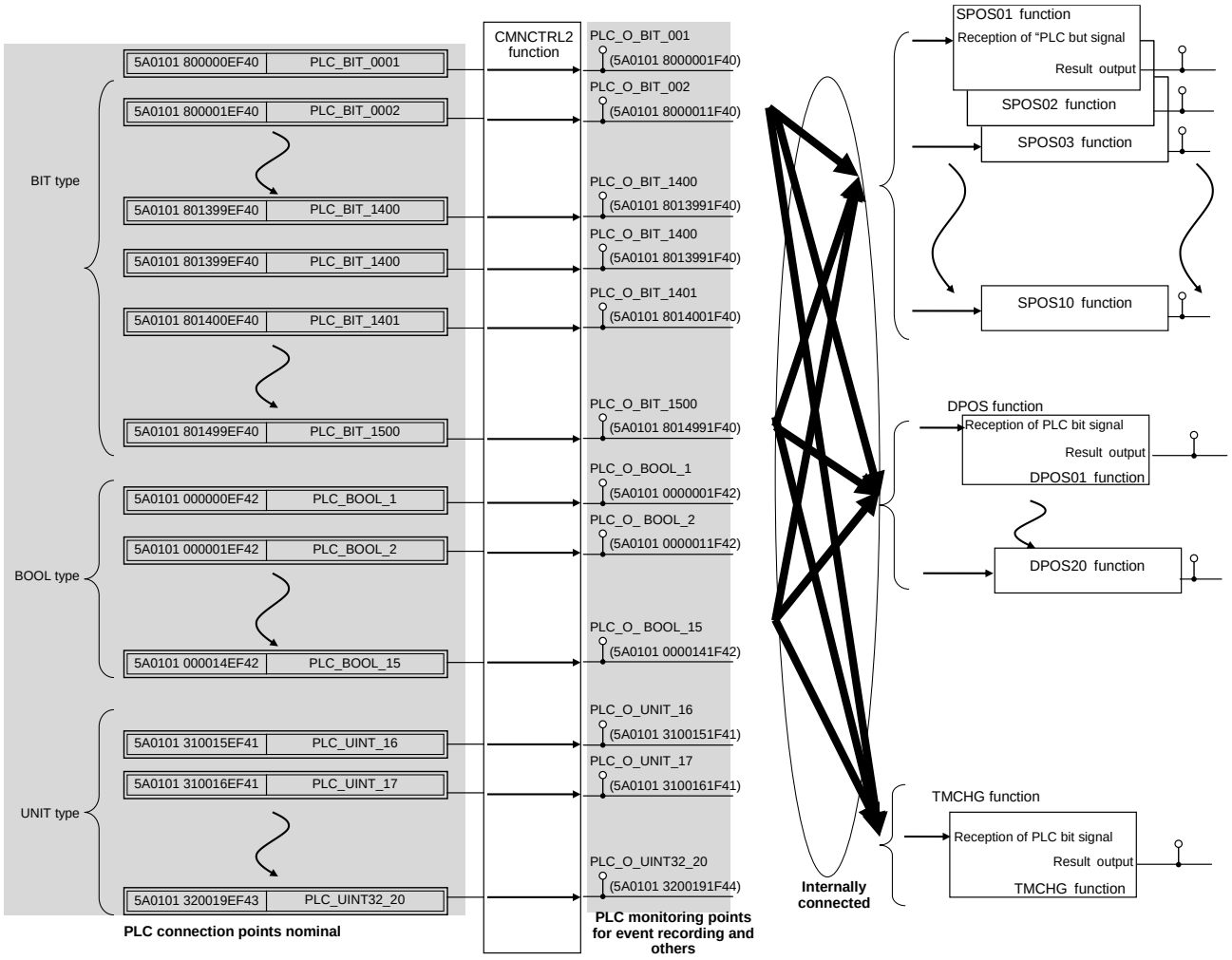


Figure 2.5-5 Mutual connections between CMNCTRL2 and control functions

Note: PLC_BIT_1401 to 1500 are available just for the models of '1F' and '2C', which are instructed with the codes at "G&T position".

2.5.3 Provision of selected status

Let us assume that a select-command is sent for an IED to control a target-device by the substation automation system (SAS†), but the target-device is not ready to be controlled. The unready condition might be due to the target-device already being in operation (e.g., CB tripping) or a failure of the device may have occurred; thus, the IED has to drop the select-command. If this occurs, the IED is required to send a message stating the reason to the SAS†. Table 2.5-2 lists the messages generated in the CMNCTRL1 function describing the failure.

Table 2.5-2 Reason messages due to the release of the select-command

Signal Number	Signal Name	Description
5A0001 3008001FB4	SCS_CTLNUM	Reason codes for the SAS†
5A0001 2008001008	SCS_ORCAT	
5A0001 2208001001	SCS_ADDCAUSE	
5A0001 6A08001009	SCS_ORIDENT	
5A0001 3008001FB4	SCS_CTLNUM	

†Note:The user should recognize that the reason messages are only available for operation with the GCS1000 control system manufactured by Toshiba.

2.5.4 Miscellaneous settings

The CMNCTRL1 function has the following five common settings:

1. Control direction: Scheme switch [**SDCEN**] can configure the control directions of the SPOS, DPOS and TPOS functions. If required these functions can be in the same control direction, set **On** for the scheme switch [**SDCEN**].
2. Return value: When the number of the counter reaches its maximum value (in case of the default setting, 999,999), it can return and begin incrementing from either 0 or 1. The return number can be set by [**CNTRV**].
3. Select-cancel timer: If the selection of a target device is made, but the control operation of the selected device is not carried out in a predetermined time limit, the selection is canceled. The time limit can be set using [**TSC**]; the setting range is between 30 and 300 seconds having a 1 second step.
4. Time out: When the selection of the target device and its control execution is made, the selection will be canceled automatically after the setting time [**EXEWAIT**] if the control result is not received at the IED from the target device. The setting time ranges from 30 to 300 seconds in 1 second steps.
5. Counter limit: The maximum value of the counters can be set between 9 and 2,147,483,647 using [**CNTVALMAX**]. The default setting is 999,999.

2.5.5 Setting

CMNCTRL setting list (FunctionID:5A0001)

Setting item		Range	Units	Contents	Default setting value	Notes
CMNCTRL	SDCEN	Off/On	-	Setting of control to the same direction	Off	
	CNTRV	0-1	-	Next value of the counter[**CNTVALMAX**] level	0	
	TSC	30-300	s	Selection cancel time-out timer	30	
	EXEWAIT	30-300	s	Waiting execute operation time-out timer	30	
	CNTVALMAX	9-2147483647	-	Upper limit level of the counter	999999	

2.5.6 Signal

◆ Connection points in bit type

CMNCTRL2 (Function ID: 5A0101)

Element ID	Name	Description	Codes 11,13, 2N,19	Codes 1F, 2C
320000EF43	CHK_NMI_M	Main CPU Monitoring Siganal1	✓	✓
320001EF43	CHK_ROMRAM_M	Main CPU Monitoring Siganal2	✓	✓
320002EF43	CHK_SUM_M	Main CPU Monitoring Siganal3	✓	✓
320003EF43	CHK_PROGRAM_M	Main CPU Monitoring Siganal4	✓	✓
320004EF43	CHK_RAM_M	Main CPU Monitoring Siganal5	✓	✓
320005EF43	CHK_ECC_M	Main CPU Monitoring Siganal6	✓	✓
320006EF43	CHK_SAMPLING_M	Main CPU Monitoring Siganal7	✓	✓
320007EF43	CHK_ACC1_M	Main CPU Monitoring Siganal8	✓	✓
320008EF43	CHK_ACC2_M	Main CPU Monitoring Siganal9	✓	✓
320009EF43	CHK_ACC3_M	Main CPU Monitoring Siganal10	✓	✓
320010EF43	CHK_GOOSERCV_M	Main CPU Monitoring Siganal11	✓	✓
320011EF43	CHK_PING1_M	Main CPU Monitoring Siganal12	✓	✓
320012EF43	CHK_PING2_M	Main CPU Monitoring Siganal13	✓	✓
320013EF43	CHK_CMLV_DAT_M	Main CPU Monitoring Siganal14	✓	✓
800000EF40	PLC_BIT_0001	PLC event bit information 1	✓	✓
800001EF40	PLC_BIT_0002	PLC event bit information 2	✓	✓
800002EF40	PLC_BIT_0003	PLC event bit information 3	✓	✓
….	…..	…..		
801399EF40	PLC_BIT_1400	PLC event bit information 1400	✓	✓
801400EF40	PLC_BIT_1401	PLC event bit information 1401	NA	✓
801401EF40	PLC_BIT_1402	PLC event bit information 1402	NA	✓
….	…..	…..		
801499EF40	PLC_BIT_1500	PLC event bit information 1500	NA	✓

◆ PLC monitoring points in unit type

CMNCTRL2 (Function ID: 5A0101)

Element ID	Name	Description	Codes 11,13, 2N,19	Codes 1F, 2C
310008EF41	PLC_UNIT_9	Free for users; reserved in 16-bit unsigned integer	✓	✓
310014EF41	PLC_UNIT_15	Free for users; reserved in 16-bit unsigned integer	✓	✓
310015EF41	PLC_UNIT_16	Free for users; reserved in 16-bit unsigned integer	✓	✓
310016EF41	PLC_UNIT_17	Free for users; reserved in 16-bit unsigned integer	✓	✓
310017EF41	PLC_UNIT_18	Free for users; reserved in 16-bit unsigned integer	✓	✓
310018EF41	PLC_UNIT_19	Free for users; reserved in 16-bit unsigned integer	✓	✓

◆ PLC monitoring points in boolean type

CMNCTRL2 (Function ID: 5A0101)

Element ID	Name	Description	Codes 11,13, 2N,19	Codes 1F, 2C
000004EF42	PLC_BOOL_5	Free for users; reserved in boolean	✓	✓
000006EF42	PLC_BOOL_7	Free for users; reserved in boolean	✓	✓
000007EF42	PLC_BOOL_8	Free for users; reserved in boolean	✓	✓
000008EF42	PLC_BOOL_9	Free for users; reserved in boolean	✓	✓
000009EF42	PLC_BOOL_10	Free for users; reserved in boolean	✓	✓
000010EF42	PLC_BOOL_11	Free for users; reserved in boolean	✓	✓
000011EF42	PLC_BOOL_12	Free for users; reserved in boolean	✓	✓
000012EF42	PLC_BOOL_13	Free for users; reserved in boolean	✓	✓
000013EF42	PLC_BOOL_14	Free for users; reserved in boolean	✓	✓
000014EF42	PLC_BOOL_15	Free for users; reserved in boolean	✓	✓

◆ PLC monitoring point in 32 bit type unsigned type

CMNCTRL2 (Function ID: 5A0101)

Element ID	Name	Description	Codes 11,13, 2N,19	Codes 1F, 2C
320014EF43	PLC_UNIT32_15	Free for users; reserved in 32bit unsigned	✓	✓
320015EF43	PLC_UNIT32_16	Free for users; reserved in 32bit unsigned	✓	✓
320016EF43	PLC_UNIT32_17	Free for users; reserved in 32bit unsigned	✓	✓
320017EF43	PLC_UNIT32_18	Free for users; reserved in 32bit unsigned	✓	✓
320018EF43	PLC_UNIT32_19	Free for users; reserved in 32bit unsigned	✓	✓
320019EF43	PLC_UNIT32_20	Free for users; reserved in 32bit unsigned	✓	✓

◆ Monitoring points in PLC logic in bit type

CMNCTRL2 (Function ID: 5A0101)

Element ID	Name	Description	Codes 11,13, 2N,19	Codes 1F, 2C
8000001F40	PLC_O_BIT_001	PLC event bit output 1	✓	✓
8000011F40	PLC_O_BIT_002	PLC event bit output 2	✓	✓
8000021F40	PLC_O_BIT_003	PLC event bit output 3	✓	✓
8000031F40	PLC_O_BIT_004	PLC event bit output 4	✓	✓
8000041F40	PLC_O_BIT_005	PLC event bit output 5	✓	✓
……	……	……		
8013981F40	PLC_O_BIT_1399	PLC event bit output 1399	✓	✓
8013991F40	PLC_O_BIT_1400	PLC event bit output 1400	✓	✓
8014001F40	PLC_O_BIT_1401	PLC event bit output 1401	NA	✓
8014011F40	PLC_O_BIT_1402	PLC event bit output 1402	NA	✓
……	……	……		
8014991F40	PLC_O_BIT_1500	PLC event bit output 1500	NA	✓

◆ Monitoring points in PLC logic

CMNCTRL2 (Function ID: 5A0101)

Element ID	Name	Description	Codes 11,13, 2N,19	Codes 1F, 2C
0000001F42	PLC_O_BOOL_1	PLC event boolean output 1	✓	✓
0000011F42	PLC_O_BOOL_2	PLC event boolean output 2	✓	✓
0000021F42	PLC_O_BOOL_3	PLC event boolean output 3	✓	✓
0000031F42	PLC_O_BOOL_4	PLC event boolean output 4	✓	✓
0000041F42	PLC_O_BOOL_5	PLC event boolean output 5	✓	✓
0000051F42	PLC_O_BOOL_6	PLC event boolean output 6	✓	✓
0000061F42	PLC_O_BOOL_7	PLC event boolean output 7	✓	✓
0000071F42	PLC_O_BOOL_8	PLC event boolean output 8	✓	✓
0000081F42	PLC_O_BOOL_9	PLC event boolean output 9	✓	✓
0000091F42	PLC_O_BOOL_10	PLC event boolean output 10	✓	✓
……..	…….	……..		
0000141F42	PLC_O_BOOL_15	PLC event boolean output 15	✓	✓

2.6 Local, remote and PLC control

The user can select either local or remote control by pressing the L | R key on the front panel of the IED. Selection is executed within the LOCRMT function. Control logic is provided by default, but the user can customize each application using the PLC function and PLC connection points. Generally, the LOCRMT function is applied within all IEDs. Figure 2.6-1 shows the LOCRMT logic. Note that the LOCRMT function changes for the remote control unconditionally if the operation/function keys on the front panel are not touched within 35 minutes in the local control.

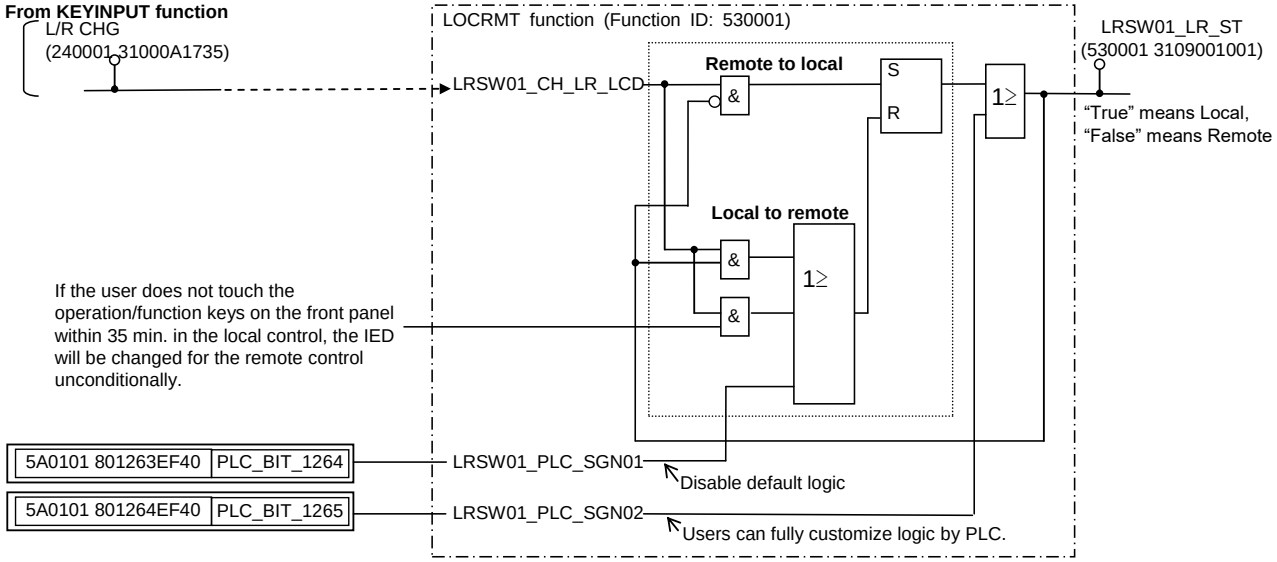


Figure 2.6-1 LOCRMT logic

Note: The implementation of particular features is dependent upon the selection of hardware and the configuration of functions. Several IED models do not support certain features. To determine whether a particular feature has been implemented within an IED, identify the IED ordering number; and check the order number for the "G&T position" referring to the comparison table below. For more information, see *Appendix: Ordering*.

Table 2.6-1 Comparative table in respective ordering numbers

Sec.	Feature	Ordering No. at "G&T"					
		BCU			BCPU		IFU
		11	13	1F	2N	2C	19
–	Main features	✓	✓	✓	✓	✓	✓

✓: Applicable NA: Not applicable

2.6.1 Local control

Local control refers to control operation from the front panel of the IED. Either the DIR or the SBO modes are available depending on the configuration selected by the user.

2.6.2 Remote control

Remote control refers to control operation from a remote control center or the SAS server. Either the DIR or the SBO modes are available depending on the configuration selected by the user. Note that the parameters used in the control commands are defined in international standards†. The parameter details are provided in the communication profiles. (See Chapter *Communication protocol and Appendices*)

†Note: As a rule, the control commands have parameters. For example, the "Off to On" and "On to Off" control directions that are used in commands are pre-configured as parameters in the communication protocol. Note that the parameters vary depending upon the respective protocol used, such as IEC61850, Modbus and others. For IEC61850, Table 2.6-2 shows the parameters defined: the rule for control direction can be found in "ctlVal", the command publisher is recognized using the parameter "origin". For more information about the parameters, see Appendix *IEC61850 MICS, PICS, PIXIT and TICS*.

Table 2.6-2 Defined command parameters in IEC61850-7-2

Parameter Types	Descriptions
ctlVal	Control direction (On or Off)
origin	Indicates the command publisher
ctlNum	Sequential Number
T	Time that the command is sent
Test	Test information (Test/On)
Check	Interlock synchronizing

2.6.3 Programmable logic control (PLC)

The programmable logic control, (PLC) function can be used to provide user-preferred control schemes. Several control functions have connection points to enable connections to be made to the PLC function; they can be used to create user-preferred control schemes. It is necessary for the user to program the PLC logic that will be used for the particular connection. Users need to apply the automatic sequence control (ASEQ) function in order to initiate the user-preferred control scheme, as shown in Figure 2.6-2. For more details on PLC programming, refer to the Chapter *PLC function*.

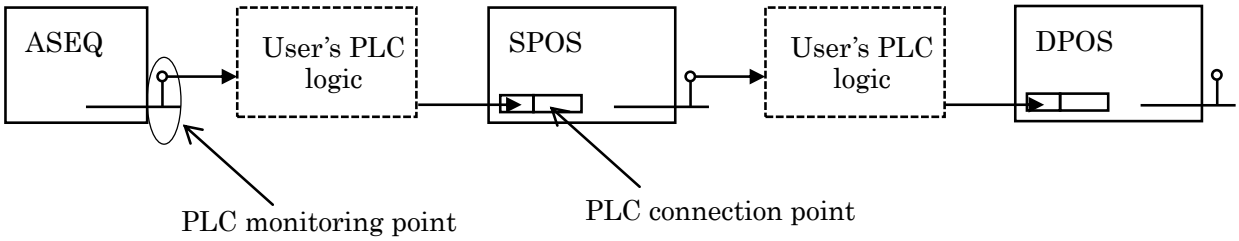


Figure 2.6-2 Example of user-preferred control scheme using PLC user logic

Note: The user-preferred control scheme implemented by users can only be operated in the DIR mode.

2.6.4 Signal for Local/Remote control

Note: The meaning of the following references are used in the column "M/O" in Table 2.6-3 and Table 2.6-4:

"O" means the signal is optional.

"M" means the user should map/set/configure the signal; otherwise, the user may experience an operational failure if the default settings are used.

"N/A" means that the user cannot change the state of the signal.

Table 2.6-3 PLC connection point (Input point for LOCRMT)

Signal Number	Signal Name	Description	M/O
240001 31000A1735	L/R CHG	[L/R] key "push"	N/A
5A0101 801263EF40	PLC_BIT_1264	Disable condition by PLC	O
5A0101 801264EF40	PLC_BIT_1265	User configurable condition by PLC	O

Table 2.6-4 Mapping points for LOCRMT

Signal Number	Signal Name	Description	M/O
530001 3009011008	LRSW01_LR_ORCAT	Mapping data for "originator" in IEC61850	N/A
530001 6A09011009	LRSW01_LR_ORIDENT	Mapping data for "originator" in IEC61850	N/A

Table 2.6-5 PLC monitoring point (LOCRMT)

Signal Number	Signal Name	Description
530001 3109001001	LRSW01_LR_ST	Local(T) / Remote(F) status (single bit expression)
530001 3009011001	LRSW01_LR_ST_RMT	Local(0x40) / Remote(0x80) status (double bit expression)

2.7 Hot standby control (HSCTRL)

To increase reliability, a hot-standby control (HSCTRL) function can be applied thus enabling operational redundancy. For example, circuit breaker (CB) control with increased reliability is achievable using the HSCTRL function enabling redundant operation using two IEDs. Figure 2.7-1 illustrates the system configuration, demonstrating CB control using either IED#1 or IED#2. IED#1 and the IED#2 are connected using hardwired-connections; this connection is achieved using the binary input circuits (BIs) and binary output circuit (BOs) of the respective IEDs. Consequently, both IEDs can exchange information with regard to their respective mode of operation. Figure 2.7-1 indicates that IED#1 is in operation (Hot mode) and IED#2 is in standby (Standby mode). That is, IED#2 does not effect CB operation.

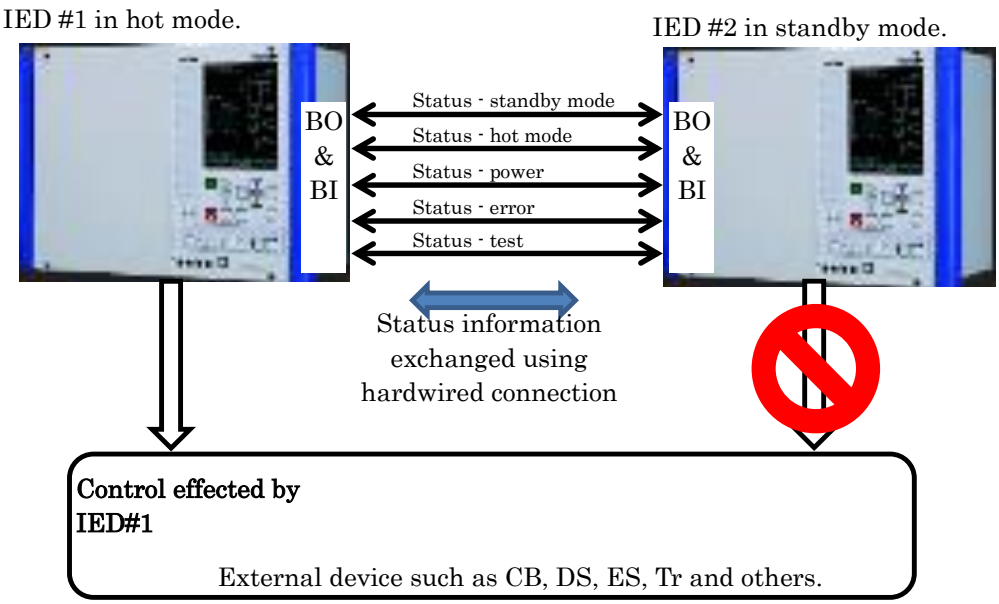


Figure 2.7-1 CB control using HSCTRL selection

Figure 2.7-2 shows IED#1 switched to standby mode when IED#1 experiences a failure. On detection of an error within IED#1, IED#2 is instructed to switch to hot mode by the HSCTRL function; consequently, control of the CB is effected by IED#2 instead of IED#1.

As stated above, the HSCTRL function operates using status information provided by hardwired-communication. This means that the HSCTRL function does not operate unless the BIs and BOs enable the hardwired-communication. An IED in the standby mode shall follow the IED which is in the hot mode. In other words, when the IED which is operating in the hot mode is switched into the test mode†, the other IED shall switch to the test mode at the same time. Consequently, both IEDs are able to operate in accord.

†Note: A test mode is provided by the IED so that the user can check several relay and control functions. See chapter *User interface: Test sub-menu* to know how to set a test mode.

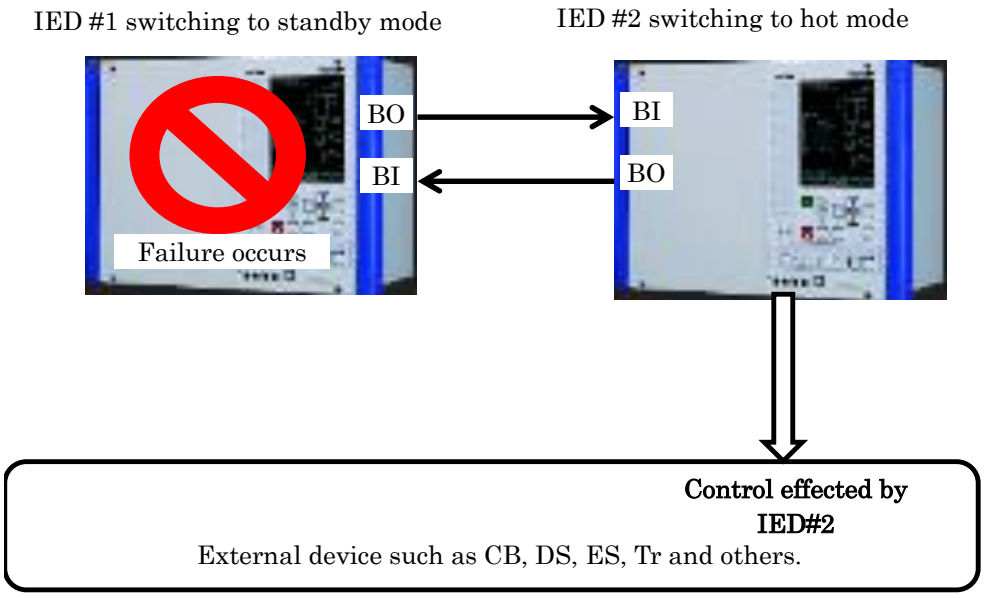


Figure 2.7-2 CB control transferred to alternative IED with HSCTRL instruction

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Note: The implementation of such features depends on the selection of hardware and the configuration of functions. Several IED models do not support certain features. To determine whether a particular feature is implemented within an IED, identify the IED ordering number; and check the order number for the "G&T position" referring to the comparison table below. For more information, see *Appendix: Ordering*.

Table 2.7-1 Comparative table in respective ordering numbers

Sec.	Feature	Ordering No. at "G&T"					
		BCU			BCPU		IFU
		11	13	1F	2N	2C	19
–	Main features	✓	✓	✓	✓	NA	NA

✓: Applicable NA: Not applicable

2.7.1 Mode indication for the corresponding IED

Figure 2.7-3 shows the HSCTRL logic; as before, performing the HSCTRL function requires connection with another IED using the BI and BO circuits.

(i) Input signals

Three signals are required to enable the HSCTRL function to determine the operational status of the corresponding IED: ①failure-state, ②standby-state, and ③error-state. The user is required to connect the BIs with the HSCTRL logic introducing the three signals to the HSCTRL logic. In Figure 2.7-3 the BI1 to BI3 circuits† are ready for the signal acquisition; the connection can be performed using the settings in the HSCTRL function.

†Note:For more details about the BIs, see chapter *Technical description: Binary IO module: Binary input circuit*. We describe BI1 to BI3 at IO_SLOT2 for this explanation. The user should select the actual BIs in accordance with the application.

①A signal, such as a power-status signal is used to determine whether the corresponding IED is in a failure-state. If the power-status signal is absent, the HSCTRL logic determines that the corresponding IED is not healthy. BI1 is connected with the HSCTRL logic using the setting [**HSCTRL-PNOPSG**]. That is, in the example of Figure 2.7-3, the PLC monitoring point "200B02 8001001172 (BI1 at IO_SLOT2)" is keyed to apply the setting.

②A signal, such as an error-state signal is used to determine whether the corresponding IED is in the standby mode normal condition. If the corresponding IED produces an error-signal, the IED in hot mode will remain in the hot mode. Setting [**HSCTRL-ENOPSG**] is used to acquire the error-state signal; another setting [**HSCTRL-HNOPSG**] is used for hot-mode signal acquisition. In the example of Figure 2.7-3, PLC monitoring points "200B02 8101011172 and 200B02 8201021172 (BI2 and BI3 at IO_SLOT2)" are keyed to apply the settings.

③ If an IED acquires the error-state signal of the corresponding IED, the HSCTRL function can determine whether the corresponding IED is in a failure-state. The CMNCTRL2 function† in the local IED provides the SERI_ERR signal to determine this conclusion.

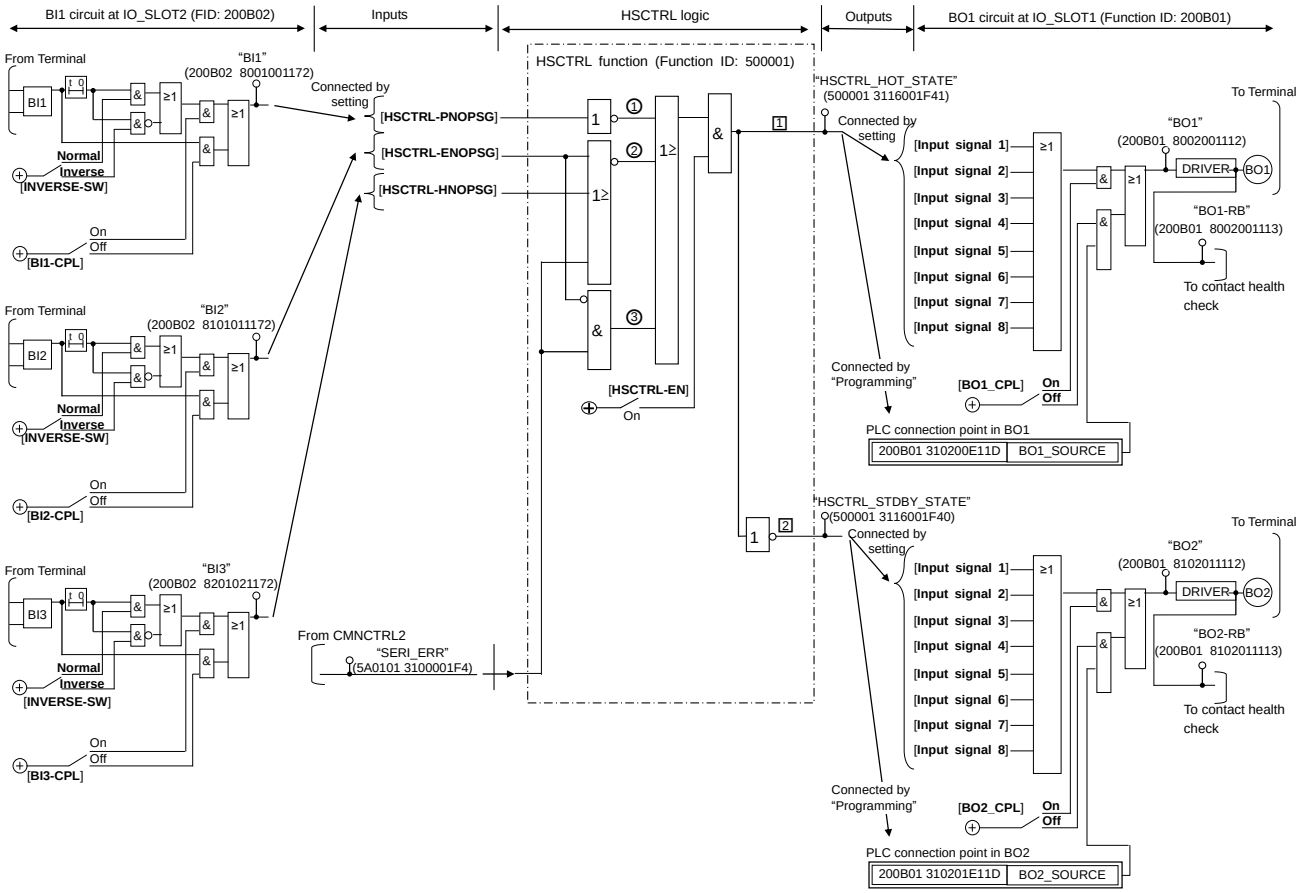


Figure 2.7-3 HSCTRL logic with input/output circuits

(ii) Output signals

Two signals outputs can be sent to the corresponding IED: 1 an instruction signal to switch to the hot mode and 2 an instruction signal to switch to the standby mode. The user is required to connect the outputs with the BOs by using the settings provided or by programming the PLC. In the example of Figure 2.7-3, the BO1 and BO2 circuits† are ready to output the signals.

†Note: For more details on the BOs, see chapter *Technical description: Binary IO module: Binary output circuit*. We describe binary outputs BO1 and BO2 for IO_SLOT1 by way of explanation. The user should select the actual BOs required in accordance with the application.

1 When it is necessary to switch the corresponding IED to the hot mode, an instruction signal appears at PLC monitoring point "HSCTRL_HOT_STATE". In the example shown in Figure 2.7-3, key "200B01 8002001112" for the setting [**Input signal 1**] for BO1 at IO_SLOT1. Of course, it is also possible for the user to make the connection using the PLC function. Incidentally, the hot-mode signal can be received at the input of the BI1 circuit if the same logic shown in Figure 2.7-3 is used in the corresponding IED.

② Under the instruction of the HSCTRL function, the corresponding IED can be switched to the stand-by mode. PLC monitoring point "HSCTRL_STDBY_STAT" is provided for this purpose; keying "200B01 8102011112" is required for the setting [**Input signal 1**] at BO2 at IO_SLOT1.

(iii) Signal name and number

Note: The user should note the meaning of the following references used in the column "M/O" in Tables 1.7-1 to 1.7-3:

"O" means the signal is provided for the optional usage.

"M" means the user should map/set/configure the signal; otherwise, the user may experience an operational failure if the default settings are used.

"N/A" means that the user cannot change the state of the signal.

Table 2.7-2 PLC connection point (Input point for HSCTRL)

Signal Number	Signal Name	Description	M/O
5A0101 3100001F43	SERI_ERR	Serious error	N/A

Table 2.7-3 Mapping points of HSCTRL

Signal Number	Signal Name	Description	M/O
500001 3116001005	HSCTRL_QUALITY	Quality signal for 61850	M
500001 9016001006	HSCTRL_TIMESTAMP	Time stamp signal for 61850	M

Table 2.7-4 PLC monitoring point of HSCTRL

Signal Number	Signal Name	Description
500001 3116001F40	HSCTRL_STDBY_STATE	Standby state
500001 3116001F41	HSCTRL_HOT_STATE	Hot state (being assigned to a BO)

(iv) Setting name

Table 2.7-5 Setting of HSCTRL

Setting Name	Description	Default	Setting item or value
HSCTRL-HNOPSG	Hot-mode signal received from the corresponding IED	none	Keying a BI point number
HSCTRL-PNOPSG	Power state signal received from the corresponding IED	none	Keying a BI point number
HSCTRL-ENOPSG	Fatal error state signal received from the corresponding IED	none	Keying a BI point number
HSCTRL-PRIORITY	Initial state of HSCTRL operation	Hot	Hot/ Standby
HSCTRL-EN	Activation of HSCTRL function	On	Off / On

2.7.2 Testing with corresponding IED

As shown in Figure 2.7-4, the HSCTRL test-logic is used when testing is performed between IEDs; the connection is required for the test. Note that, changing the test mode is executed uniformly when both IEDs operate in the hot mode or the standby mode; additionally, changing the test mode is possible even if the IED is in the fatal error state.

(i) Input signal

As we have seen, the local IED requires a signal for the test mode from the corresponding IED. On this account, both IEDs can operate in the test mode in parallel. An input signal④† is applied to the HSCTRL function to select the test condition. In the example of Figure 2.7-4, BI4 should be connected to the HSCTRL logic using the setting [**HSCTRL-MNOPSG**]; PLC monitoring point "200B02 8301031172 (BI4 at IO_SLOT2)" is keyed to apply the setting.

An input signal⑤ is also used to detect the test mode. This input signal is provided from the TEST function of the local IED.

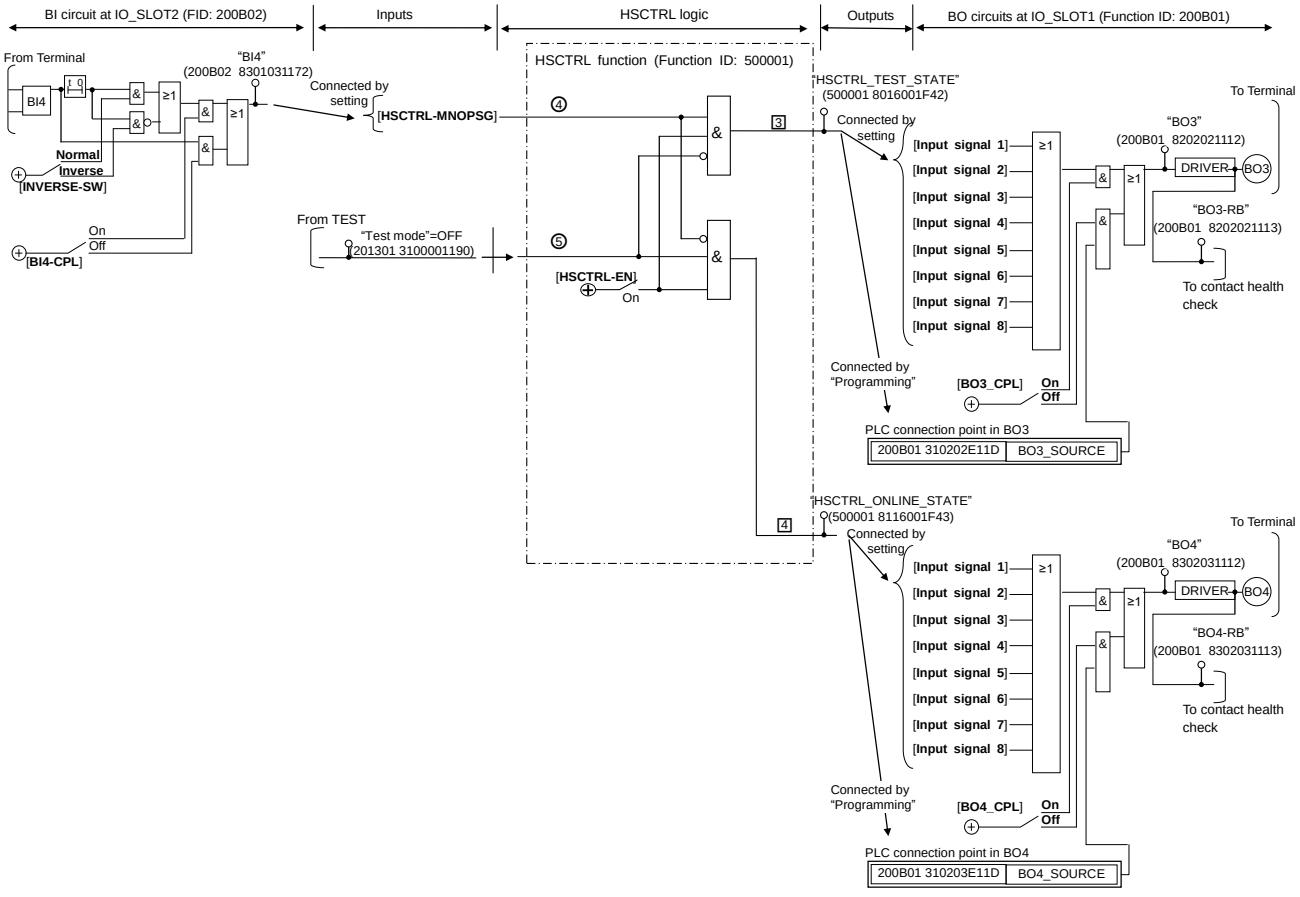


Figure 2.7-4 HSCTRL logic for test mode

†Note:The input signal④ is received from the corresponding IED; we shall see that an output signal3 at the corresponding IED can be used as the input signal④.

(ii) Output signals

Two signal outputs are available in the test mode: a signal3 indicating that the IED is in the test mode and signal4 indicating that the IED is in the standby mode. The user is required to connect the HSCTRL outputs with the BOs using the settings provided or by programming the PLC. In the example of Figure 2.7-4†, the BO3 and BO4 circuits are ready for output.

(iii) Signal name and number

Table 2.7-6 PLC monitoring points for HSCTRL testing

Signal Number	Signal Name	Description
500001 8016001F42	HSCTRL_TEST_STATE	Change indicator to the test mode
500001 8116001F43	HSCTRL_ONLINE_STATE	Change indicator to the standby mode

2.7.3 Contact health check

A health check function for BO circuits is available in the HSCTRL function; in order to the use this feature, the user should connect a BO signal to the health check function. When the health check result is true, the HSCTRL logic can determine whether the BO contact has operated successfully. If the result is not true, the HSCTRL function instructs the recording function† to register an error in the events list.

†Note: For more details, see Chapter *Recording function*.

(i) Health check for hot-mode signal

Using the logic shown in Figure 2.7-3, the hot-state signal is provided by the BO1 circuit. Thus, it is required to key the point "BO1-RB" for the setting [**HSCTRL-BORBHS**].

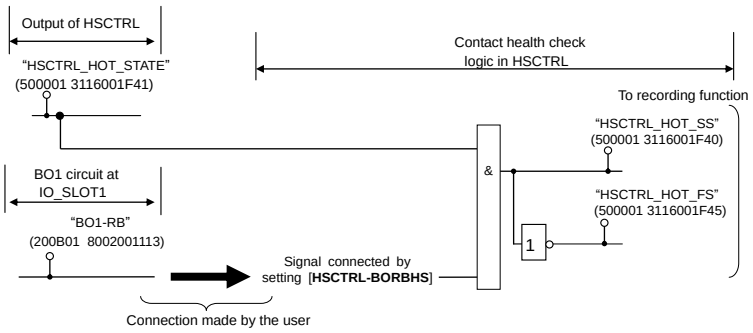


Figure 2.7-5 Example of contact health check for hot-mode

(ii) Health check for standby-mode signal

In the example shown in Figure 1.7-3, the BO2 circuit provides the standby-state signal. Thus, it is required to key the point "BO2-RB" for the setting [**HSCTRL-BORHS**].

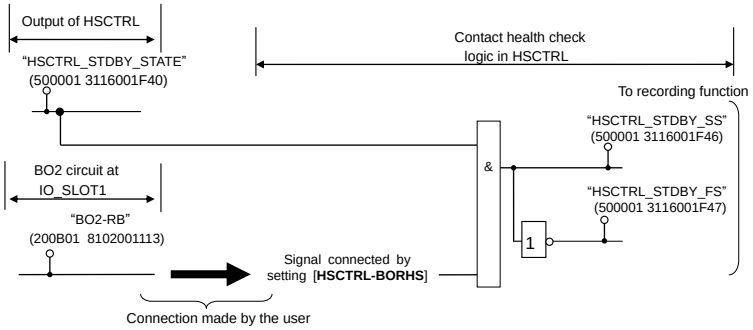


Figure 2.7-6 Example of contact health check for standby-mode

(iii) Health check for test-mode signal

The test-state signal is provided using the BO3 circuit in the example shown in Figure 2.7-4. Thus, it is required to key the point "BO3-RB" for the setting [**HSCTRL-BORBMD**].

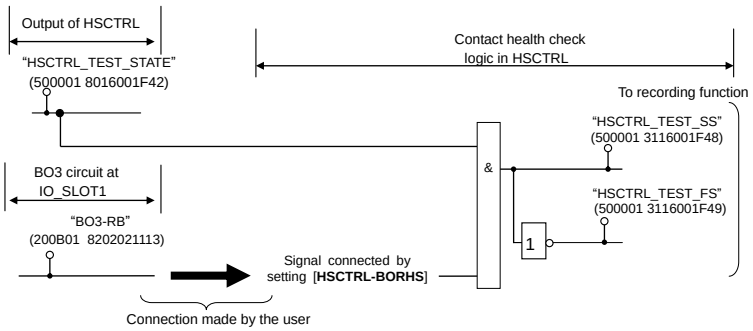


Figure 2.7-7 Example of contact health check for test-mode

(iv) Health check for online-state signal

The online-state signal is provided with the BO4 circuit in the example of Figure 2.7-4. Thus, it is required to key the point "BO4-RB" for the setting [**HSCTRL-BORMD**].

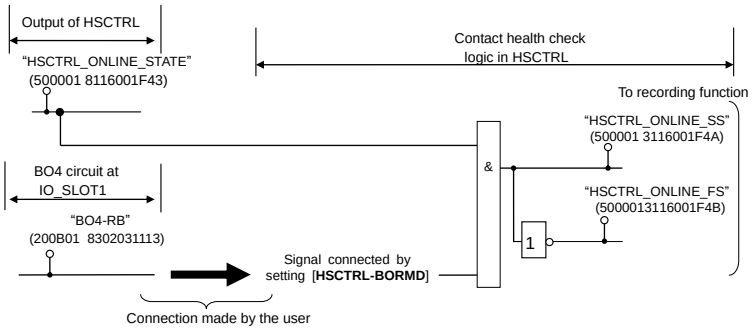


Figure 2.7-8 Example of contact health check for online-mode

(v) Signal names and numbers

Table 2.7-7 PLC monitoring points for HSCTRL health check

Signal Number	Signal Name	Description
500001 3116001F44	HSCTRL_HOT_SS	Change to hot mode successful
500001 3116001F45	HSCTRL_HOT_FS	Change to hot mode failed
500001 3116001F46	HSCTRL_STDBY_SS	Change to standby mode successful
500001 3116001F47	HSCTRL_STDBY_FS	Change to standby mode failed
500001 3116001F48	HSCTRL_TEST_SS	Change to test mode successful
500001 3116001F49	HSCTRL_TEST_FS	Change to test mode failed
500001 3116001F4A	HSCTRL_ONLINE_SS	Change to online mode successful
500001 3116001F4B	HSCTRL_ONLINE_FS	Change to online mode failed

(vi) Setting names

Table 2.7-8 Setting of HSCTRL

Setting Name	Description	Default	Setting item or value
HSCTRL-BORBHS	Acquisition of Hot-mode signal from RB-contact	none	Keying a BI point number
HSCTRL-BORHS	Acquisition of Standby-mode signal from RB-contact	none	Keying a BI point number
HSCTRL-BORBMD	Acquisition of Test-mode signal from RB-contact	none	Keying a BI point number
HSCTRL-BORMD	Acquisition of Online-mode signal from RB-contact	none	Keying a BI point number

2.7.4 Mapping for IEC61850 communication

Sending a report to the client is possible after mapping is performed for IEC61850 communication using GR-TIEMS. The user should follow steps 1 and 2 below,

Step1: Editing Logical Node

Step2: Mapping output data

(i) Editing Logical Node

The user should create a logical node (LN) for the HSCTRL function. Figure 2.7-9 exemplifies the creation of the LN; the LN "General Input/Output (GGIO)" is chosen for the HSCTRL function. After editing, the HSCTRL logical node can be saved with the name "GGIO" plus "LN Instance". Object "Alm" is defined in the HSCTRL function.

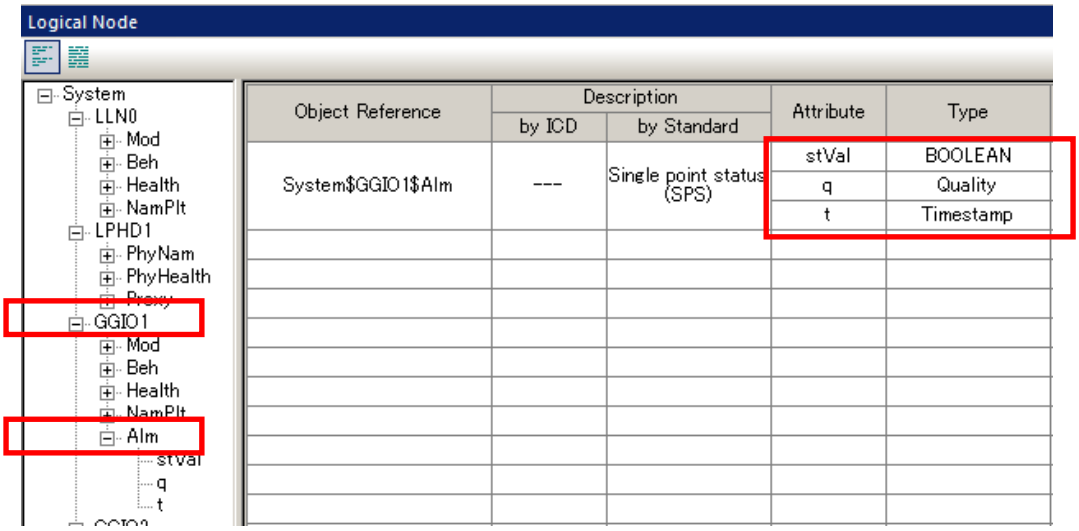


Figure 2.7-9 Defining "Alm" object in GGIO1 logic node

(ii) Mapping output data

IEC 61850 GOOSE messaging is used to send a signal to the client. The user should gather the signals corresponding to the HSCTRL function and map them to the IEC61850 communication using GR-TIEMS.

Table 2.7-9 shows the HSCTRL function signals that need to be mapped for IEC61850 communications. Figure 2.7-10 shows how to map a signal.

Table 2.7-9 Mapping signals for SPCSO object in HSCTRL function

Object_reference	Attribute	Type	FC	Signal Number	Signal Name
Ctrl/GGIO1$Alm	q	Quality	ST	500001 3116001005	HSCTRL_QUALITY
Ctrl/GGIO1$Alm	t	Timestamp	ST	500001 3116001006	HSCTRL_TIMESTAMP

Note: "Status (ST)" is defined in the function constraint (FC) of the IEC 61850 standard.

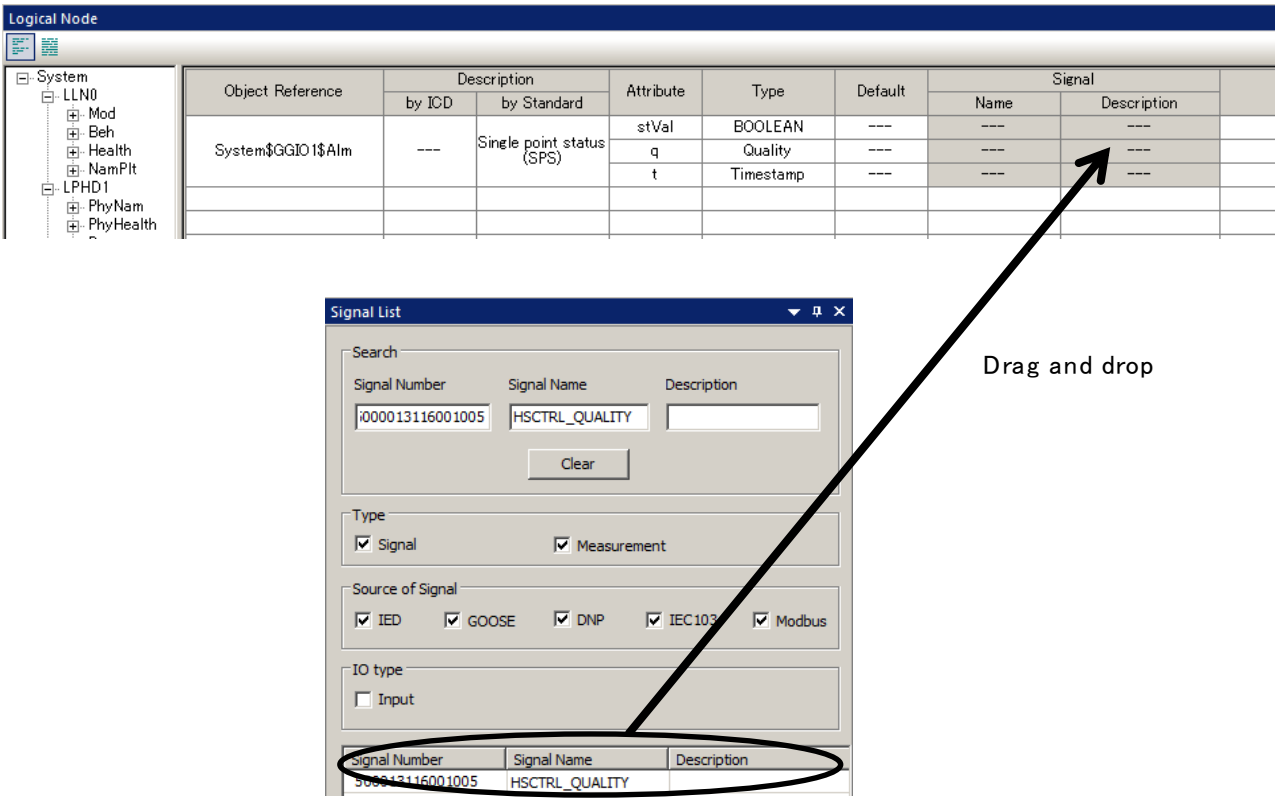


Figure 2.7-10 Quality signal being mapped into Alm object of GGIO1

2.7.5 Setting

Setting of HSCTRL (Function ID: 500001)

Setting item	Range	Units	Contents	Default setting value	Notes
HSCTRL-HNOPSG	[Keying Data ID]	–	other BCU hot signal	–	
HSCTRL-MNOPSG	[Keying Data ID]	–	other BCU test signal	–	
HSCTRL-PNOPSG	[Keying Data ID]	–	other BCU power state	–	
HSCTRL-ENOPSG	[Keying Data ID]	–	other BCU error	–	
HSCTRL-EN	Off/On	–	DEV Enable	On	
HSCTRL-PRIORITY	Standby/Hot	–	hsctrl_priority	Hot	
HSCTRL-BORBHS	[Keying Data ID]	–	hot signal BO read-back	–	
HSCTRL-BORBMD	[Keying Data ID]	–	test signal BO read-back	–	

2.8 Single position device function (SPOS)

The single position device function (SPOS) is used when the user wishes to control a device from On or Off state. When a select command is provided for the IED, the SPOS function can issue a control command if the SPOS function obtains the response from the device. The SPOS function also can accept a cancel command after issuing the selection command. In the SPOS function, issuing and receiving a command and a response are performed via a binary IO module †; hence, the user should connect the BI and BO circuits with the SPOS function. The SPOS function includes three logic groups: 1. Select logic, 2. Cancel logic, and 3. Operate logic.

Ten devices can be controlled separately, i.e. the SPOS function has separate sets of logic for control (i.e., SPOS01, SPOS02 etc. functions). For simplicity, only the SPOS01 function is discussed here; the features in the SPOS02 etc. functions are identical to the SPOS01 function.

†Note: A binary IO module has binary input circuits (BIs) and binary output circuits (BOs); the user makes the connection between the SPOS01 function and the binary IO module using a signal number (is made of a function ID and an "Element ID").The signal name and number of the SPOS01 function are listed later.

Tips: If the user wishes to apply the SPOS function quickly, go to sections 2.8.4 and 2.8.5, where setting of the BI and BO circuits and the mapping of signals for IEC 61850 communication is described.

Note: The implementation of such features is dependent upon the selection of hardware and the configuration of functions. Several IED models do not support certain features. To determine whether a particular feature has been implemented within an IED, identify the IED ordering number; and check the order number at the "G&T position" referring to the comparison table below. For more information, see *Appendix: Ordering*.

Table 2.8-1 Comparative table for respective ordering numbers

Sec.	Feature	Ordering No. at "G&T"					
		BCU			BCPU		IFU
		11	13	1F	2N	2C	19
–	Main features	✓	✓	✓	✓	✓	✓
–	Number of functions	10	10	10	10	10	10

✓: Applicable NA: Not applicable

2.8.1 Selection logic for SBO/DIR modes

The user should set scheme switch [**SPOS01-CTREN**] to **On** prior to SPOS01 operation. Table 2.8-10 shows all of the scheme switches in the SPOS function.

(i) Receiving "select command ON" from the remote-end

Figure 2.8-1 outlines the reception of the select command 'On' from the remote-end.

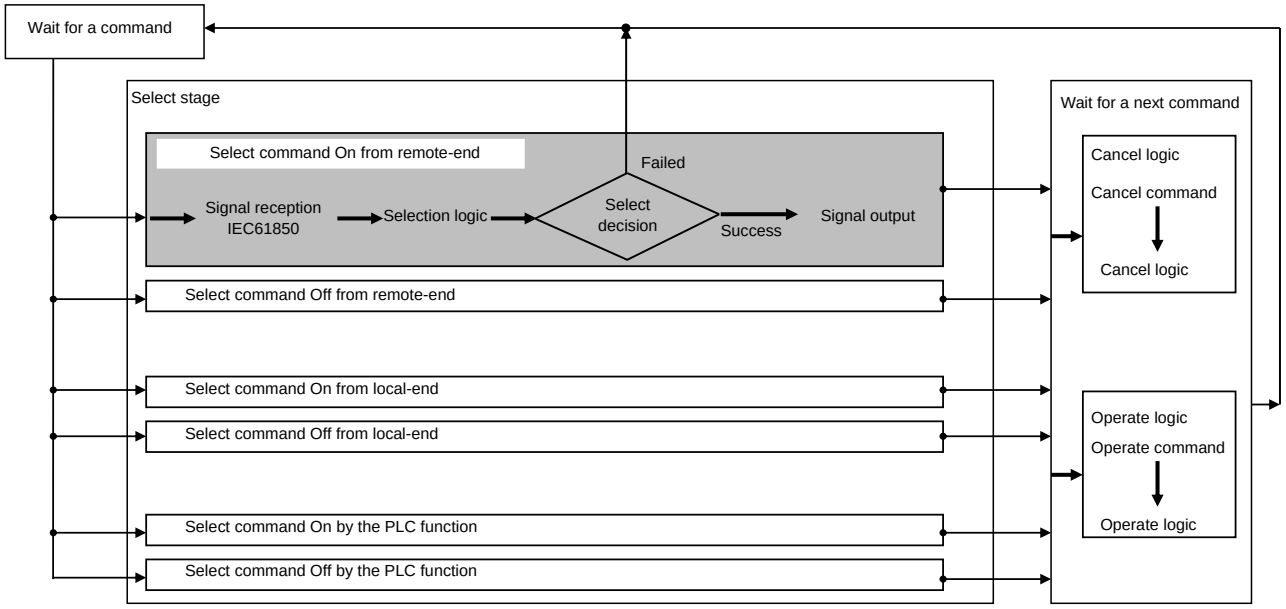


Figure 2.8-1 Outline of select command 'On'

(i)-1 Input point required mapping

Figure 2.8-2 shows the select logic when a "Select command ON (Remote-ON-Control)" signal applied to the SPOS01 function. This logic has the input-point "DEV01_CONTROL_REQ" for the reception of the selection command. That is, the input-point must be mapped for IEC 61850 communication. The function will fail to operate if mapping is not performed correctly. We will discuss how to map the input-points for IEC61850 communication in section 2.8.5.

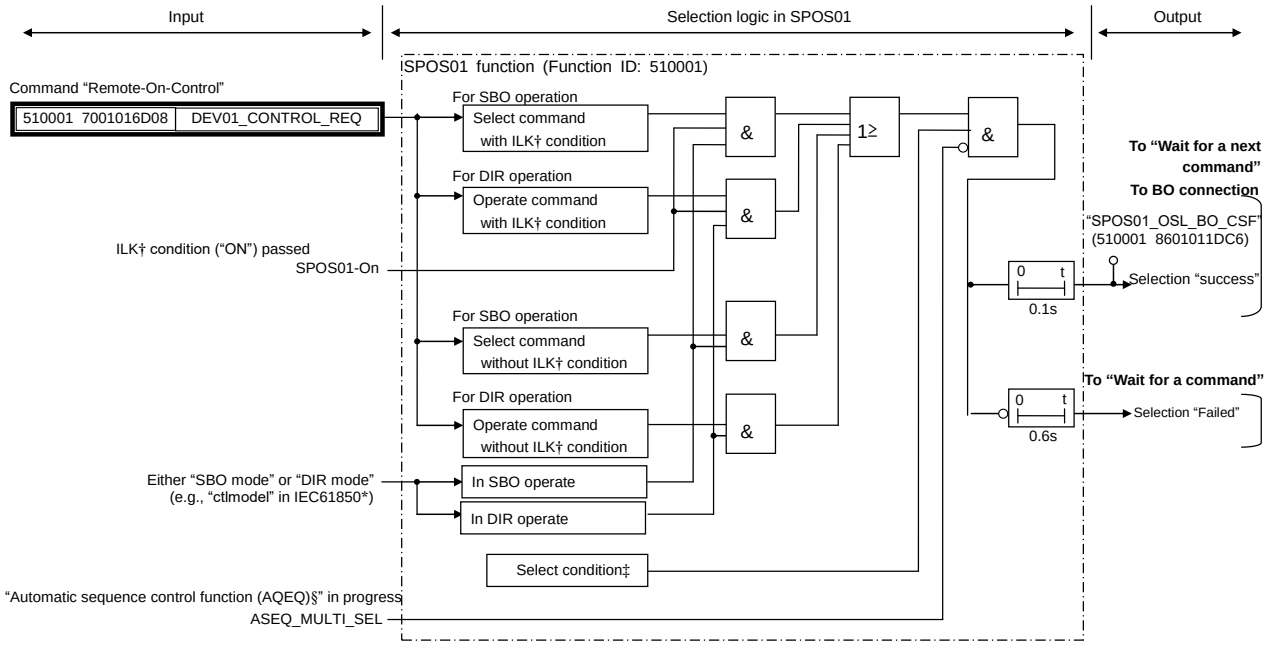


Figure 2.8-2 Select ON from the remote-end in SPOS01††

†Note: The software interlocking (ILK) function can provide the operation criteria for "On". The ILK function is discussed separately; note that the operation criteria is defined by the ILK function itself (i.e., the user cannot set the condition).

‡Note: A "select condition" signal is provided from the select condition scheme. For more information, see Figure 2.8-13.

§Note: An Automatic sequence control (ASEQ) function can provide sequential signals for automatic control. The SPOS01 operation is blocked for the ASEQ function being in the operation. For more information of the ASEQ function, see Chapter *Control and monitoring application: Automatic sequence control function*.

*Note: The SPOS01 function can run in either the "SBO mode" or the "DIR mode". The user can use a signal called "ctlmodel" when communication is implemented using IEC61850. To use this signal, the user must map it for IEC61850 communication.

††Note: To identify the input and output points of the other SPOS logics, see Table 2.8-5 and Table 2.8-9.

(i)-2 Output signal to BO

The SPOS01 function can issue an output "Selection success" signal at the output point "SPOS01_OSL_BO_CSF", when the SPOS01 function determines that the "Remote-ON-Control" signal received is true. If the SPOS01 function determines that the "Remote-ON-Control" signal is not true, the SPOS01 function returns to the "Wait for a command" stage.

(ii) Receiving “select command Off” from the remote-end

Figure 2.8-3 outlines the reception of the select command ‘Off’ from the remote- end.

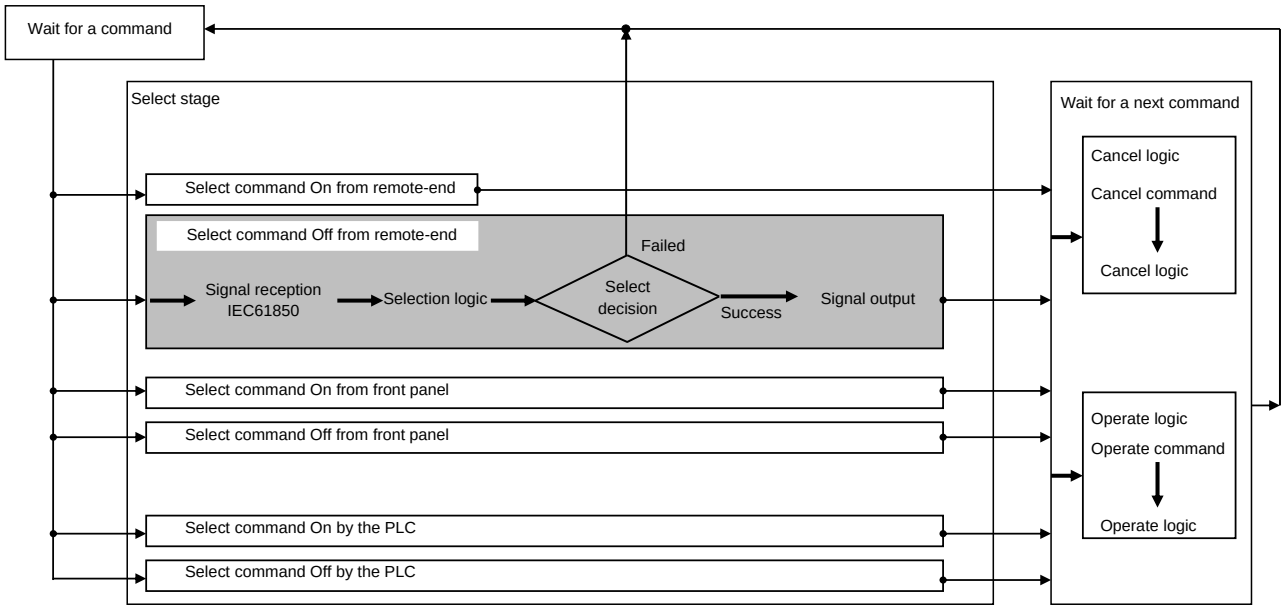


Figure 2.8-3 Outline of select command ‘Off’

(ii)-1 Input point required mapping

Figure 2.8-4 shows the select logic when a “Select command Off (Remote-OFF-Control)” signal is received at the input-point “DEV01_CONTROL_REQ”.

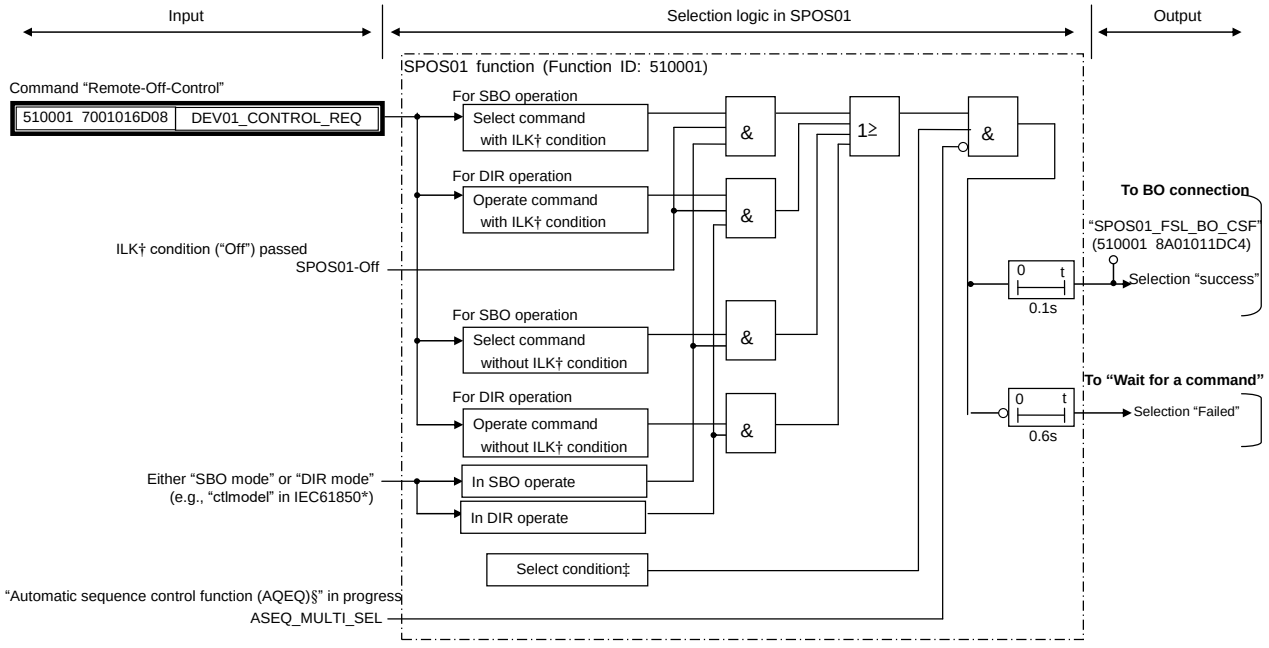


Figure 2.8-4 Select ‘OFF’ from the remote-end in SPOS01††

†Note:The ILK function provides the operation criteria for “Off”.

‡Note:The “select condition” signal is provided. See Figure 2.8-13.

††Note: To identify the input and output points of the other SPOS logics, see Table 2.8-5 and Table 2.8-9.

(ii)-2 Output signal to BO

The SPOS01 function, in Figure 2.8-4, can issue a "Select success" signal at the output point "SPOS01_FSL_BO_CSF" when the SPOS01 function determines that the "Select command Off (Remote-OFF-Control)" signal is true. If the SPOS01 function determines that the "Remote-OFF-Control" signal is not true, the SPOS01 function returns to the "Wait for a command" stage.

(iii) Receiving "Selection command On" from the local-end

Figure 2.8-5 outlines the reception of the selection command 'On' from the local-end.

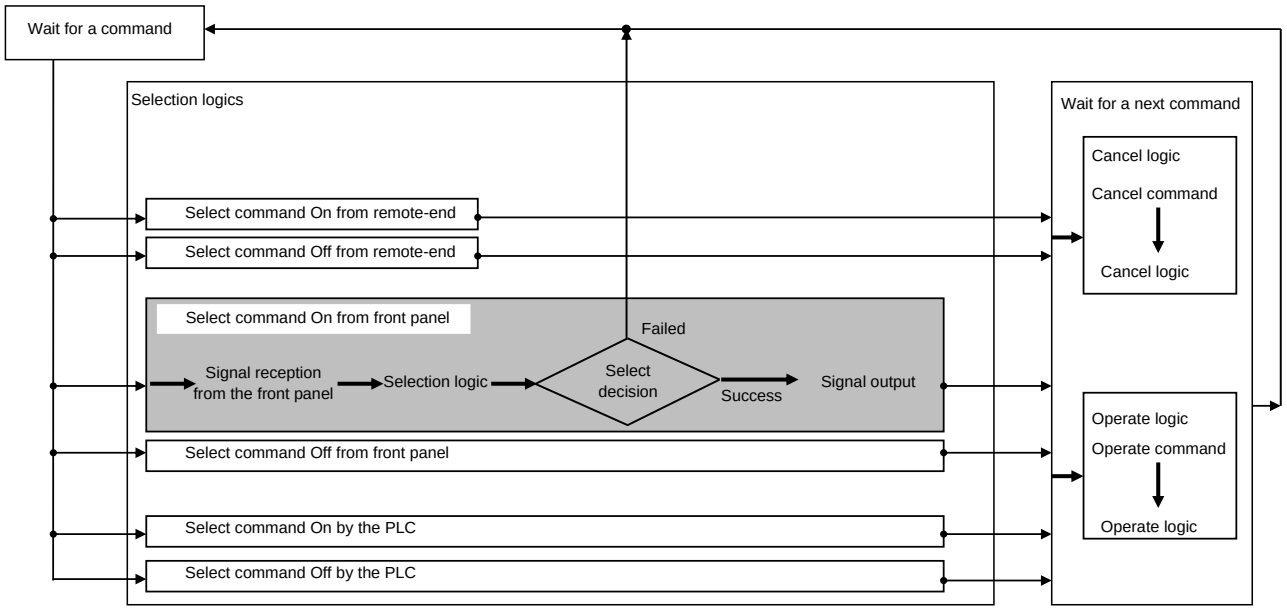


Figure 2.8-5 Outline of selection command 'On'

(iii)-1 Input signal generated at the local-end.

Figure 2.8-6 shows the select logic when a "Select command On (Local-ON-Control)" signal is applied to the SPOS01 function. The signal is provided when an "On" key is pressed on the IED front panel; the user is not required to map the signal from the IEC61850 communication. Note that the user should set the scheme switch [**SPOS01-CTRAHMI**] to **SBO** when operation from the IED front panel is required; we discuss how to set this in chapter *User interface: Control sub-menu*.

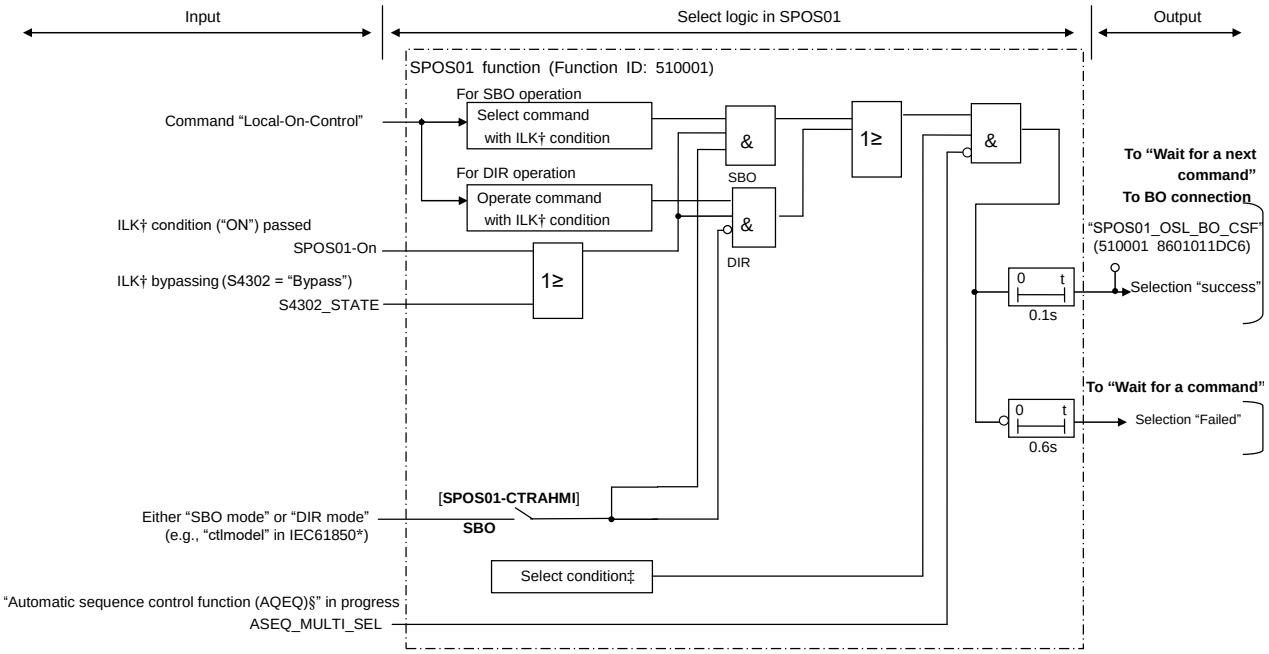


Figure 2.8-6 Select 'On' on the front panel in SPOS01††

†Note: The ILK function provides the operation criteria for "On". For testing, nullifying the ILK function is possible using "Interlock bypassing". "Interlock bypassing" is indicated by the status "S4302" in a software switch controller (SOFTSW).

‡Note: A "select condition" signal is provided from the select condition scheme. For more information, see Figure 2.8-13.

§Note: An Automatic sequence control (ASEQ) function can provide sequential signals for automatic control. The SPOS01 operation is blocked for the ASEQ function when it is in operation. For more information regarding the ASEQ function, see Chapter *Control and monitoring application: Automatic sequence control function*.

††Note: To identify the output signals of the other SPOS logic, see Table 2.8-9.

(iii)-2 Output signal to BO

When the "select condition" signal is true, the SPOS01 function can issue a "Selection success" signal at the output-point "SPOS01_OSL_BO_CSF".

Note: The signal "SPOS01_OSL_BO_CSF" is the same as the signal shown in Figure 2.8-2. If the "Local-ON-Control" signal is not true, the SPOS01 function returns to the "Wait for a command" stage.

(iv) Receiving "Select command Off" from the local-end

Figure 2.8-7 outlines the reception of the select command 'Off' from the local-end.

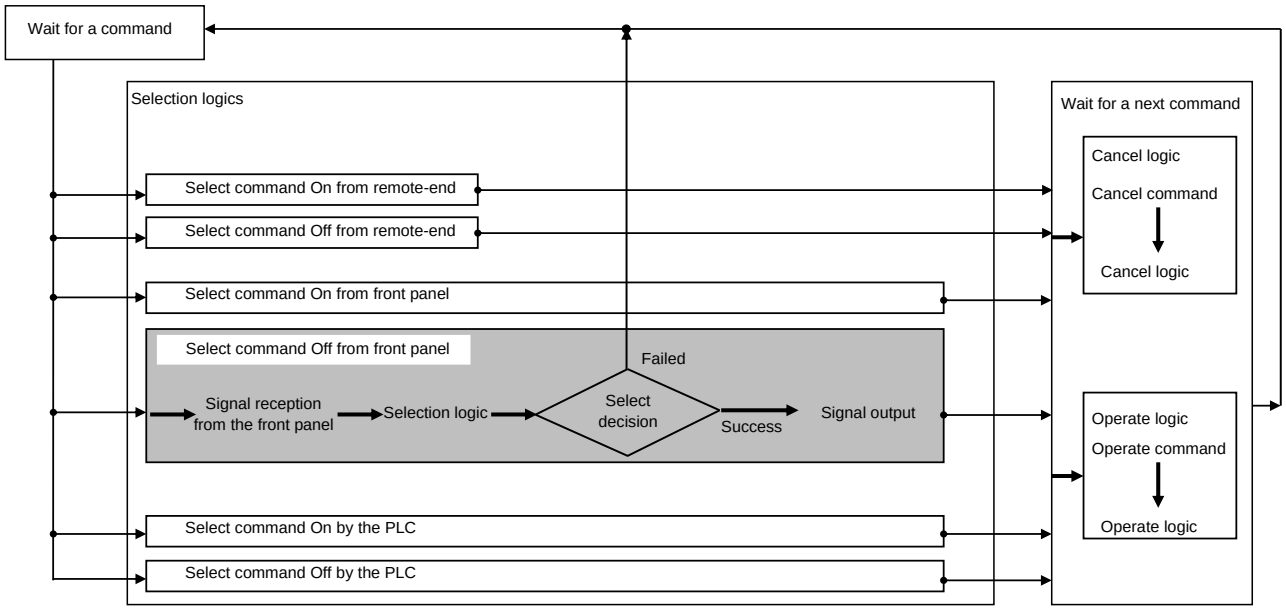


Figure 2.8-7 Outline of select command 'Off'

(iv)-1 Input signal generated at the local-end.

Figure 2.8-8 shows the select logic when a "Select command Off (Local-OFF-Control)" signal is applied to the SPOS01 function. The signal is provided when the user presses a "OFF" key on the IED front panel; the user is not required to map the signal from IEC61850 communication.

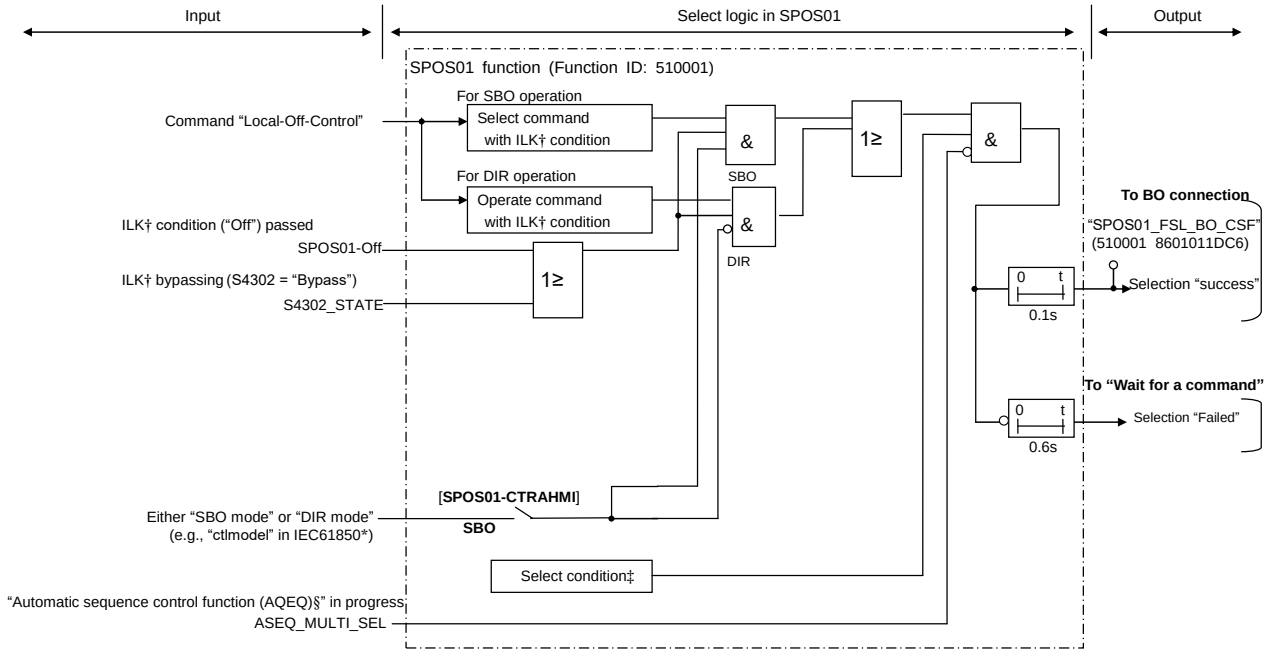


Figure 2.8-8 Select 'Off' on the front panel in SPOS01††

‡Note:A "select condition" signal is provided from the select condition scheme. For more information, see Figure 2.8-13.

§Note:An Automatic sequence control (ASEQ) function can provide sequential signals for

automatic control. The SPOS01 operation is blocked for the ASEQ function when it is in operation. For more information regarding the ASEQ function, see Chapter *Control and monitoring application: Automatic sequence control function*.

††Note: To identify the output signals of the other SPOS logics, see Table 2.8-9.

(iv)-2 Output signal to BO

When the "select condition" signal is true, the SPOS01 function can issue a "Selection success" signal at the output-point "SPOS01_FSL_BO_CSF".

[1]Note: The signal "SPOS01_FSL_BO_CSF" is the same as the signal shown in Figure 2.8-4. If the "Local-OFF-Control" signal is not true, the SPOS01 function returns to the "Wait for a command" stage.

(v) Receiving "Selection command for ON" by PLC function

Figure 2.8-9 outlines the reception of the select command 'On' by the PLC function.

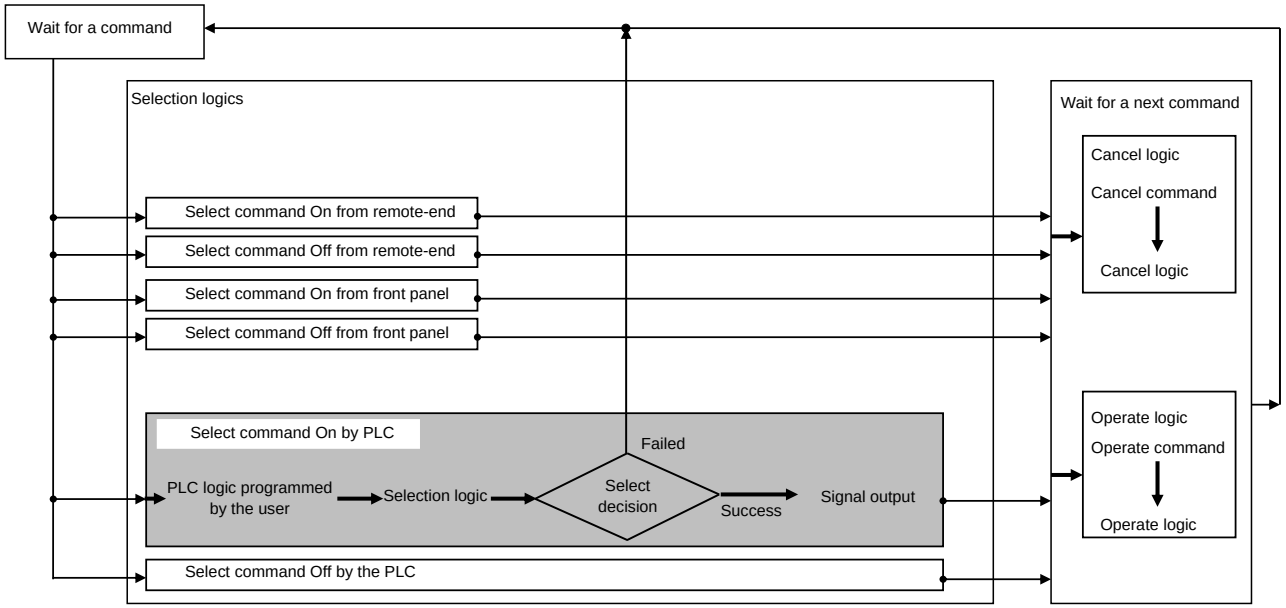


Figure 2.8-9 Outline of select command 'On'

(v)-1 Input signal required from the PLC function.

Figure 2.8-10 shows the select logic when a "Select command On (PLC-ON-Control)" signal is generated by the PLC function. There are two input points for reception of this signal: The former connection point (PLC#1) is used for the reception of the select-command requiring the interlock check, the latter connection point (PLC#2) is used for the reception of the select-command not requiring the interlock check. That is, for the SPOS01 function, when the "select command 'On' (PLC-On-Control) signal generated in the user-programmed logic is applied, and when the interlock check is required in the select logic, use the connection point (PLC#1;e.g.,PLC-BIT_0014). Alternatively, if the interlock check is not required, use the connection point (PLC#2); e.g., PLC_BIT_0013". PLC#1 and PLC#2 are shown in Table 2.8-2.

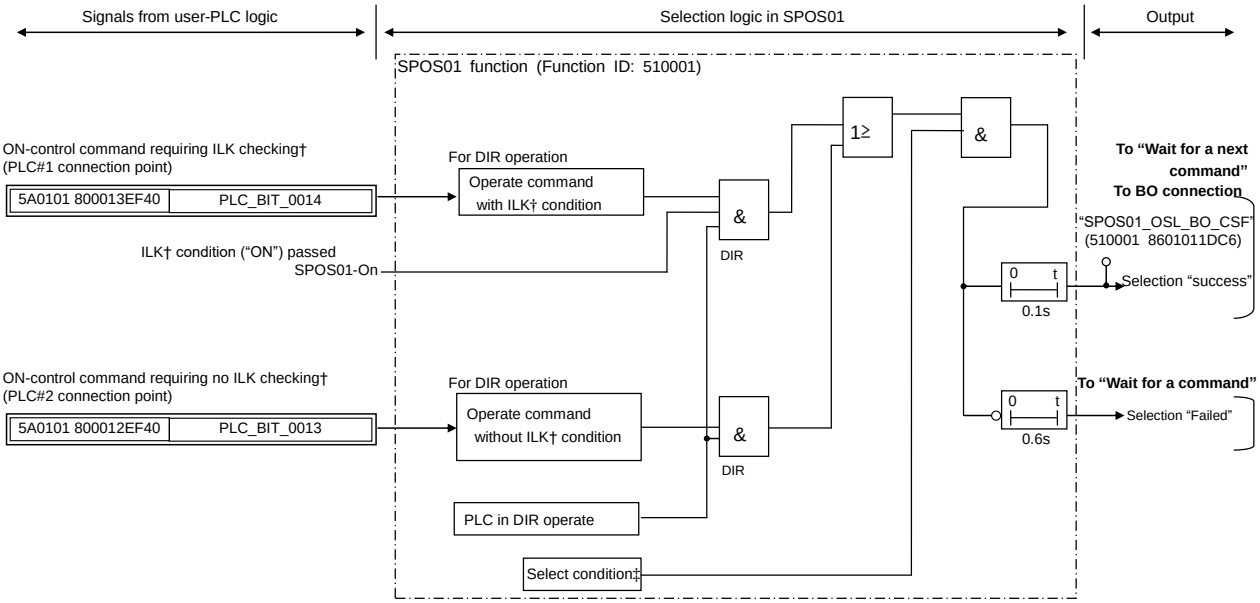


Figure 2.8-10 Select 'On' using the PLC function in SPOS01††

††Note: To identify the input and output signals of the other SPOS logics, see Table 2.8-2 and Table 2.8-9.

†Note: The software interlocking (ILK) function can provide the operation criteria for "On". The ILK function is discussed separately; note that the operation criteria is defined in the ILK function itself (i.e., the user cannot set the condition).

‡Note: A "select condition" signal is provided from the select condition scheme. For more information, see Figure 2.8-13.

(v)-2 Output signal to BO

The SPOS01 function, in Figure 2.8-10, can issue a "Select success" signal at the output-point "SPOS01_OSL_BO_CSF"[1].

[1]Note: The signal "SPOS01_OSL_BO_CSF" is the same as that shown in Figure 2.8-2.

(vi) Receiving "Select command Off" by PLC function

Figure 2.8-9 outlines the reception of the select command 'Off' by the PLC function.

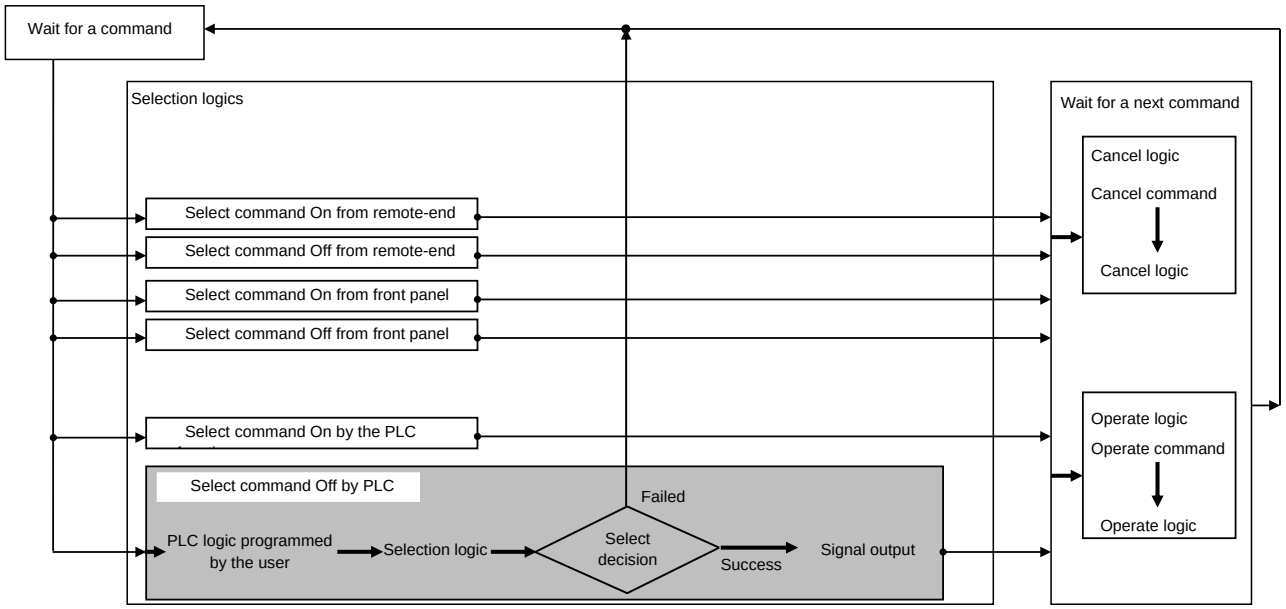


Figure 2.8-11 Outline of select command 'Off'

(vi)-1 Input signal from the PLC function

Figure 2.8-12 shows the select logic when a "Select command Off (PLC-OFF-Control)" signal is generated by the PLC function. There are two input points for the reception of this signal, like in the signal "Select command On (PLC-On-Control)" where four are available. That is, if interlock checking is required, use the connection point (PLC#1:e.g., PLC_BIT_0012). Alternatively, if the interlock-check is not required, use the connection point (PLC#2; e.g., PLC_BIT_0011). PLC#1 and PLC#2 is shown Table 2.8-3.

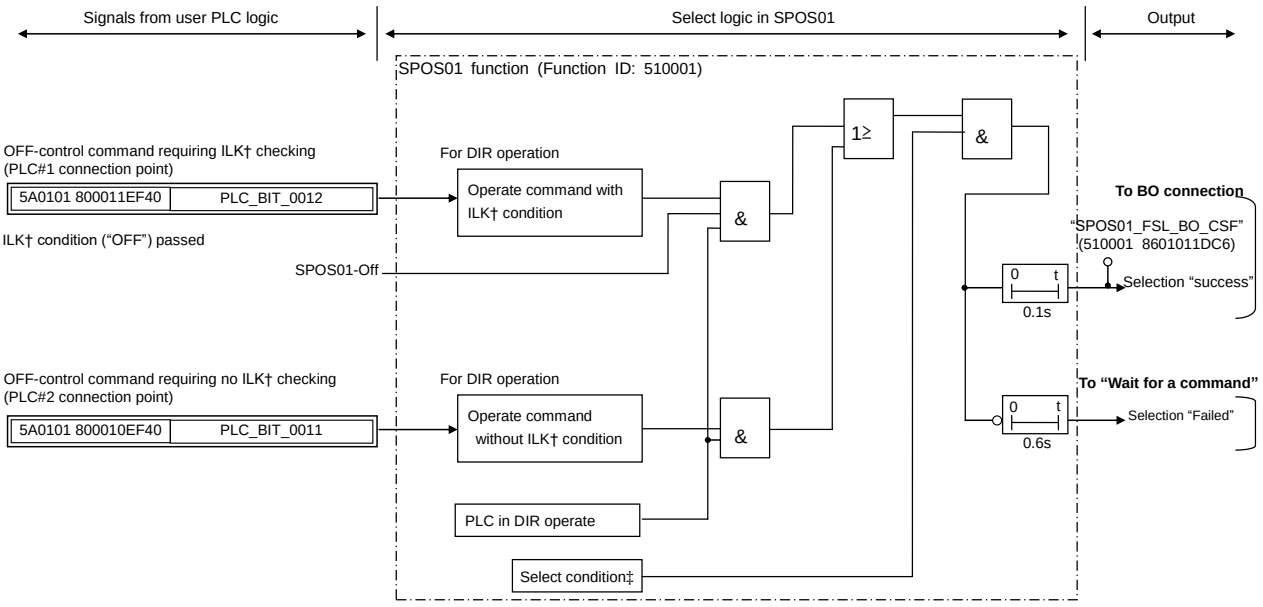


Figure 2.8-12 Selection logic for 'Off' by PLC in SPOS01††

††Note: To identify the input and output points of the other SPOS logic, see Table 2.8-3 for the input (PLC#1 and PLC#2) and Table 2.8-9 for the outputs.

(vi)-2 Output signal to BO

The SPOS01 function, in Figure 2.8-12, can issue a "Select success" signal at the output point "SPOS01_FSL_BO_CSF"[1].

[1]Note: The output point "SPOS01_FSL_BO_CSF" is the same signal as shown in Figure 2.8-4.

(vii) Select condition

Figure 2.8-13 shows the select condition logic in the SPOS01 function. The SPOS01 function checks the condition for the select command using the signal "SPOS1_STATE" (Table 2.8-25). If the original logic does not meet with the requirements of the user, the following alternatives are available:

1. The user can replace the original logic with alternative logic.
2. The user can add additional logic to the original logic.

(vii)-1 How to add another select condition signal

If adding another condition is required, the user can add a signal to the select condition logic using the PLC connection point "User Additional condition".

1. Add a user-preferred signal using PLC_BIT_0053, which is listed as PLC#1 in Table 2.8-7.
2. Set the scheme switch [**SPOS01-LGSLFFCT**] to **Fixed logic**.

(vii)-2 How to replace the original logic

If the user wishes to replace the select condition logic completely, the user can replace it using the PLC connection point "User configurable condition".

1. Connect the user-customized logic using PLC_BIT_0052, which is listed as PLC#2 in Table 2.8-7.
2. Set the scheme switch [**SPOS01-LGSLFFCT**] to **PLC**.

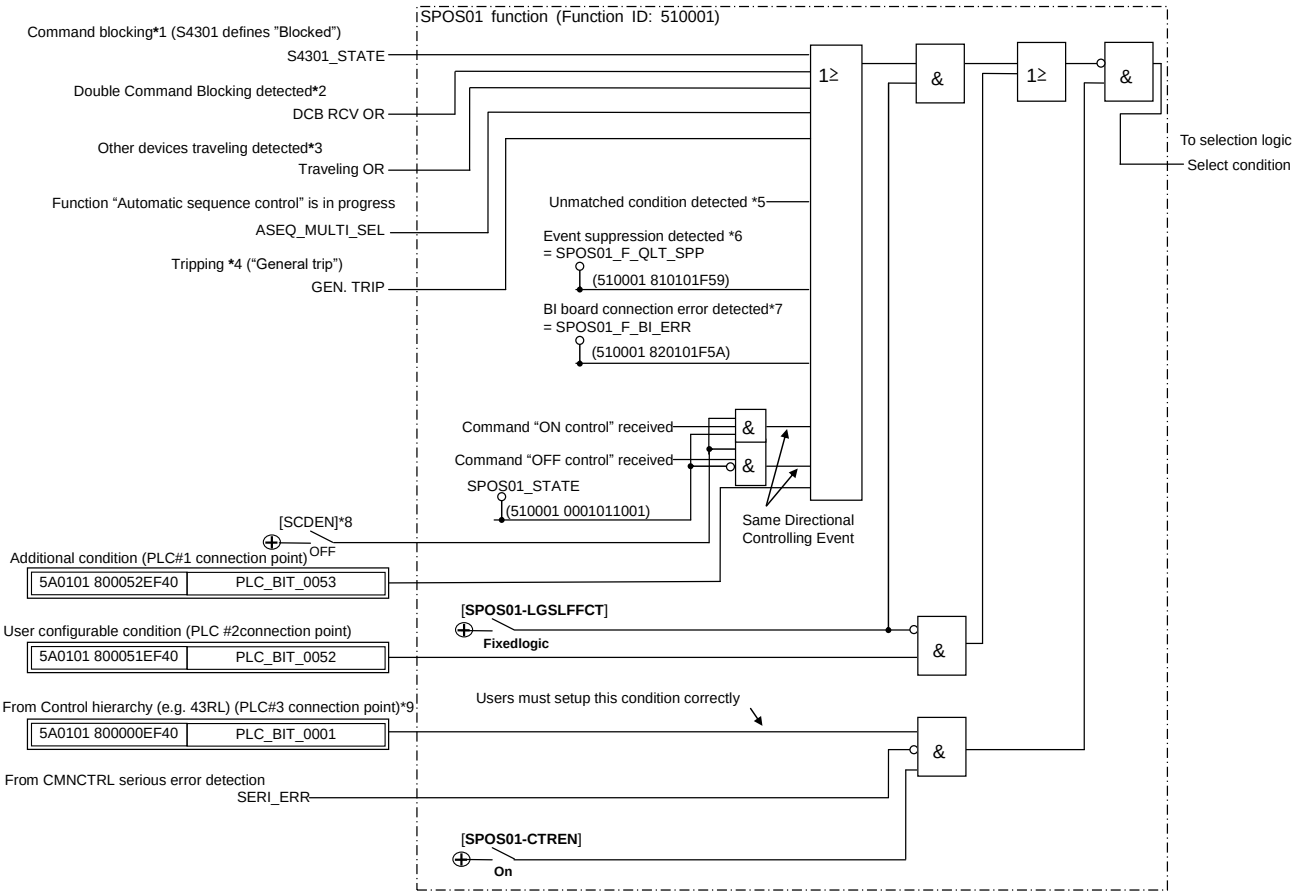


Figure 2.8-13 Select condition logic for ON/OFF in SPOS01*10

[1]Note: "Command blocking" disables any operation except its own; the "Command blocking" is initiated by the status of "S4301" in a software switch controller (SOFTSW).The IEC 61850 standard defines command blocking as "CmdBlk". For more information on "S4301", see Chapter *Control and monitoring application: Software switch controller. See the signal "S4301_STAEE of* Table 2.8-6.

[2]Note: "Double Command Blocking (DCB)" is an operation philosophy. It can be used to protect the substation. The user can program it using GR-TIEMS.

[3]Note: If the event "device-travelling is detected, it indicates that another operator is changing the statuses of a device. Thus, the IED should inhibit the operation of any device for the duration that the event is detected. The detecting signal is donated as "Travelling OR" in Table 2.8-6.

[4]Note: If the issue of a trip command is executed by the IED, any control operation is blocked until the trip operation is completed. If an IED includes a relay application, the trip command is issued at the output point "GEN_TRIP" in Table 2.8-6.

[5]Note: Criteria "unmatched conditions" are decided when "Test-bit status" in a command is not identical to "IED test status".

[6]Note: The "Event suppression" function can detect chattering on BI circuits. (See section 2.8.4(i)-2)

[7]Note: A supervision of the Binary IO module can detect connection errors for BI circuits.

[8]Note: The common control (CMNCTRL) function can test and check the 'On' and 'Off" operations performed by the logic. When the user sets **Off** for scheme switch (SCDEN), the operation of the logic is blocked if the logic is running in the same operation- direction compared with the previous operation direction. (i.e., when On (Off) is performed sequentially). On the other hand, if **On** is set for the scheme switch, the logic is not blocked.

[9]Note: The user will need to program the PLC logic "Control hierarchy condition" The user is also required to connect the logic condition with the select condition logic using the connection point "PLC_BIT_0001". For more information, *see chapter "Control and monitoring application: Control hierarchy" see PLC#3 of Table 2.8-7.*

[10]Note: To identify the input point of the other SPOS, see Table 2.8-7 for PLC#1 and PLC#2.

(viii) Signal name and number

Note: The user should note the following descriptions shown in the column "M/O" for each table:

"O" indicates that the signal is provided for optional use.

"M" indicates that the user should map/set/configure the signal; otherwise, the user may experience an operational failure if the default settings are used.

"N/A" indicates that the user cannot change the state of the signal.

Table 2.8-2 PLC connection points (Input points for command 'On')

Signal Number	Signal Name	Description	M/O
5A0101 800013EF40	PLC_BIT_0014	SPOS1 PLC On-control checking with interlock	O
5A0101 800012EF40	PLC_BIT_0013	SPOS1 PLC On-control without checking	O
5A0101 800017EF40	PLC_BIT_0018	SPOS2 PLC On-control checking with interlock	O
5A0101 800016EF40	PLC_BIT_0017	SPOS2 PLC On-control without checking	O
5A0101 800021EF40	PLC_BIT_0022	SPOS3 PLC On-control checking with interlock	O
5A0101 800020EF40	PLC_BIT_0021	SPOS3 PLC On-control without checking	O
5A0101 800025EF40	PLC_BIT_0026	SPOS4 PLC On-control checking with interlock	O
5A0101 800024EF40	PLC_BIT_0025	SPOS4 PLC On-control without checking	O
5A0101 800029EF40	PLC_BIT_0030	SPOS5 PLC On-control checking with interlock	O
5A0101 800028EF40	PLC_BIT_0029	SPOS5 PLC On-control without checking	O
5A0101 800033EF40	PLC_BIT_0034	SPOS6 PLC On-control checking with interlock	O
5A0101 800032EF40	PLC_BIT_0033	SPOS6 PLC On-control without checking	O
5A0101 800037EF40	PLC_BIT_0038	SPOS7 PLC On-control checking with interlock	O
5A0101 800036EF40	PLC_BIT_0037	SPOS7 PLC On-control without checking	O
5A0101 800041EF40	PLC_BIT_0042	SPOS8 PLC On-control checking with interlock	O
5A0101 800040EF40	PLC_BIT_0041	SPOS8 PLC On-control without checking	O
5A0101 800045EF40	PLC_BIT_0046	SPOS9 PLC On-control checking with interlock	O
5A0101 800044EF40	PLC_BIT_0045	SPOS9 PLC On-control without checking	O
5A0101 800049EF40	PLC_BIT_0050	SPOS10 PLC On-control checking with interlock	O
5A0101 800048EF40	PLC_BIT_0049	SPOS10 PLC On-control without checking	O

Table 2.8-3 PLC connection points (Input points for command 'Off')

Signal Number	Signal Name	Description	M/O
5A0101 800011EF40	PLC_BIT_0012	SPOS1 PLC Off-control checking with interlock	O
5A0101 800010EF40	PLC_BIT_0011	SPOS1 PLC Off-control without checking	O
5A0101 800015EF40	PLC_BIT_0016	SPOS2 PLC Off-control checking with interlock	O
5A0101 800014EF40	PLC_BIT_0015	SPOS2 PLC Off-control without checking	O
5A0101 800019EF40	PLC_BIT_0020	SPOS3 PLC Off-control checking with interlock	O
5A0101 800018EF40	PLC_BIT_0019	SPOS3 PLC Off-control without checking	O
5A0101 800023EF40	PLC_BIT_0024	SPOS4 PLC Off-control checking with interlock	O
5A0101 800022EF40	PLC_BIT_0023	SPOS4 PLC Off-control without checking	O
5A0101 800027EF40	PLC_BIT_0028	SPOS5 PLC Off-control checking with interlock	O
5A0101 800026EF40	PLC_BIT_0027	SPOS5 PLC Off-control without checking	O
5A0101 800031EF40	PLC_BIT_0032	SPOS6 PLC Off-control checking with interlock	O
5A0101 800030EF40	PLC_BIT_0031	SPOS6 PLC Off-control without checking	O
5A0101 800035EF40	PLC_BIT_0036	SPOS7 PLC Off-control checking with interlock	O
5A0101 800034EF40	PLC_BIT_0035	SPOS7 PLC Off-control without checking	O
5A0101 800039EF40	PLC_BIT_0040	SPOS8 PLC Off-control checking with interlock	O
5A0101 800038EF40	PLC_BIT_0039	SPOS8 PLC Off-control without checking	O
5A0101 800043EF40	PLC_BIT_0044	SPOS9 PLC Off-control checking with interlock	O
5A0101 800042EF40	PLC_BIT_0043	SPOS9 PLC Off-control without checking	O
5A0101 800047EF40	PLC_BIT_0048	SPOS10 PLC Off-control checking with interlock	O
5A0101 800046EF40	PLC_BIT_0047	SPOS10 PLC Off-control without checking	O

Table 2.8-4 PLC connection points (Interlock for command 'On/Off')

Signal Number	Signal Name	Description	M/O
570001 3101011DA0	SPOS01-Off	SPOS1 interlock condition for Off control.	N/A
570001 3101021DA0	SPOS02-Off	SPOS2 interlock condition for Off control.	N/A
570001 3101031DA0	SPOS03-Off	SPOS3 interlock condition for Off control.	N/A
570001 3101041DA0	SPOS04-Off	SPOS4 interlock condition for Off control.	N/A
570001 3101051DA0	SPOS05-Off	SPOS5 interlock condition for Off control.	N/A
570001 3101061DA0	SPOS06-Off	SPOS6 interlock condition for Off control.	N/A
570001 3101071DA0	SPOS07-Off	SPOS7 interlock condition for Off control.	N/A
570001 3101081DA0	SPOS08-Off	SPOS8 interlock condition for Off control.	N/A
570001 3101091DA0	SPOS09-Off	SPOS9 interlock condition for Off control.	N/A
570001 31010A1DA0	SPOS010-Off	SPOS10 interlock condition for Off control.	N/A
570001 3101011DA2	SPOS01-On	SPOS1 interlock condition for On control.	N/A
570001 3101011DA2	SPOS02-On	SPOS2 interlock condition for On control.	N/A
570001 3101011DA2	SPOS03-On	SPOS3 interlock condition for On control.	N/A
570001 3101011DA2	SPOS04-On	SPOS4 interlock condition for On control.	N/A
570001 3101011DA2	SPOS05-On	SPOS5 interlock condition for On control.	N/A
570001 3101011DA2	SPOS06-On	SPOS6 interlock condition for On control.	N/A
570001 3101011DA2	SPOS07-On	SPOS7 interlock condition for On control.	N/A
570001 3101011DA2	SPOS08-On	SPOS8 interlock condition for On control.	N/A
570001 3101011DA2	SPOS09-On	SPOS9 interlock condition for On control.	N/A
570001 3101011DA2	SPOS10-On	SPOS10 interlock condition for On control.	N/A

Table 2.8-5 Mapping points for the reception of control commands

Signal Number	Signal Name	Description	M/O
510001 7001016D08	DEV01_CONTROL_REQ	SPOS1 control command received. (Mapping Data)	M
510001 7001026D08	DEV02_CONTROL_REQ	SPOS2 control command received. (Mapping Data)	M
510001 7001036D08	DEV03_CONTROL_REQ	SPOS3 control command received. (Mapping Data)	M

Signal Number	Signal Name	Description	M/O
510001 7001046D08	DEV04_CONTROL_REQ	SPOS4 control command received. (Mapping Data)	M
510001 7001056D08	DEV05_CONTROL_REQ	SPOS5 control command received. (Mapping Data)	M
510001 7001066D08	DEV06_CONTROL_REQ	SPOS6 control command received. (Mapping Data)	M
510001 7001076D08	DEV07_CONTROL_REQ	SPOS7 control command received. (Mapping Data)	M
510001 7001086D08	DEV08_CONTROL_REQ	SPOS8 control command received. (Mapping Data)	M
510001 7001096D08	DEV09_CONTROL_REQ	SPOS9 control command received. (Mapping Data)	M
510001 70010A6D08	DEV10_CONTROL_REQ	SPOS10 control command received. (Mapping Data)	M

Table 2.8-6 Input signals to condition logic

Signal Number	Signal Name	Description	M/O
522001 000A011001	S4301_STATE	Command Blocking status (Off / Blocked)	N/A
522001 000A021001	S4302_STATE	Interlock bypassing status(On / Bypass)	N/A
523001 000D001F40	ASEQ_MULTI_SEL	Automatic sequence control is in progress.	N/A
5A0001 0008001F41	DCB RCV OR	Double Command Blocking(DCB) is in progress.	N/A
5A0001 0008001F40	Traveling OR	Travelling events are detected.	N/A
4A0001 8300001B6F	GEN. TRIP	General trip	N/A
5A0001 3108003F40	SDCEN	(This is setting of CMNCTRL)	N/A
5A0101 3100001F43	SERI_ERR	Serious Error detected	N/A
523001 000D001F40	ASEQ_MULTI_SEL	Automatic sequence control is in progress.	N/A

Table 2.8-7 PLC connection points (Input signal for select condition logic)

Signal Number	Signal Name	Description	M/O
5A0101 800052EF40	PLC_BIT_0053	SPOS1 additional failure condition (PLC#1)	O
5A0101 800067EF40	PLC_BIT_0068	SPOS2 additional failure condition (PLC#1)	O
5A0101 800082EF40	PLC_BIT_0083	SPOS3 additional failure condition (PLC#1)	O
5A0101 800097EF40	PLC_BIT_0098	SPOS4 additional failure condition (PLC#1)	O
5A0101 800112EF40	PLC_BIT_0113	SPOS5 additional failure condition (PLC#1)	O
5A0101 800127EF40	PLC_BIT_0128	SPOS6 additional failure condition (PLC#1)	O
5A0101 800142EF40	PLC_BIT_0143	SPOS7 additional failure condition (PLC#1)	O
5A0101 800157EF40	PLC_BIT_0158	SPOS8 additional failure condition (PLC#1)	O
5A0101 800172EF40	PLC_BIT_0173	SPOS9 additional failure condition (PLC#1)	O
5A0101 800187EF40	PLC_BIT_0188	SPOS10 additional failure condition (PLC#1)	O
5A0101 800051EF40	PLC_BIT_0052	SPOS1 user configurable select condition (PLC#2)	O
5A0101 800066EF40	PLC_BIT_0067	SPOS2 user configurable select condition (PLC#2)	O
5A0101 800081EF40	PLC_BIT_0082	SPOS3 user configurable select condition (PLC#2)	O
5A0101 800096EF40	PLC_BIT_0097	SPOS4 user configurable select condition (PLC#2)	O
5A0101 800111EF40	PLC_BIT_0112	SPOS5 user configurable select condition (PLC#2)	O
5A0101 800126EF40	PLC_BIT_0127	SPOS6 user configurable select condition (PLC#2)	O
5A0101 800141EF40	PLC_BIT_0142	SPOS7 user configurable select condition (PLC#2)	O
5A0101 800156EF40	PLC_BIT_0157	SPOS8 user configurable select condition (PLC#2)	O
5A0101 800171EF40	PLC_BIT_0172	SPOS9 user configurable select condition (PLC#2)	O
5A0101 800186EF40	PLC_BIT_0187	SPOS10 user configurable select condition (PLC#2)	O
5A0101 800000EF40	PLC_BIT_0001	SPOS1 control hierarchy condition (PLC#3)	M
5A0101 800001EF40	PLC_BIT_0002	SPOS2 control hierarchy condition (PLC#3)	M
5A0101 800002EF40	PLC_BIT_0003	SPOS3 control hierarchy condition (PLC#3)	M
5A0101 800003EF40	PLC_BIT_0004	SPOS4 control hierarchy condition (PLC#3)	M
5A0101 800004EF40	PLC_BIT_0005	SPOS5 control hierarchy condition (PLC#3)	M
5A0101 800005EF40	PLC_BIT_0006	SPOS6 control hierarchy condition (PLC#3)	M
5A0101 800006EF40	PLC_BIT_0007	SPOS7 control hierarchy condition (PLC#3)	M
5A0101 800007EF40	PLC_BIT_0008	SPOS8 control hierarchy condition (PLC#3)	M
5A0101 800008EF40	PLC_BIT_0009	SPOS9 control hierarchy condition (PLC#3)	M
5A0101 800009EF40	PLC_BIT_0010	SPOS10 control hierarchy condition (PLC#3)	M

Table 2.8-8 PLC monitoring points (Output signal for select condition logic)

Signal Number	Signal Name	Description
510001 8001011F54	SPOS01_SC_ST_ERR	SPOS01 select command mode is invalid.
510001 8001021F54	SPOS02_SC_ST_ERR	SPOS01 select command mode is invalid.
510001 8001031F54	SPOS03_SC_ST_ERR	SPOS01 select command mode is invalid.
510001 8001041F54	SPOS04_SC_ST_ERR	SPOS01 select command mode is invalid.
510001 8001051F54	SPOS05_SC_ST_ERR	SPOS01 select command mode is invalid.
510001 8001061F54	SPOS06_SC_ST_ERR	SPOS01 select command mode is invalid.
510001 8001071F54	SPOS07_SC_ST_ERR	SPOS01 select command mode is invalid.
510001 8001081F54	SPOS08_SC_ST_ERR	SPOS01 select command mode is invalid.
510001 8001091F54	SPOS09_SC_ST_ERR	SPOS01 select command mode is invalid.
510001 80010A1F54	SPOS10_SC_ST_ERR	SPOS01 select command mode is invalid.
510001 8101011F59	SPOS01_F_QLT_SPP	Event suppression detected (SPOS01)
510001 8101021F59	SPOS02_F_QLT_SPP	Event suppression detected (SPOS02)
510001 8101031F59	SPOS03_F_QLT_SPP	Event suppression detected (SPOS03)
510001 8101041F59	SPOS04_F_QLT_SPP	Event suppression detected (SPOS04)
510001 8101051F59	SPOS05_F_QLT_SPP	Event suppression detected (SPOS05)
510001 8101061F59	SPOS06_F_QLT_SPP	Event suppression detected (SPOS06)
510001 8101071F59	SPOS07_F_QLT_SPP	Event suppression detected (SPOS07)
510001 8101081F59	SPOS08_F_QLT_SPP	Event suppression detected (SPOS08)
510001 8101091F59	SPOS09_F_QLT_SPP	Event suppression detected (SPOS09)
510001 81010A1F59	SPOS10_F_QLT_SPP	Event suppression detected (SPOS10)
510001 8201011F5A	SPOS01_F_BI_ERR	BI connection error detected(SPOS01)
510001 8201021F5A	SPOS02_F_BI_ERR	BI connection error detected(SPOS02)
510001 8201031F5A	SPOS03_F_BI_ERR	BI connection error detected(SPOS03)
510001 8201041F5A	SPOS04_F_BI_ERR	BI connection error detected(SPOS04)
510001 8201051F5A	SPOS05_F_BI_ERR	BI connection error detected(SPOS05)
510001 8201061F5A	SPOS06_F_BI_ERR	BI connection error detected(SPOS06)
510001 8201071F5A	SPOS07_F_BI_ERR	BI connection error detected(SPOS07)
510001 8201081F5A	SPOS08_F_BI_ERR	BI connection error detected(SPOS08)
510001 8201091F5A	SPOS09_F_BI_ERR	BI connection error detected(SPOS09)
510001 82010A1F5A	SPOS10_F_BI_ERR	BI connection error detected(SPOS10)

Table 2.8-9 PLC monitoring points (On/Off Output-signal)

Signal Number	Signal Name	Description
510001 8601011DC6	SPOS01_OSL_BO_CSF	SPOS1 select (ON) command for Binary Output.
510001 8601021DC6	SPOS02_OSL_BO_CSF	SPOS2 select (ON) command for Binary Output.
510001 8601031DC6	SPOS03_OSL_BO_CSF	SPOS3 select (ON) command for Binary Output.
510001 8601041DC6	SPOS04_OSL_BO_CSF	SPOS4 select (ON) command for Binary Output.
510001 8601051DC6	SPOS05_OSL_BO_CSF	SPOS5 select (ON) command for Binary Output.
510001 8601061DC6	SPOS06_OSL_BO_CSF	SPOS6 select (ON) command for Binary Output.
510001 8601071DC6	SPOS07_OSL_BO_CSF	SPOS7 select (ON) command for Binary Output.
510001 8601081DC6	SPOS08_OSL_BO_CSF	SPOS8 select (ON) command for Binary Output.
510001 8601091DC6	SPOS09_OSL_BO_CSF	SPOS9 select (ON) command for Binary Output.
510001 86010A1DC6	SPOS10_OSL_BO_CSF	SPOS10 select (ON) command for Binary Output.
510001 8A01011DC4	SPOS01_FSL_BO_CSF	SPOS1 select (OFF) command for Binary Output.
510001 8A01021DC4	SPOS02_FSL_BO_CSF	SPOS2 select (OFF) command for Binary Output.
510001 8A01031DC4	SPOS03_FSL_BO_CSF	SPOS3 select (OFF) command for Binary Output.
510001 8A01041DC4	SPOS04_FSL_BO_CSF	SPOS4 select (OFF) command for Binary Output.
510001 8A01051DC4	SPOS05_FSL_BO_CSF	SPOS5 select (OFF) command for Binary Output.
510001 8A01061DC4	SPOS06_FSL_BO_CSF	SPOS6 select (OFF) command for Binary Output.
510001 8A01071DC4	SPOS07_FSL_BO_CSF	SPOS7 select (OFF) command for Binary Output.

Signal Number	Signal Name	Description
510001 8A01081DC4	SPOS08_FSL_BO_CSF	SPOS8 select (OFF) command for Binary Output.
510001 8A01091DC4	SPOS09_FSL_BO_CSF	SPOS9 select (OFF) command for Binary Output.
510001 8A010A1DC4	SPOS010_FSL_BO_CSF	SPOS10 select (OFF) command for Binary Output.

(ix) Setting names

Note: The "xx" of "SPOSxx" represents the SPOS function number. (e.g., if the SPOS03 is considered, the "xx" is equal to "03". The suffix "xx" can be represented from "01" to "10".)

Table 2.8-10 Setting of SBO control in SPOSxx

Setting Name	Description	Default	Setting item or value
SPOSxx-CTREN	Activate control function in SPOSxx	On	Off / On
SPOSxx-LGSLFFCT	Logic selector for select condition in SPOSxx	Fixedlogic	Fixedlogic / PLC
SPOSxx-CTRAHMI	Activate local panel control in SPOSxx	SBO	DIR / SBO

2.8.2 Cancel logic for SBO mode

In SBO control mode the reception of a cancel command is possible; the function can discard the select command when the cancel conditions are satisfied; finally, the operation returns to the initial stage (i.e., waiting state "Wait for a command".)

(i) Receiving "Cancel" from the remote-end

Figure 2.8-14 depicts the cancel command procedure for a cancel command initiated from the remote-end.

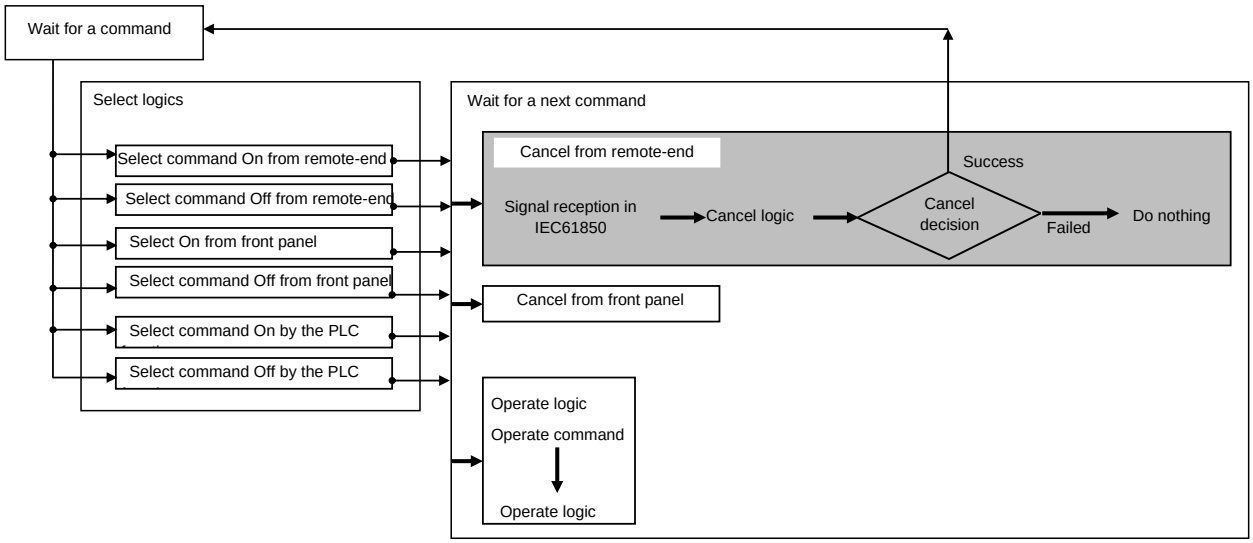


Figure 2.8-14 Outline of 'cancel' command from the remote-end

(i)-1 Input point required mapping

Figure 2.8-15 depicts the cancel logic when a "Cancel command (Remote-Cancel)" signal is applied to the SPOS01 function. The input-point "DEV01_CONTROL_REQ" is the same as that for the signal "Select command On (Remote-On-Control)".

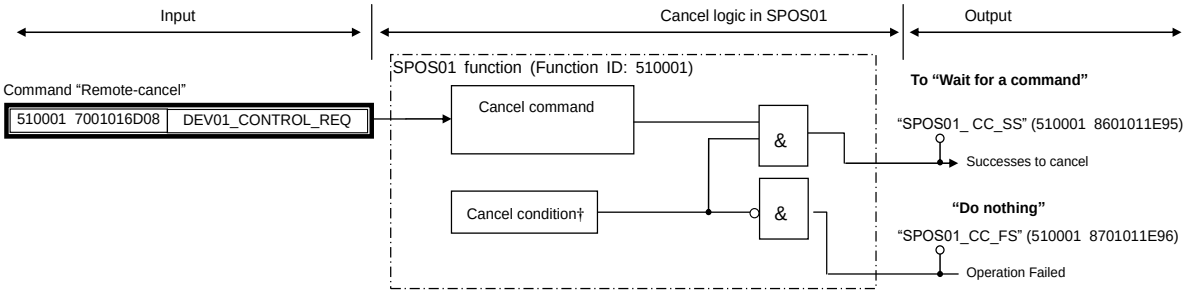


Figure 2.8-15 'Cancel' from the remote-end in SPOS01

†Note: The logic "cancel condition" is shown in Figure 2.8-18

(i)-2 Output signal to BO

The SPOS01 function can issue an output signal "Success to cancel" at the monitoring point "SPOS01_CC_SS", when the SPOS01 function has determined that the "Remote-cancel" signal

is true. Another "Operation failed" signal is issued at the monitoring point "SPOS01_CC_FS" if the SPOS01 function is able to determine that the "Remote-cancel" signal is not true.

(ii) Receiving "Cancel" from the local-end

Figure 2.8-16 outlines the reception of the cancel command from the local end.

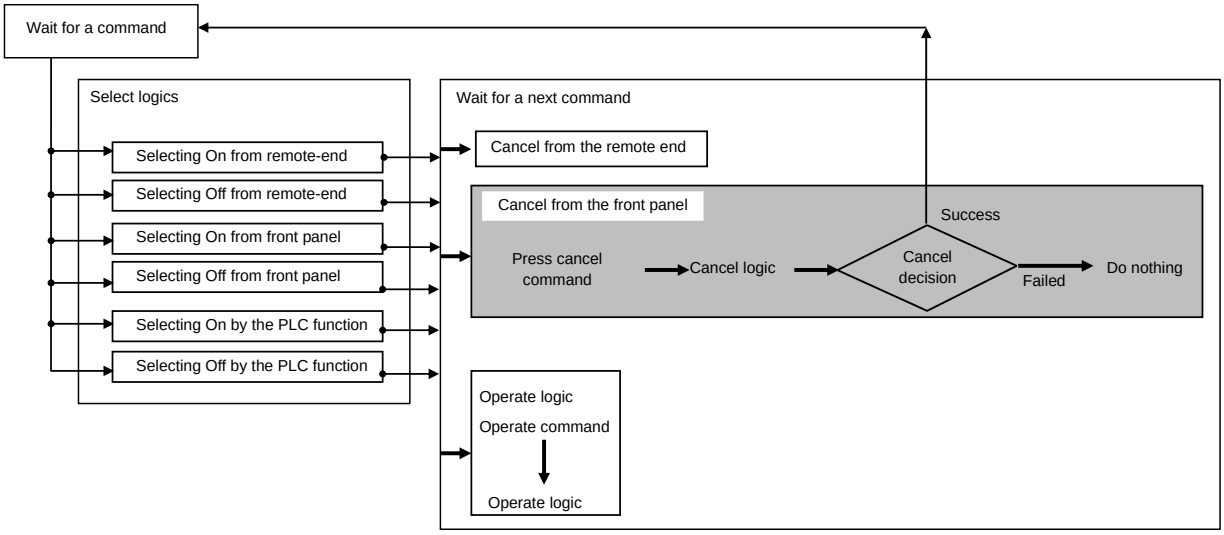


Figure 2.8-16 Outline of 'cancel' command from the local-end

(ii)-1 Input signal generated at the local-end

Figure 2.8-17 depicts the cancel logic when a "Cancel command (Local-cancel)" signal is applied to the SPOS01 function. The signal is generated when the "Cancel" key is pressed on the IED front panel; the user is not required to take account of mapping. When the logic receives the "Local-cancel" signal, the logic is able to output a result signal; provided that the "cancel condition" checking is satisfied.

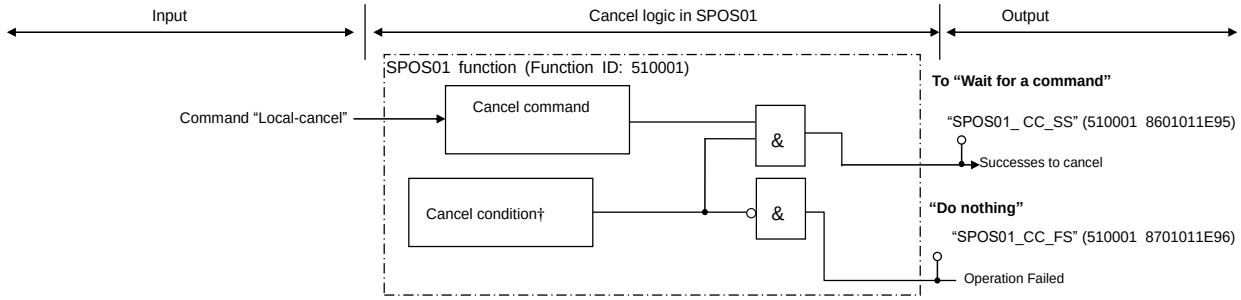


Figure 2.8-17 'Cancel' from the front panel

(ii)-2 Output signal to BO

The SPOS01 function, illustrated in Figure 2.8-17, is able to issue a "Select to cancel" signal at the monitoring point "SPOS01_CC_SS", when the SPOS01 function determines that the "Local-Cancel" signal is true.

(iii) Cancel condition logic

Figure 2.8-18 shows the cancel condition logic. As the criteria, "unmatched condition detected" is connected normally for the cancel logic, set **Fixlogic** for the scheme switch [**SPOS01_LGCNFFC**].

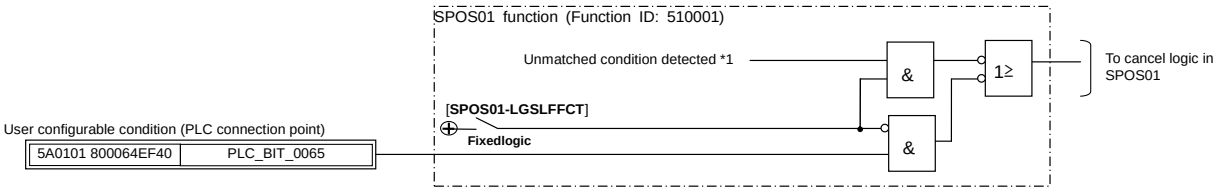


Figure 2.8-18 Logic "Cancel condition" in SPOS01

[1]Note: The Criteria "unmatched conditions" are determined when the "Test-bit status" in the cancel command is not identical to the "IED test status", like in Figure 2.8-13.

[2]Note: With the exception of the above 'cancel' condition logic, there is an operate-condition logic within the SPOS01 function; the operate-condition logic will always checks conditions. That is, the user is required to set either the "operate-condition" or the "cancel-condition" logic.

If the original logic does not meet with the requirements of the user, it can be replaced with another logic using the connection point "User Configurable condition":

1. Connect the user-customized logic with the "PLC_BIT0065".
2. Set scheme switch [**SPOS01-LGCNFFCT**] to **PLC**.

(iv) Signal name and number

Note: The user should note the following descriptions shown in the column "M/O" in each table:

"O" indicates that the signal is provided for optional use.

"M" indicates that the user should map/set/configure using the signal; otherwise, the user may experience an operational failure for the default settings.

"N/A" indicates that the user cannot change the state of the signal.

Table 2.8-11 PLC connection points (Input signal for 'cancel' condition)

Signal Number	Signal Name	Description	M/O
5A0101 800064EF40	PLC_BIT_0065	SPOS1 user configurable cancel condition	O
5A0101 800079EF40	PLC_BIT_0080	SPOS2 user configurable cancel condition	O
5A0101 800094EF40	PLC_BIT_0095	SPOS3 user configurable cancel condition	O
5A0101 800109EF40	PLC_BIT_0110	SPOS4 user configurable cancel condition	O
5A0101 800124EF40	PLC_BIT_0125	SPOS5 user configurable cancel condition	O
5A0101 800139EF40	PLC_BIT_0140	SPOS6 user configurable cancel condition	O
5A0101 800154EF40	PLC_BIT_0155	SPOS7 user configurable cancel condition	O
5A0101 800169EF40	PLC_BIT_0170	SPOS8 user configurable cancel condition	O
5A0101 800184EF40	PLC_BIT_0185	SPOS9 user configurable cancel condition	O
5A0101 800199EF40	PLC_BIT_0200	SPOS10 user configurable cancel condition	O

Table 2.8-12 PLC monitoring points (Output signal for 'cancel' condition)

Signal Number	Signal Name	Description
510001 8601011E95	SPOS01_CC_SS	Cancel succeed in SPOS01
510001 8601021E95	SPOS02_CC_SS	Cancel succeed in SPOS02
510001 8601031E95	SPOS03_CC_SS	Cancel succeed in SPOS03
510001 8601041E95	SPOS04_CC_SS	Cancel succeed in SPOS04
510001 8601051E95	SPOS05_CC_SS	Cancel succeed in SPOS05
510001 8601061E95	SPOS06_CC_SS	Cancel succeed in SPOS06
510001 8601071E95	SPOS07_CC_SS	Cancel succeed in SPOS07
510001 8601081E95	SPOS08_CC_SS	Cancel succeed in SPOS08
510001 8601091E95	SPOS09_CC_SS	Cancel succeed in SPOS09
510001 86010A1E95	SPOS10_CC_SS	Cancel succeed in SPOS10
510001 8601011E95	SPOS01_CC_SS	Cancel succeed in SPOS01
510001 8701011E96	SPOS01_CC_FS	Cancel failed in SPOS01
510001 8701021E96	SPOS02_CC_FS	Cancel failed in SPOS02
510001 8701031E96	SPOS03_CC_FS	Cancel failed in SPOS03
510001 8701041E96	SPOS04_CC_FS	Cancel failed in SPOS04
510001 8701051E96	SPOS05_CC_FS	Cancel failed in SPOS05
510001 8701061E96	SPOS06_CC_FS	Cancel failed in SPOS06
510001 8701071E96	SPOS07_CC_FS	Cancel failed in SPOS07
510001 8701081E96	SPOS08_CC_FS	Cancel failed in SPOS08
510001 8701091E96	SPOS09_CC_FS	Cancel failed in SPOS09
510001 87010A1E96	SPOS10_CC_FS	Cancel failed in SPOS10

(v) Setting name

Note: The "xx" within of "SPOSxx" represents the SPOS function number. (e.g., if SPOS03 is considered, the "xx" is equal to "03". The numbers used for "xx" can be represented by "01" to "10".)

Table 2.8-13 Setting for 'Cancel' in SPOSxx

Setting Name	Description	Default	Setting item or value
SPOSxx-LGCNFFCT	Logic selector for cancel condition in SPOSxx	Fixedlogic	Fixedlogic / PLC

2.8.3 Operate logic for SBO/DIR modes

Once the operation of the select logic is completed, the operate logic start to control the device.

(i) Receiving "operate command On" from the remote- end

Figure 2.8-19 depicts the reception of the operate command 'On' from the remote- end.

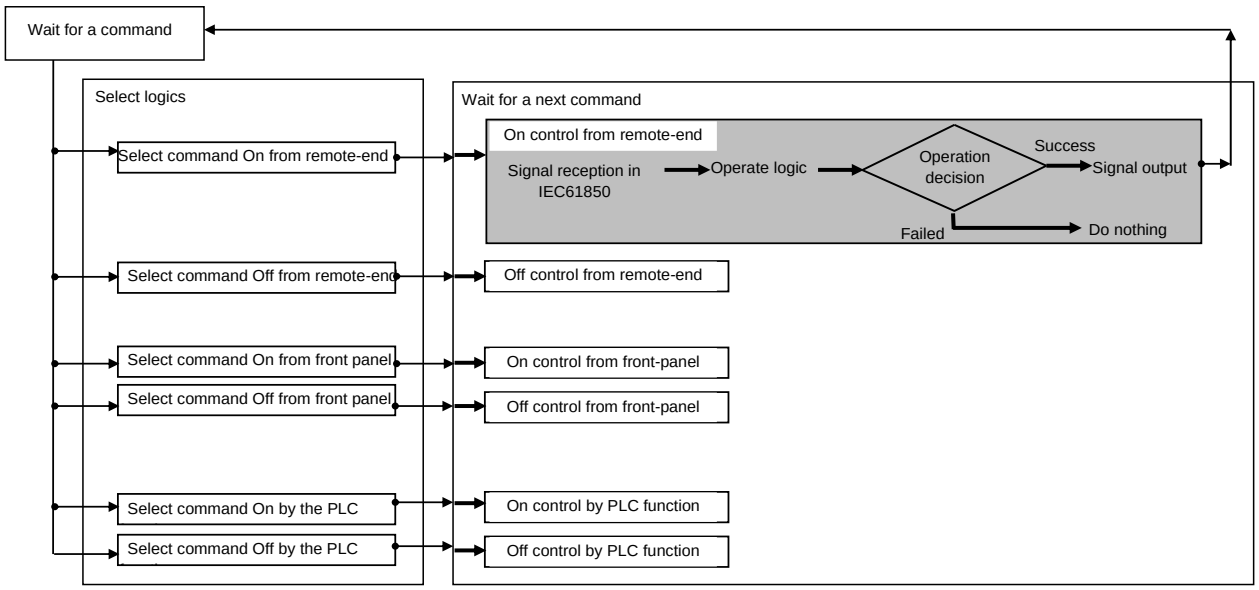


Figure 2.8-19 Outline of operate command for 'On'

(i)-1 Mapping required for Input point

Figure 2.8-20 illustrates the operate logic when an "Operate command On (Remote-ON-Control)" signal is applied to the SPOS01 function. The input-point "DEV01_CONTROL_REQ" is used for the reception of the "Operate command On (Remote-On-Control)".

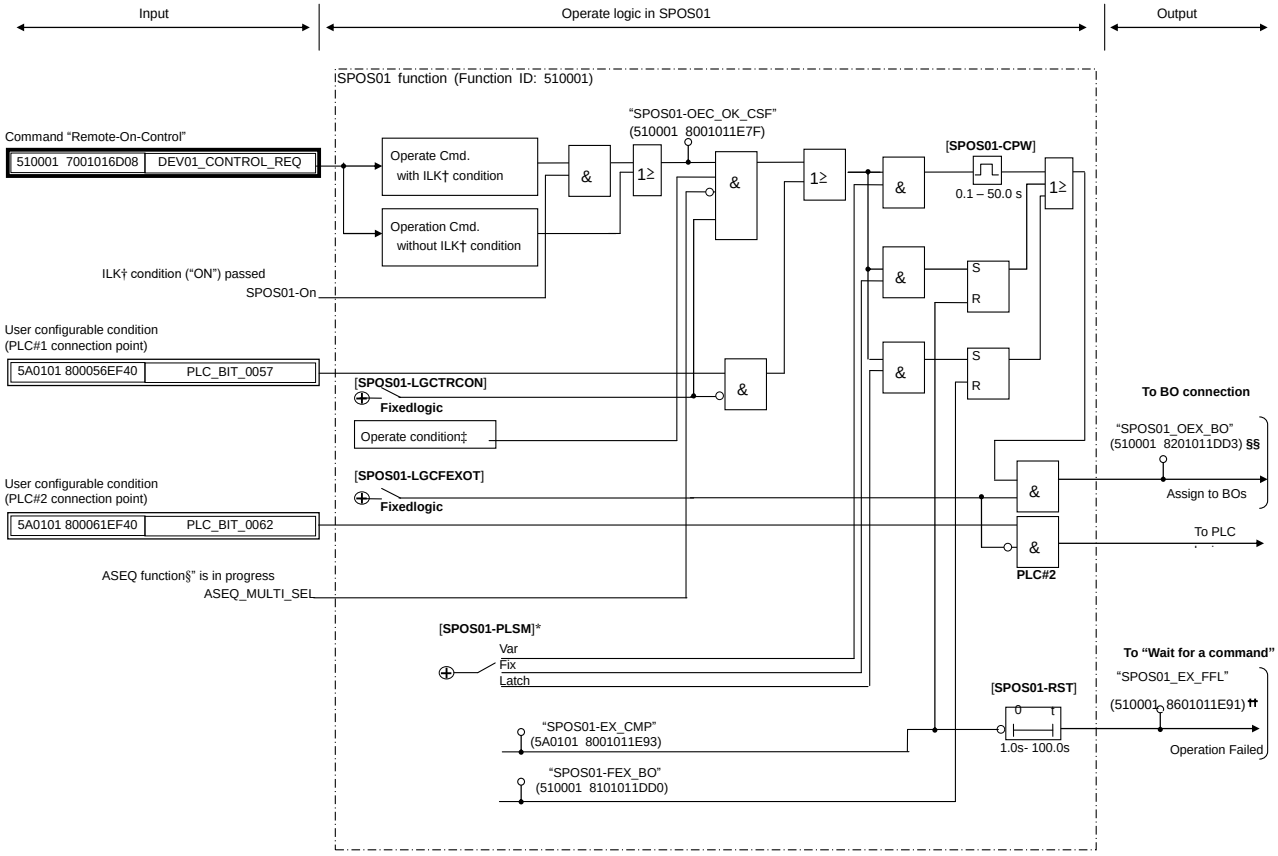


Figure 2.8-20 Operate 'On' logic by remote SAS in SPOS01††

†Note:The ILK function can provide the operation criteria for "ON".

‡Note:An "operate condition" signal is generated in the operate-condition logic (see Figure 2.8-29) when **Fixlogic** is set for scheme switch [**SPOS01-LGCTRCON**]. If an alternative "Operate-condition" is required, it can be programmed by the user and used to replace the signal generated by the original operate-condition logic. The alternative "Operate-condition" can be connected to the above logic using connection point #1 "User configurable condition". That is, set the scheme switch [**SPOS01-LGCTRCON**] to **PLC** and use "PLC_BIT_0057".

§Note:The ASEQ function can provide sequential signals for automatic control.

*Note:The user can set the type of the output signal. When **Var** is set for scheme switch [**SPOS01-PLSM**], the output period of the signal is defined by the setting [**SPOS01-CPW**]. When **Fix** is set, the signal ceases when the 43-switch is changed. When **Latch** is set, the output signal is kept issuing until the reception of "Command Off".

††Note: To identify the input and output signal-points of the other SPOS logics, see Table 2.8-14 for PLC#1, Table 2.8-15 for PLC#2, Table 2.8-19, and Table 2.8-20 for output signals.

‡‡Note: The "Operate failed" signal is issued when the state-change is not detected when the time set by [**SPOS01-RST**] has been reached.

§§Note: The “SPOS01_OEX-BO” signal is issued when **Fixlogic** is set for scheme switch [**SPOS01-LGCFEXOT**]. The “Operate completed “signal can also be issued from logic programmed by the user, in place of the logic shown in Figure 2.8-20. The user-programmed logic is connected internally to the signal “Operate completed”, hence this signal is now generated by the user-programmed logic at connection point # 2 “user-configurable condition”. That is, set the scheme switch [**SPOS01-LGCFEXOT**] to **PLC** and use “PLC_BIT_0062”.

(i)-2 Output signal to BO

The SPOS01 function, in Figure 2.8-20, can issue an “Operate” signal at the output point “SPOS01_OEX_BO”, when the SPOS01 function determines that the received signal “Remote-On-Control” is true.

(ii) Receiving "operate command Off" from the remote end

Figure 2.8-21 depicts the reception of the operate command for 'Off' from the remote-end.

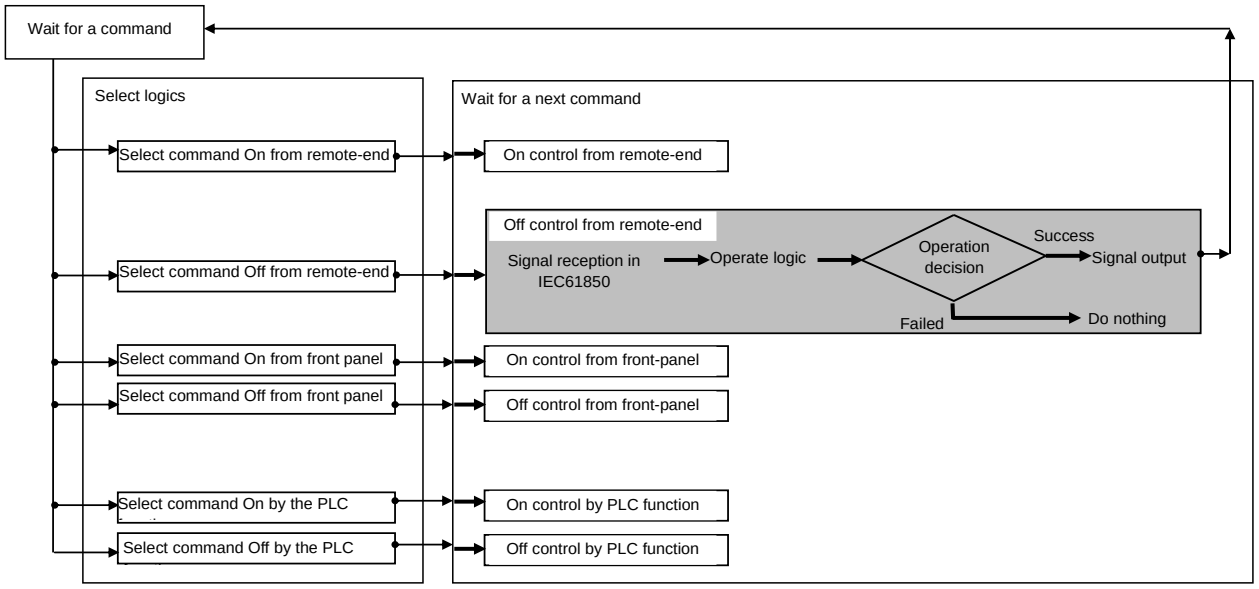


Figure 2.8-21 Outline of operate command 'Off'

(ii)-1 Mapping required for Input point from communication

Figure 2.8-22 illustrates the operate logic when an "Operate command Off (Remote-Off-Control)" signal is applied to the SPOS01 logic. The input-point "DEV01_CONTROL_REQ" is used for the reception of the "Operate command Off (Remote-Off-Control)".

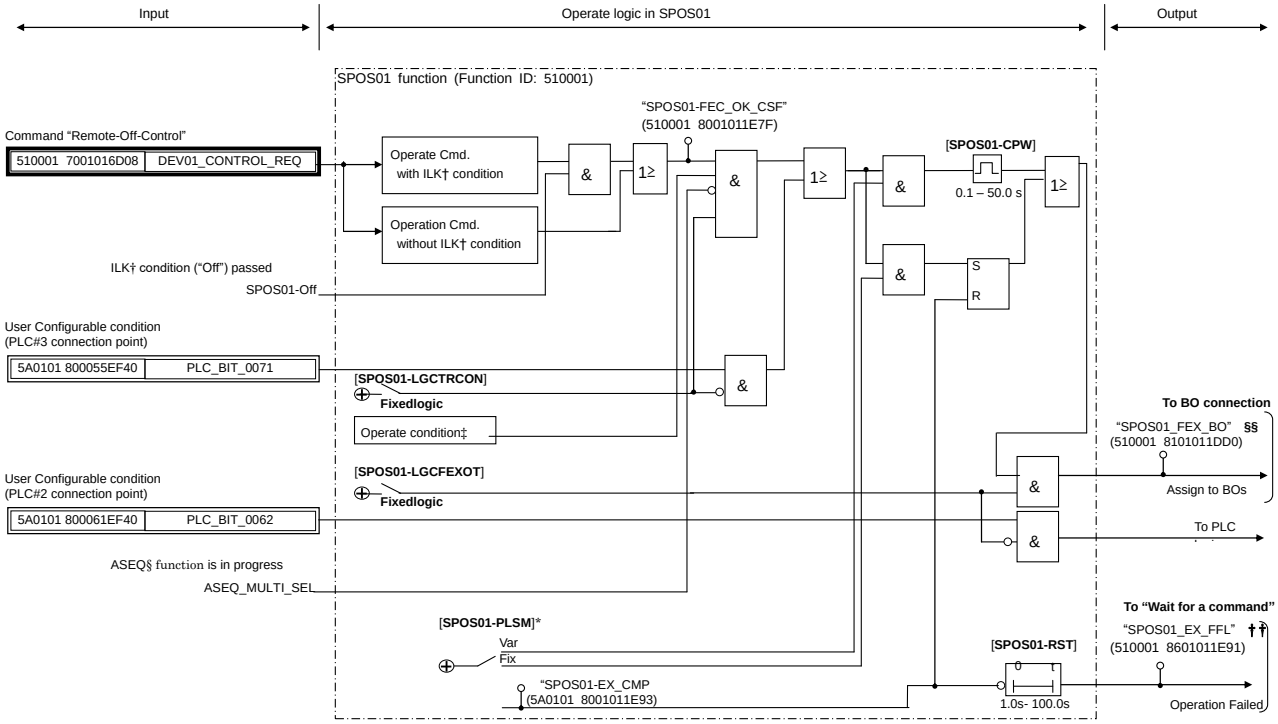


Figure 2.8-22 Operate 'Off' from the remote -end in SPOS01††

†Note:The ILK function can provide the operation criteria for "Off".

‡Note:An "operate condition" is generated in the operate-condition logic(see Figure 2.8-29) when **Fixlogic** is set for scheme switch[**SPOS01-LGCTRCON**], If an alternative "Operate-condition" is required, it can be programmed by the user and used to replace the signal generated by the original operate-condition logic. The alternative "Operate-condition" can be connected to the above logic using connection point #3 "User configurable condition". That is, set the scheme switch [**SPOS01-LGCTRCON**] to **PLC** and use PLC_BIT_0071.

‡‡Note: The "Operate failed" signal is issued when the state-change is not detected when the time set by [**SPOS01-RST**] has been reached.

§§Note: The signal "SPOS01_OEX-BO" is issued when **Fixlogic** is set for scheme switch [**SPOS01-LGCFEXOT**]. The "Operate completed "signal can also be issued from logic programmed by the user in place of the logic shown in Figure 2.8-20. The user-programmed logic is connected internally to the signal "Operate completed". Hence, this signal is now generated by the user-programmed logic at connection point # 2 "user-configurable condition". That is, set the scheme switch [**SPOS01-LGCFEXOT**] to **PLC** and use "PLC_BIT_0062".

§Note:The ASEQ function can provide sequential signals for automatic control.

*Note:The user can set the type of the output signal. When **Var** is set for scheme switch [**SPOS01-PLSM**], the output period of the signal is defined by the setting [**SPOS01-CPW**]. When **Fix** is set, the signal ceases when the 43-switch is changed. When **Latch** is set, the output signal is kept issuing until the reception of "Command Off".

††Note: To identify the input and output signal-points of the other SPOS logics, see Table 2.8-14, Table 2.8-15, Table 2.8-19, and Table 2.8-20.

(ii)-2 Output signal to BO

The SPOS01 function, in Figure 2.8-22, can issue an "Operate" signal at the output-point "SPOS01_FEX_BO", when the SPOS01 function determines that the signal "Remote-Off-Control" is true.

(iii) Receiving "operate command On" from the local-end

Figure 2.8-23 depicts the reception of the operate command for 'On' from the local-end.

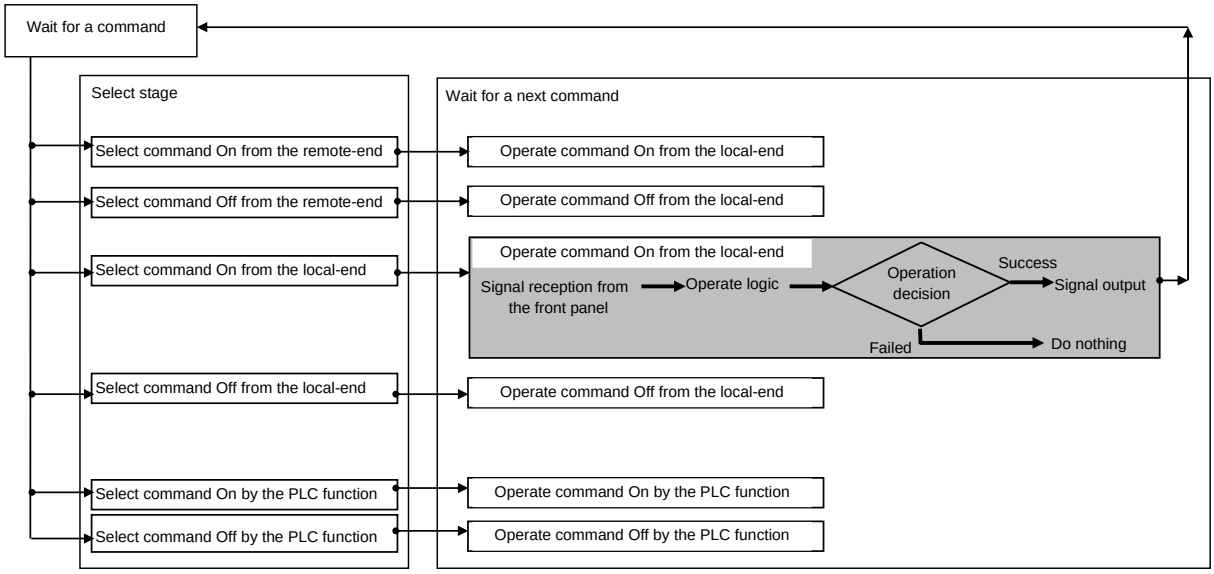


Figure 2.8-23 Outline of operate command 'On'

(iii)-1 Input signal generated at the local-end.

Figure 2.8-24 illustrates the operate logic when an "Operate command On (Local-ON-Control)" signal is applied to the SPOS01 function. The signal is generated when "Execution of On" is keyed on the IED front panel.

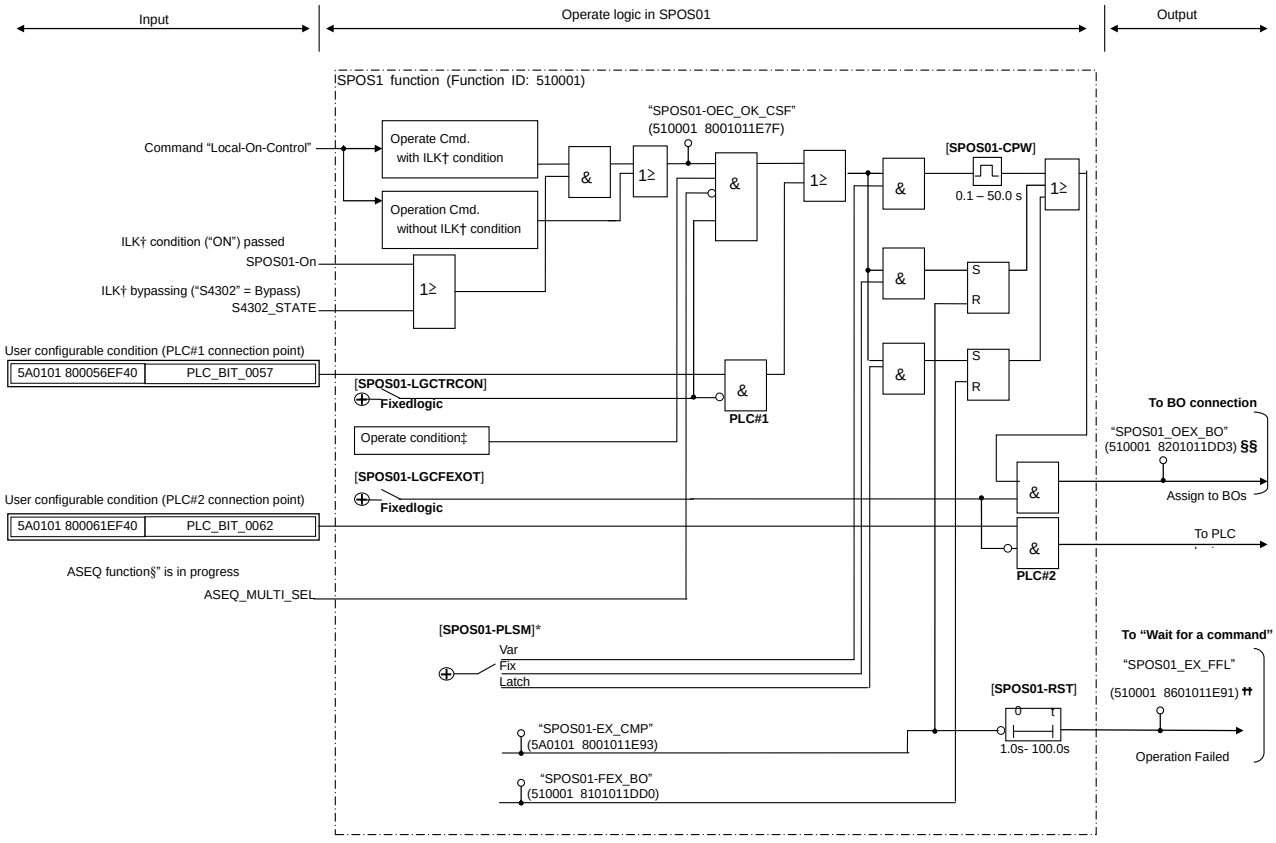


Figure 2.8-24 Operate 'On' on the front panel

‡Note:An "operate condition" signal is generated in the operate-condition logic(see

Figure 2.8-29) when **Fixlogic** is set for scheme switch [**SPOS01-LGCTRCON**], If an alternative "Operate-condition" is required, it can be programmed by the user and used to replace the signal generated by the original operate-condition logic. The alternative "Operate-condition" can be connected to the above logic using connection point #1 "User configurable condition". That is, set the scheme switch [**SPOS01-LGCTRCON**] to **PLC** and use PLC_BIT_0057.

§Note:The ASEQ function can provide sequential signals for automatic control.

*Note:The user can set the type of output signal. When **Var** is set for scheme switch [**SPOS01-PLSM**], the output period of the signal is defined by the setting [**SPOS01-CPW**]. When **Fix** is set, the signal ceases when the 43-switch is changed. When **Latch** is set, the output signal is kept issuing until the reception of "Command Off".

††Note: To identify the input and output signal-points of the other SPOS logics, see Table 2.8-14, Table 2.8-15, Table 2.8-19, and Table 2.8-20.

‡‡Note: The "Operate failed" signal is issued when the state-change is not detected until after reaching the time set by the [**SPOS01-RST**].

§§Note: The signal "SPOS01_OEX-BO" is issued when **Fixlogic** is set for the scheme logic [**SPOS01-LGCFEXOT**]. If the signal is to be issued from the logic programmed by the user in place of the logic shown in Figure 2.8-20, connect the signal "Operate completed" generated in the user-programmed logic at the connection point # 2 "user configurable condition". That is, set the scheme switch [**SPOS01-LGCFEXOT**] to **PLC** and use "PLC_BIT_0062".

(iii)-2 Output signal to BO

The SPOS01 function, in Figure 2.8-24, can issue an "Operate" signal at the output point "SPOS01_OEX_BO", when the SPOS01 function determines that the signal "Local-On-Control" is true.

(iv) Receiving "operate command Off" from the local-end

Figure 2.8-25 depicts the reception of the operate command for 'Off' from the local-end.

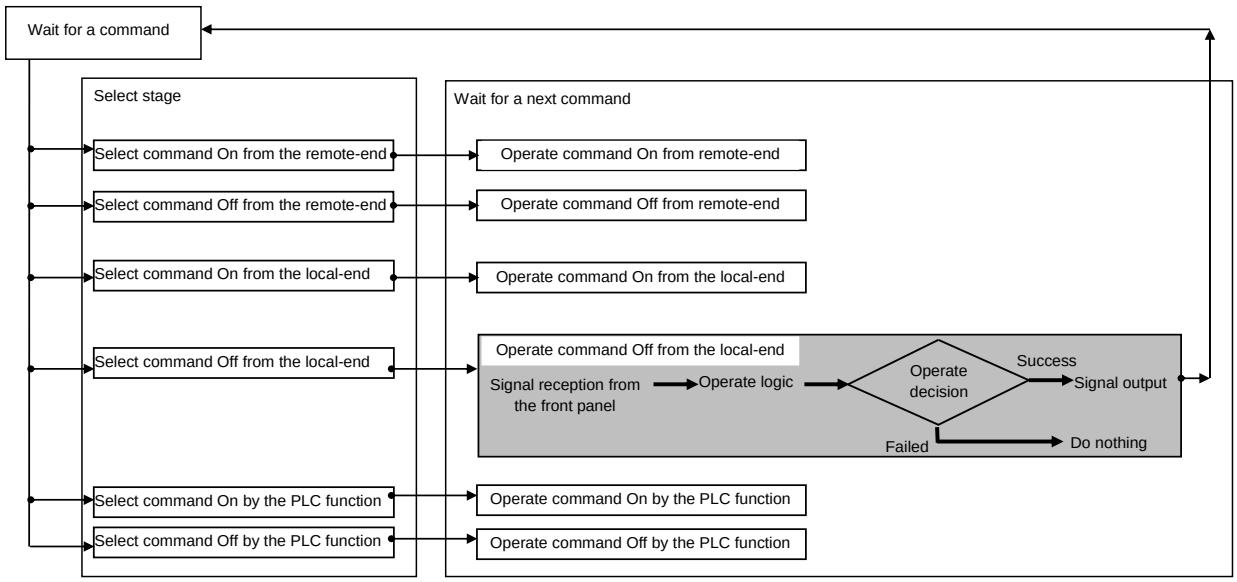


Figure 2.8-25 Outline of operate command 'Off'

(iv)-1 Input signal generated at the local-end.

Figure 2.8-26 illustrates the operate logic when an "Operate command Off (Local-OFF-Control)" signal is applied to the SPOS01 function. The input signal is generated when "Execution for Off" is keyed on the IED front panel.

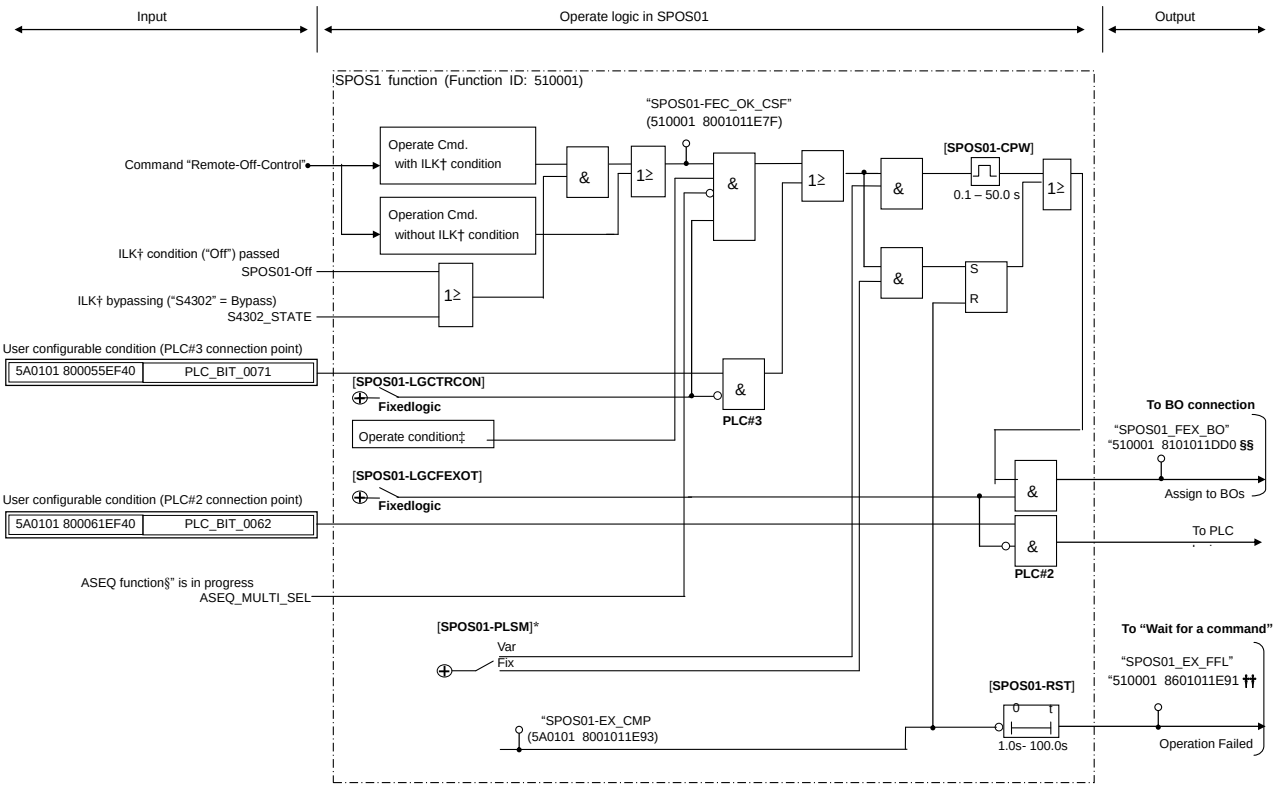


Figure 2.8-26 Operate 'Off' on the front panel in SPOS01††

‡Note:An "operate condition" signal is generated in the operate-condition logic(see Figure 2.8-29), when **Fixlogic** is set for scheme switch [**SPOS01-LGCTRCON**], If an alternative "Operate-condition" is required it can be programmed by the user and used to replace the signal generated by the original operated-condition logic. The alternative "Operate-condition" can be connected to the above logic using connection point #3 "User configurable condition". That is, set the scheme switch [**SPOS01-LGCTRCON**] to **PLC** and use PLC_BIT_0071.

§Note:The ASEQ function can provide sequential signals for automatic control.

*Note:The user can set the type of output signal. When **Var** is set for the scheme switch [**SPOS01-PLSM**], the output period of the signal is defined by the setting [**SPOS01-CPW**]. When **Fix** is set, the signal ceases when the 43-switch is changed. When **Latch** is set, the output signal is kept issuing until the reception of "Command Off".

††Note: To identify the input and output signal-points of the other SPOS logics, see Table 2.8-14, Table 2.8-15, Table 2.8-19, and Table 2.8-20.

‡‡Note: The "Operate failed" signal is issued when the state-change is not detected until after reaching the time set by the [**SPOS01-RST**].

§§Note: The signal "SPOS01_OEX-BO" is issued when **Fixlogic** is set for scheme switch [**SPOS01-LGCFEXOT**]. The "Operate completed" signal can also be issued from logic programmed by the user in place of the logic shown in Figure 2.8-20. The user-programmed logic is connected internally to the signal "Operate completed",

hence this signal is now generated by the user-programmed logic at connection point # 2 “user- configurable condition”. That is, set the scheme switch [**SPOS01-LGCFEXOT**] to **PLC** and use “PLC_BIT_0062”.

(iv)-2 Output signal to BO

The SPOS01 function, in Figure 2.8-26, can issue a signal “Operate” at the output point “SPOS01_FEX_BO”, when the SPOS01 function determines that the input signal “Local-Off-Control” is true.

(v) Receiving “operate command On” using the PLC function

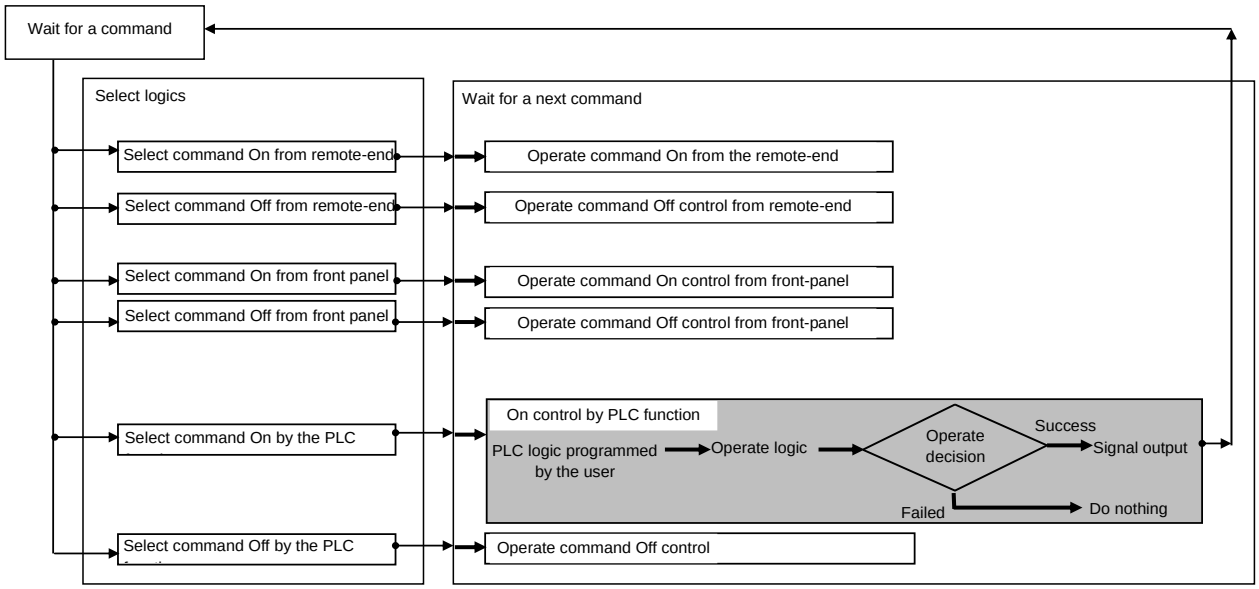


Figure 2.8-27 Outline of operate command for ‘On’

Figure 2.8-27 outlines the reception of the operate command ‘On’ with the PLC function; it describes the operate logic when an “Operate command On (PLC-On Control)” signal is generated by the PLC function. There are two input points for reception of this command signal, unlike the signal “operate command closing” (PLC-On Control).; the former connection point (PLC#3) is used for the reception of the operate-command requiring the interlock check, the latter connection point (PLC#4) is used or the reception of the operate-command not requiring interlocking check. That is, for the SPOS01 function, when the user wishes to apply for the operate logic the signal “Operate command On (PLC-On-Control)” generated in the user-programmed logic and when the interlock check is required in the operate logic, apply the signal at the connection point (PLC#3; is PLC_BIT_0013). Alternatively, if the interlock check is not required, apply the signal at the other connection point (PLC#4 i.e. PLC_BIT_0014); The PLC#3 and PLC#4 is denoted as the PLC#1 and PLC#2 in Table 2.8-2. Note that the user should set **PLC** for scheme switch [**SPOS01-LGCTRCON**].

(vi) Receiving "operate command Off" using PLC logic

Figure 2.8-28 outlines the reception of the operate command for Off using the PLC function.

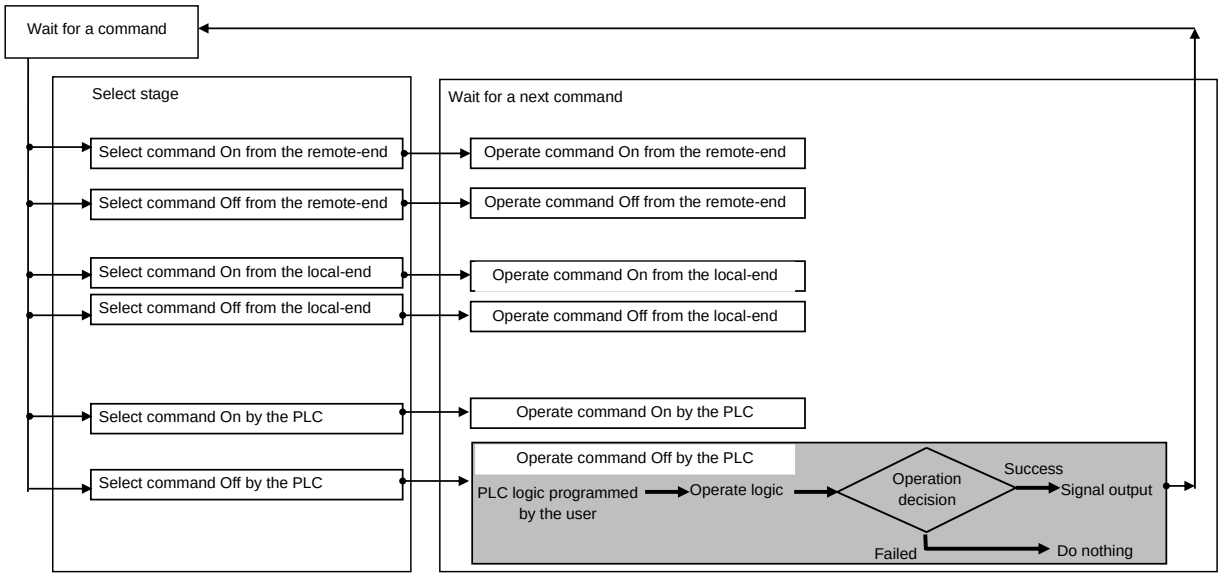


Figure 2.8-28 Outline of operate command for Off

Figure 2.8-28 depicts the operate logic when a signal "Operate Command Off (PLC-Off-Control)" is generated by the PLC function. There are two input points for reception of this command signal, unlike the signal "Operate Command On (PLC-On-Control)". That is, if an inter-lock check is required, apply the signal at connection point (PLC#3; i.e., PLC_BIT_0012). If, on the other hand an interlock check is not required, apply the signal at connection point (PLC#4; i.e., PLC_BIT_0011).

PLC#1 an PLC#2 shown in Table 2.8-3 should be treated as PLC#3 and PLC#4 here. Note that the user should set **PLC** for scheme switch [**SPOS01-LGCFEXOT**]

(vii) Operate condition

In a manner similar to which the conditions have been examined for the select command, the conditions for an operate command should be understood. Figure 2.8-29 illustrates the logic to examine an operate condition; the operate condition is determined by signal "SPOS01_STATE", if the functionality of the original logic does not meet with user-requirements, the following alternatives are available:

1. The user can replace the original logic with alternative logic.
2. The user can add another signal to the original logic.

(vii)-1 Adding another operate condition signal

If the addition of another signal is required, the user can add the signal to the operate condition logic using connection point "Additional Condition"

1. Add a user-preferred signal using "PLC_BIT_0053", listed as PLC#1 in Table 2.8-17.

2. Set scheme switch [**SPOS01-LGEXFFCT**] to **Fixedlogic.**

(vii)-2 Replacing the original logic

If the user wishes to replace the operate condition logic completely, it can be achieved using PLC connection point "User configurable condition":

1. Connect the user-customized logic using "PLC_BIT_0061", listed as PLC#2 in Table 2.8-17.
2. Set scheme switch [**SPOS01-LGEXFFCT**] to **PLC**.

Note: The user must program PLC logic "Control hierarchy condition". The Control hierarchy condition to be provided with the user-programmed PLC logic may be 43R/L; it may be connected using PLC connection point "PLC_BIT_0001" in Figure 2.8-29.

Note: The output of the operate condition logic is provided separately for On-execution and for Off-execution. To see the outputs, refer to Table 2.8-18.

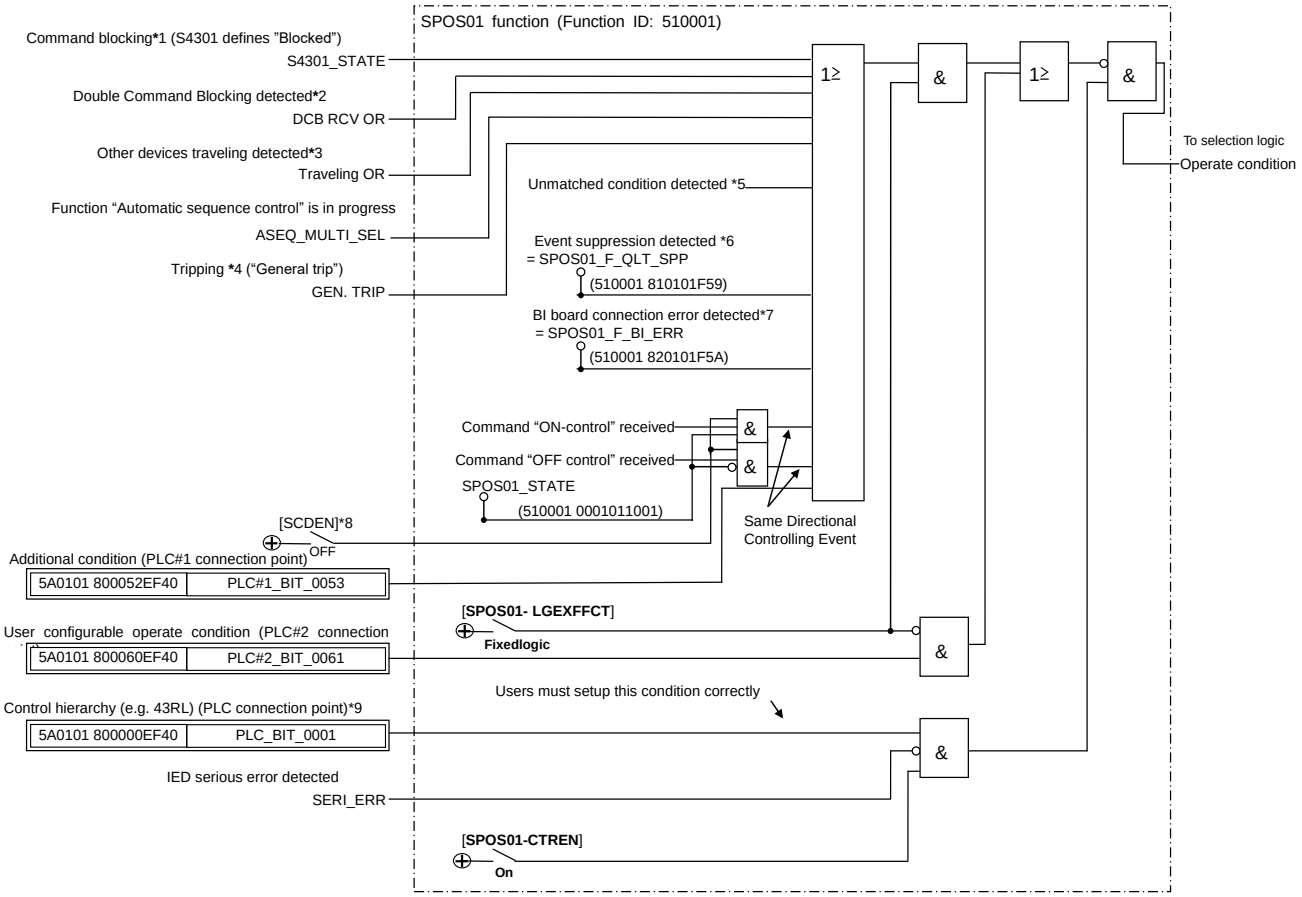


Figure 2.8-29 Operate condition logic for ON/OFF in SPOS01

[1]Note: "Command blocking" disables any operation except for itself; "Command Blocking" is implemented as "S4301"in software switch controller (SOFTSW).The IEC 61850 standard defines communication blocking as "CmdBlk". For more information, see Chapter *Control and monitoring application: Software switch*

controller. See the signal "S4301_STAEE in Table 2.8-6.

[2]Note: "Double Command Blocking (DCB)" is an operation philosophy. It can be used to protect the substation. The user can program it using GR-TIEMS.

[3]Note: Detection of event "device-travelling signifies that other operators are changing the status of one or more devices. Thus, device operation by the IED should be inhibited whilst ever the events is detected. The detection signal is donated as "Travelling OR" in Table 2.8-6.

[4]Note: If an IED is in the process of issuing a trip command, all control operation is blocked until the trip operation has been completed. If the IED has a relay application, the trip command is issued at the output point.

[5]Note: The criteria "unmatched conditions" is determined when "Test-bit status" in a "GEN_TRIP" in Table 2.8-6 command is not identical to "IED test status".

[6]Note: The function "Event suppression" can detect chattering in BI circuits. (See section 2.8.4(i)-2)

[7]Note: A supervision of the Binary IO module can detect connection errors for BI circuits.

[8]Note: The common control (CMNCTRL) function can test and check the operation – direction of logic. When the user sets off for scheme switch (SCDEN), operation of the logic is blocked if the logic is running in the same operation – direction compared with the previous operation direction. Alternatively, if **On** is set for the scheme switch, the logic is not blocked.

[9]Note: The user must program the PLC logic for "Control hierarchy condition" The user must connect the "Control hierarchy condition" to the select condition logic using the connection point "PLC_BIT_0001". For more information, see chapter "Control and monitoring application: Control hierarchy" see PLC#3 of Table 2.8-7. Note that the logic outputs are generated separately for both the On and the Off.

(viii) Signal name and number

Note: The user should note the meaning of the following abbreviations shown in column "M/O" of each table:

"O" signifies that the signal is provided for optional use.

"M" signifies that the user should map/set/configure the signal; otherwise, the user may experience an operational failure if the default settings is used.

"N/A" signifies that the user cannot change the state of the signal.

Table 2.8-14 PLC connection points (Input point for PLC#1 user a configurable condition)

Signal Number	Signal Name	Description	M/O
5A0101 800056EF40	PLC_BIT_0057	SPOS01 user configurable condition(PLC#1)	O
5A0101 800071EF40	PLC_BIT_0072	SPOS02 user configurable condition(PLC#1)	O
5A0101 800086EF40	PLC_BIT_0087	SPOS03 user configurable condition(PLC#1)	O
5A0101 800101EF40	PLC_BIT_0102	SPOS04 user configurable condition(PLC#1)	O

Signal Number	Signal Name	Description	M/O
5A0101 800116EF40	PLC_BIT_0117	SPOS05 user configurable condition(PLC#1)	O
5A0101 800131EF40	PLC_BIT_0132	SPOS06 user configurable condition(PLC#1)	O
5A0101 800146EF40	PLC_BIT_0147	SPOS07 user configurable condition(PLC#1)	O
5A0101 800161EF40	PLC_BIT_0162	SPOS08 user configurable condition(PLC#1)	O
5A0101 800176EF40	PLC_BIT_0177	SPOS09 user configurable condition(PLC#1)	O
5A0101 800191EF40	PLC_BIT_0192	SPOS10 user configurable condition(PLC#1)	O

Table 2.8-15 PLC connection points (Input point for PLC#2 user configurable condition)

Signal Number	Signal Name	Description	M/O
5A0101 800061EF40	PLC_BIT_0062	SPOS01 user configurable condition(PLC#2)	O
5A0101 800076EF40	PLC_BIT_0077	SPOS02 user configurable condition(PLC#2)	O
5A0101 800091EF40	PLC_BIT_0092	SPOS03 user configurable condition(PLC#2)	O
5A0101 800106EF40	PLC_BIT_0107	SPOS04 user configurable condition(PLC#2)	O
5A0101 800121EF40	PLC_BIT_0122	SPOS05 user configurable condition(PLC#2)	O
5A0101 800136EF40	PLC_BIT_0137	SPOS06 user configurable condition(PLC#2)	O
5A0101 800151EF40	PLC_BIT_0152	SPOS07 user configurable condition(PLC#2)	O
5A0101 800166EF40	PLC_BIT_0167	SPOS08 user configurable condition(PLC#2)	O
5A0101 800181EF40	PLC_BIT_0182	SPOS09 user configurable condition(PLC#2)	O
5A0101 800196EF40	PLC_BIT_0197	SPOS10 user configurable condition(PLC#2)	O

Table 2.8-16 PLC connection points (Input point for PLC#3 user configurable condition)

Signal Number	Signal Name	Description	M/O
5A0101 800055EF40	PLC_BIT_0071	SPOS01 user configurable condition(PLC#3)	O
5A0101 800070EF40	PLC_BIT_0086	SPOS02 user configurable condition(PLC#3)	O
5A0101 800085EF40	PLC_BIT_0101	SPOS03 user configurable condition(PLC#3)	O
5A0101 800100EF40	PLC_BIT_0116	SPOS04 user configurable condition(PLC#3)	O
5A0101 800115EF40	PLC_BIT_0131	SPOS05 user configurable condition(PLC#3)	O
5A0101 800130EF40	PLC_BIT_0146	SPOS06 user configurable condition(PLC#3)	O
5A0101 800145EF40	PLC_BIT_0161	SPOS07 user configurable condition(PLC#3)	O
5A0101 800160EF40	PLC_BIT_0176	SPOS08 user configurable condition(PLC#3)	O
5A0101 800175EF40	PLC_BIT_0191	SPOS09 user configurable condition(PLC#3)	O
5A0101 800190EF40	PLC_BIT_0071	SPOS10 user configurable condition(PLC#3)	O

Table 2.8-17 PLC connection points (Input point PLC#1 and #2 of additional and operate conditions)

Signal Number	Signal Name	Description	M/O
5A0101 800052EF40	PLC_BIT_0053	SPOS01 additional failure condition (PLC#1)	O
5A0101 800067EF40	PLC_BIT_0068	SPOS02 additional failure condition (PLC#1)	O
5A0101 800082EF40	PLC_BIT_0083	SPOS03 additional failure condition (PLC#1)	O
5A0101 800097EF40	PLC_BIT_0098	SPOS04 additional failure condition (PLC#1)	O
5A0101 800112EF40	PLC_BIT_0113	SPOS05 additional failure condition (PLC#1)	O
5A0101 800127EF40	PLC_BIT_0128	SPOS06 additional failure condition (PLC#1)	O
5A0101 800142EF40	PLC_BIT_0143	SPOS07 additional failure condition (PLC#1)	O
5A0101 800157EF40	PLC_BIT_0158	SPOS08 additional failure condition (PLC#1)	O
5A0101 800172EF40	PLC_BIT_0173	SPOS09 additional failure condition (PLC#1)	O
5A0101 800187EF40	PLC_BIT_0188	SPOS10 additional failure condition (PLC#1)	O
5A0101 800060EF40	PLC_BIT_0061	SPOS01 user configurable operate condition (PLC#2)	O
5A0101 800075EF40	PLC_BIT_0076	SPOS02 user configurable operate condition (PLC#2)	O
5A0101 800090EF40	PLC_BIT_0091	SPOS03 user configurable operate condition (PLC#2)	O
5A0101 800105EF40	PLC_BIT_0106	SPOS04 user configurable operate condition (PLC#2)	O

Signal Number	Signal Name	Description	M/O
5A0101 800120EF40	PLC_BIT_0121	SPOS05 user configurable operate condition (PLC#2)	O
5A0101 800135EF40	PLC_BIT_0136	SPOS06 user configurable operate condition (PLC#2)	O
5A0101 800150EF40	PLC_BIT_0151	SPOS07 user configurable operate condition (PLC#2)	O
5A0101 800165EF40	PLC_BIT_0166	SPOS08 user configurable operate condition (PLC#2)	O
5A0101 800180EF40	PLC_BIT_0181	SPOS09 user configurable operate condition (PLC#2)	O
5A0101 800195EF40	PLC_BIT_0196	SPOS10 user configurable operate condition (PLC#2)	O

Table 2.8-18 PLC monitoring points (Output signal for BIO)

Signal Number	Signal Name	Description
510001 8201011DD3	SPOS01_OEX_BO	SPOS01 operate (ON) command for Binary Output.
510001 8201021DD3	SPOS02_OEX_BO	SPOS02 operate (ON) command for Binary Output.
510001 8201031DD3	SPOS03_OEX_BO	SPOS03 operate (ON) command for Binary Output.
510001 8201041DD3	SPOS04_OEX_BO	SPOS04 operate (ON) command for Binary Output.
510001 8201051DD3	SPOS05_OEX_BO	SPOS05 operate (ON) command for Binary Output.
510001 8201061DD3	SPOS06_OEX_BO	SPOS06 operate (ON) command for Binary Output.
510001 8201071DD3	SPOS07_OEX_BO	SPOS07 operate (ON) command for Binary Output.
510001 8201081DD3	SPOS08_OEX_BO	SPOS08 operate (ON) command for Binary Output.
510001 8201091DD3	SPOS09_OEX_BO	SPOS09 operate (ON) command for Binary Output.
510001 82010A1DD3	SPOS10_OEX_BO	SPOS10 operate (ON) command for Binary Output.
510001 8101011DD0	SPOS01_FEX_BO	SPOS01 operate (OFF) command for Binary Output.
510001 8101021DD0	SPOS02_FEX_BO	SPOS02 operate (OFF) command for Binary Output.
510001 8101031DD0	SPOS03_FEX_BO	SPOS03 operate (OFF) command for Binary Output.
510001 8101041DD0	SPOS04_FEX_BO	SPOS04 operate (OFF) command for Binary Output.
510001 8101051DD0	SPOS05_FEX_BO	SPOS05 operate (OFF) command for Binary Output.
510001 8101061DD0	SPOS06_FEX_BO	SPOS06 operate (OFF) command for Binary Output.
510001 8101071DD0	SPOS07_FEX_BO	SPOS07 operate (OFF) command for Binary Output.
510001 8101081DD0	SPOS08_FEX_BO	SPOS08 operate (OFF) command for Binary Output.
510001 8101091DD0	SPOS09_FEX_BO	SPOS09 operate (OFF) command for Binary Output.
510001 81010A1DD0	SPOS010_FEX_BO	SPOS10 operate (OFF) command for Binary Output.

Table 2.8-19 PLC monitoring points (signals with in operate logic)

Signal Number	Signal Name	Description
510001 8101011E82	SPOS01_OEC_OK_CS	SPOS01 on direction execute command
510001 8101021E82	SPOS02_OEC_OK_CS	SPOS02 on direction execute command
510001 8101031E82	SPOS03_OEC_OK_CS	SPOS03 on direction execute command
510001 8101041E82	SPOS04_OEC_OK_CS	SPOS04 on direction execute command
510001 8101051E82	SPOS05_OEC_OK_CS	SPOS05 on direction execute command
510001 8101061E82	SPOS06_OEC_OK_CS	SPOS06 on direction execute command
510001 8101071E82	SPOS07_OEC_OK_CS	SPOS07 on direction execute command
510001 8101081E82	SPOS08_OEC_OK_CS	SPOS08 on direction execute command
510001 8101091E82	SPOS09_OEC_OK_CS	SPOS09 on direction execute command
510001 81010A1E82	SPOS10_OEC_OK_CS	SPOS10 on direction execute command
510001 8001011E81	SPOS01_FEC_OK_CS	SPOS01 off direction execute command
510001 8001021E81	SPOS02_FEC_OK_CS	SPOS02 off direction execute command
510001 8001031E81	SPOS03_FEC_OK_CS	SPOS03 off direction execute command
510001 8001041E81	SPOS04_FEC_OK_CS	SPOS04 off direction execute command
510001 8001051E81	SPOS05_FEC_OK_CS	SPOS05 off direction execute command
510001 8001061E81	SPOS06_FEC_OK_CS	SPOS06 off direction execute command
510001 8001071E81	SPOS07_FEC_OK_CS	SPOS07 off direction execute command
510001 8001081E81	SPOS08_FEC_OK_CS	SPOS08 off direction execute command
510001 8001091E81	SPOS09_FEC_OK_CS	SPOS09 off direction execute command
510001 80010A1E81	SPOS10_FEC_OK_CS	SPOS10 off direction execute command

Table 2.8-20 PLC monitoring points (Output signal for response)

Signal Number	Signal Name	Description
510001 8601011E91	SPOS01_EX_FFL	SPOS01 execute fail signal by fixedlogic
510001 8601021E91	SPOS02_EX_FFL	SPOS02 execute fail signal by fixedlogic
510001 8601031E91	SPOS03_EX_FFL	SPOS03 execute fail signal by fixedlogic
510001 8601041E91	SPOS04_EX_FFL	SPOS04 execute fail signal by fixedlogic
510001 8601051E91	SPOS05_EX_FFL	SPOS05 execute fail signal by fixedlogic
510001 8601061E91	SPOS06_EX_FFL	SPOS06 execute fail signal by fixedlogic
510001 8601071E91	SPOS07_EX_FFL	SPOS07 execute fail signal by fixedlogic
510001 8601081E91	SPOS08_EX_FFL	SPOS08 execute fail signal by fixedlogic
510001 8601091E91	SPOS09_EX_FFL	SPOS09 execute fail signal by fixedlogic
510001 86010A1E91	SPOS10_EX_FFL	SPOS10 execute fail signal by fixedlogic

(ix) Setting names

Note: The “xx” of “SPOSxx” represents the SPOS function number. (e.g., if the SPOS03 is considered, the “xx” is equal to “03”. The suffix “xx” can be represented by either a “01” to “10”).

Table 2.8-21 Setting of Operate in SPOSxx

Setting Name	Description	Default	Setting item or value
SPOSxx-PLSM	Method of command output(SPOS1-10)	Fix	Fix/Var/Latch
SPOSxx-CPW	Duration of command output(SPOS1-10)	1.0[sec]	0.1~50.0[sec]
SPOSxx-RST	Detection time for terminating control (SPOS1-10)	30.0[sec]	0.1~100.0[sec]
SPOSxx-LGCTRCON	Logic selector for operate condition (SPOS01-10)	Fixedlogic	Fixedlogic/PLC
SPOSxx-LGCFEXOT	Logic selector for command output (SPOS01-10)	Fixedlogic	Fixedlogic/PLC
SPOSxx-CTREN	Activate control function of SPOS01-10	On	Off / On
SPOSxx-LGEXFFCT	Logic selector for operate condition (SPOS01-10)	Fixedlogic	Fixedlogic / PLC

2.8.4 Setup for BIO module

The user should connect the SPOS input/output points with the BI and the BO circuits; subsequently, the SPOS function is able to issue select and operate commands. The user should execute the following four steps below.

i BI connection for status-signals

ii BO connection for "Select command On/Off"

iii BO connection for "operate command"

iv Contact health check

Note that the SPOS01 function commences operation when the scheme switch [**SPOS01-EN**] is set to **On**.

(i) BI connection for status-signals

Figure 2.8-30 exemplifies the reception of signals at the SPOS01 function; the user can set a input-point using the setting [**SPOS01-NOPSG**]†.

†Note: Normally an input-signal corresponding to phase-A is generated using a normally-open contact (NO). If the signal is generated by the normally-closed contact, the user is required to set scheme switch [**SPOS01-NSOSGI**] **On** in order that the input-signal should be decided in inversion.

(i)-1 Connection with Binary input circuit

Suppose an input signal is provided on the first BI circuit at IO#1 slot. In this case, the user should set the input point (200B01 8001001110†) for the setting [**SPOS01-NOPSG**], otherwise, the SPOS01 function cannot run correctly.

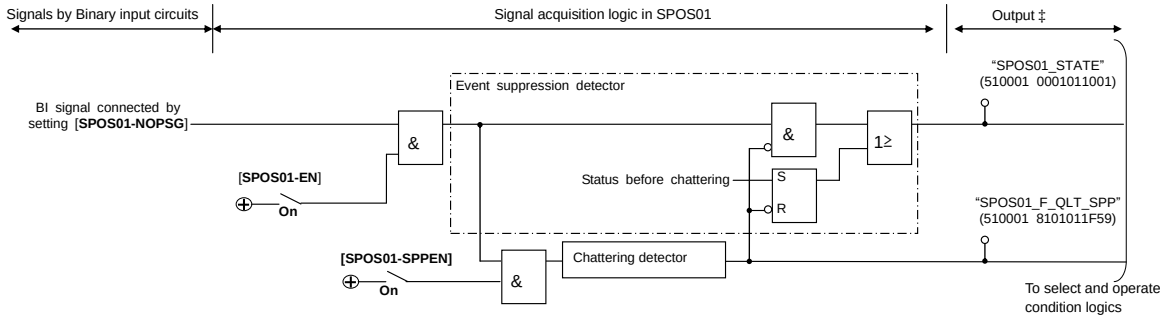


Figure 2.8-30 Acquisition of binary input signal in SPOS01

†Note: The user should set the actual input-points. For Input points see in Chapter *Technical description: Binary IO module*.

‡Note: In Figure 2.8-30 two signals can be issued: "SPOS01_STATE" and "SPOS01_F_QLT_SPP". One is used in the select condition logic and the operate condition logic (see Figure 2.8-13 and Figure 2.8-29). Another is used for operation in the event suppression detector.

(i)-2 Event suppression

If the status of a device "chatters" for a short time, the SPOS function will receive iterative signals from the device. Such iterative signals can cause extra burden for the SPOS function; hence, event suppression can be required to reduce the additional burden created.

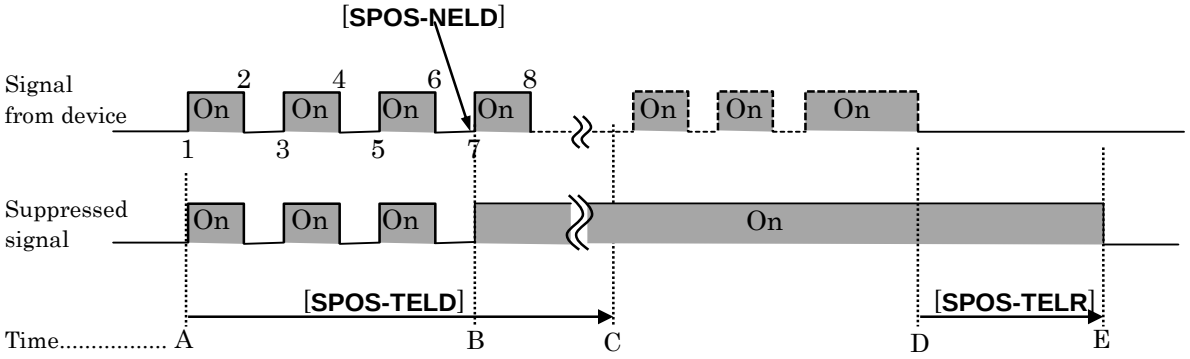


Figure 2.8-31 Iterative signals and signals suppressed

Figure 2.8-31 shows that the iterative signals received from the device have been suppressed by the event suppression function. The suppression commences on receipt of the seventh signal (at Time B). This is because the function can count the iterative number of incoming signals. Detection commences at Time A, the setting [**SPOS-NELD**] is provided so that the suppression commences at Time B. The setting [**SPOS-TELD**] is pertains to the operation of the detection function from Time A (e.g., Time A to Time C).

The event suppression ceases when the iterative signals stop. The user can adjust the point at which event suppression stops using the setting [**SPOS-TELR**]; as a result, no suppressed signal is output after the end of the iterative signals (e.g., Time D to E).

To initiate event suppression the user should set **On** for scheme switch [**SPOS01-SPPEN**].

(ii) BO connection for "Select command On/Off"

Figure 2.8-32 exemplifies the connection for the select command On and Off. Suppose that connection with the BOs is achieved by the PLC function using connection point "SPOS01_SL_BO_FLG"†; as a result, the " Select command On" and the "Select command Off" signals are issued at the BOI.

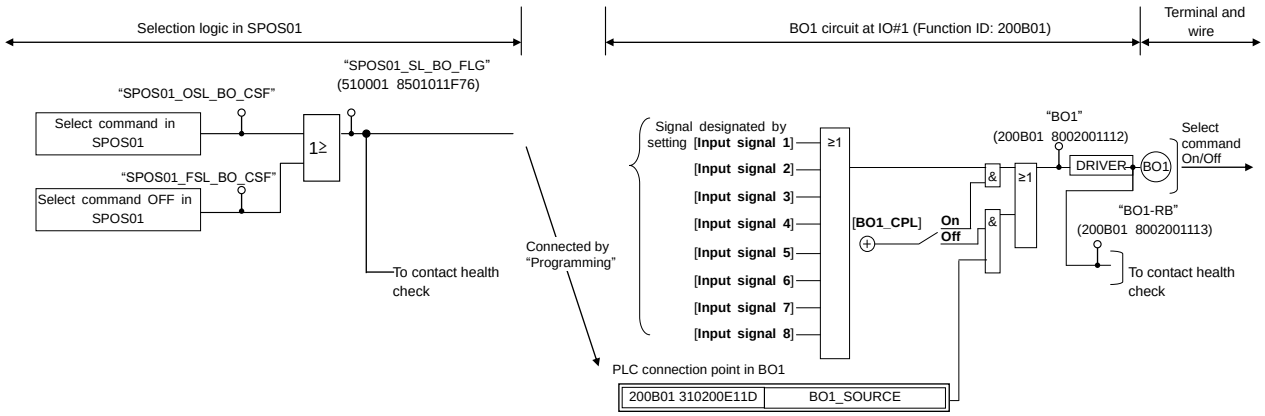


Figure 2.8-32 Example of select command connection with BO1

†Note: Table 2.8-26 shows the remaining signals with the excepting "SPOS01_SL_BO_FLG".

(iii) BO connection for "operate command On/Off"

Figure 2.8-33 exemplifies the connection for operate command On/Off. Suppose that connections with the BOs are achieved by the PLC function using connection point "SPOS01_OEX_BO" and "SPOS01_FEX_BO" as a result, the "Operate command On" and the "Operate command Off" signal is issued at BO2 or BO3.

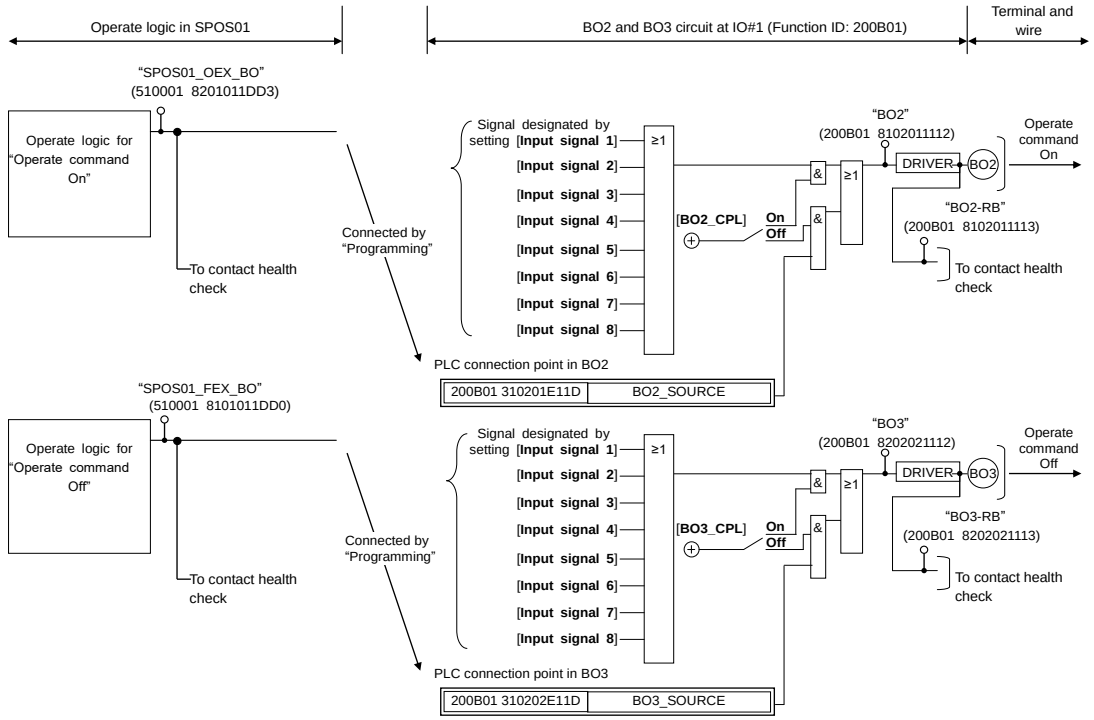


Figure 2.8-33 Example of operate commands connected with BO2 and BO3 at IO#1

†Note:Table 2.8-27 shows the remaining signals excepting "SPOS01_OEX_BO" and "SPOS01_FEX_BO".

(iv) Contact health check

The SPOS01 function has contact health check feature for the BO circuits; hence, the user is able to connect an output signal to the contact health check function when **Fixedlogic** is set for scheme switch [**SPOS01-LGXFEOT**]†. Consequently, the SPOS01 function can determine whether the signal has been successfully output from the BO. If a failure is reported, the SPOS01 function determines that the signal has not been output successfully to the BO; then, the command On or Off is canceled immediately and the SPOS01 function returns to the "Wait for a command" stage.

†Note:Table 2.8-29 shows settings for the health check feature in the other SPOS functions.

(iv)-1 Setting for "Select command On/Off"

For example, the point "SPOS01_SL_BO_FLG" is connected to the BO1 circuit for the issuing of the command, the user can connect point "BO1-RB" with the contact health check function using the setting [**SPOS01-SLBORD**]. Do not key the point "SPOS01_SL_BO_FLG".

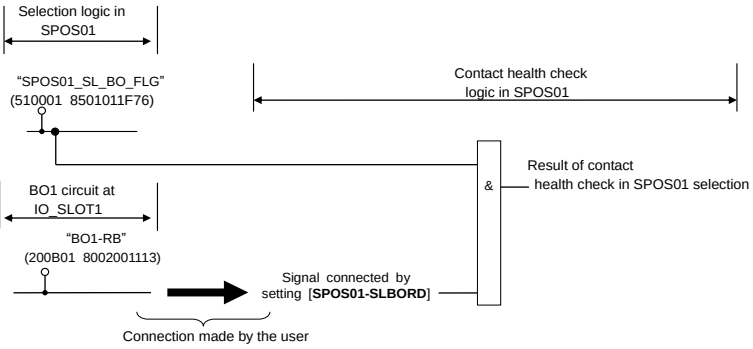


Figure 2.8-34 Example of connection of "Select command On" for the health check feature

(iv)-2 Setting for "Operate Command On"

Similarly the point "BO2-RB" must be applied for the setting [**SPOS01-OEXBORD**].

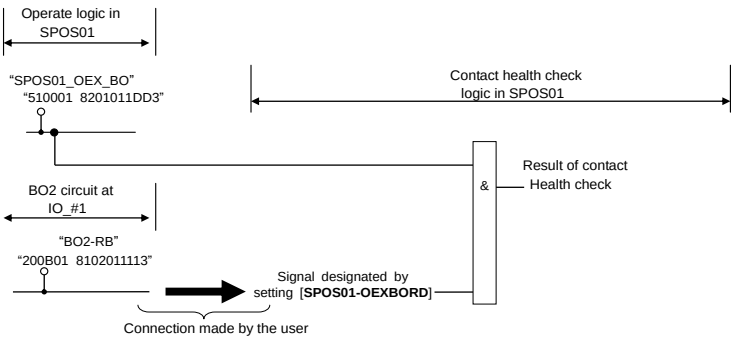


Figure 2.8-35 Example connection of "Operate Command On" for the health check

(iv)-3 Operate-Off command check

Similarly, the point "BO3-RB" must be applied for the setting [**SPOS01-FEXBORD**].

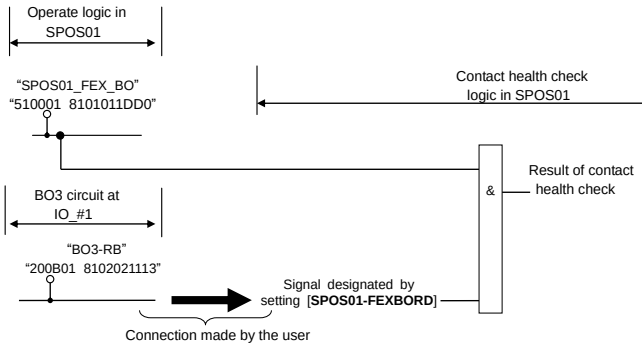


Figure 2.8-36 Example connection of "Operate command off" for the health check feature

(iv)-4 Proper setting for the contact health check (normal setting, example #1)

Figure 2.8-37 shows a setting example for the 43SW scheme. Select and operate commands drive the BO1, BO2 and BO3 contacts. To check that the contact health check function is working correctly, the respective points of the BO-RBs should be connected as shown in Table 2.8-22, to demonstrate that the settings are physically matched with the BO contacts.

Table 2.8-22 Setting example for contact health check

Example #1		Health check setting for Example #1	
"SPOS01_SL_BO_FLG" is connected to "BO1" at IO#1	⇨	200B01 8002001113(BO1-RB) set for [**SPOS01-SLBORD**]	OK
"SPOS01_OEX_BO_CSF" is connected to "BO2" at IO#1	⇨	200B01 8102011113(BO2-RB) set for [**SPOS01-OEXBORD**]	OK
"SPOS01_FEX_BO_CSF" is connected to "BO3" at IO#1	⇨	200B01 8202021113 (BO3-RB) set for [**SPOS01-FEXBORD**]	OK

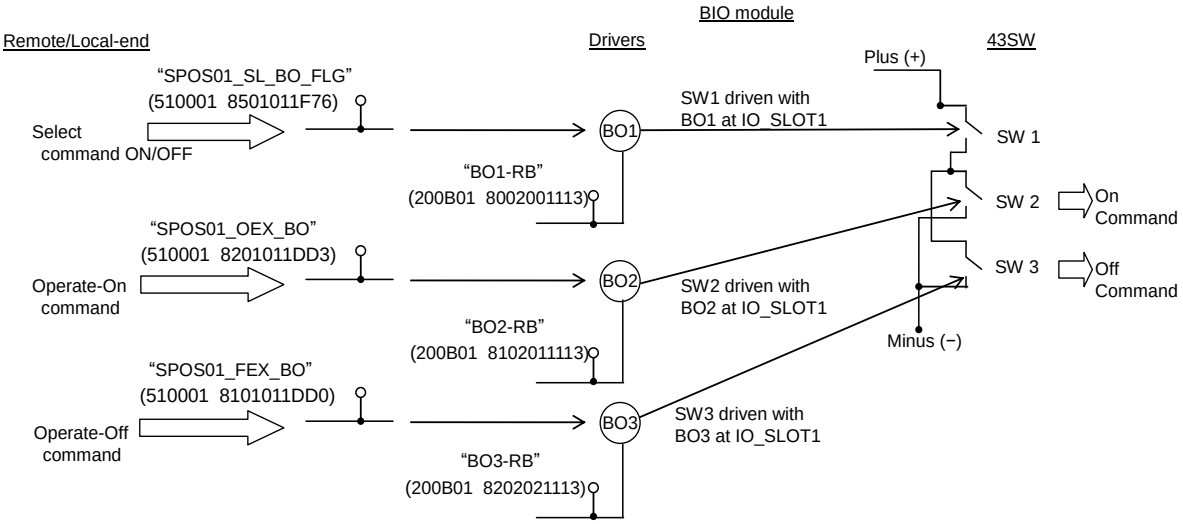


Figure 2.8-37 Contact health check setting and 43SW scheme for example #1

(iv)-5 Setting for erroneous contact health check (improper setting, example #2)

Figure 2.8-38 shows a setting example for an improper setting of the 43SW scheme. The settings are implemented incorrectly, as shown in Table 2.8-23. BO1-RB is not chosen, instead BO1 is actually chosen. In this case, the setting [**SPOS01-SLBORD**] is meaningless; hence, the issue of a select command is blocked.

Table 2.8-23 Erroneous setting example for contact health check

Example #2		Health check setting in example #2	
"SPOS01_SL_BO_FLG" is connected to "BO1" at IO#1	⇨	200B01 8002001112(BO1) set for [**SPOS01-SLBORD**]	NG
"SPOS01_OEX_BO_CSF" is connected to "BO2" at IO#1	⇨	200B01 8102011113(BO2-RB) set for [**SPOS01-OEXBORD**]	OK
"SPOS01_FEX_BO_CSF" is connected to "BO3" at IO#1	⇨	200B01 8202021113 (BO3-RB) set for [**SPOS01-FEXBORD**]	OK

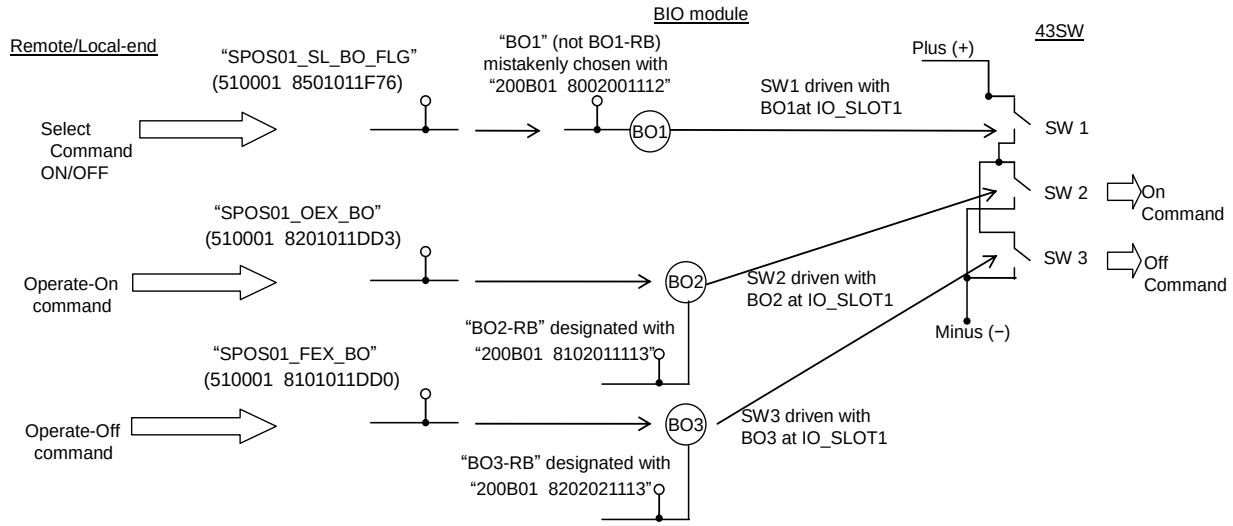


Figure 2.8-38 Contact health check setting and 43SW diagram for example #2

(iv)-6 Setting for extra contact health check (special setting, example #3)

Figure 2.8-39 shows an additional setting example for the 43SW scheme; one of the settings is made hypothetically. That is, the point "SPOS01_SL_BO_FLG" is actually chosen for the setting [**SPOS01-SLBORD**]; i.e. BO1-RB is not chosen for this selection. This special example can issue a select command; which is called "operated by internal select function". The user does not need to consider of a BO circuit for a select command, when there are no BO circuits available.

Table 2.8-24 Extra setting example for contact health check

Example #3		Setting for example #3	
"SPOS01_SL_BO_FLG" is not connected to any "BO"	⇨	"SPOS01_SL_BO_FLG" set for [**SPOS01-SLBORD**]	OK
"SPOS01_OEX_BO_CSF" is connected to "BO2" at IO#1	⇨	200B01 8102011113(BO2-RB) set for [**SPOS01-OEXBORD**]	OK
"SPOS01_FEX_BO_CSF" is connected to "BO3" at IO#1	⇨	200B01 8202021113 (BO3-RB) set for [**SPOS01-FEXBORD**]	OK

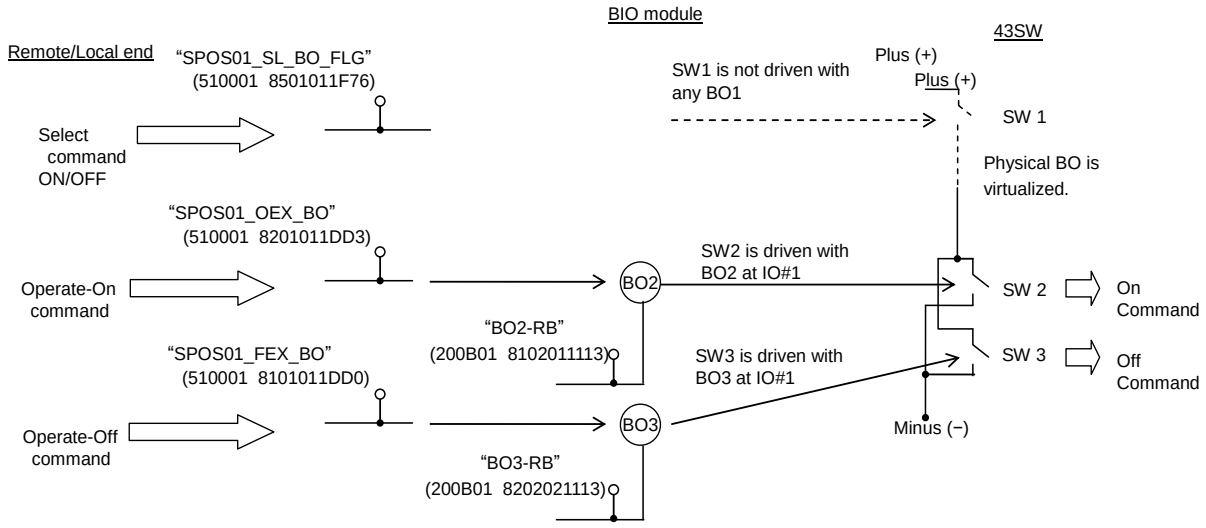


Figure 2.8-39 Contact health check setting and 43SW diagram for example #3

Table 2.8-25 PLC monitoring points (Output signal for event suppression function in SPOSxx)

Signal Number	Signal Name	Description
510001 0001011001	SPOS01_STATE	Status of SPOS01
510001 0001021001	SPOS02_STATE	Status of SPOS02
510001 0001031001	SPOS03_STATE	Status of SPOS03
510001 0001041001	SPOS04_STATE	Status of SPOS04
510001 0001051001	SPOS05_STATE	Status of SPOS05
510001 0001061001	SPOS06_STATE	Status of SPOS06
510001 0001071001	SPOS07_STATE	Status of SPOS07
510001 0001081001	SPOS08_STATE	Status of SPOS08
510001 0001091001	SPOS09_STATE	Status of SPOS09
510001 00010A1001	SPOS10_STATE	Status of SPOS10
510001 8101011F59	SPOS01_F_QLT_SPP	Event suppression detected (SPOS01)
510001 8101021F59	SPOS02_F_QLT_SPP	Event suppression detected (SPOS02)
510001 8101031F59	SPOS03_F_QLT_SPP	Event suppression detected (SPOS03)
510001 8101041F59	SPOS04_F_QLT_SPP	Event suppression detected (SPOS04)
510001 8101051F59	SPOS05_F_QLT_SPP	Event suppression detected (SPOS05)
510001 8101061F59	SPOS06_F_QLT_SPP	Event suppression detected (SPOS06)
510001 8101071F59	SPOS07_F_QLT_SPP	Event suppression detected (SPOS07)
510001 8101081F59	SPOS08_F_QLT_SPP	Event suppression detected (SPOS08)
510001 8101091F59	SPOS09_F_QLT_SPP	Event suppression detected (SPOS09)
510001 81010A1F59	SPOS10_F_QLT_SPP	Event suppression detected (SPOS10)

Table 2.8-26 PLC monitoring points (Output of select signal in SPOSxx)

Signal Number	Signal Name	Description
510001 8501011F76	SPOS01_SL_BO_FLG	Select command signal in SPOS01
510001 8501021F76	SPOS02_SL_BO_FLG	Select command signal in SPOS02
510001 8501031F76	SPOS03_SL_BO_FLG	Select command signal in SPOS03
510001 8501041F76	SPOS04_SL_BO_FLG	Select command signal in SPOS04
510001 8501051F76	SPOS05_SL_BO_FLG	Select command signal in SPOS05
510001 8501061F76	SPOS06_SL_BO_FLG	Select command signal in SPOS06
510001 8501071F76	SPOS07_SL_BO_FLG	Select command signal in SPOS07
510001 8501081F76	SPOS08_SL_BO_FLG	Select command signal in SPOS08
510001 8501091F76	SPOS09_SL_BO_FLG	Select command signal in SPOS09

Signal Number	Signal Name	Description
510001 85010A1F76	SPOS10_SL_BO_FLG	Select command signal in SPOS10

Table 2.8-27 PLC monitoring points (Output of operate signal in SPOSxx)

Signal Number	Signal Name	Description
510001 8201011DD3	SPOS01_OEX_BO	SPOS01 operate (ON) command for Binary Output.
510001 8201021DD3	SPOS02_OEX_BO	SPOS02 operate (ON) command for Binary Output.
510001 8201031DD3	SPOS03_OEX_BO	SPOS03 operate (ON) command for Binary Output.
510001 8201041DD3	SPOS04_OEX_BO	SPOS04 operate (ON) command for Binary Output.
510001 8201051DD3	SPOS05_OEX_BO	SPOS05 operate (ON) command for Binary Output.
510001 8201061DD3	SPOS06_OEX_BO	SPOS06 operate (ON) command for Binary Output.
510001 8201071DD3	SPOS07_OEX_BO	SPOS07 operate (ON) command for Binary Output.
510001 8201081DD3	SPOS08_OEX_BO	SPOS08 operate (ON) command for Binary Output.
510001 8201091DD3	SPOS09_OEX_BO	SPOS09 operate (ON) command for Binary Output.
510001 82010A1DD3	SPOS10_OEX_BO	SPOS10 operate (ON) command for Binary Output.
510001 8101011DD0	SPOS01_FEX_BO	SPOS01 operate (OFF) command for Binary Output.
510001 8101021DD0	SPOS02_FEX_BO	SPOS02 operate (OFF) command for Binary Output.
510001 8101031DD0	SPOS03_FEX_BO	SPOS03 operate (OFF) command for Binary Output.
510001 8101041DD0	SPOS04_FEX_BO	SPOS04 operate (OFF) command for Binary Output.
510001 8101051DD0	SPOS05_FEX_BO	SPOS05 operate (OFF) command for Binary Output.
510001 8101061DD0	SPOS06_FEX_BO	SPOS06 operate (OFF) command for Binary Output.
510001 8101071DD0	SPOS07_FEX_BO	SPOS07 operate (OFF) command for Binary Output.
510001 8101081DD0	SPOS08_FEX_BO	SPOS08 operate (OFF) command for Binary Output.
510001 8101091DD0	SPOS09_FEX_BO	SPOS09 operate (OFF) command for Binary Output.
510001 81010A1DD0	SPOS010_FEX_BO	SPOS10 operate (OFF) command for Binary Output.

(v) Setting names

Note: The “xx” of “SPOSxx” represents the SPOS function number. (e.g., if the SPOS03 is considered, the “xx” is equal to “03”. The suffix “xx” can be represented from “01” to “10”.)

Table 2.8-28 Settings for Binary input signals in SPOSxx

Setting Name	Description	Default	Setting item or value
SPOSxx-EN	Activate monitoring function of SPOS01-10	On	Off / On
SPOSxx-NOPSG	BI position for SPOS01-10	*none	BI signal
SPOSxx-SPPEN	Activate event suppression for SPOS01-10	On	Off / On
SPOS-NELD	Number of change to lock status	10	0~99
SPOS-TELD	Time to lock status(sliding window)	10[sec]	1~99[sec]
SPOS-TELR	Time to unlock status(sliding window)	10[sec]	1~99[sec]

Table 2.8-29 Settings for health check function in SPOSxx

Setting Name	Description	Default	Setting item or value
SPOSxx-SLBORD	Select BO signal (BO*-RB) from signal list	*user-preferred	BO readback signal
SPOSxx-OEXBORD	Select BO signal (BO*-RB) from signal list	*user-preferred	BO readback signal
SPOSxx-FEXBORD	Select BO signal (BO*-RB) from signal list	*user-preferred	BO readback signal

2.8.5 Mapping for IEC 61850 communication

The user can operate the SPOS function over IEC 61850 communications† following mapping using GR-TIEMS. Note that the SPOS function is designed for the class of "Single Point Controller (SPC)" in the IEC 61850 standard for communication. The user should follow these steps, each of which is discussed below,

Step1: Editing Logical Node

Step2: Mapping output data

Step3: Mapping input data

(i) Editing Logical Node

The user will need to create a logical node (LN) for the SPOS01 function. Figure 2.8-40 exemplifies the editing of a LN; the LN "General Input/output (GGIO)" is chosen for the SPOS01 function. After the user has defined an object "SPCSO", the SPOS01 logical node can be available with the name "GGIO" plus "LN Instance". Create a definition of the object "SPCSO" in the SPOS01 logical node. Either the SBO mode or the DIR mode can be chosen in the editing for the LN.

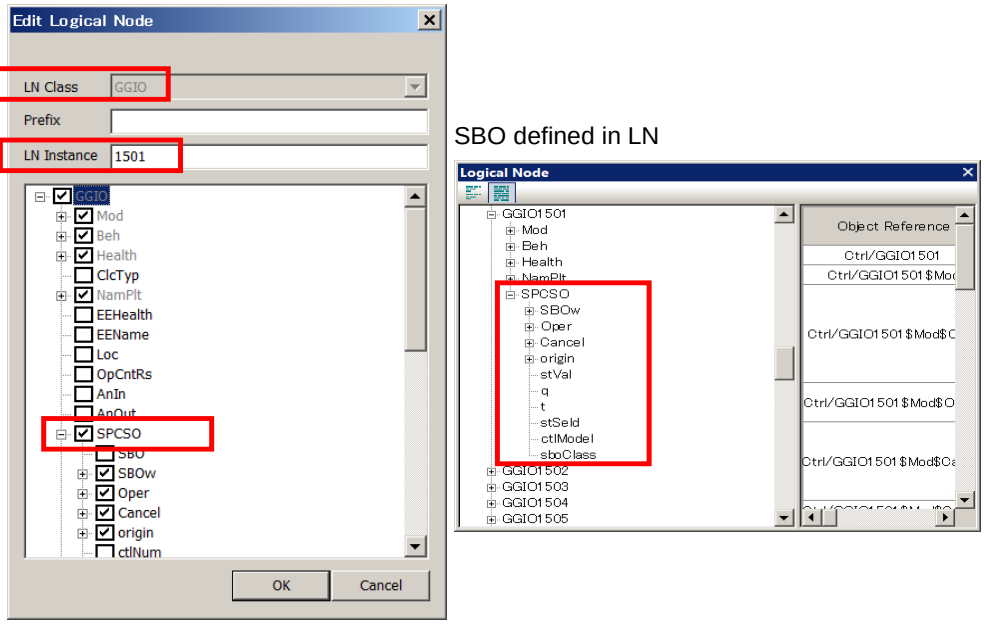
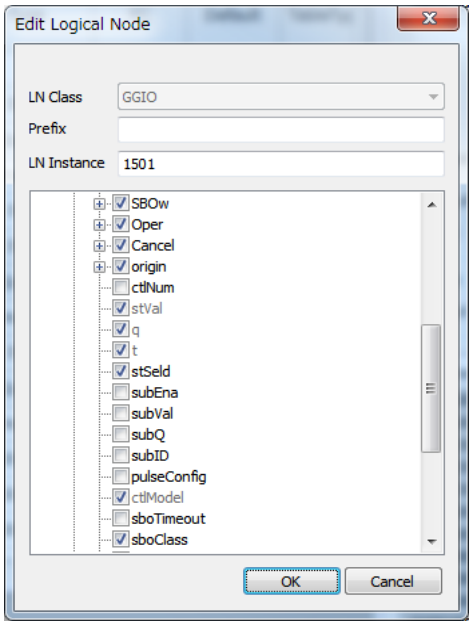


Figure 2.8-40 Defining "SPCSO" object in GGIO1501 logic node

(i)-1 Defining SBO mode

Figure 2.8-41 exemplifies the SPOS01 logic node saved as "GGIO1501". In the SBO mode, the user should select the following items for the "GGIO1501$SPCSO" using GR-TIEMS:



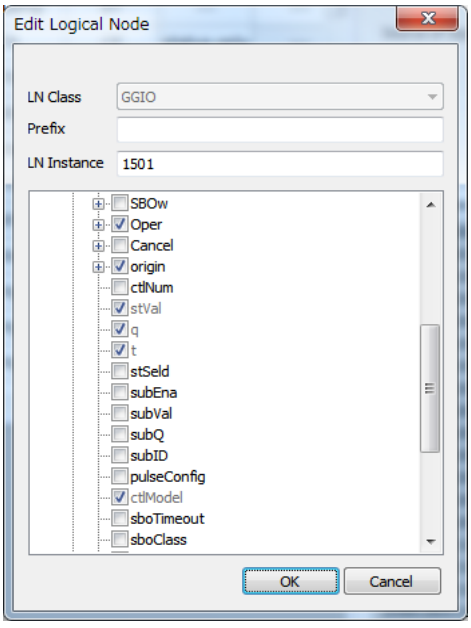
- ✓ SBOw
- ✓ Oper
- ✓ Cancel
- ✓ Origin
- ✓ stSeld
- ✓ sboClass† (choice "operate-once")
- ✓ ctlmodel (choice "SBOes or SBOns")

†"sboClass" can be found by scrolling down.

Figure 2.8-41 LN editing screen for SBO (for example)

(i)-2 Defining DIR setting mode

Figure 2.8-42 exemplifies the SPOS01 logic node saved as "GGIO1501". In the DIR mode, the following three items should be selected using GR-TIEMS:



- ✓ Oper
- ✓ origin
- ✓ ctlmodel (choice "DOes or DOns")

Figure 2.8-42 LN editing screen for DIR mode (for example)

(ii) Mapping output data

The user should group the SPOS01 signals with regard to GOOSE and Report; the user should map them for IEC 61850 communication using GR-TIEMS. Figure 2.8-43 illustrates how to map a signal; it indicates that the signals for the SPOS01 function are required to be mapped for IEC 61850 communication.

Table 2.8-30 Mapping signals for SPCSO object

Object_reference	Attribute	Type	FC	Signal Number	Signal Name
Ctrl/GGIO1501$SPCSO$origin	orCat	orCategory	ST	510001 3001011008	SPOS01_ORCAT
Ctrl/GGIO1501$SPCSO$origin	orIdent	Octet64	ST	510001 6A01011009	SPOS01_ORIDENT
Ctrl/GGIO1501$SPCSO	stVal	BOOLEAN	ST	510001 0001011001	SPOS01_STATE
Ctrl/GGIO1501$SPCSO	q	Quality	ST	510001 3101011005	SPOS01_QUALITY
Ctrl/GGIO1501$SPCSO	t	Timestamp	ST	510001 9001011006	SPOS01_TIMESTAMP
Ctrl/GGIO1501$SPCSO	stSeld	BOOLEAN	ST	510001 0001011D90	SPOS01_STD_RPT

Note: "Status (ST)" is defined in the function constraint (FC) of the IEC 61850 standard.

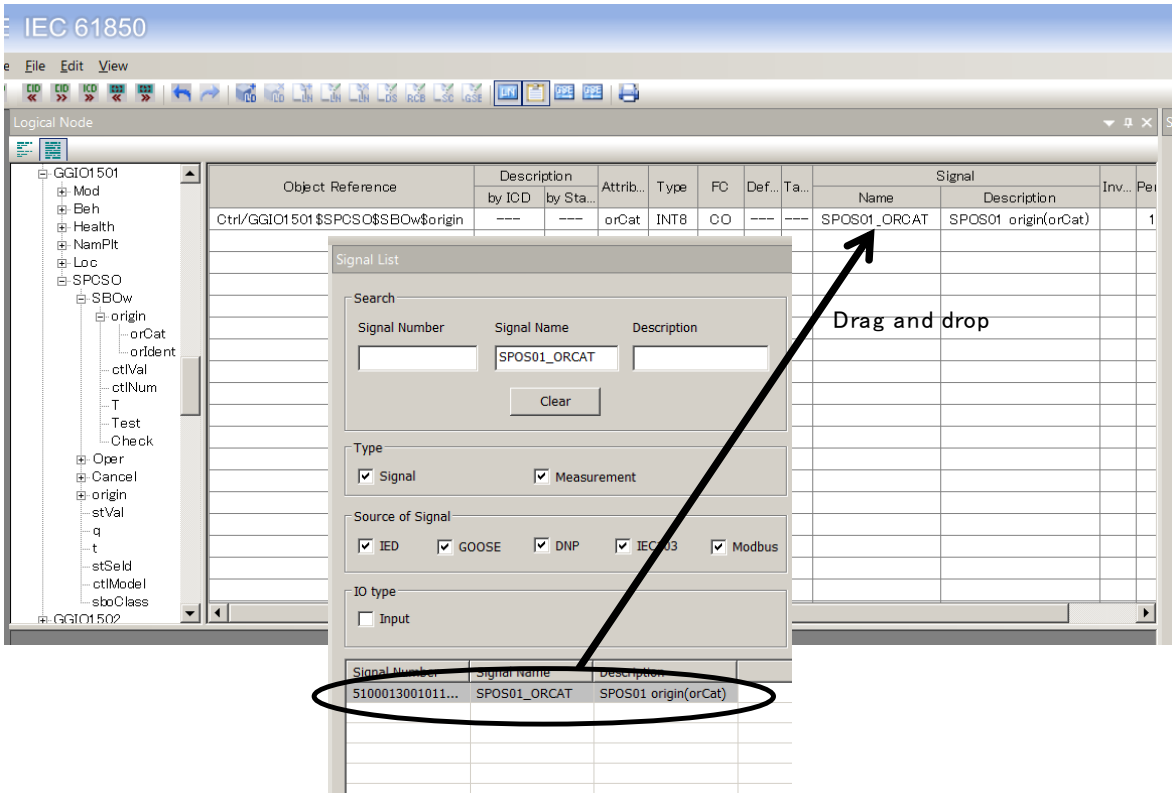


Figure 2.8-43 ocCat attribute mapped for SPCSO object of GGIO1501

(iii) Mapping input data

The SPOS01 function can receive three commands "select, operate, and cancel". Thus, the user should map the input-point "DEV01_CONTROL_REQ" to the IEC 61850 communication. Table 2.8-31 shows the input-point "DEV01_CONTROL_REQ" and the Object reference "Ctrl/GGIO1501$SPCSO"; the user should map the input point to the Object reference having attributes CO and CF†. Figure 2.8-44 shows how to map a signal.

Table 2.8-31 Mapping signals required for SPCSO object for GIG01501

Object_reference	Attribute	Type	FC	Signal Number	Signal Name
Ctrl/GGIO1501$SPCSO$SBOw	ctlVal	BOOLEAN	CO	5100017 001016D08	DEV01_CONTROL_REQ
Ctrl/GGIO1501$SPCSO$SBOw	ctlNum	INT8U	CO		
Ctrl/GGIO1501$SPCSO$SBOw	T	Timestamp	CO		
Ctrl/GGIO1501$SPCSO$SBOw	Test	BOOLEAN	CO		
Ctrl/GGIO1501$SPCSO$SBOw	Check	Check	CO		
Ctrl/GGIO1501$SPCSO$SBOw$origin	orCat	orCategory	CO		
Ctrl/GGIO1501$SPCSO$SBOw$origin	orIdent	Octet64	CO		
Ctrl/GGIO1501$SPCSO$Oper	ctlVal	BOOLEAN	CO		
Ctrl/GGIO1501$SPCSO$Oper	ctlNum	INT8U	CO		
Ctrl/GGIO1501$SPCSO$Oper	T	Timestamp	CO		
Ctrl/GGIO1501$SPCSO$Oper	Test	BOOLEAN	CO		
Ctrl/GGIO1501$SPCSO$Oper	Check	Check	CO		
Ctrl/GGIO1501$SPCSO$Oper$origin	orCat	orCategory	CO		
Ctrl/GGIO1501$SPCSO$Oper$origin	orIdent	Octet64	CO		
Ctrl/GGIO1501$SPCSO$Cancel	ctlVal	BOOLEAN	CO		
Ctrl/GGIO1501$SPCSO$Cancel	ctlNum	INT8U	CO		
Ctrl/GGIO1501$SPCSO$Cancel	T	Timestamp	CO		
Ctrl/GGIO1501$SPCSO$Cancel	Test	BOOLEAN	CO		
Ctrl/GGIO1501$SPCSO$Cancel$origin	orCat	orCategory	CO		
Ctrl/GGIO1501$SPCSO$Cancel$origin	orIdent	Octet64	CO		
Ctrl/GGIO1501$SPCSO	ctlModel	ctlModel	CF		
Ctrl/GGIO1501$SPCSO	sboClass	sboClass	CF		

†Note: The attribute is defined in the IEC 61850 standard; "CO" stands for "Control" and "CF" stands for "Configuration" in the functional constraint (FC).

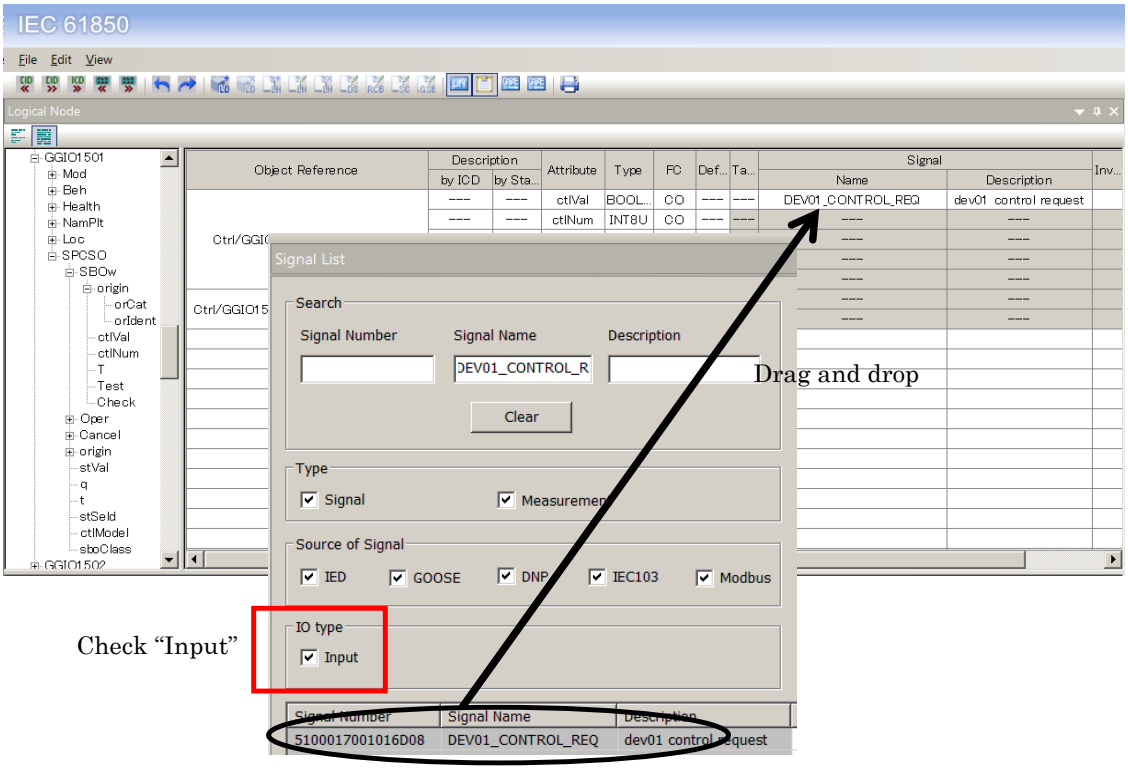


Figure 2.8-44 Input-point mapped for GGIO1501

2.8.6 Setting

Common settings list for the SPOS(FunctionID:510001)

Setting item			Range	Units	Contents	Default setting value	Notes
	common	SPOS-NELD	0 - 99	-	Number of Event lock detect time	10	
		SPOS-TELD	1 - 99	s	Timer for detection of event lock	10	
		SPOS-TELR	1 - 99	s	Timer for recovery from event lock	10	

SPOS01 settings list (FunctionID:510001)

Setting item			Range	Units	Contents	Default setting value	Notes
	DEV1	SPOS01-EN	Off/On		DEV1 Enable	Off	
		SPOS01-NOPSG			Normally Open Signal for Dev1		
		SPOS01-NSOSGI	Off/On		Signal inverse or not inversed	Off	
		SPOS01-SPPEN	Off/On		Automatic event suppression function	Off	
		SPOS01-CTREN	Off/On		control mode (control enable)	Off	
		SPOS01-CTRMENU	Off/On		control from MENU enable	Off	
		SPOS01-CTRAHMI	DIR/SBO		control action(Direct or SBO)by HMI	SBO	
		SPOS01-SLBORD			select binary output read data(DataID)		
		SPOS01-OEXBORD			on direction execute binary output read data(DataID)		
		SPOS01-FEXBORD			off direction execute binary output read data(DataID)		
		SPOS01-OFEXBORD			on/off direction execute binary output read data(DataID)		
		SPOS01-LGCTRCON	FixedLogic/PLC		Change logic for control condition	FixedLogic	
		SPOS01-LGSLFFCT	FixedLogic/PLC		Change logic for select fail factor	FixedLogic	
		SPOS01-LGEXFFCT	FixedLogic/PLC		Change logic for execute command fail factor	FixedLogic	
		SPOS01-LGFEXOT	FixedLogic/PLC		Change logic for off direction execute output	FixedLogic	
		SPOS01-LGCNFFCT	FixedLogic/PLC		Change logic for cancel command fail factor	FixedLogic	
		SPOS01-PLSM	Fix/Var/Latch		pulse mode	Latch	
		SPOS01-CPW	0.1-50.0	s	control pulse width	1	
		SPOS01-RST	1.0-100.0	s	response check timer	30	
		SPOS01-CTRDIR	Off/On		Capable control direction	On	
		SPOS01-APBD	Process/Bay		status change origin	Process	

Note: The SPOS function is available for a 2nd Device and other devices. We have omitted the others because their setting tables are the same as the 1st device table with the exception of the device number.

2.8.7 Signal

◆ Signal monitoring points in SPOS01

SPOS(FunctionID:510001)

Element ID	Name	Description
8001011DE0	DEV1PLCCTRLFAIL	DEV1PLCCTRLFAIL
8001011D51	SPOS01_SC_OWS	SPOS01 select command by OWS(HMI)
8001011D52	SPOS01_SC_RCC	SPOS01 select command by RCC
8001011D53	SPOS01_SC_RMT	SPOS01 select command by Remote
8001011D54	SPOS01_SC_LCD	SPOS01 select command by LCD
8001011D55	SPOS01_EC_OWS	SPOS01 execute command by OWS(HMI)
8001011D56	SPOS01_EC_RCC	SPOS01 execute command by RCC
8001011D57	SPOS01_EC_RMT	SPOS01 execute command by Remote
8001011D58	SPOS01_EC_LCD	SPOS01 execute command by LCD
8001011D59	SPOS01_EC_PLC	SPOS01 execute command by PLC
8701011E98	SPOS01_SLF_FCT_EIS	SPOS01 select fail factor signal except interlock/synchronism check
8B01011EA2	SPOS01_CTR_SGU	SPOS01 control logic stage(under selection)
8301011E9D	SPOS01_CTR_SGN	SPOS01 control logic stage(unselected)
8101011E9A	SPOS01_ECF_FCT_EIS	SPOS01 execute command fail factor signal except interlock/synchronism check
8001011F55	SPOS01_EC_ST_ERR	SPOS01 execute command mode err
8001011E93	SPOS01_EX_CMP	SPOS01 execute complete signal
8901011F6C	SPOS01_EX_CS01	SPOS01 execute condition signal 01
8A01011F6D	SPOS01_EX_CS02	SPOS01 execute condition signal 02
8B01011F6E	SPOS01_EX_CS03	SPOS01 execute condition signal 03
8E01011F67	SPOS01_EX_CS04	SPOS01 execute condition signal 04
8B01011F68	SPOS01_EX_CS05	SPOS01 execute condition signal 05
8601011E91	SPOS01_EX_FFL	SPOS01 execute fail signal by fixedlogic
8501011E8F	SPOS01_EX_SFL	SPOS01 execute success signal by fixedlogic
8001011F56	SPOS01_NSL_CS06	SPOS01 no direction select condition signal 06
8601011F5E	SPOS01_NSL_CS07	SPOS01 no direction select condition signal 07
8201011F5F	SPOS01_NSL_CS10	SPOS01 no direction select condition signal 10
8101011E7B	SPOS01_SLF_CS	SPOS01 no direction select fail condition signal
8101011DD0	SPOS01_FEX_BO	SPOS01 off direction execute binary output signal
8001011E81	SPOS01_FEC_OK_CS	SPOS01 off direction execute command OK condition signal
8001011E7E	SPOS01_FEC_OK_CSF	SPOS01 off direction execute command OK condition signal by fixedlogic
8201011E88	SPOS01_FEC_F_CS	SPOS01 off direction execute command fail condition signal
8101011E85	SPOS01_FEC_F_CSF	SPOS01 off direction execute command fail condition signal by fixedlogic
8A01011DC4	SPOS01_FSL_BO_CSF	SPOS01 off direction select binary output condition signal by fixedlogic
8501011F60	SPOS01_FSL_CS19	SPOS01 off direction select condition signal 19
8A01011F61	SPOS01_FSL_CS20	SPOS01 off direction select condition signal 20
8101011F64	SPOS01_FSL_CS21	SPOS01 off direction select condition signal 21
8201011DD3	SPOS01_OEX_BO	SPOS01 on direction execute binary output signal
8101011E82	SPOS01_OEC_OK_CS	SPOS01 on direction execute command OK condition signal
8001011E7F	SPOS01_OEC_OK_CSF	SPOS01 on direction execute command OK condition signal by fixedlogic
8301011E89	SPOS01_OEC_F_CS	SPOS01 on direction execute command fail condition signal
8101011E86	SPOS01_OEC_F_CSF	SPOS01 on direction execute command fail condition signal by fixedlogic
8601011DC6	SPOS01_OSL_BO_CSF	SPOS01 on direction select binary output condition signal by fixedlogic
8501011F65	SPOS01_OSL_CS40	SPOS01 on direction select condition signal 40
8801011F5D	SPOS01_OSL_CS41	SPOS01 on direction select condition signal 41
8501011F5B	SPOS01_OSL_CS42	SPOS01 on direction select condition signal 42
8601011F5C	SPOS01_OSL_CS43	SPOS01 on direction select condition signal 43
8401011F77	SPOS01_OFEX_BO	SPOS01 on/off direction execute binary output signal
8901011DC0	SPOS01_NSL_BO_CSF	SPOS01 select binary output condition signal by fixedlogic
8501011F76	SPOS01_SL_BO_FLG	SPOS01 select binary output signal by fixedlogic
8001011F54	SPOS01_SC_ST_ERR	SPOS01 select command mode err
8601011F62	SPOS01_SLF_FCT_FLG03	SPOS01 select fail factor signal by fixedlogic 03

◆ Signal monitoring points in SPOS01

SPOS(FunctionID:510001)

Element ID	Name	Description
8701011F63	SPOS01_SLF_FCT_FLG04	SPOS01 select fail factor signal by fixedlogic 04
8801011F6B	SPOS01_SLF_FCT_FLG07	SPOS01 select fail factor signal by fixedlogic 07
8901011F72	SPOS01_SLF_FCT_FLG08	SPOS01 select fail factor signal by fixedlogic 08
8001011E7D	SPOS01_SLR_CS	SPOS01 select release condition signal
8001011E76	SPOS01_SLD_CS	SPOS01 selected condition signal
8001011F66	SPOS01_SLD_CS04	SPOS01 selected condition signal 04
8E01011F57	SPOS01_SLD_TMO	SPOS01 time out after selected
8F01011F58	SPOS01_EX_CMP_TMO	SPOS01 timeout after execute completion

Note: In the table above, the user will only find Element IDs and their names for the 1st device, but a 2nd and other devices are also provided in the SPOS function. We have omitted the Element IDs and their names for the other devices to improve readability. Use the rule described below when the user wishes to obtain the Element IDs and their names for the other devices.

Rule: The same types of signal monitoring points are provided in every device; hence, the user can find the same ones for all of the other devices. For example, when the user wishes to find the "SPOS01_SC_OWS" point for the 2nd device, use the description of "SPOS02_SC_OWS" in place of "SPOS01_SC_OWS". The user can obtain the ID value of "SPOS02_SC_OWS" by using the following steps:

Step 1 Find the element ID for SPOS01_SC_OWS (i.e., "8001011D51")

Step 2 Identify the number at the fifth digit from the ID. (i.e., "1")

Step 3 Choose a new device number. (i.e., pick the number "2" for the 2nd device)

Step 4 Replace the number that occurs at the fifth digit with the new device number. (i.e., get new ID "8001021D51" of "SPOS02_SC_OWS") The ID is expressed in hexadecimal notation. Thus, the user must change the device number from decimal notation to hexadecimal notation.

2.9 Double position device function (DPOS)

The double position device (DPOS) function is used when the user wishes to control a device having On and Off states, which is equivalent to controlling a device from the "Closed" or "Open" condition; the device is represented as DS or an ES. The DPOS function provides "Operation counters" and "Operation time measurement"; these features are used for the examination of the devices, these features are useful when the user wishes to assess the operating time of the device, which is performed by counting the state-change of the device. The BO circuits connected with the DPOS function are used for issuing commands; the BI circuits are used for receiving responses; hence, the user should connect the BI and BO circuits with the DPOS function(†). The DPOS function includes three logic groups: 1. Select logic, 2. Cancel logic, and 3. Operate logic.

Twenty devices can be controlled separately; i.e. the DPOS has 20 separate sets of logic for the control‡ (i.e., DPOS01, DPOS02 … DPOS20 functions). For simplicity, only the DPOS01 function is discussed here; the features in the other DPOS02–20 functions are identical to the DPOS01 function.

†Note: A binary IO module has binary input circuits (BIs) and binary output circuits (BOs); the user makes the connection between the DPOS01 function and the binary IO module using a signal number (is made of a "Function ID" and an "Element ID"). The signal name and number of the DPOS01 function are listed later.

‡Note: The DPOS function provides the other 10 logics (DPOS21–30) for monitoring.

Tips: If the user wishes to apply the DPOS function quickly, go to sections 2.9.6 and 2.9.7, where setting of the BI and BO circuits and the mapping of signal-points for IEC61850 communication is described.

Note: The implementation of such features is dependent upon the selection of hardware and the configuration of functions. Several IED models do not support certain features. To determine whether a particular feature has been implemented within an IED, identify the IED ordering number; and check the order number at the "G&T position" referring to the comparison table below. For more information, see *Appendix: Ordering*.

Table 2.9-1 Comparative table for respective ordering numbers

Sec.	Feature	Ordering No. at "G&T"					
		BCU			BCPU		IFU
		11	13	1F	2N	2C	19
–	Main features	✓	✓	✓	✓	✓	✓
–	Number of operative features‡	20	20	20	20	15	20
–	Number of monitoring features‡	30	20	30	30	15	30
–	Total number of functions‡	30	20	30	30	15	30

✓: Applicable NA: Not applicable

2.9.1 Select logic for SBO/DIR modes

The user should set scheme switch [**DPOS01-CTREN**] to **On** prior to DPOS01 operation. Table 2.9-11 shows all of the scheme switches in the DPOS function.

(i) Receiving "Select command On" from the remote-end

Figure 2.9-1 outlines the reception of the select command 'On' from the remote-end.

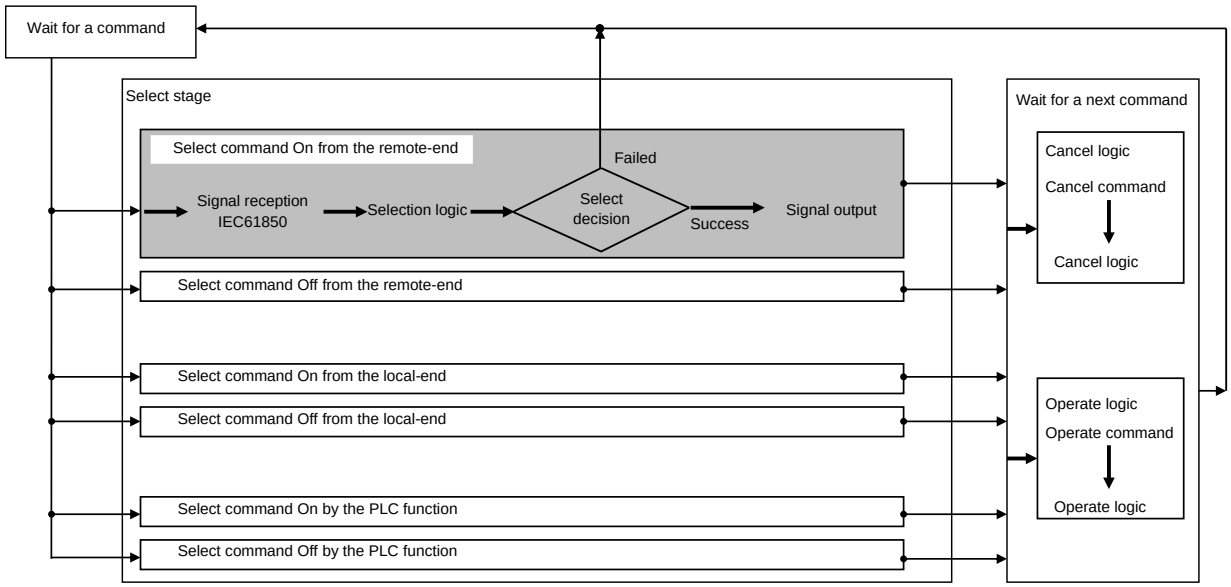


Figure 2.9-1 Outline of Select command 'On'

(i)-1 Input point required mapping

Figure 2.9-2 shows the Select logic when a "Select command On (Remote-ON-Control)" signal is applied to the DPOS01 function. The logic has the input-point "DEV01_CONTROL_REQ" for the reception of the select command. That is, the input-point must be mapped for IEC61850 communication. The function will fail to operate if mapping is not performed correctly. We will discuss how to map the input-points for IEC61850 communication in section 2.9.7.

(i)-2 Output signal to BO

The DPOS01 function can issue a "Select success" signal at the output point "DPOS01_OSL_BO_FLG", when the DPOS01 function determines that the "Remote-ON-Control" signal is true. If the DPOS01 function determines that the "Remote-ON-Control" signal is not true, the DPOS01 function returns to the "Wait for a command" stage.

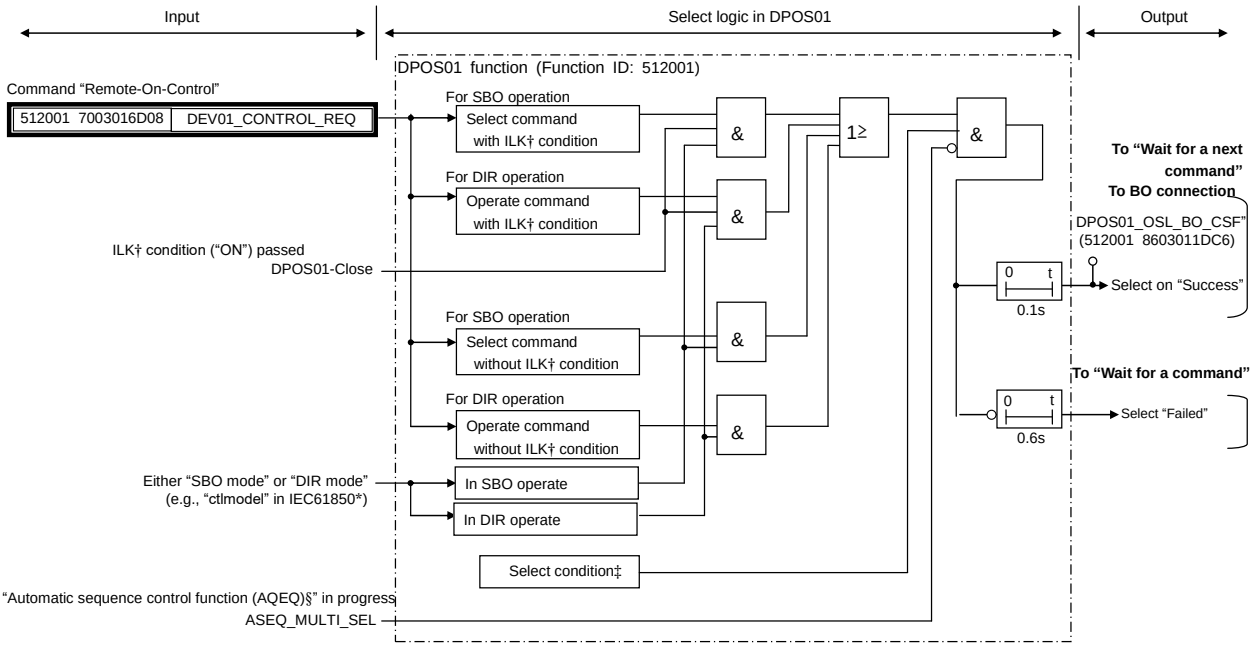


Figure 2.9-2 Select 'On' from the remote-end in DPOS01††

†Note: The software interlocking (ILK) function provides the operation criteria for "On". The ILK function is discussed separately; note that the operation criteria is defined by the ILK function itself (i.e., the user cannot set the condition).

‡Note: A "select condition" signal is provided from the select condition scheme. For more information, see Figure 2.9-13.

§Note: An automatic sequence control (ASEQ) function can provide sequential signals for automatic control. The DPOS01 operation is blocked for the ASEQ function being in operation. For more information of the ASEQ function, see Chapter *Control and monitoring application: Automatic sequence control function*.

*Note: The DPOS01 function can run in either the "SBO mode" or the "DIR mode" using a signal called "ctlmodel" when communication is implemented using IEC61850. To use this signal, the user must map it for IEC61850 communication.

††Note: To identify the input and output points of the other DPOS logics, see Table 2.9-5 and Table 2.9-9.

(ii) Receiving “Select command Off” from the remote-end

Figure 2.9-3 outlines the reception of the Select command ‘Off’ from the remote-end.

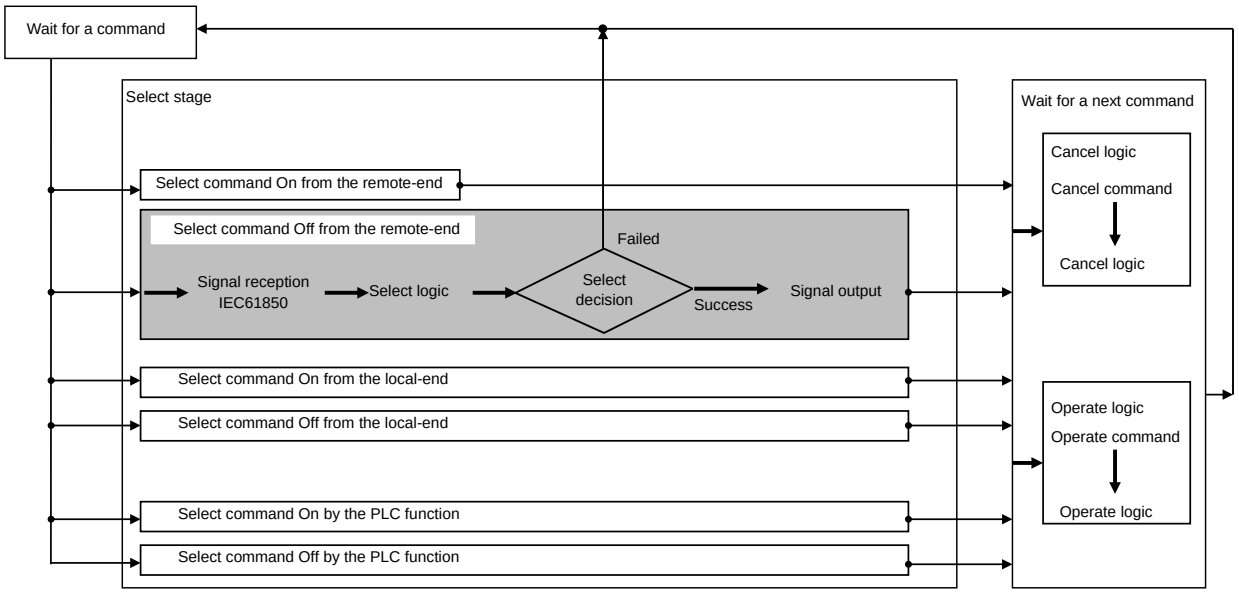


Figure 2.9-3 Outline of Select command ‘Off’

(ii)-1 Input point mapped from the communication

Figure 2.9-4 shows the Select logic when a “Select command Off (Remote-OFF-Control)” signal is applied at the input-point “DEV01_CONTROL_REQ”.

(ii)-2 Output signal to BO

The DPOS01 function, in Figure 2.9-4, can issue a “Select success” signal at the output point “DPOS01_FSL_BO_FLG” when the DPOS01 function determines that the received “Select command Off (Remote-OFF-Control)” signal is true. If the DPOS01 function determines that the “Remote-OFF-Control” signal is not true, the DPOS01 function returns to the “Wait for a command” stage.

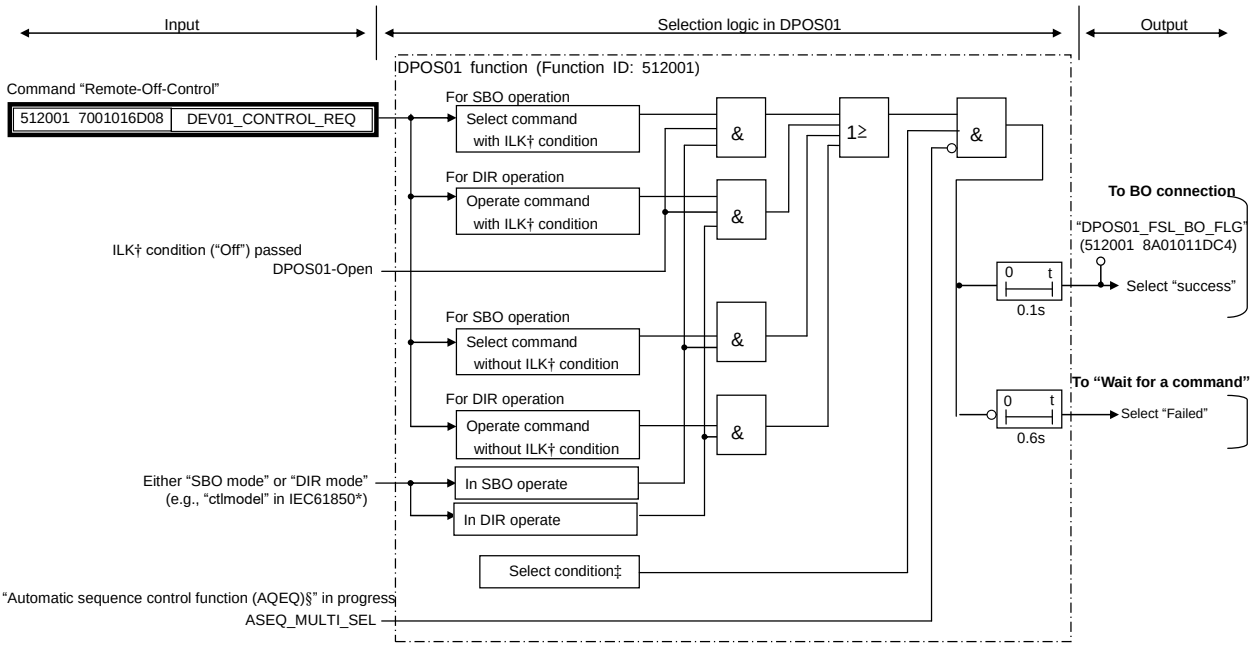


Figure 2.9-4 Select 'Off' from the remote-end in DPOS01††

†Note:The ILK function provides the operation criteria for "Off".

‡Note:A "select condition" signal is provided from the select condition scheme. For more information, see Figure 2.9-13.

§Note:An automatic sequence control (ASEQ) function can provide sequential signals for automatic control. The DPOS01 operation is blocked for the ASEQ function when it is in operation. For more information of the ASEQ function, see Chapter *Control and monitoring application: Automatic sequence control function*.

††Note: To know the input and output points of the other DPOS logics, see Table 2.9-5 and Table 2.9-9.

(iii) Receiving "Select command On" from the local-end

Figure 2.9-5 outlines the reception of the Select command 'On' from the local-end.

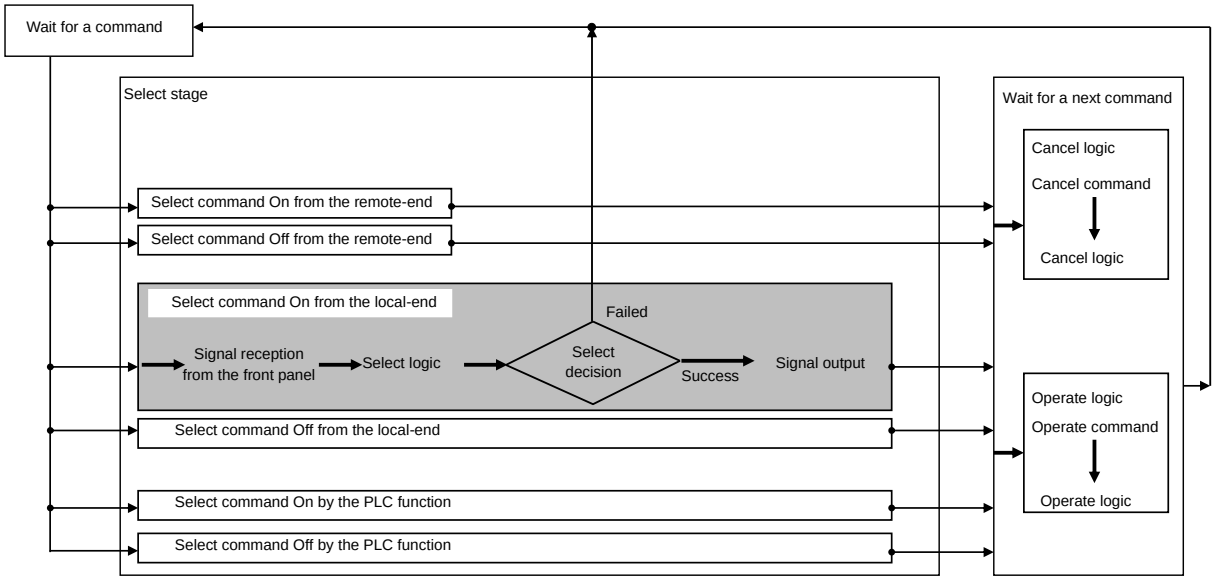


Figure 2.9-5 Outline of Select command 'On'

(iii)-1 Input signal generated at the local-end

Figure 2.9-6 shows the Select logic when "Select command On (Local-ON-Control)" signal is applied to the DPOS01 function. The signal is provided when an "On" key is pressed on the IED front panel; the user is not required to take account of mapping. Note that the user should set the scheme switch [**DPOS01-CTRAHMI**] to **SBO** when operation from the IED front panel is required, we discuss how to set this in chapter *User interface: Control sub-menu*.

(iii)-2 Output signal to BO

When the "select condition" signal is true, the DPOS01 function can issue a "Select success" signal at the output-point "DPOS01_OSL_BO_CSF".

Note: The "DPOS01_OSL_BO_CSF" signal is the same as the signal shown in Figure 2.9-2. If the input signal "Local-ON-Control" is not true, the DPOS01 function returns to the "Wait for a command" stage.

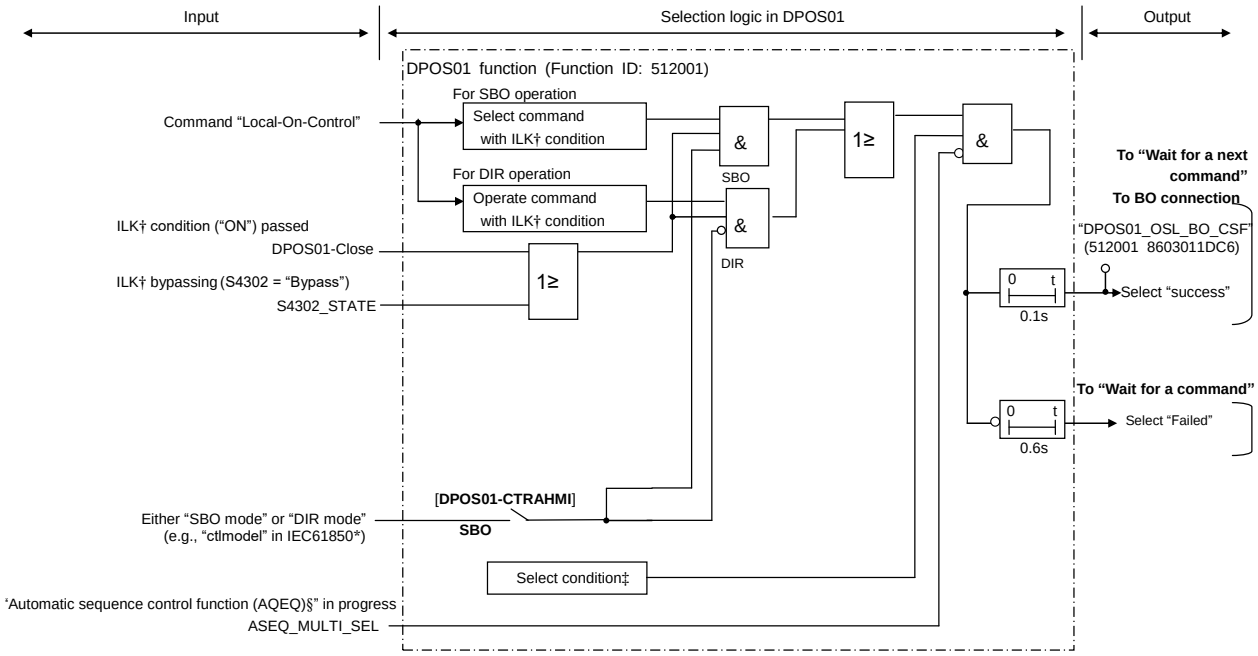


Figure 2.9-6 Select 'On' on the front panel in DPOS01††

†Note: The ILK function provides the operation criterion for "On". For testing, nullifying the ILK function is possible using "Interlock bypassing". "Interlock bypassing" is indicated by the status "S4302" in a software switch controller (SOFTSW).

‡Note: A "select condition" signal is provided from the select condition scheme. For more information, see Figure 2.9-13.

§Note: An automatic sequence control (ASEQ) function can provide sequential signals for automatic control. The DPOS01 operation is blocked for the ASEQ function when it is in operation. For more information regarding the ASEQ function, see Chapter *Control and monitoring application: Automatic sequence control function*.

††Note: To identify the output signals of the other DPOS logics, see Table 2.9-9.

(iv) Receiving “Select command Off” from the local-end

Figure 2.9-7 outlines the reception of the Select command ‘Off’ from the local-end.

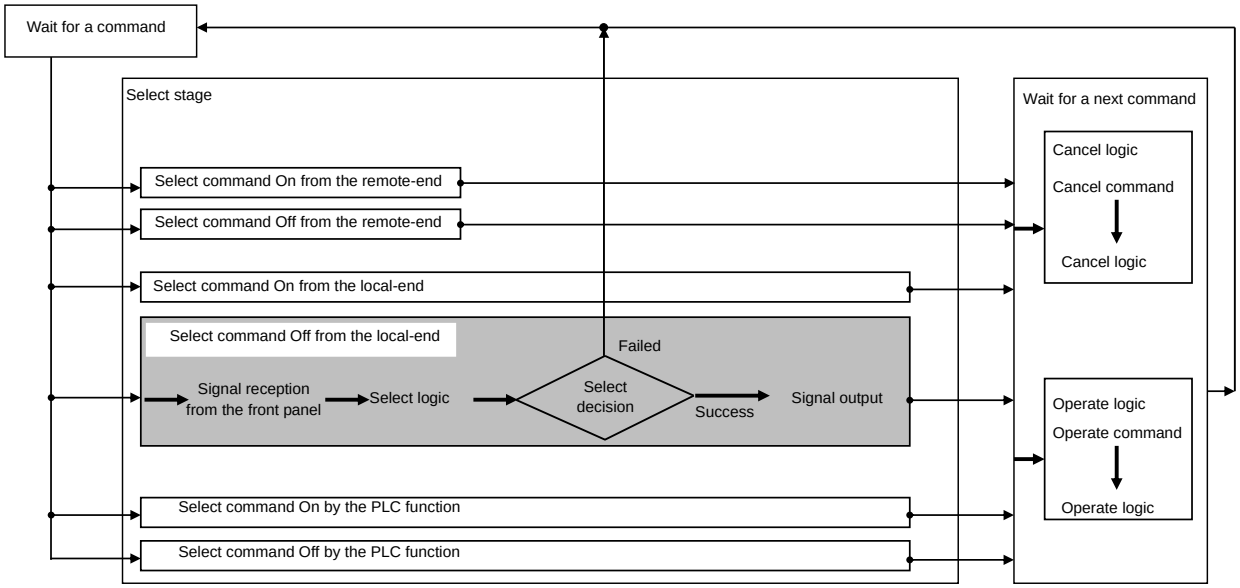


Figure 2.9-7 Outline of Select command ‘Off’

(iv)-1 Input signal generated at the local-end

Figure 2.9-8 shows the Select logic when a “Select command Off (Local-OFF-Control)” signal is received is applied to the DPOS01 function. The signal is provided when the user presses the “OFF” key on the IED front panel; the user is not required to map the signal from IEC61850 communication.

(iv)-2 Output signal to BO

When the “select condition” signal is true, the DPOS01 function can issue a “Select success” signal at the output-point “DPOS01_FSL_BO_FLG”.

[1]Note: The signal “DPOS01_FSL_BO_FLG” is the same as the signal shown in Figure 2.9-4. If the signal “Local-OFF-Control” is not true, the DPOS01 function returns to the “Wait for a command” stage.

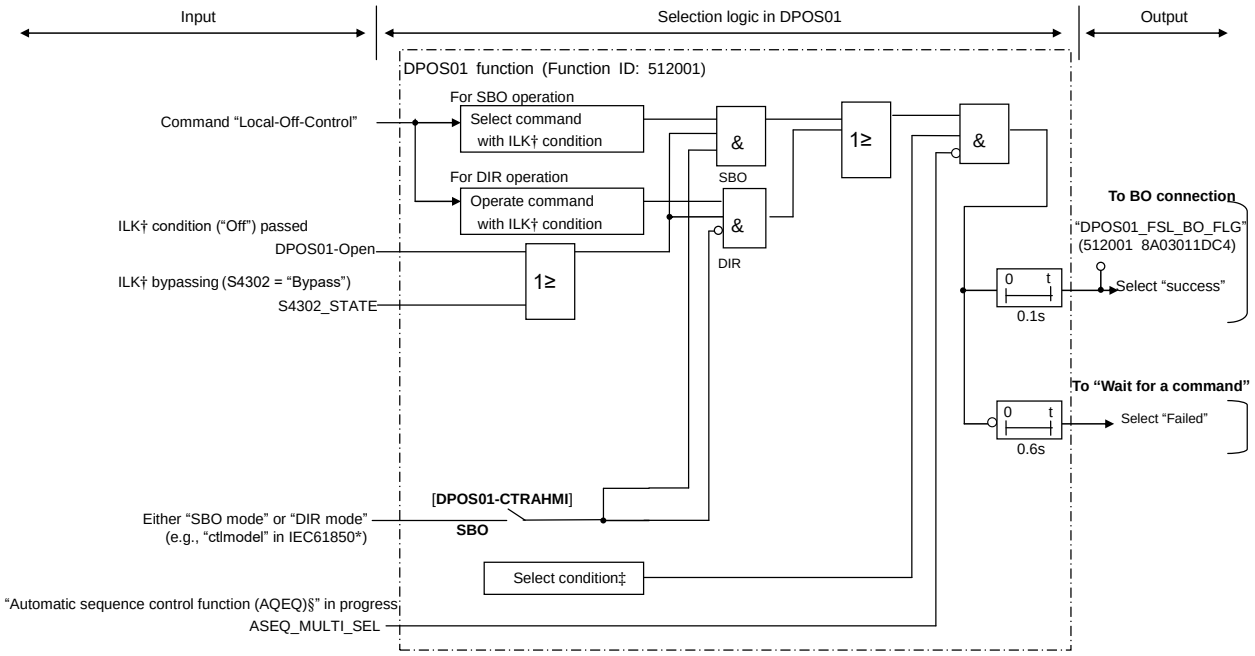


Figure 2.9-8 Select 'Off' on the front panel in DPOS01††

†Note:The ILK function provides the operation criteria for "Off".

‡Note:A "select condition" signal is provided from the select condition scheme. For more information, see Figure 2.9-13.

§Note:An automatic sequence control (ASEQ) function can provide sequential signals for automatic control. The DPOS01 operation is blocked for the ASEQ function when it is in operation. For more information regarding the ASEQ function, see Chapter *Control and monitoring application: Automatic sequence control function*.

††Note: To identify the output signals of the other DPOS logics, see Table 2.9-9.

(v) Receiving "Select command On" by PLC function

Figure 2.9-9 outlines the reception of the select command 'On' by the PLC function.

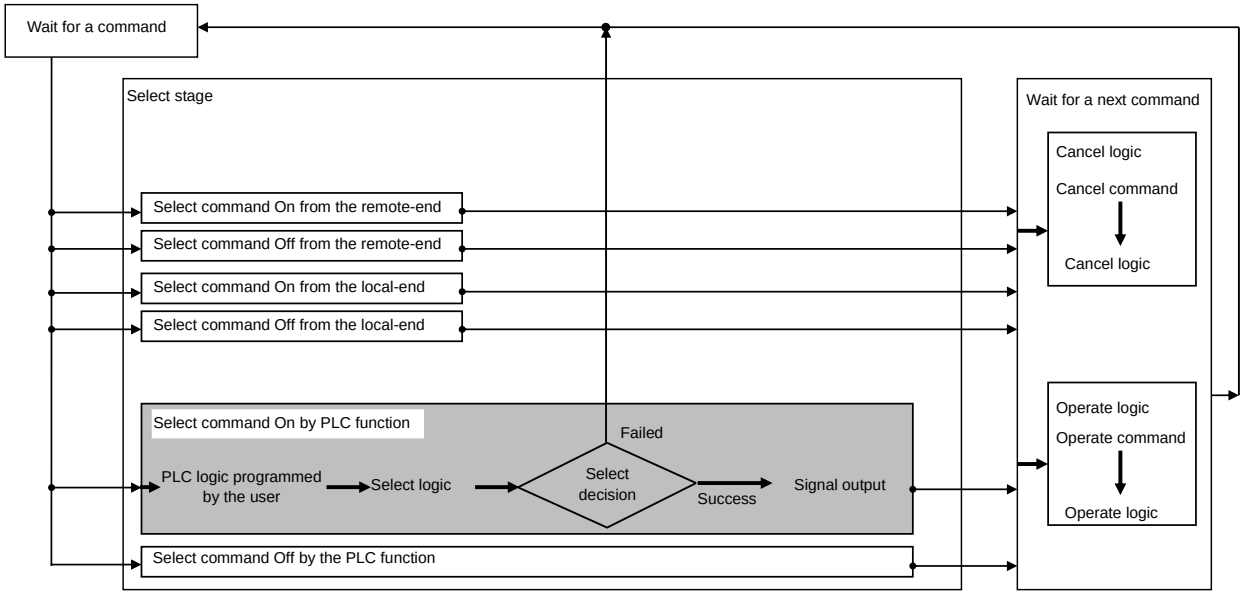


Figure 2.9-9 Outline of Select command 'On'

(v)-1 Input signal from the PLC function

Figure 2.9-10 shows the Select logic when a "select command On (PLC-On-Control)" signal is generated by the PLC function. There are two input points for reception of this signal: the former connection point, (PLC#1) is used for the reception of the select-command requiring the interlock check, the later connection point, (PLC#2) is used for the reception of the select-command not requiring the interlock check. That is, for the DPOS01 function, when the "Select command On (PLC-ON-Control)" signal generated in the user-programmed logic is applied for the select logic and when the interlock check is required in the select logic, use the connection point (PLC#1: Eg.PLC_BIT_0632). Alternatively, if the interlock check is not required, use the other connection point (PLC# 2: e.g., PLC_BIT_0633) for the injection. PLC#1 and PLC#2 is shown in Table 2.9-2.

(v)-2 Output signal to BO

The DPOS01 function, in Figure 2.9-10, can issue a "Select success" signal at the output-point "DPOS01_OSL_BO_CSF"[1].

[1]Note: The "DPOS01_OSL_BO_CSF" signal is the same signal as that shown in Figure 2.9-2.

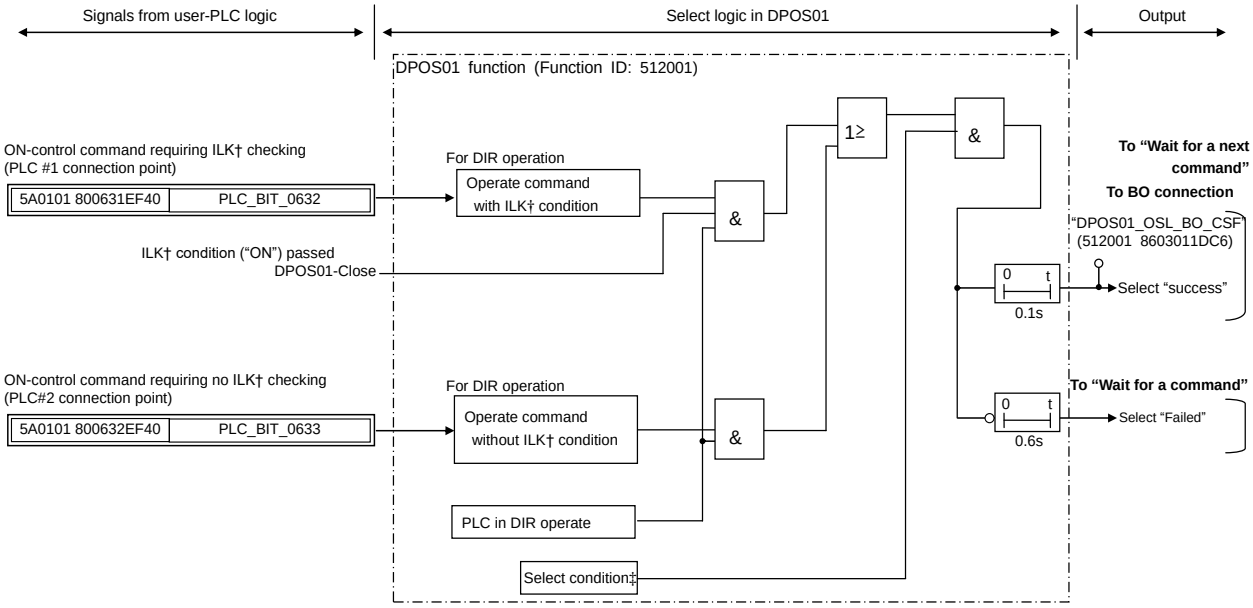


Figure 2.9-10 Select 'On' using the PLC function in DPOS01††

†Note: The software interlocking (ILK) function provides the operation criteria for "On". The ILK function is discussed separately; note that the operation criteria is defined in the ILK function itself (i.e., the user cannot set the condition).

‡Note: A "select condition" signal is provided from the select condition scheme. For more information, see Figure 2.9-13.

††Note: To identify the input and output points of the other DPOS logics, see Table 2.9-2 for the inputs (PLC#1 and PLC#2) and Table 2.9-9 for the outputs.

(vi) Receiving "Select command Off" by PLC function

Figure 2.9-11 outlines the reception of the Select command 'Off' by the PLC function.

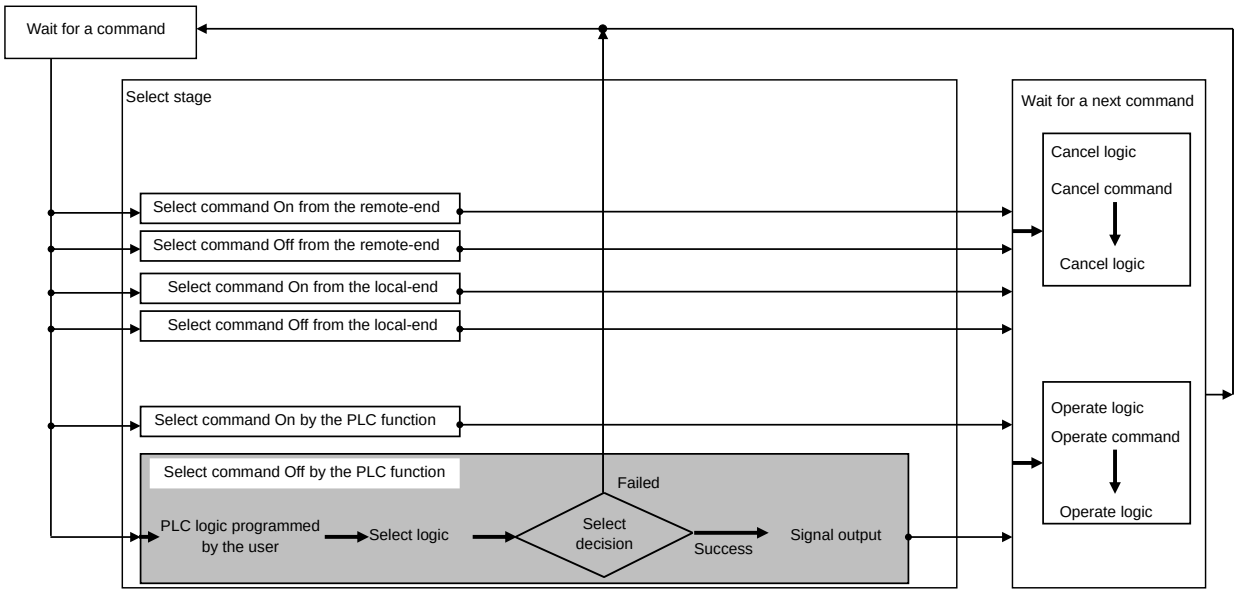


Figure 2.9-11 Outline of Select command Off

(vi)-1 Input signal from the PLC function

Figure 2.9-12 shows the Select logic when a "select command Off (PLC-Off-Control)" signal is generated by the PLC function. There are two input points for the reception of this signal: like in signal "select command On (PLC-On-Control): That is, if interlock checking is required, use the connection point (PLC#1: E.g. PLC_BIT_0631). Alternatively, if the interlock check is not required, use the connection point (PLC# 2: E.g. PLC_BIT_0630). PLC#1 and PLC#2 are shown in Table 2.9-3.

(vi)-2 Output signal to BO

The DPOS01 function, in Figure 2.9-12, can issue a "Select success" signal at the output point "DPOS01_FSL_BO_CSF"[1].

[1]Note: The output point "DPOS01_FSL_BO_CSF" is the same signal as that shown in Figure 2.9-4.

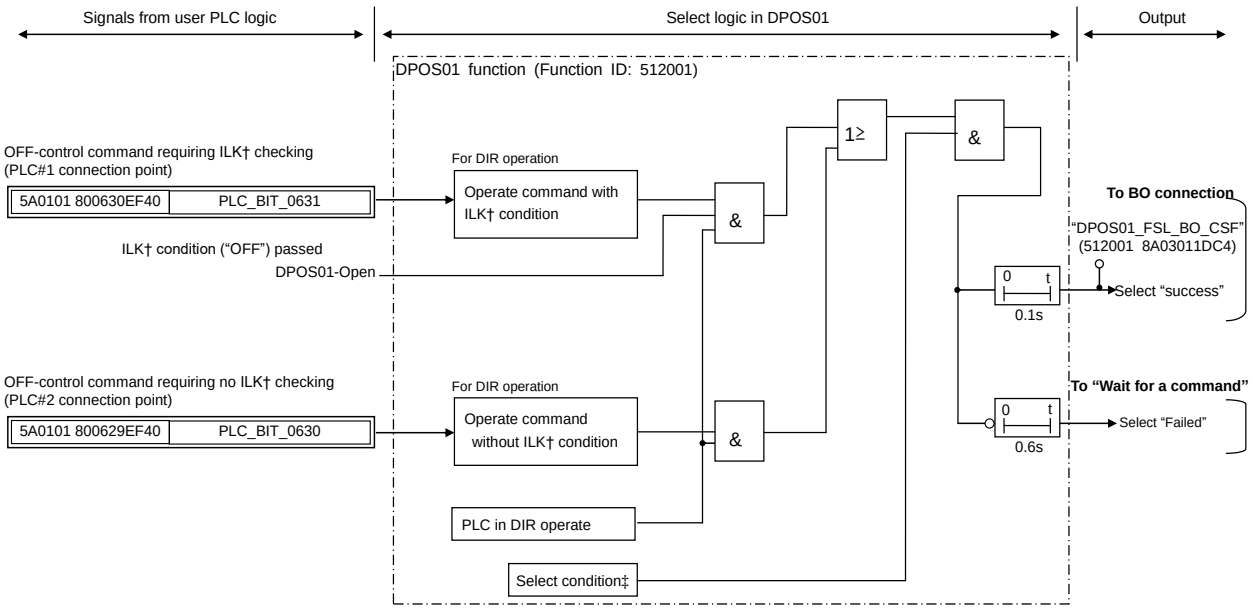


Figure 2.9-12 Select 'Off' by the PLC function in DPOS01††

†Note:The ILK function provides the operation criteria for "Off".

‡Note:A "select condition" signal is provided from the select condition scheme. For more information, see Figure 2.9-13.

††Note: To identify the input and output points of the other DPOS logics, see Table 2.9-3 for the inputs (PLC#1 and PLC#2) and Table 2.9-9 for the outputs.

(vii) Select condition

Figure 2.9-13 shows the select condition logic in the DPOS01 function. The DPOS01 function checks the condition for the Select command using the signal "DPOS1_3PH_STATE" (see Table 2.9-34). If the original logic does not meet with the requirements of the user, the following alternatives are available:

1. The user can replace the original logic with alternative logic,
2. The user can add additional logic to the original logic.

(vii)-1 How to replace the original logic

If the user wishes to replace the select condition logic, the user can replace it using the PLC connection point "User configurable condition":

1. Connect the user-customized logic using "PLC_BIT_0636", which is listed as PLC#2 in Table 2.9-7.
2. Set the scheme switch [**DPOS01-LGSLFFCT**] to **PLC**.

(vii)-2 How to add another select condition signal

If adding another condition is required, the user can add a signal using the PLC connection point "Additional condition".

1. Add a user-preferred signal using "PLC_BIT_0637", which is listed as PLC#1 in Table 2.9-7.
2. Set the scheme switch [**DPOS01-LGSLFFCT**] to **Fixedlogic**.

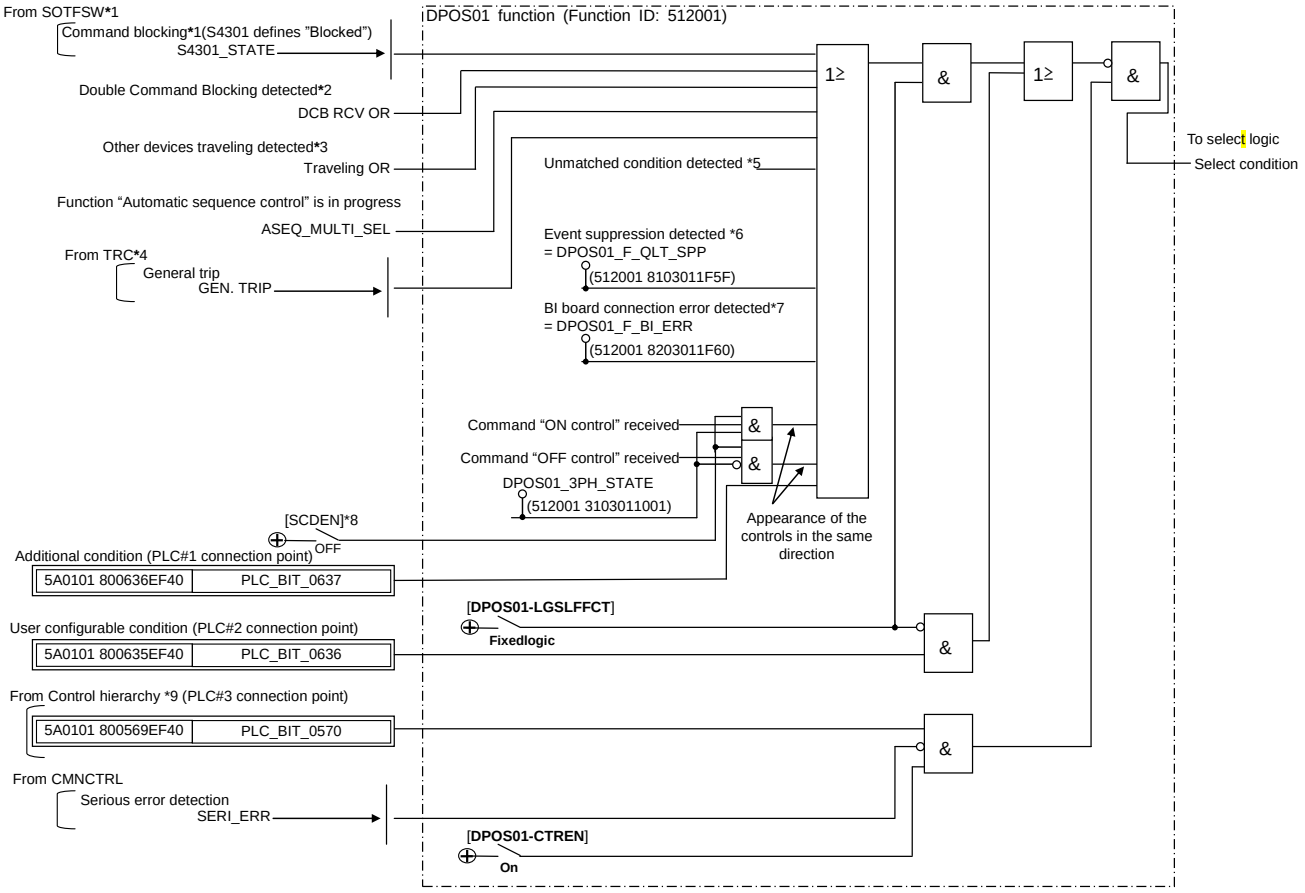


Figure 2.9-13 Select condition logic for 'ON/OFF' in DPOS01*10

[1]Note: "Command Blocking" disables any operation except its own; the "Command Blocking" is initiated by the status "S4301" in a software switch controller (SOTFSW). The IEC61850 standard defines "Command Blocking" as "CmdBlk". For more information on "S4301", see Chapter *Control and monitoring application: Software switch controller. See the signal* "S4301_STATE" of Table 2.9-6.

[2]Note: "Double Command Blocking" (DCB) is an operation philosophy in the common control function (CMNCTRL). It can be used to protect the substation. The user can program it using GR-TIEMS. The DCB operating signal is denoted as "DCB RCV OR" in Table 2.9-6. For more information see Chapter *Control and monitoring application*: *Common controls.*

[3]Note: If the event "device-travelling" is detected in the CMNCTRL function, it indicates that another operator is changing the status of a device. Thus, the IED should inhibit the operation of any device for the duration that the event is detected. The detected signal is denoted as "Travelling OR" in Table 2.9-6.

[4]Note: If the issue of a trip command is executed by the IED, any control operation is blocked until the trip operation is completed. If an IED includes a relay application, the trip command is issues at the output_point "GEN_TRIP" in Table 2.9-7.

[5]Note: Criteria “unmatched conditions” are decided when “Test-bit status” in a command is not identical to “IED test status”.

[6]Note: The function “Event suppression” can detect chattering on BI circuits. (See section 2.9.6(i)-3)

[7]Note: A supervision of the Binary IO module can detect connection errors for BI circuits.

[8]Note: The Common control (CMNCTRL) function can test and check the ‘On and Off operations performed by the logic. When the user sets **Off** for scheme switch [**SCDEN**], the operation of the logic is blocked if the logic is running in the same operation-direction compared with the previous operation-direction (i.e., when on (off) is performed sequentially). On the other hand, if **On** is set for the scheme switch, the logic is not blocked.

[9]Note: The user will need to program the PLC logic “Control hierarchy condition”. The user is also required to connect the logic condition with the select condition logic using the connection point “PLC_BIT_0570”. For more information, see Chapter *Control and monitoring application: Control hierarchy*. See PLC#3 of Table 2.9-7.

[10]Note: To identify the input point of the other DPOS, see Table 2.9-7 for PLC#1 and PLC#2.

(viii) Signal name and number

Note: The user should note the following descriptions shown in the column "M/O" for each table:

"O" indicated that the signal is provided for optional use.

"M" indicates that the user should map/set/configure the signal; otherwise, the user may experience an operational failure if the default settings are used.

"N/A" indicates that the user cannot change the state of the signal.

Table 2.9-2 PLC Connection points (Input points for Command 'On')

Signal Number	Signal Name	Description	M/O
5A0101 800632EF40	PLC_BIT_0633	DPOS01 PLC On-control checking with interlock(PLC#1)	O
5A0101 800652EF40	PLC_BIT_0653	DPOS02 PLC On-control checking with interlock(PLC#1)	O
5A0101 800672EF40	PLC_BIT_0673	DPOS03 PLC On-control checking with interlock(PLC#1)	O
5A0101 800692EF40	PLC_BIT_0693	DPOS04 PLC On-control checking with interlock(PLC#1)	O
5A0101 800712EF40	PLC_BIT_0713	DPOS05 PLC On-control checking with interlock(PLC#1)	O
5A0101 800732EF40	PLC_BIT_0733	DPOS06 PLC On-control checking with interlock(PLC#1)	O
5A0101 800752EF40	PLC_BIT_0753	DPOS07 PLC On-control checking with interlock(PLC#1)	O
5A0101 800772EF40	PLC_BIT_0773	DPOS08 PLC On-control checking with interlock(PLC#1)	O
5A0101 800792EF40	PLC_BIT_0793	DPOS09 PLC On-control checking with interlock(PLC#1)	O
5A0101 800812EF40	PLC_BIT_0813	DPOS10 PLC On-control checking with interlock(PLC#1)	O
5A0101 800832EF40	PLC_BIT_0833	DPOS11 PLC On-control checking with interlock(PLC#1)	O
5A0101 800852EF40	PLC_BIT_0853	DPOS12 PLC On-control checking with interlock(PLC#1)	O
5A0101 800872EF40	PLC_BIT_0873	DPOS13 PLC On-control checking with interlock(PLC#1)	O
5A0101 800892EF40	PLC_BIT_0893	DPOS14 PLC On-control checking with interlock(PLC#1)	O
5A0101 800912EF40	PLC_BIT_0913	DPOS15 PLC On-control checking with interlock(PLC#1)	O
5A0101 800932EF40	PLC_BIT_0933	DPOS16 PLC On-control checking with interlock(PLC#1)	O
5A0101 800952EF40	PLC_BIT_0953	DPOS17 PLC On-control checking with interlock(PLC#1)	O
5A0101 800972EF40	PLC_BIT_0973	DPOS18 PLC On-control checking with interlock(PLC#1)	O
5A0101 800992EF40	PLC_BIT_0993	DPOS19 PLC On-control checking with interlock(PLC#1)	O
5A0101 801012EF40	PLC_BIT_1013	DPOS20 PLC On-control checking with interlock(PLC#1)	O
5A0101 800631EF40	PLC_BIT_0632	DPOS01 PLC On-control without checking(PLC#2)	O
5A0101 800651EF40	PLC_BIT_0652	DPOS02 PLC On-control without checking(PLC#2)	O
5A0101 800671EF40	PLC_BIT_0672	DPOS03 PLC On-control without checking(PLC#2)	O
5A0101 800691EF40	PLC_BIT_0692	DPOS04 PLC On-control without checking(PLC#2)	O
5A0101 800711EF40	PLC_BIT_0712	DPOS05 PLC On-control without checking(PLC#2)	O
5A0101 800731EF40	PLC_BIT_0732	DPOS06 PLC On-control without checking(PLC#2)	O
5A0101 800751EF40	PLC_BIT_0752	DPOS07 PLC On-control without checking(PLC#2)	O
5A0101 800771EF40	PLC_BIT_0772	DPOS08 PLC On-control without checking(PLC#2)	O
5A0101 800791EF40	PLC_BIT_0792	DPOS09 PLC On-control without checking(PLC#2)	O
5A0101 800811EF40	PLC_BIT_0812	DPOS10 PLC On-control without checking(PLC#2)	O
5A0101 800831EF40	PLC_BIT_0832	DPOS11 PLC On-control without checking(PLC#2)	O
5A0101 800851EF40	PLC_BIT_0852	DPOS12 PLC On-control without checking(PLC#2)	O
5A0101 800871EF40	PLC_BIT_0872	DPOS13 PLC On-control without checking(PLC#2)	O
5A0101 800891EF40	PLC_BIT_0892	DPOS14 PLC On-control without checking(PLC#2)	O
5A0101 800911EF40	PLC_BIT_0912	DPOS15 PLC On-control without checking(PLC#2)	O
5A0101 800931EF40	PLC_BIT_0932	DPOS16 PLC On-control without checking(PLC#2)	O
5A0101 800951EF40	PLC_BIT_0952	DPOS17 PLC On-control without checking(PLC#2)	O
5A0101 800971EF40	PLC_BIT_0972	DPOS18 PLC On-control without checking(PLC#2)	O
5A0101 800991EF40	PLC_BIT_0992	DPOS19 PLC On-control without checking(PLC#2)	O
5A0101 801011EF40	PLC_BIT_1012	DPOS20 PLC On-control without checking(PLC#2)	O

Table 2.9-3 PLC Connection points (Input points for Command 'Off')

Signal Number	Signal Name	Description	M/O
5A0101 800629EF40	PLC_BIT_0630	DPOS01 PLC Off-control checking with interlock(PLC#1)	O
5A0101 800649EF40	PLC_BIT_0650	DPOS02 PLC Off-control checking with interlock(PLC#1)	O
5A0101 800669EF40	PLC_BIT_0670	DPOS03 PLC Off-control checking with interlock(PLC#1)	O
5A0101 800689EF40	PLC_BIT_0690	DPOS04 PLC Off-control checking with interlock(PLC#1)	O
5A0101 800709EF40	PLC_BIT_0710	DPOS05 PLC Off-control checking with interlock(PLC#1)	O
5A0101 800729EF40	PLC_BIT_0730	DPOS06 PLC Off-control checking with interlock(PLC#1)	O
5A0101 800749EF40	PLC_BIT_0750	DPOS07 PLC Off-control checking with interlock(PLC#1)	O
5A0101 800769EF40	PLC_BIT_0770	DPOS08 PLC Off-control checking with interlock(PLC#1)	O
5A0101 800789EF40	PLC_BIT_0790	DPOS09 PLC Off-control checking with interlock(PLC#1)	O
5A0101 800809EF40	PLC_BIT_0810	DPOS10 PLC Off-control checking with interlock(PLC#1)	O
5A0101 800829EF40	PLC_BIT_0830	DPOS11 PLC Off-control checking with interlock(PLC#1)	O
5A0101 800849EF40	PLC_BIT_0850	DPOS12 PLC Off-control checking with interlock(PLC#1)	O
5A0101 800869EF40	PLC_BIT_0870	DPOS13 PLC Off-control checking with interlock(PLC#1)	O
5A0101 800889EF40	PLC_BIT_0890	DPOS14 PLC Off-control checking with interlock(PLC#1)	O
5A0101 800909EF40	PLC_BIT_0910	DPOS15 PLC Off-control checking with interlock(PLC#1)	O
5A0101 800929EF40	PLC_BIT_0930	DPOS16 PLC Off-control checking with interlock(PLC#1)	O
5A0101 800949EF40	PLC_BIT_0950	DPOS17 PLC Off-control checking with interlock(PLC#1)	O
5A0101 800969EF40	PLC_BIT_0970	DPOS18 PLC Off-control checking with interlock(PLC#1)	O
5A0101 800989EF40	PLC_BIT_0990	DPOS19 PLC Off-control checking with interlock(PLC#1)	O
5A0101 801009EF40	PLC_BIT_1010	DPOS20 PLC Off-control checking with interlock(PLC#1)	O
5A0101 800630EF40	PLC_BIT_0631	DPOS01 PLC Off-control without checking(PLC#2)	O
5A0101 800650EF40	PLC_BIT_0651	DPOS02 PLC Off-control without checking(PLC#2)	O
5A0101 800670EF40	PLC_BIT_0671	DPOS03 PLC Off-control without checking(PLC#2)	O
5A0101 800690EF40	PLC_BIT_0691	DPOS04 PLC Off-control without checking(PLC#2)	O
5A0101 800710EF40	PLC_BIT_0711	DPOS05 PLC Off-control without checking(PLC#2)	O
5A0101 800730EF40	PLC_BIT_0731	DPOS06 PLC Off-control without checking(PLC#2)	O
5A0101 800750EF40	PLC_BIT_0751	DPOS07 PLC Off-control without checking(PLC#2)	O
5A0101 800770EF40	PLC_BIT_0771	DPOS08 PLC Off-control without checking(PLC#2)	O
5A0101 800790EF40	PLC_BIT_0791	DPOS09 PLC Off-control without checking(PLC#2)	O
5A0101 800810EF40	PLC_BIT_0811	DPOS10 PLC Off-control without checking(PLC#2)	O
5A0101 800830EF40	PLC_BIT_0831	DPOS11 PLC Off-control without checking(PLC#2)	O
5A0101 800850EF40	PLC_BIT_0851	DPOS12 PLC Off-control without checking(PLC#2)	O
5A0101 800870EF40	PLC_BIT_0871	DPOS13 PLC Off-control without checking(PLC#2)	O
5A0101 800890EF40	PLC_BIT_0891	DPOS14 PLC Off-control without checking(PLC#2)	O
5A0101 800910EF40	PLC_BIT_0911	DPOS15 PLC Off-control without checking(PLC#2)	O
5A0101 800930EF40	PLC_BIT_0931	DPOS16 PLC Off-control without checking(PLC#2)	O
5A0101 800950EF40	PLC_BIT_0951	DPOS17 PLC Off-control without checking(PLC#2)	O
5A0101 800970EF40	PLC_BIT_0971	DPOS18 PLC Off-control without checking(PLC#2)	O
5A0101 800990EF40	PLC_BIT_0991	DPOS19 PLC Off-control without checking(PLC#2)	O
5A0101 801010EF40	PLC_BIT_1011	DPOS20 PLC Off-control without checking(PLC#2)	O

Table 2.9-4 PLC Connection points (Interlock for Command 'On/Off')

Signal Number	Signal Name	Description	M/O
570001 3103021DA2	DPOS01-Close	DPOS01 interlock condition for On control.	N/A
570001 3103031DA2	DPOS02-Close	DPOS02 interlock condition for On control.	N/A
570001 3103041DA2	DPOS03-Close	DPOS03 interlock condition for On control.	N/A
570001 3103051DA2	DPOS04-Close	DPOS04 interlock condition for On control.	N/A
570001 3103061DA2	DPOS05-Close	DPOS05 interlock condition for On control.	N/A
570001 3103071DA2	DPOS06-Close	DPOS06 interlock condition for On control.	N/A
570001 3103081DA2	DPOS07-Close	DPOS07 interlock condition for On control.	N/A
570001 3103091DA2	DPOS08-Close	DPOS08 interlock condition for On control.	N/A
570001 31030A1DA2	DPOS09-Close	DPOS09 interlock condition for On control.	N/A

Signal Number	Signal Name	Description	M/O
570001 31030B1DA2	DPOS10-Close	DPOS10 interlock condition for On control.	N/A
570001 31030C1DA2	DPOS11-Close	DPOS11 interlock condition for On control.	N/A
570001 31030D1DA2	DPOS12-Close	DPOS12 interlock condition for On control.	N/A
570001 31030E1DA2	DPOS13-Close	DPOS13 interlock condition for On control.	N/A
570001 31030F1DA2	DPOS14-Close	DPOS14 interlock condition for On control.	N/A
570001 3103101DA2	DPOS15-Close	DPOS15 interlock condition for On control.	N/A
570001 3103111DA2	DPOS16-Close	DPOS16 interlock condition for On control.	N/A
570001 3103121DA2	DPOS17-Close	DPOS17 interlock condition for On control.	N/A
570001 3103131DA2	DPOS18-Close	DPOS18 interlock condition for On control.	N/A
570001 3103141DA2	DPOS19-Close	DPOS19 interlock condition for On control.	N/A
570001 3103011DA2	DPOS20-Close	DPOS20 interlock condition for On control.	N/A
570001 3103011DA0	DPOS01-Open	DPOS01 interlock condition for Off control.	N/A
570001 3103021DA0	DPOS02-Open	DPOS02 interlock condition for Off control.	N/A
570001 3103031DA0	DPOS03-Open	DPOS03 interlock condition for Off control.	N/A
570001 3103041DA0	DPOS04-Open	DPOS04 interlock condition for Off control.	N/A
570001 3103051DA0	DPOS05-Open	DPOS05 interlock condition for Off control.	N/A
570001 3103061DA0	DPOS06-Open	DPOS06 interlock condition for Off control.	N/A
570001 3103071DA0	DPOS07-Open	DPOS07 interlock condition for Off control.	N/A
570001 3103081DA0	DPOS08-Open	DPOS08 interlock condition for Off control.	N/A
570001 3103091DA0	DPOS09-Open	DPOS09 interlock condition for Off control.	N/A
570001 31030A1DA0	DPOS10-Open	DPOS10 interlock condition for Off control.	N/A
570001 31030B1DA0	DPOS11-Open	DPOS11 interlock condition for Off control.	N/A
570001 31030C1DA0	DPOS12-Open	DPOS12 interlock condition for Off control.	N/A
570001 31030D1DA0	DPOS13-Open	DPOS13 interlock condition for Off control.	N/A
570001 31030E1DA0	DPOS14-Open	DPOS14 interlock condition for Off control.	N/A
570001 31030F1DA0	DPOS15-Open	DPOS15 interlock condition for Off control.	N/A
570001 3103101DA0	DPOS16-Open	DPOS16 interlock condition for Off control.	N/A
570001 3103111DA0	DPOS17-Open	DPOS17 interlock condition for Off control.	N/A
570001 3103121DA0	DPOS18-Open	DPOS18 interlock condition for Off control.	N/A
570001 3103131DA0	DPOS19-Open	DPOS19 interlock condition for Off control.	N/A
570001 3103141DA0	DPOS20-Open	DPOS20 interlock condition for Off control.	N/A

Table 2.9-5 Mapping points for the reception of control commands

Signal Number	Signal Name	Description	M/O
512001 7003016D08	DEV01_CONTROL_REQ	DPOS01 control command received. (Mapping Data)	M
512001 7003026D08	DEV02_CONTROL_REQ	DPOS02 control command received. (Mapping Data)	M
512001 7003036D08	DEV03_CONTROL_REQ	DPOS03 control command received. (Mapping Data)	M
512001 7003046D08	DEV04_CONTROL_REQ	DPOS04 control command received. (Mapping Data)	M
512001 7003056D08	DEV05_CONTROL_REQ	DPOS05 control command received. (Mapping Data)	M
512001 7003066D08	DEV06_CONTROL_REQ	DPOS06 control command received. (Mapping Data)	M
512001 7003076D08	DEV07_CONTROL_REQ	DPOS07 control command received. (Mapping Data)	M
512001 7003086D08	DEV08_CONTROL_REQ	DPOS08 control command received. (Mapping Data)	M
512001 7003096D08	DEV09_CONTROL_REQ	DPOS09 control command received. (Mapping Data)	M
512001 70030A6D08	DEV10_CONTROL_REQ	DPOS10 control command received. (Mapping Data)	M
512001 70030B6D08	DEV11_CONTROL_REQ	DPOS11 control command received.(Mapping Data)	M
512001 70030C6D08	DEV12_CONTROL_REQ	DPOS12 control command received. (Mapping Data)	M
512001 70030D6D08	DEV13_CONTROL_REQ	DPOS13 control command received. (Mapping Data)	M
512001 70030E6D08	DEV14_CONTROL_REQ	DPOS14 control command received. (Mapping Data)	M
512001 70030F6D08	DEV15_CONTROL_REQ	DPOS15 control command received. (Mapping Data)	M
512001 7003106D08	DEV16_CONTROL_REQ	DPOS16 control command received. (Mapping Data)	M
512001 7003116D08	DEV17_CONTROL_REQ	DPOS17 control command received. (Mapping Data)	M
512001 7003126D08	DEV18_CONTROL_REQ	DPOS18 control command received. (Mapping Data)	M
512001 7003136D08	DEV19_CONTROL_REQ	DPOS19 control command received. (Mapping Data)	M

Signal Number	Signal Name	Description	M/O
512001 7003146D08	DEV20_CONTROL_REQ	DPOS20 control command received. (Mapping Data)	M

Table 2.9-6 Input signals to condition logic

Signal Number	Signal Name	Description	M/O
522001 000A011001	S4301_STATE	Command Blocking status (Off / Blocked)	N/A
523001 000D001F40	ASEQ_MULTI_SEL	Automatic sequence control is in progress.	N/A
5A0001 0008001F41	DCB RCV OR	Double Command Blocking(DCB) is in progress.	N/A
5A0001 0008001F40	Travelling OR	Travelling events are detected.	N/A
4A0001 8300001B6F	GEN. TRIP	General trip	N/A
5A0001 3108003F40	SDCEN	(This is setting of CMNCTRL)	N/A
5A0101 3100001F43	SERI_ERR	Serious Error detected	N/A

Table 2.9-7 PLC Connection points (Input signals for select condition logic)

Signal Number	Signal Name	Description	M/O
5A0101 800636EF40	PLC_BIT_0637	DPOS01 additional failure condition(PLC#1)	O
5A0101 800656EF40	PLC_BIT_0657	DPOS02 additional failure condition(PLC#1)	O
5A0101 800676EF40	PLC_BIT_0677	DPOS03 additional failure condition(PLC#1)	O
5A0101 800696EF40	PLC_BIT_0697	DPOS04 additional failure condition(PLC#1)	O
5A0101 800716EF40	PLC_BIT_0717	DPOS05 additional failure condition(PLC#1)	O
5A0101 800736EF40	PLC_BIT_0737	DPOS06 additional failure condition(PLC#1)	O
5A0101 800756EF40	PLC_BIT_0757	DPOS07 additional failure condition(PLC#1)	O
5A0101 800776EF40	PLC_BIT_0777	DPOS08 additional failure condition(PLC#1)	O
5A0101 800796EF40	PLC_BIT_0797	DPOS09 additional failure condition(PLC#1)	O
5A0101 800816EF40	PLC_BIT_0817	DPOS10 additional failure condition(PLC#1)	O
5A0101 800836EF40	PLC_BIT_0837	DPOS11 additional failure condition(PLC#1)	O
5A0101 800856EF40	PLC_BIT_0857	DPOS12 additional failure condition(PLC#1)	O
5A0101 800876EF40	PLC_BIT_0877	DPOS13 additional failure condition(PLC#1)	O
5A0101 800896EF40	PLC_BIT_0897	DPOS14 additional failure condition(PLC#1)	O
5A0101 800916EF40	PLC_BIT_0917	DPOS15 additional failure condition(PLC#1)	O
5A0101 800936EF40	PLC_BIT_0937	DPOS16 additional failure condition(PLC#1)	O
5A0101 800956EF40	PLC_BIT_0957	DPOS17 additional failure condition(PLC#1)	O
5A0101 800976EF40	PLC_BIT_0977	DPOS18 additional failure condition(PLC#1)	O
5A0101 800996EF40	PLC_BIT_0997	DPOS19 additional failure condition(PLC#1)	O
5A0101 801016EF40	PLC_BIT_1017	DPOS20 additional failure condition(PLC#1)	O
5A0101 800635EF40	PLC_BIT_0636	DPOS01 user configurable select condition(PLC#2)	O
5A0101 800655EF40	PLC_BIT_0656	DPOS02 user configurable select condition(PLC#2)	O
5A0101 800675EF40	PLC_BIT_0676	DPOS03 user configurable select condition(PLC#2)	O
5A0101 800695EF40	PLC_BIT_0696	DPOS04 user configurable select condition(PLC#2)	O
5A0101 800715EF40	PLC_BIT_0716	DPOS05 user configurable select condition(PLC#2)	O
5A0101 800735EF40	PLC_BIT_0736	DPOS06 user configurable select condition(PLC#2)	O
5A0101 800755EF40	PLC_BIT_0756	DPOS07 user configurable select condition(PLC#2)	O
5A0101 800775EF40	PLC_BIT_0776	DPOS08 user configurable select condition(PLC#2)	O
5A0101 800795EF40	PLC_BIT_0796	DPOS09 user configurable select condition(PLC#2)	O
5A0101 800815EF40	PLC_BIT_0816	DPOS10 user configurable select condition(PLC#2)	O
5A0101 800835EF40	PLC_BIT_0836	DPOS11 user configurable select condition(PLC#2)	O
5A0101 800855EF40	PLC_BIT_0856	DPOS12 user configurable select condition(PLC#2)	O
5A0101 800875EF40	PLC_BIT_0876	DPOS13 user configurable select condition(PLC#2)	O
5A0101 800895EF40	PLC_BIT_0896	DPOS14 user configurable select condition(PLC#2)	O
5A0101 800915EF40	PLC_BIT_0916	DPOS15 user configurable select condition(PLC#2)	O
5A0101 800935EF40	PLC_BIT_0936	DPOS16 user configurable select condition(PLC#2)	O
5A0101 800955EF40	PLC_BIT_0956	DPOS17 user configurable select condition(PLC#2)	O
5A0101 800975EF40	PLC_BIT_0976	DPOS18 user configurable select condition(PLC#2)	O

Signal Number	Signal Name	Description	M/O
5A0101 800995EF40	PLC_BIT_0996	DPOS19 user configurable select condition(PLC#2)	O
5A0101 801015EF40	PLC_BIT_1016	DPOS20 user configurable select condition(PLC#2)	O
5A0101 800569EF40	PLC_BIT_0570	DPOS01 control hierarchy condition(PLC#3)	M
5A0101 800572EF40	PLC_BIT_0573	DPOS02 control hierarchy condition(PLC#3)	M
5A0101 800575EF40	PLC_BIT_0576	DPOS03 control hierarchy condition(PLC#3)	M
5A0101 800578EF40	PLC_BIT_0579	DPOS04 control hierarchy condition(PLC#3)	M
5A0101 800581EF40	PLC_BIT_0582	DPOS05 control hierarchy condition(PLC#3)	M
5A0101 800584EF40	PLC_BIT_0585	DPOS06 control hierarchy condition(PLC#3)	M
5A0101 800587EF40	PLC_BIT_0588	DPOS07 control hierarchy condition(PLC#3)	M
5A0101 800590EF40	PLC_BIT_0591	DPOS08 control hierarchy condition(PLC#3)	M
5A0101 800593EF40	PLC_BIT_0594	DPOS09 control hierarchy condition(PLC#3)	M
5A0101 800596EF40	PLC_BIT_0597	DPOS10 control hierarchy condition(PLC#3)	M
5A0101 800599EF40	PLC_BIT_0600	DPOS11 control hierarchy condition(PLC#3)	M
5A0101 800602EF40	PLC_BIT_0603	DPOS12 control hierarchy condition(PLC#3)	M
5A0101 800605EF40	PLC_BIT_0606	DPOS13 control hierarchy condition(PLC#3)	M
5A0101 800608EF40	PLC_BIT_0609	DPOS14 control hierarchy condition(PLC#3)	M
5A0101 800611EF40	PLC_BIT_0612	DPOS15 control hierarchy condition(PLC#3)	M
5A0101 800614EF40	PLC_BIT_0615	DPOS16 control hierarchy condition(PLC#3)	M
5A0101 800617EF40	PLC_BIT_0618	DPOS17 control hierarchy condition(PLC#3)	M
5A0101 800620EF40	PLC_BIT_0621	DPOS18 control hierarchy condition(PLC#3)	M
5A0101 800623EF40	PLC_BIT_0624	DPOS19 control hierarchy condition(PLC#3)	M
5A0101 800626EF40	PLC_BIT_0627	DPOS20 control hierarchy condition(PLC#3)	M

Table 2.9-8 PLC Monitoring points (Output signal for select condition logic)

Signal Number	Signal Name	Description
512001 8003011F5A	DPOS01_SC_ST_ERR	DPOS01 select command mode is invalid.
512001 8003021F5A	DPOS02_SC_ST_ERR	DPOS02 select command mode is invalid.
512001 8003031F5A	DPOS03_SC_ST_ERR	DPOS03 select command mode is invalid.
512001 8003041F5A	DPOS04_SC_ST_ERR	DPOS04 select command mode is invalid.
512001 8003051F5A	DPOS05_SC_ST_ERR	DPOS05 select command mode is invalid.
512001 8003061F5A	DPOS06_SC_ST_ERR	DPOS06 select command mode is invalid.
512001 8003071F5A	DPOS07_SC_ST_ERR	DPOS07 select command mode is invalid.
512001 8003081F5A	DPOS08_SC_ST_ERR	DPOS08 select command mode is invalid.
512001 8003091F5A	DPOS09_SC_ST_ERR	DPOS09 select command mode is invalid.
512001 80030A1F5A	DPOS10_SC_ST_ERR	DPOS10 select command mode is invalid.
512001 80030B1F5A	DPOS11_SC_ST_ERR	DPOS11 select command mode is invalid.
512001 80030C1F5A	DPOS12_SC_ST_ERR	DPOS12 select command mode is invalid.
512001 80030D1F5A	DPOS13_SC_ST_ERR	DPOS13 select command mode is invalid.
512001 80030E1F5A	DPOS14_SC_ST_ERR	DPOS14 select command mode is invalid.
512001 80030F1F5A	DPOS15_SC_ST_ERR	DPOS15 select command mode is invalid.
512001 8003101F5A	DPOS16_SC_ST_ERR	DPOS16 select command mode is invalid.
512001 8003111F5A	DPOS17_SC_ST_ERR	DPOS17 select command mode is invalid.
512001 8003121F5A	DPOS18_SC_ST_ERR	DPOS18 select command mode is invalid.
512001 8003131F5A	DPOS19_SC_ST_ERR	DPOS19 select command mode is invalid.
512001 8003141F5A	DPOS20_SC_ST_ERR	DPOS20 select command mode is invalid.
512001 8103011F5F	DPOS01_F_QLT_SPP	Event suppression detected (DPOS01)
512001 8103021F5F	DPOS02_F_QLT_SPP	Event suppression detected (DPOS02)
512001 8103031F5F	DPOS03_F_QLT_SPP	Event suppression detected (DPOS03)
512001 8103041F5F	DPOS04_F_QLT_SPP	Event suppression detected (DPOS04)
512001 8103051F5F	DPOS05_F_QLT_SPP	Event suppression detected (DPOS05)
512001 8103061F5F	DPOS06_F_QLT_SPP	Event suppression detected (DPOS06)
512001 8103071F5F	DPOS07_F_QLT_SPP	Event suppression detected (DPOS07)
512001 8103081F5F	DPOS08_F_QLT_SPP	Event suppression detected (DPOS08)

Signal Number	Signal Name	Description
512001 8103091F5F	DPOS09_F_QLT_SPP	Event suppression detected (DPOS09)
512001 81030A1F5F	DPOS10_F_QLT_SPP	Event suppression detected (DPOS10)
512001 81030B1F5F	DPOS11_F_QLT_SPP	Event suppression detected (DPOS11)
512001 81030C1F5F	DPOS12_F_QLT_SPP	Event suppression detected (DPOS12)
512001 81030D1F5F	DPOS13_F_QLT_SPP	Event suppression detected (DPOS13)
512001 81030E1F5F	DPOS14_F_QLT_SPP	Event suppression detected (DPOS14)
512001 81030F1F5F	DPOS15_F_QLT_SPP	Event suppression detected (DPOS15)
512001 8103101F5F	DPOS16_F_QLT_SPP	Event suppression detected (DPOS16)
512001 8103111F5F	DPOS17_F_QLT_SPP	Event suppression detected (DPOS17)
512001 8103121F5F	DPOS18_F_QLT_SPP	Event suppression detected (DPOS18)
512001 8103131F5F	DPOS19_F_QLT_SPP	Event suppression detected (DPOS19)
512001 8103141F5F	DPOS20_F_QLT_SPP	Event suppression detected (DPOS20)
512001 8203011F60	DPOS01_F_BI_ERR	BI connection error detected(DPOS01)
512001 8203021F60	DPOS02_F_BI_ERR	BI connection error detected(DPOS02)
512001 8203031F60	DPOS03_F_BI_ERR	BI connection error detected(DPOS03)
512001 8203041F60	DPOS04_F_BI_ERR	BI connection error detected(DPOS04)
512001 8203051F60	DPOS05_F_BI_ERR	BI connection error detected(DPOS05)
512001 8203061F60	DPOS06_F_BI_ERR	BI connection error detected(DPOS06)
512001 8203071F60	DPOS07_F_BI_ERR	BI connection error detected(DPOS07)
512001 8203081F60	DPOS08_F_BI_ERR	BI connection error detected(DPOS08)
512001 8203091F60	DPOS09_F_BI_ERR	BI connection error detected(DPOS09)
512001 82030A1F60	DPOS10_F_BI_ERR	BI connection error detected(DPOS10)
512001 82030B1F60	DPOS11_F_BI_ERR	BI connection error detected(DPOS11)
512001 82030C1F60	DPOS12_F_BI_ERR	BI connection error detected(DPOS12)
512001 82030D1F60	DPOS13_F_BI_ERR	BI connection error detected(DPOS13)
512001 82030E1F60	DPOS14_F_BI_ERR	BI connection error detected(DPOS14)
512001 82030F1F60	DPOS15_F_BI_ERR	BI connection error detected(DPOS15)
512001 8203101F60	DPOS16_F_BI_ERR	BI connection error detected(DPOS16)
512001 8203111F60	DPOS17_F_BI_ERR	BI connection error detected(DPOS17)
512001 8203121F60	DPOS18_F_BI_ERR	BI connection error detected(DPOS18)
512001 8203131F60	DPOS19_F_BI_ERR	BI connection error detected(DPOS19)
512001 8203141F60	DPOS20_F_BI_ERR	BI connection error detected(DPOS20)

Table 2.9-9 PLC Monitoring points (On/Off output-signal for BIO)

Signal Number	Signal Name	Description
512001 8A03011DC4	DPOS01_FSL_BO_FLG	DPOS01 select (Off) command for Binary Output.
512001 8A03021DC4	DPOS02_FSL_BO_FLG	DPOS02 select (Off) command for Binary Output.
512001 8A03031DC4	DPOS03_FSL_BO_FLG	DPOS03 select (Off) command for Binary Output.
512001 8A03041DC4	DPOS04_FSL_BO_FLG	DPOS04 select (Off) command for Binary Output.
512001 8A03051DC4	DPOS05_FSL_BO_FLG	DPOS05 select (Off) command for Binary Output.
512001 8A03061DC4	DPOS06_FSL_BO_FLG	DPOS06 select (Off) command for Binary Output.
512001 8A03071DC4	DPOS07_FSL_BO_FLG	DPOS07 select (Off) command for Binary Output.
512001 8A03081DC4	DPOS08_FSL_BO_FLG	DPOS08 select (Off) command for Binary Output.
512001 8A03091DC4	DPOS09_FSL_BO_FLG	DPOS09 select (Off) command for Binary Output.
512001 8A030A1DC4	DPOS10_FSL_BO_FLG	DPOS10 select (Off) command for Binary Output.
512001 8A030B1DC4	DPOS11_FSL_BO_FLG	DPOS11 select (Off) command for Binary Output.
512001 8A030C1DC4	DPOS12_FSL_BO_FLG	DPOS12 select (Off) command for Binary Output.
512001 8A030D1DC4	DPOS13_FSL_BO_FLG	DPOS13 select (Off) command for Binary Output.
512001 8A030E1DC4	DPOS14_FSL_BO_FLG	DPOS14 select (Off) command for Binary Output.
512001 8A030F1DC4	DPOS15_FSL_BO_FLG	DPOS15 select (Off) command for Binary Output.
512001 8A03101DC4	DPOS16_FSL_BO_FLG	DPOS16 select (Off) command for Binary Output.
512001 8A03111DC4	DPOS17_FSL_BO_FLG	DPOS17 select (Off) command for Binary Output.
512001 8A03121DC4	DPOS18_FSL_BO_FLG	DPOS18 select (Off) command for Binary Output.

Signal Number	Signal Name	Description
512001 8A03131DC4	DPOS19_FSL_BO_FLG	DPOS19 select (Off) command for Binary Output.
512001 8A03141DC4	DPOS20_FSL_BO_FLG	DPOS20 select (Off) command for Binary Output.
512001 8603011DC6	DPOS01_OSL_BO_FLG	DPOS01 select (ON) command for Binary Output.
512001 8603021DC6	DPOS02_OSL_BO_FLG	DPOS02 select (ON) command for Binary Output.
512001 8603031DC6	DPOS03_OSL_BO_FLG	DPOS03 select (ON) command for Binary Output.
512001 8603041DC6	DPOS04_OSL_BO_FLG	DPOS04 select (ON) command for Binary Output.
512001 8603051DC6	DPOS05_OSL_BO_FLG	DPOS05 select (ON) command for Binary Output.
512001 8603061DC6	DPOS06_OSL_BO_FLG	DPOS06 select (ON) command for Binary Output.
512001 8603071DC6	DPOS07_OSL_BO_FLG	DPOS07 select (ON) command for Binary Output.
512001 8603081DC6	DPOS08_OSL_BO_FLG	DPOS08 select (ON) command for Binary Output.
512001 8603091DC6	DPOS09_OSL_BO_FLG	DPOS09 select (ON) command for Binary Output.
512001 86030A1DC6	DPOS10_OSL_BO_FLG	DPOS10 select (ON) command for Binary Output.
512001 86030B1DC6	DPOS11_OSL_BO_FLG	DPOS11 select (On) command for Binary Output.
512001 86030C1DC6	DPOS12_OSL_BO_FLG	DPOS12 select (On) command for Binary Output.
512001 86030D1DC6	DPOS13_OSL_BO_FLG	DPOS13 select (On) command for Binary Output.
512001 86030E1DC6	DPOS14_OSL_BO_FLG	DPOS14 select (On) command for Binary Output.
512001 86030F1DC6	DPOS15_OSL_BO_FLG	DPOS15 select (On) command for Binary Output.
512001 8603101DC6	DPOS16_OSL_BO_FLG	DPOS16 select (On) command for Binary Output.
512001 8603111DC6	DPOS17_OSL_BO_FLG	DPOS17 select (On) command for Binary Output.
512001 8603121DC6	DPOS18_OSL_BO_FLG	DPOS18 select (On) command for Binary Output.
512001 8603131DC6	DPOS19_OSL_BO_FLG	DPOS19 select (On) command for Binary Output.
512001 8603141DC6	DPOS20_OSL_BO_FLG	DPOS20 select (On) command for Binary Output.

Table 2.9-10 Reason signal and messages for selection failure

<table>
<tr><th>Signal Number</th><th>Signal Name</th><th>Description</th></tr>
<tr><td>57001 3102011D81</td><td>DPOS01_TMP_07</td><td>DPOS01 selection failure signal, that indicating the reason about the last aborted selected command. The signal is show in Enumeration.
Value 0: No reason
Other values: see the below:
<table>
<tr><th>Event message</th><th>IEC61850 Add Cause definition</th></tr>
<tr><td>BLK BY SWITCH</td><td>Blocked by switching hierarchy</td></tr>
<tr><td>BLK BY SEL FAIL</td><td>Select failed</td></tr>
<tr><td>BLK BY INV POS</td><td>Invalid position</td></tr>
<tr><td>BLK BY POS RCH</td><td>Position reached</td></tr>
<tr><td>PRM CHG</td><td>Parameter change in execution</td></tr>
<tr><td>BLK BY STEP LMT</td><td>Step limit</td></tr>
<tr><td>BLK BY MODE</td><td>Blocked by Mode</td></tr>
<tr><td>BLK BY PROCESS</td><td>Blocked by process</td></tr>
<tr><td>BLK BY INK</td><td>Blocked by interlocking</td></tr>
<tr><td>BLK BY SYN</td><td>Blocked by synchrocheck</td></tr>
<tr><td>BLK BY CMD INPRG</td><td>Command already in execution</td></tr>
<tr><td>BLK BY HEALTH</td><td>Blocked by health</td></tr>
<tr><td>BLK BY 1 OFN</td><td>1 of n control</td></tr>
<tr><td>BLK BY CANCEL</td><td>Abortion by cancel</td></tr>
<tr><td>BLK BY TLMT OVER</td><td>Time limit over</td></tr>
<tr><td>BLK BY TRIP</td><td>Abortion by trip</td></tr>
<tr><td>BLK BY NOT SEL</td><td>Object not selected</td></tr>
<tr><td>BLK BY ALR SEL</td><td>Object already selected</td></tr>
<tr><td>BLK BY AUTHORITY</td><td>No access authority</td></tr>
<tr><td>BLK BY OVERSHOOT</td><td>Ended with overshoot</td></tr>
<tr><td>BLK BY DEVIATION</td><td>Abortion due to deviation</td></tr>
<tr><td>BLK BY CMMLOSS</td><td>Abortion by command loss</td></tr>
<tr><td>BLK BY CMDBLK</td><td>Blocked by command</td></tr>
<tr><td>NONE</td><td>None</td></tr>
<tr><td>BLK BY NCNST PRM</td><td>Inconsistent parameters</td></tr>
<tr><td>BLK BY OTER CLT</td><td>Locked by other client</td></tr>
</table>
</td></tr>
</table>

(ix) Setting names

Note: The “xx” within “DPOSxx” represents the DPOS function number. (e.g., if DPOS03 is considered, the “xx” is equal to “03”. The numbers used for “xx” can be represented from “01” to “20”.)

Table 2.9-11 Settings for select logics

Setting Name	Description	Default	Setting item or value
DPOSxx-CTREN	Activate control function of DPOSxx	On	Off / On
DPOSxx-LGSLFFCT	Logic selector for select condition in DPOSxx	Fixedlogic	Fixedlogic / PLC
DPOSxx-CTRAHMI	Activate local panel control in DPOSxx	SBO	DIR/ SBO

2.9.2 Cancel logic for SBO mode

In the SBO control mode the reception of a cancel command is possible; when the cancel conditions are satisfied, accordingly the function can discard the select command; finally, the operation returns to the initial stage (i.e., "Wait for a command".)

(i) Receiving "Cancel" from the remote-end

Figure 2.9-14 depicts the cancel command procedure for a cancel command initiated from the remote-end.

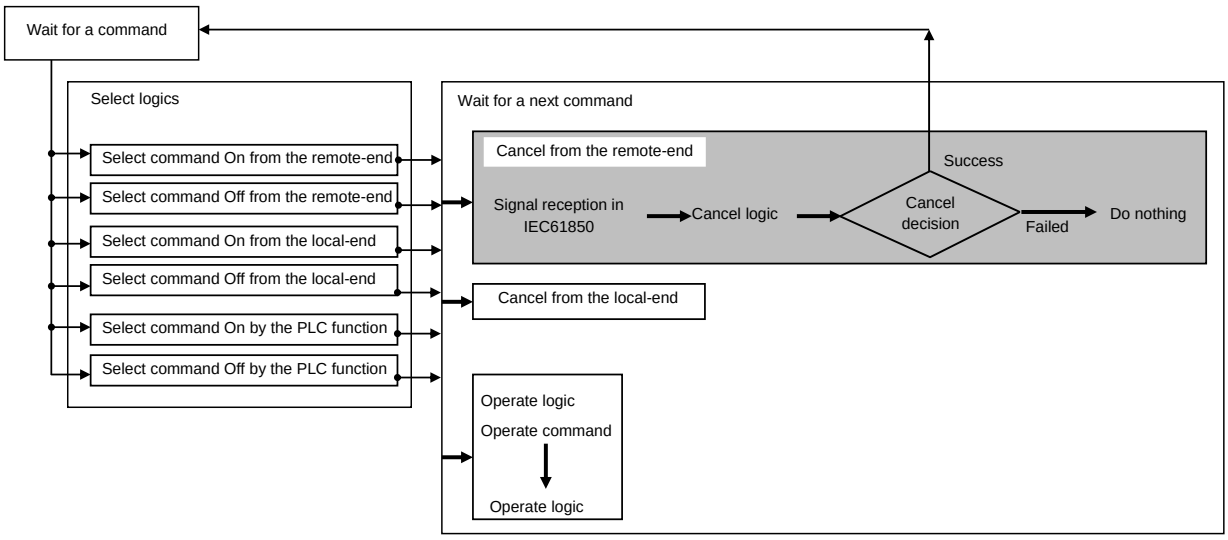


Figure 2.9-14 Outline of 'cancel' command from the remote-end

(i)-1 Input point required mapping

Figure 2.9-15 depicts the cancel logic when a "Cancel command (Remote-Cancel)" signal is applied to the DPOS01 function. The input-point "DEV01_CONTROL_REQ" is the same as that for the signal "Select command On (Remote-ON-Control)".

(i)-2 Output signal to BO

The DPOS01 function can issue a "Success to cancel" signal at the monitoring point "DPOS01_CC_SS", when the DPOS01 function has determined that the signal "Remote-cancel" is true. Another signal "Operation failed" is issued at monitoring point "DPOS01_CC_FS" if the DPOS01 function is able to determine that the signal "Remote-cancel" is not true.

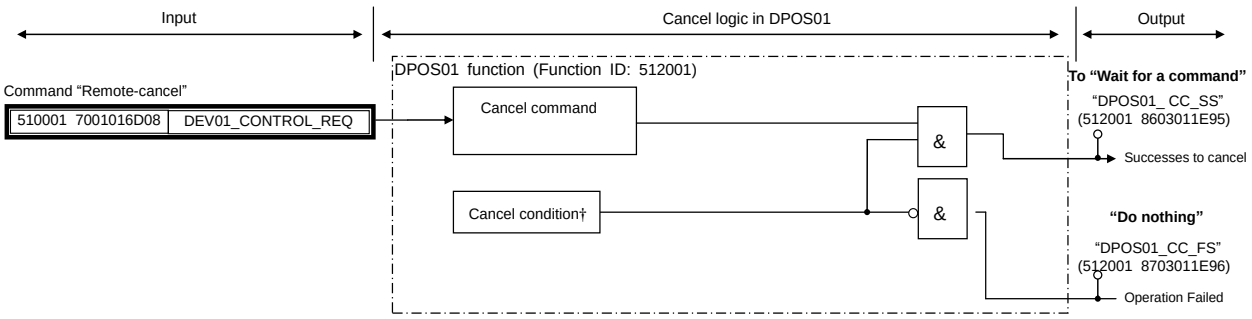


Figure 2.9-15 'Cancel' from the remote-end in DPOS01

†Note: The "cancel condition" logic shall be seen in Figure 2.9-18.

(ii) Receiving "Cancel" from the local-end

Figure 2.9-16 depicts the cancel command procedure for a cancel command initiated from the local-end.

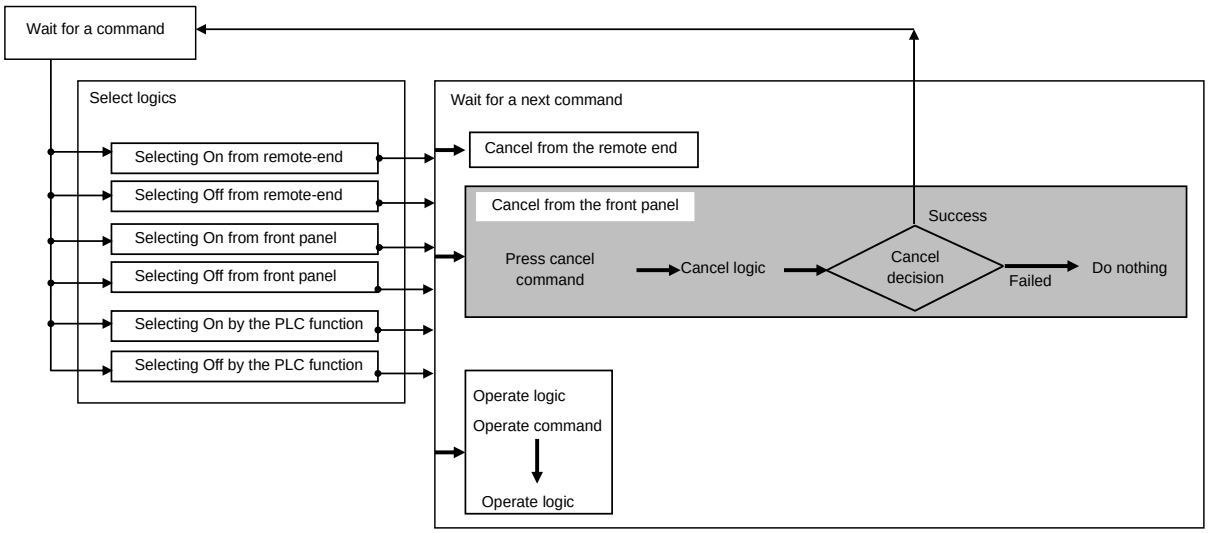


Figure 2.9-16 Outline of 'cancel' command from the local-end

(ii)-1 Input signal generated at the local-end

Figure 2.9-17 depicts the cancel logic when a "Cancel command (Local-cancel)" signal is applied to the DPOS01 function. The signal is generated when the "Cancel" key is pressed on the IED front panel; the user is not required to take account of mapping. When the logic receives the "Local-cancel" signal, the logic ia able to output a result signal, provided that the "cancel condition" checking is satisfied.

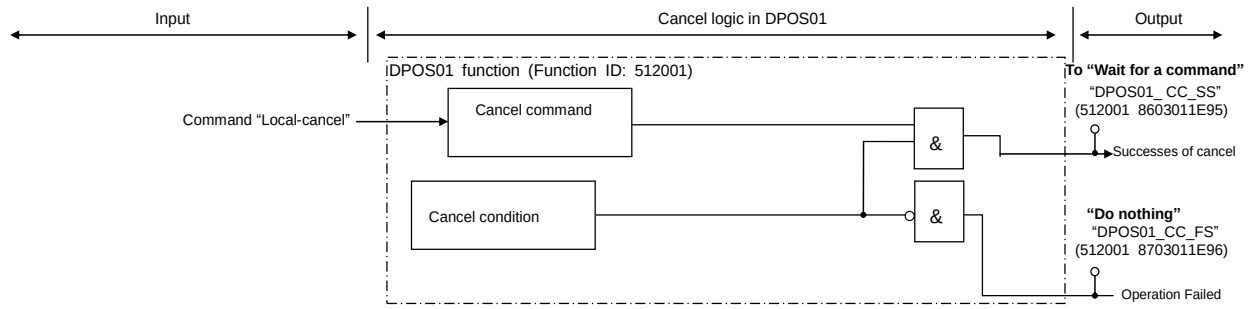


Figure 2.9-17 'Cancel' from the front panel

(ii)-2 Output signal to BO

The DPOS01 function, illustrated in Figure 2.9-17, is able to issue a "Success of cancel" signal at the monitoring point "DPOS01_CC_SS", when the DPOS01 function determines that the signal "Local-Cancel" is true.

(iii) Cancel condition logic

Figure 2.9-18 shows the cancel condition logic. As the criteria, "Unmatched condition detected" is connected normally for the cancel logic, set **Fixedlogic** for the scheme switch [**DPOS01-LGCNFFCT**].

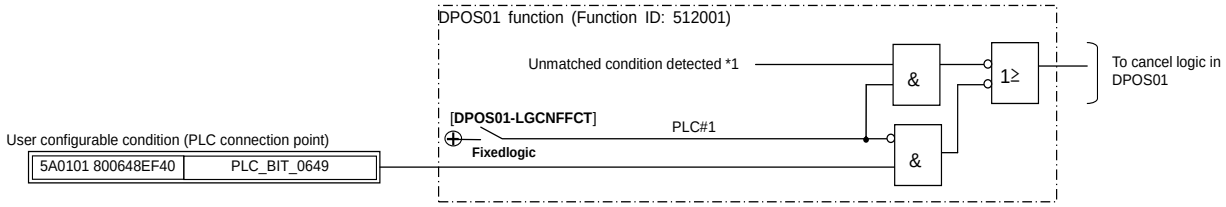


Figure 2.9-18 Logic "Cancel condition" in DPOS01

[1]Note: The criteria "unmatched conditions" are determined when the "Test-bit status" in the 'cancel' command is not identical to the "IED test status" as in Figure 2.9-13.

[2]Note: With the exception of the above 'cancel-condition' logic, there is an operate-condition logic within the DPOS01 function; the operate-condition logic will always checks conditions. That is, the user is required to set either the "operate-condition" or the "cancel-condition" logic.

If the original logic does not meet with the requirement of the user, it can be relpced using the connection point "User configurable condition".

1. Connect the user-customized logic with the "PLC_BIT_0649", which is listed in Table 2.9-12.
2. Set scheme switch [**DPOS01-LGCNFFCT**] to **PLC**.

(iv) Signal name and number

Note: The user should note the following descriptions shown in the column "M/O" for each table:

"O" indicates that the signal is provided for the optional use.

"M" indicates that the user should map/set/configure using the signal; otherwise, the user may experience an operational failure if the default settings are used.

"N/A" indicates that the user cannot change the state of the signal.

Table 2.9-12 PLC connection points (Input signal for 'cancel' condition logic)

Signal Number	Signal Name	Description	M/O
5A0101 800648EF40	PLC_BIT_0649	DPOS01 user configurable cancel condition	O
5A0101 800668EF40	PLC_BIT_0669	DPOS02 user configurable cancel condition	O
5A0101 800688EF40	PLC_BIT_0689	DPOS03 user configurable cancel condition	O
5A0101 800708EF40	PLC_BIT_0709	DPOS04 user configurable cancel condition	O
5A0101 800728EF40	PLC_BIT_0729	DPOS05 user configurable cancel condition	O
5A0101 800748EF40	PLC_BIT_0749	DPOS06 user configurable cancel condition	O
5A0101 800768EF40	PLC_BIT_0769	DPOS07 user configurable cancel condition	O
5A0101 800788EF40	PLC_BIT_0789	DPOS08 user configurable cancel condition	O
5A0101 800808EF40	PLC_BIT_0809	DPOS09 user configurable cancel condition	O
5A0101 800828EF40	PLC_BIT_0829	DPOS10 user configurable cancel condition	O
5A0101 800848EF40	PLC_BIT_0849	DPOS11 user configurable cancel condition	O
5A0101 800868EF40	PLC_BIT_0869	DPOS12 user configurable cancel condition	O
5A0101 800888EF40	PLC_BIT_0889	DPOS13 user configurable cancel condition	O
5A0101 800908EF40	PLC_BIT_0909	DPOS14 user configurable cancel condition	O
5A0101 800928EF40	PLC_BIT_0929	DPOS15 user configurable cancel condition	O
5A0101 800948EF40	PLC_BIT_0949	DPOS16 user configurable cancel condition	O
5A0101 800968EF40	PLC_BIT_0969	DPOS17 user configurable cancel condition	O
5A0101 800988EF40	PLC_BIT_0989	DPOS18 user configurable cancel condition	O
5A0101 801008EF40	PLC_BIT_1009	DPOS19 user configurable cancel condition	O
5A0101 801028EF40	PLC_BIT_1029	DPOS20 user configurable cancel condition	O

Table 2.9-13 PLC monitoring points (Output signal for 'cancel' condition)

Signal Number	Signal Name	Description
512001 8603011E95	DPOS01_CC_SS	DPOS01 cancel success
512001 8603021E95	DPOS02_CC_SS	DPOS02 cancel success
512001 8603031E95	DPOS03_CC_SS	DPOS03 cancel success
512001 8603041E95	DPOS04_CC_SS	DPOS04 cancel success
512001 8603051E95	DPOS05_CC_SS	DPOS05 cancel success
512001 8603061E95	DPOS06_CC_SS	DPOS06 cancel success
512001 8603071E95	DPOS07_CC_SS	DPOS07 cancel success
512001 8603081E95	DPOS08_CC_SS	DPOS08 cancel success
512001 8603091E95	DPOS09_CC_SS	DPOS09 cancel success
512001 86030A1E95	DPOS10_CC_SS	DPOS10 cancel success
512001 86030B1E95	DPOS11_CC_SS	DPOS11 cancel success
512001 86030C1E95	DPOS12_CC_SS	DPOS12 cancel success
512001 86030D1E95	DPOS13_CC_SS	DPOS13 cancel success
512001 86030E1E95	DPOS14_CC_SS	DPOS14 cancel success
512001 86030F1E95	DPOS15_CC_SS	DPOS15 cancel success
512001 8603101E95	DPOS16_CC_SS	DPOS16 cancel success

Signal Number	Signal Name	Description
512001 8603111E95	DPOS17_CC_SS	DPOS17 cancel success
512001 8603121E95	DPOS18_CC_SS	DPOS18 cancel success
512001 8603131E95	DPOS19_CC_SS	DPOS19 cancel success
512001 8603141E95	DPOS20_CC_SS	DPOS20 cancel success
512001 8703011E96	DPOS01_CC_FS	DPOS01 cancel failed
512001 8703021E96	DPOS02_CC_FS	DPOS02 cancel failed
512001 8703031E96	DPOS03_CC_FS	DPOS03 cancel failed
512001 8703041E96	DPOS04_CC_FS	DPOS04 cancel failed
512001 8703051E96	DPOS05_CC_FS	DPOS05 cancel failed
512001 8703061E96	DPOS06_CC_FS	DPOS06 cancel failed
512001 8703071E96	DPOS07_CC_FS	DPOS07 cancel failed
512001 8703081E96	DPOS08_CC_FS	DPOS08 cancel failed
512001 8703091E96	DPOS09_CC_FS	DPOS09 cancel failed
512001 87030A1E96	DPOS10_CC_FS	DPOS10 cancel failed
512001 87030B1E96	DPOS11_CC_FS	DPOS11 cancel failed
512001 87030C1E96	DPOS12_CC_FS	DPOS12 cancel failed
512001 87030D1E96	DPOS13_CC_FS	DPOS13 cancel failed
512001 87030E1E96	DPOS14_CC_FS	DPOS14 cancel failed
512001 87030F1E96	DPOS15_CC_FS	DPOS15 cancel failed
512001 8703101E96	DPOS16_CC_FS	DPOS16 cancel failed
512001 8703111E96	DPOS17_CC_FS	DPOS17 cancel failed
512001 8703121E96	DPOS18_CC_FS	DPOS18 cancel failed
512001 8703131E96	DPOS19_CC_FS	DPOS19 cancel failed
512001 8703141E96	DPOS20_CC_FS	DPOS20 cancel failed

(v) Setting name

Note: The “xx” within “DPOSxx” represents the DPOS function number. (e.g., if DPOS03 is considered, the “xx” is equal to “03”. The numbers used for “xx” can be represented by “01” to “20”.)

Table 2.9-14 Setting for ‘Cancel’ in DPOSxx

Setting Name	Description	Default	Setting item or value
DPOSxx-LGCNFFCT	Logic selector for cancel condition in DPOSxx	Fixedlogic	Fixedlogic / PLC

2.9.3 Operate logic for SBO/DIR modes

Once the operation of the select logic is complete, the operate logic start to control the device.

(i) Receiving "Operate command On" from the remote-end

Figure 2.9-19 depicts the reception of the operate command 'On' from the remote-end.

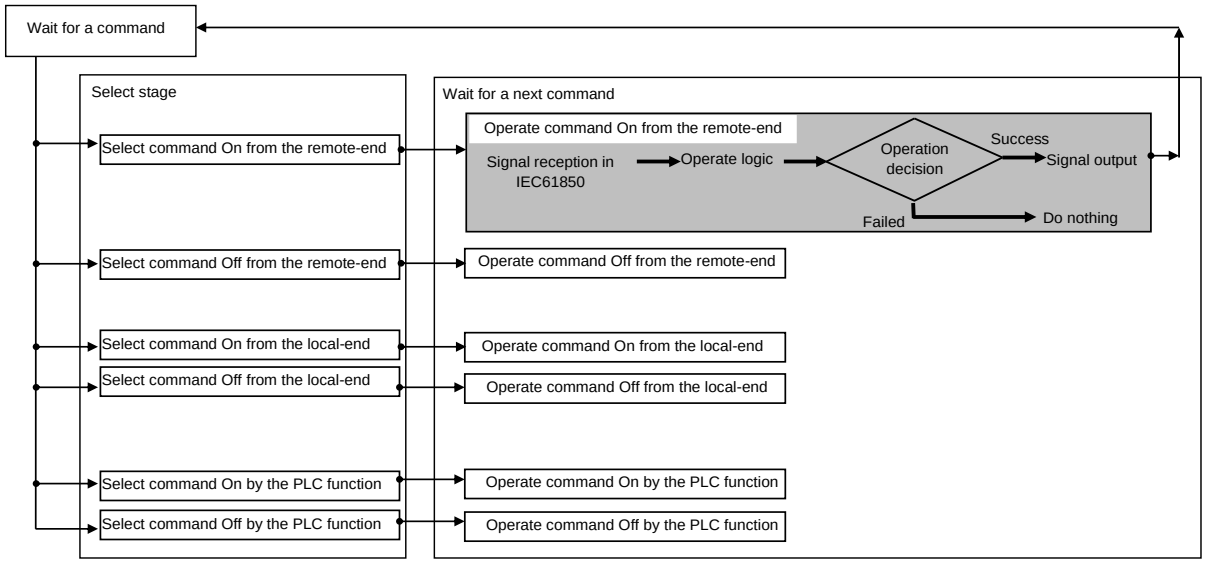


Figure 2.9-19 Outline of Operate command 'On'

(i)-1 Mapping required for Input point

Figure 2.9-20 illustartes the operate logic when an "Operate command On (Remote-ON-Control)" signal is applied to the DPOS01 function. The input-point "DEV01_CONTROL_REQ" is used for the reception of the "Operate command On (Remote-On-Control)".

(i)-2 Output signal to BO

The DPOS01 function, in Figure 2.9-20, can issue an "Operate" signal at the output point "DPOS01_OEX_BO", when the DPOS01 function determines that the received signal "Remote-On-Control" is true.

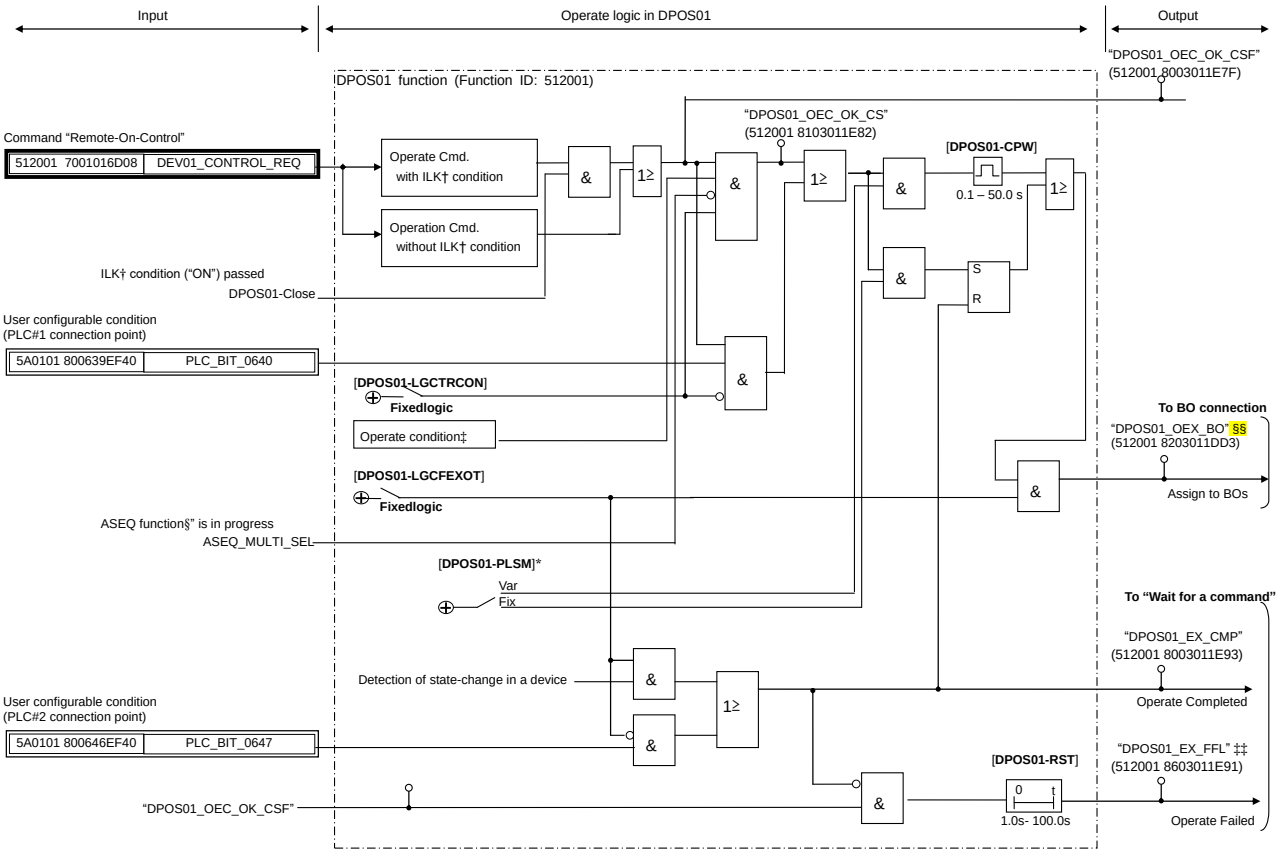


Figure 2.9-20 Operate On from the remote-end in DPOS01††

†Note:The ILK function can provide the operation criteria for "On".

‡Note:An "operate condition" signal is generated in the operate-condition logic (see Figure 2.9-31), when **Fixlogic** is set for scheme switch [**DPOS01-LGCTRCON**]. If an alternative "operate-condition" is required, it can be programmed by the user and used to replace the signal generated by the original operate-condition logic. The alternative "operate-condition" can be connected to the above logic using connection point "#1" user configurable condition. That is set the scheme switch [**DPOS01-LGCTRCON**] to **PLC** and use "PLC_BIT_0640".

§Note:The ASEQ function can provide sequential signals for automatic control.

§§Note: The "DPOS01_OEX_BO" signal is issued when **Fixedlogic** is set for scheme switch [**DPOS01-LGCFEXOT**]. The "Operate-completed" signal can also be issued from the logic programmed by the user in place of the logic shown in Figure 2.9-20. The user-programmed logic is connected internally to the signal "Operate completed", hence this signal is now generated by the user-programmed logic at the connection point #2 "User configurable condition". That is, set the scheme switch [**DPOS01-LGCFEXOT**] to **PLC** and use "PLC_BIT_0647".

*Note:The user can select the type of the output signal. When **Fix** is set for scheme switch [**DPOS01-PLSM**], the output period of the signal is defined by the setting [**DPOS01-CPW**]. When **Var** is set, the signal ceases when the 43-switch is changed.

††Note: To identify the input and output signal-points of the other DPOS logics, see Table 2.9-15 for PLC#1, Table 2.9-16 for PLC#2, Table 2.9-19 and Table 2.9-21 for output signals.

‡‡Note: The "Operate failed" signal is issued when the state-change is not detected when the time set by the [**DPOS01-RST**] has been reached.

(ii) Receiving "Operate command Off" from the remote-end

Figure 2.9-21 depicts the reception of the operate command 'Off' from the remote-end.

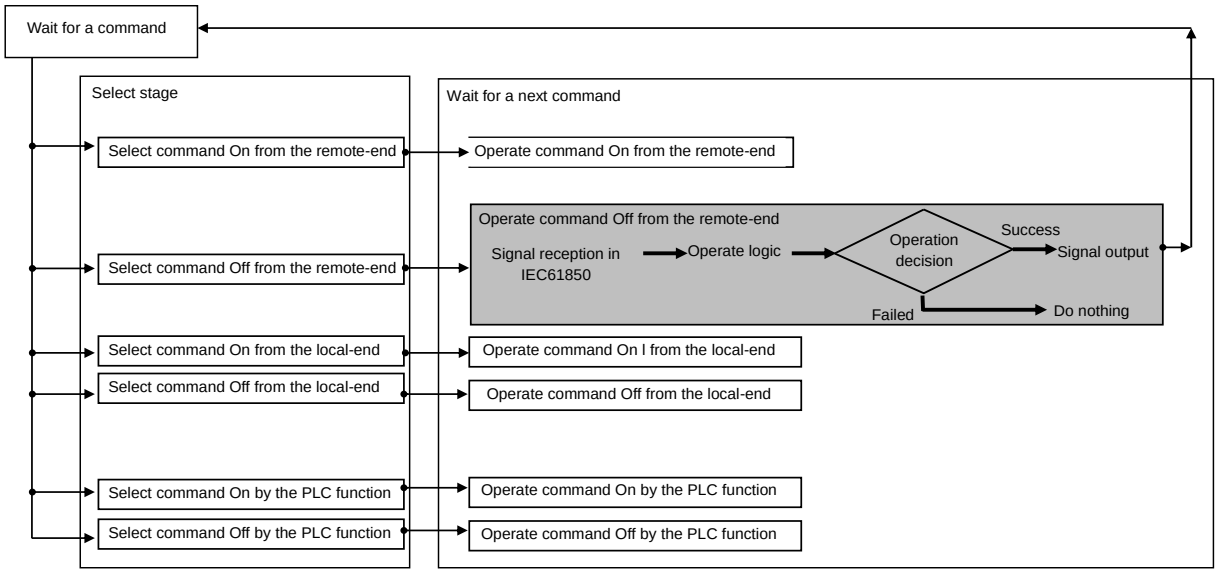


Figure 2.9-21 Outline of Operate command 'Off'

(ii)-1 Mapping required for Input point

Figure 2.9-22 illustrates the operate logic when an "Operate command Off (Remote-Off-Control)" signal is applied to the DPOS01 logic. The input-point "DEV01_CONTROL_REQ" is used for the reception of the "Operate command Off (Remote-Off-Control)".

(ii)-2 Output signal to BO

The DPOS01 function, in Figure 2.9-22, can issue an "Operate" signal at the output-point "DPOS01_FEX_BO", when the DPOS01 function determines that the input signal "Remote-Off-Control" is true.

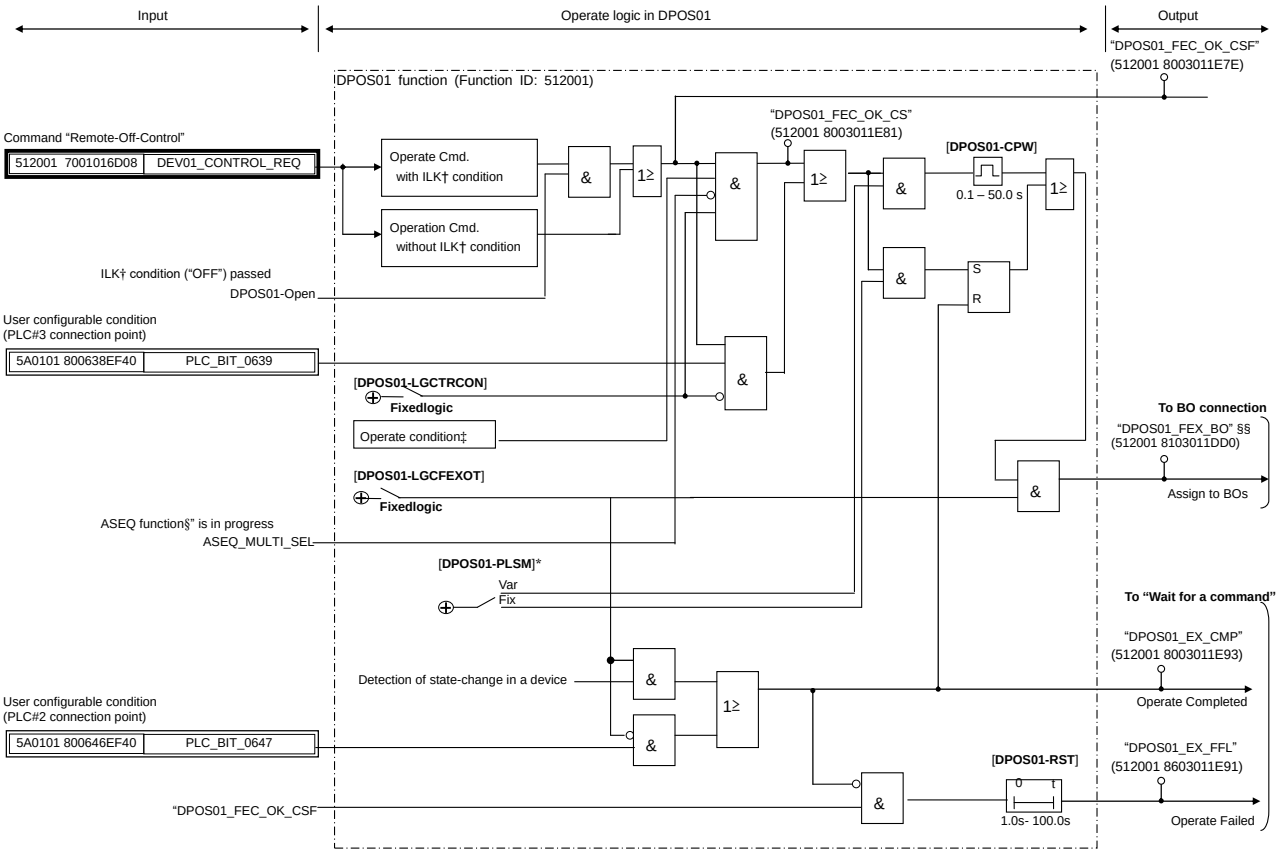


Figure 2.9-22 Operate Off from the remote-end in DPOS01††

†Note:The ILK function can provide the operation criteria for "Off".

‡Note:An "operate condition" signal is generated in the operate-condition logic (see Figure 2.9-31), when **Fixlogic** is set for scheme switch [**DPOS01-LGCTRCON**]. If an alternative "operate-condition" is required, it can be programmed by the user and used to replace the signal generated by the original operate-condition logic. The alternative "operate-condition" can be connected to the above logic using connection point #3 "User-configurable condition". That is set the [**DPOS01-LGCTRCON**] to **PLC** and use "PLC_BIT_0639".

§Note:The ASEQ function can provide sequential signals for automatic control.

§§Note: The "DPOS01_OEX_BO" signal is issued when **Fixedlogic** is set for scheme switch [**DPOS01-LGCFEXOT**]. The "Operate completed" signal can also be issued from logic programmed by the user in place of the logic shown in Figure 2.9-20. The user programmed logic is connected internally to the signal "Operate completed", hence this signal is now generated the user-programmed logic at connection point #2 "User-configurable condition". That is, set the scheme switch [**DPOS01-LGCFEXOT**] to **PLC** and use "PLC_BIT_0647".

*Note:The user can select a type of output signal. When **Var** is set for scheme switch [**DPOS01-PLSM**], the output period of the signal is defined by the setting [**DPOS01-CPW**]. When **Fix** is set, the signal ceases when the 43-switch is changed.

††Note: To identify the input and output signals of the other DPOS logics, see Table 2.9-16 for PLC#2, Table 2.9-17 for PLC#3, Table 2.9-19 and Table 2.9-21 for output signals.

‡‡Note: The "Operate failed" signal is issued when the state-change is not detected until after reaching the time set by the [**DPOS01-RST**].

(iii) Receiving "Operate command On" from the local-end

Figure 2.9-23 depicts the reception of the operate command 'On' from the local-end.

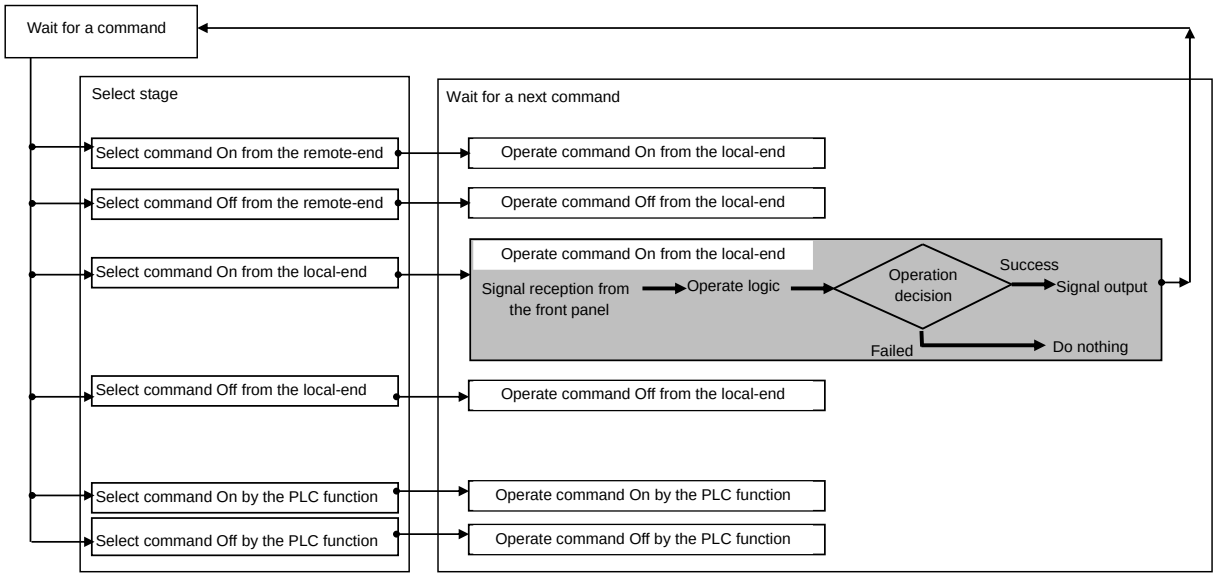


Figure 2.9-23 Outline of Operate command 'On'

(iii)-1 Input signal generated at the local-end

Figure 2.9-24 illustrates the operate logic when an "Operate command signal On (Local-ON-Control)" is applied to the DPOS01 function. The signal is generated when "Execution of On" is keyed on the IED front panel.

(iii)-2 Output signal to BO

The DPOS01 function, in Figure 2.9-24, can issue an "Operate" signal at the output point "DPOS01_OEX_BO", when the DPOS01 function determines that the signal "Local-On-Control" is true.

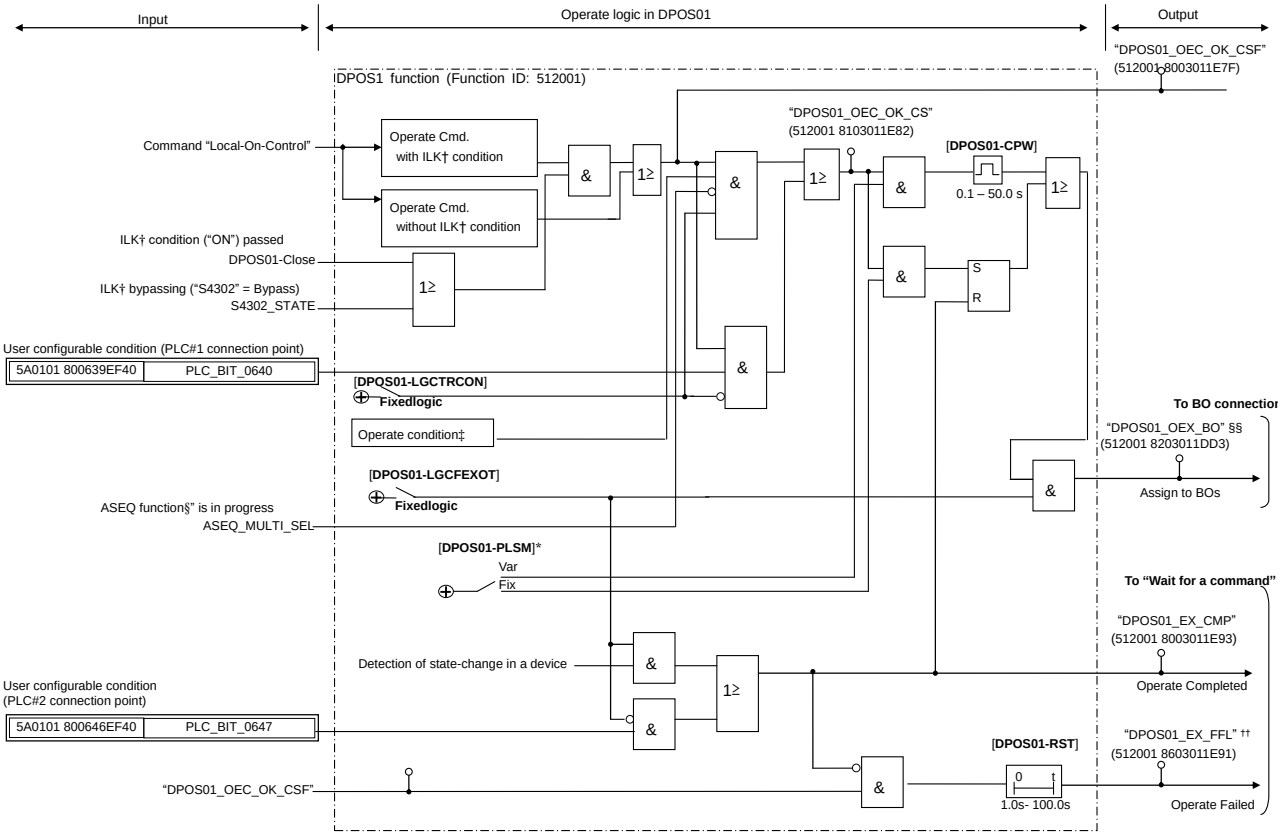


Figure 2.9-24 Operate On on the front panel in DPOS01††

†Note:The ILK function can provide the operation criteria for "On".

‡Note:An "operate condition" signal is generated in the operate-condition logic (see Figure 2.9-31), when **Fixlogic** is set for scheme switch [**DPOS01-LGCTRCON**]. If an alternative "operate-condition" is required, it can be programmed by the user and used to replace the signal generated by the original operate-condition logic. The alternative "operate-condition" can be connected to the above using connection point #1" user configurable condition". That is set the [**DPOS01-LGCTRCON**] to **PLC** and use "PLC_BIT_0640".

§Note:The ASEQ function can provide sequential signals for automatic control.

§§Note: The "DPOS01_OEX_BO" signal is issued when **Fixedlogic** is set for scheme switch [**DPOS01-LGCFEXOT**]. The "Operate comleted" signal can also be issued from logic programmed by the user in place of the logic shown in Figure 2.9-20. The user-programmed logic is connected internally to the signal "Operate completed", hence this is now generated by the user-programmed logic at connection point #2 "User configurable condition". That is, set the scheme switch [**DPOS01-LGCFEXOT**] to **PLC** and use "PLC_BIT_0647".

*Note:The user can set the type of output signal. When **Var** is set for scheme switch [**DPOS01-PLSM**], the output period of the signal is defined by the setting [**DPOS01-CPW**]. When **Fix** is set, the signal ceases when the 43-switch is changed.

††Note: To identify the input and output signal-points of the other DPOS logics, see Table 2.9-15 for PLC#1, Table 2.9-16 for PLC#2, Table 2.9-19 and Table 2.9-21 for output signals.

‡‡Note: The "Operate failed" signal is issued when the state-change is not detected until after reaching the time set by the [**DPOS01-RST**].

(iv) Receiving "Operate command Off" from the local-end

Figure 2.9-25 outlines the reception of the operate command 'Off' from the local-end.

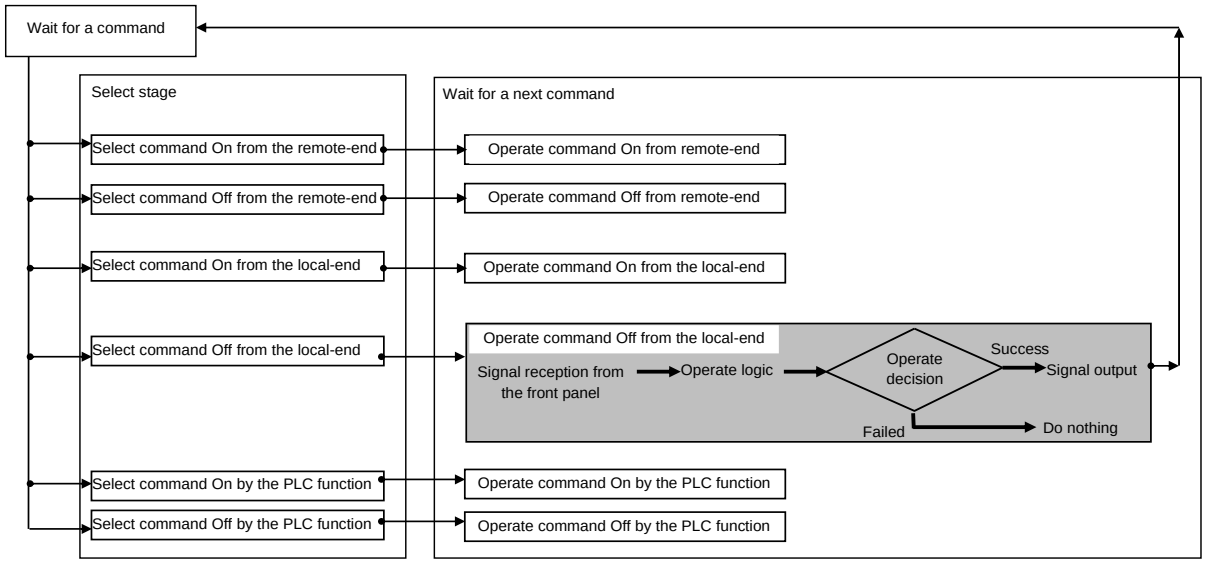


Figure 2.9-25 Outline of Operate command 'Off'

(iv)-1 Input signal generated at the local-end

Figure 2.9-26 illustrates the operate logic when an "Operate command Off (Local-OFF-Control)" signal is applied to the DPOS01 logic. The input signal is provided when "Execution for Off" is keyed on the IED front panel.

(iv)-2 Output signal to BO

The DPOS01 function, in Figure 2.9-26, can issue an "Operate" signal at the output point "DPOS01_FEX_BO", when the DPOS01 function determines that the input signal "Local-Off-Control" is true.

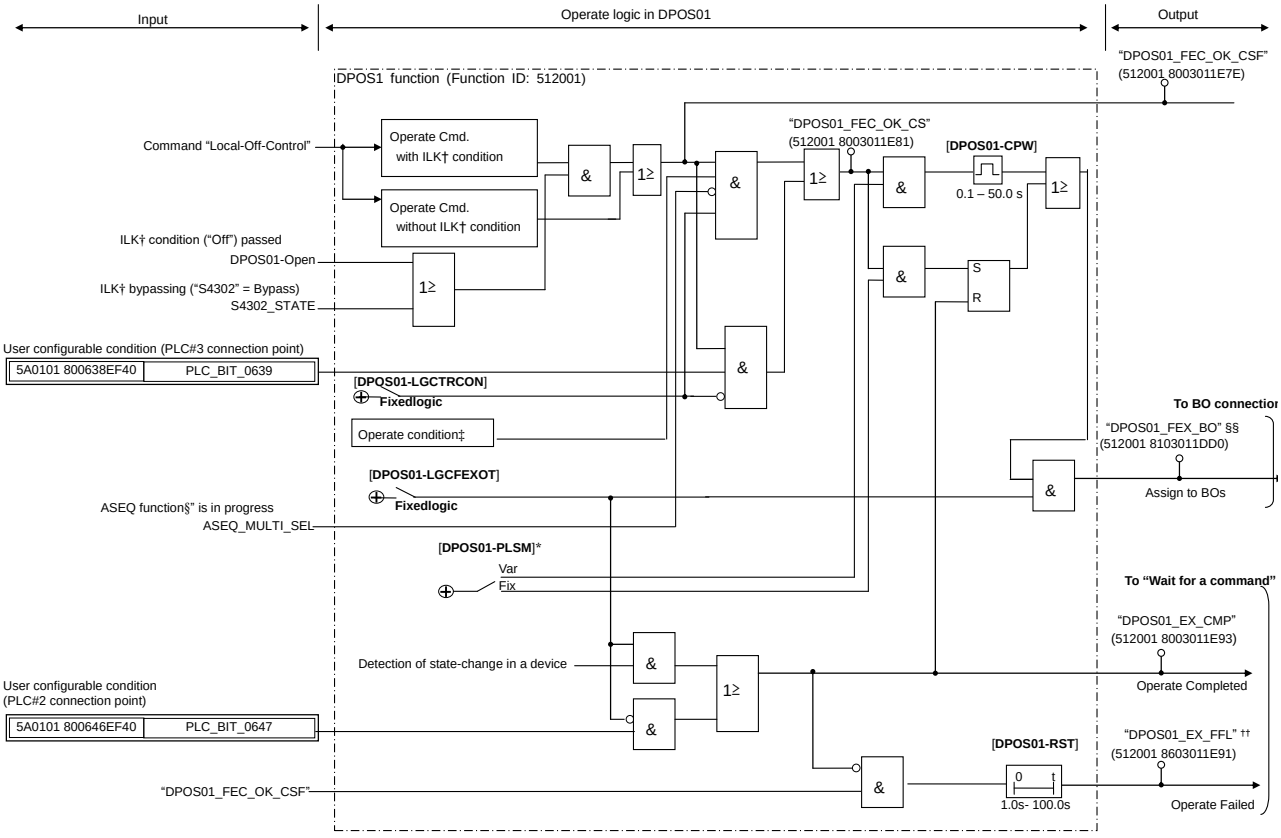


Figure 2.9-26 Operate Off on the front panel in DPOS01††

†Note:The ILK function can provide the operation criteria for "Off".

‡Note:An "operate condition" signal is generated in the operate-condition logic (see Figure 2.9-31), when **Fixlogic** is set for scheme switch [**DPOS01-LGCTRCON**]. If an alternative "operate-condition" is required it can be programmed by the user and used to replace the signal generated by the original operate-condition logic. The alternative "operate-condition" can be connected to the above logic using connection point #3 "User configurable condition". That is, set the [**DPOS01-LGCTRCON**] to **PLC** and use "PLC_BIT_0639".

§Note:The ASEQ function can provide sequential signals for automatic control.

§§Note: The "DPOS01_OEX_BO" signal is issued when **Fixedlogic** is set for the scheme switch [**DPOS01-LGCFEXOT**]. The "Operate completed" signal can also be issued from the logic programmed by the user in place of the logic shown in Figure 2.9-20. The user-programmed logic is connected internally to the signal "Operate completed", hence this signal is now generated by the user-programmed logic at connection point #2 "User configurable condition". That is, set the scheme switch [**DPOS01-LGCFEXOT**] to **PLC** and use "PLC_BIT_0647".

*Note:The user can select a type of output signal. When **Var** is set for scheme switch [**DPOS01-PLSM**], the output period of the signal is defined by the setting [**DPOS01-CPW**]. When **Fix** is set, the signal ceases when the 43-switch is changed.

††Note: To identify the input and output signals of the other DPOS logics, see Table 2.9-16 for PLC#2, Table 2.9-17 for PLC#3, Table 2.9-19 and Table 2.9-21 for output signals.

‡‡Note: The "Operate failed" signal is issued when the state-change is not detected until after reaching the time set by the [**DPOS01-RST**].

(v) Receiving "Operate command On" using the PLC function

Figure 2.9-27 outlines the reception of the operate command 'On' with the PLC function.

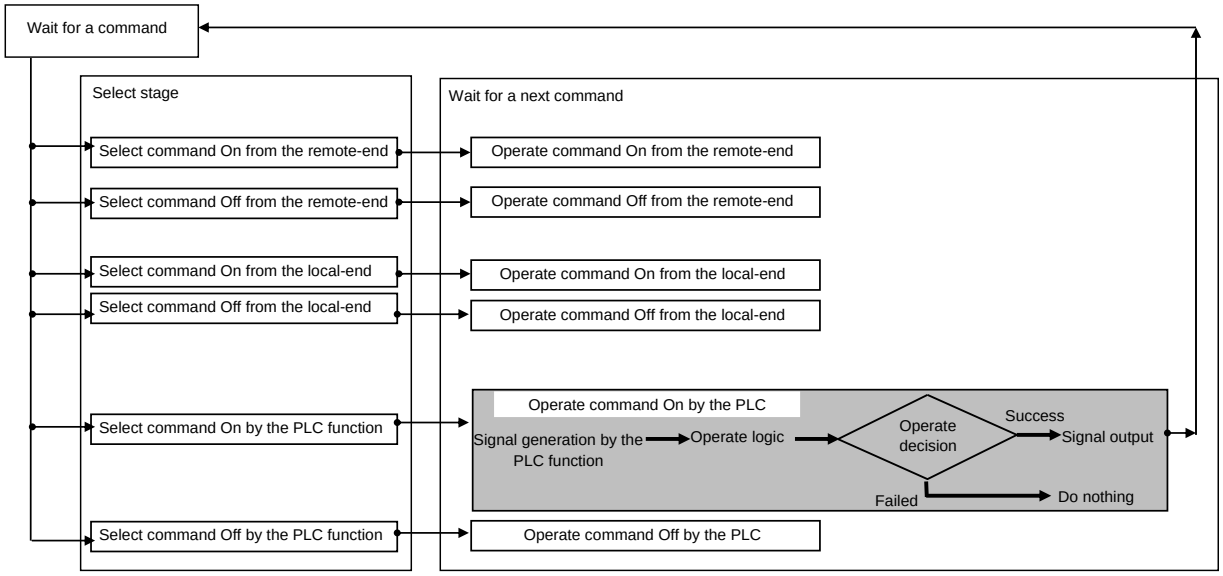


Figure 2.9-27 Outline of Operate command 'On'

(v)-1 Input signal from the PLC function

Figure 2.9-28 describes the operate logic when an "Operate command On (PLC-On-control)" signal is generated by the PLC function. There are two input points for reception of the signal "Operate command On (PLC-On-control)": the former connection point (PLC#3) is used for the reception of the operate-command when the interlock check is required, the later connection point (PLC#4) is used for the reception of the operate-command when the interlock check is not required. That is, for the DPOS01 function when the "Operate command On (PLC-On-Control)" signal generated in the user-programmed logic and when the interlock check is required in the operate logic, user should apply the signal at connection point (PLC#3: i.e. PLC_BIT_0632). Alternatively, if the interlock check is not required, apply the signal at connection point (PLC#4: i.e. PLC_BIT_0633). The PLC#3 and PLC#4 are denoted as PLC#1 and PLC#2 in Table 2.9-2. Note that the user should set **PLC** for scheme switch [**DPOS01-LGCTRCON**].

(v)-2 Output signal to BO

The DPOS01 function, in Figure 2.9-28, can issue an "Operate" signal at output point "DPOS01_OEX_BO", when the DPOS01 function determines that the signal "PLC-On-Control"

is true.

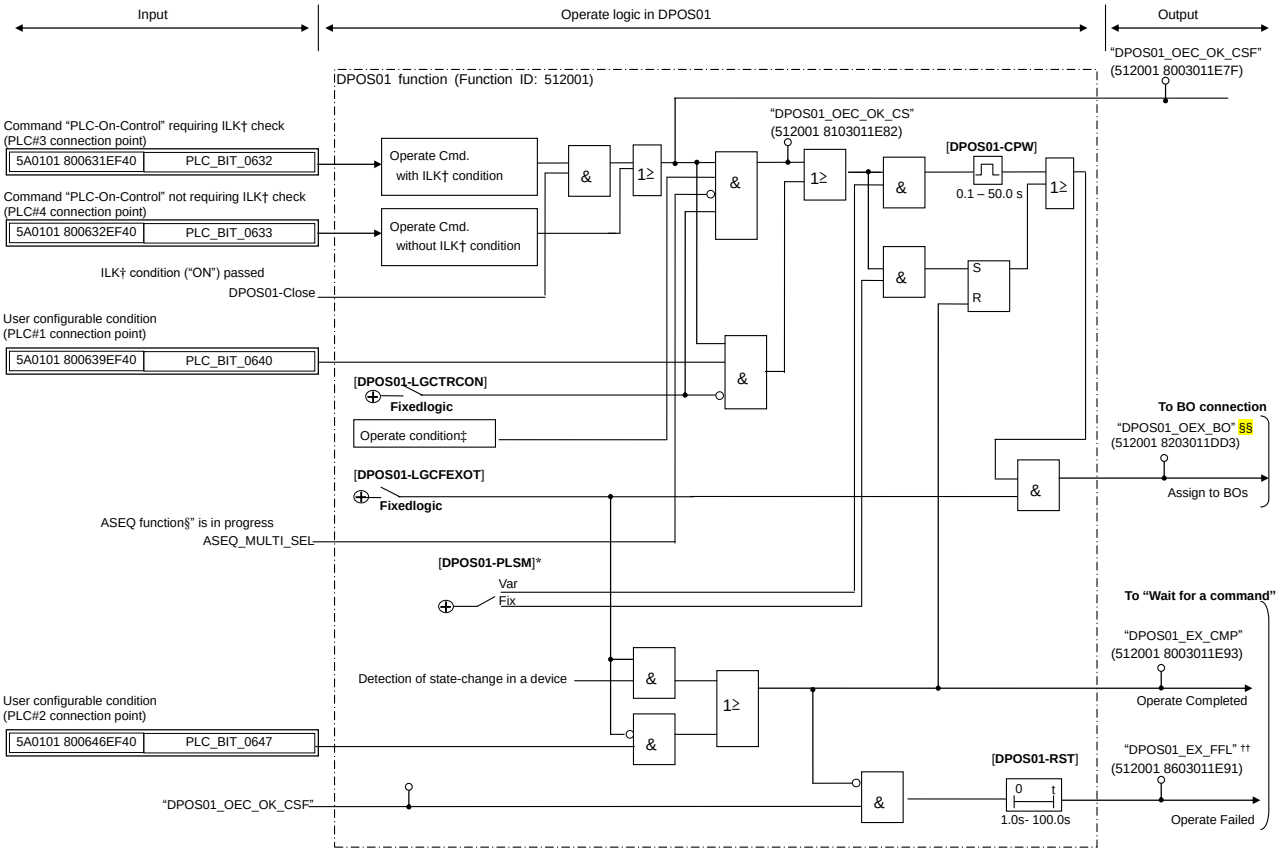


Figure 2.9-28 Operate On by the PLC function in DPOS01††

†Note:The ILK function can provide the operation criteria for "On".

‡Note:An "operate condition" signal is generated in the operate-condition logic (see Figure 2.9-31), when **Fixlogic** is set for scheme switch [**DPOS01-LGCTRCON**]. If an alternative "operate-condition" programmed by the user is required in place of the signal generated by the original operate-condition logic, connect the alternative "operate-condition" to the logic shown in Figure 2.9-28 using connection point #1 "User configurable condition". That is set the scheme switch [**DPOS01-LGCTRCON**] to **PLC** and use "PLC_BIT_0640".

§Note:The ASEQ function can provide sequential signals for automatic control.

§§Note: The "DPOS01_OEX_BO" signal is issued when **Fixedlogic** is set for scheme switch [**DPOS01-LGCFEXOT**]. If the signal is to be issued from the logic programmed by the user instead of the logic shown in Figure 2.9-20, connect the "Operate completed" signal generated in the user-programmed logic to connection point #2 "User configurable condition". That is, set the scheme switch [**DPOS01-LGCFEXOT**] to **PLC** and use "PLC_BIT_0647".

*Note:The user can select a type of output signal. When **Var** is set for scheme switch [**DPOS01-PLSM**], the output period of the signal is defined by the setting applied

to [**DPOS01-CPW**]. When **Fix** is set, the signal ceases when the 43-switch is changed.

††Note: To identify the input and output signal-points in the other DPOS logics, see Table 2.9-15 for PLC#1, Table 2.9-16 for PLC#2, Table 2.9-19 and Table 2.9-21 for output signals.

‡‡Note: The "Operate failed" signal is issued when a state-change remains undetected following expiration of the setting to timer [**DPOS01-RST**].

(vi) Receiving "Operate command Off" using PLC function

Figure 2.9-29 outlines the reception of the operate command 'Off' by the PLC function.

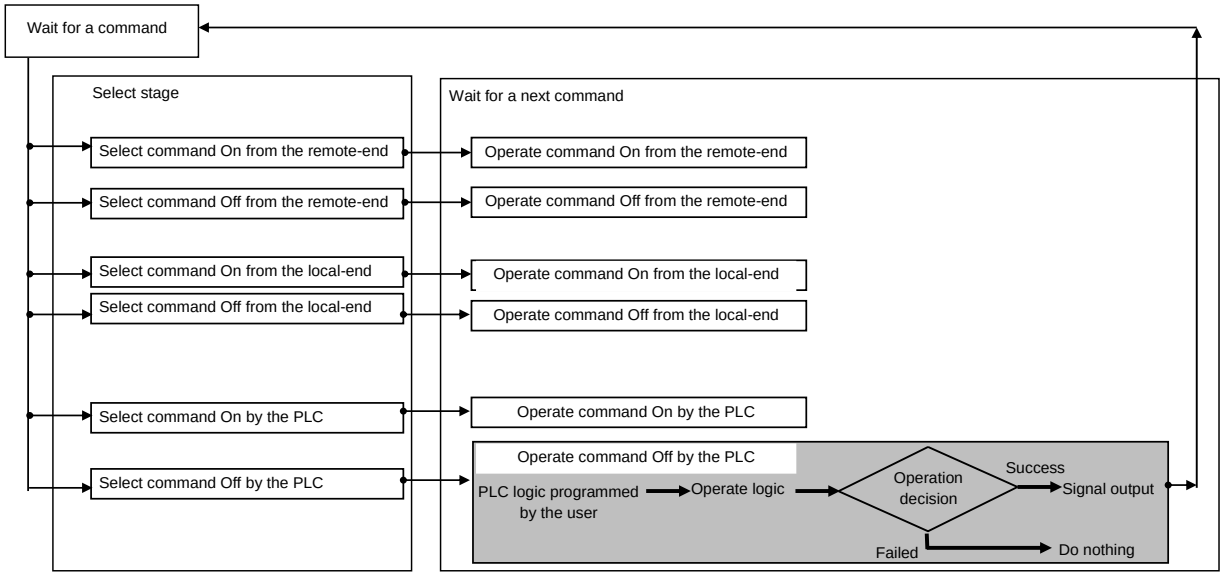


Figure 2.9-29 Outline of Operate command 'Off'

(vi)-1 Input signal from the PLC function

Figure 2.9-30 depicts the operate logic when an "Operate command Off (PLC-Off-control)" signal is generated by the PLC function. There are two input points for reception of this command signal, like the signal "Operate command On (PLC-On-control)", That is, if an interlock check is required, apply the signal at connection point (PLC#3: i.e. PLC_BIT_0631). If, on the other hand an interlock check is not required, apply the signal at the other connection point (PLC#4: i.e. PLC_BIT_0630). PLC#3 and PLC#4 are denoted as PLC#1 and PLC#2 in Table 2.9-3.

(vi)-2 Output signal to BO

The DPOS01 function, in Figure 2.9-30, can issue an "Operate" signal at output-point "DPOS01_FEX_BO", when the DPOS01 function determines that the signal "PLC-Off-Control" is true.

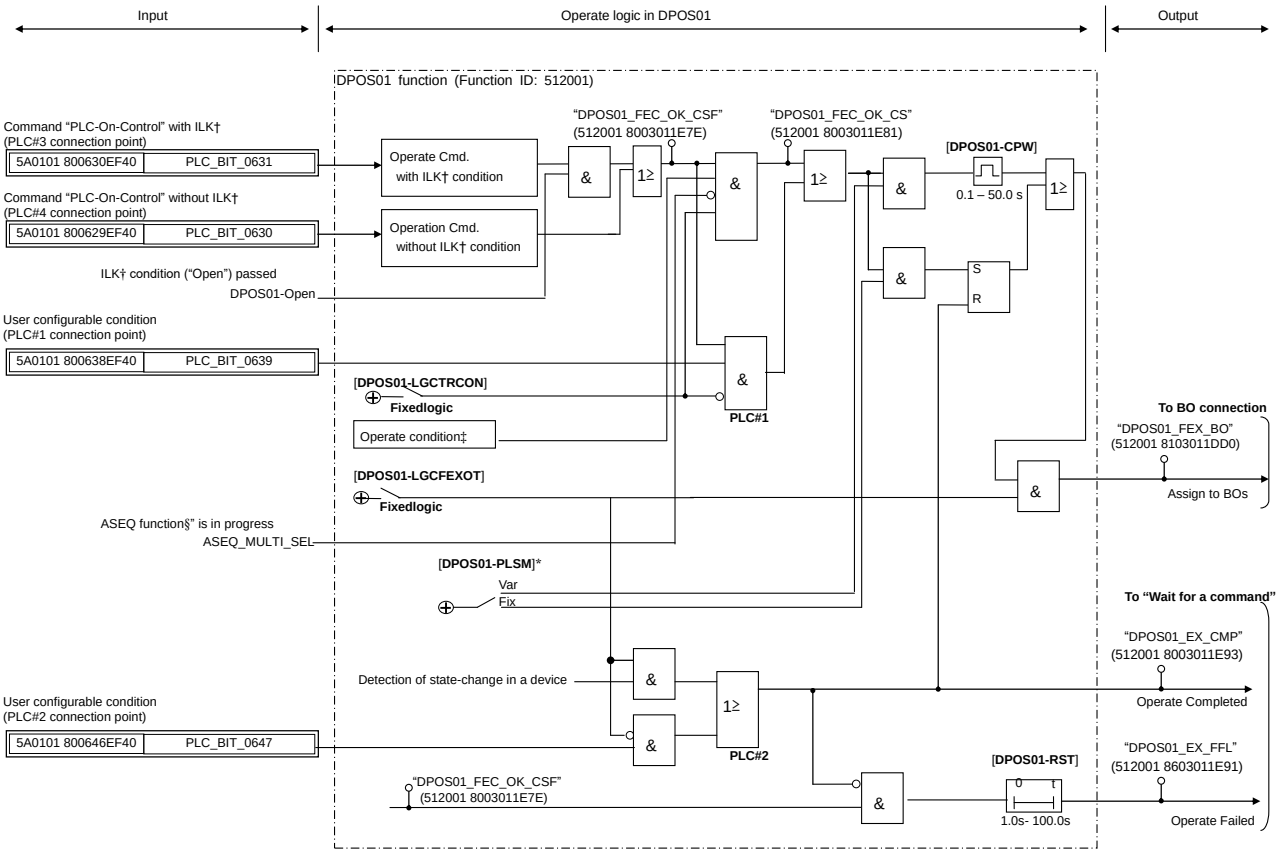


Figure 2.9-30 Operate 'Off' by the PLC function in DPOS01††

†Note:The ILK function can provide the criteria for operation for control of the "Off" operation.

‡Note:An "operate condition" signal is generated in the operate-condition logic (see Figure 2.9-31), when **Fixlogic** is set for scheme switch [**DPOS01-LGCTRCON**]. If an alternative "operate-condition" programmed by the user is required in place of the signal generated by the original operate-condition logic, connect the alternative "operate-condition" to the logic shown in Figure 2.9-30 using connection point #1 "User configurable condition". That is set the scheme switch [**DPOS01-LGCTRCON**] to **PLC** and use "PLC_BIT_0639".

§Note:The ASEQ function can provide sequential signals for automatic control.

§§Note: The "DPOS01_OEX_BO" signal is issued when **Fixedlogic** is set for the scheme switch [**DPOS01-LGCFEXOT**]. If the signal is to be issued from the programmed logic by the user in place of the logic in Figure 2.9-20, connect the signal "Operate completed" generated in the programmed logic to the connection point #2 "User configurable condition". That is, set the scheme switch [**DPOS01-LGCFEXOT**] to **PLC** and use "PLC_BIT_0647".

*Note:The user can select a type of the output signal. When **Var** is set for scheme switch [**DPOS01-PLSM**], the output period of the signal is defined by the setting applied to [**DPOS01-CPW**]. When **Fix** is set, the signal ceases when the 43-switch is

changed.

††Note: To identify the input and output signal-points of the other DPOS logics, see Table 2.9-16 for PLC#2, Table 2.9-17 for PLC#3, Table 2.9-19 and Table 2.9-21 for output signals.

‡‡Note: The "Operate failed" signal is issued when the state-change is not detected until after reaching the time set by the [**DPOS01-RST**].

(vii) Operate condition

In a manner similar to which the conditions have been examined for the select command, the conditions for an operate command should be understood. Figure 2.9-31 illustrates the logic to examine an operate condition; the operate condition is determined by signal "DPOS01_3PH_STATE". If the functionality of the original logic does not meet with user-requirements, the following alternatives are available:

1. The user can replace the original logic with alternative logic.
2. The user can add another signal to the original logic.

(vii)-1 Replacing the original logic

If the user wishes to replace the operate condition logic completely, it can be achieved using connection point "User configurable condition":

1. Connect the user-customized logic using "PLC_BIT_0644", listed as PLC#2 in Table 2.9-18.
2. Set scheme switch [**DPOS01-LGEXFFCT**] to **PLC**.

(vii)-2 Adding another operate condition signal

If the addition of another signal is required, the user can add the signal to the operate condition logic using connection point "Additional condition"

1. Add a user-preferred signal using PLC_BIT_0643, listed as PLC#1 in Table 2.9-18.
2. Set scheme switch [**DPOS01-LGEXFFCT**] to **Fixedlogic**.

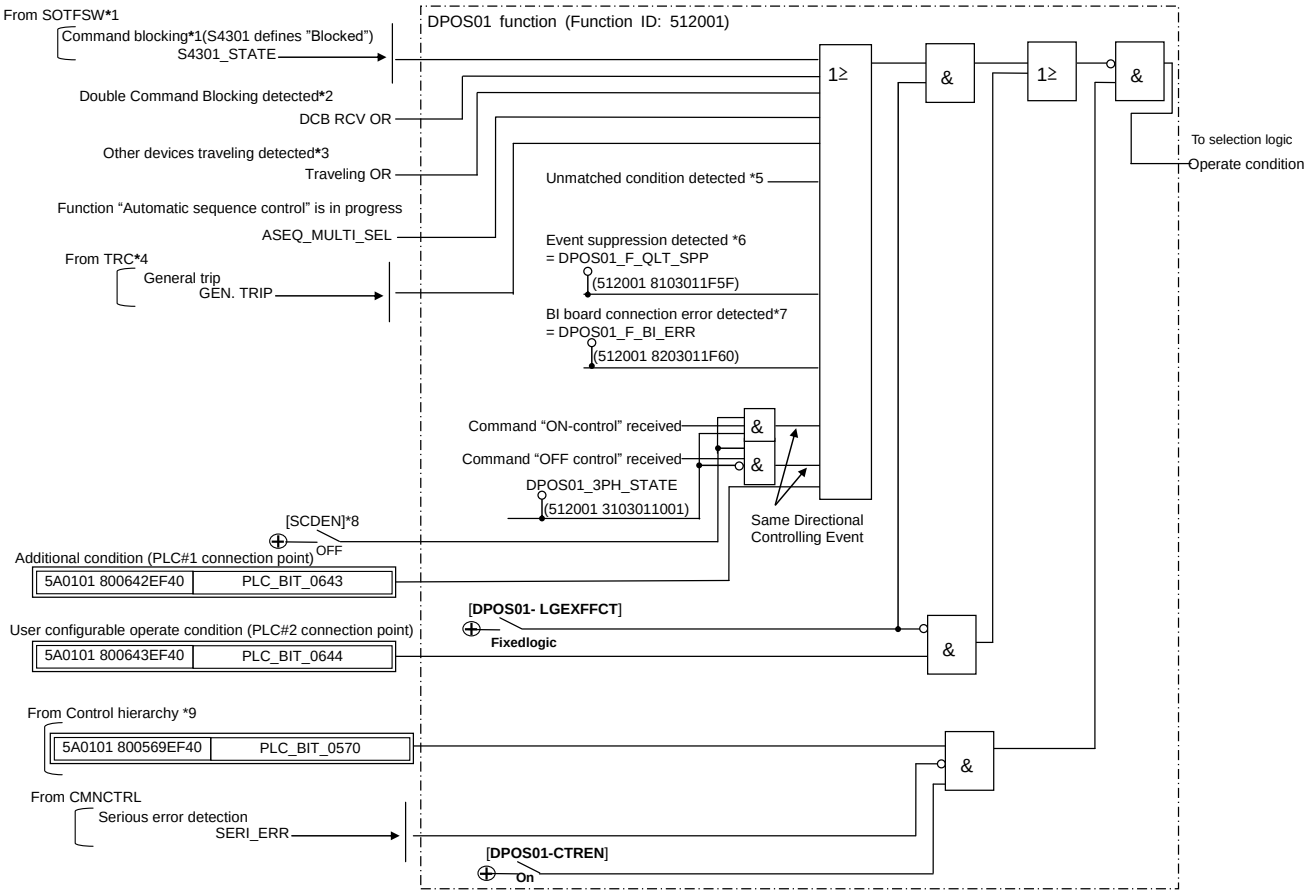


Figure 2.9-31 Operate condition logic for On/Off in DPOS01

[1]Note: "Command Blocking" disables all operation except for its own; "Command Blocking" is implemented as "S4301" in a software switch controller (SOTFSW). The IEC61850 standard defines "Command Blocking" as "CmdBlk". For more information on "S4301", see Chapter *Control and monitoring application: Software switch controller. See the signal "*"S4301_STATE" in Table 2.9-6.

[2]Note: "Double Command Blocking" (DCB) is an operation philosophy in the common control function (CMNCTRL). It can be used to protect the substation. The user can program it using GR-TIEMS. The DCB operating signal is denoted as "DCB RCV OR" in Table 2.9-6. For more information see Chapter *Control and monitoring application*:*Common controls.*

[3]Note: Detection of event "device-travelling" signifies that other operators are changing the status of one or more devices. Thus, device operation by the IED should be inhibited whilst ever the event is being detected. The detection signal is denoted as "Travelling OR" in Table 2.9-6.

[4]Note: If an IED in the process of issuing a trip command, all control operation is blocked until the trip operation has been completed. If the IED has a relay application, the trip command is issued at the output_point "GEN_TRIP" in Table 2.9-7.

[5]Note: The criteria "unmatched conditions" is determined when "Test-bit status" in a

command is not identical to "IED test status".

[6]Note: The "Event suppression" function can detect chattering in BI circuits. (See section 2.9.6(i)-3)

[7]Note: A supervision of the Binary IO module can detect connection errors for BI circuits.

[8]Note: The Common control (CMNCTRL) function can test and check the operation-direction of logic. When the user sets **Off** for scheme switch [**SCDEN**], operation of the logic is blocked if the logic is running in the same operation-direction compared with the previous operation-direction. Alernatively, if **On** is set for the scheme switch, the logic is not blocked.

[9]Note: The user must program the PLC logic "Control hierarchy condition". The user must connect the "Control hierarchy condition" to the select condition logic using the connection point "PLC_BIT_0570". For more information, see Chapter *Control and monitoring application: Control hierarchy*. See PLC#3 of Table 2.9-7.Note that the logic outputs are generated separately for both On and Off.

(viii) Signal name and number

Note: The user should note the menaing of the following descriptions as shown in column "M/O" of each table:

"O" indicates that the signal is provided for optional use.

"M" indicated that the user should map/set/configure the signal; otherwise, the user experience an operational failure if the default settings are used.

"N/A" indicates that that the user cannot change the state of the signal.

Table 2.9-15 PLC connection points (Input point for PLC#1 User configurable condition)

Signal Number	Signal Name	Description	M/O
5A0101 800639EF40	PLC_BIT_0640	DPOS01 user configurable condition(PLC#1)	O
5A0101 800659EF40	PLC_BIT_0660	DPOS02 user configurable condition(PLC#1)	O
5A0101 800679EF40	PLC_BIT_0680	DPOS03 user configurable condition(PLC#1)	O
5A0101 800699EF40	PLC_BIT_0700	DPOS04 user configurable condition(PLC#1)	O
5A0101 800719EF40	PLC_BIT_0720	DPOS05 user configurable condition(PLC#1)	O
5A0101 800739EF40	PLC_BIT_0740	DPOS06 user configurable condition(PLC#1)	O
5A0101 800759EF40	PLC_BIT_0760	DPOS07 user configurable condition(PLC#1)	O
5A0101 800779EF40	PLC_BIT_0780	DPOS08 user configurable condition(PLC#1)	O
5A0101 800799EF40	PLC_BIT_0800	DPOS09 user configurable condition(PLC#1)	O
5A0101 800819EF40	PLC_BIT_0820	DPOS10 user configurable condition(PLC#1)	O
5A0101 800839EF40	PLC_BIT_0840	DPOS11 user configurable condition(PLC#1)	O
5A0101 800859EF40	PLC_BIT_0860	DPOS12 user configurable condition(PLC#1)	O
5A0101 800879EF40	PLC_BIT_0880	DPOS13 user configurable condition(PLC#1)	O
5A0101 800899EF40	PLC_BIT_0900	DPOS14 user configurable condition(PLC#1)	O
5A0101 800919EF40	PLC_BIT_0920	DPOS15 user configurable condition(PLC#1)	O
5A0101 800939EF40	PLC_BIT_0940	DPOS16 user configurable condition(PLC#1)	O
5A0101 800959EF40	PLC_BIT_0960	DPOS17 user configurable condition(PLC#1)	O
5A0101 800979EF40	PLC_BIT_0980	DPOS18 user configurable condition(PLC#1)	O
5A0101 800999EF40	PLC_BIT_1000	DPOS19 user configurable condition(PLC#1)	O
5A0101 801019EF40	PLC_BIT_1020	DPOS20 user configurable condition(PLC#1)	O

Table 2.9-16 PLC connection points (Input point for PLC#2 User configurable condition)

Signal Number	Signal Name	Description	M/O
5A0101 800646EF40	PLC_BIT_0647	DPOS01 user configurable condition(PLC#2)	O
5A0101 800666EF40	PLC_BIT_0667	DPOS02 user configurable condition(PLC#2)	O
5A0101 800686EF40	PLC_BIT_0687	DPOS03 user configurable condition(PLC#2)	O
5A0101 800706EF40	PLC_BIT_0707	DPOS04 user configurable condition(PLC#2)	O
5A0101 800726EF40	PLC_BIT_0727	DPOS05 user configurable condition(PLC#2)	O
5A0101 800746EF40	PLC_BIT_0747	DPOS06 user configurable condition(PLC#2)	O
5A0101 800766EF40	PLC_BIT_0767	DPOS07 user configurable condition(PLC#2)	O
5A0101 800786EF40	PLC_BIT_0787	DPOS08 user configurable condition(PLC#2)	O
5A0101 800806EF40	PLC_BIT_0807	DPOS09 user configurable condition(PLC#2)	O
5A0101 800826EF40	PLC_BIT_0827	DPOS10 user configurable condition(PLC#2)	O
5A0101 800846EF40	PLC_BIT_0847	DPOS11 user configurable condition(PLC#2)	O
5A0101 800866EF40	PLC_BIT_0867	DPOS12 user configurable condition(PLC#2)	O
5A0101 800886EF40	PLC_BIT_0887	DPOS13 user configurable condition(PLC#2)	O
5A0101 800906EF40	PLC_BIT_0907	DPOS14 user configurable condition(PLC#2)	O
5A0101 800926EF40	PLC_BIT_0927	DPOS15 user configurable condition(PLC#2)	O
5A0101 800946EF40	PLC_BIT_0947	DPOS16 user configurable condition(PLC#2)	O
5A0101 800966EF40	PLC_BIT_0967	DPOS17 user configurable condition(PLC#2)	O
5A0101 800986EF40	PLC_BIT_0987	DPOS18 user configurable condition(PLC#2)	O
5A0101 801006EF40	PLC_BIT_1007	DPOS19 user configurable condition(PLC#2)	O
5A0101 801026EF40	PLC_BIT_1027	DPOS20 user configurable condition(PLC#2)	O

Table 2.9-17 PLC connection points (Input point for PLC#3 User configurable condition)

Signal Number	Signal Name	Description	M/O
5A0101 800638EF40	PLC_BIT_0639	DPOS01 user configurable condition(PLC#3)	O
5A0101 800658EF40	PLC_BIT_0659	DPOS02 user configurable condition(PLC#3)	O
5A0101 800678EF40	PLC_BIT_0679	DPOS03 user configurable condition(PLC#3)	O
5A0101 800698EF40	PLC_BIT_0699	DPOS04 user configurable condition(PLC#3)	O
5A0101 800718EF40	PLC_BIT_0719	DPOS05 user configurable condition(PLC#3)	O
5A0101 800738EF40	PLC_BIT_0739	DPOS06 user configurable condition(PLC#3)	O
5A0101 800758EF40	PLC_BIT_0759	DPOS07 user configurable condition(PLC#3)	O
5A0101 800778EF40	PLC_BIT_0779	DPOS08 user configurable condition(PLC#3)	O
5A0101 800798EF40	PLC_BIT_0799	DPOS09 user configurable condition(PLC#3)	O
5A0101 800818EF40	PLC_BIT_0819	DPOS10 user configurable condition(PLC#3)	O
5A0101 800838EF40	PLC_BIT_0839	DPOS11 user configurable condition(PLC#3)	O
5A0101 800858EF40	PLC_BIT_0859	DPOS12 user configurable condition(PLC#3)	O
5A0101 800878EF40	PLC_BIT_0879	DPOS13 user configurable condition(PLC#3)	O
5A0101 800898EF40	PLC_BIT_0899	DPOS14 user configurable condition(PLC#3)	O
5A0101 800918EF40	PLC_BIT_0919	DPOS15 user configurable condition(PLC#3)	O
5A0101 800938EF40	PLC_BIT_0939	DPOS16 user configurable condition(PLC#3)	O
5A0101 800958EF40	PLC_BIT_0959	DPOS17 user configurable condition(PLC#3)	O
5A0101 800978EF40	PLC_BIT_0979	DPOS18 user configurable condition(PLC#3)	O
5A0101 800998EF40	PLC_BIT_0999	DPOS19 user configurable condition(PLC#3)	O
5A0101 801018EF40	PLC_BIT_1019	DPOS20 user configurable condition(PLC#3)	O

Table 2.9-18 PLC connection points (Input point for PLC#1 and PLC#2 for additional and operate condition)

Signal Number	Signal Name	Description	M/O
5A0101 800642EF40	PLC_BIT_0643	DPOS01 user additional condition(PLC#1)	O

Signal Number	Signal Name	Description	M/O
5A0101 800662EF40	PLC_BIT_0663	DPOS02 user additional condition(PLC#1)	O
5A0101 800682EF40	PLC_BIT_0683	DPOS03 user additional condition(PLC#1)	O
5A0101 800702EF40	PLC_BIT_0703	DPOS04 user additional condition(PLC#1)	O
5A0101 800722EF40	PLC_BIT_0723	DPOS05 user additional condition(PLC#1)	O
5A0101 800742EF40	PLC_BIT_0743	DPOS06 user additional condition(PLC#1)	O
5A0101 800762EF40	PLC_BIT_0763	DPOS07 user additional condition(PLC#1)	O
5A0101 800782EF40	PLC_BIT_0783	DPOS08 user additional condition(PLC#1)	O
5A0101 800802EF40	PLC_BIT_0803	DPOS09 user additional condition(PLC#1)	O
5A0101 800822EF40	PLC_BIT_0823	DPOS10 user additional condition(PLC#1)	O
5A0101 800842EF40	PLC_BIT_0843	DPOS11 user additional condition(PLC#1)	O
5A0101 800862EF40	PLC_BIT_0863	DPOS12 user additional condition(PLC#1)	O
5A0101 800882EF40	PLC_BIT_0883	DPOS13 user additional condition(PLC#1)	O
5A0101 800902EF40	PLC_BIT_0903	DPOS14 user additional condition(PLC#1)	O
5A0101 800922EF40	PLC_BIT_0923	DPOS15 user additional condition(PLC#1)	O
5A0101 800942EF40	PLC_BIT_0943	DPOS16 user additional condition(PLC#1)	O
5A0101 800962EF40	PLC_BIT_0963	DPOS17 user additional condition(PLC#1)	O
5A0101 800982EF40	PLC_BIT_0983	DPOS18 user additional condition(PLC#1)	O
5A0101 801002EF40	PLC_BIT_1003	DPOS19 user additional condition(PLC#1)	O
5A0101 801022EF40	PLC_BIT_1023	DPOS20 user additional condition(PLC#1)	O
5A0101 800643EF40	PLC_BIT_0644	DPOS01 user configurable operate condition(PLC#2)	O
5A0101 800663EF40	PLC_BIT_0664	DPOS02 user configurable operate condition(PLC#2)	O
5A0101 800683EF40	PLC_BIT_0684	DPOS03 user configurable operate condition(PLC#2)	O
5A0101 800703EF40	PLC_BIT_0704	DPOS04 user configurable operate condition(PLC#2)	O
5A0101 800723EF40	PLC_BIT_0724	DPOS05 user configurable operate condition(PLC#2)	O
5A0101 800743EF40	PLC_BIT_0744	DPOS06 user configurable operate condition(PLC#2)	O
5A0101 800763EF40	PLC_BIT_0764	DPOS07 user configurable operate condition(PLC#2)	O
5A0101 800783EF40	PLC_BIT_0784	DPOS08 user configurable operate condition(PLC#2)	O
5A0101 800803EF40	PLC_BIT_0804	DPOS09 user configurable operate condition(PLC#2)	O
5A0101 800823EF40	PLC_BIT_0824	DPOS10 user configurable operate condition(PLC#2)	O
5A0101 800843EF40	PLC_BIT_0844	DPOS11 user configurable operate condition(PLC#2)	O
5A0101 800863EF40	PLC_BIT_0864	DPOS12 user configurable operate condition(PLC#2)	O
5A0101 800883EF40	PLC_BIT_0884	DPOS13 user configurable operate condition(PLC#2)	O
5A0101 800903EF40	PLC_BIT_0904	DPOS14 user configurable operate condition(PLC#2)	O
5A0101 800923EF40	PLC_BIT_0924	DPOS15 user configurable operate condition(PLC#2)	O
5A0101 800943EF40	PLC_BIT_0944	DPOS16 user configurable operate condition(PLC#2)	O
5A0101 800963EF40	PLC_BIT_0964	DPOS17 user configurable operate condition(PLC#2)	O
5A0101 800983EF40	PLC_BIT_0984	DPOS18 user configurable operate condition(PLC#2)	O
5A0101 801003EF40	PLC_BIT_1004	DPOS19 user configurable operate condition(PLC#2)	O
5A0101 801023EF40	PLC_BIT_1024	DPOS20 user configurable operate condition(PLC#2)	O

Table 2.9-19 PLC monitoring points (Output signal for BIO)

Signal Number	Signal Name	Description
512001 8203011DD3	DPOS01_OEX_BO	DPOS01 operate (ON) command for Binary Output.
512001 8203021DD3	DPOS02_OEX_BO	DPOS02 operate (ON) command for Binary Output.
512001 8203031DD3	DPOS03_OEX_BO	DPOS03 operate (ON) command for Binary Output.
512001 8203041DD3	DPOS04_OEX_BO	DPOS04 operate (ON) command for Binary Output.
512001 8203051DD3	DPOS05_OEX_BO	DPOS05 operate (ON) command for Binary Output.
512001 8203061DD3	DPOS06_OEX_BO	DPOS06 operate (ON) command for Binary Output.
512001 8203071DD3	DPOS07_OEX_BO	DPOS07 operate (ON) command for Binary Output.
512001 8203081DD3	DPOS08_OEX_BO	DPOS08 operate (ON) command for Binary Output.
512001 8203091DD3	DPOS09_OEX_BO	DPOS09 operate (ON) command for Binary Output.
512001 82030A1DD3	DPOS10_OEX_BO	DPOS10 operate (ON) command for Binary Output.
512001 82030B1DD3	DPOS11_OEX_BO	DPOS11 operate (ON) command for Binary Output.

Signal Number	Signal Name	Description
512001 82030C1DD3	DPOS12_OEX_BO	DPOS12 operate (ON) command for Binary Output.
512001 82030D1DD3	DPOS13_OEX_BO	DPOS13 operate (ON) command for Binary Output.
512001 82030E1DD3	DPOS14_OEX_BO	DPOS14 operate (ON) command for Binary Output.
512001 82030F1DD3	DPOS15_OEX_BO	DPOS15 operate (ON) command for Binary Output.
512001 8203101DD3	DPOS16_OEX_BO	DPOS16 operate (ON) command for Binary Output.
512001 8203111DD3	DPOS17_OEX_BO	DPOS17 operate (ON) command for Binary Output.
512001 8203121DD3	DPOS18_OEX_BO	DPOS18 operate (ON) command for Binary Output.
512001 8203131DD3	DPOS19_OEX_BO	DPOS19 operate (ON) command for Binary Output.
512001 8203141DD3	DPOS20_OEX_BO	DPOS20 operate (ON) command for Binary Output.
512001 8103011DD0	DPOS01_FEX_BO	DPOS01 operate (OFF) command for Binary Output.
512001 8103021DD0	DPOS02_FEX_BO	DPOS02 operate (OFF) command for Binary Output.
512001 8103031DD0	DPOS03_FEX_BO	DPOS03 operate (OFF) command for Binary Output.
512001 8103041DD0	DPOS04_FEX_BO	DPOS04 operate (OFF) command for Binary Output.
512001 8103051DD0	DPOS05_FEX_BO	DPOS05 operate (OFF) command for Binary Output.
512001 8103061DD0	DPOS06_FEX_BO	DPOS06 operate (OFF) command for Binary Output.
512001 8103071DD0	DPOS07_FEX_BO	DPOS07 operate (OFF) command for Binary Output.
512001 8103081DD0	DPOS08_FEX_BO	DPOS08 operate (OFF) command for Binary Output.
512001 8103091DD0	DPOS09_FEX_BO	DPOS09 operate (OFF) command for Binary Output.
512001 81030A1DD0	DPOS10_FEX_BO	DPOS10 operate (OFF) command for Binary Output.
512001 81030B1DD0	DPOS11_FEX_BO	DPOS11 operate (OFF) command for Binary Output.
512001 81030C1DD0	DPOS12_FEX_BO	DPOS12 operate (OFF) command for Binary Output.
512001 81030D1DD0	DPOS13_FEX_BO	DPOS13 operate (OFF) command for Binary Output.
512001 81030E1DD0	DPOS14_FEX_BO	DPOS14 operate (OFF) command for Binary Output.
512001 81030F1DD0	DPOS15_FEX_BO	DPOS15 operate (OFF) command for Binary Output.
512001 8103101DD0	DPOS16_FEX_BO	DPOS16 operate (OFF) command for Binary Output.
512001 8103111DD0	DPOS17_FEX_BO	DPOS17 operate (OFF) command for Binary Output.
512001 8103121DD0	DPOS18_FEX_BO	DPOS18 operate (OFF) command for Binary Output.
512001 8103131DD0	DPOS19_FEX_BO	DPOS19 operate (OFF) command for Binary Output.
512001 8103141DD0	DPOS20_FEX_BO	DPOS20 operate (OFF) command for Binary Output.

Table 2.9-20 PLC monitoring points (Signals within operate logic)

Signal Number	Signal Name	Description
512001 8003011E7F	DPOS01_OEC_OK_CSF	DPOS01 On-direction execute command
512001 8003021E7F	DPOS02_OEC_OK_CSF	DPOS02 On-direction execute command
512001 8003031E7F	DPOS03_OEC_OK_CSF	DPOS03 On-direction execute command
512001 8003041E7F	DPOS04_OEC_OK_CSF	DPOS04 On-direction execute command
512001 8003051E7F	DPOS05_OEC_OK_CSF	DPOS05 On-direction execute command
512001 8003061E7F	DPOS06_OEC_OK_CSF	DPOS06 On-direction execute command
512001 8003071E7F	DPOS07_OEC_OK_CSF	DPOS07 On-direction execute command
512001 8003081E7F	DPOS08_OEC_OK_CSF	DPOS08 On-direction execute command
512001 8003091E7F	DPOS09_OEC_OK_CSF	DPOS09 On-direction execute command
512001 80030A1E7F	DPOS10_OEC_OK_CSF	DPOS10 On-direction execute command
512001 80030B1E7F	DPOS11_OEC_OK_CSF	DPOS11 On-direction execute command
512001 80030C1E7F	DPOS12_OEC_OK_CSF	DPOS12 On-direction execute command
512001 80030D1E7F	DPOS13_OEC_OK_CSF	DPOS13 On-direction execute command
512001 80030E1E7F	DPOS14_OEC_OK_CSF	DPOS14 On-direction execute command
512001 80030F1E7F	DPOS15_OEC_OK_CSF	DPOS15 On-direction execute command
512001 8003101E7F	DPOS16_OEC_OK_CSF	DPOS16 On-direction execute command
512001 8003111E7F	DPOS17_OEC_OK_CSF	DPOS17 On-direction execute command
512001 8003121E7F	DPOS18_OEC_OK_CSF	DPOS18 On-direction execute command
512001 8003131E7F	DPOS19_OEC_OK_CSF	DPOS19 On-direction execute command
512001 8003141E7F	DPOS20_OEC_OK_CSF	DPOS20 On-direction execute command
512001 8003011E7E	DPOS01_FEC_OK_CSF	DPOS01 Off-direction execute command

Signal Number	Signal Name	Description
512001 8003021E7E	DPOS02_FEC_OK_CSF	DPOS02 Off-direction execute command
512001 8003031E7E	DPOS03_FEC_OK_CSF	DPOS03 Off-direction execute command
512001 8003041E7E	DPOS04_FEC_OK_CSF	DPOS04 Off-direction execute command
512001 8003051E7E	DPOS05_FEC_OK_CSF	DPOS05 Off-direction execute command
512001 8003061E7E	DPOS06_FEC_OK_CSF	DPOS06 Off-direction execute command
512001 8003071E7E	DPOS07_FEC_OK_CSF	DPOS07 Off-direction execute command
512001 8003081E7E	DPOS08_FEC_OK_CSF	DPOS08 Off-direction execute command
512001 8003091E7E	DPOS09_FEC_OK_CSF	DPOS09 Off-direction execute command
512001 80030A1E7E	DPOS10_FEC_OK_CSF	DPOS10 Off-direction execute command
512001 80030B1E7E	DPOS11_FEC_OK_CSF	DPOS11 Off-direction execute command
512001 80030C1E7E	DPOS12_FEC_OK_CSF	DPOS12 Off-direction execute command
512001 80030D1E7E	DPOS13_FEC_OK_CSF	DPOS13 Off-direction execute command
512001 80030E1E7E	DPOS14_FEC_OK_CSF	DPOS14 Off-direction execute command
512001 80030F1E7E	DPOS15_FEC_OK_CSF	DPOS15 Off-direction execute command
512001 8003101E7E	DPOS16_FEC_OK_CSF	DPOS16 Off-direction execute command
512001 8003111E7E	DPOS17_FEC_OK_CSF	DPOS17 Off-direction execute command
512001 8003121E7E	DPOS18_FEC_OK_CSF	DPOS18 Off-direction execute command
512001 8003131E7E	DPOS19_FEC_OK_CSF	DPOS19 Off-direction execute command
512001 8003141E7E	DPOS20_FEC_OK_CSF	DPOS20 Off-direction execute command
512001 8103011E82	DPOS01_OEC_OK_CS	DPOS01 On-direction execute command
512001 8103021E82	DPOS02_OEC_OK_CS	DPOS02 On-direction execute command
512001 8103031E82	DPOS03_OEC_OK_CS	DPOS03 On-direction execute command
512001 8103041E82	DPOS04_OEC_OK_CS	DPOS04 On-direction execute command
512001 8103051E82	DPOS05_OEC_OK_CS	DPOS05 On-direction execute command
512001 8103061E82	DPOS06_OEC_OK_CS	DPOS06 On-direction execute command
512001 8103071E82	DPOS07_OEC_OK_CS	DPOS07 On-direction execute command
512001 8103081E82	DPOS08_OEC_OK_CS	DPOS08 On-direction execute command
512001 8103091E82	DPOS09_OEC_OK_CS	DPOS09 On-direction execute command
512001 81030A1E82	DPOS10_OEC_OK_CS	DPOS10 On-direction execute command
512001 81030B1E82	DPOS11_OEC_OK_CS	DPOS11 On-direction execute command
512001 81030C1E82	DPOS12_OEC_OK_CS	DPOS12 On-direction execute command
512001 81030D1E82	DPOS13_OEC_OK_CS	DPOS13 On-direction execute command
512001 81030E1E82	DPOS14_OEC_OK_CS	DPOS14 On-direction execute command
512001 81030F1E82	DPOS15_OEC_OK_CS	DPOS15 On-direction execute command
512001 8103101E82	DPOS16_OEC_OK_CS	DPOS16 On-direction execute command
512001 8103111E82	DPOS17_OEC_OK_CS	DPOS17 On-direction execute command
512001 8103121E82	DPOS18_OEC_OK_CS	DPOS18 On-direction execute command
512001 8103131E82	DPOS19_OEC_OK_CS	DPOS19 On-direction execute command
512001 8103141E82	DPOS20_OEC_OK_CS	DPOS20 On-direction execute command
512001 8003011E81	DPOS01_FEC_OK_CS	DPOS01 Off-direction execute command
512001 8003021E81	DPOS02_FEC_OK_CS	DPOS02 Off-direction execute command
512001 8003031E81	DPOS03_FEC_OK_CS	DPOS03 Off-direction execute command
512001 8003041E81	DPOS04_FEC_OK_CS	DPOS04 Off-direction execute command
512001 8003051E81	DPOS05_FEC_OK_CS	DPOS05 Off-direction execute command
512001 8003061E81	DPOS06_FEC_OK_CS	DPOS06 Off-direction execute command
512001 8003071E81	DPOS07_FEC_OK_CS	DPOS07 Off-direction execute command
512001 8003081E81	DPOS08_FEC_OK_CS	DPOS08 Off-direction execute command
512001 8003091E81	DPOS09_FEC_OK_CS	DPOS09 Off-direction execute command
512001 80030A1E81	DPOS10_FEC_OK_CS	DPOS10 Off-direction execute command
512001 80030B1E81	DPOS11_FEC_OK_CS	DPOS11 Off-direction execute command
512001 80030C1E81	DPOS12_FEC_OK_CS	DPOS12 Off-direction execute command
512001 80030D1E81	DPOS13_FEC_OK_CS	DPOS13 Off-direction execute command
512001 80030E1E81	DPOS14_FEC_OK_CS	DPOS14 Off-direction execute command
512001 80030F1E81	DPOS15_FEC_OK_CS	DPOS15 Off-direction execute command
512001 8003101E81	DPOS16_FEC_OK_CS	DPOS16 Off-direction execute command

Signal Number	Signal Name	Description
512001 8003111E81	DPOS17_FEC_OK_CS	DPOS17 Off-direction execute command
512001 8003121E81	DPOS18_FEC_OK_CS	DPOS18 Off-direction execute command
512001 8003131E81	DPOS19_FEC_OK_CS	DPOS19 Off-direction execute command
512001 8003141E81	DPOS20_FEC_OK_CS	DPOS20 Off-direction execute command

Table 2.9-21 PLC monitoring points (Output signals for response)

Signal Number	Signal Name	Description
512001 8003011E93	DPOS01_EX_CMP	DPOS01 completed control
512001 8003021E93	DPOS02_EX_CMP	DPOS02 completed control
512001 8003031E93	DPOS03_EX_CMP	DPOS03 completed control
512001 8003041E93	DPOS04_EX_CMP	DPOS04 completed control
512001 8003051E93	DPOS05_EX_CMP	DPOS05 completed control
512001 8003061E93	DPOS06_EX_CMP	DPOS06 completed control
512001 8003071E93	DPOS07_EX_CMP	DPOS07 completed control
512001 8003081E93	DPOS08_EX_CMP	DPOS08 completed control
512001 8003091E93	DPOS09_EX_CMP	DPOS09 completed control
512001 80030A1E93	DPOS10_EX_CMP	DPOS10 completed control
512001 80030B1E93	DPOS11_EX_CMP	DPOS11 completed control
512001 80030C1E93	DPOS12_EX_CMP	DPOS12 completed control
512001 80030D1E93	DPOS13_EX_CMP	DPOS13 completed control
512001 80030E1E93	DPOS14_EX_CMP	DPOS14 completed control
512001 80030F1E93	DPOS15_EX_CMP	DPOS15 completed control
512001 8003101E93	DPOS16_EX_CMP	DPOS16 completed control
512001 8003111E93	DPOS17_EX_CMP	DPOS17 completed control
512001 8003121E93	DPOS18_EX_CMP	DPOS18 completed control
512001 8003131E93	DPOS19_EX_CMP	DPOS19 completed control
512001 8003141E93	DPOS20_EX_CMP	DPOS20 completed control
512001 8603011E91	DPOS01_EX_FFL	DPOS01 failed control
512001 8603021E91	DPOS02_EX_FFL	DPOS02 failed control
512001 8603031E91	DPOS03_EX_FFL	DPOS03 failed control
512001 8603041E91	DPOS04_EX_FFL	DPOS04 failed control
512001 8603051E91	DPOS05_EX_FFL	DPOS05 failed control
512001 8603061E91	DPOS06_EX_FFL	DPOS06 failed control
512001 8603071E91	DPOS07_EX_FFL	DPOS07 failed control
512001 8603081E91	DPOS08_EX_FFL	DPOS08 failed control
512001 8603091E91	DPOS09_EX_FFL	DPOS09 failed control
512001 86030A1E91	DPOS10_EX_FFL	DPOS10 failed control
512001 86030B1E91	DPOS11_EX_FFL	DPOS11 failed control
512001 86030C1E91	DPOS12_EX_FFL	DPOS12 failed control
512001 86030D1E91	DPOS13_EX_FFL	DPOS13 failed control
512001 86030E1E91	DPOS14_EX_FFL	DPOS14 failed control
512001 86030F1E91	DPOS15_EX_FFL	DPOS15 failed control
512001 8603101E91	DPOS16_EX_FFL	DPOS16 failed control
512001 8603111E91	DPOS17_EX_FFL	DPOS17 failed control
512001 8603121E91	DPOS18_EX_FFL	DPOS18 failed control
512001 8603131E91	DPOS19_EX_FFL	DPOS19 failed control
512001 8603141E91	DPOS20_EX_FFL	DPOS20 failed control

Table 2.9-22 Reason signals and messages for execution and operation failure

<table>
<tr><th>Signal Number</th><th>Signal Name</th><th>Description</th></tr>
<tr><td>512001 3102011D84</td><td>DPOS01_TMP_10</td><td>DPOS01 execution failure signal due for the failure to issue BO command. It has a reason message about the last aborted execution command. The message is shown below:
Value 0: No reason
Other values: see the below:
<table>
<tr><th>Event message</th><th>IEC61850 Add Cause definition</th></tr>
<tr><td>BLK BY SWITCH</td><td>Blocked by switching hierarchy</td></tr>
<tr><td>BLK BY SEL FAIL</td><td>Select failed</td></tr>
<tr><td>BLK BY INV POS</td><td>Invalid position</td></tr>
<tr><td>BLK BY POS RCH</td><td>Position reached</td></tr>
<tr><td>PRM CHG</td><td>Parameter change in execution</td></tr>
<tr><td>BLK BY STEP LMT</td><td>Step limit</td></tr>
<tr><td>BLK BY MODE</td><td>Blocked by Mode</td></tr>
<tr><td>BLK BY PROCESS</td><td>Blocked by process</td></tr>
<tr><td>BLK BY INK</td><td>Blocked by interlocking</td></tr>
<tr><td>BLK BY SYN</td><td>Blocked by synchrocheck</td></tr>
<tr><td>BLK BY CMD INPRG</td><td>Command already in execution</td></tr>
<tr><td>BLK BY HEALTH</td><td>Blocked by health</td></tr>
<tr><td>BLK BY 1 OFN</td><td>1 of n control</td></tr>
<tr><td>BLK BY CANCEL</td><td>Abortion by cancel</td></tr>
<tr><td>BLK BY TLMT OVER</td><td>Time limit over</td></tr>
<tr><td>BLK BY TRIP</td><td>Abortion by trip</td></tr>
<tr><td>BLK BY NOT SEL</td><td>Object not selected</td></tr>
<tr><td>BLK BY ALR SEL</td><td>Object already selected</td></tr>
<tr><td>BLK BY AUTHORITY</td><td>No access authority</td></tr>
<tr><td>BLK BY OVERSHOOT</td><td>Ended with overshoot</td></tr>
<tr><td>BLK BY DEVIATION</td><td>Abortion due to deviation</td></tr>
<tr><td>BLK BY CMMLOSS</td><td>Abortion by command loss</td></tr>
<tr><td>BLK BY CMDBLK</td><td>Blocked by command</td></tr>
<tr><td>NONE</td><td>None</td></tr>
<tr><td>BLK BY NCNST PRM</td><td>Inconsistent parameters</td></tr>
<tr><td>BLK BY OTER CLT</td><td>Locked by other client</td></tr>
</table></td></tr>
<tr><td>512001 3102011D86</td><td>DPOS01_TMP_11</td><td>DPOS01 operation failure signal. It has a reason message about the last aborted execution command. The message is the same as the one of DPOS01_TMP_10 (see above table).</td></tr>
</table>

(ix) Setting names

Note: The “xx” of “DPOSxx” represents the DPOS function number. (e.g., if the DPOS03 is considered, the “xx” is equal to “03”. The suffix “xx” can be represented by “01” to “20”.)

Table 2.9-23 Setting of Operate in DPOSxx

Setting Name	Description	Default	Setting item or value
DPOSxx-PLSM	Methods of command output(DPOS1-20)	Fix	Fix/Var/Latch
DPOSxx-CPW	Duration of command output(DPOS1-20)	1.0[sec]	0.1~50.0[sec]
DPOSxx-RST	Detection time for terminating control (DPOS1-20)	30.0[sec]	0.1~100.0[sec]
DPOSxx-LGCTRCON	Logic selector for operate condition (DPOS01-20)	Fixedlogic	Fixedlogic/PLC
DPOSxx-LGCFEXOT	Logic selector for command output (DPOS01-20)	Fixedlogic	Fixedlogic/PLC
DPOSxx-CTREN	Activate control function of DPOS01-20	On	Off / On
DPOSxx-LGEXFFCT	Logic selector for operate condition (DPOS01-20)	Fixedlogic	Fixedlogic / PLC

2.9.4 Operation counter

The DPOS01 function has an operation-counter†; the user can utilize the operation-counter to predict the lifespan of switchgear and other functions. The user can select a count mode using a setting. Table 2.9-24 and Figure 2.9-32 show the modes, for which a user is required to change a mode in response to a device signal. For instance for the DPOS01 function, a user can select the mode using scheme switch [**DPOS01-CNTS**], which is set to **C-On**; counting-up is performed when a switchgear signal gives rise to a change in state from "Off to On".

Table 2.9-24 Mode of operation counter

Mode	Description
C-On	Counting-up is performed when a signal changes to closed (On). When the signal is changed from "Off to On", the counter value is incremented.
C-Off	Counting-up is performed when a signal changes to open (Off). When the signal is changed from "On to Off", the counter value is incremented.
C-OnOff	Counting-up occurs when any state change occurs: that is, "Off to On" or "On to Off".
NA	Stop the count function

†Note:The operation-counter value is not cleared when power is removed from the IED.

The operation-counter is available in the DPOS01 to DPOS20 functions.

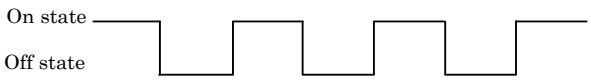


Figure 2.9-32 Device signal

The user can change the value of the operation-counter from either the front panel or remotely. For example, in the sub-menu for "Operation counter", the user can set a user-preferred value for the operation-counter. See chapter *User interface: Monitoring sub-menu*.

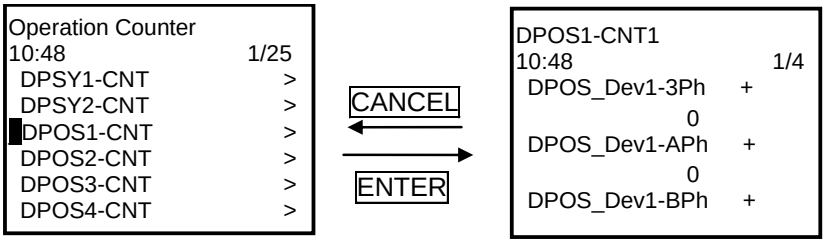


Figure 2.9-33 Operation counter sub-menu

Note: With regard to signal "DPOS01_3PH_STATE", the sub-menu represents it as "DPOS_Dev1-3Ph". Analogous to the signal "DPOS01_3PH_STATE", "DPOS01_APH_STATE" is represented as "DPOS_Dev1-APh". Signals "DPOS01_BPH_STATE" and "DPOS01_CPH_STATE" are displayed in a similar manner.

(i) Receiving "change value for counter" from the remote-end

(i)-1 Mapping of Input signal required

Figure 2.9-34 depicts the logic when a command "change value for counter" is received at the DPOS01 logic. With regard to a three-phase counter, the input-point "DEV01_3PH_CONTROL_REQ" is used. With regard to a phase-A counter, the input-point "DEV01_APH_CONTROL_REQ" is used. For phase-B and phase-C, the input-points "DEV01_BPH_CONTROL_REQ" and "DEV01_CPH_CONTROL_REQ" are used.

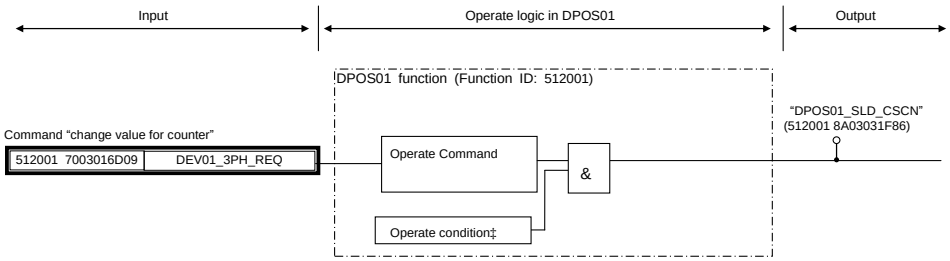


Figure 2.9-34 Changing counter value for three-phase† with operation from the remote-end in DPOS01

‡Note:The "operate condition" signal is provided from the operate condition logic of Figure 2.9-36.

†Note: The user can apply other counter change commands for phase-A, -B, and –C as shown in Table 2.9-25. The resultant signals for the other DPOS02-20 logics are shown in Table 2.9-26.

(i)-2 Output signal to BO

The DPOS01 function can issue a "Result" signal at output point "DPOS01_SLD_CSCN".

(ii) Receiving "change value for counter" from the local-end

(ii)-1 Input signal from the front panel

Figure 2.9-35 depicts the logic when a "change value for counter" command is provided in the DPOS01 function. The command is provided from the sub-menu, as shown in Figure 2.9-33.

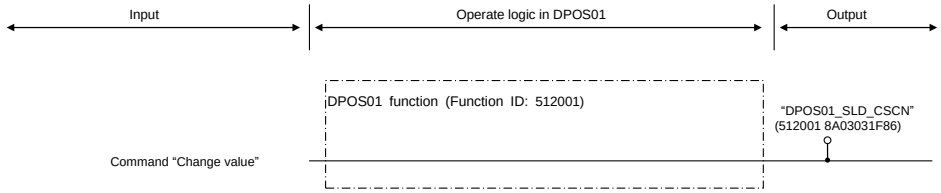


Figure 2.9-35 Changing counter value by operation from the front panel in DPOS01

(ii)-2 Output signal to BO

The DPOS01 function can issue a "Result" signal at output point "DPOS01_SLD_CSCN".

(iii) Operate condition for the counter

Figure 2.9-36 illustrates the operate condition logic. The DPOS01 function can determine an operate-condition using a signal received from "Control-hierarchy". The control-hierarchy condition is provided by user-programmed PLC logic; the user must connect the control-hierarchy with the DPOS01 function using connection point "PLC_BIT_0570" (see Table 2.9-7).

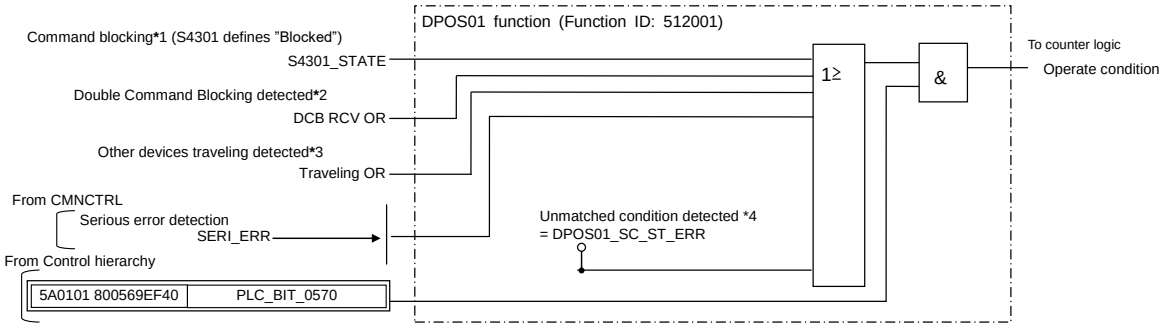


Figure 2.9-36 Operate condition logic for changing the counter in DPOS01

[1]Note: "Command Blocking" disables all operation except for its own; the "Command Blocking" function is initiated by the status of "S4301" in a software switch controller (SOTFSW). The IEC 61850 standard defines the "Command Blocking" function as "CmdBlk". For more information on "S4301", see Chapter *Control and monitoring application: Software switch controller. See the signal "*"S4301_STATE" of Table 2.9-6.

[2]Note: "Double Command Blocking" (DCB) is an operation philosophy in the common control function (CMNCTRL). It can be used to protect the substation. The user can program it using GR-TIEMS. The DCB operating signal is denoted as "DCB RCV OR" in Table 2.9-6. For more information see Chapter *Control and monitoring application : Common controls.*

[3]Note: If the event "device-travelling" is detected in the CMNCTRL function, it indicates that another operator is changing the status of a device. Thus, the IED should inhibit the operation of any device for the duration that the event is detected. The detected signal is denoted by "Travelling OR" in Table 2.9-6.

[4]Note: If the issuing of a trip command is executed by the IED, any control operation is blocked until the trip operation is completed. If an IED includes a relay application, the trip command is issues at the output_point "GEN_TRIP" in Table 2.9-7.

(iv) Signal names and number

Table 2.9-25 Mapping points

Signal Number	Signal Name	Description
512001 7003016D09	DEV01_3PH_REQ	DPOS01 change command received. (Mapping Data) for 3-phase counter value
512001 7003026D09	DEV02_3PH_REQ	DPOS02 change command received. (Mapping Data) for 3-phase counter value
512001 7003036D09	DEV03_3PH_REQ	DPOS03 change command received. (Mapping Data) for 3-phase counter value
512001 7003046D09	DEV04_3PH_REQ	DPOS04 change command received. (Mapping Data) for 3-phase counter value

Signal Number	Signal Name	Description
512001 7003056D09	DEV05_3PH_REQ	DPOS05 change command received. (Mapping Data) for 3-phase counter value
512001 7003066D09	DEV06_3PH_REQ	DPOS06 change command received. (Mapping Data) for 3-phase counter value
512001 7003076D09	DEV07_3PH_REQ	DPOS07 change command received. (Mapping Data) for 3-phase counter value
512001 7003086D09	DEV08_3PH_REQ	DPOS08 change command received. (Mapping Data) for 3-phase counter value
512001 7003096D09	DEV09_3PH_REQ	DPOS09 change command received. (Mapping Data) for 3-phase counter value
512001 70030A6D09	DEV10_3PH_REQ	DPOS10 change command received. (Mapping Data) for 3-phase counter value
512001 70030B6D09	DEV11_3PH_REQ	DPOS11 change command received. (Mapping Data) for 3-phase counter value
512001 70030C6D09	DEV12_3PH_REQ	DPOS12 change command received. (Mapping Data) for 3-phase counter value
512001 70030D6D09	DEV13_3PH_REQ	DPOS13 change command received. (Mapping Data) for 3-phase counter value
512001 70030E6D09	DEV14_3PH_REQ	DPOS14 change command received. (Mapping Data) for 3-phase counter value
512001 70030F6D09	DEV15_3PH_REQ	DPOS15 change command received. (Mapping Data) for 3-phase counter value
512001 7003106D09	DEV16_3PH_REQ	DPOS16 change command received. (Mapping Data) for 3-phase counter value
512001 7003116D09	DEV17_3PH_REQ	DPOS17 change command received. (Mapping Data) for 3-phase counter value
512001 7003126D09	DEV18_3PH_REQ	DPOS18 change command received. (Mapping Data) for 3-phase counter value
512001 7003136D09	DEV19_3PH_REQ	DPOS19 change command received. (Mapping Data) for 3-phase counter value
512001 7003146D09	DEV20_3PH_REQ	DPOS20 change command received. (Mapping Data) for 3-phase counter value
512001 7003016D0A	DEV01_APH_REQ	DPOS01 change command received. (Mapping Data) for A-phase counter value
512001 7003026D0A	DEV02_APH_REQ	DPOS02 change command received. (Mapping Data) for A-phase counter value
512001 7003036D0A	DEV03_APH_REQ	DPOS03 change command received. (Mapping Data) for A-phase counter value
512001 7003046D0A	DEV04_APH_REQ	DPOS04 change command received. (Mapping Data) for A-phase counter value
512001 7003056D0A	DEV05_APH_REQ	DPOS05 change command received. (Mapping Data) for A-phase counter value
512001 7003066D0A	DEV06_APH_REQ	DPOS06 change command received. (Mapping Data) for A-phase counter value
512001 7003076D0A	DEV07_APH_REQ	DPOS07 change command received. (Mapping Data) for A-phase counter value
512001 7003086D0A	DEV08_APH_REQ	DPOS08 change command received. (Mapping Data) for A-phase counter value
512001 7003096D0A	DEV09_APH_REQ	DPOS09 change command received. (Mapping Data) for A-phase counter value
512001 70030A6D0A	DEV10_APH_REQ	DPOS10 change command received. (Mapping Data) for A-phase counter value
512001 70030B6D0A	DEV11_APH_REQ	DPOS11 change command received. (Mapping Data) for A-phase counter value
512001 70030C6D0A	DEV12_APH_REQ	DPOS12 change command received. (Mapping Data) for A-phase counter value
512001 70030D6D0A	DEV13_APH_REQ	DPOS13 change command received. (Mapping Data) for A-phase counter value
512001 70030E6D0A	DEV14_APH_REQ	DPOS14 change command received. (Mapping Data) for A-phase counter value
512001 70030F6D0A	DEV15_APH_REQ	DPOS15 change command received. (Mapping Data) for A-phase counter value
512001 7003106D0A	DEV16_APH_REQ	DPOS16 change command received. (Mapping Data) for A-phase counter value
512001 7003116D0A	DEV17_APH_REQ	DPOS17 change command received. (Mapping Data) for A-phase counter value
512001 7003126D0A	DEV18_APH_REQ	DPOS18 change command received. (Mapping Data) for A-phase counter value
512001 7003136D0A	DEV19_APH_REQ	DPOS19 change command received. (Mapping Data) for A-phase counter value
512001 7003146D0A	DEV20_APH_REQ	DPOS20 change command received. (Mapping Data) for A-phase counter value
512001 7003016D0B	DEV01_BPH_REQ	DPOS01 change command received. (Mapping Data) for B-phase counter value
512001 7003026D0B	DEV02_BPH_REQ	DPOS02 change command received. (Mapping Data) for B-phase counter value
512001 7003036D0B	DEV03_BPH_REQ	DPOS03 change command received. (Mapping Data) for B-phase counter value
512001 7003046D0B	DEV04_BPH_REQ	DPOS04 change command received. (Mapping Data) for B-phase counter value
512001 7003056D0B	DEV05_BPH_REQ	DPOS05 change command received. (Mapping Data) for B-phase counter value
512001 7003066D0B	DEV06_BPH_REQ	DPOS06 change command received. (Mapping Data) for B-phase counter value
512001 7003076D0B	DEV07_BPH_REQ	DPOS07 change command received. (Mapping Data) for B-phase counter value
512001 7003086D0B	DEV08_BPH_REQ	DPOS08 change command received. (Mapping Data) for B-phase counter value
512001 7003096D0B	DEV09_BPH_REQ	DPOS09 change command received. (Mapping Data) for B-phase counter value
512001 70030A6D0B	DEV10_BPH_REQ	DPOS10 change command received. (Mapping Data) for B-phase counter value
512001 70030B6D0B	DEV11_BPH_REQ	DPOS11 change command received. (Mapping Data) for B-phase counter value
512001 70030C6D0B	DEV12_BPH_REQ	DPOS12 change command received. (Mapping Data) for B-phase counter value
512001 70030D6D0B	DEV13_BPH_REQ	DPOS13 change command received. (Mapping Data) for B-phase counter value
512001 70030E6D0B	DEV14_BPH_REQ	DPOS14 change command received. (Mapping Data) for B-phase counter value
512001 70030F6D0B	DEV15_BPH_REQ	DPOS15 change command received. (Mapping Data) for B-phase counter value
512001 7003106D0B	DEV16_BPH_REQ	DPOS16 change command received. (Mapping Data) for B-phase counter value
512001 7003116D0B	DEV17_BPH_REQ	DPOS17 change command received. (Mapping Data) for B-phase counter value
512001 7003126D0B	DEV18_BPH_REQ	DPOS18 change command received. (Mapping Data) for B-phase counter value
512001 7003136D0B	DEV19_BPH_REQ	DPOS19 change command received. (Mapping Data) for B-phase counter value

Signal Number	Signal Name	Description
512001 7003146D0B	DEV20_BPH_REQ	DPOS20 change command received. (Mapping Data) for B-phase counter value
512001 7003016D0C	DEV01_CPH_REQ	DPOS01 change command received. (Mapping Data) for C-phase counter value
512001 7003026D0C	DEV02_CPH_REQ	DPOS02 change command received. (Mapping Data) for C-phase counter value
512001 7003036D0C	DEV03_CPH_REQ	DPOS03 change command received. (Mapping Data) for C-phase counter value
512001 7003046D0C	DEV04_CPH_REQ	DPOS04 change command received. (Mapping Data) for C-phase counter value
512001 7003056D0C	DEV05_CPH_REQ	DPOS05 change command received. (Mapping Data) for C-phase counter value
512001 7003066D0C	DEV06_CPH_REQ	DPOS06 change command received. (Mapping Data) for C-phase counter value
512001 7003076D0C	DEV07_CPH_REQ	DPOS07 change command received. (Mapping Data) for C-phase counter value
512001 7003086D0C	DEV08_CPH_REQ	DPOS08 change command received. (Mapping Data) for C-phase counter value
512001 7003096D0C	DEV09_CPH_REQ	DPOS09 change command received. (Mapping Data) for C-phase counter value
512001 70030A6D0C	DEV10_CPH_REQ	DPOS10 change command received. (Mapping Data) for C-phase counter value
512001 70030B6D0C	DEV11_CPH_REQ	DPOS11 change command received. (Mapping Data) for C-phase counter value
512001 70030C6D0C	DEV12_CPH_REQ	DPOS12 change command received. (Mapping Data) for C-phase counter value
512001 70030D6D0C	DEV13_CPH_REQ	DPOS13 change command received. (Mapping Data) for C-phase counter value
512001 70030E6D0C	DEV14_CPH_REQ	DPOS14 change command received. (Mapping Data) for C-phase counter value
512001 70030F6D0C	DEV15_CPH_REQ	DPOS15 change command received. (Mapping Data) for C-phase counter value
512001 7003106D0C	DEV16_CPH_REQ	DPOS16 change command received. (Mapping Data) for C-phase counter value
512001 7003116D0C	DEV17_CPH_REQ	DPOS17 change command received. (Mapping Data) for C-phase counter value
512001 7003126D0C	DEV18_CPH_REQ	DPOS18 change command received. (Mapping Data) for C-phase counter value
512001 7003136D0C	DEV19_CPH_REQ	DPOS19 change command received. (Mapping Data) for C-phase counter value
512001 7003146D0C	DEV20_CPH_REQ	DPOS20 change command received. (Mapping Data) for C-phase counter value

Table 2.9-26 Results of changing counter

Signal Number	Signal Name	Description
512001 8A03011F86	DPOS01_SLD_CSCN	DPOS01 select command for Binary Output.
512001 8A03021F86	DPOS02_SLD_CSCN	DPOS02 select command for Binary Output.
512001 8A03031F86	DPOS03_SLD_CSCN	DPOS03 select command for Binary Output.
512001 8A03041F86	DPOS04_SLD_CSCN	DPOS04 select command for Binary Output.
512001 8A03051F86	DPOS05_SLD_CSCN	DPOS05 select command for Binary Output.
512001 8A03061F86	DPOS06_SLD_CSCN	DPOS06 select command for Binary Output.
512001 8A03071F86	DPOS07_SLD_CSCN	DPOS07 select command for Binary Output.
512001 8A03081F86	DPOS08_SLD_CSCN	DPOS08 select command for Binary Output.
512001 8A03091F86	DPOS09_SLD_CSCN	DPOS09 select command for Binary Output.
512001 8A030A1F86	DPOS10_SLD_CSCN	DPOS10 select command for Binary Output.
512001 8A030B1F86	DPOS11_SLD_CSCN	DPOS11 select command for Binary Output.
512001 8A030C1F86	DPOS12_SLD_CSCN	DPOS12 select command for Binary Output.
512001 8A030D1F86	DPOS13_SLD_CSCN	DPOS13 select command for Binary Output.
512001 8A030E1F86	DPOS14_SLD_CSCN	DPOS14 select command for Binary Output.
512001 8A030F1F86	DPOS15_SLD_CSCN	DPOS15 select command for Binary Output.
512001 8A03101F86	DPOS16_SLD_CSCN	DPOS16 select command for Binary Output.
512001 8A03111F86	DPOS17_SLD_CSCN	DPOS17 select command for Binary Output.
512001 8A03121F86	DPOS18_SLD_CSCN	DPOS18 select command for Binary Output.
512001 8A03131F86	DPOS19_SLD_CSCN	DPOS19 select command for Binary Output.
512001 8A03141F86	DPOS20_SLD_CSCN	DPOS20 select command for Binary Output.

(v) Setting name

Table 2.9-27 Setting for operation counter in DPOSxx

Setting Name	Description	Default	Setting item or value
DPOSxx-CNTS	Mode selection of the counter in DPOSxx	*user-preferred	NA / C-On / C-Off / C-OnOff

2.9.5 Measurement of operation intervals

The DPOS01 function can measure operation intervals (OT1 to OT4) †; the intervals OT1 to OT2 can represent the period of time when a switch changes from "Closed" to "open". In the DPOS01 function the operation period is grouped into sub-time periods, as shown in Table 2.9-28. The user should set scheme switch [**DPOS01-OPETMEN**] to **On**.

Table 2.9-28 Four intervals measured in DPOS01 function

Intervals	Trigger	Events for measurement
OT1	Start	Signal "DPOS01_FEX_BO" sensed
	End	Switch status is changed from "On" to "Intermediate"
OT2	Start	Device status "Intermediate" sensed
	End	Switch status is changed from "Intermediate" to "Off"
OT3	Start	Signal "DPOS01_OEX_BO" sensed
	End	Switch status is changed from "Off" to "Intermediate"
OT4	Start	Device status "Intermediate" sensed
	End	Switch status is changed from "Intermediate" to "On"

†Note:The function "operation time measurement" is available in the DPOS01 to DPOS20 functions.

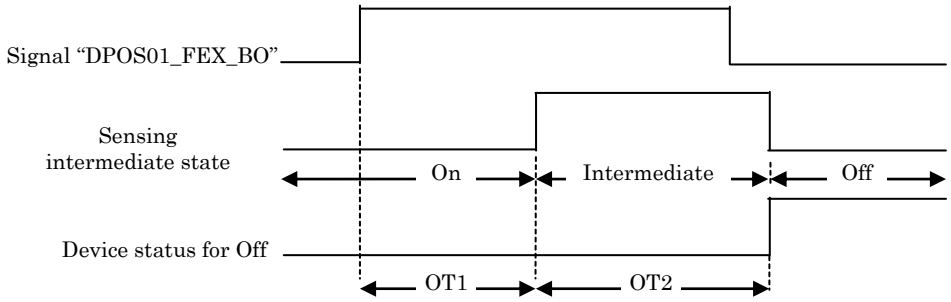


Figure 2.9-37 Two intervals (OT1 and OT2) for Off-control

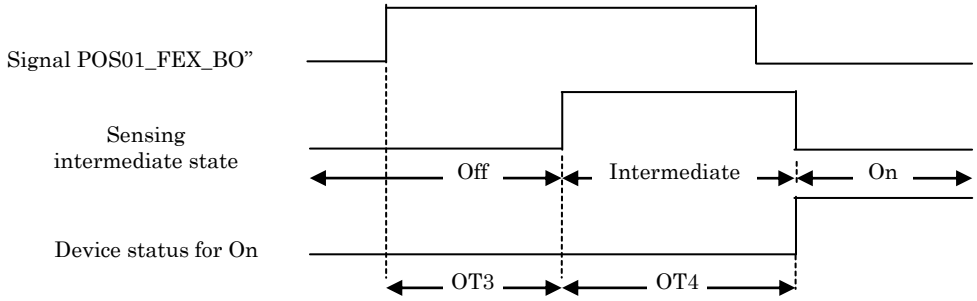


Figure 2.9-38 Two intervals (OT3 and OT4) for On-control

The user can clear the intervals (OT1 to OT4) by key-operation of the "Operation time" sub-menu Figure 2.9-39 or operation from the remote-end. See chapter *User interface: Monitoring sub-menu*.

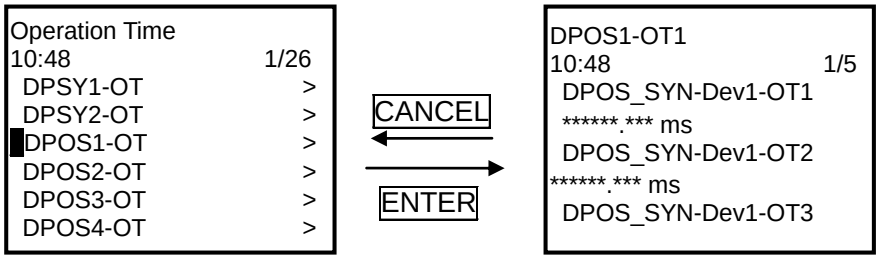


Figure 2.9-39 Operation time sub-menu

(i) Signal names and numbers

Table 2.9-29 Mapping points

Signal Number	Signal Name	Description
512001 7003006D0D	DEV01_RESET_REQ	DPOS01 operation time reset command received (Mapping Data)
512001 7003016D0D	DEV02_RESET_REQ	DPOS02 operation time reset command received (Mapping Data)
512001 7003026D0D	DEV03_RESET_REQ	DPOS03 operation time reset command received (Mapping Data)
512001 7003036D0D	DEV04_RESET_REQ	DPOS04 operation time reset command received (Mapping Data)
512001 7003046D0D	DEV05_RESET_REQ	DPOS05 operation time reset command received (Mapping Data)
512001 7003056D0D	DEV06_RESET_REQ	DPOS06 operation time reset command received (Mapping Data)
512001 7003066D0D	DEV07_RESET_REQ	DPOS07 operation time reset command received (Mapping Data)
512001 7003076D0D	DEV08_RESET_REQ	DPOS08 operation time reset command received (Mapping Data)
512001 7003086D0D	DEV09_RESET_REQ	DPOS09 operation time reset command received (Mapping Data)
512001 7003096D0D	DEV10_RESET_REQ	DPOS10 operation time reset command received (Mapping Data)
512001 70030A6D0D	DEV11_RESET_REQ	DPOS11 operation time reset command received (Mapping Data)
512001 70030B6D0D	DEV12_RESET_REQ	DPOS12 operation time reset command received (Mapping Data)
512001 70030C6D0D	DEV13_RESET_REQ	DPOS13 operation time reset command received (Mapping Data)
512001 70030D6D0D	DEV14_RESET_REQ	DPOS14 operation time reset command received (Mapping Data)
512001 70030E6D0D	DEV15_RESET_REQ	DPOS15 operation time reset command received (Mapping Data)
512001 70030F6D0D	DEV16_RESET_REQ	DPOS16 operation time reset command received (Mapping Data)
512001 7003106D0D	DEV17_RESET_REQ	DPOS17 operation time reset command received (Mapping Data)
512001 7003116D0D	DEV18_RESET_REQ	DPOS18 operation time reset command received (Mapping Data)
512001 7003126D0D	DEV19_RESET_REQ	DPOS19 operation time reset command received (Mapping Data)
512001 7003136D0D	DEV20_RESET_REQ	DPOS20 operation time reset command received (Mapping Data)

(ii) Setting name

Table 2.9-30 Setting of operation time function in DPOSxx

Setting Name	Description	Default	Setting item or value
DPOSxx-OPETMEN	Activation of the operation time measurement in DPOSxx	On	Off / On

2.9.6 Setup for BIO module

The user should connect the DPOS input/output points with the BI and the BO circuits; subsequently, the DPOS function is able to issue select and operate commands. In order to set up the DPOS function the user should execute the following four steps.

i BI connection for status signal

ii BO connection for "Select command On/Off"

iii BO connection for "Operate command"

iv Contact health check

Note that the DPOS01 function commences operation when the scheme switch [**DPOS01-EN**] is set to **On**.

(i) BI connection for status signals

Figure 2.9-40 exemplifies the reception of signals at the DPOS01 function. To acquire the status signal§ for phase-A, the user should set two input points for settings [**DPOS01A-NOPSG**] and [**DPOS01A-NCLSG**]†. Note that other DPOS function can be connected with other IO circuits to monitor‡ the devices.

†Note:Normally an input-signal corresponding to phase-A is generated using a normally-open contact (NO) and a normally-closed contact (NC). If a NO and a NC contact are exchanged, the input-signal should be determined by inversion; that is, the user is required to set **On** for both scheme switches [**DPOS01A-NOPSGI**] and [**DPOS01A-NCLSGI**].

‡Note:The DPOS function (DPOS21 to 30) is provided only for monitoring.

§Note: The state signal acquired can be monitored. For more information, see Chapter *Automatic supervision*.

(i)-1 Grouping three-phase signals corresponding to a state

Suppose the status signals are acquired on the six BI circuits at IO#1 slot. The signals corresponding to phase-A can be acquired via N/C and N/O contacts; thus, the user should set two input-points (8001001110 and 810101110 at 200B01†) for the settings [**DPOS01A-NOPSG**] and [**DPOS01A-NCLSG**], respectively, as shown in Figure 2.9-40. For input points corresponding to phase-B and phase-C, the user must also apply input-points via settings. The user sets **And** for both the scheme switches [**DPOS01-OPC**] and [**DPOS01-CLC**] respectively; finally the scheme switch [**DPOS01-DEVTYPE**] should be set to **3-Pole**.

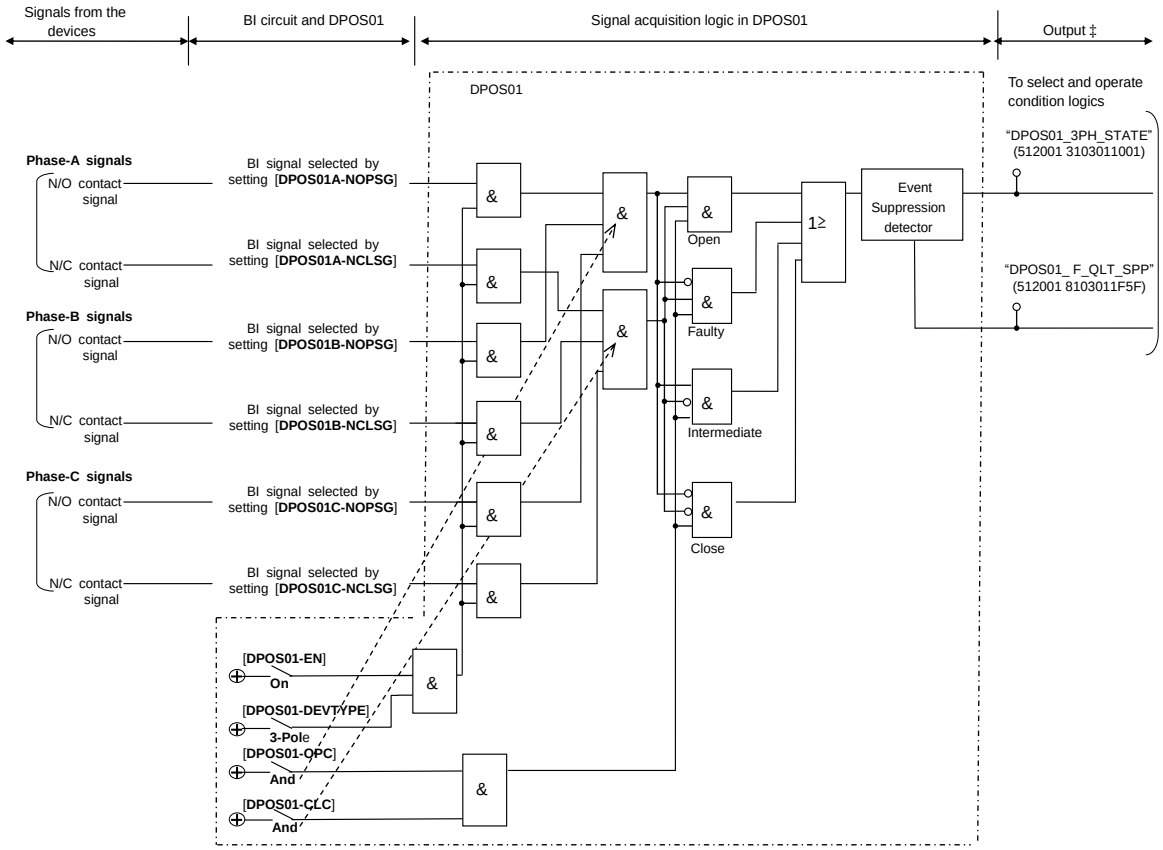


Figure 2.9-40 Acquisition of a state signal

†Note: The user should set the actual input-points. See chapter *Technical description: Binary IO module*.

‡Note: In Figure 2.9-40 two signals can be issued: "DPOS01_3PH_STATE" and "DPOS01_F_QLT_SPP". One is used in the select condition logic and the operate condition logic (see Figure 2.9-13 and Figure 2.9-28). Another is used for operation in the event suppression function. Other signals are also provided: DPOS01_APH_STATE, DPOS01_BPH_STATE, and DPOS01_CPH_STATE.

(i)-2 Acquisition of a signal corresponding to a phase

Suppose that a state signal is acquired on the two BI circuits at IO#1 slot. An individual phase signal can be taken using the N/C and the N/O contacts; thus, the user should set two input-points (8001001110 and 810101110 in 200B01†) for the settings [**DPOS01A-NOPSG**] and [**DPOS01A-NCLSG**]. The user should set the scheme switch [**DPOS01-DEVTYPE**] to **1-Pole**.

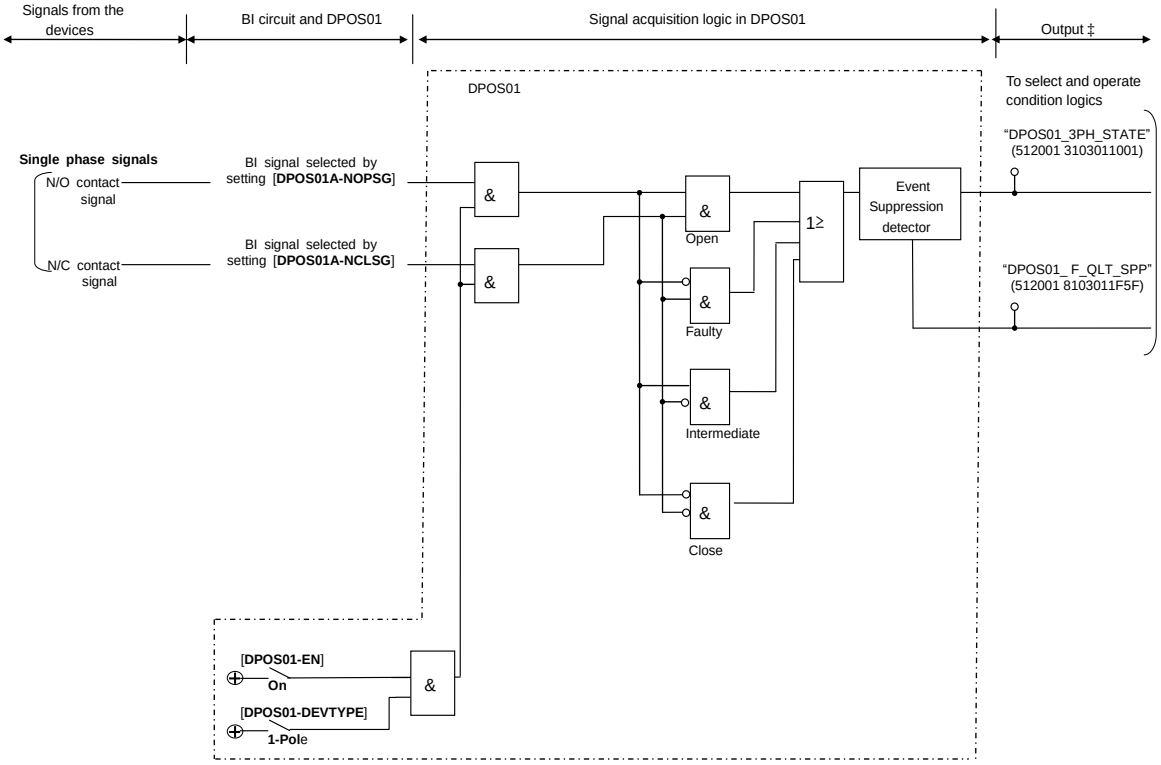


Figure 2.9-41 Acquisition of single-phase signal at DPOS01

‡Note: In Figure 2.9-41 two signals can be issued "DPOS01_3PH_STATE" and "DPOS01_F_QLT_SPP", which are the same as the ones of the Figure 2.9-40.

(i)-3 Event suppression

If the status of a device "chatters" for a short time, the DPOS function will receive iterative signals from the device. Such iterative signals can cause extra burden for the DPOS function; hence, event suppression can be required to reduce additional burden created.

The DPOS function has an event suppression detector. The user should take into account of the scheme switches [**DPOS-NELD**], [**DPOS-TELD**] and [**DPOS-TELR**]†. Set **On** for scheme switch [**DPOS01-SPPEN**].

†Note: Their setting meanings have been briefed in the event suppression detector of the SPOS function.

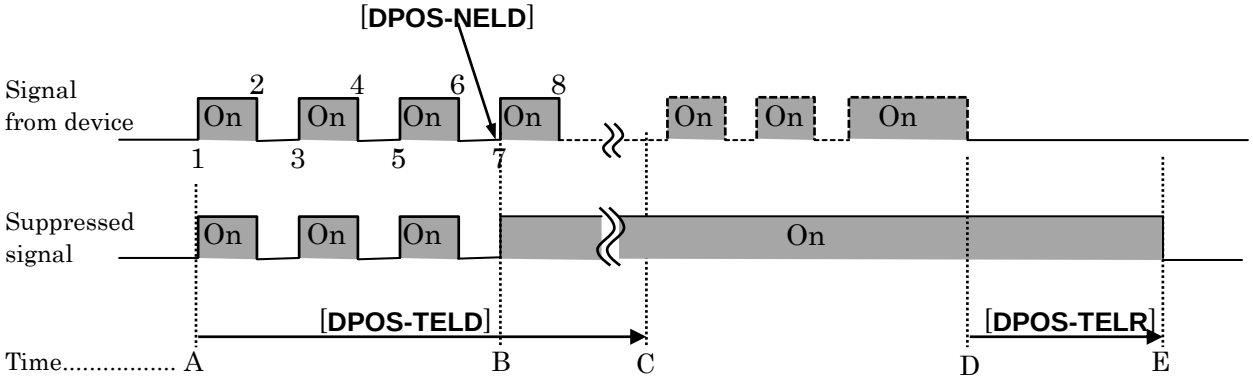


Figure 2.9-42 Iterative signals and signals suppressed

Figure 2.9-42 shows that the iterative signals received from the device have been suppressed by the event suppression function. The suppression commences on receipt of the seventh signal (at Time B). This is because the function can count the iterative number of incoming signals. Detection commences at Time 'A', the setting [**DPOS-NELD**] is provided so that the suppression commences at Time 'B'. The setting [**DPOS-TELD**] pertains to the operation of the detection function from Time 'A' (e.g., Time 'A' to Time 'C').

The event suppression ceases when the iterative signals stop. The user can adjust the point at which event suppression stops using the setting [**DPOS-TELR**]; as a result, no suppressed signal is output after the end of the iterative signals (e.g., Time 'D' to Time 'E').

To initiate the event suppression the user should set **On** for scheme switch [**DPOS01-SPPEN**].

(ii) BO connection for "Select command On/Off"

Figure 2.9-43 exemplifies the connection for the select command On and Off. Suppose that connection with the BOs is achieved by the PLC function using connection points "DPOS01_OSL_BO_FLG" and "DPOS01_FSL_BO_FLG"†; as a result, the "Select command On" and the "Select command Off" signals are issued at BO1 and BO2 respectively.

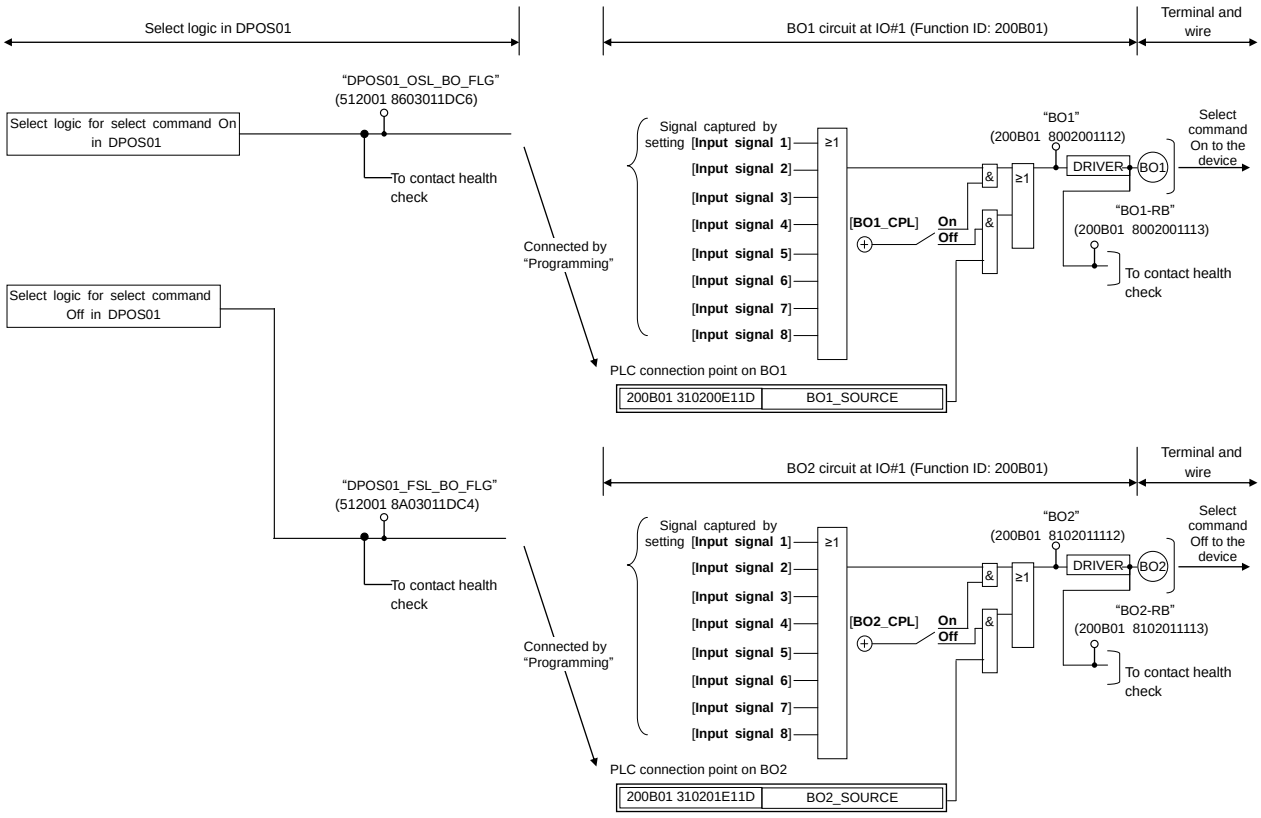


Figure 2.9-43 Example of select commands connected with BO1 & BO2 at IO#1

†Note:Table 2.9-9 shows the remaining signals with the exception of "DPOS01_OSL_BO_FLG" and "DPOS01_FSL_BO_FLG".

(iii) BO connection for "Operate command On/Off"

Figure 2.9-44 exemplifies the connection for operate command On/Off. Suppose that connection with the BOs is achieved by the PLC function using connection points "DPOS01_OEX_BO" and "DPOS01_FEX_BO"; as a result, the "Operate command On" and the "Operate command Off" signals are issued at BO3 and BO4 respectively.

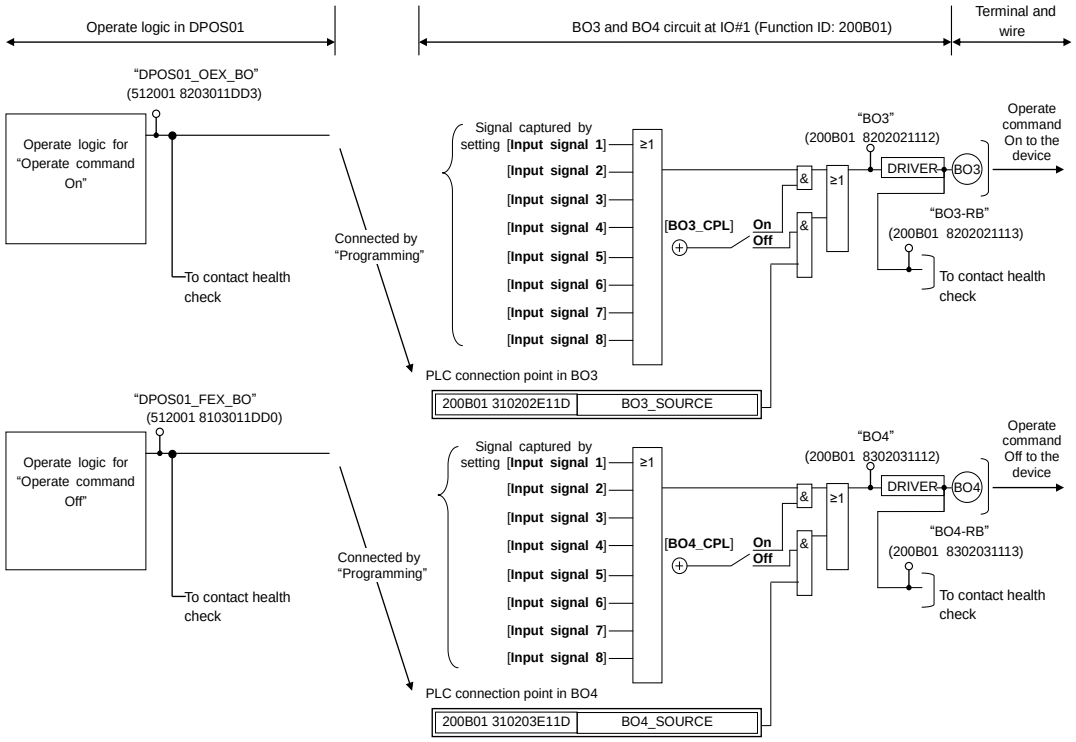


Figure 2.9-44 Example of operate commands connected with BO3 and BO4 at IO#1

†Note:Table 2.9-19 shows the remaining signals with the exception of "DPOS01_OEX_BO" and "DPOS01_FEX_BO".

(iv) Contact health check

The DPOS01 function has a contact health check feature for the BO circuits; hence, the user is able to connect an output signal to the contact health check function when **Fixedlogic** is set for scheme switch [**DPOS01-LGXFEOT**]†. Consequently, the DPOS01 function can determine whether the signal has been successfully output from the BO. If a failure is reported, the DPOS01 function determines that the signal has not been output successfully to the BO; then, the command On or Off is canceled immediately and the DPOS01 function returns to the "Wait for a command" stage.

†Note:Table 2.9-36 shows settings for the health check feature in the other DPOS functions.

(iv)-1 Setting for “Select command On”

For example, the point “DPOS01_OSL_BO_FLG” is connected to the BO1 circuit for the issuing of the command; the user can connect point “BO1-RB” with the contact health check function using the setting [**DPOS01-OSLBORD**]. Do not key the point “DPOS01_OSL_BO_FLG” .

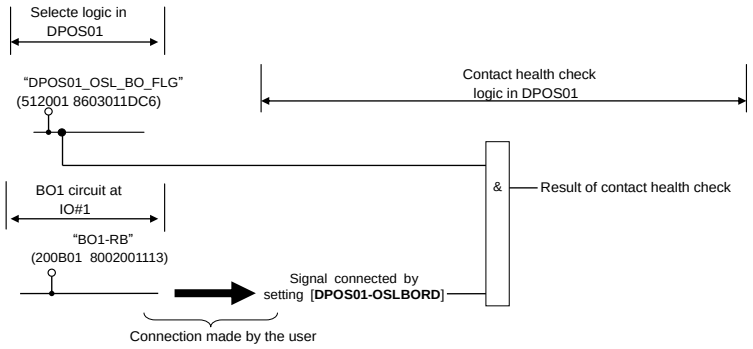


Figure 2.9-45 Example connection of “Select command On” for the health check feature

(iv)-2 Setting for “Select command Off”

Similar to “select command On”, the point “DPOS01_FSL_BO_FLG” is connected with the BO2 circuit; the user is required to key point “BO2-RB” for the setting [**DPOS01-FSLBORD**]. Do not key the point “DPOS01_FSL_BO_FLG”.

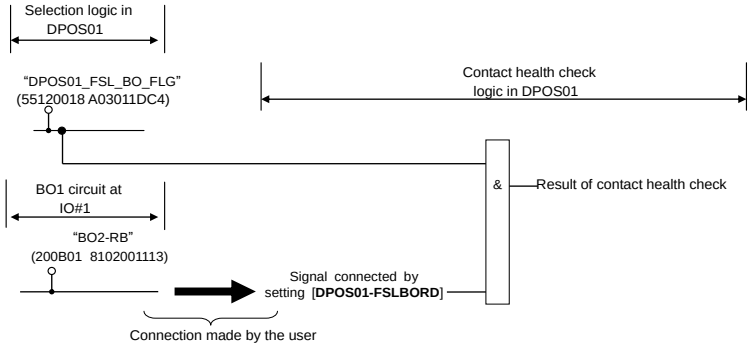


Figure 2.9-46 Example connection of “Select command Off” for the health check feature

(iv)-3 Setting for “Operate command On”

Similarly, the point “BO3-RB” must be applied for the setting [**DPOS01-OEXBORD**].

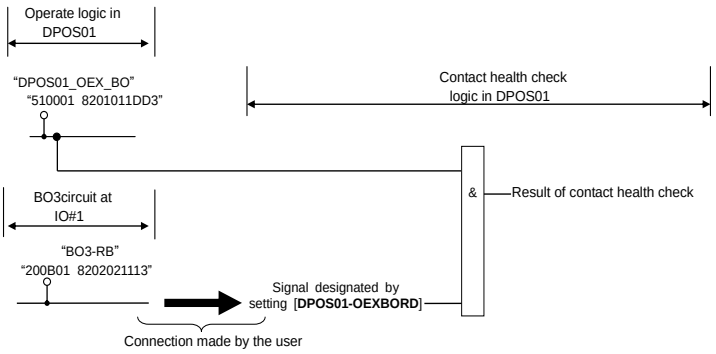


Figure 2.9-47 Example connection of “Operate command On” for the health check feature

(iv)-4 Setting for “Operate command Off”

Similarly, the point “BO4-RB” must be applied for the setting [**DPOS01-FEXBORD**].

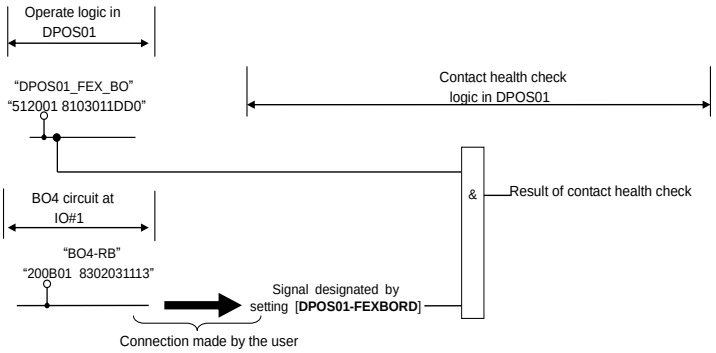


Figure 2.9-48 Example connection of “Operate command Off” for the health check feature

(iv)-5 Setting for the contact health check (normal setting, example #1)

Figure 2.9-49 shows a setting example for the 43SW scheme. Select and operate commands drive the BO1 to BO4 contacts. To check that the contact health check function is working correctly, the respective points of the BO-RBs should be connected as shown in Table 2.9-31, to demonstrate that the settings are physically matched with the BO contacts.

Table 2.9-31 Setting example for contact health check

Example #1		Contact health check settings for example #1	
"DPOS01_OSL_BO_FLG" is connected to "BO1" at IO#1	⇨	200B01 8002001113(BO1-RB) set for [**DPOS01-OSLORD**]	OK
"DPOS01_FSL_BO_FLG" is connected to "BO2" at IO#1	⇨	200B01 8102011113 (BO2-RB) set for [**DPOS01-FSLBORD**]	OK
"DPOS01_OEX_BO_CSF" is connected to "BO3" at IO#1	⇨	200B01 8202021113(BO3-RB) set for [**DPOS01-OEXBORD**]	OK
"DPOS01_FEX_BO_CSF" is connected to "BO4" atIO#1	⇨	200B01 8302031113(BO4-RB) set for [**DPOS01-FEXBORD**]	OK

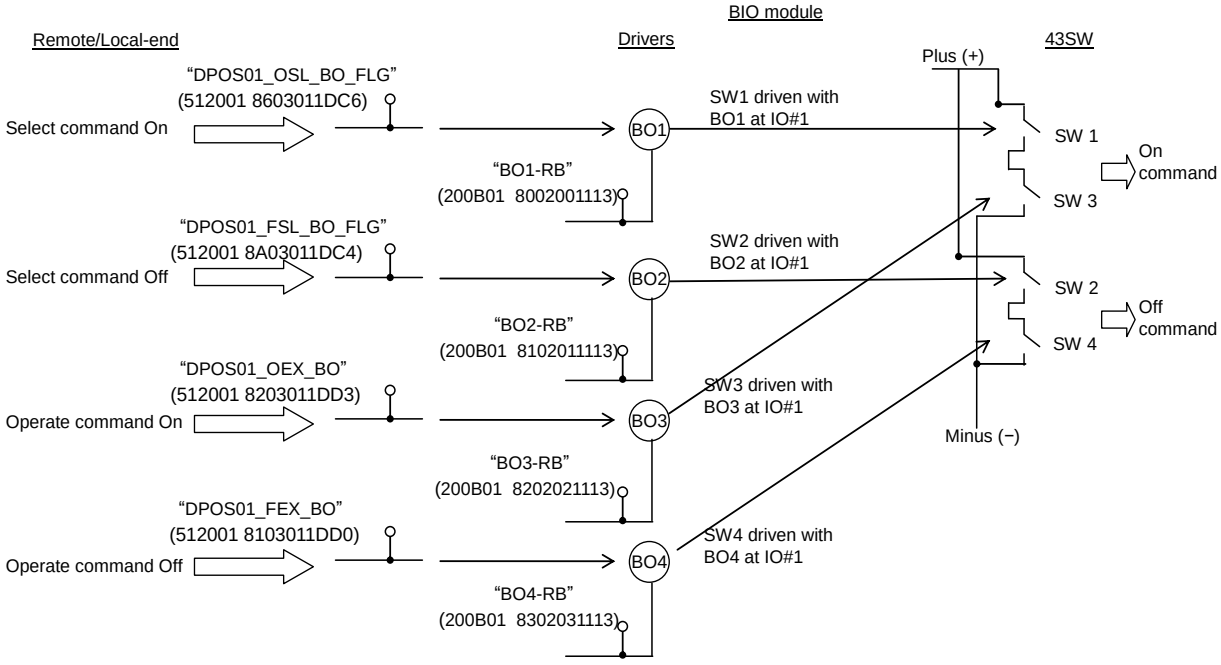


Figure 2.9-49 Contact health check setting and 43SW scheme for example #1

(iv)-6 Settings for erroneous contact health check (improper setting, example #2)

Figure 2.9-50 shows a setting example of an improper setting of the 43SW scheme. The settings are implemented incorrectly as shown in Table 2.9-32, BO1-RB is not chosen, instead BO1 is actually chosen, which is incorrect. In this case, the setting [**DPOS01-OSLBORD**] is meaningless ; hence, the issue of a select command is blocked.

Table 2.9-32 Erroneous setting example for contact health check

Example #2	Contact health check setting for example #2	
"DPOS01_OSL_BO_FLG" is connected to "BO1" at IO#1	200B01 8002001112 (BO1) set for [**DPOS01-OSLORD**]	NG
"DPOS01_FSL_BO_FLG" is connected to "BO2" at IO#1	200B01 8102011113 (BO2-RB) set for [**DPOS01-FSLBORD**]	OK
"DPOS01_OEX_BO_CSF" is connected to "BO3" at IO#1	200B01 8202021113(BO3-RB) set for [**DPOS01-OEXBORD**]	OK
"DPOS01_FEX_BO_CSF" is connected to "BO4" at IO#1	200B01 8302031113(BO4-RB) set for [**DPOS01-FEXBORD**]	OK

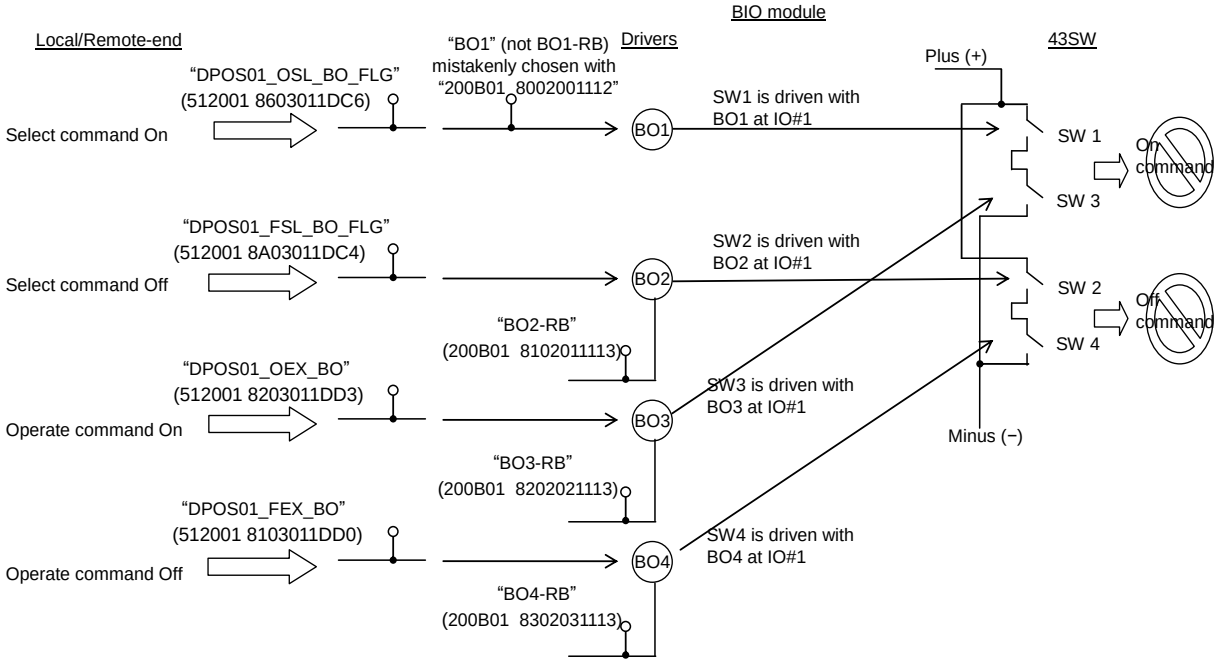


Figure 2.9-50 Contact health check setting and 43SW scheme for example#2

(iv)-7 Settings for extra contact health check (special setting, example #3)

Figure 2.9-51 shows an additional setting example for the 43SW scheme; one of the settings is made hypothetically. That is, the point "DPOS01_OSL_BO_FLG" is actually chosen for the setting [**DPOS01-OSLBORD**]; i.e. BO1-RB is not chosen for this selection. This special setting can issue a select command, which is called "operated by internal select function". The user does not need to consider the use of a BO circuit for a select command, when there are no BIO circuits available.

Table 2.9-33 Extra setting example for contact health check

Example #3		Contact health check setting for example #3	
"DPOS01_OSL_BO_FLG" is not connected to any "BO"	⇨	"DPOS01_OSL_BO_FLG" set for [**DPOS01-OSLBORD**]	OK
"DPOS01_FSL_BO_FLG" is not connected to any "BO"	⇨	"DPOS01_OSL_BO_FLG" set for [**DPOS01-FSLBORD**]	OK
"DPOS01_OEX_BO_CSF" is connected to "BO3" at IO#1	⇨	200B01 8102011113(BO2-RB) set for [**DPOS01-OEXBORD**]	OK
"DPOS01_FEX_BO_CSF" is connected to "BO4" at IO#1	⇨	200B01 8202021113 (BO3-RB) set for [**DPOS01-FEXBORD**]	OK

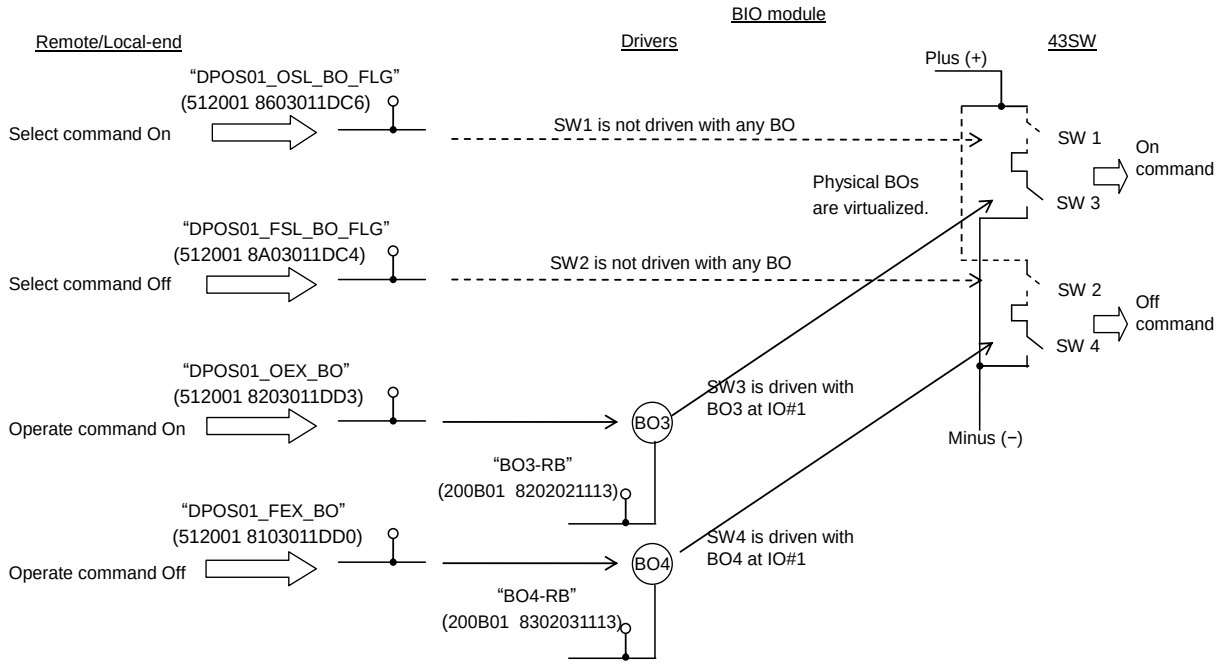


Figure 2.9-51 Contact health check setting and 43SW scheme for example#3

(v) Signal name and number

Table 2.9-34 PLC monitoring points (Output signal for event suppression function in DPOSxx)

Signal Number	Signal Name	Description
512001 3103011001	DPOS01_3PH_STATE	DPOS01 3ph_state
512001 3103021001	DPOS02_3PH_STATE	DPOS02 3ph_state
512001 3103031001	DPOS03_3PH_STATE	DPOS03 3ph_state
512001 3103041001	DPOS04_3PH_STATE	DPOS04 3ph_state
512001 3103051001	DPOS05_3PH_STATE	DPOS05 3ph_state
512001 3103061001	DPOS06_3PH_STATE	DPOS06 3ph_state
512001 3103071001	DPOS07_3PH_STATE	DPOS07 3ph_state
512001 3103081001	DPOS08_3PH_STATE	DPOS08 3ph_state
512001 3103091001	DPOS09_3PH_STATE	DPOS09 3ph_state
512001 31030A1001	DPOS10_3PH_STATE	DPOS10 3ph_state
512001 31030B1001	DPOS11_3PH_STATE	DPOS11 3ph_state
512001 31030C1001	DPOS12_3PH_STATE	DPOS12 3ph_state
512001 31030D1001	DPOS13_3PH_STATE	DPOS13 3ph_state
512001 31030E1001	DPOS14_3PH_STATE	DPOS14 3ph_state
512001 31030F1001	DPOS15_3PH_STATE	DPOS15 3ph_state
512001 3103101001	DPOS16_3PH_STATE	DPOS16 3ph_state
512001 3103111001	DPOS17_3PH_STATE	DPOS17 3ph_state
512001 3103121001	DPOS18_3PH_STATE	DPOS18 3ph_state
512001 3103131001	DPOS19_3PH_STATE	DPOS19 3ph_state
512001 3103141001	DPOS20_3PH_STATE	DPOS20 3ph_state
512001 3103151001	DPOS21_3PH_STATE	DPOS21 3ph_state
512001 3103161001	DPOS22_3PH_STATE	DPOS22 3ph_state
512001 3103171001	DPOS23_3PH_STATE	DPOS23 3ph_state
512001 3103181001	DPOS24_3PH_STATE	DPOS24 3ph_state
512001 3103191001	DPOS25_3PH_STATE	DPOS25 3ph_state
512001 31031A1001	DPOS26_3PH_STATE	DPOS26 3ph_state
512001 31031B1001	DPOS27_3PH_STATE	DPOS27 3ph_state
512001 31031C1001	DPOS28_3PH_STATE	DPOS28 3ph_state
512001 31031D1001	DPOS29_3PH_STATE	DPOS29 3ph_state
512001 31031E1001	DPOS30_3PH_STATE	DPOS30 3ph_state
512001 8103011F5F	DPOS01_F_QLT_SPP	Event suppression detected (DPOS01)
512001 8103021F5F	DPOS02_F_QLT_SPP	Event suppression detected (DPOS02)
512001 8103031F5F	DPOS03_F_QLT_SPP	Event suppression detected (DPOS03)
512001 8103041F5F	DPOS04_F_QLT_SPP	Event suppression detected (DPOS04)
512001 8103051F5F	DPOS05_F_QLT_SPP	Event suppression detected (DPOS05)
512001 8103061F5F	DPOS06_F_QLT_SPP	Event suppression detected (DPOS06)
512001 8103071F5F	DPOS07_F_QLT_SPP	Event suppression detected (DPOS07)
512001 8103081F5F	DPOS08_F_QLT_SPP	Event suppression detected (DPOS08)
512001 8103091F5F	DPOS09_F_QLT_SPP	Event suppression detected (DPOS09)
512001 81030A1F5F	DPOS10_F_QLT_SPP	Event suppression detected (DPOS10)
512001 81030B1F5F	DPOS11_F_QLT_SPP	Event suppression detected (DPOS11)
512001 81030C1F5F	DPOS12_F_QLT_SPP	Event suppression detected (DPOS12)
512001 81030D1F5F	DPOS13_F_QLT_SPP	Event suppression detected (DPOS13)
512001 81030E1F5F	DPOS14_F_QLT_SPP	Event suppression detected (DPOS14)
512001 81030F1F5F	DPOS15_F_QLT_SPP	Event suppression detected (DPOS15)
512001 8103101F5F	DPOS16_F_QLT_SPP	Event suppression detected (DPOS16)
512001 8103111F5F	DPOS17_F_QLT_SPP	Event suppression detected (DPOS17)
512001 8103121F5F	DPOS18_F_QLT_SPP	Event suppression detected (DPOS18)
512001 8103131F5F	DPOS19_F_QLT_SPP	Event suppression detected (DPOS19)
512001 8103141F5F	DPOS20_F_QLT_SPP	Event suppression detected (DPOS20)

Signal Number	Signal Name	Description
512001 8103151F5F	DPOS21_F_QLT_SPP	Event suppression detected (DPOS21)
512001 8103161F5F	DPOS22_F_QLT_SPP	Event suppression detected (DPOS22)
512001 8103171F5F	DPOS23_F_QLT_SPP	Event suppression detected (DPOS23)
512001 8103181F5F	DPOS24_F_QLT_SPP	Event suppression detected (DPOS24)
512001 8103191F5F	DPOS25_F_QLT_SPP	Event suppression detected (DPOS25)
512001 81031A1F5F	DPOS26_F_QLT_SPP	Event suppression detected (DPOS26)
512001 81031B1F5F	DPOS27_F_QLT_SPP	Event suppression detected (DPOS27)
512001 81031C1F5F	DPOS28_F_QLT_SPP	Event suppression detected (DPOS28)
512001 81031D1F5F	DPOS29_F_QLT_SPP	Event suppression detected (DPOS29)
512001 81031E1F5F	DPOS30_F_QLT_SPP	Event suppression detected (DPOS30)

(vi) Setting names

Note: The “xx” of “DPOSxx” represents the DPOS function number. (e.g., if the DPOS03 is considered, the “xx” is equal to “03”. The suffix “xx” can be represented as “01” to “20(30)” for control (monitor).

Table 2.9-35 Setting for Binary input signals in DPOSxx

Setting Name	Description	Default	Setting item or value
DPOSxx-CTREN	Activate control function of DPOS01-20	On	Off / On
DPOSxx-CTRAHMI	Activate local panel control of DPOS01-20	SBO	DIR / SBO
DPOSxx-EN	Activate monitoring function of DPOS01-30	On	Off / On
DPOSxx-DEVTYPE	Selection of device type	3-pole	3-pole/1-pile/ switch
DPOSxx-OPC	Activate monitoring function of DPOS01-30	On	Off / On
DPOSxx-CPC	Activate monitoring function of DPOS01-30	On	Off / On
DPOSxxA-NOPSG	BI position for DPOS01-30	*none	BI signal
DPOSxxA-NCLSG	BI position for DPOS01-30	*none	BI signal
DPOSxxB-NOPSG	BI position for DPOS01-30	*none	BI signal
DPOSxxB-NCLSG	BI position for DPOS01-30	*none	BI signal
DPOSxxC-NOPSG	BI position for DPOS01-30	*none	BI signal
DPOSxxC-NCLSG	BI position for DPOS01-30	*none	BI signal
DPOSxx-SPPEN	Activate event suppression for DPOS01-30	On	Off / On
DPOS-NELD	Number of change to lock status.	10	0~99
DPOS-TELD	Time to locking state(sliding window)	10[sec]	1~99[sec]
DPOS-TELR	Time to unlocking state (sliding window)	10[sec]	1~99[sec]

Table 2.9-36 Setting for health check feature in DPOSxx

Setting Name	Description	Default	Setting item or value
DPOSxx-OSLBORD	Select BO signal (BO*-RB) from signal list	*user-preferred	BO read-back number
DPOSxx-FSLBORD	Select BO signal (BO*-RB) from signal list	*user-preferred	BO read-back number
DPOSxx-OEXBORD	Select BO signal (BO*-RB) from signal list	*user-preferred	BO read-back number
DPOSxx-FEXBORD	Select BO signal (BO*-RB) from signal list	*user-preferred	BO read-back number

2.9.7 Mapping for IEC61850 communication

The user can operate the DPOS function over IEC 61850 communications following mapping using GR-TIEMS. Note that the DPOS function is designed for the class of “Double Point Controller (DPC)” in the IEC 61850 standard for communication. The user should follow these steps, each of which is discussed below:

Step1: Editing Logical Node

Step2: Mapping output data

Step3: Mapping input data

(i) Editing Logical Node

The user will need to create a logical node (LN) for the DPOS01 function. Figure 2.9-52 exemplifies the editing of a LN; the LN “Common Switch controller (CSWI)” is chosen for the DPOS01 function. After the user has defined an object “DPC”, the DPOS01 logical node can be saved with the name “CSWI” plus “LN Instance”. Create a definition of the object “DPC” in the DPOS01 logical node. Either the SBO mode or the DIR mode can be chosen in the editing for the LN.

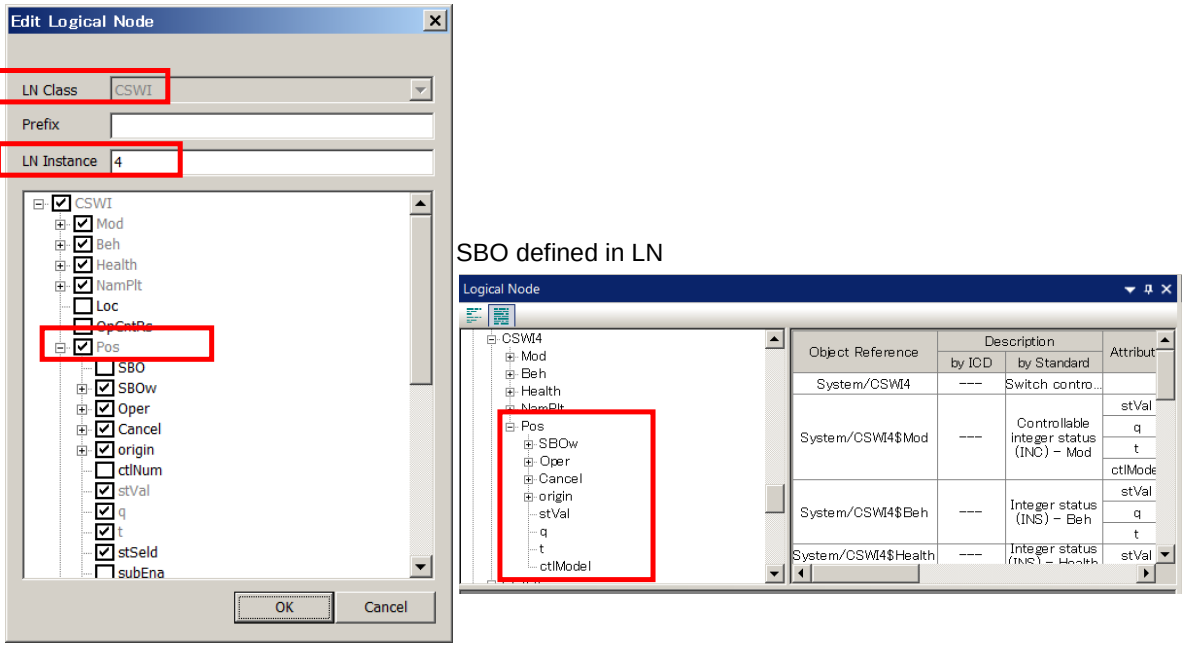
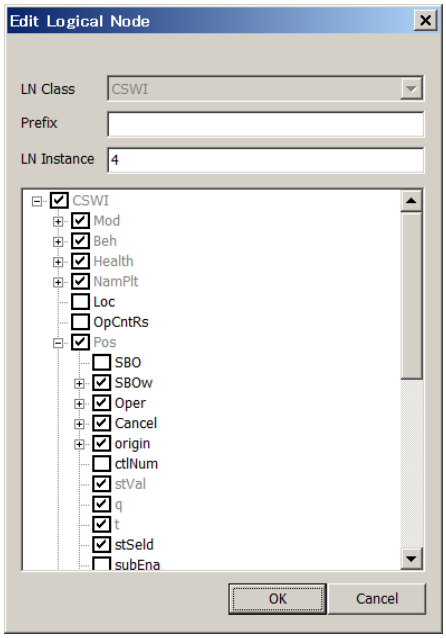


Figure 2.9-52 Defining “DPC” object in CSWI4 logic node

(i)-1 Defining SBO mode

Figure 2.9-53 exemplifies the DPOS01 logic node saved as “CSWI4”. In the SBO mode, the user should select the following items for the “CSWI4$Pos” using GR-TIEMS:



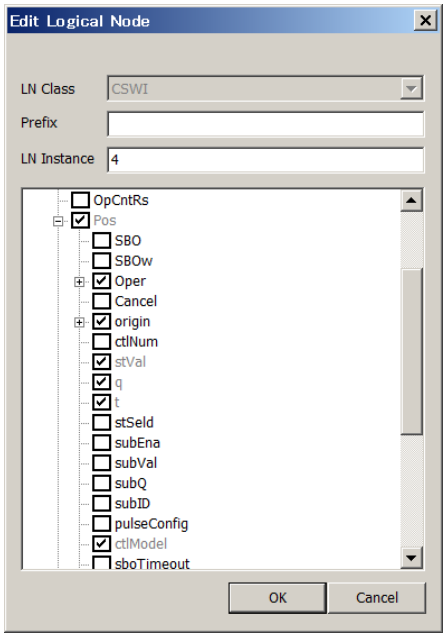
- ✓ SBOw
- ✓ Oper
- ✓ Cancel
- ✓ Origin
- ✓ stSeld
- ✓ sboClass† (choice ”operate-once”)
- ✓ ctlmodel (choice ”SBOes or SBOns”)

†”sboClass” can be found by scrolling down.

Figure 2.9-53 LN editing screen for SBO mode (for example)

(i)-2 Defining DIR mode

Figure 2.9-54 exemplifies the DPOS01 logic node saved as save as “CSWI4”. In the DIR mode, the following three items should be selected using GR-TIEMS.



- ✓ Oper
- ✓ origin
- ✓ ctlmodel (choice ”DOes or DOns”)

Figure 2.9-54 LN editing screen for DIR mode (for example)

(ii) Mapping output data

The user should group the DPOS01 signals with regard to GOOSE and REPORT; the user should map them for IEC 61850 communication using GR-TIEMS. (Figure 2.9-55 illustrates how to map a signal); it indicates that the signals for the DPOS01 function are required to map for IEC 61850 communications.

Table 2.9-37 Mapping signals required for CSWI4 object in DPOS01 function

Object_reference	Attribute	Type	FC	Signal Number	Signal Name
Ctrl/CSWI4Posorigin	orCat	orCategory	ST	512001 3103011008	DPOS01_3PH_ORCAT
Ctrl/CSWI4Posorigin	orIdent	Octet64	ST	512001 6A03011009	DPOS01_3PH_ORIDENT
Ctrl/CSWI4$Pos	stVal	Dbpos	ST	512001 3103011001	DPOS01_3PH_STATE
Ctrl/CSWI4$Pos	q	Quality	ST	512001 3103011005	DPOS01_3PH_QUALITY
Ctrl/CSWI4$Pos	t	Timestamp	ST	512001 9003011006	DPOS01_3PH_TIMESTAMP
Ctrl/CSWI4$Pos	stSeld	BOOLEAN	ST	512001 0003011D90	DPOS01_STD_RPT

Note: "Status (ST)" is defined in the function constraint (FC) of the IEC 61850 standard.

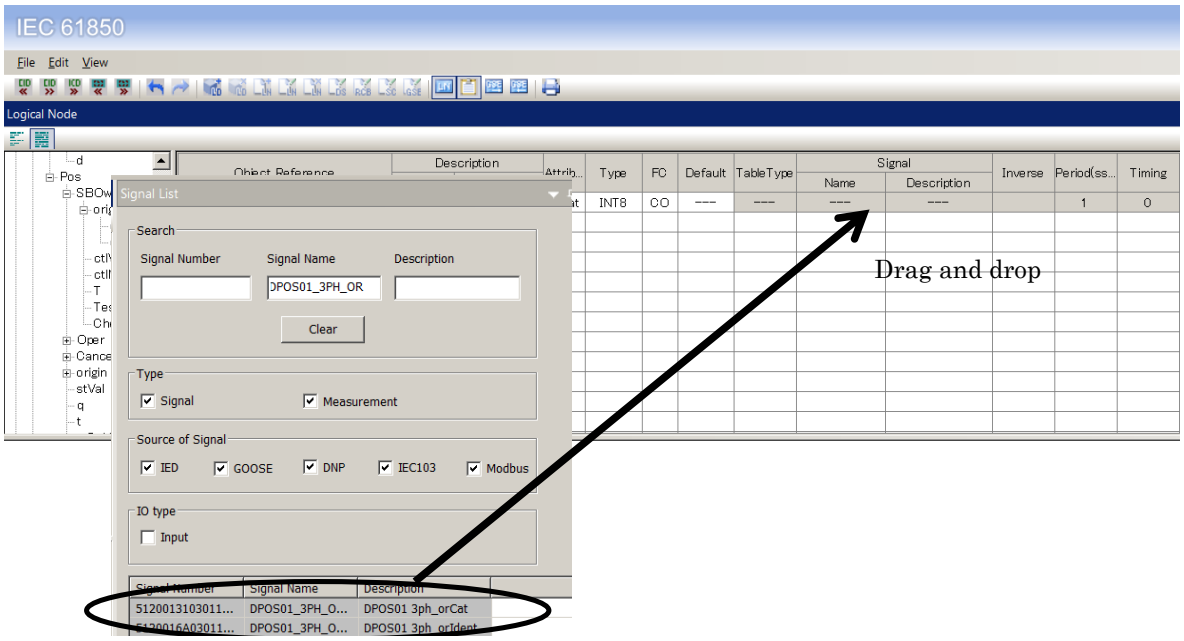


Figure 2.9-55 Attribute mapped into DPCSO object of CSWI4

(iii) Mapping input data

The DPOS01 function can receive three commands "select, operate, and cancel". Thus, the user should map the input-point "DEV01_CONTROL_REQ" to the IEC61850 communication. Table 2.9-38 shows the input "DEV01_CONTROL_REQ" and the Object reference "Ctrl/CSWI4$Pos"; the user should map the input-point to the Object reference having attribute CO†. Figure 2.9-56 shows how to map a signal.

†Note: The attribute is defined in the IEC 61850 standard; "CO" stands for "Control" in the functional constraint (FC).

Table 2.9-38 Mapping signals required for DPC object for CSWI4

Object_reference	Attribute	Type	FC	Signal Number	Signal Name
Ctrl/CSWI4PosSBOw	ctlVal	BOOLEAN	CO	512001 7003016D08	DEV01_CONTROL_REQ
Ctrl/CSWI4PosSBOw	ctlNum	INT8U	CO		
Ctrl/CSWI4PosSBOw	T	Timestamp	CO		
Ctrl/CSWI4PosSBOw	Test	BOOLEAN	CO		
Ctrl/CSWI4PosSBOw	Check	Check	CO		
Ctrl/CSWI4PosSBOw$origin	orCat	orCategory	CO		
Ctrl/CSWI4PosSBOw$origin	orIdent	Octet64	CO		
Ctrl/CSWI4PosOper	ctlVal	BOOLEAN	CO		
Ctrl/CSWI4PosOper	ctlNum	INT8U	CO		
Ctrl/CSWI4PosOper	T	Timestamp	CO		
Ctrl/CSWI4PosOper	Test	BOOLEAN	CO		
Ctrl/CSWI4PosOper	Check	Check	CO		
Ctrl/CSWI4PosOper$origin	orCat	orCategory	CO		
Ctrl/CSWI4PosOper$origin	orIdent	Octet64	CO		
Ctrl/CSWI4PosCancel	ctlVal	BOOLEAN	CO		
Ctrl/CSWI4PosCancel	ctlNum	INT8U	CO		
Ctrl/CSWI4PosCancel	T	Timestamp	CO		
Ctrl/CSWI4PosCancel	Test	BOOLEAN	CO		
Ctrl/CSWI4PosCancel$origin	orCat	orCategory	CO		
Ctrl/CSWI4PosCancel$origin	orIdent	Octet64	CO		
Ctrl/CSWI4PosSBOw	ctlVal	BOOLEAN	CO		
Ctrl/CSWI4PosSBOw	ctlNum	INT8U	CO		

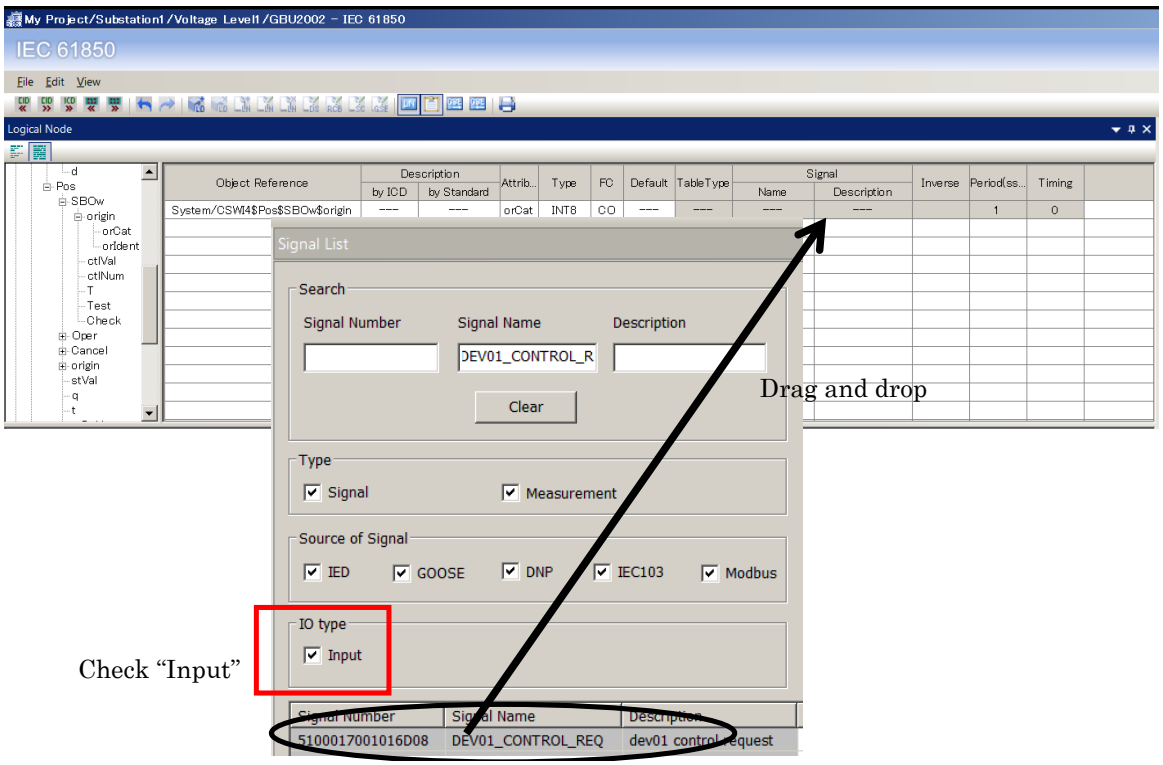


Figure 2.9-56 Input-point mapped for CSWI4

2.9.8 Setting

Common settings list for the DPOS(Function ID: 512001)

Setting items		Range	Units	Contents	Default setting value	Notes
	DPOS-NELD	0-99	–	Number of Event lock detect time	10	
	DPOS-TELD	1-99	s	Timer for detection of event lock	10	
	DPOS-TELR	1-99	s	Timer for recovery from event lock	10	

DPOS01 settings list (Function ID: 512001)

Setting items		Range	Units	Contents	Default setting value	Notes
	DPOS01-EN	Off/On	–	DPOS_DEV1 Enable	Off	
	DPOS01-DEVTYPE	1-Pole/3-Pole/switch	–	Device Type	1-Pole	
	DPOS01A-NOPSG		–	Normally Open Signal for a single-pole or phase A		
	DPOS01A-NOPSGI	Off/On	–	Signal inverse or not inversed	Off	
	DPOS01A-NCLSG		–	Normally Close Signal for a single-pole or phase A		
	DPOS01A-NCLSGI	Off/On	–	Signal inverse or not inversed	Off	
	DPOS01B-NOPSG		–	Normally Open Signal of phase B		
	DPOS01B-NOPSGI	Off/On	–	Signal inverse or not inversed	Off	
	DPOS01B-NCLSG		–	Normally Close Signal for phase B		
	DPOS01B-NCLSGI	Off/On	–	Signal inverse or not inversed	Off	
	DPOS01C-NOPSG		–	Normally Open Signal for phase C		
	DPOS01C-NOPSGI	Off/On	–	Signal inverse or not inversed	Off	
	DPOS01C-NCLSG		–	Normally Close Signal for phase C		
	DPOS01C-NCLSGI	Off/On	–	Signal inverse or not inversed	Off	
	DPOS01-OPC	And/Or	–	Normally Open contact grouping	And	
	DPOS01-CLC	And/Or	–	Normally Close contact grouping	Or	
	DPOS01-SPPEN	Off/On	–	Automatic event suppression function	Off	
	DPOS01-UDFEN	Off/On/CHKONLY	–	undefined pallet check function	Off	
	DPOS01-UDFTIM	0.1-100.0	s	palette undefined check timer	30	
	DPOS01-FLTEN	Off/On/CHKONLY	–	faulty pallet check function	Off	
	DPOS01-FLTTIM	0.1-100.0	s	palette faulty check timer	30	
	DPOS01-CTREN	Off/On	–	control mode (control enable)	Off	
	DPOS01-CTRMENU	Off/On	–	control from MENU enable	Off	
	DPOS01-CTRAHMI	DIR/SBO	–	control action(Direct or SBO)by HMI	SBO	
	DPOS01-NSLBORD1		–	select binary output read data(Signal number)1 for no direction select command		
	DPOS01-NSLBORD2		–	select binary output read data(Signal number)1 for no direction select command		
	DPOS01-FSLBORD		–	select binary output read data(Signal number) for Off-direction		

DPOS01 settings list (Function ID: 512001)

Setting items		Range	Units	Contents	Default setting value	Notes
				select command		
	DPOS01-OSLBORD		–	select binary output read data(Signal number) for On-direction select command		
	DPOS01-FEXBORD		–	execute binary output read data(Signal number) for Off-direction execute command		
	DPOS01-OEXBORD		–	execute binary output read data(Signal number) for On-direction execute command		
	DPOS01-LGCTRCON	FixedLogic/PLC	–	Change logic for control condition	FixedLogic	
	DPOS01-LGSLFFCT	FixedLogic/PLC	–	Change logic for select fail factor	FixedLogic	
	DPOS01-LGEXFFCT	FixedLogic/PLC	–	Change logic for execute command fail factor	FixedLogic	
	DPOS01-LGFEXOT	FixedLogic/PLC	–	Change logic forOff-direction execute output	FixedLogic	
	DPOS01-LGOEXOT	FixedLogic/PLC	–	Change logic for On-direction execute output	FixedLogic	
	DPOS01-LGCNFFCT	FixedLogic/PLC	–	Change logic for cancel command fail factor	FixedLogic	
	DPOS01-PLSM	Fix/Var	–	pulse mode	Fix	
	DPOS01-CPW	0.1-50.0	s	control pulse width	1	
	DPOS01-RST	1.0-100.0	s	response check timer	30	
	DPOS01-CNTS	NA/C-On/C-Off/C-OnOff	–	count status	NA	
	DPOS01-OPETMEN	Off/On	–	Operation Time Measurement enable	Off	
	DPOS01-APBD	Process/Bay	–	status change origin	Process	
	DPOS01-CTRDIR	Off/On	–	Capable control direction	On	

Note: The DPOS function is available for a 2nd Device and other devices. We have omitted the other tables because this will be the same as the table for the 1st device with the exception of the device number.

2.9.9 Signal

◆ Common signal monitoring points

DPOS(Function ID: 512001)

Element ID	Name	Description
8003001D5B	DPOS00_CH_SC_OWS	DPOS00 count change select command by OWS(HMI)
8003001D5C	DPOS00_CH_SC_RCC	DPOS00 count change select command by RCC
8003001D5D	DPOS00_CH_SC_RMT	DPOS00 count change select command by Remote
8003001F95	DPOS00_CH_SC_LCD	DPOS00 count change select command by LCD
8003001D5E	DPOS00_CH_EC_OWS	DPOS00 count change execute command by OWS(HMI)
8003001D5F	DPOS00_CH_EC_RCC	DPOS00 count change execute command by RCC
8003001D60	DPOS00_CH_EC_RMT	DPOS00 count change execute command by Remote
8003001F96	DPOS00_CH_EC_LCD	DPOS00 count change execute command by LCD

◆ Signal monitoring points in DPOS01

DPOS(Function ID: 512001)

Element ID	Name	Description
8003011DE0	DEV1PLCCTRLFAIL	DEV1PLCCTRLFAIL
8303011F49	DPOS01A_FLT_DET	DPOS01 Phase-A Faulty Detected
8303011F48	DPOS01A_FLT_STA	DPOS01 Phase-A Faulty Start
8203011F47	DPOS01A_UDF_DET	DPOS01 Phase-A Undefined Detected
8203011F46	DPOS01A_UDF_STA	DPOS01 Phase-A Undefined Start
8503011F4D	DPOS01B_FLT_DET	DPOS01 Phase-B Faulty Detected
8503011F4C	DPOS01B_FLT_STA	DPOS01 Phase-B Faulty Start
8403011F4B	DPOS01B_UDF_DET	DPOS01 Phase-B Undefined Detected
8403011F4A	DPOS01B_UDF_STA	DPOS01 Phase-B Undefined Start
8703011F51	DPOS01C_FLT_DET	DPOS01 Phase-C Faulty Detected
8703011F50	DPOS01C_FLT_STA	DPOS01 Phase-C Faulty Start
8603011F4F	DPOS01C_UDF_DET	DPOS01 Phase-C Undefined Detected
8603011F4E	DPOS01C_UDF_STA	DPOS01 Phase-C Undefined Start
8103011F41	DPOS01_FLT_DET0	DPOS01 Faulty Detected
8103011F45	DPOS01_FLT_DET1	DPOS01 Faulty Detected (3 phase grouped data only)
8103011F44	DPOS01_FLT_STA	DPOS01 Faulty Start
8203011F60	DPOS01_F_BI_ERR	DPOS01 Inside of connection poor of binary input
8103011D03	DPOS01_ST_ON	DPOS01 Normal close state
8303011D02	DPOS01_ST_OFF	DPOS01 Normal open state
8003011F40	DPOS01_UDF_DET0	DPOS01 Undefined Detected
8003011F43	DPOS01_UDF_DET1	DPOS01 Undefined Detected (3 phase grouped data only)
8003011F42	DPOS01_UDF_STA	DPOS01 Undefined Start
8103011F5F	DPOS01_F_QLT_SPP	DPOS01 Under a lock of change of state
8C03011F70	DPOS01_EX_CS04	DPOS01 close timer for under execution
8003011EA0	DPOS01_CTR_SGE	DPOS01 control logic stage(execute command check)
8003011E9E	DPOS01_CTR_SGC	DPOS01 control logic stage(select command check)
8003011E9F	DPOS01_CTR_SGS	DPOS01 control logic stage(selected)
8303011E9D	DPOS01_CTR_SGN	DPOS01 control logic stage(unselected)
8003011EA1	DPOS01_CTR_SGW	DPOS01 control logic stage(wait for change)
8803011F9B	DPOS01_SLF_FCT_F03CN	DPOS01 count change select fail factor signal by fixedlogic 03
8703011F9C	DPOS01_SLF_FCT_F04CN	DPOS01 count change select fail factor signal by fixedlogic 04
8A03011F86	DPOS01_SLD_CSCN	DPOS01 count change selected condition signal
8003011F85	DPOS01_TMP_70	DPOS01 count change selected condition signal check
8603011F7B	DPOS01_CNT_CS07	DPOS01 count change selected fail condition signal
8503011F87	DPOS01_SE_RCV_RMTCN	DPOS01 count change selected fail condition signal check
8903011F99	DPOS01_CTR_SGUCN	DPOS01 count change selected signal
8303011F9A	DPOS01_SLF_FCT_F07CN	DPOS01 count change selected timer for a check
8A03011F9D	DPOS01_SLD_TMOCN	DPOS01 count change time out after selected

◆ Signal monitoring points in DPOS01

DPOS(Function ID: 512001)

Element ID	Name	Description
8903011F9E	DPOS01_EX_CMP_TMOCN	DPOS01 count change timeout after execute completion
8003011D58	DPOS01_EC_LCD	DPOS01 execute command by LCD
8003011D55	DPOS01_EC_OWS	DPOS01 execute command by OWS(HMI)
8003011D59	DPOS01_EC_PLC	DPOS01 execute command by PLC
8003011D56	DPOS01_EC_RCC	DPOS01 execute command by RCC
8003011D57	DPOS01_EC_RMT	DPOS01 execute command by Remote
8203011E8B	DPOS01_EC_F_CS	DPOS01 execute command fail condition signal
8103011E9A	DPOS01_ECF_FCT_EIS	DPOS01 execute command fail factor signal except interlock/synchronism check
8003011F5B	DPOS01_EC_ST_ERR	DPOS01 execute command mode err
8003011E93	DPOS01_EX_CMP	DPOS01 execute complete signal
8603011E91	DPOS01_EX_FFL	DPOS01 execute fail signal by fixedlogic
8503011E8F	DPOS01_EX_SFL	DPOS01 execute success signal by fixedlogic
8103011E7B	DPOS01_SLF_CS	DPOS01 no direction select fail condition signal
8103011DD0	DPOS01_FEX_BO	DPOS01 Off-direction execute binary output signal
8003011E81	DPOS01_FEC_OK_CS	DPOS01 Off-direction execute command OK condition signal
8003011E7E	DPOS01_FEC_OK_CSF	DPOS01 Off-direction execute command OK condition signal by fixedlogic
8103011E85	DPOS01_FEC_F_CSF	DPOS01 Off-direction execute command fail condition signal by fixedlogic
8A03011DC4	DPOS01_FSL_BO_FLG	DPOS01 Off-direction select binary output signal
8203011DD3	DPOS01_OEX_BO	DPOS01 On-direction execute binary output signal
8103011E82	DPOS01_OEC_OK_CS	DPOS01 On-direction execute command OK condition signal
8003011E7F	DPOS01_OEC_OK_CSF	DPOS01 On-direction execute command OK condition signal by fixedlogic
8103011E86	DPOS01_OEC_F_CSF	DPOS01 On-direction execute command fail condition signal by fixedlogic
8603011DC6	DPOS01_OSL_BO_FLG	DPOS01 On-direction select binary output signal
8803011F73	DPOS01_OSL_CS41	DPOS01 On-direction select condition signal 41
8B03011F6F	DPOS01_EX_CS03	DPOS01 open timer for under execution
8003011F98	DPOS01_RE_EC_LCD	DPOS01 reset time execute command by LCD
8003011D7B	DPOS01_RE_EC_OWS	DPOS01 reset time execute command by OWS(HMI)
8003011D7C	DPOS01_RE_EC_RCC	DPOS01 reset time execute command by RCC
8003011D7D	DPOS01_RE_EC_RMT	DPOS01 reset time execute command by Remote
8003011F97	DPOS01_RE_SC_LCD	DPOS01 reset time select command by LCD
8003011D78	DPOS01_RE_SC_OWS	DPOS01 reset time select command by OWS(HMI)
8003011D79	DPOS01_RE_SC_RCC	DPOS01 reset time select command by RCC
8003011D7A	DPOS01_RE_SC_RMT	DPOS01 reset time select command by Remote
8803011FA1	DPOS01_SLF_FCT_F03RS	DPOS01 reset time select fail factor signal by fixedlogic 03
8703011FA2	DPOS01_SLF_FCT_F04RS	DPOS01 reset time select fail factor signal by fixedlogic 04
8A03011F89	DPOS01_SLD_CSRT	DPOS01 reset time selected condition signal
8003011F88	DPOS01_TMP_71	DPOS01 reset time selected condition signal check
8603011F8B	DPOS01_RST_CS07	DPOS01 reset time selected fail condition signal
8503011F8A	DPOS01_SE_RCV_RMTRT	DPOS01 reset time selected fail condition signal check
8903011F9F	DPOS01_CTR_SGURS	DPOS01 reset time selected signal
8303011FA0	DPOS01_SLF_FCT_F07RS	DPOS01 reset time selected timer for a check
8A03011FA3	DPOS01_SLD_TMORS	DPOS01 reset time time out after selected
8903011FA4	DPOS01_EX_CMP_TMORS	DPOS01 reset time timeout after execute completion
8A03011F6E	DPOS01_EX_CS02	DPOS01 response supervisory timer for close
8903011F6D	DPOS01_EX_CS01	DPOS01 response supervisory timer for open
8903011DC0	DPOS01_NSL_BO_FLG	DPOS01 select binary output signal
8503011F82	DPOS01_TMP_67	DPOS01 select BO close signal check
8103011F7F	DPOS01_TMP_64	DPOS01 select BO open signal check
8203011F7C	DPOS01_TMP_61	DPOS01 select BO signal check
8003011D54	DPOS01_SC_LCD	DPOS01 select command by LCD
8003011D51	DPOS01_SC_OWS	DPOS01 select command by OWS(HMI)
8003011D52	DPOS01_SC_RCC	DPOS01 select command by RCC
8003011D53	DPOS01_SC_RMT	DPOS01 select command by Remote

◆ Signal monitoring points in DPOS01

DPOS(Function ID: 512001)

Element ID	Name	Description
8003011F5A	DPOS01_SC_ST_ERR	DPOS01 select command mode err
8603011F63	DPOS01_SLF_FCT_FLG03	DPOS01 select fail factor signal by fixedlogic 03
8703011F64	DPOS01_SLF_FCT_FLG04	DPOS01 select fail factor signal by fixedlogic 04
8503011F65	DPOS01_SLF_FCT_FLG05	DPOS01 select fail factor signal by fixedlogic 05
8703011E98	DPOS01_SLF_FCT_EIS	DPOS01 select fail factor signal except interlock/synchronism check
8503011F83	DPOS01_TMP_68	DPOS01 select receive closed signal check
8603011F84	DPOS01_TMP_69	DPOS01 select receive closed signal check answer
8503011F80	DPOS01_TMP_65	DPOS01 select receive open signal check
8A03011F81	DPOS01_FSL_CS19	DPOS01 select receive open signal check answer
8003011F7D	DPOS01_TMP_62	DPOS01 select receive signal check
8603011F7E	DPOS01_NSL_CS07	DPOS01 select receive signal check answer
8003011E7D	DPOS01_SLR_CS	DPOS01 select release condition signal
8003011E76	DPOS01_SLD_CS	DPOS01 selected condition signal
8003011F67	DPOS01_SLD_CS04	DPOS01 selected condition signal 04
8103011F68	DPOS01_SLD_CS05	DPOS01 selected condition signal 05
8203011F69	DPOS01_SLD_CS06	DPOS01 selected condition signal 06
8B03011F79	DPOS01_CTR_SGU	DPOS01 selected signal
8803011F6C	DPOS01_SLF_FCT_FLG07	DPOS01 selected timer for a check
8E03011F5D	DPOS01_SLD_TMO	DPOS01 time out after selected
8F03011F5E	DPOS01_EX_CMP_TMO	DPOS01 timeout after execute completion

Note: In the table above, the user will only find Element IDs and their names for the 1st device, but a 2nd and other devices are also provided in the DPOS function. We have omitted the Element IDs and their names for the other devices to improve readability. Use the rule described below when the user wishes to obtain the Element IDs and their names for the other devices.

Rule: The same types of signal monitoring points are provided in every device; hence, the user can find the same ones for all of the other devices. For example, when the user wishes to find the "DPOS02A_FLT_DET" point provided for the 2nd device, use the description of "DPOS01A_FLT_DET". The user can obtain the ID value of "DPOS02A_FLT_DE" by using the folloe=wing steps:

Step 1 Find the element ID for DPOS01A_FLT_DET (i.e., "8303011F49")

Step 2 Identify the numbers at the fifth and sixth digit from the ID. (i.e., "01")

Step 3 Choose a new device number. (i.e., pick the number "2" for the 2nd device)

Step 4 Replace the sixth and fifth digit numbers with the new device number. (i.e., get new ID "8303021F49" of "DPOS02A_FLT_DET") The ID is expressed in hexadecimal notation. Thus, the user must change the device number from decimal notation to hexadecimal notation.

2.10 Double position controller with synchronizing-checking (DPSY)

The double position controller with synchronizing-check (DPSY†) function is used when the user wishes to control a device from the "Closed" or "Open" condition. Generally, the device controlled by the DPSY function is either a 43-switch or a CB. The DPSY function has two measurements: an operation counter and an operation timer. The two features are useful when the user wishes to assess the operating time of the device and the total service duration in the operated state; these features are performed by counting the state-changes for the device.

†Note:The DPSY function is similar to the DPOS function; the DPSY function is required to operate together with the synchronizing function (SYNDIF), which has relay elements corresponding to voltages, and can coordinate the timing for closing or opening. For more detailed information with regard to the SYNDIF function, see Chapter *Control and monitoring application: Synchronizing check for different network*.

The BO circuits are used for issuing commands; the BI circuits are used for receiving responses; hence, the user should set the BIO† together with the DPSY function. The DPSY function includes three logic groups: 1. Selection logic, 2. Cancel logic, and 3. Operate logic.

Tips: If the user wishes to apply the DPSY function quickly, go to sections 2.10.6 and 2.10.7, where setting of the BI and BO circuits and the mapping of signals for IEC61850 communication is described.

Note: The implementation of such features is dependent upon the selection of hardware and the configuration of functions. Several IED models do not support certain features. To determine whether a particular feature has been implemented within an IED, identify the IED ordering number; and check the order number at the "G&T position" referring to the comparison table below. For more information, see *Appendix: Ordering*.

Table 2.10-1 Comparative table for respective ordering numbers

Sec.	Feature	Ordering No. at "G&T"					
		BCU			BCPU		IFU
		11	13	1F	2N	2C	19
–	Main features	✓	✓	✓	✓	✓	NA
–	Number of functions	2	1	2	2	1	–

✓: Applicable NA: Not applicable

MainText;GBU200;Global;English;MSWord2016;ControlApplication;Control_and_monitoring

_applicationTwo devices can be controlled separately; i.e., the DPSY function has two separate sets of logic for control (i.e., DPSY01 and DPSY02 functions). For simplicity, only the DPSY01 function is discussed here; the features in the DPSY02 function are identical to the DPSY01 function.

2.10.1 Select logic for SBO/DIR modes

The user should set scheme switch [**DPSY01-CTREN**] **On** prior to DPSY01 operation. Table 2.10-12 shows all of the scheme switches in the DPSY function.

(i) Receiving "select command Closing" from the remote-end

Figure 2.10-1 outlines the reception of the select command 'Closing' from the remote- end.

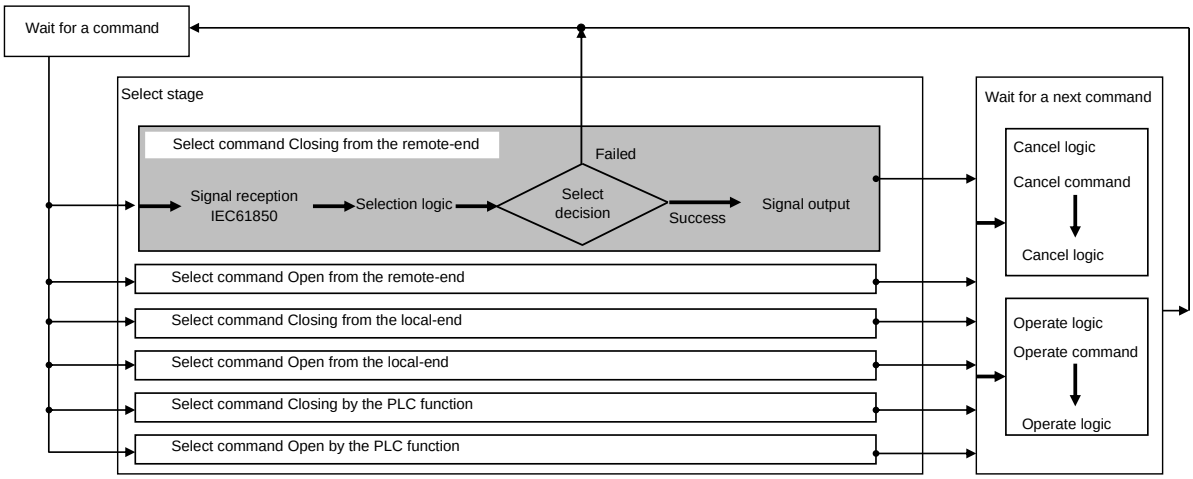


Figure 2.10-1 Outline of select command 'Closing'

(i)-1 Input point required mapping

Figure 2.10-2 shows the select logic when a "Select command closing (Remote-Closing-Control)" signal is applied to the DPSY01 function.

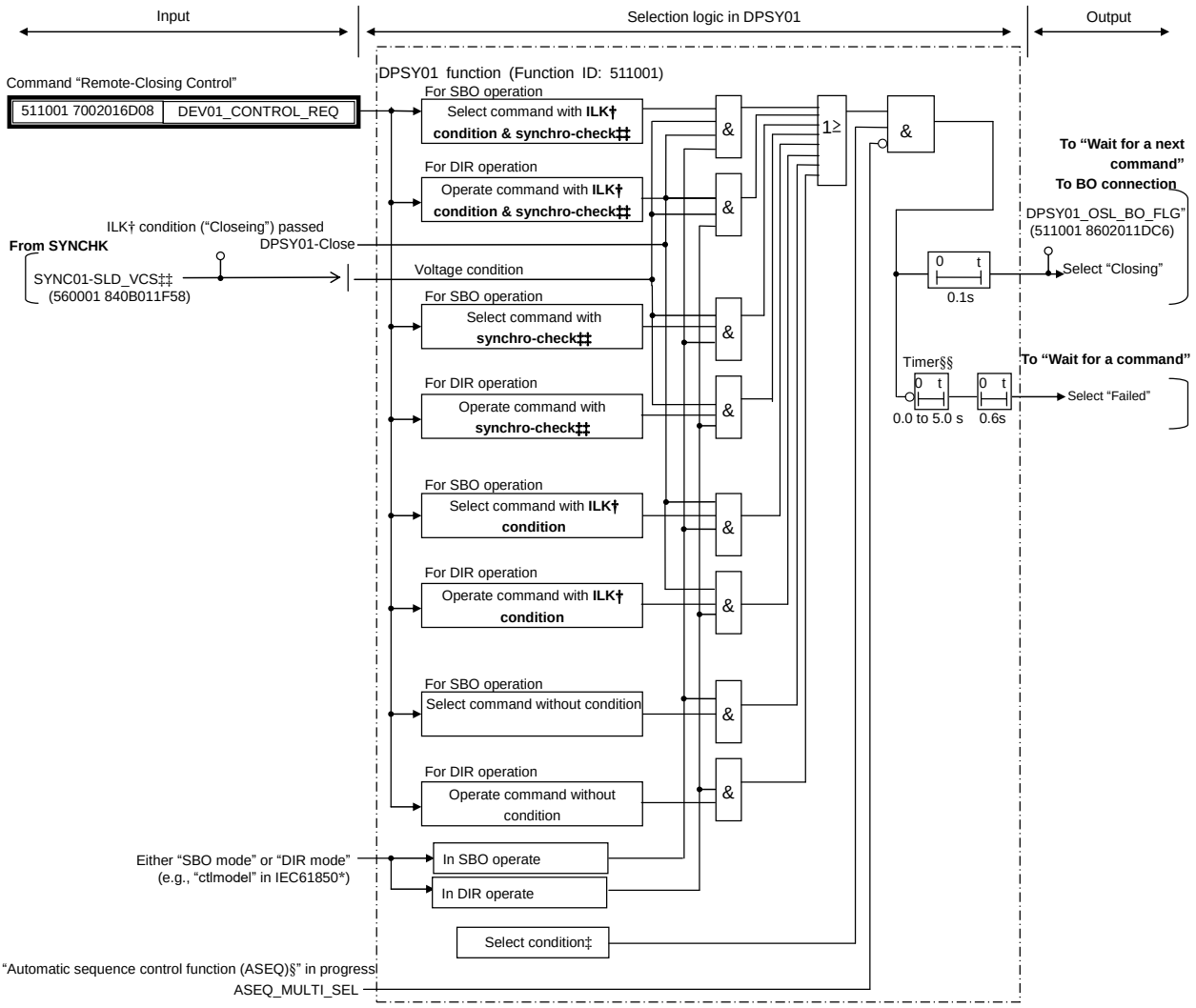


Figure 2.10-2 Select logic 'Closing' from the remote-end in DPSY01††

†Note: The Software interlocking (ILK) function can provide the operation criteria for "Closing". The ILK function is discussed separately; note that the operation criteria is defined by the ILK function itself (i.e., the user cannot set the condition).

‡Note: A "select condition" signal is provided from the select condition scheme. For more information, see Figure 2.10-13.

§Note: An Automatic sequence control (ASEQ) function can provide sequential signals for automatic control. The DPSY01 operation is blocked for the ASEQ function being in operation. For more information of the ASEQ function, see Chapter *Control and monitoring application: Automatic sequence control function*.

*Note: The DPSY01 function can run in either the "SBO mode" or the "DIR mode". The user can use a signal called "ctlmodel" when communication is implemented using IEC61850. To use this signal, the user must map it for IEC61850 communication.

††Note: To identify the input and output points of the DPSY02 logic, see Table 2.10-6 and Table 2.10-10.

##Note: The synchronism voltage check is executed by the SYNCHK function.

§§Note: A timer is provided to determine an operation failure. The maximum value of the settings [**SYNC01_TLRDIDRLI**] or [**SYNC01_TDRDI**] is used as the decision time. For more information on settings, see the SYNDIF function.

This logic has the input-point "DEV01_CONTROL_REQ" for the reception of a select command. That is, the input-point must be mapped for communication. The function will fail to operate if mapping is not performed correctly. We will discuss how to map the input-points for IEC61850 communication in section 2.10.7.

(i)-2 Output signal to BO

The DPSY01 function can issue an output signal "Selection success" at the output point "DPSY01_OSL_BO_FLG", when the DPSY01 function determines that the "Remote-Closing-Control" signal received is true. If the DPSY01 function determines that the "Remote-Closing-Control" signal is not true, the DPSY01 function returns to the "Wait for a command" stage.

The user should note that the operation decision of the SYNDIF01 function is required for the DPSY01 function; the operation decision is determined by the measurement of running voltage and incoming voltage. Table 2.10-2 shows the relay-elements used in the SYNDIF01 function.

Table 2.10-2 Voltage checking elements in SYNDIF01

Relay-Element	Description
SyncRy1-VR	Running Voltage channel selector for DPSY01
SyncRy1-VI	Incoming Voltage channel selector for DPSY01
OVR1	Voltage for checking Live-Running Voltage for DPSY01
UVR1	Voltage for checking Dead-Running Voltage for DPSY01
OVI1	Voltage for checking Live-Incoming Voltage for DPSY01
UVI1	Voltage for checking Dead-Incoming Voltage for DPSY01

(ii) Receiving “select command Open” from the remote-end

Figure 2.10-3 outlines the reception of the select command ‘Open’ from the remote-end.

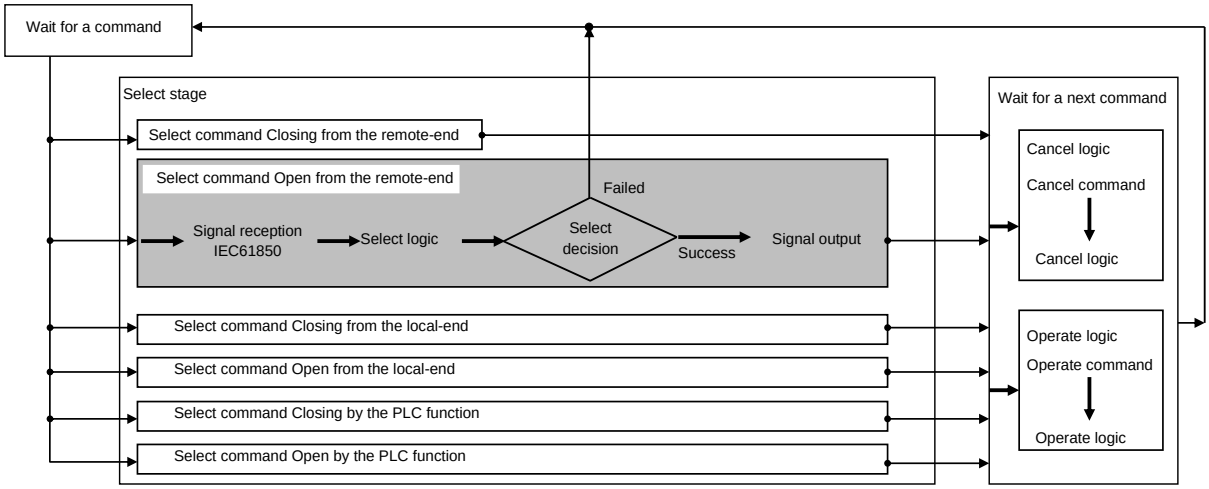


Figure 2.10-3 Outline of select command for Open

(ii)-1 Input point required mapping

Figure 2.10-4 shows the select logic when a “Select command (Remote-Open-Control)” signal is applied to the DPSY01 function. The input-point “DEV01_CONTROL_REQ” is used for the reception of the “select command (Remote-Open-Control)” signal.

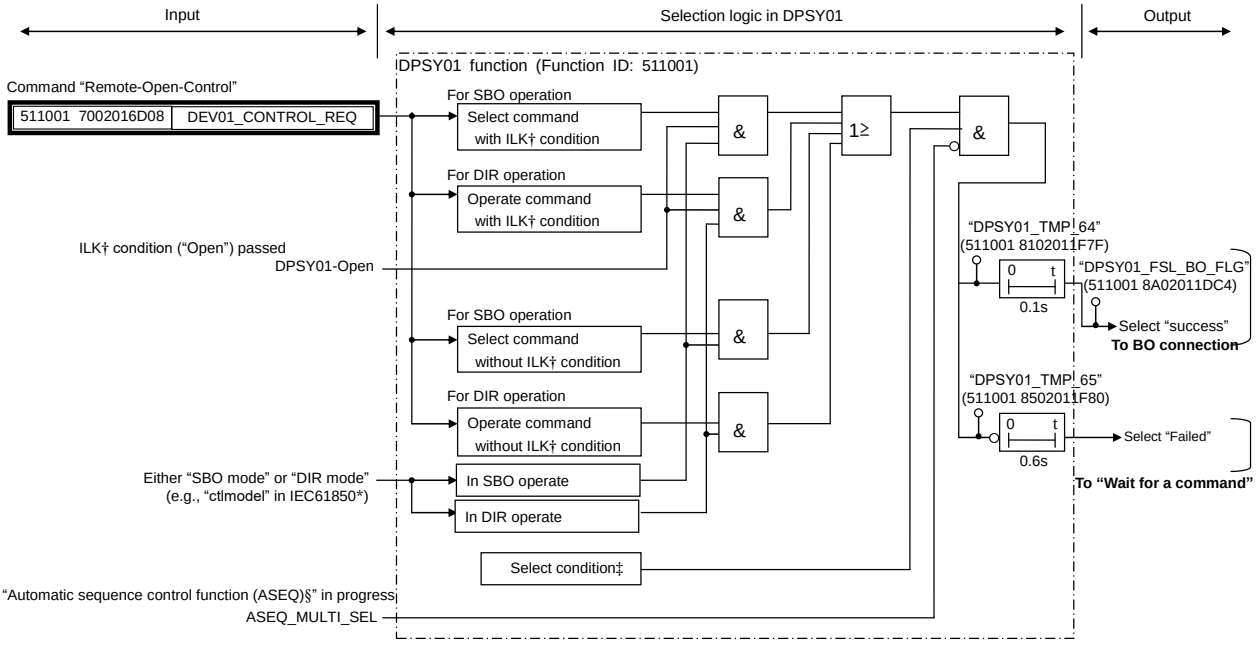


Figure 2.10-4 Select ‘Open’ from the remote-end in DPSY01††

†Note: The ILK function can provide the operation criteria for “Open”.

‡Note: A “select condition” signal is provided from the select condition scheme. For more information, see Figure 2.10-13.

§Note: An Automatic sequence control (ASEQ) function can provide sequential signals for automatic control. The DPSY01 operation is blocked for the ASEQ function when

it is in operation. For more information of the ASEQ function, see Chapter *Control and monitoring application: Automatic sequence control function*.

††Note: To know the input and output points of the DPSY02 logic, see Table 2.10-6 and Table 2.10-10.

(ii)-2 Output signal to BO

The DPSY01 function, in Figure 2.10-4, can issue a "Select success" signal at the output point "DPSY01_FSL_BO_FLG" when the DPSY01 function determines that the "Selection command Open (Remote-Open-Control)" signal is true. If the DPSY01 function determines that the "Remote-Open-Control" signal is not true, the DPSY01 function returns to the "Wait for a command" stage.

(iii) Receiving "Select command Closing" from the local-end

Figure 2.10-5 outlines the reception of the select command 'Closing' from the local-end.

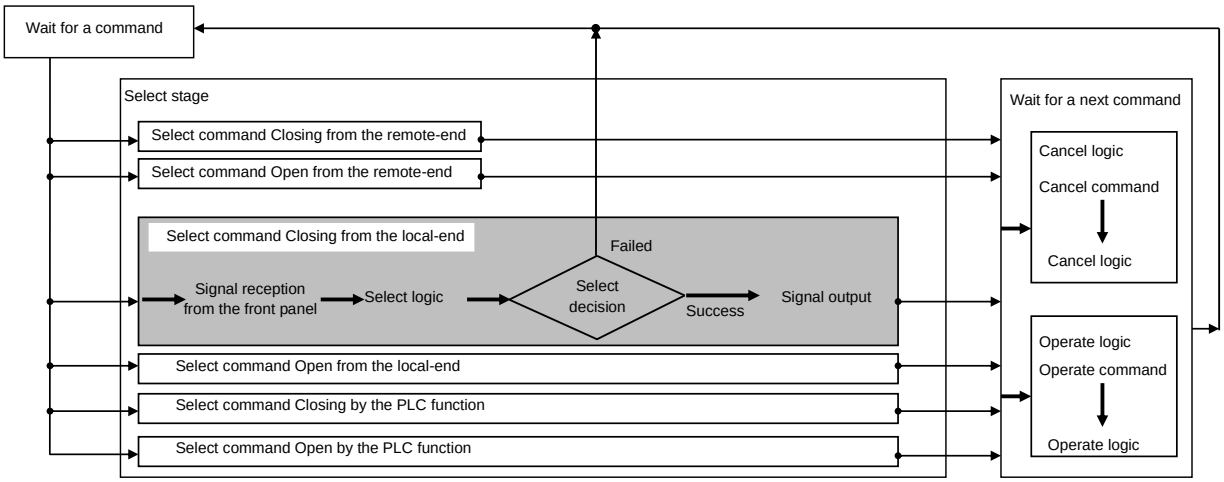


Figure 2.10-5 Outline of select command for 'Closing'

(iii)-1 Input signal generated at the local-end

Figure 2.10-6 shows the select logic when a "Select command Closing (Local-Closing-Control)" signal is applied to the DPSY01 function. The signal is provided when a "Selection for Closing" key is pressed on the IED front panel; the user is not required to map the signal from the IEC61850 communication. Note that the user should set the scheme switch [**DPSY01-CTRAHMI**] to **SBO** when operation from the IED front panel is required, we discuss how to set this in chapter *User interface: Control sub-menu*.

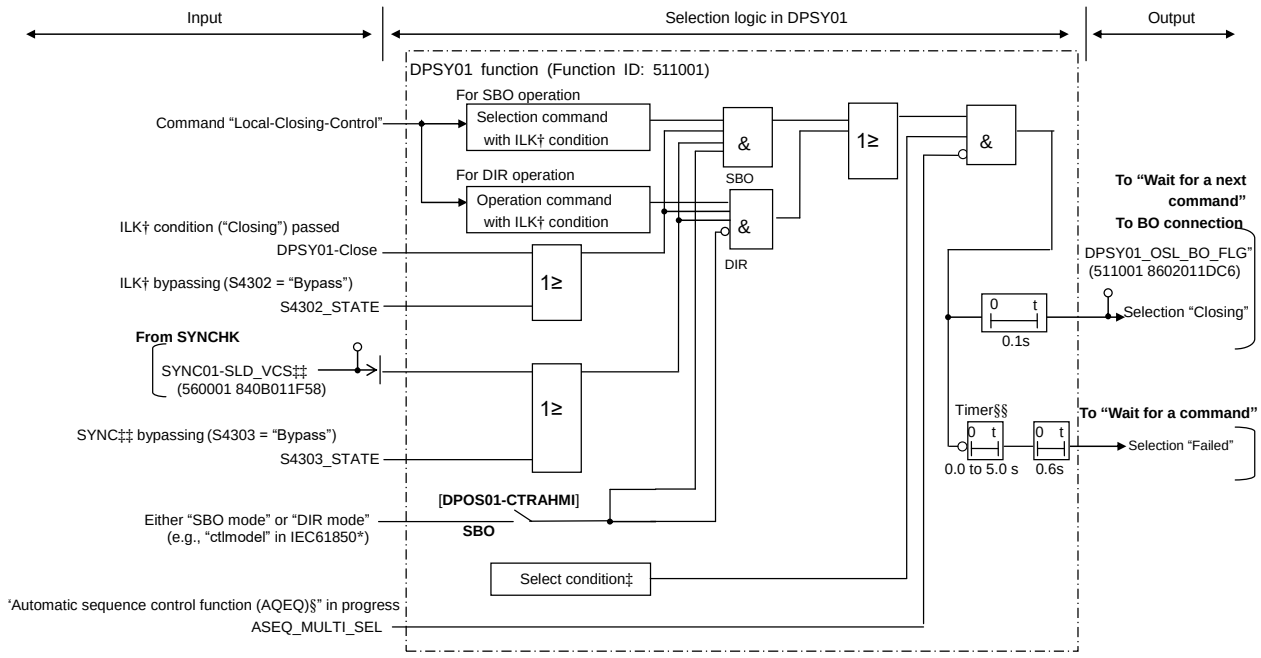


Figure 2.10-6 Select 'Closing' on the front panel in DPSY01††

†Note: The ILK function provides the operation criterion for "On". For testing, nullifying the ILK function is possible using "Interlock bypassing". "Interlock bypassing" is indicated by the status "S4302" in a software switch controller (SOFTSW).

‡Note: A "select condition" signal is provided from the select condition scheme. For more information, see Figure 2.10-13.

§Note: An Automatic sequence control (ASEQ) function can provide sequential signals for automatic control. The DPSY01 operation is blocked for the ASEQ function when it is in operation. For more information regarding the ASEQ function, see Chapter *Control and monitoring application: Automatic sequence control function*.

††Note: To identify the output signals of the DPSY02 logic, see Table 2.10-10.

‡‡Note: The SYNDIF function provides the synchronism criteria for "Closing". For testing, nullifying the SYNDIF function is possible using "Synchro-check bypassing". "Synchro-check bypassing" is indicated by the status "S4303" in the SOFTSW.

(iii)-2 Output signal to BO

When the signal "select condition" is true, the DPSY01 function can issue a "Selection success" signal at the output-point "DPSY01_OSL_BO_CSF".

Note: The signal "DPSY01_OSL_BO_CSF" is the same as the signal shown in Figure 2.10-2. If the "Local-Closing-Control" signal is not true, the DPSY01 function returns to the "Wait for a command" stage.

(iv) Receiving “Select command Open” from the local-end

Figure 2.10-7 outlines the reception of the select command ‘Open’ from the local-end.

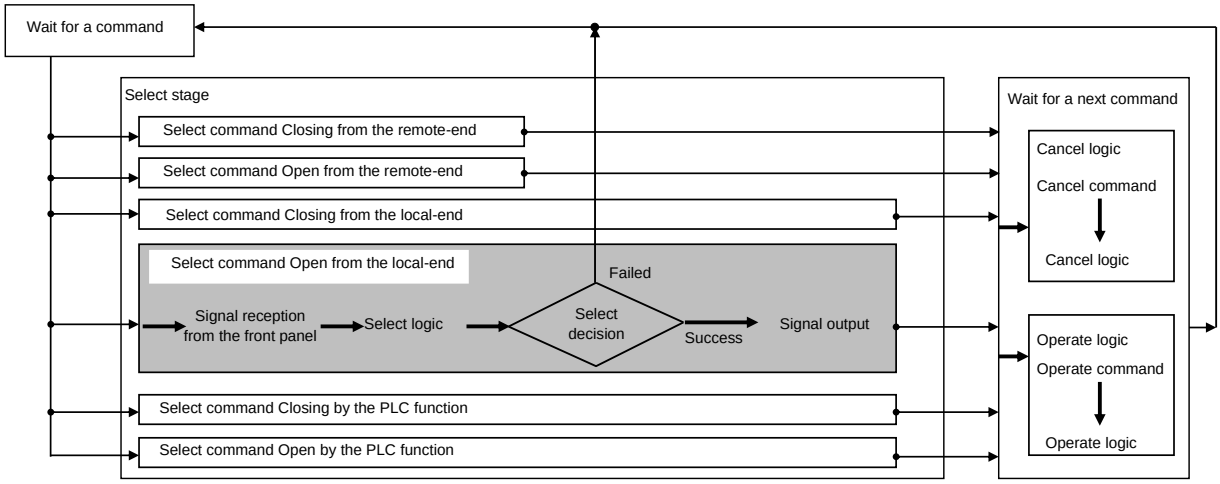


Figure 2.10-7 Outline of select command ‘Open’

(iv)-1 Input signal generated at the local-end

Figure 2.10-8 shows the select logic when a “Select command open (Local-Open-Control)” signal is applied to the DPSY01 function. The signal is provided when the user presses a “Selection for Open” key on the IED front panel; the user is not required to map the signal from IEC61850 communication.

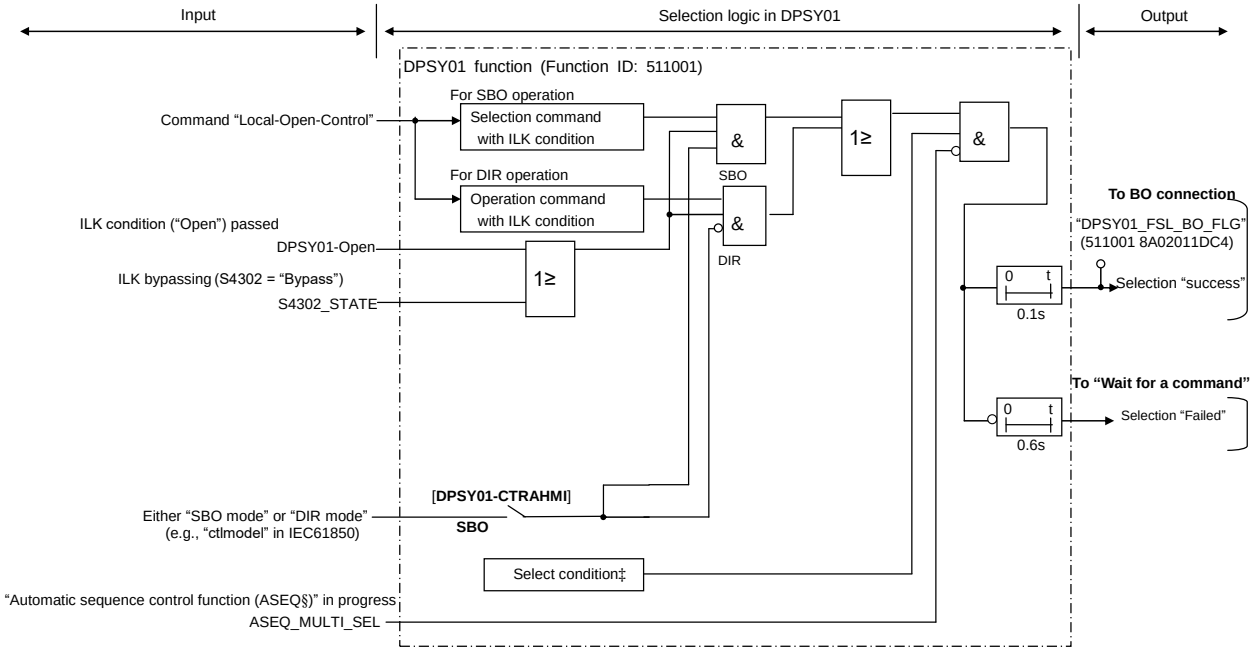


Figure 2.10-8 Select ‘Open’ on the front panel in DPSY01††

‡Note: A “select condition” signal is provided from the select condition scheme. For more information, see Figure 2.10-13.

§Note: An Automatic sequence control (ASEQ) function can provide sequential signals for automatic control. The DPSY01 operation is blocked for the ASEQ function when

it is in operation. For more information regarding the ASEQ function, see Chapter *Control and monitoring application: Automatic sequence control function*.

††Note: To identify the output signals of the DPSY02 logic, see Table 2.10-10.

(iv)-2 Output signal to BO

When the "select condition" signal is true, the DPSY01 function can issue a "Select success" signal at the output-point "DPSY01_FSL_BO_FLG".

[1]Note: The signal "DPSY01_FSL_BO_FLG" is the same as the signal shown in Figure 2.10-4. If the signal "Local-Open-Control" is not true, the DPSY01 function returns to the "Wait for a command" stage.

(v) Receiving "Select command Closing" by PLC function

Figure 2.10-9 outlines the reception of the select command 'Closing' by the PLC function.

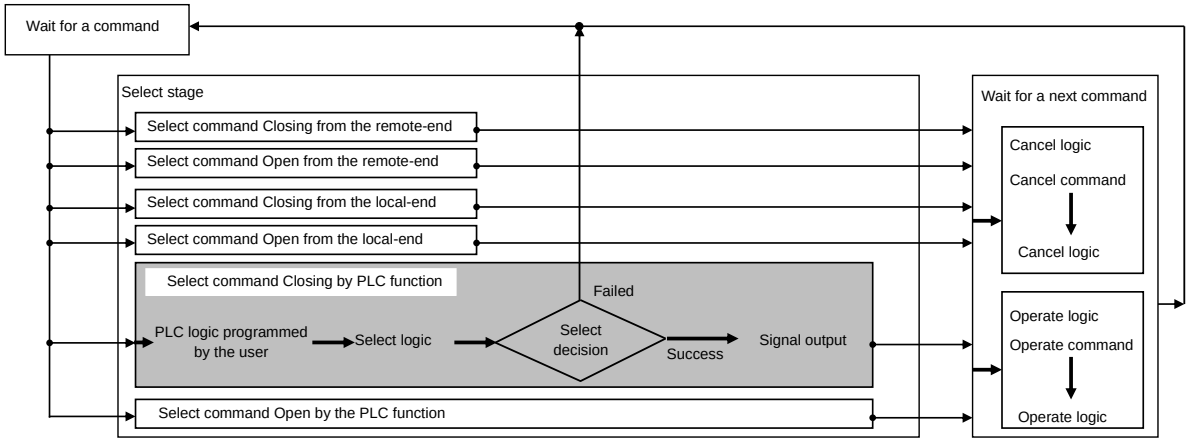


Figure 2.10-9 Outline of select command 'Closing'

(v)-1 Input signal from the PLC function

Figure 2.10-10 shows the select logic when a "Select command Closing (PLC-Closing-Control)" signal is generated by the PLC function. There are four input points for reception of this signal. The first connecting point, (PLC#1) is used for the reception of the select-command requiring the ILK and the SYNDIF check. The second connection point, (PLC#2) is used for the reception of the select-command requiring the SYNDIF check only. The third connection point (PLC#3) is used for the reception of the select-command requiring the ILK check only and the fourth connection point (PLC#4) is used for the reception of the select command with no check. That is, for example, for the DPSY01 function, when the "Select command 'Closing' (PLC-Closing-Control)" signal generated in the user-programmed logic is applied and when the ILK and the SYNDIF checks are both required in the select logic, use the connection point (PLC#1: e.g., PLC_BIT_0528). PLC#1 to PLC#4 are shown in Table 2.10-3.

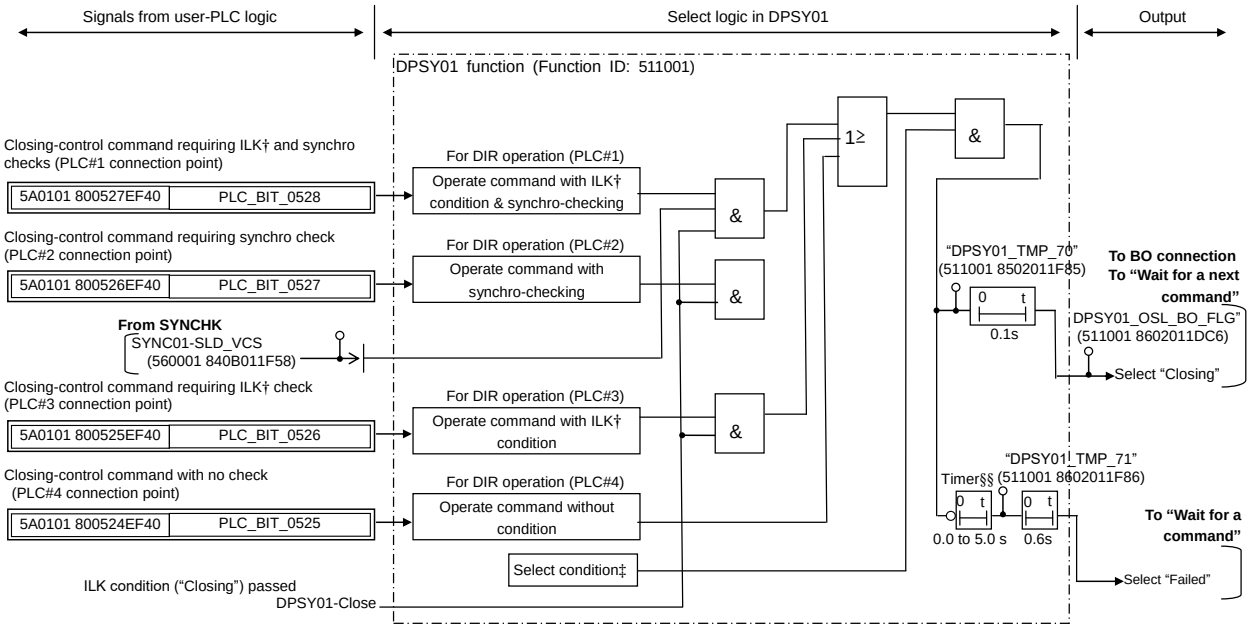


Figure 2.10-10 Select 'Closing' using the PLC function in DPSY01††

††Note: To identify the input and output signals of the DPSY02 logic, see Table 2.10-3 and Table 2.10-10.

†Note: The Software interlocking (ILK) function can provide the operation criteria for "Closing". The ILK function is discussed separately; note that the operation criteria is defined in the ILK function itself (i.e., the user cannot set the condition).

‡Note: A "select condition" signal is provided from the select condition scheme. For more information, see Figure 2.10-13.

§§Note: A timer is provided to determine a failure to operate. The maximum value of the settings [**SYNC01_TLRDIDRLI**] or [**SYNC01_TDRDI**] is used for the decision time. For more information on settings, see the SYNDIF function.

(v)-2 Output signal to BO

The DPSY01 function, in Figure 2.10-10, can issue a "Select success" signal at the output-point "DPSY01_OSL_BO_CSF"[1].

[1]Note: The signal "DPSY01_OSL_BO_CSF" is the same signal as that shown in Figure 2.10-2.

(vi) Receiving “Select command Open” by PLC function

Figure 2.10-11 outlines the reception of the select command ‘Open’ by the PLC function.

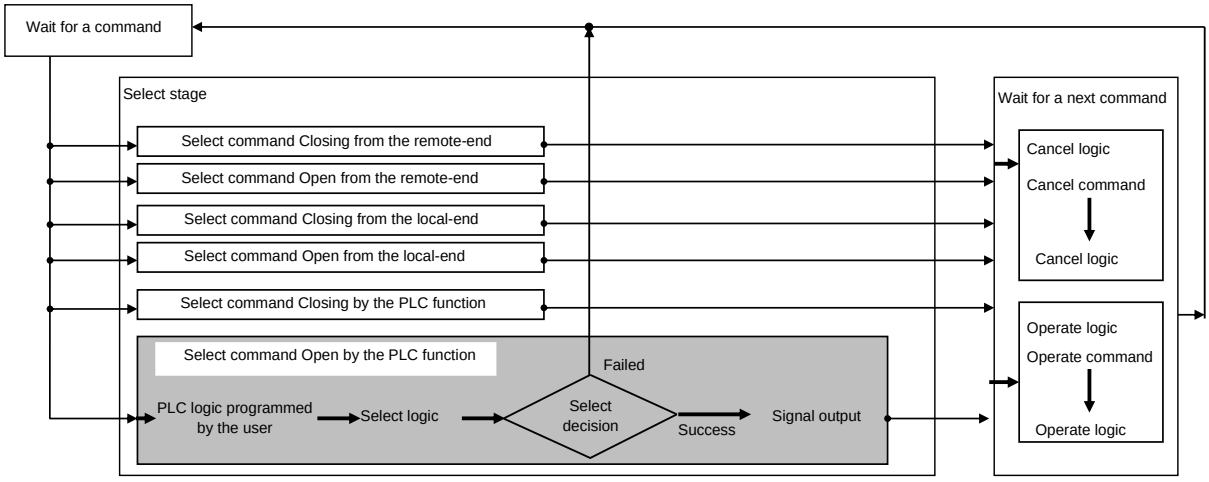


Figure 2.10-11 Outline of select command ‘Open’

(vi)-1 Input signal from the PLC function

Figure 2.10-12 shows the select logic when a “Select command Open (PLC-Open-Control)” signal is generated by the PLC function There are two input-points for the reception of this signal, unlike in the signal “Select command Closing (PLC-Closing-Control)” where four are available. That is, if interlock checking is required, use the connection point (PLC#1:e.g., PLC_BIT_0524). Alternatively, if the interlock check is not required, use the connection point (PLC#2:e.g., PLC_BIT_0523). PLC#1 and the PLC#2 are shown in Table 2.10-4.

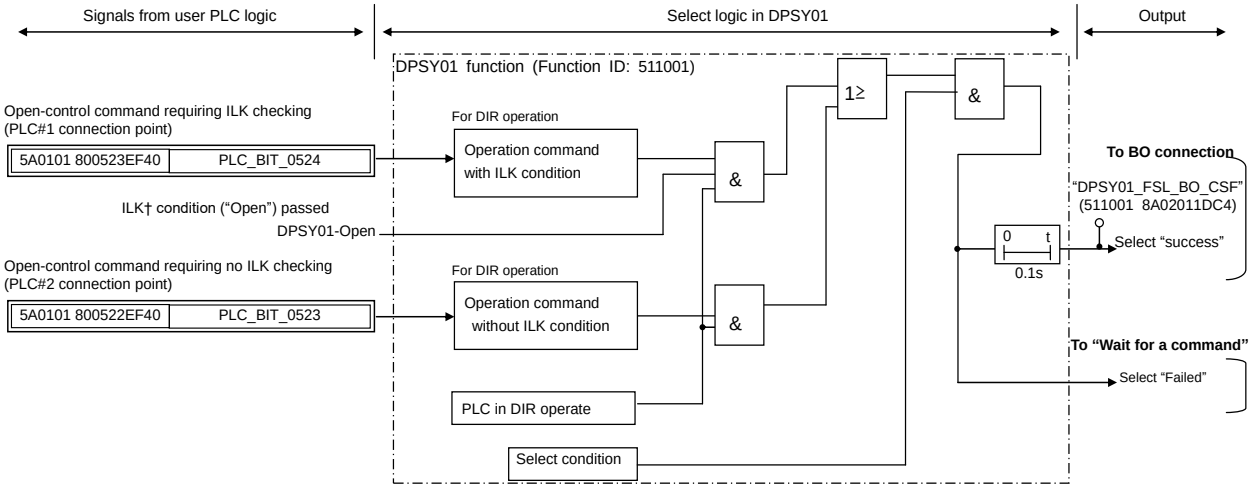


Figure 2.10-12 Select Open by PLC function in DPSY01††

††Note: To identify the input and output points of the DPSY02 logic, see Table 2.10-4 for the inputs (PLC#1 and PLC#2) and Table 2.10-12 for the outputs.

(vi)-2 Output signal to BO

The DPSY01 function, in Figure 2.10-12, can issue a “Select success” signal at the output point

"DPSY01_FSL_BO_CSF"[1].

[1]Note: The output point "DPSY01_FSL_BO_CSF" is the same signal as shown in Figure 2.10-4.

(vii) Select condition

Figure 2.10-13 shows the select condition logic in the DPSY01 function. The DPSY01 function checks the condition for the select command using the signal "DPSY01_3PH_STATE" (See Table 2.10-36). If the original logic does not meet with the requirements of the user, the following alternatives are available:

1. The user can replace the original logic with alternative logic.
2. The user can add additional logic to the original logic.

(vii)-1 How to replace the original logic

If the user wishes to replace the select condition logic completely, the user can replace it using the PLC connection point "User Configurable Condition".

1. Connect the user-customized logic using "PLC_BIT_0533", which is listed as PLC#2 in Table 2.10-8.
2. Set the scheme switch [**DPSY01-LGSLFFCT**] to **PLC**.

(vii)-2 How to add another select condition signal

If adding another condition is required, the user can add a signal to the select condition logic using the PLC condition point "User Additional Condition".

1. Add a user-preferred signal using "PLC_BIT_0532", which is listed as PLC#1 in Table 2.10-8.
2. Set the scheme switch [**DPSY01-LGSLFFCT**] to **Fixedlogic**.

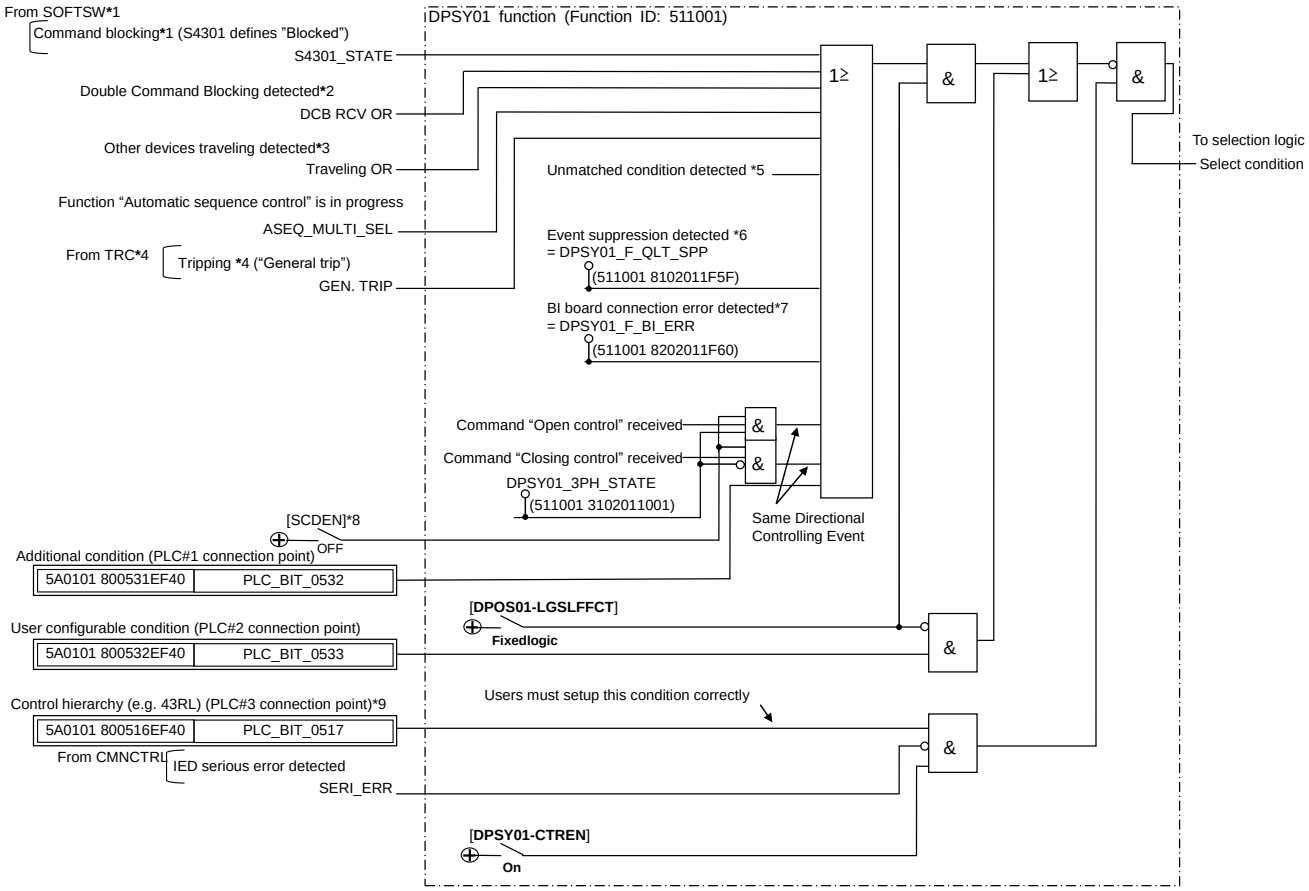


Figure 2.10-13 Select condition logic for 'Closing/Open' in DPSY01*10

[1]Note: "Command Blocking" disables any operation except its own; the "Command Blocking" is initiated by the status of "S4301" in a software switch controller (SOTFSW). The IEC 61850 standard defines "Command Blocking" as "CmdBlk". For more information on "S4301", see Chapter *Control and monitoring application: Software switch controller. See the signal* "S4301_STATE" of Table 2.10-7.

[2]Note: "Double Command Blocking" (DCB) is an operation philosophy. It can be used to protect the substation. The user can program it using GR-TIEMS. The DCB operating signal is denoted as "DCB RCV OR) in Table 2.10-7.

[3]Note: If the event "device-travelling" is detected, it indicates that another operator is changing the status of a device. Thus, the IED should inhibit the operation of any device for the duration that the event is detected. The detecting signal is denoted as "Travelling OR" in Table 2.10-7.

[4]Note: If the issue of a trip command is executed by the IED, any control operation is blocked until the trip operation is completed. If an IED includes a relay application, the trip command is issued at the output-point "GEN.TRIP" in Table 2.10-7.

[5]Note: Criteria "unmatched conditions" are decided when "Test-bit status" in a command is not identical to the "IED test status".

[6]Note: The "Event suppression" function can detect chattering on BI circuits. (See section 2.10.6(i)-3)

[7]Note: A supervision of the Binary IO module can detect connection errors for BI circuits.

[8]Note: The Common control (CMNCTRL) function can test and check the 'Opening' and 'Closing' operations performed by the logic. When the user sets **Off** for scheme switch [**SCDEN**], the operation of the logic is blocked if the logic is running in the same operation-direction compared with the previous operation-direction (i.e., when closing (opening) is performed sequentially). On the other hand, if **On** is set for the scheme switch, the logic is not blocked.

[9]Note: The user will need to program the PLC logic "Control hierarchy condition". The user is also required to connect the logic condition with the select condition logic using the connection point "PLC_BIT_0517". For more information, see Chapter *Control and monitoring application: Control hierarchy*. See PLC#3 of Table 2.10-8.

[10]Note: To identify the input points of the DPSY02, see Table 2.10-8.

(viii) Signal name and number

Note: The user should note the following descriptions shown in the column "M/O" for each table:

"O" indicates that the signal is provided for optional use.

"M" indicates that the user should map/set/configure the signal; otherwise, the user may experience an operational failure if the default settings are used.

"N/A" indicates that the user cannot change the state of the signal.

Table 2.10-3 PLC connection points (Input points for Command 'Closing')

Signal Number	Signal Name	Description	M/O
5A0101 800527EF40	PLC_BIT_0528	DPSY01 PLC Close-control checking with interlock & Sync (PLC#1)	O
5A0101 800551EF40	PLC_BIT_0552	DPSY02 PLC Close-control checking with interlock & Sync (PLC#1)	O
5A0101 800526EF40	PLC_BIT_0527	DPSY01 PLC Close-control with Sync (PLC#2)	O
5A0101 800550EF40	PLC_BIT_0551	DPSY02 PLC Close-control with Sync (PLC#2)	O
5A0101 800525EF40	PLC_BIT_0526	DPSY01 PLC Close-control checking with interlock(PLC#3)	O
5A0101 800549EF40	PLC_BIT_0550	DPSY02 PLC Close-control checking with interlock(PLC#3)	O
5A0101 800524EF40	PLC_BIT_0525	DPSY01 PLC Close-control none checking (PLC#4)	O
5A0101 800548EF40	PLC_BIT_0549	DPSY02 PLC Close-control none checking (PLC#4)	O

Table 2.10-4 PLC connection points (Input points for Command 'Open')

Signal Number	Signal Name	Description	M/O
5A0101 800523EF40	PLC_BIT_0524	DPSY01 PLC Open-control checking with interlock(PLC#1)	O
5A0101 800547EF40	PLC_BIT_0548	DPSY02 PLC Open-control checking with interlock(PLC#1)	O
5A0101 800522EF40	PLC_BIT_0523	DPSY01 PLC Open-control without checking(PLC#2)	O
5A0101 800546EF40	PLC_BIT_0547	DPSY02 PLC Open-control without checking(PLC#2)	O

Table 2.10-5 PLC connection points (Interlock for Command 'Closing/Open')

Signal Number	Signal Name	Description	M/O
570001 3102011DA2	DPSY01-Open	DPSY01 interlock condition for Open control.	N/A
570001 3102021DA2	DPSY02-Open	DPSY02 interlock condition for Open control.	N/A
570001 3102011DA0	DPSY01-Close	DPSY01 interlock condition for Close control.	N/A
570001 3102021DA0	DPSY02-Close	DPSY02 interlock condition for Close control.	N/A

Table 2.10-6 Mapping points for the reception of control commands

Signal Number	Signal Name	Description	M/O
511001 7002016D08	DEV01_CONTROL_REQ	DPSY01 control command received.(Mapping Data)	M
511001 7002026D08	DEV02_CONTROL_REQ	DPSY02 control command received. (Mapping Data)	M

Table 2.10-7 Input signals to condition logic

Signal Number	Signal Name	Description	M/O
570001 3103011DA2	ASEQ_MULTI_SEL	Automatic sequence control is in progress.	N/A
522001 000A011001	S4301_STATE	Command Blocking status (Open / Blocked)	N/A
522001 000A021001	S4302_STATE	Interlock-Bypassing Switch	N/A
522001 000A031001	S4303_STATE	Synch-Bypassing Switch	N/A
5A0001 0008001F41	DCB RCV OR	Double Command Blocking(DCB) is in progress.	N/A
5A0001 0008001F40	Traveling OR	Travelling events are detected.	N/A
4A0001 8300001B6F	GEN. TRIP	General trip	N/A
5A0001 3108003F40	SDCEN	(This is setting of CMNCTRL)	N/A
5A0101 3100001F43	SERI_ERR	Serious Error detected	N/A

Table 2.10-8 PLC connection points (Input signals for select condition logic)

Signal Number	Signal Name	Description	M/O
5A0101 800531EF40	PLC_BIT_0532	DPSY01 additional failure condition(PLC#1)	O
5A0101 800554EF40	PLC_BIT_0555	DPSY02 additional failure condition(PLC#1)	O
5A0101 800532EF40	PLC_BIT_0533	DPSY01 user configurable select condition(PLC#2)	O
5A0101 800555EF40	PLC_BIT_0556	DPSY02 user configurable select condition(PLC#2)	O
5A0101 800516EF40	PLC_BIT_0517	DPSY01 control hierarchy condition(PLC#3)	M
5A0101 800519EF40	PLC_BIT_0520	DPSY02 control hierarchy condition(PLC#3)	M

Table 2.10-9 PLC monitoring points (Output signal for select condition logic)

Signal Number	Signal Name	Description
511001 8002011F5A	DPSY01_SC_ST_ERR	DPSY01 Unmatched condition.
511001 8002021F5A	DPSY02_SC_ST_ERR	DPSY02 Unmatched condition.
511001 8102011F5F	DPSY01_F_QLT_SPP	Event suppression detected (DPSY01)
511001 8102021F5F	DPSY02_F_QLT_SPP	Event suppression detected (DPSY02)
511001 8202011F60	DPSY01_F_BI_ERR	BI connection error detected(DPSY01)
511001 8202021F60	DPSY02_F_BI_ERR	BI connection error detected(DPSY02)

Table 2.10-10 PLC monitoring points (Closing/Open output signals for BIO)

Signal Number	Signal Name	Description
511001 8602011DC6	DPSY01_OSL_BO_FLG	DPSY01 select (Closing) command for Binary Output.
511001 8602021DC6	DPSY02_OSL_BO_FLG	DPSY02 select (Closing) command for Binary Output.
511001 8A02011DC4	DPSY01_FSL_BO_FLG	DPSY01 select (Open) command for Binary Output.
511001 8A02021DC4	DPSY02_FSL_BO_FLG	DPSY02 select (Open) command for Binary Output.

Table 2.10-11 Reason signal and messages for selection failure

<table>
<tr><th>Signal Number</th><th>Signal Name</th><th>Description</th></tr>
<tr><td>511001 3102011D81</td><td>DPSY01_TMP_07</td><td>DPSY01 selection failure signal, that indicating the reason about the last aborted selected command. The signal is show in Enumeration.
Value 0: No reason
Other values: see the below:
<table>
<tr><th>Event message</th><th>IEC61850 Add Cause definition</th></tr>
<tr><td>BLK BY SWITCH</td><td>Blocked by switching hierarchy</td></tr>
<tr><td>BLK BY SEL FAIL</td><td>Select failed</td></tr>
<tr><td>BLK BY INV POS</td><td>Invalid position</td></tr>
<tr><td>BLK BY POS RCH</td><td>Position reached</td></tr>
<tr><td>PRM CHG</td><td>Parameter change in execution</td></tr>
<tr><td>BLK BY STEP LMT</td><td>Step limit</td></tr>
<tr><td>BLK BY MODE</td><td>Blocked by Mode</td></tr>
<tr><td>BLK BY PROCESS</td><td>Blocked by process</td></tr>
<tr><td>BLK BY INK</td><td>Blocked by interlocking</td></tr>
<tr><td>BLK BY SYN</td><td>Blocked by synchrocheck</td></tr>
<tr><td>BLK BY CMD INPRG</td><td>Command already in execution</td></tr>
<tr><td>BLK BY HEALTH</td><td>Blocked by health</td></tr>
<tr><td>BLK BY 1 OFN</td><td>1 of n control</td></tr>
<tr><td>BLK BY CANCEL</td><td>Abortion by cancel</td></tr>
<tr><td>BLK BY TLMT OVER</td><td>Time limit over</td></tr>
<tr><td>BLK BY TRIP</td><td>Abortion by trip</td></tr>
<tr><td>BLK BY NOT SEL</td><td>Object not selected</td></tr>
<tr><td>BLK BY ALR SEL</td><td>Object already selected</td></tr>
<tr><td>BLK BY AUTHORITY</td><td>No access authority</td></tr>
<tr><td>BLK BY OVERSHOOT</td><td>Ended with overshoot</td></tr>
<tr><td>BLK BY DEVIATION</td><td>Abortion due to deviation</td></tr>
<tr><td>BLK BY CMMLOSS</td><td>Abortion by command loss</td></tr>
<tr><td>BLK BY CMDBLK</td><td>Blocked by command</td></tr>
<tr><td>NONE</td><td>None</td></tr>
<tr><td>BLK BY NCNST PRM</td><td>Inconsistent parameters</td></tr>
<tr><td>BLK BY OTER CLT</td><td>Locked by other client</td></tr>
</table>
</td></tr>
</table>

(ix) Setting names

Table 2.10-12 Setting of SBO control in DPSY

Setting Name	Description	Default	Setting item or value
DPSY01-CTREN	Activate control function	Close	Open / Close
DPSY01-LGSLFFCT	Logic selector for select condition	Fixedlogic	Fixedlogic / PLC
DPSY01-CTRAHMI	Activate local panel control	SBO	DIR / SBO
DPSY02-CTREN	Activate control function	Close	Open / Close
DPSY02-LGSLFFCT	Logic selector for select condition	Fixedlogic	Fixedlogic / PLC
DPSY02-CTRAHMI	Activate local panel control	SBO	DIR / SBO

2.10.2 Cancel logic for SBO mode

In the SBO control mode, the reception of a cancel command is possible; when the cancel conditions are satisfied, accordingly, the IED can discard the select command; finally, the operation returns to the initial stage (i.e., "Wait for a command".)

(i) Receiving "Cancel" from the remote-end

Figure 2.10-14 depicts the cancel command procedure for a cancel command initiated from the remote-end.

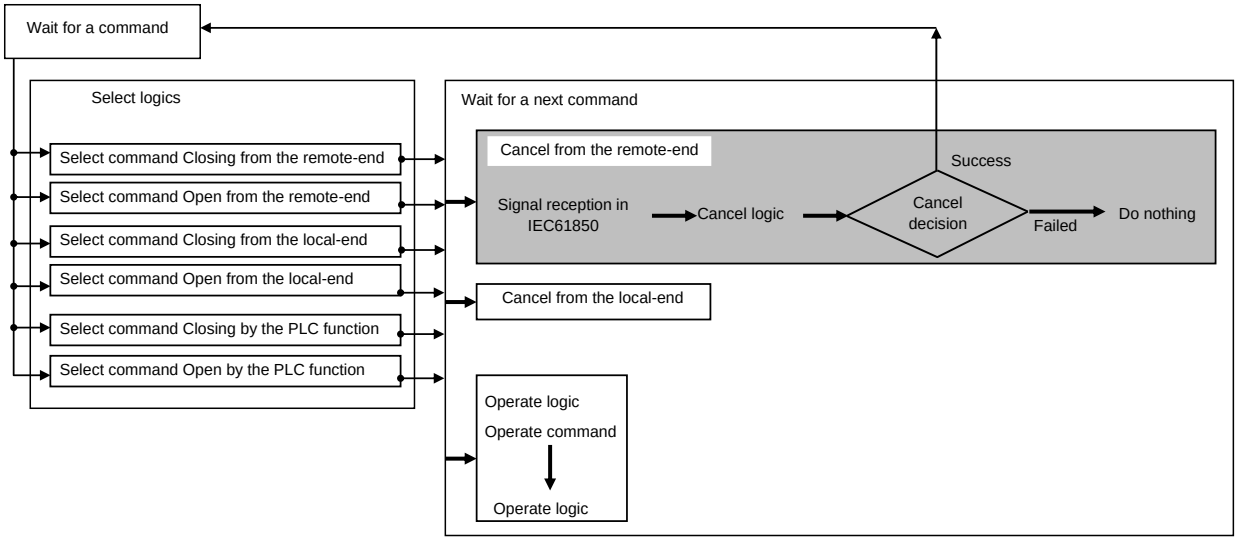


Figure 2.10-14 Outline of 'cancel' command from the remote-end

(i)-1 Input point required mapping

Figure 2.10-15 depicts the cancel logic when a "Cancel command (Remote-Cancel)" signal is applied to the DPSY01 function. The input-point "DEV01_CONTROL_REQ" is the same as that for the signal "Select command Closing (Remote-Closing-Control)".

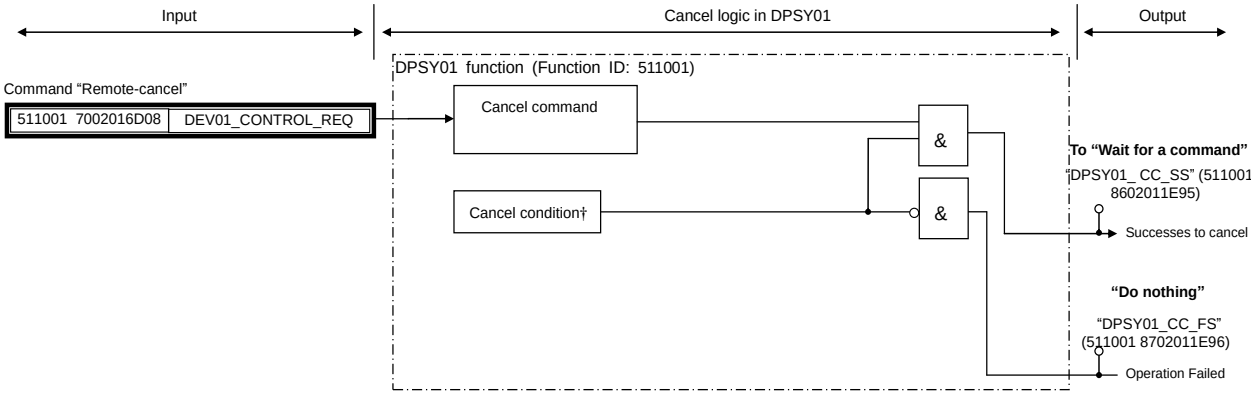


Figure 2.10-15 'Cancel' from the remote-end in DPSY01

†Note: The "cancel condition" logic is shown in Figure 2.10-18.

(i)-2 Output signal to BO

The DPSY01 function can issue a "Success to cancel" signal at the monitoring point "DPSY01_CC_SS", when the DPSY01 function has determined that the "Remote-cancel" signal is true. Another "Operation failed" signal is issued at monitoring point DPSY01_CC_FS" "if the DPSY01 function is able to determine that the "Remote-cancel" signal is not true.

(ii) Receiving "Cancel" from the local-end

Figure 2.10-16 outlines the reception of the cancel command from the local-end.

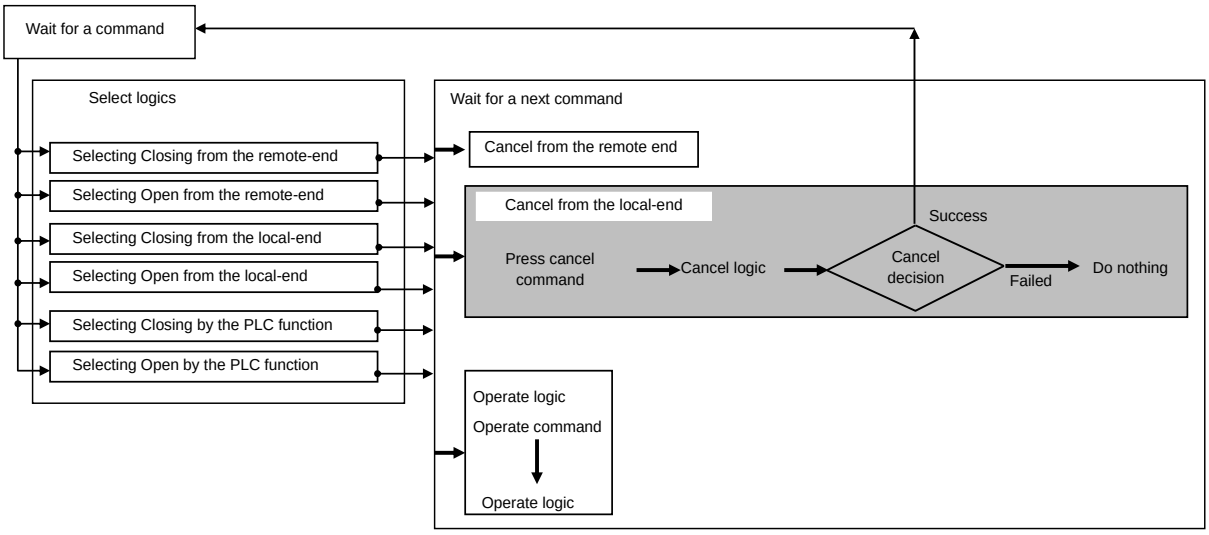


Figure 2.10-16 Outline of 'cancel' command from the local-end

(ii)-1 Input signal generated at the local-end

Figure 2.10-17 depicts the cancel logic when a "Cancel command (Local-cancel)" signal is applied to the DPSY01 function. The signal is generated when the "Cancel" key is pressed on the IED front panel; the user is not required to take account of mapping. When the logic receives the "Local-cancel" signal, the logic is able to output a result signal, provided that the "cancel condition" checking is satisfied.

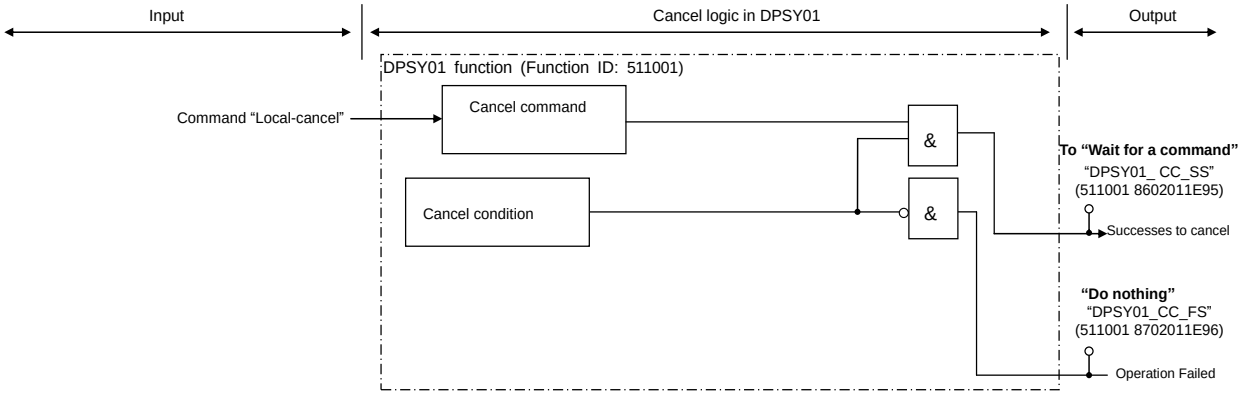


Figure 2.10-17 'Cancel' from the front panel

(ii)-2 Output signal to BO

The DPSY01 function, illustrated in Figure 2.10-17, is able to issue a "Select to cancel" signal at the monitoring point "DPSY01_CC_SS", when the DPSY01 function determines that the "Local-Cancel" signal is true.

(iii) Cancel condition logic

Figure 2.10-18 shows the cancel condition logic. As the criteria "Unmatched condition detected" is connected normally for the cancel logic, set **Fixlogic** for the scheme switch [**DPSY01-LGCNFFCT**].

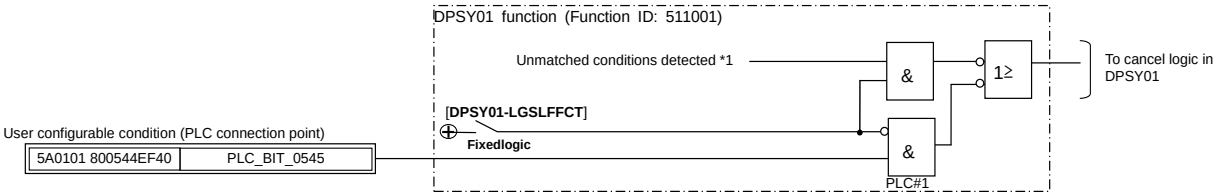


Figure 2.10-18 Logic "Cancel condition" in DPSY01

[1]Note: The criteria "unmatched conditions" are determined when the "Test-bit status" in the 'cancel' command is not identical to the "IED test status".

[2]Note: With the exception of the above 'cancel' logic, there is an operate-condition logic within the DPSY01 function; the operate-condition logic will always checks conditions. That is, the user is only required to set either the "operate-condition" or the "cancel-condition" logic.

If the original logic does not meet with the requirements of the user, it can be replaced using the connection point "User configurable condition":

1. Connect the user-customized logic with the "PLC_BIT_0545", which is listed in Table 2.10-13.
2. Set scheme switch [**DPSY01-LGCNFFCT**] to **PLC**.

(iv) Signal name and number

Note: The user should note the following descriptions shown in the column "M/O" in each table:

"O" indicates that the signal is provided for optional usage.

"M" indicates that the user should map/set/configure using the signal; otherwise, the user may experience an operational failure for the default settings.

"N/A" indicates that the user cannot change the state of the signal.

Table 2.10-13 PLC connection points (Input signal for 'cancel' condition)

Signal Number	Signal Name	Description	M/O
5A0101 800544EF40	PLC_BIT_0545	DPSY1 user configurable cancel condition	O
5A0101 800567EF40	PLC_BIT_0568	DPSY2 user configurable cancel condition	O

Table 2.10-14 PLC monitoring points (Output signal for 'cancel' condition)

Signal Number	Signal Name	Description
511001 8602011E95	DPSY01_CC_SS	DPSY1 cancel succeed
511001 8602021E95	DPSY02_CC_SS	DPSY2 cancel succeed
511001 8702011E96	DPSY01_CC_FS	DPSY1 cancel failed
511001 8702021E96	DPSY02_CC_FS	DPSY2 cancel failed

(v) Setting name

Note: The "xx" within "DPSYxx" represents the DPSY function number. (e.g., if DPSY01 is considered, the "xx" is equal to "01". The numbers used for "xx" can be represented by either "01" or "02".)

Table 2.10-15 Setting for 'Cancel' in DPSYxx

Setting Name	Description	Default	Setting item or value
DPSYxx-LGCNFFCT	Logic selector for cancel condition (DPSY01-02)	Fixedlogic	Fixedlogic / PLC

2.10.3 Operate logic for SBO/DIR modes

Once the operation of the select logic is complete, the operate logic start to control the device.

(i) Receiving "operate command Closing" from the remote-end

Figure 2.10-19 depicts the reception of the operate command 'Closing' from the remote-end.

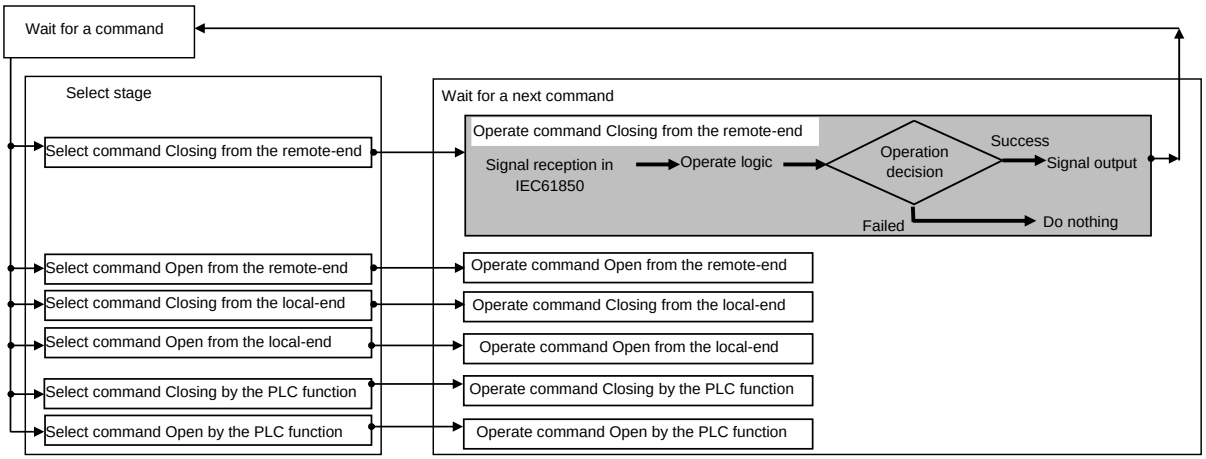


Figure 2.10-19 Outline of operate command 'Closing'

(i)-1 Mapping required for Input point

Figure 2.10-20 illustrates the operate logic when an "Operate command (Remote-Closing-Control)" signal is applied to the DPSY01 function. The input-point "DEV01_CONTROL_REQ" is used for the reception of the "Operate command Closing (Remote-Closing-Control)".

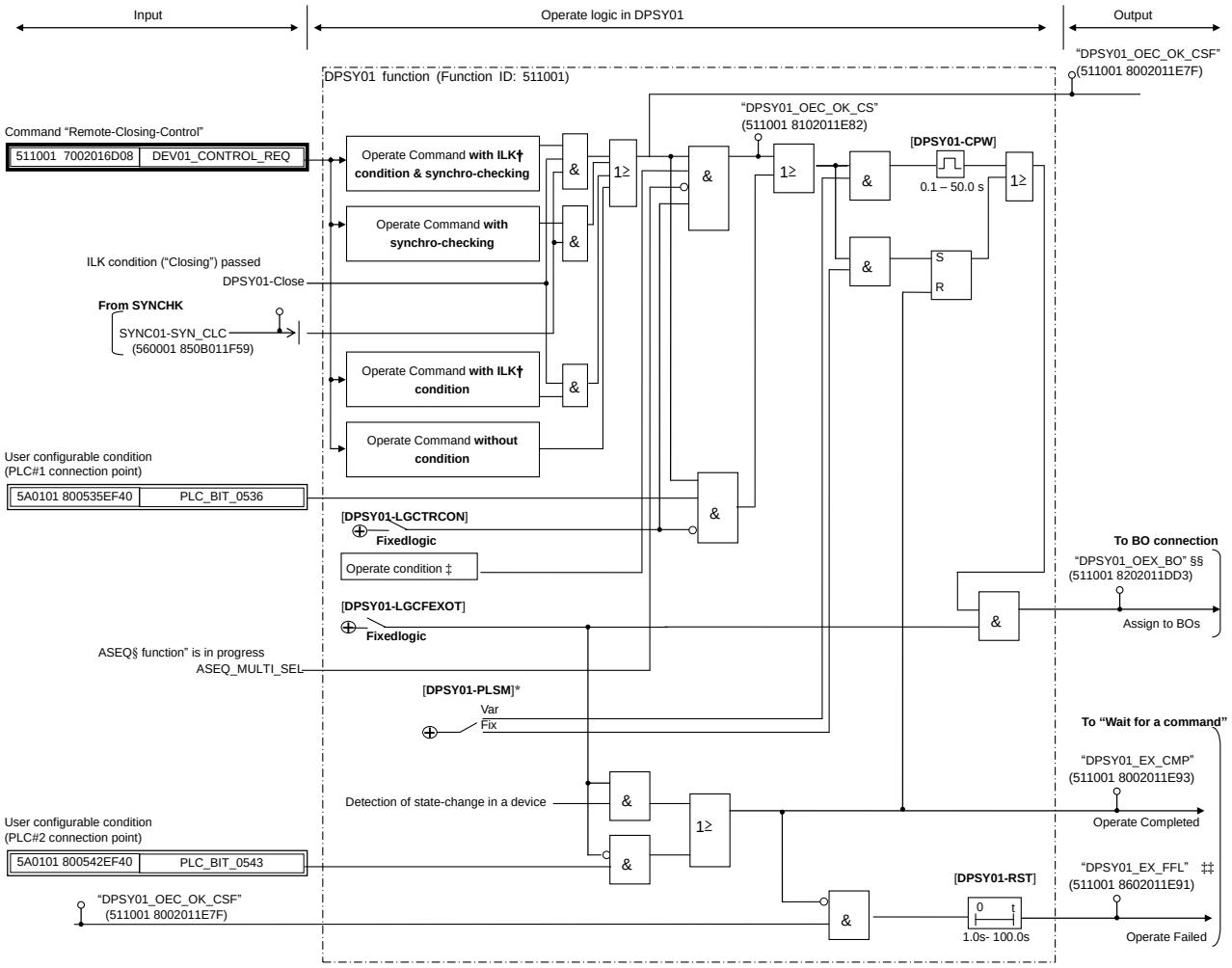


Figure 2.10-20 Operate 'Closing' from the remote-end in DPSY01††

†Note:The ILK function can provide the operation criteria for "Closing".

‡Note:An "operate condition" signal is generated in the operate-condition logic (see Figure 2.10-31) when **Fixlogic** is set for scheme switch [**DPSY01-LGCTRCON**]. If an alternative "operate-condition" is required, it can be programmed by the user and used to replace the signal generated by the original operated-condition logic. The alternative "operate-condition" can be connected to the above logic using connection point #1 "User-configurable condition". That is, set the scheme switch [**DPSY01-LGCTRCON**] to **PLC** and use "PLC_BIT_0536".

§Note:The ASEQ function can provide sequential signals for automatic control.

§§Note: The signal "DPSY01_OEX_BO" is issued when **Fixlogic** is set for scheme switch [**DPSY01-LGCFEXOT**]. The "Operate completed" signal can also be issued from logic programmed by the user, in place of the logic shown in Figure 2.10-20. The user-programmed logic is connected internally to the signal "Operate completed", hence this signal is now generated by the user-programmed logic at connection point #2 "User-configurable condition". That is, set the scheme switch [**DPSY01-LGCFEXOT**] to **PLC** and use "PLC_BIT_0543".

*Note:The user can set the type of the output signal. When **Var** is set for scheme switch [**DPSY01-PLSM**], the output period of the signal is defined by the setting [**DPSY01-CPW**]. When **Fix** is set, the signal ceases when the 43-switch is changed.

††Note: To identify the input and output signal-points of the DPSY02 logic, see Table 2.10-16 for PLC#1, Table 2.10-17 for PLC#2, Table 2.10-21, and Table 2.10-22 for output signals.

‡‡Note: The "Operate failed" signal is issued when the state-change is not detected when the time set by the [**DPSY01-RST**] has been reached.

(i)-2 Output signal to BO

The DPSY01 function, in Figure 2.10-20, can issue an "Operate" signal at the output point "DPSY01_OEX_BO", when the DPSY01 function determines that the received signal "Remote-Closing-Control" is true.

(ii) Receiving "operate command Open" from the remote-end

Figure 2.10-21 depicts the reception of the operate command 'Open' from the remote-end.

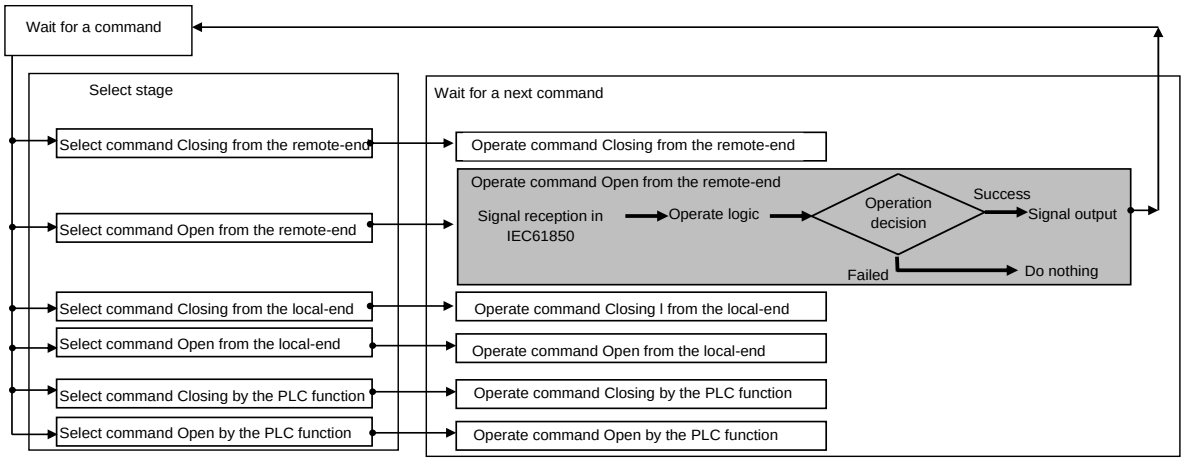


Figure 2.10-21 Outline of operate command 'Open'

(ii)-1 Mapping required for Input point from communication

Figure 2.10-22 illustrates the operate logic when an "Operate command (Remote-Open-Control)" signal is applied to the DPSY01 logic. The input-point "DEV01_CONTROL_REQ" is used for the reception of the "Operate command Open (Remote-Open-Control)".

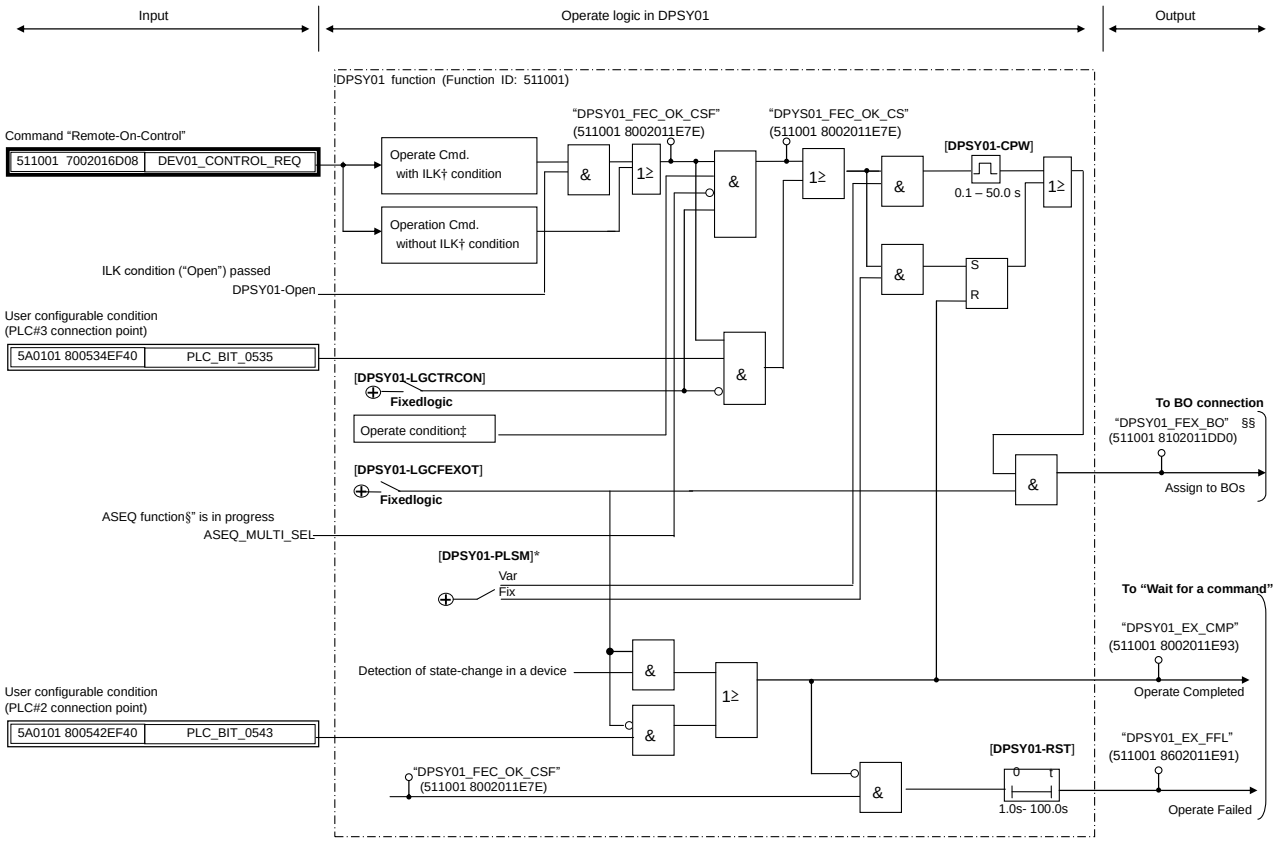


Figure 2.10-22 'Open' operate from the remote-end in DPSY01††

†Note:The ILK function can provide the operation criteria for "Open".

‡Note:An "operate condition" signal is generated in the operate-condition logic (see Figure 2.10-31) when **Fixlogic** is set for scheme switch [**DPSY01-LGCTRCON**]. If an alternative "operate-condition" is required, it can be programmed by the user and used to replace the signal generated by the original operated-condition logic. The alternative "operate-condition" can be connected to the above logic using connection point #3 "User-configurable condition". That is, set the scheme switch [**DPSY01-LGCTRCON**] to **PLC** and use "PLC_BIT_0535".

§Note:The ASEQ function can provide sequential signals for automatic control.

§§Note: The signal "DPSY01_OEX_BO" is issued when **Fixlogic** is set for scheme switch [**DPSY01-LGCFEXOT**]. The "Operate completed" signal can also be issued from logic programmed by the user, in place of the logic shown in Figure 2.10-20. The user-programmed logic is connected internally to the signal "Operate completed", hence this signal is now generated by the user-programmed logic at connection point #2 "User-configurable condition". That is, set the scheme switch [**DPSY01-LGCFEXOT**] to **PLC** and use "PLC_BIT_0543".

*Note:The user can set the type of output signal. When **Var** is set for scheme switch [**DPSY01-PLSM**], the output period of the signal is defined by the setting [**DPSY01-CPW**]. When **Fix** is set, the signal ceases when the 43-switch is changed.

††Note: To identify the input and output signals of the DPSY02 logic, see Table 2.10-17

for PLC#2, Table 2.10-18 for PLC#3, Table 2.10-20, and Table 2.10-22 for the outputs.

(ii)-2 Output signal to BO

The DPSY01 function, in Figure 2.10-22, can issue an "Operate" signal at the output-point "DPSY01_FEX_BO", when the DPSY01 function determines that the input signal "Remote-Open-Control" is true.

(iii) Receiving "operate command Closing" from the local-end

Figure 2.10-23 depicts the reception of the operate command 'Closing' from the local-end.

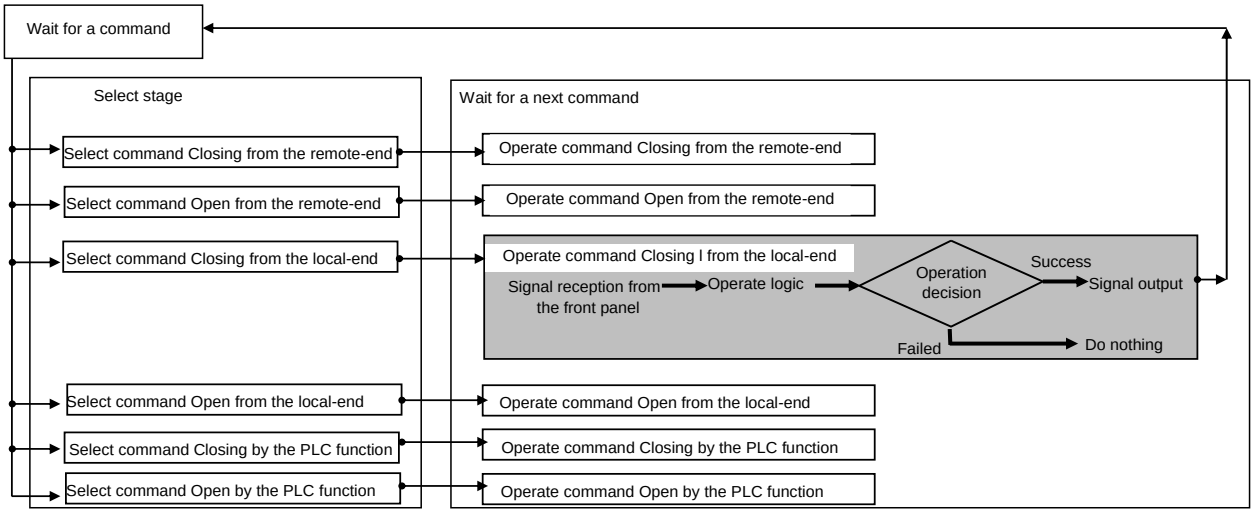


Figure 2.10-23 Outline of operate command Closing

(iii)-1 Input signal generated at the local-end

Figure 2.10-24 illustrates the operate logic when an "Operate command Closing (Local-Closing-Control)" signal is applied to the DPSY01 function. The signal is generated when "Execution of Closing" is keyed on the IED front panel.

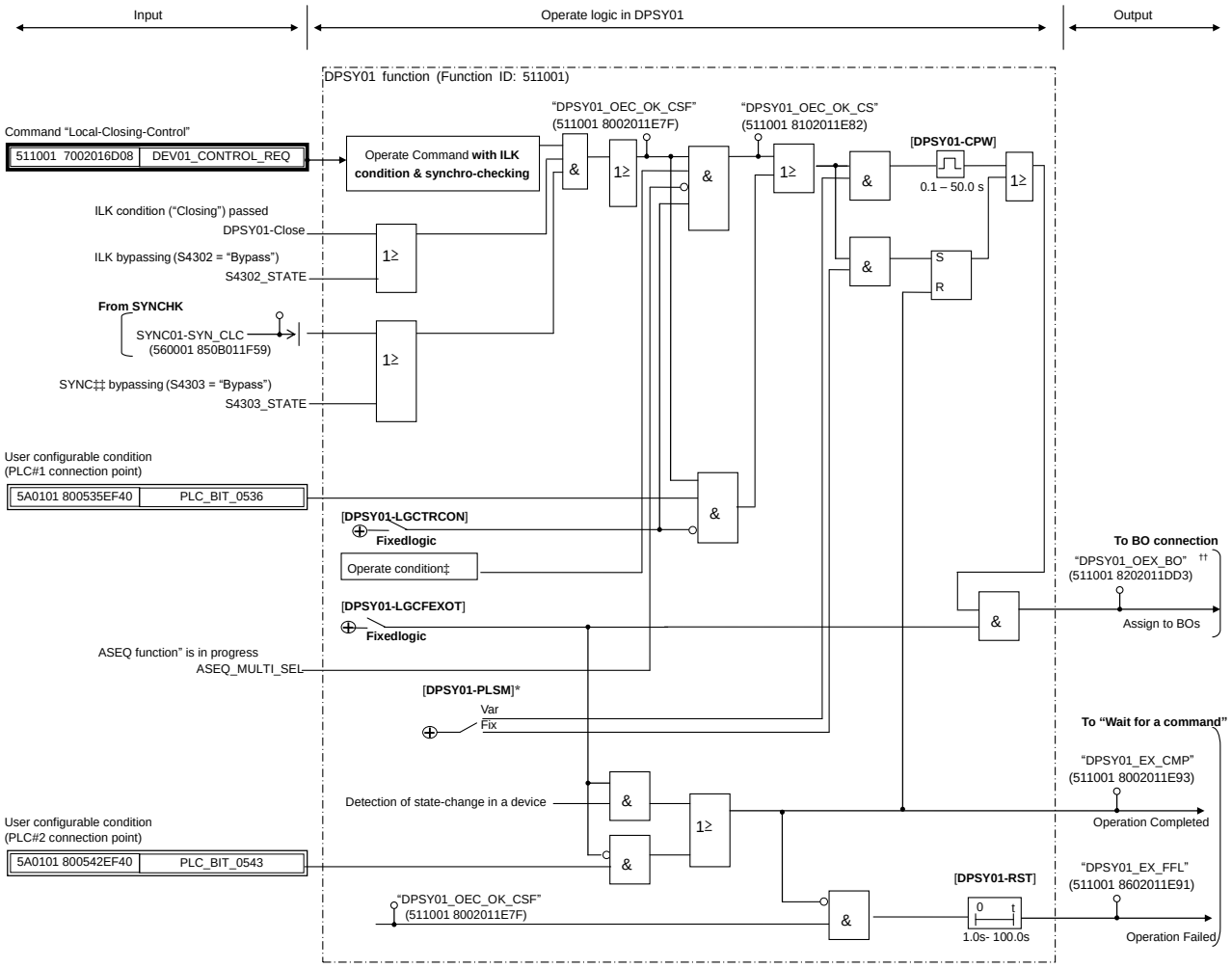


Figure 2.10-24 Operate closing on the front panel in DPSY01

†Note:The ILK function can provide the operation criteria for "Closing".

‡Note:An "operate condition" signal is generated in the operate-condition logic (see Figure 2.10-31) when **Fixlogic** is set for scheme switch [**DPSY01-LGCTRCON**]. If an alternative "operate-condition" is required, it can be programmed by the user and used to replace the signal generated by the original operated-condition logic. The alternative "operate-condition" can be connected to the above logic using connection point #1 "User-configurable condition". That is, set the scheme switch [**DPSY01-LGCTRCON**] to **PLC** and use "PLC_BIT_0536".

§Note:The ASEQ function can provide sequential signals for automatic control.

§§Note: The signal "DPSY01_OEX_BO" is issued when **Fixlogic** is set for scheme switch [**DPSY01-LGCFEXOT**]. The "Operate completed" signal can also be issued from logic programmed by the user in place of the logic shown in Figure 2.10-20., The user-programmed logic is connected internally to the signal "Operate completed", hence this signal is now generated by the user-programmed logic at connection point #2 "User-configurable condition". That is, set the scheme switch [**DPSY01-LGCFEXOT**] to **PLC** and use "PLC_BIT_0543".

*Note:The user can set the type of output signal. When **Var** is set for scheme switch [**DPSY01-PLSM**], the output period of the signal is defined by the setting [**DPSY01-CPW**]. When **Fix** is set, the signal ceases when the 43-switch is changed.

††Note: To identify the input and output signal-points of the DPSY02 logic, see Table 2.10-16 for PLC#1, Table 2.10-17 for PLC#2, Table 2.10-21, and Table 2.10-22 for output signals.

‡‡Note: The "Operate failed" signal is issued when the state-change is not detected until after reaching the time set by the [**DPSY01-RST**].

(iii)-2 Output signal to BO

The DPSY01 function, in Figure 2.10-24, can issue an "Operate" signal at the output point "DPSY01_OEX_BO", if the DPSY01 function determines that the signal "Local-Closing-Control" is true.

(iv) Receiving "operate command Open" from front panel

Figure 2.10-25 depicts the reception of the operate command for 'Open' from the front panel. These input and output signals and the procedure are highlighted in the figure below.

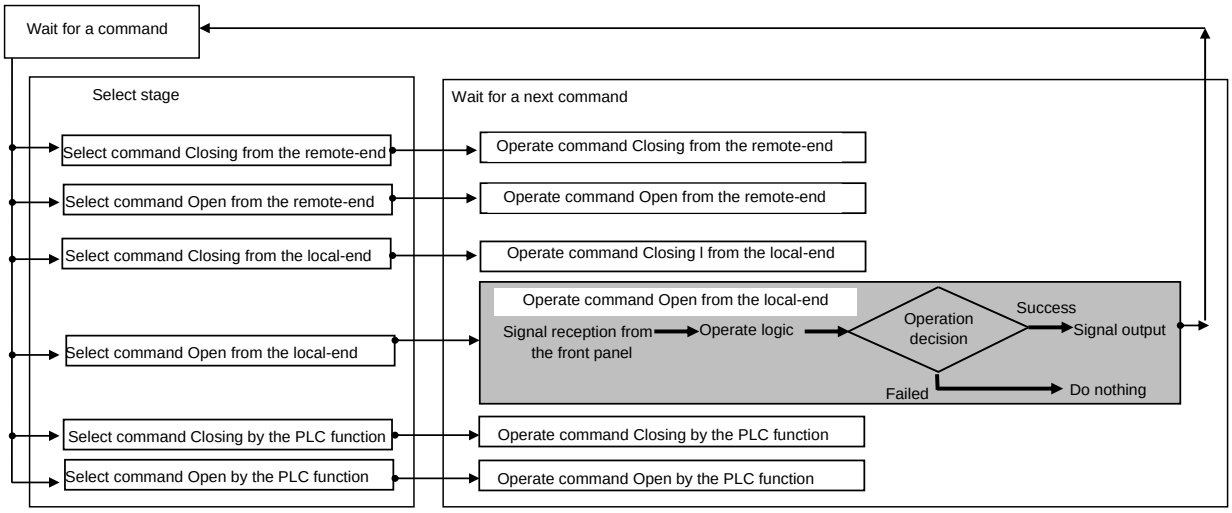


Figure 2.10-25 Outline of operate command Open

(iv)-1 Input signal generated at the local-end

Figure 2.10-26 illustrates the operate logic when an "Operate command Open (Local-Open-Control)" signal is applied to the DPSY01 function. The signal is generated when "Execution for Open" is keyed on the IED front panel.

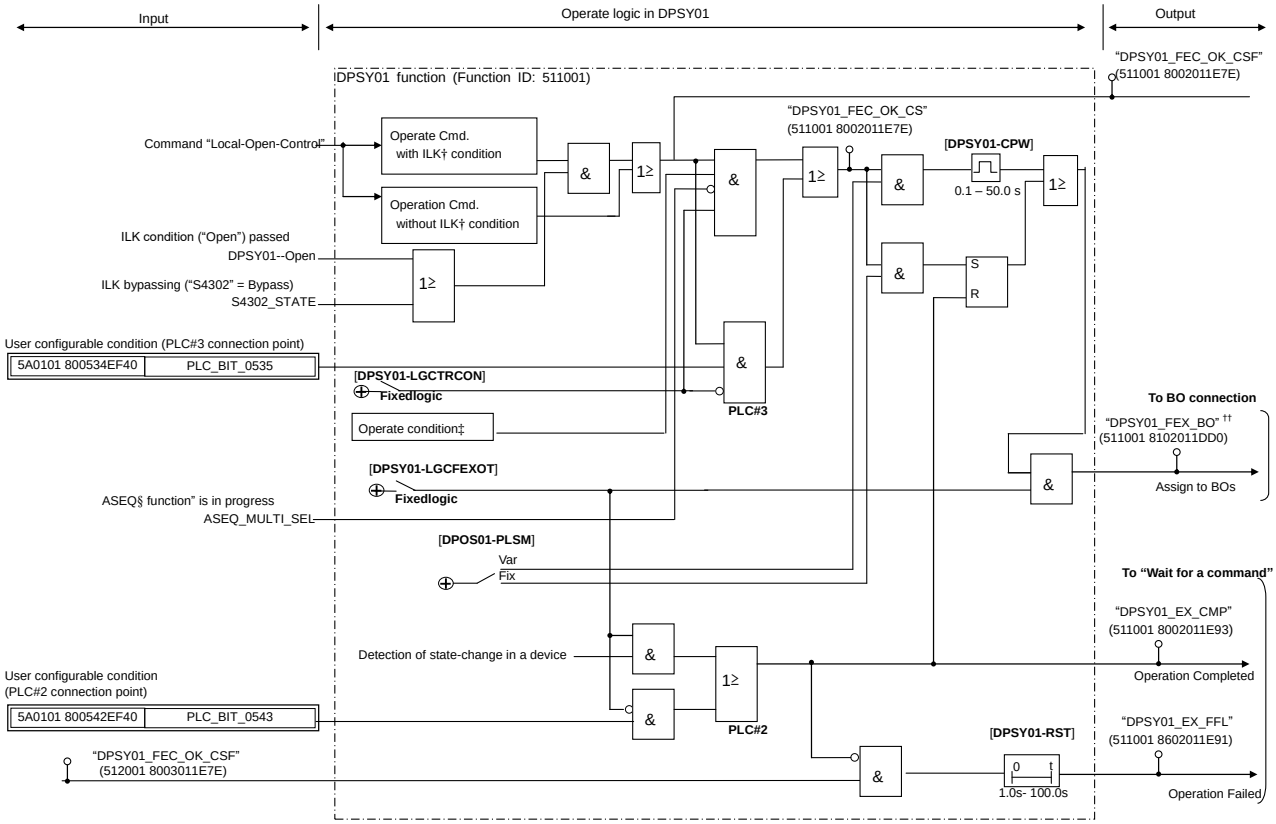


Figure 2.10-26 Operate Open logic at local in DPSY01

†Note:The ILK function can provide the operation criteria for "Open".

‡Note:An "operate condition" signal is generated in the operate-condition logic (see Figure 2.10-31) when **Fixlogic** is set for scheme switch [**DPSY01-LGCTRCON**]. If an alternative "operate-condition" is required it can be programmed by the user and used to replace the signal generated by the original operated-condition logic. The alternative "operate-condition" can be connected to the above logic using connection point #3 "User-configurable condition". That is, set the scheme switch [**DPSY01-LGCTRCON**] to **PLC** and use "PLC_BIT_0535".

§Note:The ASEQ function can provide sequential signals for automatic control.

§§Note: The signal "DPSY01_OEX_BO" is issued when **Fixlogic** is set for the scheme switch [**DPSY01-LGCFEXOT**]. The "Operate completed" signal can also be issued from the logic programmed by the user in place of the logic shown in Figure 2.10-20. The user-programmed logic is connected internally to the signal "Operate completed", hence this signal is now generated by the user-programmed logic at connection point #2 "User configurable condition". That is, set the scheme switch [**DPSY01-LGCFEXOT**] to **PLC** and use "PLC_BIT_0543".

*Note:The user can set the type of output signal. When **Var** is set for scheme switch [**DPSY01-PLSM**], the output period of the signal is defined by the setting [**DPSY01-CPW**]. When **Fix** is set, the signal ceases when the 43-switch is changed.

††Note: To identify the input and output signals of the DPSY02 logic, see Table 2.10-17

for PLC#2, Table 2.10-18 for PLC#3, Table 2.10-20, and Table 2.10-22 for the outputs.

(iv)-2 Output signal to BO

The DPSY01 function, in Figure 2.10-31, can issue an "Operate" signal at the output point "DPSY01_FEX_BO", when the DPSY01 function determines that the signal "Local-Open-Control" is true.

(v) Receiving "operate command Closing" using the PLC logic

Figure 2.10-27 outlines the reception of the operate command closing with the PLC function.

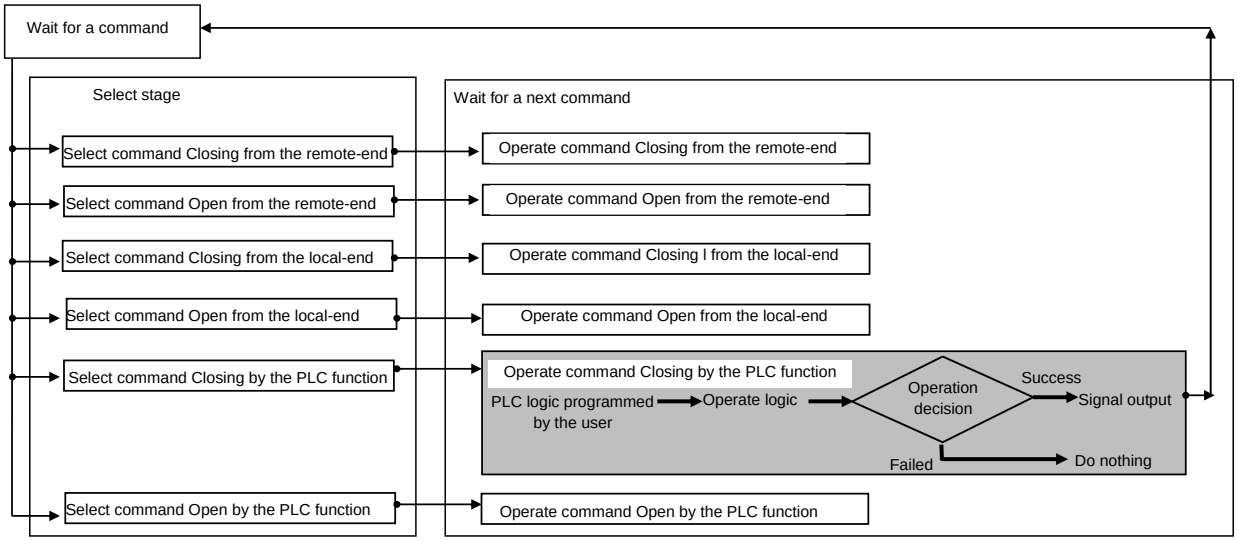


Figure 2.10-27 Outline of operate command closing

(v)-1 Input signal from the PLC function

Figure 2.10-28 describes the operate logic when an "Operate command Closing (PLC-Closing-Control)" signal is generated by the PLC function. There are four input points for reception of the signal "operate command closing". The input point is selected in accordance with one of the following four conditions: for the first condition, the issue of the operate command to the device is decided in coordination with checks for both the ILK and the SYNCHK functions, the signal is applied at connection point (PLC#1: i.e., "PLC_BIT_0528") (Table 2.10-3). For the second condition, the issue of the operate command for the device is determined in coordination with a check using the SYCHK function only, the signal is applied at connection point ("PLC#2: i.e., "PLC_BIT_0527") (Table 2.10-3). If the third condition is used, the issue of the operate command for the device is determined in coordination with a check using the ILK function only, apply the signal at connection point ("PLC#3: i.e., PLC_BIT_0526") (Table 2.10-3). Regarding the fourth condition, the issue of the operate command to the device is made with no check, the signal is applied at connection point ("PLC#4: i.e., PLC_BIT_0525") (Table 2.10-3). Note that the user should set **PLC** for scheme switch [**DPSY-LGCTRCON**].

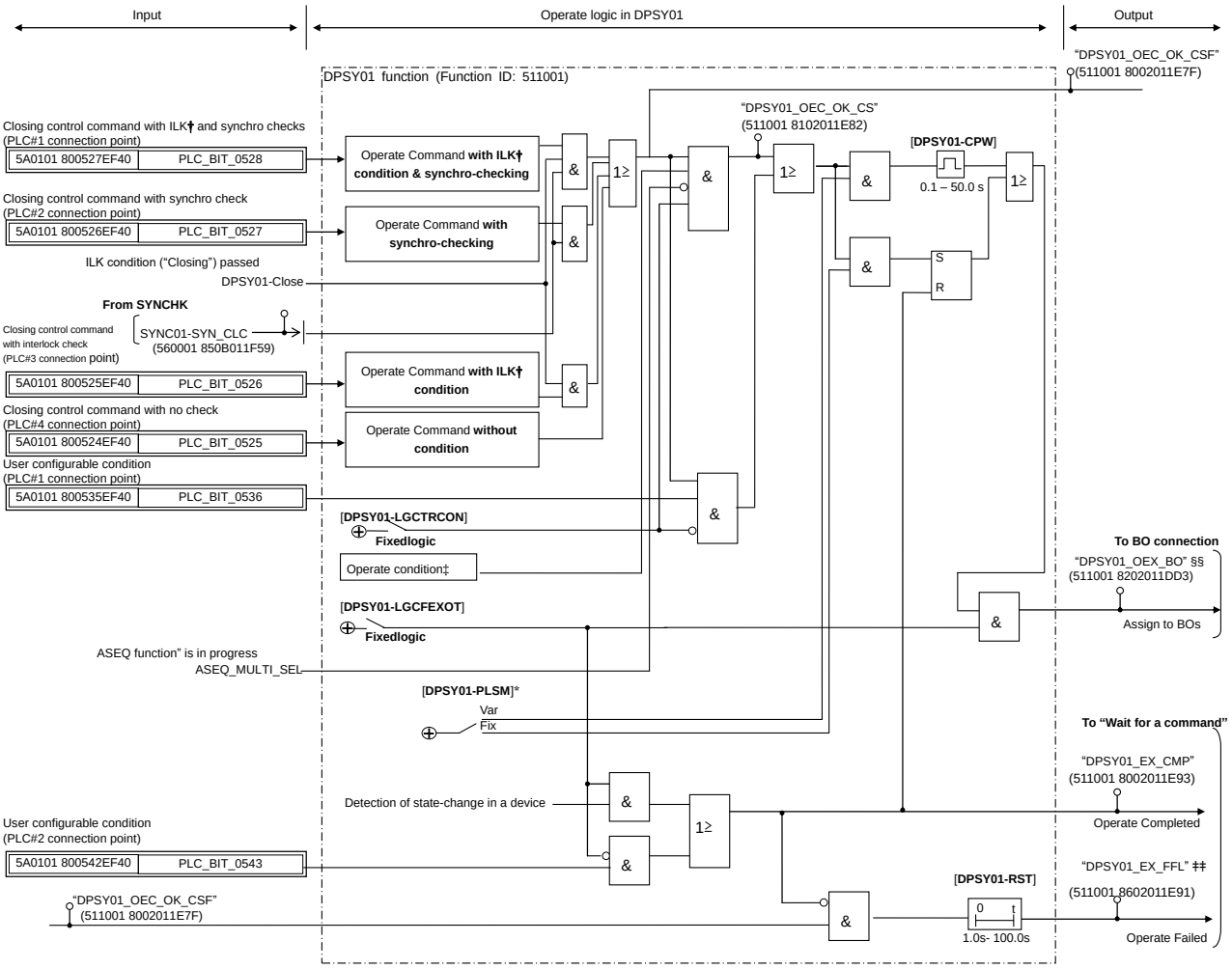


Figure 2.10-28 Closing operation logic with PLC in DPSY01††

†Note:The ILK function can provide the criteria for operation for "Closing" control.

‡Note:An "operate condition" signal is generated in the operate-condition logic (see Figure 2.10-31) when **Fixlogic** is set for scheme switch [**DPSY01-LGCTRCON**]. If an alternative "operate-condition" programmed by the user is required in place of the signal generated by the original operated-condition logic, connect the alternative "operate-condition" to the logic shown in Figure 1.10-28 using connection point #1 "User-configurable condition". That is, set the scheme switch [**DPSY01-LGCTRCON**] to **PLC** and use "PLC_BIT_0536".

§Note:The ASEQ function can provide sequential signals for automatic control.

§§Note: The signal "DPSY01_OEX_BO" is issued when **Fixlogic** is set for scheme switch [**DPSY01-LGCFEXOT**]. If the signal to be issued from the logic programmed by the user instead of the logic shown in Figure 2.10-20, connect the signal "Operate completed" generated in the user-programmed logic to connection point #2 "User configurable condition". That is, set the scheme switch [**DPSY01-LGCFEXOT**] to **PLC** and use "PLC_BIT_0543".

*Note:The user can set the type of output signal. When **Var** is set for scheme switch

[**DPSY01-PLSM**], the output period of the signal is defined by the setting applied to [**DPSY01-CPW**]. When **Fix** is set, the signal ceases when the 43-switch is changed.

††Note: To identify the input and output signal-points in the DPSY02 logic, see Table 2.10-3 and Table 2.10-4 for PLC#1 to PLC#4, Table 2.10-16 and Table 2.10-17 for PLC#1/#2 for user configurable conditions, Table 2.10-21, and Table 2.10-22 for the outputs.

‡‡Note: The "Operate failed" signal is issued when a state-change remains undetected following expiration of the setting applied to timer [**DPSY01-RST**].

(v)-2 Output signal to BO

The DPSY01 function, in Figure 2.10-28, can issue an "Operate" signal at output point "DPSY01_OEX_BO", when the DPSY01 function determines that the "PLC-Closing-Control" signal is true.

(vi) Receiving "operate command Open" using PLC logic

Figure 2.10-29 depicts the reception of the operate command for Open using the PLC function. These input and output signals and the process are highlighted in the figure below.

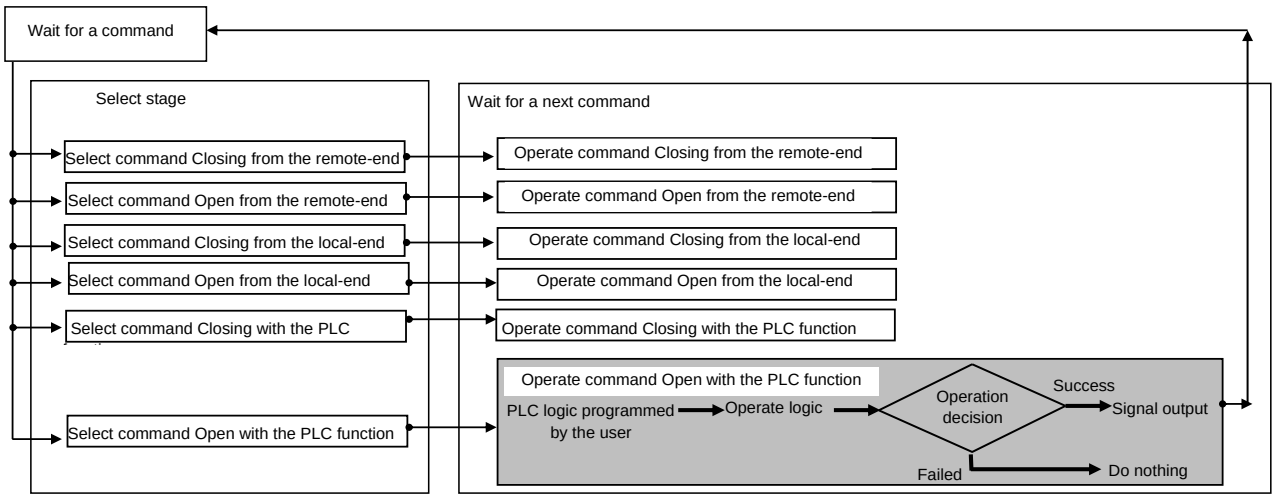


Figure 2.10-29 Outline of operate command for Open

(vi)-1 Input signal from the PLC function

Figure 2.10-30 depicts the operate logic when an "Operate command Open (PLC-Open-Control)" signal is generated by the PLC function. There are two points for reception of this command signal, unlike the signal ("Operate command Closing (PLC-Closing-Control)". That is, if an interlock check is required, apply the signal at connection point ("PLC#4: i.e., PLC_BIT_0524"). If, on the other hand an interlock check is not required, apply the signal at connection point ("PLC#5: i.e., PLC_BIT_0523"). PLC#1 and PLC#2 shown in Table 2.10-4 should be treated as PLC#3 and PLC#4 here.

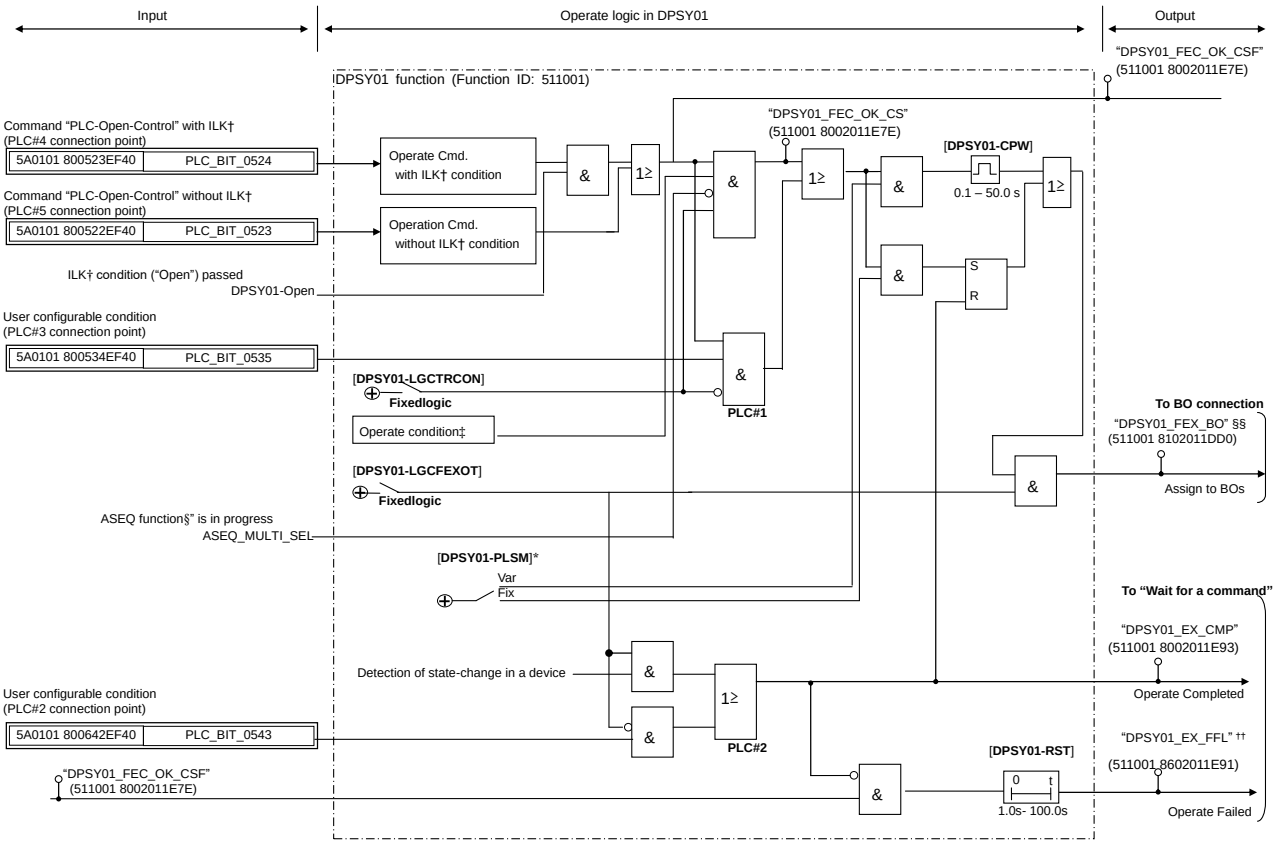


Figure 2.10-30 Open operation logic by PLC in DPSY01††

†Note:The ILK function can provide the criteria for operation for control of the "Open" operation.

‡Note:An "operate condition" signal is generated in the operate-condition logic (see Figure 2.10-31) when **Fixlogic** is set for scheme switch [**DPSY01-LGCTRCON**]. If an alternative "operate-condition" programmed by the user is required in place of the signal generated by the original operated-condition logic, connect the alternative "operate-condition" to the logic shown in Figure 1.10-30 using connection point #3 "User-configurable condition". That is, set the scheme switch [**DPSY01-LGCTRCON**] to **PLC** and use "PLC_BIT_0535".

§Note:The ASEQ function can provide sequential signals for automatic control.

§§Note: The signal "DPSY01_OEX_BO" is issued when **Fixlogic** is set for the scheme switch [**DPSY01-LGCFEXOT**]. If the signal to be issued from the programmed logic by the user in place of Figure 2.10-20 logic, connect the signal "Operate completed" generated in the programmed logic to the connection point #2 "User configurable condition". That is, the set the scheme switch [**DPSY01-LGCFEXOT**] to **PLC** and use "PLC_BIT_0543".

*Note:The user can set the type of the output signal. When **Var** is set for scheme switch [**DPSY01-PLSM**], the output period of the signal is defined by the setting applied to [**DPSY01-CPW**]. When **Fix** is set, the signal ceases when the 43-switch is changed.

††Note: To identify the input and output signal-points in the DPSY02 logic, see Table 2.10-17 for PLC#2, Table 2.10-18 for PLC#3, Table 2.10-20, and Table 2.10-22 for the outputs.

(vi)-2 Output signal to BO

The DPSY01 function, in Figure 2.10-30, can issue an "Operate" signal at output-point "DPSY01_FEX_BO", when the DPSY01 function determines that the "PLC-Open-Control" signal is true.

(vii) Operate condition

In a manner similar to which the conditions have been examined for the select command, the conditions for an operate command should be understood. Figure 2.10-31 illustrates the logic to examine an operate condition; the operate condition is determined by signal "DPSY01_STATE". If the functionality of the original logic does not meet with user-requirements, the following alternatives are available:

3. The user can replace the original logic with alternative logic.
4. The user can add another signal to the original logic.

(vii)-1 Replacing the original logic

If the user wishes to replace the operate condition logic completely, it can be achieved using PLC connection point "User configurable condition":

1. Connect the user-customized logic using PLC-BIT-0540, listed as PLC#2 in Table 2.10-19.
2. Set scheme switch [**DPSY01-LGEXFFCT**] to **PLC**.

(vii)-2 Adding another operate condition signal

If the addition of another operate condition is required, the user can add the signal to the operate condition logic using PLC connection point "Additional condition":

1. Add a user-preferred signal using "PLC-BIT-0539", listed as PLC#1 in Table 2.10-19.
2. Set scheme switch [**DPSY01-LGEXFFCT**] to **Fixedlogic**. (Table 2.10-24)

Note: The user must program PLC logic "Control hierarchy condition". The Control hierarchy condition to be provided with the user-programmed PLC logic may be 43R/L; it may be connected using PLC connection point "PLC_BIT_0517" in Figure 2.10-31.

Note: The output of the operate condition logic is provided separately for Closing-execution and for Open-execution. To see the outputs, refer to Table 2.10-20.

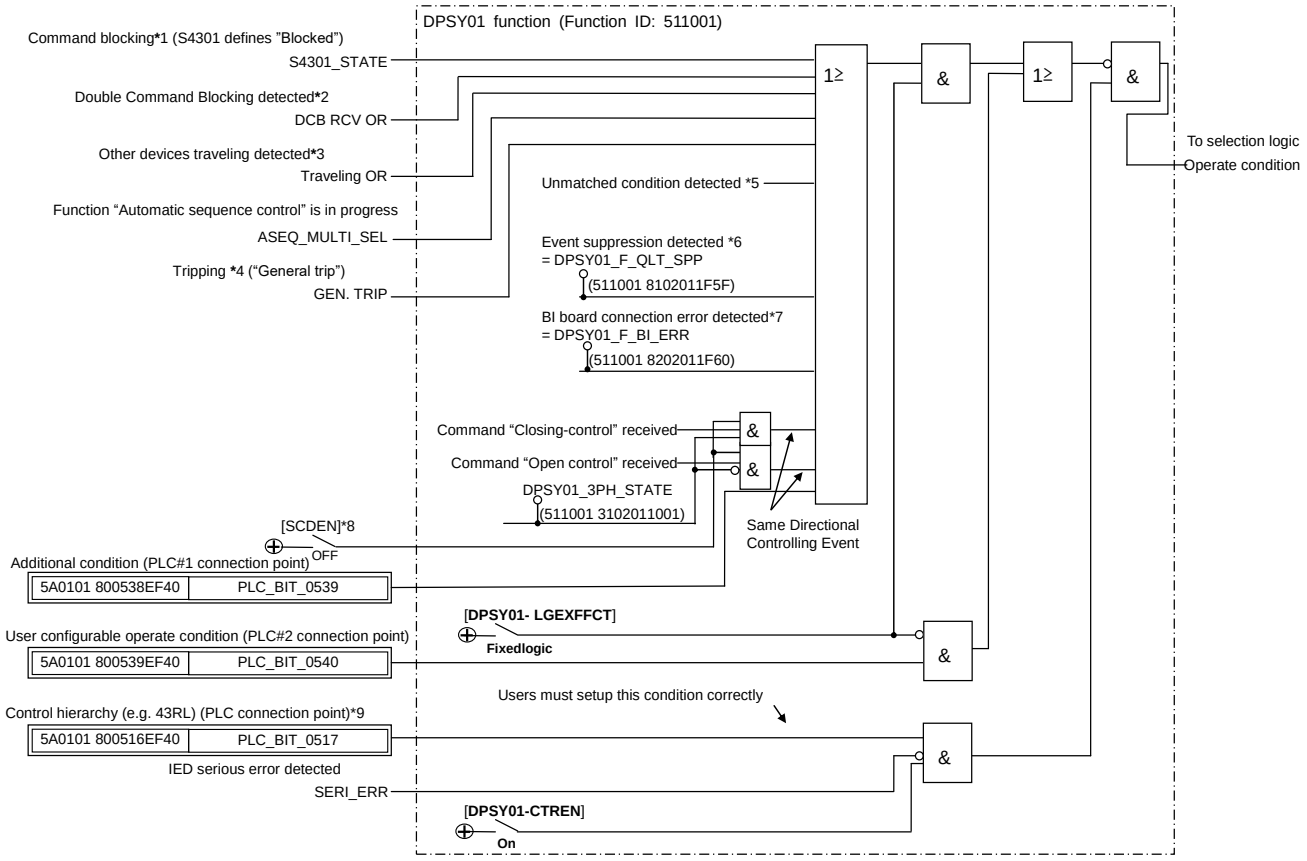


Figure 2.10-31 Operate condition logic for 'Closing/Open' in DPSY01

[1]Note: "Command Blocking" disables any operation except for itself; "Command Blocking" is implemented as "S4301" in a software switch controller (SOTFSW). The IEC 61850 standard defines "Command Blocking" as "CmdBlk". For more information on "S4301", see Chapter *Control and monitoring application: Software switch controller. See the signal "*"S4301_STATE" in Table 2.10-7.

[2]Note: "Double Command Blocking" (DCB) is an operation philosophy. It can be used to protect the substation. The user can program it using GR-TIEMS. The DCB operating signal is denoted as "DCB RCV OR) in Table 2.10-7.

[3]Note: Detection of event "device-travelling", signifies that other operators are changing the status of one or more devices. Thus, device operation by the IED should be inhibited whilst ever the event is detected. The detection signal is denoted as "Travelling OR" in Table 2.10-7.

[4]Note: If an IED is in the process of issuing a trip command, all control operation is blocked until the trip operation has been completed. If the IED has a relay application, the trip command is issued at the output-point "GEN.TRIP" in Table 2.10-7.

[5]Note: The criteria "unmatched conditions" is determined when "Test-bit status" in a command is not identical to the "IED test status".

[6]Note: The "Event suppression" function can detect chattering in BI circuits. (See section

2.10.6(i)-3)

[7]Note: A supervision of the Binary IO module can detect connection errors for BI circuits.

[8]Note: The "Common control" (CMNCTRL) function can test and check the operation-direction of logic. When the user sets **Off** for scheme switch [**SCDEN**], operation of the logic is blocked if the logic is running in the same operation-direction compared with the previous operation-direction. Alternatively, if **On** is set for the scheme switch, the logic is not blocked.

[9]Note: The user must program the PLC logic for "Control hierarchy condition". The user must connect the "Control hierarchy condition" to the select condition logic using the connection point "PLC_BIT_0517". For more information, see Chapter *Control and monitoring application: Control hierarchy*. See PLC#3 of Table 2.10-8. Note that the logic outputs are generated separately for both the Closing-execution and the Open-execution.

(viii) Signal name and number

Note: The user should note the meaning of the following abbreviations shown in column "M/O" of each table:

"O" signifies that the signal is provided for optional use.

"M" signifies that the user should map/set/configure the signal; otherwise, the user may experience an operational failure if the default settings are used.

"N/A" signifies that the user cannot change the state of the signal.

Table 2.10-16 PLC connection points (Input point for PLC#1 user a configurable condition)

Signal Number	Signal Name	Description	M/O
5A0101 800535EF40	PLC_BIT_0536	DPSY01 user configurable condition(PLC#1)	O
5A0101 800558EF40	PLC_BIT_0559	DPSY02 user configurable condition(PLC#1)	O

Table 2.10-17 PLC connection points (Input point for PLC#2 operate command Closing)

Signal Number	Signal Name	Description	M/O
5A0101 800542EF40	PLC_BIT_0543	DPSY01 user configurable condition(PLC#2)	O
5A0101 800565EF40	PLC_BIT_0566	DPSY02 user configurable condition(PLC#2)	O

Table 2.10-18 PLC connection points (Input point for PLC#3 operate command Closing)

Signal Number	Signal Name	Description	M/O
5A0101 800534EF40	PLC_BIT_0535	DPSY01 user configurable condition(PLC#3)	O
5A0101 800557EF40	PLC_BIT_0558	DPSY02 user configurable condition(PLC#3)	O

Table 2.10-19 PLC connection points (Input point for operate condition logic)

Signal Number	Signal Name	Description	M/O
5A0101 800538EF40	PLC_BIT_0539	DPSY01 user additional condition(PLC#1)	O

Signal Number	Signal Name	Description	M/O
5A0101 800561EF40	PLC_BIT_0562	DPSY02 user additional condition(PLC#1)	O
5A0101 800539EF40	PLC_BIT_0540	DPSY01 user configurable operate condition(PLC#2)	O
5A0101 800562EF40	PLC_BIT_0563	DPSY02 user configurable operate condition(PLC#2)	O
5A0101 800516EF40	PLC_BIT_0517	DPSY01 control hierarchy condition(PLC#3)	M
5A0101 800519EF40	PLC_BIT_0520	DPSY02 control hierarchy condition(PLC#3)	M

Table 2.10-20 PLC monitoring points (Output signal for BIO)

Signal Number	Signal Name	Description
511001 8202011DD3	DPSY01_OEX_BO	DPSY01 operate (CLOSE) command for Binary Output.
511001 8202021DD3	DPSY02_OEX_BO	DPSY02 operate (CLOSE) command for Binary Output.
511001 8102011DD0	DPSY01_FEX_BO	DPSY01 operate(OPEN) command for Binary Output.
511001 8102021DD0	DPSY02_FEX_BO	DPSY02 operate(OPEN) command for Binary Output.

Table 2.10-21 PLC monitoring points (Signals within operate logic)

Signal Number	Signal Name	Description
511001 8002011E7F	DPSY01_OEC_OK_CSF	DPSY01 Close direction execute command
511001 8002021E7F	DPSY02_OEC_OK_CSF	DPSY02 Close direction execute command
511001 8102011E82	DPSY01_OEC_OK_CS	DPSY01 Close direction execute command
511001 8102021E82	DPSY02_OEC_OK_CS	DPSY02 Close direction execute command
511001 8002011E7E	DPSY01_FEC_OK_CSF	DPSY01 Open direction execute command
511001 8002021E7E	DPSY02_FEC_OK_CSF	DPSY02 Open direction execute command
511001 8002011E7E	DPSY01_FEC_OK_CS	DPSY01 Open direction execute command
511001 8002021E7E	DPSY02_FEC_OK_CS	DPSY02 Open direction execute command

Table 2.10-22 PLC monitoring points (Output signal for response)

Signal Number	Signal Name	Description
511001 8002011E93	DPSY01_EX_CMP	DPSY01 completed control
511001 8002021E93	DPSY02_EX_CMP	DPSY02 completed control
511001 8602011E91	DPSY01_EX_FFL	DPSY01 failed control
511001 8602021E91	DPSY02_EX_FFL	DPSY02 failed control

Table 2.10-23 Reason signals and messages for execution and operation failure

<table>
<tr><th>Signal Number</th><th>Signal Name</th><th>Description</th></tr>
<tr><td>511001 3102011D84</td><td>DPSY01_TMP_10</td><td>DPSY01 execution failure signal due for the failure to issue BO command. It has a reason message about the last aborted execution command. The message is shown below:
Value 0: No reason
Other values: see the below:
<table>
<tr><th>Event message</th><th>IEC61850 Add Cause definition</th></tr>
<tr><td>BLK BY SWITCH</td><td>Blocked by switching hierarchy</td></tr>
<tr><td>BLK BY SEL FAIL</td><td>Select failed</td></tr>
<tr><td>BLK BY INV POS</td><td>Invalid position</td></tr>
<tr><td>BLK BY POS RCH</td><td>Position reached</td></tr>
<tr><td>PRM CHG</td><td>Parameter change in execution</td></tr>
<tr><td>BLK BY STEP LMT</td><td>Step limit</td></tr>
<tr><td>BLK BY MODE</td><td>Blocked by Mode</td></tr>
<tr><td>BLK BY PROCESS</td><td>Blocked by process</td></tr>
<tr><td>BLK BY INK</td><td>Blocked by interlocking</td></tr>
<tr><td>BLK BY SYN</td><td>Blocked by synchrocheck</td></tr>
<tr><td>BLK BY CMD INPRG</td><td>Command already in execution</td></tr>
<tr><td>BLK BY HEALTH</td><td>Blocked by health</td></tr>
<tr><td>BLK BY 1 OFN</td><td>1 of n control</td></tr>
<tr><td>BLK BY CANCEL</td><td>Abortion by cancel</td></tr>
<tr><td>BLK BY TLMT OVER</td><td>Time limit over</td></tr>
<tr><td>BLK BY TRIP</td><td>Abortion by trip</td></tr>
<tr><td>BLK BY NOT SEL</td><td>Object not selected</td></tr>
<tr><td>BLK BY ALR SEL</td><td>Object already selected</td></tr>
<tr><td>BLK BY AUTHORITY</td><td>No access authority</td></tr>
<tr><td>BLK BY OVERSHOOT</td><td>Ended with overshoot</td></tr>
<tr><td>BLK BY DEVIATION</td><td>Abortion due to deviation</td></tr>
<tr><td>BLK BY CMMLOSS</td><td>Abortion by command loss</td></tr>
<tr><td>BLK BY CMDBLK</td><td>Blocked by command</td></tr>
<tr><td>NONE</td><td>None</td></tr>
<tr><td>BLK BY NCNST PRM</td><td>Inconsistent parameters</td></tr>
<tr><td>BLK BY OTER CLT</td><td>Locked by other client</td></tr>
</table></td></tr>
<tr><td>511001 3102011D86</td><td>DPSY01_TMP_11</td><td>DPSY01 operation failure signal. It has a reason message about the last aborted execution command. The message is the same as the one of DPSY01_TMP_10 (see above table).</td></tr>
</table>

(ix) Setting names

Note: The “xx” of “DPSYxx” represents the DPSY function number. (e.g., if the DPSY01 is considered, the “xx” is equal to “01”. The suffix “xx” can be represented by either a “01” or “02”.)

Table 2.10-24 Setting of Operate in DPSYxx

Setting Name	Description	Default	Setting item or value
DPSYxx-PLSM	Method of command output (DPSY01-02)	Fix	Fix/Var
DPSYxx-CPW	Duration of command output (DPSY01-02)	1.0[sec]	0.1~50.0[sec]
DPSYxx-RST	Detection time for terminating control (DPSY01-02)	30.0[sec]	0.1~100.0[sec]
DPSYxx-LGCTRCON	Logic selector for operate condition (DPSY01 -02)	Fixedlogic	Fixedlogic/PLC
DPSYxx-LGCFEXOT	Logic selector for command output (DPSY01 -02)	Fixedlogic	Fixedlogic/PLC
DPSYxx-CTREN	Activate control function (DPSY01 -02)	Close	Open / Close
DPSYxx-LGEXFFCT	Logic selector for operate condition (DPSY01 -02)	Fixedlogic	Fixedlogic / PLC

2.10.4 Operation counter

The DPSY01 function has an operation-counter†; the user can utilize the operation-counter to predict the lifespan of switchgear and other functions. The user can select a count mode using a setting. Table 2.10-25 and Figure 2.10-32 show the modes for which a user is required to change a mode in response to a device signal. For instance in the DPSY01 function, a user can select the mode using scheme switch [**DPSY01-CNTS**] ,which is set to **C-On**; counting-up is performed when a switchgear signal gives rise to a change in state from "Open to Closing".

Table 2.10-25 Mode of operation counter

Mode	Description
C-On	Counting-up is performed when a signal changes to closed (ON). When the signal is changed from "Open to Closed", the counter value is incremented.
C-Off	Counting-up is performed when a signal changes to open (OFF). When the signal is changed from "Closed to Open", the counter value is incremented.
C-OnOff	Counting-up occurs when any state change occurs: "Open to Closed" and "Closed to Open".
NA	Stops the count function

†Note:The operation-counter value is not cleared when power is removed from the IED. This counter is available in the DPSY01 and DPSY02 functions.

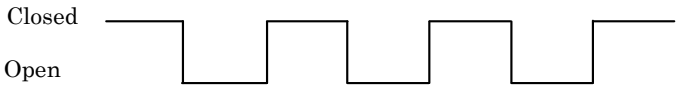


Figure 2.10-32 Device Signal

The user can change the value of the operation-counter from either the front panel or remotely. For example, in the sub-menu for "Operation Counter, the user can set a user-preferred value for the operation-counter. See Chapter *User interface: Monitoring sub-menu* on how to operate the sub-menu.

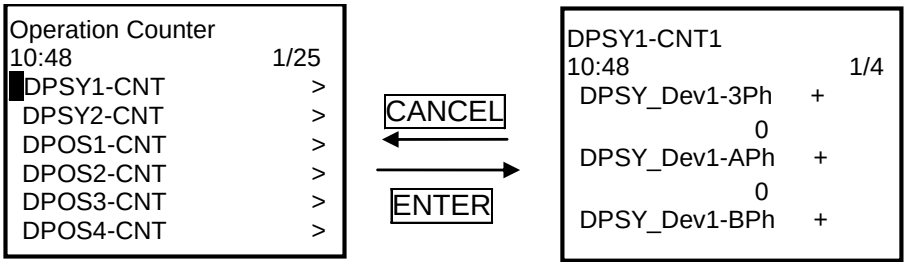


Figure 2.10-33 Operation counter sub-menu

Note: With regard to the signal "DPSY01_3PH_STATE", the sub-menu represents it as "DPSY_Dev1-3Ph". Analogous to signal "DPSY01_3PH_STATE", the signal "DPSY01_APH_STATE" is represented as "DPSY_Dev1-APh". The signals "DPSY01_BPH_STATE" and "DPSY01_CPH_STATE" are displayed in a similar manner.

(i) Receiving “change value for counter” from the remote end

(i)-1 Mapping of Input point required

Figure 2.10-34 depicts the logic when a “change value for counter” command is received at the DPSY01 logic. With regard to a three-phase counter, the input-point “DEV01_3PH_CONTROL_REQ” is used. With regard to a phase-A counter, the input-point “DEV01_APH_CONTROL_REQ” is used. For phase-B and phase-C, the input-points “DEV01_BPH_CONTROL_REQ” and “DEV01_CPH_CONTROL_REQ” are used.

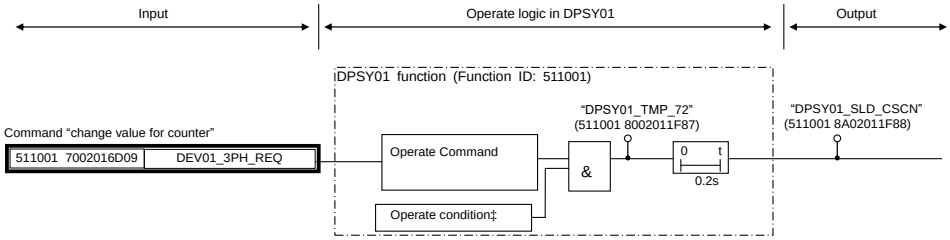


Figure 2.10-34 Change counter value for three-phase† with operation from the remote-end in DPSY01

‡Note: The “operate condition” signal is provided from the operate condition logic shown in Figure 2.10-36.

†Note: The user can apply other counter change commands for phase-A, -B, and –C as shown in Table 2.10-26. The resultant signals for the DPSY02 logic are shown in Table 2.10-27.

(i)-2 Output signal to BO

The DPSY01 function can issue a “Result” signal at output point “DPSY01_SLD_CSCN”. The counter values are issued at points “DPSY01_CNT_VAL", “DPSY01A_CNT_VAL", “DPSY01B_CNT_VAL", and “DPSY01C_CNT_VAL".

(ii) Receiving “change value for counter” from the local-end

(ii)-1 Input signal from the front panel

Figure 2.10-35 depicts the logic when a “change value for counter” command is provided in the DPSY01 function. The command is provided from the sub-menu (see Figure 2.10-33).

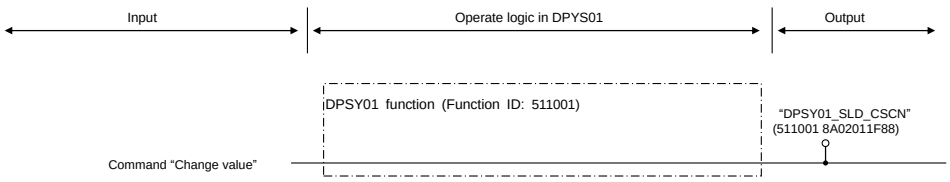


Figure 2.10-35 Changing counter value by operation from the front panel in DPSY01

(ii)-2 Output signal to BO

The DPSY01 function can issue a “Result” signal at the output point “DPSY01_SLD_CSCN”.

(iii) Operate condition for the counter

Figure 2.10-36 illustrates the operate condition logic. The DPSY01 function can determine an operate-condition using a signal received from “Control hierarchy”. The Control hierarchy condition is provided by user-programmed PLC logic (i.e., 43R/L); the user must connect the control-hierarchy with the DPSY01 function using connection point “PLC_BIT_0518” (see Table 2.10-28).

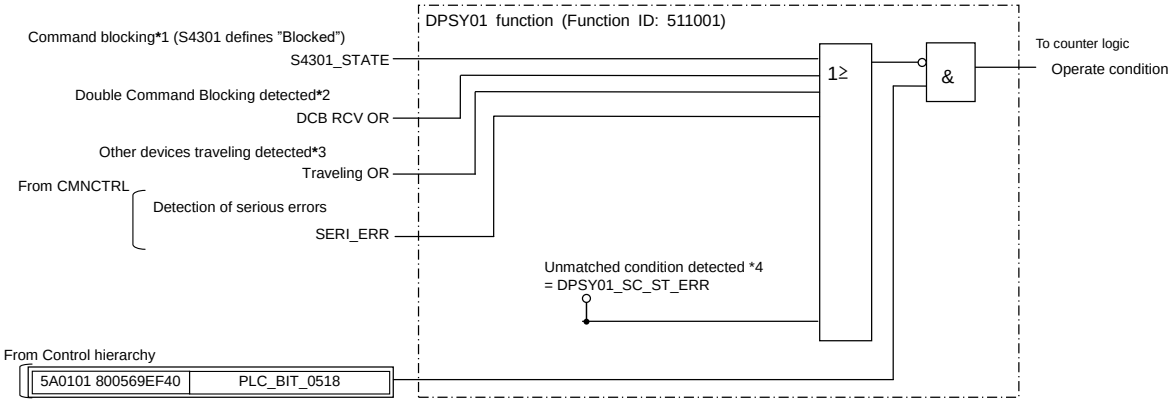


Figure 2.10-36 Operate condition logic for changing the counter in DPSY01

[1]Note: “Command Blocking” disables all operation except for its own; the “Command Blocking” function is initiated by the status of “S4301” in a software switch controller (SOTFSW). The IEC 61850 standard defines the “Command Blocking” function as “CmdBlk”. For more information on “S4301”, see Chapter *Control and monitoring application: Software switch controller. See the signal “*“S4301_STATE” of Table 2.10-7.

[2]Note: “Double Command Blocking” (DCB) is an operation philosophy. It can be used to protect the substation. The user can program it using GR-TIEMS. The DCB operating signal is denoted as “DCB RCV OR) in Table 2.10-7.

[3]Note: If the event “device-travelling” is detected, it indicates that another operator is changing the status of a device. Thus, the IED should inhibit the operation of any device for the duration that the event is detected. The detecting signal is denoted as “Travelling OR” in Table 2.10-7.

[4]Note: If the issue of a trip command is executed by the IED, any control operation is blocked until the trip operation is completed. If an IED includes a relay application, the trip command is issued at the output-point “GEN.TRIP” in Table 2.10-7.

(iv) Signal names and number

Table 2.10-26 Mapping points

Signal Number	Signal Name	Description
511001 7002016D09	DEV01_3PH_REQ	DPSY01 change command received.(Mapping Data) for 3-phase counter value
511001 7002016D0A	DEV01_APH_REQ	DPSY01 change command received.(Mapping Data) for phase-A counter value
511001 7002016D0B	DEV01_BPH_REQ	DPSY01 change command received.(Mapping Data) for phase-B counter value
511001 7002016D0C	DEV01_CPH_REQ	DPSY01 change command received.(Mapping Data) for phase-C counter value
511001 7002026D09	DEV02_3PH_REQ	DPSY02 change command received.(Mapping Data) for 3-phase counter value
511001 7002026D0A	DEV02_APH_REQ	DPSY02 change command received.(Mapping Data) for phase-A counter value
511001 7002026D0B	DEV02_BPH_REQ	DPSY02 change command received.(Mapping Data) for phase-B counter value
511001 7002026D0C	DEV02_CPH_REQ	DPSY02 change command received.(Mapping Data) for phase-C counter value

Table 2.10-27 PLC monitoring points and output results

Signal Number	Signal Name	Description
511001 8A02011F88	DPSY01_SLD_CSCN	DPSY01 select command for Binary Output.
511001 3202011D20	DPSY01_CNT_VAL	DPSY01 operation counter value
511001 3202011D24	DPSY01A_CNT_VAL	DPSY01 phase-A operation counter value
511001 3202011D28	DPSY01B_CNT_VAL	DPSY01 phase-B operation counter value
511001 3202011D2C	DPSY01C_CNT_VAL	DPSY01 phase-C operation counter value
511001 8A02021F88	DPSY02_SLD_CSCN	DPSY02 select command for Binary Output.
511001 3202021D20	DPSY02_CNT_VAL	DPSY02 operation counter value
511001 3202021D24	DPSY02A_CNT_VAL	DPSY02 phase-A operation counter value
511001 3202021D28	DPSY02B_CNT_VAL	DPSY02 phase-B operation counter value
511001 3202021D2C	DPSY02C_CNT_VAL	DPSY02 phase-C operation counter value

Table 2.10-28 PLC connection points for control hierarchy

Signal Number	Signal Name	Description	M/O
5A0101 800517EF40	PLC_BIT_0518	DPSY1 CNT control hierarchy condition	M
5A0101 800520EF40	PLC_BIT_0521	DPSY2 CNT control hierarchy condition	M

(v) Setting name

Table 2.10-29 Setting for pulse counter in DPSYxx

Setting Name	Description	Default	Setting item or value
DPSYxx-CNTS	Mode selection of the counter in DPSYxx	*user-preferred	NA / C-Close / C-Open / C-OnOff

2.10.5 Measurement of operation intervals

The DPSY01 function can measure operation intervals (OT1 to OT4)†; the intervals OT1 to OT2 can represent the period of time when a switch changes from "Closed" to "open". In the DPSY01 function the operation period is grouped into sub-time periods, as shown in Table 2.10-30. The user should set scheme switch [**DPSY01-OPETMEN**] to **On**.

Table 2.10-30 Intervals measured in the DPSY01 function

Intervals	Trigger	Events for measurement
OT1	Start	Signal "DPSY01_FEX_BO" sensed
	End	Switch status is changed from "Closed" to "Intermediate"
OT2	Start	Switch status "Intermediate" sensed
	End	Switch status is changed from "Intermediate" to "Open"
OT3	Start	Signal "DPSY01_OEX_BO" sensed
	End	Switch status is changed from "Open" to "Intermediate"
OT4	Start	Switch status "Intermediate" sensed
	End	Switch status is changed from "Intermediate" to "Closed"

†Note:The function "operation time measurement" is also available in the DPSY02 function.

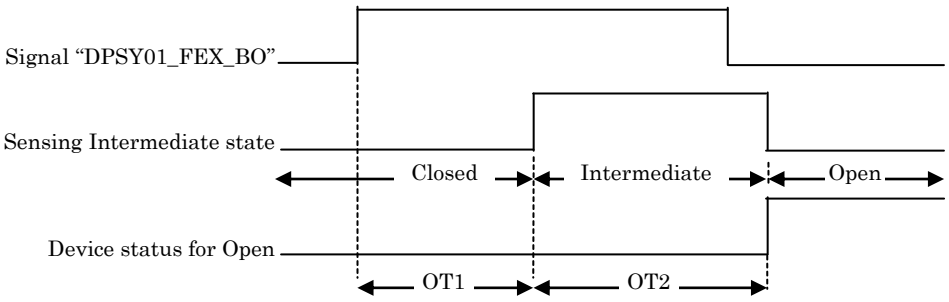


Figure 2.10-37 Two intervals (OT1 and OT2) for Open-control

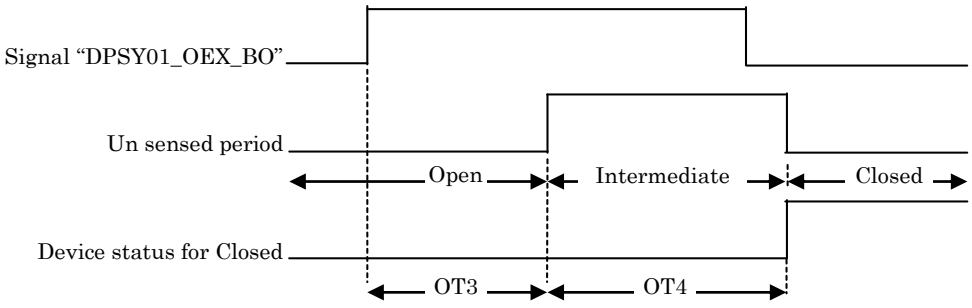


Figure 2.10-38 Two intervals (OT3 and OT4) for Closing-control

The user can clear the operation interval (OT1 to OT4) by key-operation of the "Operation time" sub-menu (Figure 2.10-39) or operation from the remote-end. See chapter *User interface:*

Monitoring sub-menu.

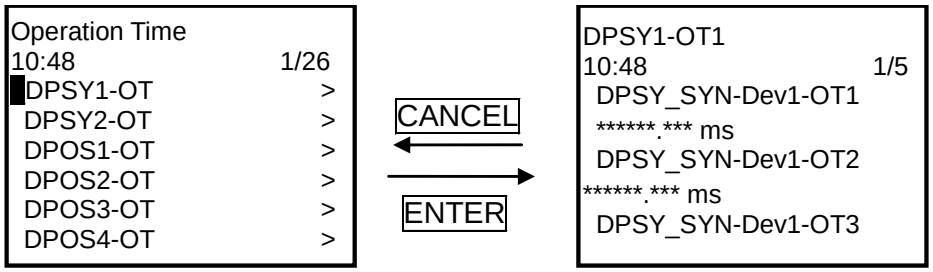


Figure 2.10-39 Operation time sub-menu

(i) Signal names and numbers

Table 2.10-31 Mapping points

Signal Number	Signal Name	Description
511001 7002016D0D	DEV01_RESET_REQ	DPSY01 operation time reset command received (Mapping Data)
511001 7002026D0D	DEV02_RESET_REQ	DPSY02 operation time reset command received (Mapping Data)

(ii) Setting names

Table 2.10-32 Setting of operation time function in DPSY

Setting Name	Description	Default	Setting item or value
DPSY01-OPETMEN	Activation of the operation time measurement in DPSY01	On	Off / On
DPSY02-OPETMEN	Activation of the operation time measurement in DPSY02	On	Off / On

2.10.6 Setup for BIO module

The user should connect the DPSY input/output points with the BI and the BO circuits; subsequently, the DPSY function is able to issue select and operate commands. In order to set up the DPSY function the user should execute the following four steps. Do not confuse setting BOs between step (ii) and step (iii).

i BI connection for status

ii BO connection for "select command"

iii BO connection for "operate command"

iv Contact health check

Note that the DPSY01 function commences operation when the scheme switch [**DPSY01-EN**] is set to **On**.

(i) BI connection for status signals

Figure 2.10-40 exemplifies the reception of signals at the DPSY01 function; to acquire the status§ signal for phase-A, the user should set two input-points for settings [**DPSY01A-NOPSG**] and [**DPSY01A-NCLSG**]†.

†Note: Normally an input-signal corresponding to phase-A is generated using a normally-open contact (NO) and a normally-closed contact (NC). If a NO and a NC contact are exchanged, the input-signal should be determined by inversion; that is, the user is required to set **On** for both scheme switches [**DPSY01A-NOPSGI**] and [**DPSY01A-NCLSGI**].

§Note: The state signal acquired can be monitored. For more information, see Chapter *Automatic supervision*.

(i)-1 Grouping three-phase signals corresponding to a state

Suppose that status signals are acquired on the six BI circuits at IO#1 slot. The signals corresponding to phase-A can be acquired via N/C and N/O contacts; thus, the user should set two input-points (8001001110 and 810101110 in 200B01†) for the settings [**DPSY01A-NOPSG**] and [**DPSY01A-NCLSG**], respectively, as shown in Figure 2.10-40. For input points corresponding to phase-B and phase-C, the user must also apply input-points via settings. The user sets **And** for scheme switches [**DPSY01-OPC**] and [**DPSY01-CLC**], respectively; finally, the scheme switch [**DPSY01-DEVTYPE**] should be set to **3-Pole**.

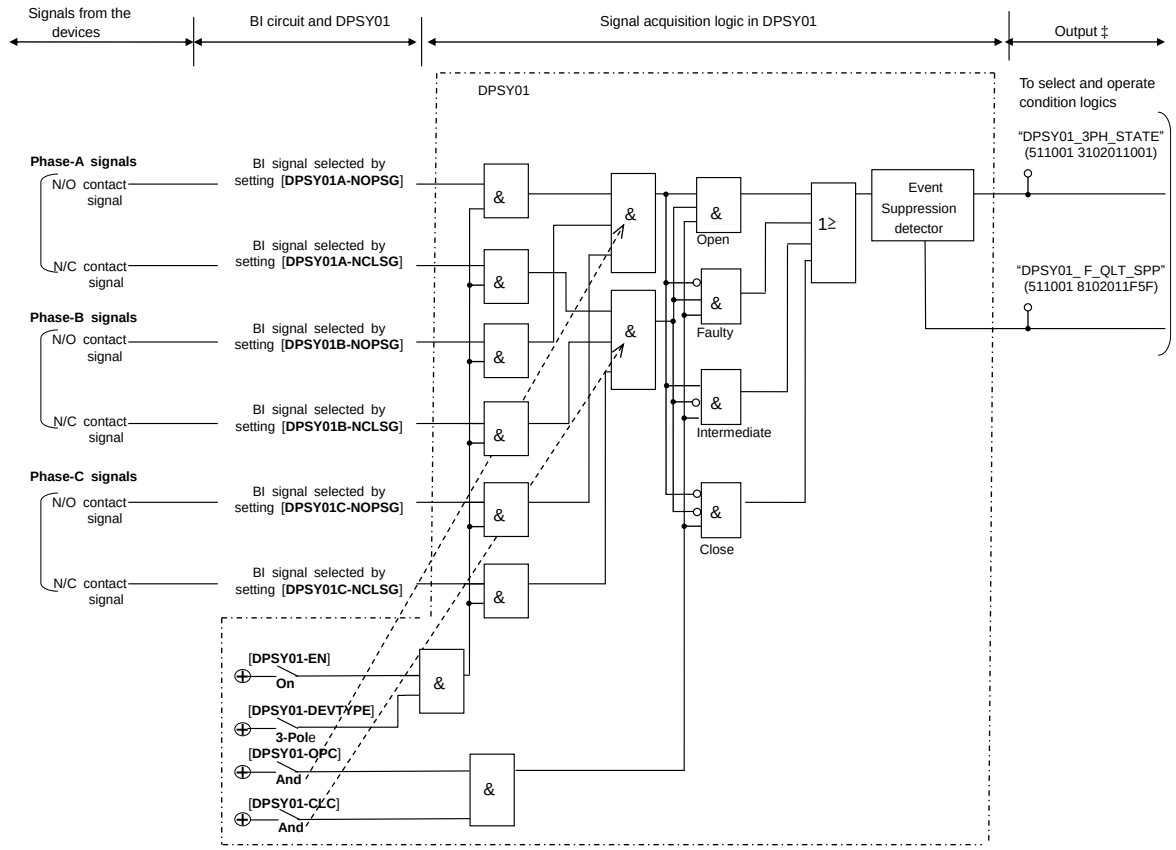


Figure 2.10-40 Acquisition of a state signal

†Note: The user should set the actual input-points. See chapter *Technical description: Binary IO module*.

‡Note: In Figure 2.10-40 two signals can be issued: "DPSY01_3PH_STATE" and "DPSY01_F_QLT_SPP". One is used in the select condition logic and operate condition logic (see Figure 2.10-13 and Figure 2.10-28). Another is used for operation in the event suppression function. Other signals are also provided: DPSY01_APH_STATE, DPSY01_BPH_STATE, and DPSY01_CPH_STATE.

(i)-2 Acquisition of a signal corresponding to a phase

Suppose that a state-signal is acquired on the two BI circuits at IO#1 slot. An individual phase signal can be taken using the N/C and the N/O contacts; thus, the user should set two input-points (8001001110 and 810101110 in 200B01†) for the settings [**DPSY01A-NOPSG**] and [**DPSY01A-NCLSG**], respectively, as shown in Figure 2.10-41. The user should set the scheme switch [**DPSY01-DEVTYPE**] to **1-Pole**.

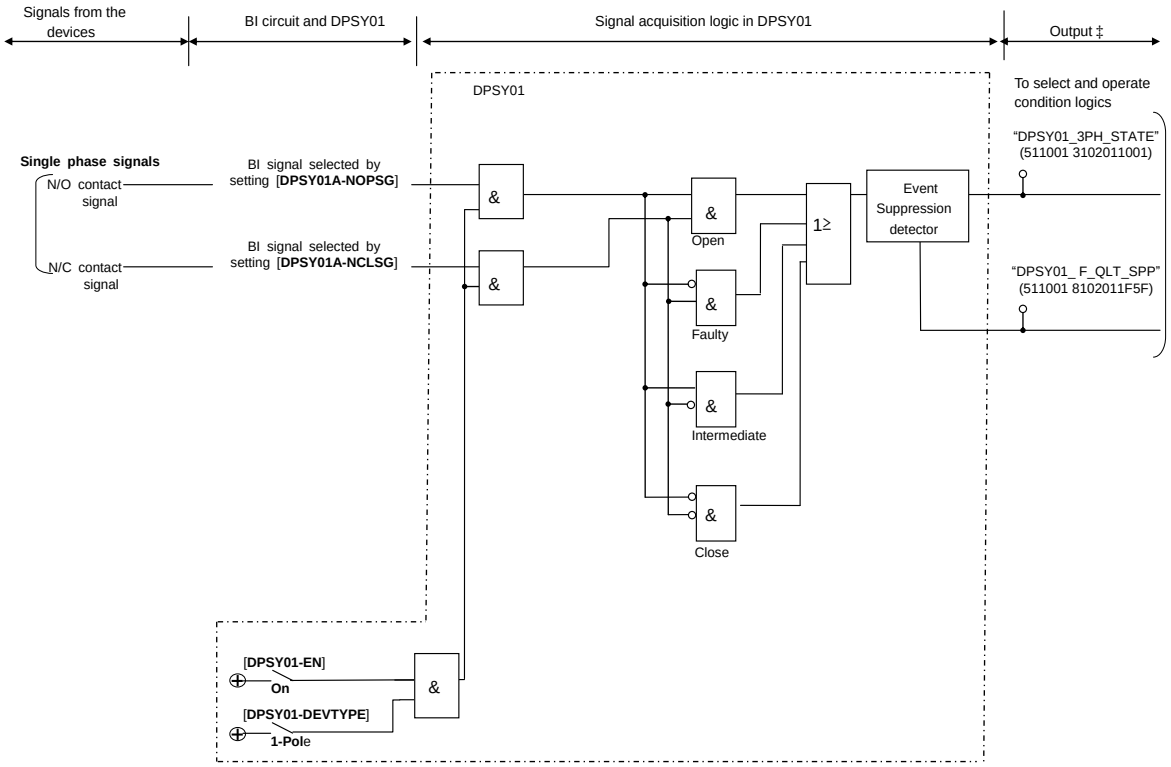


Figure 2.10-41 Acquisition of single-phase signal at DPSY01

‡Note:In Figure 2.10-41 two signals can be issued "DPSY01_3PH_STATE" and "DPSY01_F_QLT_SPP", which are the same as the signals in the Figure 2.10-40.

(i)-3 Event suppression

If the status of a device "chatters" for a short time, the DPSY function will receive iterative signals from the device. Such iterative signals can cause extra burden for the DPSY function; hence, event suppression can be required to reduce the additional burden created.

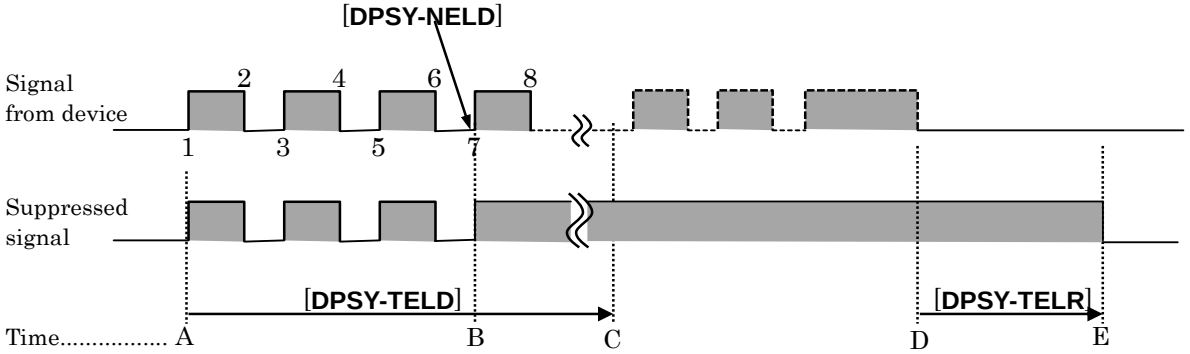


Figure 2.10-42 Iterative signals and signals suppressed

Figure 2.10-42 shows that the iterative signals received from the device have been suppressed by the event suppression function. The suppression commences on receipt of the seventh signal (at Time 'B'). This is because the function can count the iterative number of incoming signals. Detection commences at Time 'A', the setting [**DPSY-NELD**] is provided so that the suppression commences at Time B. The setting [**DPSY-TELD**] is pertains to the

operation of the detection function from Time 'A' (e.g., Time 'A' to Time 'C').

The event suppression ceases when the iterative signals stop. The user can adjust the point at which event suppression stops using the setting [**DPSY-TELR**]; as a result, no suppressed signal is output after the end of the iterative signals (e.g., Time 'D' to 'E').

To initiate event suppression the user should set **On** for scheme switch [**DPSY01-SPPEN**].

(ii) BO connection for "select command Open/Closing"

Figure 2.10-43 exemplifies the connection for the select command Open/Closing. Suppose that connection with the BOs is achieved by the PLC function using connection points "DPSY01_OSL_BO_FLG" and "DPSY01_FSL_BO_FLG"†; as a result, the "Select command Closing" and the "Select command Open" signals are issued at BO1 and BO2 respectively.

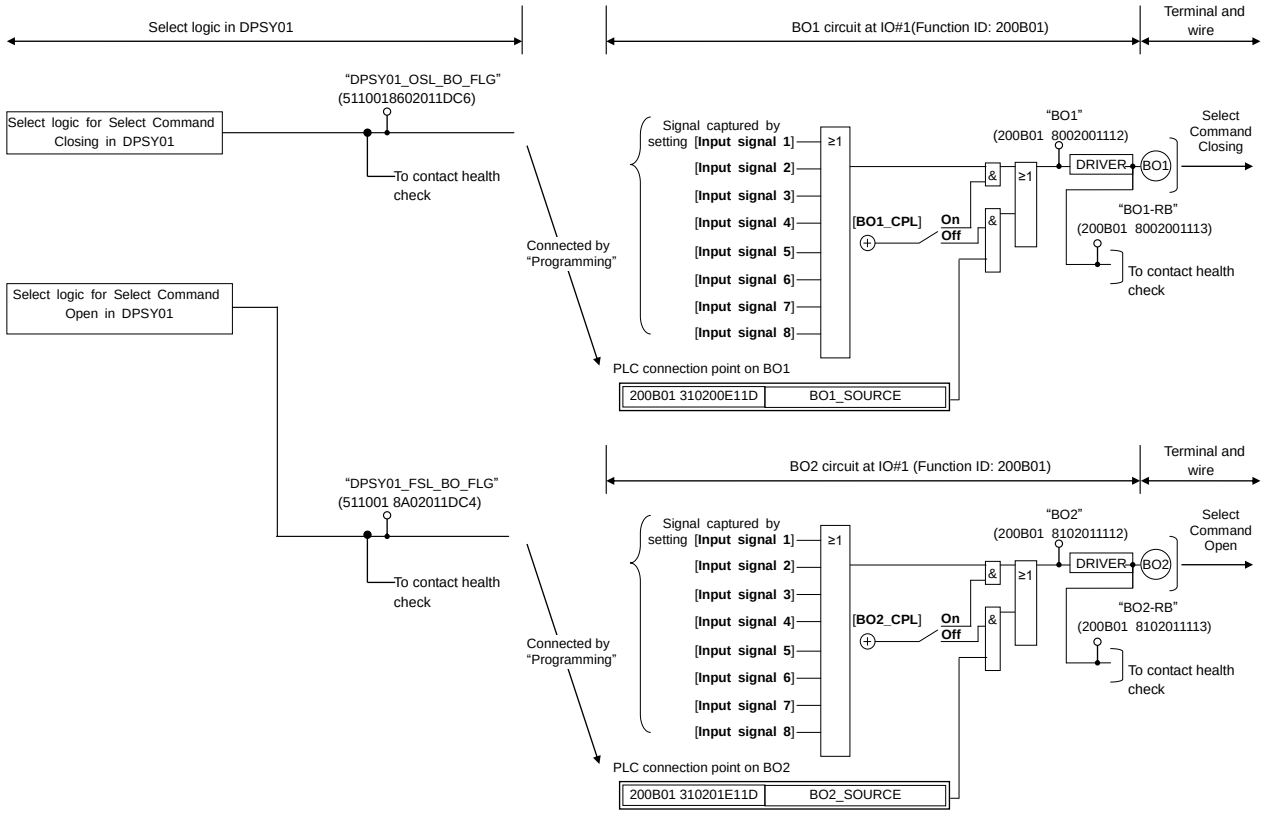


Figure 2.10-43 Example for select commands connection with BO1 & BO2 at IO#1

†Note:Table 2.10-10 shows the remaining signals with the excepting "DPSY01_OSL_BO_FLG" and "DPSY01_FSL_BO_FLG".

(iii) BO connection for "operate command Open/Closing"

Figure 2.10-44 exemplifies the connection for "Operate command Closing" or "Operate command Open". Suppose that connection with the BOs is achieved by the PLC function using

connection points “DPSY01_OEX_BO” and “DPSY01_FEX_BO”; as a result, the “Operate command Closing” and the “Operate command Open” signals are issued at BO3 and BO4 respectively.

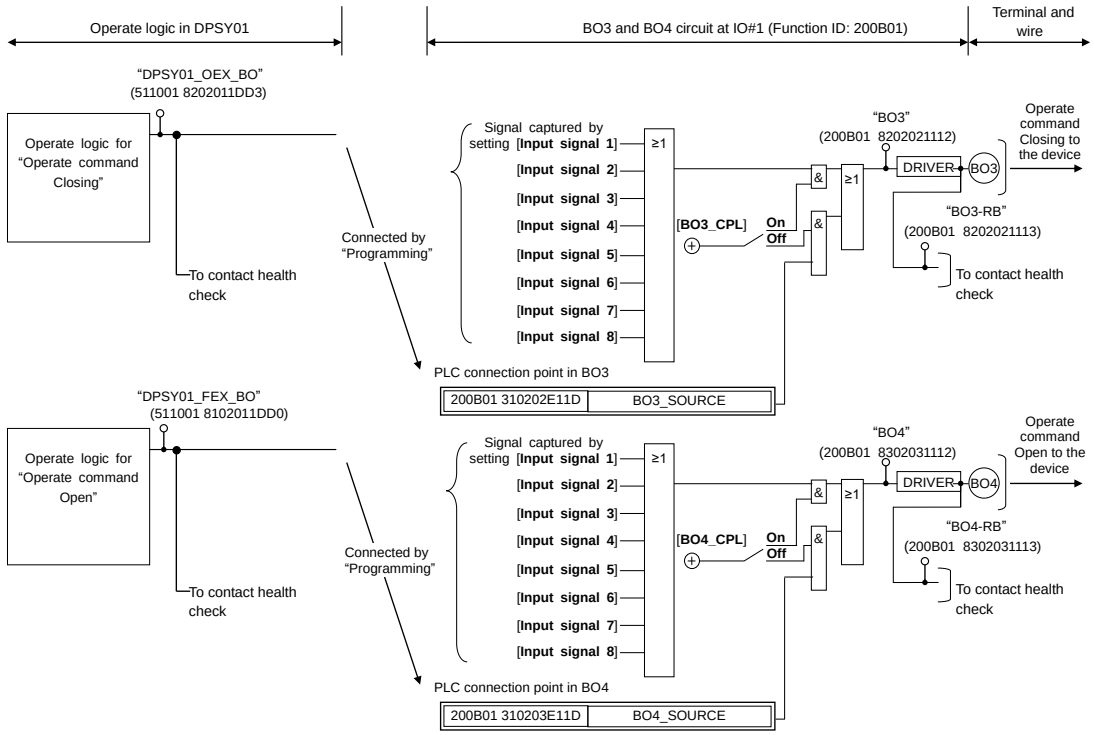


Figure 2.10-44 Example of operate commands connected with BO2 and BO3 at IO#1

†Note:Table 2.10-38 shows the remaining signals excepting “DPSY01_OEX_BO” and “DPSY01_FEX_BO”.

(iv) Contact health check

The DPSY01 function has a contact health check feature for the BO circuits; hence, the user is able to connect an output signal to the contact health check function when **Fixedlogic** is set for scheme switch [**DPSY01-LGXFEOT**]†. Consequently, the DPSY01 function can determine whether the signal has been successfully output from the BO. If a failure is reported, the DPSY01 function determines that the signal has not been output successfully to the BO; then, the Closing- or Open-command is canceled immediately and the DPSY01 function returns to the “Wait for a command” stage.

†Note:Table 2.10-40 shows settings for the health check feature in the DPSY02 function.

(iv)-1 Setting for “Select command Closing”

For example, the point “DPSY01_OSL_BO_FLG” is connected to the BO1 circuit for the issuing of the command; the user can connect point “BO1-RB” with the contact health check function using the setting [**DPSY01-OSLBORD**]. Do not key the point “DPSY01_OSL_BO_FLG”.

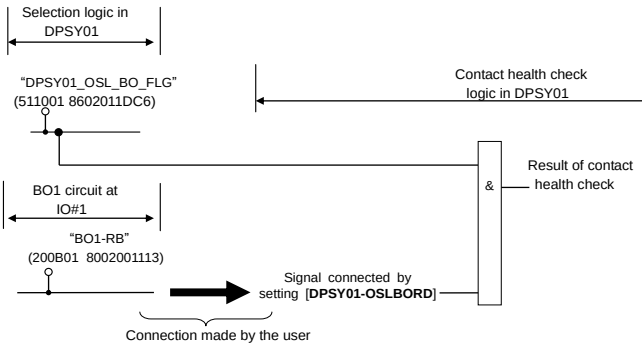


Figure 2.10-45 Example connection of “Select command Closing” for the health check feature

(iv)-2 Setting the “Select command Open”

Similar to “select command Closing”, the point “DPSY01_FSL_BO_FLG” is connected with the BO2 circuit; the user is required to key point “BO2-RB” for the setting [**DPSY01-FSLBORD**]. Do not key the point “DPSY01_FSL_BO_FLG”.

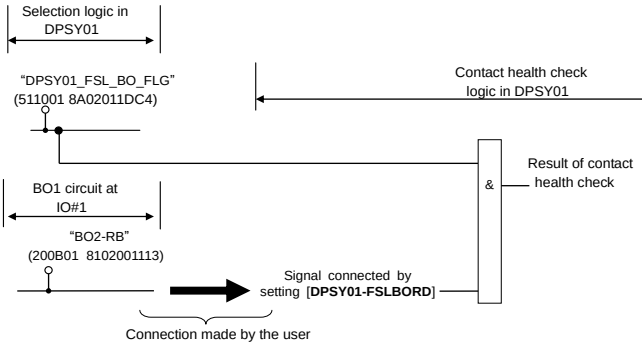


Figure 2.10-46 Example connection of “Select command Open” for the health check feature

(iv)-3 Setting for “Operate command Closing”

Similarly, the point “BO3-RB” must be applied for the setting [**DPSY01-OEXBORD**].

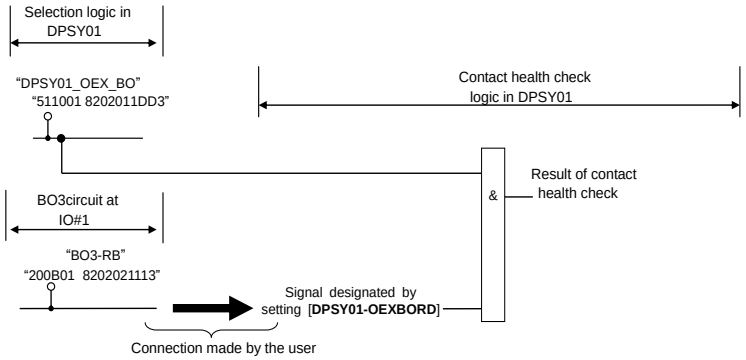


Figure 2.10-47 Example connection of "Operate command Closing" for the health check feature

(iv)-4 Setting for "Operate command Open"

Similarly, the point "BO4-RB" must be applied for the setting [**DPSY01-FEXBORD**].

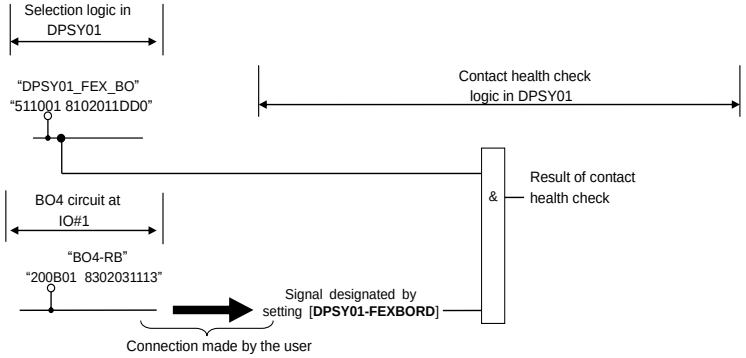


Figure 2.10-48 Example connection of "Operate command Open" for the health check feature

(iv)-5 Setting for the contact health check (normal setting, example)

Figure 2.10-49 shows a setting example for the 43SW scheme. Select and operate commands drive the BO1 to BO4 contacts. To check that the contact health check function is working correctly, the respective points of the BO-RBs should be connected as shown in Table 2.10-33, to demonstrate that the settings are physically matched with the BO contacts.

Table 2.10-33 Setting example for contact health check

Example #1		Contact health check settings for example #1	
"DPSY01_OSL_BO_FLG" is connected to "BO1" at IO#1	⇨	[DPSY01-OSLBORD] =" 200B018002001113"(BO1-RB)	OK
"DPSY01_FSL_BO_FLG" is connected to "BO2" at IO#1	⇨	[DPSY01-FSLBORD]=" 200B018102011113" (BO2-RB)	OK
"DPSY01_OEX_BO_CSF" is connected to "BO3" at IO#1	⇨	[DPSY01-OEXBORD]=" 200B018202021113" (BO3-RB)	OK
"DPSY01_FEX_BO_CSF" is connected to "BO4" at IO#1	⇨	[DPSY01-OEXBORD]=" 200B018302031113" (BO4-RB)	OK

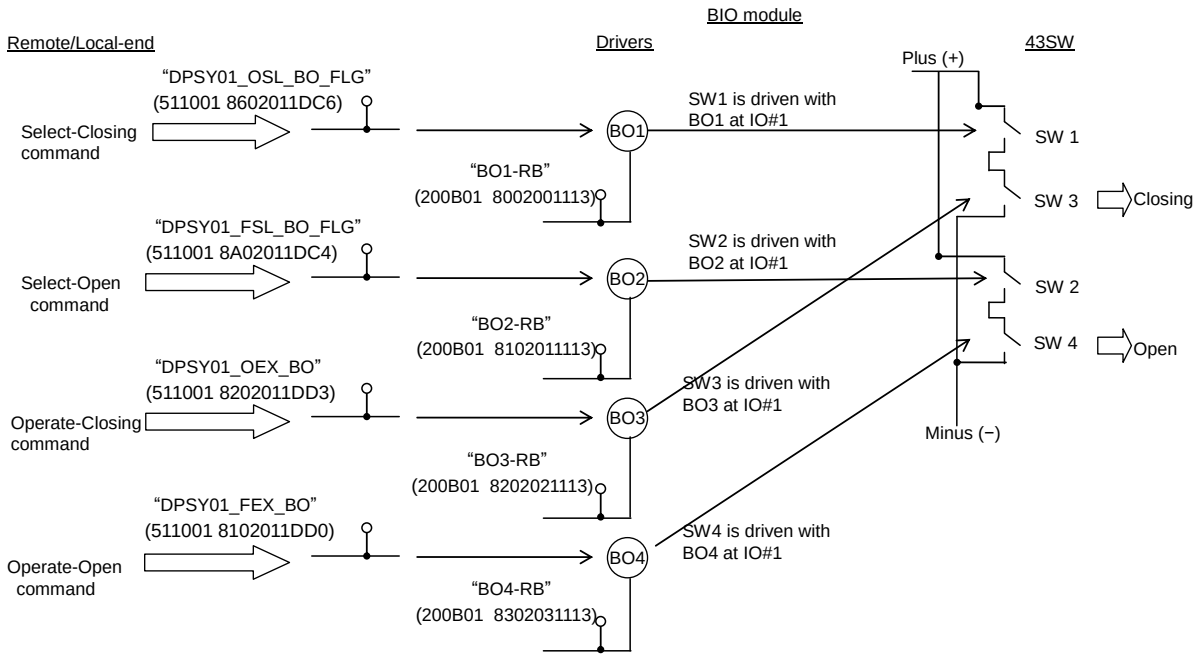


Figure 2.10-49 Contact health check setting and 43SW diagram for example #1

(iv)-6 Settings for erroneous contact health check (improper setting, example #2)

Figure 2.10-50 shows a setting example an improper setting of the 43SW scheme. The settings are implemented incorrectly as shown in Table 2.10-34, BO1-RB is not chosen, instead BO1 is actually chosen, which is incorrect. In this case, the setting [**DPSY01-OSLBORD**] is meaningless; hence, the issue of a select command is blocked.

Table 2.10-34 Erroneous setting example for contact health check

Example #2	Contact health check setting for example #2	
"DPSY01_OSL_BO_FLG" is connected to "BO1" Close SLOT1	[DPSY01-OSLBORD] =" 200B018002001112"(BO1)	NG
"DPSY01_FSL_BO_FLG" is connected to "BO2" Close SLOT1	[DPSY01-FSLBORD]=" 200B018102011113" (BO2-RB)	OK
"DPSY01_OEX_BO_CSF" is connected to "BO3" Close SLOT1	[DPSY01-OEXBORD]=" 200B018202021113" (BO3-RB)	OK
"DPSY01_FEX_BO_CSF" is connected to "BO4" Close SLOT1	[DPSY01-OEXBORD]=" 200B018302031113" (BO4-RB)	OK

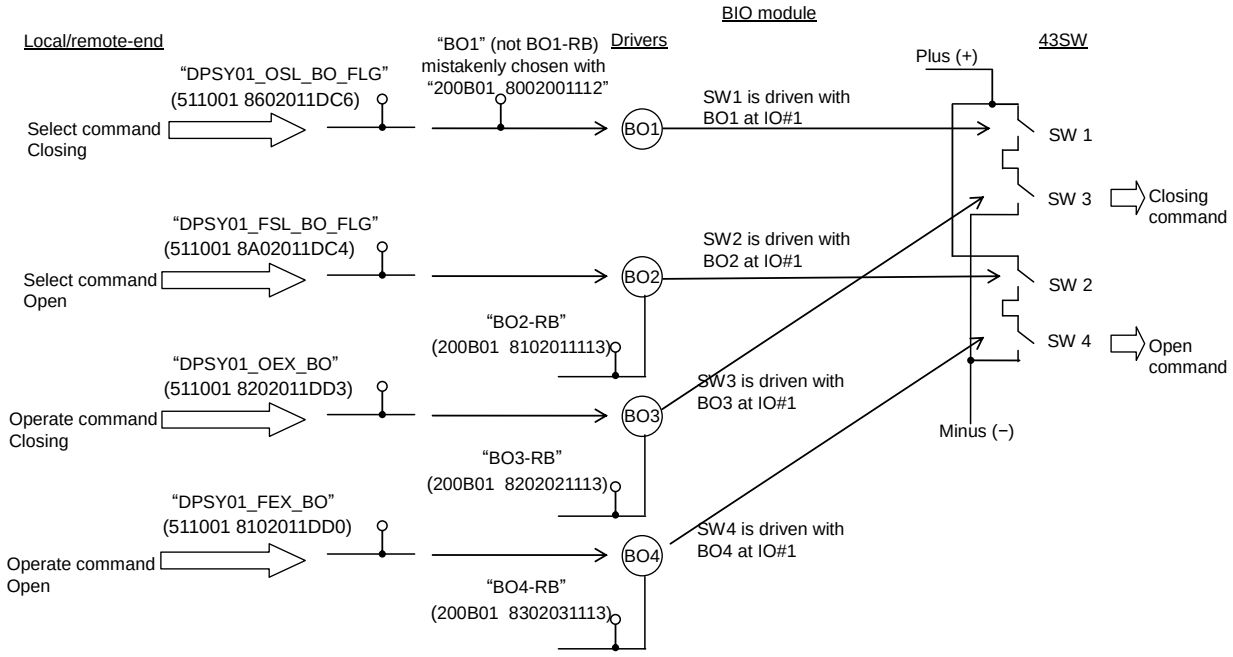


Figure 2.10-50 Contact health check setting and 43SW diagram for example #2

(iv)-7 Settings for extra contact health check (special setting, example #3)

Figure 2.10-51 shows an additional setting example for the 43SW scheme; one of the settings is made hypothetically. That is, the point "DPSY01_OSL_BO_FLG" is actually chosen for the setting [**DPSY01-OSLBORD**]; i.e. BO1-RB is not chosen for this selection. This special example can issue a select command, which is called "operated by internal select function". The user does not need to consider the use of a BO circuit for a select command, when there are no BO circuits available.

Table 2.10-35 Extra setting example for contact health check

Example #3	Setting for example #3	
"DPSY01_OSL_BO_FLG" is not connected to any BO	[DPSY01-OSLBORD] =" DPSY01_OSL_BO_FLG"	OK
"DPSY01_FSL_BO_FLG" is not connected to any BO	[DPSY01-FSLBORD]=" " DPSY01_OSL_BO_FLG"	OK
"DPSY01_OEX_BO_CSF" is connected to "BO3" at IO#1	[DPSY01-OEXBORD]=" 200B018202021113" (BO3-RB)	OK
"DPSY01_FEX_BO_CSF" is connected to "BO4" at IO#1	[DPSY01-OEXBORD]=" 200B018202031113" (BO4-RB)	OK

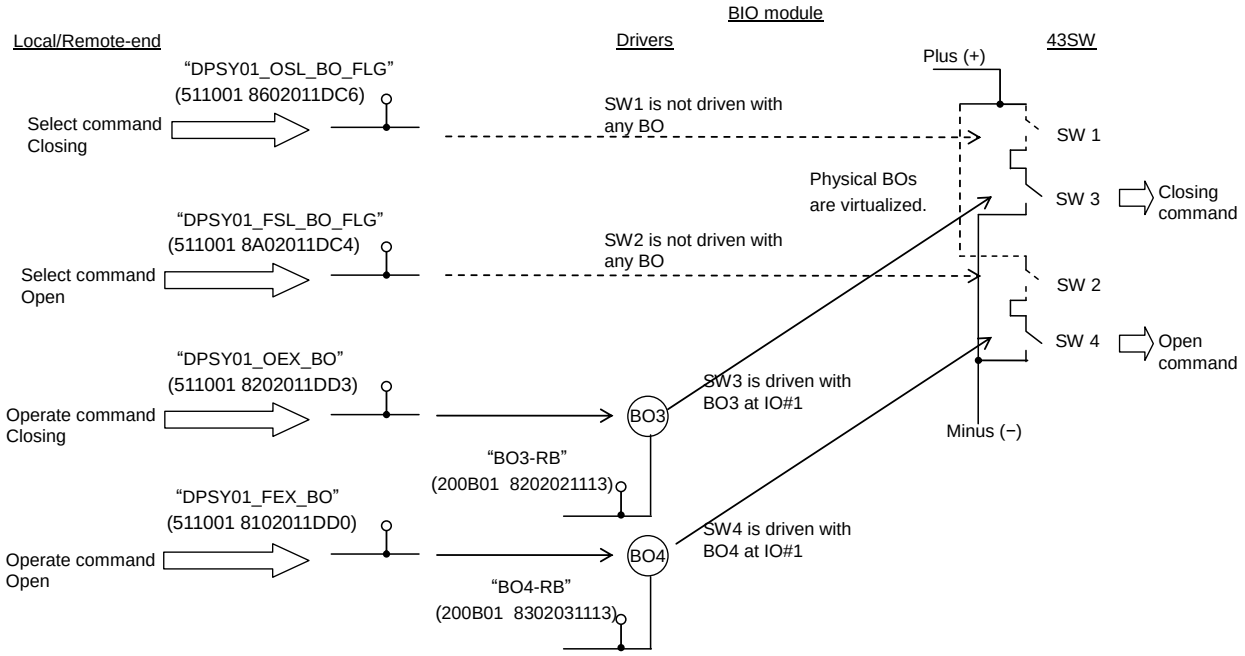


Figure 2.10-51 Contact health check setting and 43SW diagram for example #3

Table 2.10-36 PLC monitoring points (Output signal for event suppression function in DPSY)

Signal Number	Signal Name	Description
511001 3102011001	DPSY01_3PH_STATE	DPSY01 3ph_state
511001 3102021001	DPSY02_3PH_STATE	DPSY02 3ph_state
511001 8102011F5F	DPSY01_F_QLT_SPP	Event suppression detected (DPSY01)
511001 8102021F5F	DPSY02_F_QLT_SPP	Event suppression detected (DPSY02)

Table 2.10-37 PLC monitoring points (Output of select signal in DPSY)

Signal Number	Signal Name	Description
511001 8602011DC6	DPSY01_OSL_BO_FLG	DPSY01 select (CLOSE) command for Binary Output.
511001 8602021DC6	DPSY02_OSL_BO_FLG	DPSY02 select (CLOSE) command for Binary Output.
511001 8A02011DC4	DPSY01_FSL_BO_FLG	DPSY01 select (OPEN) command for Binary Output.

Signal Number	Signal Name	Description
511001 8A02021DC4	DPSY02_FSL_BO_FLG	DPSY02 select (OPEN) command for Binary Output.

Table 2.10-38 PLC monitoring points (Output of operate signal in DPSY)

Signal Number	Signal Name	Description
511001 8202011DD3	DPSY01_OEX_BO	DPSY01 operate (CLOSE) command for Binary Output.
511001 8202021DD3	DPSY02_OEX_BO	DPSY02 operate (CLOSE) command for Binary Output.
511001 8102011DD0	DPSY01_FEX_BO	DPSY01 operate (OPEN) command for Binary Output.
511001 8102021DD0	DPSY02_FEX_BO	DPSY2 operate (OPEN) command for Binary Output.

(v) Setting names

Table 2.10-39 Setting for Binary input signals in DPSY

Setting Name	Description	Default	Setting item or value
DPSY01-CTREN	Activate control function (DPSY01)	On	Off / On
DPSY01-CTRAHMI	Activate local panel control(DPSY01)	SBO	DIR / SBO
DPSY01-EN	Activate monitoring function (DPSY01)	Close	Open / Close
DPSY01-DEVTYPE	Phase selector switch	3-pole	3-pole/1-pile/ switch
DPSY01-OPC	Activate monitoring function (DPSY01)	Close	Open / Close
DPSY01-CPC	Activate monitoring function (DPSY01)	Close	Open / Close
DPSY01A-NOPSG	BI position for DPSY01	*none	BI signal
DPSY01A-NCLSG	BI position for DPSY01	*none	BI signal
DPSY01B-NOPSG	BI position for DPSY01	*none	BI signal
DPSY01B-NCLSG	BI position for DPSY01	*none	BI signal
DPSY01C-NOPSG	BI position for DPSY01	*none	BI signal
DPSY01C-NCLSG	BI position for DPSY01	*none	BI signal
DPSY01-SPPEN	Activate event suppression for DPSY01	On	On / Off (Close/Open)
DPSY02-CTREN	Activate control function (DPSY02)	On	Off / On
DPSY02-CTRAHMI	Activate local panel control(DPSY02)	SBO	DIR / SBO
DPSY02-EN	Activate monitoring function (DPSY02)	Close	Open / Close
DPSY02-DEVTYPE	Phase selector switch	3-pole	3-pole/1-pile/ switch
DPSY02-OPC	Activate monitoring function (DPSY02)	Close	Open / Close
DPSY02-CPC	Activate monitoring function (DPSY02)	Close	Open / Close
DPSY02A-NOPSG	BI position for DPSY02	*none	BI signal
DPSY02A-NCLSG	BI position for DPSY02	*none	BI signal
DPSY02B-NOPSG	BI position for DPSY02	*none	BI signal
DPSY02B-NCLSG	BI position for DPSY02	*none	BI signal
DPSY02C-NOPSG	BI position for DPSY02	*none	BI signal
DPSY02C-NCLSG	BI position for DPSY02	*none	BI signal
DPSY02-SPPEN	Activate event suppression for DPSY02	On	On / Off (Close/Open)
DPSY-NELD	Number of change to lock status.	10	0~99
DPSY-TELD	Time to locking state(sliding window)	10[sec]	1~99[sec]
DPSY-TELR	Time to unlocking state(sliding window)	10[sec]	1~99[sec]

Table 2.10-40 Settings for health check function in DPSY

Setting Name	Description	Default	Setting item or value
DPSY01-OSLBORD	Select BO signal (BO*-RB) from signal list	*User-preferred	BO read-back signal
DPSY01-FSLBORD	Select BO signal (BO*-RB) from signal list	*User-preferred	BO read-back signal
DPSY01-OEXBORD	Select BO signal (BO*-RB) from signal list	*User-preferred	BO read-back signal
DPSY01-FEXBORD	Select BO signal (BO*-RB) from signal list	*User-preferred	BO read-back signal
DPSY02-OSLBORD	Select BO signal (BO*-RB) from signal list	*User-preferred	BO read-back signal
DPSY02-FSLBORD	Select BO signal (BO*-RB) from signal list	*User-preferred	BO read-back signal

Setting Name	Description	Default	Setting item or value
DPSY02-OEXBORD	Select BO signal (BO*-RB) from signal list	*User-preferred	BO read-back signal
DPSY02-FEXBORD	Select BO signal (BO*-RB) from signal list	*User-preferred	BO read-back signal

2.10.7 Mapping for IEC 61850 communication

The user can operate the DPSY function over IEC 61850 communications† following mapping using GR-TIEMS. Note that the DPSY function is designed for the class of "Double Point Controller (DPC)" in the IEC 61850 standard for communication. The user should follow these steps, each of which is discussed below:

Step1: Editing Logical Node

Step2: Mapping output data

Step3: Mapping input data

(i) Editing Logical Node

The user will need to create a logical node (LN) for the DPSY01 function. Figure 2.10-52 exemplifies the editing of a LN; the LN "Common Switch controller (CSWI)" is chosen for the DPSY01 function. After the user has defined an object "DPC", the DPSY01 logical node can be saved with the name "CSWI" plus "LN Instance". Create a definition of object "DPC" in the DPSY01 logical node. Either the SBO mode or the DIR mode should be chosen in the editing for the LN.

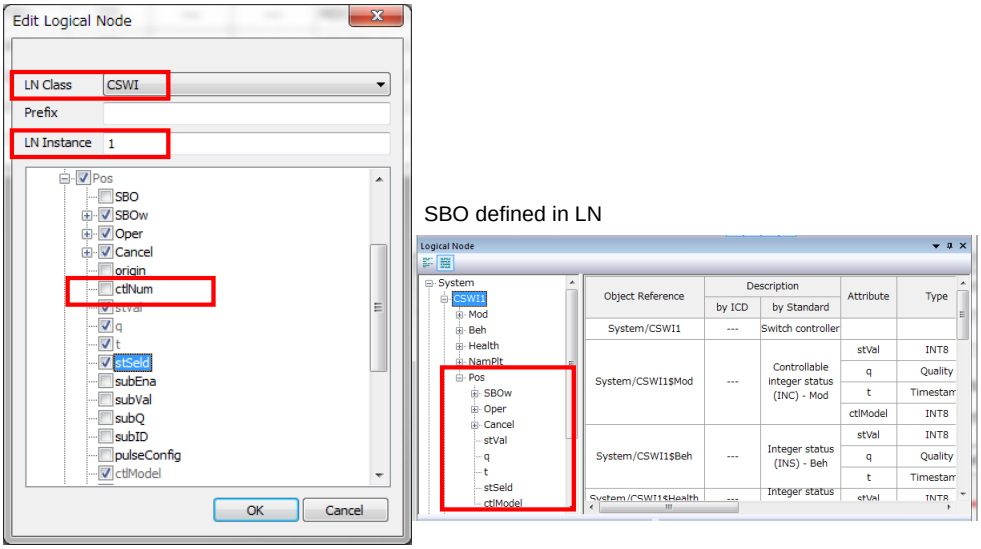
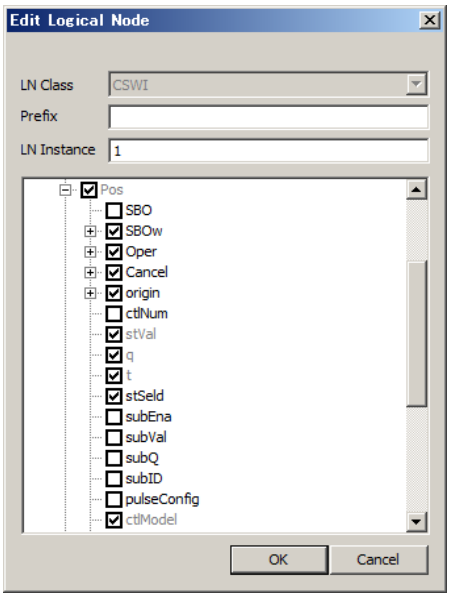


Figure 2.10-52 Defining "DPC" object in CSWI1 logic node

(i)-1 Defining SBO mode

Figure 2.10-53 exemplifies the DPSY01 logic node saved as "CSWI1". In the SBO mode, the user should select the following items for the "CSWI1$Pos" using GR-TIEMS:

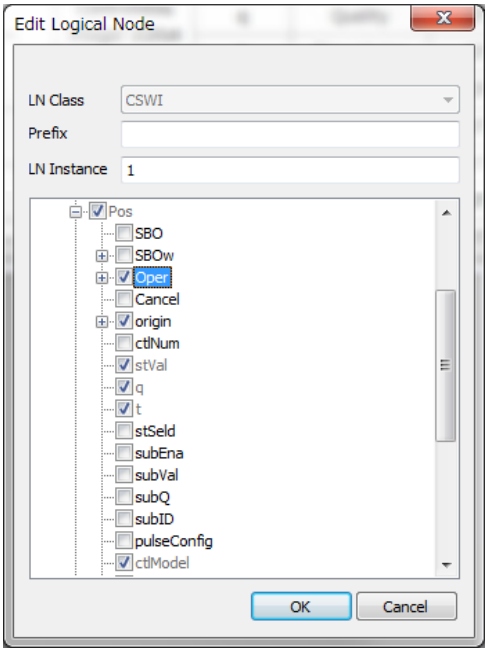


✓ SBOw
✓ Oper
✓ Cancel
✓ origin
✓ stSeld
✓ sboClass† (choice "operate-once")
✓ ctlmodel (choice "SBOes or SBOns")
†"sboClass" can be found by scrolling down.

Figure 2.10-53 LN editing screen for SBO mode

(i)-2 Defining DIR mode

Figure 2.10-54 exemplifies the SPOS logic node saved as "CSWI1". In the DIR mode, the following three items should be selected using GR-TIEMS.



✓ Oper
✓ origin
✓ ctlmodel (choice "DOes or DOns")

Figure 2.10-54 LN editing screen for DIR mode

(ii) Mapping output data

The user should group the DPSY01 signals with regard to GOOSE and REPORT; the user should map them for IEC61850 communication using GR-TIEMS. Figure 2.10-55 illustrates how to map a signal; it indicates that the signals for the DPSY01 function are required to be mapped for IEC 61850 communications.

Table 2.10-41 Mapping signals for CSWI1 object

Object_reference	Attribute	Type	FC	Signal Number	Signal Name
Ctrl/CSWI1Posorigin	orCat	orCategory	ST	511001 3102011008	DPSY01_3PH_ORCAT
Ctrl/CSWI1Posorigin	orIdent	Octet64	ST	511001 6A02011009	DPSY01_3PH_ORIDENT
Ctrl/CSWI1$Pos	stVal	Dbpos	ST	511001 3102011001	DPSY01_3PH_STATE
Ctrl/CSWI1$Pos	q	Quality	ST	511001 3102011005	DPSY01_3PH_QUALITY
Ctrl/CSWI1$Pos	t	Timestamp	ST	511001 9002011006	DPSY01_3PH_TIMESTAMP
Ctrl/CSWI1$Pos	stSeld	BOOLEAN	ST	511001 0002011D90	DPSY01_STD_RPT

Note: "Status (ST)" is defined in the function constraint (FC) of the IEC 61850.

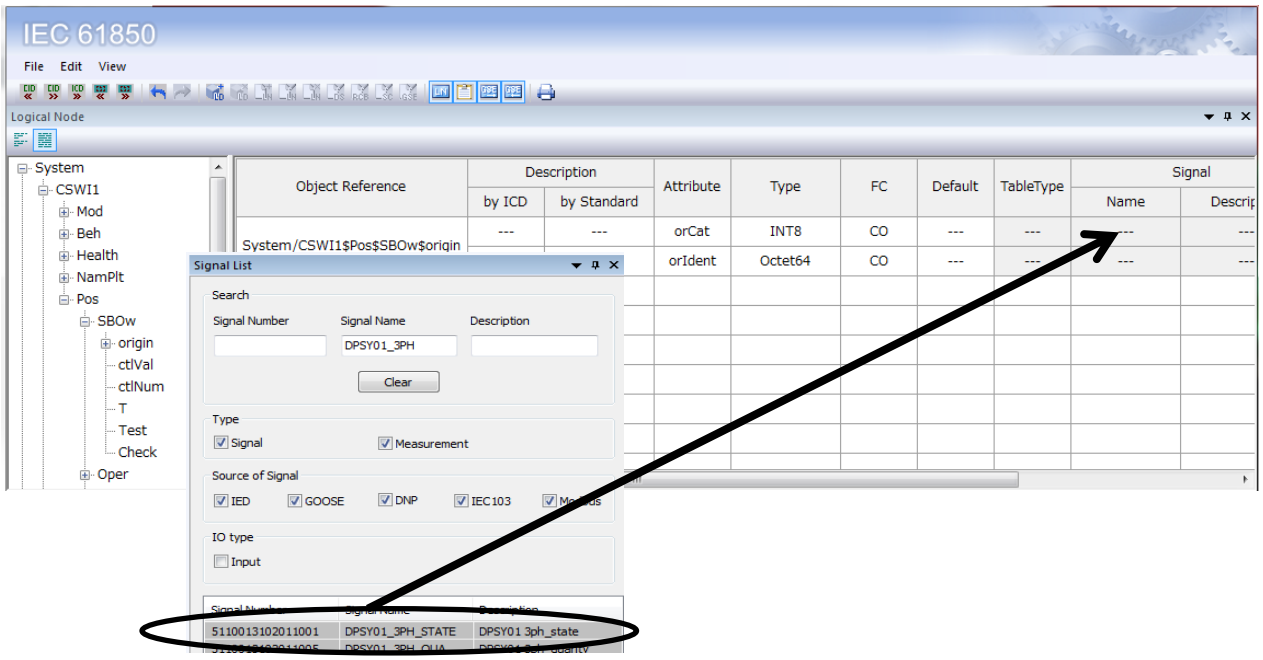


Figure 2.10-55 orCat attribute mapped into DPC object of CSWI1

(iii) Mapping input data

The DPSY01 function can receive three commands "select, operate and cancel." Thus, the user should map the input-point "DEV01_CONTROL_REQ" to the IEC 61850 configuration. Table 2.10-42 shows the input-point "DEV01_CONTROL_REQ" and the Object reference "Ctrl/CSWI1$Pos"; the user should map the input-point to the Object reference having attribute CO†.. Figure 2.10-56 shows how to map a signal.

†Note: The attribute is defined in the IEC 61850; "CO" stands for "Control" in the functional constraint (FC).

Table 2.10-42 Mapping signals required for DPC object for CSWI1

Object_reference	Attribute	Type	FC	Signal Number	Signal Name
Ctrl/CSWI1PosSBOw	ctlVal	BOOLEAN	CO	5110017002016D08	DEV01_CONTROL_REQ
Ctrl/CSWI1PosSBOw	ctlNum	INT8U	CO		
Ctrl/CSWI1PosSBOw	T	Timestamp	CO		
Ctrl/CSWI1PosSBOw	Test	BOOLEAN	CO		
Ctrl/CSWI1PosSBOw	Check	Check	CO		
Ctrl/CSWI1PosSBOw$origin	orCat	orCategory	CO		
Ctrl/CSWI1PosSBOw$origin	orIdent	Octet64	CO		
Ctrl/CSWI1PosOper	ctlVal	BOOLEAN	CO		
Ctrl/CSWI1PosOper	ctlNum	INT8U	CO		
Ctrl/CSWI1PosOper	T	Timestamp	CO		
Ctrl/CSWI1PosOper	Test	BOOLEAN	CO		
Ctrl/CSWI1PosOper	Check	Check	CO		
Ctrl/CSWI1PosOper$origin	orCat	orCategory	CO		
Ctrl/CSWI1PosOper$origin	orIdent	Octet64	CO		
Ctrl/CSWI1PosCancel	ctlVal	BOOLEAN	CO		
Ctrl/CSWI1PosCancel	ctlNum	INT8U	CO		
Ctrl/CSWI1PosCancel	T	Timestamp	CO		
Ctrl/CSWI1PosCancel	Test	BOOLEAN	CO		
Ctrl/CSWI1PosCancel$origin	orCat	orCategory	CO		
Ctrl/CSWI1PosCancel$origin	orIdent	Octet64	CO		
Ctrl/CSWI1PosSBOw	ctlVal	BOOLEAN	CO		
Ctrl/CSWI1PosSBOw	ctlNum	INT8U	CO		

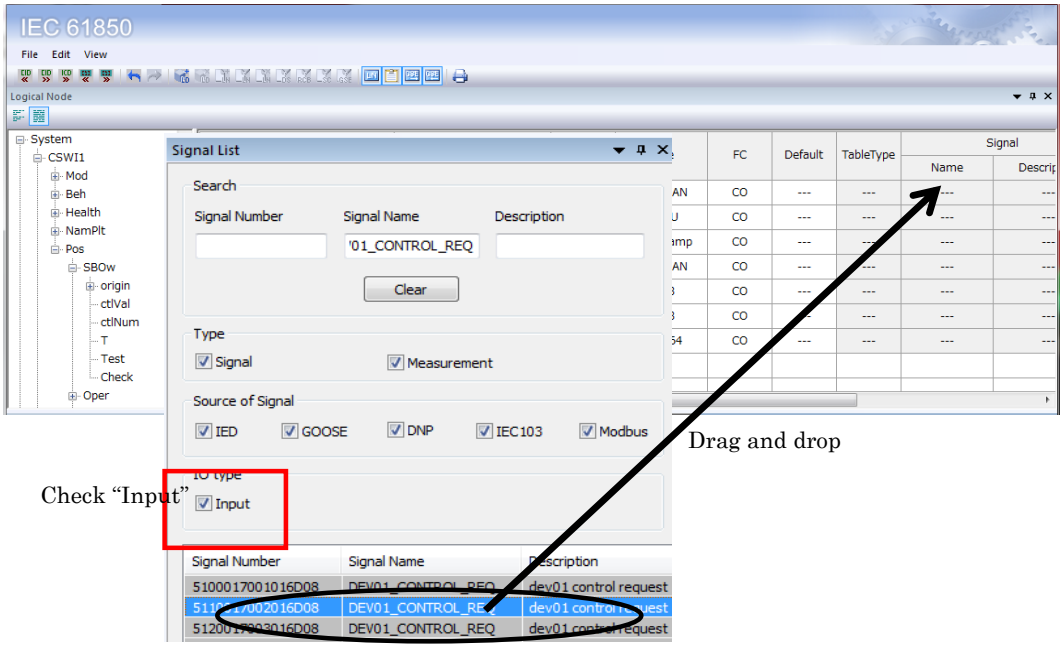


Figure 2.10-56 Input-point mapped for CSWI1

2.10.8 Settings

Common settings list for the DPSY(FunctionID:511001)

Setting items	Range	Units	Contents	Default setting value	Notes
DPSY-NELD	0-99	–	Number of Event lock detect time	10	
DPSY-TELD	1-99	s	Timer for detection of event lock	10	
DPSY-TELR	1-99	s	Timer for recovery from event lock	10	

DPSY01 Settings list (FunctionID:511001)

Setting items	Range	Units	Contents	Default setting value	Notes
DPSY01-EN	Off/On	–	DPSYSY_DEV1 Enable	Off	
DPSY01-DEVTYPE	1-Pole/3-Pole	–	Device Type	1-Pole	
DPSY01A-NOPSG		–	Normally Open Signal for a single-pole or phase A		
DPSY01A-NOPSGI	Off/On	–	Signal inverse or not inversed	Off	
DPSY01A-NCLSG		–	Normally Close Signal for a single-pole or phase A		
DPSY01A-NCLSGI	Off/On	–	Signal inverse or not inversed	Off	
DPSY01B-NOPSG		–	Normally Open Signal for phase B		
DPSY01B-NOPSGI	Off/On	–	Signal inverse or not inversed	Off	
DPSY01B-NCLSG		–	Normally Close Signal for phase B		
DPSY01B-NCLSGI	Off/On	–	Signal inverse or not	Off	
DPSY01C-NOPSG		–	Normally Open Signal of phase C		
DPSY01C-NOPSGI	Off/On	–	Signal inverse or not inversed	Off	
DPSY01C-NCLSG		–	Normally Close Signal for phase C		
DPSY01C-NCLSGI	Off/On	–	Signal inverse or not inversed	Off	
DPSY01-OPC	And/Or	–	Normally Open contact grouping	And	
DPSY01-CLC	And/Or	–	Normally Close contact grouping	Or	
DPSY01-SPPEN	Off/On	–	Automatic event suppression function	Off	
DPSY01-UDFEN	Off/On/CHKONLY	–	Undefined auxiliary -contact check function	Off	
DPSY01-UDFTIM	0.1-100.0	s	auxiliary-contact undefined check timer	30	
DPSY01-FLTEN	Off/On/CHKONLY	–	faulty pallet check function	Off	
DPSY01-FLTTIM	0.1-100.0	s	auxiliary-contact faulty check timer	30	
DPSY01-CTREN	Off/On	–	control mode (control enable)	Off	
DPSY01-SYNEN	APPLY/Bypass	–	Synchronism Check Apply or Bypass	APPLY	
DPSY01-CTRMENU	Off/On	–	control from MENU enable	Off	
DPSY01-CTRAHMI	DIR/SBO	–	control action(Direct or SBO)by HMI	SBO	
DPSY01-NSLBORD1		–	select binary output read data(DataID)1 for closed-direction command		
DPSY01-NSLBORD2		–	select binary output read data(Data ID)2 for closed-direction command		

DPSY01 Settings list (FunctionID:511001)

Setting items	Range	Units	Contents	Default setting value	Notes
DPSY01-FSLBORD		–	select binary output read data(Data ID) for open-direction select command		
DPSY01-OSLBORD		–	select binary output read data(Data ID) for closed-direction select command		
DPSY01-FEXBORD		–	execute binary output read data(Data ID) for open-direction execute command		
DPSY01-OEXBORD		–	execute binary output read data(Data ID) for closed-direction execute command		
DPSY01-LGCTRCON	FixedLogic/PLC	–	Change logic for control condition	FixedLogic	
DPSY01-LGSLFFCT	FixedLogic/PLC	–	Change logic for select fail factor	FixedLogic	
DPSY01-LGEXFFCT	FixedLogic/PLC	–	Change logic for execute command fail factor	FixedLogic	
DPSY01-LGFEXOT	FixedLogic/PLC	–	Change logic for open-direction execute output	FixedLogic	
DPSY01-LGOEXOT	FixedLogic/PLC	–	Change logic for closed-direction execute output	FixedLogic	
DPSY01-LGCNFFCT	FixedLogic/PLC	–	Change logic for cancel command fail factor	FixedLogic	
DPSY01-PLSM	Fix/Var	–	pulse mode	Fix	
DPSY01-CPW	0.1-50.0	s	control pulse width	1	
DPSY01-RST	1.0-100.0	s	response check timer	30	
DPSY01-CNTS	NA/C-On/C-Off/C-OnOff	–	count status	NA	
DPSY01-OPETMEN	Off/On	–	Operation Time Measurement enable	Off	
DPSY01-APBD	Process/Bay	–	status change origin	Process	
DPSY01-CTRDIR	Off/On	–	Capable control direction	On	

Note: The DPSY function is available for a 2nd Device. Hence, the DPSY setting table is provided for a 2nd device. We have omitted a 2nd table because this will be the same as the table for the 1st device with the exception of the device number.

2.10.9 Signals

◆ PLC connection points

DPSY(Function ID: 511001)

Element ID	Name	Description
830201EF56	DPSY01IN_TMP_25	PLC connection point connecting to PLC_BIT_529
820201ED50	DPSY01IN_TMP_28	PLC connection point connecting to PLC_BIT_517
800201EE53	DPSY01IN_TMP_29	PLC connection point connecting to PLC_BIT_530
810201EE54	DPSY01IN_TMP_30	PLC connection point connecting to PLC_BIT_531
800201EE61	DPSY01IN_TMP_31	PLC connection point connecting to PLC_BIT_532
810201EE62	DPSY01IN_TMP_32	PLC connection point connecting to PLC_BIT_533
800201EE55	DPSY01IN_TMP_33	PLC connection point connecting to PLC_BIT_534
800201EE56	DPSY01IN_TMP_34	PLC connection point connecting to PLC_BIT_535
810201EE57	DPSY01IN_TMP_35	PLC connection point connecting to PLC_BIT_536
820201EE5A	DPSY01IN_TMP_37	PLC connection point connecting to PLC_BIT_537
830201EE5B	DPSY01IN_TMP_38	PLC connection point connecting to PLC_BIT_538
800201EE65	DPSY01IN_TMP_40	PLC connection point connecting to PLC_BIT_539
810201EE66	DPSY01IN_TMP_41	PLC connection point connecting to PLC_BIT_540
800201EDDA	DPSY01IN_TMP_42	PLC connection point connecting to PLC_BIT_541
810201EDDB	DPSY01IN_TMP_43	PLC connection point connecting to PLC_BIT_542
820201EE5E	DPSY01IN_TMP_44	PLC connection point connecting to PLC_BIT_543
830201EE5F	DPSY01IN_TMP_45	PLC connection point connecting to PLC_BIT_544
800201EE69	DPSY01IN_TMP_46	PLC connection point connecting to PLC_BIT_545

◆ Common Signal monitoring points

DPSY(Function ID: 511001)

Element ID	Name	Description
8002001D5B	DPSY00_CH_SC_OWS	DPSY00 count change select command by OWS(HMI)
8002001D5C	DPSY00_CH_SC_RCC	DPSY00 count change select command by RCC
8002001D5D	DPSY00_CH_SC_RMT	DPSY00 count change select command by Remote
8002001F98	DPSY00_CH_SC_LCD	DPSY00 count change select command by LCD
8002001D5E	DPSY00_CH_EC_OWS	DPSY00 count change execute command by OWS(HMI)
8002001D5F	DPSY00_CH_EC_RCC	DPSY00 count change execute command by RCC
8002001D60	DPSY00_CH_EC_RMT	DPSY00 count change execute command by Remote
8002001F99	DPSY00_CH_EC_LCD	DPSY00 count change execute command by LCD

◆ Signal monitoring points in DPSY01

DPSY(Function ID: 511001)

Element ID	Name	Description
8002011DE0	DEV1PLCCTRLFAIL	DEV1PLCCTRLFAIL
8302011F49	DPSY01A_FLT_DET	DPSY01 Phase-A Faulty Detected
8302011F48	DPSY01A_FLT_STA	DPSY01 Phase-A Faulty Start
8202011F47	DPSY01A_UDF_DET	DPSY01 Phase-A Undefined Detected
8202011F46	DPSY01A_UDF_STA	DPSY01 Phase-A Undefined Start
8502011F4D	DPSY01B_FLT_DET	DPSY01 Phase-B Faulty Detected
8502011F4C	DPSY01B_FLT_STA	DPSY01 Phase-B Faulty Start
8402011F4B	DPSY01B_UDF_DET	DPSY01 Phase-B Undefined Detected
8402011F4A	DPSY01B_UDF_STA	DPSY01 Phase-B Undefined Start
8702011F51	DPSY01C_FLT_DET	DPSY01 Phase-C Faulty Detected
8702011F50	DPSY01C_FLT_STA	DPSY01 Phase-C Faulty Start
8602011F4F	DPSY01C_UDF_DET	DPSY01 Phase-C Undefined Detected
8602011F4E	DPSY01C_UDF_STA	DPSY01 Phase-C Undefined Start
8802011E9B	DPSY01_CC_ST_ERR	DPSY01 Mode disagreement (tested for a release command)
8102011F41	DPSY01_FLT_DET0	DPSY01 Faulty Detected

◆ Signal monitoring points in DPSY01

DPSY(Function ID: 511001)

Element ID	Name	Description
8102011F45	DPSY01_FLT_DET1	DPSY01 Faulty Detected (3 phase grouped data only)
8102011F44	DPSY01_FLT_STA	DPSY01 Faulty Start
8202011F60	DPSY01_F_BI_ERR	DPSY01 Inside of connection poor of binary input
8102011D03	DPSY01_ST_ON	DPSY01 Normal close state
8302011D02	DPSY01_ST_OFF	DPSY01 Normal open state
8302011E9C	DPSY01_CCF_FCT_CS	DPSY01 Release poor factor
8202011ED1	DPSY01_SYNEN	DPSY01 Synchronism Check Apply or Bypass
8002011F40	DPSY01_UDF_DET0	DPSY01 Undefined Detected
8002011F43	DPSY01_UDF_DET1	DPSY01 Undefined Detected (3 phase grouped data only)
8002011F42	DPSY01_UDF_STA	DPSY01 Undefined Start
8102011F5F	DPSY01_F_QLT_SPP	DPSY01 Under a lock of change of state
8702011E96	DPSY01_CC_FS	DPSY01 cancel fail signal
8602011E95	DPSY01_CC_SS	DPSY01 cancel success signal
8C02011F70	DPSY01_EX_CS04	DPSY01 close timer for under execution
8002011EA0	DPSY01_CTR_SGE	DPSY01 control logic stage(execute command check)
8002011E9E	DPSY01_CTR_SGC	DPSY01 control logic stage(select command check)
8002011E9F	DPSY01_CTR_SGS	DPSY01 control logic stage(selected)
8302011E9D	DPSY01_CTR_SGN	DPSY01 control logic stage(unselected)
8002011EA1	DPSY01_CTR_SGW	DPSY01 control logic stage(wait for change)
8802011F9D	DPSY01_SLF_FCT_F03CN	DPSY01 count change select fail factor signal by fixedlogic 03
8702011F9E	DPSY01_SLF_FCT_F04CN	DPSY01 count change select fail factor signal by fixedlogic 04
8A02011F88	DPSY01_SLD_CSCN	DPSY01 count change selected condition signal
8002011F87	DPSY01_TMP_72	DPSY01 count change selected condition signal check
8602011F8A	DPSY01_CNT_CS07	DPSY01 count change selected fail condition signal
8502011F89	DPSY01_SE_RCV_RMTCN	DPSY01 count change selected fail condition signal check
8902011F9B	DPSY01_CTR_SGUCN	DPSY01 count change selected signal
8302011F9C	DPSY01_SLF_FCT_F07CN	DPSY01 count change selected timer for a check
8A02011F9F	DPSY01_SLD_TMOCN	DPSY01 count change time out after selected
8902011FA0	DPSY01_EX_CMP_TMOCN	DPSY01 count change timeout after execute completion
8002011D58	DPSY01_EC_LCD	DPSY01 execute command by LCD
8002011D55	DPSY01_EC_OWS	DPSY01 execute command by OWS(HMI)
8002011D59	DPSY01_EC_PLC	DPSY01 execute command by PLC
8002011D56	DPSY01_EC_RCC	DPSY01 execute command by RCC
8002011D57	DPSY01_EC_RMT	DPSY01 execute command by Remote
8102011E9A	DPSY01_ECF_FCT_EIS	DPSY01 execute command fail factor signal except interlock/synchronism check
8002011F5B	DPSY01_EC_ST_ERR	DPSY01 execute command mode err
8002011E93	DPSY01_EX_CMP	DPSY01 execute complete signal
8602011E91	DPSY01_EX_FFL	DPSY01 execute fail signal by fixedlogic
8502011E8F	DPSY01_EX_SFL	DPSY01 execute success signal by fixedlogic
8102011E7B	DPSY01_SLF_CS	DPSY01 no direction select fail condition signal
8102011DD0	DPSY01_FEX_BO	DPSY01 open-direction execute binary output signal
8002011E81	DPSY01_FEC_OK_CS	DPSY01 open-direction execute command OK condition signal
8002011E7E	DPSY01_FEC_OK_CSF	DPSY01 open-direction execute command OK condition signal by fixedlogic
8202011E88	DPSY01_FEC_F_CS	DPSY01 open-direction execute command fail condition signal
8102011E85	DPSY01_FEC_F_CSF	DPSY01 open-direction execute command fail condition signal by fixedlogic
8A02011DC4	DPSY01_FSL_BO_FLG	DPSY01 open-direction select binary output signal
8202011DD3	DPSY01_OEX_BO	DPSY01 closed-direction execute binary output signal
8102011E82	DPSY01_OEC_OK_CS	DPSY01 closed -direction execute command OK condition signal
8002011E7F	DPSY01_OEC_OK_CSF	DPSY01 closed -direction execute command OK condition signal by fixedlogic
8302011E89	DPSY01_OEC_F_CS	DPSY01 closed -direction execute command fail condition signal
8102011E86	DPSY01_OEC_F_CSF	DPSY01 closed -direction execute command fail condition signal by fixedlogic
8B02011E48	DPSY01_OEC_RCV	DPSY01 closed -direction execute command received

◆ Signal monitoring points in DPSY01

DPSY(Function ID: 511001)

Element ID	Name	Description
8602011DC6	DPSY01_OSL_BO_FLG	DPSY01 closed -direction select binary output signal
8802011F73	DPSY01_OSL_CS41	DPSY01 closed -direction select condition signal 41
8902011F74	DPSY01_OSL_CS42	DPSY01 closed -direction select condition signal 42
8A02011F75	DPSY01_OSL_CS43	DPSY01 closed -direction select condition signal 43
8002011E45	DPSY01_OSE_RCV	DPSY01 closed -direction select or execute command received
8B02011F6F	DPSY01_EX_CS03	DPSY01 open timer for under execution
8002011F98	DPSY01_RE_EC_LCD	DPSY01 reset time execute command by LCD
8002011D7B	DPSY01_RE_EC_OWS	DPSY01 reset time execute command by OWS(HMI)
8002011D7C	DPSY01_RE_EC_RCC	DPSY01 reset time execute command by RCC
8002011D7D	DPSY01_RE_EC_RMT	DPSY01 reset time execute command by Remote
8002011F9A	DPSY01_RE_SC_LCD	DPSY01 reset time select command by LCD
8002011D78	DPSY01_RE_SC_OWS	DPSY01 reset time select command by OWS(HMI)
8002011D79	DPSY01_RE_SC_RCC	DPSY01 reset time select command by RCC
8002011D7A	DPSY01_RE_SC_RMT	DPSY01 reset time select command by Remote
8802011FA3	DPSY01_SLF_FCT_F03RS	DPSY01 reset time select fail factor signal by fixedlogic 03
8702011FA4	DPSY01_SLF_FCT_F04RS	DPSY01 reset time select fail factor signal by fixedlogic 04
8A02011F8C	DPSY01_SLD_CSRS	DPSY01 reset time selected condition signal
8002011F8B	DPSY01_TMP_73	DPSY01 reset time selected condition signal check
8602011F8E	DPSY01_RST_CS07	DPSY01 reset time selected fail condition signal
8502011F8D	DPSY01_SE_RCV_RMTRS	DPSY01 reset time selected fail condition signal check
8902011FA1	DPSY01_CTR_SGURS	DPSY01 reset time selected signal
8302011FA2	DPSY01_SLF_FCT_F07RS	DPSY01 reset time selected timer for a check
8A02011FA5	DPSY01_SLD_TMORS	DPSY01 reset time out after selected
8902011FA6	DPSY01_EX_CMP_TMORS	DPSY01 reset time timeout after execute completion
8A02011F6E	DPSY01_EX_CS02	DPSY01 response supervisory timer for close
8902011F6D	DPSY01_EX_CS01	DPSY01 response supervisory timer for open
8902011DC0	DPSY01_NSL_BO_FLG	DPSY01 select binary output signal
8502011F82	DPSY01_TMP_67	DPSY01 select BO close signal check
8702011F84	DPSY01_TMP_69	DPSY01 select BO close(interlock) signal check
8602011F83	DPSY01_TMP_68	DPSY01 select BO close(synchronism) signal check
8102011F7F	DPSY01_TMP_64	DPSY01 select BO open signal check
8202011F7C	DPSY01_TMP_61	DPSY01 select BO signal check
8002011D54	DPSY01_SC_LCD	DPSY01 select command by LCD
8002011D51	DPSY01_SC_OWS	DPSY01 select command by OWS(HMI)
8002011D52	DPSY01_SC_RCC	DPSY01 select command by RCC
8002011D53	DPSY01_SC_RMT	DPSY01 select command by Remote
8002011F5A	DPSY01_SC_ST_ERR	DPSY01 select command mode err
8602011F63	DPSY01_SLF_FCT_FLG03	DPSY01 select fail factor signal by fixedlogic 03
8702011F64	DPSY01_SLF_FCT_FLG04	DPSY01 select fail factor signal by fixedlogic 04
8502011F65	DPSY01_SLF_FCT_FLG05	DPSY01 select fail factor signal by fixedlogic 05
8702011E98	DPSY01_SLF_FCT_EIS	DPSY01 select fail factor signal except interlock/synchronism check
8502011F85	DPSY01_TMP_70	DPSY01 select receive closed signal check
8602011F86	DPSY01_TMP_71	DPSY01 select receive closed signal check answer
8502011F80	DPSY01_TMP_65	DPSY01 select receive open signal check
8A02011F81	DPSY01_FSL_CS19	DPSY01 select receive open signal check answer
8002011F7D	DPSY01_TMP_62	DPSY01 select receive signal check
8602011F7E	DPSY01_NSL_CS07	DPSY01 select receive signal check answer
8002011E7D	DPSY01_SLR_CS	DPSY01 select release condition signal
8002011E76	DPSY01_SLD_CS	DPSY01 selected condition signal
8002011F67	DPSY01_SLD_CS04	DPSY01 selected condition signal 04
8102011F68	DPSY01_SLD_CS05	DPSY01 selected condition signal 05
8202011F69	DPSY01_SLD_CS06	DPSY01 selected condition signal 06
8402011F76	DPSY01_OSL_CS44	DPSY01 selected condition signal 44

◆ Signal monitoring points in DPSY01

DPSY(Function ID: 511001)

Element ID	Name	Description
8502011F77	DPSY01_OSL_CS45	DPSY01 selected condition signal 45
8602011F78	DPSY01_OSL_CS46	DPSY01 selected condition signal 46
8B02011F79	DPSY01_CTR_SGU	DPSY01 selected signal
8802011F6C	DPSY01_SLF_FCT_FLG07	DPSY01 selected timer for a check
8E02011F5D	DPSY01_SLD_TMO	DPSY01 time out after selected
8F02011F5E	DPSY01_EX_CMP_TMO	DPSY01 timeout after execute completion
0002011D95	DPSY01_TMP_02	DPSY01 time reset selected signal(stSeld) for SAS
3102011D80	DPSY01_TMP_06	DPSY01 control event data (selected)
3102011D81	DPSY01_TMP_07	DPSY01 control event data (select fail)
3102011D82	DPSY01_TMP_08	DPSY01 control event data (select release)
3102011D83	DPSY01_TMP_09	DPSY01 control event data (execute output on)
3102011D84	DPSY01_TMP_10	DPSY01 control event data (execute command ng)
3102011D86	DPSY01_TMP_11	DPSY01 control event data (execute fail)
8202011F7C	DPSY01_TMP_61	DPSY01 select bo signal check
8002011F7D	DPSY01_TMP_62	DPSY01 select recive signal check
8102011F7F	DPSY01_TMP_64	DPSY01 select bo open signal check
8502011F80	DPSY01_TMP_65	DPSY01 select recive open signal check
8502011F82	DPSY01_TMP_67	DPSY01 select bo close signal check
8602011F83	DPSY01_TMP_68	DPSY01 select bo close(synchronism) signal check
8702011F84	DPSY01_TMP_69	DPSY01 select bo close(interlock) signal check
8502011F85	DPSY01_TMP_70	DPSY01 select recive cloase signal check
8602011F86	DPSY01_TMP_71	DPSY01 select recive cloase signal check answer
8002011F87	DPSY01_TMP_72	DPSY01 count change selected condition signal check
8002011F8B	DPSY01_TMP_73	DPSY01 reset time selected condition signal check

Note: In the table above, the user will only find Element IDs and their names for the 1st device, but a 2nd and other devices are also provided in the DPSY function. We have omitted the Element IDs and their names for the other devices to improve readability. Use the rule described below when the user wishes to obtain the Element IDs and their names for the other devices.

Rule: The same types of signal monitoring points are provided in every device; hence, the user can find the same ones for all of the other devices. For example, when the user wishes to find the "DPSY01_SC_OWS" point for the 2nd device, use the description of "DPSY02_SC_OWS" in place of "DPSY01_SC_OWS". The user can obtain the ID value of "DPSY02_SC_OWS" by using the following steps:

Step 1 Find the element ID for DPSY01_SC_OWS (i.e., "8002011D51").

Step 2 Identify the number at the fifth digit from the ID. (i.e., "1").

Step 3 Choose a new device number. (i.e. pick the number "2" for the 2nd device).

Step 4 Replace the number that occurs at the fifth digit with the new device number. (i.e., get new ID "8002021D51" of "DPSY02_SC_OWS") The ID is expressed in hexadecimal

notation. Thus, the user must change the device number from decimal notation to hexadecimal notation.

2.11 Three position device function (TPOS)

The three-position device function (TPOS) is used when it is required to control a device having a triple selector (e.g., the selector has three positions: P1, P2, or P3). The user can experience the following devices as the triple selector: A 43-switch (43S), an earth-switch (ES) with a disconnector (DS) and others.

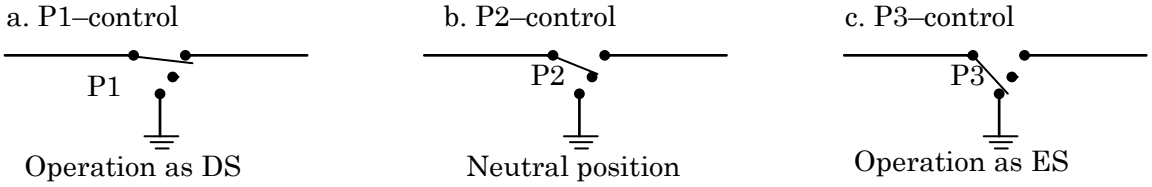


Figure 2.11-1 Example of switch positions in EDS operation

The TPOS function has “Operation counters” and “Operation time measurement”; these features are used to examine the devices; these features are useful when the user wishes to assess the operating time of the device; these features are performed by counting the state-changes for the device. The BO circuits connected with the TPOS function are used for issuing commands; the BI circuits are used for receiving responses; hence, the user should connect the BO and BI circuits with the TPOS function†. The TPOS function includes three logic groups: 1. Select logic, 2. Cancel logic, and 3. Operate logic.

EDS devices (43-switches) can be controlled separately; i.e., the function has three separate sets of logic for control (i.e., TPOS01, TPOS02 and TPOS03). For simplicity, only the TPOS01 function is discussed here; the features in the other TPOS02 and 03 functions are identical to the TPOS01 function.

†Note: A binary IO module has binary input circuits (BIs) and binary output circuits (BOs); the user makes the connection between the TPOS01 function and the binary IO module using a signal number (is made of a “Function_ID” and an “Element_ID”). The signal numbers and names in the TPOS01 function are listed later.

Tips: If the user wishes to apply the TPOS function quickly, go to sections 2.11.6 and 2.11.5, where settings of the BI and BO circuits and the mapping of signal-points for IEC61850 communication is described.

Note: The implementation of such features is dependent upon the selection of hardware and the configuration of functions. Several IED models do not support certain features. To determine whether a particular feature has been implemented within an IED, identify the IED ordering number; and check the order number at the "G&T position" referring to the comparison table below. For more information, see *Appendix: Ordering*.

Table 2.11-1 Comparative table in respective ordering numbers

Sec.	Feature	Ordering No. at "G&T"					
		BCU			BCPU		IFU
		11	13	1F	2N	2C	19
–	Main features	✓	✓	✓	✓	NA	NA
–	Number of functions	3	3	3	3	–	–

✓: Applicable NA: Not applicable

2.11.1 PLC_BIT_Select logic for SBO/DIR modes

The user should set scheme switch [**TPOS01-CTREN**] to **On** prior to TPOS01 operation. Table 2.11-11 shows all of the scheme switches in the TPOS function.

(i) Receiving "select command P1-control" from the remote-end

Figure 2.11-2 outlines the reception of the select command 'P1-control' from the remote-end.

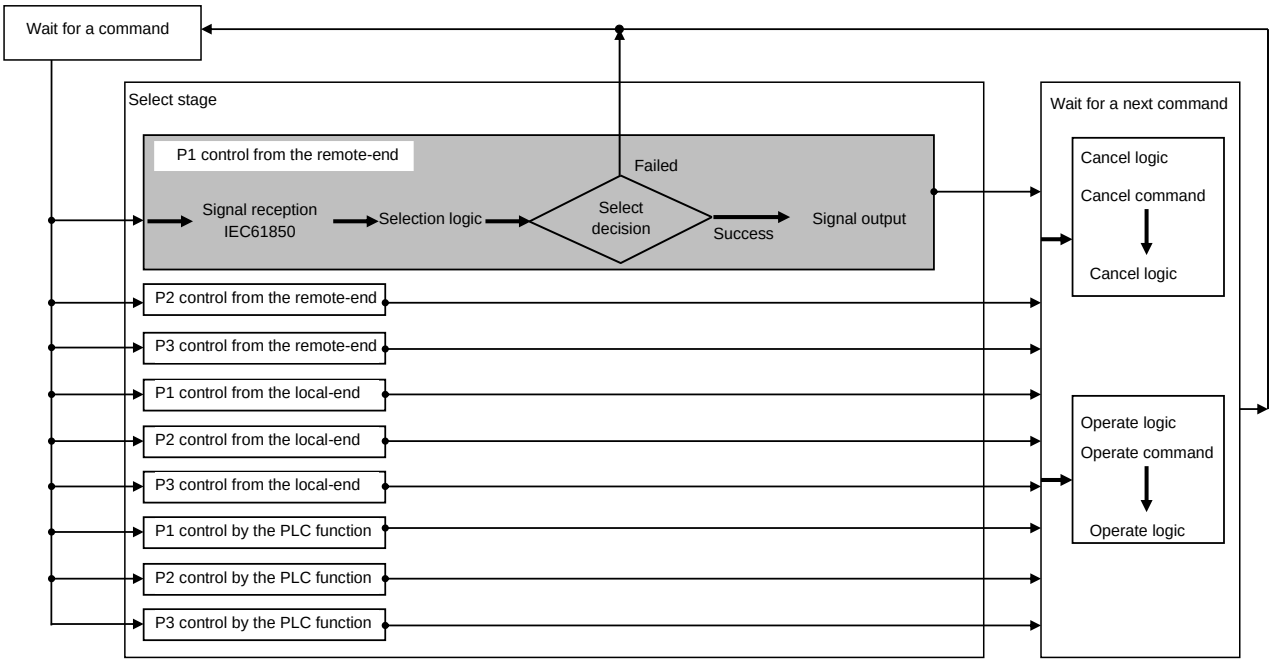


Figure 2.11-2 Outline of select command 'P1-control'

(i)-1 Input point required mapping

Figure 2.11-3 shows the select logic when a "Selection command (Remote-P1-Control)" signal is applied to the TPOS01 function. This logic has the input-point "DEV01_CONTROL_REQ" for the reception of a select command; the input-point should be mapped for IEC 61850 communication. The function will fail to operate if mapping is not performed correctly. We will discuss how to map the input-points for IEC 61850 communication in section 2.11.7.

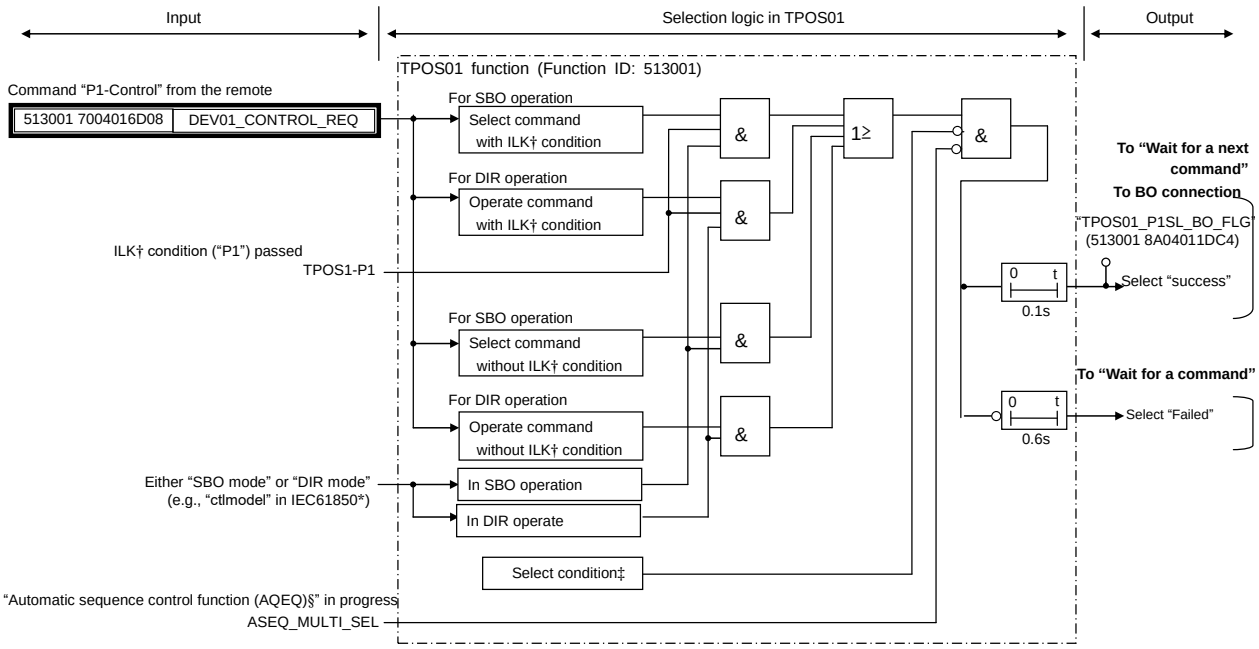


Figure 2.11-3 Select P1-control from the remote-end in TPOS01††

†Note: The software interlocking (ILK) function provides the operation criteria for "P1 control". The ILK function is discussed separately; note that the operation criteria is defined by the ILK function itself (i.e., the user cannot set the condition).

‡Note: A "select condition" signal is provided from the select condition scheme. For more information, see Figure 2.11-20.

§Note: An automatic sequence control (ASEQ) function can provide sequential signals for automatic control. The TPOS01 operation is blocked for the ASEQ function being in the operation. For more information of the ASEQ function, see Chapter *Control and monitoring application: Automatic sequence control function*.

*Note: The TPOS01 function can run in either the "SBO mode" or the "DIR mode". The user can use signal called "ctlmodel" when communication is implemented using IEC61850. To use this signal, the user must map for IEC61850 communication.

††Note: To identify the input and output points of the other TPOS logics, see Table 2.11-5, Table 2.11-7, and Table 2.11-10.

(i)-2 Output signal to BO

The TPOS01 function can issue an signal "Select success" at the output point "TPOS01_P1SL_BO_FLG", when the TPOS01 function determines that the input signal "Remote-P1-Control" received is true. If the TPOS01 function determines that the "Remote-P1-Control" is not true, the TPOS01 function returns to the "Wait for a command" stage.

(ii) Receiving “select command P2-control” from the remote-end

Figure 2.11-4 outlines the reception of the select command ‘P2-control’ from the remote-end.

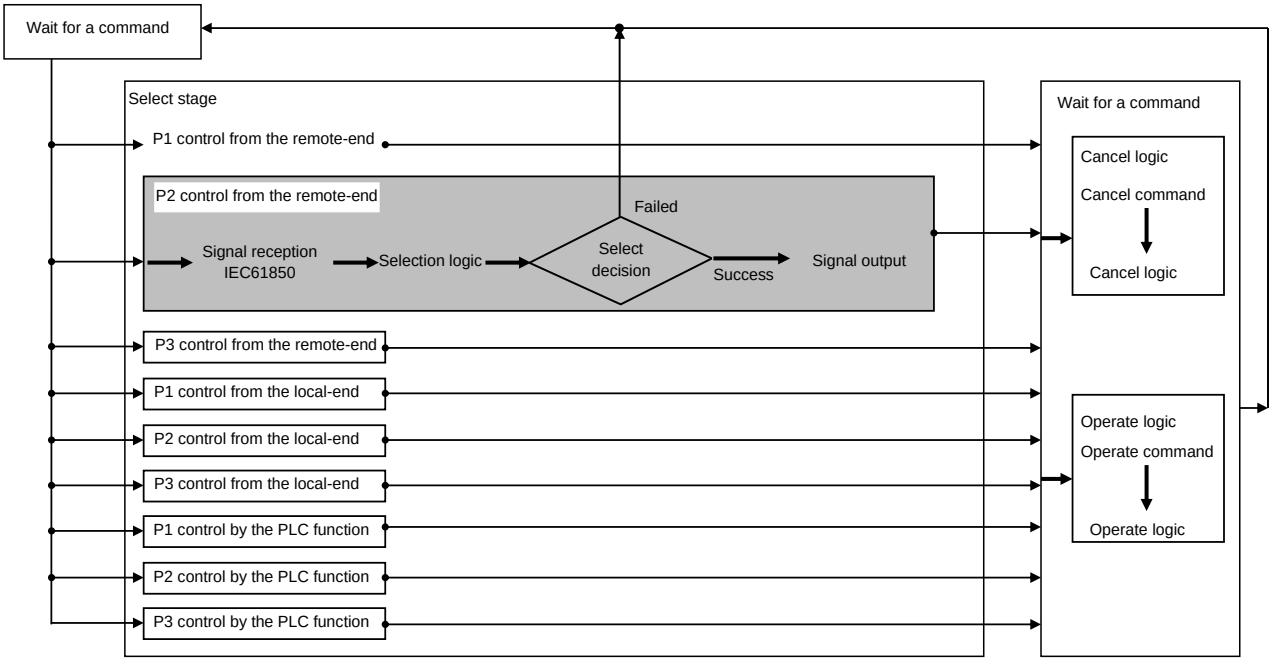


Figure 2.11-4 Outline of select command ‘P2-control’

(ii)-1 Input point mapped from the communication

Figure 2.11-5 shows the select logic when a “Select command P2 (Remote-P2-Control)” signal is received at the input-point “DEV01_CONTROL_REQ”.

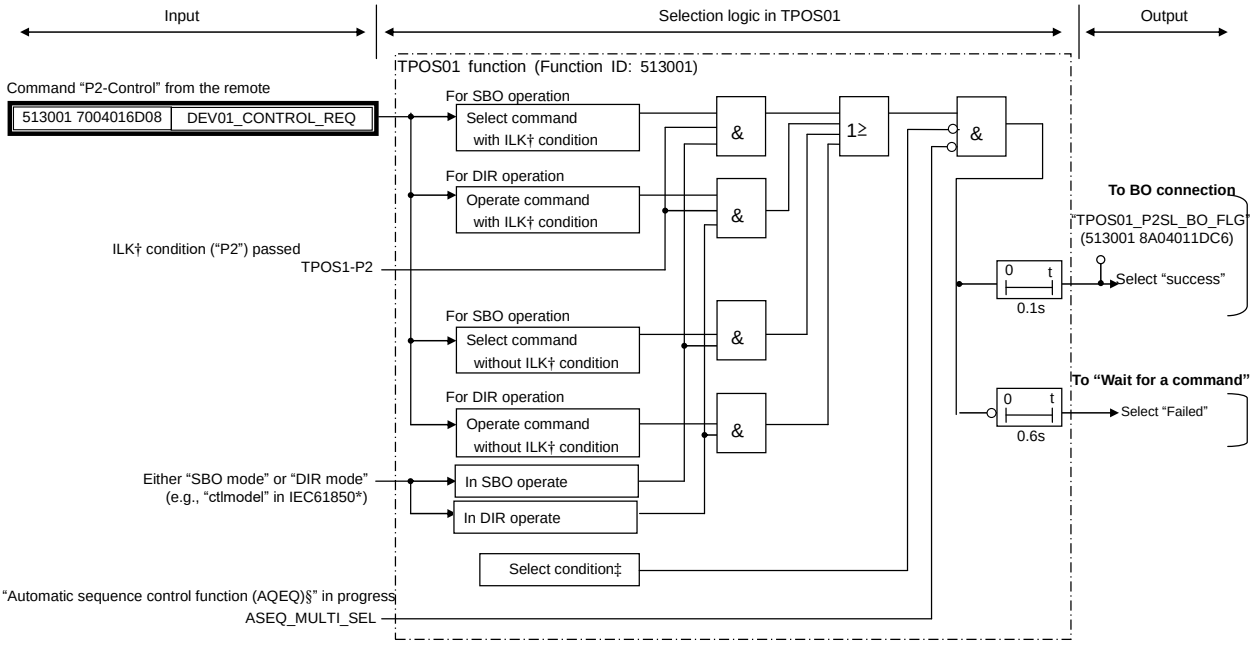


Figure 2.11-5 Select P2-control from the remote-end in TPOS01††

†Note:The ILK function provides the operation criteria for “P2-control”.

††Note: To identify the input and output points of the other TPOS logics, see Table

2.11-5,Table 2.11-7, and Table 2.11-10.

§Note:An automatic sequence control (ASEQ) function can provide sequential signals for automatic control. The TPOS01 operation is blocked for the ASEQ function when it is in operation. For more information regarding the ASEQ function, see Chapter *Control and monitoring application: Automatic sequence control function*.

(ii)-2 Output signal to BO

The TPOS01 function, in Figure 2.11-5, can issue a "Select success" signal at the output point "TPOS01_P2SL_BO_FL" when the TPOS01 function determines that the received signal "Select command (Remote-P2-Control)" is true. If the TPOS01 function determines that the "Remote-P2-Control" signal is not true, the TPOS01 function returns to the "Wait for a command" stage.

(iii) Receiving "select command P3-control" from the remote-end

Figure 2.11-6 outlines the reception of the select command e in P3-control from the remote end.

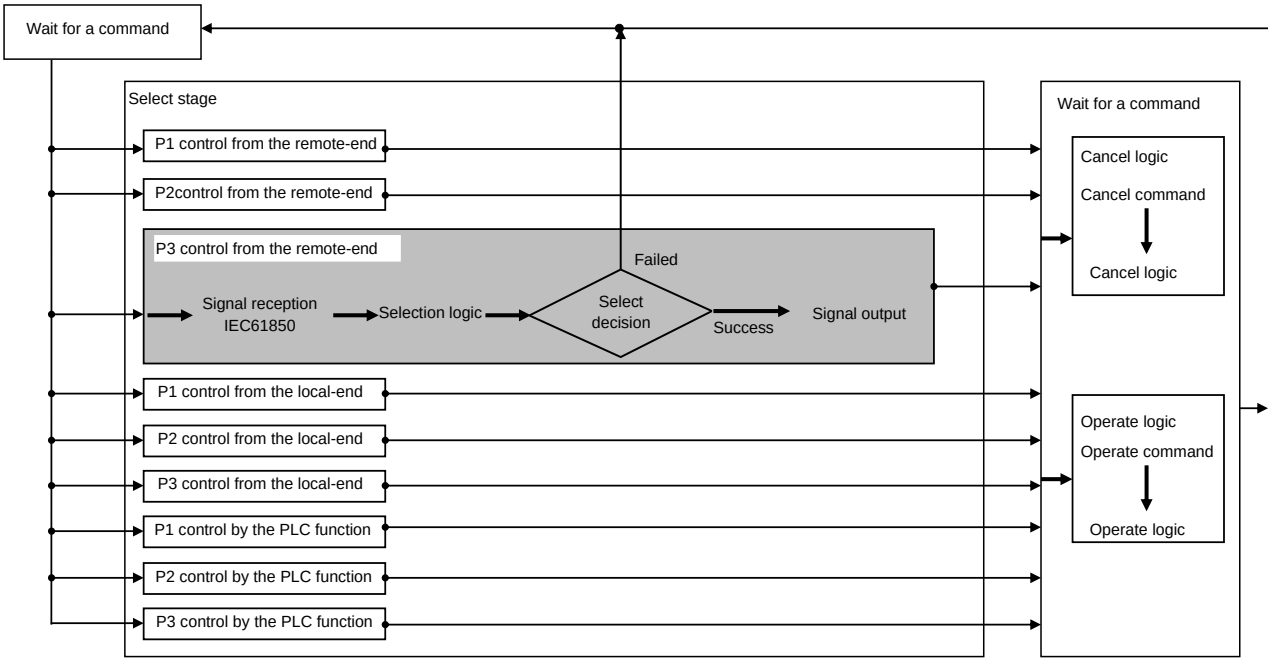


Figure 2.11-6 Outline of select command for 'P3-control'

(iii)-1 Input point mapped from the communication.

Figure 2.11-7 shows the select logic when a "Select command P3 (Remote-P3-Control)" signal is received at the input-point "DEV01_CONTROL_REQ".

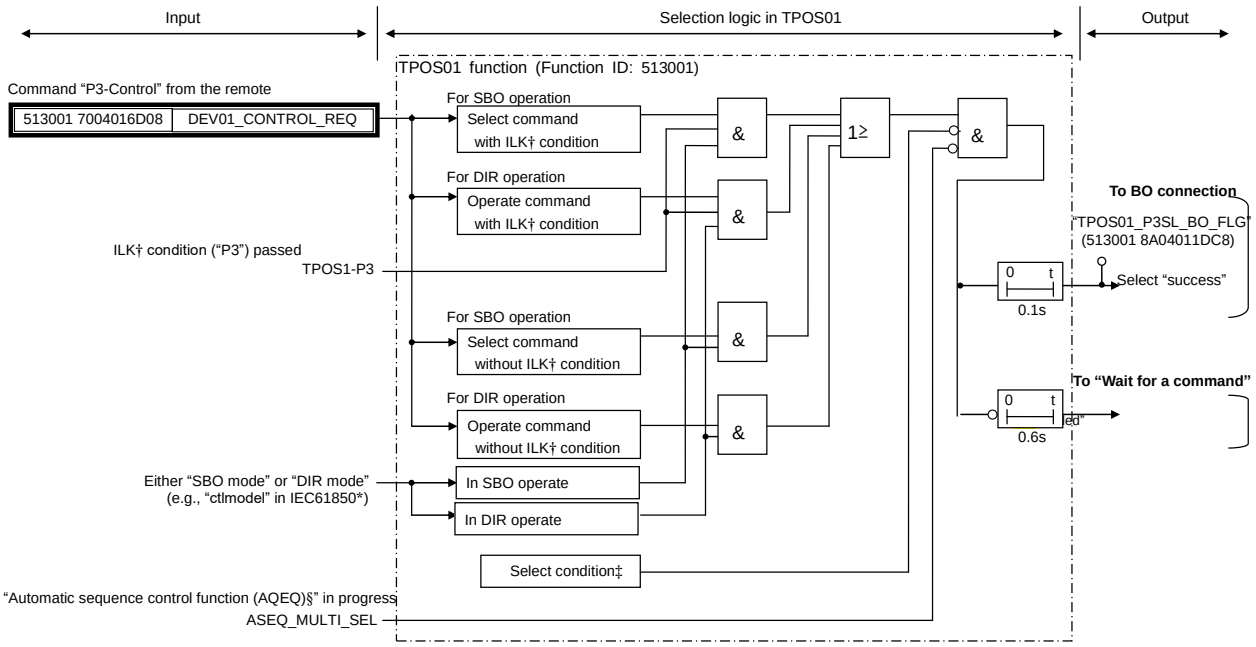


Figure 2.11-7 Select 'P3-control' from the remote-end in TPOS01††

†Note:The ILK function provides the operation criteria for "P3 control".

††Note: To identify the input and output points of the other TPOS logics, see Table 2.11-5, Table 2.11-7 and Table 2.11-10.

§Note:An automatic sequence control (ASEQ) function can provide sequential signals for automatic control. The TPOS01 operation is blocked for the ASEQ function when it is in operation. For more information regarding the ASEQ function, see Chapter *Control and monitoring application: Automatic sequence control function*.

(iii)-2 Output signal to BO

The TPOS01 function, in Figure 2.11-7, can issue a signal "Select success" at the output point "TPOS01_P3SL_BO_FL" when the TPOS01 function determines that the received signal "Select command P3 (Remote-P3-Control)" is true. If the TPOS01 function determines that the "Remote-P3-Control" is not true, the TPOS01 function returns to the "Wait for a command" stage.

(iv) Receiving "Select command P1-control" from the local-end.

Figure 2.11-8 outlines the reception of the select command 'P1-control' from the local-end.

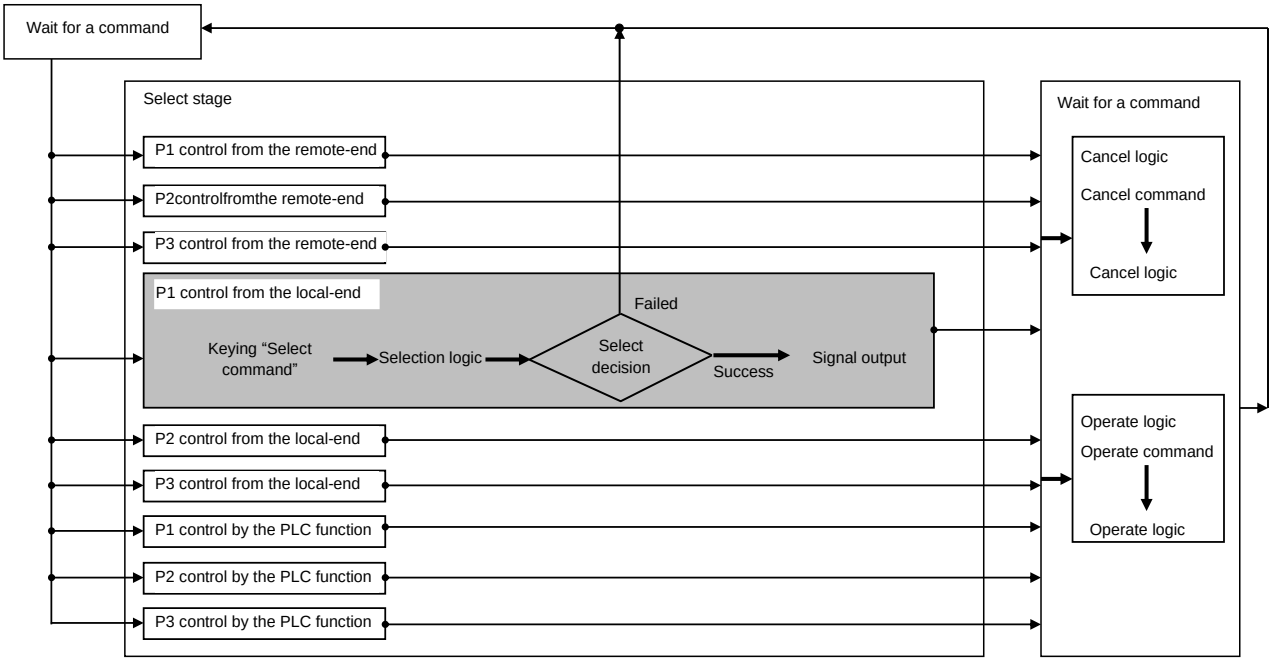


Figure 2.11-8 Outline of select command 'P1-control'

(iv)-1 Input signal generated at the local-end

Figure 2.11-9 shows the select logic when a "Select command (Local-P1-Control)" signal is applied to the TPOS01 function. The signal is provided when a "Local-P1-control" key is pressed on the IED front panel; the user is not required to map the signal from IEC61850. Note that the user should set scheme switch [**TPOS01-CTRAHMI**] to **SBO** when the operation from the IED front panel is required, we will discuss how to set in chapter *User interface: Control sub-menu*.

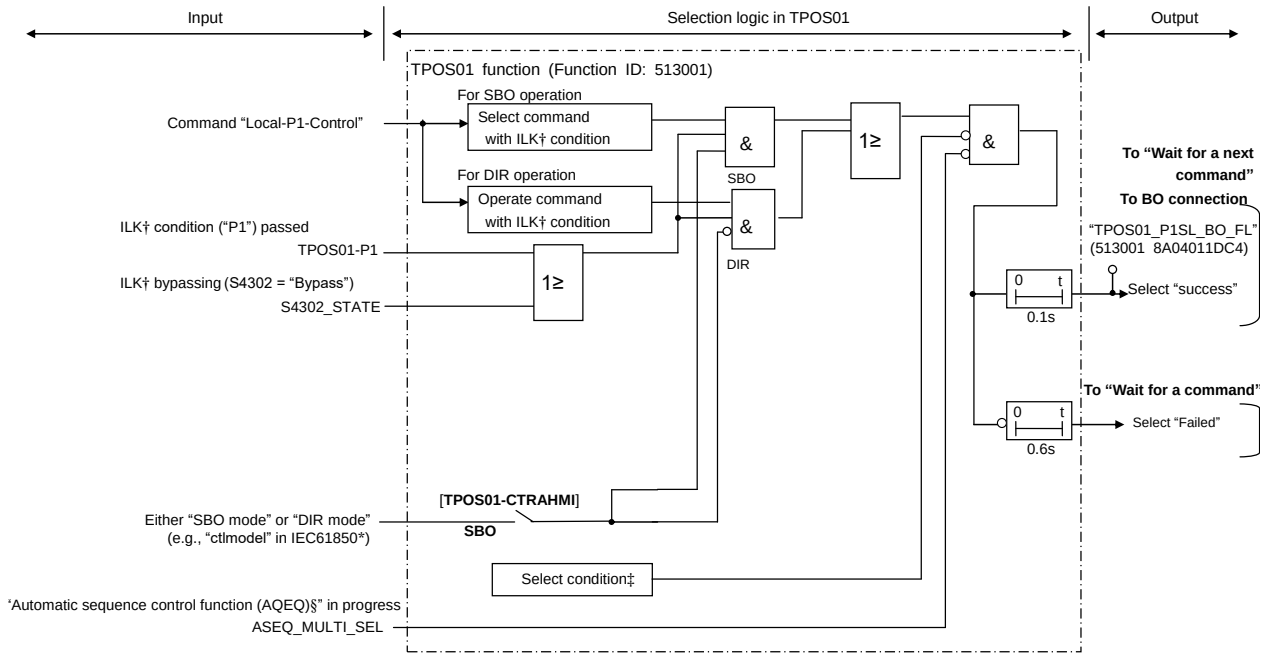


Figure 2.11-9 Selection logic for P1-control at the IED locally in TPOS01††

†Note:The ILK function provides the operation criteria for "P1-control".

‡Note:A "select condition" signal is provided from the select condition scheme. For more information, see Figure 2.11-20

§Note:An automatic sequence control (ASEQ) function can provide sequential signals for automatic control. The TPOS01 operation is blocked for the ASEQ function when it is in operation. For more information regarding the ASEQ function, see Chapter *Control and monitoring application: Automatic sequence control function*.

††Note: To identify the input/output signals of the other TPOS logics, see Table 2.11-6, Table 2.11-7 and Table 2.11-10.

(iv)-2 Output signal to BO

When the "select condition" signal is true, the TPOS01 function can issue a "Select success" signal at the output-point "TPOS01_P1SL_BO_FL".

Note: The signal "TPOS01_P1SL_BO_FL" is the same as the signal shown in Figure 2.11-3. If the input signal "Local-P1-Control" is not true, the TPOS01 function returns to the "Wait for a command" stage.

(v) Receiving "Select command P2-control" from the local-end.

Figure 2.11-10 outlines the reception of the select command 'P2-control' from the local-end.

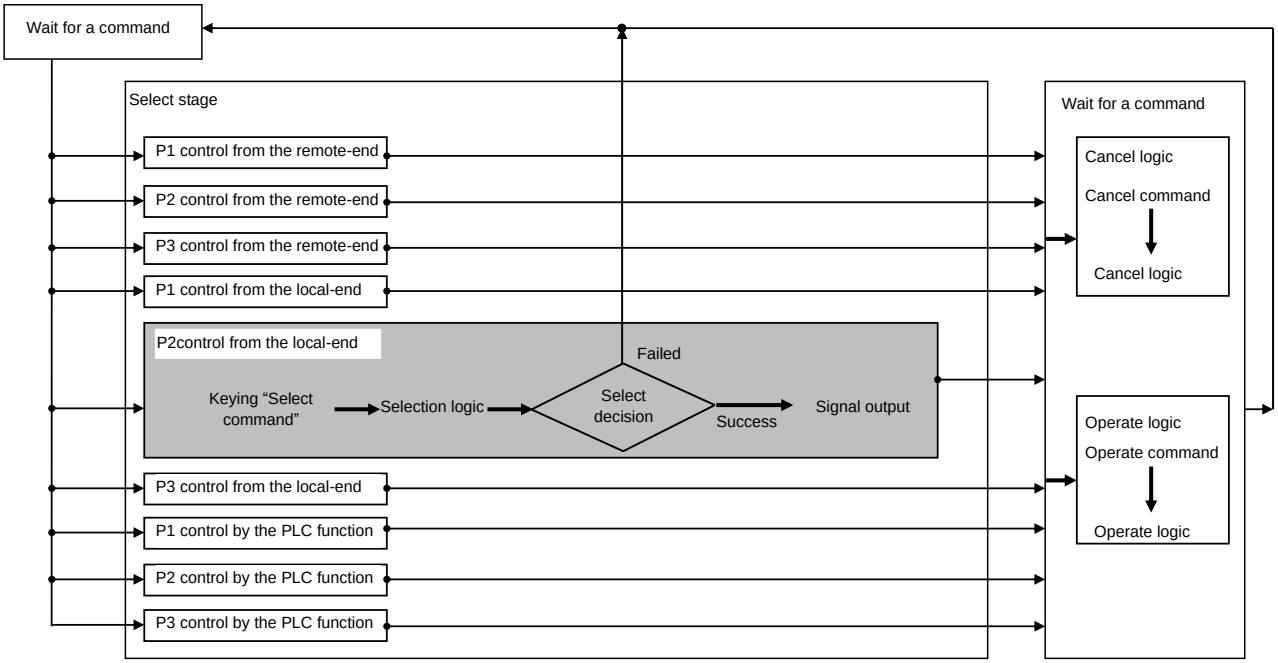


Figure 2.11-10 Outline of select command for 'P2-control'

(v)-1 Input signal generated at the local-end

Figure 2.11-11 shows the select logic when a "Select command P2 (Local-P2-Control)" signal is applied to the TPOS01 function. The signal is provided when the user presses a "Local-P2-control" key on the IED front panel; the user is not required to take account of mapping.

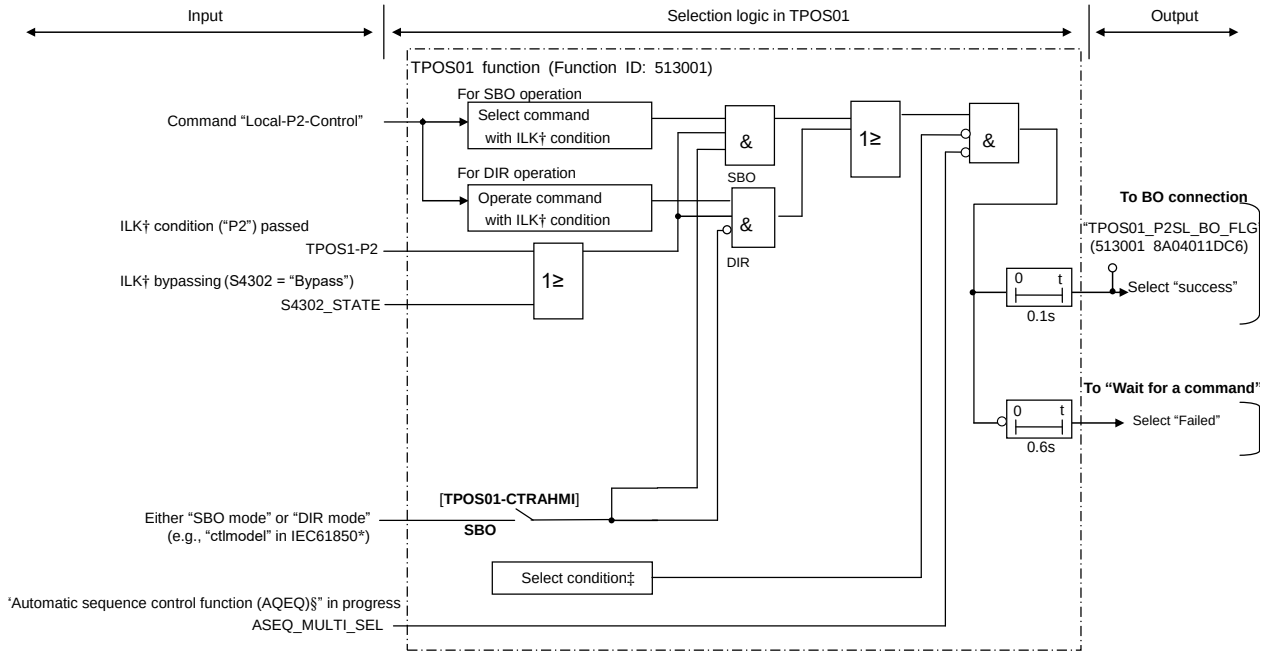


Figure 2.11-11 Select P2-control on the front panel in TPOS01††

†Note:The ILK function provides the operation criteria for "P2-control".

§Note:An automatic sequence control (ASEQ) function can provide sequential signals for automatic control. The TPOS01 operation is blocked for the ASEQ function when

it is in operation. For more information regarding the ASEQ function, see Chapter *Control and monitoring application: Automatic sequence control function*.

‡Note: A "select condition" signal is provided from the select condition scheme. For more information, see Figure 2.11-20.

††Note: To identify the input/output signals of the other TPOS logics, see Table 2.11-6, Table 2.11-7, and Table 2.11-10.

(v)-2 Output signal to BO

When the "select condition" signal is true, the TPOS01 function can issue "Select success" signal at the output-point "TPOS01_P2SL_BO_FLG".

[1]Note: The "TPOS01_P2SL_BO_FLG" signal is the same as the signal shown in Figure 2.11-5. If the "Local-P2-Control" signal is not true, the TPOS01 function returns to the "Wait for a command" stage.

(vi) Receiving "Select command P3-control" from the local-end

Figure 2.11-12 outlines the reception of the select command 'P3-control' from the local-end.

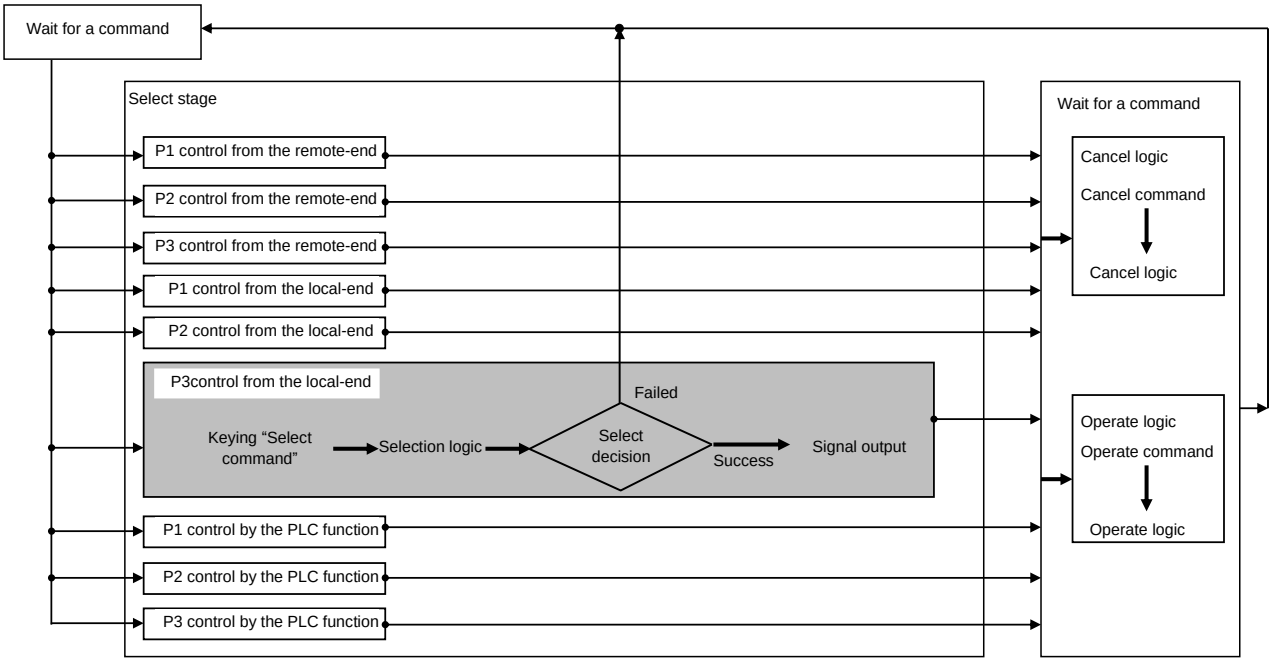


Figure 2.11-12 Outline of select command 'P3-control'

(vi)-1 Input signal generated at the local-end

Figure 2.11-13 shows the select logic when a "Select command (Local-P3-Control)" signal is applied to the TPOS01 function. The signal is provided when the user press a "Local-P3-control" key on the IED front panel; the user is not required to take account of mapping.

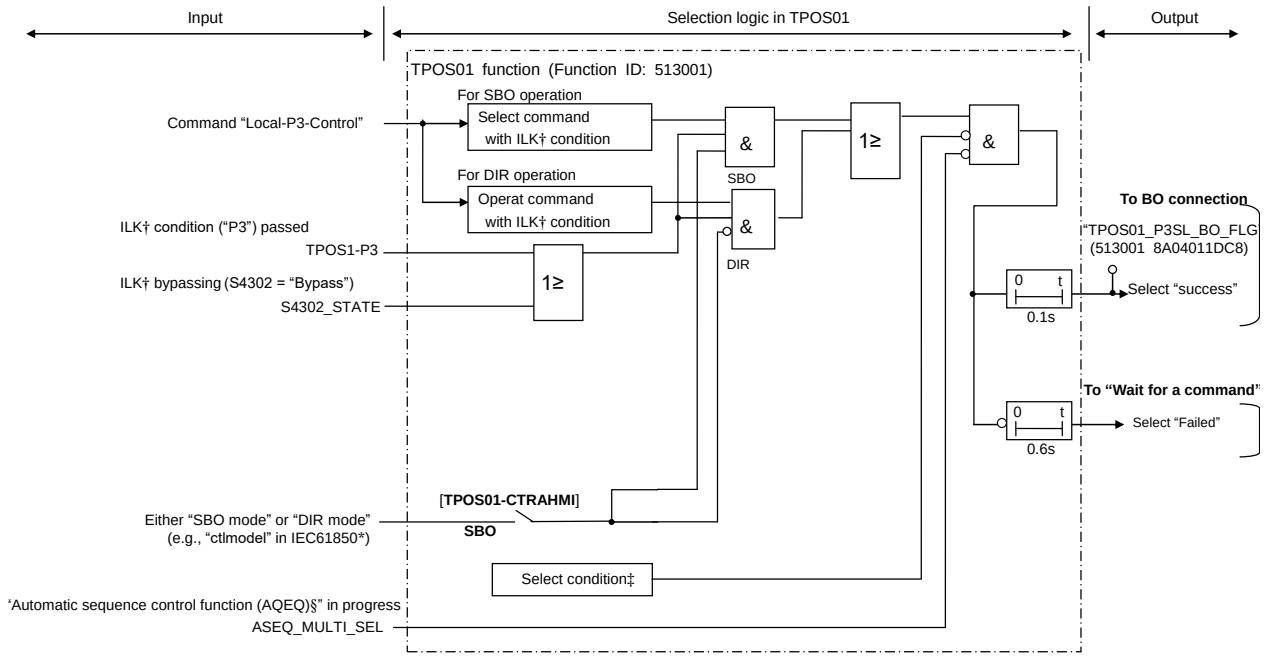


Figure 2.11-13 Select 'P3-control' on the front panel in TPOS01††

†Note:The ILK function provides the operation criteria for "P3-control".

††Note: To identify the input/output signals of the other TPOS logics, see Table 2.11-6,Table 2.11-7 , and Table 2.11-10.

‡Note:A "select condition" signal is provided from the select condition scheme. For more information, see Figure 2.11-20.

§Note:An automatic sequence control (ASEQ) function can provide sequential signals for automatic control. The TPOS01 operation is blocked for the ASEQ function when it is in operation. For more information regarding the ASEQ function, see Chapter *Control and monitoring application: Automatic sequence control function*.

(vi)-2 Output signal to BO

When the "select condition" signal is true, the TPOS01 function can issue a "Select success" signal at the output-point "TPOS01_P3SL_BO_FLG".

[1]Note: The "TPOS01_P3SL_BO_FLG" signal is the same signal as shown in Figure 2.11-7. If the "Local-P3-Control" signal is not true, the TPOS01 function returns to the "Wait for a command" stage.

(vii) Receiving "Select command P1-control" by PLC function

Figure 2.11-14 outlines the reception of the select command 'P1-control' by the PLC function.

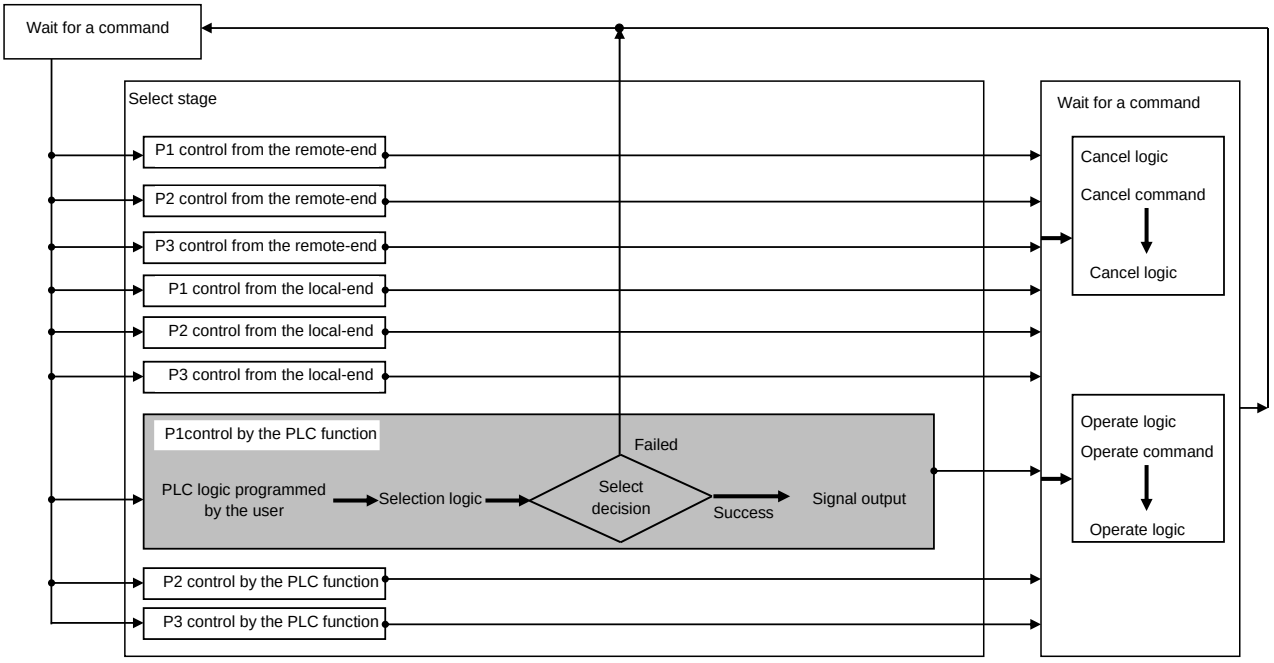


Figure 2.11-14 Outline of select command 'P1-control'

(vii)-1 Input signal from the PLC function

Figure 2.11-15 shows the select logic when a "Select command P1-Control (PLC-P1-Control)" signal is generated by the PLC function. There are two input points for the reception: the former connection point(PLC#1) is used for the reception of the select-command when the interlock check is required, the later connection point(PLC#2) is used for the reception of the select-command when the interlock check is not required. That is, for the TPOS01 function, when the signal "Select command P1-Contol (PLC-P1-Control)" generated in the user-programmed logic is applied for the select logic, and when interlock-check is required in the select-logic, use connection point (PLC#1:e.g.,PLC_BIT_1041)". Alternatively, if the interlock check is not required, use the other connection point (PLC#2:e.g., PLC_BIT_1040)". PLC#1 and PLC#2 are shown in Table 2.11-2.

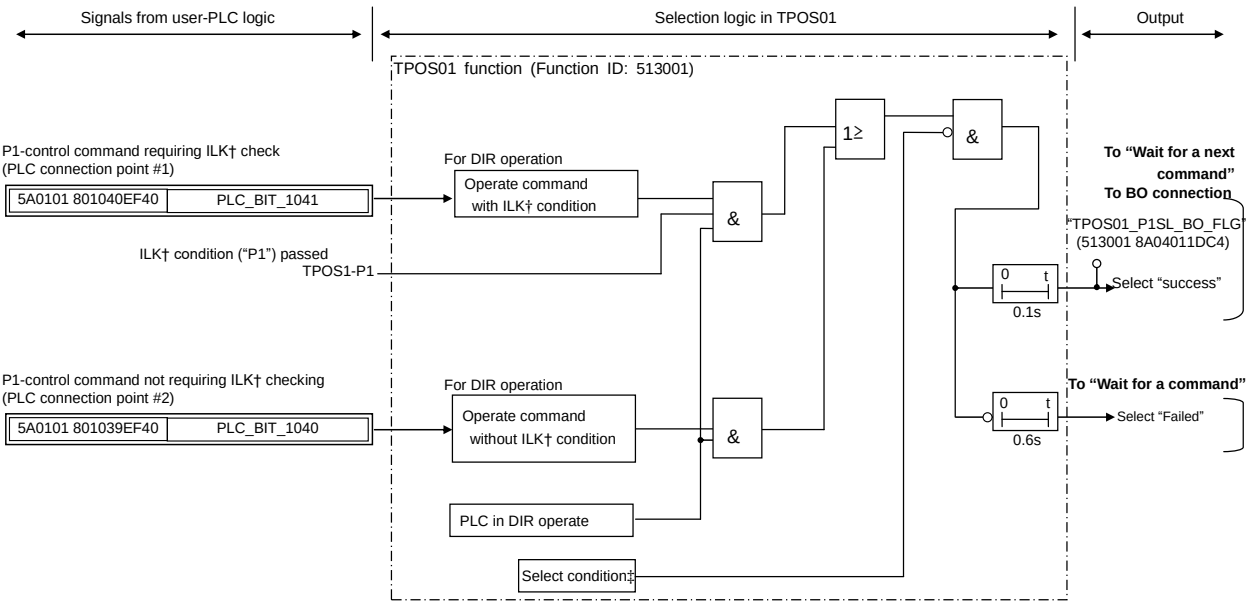


Figure 2.11-15 Select 'P1-control' by the PLC function in TPOS01††

†Note: The ILK function provides the operation criteria for "P1-control".

‡Note: A "select condition" signal is provided from the select condition scheme. For more information, see Figure 2.11-20.

§Note: An automatic sequence control (ASEQ) function can provide sequential signals for automatic control. The TPOS01 operation is blocked for the ASEQ function when it is in operation. For more information regarding the ASEQ function, see Chapter *Control and monitoring application: Automatic sequence control function*.

*Note: The TPOS01 function can run in either the "SBO mode" or the "DIR mode". The user can use signal called "ctlmodel" when communication is implemented using IEC61850. To use this signal, the user must map for IEC61850 communication.

††Note: To identify the input and output point of the other TPOS logics, see Table 2.11-8 for the inputs PLC#1 and PLC#2, Table 2.11-10 for the outputs.

(vii)-2 Output signal to BO

The TPOS01 function, in Figure 2.11-15, can issue a "Select success" signal at the output-point "TPOS01_P1SL_BO_FLG"[1].

[1]Note: The "TPOS01_P1SL_BO_FLG" signal is the same as the signal shown in Figure 2.11-13.

(viii) Receiving "Select command P2-control" by PLC function

Figure 2.11-16 outlines the reception of the select command 'P2-control' by the PLC function.

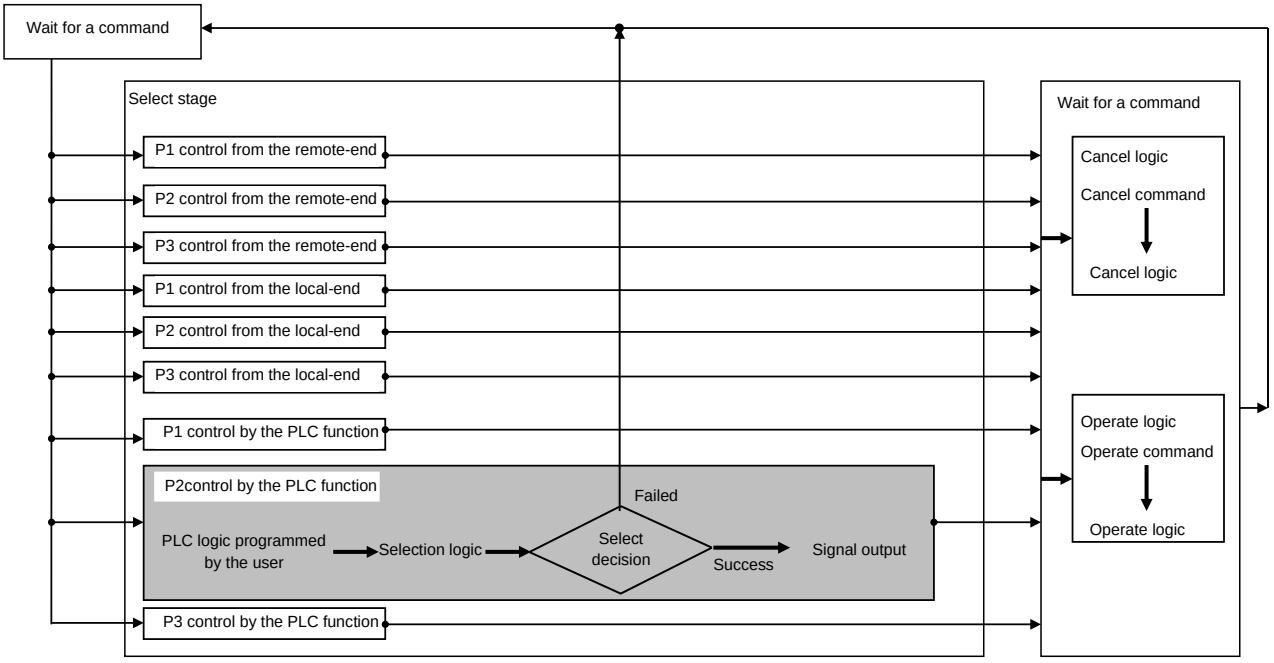


Figure 2.11-16 Outline of select command 'P2-control'

(viii)-1 Input signal from the PLC function

Figure 2.11-17 shows the select logic when a signal "Selection command P2-Control (PLC-P2-Control)" is generated by the PLC function. There are two input points for the reception, like in the "Select command P1-Control (PLC-P1-Control)" signal. That is, if interlock checking is required, use connection point (PLC#1:e.g., PLC_BIT_1043). Alternatively, if the inter-lock check is not required, use the connection point (PLC#2:e.g., PLC_BIT_1042). PLC#1 and the PLC#2 are shown in Table 2.11-3.

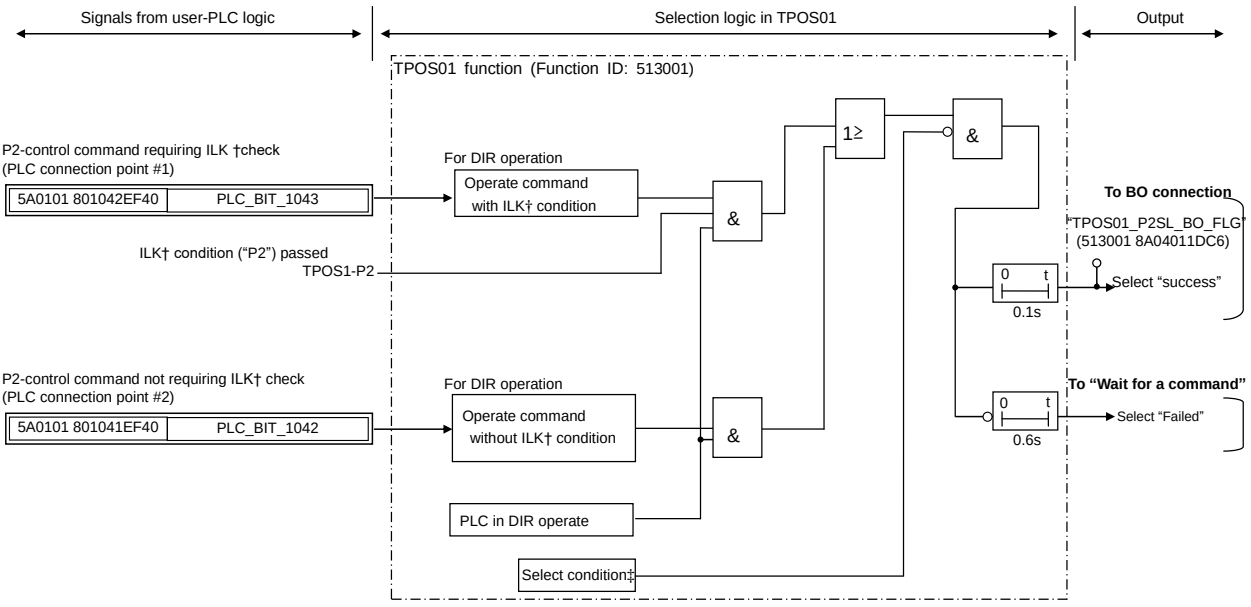


Figure 2.11-17 Select logic 'P2-control' using the PLC function in TPOS01††

††Note: To identify the input and output points of the other TPOS logics, see Table 2.11-3 for PLC#1 and #2, and Table 2.11-10 for the outputs.

†Note:The ILK function provides the operation criteria for "P2-control".

‡Note:A "select condition" signal is provided from the select condition scheme. For more information, see Figure 2.11-20.

(viii)-2 Output signal to BO

The TPOS01 function, in Figure 2.11-17, can issue a "Select success" signal at the output point "TPOS01_P2SL_BO_FLG"[1].

[1]Note: The output point "TPOS01_P2SL_BO_FLG" is the same as the signal shown in Figure 2.11-5.

(ix) Receiving "Select command P3-control" by the PLC function

Figure 2.11-18 outlines the reception of the select command 'P3-control' by the PLC function.

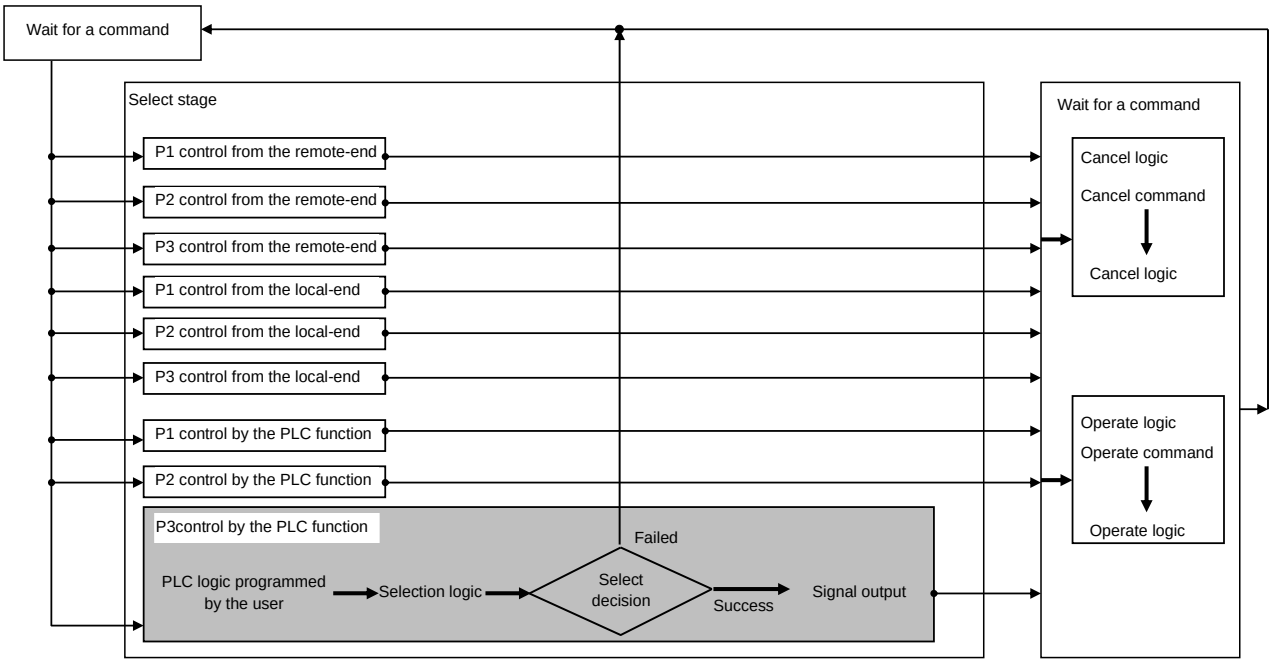


Figure 2.11-18 Outline of select command 'P3-control'

(ix)-1 Input signal from the PLC function

Figure 2.11-9 shows the select logic when a "Select command P3-Control (PLC-P3-Control)" signal is generated by the PLC function. There are two input points for the reception of this signal, like in the "Select Command P1-Control (PLC-P1-Contol)" signal. That is, if interlock checking is required, use the connection point (PLC#1; e.g., PLC_BIT_1045). Alternatively, if the interlock check is not required, use the connection point (PLC#2; e.g., PLC_BIT_1044). PLC#1 and PLC#2 are shown in Table 2.11-4.

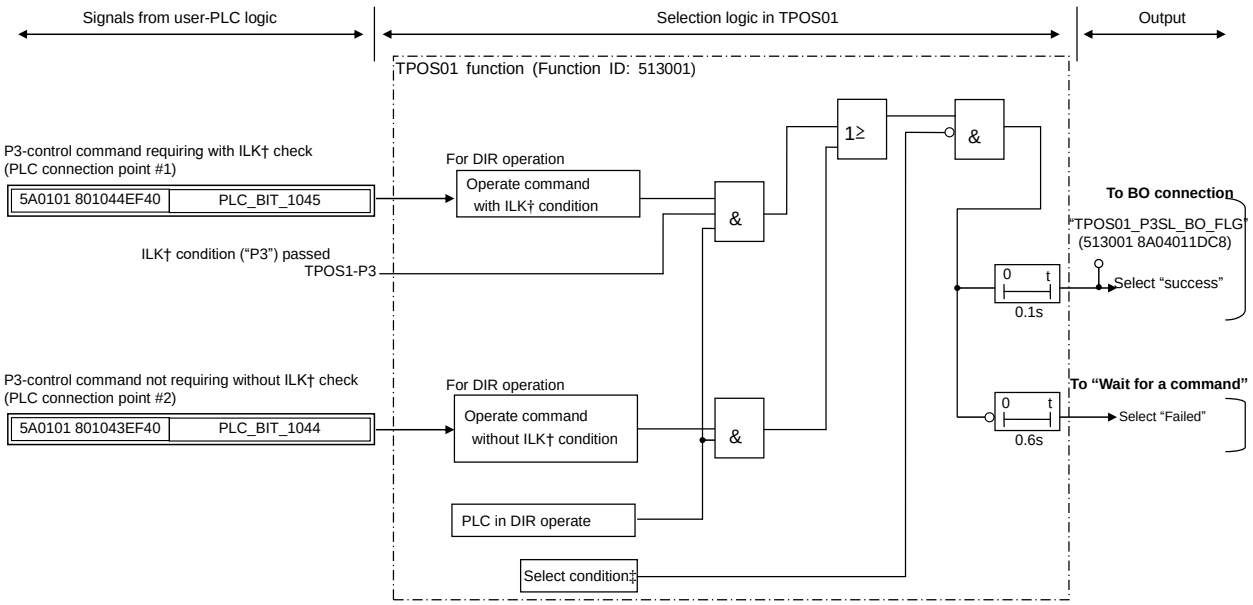


Figure 2.11-19 Select 'P3-control' using the PLC function in TPOS01††

††Note: To know the input and output points of the other TPOS logics, see Table 2.11-4 for the input PLC#1 and PLC#2 and Table 2.11-10 for the outputs.

(ix)-2 Output signal to BO

The TPOS01 function, in Figure 2.11-19, can issue a "Select success" signal at the output point "TPOS01_P3SL_BO_FLG"[1].

[1]Note: The output point "TPOS01_P3SL_BO_FLG" is the same as the signal shown in Figure 2.11-7.

(x) Select condition

Figure 2.11-20 shows the select condition logic in the TPOS01 function. The TPOS01 function can check the condition for the select command using the signals "TPOS01_ST_P1", "TPOS01_ST_P2", and "TPOS01_ST_P3" (see Table 2.11-35). If the original logic does not meet with the requirements of the user, the following alternatives are available:

1. The user can replace the original logic with alternative logic,
2. The user can add additional logic to the original logic.

(x)-1 How to replace the original logic

If the user wishes to replace the select condition logic, the user can replace it using the PLC connection point "User configurable condition" set items:

1. Connect the user-customized logic with PLC_BIT_1049, which is listed as PLC#2 in Table 2.11-8.
2. Set the scheme switch [**TPOS01-LGSLFFCT**] to **PLC**.

(x)-2 How to add another select condition signal

If adding another condition is required, the user can add a signal to the select condition logic using the PLC condition point "User Additional Condition".

1. Add a user-preferred signal using PLC_BIT_1048, which is listed as PLC#1 in Table 2.11-8.
2. Set the scheme switch [**TPOS01-LGSLFFCT**] to **Fixed logic**.

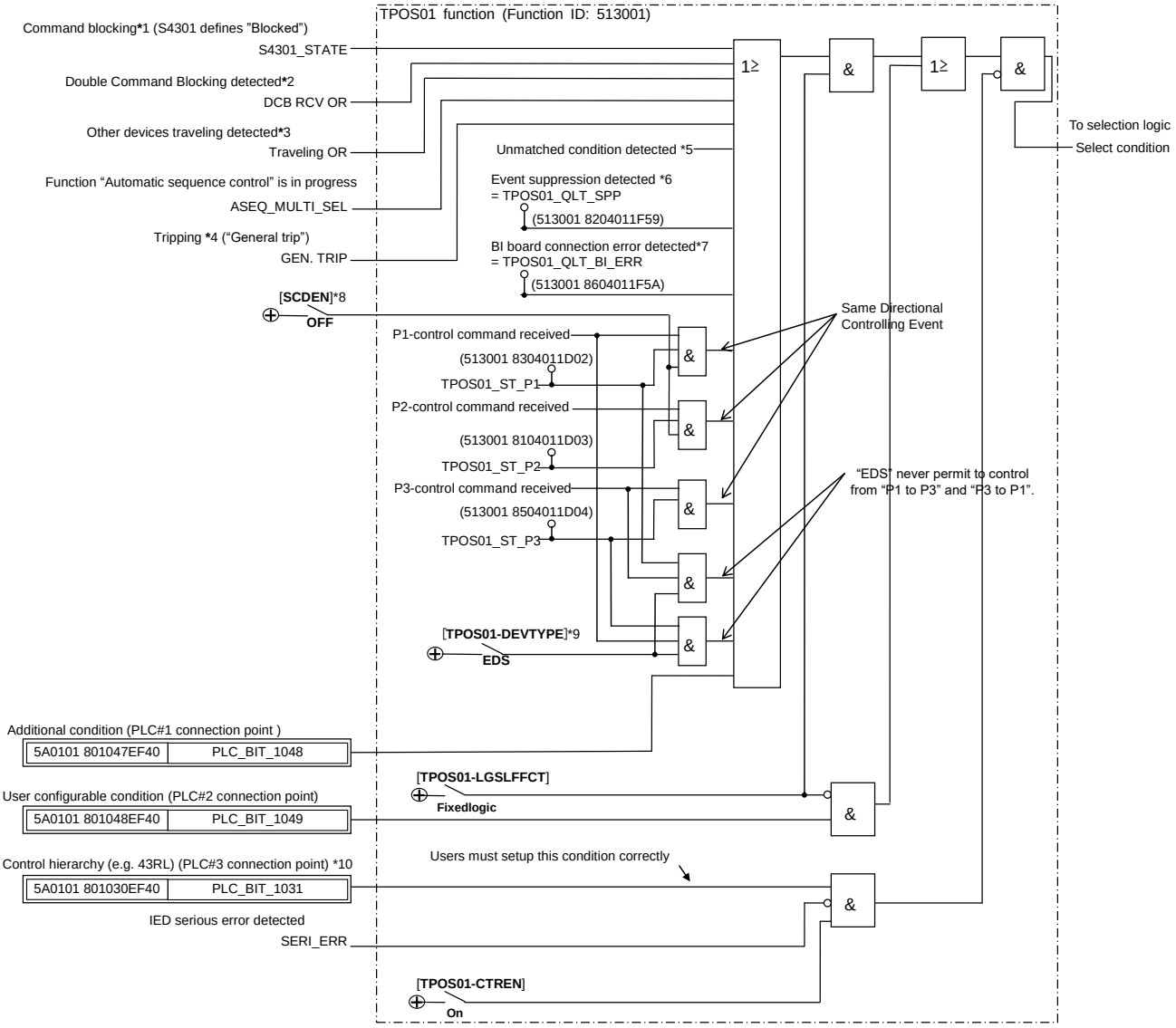


Figure 2.11-20 Select condition logic for 'P1–P3 control' in TPOS01*[11]

*[1]Note: "Command Blocking" disables any operation except its own; the "Command blocking" is initiated by the status of "S4301" in a software switch controller (SOFTSW). The IEC 61850 standard defines "Command Blocking" as "CmdBlk". For more information of "S4301", see Chapter *Control and monitoring application: Software switch control*. See the signal "S4301_STATE" of Table 2.11-6.

*[2]Note: "Double Command Blocking (DCB)" is an operation philosophy. It can be used to protect the substation. The user can program it using GR-TIEMS.

*[3]Note: If the event "device-travelling is detected, it indicates that another operator

is changing the states of a device. Thus, the IED should inhibit the operation of any device for the duration that the event is detected. The detecting signal is denoted as "Traveling OR" in Table 2.11-6.

*4Note: If the issue of a trip command is executed by the IED, any control operation is blocked until the trip operation is completed. If an IED includes a relay application, the trip command is issued at the output-point "GEN.TRIP" in Table 2.11-6.

*5Note: Criteria "unmatched conditions" are decided when "Test-bit status" in a command is not identical to "IED test status".

*6Note: The "Event suppression" function can detect chattering on BI circuits. (See 2.11.6(i)-3)

*7Note: A supervision of the Binary IO module can detect connection errors for BI circuits.

*8Note: The Common control (CMNCTRL) function can test or check the P1–P3 control operations performed by the logic. When the user sets **Off** for scheme switch [**SCDEN**], the operation of the logic is blocked if the logic is running in the same operation-direction compared with the previous operation-direction. On the other hand, if **On** is set for the scheme switch, the logic is not blocked.

*9Note: The user should set scheme switch [**TPOS01-DEVTYPE**] to **EDS** when the earth-switch(ES) is applied for the TPOS01 function.

*10Note: The user will need to program the PLC logic "Control hierarchy condition" The user is also required to connect the logic condition with the select condition logic using the connection point "PLC_BIT_1031". For more information, see chapter *Control and monitoring application: Control hierarchy*". See PLC#3 of Table 2.11-8.

*11Note: To identify the input points of the other TPOS, see Table 2.11-8 for PLC#1 to #3.

(xi) Signal name and number

Note: The user should note that the following descriptions shown in the column "M/O" for each table:

"O" indicates that the signal is provided for the optional usage.

"M" indicates that the user should map/set/configure the signal; otherwise, the user may face an operational failure if the default settings are used.

"N/A" indicates that the user cannot change the state of the signal.

Table 2.11-2 PLC connection points (Input points for 'P1-control')

Signal Number	Signal Name	Description	M/O
5A0101 801040EF40	PLC_BIT_1041	P1-control checking with interlock in TPOS01 (for PLC#1)	O
5A0101 801065EF40	PLC_BIT_1066	P1-control checking with interlock in TPOS02 (for PLC#1)	O
5A0101 801090EF40	PLC_BIT_1091	P1-control checking with interlock in TPOS03 (for PLC#1)	O
5A0101 801039EF40	PLC_BIT_1040	P1-control without checking in TPOS01 (for PLC#2)	O
5A0101 801064EF40	PLC_BIT_1065	P1-control without checking in TPOS02 (for PLC#2)	O
5A0101 801089EF40	PLC_BIT_1090	P1-control without checking in TPOS03 (for PLC#2)	O

Table 2.11-3 PLC connection points (Input point for 'P2-control')

Signal Number	Signal Name	Description	M/O
5A0101 801042EF40	PLC_BIT_1043	P2-control checking with interlock in TPOS01 (for PLC#1)	O
5A0101 801067EF40	PLC_BIT_1068	P2-control checking with interlock in TPOS02 (for PLC#1)	O
5A0101 801092EF40	PLC_BIT_1093	P2-control checking with interlock in TPOS03 (for PLC#1)	O
5A0101 801041EF40	PLC_BIT_1042	P2-control without checking in TPOS01 (for PLC#2)	O
5A0101 801066EF40	PLC_BIT_1067	P2-control without checking in TPOS02 (for PLC#2)	O
5A0101 801091EF40	PLC_BIT_1092	P2-control without checking in TPOS03 (for PLC#2)	O

Table 2.11-4 PLC connection points (Input point for 'P3-control')

Signal Number	Signal Name	Description	M/O
5A0101 801044EF40	PLC_BIT_1045	P3-control checking with interlock in TPOS01 (for PLC#1)	O
5A0101 801069EF40	PLC_BIT_1070	P3-control checking with interlock in TPOS02 (for PLC#1)	O
5A0101 801094EF40	PLC_BIT_1095	P3-control checking with interlock in TPOS03 (for PLC#1)	O
5A0101 801043EF40	PLC_BIT_1044	P3-control without checking in TPOS01 (for PLC#2)	O
5A0101 801068EF40	PLC_BIT_1069	P3-control without checking in TPOS02 (for PLC#2)	O
5A0101 801093EF40	PLC_BIT_1094	P3-control without checking in TPOS03 (for PLC#2)	O

Table 2.11-5 Mapping points for the reception of control commands

Signal Number	Signal Name	Description	M/O
513001 7004016D08	DEV01_CONTROL_REQ	TPOS01 control command received. (Mapping Data)	M
513001 7004026D08	DEV02_CONTROL_REQ	TPOS02 control command received. (Mapping Data)	M
513001 7004036D08	DEV03_CONTROL_REQ	TPOS03 control command received. (Mapping Data)	M

Table 2.11-6 Input signals to condition logic

Signal Number	Signal Name	Description	M/O
522001 000A011001	S4301_STATE	Command Blocking status (Off / Blocked)	N/A
522001 000A021001	S4302_STATE	Interlock bypassing switch	N/A
5A0001 0008001F41	DCB RCV OR	Double Command Blocking(DCB) is in progress.	N/A
5A0001 0008001F40	Traveling OR	Travelling events are detected.	N/A

Signal Number	Signal Name	Description	M/O
4A0001 8300001B6F	GEN. TRIP	General trip	N/A
5A0001 3108003F40	SDCEN	(This is setting of CMNCTRL)	N/A
5A0101 3100001F43	SERI_ERR	Serious Error detected	N/A
570001 3103011DA2	ASEQ_MULTI_SEL	Automatic sequence control is in progress.	N/A

Table 2.11-7 PLC connection points Interlock for P1, P2, and P3-control

Signal Number	Signal Name	Description	M/O
570001 3104011DA0	TPOS1-P1	Interlock condition for P1 control in TPOS01.	N/A
570001 3104021DA0	TPOS2-P1	Interlock condition for P1 control in TPOS02	N/A
570001 3104031DA0	TPOS3-P1	Interlock condition for P1 control in TPOS03	N/A
570001 3104011DA2	TPOS1-P2	Interlock condition for P2 control in TPOS01.	N/A
570001 3104021DA2	TPOS2-P2	Interlock condition for P2 control in TPOS02	N/A
570001 3104031DA2	TPOS3-P2	Interlock condition for P2 control in TPOS03	N/A
570001 3104011DA4	TPOS1-P3	Interlock condition for P3 control in TPOS01.	N/A
570001 3104021DA4	TPOS2-P3	Interlock condition for P3 control in TPOS02	N/A
570001 3104031DA4	TPOS3-P3	Interlock condition for P3 control in TPOS03	N/A

Table 2.11-8 PLC connection points (Input signals for select condition logic)

Signal Number	Signal Name	Description	M/O
5A0101 801047EF40	PLC_BIT_1048	TPOS01 additional failure condition(PLC#1)	O
5A0101 801072EF40	PLC_BIT_1073	TPOS02 additional failure condition(PLC#1)	O
5A0101 801097EF40	PLC_BIT_1098	TPOS03 additional failure condition(PLC#1)	O
5A0101 801048EF40	PLC_BIT_1049	TPOS01 user configurable select condition(PLC#2)	O
5A0101 801073EF40	PLC_BIT_1074	TPOS02 user configurable select condition(PLC#2)	O
5A0101 801098EF40	PLC_BIT_1099	TPOS03 user configurable select condition(PLC#2)	O
5A0101 801030EF40	PLC_BIT_1031	TPOS01 control hierarchy condition(PLC#3)	M
5A0101 801033EF40	PLC_BIT_1034	TPOS02 control hierarchy condition(PLC#3)	M
5A0101 801036EF40	PLC_BIT_1037	TPOS03 control hierarchy condition(PLC#3)	M

Table 2.11-9 PLC monitoring points (Output signal for select condition logic)

Signal Number	Signal Name	Description
5130018004011F54	TPOS01_SC_ST_ERR	TPOS01 select command mode is invalid.
5130018004021F54	TPOS02_SC_ST_ERR	TPOS02 select command mode is invalid.
5130018004031F54	TPOS03_SC_ST_ERR	TPOS03 select command mode is invalid.
5130018204011F59	TPOS01_QLT_SPP	Event suppression detected (TPOS01)
5130018204021F59	TPOS02_QLT_SPP	Event suppression detected (TPOS02)
5130018204031F59	TPOS03_QLT_SPP	Event suppression detected (TPOS03)
5130018604011F5A	TPOS01_QLT_BI_ERR	BI connection error detected(TPOS01)
5130018604021F5A	TPOS02_QLT_BI_ERR	BI connection error detected(TPOS02)
5130018604031F5A	TPOS03_QLT_BI_ERR	BI connection error detected(TPOS03)

Table 2.11-10 PLC monitoring points (Output signal for BIO)

Signal Number	Signal Name	Description
513001 8A04011DC4	TPOS01_P1SL_BO_FLG	Select command (P1) for Binary Output in TPOS01
513001 8A04021DC4	TPOS02_P1SL_BO_FLG	Select command (P1) for Binary Output in TPOS02
513001 8A04031DC4	TPOS03_P1SL_BO_FLG	Select command (P1) for Binary Output in TPOS03
513001 8A04011DC6	TPOS01_P2SL_BO_FLG	Select command (P2) for Binary Output in TPOS01
513001 8A04021DC6	TPOS02_P2SL_BO_FLG	Select command (P2) for Binary Output in TPOS02
513001 8A04031DC6	TPOS03_P2SL_BO_FLG	Select command (P2) for Binary Output in TPOS03

Signal Number	Signal Name	Description
513001 8A04011DC8	TPOS01_P3SL_BO_FLG	Select command (P3) for Binary Output in TPOS01
513001 8A04021DC8	TPOS02_P3SL_BO_FLG	Select command (P3) for Binary Output in TPOS02
513001 8A04031DC8	TPOS03_P3SL_BO_FLG	Select command (P3) for Binary Output in TPOS03

(xii) Setting names

Note: The “xx” within “TPOSxx” represents the TPOS function number. (e.g., if TPOS03 is considered, the “xx” is equal to “03”. The suffix “xx” can be represented from “01” to “03”.)

Table 2.11-11 Settings for ‘SBO contro’l in TPOSxx

Setting Name	Description	Default	Setting item or value
TPOSxx-CTREN	Activation of the control function in TPOS01–03	On	Off / On
TPOSxx-LGSLFFCT	Logic selector for select condition (TPOS01–03)	Fixedlogic	Fixedlogic / PLC
TPOSxx-DEVTYPE	Equipment(EDS or 43SW) type selector	switch	switch / EDS
TPOSxx-CTRHMI	Activation for the panel control locally (TPOS01–03)	On	Off / On

2.11.2 Cancel logic for SBO mode

In the SBO control mode, the reception of a cancel command can be possible when the cancel conditions are satisfied, the function can discard the select command; finally, the operation returns to the initial stage (i.e., "wait for a command").

(i) Receiving "Cancel" from the remote-end

Figure 2.11-21 depicts the cancel command procedure for a cancel command initiated from the remote-end.

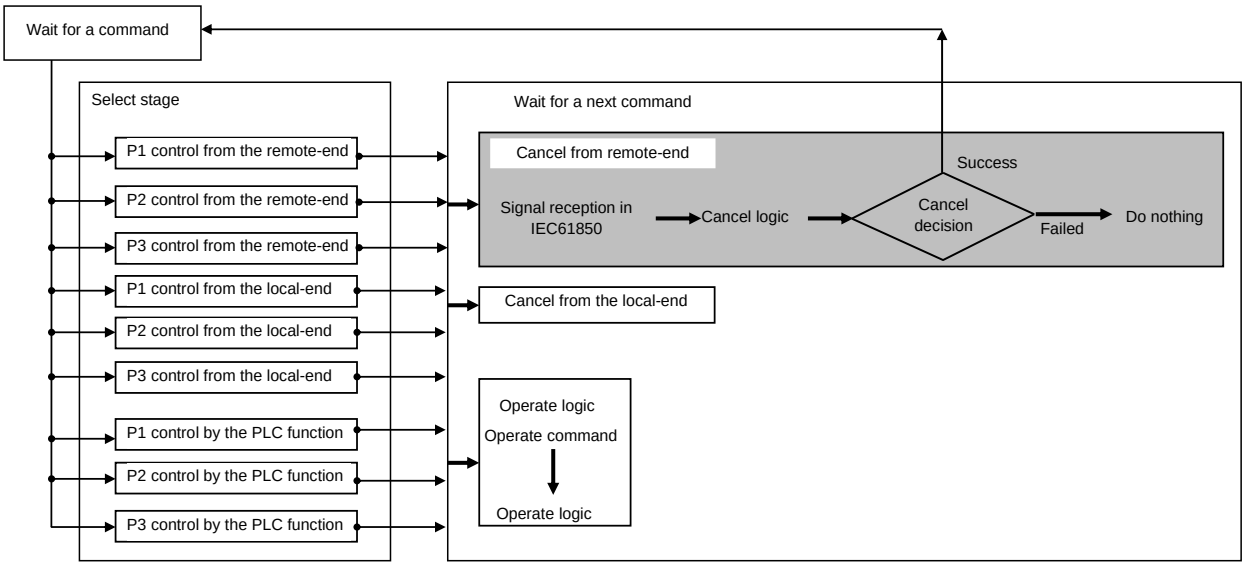


Figure 2.11-21 Outline of 'cancel' command from remote-end

(i)-1 Input point required mapping

Figure 2.11-22 depicts the cancel logic when a "Cancel command (Remote-Cancel)" signal is applied to the TPOS01 function. The input-point "DEV01_CONTROL_REQ" is the same as that for the "Selection command P1 (Remote-P1-Control)" signal.

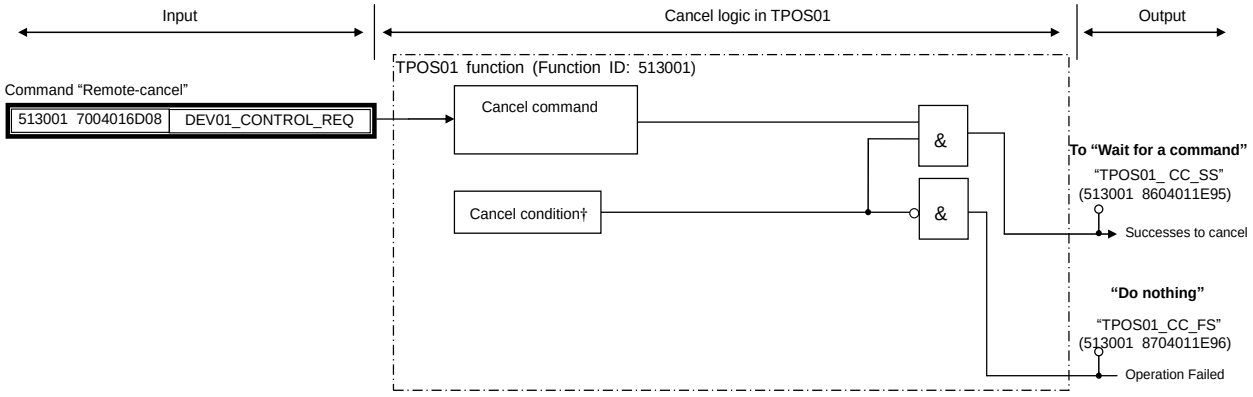


Figure 2.11-22 'Cancel' from the remote-end in TPOS01

†Note: The logic "cancel condition" is shown in Figure 2.11-25.

(i)-2 Output signal to BO

The TPOS01 function can issue a "Success to cancel" signal at the monitoring, point "TPOS01_CC_SS", when the TPOS01 function has determined that the "Remote-cancel" signal is true. Another "Operate failed" signal is issued at monitoring point "TPOS01_CC_FS" if the TPOS01 function is able to determine that the "Remote-cancel" signal is not true.

(ii) Receiving "Cancel" from the local-end

Figure 2.11-23 outlines the reception of the 'cancel' command from the local-end.

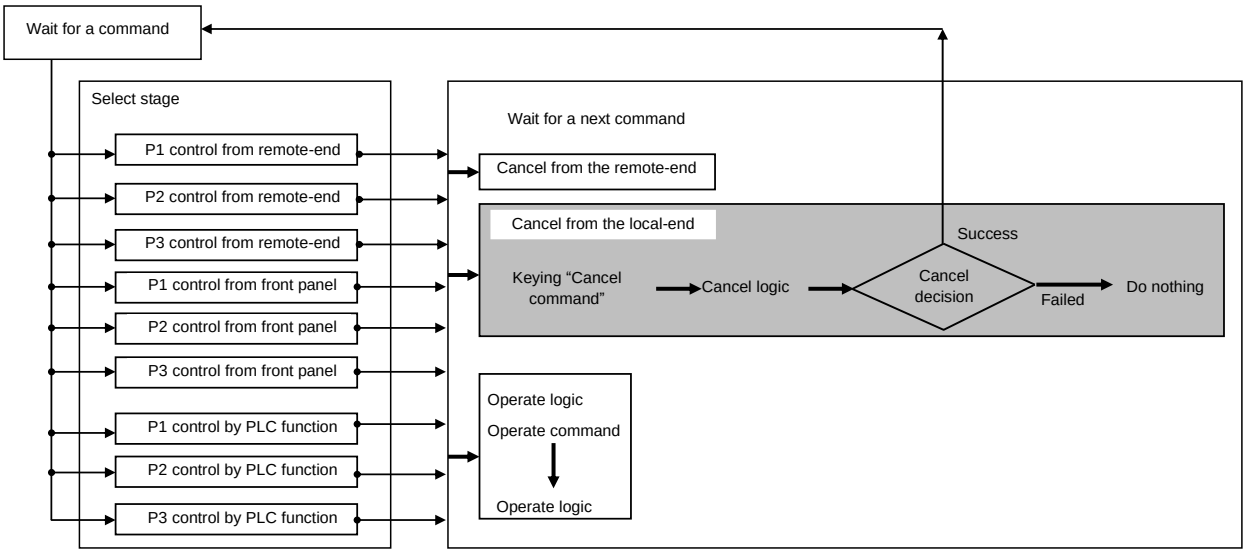


Figure 2.11-23 Outline of 'cancel' command from the local-end

(ii)-1 Input signal

Figure 2.11-24 depicts the cancel logic when a "Cancel command (Local-cancel)" signal is applied to the TPOS01 function. The signal is generated when the "Cancel" key is pressed on the IED front panel; the user is not required to take account of mapping. When the logic receives the "Local-cancel" signal, the logic is able to output a result signal, provided that the "cancel condition" checking is satisfied.

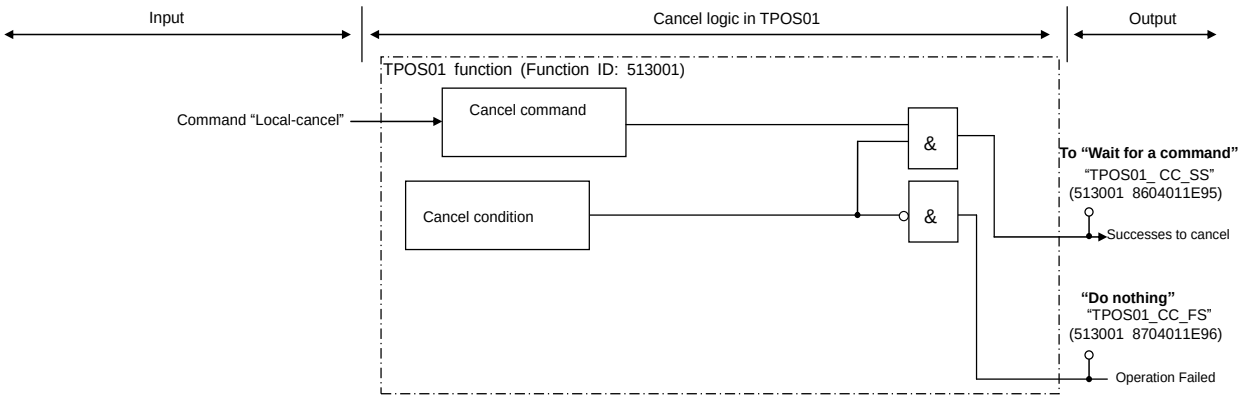


Figure 2.11-24 'Cancel' from the front panel

(ii)-2 Output signal to BO

The TPOS01 function, illustrated in Figure 2.11-24, is able to issue a "Selection to cancel"

signal at the monitoring point "TPOS01_CC_SS", when the TPOS01 function determines that the "Local-Cancel" signal is true.

(iii) Cancel condition logic

Figure 2.11-25 shows the cancel condition logic. As the criteria "Unmatched condition detected" is connected normally for the cancel condition logic, set **Fixedlogic** for the scheme switch [**TPOS01-LGCNFFCT**].

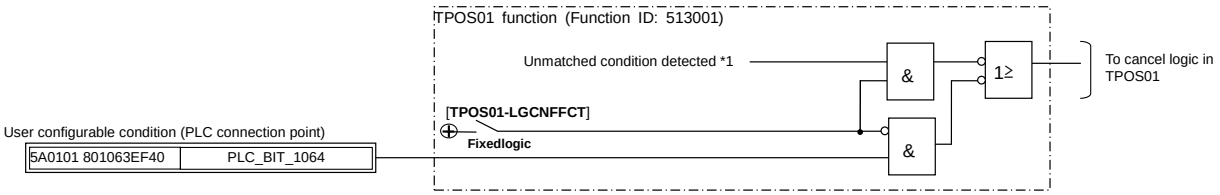


Figure 2.11-25 Logic "Cancel condition" in TPOS01

[1]Note: The criteria "unmatched conditions" are determined when the "Test-bit status" in the 'cancel' command is not identical to the "IED test status", like in Figure 2.11-20.

[2]Note: With the exception of the above 'cancel' logic, there is an operate-condition logic within the TPOS01 function; the operate-condition logic will always checks conditions. That is, the user is required to set either the "Operate-condition" or the "cancel-condition" logic.

If the original logic does not meet with the requirements of the user, it can be replaced using the connection point "User Configurable condition":

- Connect the user-customized logic, with the "PLC_BIT_1064", which is listed in Table 2.11-12.
- Set scheme switch [**TPOS01-LGCNFFCT**] to **PLC**.

(iv) Signal name and number

Note: The user should note the following descriptions shown in the column "M/O" in each table:

"O" indicates that the signal is provided for the optional use.

"M" indicates that the user should map/set/configure using the signal; otherwise, the user may experience an operational failure for the default settings.

"N/A" indicates that the user cannot change the state of the signal.

Table 2.11-12 PLC connection points (Input signal for 'cancel' condition)

Signal Number	Signal Name	Description	M/O
5A0101 801064EF40	PLC_BIT_1064	TPOS1 user configurable cancel condition	O
5A0101 801089EF40	PLC_BIT_1089	TPOS2 user configurable cancel condition	O
5A0101 801114EF40	PLC_BIT_1114	TPOS3 user configurable cancel condition	O

Table 2.11-13 PLC monitoring points (Output signal for 'cancel' condition)

Signal Number	Signal Name	Description
513001 8604011E95	TPOS01_CC_SS	Cancel succeed in TPOS01
513001 8604021E95	TPOS02_CC_SS	Cancel succeed in TPOS02
513001 8604031E95	TPOS03_CC_SS	Cancel succeed in TPOS03
513001 8704011E96	TPOS01_CC_FS	Cancel failed in TPOS01
513001 8704021E96	TPOS02_CC_FS	Cancel failed in TPOS02
513001 8704031E96	TPOS03_CC_FS	Cancel failed in TPOS03

(v) Setting name

Note: The "xx" within "TPOSxx" represents the TPOS function number. (e.g., if TPOS03 is considered, the "xx" is equal to "03". The suffix "xx" can be represented from "01" to "03".)

Table 2.11-14 Setting for 'Cancel' in TPOSxx

Setting Name	Description	Default	Setting item or value
TPOSxx-LGCNFFCT	Logic selector for cancel condition (TPOS01–03)	Fixedlogic	Fixedlogic / PLC

2.11.3 Operate logic for SBO/DIR modes

After the completion of the operation of the select logic, the operate logic starts to control the device.

(i) Receiving "Operate command for P1-control" from the remote-end

Figure 2.11-26 depicts the reception of the operate command 'P1-control' from the remote-end.

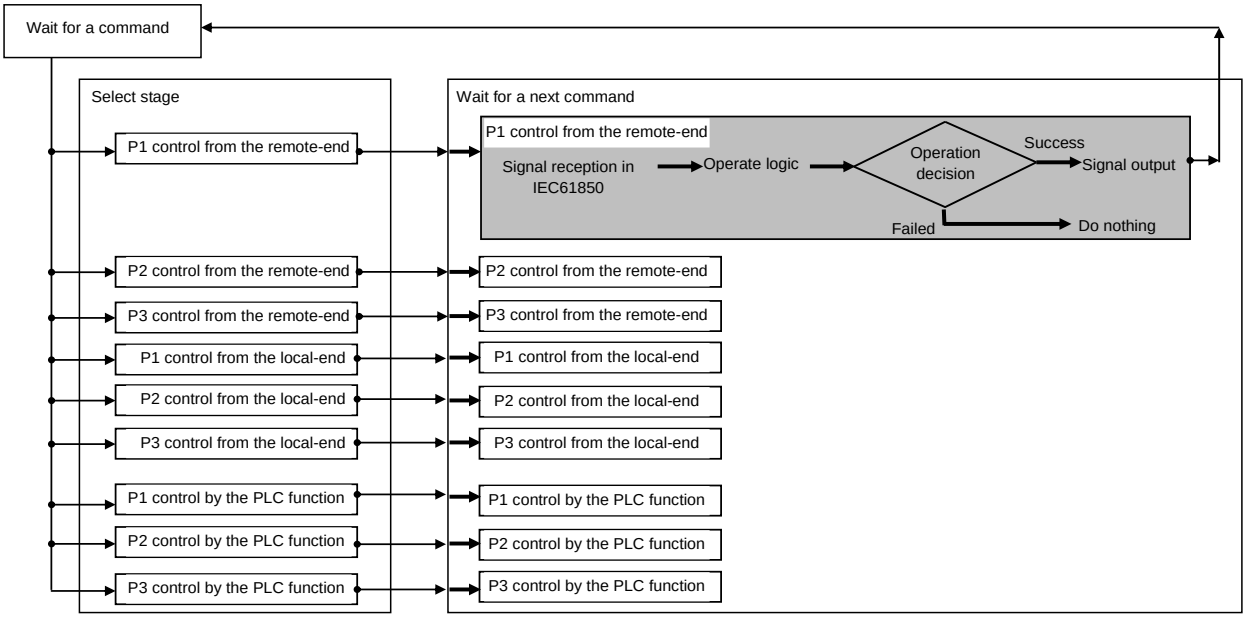


Figure 2.11-26 Outline of operate command 'P1-control'

(i)-1 Mapping required for Input point

Figure 2.11-27 illustrates the operate logic when a "Operate command P1 (Remote-P1-Control)" signal is applied to the TPOS01 function. The input-point "DEV01_CONTROL_REQ" is used for the reception of the "Operate command P1 (Remote-P1-Control)".

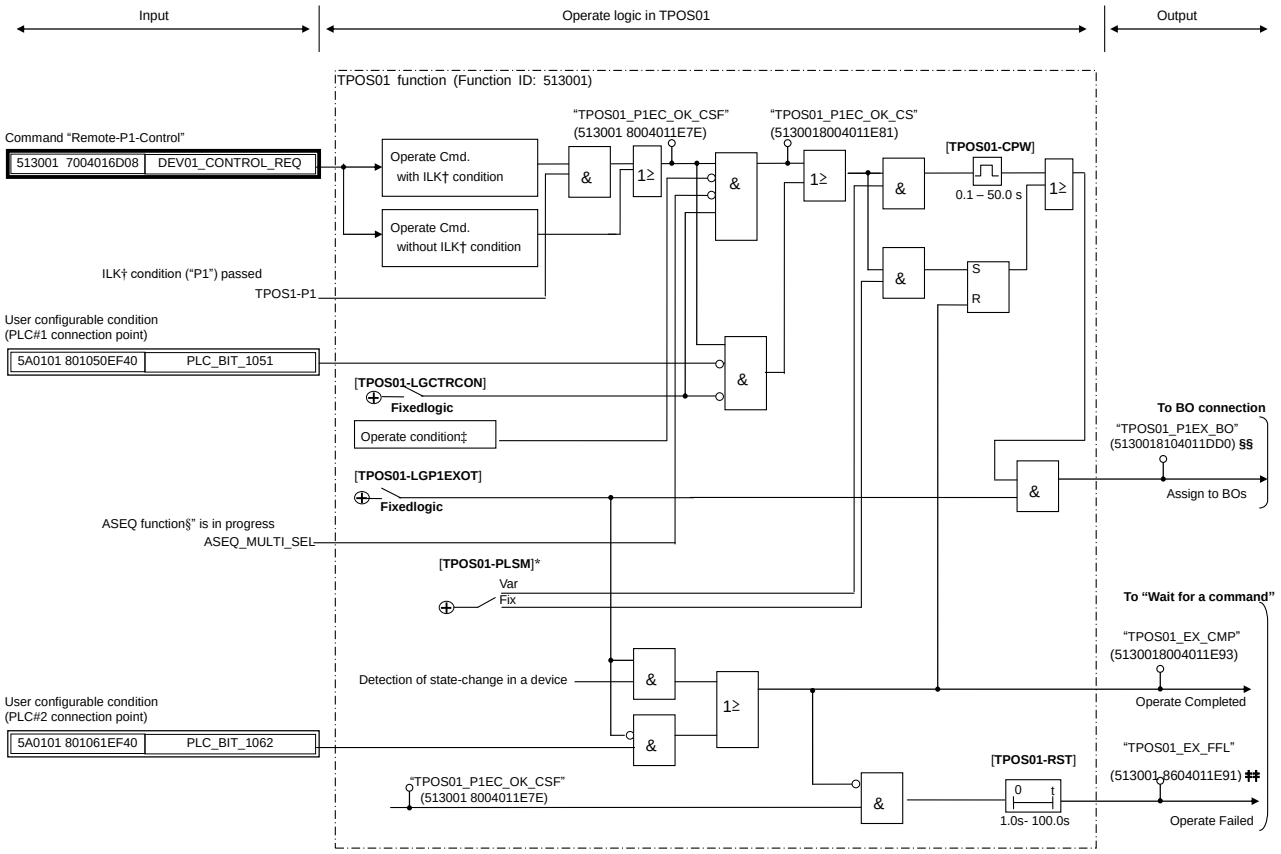


Figure 2.11-27 Operate 'P1-control' from the remote-end in TPOS01††

†Note:The ILK function can provide the operation criteria for "P1" control.

‡Note:An "operate condition" signal is generated in the operate-condition logic (Figure 2.11-44) when **Fixlogic** is set for scheme switch [**TPOS01-LGCTRCON**]. If an alternative "operate-condition" signal is required, it can be programmed by the user and used to replace the signal the signal generated by the original operate-condition logic. The alternative "operate-condition" can be connected to the above logic using connection point #1 "User configurable condition" That is, set the scheme switch [**TPOS01-LGCTRCON**] to **PLC** and use "PLC_BIT_1051".

§Note:The ASEQ function can provide sequential signals for automatic control.

*Note:The user can set the type of the output signal. When **Var** is set for scheme switch [**TPOS01-PLSM**], the output period of the signal is defined by the setting [**TPOS01-CPW**]. When **Fix** is set, the signal ceases when the 43S or an ES is changed.

††Note: To identify the input and output signal-points of the P1-control in the other TPOS logics, see Table 2.11-15 for PLC#1, Table 2.11-16 for PLC#2 and Table 2.11-20 for the outputs.

‡‡Note: The "Operate failed" signal is issued when the state-change is not detected when the time set by the [**TPOS01-RST**] has been reached.

§§Note: The signal "TPOS01-PIEX-BO" is issued when **Fixlogic** is set for scheme switch

[**TPOS01-LGP1EXOT**]. The "Operate-completed" signal can also be issued from logic programmed by the user, in place of the logic shown in Figure 2.11-26. The user-programmed logic is connected internally to the signal "operate completed", hence this signal is now generated by the user-programmed logic at connection point#2 "User-configurable condition". That is, set the scheme switch [**TPOS01-LGP1EXOT**] to **PLC** and use "PLC_BIT_1062".

(i)-2 Output signal to BO

The TPOS01 function, in Figure 2.11-27, can issue an "Operate" signal at the output point "TPOS01_P1EX_BO", when the TPOS01 function determines that the received "Remote-P1-Control" signal is true.

(ii) Receiving "Operate command P2-control" from the remote-end

Figure 2.11-28 depicts the reception of the operate command 'P2-control' from the remote-end.

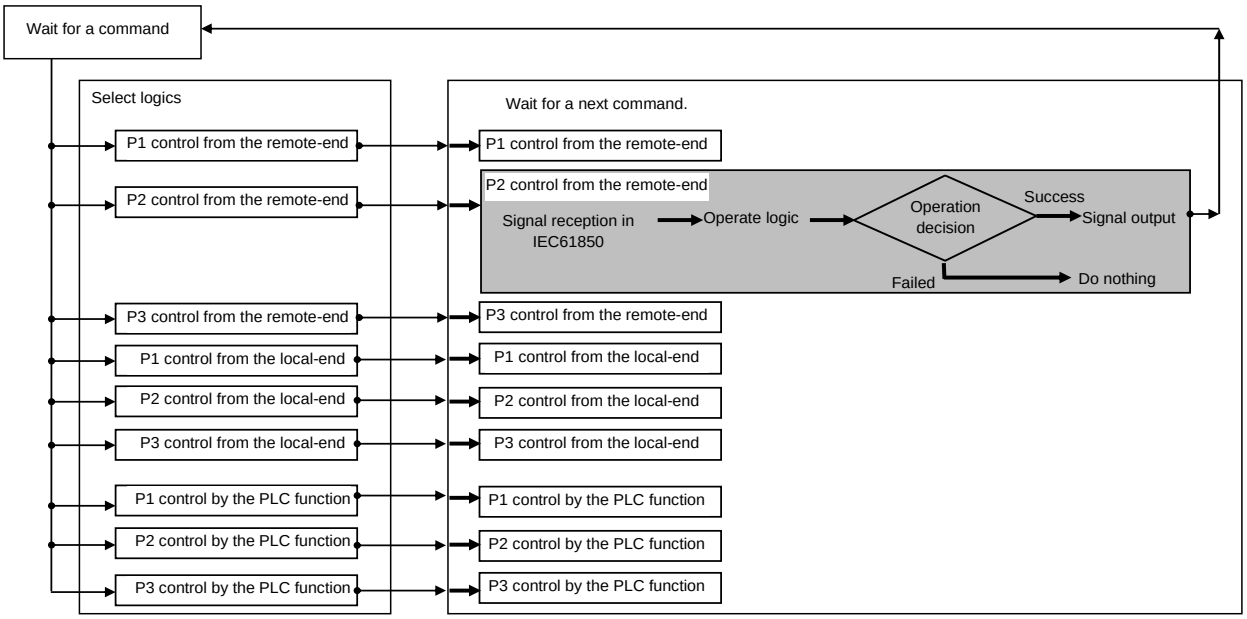


Figure 2.11-28 Outline of operate command 'P2-control'

(ii)-1 Input signal required mapping

Figure 2.11-19 illustrates the operate logic when an "Operate command P2 (Remote-P2-Control)" signal is applied to the TPOS01 function. The input-point "DEV01_CONTROL_REQ" is used for the reception of the "Operate command P2 (Remote-P2-Control)".

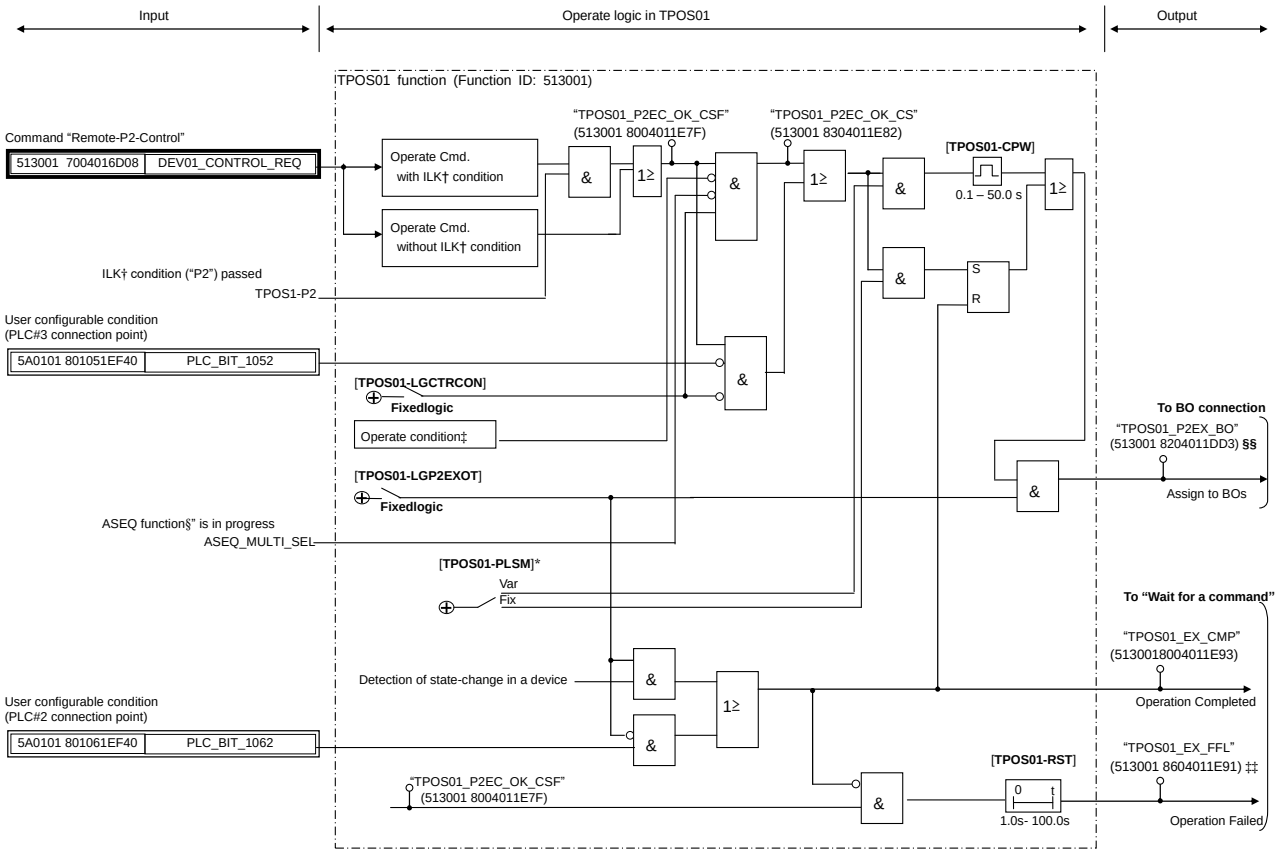


Figure 2.11-29 Operate 'P2-control' from the remote-end in TPOS01††

†Note:The ILK function can provide the operation criteria for "P2" control.

‡Note:An "operate condition" signal is generated in the operate-condition logic (Figure 2.11-44) when **Fixlogic** is set for scheme switch [**TPOS01-LGCTRCON**]. If an alternative "operate-condition" signal is required, it can be programmed by the user and used to replace the signal generated by the original operate-condition logic. The alternative "operate-condition" can be connected to the above logic using connection point #3 "User configurable condition" That is, set the scheme switch [**TPOS01-LGCTRCON**] to **PLC** and use "PLC_BIT_1052".

§Note:The ASEQ function can provide sequential signals for automatic control.

*Note:The user can set the type of output signal. When **Var** is set for the scheme switch [**TPOS01-PLSM**], the output period of the signal is defined by the setting [**TPOS01-CPW**]. When **Fix** is set, the signal ceases when the 43S or an ES is changed.

‡‡Note: The "Operate failed" signal is issued when the state-change is not detected until after reaching the time set by the setting [**TPOS01-RST**].

§§Note: The signal "TPOS01-PIEX-BO" is issued when **Fixlogic** is set for scheme switch [**TPOS01-LGP1EXOT**]. The "operate-completed"signal can also be issued from logic programmed by the user, in place of the logic shown in Figure 2.11-26. connect the signal "operate completed" generated in the programmed logic to the

connection point#2 “User configurable condition”. That is, set the scheme switch [**TPOS01-LGP1EXOT**] to **PLC** and use “PLC_BIT_1062”.

††Note: To identify the input and output signals of the other TPOS logics, see Table 2.11-16 for PLC#2, Table 2.11-17 for PLC#3 and Table 2.11-20 for the outputs.

(ii)-2 Output signal to BO

The TPOS01 function, in Figure 2.11-29, can issue an “Operate” signal at the output-point “TPOS01_P2EX_BO”, when the TPOS01 function determine that the input signal “Remote-P2-Control” is true.

(iii) Receiving “Operate command P3-control” from the remote-end

Figure 2.11-28 depicts the reception of the operate command ‘P3-control’ from the remote-end.

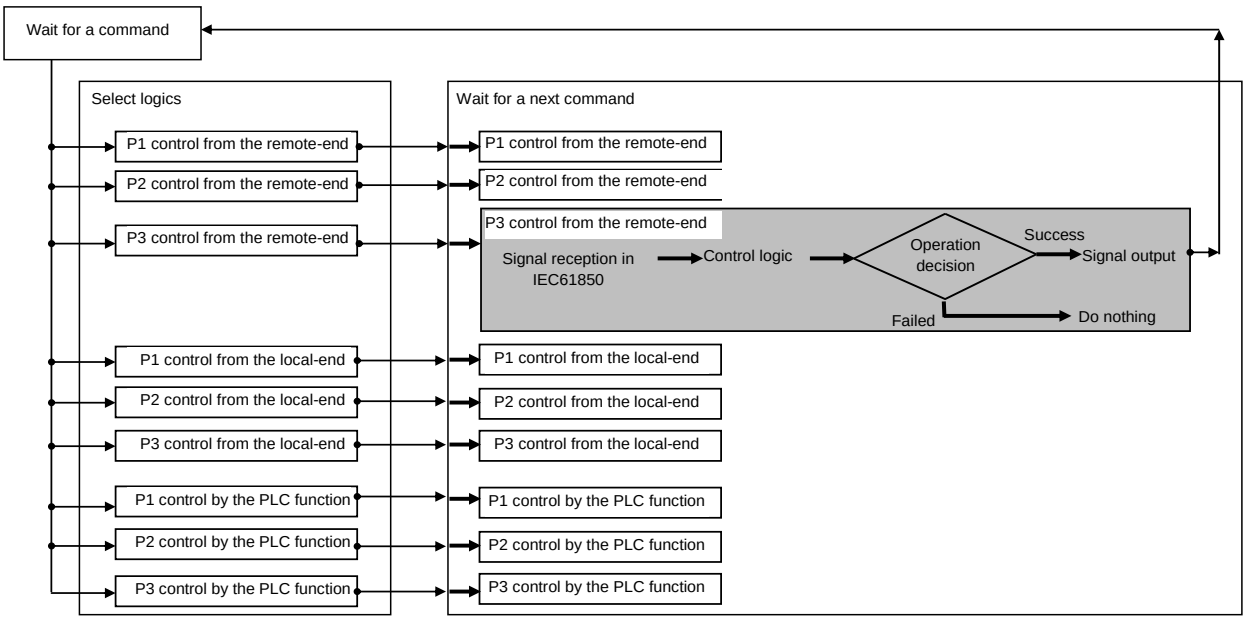


Figure 2.11-30 Outline of operate command ‘P3-control’

(iii)-1 Input signal required mapping

Figure 2.11-31 illustrate the operate logic when an “Operate command P3 (Remote-P3-Control)” signal is applied to the TPOS01 function. The input-point “DEV01_CONTROL_REQ” is used for the reception of the “Operate command P3 (Remote-P3-Control)”.

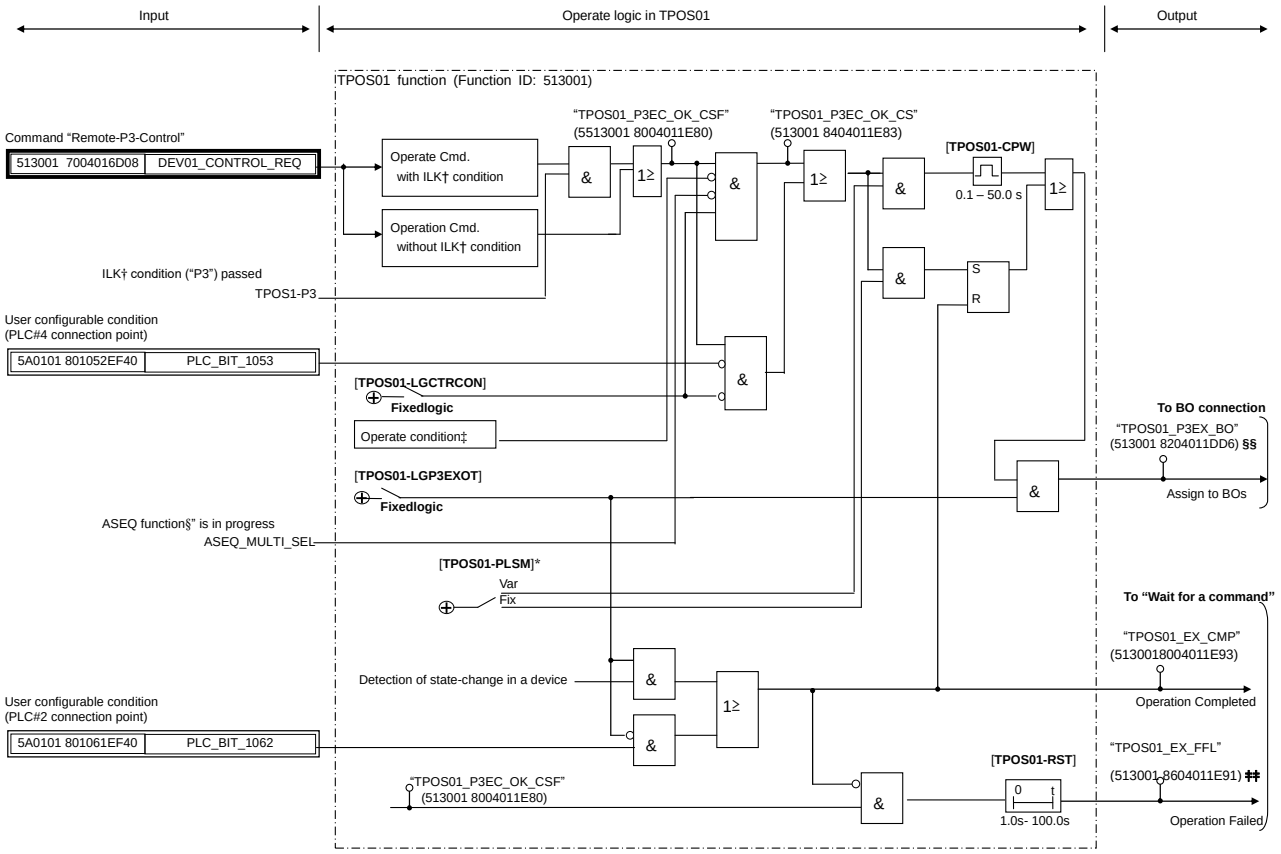


Figure 2.11-31 Operate 'P3-control' from the remote-end in TPOS01††

†Note:The ILK function can provide the operation criteria for "P3" control.

††Note: To identify the input and output signals of the other TPOS logics, see Table 2.11-16 for PLC#2, Table 2.11-18 for PLC#4, and Table 2.11-20 for the outputs.

‡Note:An "operate condition" signal is generated inthe operate-condition logic (Figure 2.11-44) when Fix logic is set for scheme switch [**TPOS01-LGCTRCON**]. If an alternative "operate-condition" is required, it can be programmed by the user and used to replace the signal generated by the original operate-condition logic. The alternative "operate-condition" can be connected to the above logic using connection point #4 "User configurable condition" That is, set the scheme switch [**TPOS01-LGCTRCON**] to **PLC** and use " PLC_BIT_1053".

§Note:The ASEQ function can provide sequential signals for automatic control.

*Note:The user can set the type of output signal. When **Var** is set for the scheme switch [**TPOS01-PLSM**], the output period of the signal is defined by the setting [**TPOS01-CPW**]. When **Fix** is set, the signal ceases when the 43S or an ES is changed.

‡‡Note: The "Operate failed" signal is issued when the state-change is not detected until after reaching the time set by the setting [**TPOS01-RST**]

§§Note: The "TPOS01-PIEX-BO" signal is issued when **Fixlogic** is set for scheme switch [**TPOS01-LGP1EXOT**]. The "Operate-completed" signal can also be issued from

logic programmed by the user in place of the logic shown in Figure 2.11-26. The user-programmed logic is connected internally to the "operate completed" signal, hence this signal is now generated by the user-programmed logic at connection point#2 "User configurable condition". That is, set the scheme switch [**TPOS01-LGP1EXOT**] to **PLC** and use "PLC_BIT_1062".

(iii)-2 Output signal to BO

The TPOS01 function, in Figure 2.11-31, can issue an "Operate" signal at the output-point "TPOS01_P3EX_BO", when the TPOS01 function determines that the input signal "Remote-P3-Control" is true.

(iv) Receiving "Operate command P1-control" from the local-end

Figure 2.11-32 depicts the operation logic of the operate command 'P1-control' from the local-end.

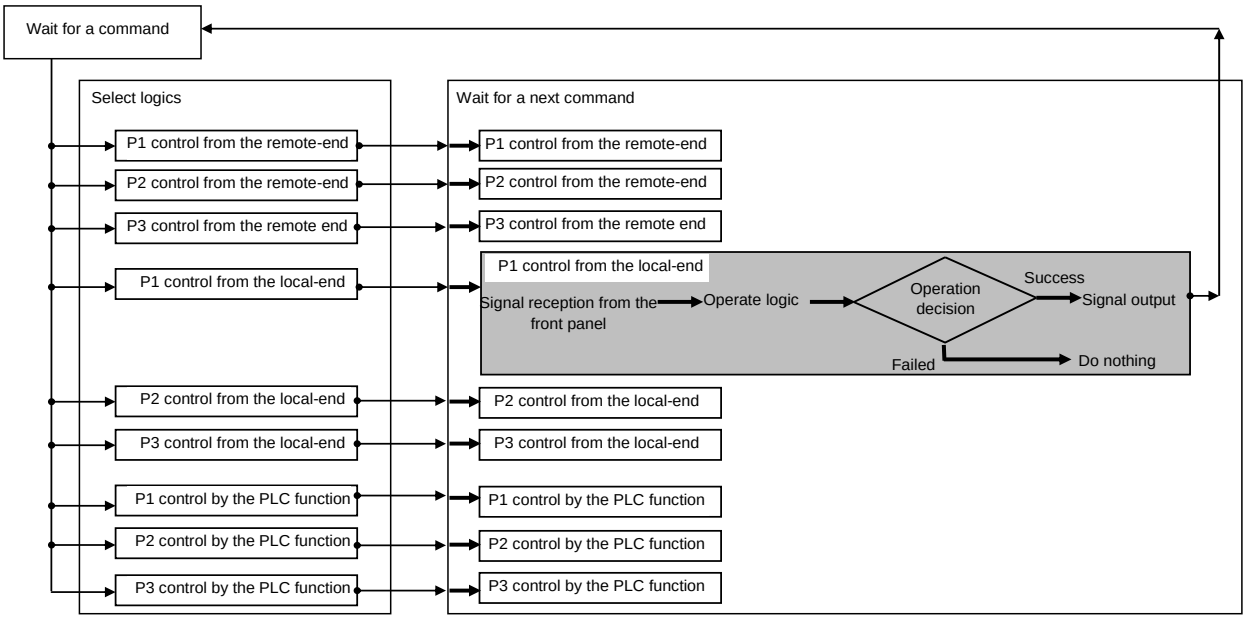


Figure 2.11-32 Outline of Operate command 'P1-control'

(iv)-1 Input signal generated at the local-end

Figure 2.11-33 illustrates the operate logic when an "Operate command P1 (Local-P1-Control)" signal is applied to the TPOS01 function. The signal is provided when "P1-control" is keyed on the IED front panel.

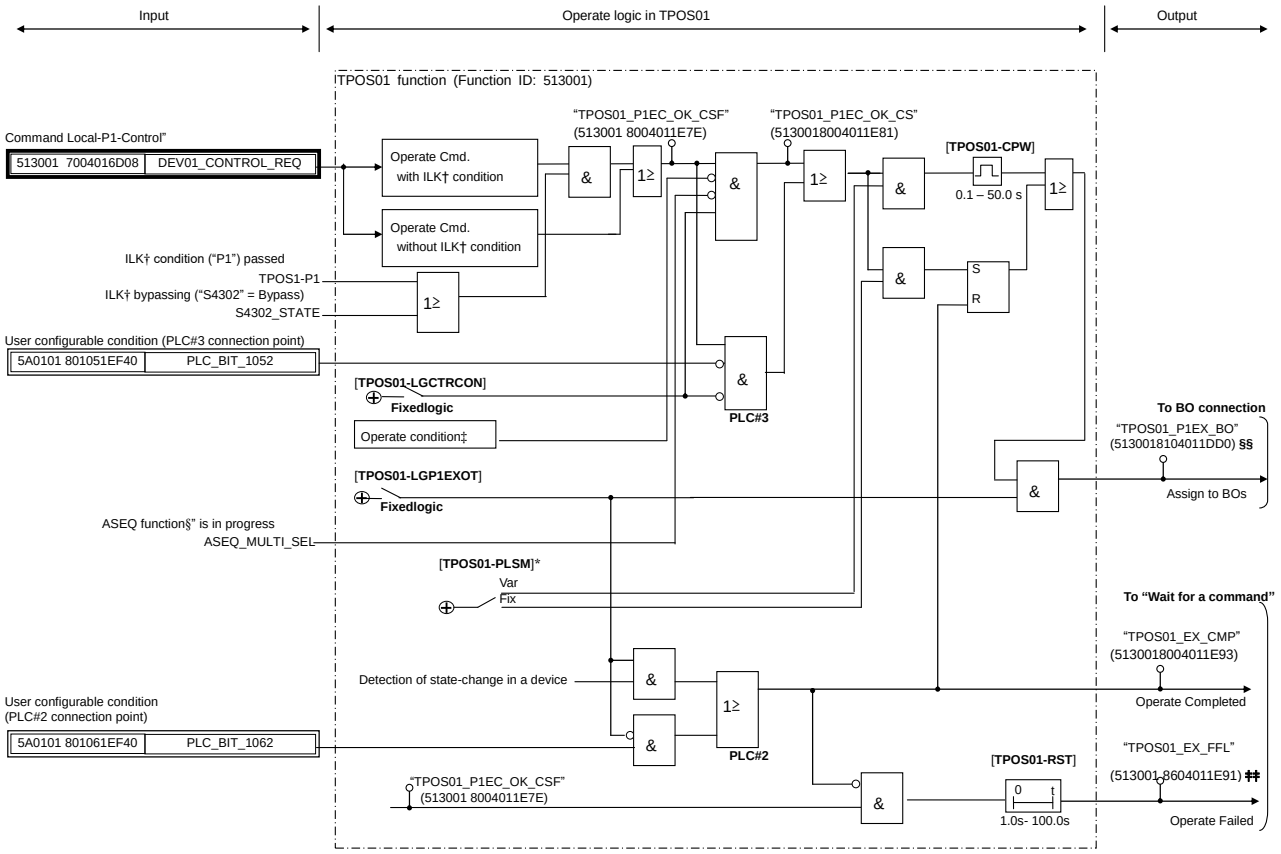


Figure 2.11-33 Operate 'P1-control' on the front panel TPOS01††

†Note:The ILK function can provide the operation criteria for "P1" control.

‡Note:An "operate condition" signal is generated in the operate-condition logic (Figure 2.11-44) when **Fixlogic** is set for scheme switch [**TPOS01-LGCTRCON**]. If an alternative "operate-condition" is required it can be programmed by the user and used to replace the signal generated by the original operate-condition logic. The alternative "operate-condition" can be connected to the above logic using connection point #3 "User configurable condition" That is, set the scheme switch [**TPOS01-LGCTRCON**] to **PLC** and use " PLC_BIT_1052".

§Note:The ASEQ function can provide sequential signals for automatic control.

*Note:The user can set the type of output signal. When **Var** is set for scheme switch [**TPOS01-PLSM**], the output period of the signal is defined by the setting [**TPOS01-CPW**]. When **Fix** is set, the signal ceases when the 43S or an ES is changed.

††Note: To identify the input and output signal-points of the P1-control in the other TPOS logics, see Table 2.11-15 for PLC#1, Table 2.11-16 for PLC#2 and Table 2.11-20 for the outputs.

‡‡Note: The "Operate failed" signal is issued when the state-change is not detected until after reaching the time set by the setting [**TPOS01-RST**].

§§Note: The signal "TPOS01-PIEX-BO" is issued when **Fixlogic** is set for the scheme switch [**TPOS01-LGP1EXOT**]. The "Operate completed" signal can also be issued from the logic programmed by the user in place of the logic shown in Figure 2.11-26. The user-programmed logic is connected internally to the "operate completed", hence this signal is now generated by the user-programmed logic at connection point#2 "User configurable condition". That is, set the scheme switch [**TPOS01-LGP1EXOT**] to **PLC** and use "PLC_BIT_1062".

(iv)-2 Output signal to BO

The TPOS01 function, in Figure 2.11-33, can issue an "Operate" signal at the output point "TPOS01_P1EX_BO", when the TPOS01 function determines that the "Local-P1-Control" signal is true.

(v) Receiving "operate command P2-control" from the local-end

Figure 2.11-34 depicts the reception of the operate command 'P2-control' from the local-end.

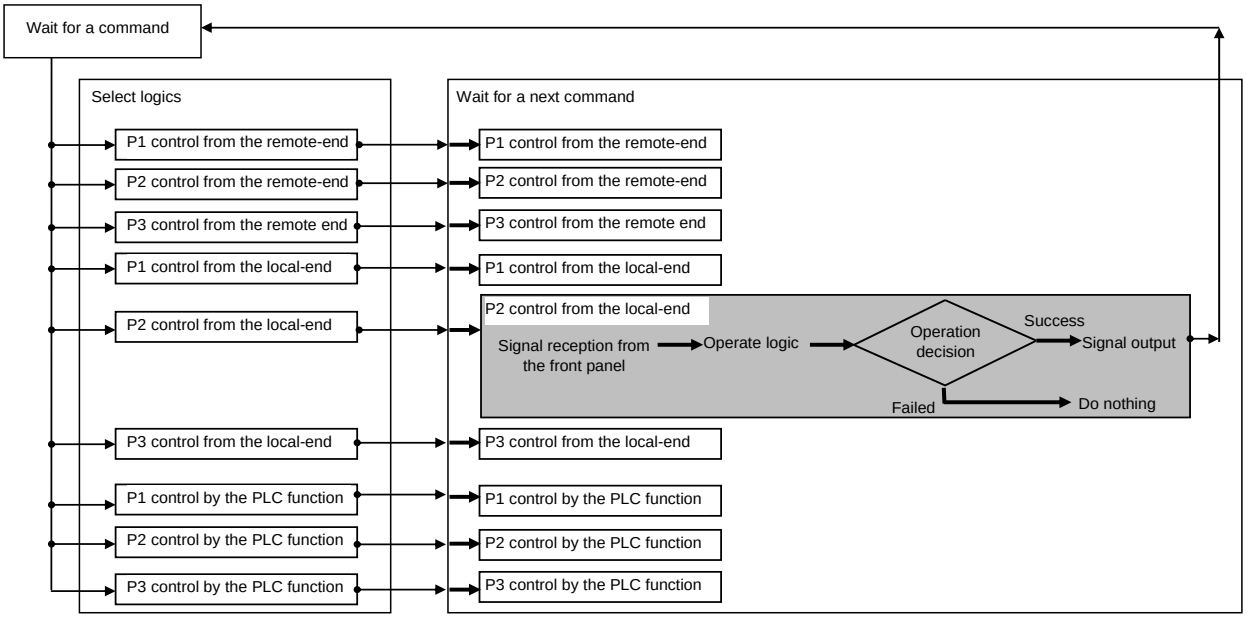


Figure 2.11-34 Outline of Operate command 'P2-control'

(v)-1 Input signal generated at the local-end.

Figure 2.11-35 illustrates the operate logic when an "Operation command P2 (Local-P2-Control)" signal is applied to the TPOS01 function. The input signal is provided when "P2-control" is keyed on the IED front panel.

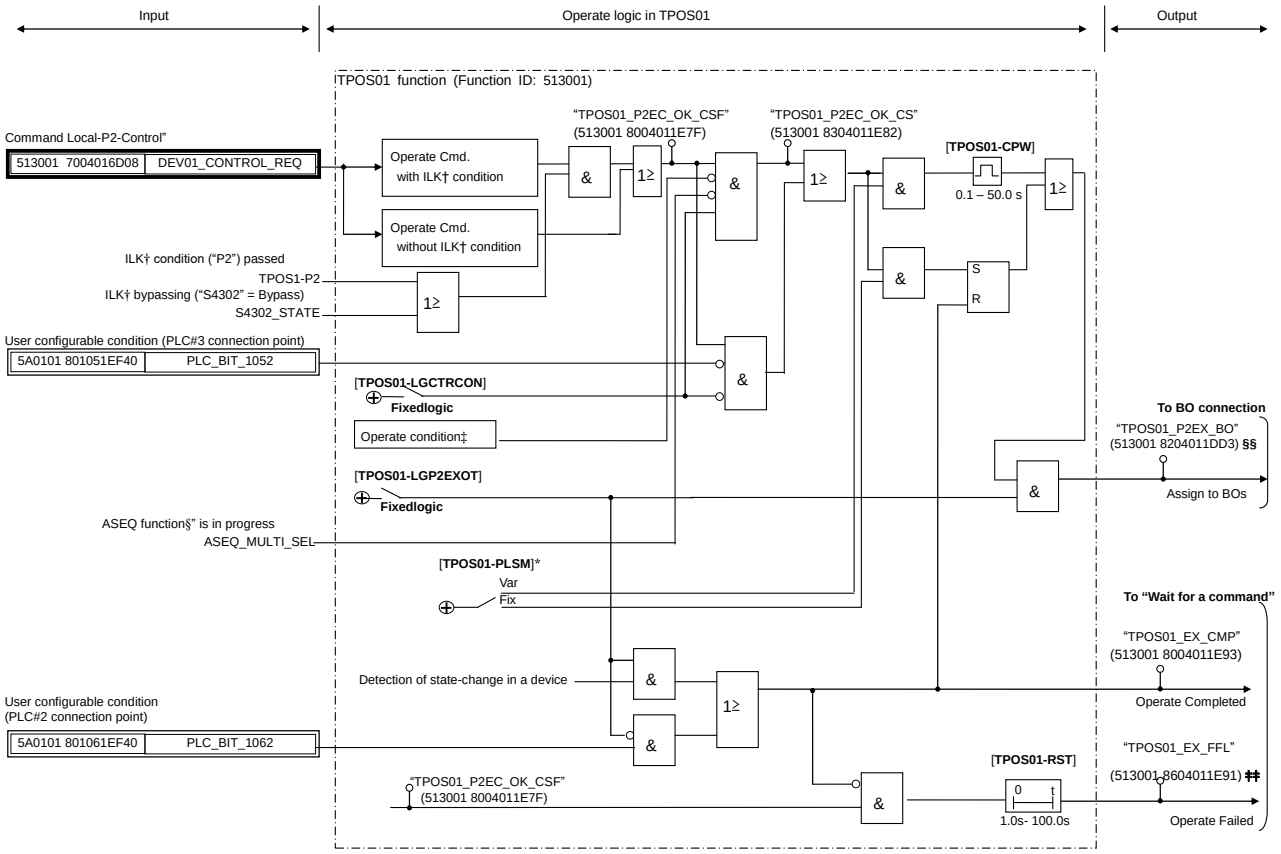


Figure 2.11-35 Operate 'P2-control' on the front panel in TPOS01††

†Note:The ILK function can provide the operation criteria for "P2" control.

‡Note:An "operate condition" signal is generated in the operate-condition logic (Figure 2.11-44) when **Fixlogic** is set for scheme switch [**TPOS01-LGCTRCON**]. If an alternative "operate-condition is required it can be programmed by the user and used to replace the signal generated by the original operate-condition logic. The alternative "operate-condition" can be connected to the to the above logic using connection point #3 "User configurable condition" That is, set the [**TPOS01-LGCTRCON**] to PLC and using " PLC_BIT_1052".

§Note:The ASEQ function can provide sequential signals for automatic control.

*Note:The user can set the type of output signal. When **Var** is set for scheme switch [**TPOS01-PLSM**], the output period of the signal is defined by the setting [**TPOS01-CPW**]. When **Fix** is set, the signal ceases when the 43S or an ES is changed.

‡‡Note: The "Operate failed" signal is issued when the state-change is not detected until after reaching the time set by the [**TPOS01-RST**].

§§Note: The signal "TPOS01-PIEX-BO" is issued when **Fixlogic** is set for the [**TPOS01-LGP1EXOT**]. The "Operate completed" signal can also be issued from the logic programmed by the user in place of the logic shown in Figure 2.11-26 . The user-programmed logic is connected internally to the signal "operate completed", hence

this signal is now generated by the user-programmed logic at connection point#2 "User configurable condition". That is, set the scheme switch [**TPOS01-LGP1EXOT**] to **PLC** and use "PLC_BIT_1062".

††Note: To identify the input and output signals of the other TPOS logics, see Table 2.11-16 for PLC#2, Table 2.11-17 for PLC#3 and Table 2.11-20 for the outputs.

(v)-2 Output signal to BO

The TPOS01 function, in Figure 2.11-35, can issue an "Operate" signal at the output point "TPOS01_P2EX_BO", when the TPOS01 function determines that the "Local-P2-Control" signal is true.

(vi) Receiving "operate command P3-control" from the local-end

Figure 2.11-36 depicts the reception of the operate command 'P3-control' from the local-end.

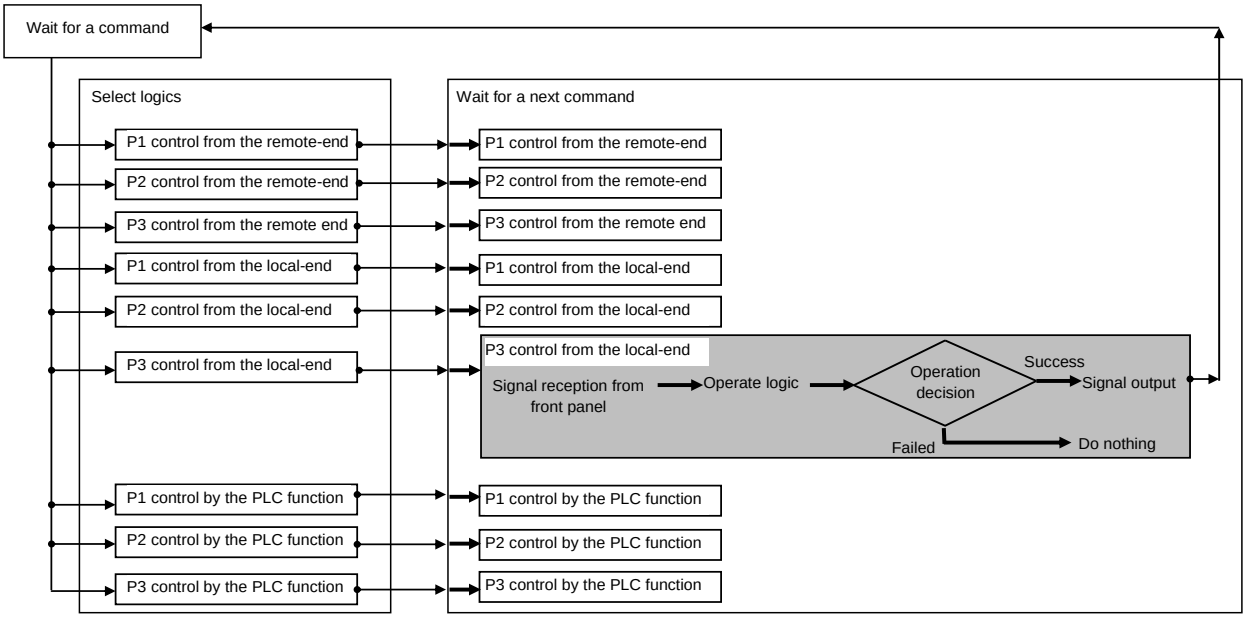


Figure 2.11-36 Outline of Operate command 'P3-control'

(vi)-1 Input signal generated at the local-end

Figure 2.11-37 illustrates the operate logic when an "Operate command P3 (Local-P3-Control)" signal is applied to the TPOS01 function. The input signal is provided when "P3-control" is keyed on the IED front panel.

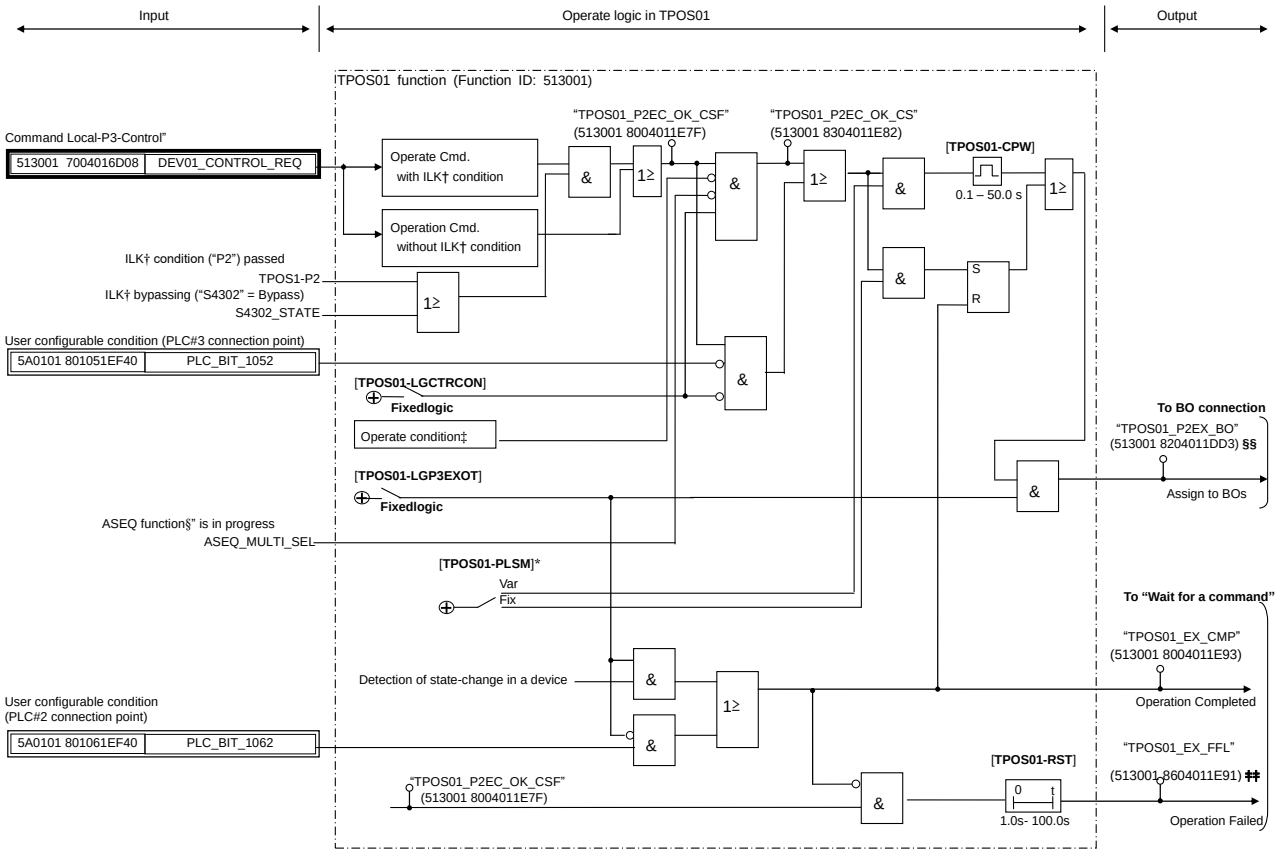


Figure 2.11-37 Operate 'P3-control' on the front panel in TPOS01

†Note:The ILK function can provide the operation criteria for "P3" control.

††Note: To identify the input and output signals of the other TPOS logics, see Table 2.11-16 for PLC#2, Table 2.11-18 for PLC#4, and Table 2.11-20 for the outputs.

‡Note:An "operate condition signal" is generated in the operate-condition logic (Figure 2.11-44) when **Fixlogic** is set for scheme switch [**TPOS01-LGCTRCON**]. If an alternative "operate-condition" is required it can be programmed by the user and used to replace the signal generated by the original operate-condition logic. The alternative "operate-condition" can be connected to the above logic using connection point #3 "User configurable condition" That is, set the scheme switch [**TPOS01-LGCTRCON**] to **PLC** and use "PLC_BIT_1052".

§Note:The ASEQ function can provide sequential signals for automatic control.

*Note:The user can set the type of output signal. When **Var** is set for the scheme switch [**TPOS01-PLSM**], the output period of the signal is defined by the setting [**TPOS01-CPW**]. When **Fix** is set, the signal ceases when the 43S or an ES is changed.

‡‡Note: The "Operate failed" signal is issued when the state-change is not detected until after reaching the time set by the setting [**TPOS01-RST**].

§§Note: The "TPOS01-PIEX-BO" signal is issued when **Fixlogic** is set for scheme switch [**TPOS01-LGP1EXOT**]. The "Operate completed" signal can also be issued from the

logic programmed by the user in place of the logic shown in Figure 2.11-26. The user-programmed logic is connected internally to the signal "operate completed", hence this signal is now generated by the user-programmed logic at connection point#2 "User configurable condition". That is, set the scheme switch [**TPOS01-LGP1EXOT**] to **PLC** and use "PLC_BIT_1062".

(vi)-2 Output signal to BO

The TPOS01 function, in Figure 2.11-37, can issue an "Operate" signal at the output point "TPOS01_P3EX_BO", when the TPOS01 function determines that the "Local-P3-Control" signal is true.

(vii) Receiving "operate command P1-control" using the PLC function

Figure 2.11-38 outlines the reception of the operate command 'P1-control' using the PLC function.

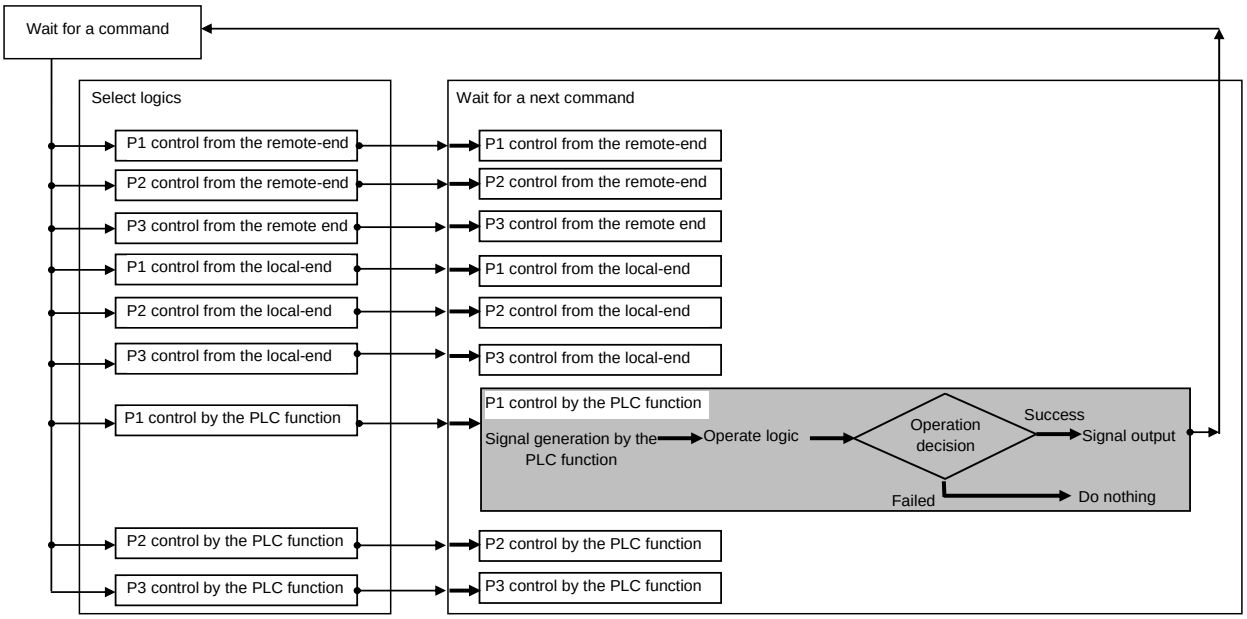


Figure 2.11-38 Outline of Operate command 'P1-control'

(vii)-1 Input signal from the PLC function

Figure 2.11-39 describes the operate logic when an "Operate command P1 (PLC-P1-Control)" signal is generated by the PLC function. There are two input points for the reception: the former connection point (PLC#3) is used for the reception of the operate-command when the interlock-check is required, the latter connection point (PLC#4) is used for the reception of the operate-command when the interlock check is not required. That is, for the TPOS01 function "Operate command P1 (PLC-P1-Control)" signal generated in the user-programmed logic and when the interlock check is required in the operate logic, apply the signal at connection point (PLC#3; i.e., PLC_BIT_1041).Alternatively, if the interlock check is not required, apply the signal at other connection point (PLC#4;i.e.,PLC_BIT_1040). We should assume the PLC#3

and PLC#4 as PLC#1 and PLC#2 in Table 2.11-2. Note that the user should set **PLC** for scheme switch [**TPOS01-LGP1EXOT**].

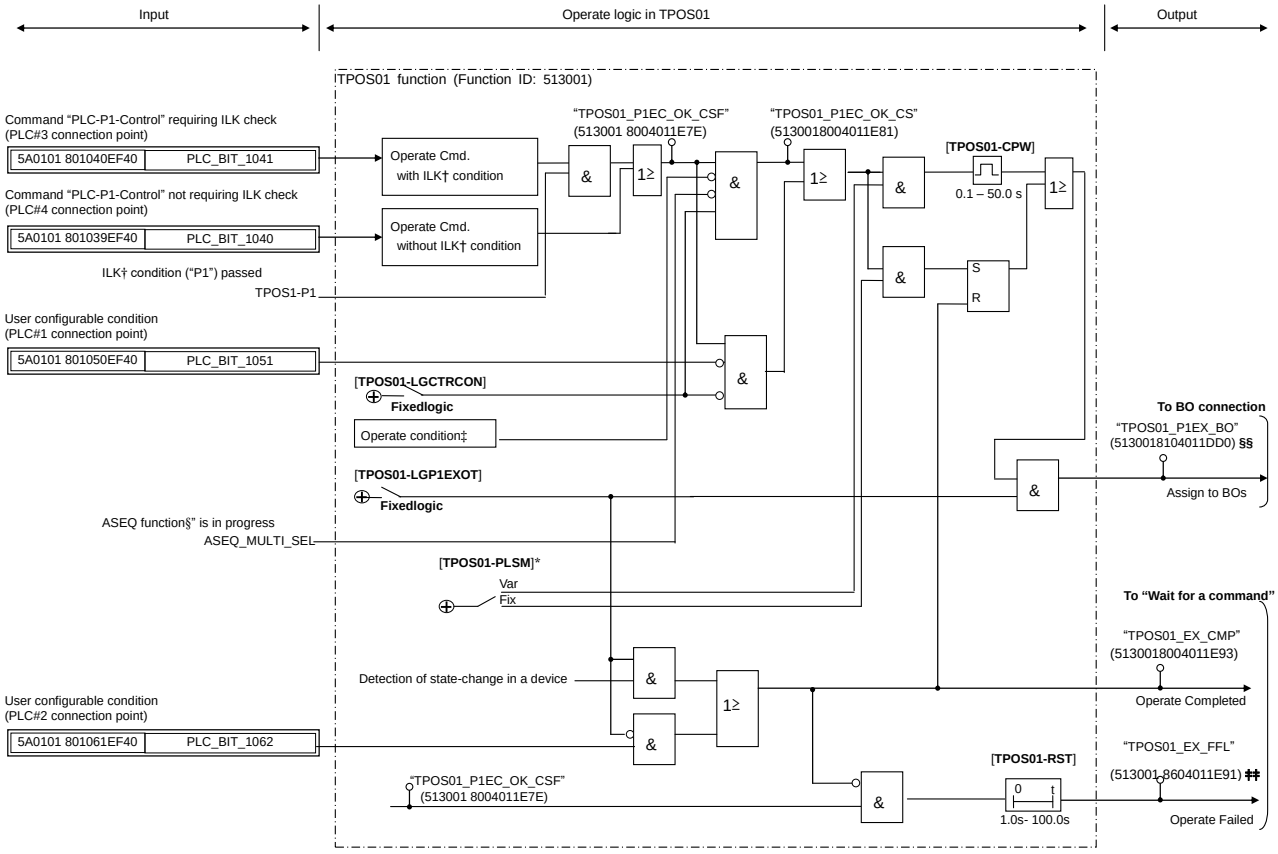


Figure 2.11-39 Operate P1- control using the PLC function in TPOS01††

†Note:The ILK function can provide the criteria for operation for "P1" control.

‡Note:An "operate condition" signal is generated in the operate-condition logic (Figure 2.11-44) when **Fixlogic** is set for scheme switch [**TPOS01-LGCTRCON**]. If an alternative "operate-condition" programmed by the user is required in place of the signal generated by the original operate-condition logic, connect the alternative "operate-condition" to the logic shown in Figure 2.11-39 using connection point #1 "User configurable condition" That is, set the scheme switch [**TPOS01-LGCTRCON**] to **PLC** and use " PLC_BIT_1051".

§Note:The ASEQ function can provide sequential signals for automatic control.

*Note:The user can set the type of output signal. When **Var** is set the scheme switch [**TPOS01-PLSM**], the output period of the signal is defined by the setting applied to [**TPOS01-CPW**]. When **Fix** is set, the signal ceases when the 43S or an ES is changed.

††Note: To identify the input and output signal-points of the P1-control in the other TPOS logics, see Table 2.11-15 for PLC#1, Table 2.11-16 for PLC#2 and Table 2.11-20 for the outputs.

‡‡Note: The "Operate failed" signal is issued when a state-change remains undetected

failing expiration of the setting applied to timer [**TPOS01-RST**]

§§Note: The "TPOS01-PIEX-BO" signal is issued when **Fixlogic** is set the scheme switch [**TPOS01-LGP1EXOT**]. If the signal to be issued from the logic programmed by the user instead of the logic shown in Figure 2.11-26, connect the "operate completed" signal generated in the user-programmed logic to connection point#2 "User configurable condition". That is, set **PLC** to the scheme switch [**TPOS01-LGP1EXOT**] and use "PLC_BIT_1062".

(vii)-2 Output signal to BO

The TPOS01 function, in Figure 2.11-39, can issue a "Operate P1-control" signal at output point "TPOS01_P1EX_BO", when the TPOS01 function determines that the signal "PLC-P1-Control" is true.

(viii) Receiving "operate command P2-control" using the PLC function

Figure 2.11-40 depicts the reception of the operate command "P2-control' using the PLC function.

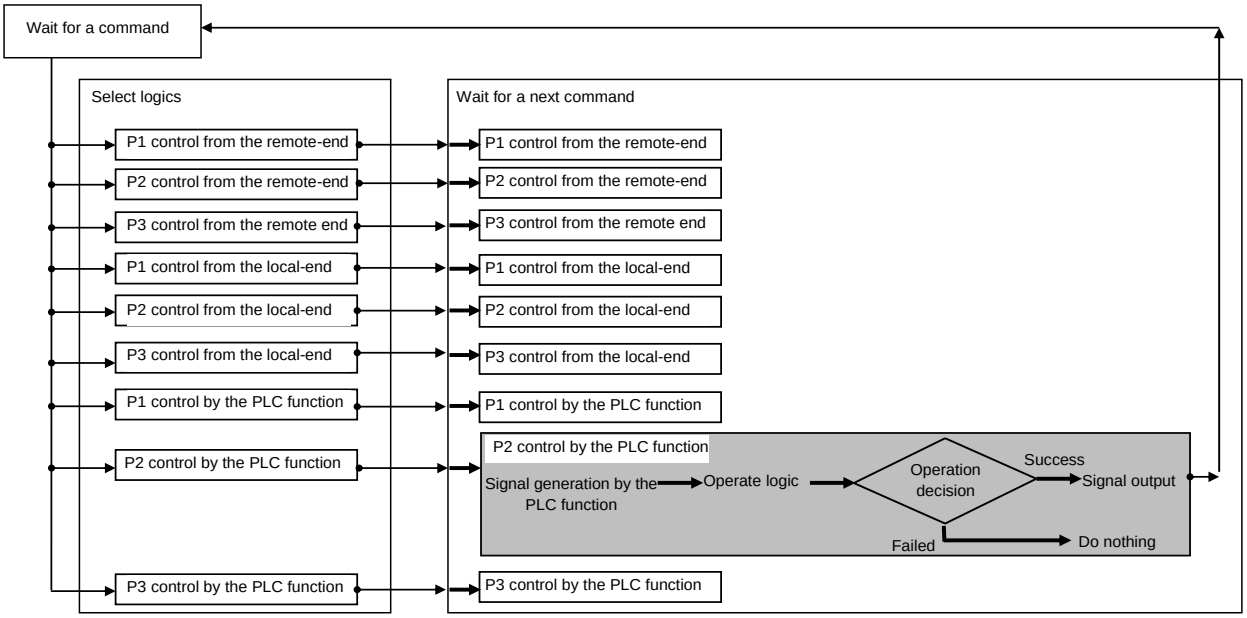


Figure 2.11-40 Outline of Operate command 'P2-control' function

(viii)-1 Input signal from the PLC function

Figure 2.11-41 depicts the operation logic when an "Operate command P2 (PLC-P2-Control)" signal is generated by the PLC function. There are two input points for the reception of this command signal, like in the "Operate command P2 (PLC-P2-Control)" signal. That is, if an interlock check is required, apply the signal at connection point (PLC#3:i.e., PLC_BIT_1043). On the other hand, if an interlock check is not required, apply the signal at connection point (PLC#4:i.e., PLC_BIT_1042). PLC#3 and PLC#4 here are to be treated as PLC#1 and PLC#2 in Table 2.11-3. Note that the user should set **PLC** for scheme switch [**TPOS01-LGP2EXOT**].

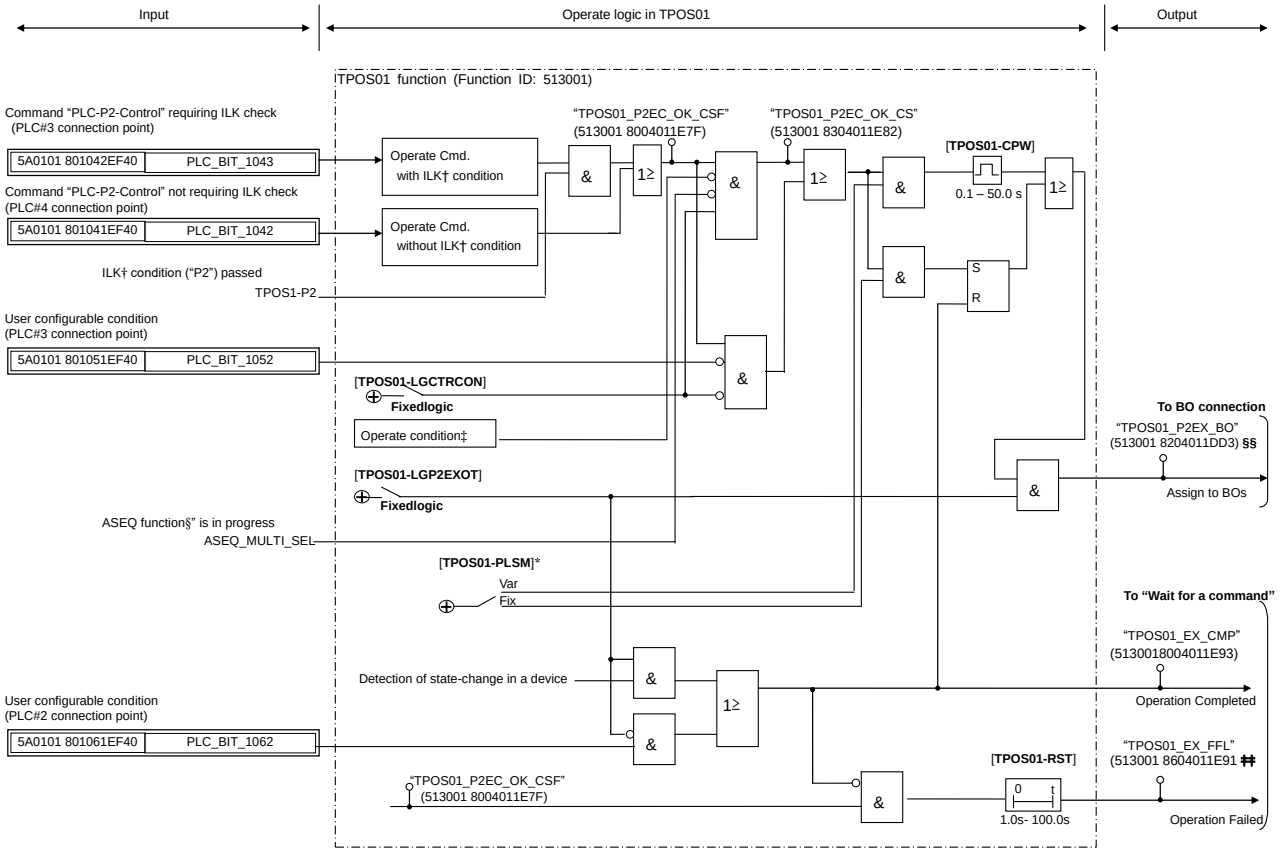


Figure 2.11-41 Operate P2-Control by the PLC function in TPOS01††

†Note:The ILK function can provide the criteria foe operation for "P2" control.

‡Note:An "operate condition" signal is generated in the operate-condition logic (Figure 2.11-44) when **Fixlogic** is set for scheme switch [**TPOS01-LGCTRCON**]. If an alternative "operate-condition programmed by the user is required in place of the signal generated by the original operate-condition logic, connect the alternative "operate-condition" to the logic shown in Figure 2.11-41 using connection point #3 "User configurable condition" That is, set the scheme switch [**TPOS01-LGCTRCON**] to **PLC** and use " PLC_BIT_1052".

§Note:The ASEQ function can provide sequential signals for automatic control.

*Note:The user can set the type of output signal. When **Var** is set for the scheme switch [**TPOS01-PLSM**], the output period of the signal is defined by the setting applied to [**TPOS01-CPW**]. When **Fix** is set, the signal ceases when the 43S or an ES is changed.

‡‡Note: The "Operate failed" signal is issued when the state-change is not detected until after reaching the time set by the setting [**TPOS01-RST**]

§§Note: The signal "TPOS01-PIEX-BO" is issued when **Fixlogic** is set for [**TPOS01-LGP1EXOT**]. If the signal is to be issued from the logic programmed by the user instead of the logic shown in Figure 2.11-26, connect the "operate completed"

signal generated in the user-programmed logic to connection point#2 “User configurable condition”. That is, set the scheme switch [**TPOS01-LGP1EXOT**] to **PLC** and use “PLC_BIT_1062”.

††Note: To identify the input and output signals of the other TPOS logics, see Table 2.11-16 for PLC#2, Table 2.11-17 for PLC#3 and Table 2.11-20 for the outputs.

(viii)-2 Output signal to BO

The TPOS01 function, in Figure 2.11-41, can issue a signal “Operate P2-control” at output point “TPOS01_P2EX_BO”, when the TPOS01 function determines that the “PLC-P2-Control” signal is true.

(ix) Receiving “operate command P3-control” using the PLC function

Figure 2.11-42 outlines the reception of the operate command P3-control by the PLC function.

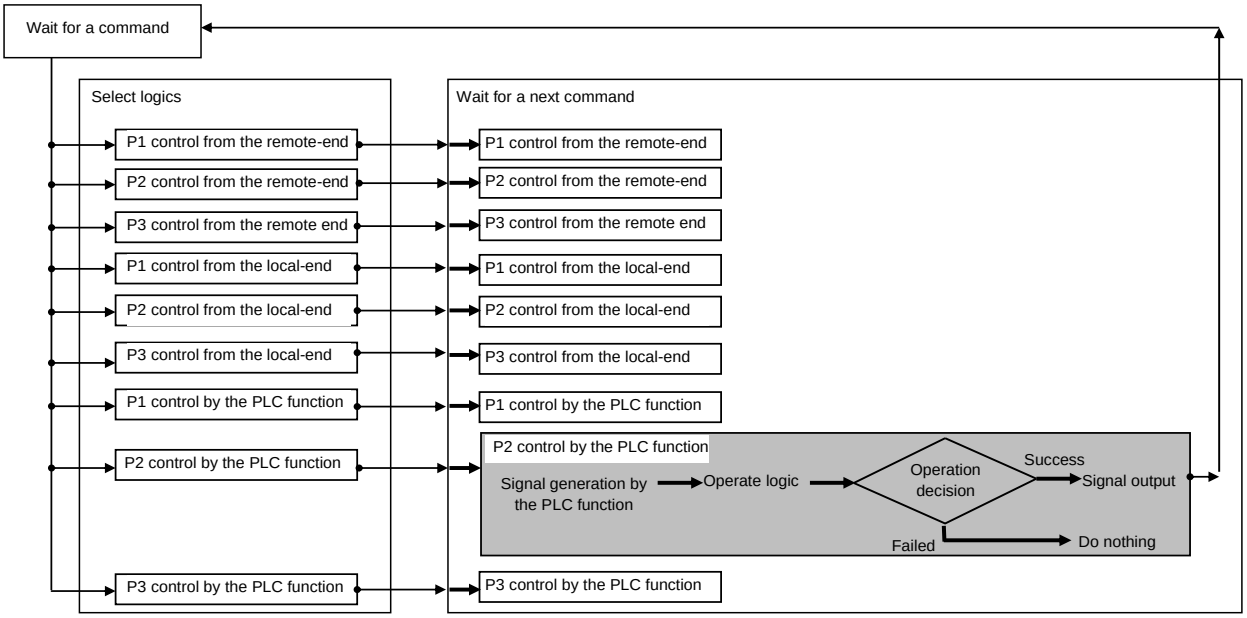


Figure 2.11-42 Outline of operate command ‘P3-control’

(ix)-1 Input signal required to connect

Figure 2.11-43 depicts the operate logic when an “Operate command P3 (PLC-P3-Control)” signal is generated by the PLC function. There are two input points for reception of this command signal, like the signal “Operate command P1 (PLC-P1-Control)”. That is, if an interlock check is required, apply the signal at connection point (PLC#3:i.e., PLC_BIT_1045). If, on the other hand, an interlock check is not required, apply the signal at connection point (PLC#4:i.e., PLC_BIT_1044). We shall assume the PLC#3 and PLC#4 as PLC#1 and PLC#2 in Table 2.11-4. Note that the user should set **PLC** for scheme switch [**TPOS01-LGP3EXOT**].

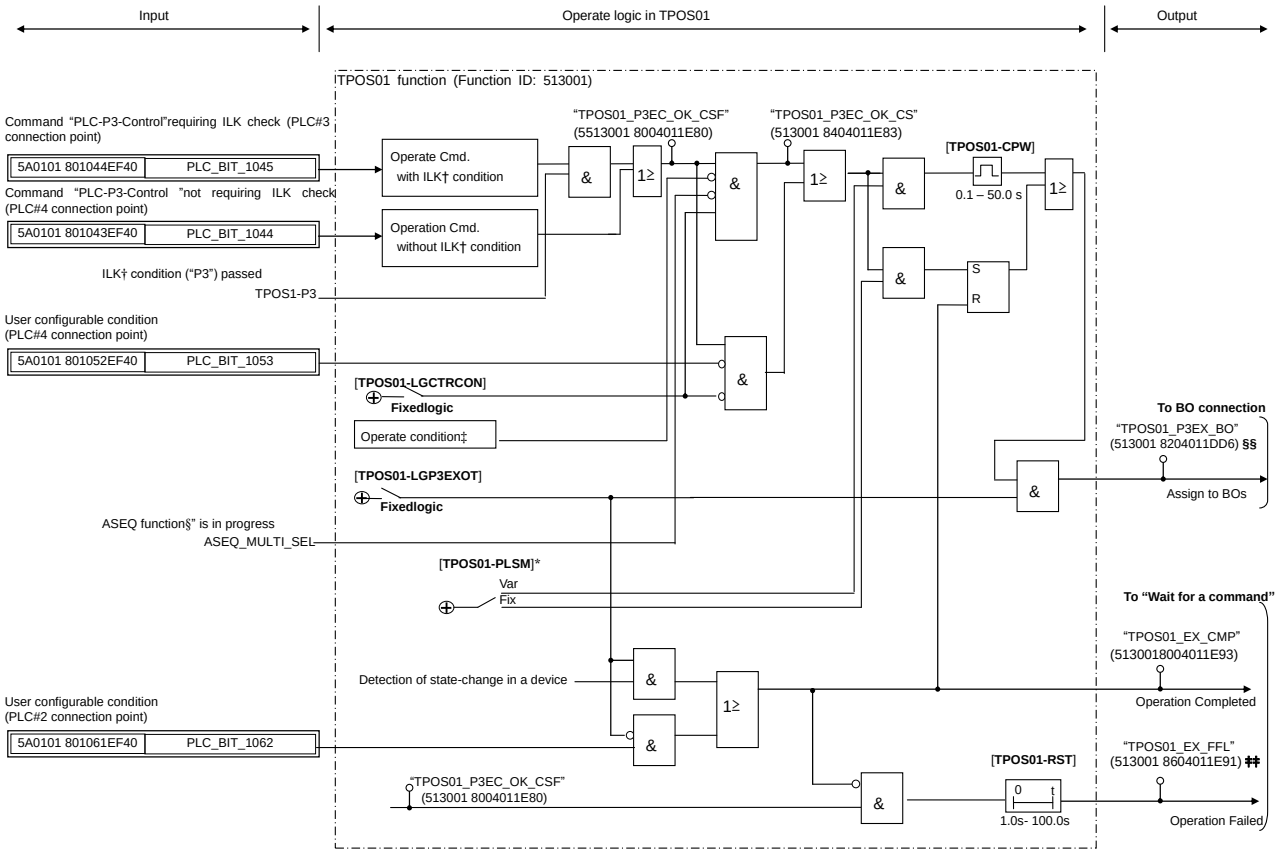


Figure 2.11-43 Operate 'P3-control' using the PLC function TPOS01††

†Note:The ILK function can provide the criteria for operation for "P3" control.

††Note: To identify the input and output signals of the other TPOS logics, see Table 2.11-16 for PLC#2, Table 2.11-18 for PLC#4, and Table 2.11-20 for the outputs.

‡Note:An "operate condition" signal is generated in the operate-condition logic (Figure 2.11-44) when **Fixlogic** is set for scheme switch [**TPOS01-LGCTRCON**]. If an alternative "operate-condition programmed by the user is required in place of the signal generated by the original operate-condition logic, connect the alternative "operate-condition" to the logic shown in Figure 2.11-43 using connection point #4 "User configurable condition" That is, set the scheme switch [**TPOS01-LGCTRCON**] to **PLC** and using "PLC_BIT_1053".

§Note:The ASEQ function can provide sequential signals for automatic control.

*Note:The user can set the type of output signal. When **Var** is set for the scheme switch [**TPOS01-PLSM**], the output period of the signal is defined by the setting applied to [**TPOS01-CPW**]. When **Fix** is set, the signal ceases when the 43S switch or an ES is changed.

‡‡Note: The Operate failed" signal "is issued when a state-change remains undetected following expiration of the setting applied to timer [**TPOS01-RST**].

§§Note: The "TPOS01-PIEX-BO" signal is issued when **Fixlogic** is set for scheme switch [**TPOS01-LGP1EXOT**]. If the signal is to be issued from the programmed logic by

the user instead of the logic shown in Figure 2.11-26, connect the "operate completed" signal generated in the user-programmed logic to connection point#2 "User configurable condition". That is, set the scheme switch [**TPOS01-LGP1EXOT**] to **PLC** and use "PLC_BIT_1062".

(ix)-2 Output signal to BO

The TPOS01 function, in Figure 2.11-43, can issue a signal "Operate P3-control" at output point "TPOS01_P3EX_BO", when the TPOS01 function determines that the signal "PLC-P3-Control" is true.

(x) Operate condition

In a manner similar to which the conditions have been examined for the select command, the conditions for an operate command should be understood. Figure 2.11-44 illustrates the logic to examine an operate condition. The operate condition is determined by signal "TPOS01_STATE". If the functionality of the original logic does not meet with user-requirements, the following alternatives are provided:

1. The user can replace the original logic with alternative logic,
2. The user can add another signal to the original logic.

(x)-1 Replacing the original logic

If the user wishes to replace the operate condition logic completely, it can be achieved using PLC connect point "User configurable operate condition".

1. Connect the user-customized logic using "PLC_BIT_1058", listed as PLC#2 in Table 2.11-19.
2. Set scheme switch [**TPOS01-LGEXFFCT**] to **PLC.**

(x)-2 Adding another operate condition signal

If the addition of another operate condition is required, the user can add the signal to operate condition logic using PLC connection point "Additional condition".

1. Add a user-preferred signal using "PLC_BIT_1057", listed as PLC#1 in Table 2.11-19.
2. Set scheme switch [**TPOS01-LGEXFFCT**] to **Fixed logic**.

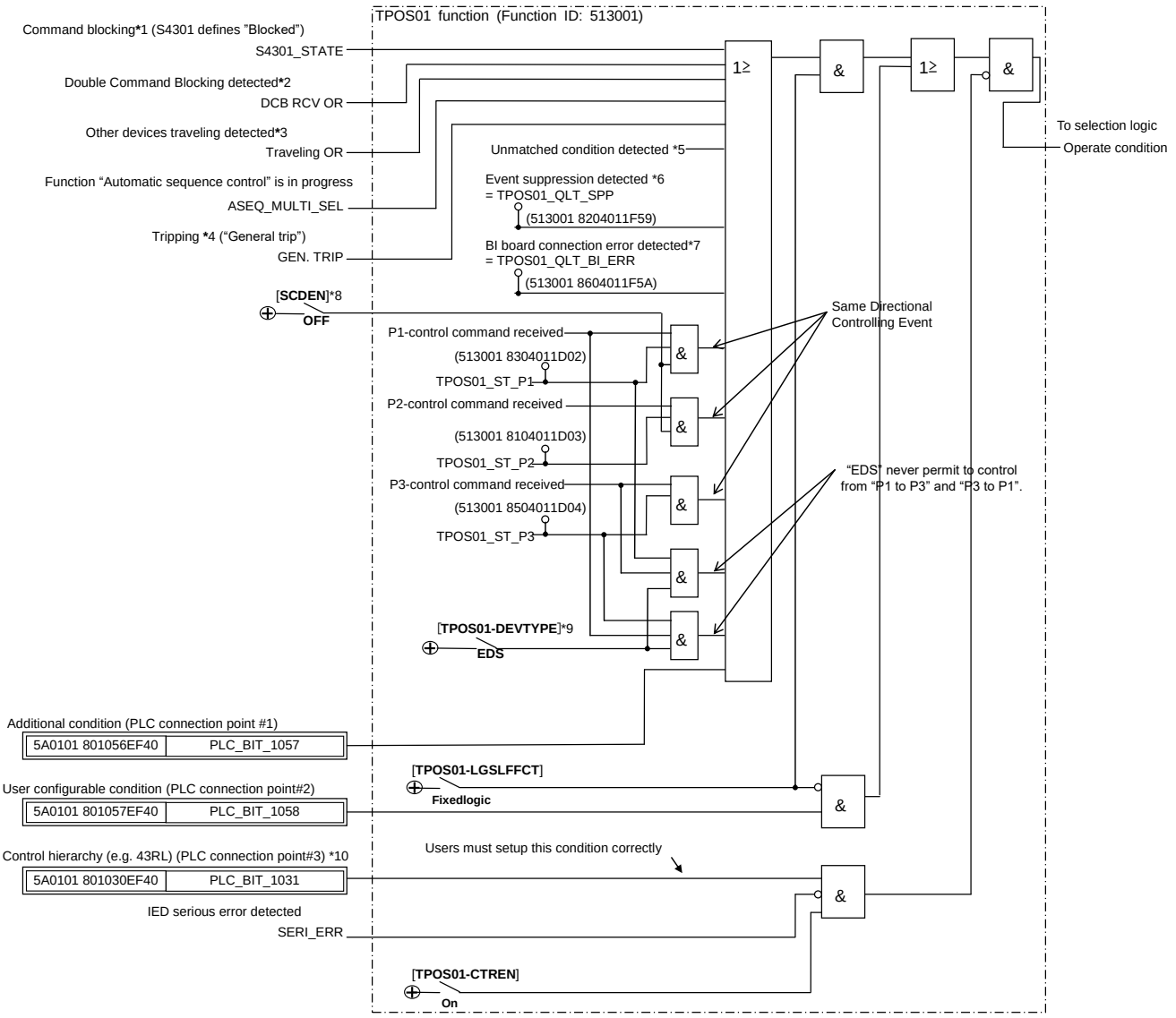


Figure 2.11-44 Operate condition logic for P1–3 control in TPOS01*11

*1Note: "Command Blocking" disables any operation except for itself; "Command blocking" is implemented as "S4301" in a software switch controller (SOFTSW);. The IEC 61850 defines "Command Blocking" as "CmdBlk". For more information of "S4301", see Chapter *Control and monitoring application: Software switch control function*. See the signal "S4301_STATE" in Table 2.11-6.

*2Note: "Double Command Blocking (DCB)" is an operation philosophy. It can be used to protect the substation. The user can program it using GR-TIEMS.

*3Note: Detection of event "device-travelling signifies that other operators are changing the status of one or more devices. Thus, device operation by the IED should be inhibited whilst ever the event is detected. The detection signal is denoted as "Traveling OR" in Table 2.11-6.

*4Note: If an IED is in the process of issuing a trip command, all control operation is blocked until the trip operation has been completed. If the IED has a relay application, the trip command is issued at the output-point "GEN.TRIP" in Table

2.11-6.

*5Note: The criteria "unmatched conditions" is determined when "Test-bit status" in a command is not identical to "IED test status".

*6Note: The Function "Event suppression" can detect chattering in BI circuits. (See 2.11.6(i)-3)

*7Note: A supervision of the Binary IO module can detect connection errors for BI circuits.

*8Note: The "Common control" (CMNCTRL) function can test or check the operation – direction of logic. When the user sets off for scheme switch [**SCDEN**], operation of the logic is blocked if the logic is running in the same operation-direction compared with the previous operation-direction. Alternatively, if **On** is set for the scheme switch, the logic is not blocked.

*9Note: The user should set scheme switch [**TPOS01-DEVTYPE**] **EDS** when the earth-switch(ES) is applied for the TPOS01 function.

*10Note: The user must program the PLC logic for "Control hierarchy condition" The user must connect the "Control hierarchy" condition to the select condition logic using the connection point PLC_BIT_1031" for more information, see chapter *Control and monitoring application: Control hierarchy*" see PLC#3 of Table 2.11-8.

*11Note: To identify the input points of the other TPOS, see Table 2.11-8 for PLC#1 to #3. Note that the logic outputs are generated separately for P1, P2 and P3-control.

(xi) Signal name and number

Note: The user should note the meaning of the following abbreviations as shown in column "M/O" of each table:

"O" signifies that the signal is provided for the optional use.

"M" signifies that the user should map/set/configure the signal; otherwise, the user may experience an operational failure if the default settings is used.

"N/A" signifies that the user cannot change the state of the signal.

Table 2.11-15 PLC connection points (Input signal PLC#1 user a configurable condition)

Signal Number	Signal Name	Description	M/O
5A0101 801050EF40	PLC_BIT_1051	TPOS01 operate condition configured by the user (for PLC#1)	O
5A0101 801075EF40	PLC_BIT_1076	TPOS02 operate condition configured by the user (for PLC#1)	O
5A0101 801100EF40	PLC_BIT_1101	TPOS03 operate condition configured by the user (for PLC#1)	O

Table 2.11-16 PLC connection points (Input signal PLC#2 user configurable condition)

Signal Number	Signal Name	Description	M/O
5A0101 801061EF40	PLC_BIT_1062	TPOS01 operate condition configured by the user (for PLC#2)	O
5A0101 801086EF40	PLC_BIT_1087	TPOS02 operate condition configured by the user (for PLC#2)	O
5A0101 801111EF40	PLC_BIT_1112	TPOS03 operate condition configured by the user (for PLC#2)	O

Table 2.11-17 PLC connection points (Input signal PLC#3 user configurable condition)

Signal Number	Signal Name	Description	M/O
5A0101 801051EF40	PLC_BIT_1052	TPOS01 operate condition configured by the user (for PLC#3)	O
5A0101 801076EF40	PLC_BIT_1077	TPOS02 operate condition configured by the user (for PLC#3)	O
5A0101 801101EF40	PLC_BIT_1102	TPOS03 operate condition configured by the user (for PLC#3)	O

Table 2.11-18 PLC connection points (Input signal PLC#4 user configurable condition)

Signal Number	Signal Name	Description	M/O
5A0101 801052EF40	PLC_BIT_1053	TPOS01 operate condition configured by the user (for PLC#4)	O
5A0101 801077EF40	PLC_BIT_1078	TPOS02 operate condition configured by the user (for PLC#4)	O
5A0101 801102EF40	PLC_BIT_1103	TPOS03 operate condition configured by the user (for PLC#4)	O

Table 2.11-19 PLC connection points (Input point additional, user configurable condition)

Signal Number	Signal Name	Description	M/O
5A0101 801056EF40	PLC_BIT_1057	Condition added by the user in TPOS01 (for PLC#1)	O
5A0101 801081EF40	PLC_BIT_1082	Condition added by the user in TPOS02 (for PLC#1)	O
5A0101 801106EF40	PLC_BIT_1107	Condition added by the user in TPOS03 (for PLC#1)	O
5A0101 801057EF40	PLC_BIT_1058	Condition added by the user in TPOS01 (for PLC#2)	O
5A0101 801082EF40	PLC_BIT_1083	Condition added by the user in TPOS02 (for PLC#2)	O
5A0101 801107EF40	PLC_BIT_1108	Condition added by the user in TPOS03 (for PLC#2)	O

Table 2.11-20 PLC monitoring points (Output signal for BIO)

Signal Number	Signal Name	Description
513001 8104011DD0	TPOS01_P1EX_BO	Operate command (P1) for Binary Output in TPOS01
513001 8104021DD0	TPOS02_P1EX_BO	Operate command (P1) for Binary Output in TPOS02
513001 8104031DD0	TPOS03_P1EX_BO	Operate command (P1) for Binary Output in TPOS03
513001 8204011DD3	TPOS01_P2EX_BO	Operate command (P2) for Binary Output in TPOS01
513001 8204021DD3	TPOS02_P2EX_BO	Operate command (P2) for Binary Output in TPOS02
513001 8204031DD3	TPOS03_P2EX_BO	Operate command (P2) for Binary Output in TPOS03
513001 8204011DD6	TPOS01_P3EX_BO	Operate command (P3) for Binary Output in TPOS01
513001 8204021DD6	TPOS02_P3EX_BO	Operate command (P3) for Binary Output in TPOS02
513001 8204031DD6	TPOS03_P3EX_BO	Operate command (P3) for Binary Output in TPOS03
513001 8004011E7E	TPOS01_P1EC_OK_CSF	TPOS01 P1 direction execute command
513001 8004021E7E	TPOS02_P1EC_OK_CSF	TPOS02 P1 direction execute command
513001 8004031E7E	TPOS03_P1EC_OK_CSF	TPOS03 P1 direction execute command
513001 8004011E7F	TPOS01_P2EC_OK_CSF	TPOS01 P2 direction execute command
513001 8004021E7F	TPOS02_P2EC_OK_CSF	TPOS02 P2 direction execute command
513001 8004031E7F	TPOS03_P2EC_OK_CSF	TPOS03 P2 direction execute command
513001 8004011E80	TPOS01_P3EC_OK_CSF	TPOS01 P3 direction execute command
513001 8004021E80	TPOS02_P3EC_OK_CSF	TPOS02 P3 direction execute command
513001 8004031E80	TPOS03_P3EC_OK_CSF	TPOS03 P3 direction execute command
513001 8004011E81	TPOS01_P1EC_OK_CS	TPOS01 P1 direction execute command
513001 8004021E81	TPOS02_P1EC_OK_CS	TPOS02 P1 direction execute command
513001 8004031E81	TPOS03_P1EC_OK_CS	TPOS03 P1 direction execute command
513001 8304011E82	TPOS01_P2EC_OK_CS	TPOS01 P2 direction execute command
513001 8304021E82	TPOS02_P2EC_OK_CS	TPOS02 P2 direction execute command
513001 8304031E82	TPOS03_P2EC_OK_CS	TPOS03 P2 direction execute command
513001 8404011E83	TPOS01_P3EC_OK_CS	TPOS01 P3 direction execute command
513001 8404021E83	TPOS02_P3EC_OK_CS	TPOS02 P3 direction execute command

Signal Number	Signal Name	Description
513001 8404031E83	TPOS03_P3EC_OK_CS	TPOS03 P3 direction execute command
513001 8004011E93	TPOS01_EX_CMP	TPOS01 completed control
513001 8004021E93	TPOS02_EX_CMP	TPOS02 completed control
513001 8004031E93	TPOS03_EX_CMP	TPOS03 completed control
513001 8604011E91	TPOS01_EX_FFL	TPOS01 failed control
513001 8604021E91	TPOS02_EX_FFL	TPOS02 failed control
513001 8604031E91	TPOS03_EX_FFL	TPOS03 failed control

(xii) Setting names

Note: The “xx” of “TPOSxx” represents the TPOS function number. (e.g., if the TPOS03 is considered, the “xx” is equal to “03”. The suffix “xx” can be represented from “01” to “03”.)

Table 2.11-21 Setting of Operate in TPOSxx

Setting Name	Description	Default	Setting item or value
TPOSxx-PLSM	Method of command output(TPOS01–03)	Fix	Fix/Var
TPOSxx-CPW	Duration of command output(TPOS01–03)	1.0[sec]	0.1~50.0[sec]
TPOSxx-RST	Detection time for terminating control (TPOS01–03)	30.0[sec]	0.1~100.0[sec]
TPOSxx-LGCTRCON	Logic selector for operate condition (TPOS01–03)	Fixedlogic	Fixedlogic/PLC
TPOSxx-LGP1EXOT	Logic selector for command output (TPOS01–03)	Fixedlogic	Fixedlogic/PLC
TPOSxx-LGP2EXOT	Logic selector for command output (TPOS01–03)	Fixedlogic	Fixedlogic/PLC
TPOSxx-LGP3EXOT	Logic selector for command output (TPOS01–03)	Fixedlogic	Fixedlogic/PLC
TPOSxx-LGEXFFCT	Logic selector for operate condition (TPOS01–03)	Fixedlogic	Fixedlogic/PLC

2.11.4 Operation counter

The TPOS01 function has an operation-counter†; the user can utilize the operation counter to predict the lifespan of an EDS. The user can select a count mode in response to a device signal. Table 2.11-22 and Figure 2.11-45 show the mode, for which a user is required to change a mode in response to a device signal and the signal of the device such as the EDS. For instance of the P1-control in the TPOS01 function, a user can select the mode using scheme switch [**TPOS01-P1CNTS**], which is set to **C-On**; counting-up is performed when a switch-gear signal gives rise to a change in state from "Open to Closing".

Table 2.11-22 Mode of operation counter

Mode	Description
C-On	Counting-up is performed when a signal changes to closed (ON). When the signal is changed from "Open to Closed", the counter value is incremented.
C-Off	Counting-up is performed when a signal changes to open (OFF). When the signal is changed from "Closed to Open", the counter value is incremented.
C-OnOff	Counting-up is made when any state change occurs: "Open to Closed" and "Closed to Open".
NA	Stop the count function

†Note:The operation-counter value is not cleared when power is removed from the IED. This counter is available in the TPOS01 to TPOS03 functions.

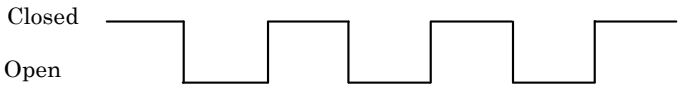


Figure 2.11-45 Device signal

The user can change the value of the operation-counter from either the front panel or remotely. For example, in the sub-menu for "Operation counter", the user can set a user-preferred value for the operation-counter. See Chapter *User interface: Monitoring sub-menu* on how to operate the sub-menu.

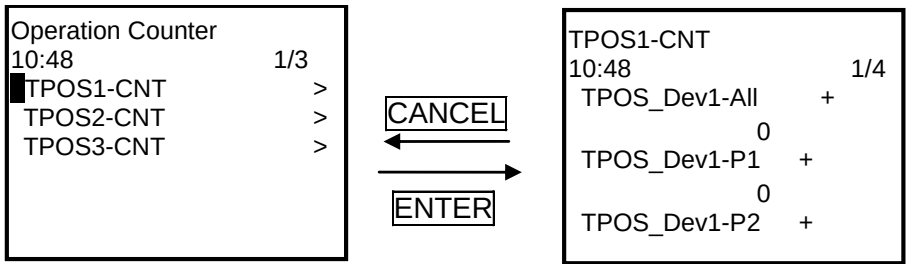


Figure 2.11-46 Operation counter sub-menu

Note: With regard to the signal "TPOS01_ST_P1", the sub-menu represents it as "TPOS_Dev1-P1". Analogous to the signal "TPOS01_ST_P1", the signals "TPOS01_ST_P2" and "TPOS01_ST_P3" are represented as "TPOS_Dev1-P2" and

"TPOS_Dev1-P3", respectively. The "TPOS_Dev1-All" represents the net counter of "TPOS01_ST_P1", "TPOS01_ST_P2" and "TPOS01_ST_P3".

(i) Receiving "change value for counter" from the remote-end

(i)-1 Mapping of Input point required

Figure 2.11-47 depicts the logic when a "change value for counter" command is received at the TPOS01 function. With regard to the net counter, the input-point "DEV01_ALLCNT_REQ" is used. With regard to a P1-control counter, the input-point "DEV01_P1CNT_REQ" is used. For P2-control and P3-control, the input-points "DEV01_P2CNT_REQ" and "DEV01_P3CNT_REQ" are used.

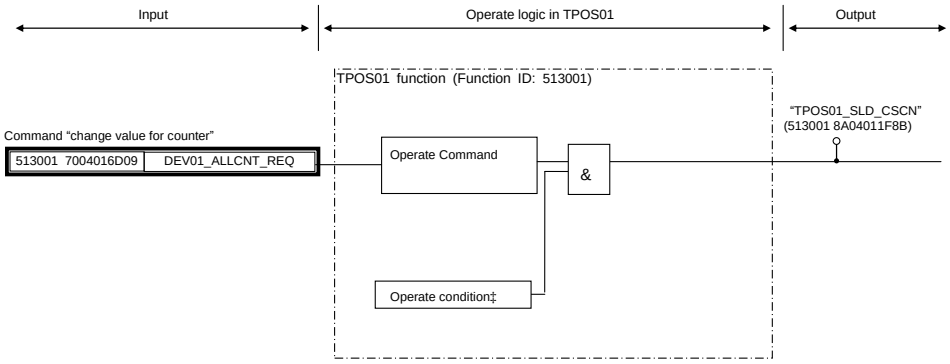


Figure 2.11-47 Change counter value in net counter† by the remote-end in TPOS01

‡Note: The "operate condition" signal is provided from the operate condition logic shown in Figure 2.11-49.

†Note: The user can apply the other counter change commands for P1-control, P2-control and P3-control as shown in Table 2.11-24. The resultant signals for the other TPOS02-03 logics are shown in Table 2.11-23.

(i)-2 Output signal to BO

The TPOS01 function can issue a "Result" signal at output point "TPOS01_SLD_CSCN".

(ii) Receiving "change value for counter" from the local-end

(ii)-1 Input signal from the front panel

Figure 2.11-48 depicts the logic when a "change value for counter" command is provided in the TPOS01 function. The command is provided from the sub-menu (see Figure 2.11-46).

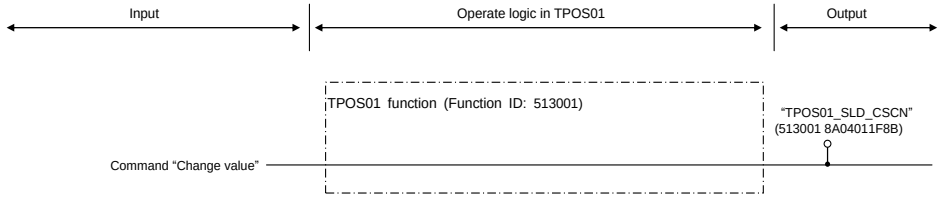


Figure 2.11-48 Changing value by the operation of the front panel in TPOS01

(ii)-2 Output signal to BO

The TPOS01 function can issue a “Result” signal at output point “TPOS01_SLD_CSCN”.

(iii) Operate condition for the counter

Figure 2.11-49 illustrates the operate condition logic. The TPOS01 function can determine an operate-condition using a signal received from “Control hierarchy”. The Control hierarchy condition is provided by user-programmed PLC logic; the user must connect the control-hierarchy with the TPOS01 function using connection point “PLC_BIT_1032” (see Table 2.11-25).

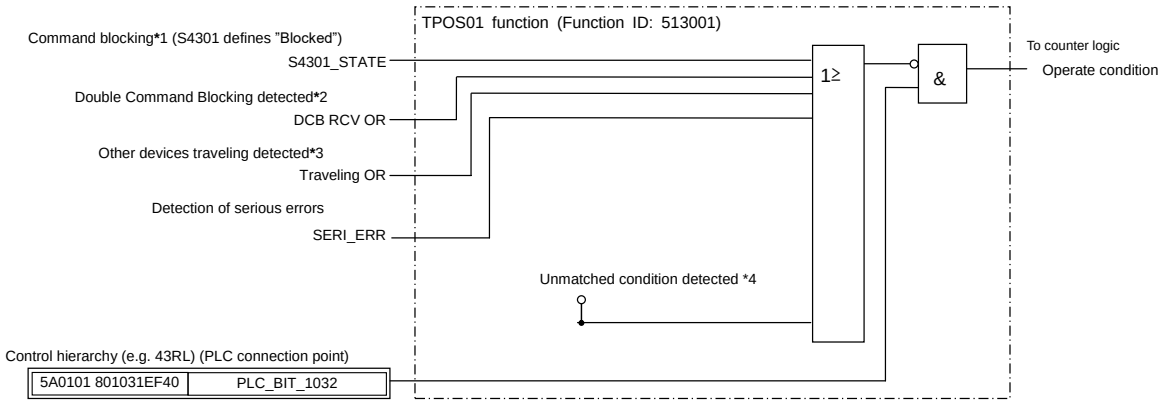


Figure 2.11-49 Operate condition logic for changing the counter in TPOS01

*1Note: “Command Blocking” disables all operation except for its own; the “Command blocking” function is initiated by the status of “S4301” in a software switch controller (SOFTSW). The IEC 61850 standard defines the “Command Blocking” function as “CmdBlk”. For more information on “S4301”, see Chapter *Control and monitoring application: Software switch control function*. See the signal “S4301_STATE” of Table 2.11-6.

*2Note: “Double Command Blocking (DCB)” is an operation philosophy. It can be used to protect the substation. The user can program it using GR-TIEMS.

*3Note: If the event “device-travelling is detected, it indicates that another operator is changing the status of a device. Thus, the IED should inhibit the operation of any device for the duration that the event is detected. The detecting signal is denoted as “Traveling OR” in Table 2.11-6.

*4Note: If the issue of a trip command is executed by the IED, any control operation is blocked until the trip operation is completed. If an IED includes a relay application, the trip command is issued at the output-point “GEN.TRIP” in Table 2.11-6.

(iv) Signal names and number

Table 2.11-23 Results of changing counter

Signal Number	Signal Name	Description
513001 8A04011F8B	TPOS01_SLD_CSCN	TPOS01 counter selected
513001 8A04021F8B	TPOS02_SLD_CSCN	TPOS02 counter selected
513001 8A04031F8B	TPOS03_SLD_CSCN	TPOS03 counter selected

Table 2.11-24 Mapping points

Signal Number	Signal Name	Description
513001 7004016D09	DEV01_ALLCNT_REQ	TPOS01 counter correction request for summation counter value
513001 7004026D09	DEV02_ALLCNT_REQ	TPOS02 counter correction request for summation counter value
513001 7004036D09	DEV03_ALLCNT_REQ	TPOS03 counter correction request for summation counter value
513001 7004016D0A	DEV01_P1CNT_REQ	TPOS01 counter correction request for P1 counter value
513001 7004026D0A	DEV02_P1CNT_REQ	TPOS02 counter correction request for P1 counter value
513001 7004036D0A	DEV03_P1CNT_REQ	TPOS03 counter correction request for P1 counter value
513001 7004016D0B	DEV01_P2CNT_REQ	TPOS01 counter correction request for P2 counter value
513001 7004026D0B	DEV02_P2CNT_REQ	TPOS02 counter correction request for P2 counter value
513001 7004036D0B	DEV03_P2CNT_REQ	TPOS03 counter correction request for P2 counter value
513001 7004016D0C	DEV01_P3CNT_REQ	TPOS01 counter correction request for P3 counter value
513001 7004026D0C	DEV02_P3CNT_REQ	TPOS02 counter correction request for P3 counter value
513001 7004036D0C	DEV03_P3CNT_REQ	TPOS03 counter correction request for P3 counter value

Table 2.11-25 PLC connection points for control hierarchy

Signal Number	Signal Name	Description	M/O
5A0101 801031EF40	PLC_BIT_1032	TPOS1 control hierarchy condition(PLC#1) for counters	M
5A0101 801034EF40	PLC_BIT_1035	TPOS2 control hierarchy condition(PLC#1) for counters	M
5A0101 801037EF40	PLC_BIT_1038	TPOS3 control hierarchy condition(PLC#1) for counters	M

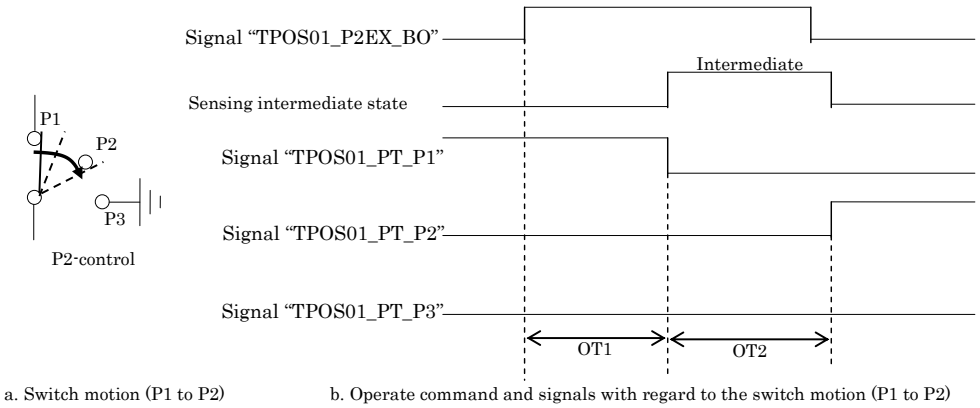
(v) Setting name

Table 2.11-26 Setting for pulse counter in TPOSxx

Setting Name	Description	Default	Setting item or value
TPOSxx-P1CNTS	Mode selection of the counter in P1-control	*user-preferred	NA / C-On / C-Off / C-OnOff
TPOSxx-P2CNTS	Mode selection of the counter in P2-control	*user-preferred	NA / C-On / C-Off / C-OnOff
TPOSxx-P3CNTS	Mode selection of the counter in P3-control	*user-preferred	NA / C-On / C-Off / C-OnOff

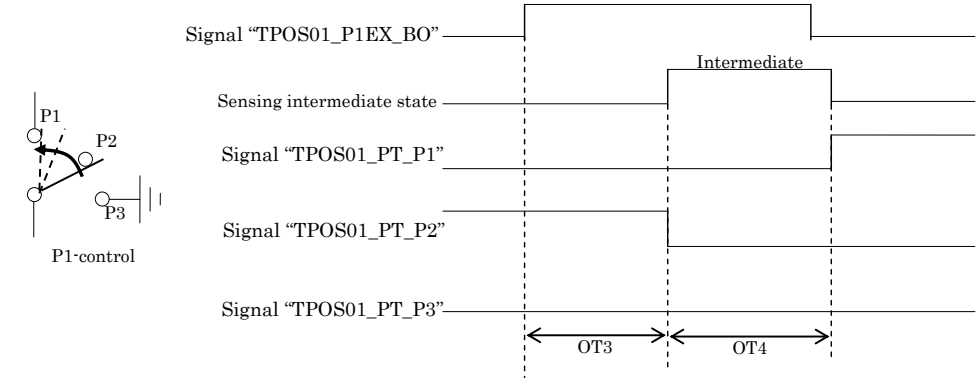
2.11.5 Measurement of operation Intervals

The TPOS01 function can measure operation intervals time†, the intervals OT1 and OT2 can represent the period of time when an earth-switch changes a position from another position. As shown in Table 2.11-27 the eight intervals are defined as switching as shown in Figure 2.11-50 to Figure 2.11-53. The user should set scheme switch [**TPOS01-OPETMEN**] **On.**



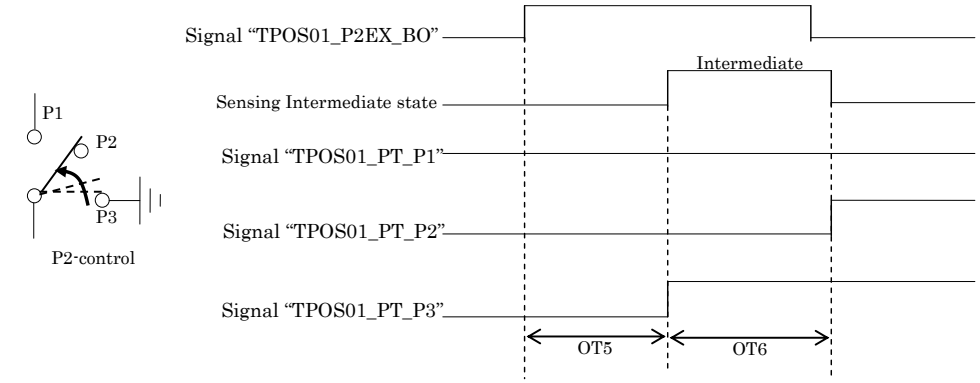
a. Switch motion (P1 to P2) b. Operate command and signals with regard to the switch motion (P1 to P2)

Figure 2.11-50 Two Intervals (OT1 and OT2) for P2 control



a. Switch motion (P2 to P1) b. Operate command and signals with regard to the switch motion (P2 to P1)

Figure 2.11-51 Two Intervals (OT3 and OT4) for P1 control



a. Switch motion (P3 to P2) b. Operate command and signals with regard to the switch motion (P3 to P2)

Figure 2.11-52 Two Intervals (OP5 and OP6) for P2 control

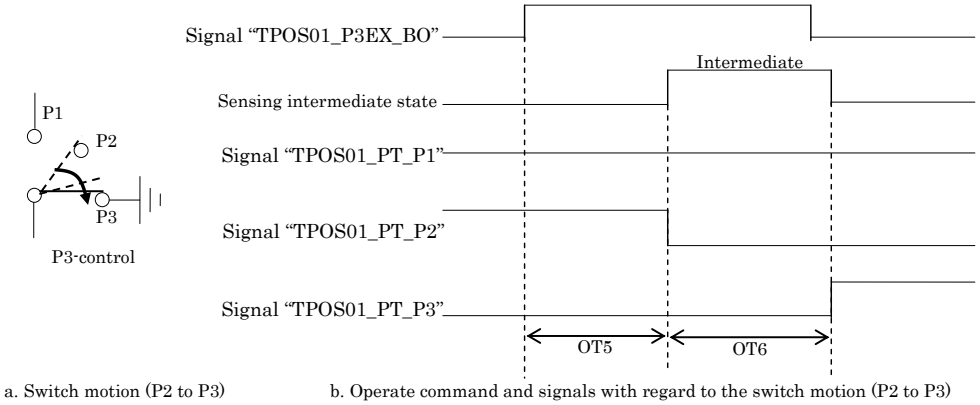


Figure 2.11-53 Two intervals (OP7 and OP8) for P3 control

Table 2.11-27 Eight intervals measured in TPOS01 function

Intervals	Trigger	Events for measurement
OT1	Start	Signal "TPOS01_P2EX_BO" sensed
	End	Signal "TPOS01_PT_P1" unsensed
OT2	Start	Signal "TPOS01_PT_P1" sensed
	End	Signal "TPOS01_PT_P2" unsensed
OT3	Start	Signal "TPOS01_P1EX_BO" sensed
	End	Signal "TPOS01_PT_P2" unsensed
OT4	Start	Signal "TPOS01_PT_P2" is sensed
	End	Signal "TPOS01_PT_P1" unsensed
OT5	Start	Signal "TPOS01_P2EX_BO" sensed
	End	Signal "TPOS01_PT_P3" unsensed
OT6	Start	Signal "TPOS01_PT_P3" sensed
	End	Signal "TPOS01_PT_P2" unsensed
OT7	Start	Signal "TPOS01_P3EX_BO" sensed
	End	Signal "TPOS01_PT_P2" unsensed
OT8	Start	Signal "TPOS01_PT_P2" sensed
	End	Signal "TPOS01_PT_P3" unsensed

†Note:The function "operation time measurement" is also available in the TPOS02 and TPOS03 functions.

The user can clear the operation-intervals (OT1 to OT8) by key-operation of the "Operation time" sub-menu or operation from the remote-end. Figure 2.11-54 shows that the user can clear the eight operation times using this screen. See chapter *User interface: Monitoring sub-menu* for the operation.

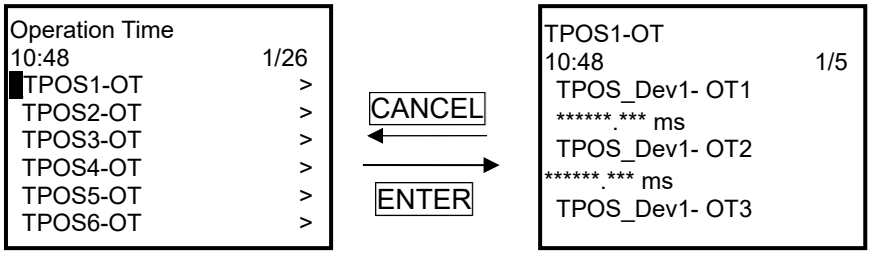


Figure 2.11-54 Operation time sub-menu

(i) Signal names and numbers

Table 2.11-28 Mapping point for clearance of operation times

Signal Number	Signal Name	Description
513001 7004016D0D	DEV01_RESET_REQ	TPOS1 operation time reset command (Mapping Data)
513001 7004026D0D	DEV02_RESET_REQ	TPOS2 operation time reset command (Mapping Data)
513001 7004036D0D	DEV03_RESET_REQ	TPOS3 operation time reset command (Mapping Data)

(ii) Setting names

Table 2.11-29 Setting of operation time function in TPOSxx

Setting Name	Description	Default	Setting item or value
TPOSxx-OPETMEN	Activation of the operation time measurement in TPOSxx	On	Off / On

2.11.6 Setup for BIO module

The user should connect the TPOS input /output points with the BI and the BO circuits; subsequently, the TPOS function is able to issue select and operate commands. The user should execute the following four steps.

i BI connection for status signals

ii BO connection for "select command"

iii BO connection for "operate command"

iv Contact health check

Note that the TPOS01 function commences operation when the scheme switch [**TPOS01-EN**] is set to **On**.

(i) BI connection for status signals

Figure 2.11-55 exemplifies the reception of signals at the TPOS01 function; to acquire the status signal§, the user should set input-point for the settings [**TPOS01-P1NOPSG**], [**TPOS01-P2NOPSG**], and [**TPOS01-P3NOPSG**].

†Note:Normally the input-signals (P1, P2, P3) are generated using normally-open contacts (NOs). If the P1 signal is generated by the normal-closed contact (NC), the user should set scheme switch [**TPOS01- P1NOPSGI**] to **On** in order that the P1 input-signal is inverted.

§Note: The state signal acquired can be monitored. For more information, see Chapter *Automatic supervision*.

(i)-1 Connection with Binary input circuits

For example, as shown in Figure 2.11-1, suppose three kinds of signals (P1, P2, or P3) are provided on the first (BI1), second (BI2), and third BI (BI3) circuits at IO#1 slot. In this case, the user should set three input-points (200B01–8001001110, 8101011110, and 8201021110†) for the settings [**TPOS01-P1NOPSG**], [**TPOS01-P2NOPSG**], and [**TPOS01-P3NOPSG**].

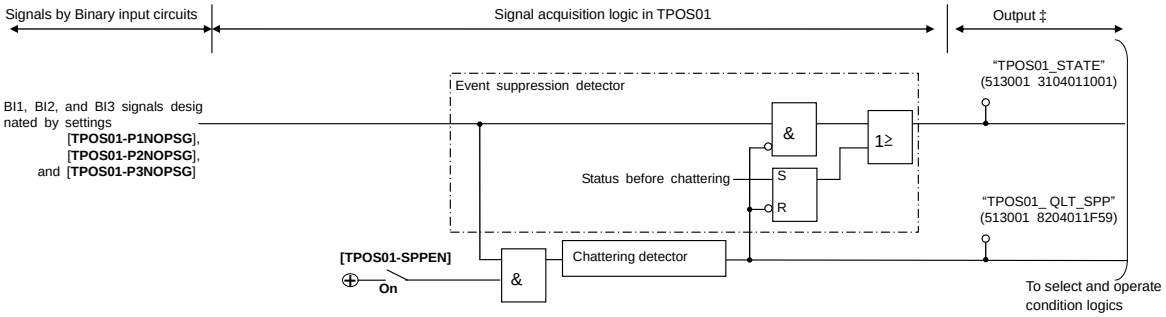


Figure 2.11-55 BI1, BI2 and BI3 signals provided into TPOS01

†Note:The user should set the actual input- points, see Chapter *Technical description: Binary IO module*.

‡Note:In Figure 2.11-55 two signals can be issued: "TPOS01_STATE" and

"TPOS01_QLT_SPP". The former one is used in the select condition logic and the operate condition (see Figure 2.11-20 and Figure 2.11-44). The latter is used for an event suppression detector.

(i)-2 Decision by input signals

The logic in Figure 2.11-55 can give a decision in response to the reception of the signals; the decision is of either "P1", "P2", "P3", "Faulty", and "Intermediate". Table 2.11-30 exemplifies the decisions in response to the BI1 - BI3 input signals; the decision can be acquired at the monitoring point "TPOS01_STATE".

Suppose, the BI1–BI3 circuits receive "On–Off–Off" signals when an earth-switch is located at "P1" (see Figure 2.11-1); the value "1" is given, because the decision can be made with the "On–Off–Off" signals.

If "On–On–Off" signals are applied to the BI1–BI3 circuits, the decision cannot be made because the earth switch is still kinetic and is not standstill; thus, the decision is given as "Intermediate", the value "3" is given at the connection point "TPOS01_STATE".

If "On–On–On" signals are applied to the BI1–BI3 circuits, the decision cannot be made because the earth-switch may be broken; hence, the value "7" is given.

Table 2.11-30 Decision made by the TPOS01 function

Input signals at IO#1 (200B01)			Decision by TPOS01	Generated value "TPOS01_STATE" (513001 3104011001)
BI1 (8001001110)	BI2 (8101011110)	BI3 (8201021110)		
Off (0)	Off (0)	Off (0)	Intermediate	0
On (1)	Off (0)	Off (0)	P1	1
Off (0)	On (1)	Off (0)	P2	2
On (1)	On (1)	Off (0)	Intermediate	3
Off (0)	Off (0)	On (1)	P3	4
On (1)	Off (0)	On (1)	Intermediate	5
Off (0)	On (1)	On (1)	Intermediate	6
On (1)	On (1)	On (1)	Faulty	7

Note: When handling the raw information other than the decision, the user can take respective states of binary input circuits using other monitoring points. That is, the user can take either state On (1) or state Off (0) corresponding to the BI1 circuit using the monitoring point "TOPS01_PT_P1". Likewise, the BI2 and BI3 states can be taken using the monitoring points "TOPS01_PT_P2" and "TOPS01_PT_P3". (See Table 2.11-35)

(i)-3 Event suppression detector

If the status of a device "chatters" for a short time, the TPOS function will receive iterative signals from the device. Such iterative signals can cause extra burden for the TPOS function; hence, event suppression can be required to reduce the additional burden created.

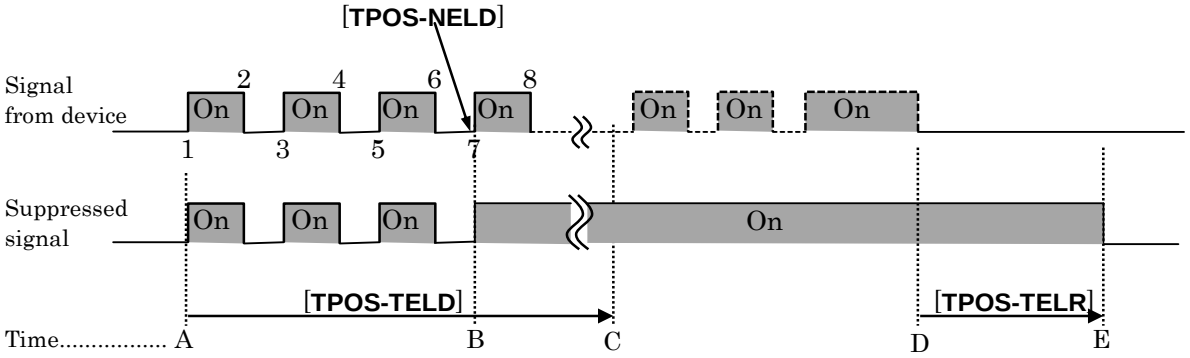


Figure 2.11-56 Iterative signals and signals suppressed

Figure 2.11-56 shows that the iterative signals received from the device have been suppressed by the event suppression function. The suppression commences on receipt of the seventh signal (at Time B). This is because the function can count the iterative number of incoming signals. Detection commences at Time A, the setting [**TPOS-NELD**] is provided so that the suppression commences at Time B. The setting [**TPOS-TELD**] is pertains to the operation of the detection function from Time A (e.g., Time A to Time C).

The event suppression ceases when the iterative signal stops. The user can adjust the point at which event suppression stops using the setting [**TPOS-TELR**]; as a result, no suppressed signal is output after the end of the iterative signals (e.g., Time D to E).

To initiate event suppression the user should set **On** for scheme switch [**TPOS01-SPPEN**].

(ii) BO connection for "select commands"

Figure 2.11-57 exemplifies the connections for operate commands P1/P2/P3. Suppose that connection with the BOs is achieved by the PLC function using connection points "TPOS01_P1SL_BO_FLG" to "TPOS01_P3SL_BO_FLG"; as a result, either of the signals "Operate command P1 to P3" is issued at one of the BOs.

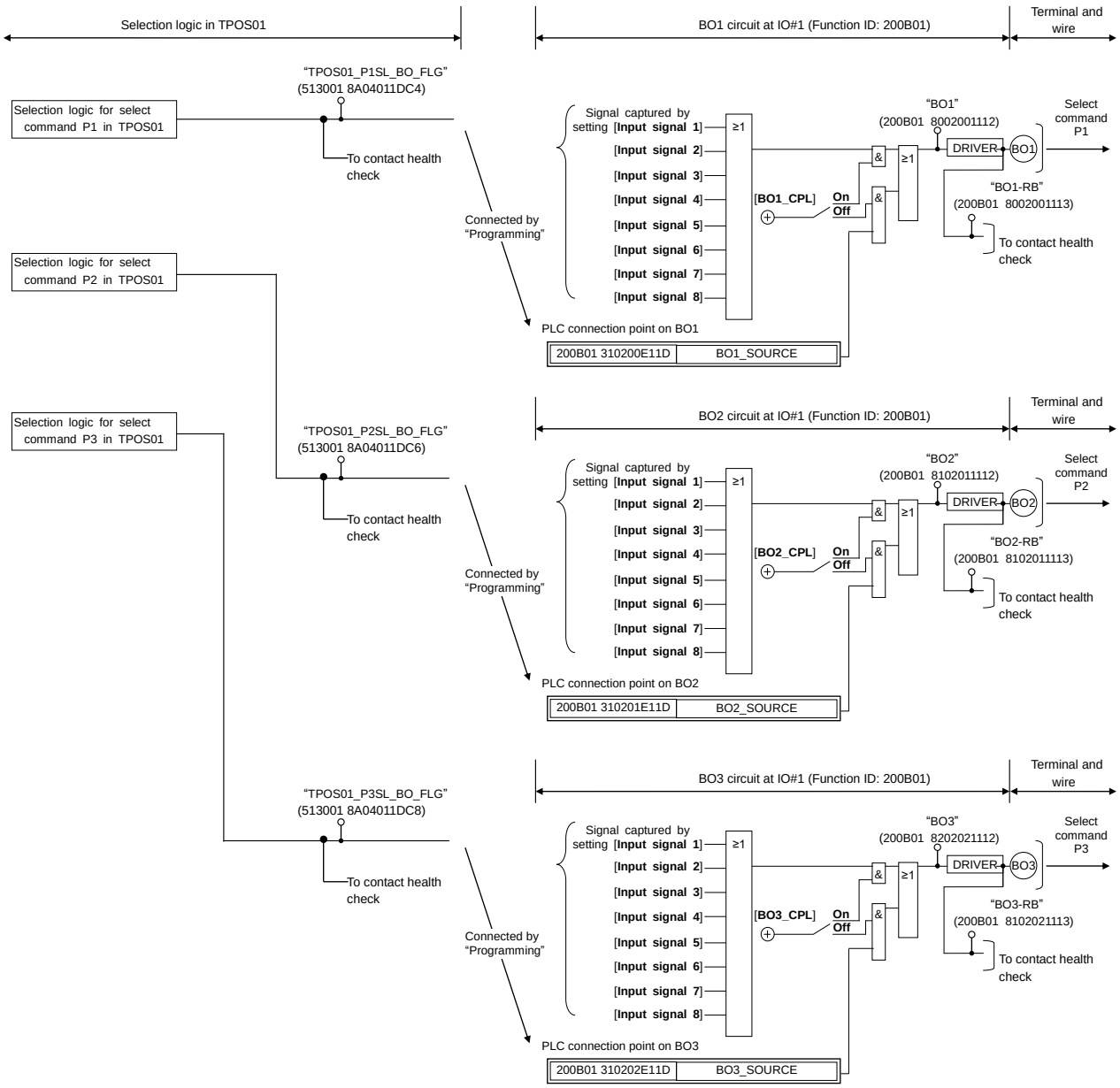


Figure 2.11-57 Example select connected with BO1-BO3

(iii) BO connection for "operate command"

Figure 2.11-58 exemplifies the connections for operate commands P1/P2/P3; the BO4–BO6 circuits issue the operate command.

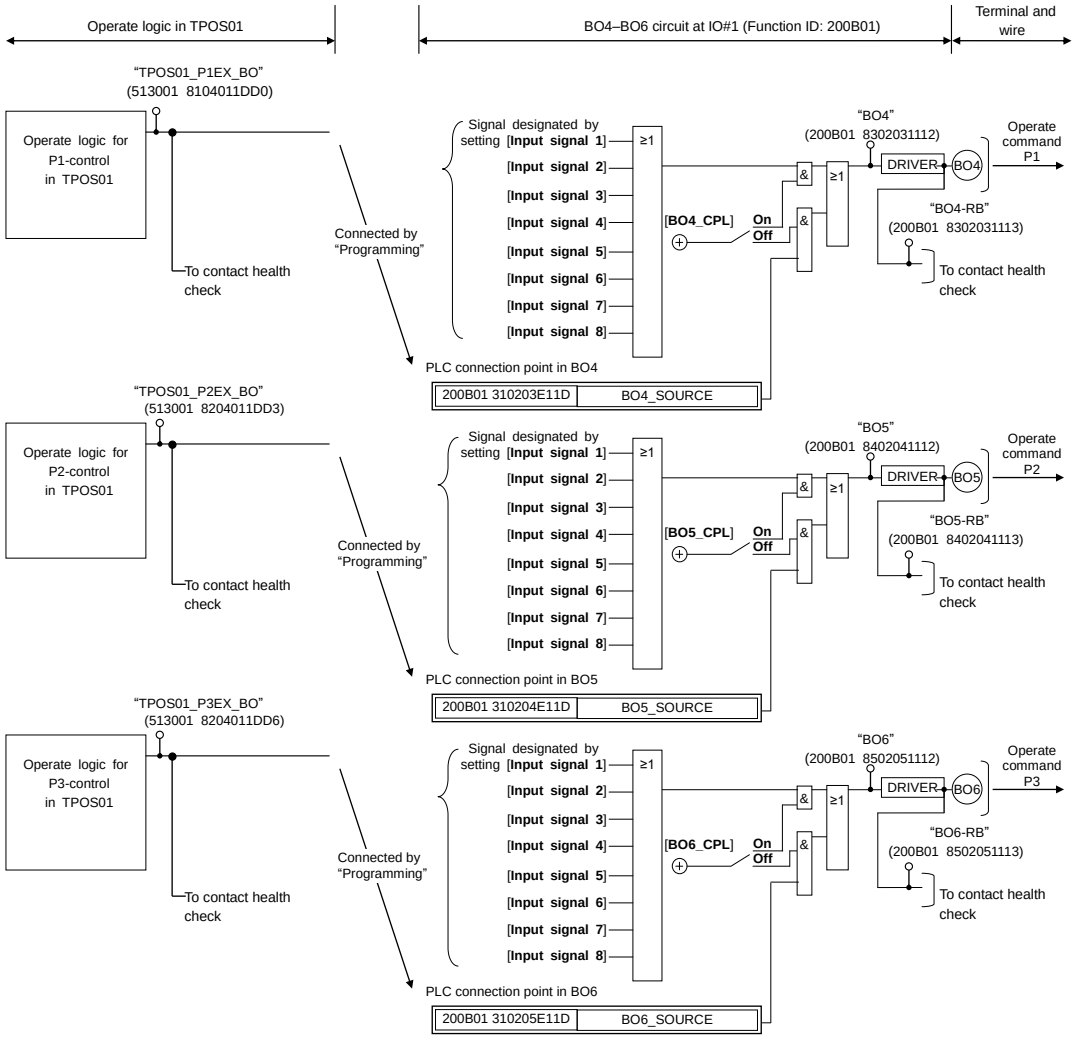


Figure 2.11-58 Example of operate commands connected with BO4-BO2

†Note:Table 2.11-20 shows the remaining signals except for "TPOS01".

(iv) Contact health check

The TPOS01 function has contact health check feature for the BO circuits; hence, the user is able to connect an output signal to the contact health check function when **Fixedlogic** is set for scheme switches [**TPOS01- LGP1EXOT**] to [**TPOS01-LGP3EXOT**]†. Consequently, the TPOS01 function can determine whether the signal has been successfully output from the BO. If a failure is reported, the TPOS01 function determines that the signal is not output successfully to the BO; then the command is canceled immediately and the TPOS01 function returns to the "Wait for a command" stage.

†Note:Table 2.11-21 shows settings for the health check feature in the other TPOS functions.

(iv)-1 Setting for "select command P1/P2/P3"

For example, the point"TPOS01_P1SL_BO" is connected to the BO1 circuit for the issuing of

the command, the user can connect point “BO1-RB “ with the contact health check function using the setting [**TPOS01-P1SLBORD**]. Do not key the point “TPOS01_P1SL_BO”. Likewise, BO2-RB and BO3-RB are required to be set.

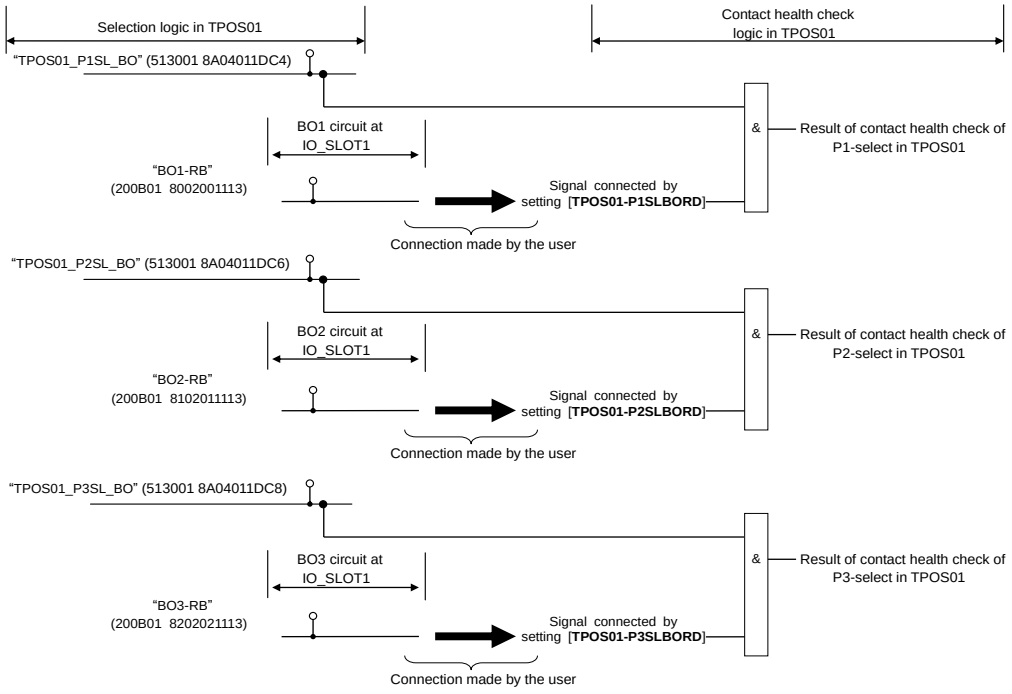


Figure 2.11-59 Example contact health check feature for P1–P3 select commands

(iv)-2 Setting for “Operate command P1/P2/P3”

Similarly, the points “BO4-RB” and “BO6-RB” are required to be set for the settings [**TPOS01-P1EXBORD**] to [**TPOS01-P3EXBORD**].

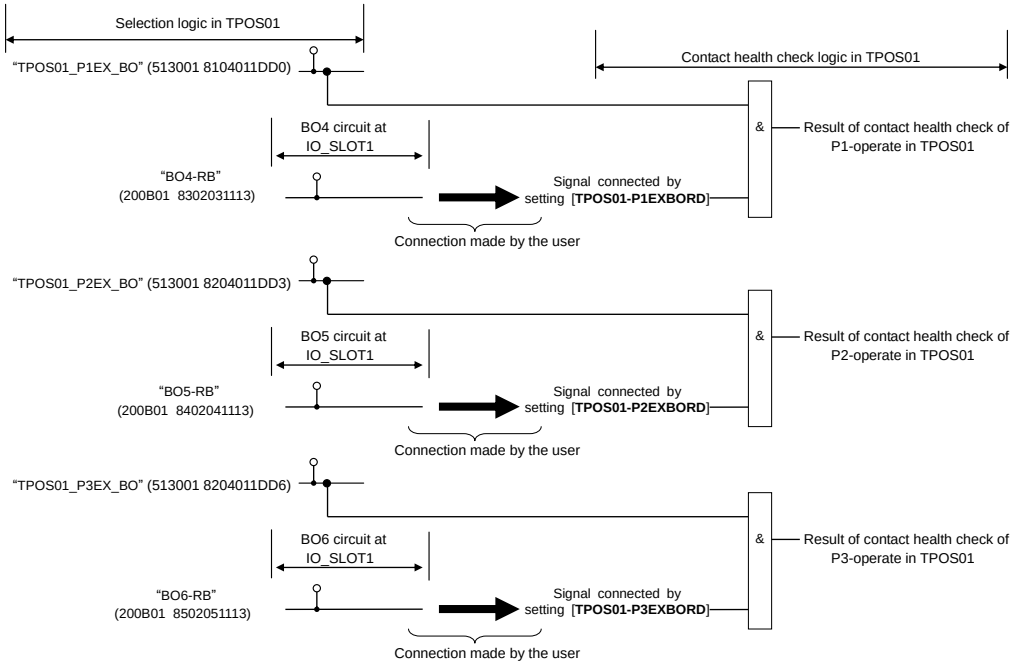


Figure 2.11-60 Contact health check logic for P1–P3 operate commands

(iv)-3 Proper setting for the contact health check (normal setting, example #1)

Figure 2.11-61 shows a setting example for 43S/EDS driving. Select and operate commands drive the BO1–BO6 contacts. To check that the contact health check function is working correctly, the respective points of the BO (RBs) should be connected, as shown in Table 2.11-31, to demonstrate that the settings are physically matched with the BO contacts.

Table 2.11-31 Setting example for contact health check

Example #1		Health check settings for example #1	
"TPOS01_P1SL_BO_FLG" is connected to "BO1" at IO#1	⇨	200B01 8002001113(BO1-RB) set for [**TPOS01-P1SLBORD**]	OK
"TPOS01_P2SL_BO_FLG" is connected to "BO2" at IO#1	⇨	200B01 8102011113(BO2-RB) set for [**TPOS01-P2SLBORD**]	OK
"TPOS01_P3SL_BO_FLG" is connected to "BO3" at IO#1	⇨	200B01 8202021113(BO3-RB) set for [**TPOS01-P3SLBORD**]	OK
"TPOS01_P1EX_BO" is connected to "BO4" at IO#1	⇨	200B01 8302031113(BO4-RB) set for [**TPOS01-P1EXBORD**]	OK
"TPOS01_P2EX_BO" is connected to "BO5" at IO#1	⇨	200B01 8402041113(BO5-RB) set for [**TPOS01-P2EXBORD**]	OK
"TPOS01_P3EX_BO" is connected to "BO6" at IO#1	⇨	200B01 8502051113(BO6-RB) set for [**TPOS01-P3EXBORD**]	OK

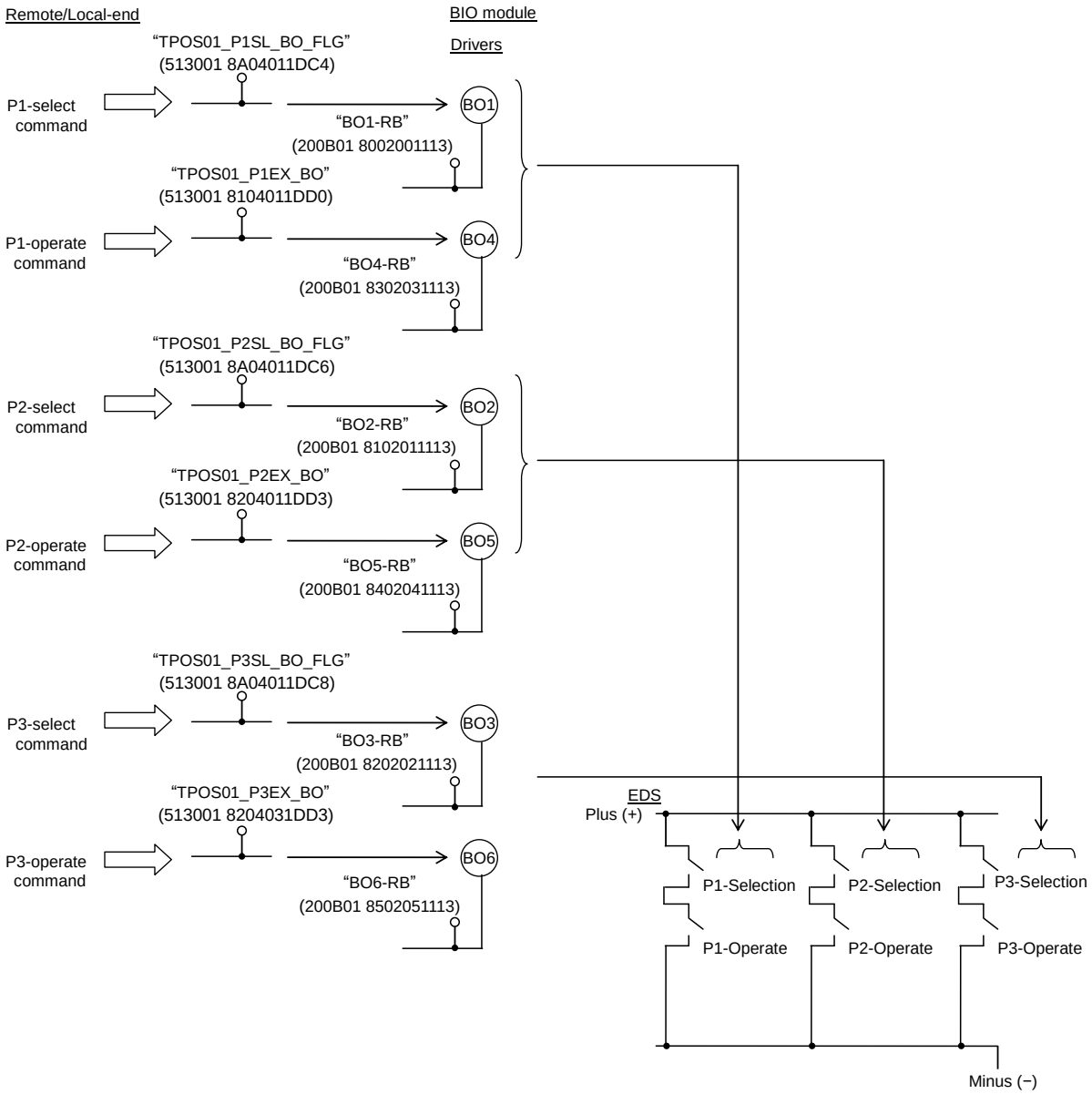


Figure 2.11-61 Contact health check setting and EDS scheme for example #1

(iv)-4 Setting for erroneous in contact health check (improper setting, example #2)

Figure 2.11-62 shows a setting example for an improper setting of the 43S/EDS scheme. The settings are implemented incorrectly as shown in Table 2.11-32, BO1-RB is not chosen, instead BO1 is actually chosen, which is incorrect. In this case, the setting [**TPOS01-SLBORD**] is meaningless; hence, the issue of a select command is blocked.

Table 2.11-32 Erroneous setting example for contact health check

Example #2	Health check setting for example #2	
"TPOS01_P1SL_BO_FLG" is connected to "BO1" on SLOT1	**200B01 8002001112** (BO1) set for [**TPOS01-P1SLBORD**]	NG
"TPOS01_P2SL_BO_FLG" is connected to "BO2" on SLOT1	200B01 8102011113(BO2-RB) set for [**TPOS01-P2SLBORD**]	OK
"TPOS01_P3SL_BO_FLG" is connected to "BO3" on SLOT1	200B01 8202021113(BO3-RB) set for [**TPOS01-P3SLBORD**]	OK
"TPOS01_P1EX_BO" is connected to "BO4" on SLOT1	200B01 8302031113(BO4-RB) set for [**TPOS01-P1EXBORD**]	OK
"TPOS01_P2EX_BO" is connected to "BO5" on SLOT1	200B01 8402041113(BO5-RB) set for [**TPOS01-P2EXBORD**]	OK
"TPOS01_P3EX_BO" is connected to "BO6" on SLOT1	200B01 8502051113(BO6-RB) set for [**TPOS01-P3EXBORD**]	OK

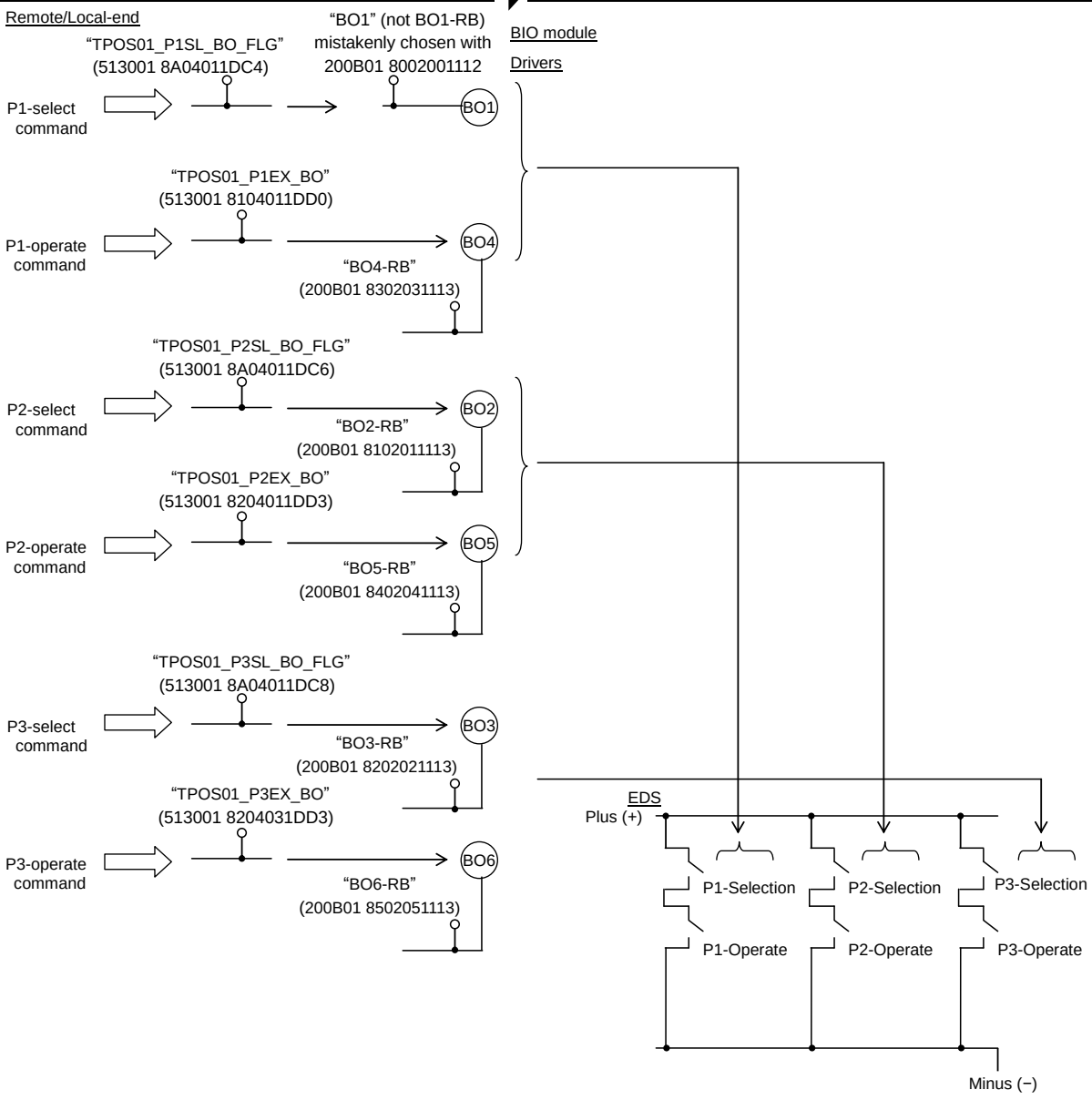


Figure 2.11-62 Contact health check setting and EDS diagram for example #2

(iv)-5 Setting for extra contact health check (special setting, example #3)

Figure 2.11-63 shows an additional setting example for the EDS scheme; one of the settings is made hypothetically. That is, the point "SPO01_P1*SL_BO_FLG" is actually chosen for the setting [**TPOS01-P1*SLBORD**]; i.e. BO1-RB is not chosen for this selection. This special

example can issue a select command; which is called “operated by internal select function”. The user does not need to consider the use of a BO circuit for a select command, when there are no BO circuits available.

Table 2.11-33 Extra setting example for contact health check

Example #3		Setting for example #3	
“TPOS01_P1SL_BO_FLG” is not connected to any BO	⇨	**“TPOS01_P1SL_BO_FLG”** set for [**TPOS01-P1SLBORD**]	OK
“TPOS01_P2SL_BO_FLG” is not connected to any BO	⇨	**“TPOS01_P2SL_BO_FLG”** set for [**TPOS01-P2SLBORD**]	OK
“TPOS01_P3SL_BO_FLG” is not connected to any BO	⇨	**“TPOS01_P3SL_BO_FLG”** set for [**TPOS01-P3SLBORD**]	OK
“TPOS01_P1EX_BO” is connected to “BO4” on SLOT1	⇨	200B01 8302031113(BO4-RB) set for [**TPOS01-P1EXBORD**]	OK
“TPOS01_P2EX_BO” is connected to “BO5” on SLOT1	⇨	200B01 8402041113(BO5-RB) set for [**TPOS01-P2EXBORD**]	OK
“TPOS01_P3EX_BO” is connected to “BO6” on SLOT1	⇨	200B01 8502051113(BO6-RB) set for [**TPOS01-P3EXBORD**]	OK

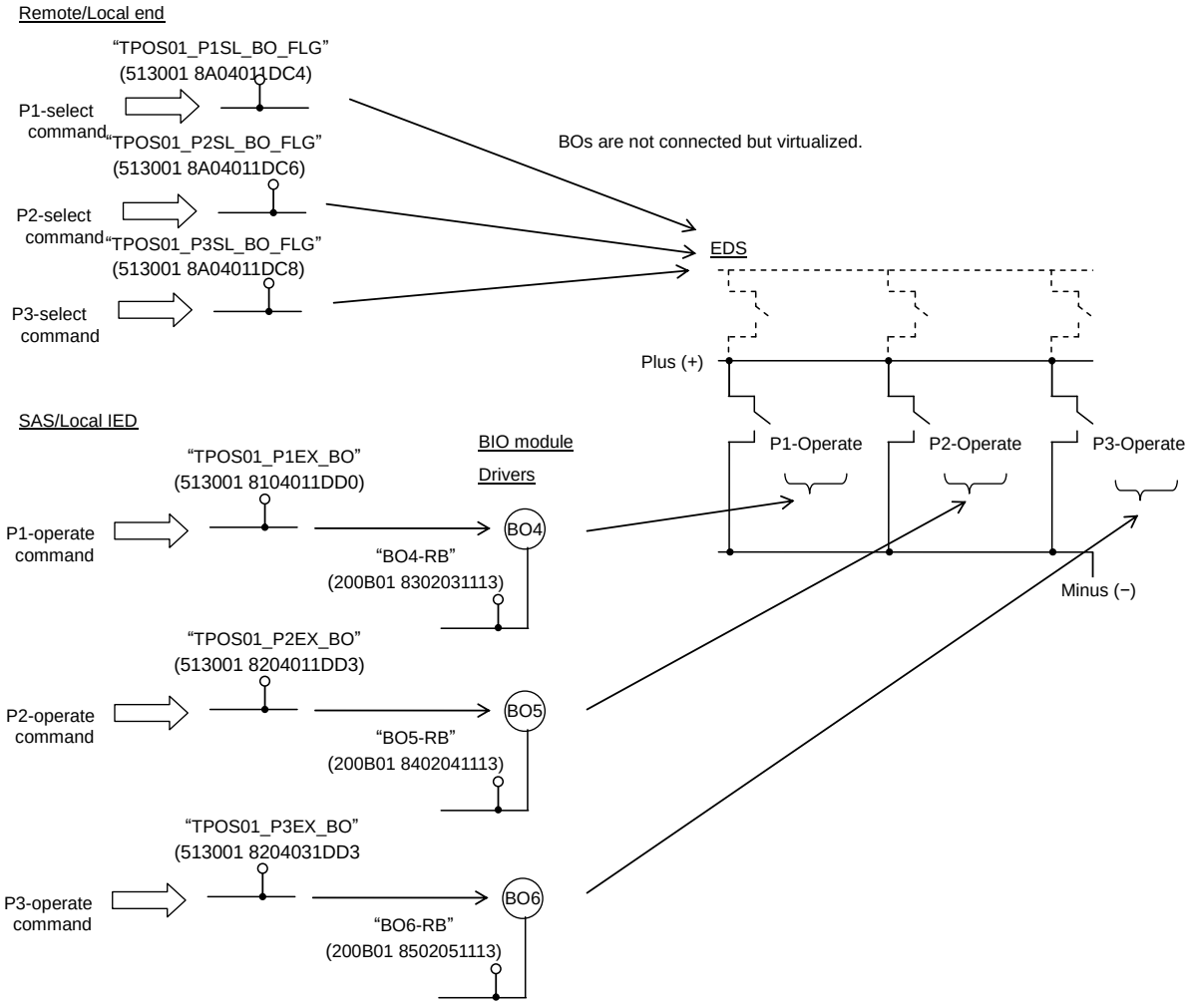


Figure 2.11-63 Contact health check setting and EDS diagram for example #3

(v) Signal name and number

Table 2.11-34 PLC monitoring points (Output signal for event suppression function in TPOSxx)

Signal Number	Signal Name	Description
513001 8204011F59	TPOS01_QLT_SPP	Event suppression detected (TPOS01)
513001 8204021F59	TPOS02_QLT_SPP	Event suppression detected (TPOS02)
513001 8204031F59	TPOS03_QLT_SPP	Event suppression detected (TPOS03)

Table 2.11-35 PLC monitoring points (P1–P3 state signals)

Signal Number	Signal Name	Description
513001 8304011D02	TPOS01_ST_P1	TPOS01 P1 On(0/1)
513001 8104011D03	TPOS01_ST_P2	TPOS01 P2 On(0/1)
513001 8504011D04	TPOS01_ST_P3	TPOS01 P3 On(0/1)
513001 8304021D02	TPOS02_ST_P1	TPOS02 P1 On(0/1)
513001 8104021D03	TPOS02_ST_P2	TPOS02 P2 On(0/1)
513001 8504021D04	TPOS02_ST_P3	TPOS02 P3 On(0/1)
513001 8104031D03	TPOS03_ST_P2	TPOS03 P2 On(0/1)
513001 8304031D02	TPOS03_ST_P1	TPOS03 P1 On(0/1)
513001 8504031D04	TPOS03_ST_P3	TPOS03 P3 On(0/1)

(vi) Setting names

Note: The “xx” of “TPOSxx” represents the TPOS function number. (e.g., if the TPOS03 is considered, the “xx” is equal to “03”. The suffix “xx” can be represented from “01” to “03”.)

Table 2.11-36 Setting for Binary input signals in TPOSxx

Setting Name	Description	Default	Setting item or value
TPOSxx-EN	Activate monitoring function of TPOS01-03	On	Off / On
TPOSxx-DEVTYPE	Equipment type selector.	switch	switch/EDS
TPOSxxP1-NOPSG	BI position for TPOS01–03	*none	BI signal
TPOSxxP2-NOPSG	BI position for TPOS01–03	*none	BI signal
TPOSxxP3-NOPSG	BI position for TPOS01–03	*none	BI signal
TPOSxx-SPPEN	Activate event suppression for TPOS01–03	On	Off / On
TPOS-NELD	Number of change to lock status.	10	0~99
TPOS-TELD	Time to locking state(sliding window)	10[sec]	1~99[sec]
TPOS-TELR	Time to unlocking state(sliding window)	10[sec]	1~99[sec]

Table 2.11-37 Settings for health check function in TPOSxx

Setting Name	Description	Default	Setting item or value
TPOSxx-P1SLBORD	Select BO signal (BO*-RB) from signal list	*none	BO readback signal
TPOSxx-P2SLBORD	Select BO signal (BO*-RB) from signal list	*none	BO readback signal
TPOSxx-P3SLBORD	Select BO signal (BO*-RB) from signal list	*none	BO readback signal
TPOSxx-P1EXBORD	Select BO signal (BO*-RB) from signal list	*none	BO readback signal
TPOSxx-P2EXBORD	Select BO signal (BO*-RB) from signal list	*none	BO readback signal
TPOSxx-P3EXBORD	Select BO signal (BO*-RB) from signal list	*none	BO readback signal

2.11.7 Mapping for IEC61850 commination

The user can operate the TPOS function over IEC 61850 communications† following mapping using GR-TIEMS. Note that the TPOS function is designed for the class of "Integer Status Controller (ISC)" in the IEC 61850 standard for communication. The user should follow these steps, eac of which is discussed below:

Step1: Editing Logical Node

Step2: Mapping output data

Step3: Mapping input data

(i) Editing Logical Node

The user will need to create a logical node (LN) for the TPOS01 function. Figure 2.11-64 exemplifies the editing of a LN; the LN "Integer Status Controllable Status Output (ISCSO)" is chosen for the TPOS01 function. After the user defined an object "ISCSO", the TPOS01 logical node can be available with the name "GGIO" plus "LN Instance". Create a definition of the object "ISCSO" in the TPOS01 logical node. Either the SBO mode or the DIR mode can be chosen in the editing of the LN.

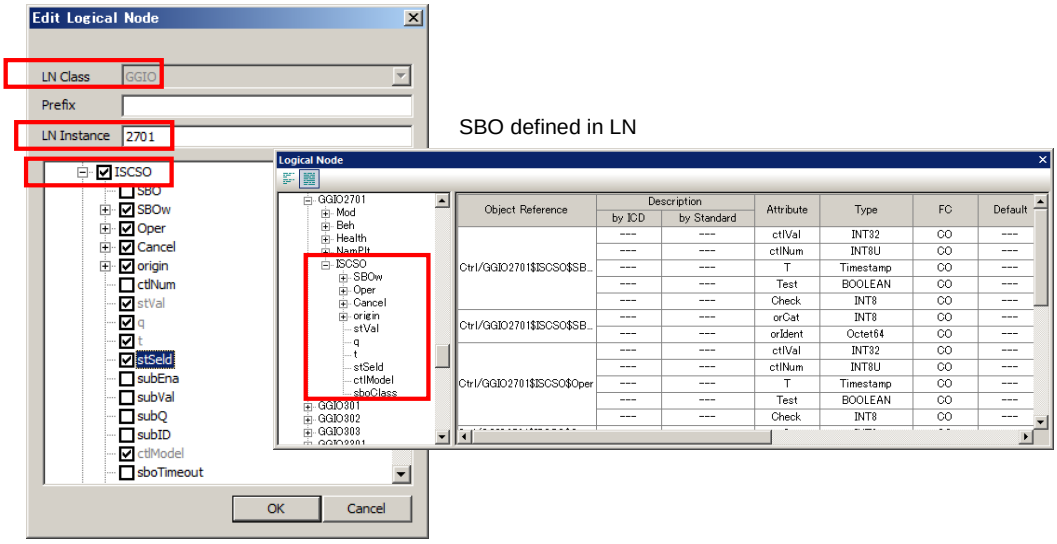
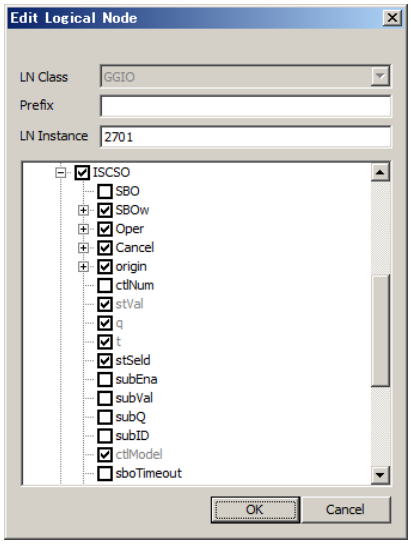


Figure 2.11-64 Defining "ISCSO" object in GGIO2701 logic node

(i)-1 Defining SBO mode

Figure 2.11-65 exemplifies the TPOS01 logic node saved as "GGIO2701". For the SBO mode, the user should select the following items for the "GGIO2701$ISCSO" using GR-TIEMS:

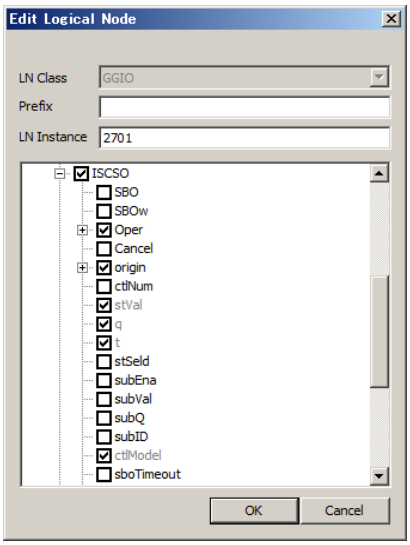


✓ SBOw
✓ Oper
✓ Cancel
✓ origin
✓ stSeld
✓ sboClass† (choice "operate-once")
✓ ctlmodel (choice "SBOes or SBOns")
†"sboClass" can be found by scrolling down.

Figure 2.11-65 LN editing screen for SBO (for example)

(i)-2 Defining DIR mode

Figure 2.11-66 exemplifies the TPOS logic node saved as "GGIO2701". In the DIR mode, the following three items should be selected using GR-TIEMS:



✓ Oper
✓ origin
✓ ctlmodel (choice "DOes or DOns")

Figure 2.11-66 LN editing screen for DIR mode (for example)

(ii) Mapping output data

The user should group the TPOS01 signals with regard to GOOSE and REPORT; the user should map them for IEC61850 communication using GR-TIEMS. Figure 2.11-43 illustrates how to map a signal; it indicates that the signals for the TPOS01 function are required to map for IEC 61850 communication.

Table 2.11-38 Mapping signals for ISCSO object

Object_reference	Attribute	Type	FC	Signal Number	Signal Name
Ctrl/GGIO2701$ISCSO$origin	orCat	orCategory	ST	513001 3104011008	TPOS01_ORCAT
Ctrl/GGIO2701$ISCSO$origin	orIdent	Octet64	ST	513001 6A04011009	TPOS01_ORIDENT
Ctrl/GGIO2701$ISCSO	stVal	INT32	ST	513001 3104011001	TPOS01_STATE
Ctrl/GGIO2701$ISCSO	q	Quality	ST	513001 3104011005	TPOS01_QUALITY
Ctrl/GGIO2701$ISCSO	t	Timestamp	ST	513001 9004011006	TPOS01_TIMESTAMP
Ctrl/GGIO2701$ISCSO	stSeld	BOOLEAN	ST	513001 0004011D90	TPOS01_SLD_RPT

Note: "Status (ST)" is defined in the function constraint (FC) of the IEC 61850 standard.

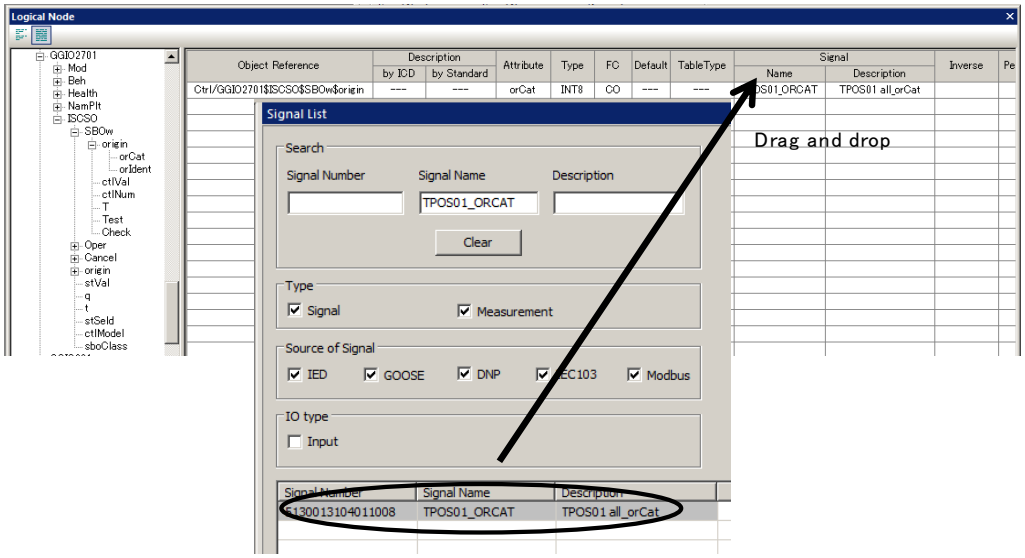


Figure 2.11-67 ocCat attribute mapped for ISCSO object of GGIO2701

(iii) Mapping input data

The TPOS01 function can receive three commands "select, operate, and cancel". Thus, the user should map the input-point "DEV01_CONTROL_REQ" to the IEC61850 communication. Table 2.11-39 shows the input-point "DEV01_CONTROL_REQ" and the Object reference "Ctrl/GGIO2701$ISCSO"; the user should map the input-point to the Object references having attributes CO and CF†. Figure 2.11-68 shows how to map a signal.

†Note: The attribute is defined in the IEC 61850 standard; "CO" stands for "Control" and "CF" stands for "Configuration" in the functional constraint (FC).

Table 2.11-39 Mapping signals required for ISCSO object for GIGO2701

Object_reference	Attribute	Type	FC	Signal Number	Signal Name
Ctrl/GGIO2701$ISCSO$SBOw	ctlVal	INT32	CO	5130017 004016D08	DEV01_CONTROL_REQ
Ctrl/GGIO2701$ISCSO$SBOw	ctlNum	INT8U	CO		
Ctrl/GGIO2701$ISCSO$SBOw	T	Timestamp	CO		
Ctrl/GGIO2701$ISCSO$SBOw	Test	BOOLEAN	CO		
Ctrl/GGIO2701$ISCSO$SBOw	Check	Check	CO		
Ctrl/GGIO2701$ISCSO$SBOw$origin	orCat	orCategory	CO		
Ctrl/GGIO2701$ISCSO$SBOw$origin	orIdent	Octet64	CO		
Ctrl/GGIO2701$ISCSO$Oper	ctlVal	INT32	CO		
Ctrl/GGIO2701$ISCSO$Oper	ctlNum	INT8U	CO		
Ctrl/GGIO2701$ISCSO$Oper	T	Timestamp	CO		
Ctrl/GGIO2701$ISCSO$Oper	Test	BOOLEAN	CO		
Ctrl/GGIO2701$ISCSO$Oper	Check	Check	CO		
Ctrl/GGIO2701$ISCSO$Oper$origin	orCat	orCategory	CO		
Ctrl/GGIO2701$ISCSO$Oper$origin	orIdent	Octet64	CO		
Ctrl/GGIO2701$ISCSO$Cancel	ctlVal	INT32	CO		
Ctrl/GGIO2701$ISCSO$Cancel	ctlNum	INT8U	CO		
Ctrl/GGIO2701$ISCSO$Cancel	T	Timestamp	CO		
Ctrl/GGIO2701$ISCSO$Cancel	Test	BOOLEAN	CO		
Ctrl/GGIO2701$ISCSO$Cancel$origin	orCat	orCategory	CO		
Ctrl/GGIO2701$ISCSO$Cancel$origin	orIdent	Octet64	CO		
Ctrl/GGIO2701$ISCSO	ctlModel	ctlModel	CF		
Ctrl/GGIO2701$ISCSO	sboClass	sboClass	CF		

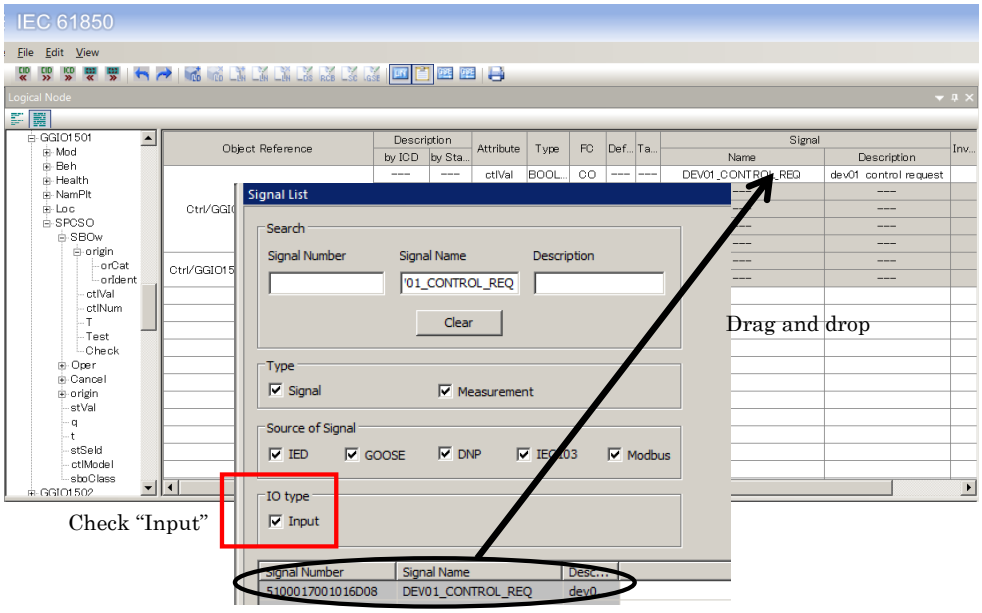


Figure 2.11-68 Input-point mapped for GGIO2701

2.11.8 Setting

Common settings list for the TPOS(FunctionID:513001)

Setting item		Range	Uni	Contents	Default setting value	Notes
common	TPOS-NELD	0 - 99	-	Number of Event lock detect time	10	
	TPOS-TELD	1 - 99	s	Timer for detection of event lock	10	
	TPOS-TELR	1 - 99	s	Timer forrecovery from event lock	10	

TPOS01 settings list (FunctionID:513001)

Setting item		Range	Units	Contents	Default setting value	Notes
DEV1	TPOS01-EN	Off/On		DEV1 Enable	Off	
	TPOS01-NOPSG			Normally Open Signal for Dev1		
	TPOS01-NSOSGI	Off/On		Signal inverse or not inversed	Off	
	TPOS01-SPPEN	Off/On		Automatic event suppression function	Off	
	TPOS01-CTREN	Off/On		control mode (control enable)	Off	
	TPOS01-CTRMENU	Off/On		control by MENU enable	Off	
	TPOS01-CTRAHMI	DIR/SBO		control action(Direct or SBO)by HMI	SBO	
	TPOS01-SLBORD			select binary output read data(DataID)		
	TPOS01-OEXBORD			on direction execute binary output read data(DataID)		
	TPOS01-FEXBORD			off direction execute binary output read data(DataID)		
	TPOS01-OFEXBORD			on/off direction execute binary output read data(DataID)		
	TPOS01-LGCTRCON	FixedLogic/PLC		Change logic for control condition	FixedLogic	
	TPOS01-LGSLFFCT	FixedLogic/PLC		Change logic for select fail factor	FixedLogic	
	TPOS01-LGEXFFCT	FixedLogic/PLC		Change logic for execute command fail factor	FixedLogic	
	TPOS01-LGFEXOT	FixedLogic/PLC		Change logic for off direction execute output	FixedLogic	
	TPOS01-LGCNFFCT	FixedLogic/PLC		Change logic for cancel command fail factor	FixedLogic	
	TPOS01-PLSM	Fix/Var/Latch		pulse mode	Latch	
	TPOS01-CPW	0.1-50.0	s	control pulse width	1	
	TPOS01-RST	1.0-100.0	s	response check timer	30	
	TPOS01-CTRDIR	Off/On		Capable control direction	On	
	TPOS01-APBD	Process/Bay		status change origin	Process	

Note: The TPOS function is available for a 2nd Device and other devices. We have omitted the others because this will be the same as the 1st device with the exception of the device number.

2.11.9 Signal

◆ Signal monitoring points in TPOS01

TPOS(FunctionID:513001)

Element ID	Name	Description
8001011DE0	DEV1PLCCTRLFAIL	DEV1PLCCTRLFAIL
8001011D51	TPOS01_SC_OWS	TPOS01 select command by OWS(HMI)
8001011D52	TPOS01_SC_RCC	TPOS01 select command by RCC
8001011D53	TPOS01_SC_RMT	TPOS01 select command by Remote
8001011D54	TPOS01_SC_LCD	TPOS01 select command by LCD
8001011D55	TPOS01_EC_OWS	TPOS01 execute command by OWS(HMI)
8001011D56	TPOS01_EC_RCC	TPOS01 execute command by RCC
8001011D57	TPOS01_EC_RMT	TPOS01 execute command by Remote
8001011D58	TPOS01_EC_LCD	TPOS01 execute command by LCD
8001011D59	TPOS01_EC_PLC	TPOS01 execute command by PLC
8701011E98	TPOS01_SLF_FCT_EIS	TPOS01 select fail factor signal except interlock/synchronism check
8B01011EA2	TPOS01_CTR_SGU	TPOS01 control logic stage(under selection)
8301011E9D	TPOS01_CTR_SGN	TPOS01 control logic stage(unselected)
8101011E9A	TPOS01_ECF_FCT_EIS	TPOS01 execute command fail factor signal except interlock/synchronism check
8001011F55	TPOS01_EC_ST_ERR	TPOS01 execute command mode err
8001011E93	TPOS01_EX_CMP	TPOS01 execute complete signal
8901011F6C	TPOS01_EX_CS01	TPOS01 execute condition signal 01
8A01011F6D	TPOS01_EX_CS02	TPOS01 execute condition signal 02
8B01011F6E	TPOS01_EX_CS03	TPOS01 execute condition signal 03
8E01011F67	TPOS01_EX_CS04	TPOS01 execute condition signal 04
8B01011F68	TPOS01_EX_CS05	TPOS01 execute condition signal 05
8601011E91	TPOS01_EX_FFL	TPOS01 execute fail signal by fixedlogic
8501011E8F	TPOS01_EX_SFL	TPOS01 execute success signal by fixedlogic
8001011F56	TPOS01_NSL_CS06	TPOS01 no direction select condition signal 06
8601011F5E	TPOS01_NSL_CS07	TPOS01 no direction select condition signal 07
8201011F5F	TPOS01_NSL_CS10	TPOS01 no direction select condition signal 10
8101011E7B	TPOS01_SLF_CS	TPOS01 no direction select fail condition signal
8101011DD0	TPOS01_FEX_BO	TPOS01 off direction execute binary output signal
8001011E81	TPOS01_FEC_OK_CS	TPOS01 off direction execute command OK condition signal
8001011E7E	TPOS01_FEC_OK_CSF	TPOS01 off direction execute command OK condition signal by fixedlogic
8201011E88	TPOS01_FEC_F_CS	TPOS01 off direction execute command fail condition signal
8101011E85	TPOS01_FEC_F_CSF	TPOS01 off direction execute command fail condition signal by fixedlogic
8A01011DC4	TPOS01_FSL_BO_CSF	TPOS01 off direction select binary output condition signal by fixedlogic
8501011F60	TPOS01_FSL_CS19	TPOS01 off direction select condition signal 19
8A01011F61	TPOS01_FSL_CS20	TPOS01 off direction select condition signal 20
8101011F64	TPOS01_FSL_CS21	TPOS01 off direction select condition signal 21
8201011DD3	TPOS01_OEX_BO	TPOS01 on direction execute binary output signal
8101011E82	TPOS01_OEC_OK_CS	TPOS01 on direction execute command OK condition signal
8001011E7F	TPOS01_OEC_OK_CSF	TPOS01 on direction execute command OK condition signal by fixedlogic
8301011E89	TPOS01_OEC_F_CS	TPOS01 on direction execute command fail condition signal
8101011E86	TPOS01_OEC_F_CSF	TPOS01 on direction execute command fail condition signal by fixedlogic
8601011DC6	TPOS01_OSL_BO_CSF	TPOS01 on direction select binary output condition signal by fixedlogic
8501011F65	TPOS01_OSL_CS40	TPOS01 on direction select condition signal 40
8801011F5D	TPOS01_OSL_CS41	TPOS01 on direction select condition signal 41
8501011F5B	TPOS01_OSL_CS42	TPOS01 on direction select condition signal 42
8601011F5C	TPOS01_OSL_CS43	TPOS01 on direction select condition signal 43
8401011F77	TPOS01_OFEX_BO	TPOS01 on/off direction execute binary output signal
8901011DC0	TPOS01_NSL_BO_CSF	TPOS01 select binary output condition signal by fixedlogic
8501011F76	TPOS01_SL_BO_FLG	TPOS01 select binary output signal by fixedlogic
8001011F54	TPOS01_SC_ST_ERR	TPOS01 select command mode err
8601011F62	TPOS01_SLF_FCT_FLG03	TPOS01 select fail factor signal by fixedlogic 03

◆ Signal monitoring points in TPOS01

TPOS(FunctionID:513001)

Element ID	Name	Description
8701011F63	TPOS01_SLF_FCT_FLG04	TPOS01 select fail factor signal by fixedlogic 04
8801011F6B	TPOS01_SLF_FCT_FLG07	TPOS01 select fail factor signal by fixedlogic 07
8901011F72	TPOS01_SLF_FCT_FLG08	TPOS01 select fail factor signal by fixedlogic 08
8001011E7D	TPOS01_SLR_CS	TPOS01 select release condition signal
8001011E76	TPOS01_SLD_CS	TPOS01 selected condition signal
8001011F66	TPOS01_SLD_CS04	TPOS01 selected condition signal 04
8E01011F57	TPOS01_SLD_TMO	TPOS01 time out after selected
8F01011F58	TPOS01_EX_CMP_TMO	TPOS01 timeout after execute completion

Note: In the table above, the user will only find Element IDs and their names for the 1st device, but a 2nd and other devices are also provided in the TPOS function. We have omitted the Element IDs and their names for the other devices to improve readability. Use the rule described below when the user wishes to obtain the Element IDs and their names for the other devices.

Rule: The same types of signal monitoring points are provided in every device; hence, the user can find the same ones for all of the other devices. For example, when the user wishes to find the "TPOS01_SC_OWS" point for the 2nd device, use the description of "TPOS02_SC_OWS" in place of "TPOS02_SC_OWS". The user can obtain the ID value of "TPOS01_SC_OWS" by using the following steps:

Step 1 Find the element ID for TPOS01_SC_OWS (i.e., "8001011D51")

Step 2 identify the number at the fifth digit from the ID. (i.e., "1")

Step 3 Choose a new device number. (i.e., pick the number "2" for the 2nd device)

Step 4 Replace the number that occurs at the fifth digit with the new device number. (i.e., get new ID "8001021D51" of "TPOS02_SC_OWS") The ID is expressed in hexadecimal notation. Thus, the user must change the device number from decimal notation to hexadecimal notation.

2.12 Virtual switch controller function (VPOS)

Hypothetical 64 single-position software-switches (VPOS01-64) are provided in the IED memory as virtual switches; they are used to determine the operation of internal processes in the IED. Either a criteria "Enable (On)" or "Disable (Off)" may be applied in each software switch.

Note: The implementation of certain features is dependent upon the selection of hardware and the configuration of functions. Several IED models do not support certain features. To determine whether a particular feature has been implemented within an IED, identify the IED ordering number; and check the order number at the "G&T position" whilst referring to the comparison table below. For more information, see *Appendix: Ordering*.

Table 2.12-1 Comparative table in respective ordering numbers

Sec.	Feature	Ordering No. at "G&T"					
		BCU			BCPU		IFU
		11	13	1F	2N	2C	19
–	Main features	NA	NA	✓	NA	✓	NA
–	Num. of features	–	–	64	–	64	–

✓: Applicable NA: Not applicable

Figure 2.12-1 shows the 64 switches and their controller functions. The states of VPOS switches are stored in the IED non-volatile memory; hence, the IED can retrieve their status while the power is not supplied to the IED.

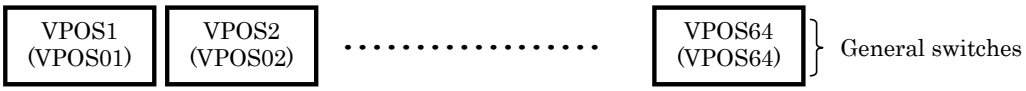


Figure 2.12-1 Virtual switches and their controller

The VPOS function can control 64 VPOS switches separately. To simplify the explanation provided below only the VPOS1 switch is discussed. The features in the other VPOS2–64 switches are similar to the VPOS1 switch.

2.12.1 VPOS controlling

(i) VPOS controlling switches

The VPOS1 to VPOS64 functions are provided for control of the VPOS1 to VPOS64 switches, as described previously. Figure 2.12-2 shows that VPOS1 function controls the VPOS1 switch. Controlling VPOS1 switch is enabled when the user sets the scheme switch [**VPOS01-EN**]† to **On**. Likewise, the user is required to set **On** for scheme switches [**VPOS02-EN**] to [**VPOS64-EN**] with regard to the VPOS2–64 operations, respectively.

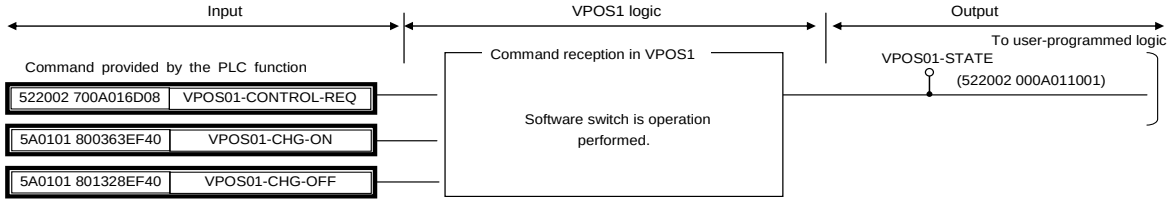


Figure 2.12-2 Logic "VPOS01" and response "VPOS01_STATE"

(ii) VPOS output-status

Table 2.12-2 shows the list of output signals of the VPOS functions.

Table 2.12-2 Output signals of VPOS function

Signal Number	Signal Name	Description
522002 000A011001	VPOS01-STATE	VPOS01 switch status
522002 000A021001	VPOS02-STATE	VPOS02 switch status
522002 000A031001	VPOS03-STATE	VPOS03 switch status
522002 000A041001	VPOS04-STATE	VPOS04 switch status
522002 000A051001	VPOS05-STATE	VPOS05 switch status
522002 000A061001	VPOS06-STATE	VPOS06 switch status
522002 000A071001	VPOS07-STATE	VPOS07 switch status
522002 000A081001	VPOS08-STATE	VPOS08 switch status
522002 000A091001	VPOS09-STATE	VPOS09 switch status
522002 000A0A1001	VPOS10-STATE	VPOS10 switch status
522002 000A0B1001	VPOS11-STATE	VPOS11 switch status

Signal Number	Signal Name	Description
522002 000A0C1001	VPOS12-STATE	VPOS12 switch status
522002 000A0D1001	VPOS13-STATE	VPOS13 switch status
522002 000A0E1001	VPOS14-STATE	VPOS14 switch status
522002 000A0F1001	VPOS15-STATE	VPOS15 switch status
522002 000A101001	VPOS16-STATE	VPOS16 switch status
522002 000A111001	VPOS17-STATE	VPOS17 switch status
522002 000A121001	VPOS18-STATE	VPOS18 switch status
522002 000A131001	VPOS19-STATE	VPOS19 switch status
522002 000A141001	VPOS20-STATE	VPOS20 switch status
522002 000A151001	VPOS21-STATE	VPOS21 switch status
522002 000A161001	VPOS22-STATE	VPOS22 switch status
522002 000A171001	VPOS23-STATE	VPOS23 switch status
522002 000A181001	VPOS24-STATE	VPOS24 switch status
522002 000A191001	VPOS25-STATE	VPOS25 switch status
522002 000A1A1001	VPOS26-STATE	VPOS26 switch status
522002 000A1B1001	VPOS27-STATE	VPOS27 switch status
522002 000A1C1001	VPOS28-STATE	VPOS28 switch status
522002 000A1D1001	VPOS29-STATE	VPOS29 switch status
522002 000A1E1001	VPOS30-STATE	VPOS30 switch status
522002 000A1F1001	VPOS31-STATE	VPOS31 switch status
522002 000A201001	VPOS32-STATE	VPOS32 switch status
522002 000A211001	VPOS33-STATE	VPOS33 switch status
522002 000A221001	VPOS34-STATE	VPOS34 switch status
522002 000A231001	VPOS35-STATE	VPOS35 switch status
522002 000A241001	VPOS36-STATE	VPOS36 switch status
522002 000A251001	VPOS37-STATE	VPOS37 switch status
522002 000A261001	VPOS38-STATE	VPOS38 switch status
522002 000A271001	VPOS39-STATE	VPOS39 switch status
522002 000A281001	VPOS40-STATE	VPOS40 switch status
522002 000A291001	VPOS41-STATE	VPOS41 switch status
522002 000A2A1001	VPOS42-STATE	VPOS42 switch status
522002 000A2B1001	VPOS43-STATE	VPOS43 switch status
522002 000A2C1001	VPOS44-STATE	VPOS44 switch status
522002 000A2D1001	VPOS45-STATE	VPOS45 switch status
522002 000A2E1001	VPOS46-STATE	VPOS46 switch status
522002 000A2F1001	VPOS47-STATE	VPOS47 switch status
522002 000A301001	VPOS48-STATE	VPOS48 switch status
522002 000A311001	VPOS49-STATE	VPOS49 switch status
522002 000A321001	VPOS50-STATE	VPOS50 switch status
522002 000A331001	VPOS51-STATE	VPOS51 switch status
522002 000A341001	VPOS52-STATE	VPOS52 switch status
522002 000A351001	VPOS53-STATE	VPOS53 switch status
522002 000A361001	VPOS54-STATE	VPOS54 switch status
522002 000A371001	VPOS55-STATE	VPOS55 switch status
522002 000A381001	VPOS56-STATE	VPOS56 switch status
522002 000A391001	VPOS57-STATE	VPOS57 switch status
522002 000A3A1001	VPOS58-STATE	VPOS58 switch status
522002 000A3B1001	VPOS59-STATE	VPOS59 switch status
522002 000A3C1001	VPOS60-STATE	VPOS60 switch status
522002 000A3D1001	VPOS61-STATE	VPOS61 switch status
522002 000A3E1001	VPOS62-STATE	VPOS62 switch status
522002 000A3F1001	VPOS63-STATE	VPOS63 switch status
522002 000A401001	VPOS64-STATE	VPOS64 switch status

2.12.2 Control logics for SBO/DIR modes

Controlling the VPOS01 switch is enable when the user sets the scheme switch [**VPOS01-EN**] to **On**. Likewise, the user is required to set **On** for scheme switches [**VPOS02-EN**] to [**VPOS64-EN**] with regard to the VPOS2–64 operations, respectively. Table 2.12-8 shows all scheme switches for the VPOS functions.

(i) Receiving "select command for On operation" from the remote end

Figure 2.12-3 shows the logic when a "Select command (Remote-ON-Control)" signal is applied to the VPOS1 logic. The logic has an input-point "VPOS01-CONTROL-REQ" for the reception of the select command. That is, the input-point should be mapped for the IEC61850 communication. The input-point "VPOS01-CONTROL-REQ" is significant for the VPOS1 operation; hence, an operation failure in the IED is indicated if mapping is not performed correctly. Section 2.12.5 discusses how to map the information of the IEC61850 to the input-point.

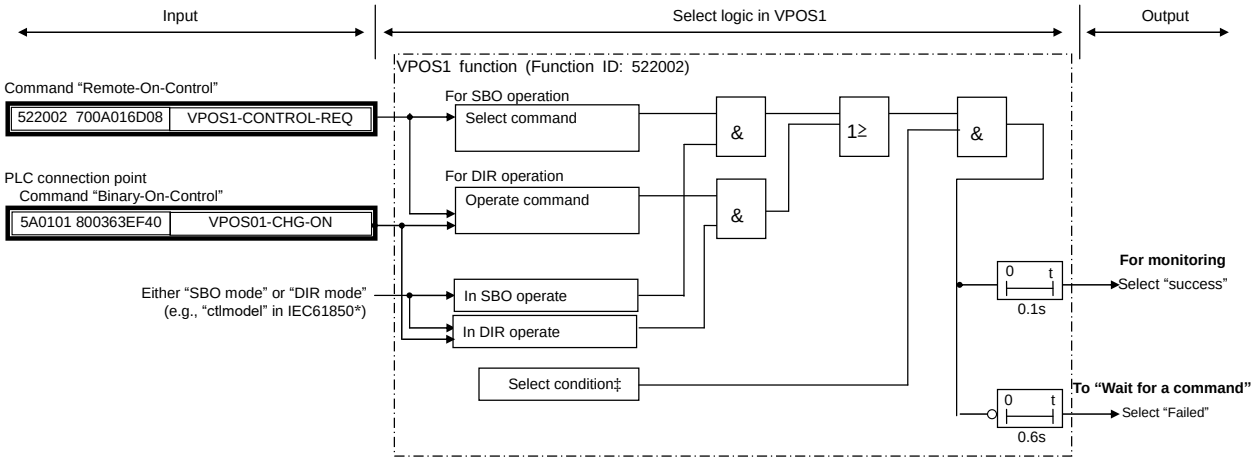


Figure 2.12-3 Select logic for 'ON' operation from the remote end in VPOS1†

†Note: To identify the input points of the other VPOS logics, see Table 2.12-5.

‡Note: Signal "select condition" is provided from select condition scheme. For more information, see Figure 2.12-7.

*Note: The VPOS1 function can run on either the "SBO mode" or the "DIR mode". The user can use the signal "ctlmodel" in the IEC61850 communication.

(ii) Receiving "select command for Off operation" from the remote end

Figure 2.12-4 shows the logic when a "Select command (Remote-OFF-Control)" signal is applied at the VPOS1 logic. The input-point "VPOS01-CONTROL-REQ" is also used for the reception of the select command (Remote-OFF-Control).

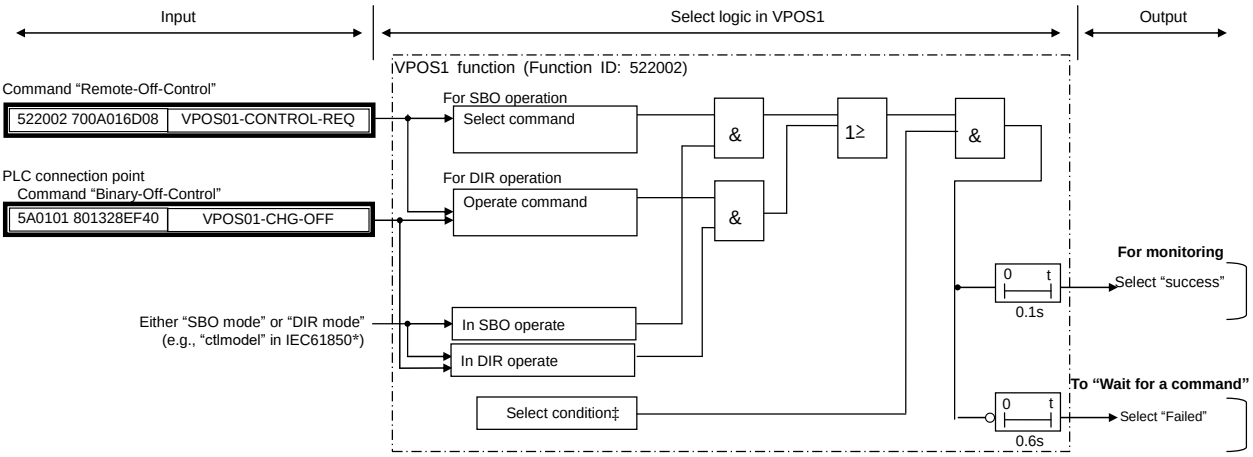


Figure 2.12-4 Select logic for 'OFF' operation from the remote end in VPOS1†

†Note: To identify the input and output points of the other VPOS logics, see Table 2.12-5.

‡Note:Signal "select condition" is provided in Figure 2.12-7.

Receiving "Select command for On operation" from the front panel

Figure 2.12-5 shows the logic when a "Select command (Local-ON-Control)" signal is applied to the VPOS1 logic. The input signal is provided when "On" key is pressed on the IED front panel; the input-point is not required to be mapped. Note that the user should set scheme switch [**VPOS01-CTRAHMI**] to **SBO** when the operation from the IED front panel is performed; chapter *User interface: Control sub-menu* discusses how to operate.

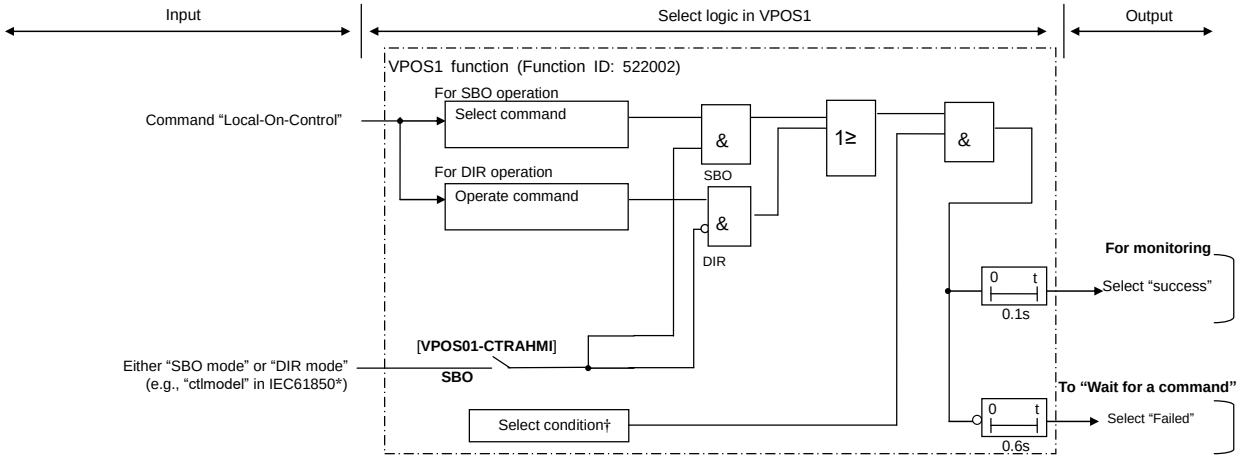


Figure 2.12-5 Select logic for 'ON' operation at the local end in VPOS1

†Note:Signal "select condition" is provided. See Figure 2.12-7.

(iii) Receiving "Select command for Off operation" from the front panel

Figure 2.12-6 shows the logic when a "Select command (Local-OFF-Control)" signal is applied to the VPOS1 logic. The input signal is provided when the user presses "OFF" key on the IED front panel; the input-point is not required to be mapped.

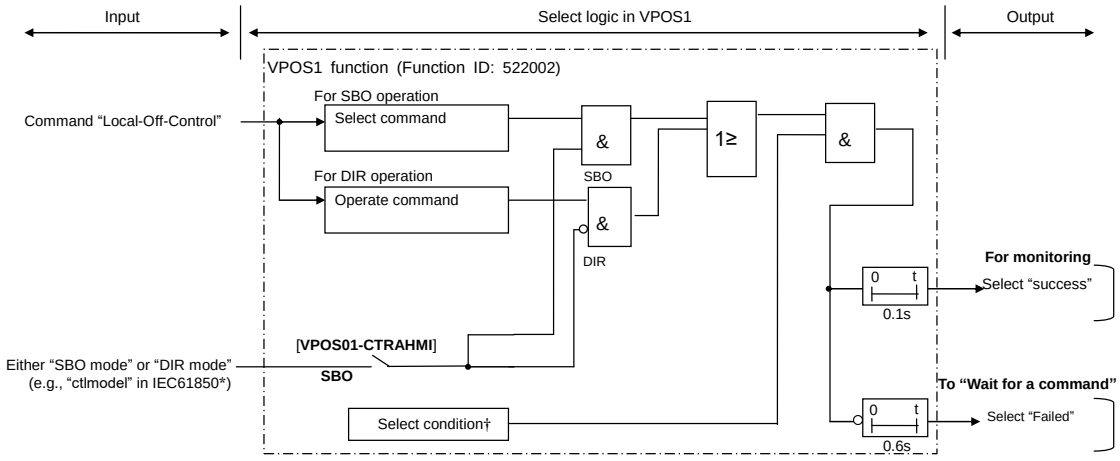


Figure 2.12-6 Select logic for 'OFF' operation at the local end in VPOS1

‡Note:Signal "select condition" is provided. See Figure 2.12-7.

(iv) Select condition

Figure 2.12-7 shows the select condition logic, which examines the operate-condition in the VPOS1 function using the VPOS01_STATE signal. The VPOS01_STATE signal is used to block any operation except its own[1].

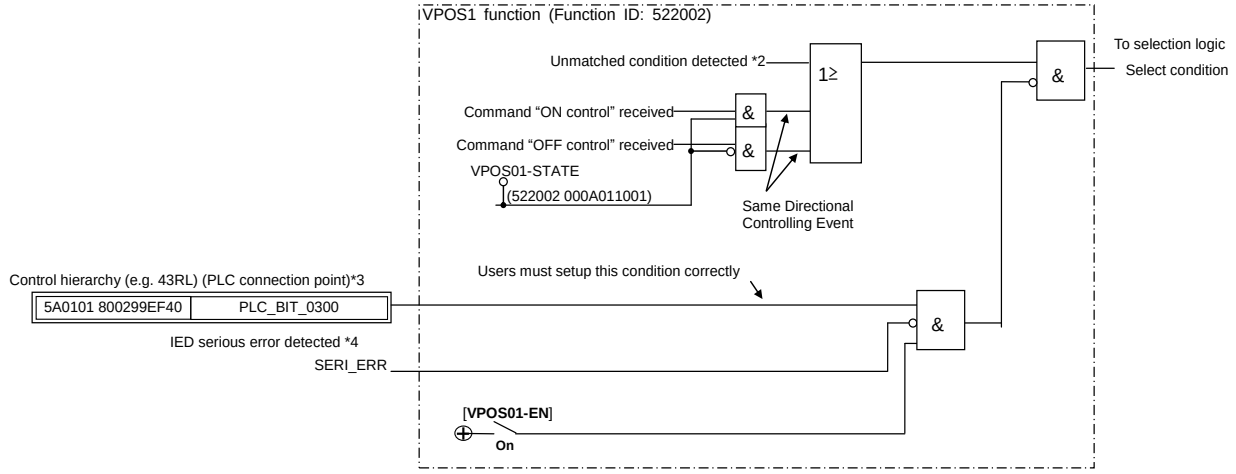


Figure 2.12-7 Select condition logic for 'ON/OFF' in VPOS1

[1]Note: "Command blocking" is denoted by with the VPOS01_STATE, which is listed in Table 2.12-7.

[2]Note: Criteria "unmatched conditions" are decided when "Test-bit status" in command is not identical to "IED test status".

[3]Note: The user should program the PLC logic "Control hierarchy condition", which may be 43R/L provided by the user-programmed PLC logic. Table 2.12-3 shows the connection points for the "Control hierarchy condition".

[4]Note: Table 2.12-7 shows the point of the SERI_ERR.

(v) Signal name and number

Note: The user should note the following descriptions shown in the column "M/O" for each table:

"O" indicates that the signal is provided for optional use.

"M" indicates that the user should map/set/configure the signal; otherwise, the user may experience an operational failure if the default settings are used.

"N/A" indicates that the user cannot change the state of the signal.

Table 2.12-3 PLC connection point (Input points on select condition logic)

Signal Number	Signal Name	Description	M/O
5A0101 800299EF40	PLC_BIT_0300	Control hierarchy condition in VPOS1	M
5A0101 800300EF40	PLC_BIT_0301	Control hierarchy condition in VPOS2	M
5A0101 800301EF40	PLC_BIT_0302	Control hierarchy condition in VPOS3	M
5A0101 800302EF40	PLC_BIT_0303	Control hierarchy condition in VPOS4	M
5A0101 800303EF40	PLC_BIT_0304	Control hierarchy condition in VPOS5	M
5A0101 800304EF40	PLC_BIT_0305	Control hierarchy condition in VPOS6	M
5A0101 800305EF40	PLC_BIT_0306	Control hierarchy condition in VPOS7	M
5A0101 800306EF40	PLC_BIT_0307	Control hierarchy condition in VPOS8	M
5A0101 800307EF40	PLC_BIT_0308	Control hierarchy condition in VPOS9	M
5A0101 800308EF40	PLC_BIT_0309	Control hierarchy condition in VPOS10	M
5A0101 800309EF40	PLC_BIT_0310	Control hierarchy condition in VPOS11	M
5A0101 800310EF40	PLC_BIT_0311	Control hierarchy condition in VPOS12	M
5A0101 800311EF40	PLC_BIT_0312	Control hierarchy condition in VPOS13	M
5A0101 800312EF40	PLC_BIT_0313	Control hierarchy condition in VPOS14	M
5A0101 800313EF40	PLC_BIT_0314	Control hierarchy condition in VPOS15	M
5A0101 800314EF40	PLC_BIT_0315	Control hierarchy condition in VPOS16	M
5A0101 800315EF40	PLC_BIT_0316	Control hierarchy condition in VPOS17	M
5A0101 800316EF40	PLC_BIT_0317	Control hierarchy condition in VPOS18	M
5A0101 800317EF40	PLC_BIT_0318	Control hierarchy condition in VPOS19	M
5A0101 800318EF40	PLC_BIT_0319	Control hierarchy condition in VPOS20	M
5A0101 800319EF40	PLC_BIT_0320	Control hierarchy condition in VPOS21	M
5A0101 800320EF40	PLC_BIT_0321	Control hierarchy condition in VPOS22	M
5A0101 800321EF40	PLC_BIT_0322	Control hierarchy condition in VPOS23	M
5A0101 800322EF40	PLC_BIT_0323	Control hierarchy condition in VPOS24	M
5A0101 800323EF40	PLC_BIT_0324	Control hierarchy condition in VPOS25	M
5A0101 800324EF40	PLC_BIT_0325	Control hierarchy condition in VPOS26	M
5A0101 800325EF40	PLC_BIT_0326	Control hierarchy condition in VPOS27	M
5A0101 800326EF40	PLC_BIT_0327	Control hierarchy condition in VPOS28	M
5A0101 800327EF40	PLC_BIT_0328	Control hierarchy condition in VPOS29	M
5A0101 800328EF40	PLC_BIT_0329	Control hierarchy condition in VPOS30	M
5A0101 800329EF40	PLC_BIT_0330	Control hierarchy condition in VPOS31	M
5A0101 800330EF40	PLC_BIT_0331	Control hierarchy condition in VPOS32	M
5A0101 800331EF40	PLC_BIT_0332	Control hierarchy condition in VPOS33	M
5A0101 800332EF40	PLC_BIT_0333	Control hierarchy condition in VPOS34	M
5A0101 800333EF40	PLC_BIT_0334	Control hierarchy condition in VPOS35	M
5A0101 800334EF40	PLC_BIT_0335	Control hierarchy condition in VPOS36	M
5A0101 800335EF40	PLC_BIT_0336	Control hierarchy condition in VPOS37	M
5A0101 800336EF40	PLC_BIT_0337	Control hierarchy condition in VPOS38	M
5A0101 800337EF40	PLC_BIT_0338	Control hierarchy condition in VPOS39	M
5A0101 800338EF40	PLC_BIT_0339	Control hierarchy condition in VPOS40	M
5A0101 800339EF40	PLC_BIT_0340	Control hierarchy condition in VPOS41	M
5A0101 800340EF40	PLC_BIT_0341	Control hierarchy condition in VPOS42	M

Signal Number	Signal Name	Description	M/O
5A0101 800341EF40	PLC_BIT_0342	Control hierarchy condition in VPOS43	M
5A0101 800342EF40	PLC_BIT_0343	Control hierarchy condition in VPOS44	M
5A0101 800343EF40	PLC_BIT_0344	Control hierarchy condition in VPOS45	M
5A0101 800344EF40	PLC_BIT_0345	Control hierarchy condition in VPOS46	M
5A0101 800345EF40	PLC_BIT_0346	Control hierarchy condition in VPOS47	M
5A0101 800346EF40	PLC_BIT_0347	Control hierarchy condition in VPOS48	M
5A0101 800347EF40	PLC_BIT_0348	Control hierarchy condition in VPOS49	M
5A0101 800348EF40	PLC_BIT_0349	Control hierarchy condition in VPOS50	M
5A0101 800349EF40	PLC_BIT_0350	Control hierarchy condition in VPOS51	M
5A0101 800350EF40	PLC_BIT_0351	Control hierarchy condition in VPOS52	M
5A0101 800351EF40	PLC_BIT_0352	Control hierarchy condition in VPOS53	M
5A0101 800352EF40	PLC_BIT_0353	Control hierarchy condition in VPOS54	M
5A0101 800353EF40	PLC_BIT_0354	Control hierarchy condition in VPOS55	M
5A0101 800354EF40	PLC_BIT_0355	Control hierarchy condition in VPOS56	M
5A0101 800355EF40	PLC_BIT_0356	Control hierarchy condition in VPOS57	M
5A0101 800356EF40	PLC_BIT_0357	Control hierarchy condition in VPOS58	M
5A0101 800357EF40	PLC_BIT_0358	Control hierarchy condition in VPOS59	M
5A0101 800358EF40	PLC_BIT_0359	Control hierarchy condition in VPOS60	M
5A0101 800359EF40	PLC_BIT_0360	Control hierarchy condition in VPOS61	M
5A0101 800360EF40	PLC_BIT_0361	Control hierarchy condition in VPOS62	M
5A0101 800361EF40	PLC_BIT_0362	Control hierarchy condition in VPOS63	M
5A0101 800362EF40	PLC_BIT_0363	Control hierarchy condition in VPOS64	M

Table 2.12-4 PLC connection point (Input points on select logic)

Signal Number	Signal Name	Description	M/O
5A0101 800363EF40	PLC_BIT_0364	VPOS01 change to 'ON'	O
5A0101 800364EF40	PLC_BIT_0365	VPOS02 change to 'ON'	O
5A0101 800365EF40	PLC_BIT_0366	VPOS03 change to 'ON'	O
5A0101 800366EF40	PLC_BIT_0367	VPOS04 change to 'ON'	O
5A0101 800367EF40	PLC_BIT_0368	VPOS05 change to 'ON'	O
5A0101 800368EF40	PLC_BIT_0369	VPOS06 change to 'ON'	O
5A0101 800369EF40	PLC_BIT_0370	VPOS07 change to 'ON'	O
5A0101 800370EF40	PLC_BIT_0371	VPOS08 change to 'ON'	O
5A0101 800371EF40	PLC_BIT_0372	VPOS09 change to 'ON'	O
5A0101 800372EF40	PLC_BIT_0373	VPOS10 change to 'ON'	O
5A0101 800373EF40	PLC_BIT_0374	VPOS11 change to 'ON'	O
5A0101 800374EF40	PLC_BIT_0375	VPOS12 change to 'ON'	O
5A0101 800375EF40	PLC_BIT_0376	VPOS13 change to 'ON'	O
5A0101 800376EF40	PLC_BIT_0377	VPOS14 change to 'ON'	O
5A0101 800377EF40	PLC_BIT_0378	VPOS15 change to 'ON'	O
5A0101 800378EF40	PLC_BIT_0379	VPOS16 change to 'ON'	O
5A0101 800379EF40	PLC_BIT_0380	VPOS17 change to 'ON'	O
5A0101 800380EF40	PLC_BIT_0381	VPOS18 change to 'ON'	O
5A0101 800381EF40	PLC_BIT_0382	VPOS19 change to 'ON'	O
5A0101 800382EF40	PLC_BIT_0383	VPOS20 change to 'ON'	O
5A0101 800383EF40	PLC_BIT_0384	VPOS21 change to 'ON'	O
5A0101 800384EF40	PLC_BIT_0385	VPOS22 change to 'ON'	O
5A0101 800385EF40	PLC_BIT_0386	VPOS23 change to 'ON'	O
5A0101 800386EF40	PLC_BIT_0387	VPOS24 change to 'ON'	O
5A0101 800387EF40	PLC_BIT_0388	VPOS25 change to 'ON'	O
5A0101 800388EF40	PLC_BIT_0389	VPOS26 change to 'ON'	O
5A0101 800389EF40	PLC_BIT_0390	VPOS27 change to 'ON'	O
5A0101 800390EF40	PLC_BIT_0391	VPOS28 change to 'ON'	O

Signal Number	Signal Name	Description	M/O
5A0101 800391EF40	PLC_BIT_0392	VPOS29 change to 'ON'	O
5A0101 800392EF40	PLC_BIT_0393	VPOS30 change to 'ON'	O
5A0101 800393EF40	PLC_BIT_0394	VPOS31 change to 'ON'	O
5A0101 800394EF40	PLC_BIT_0395	VPOS32 change to 'ON'	O
5A0101 800395EF40	PLC_BIT_0396	VPOS33 change to 'ON'	O
5A0101 800396EF40	PLC_BIT_0397	VPOS34 change to 'ON'	O
5A0101 800397EF40	PLC_BIT_0398	VPOS35 change to 'ON'	O
5A0101 800398EF40	PLC_BIT_0399	VPOS36 change to 'ON'	O
5A0101 800399EF40	PLC_BIT_0400	VPOS37 change to 'ON'	O
5A0101 800400EF40	PLC_BIT_0401	VPOS38 change to 'ON'	O
5A0101 800401EF40	PLC_BIT_0402	VPOS39 change to 'ON'	O
5A0101 800402EF40	PLC_BIT_0403	VPOS40 change to 'ON'	O
5A0101 800403EF40	PLC_BIT_0404	VPOS41 change to 'ON'	O
5A0101 800404EF40	PLC_BIT_0405	VPOS42 change to 'ON'	O
5A0101 800405EF40	PLC_BIT_0406	VPOS43 change to 'ON'	O
5A0101 800406EF40	PLC_BIT_0407	VPOS44 change to 'ON'	O
5A0101 800407EF40	PLC_BIT_0408	VPOS45 change to 'ON'	O
5A0101 800408EF40	PLC_BIT_0409	VPOS46 change to 'ON'	O
5A0101 800409EF40	PLC_BIT_0410	VPOS47 change to 'ON'	O
5A0101 800410EF40	PLC_BIT_0411	VPOS48 change to 'ON'	O
5A0101 800411EF40	PLC_BIT_0412	VPOS49 change to 'ON'	O
5A0101 800412EF40	PLC_BIT_0413	VPOS50 change to 'ON'	O
5A0101 800413EF40	PLC_BIT_0414	VPOS51 change to 'ON'	O
5A0101 800414EF40	PLC_BIT_0415	VPOS52 change to 'ON'	O
5A0101 800415EF40	PLC_BIT_0416	VPOS53 change to 'ON'	O
5A0101 800416EF40	PLC_BIT_0417	VPOS54 change to 'ON'	O
5A0101 800417EF40	PLC_BIT_0418	VPOS55 change to 'ON'	O
5A0101 800418EF40	PLC_BIT_0419	VPOS56 change to 'ON'	O
5A0101 800419EF40	PLC_BIT_0420	VPOS57 change to 'ON'	O
5A0101 800420EF40	PLC_BIT_0421	VPOS58 change to 'ON'	O
5A0101 800421EF40	PLC_BIT_0422	VPOS59 change to 'ON'	O
5A0101 800422EF40	PLC_BIT_0423	VPOS60 change to 'ON'	O
5A0101 800423EF40	PLC_BIT_0424	VPOS61 change to 'ON'	O
5A0101 800424EF40	PLC_BIT_0425	VPOS62 change to 'ON'	O
5A0101 800425EF40	PLC_BIT_0426	VPOS63 change to 'ON'	O
5A0101 800426EF40	PLC_BIT_0427	VPOS64 change to 'ON'	O
5A0101 80 1328EF40	PLC_BIT_1329	VPOS01 change to 'OFF'	O
5A0101 80 1329EF40	PLC_BIT_1330	VPOS02 change to 'OFF'	O
5A0101 80 1330EF40	PLC_BIT_1331	VPOS03 change to 'OFF'	O
5A0101 80 1331EF40	PLC_BIT_1332	VPOS04 change to 'OFF'	O
5A0101 80 1332EF40	PLC_BIT_1333	VPOS05 change to 'OFF'	O
5A0101 80 1333EF40	PLC_BIT_1334	VPOS06 change to 'OFF'	O
5A0101 80 1334EF40	PLC_BIT_1335	VPOS07 change to 'OFF'	O
5A0101 80 1335EF40	PLC_BIT_1336	VPOS08 change to 'OFF'	O
5A0101 80 1336EF40	PLC_BIT_1337	VPOS09 change to 'OFF'	O
5A0101 80 1337EF40	PLC_BIT_1338	VPOS10 change to 'OFF'	O
5A0101 80 1338EF40	PLC_BIT_1339	VPOS11 change to 'OFF'	O
5A0101 80 1339EF40	PLC_BIT_1340	VPOS12 change to 'OFF'	O
5A0101 80 1340EF40	PLC_BIT_1341	VPOS13 change to 'OFF'	O
5A0101 80 1341EF40	PLC_BIT_1342	VPOS14 change to 'OFF'	O
5A0101 80 1342EF40	PLC_BIT_1343	VPOS15 change to 'OFF'	O
5A0101 80 1343EF40	PLC_BIT_1344	VPOS16 change to 'OFF'	O
5A0101 80 1344EF40	PLC_BIT_1345	VPOS17 change to 'OFF'	O
5A0101 80 1345EF40	PLC_BIT_1346	VPOS18 change to 'OFF'	O
5A0101 80 1346EF40	PLC_BIT_1347	VPOS19 change to 'OFF'	O

Signal Number	Signal Name	Description	M/O
5A0101 80 1347EF40	PLC_BIT_1348	VPOS20 change to 'OFF'	O
5A0101 80 1348EF40	PLC_BIT_1349	VPOS21 change to 'OFF'	O
5A0101 80 1349EF40	PLC_BIT_1350	VPOS22 change to 'OFF'	O
5A0101 80 1350EF40	PLC_BIT_1351	VPOS23 change to 'OFF'	O
5A0101 80 1351EF40	PLC_BIT_1352	VPOS24 change to 'OFF'	O
5A0101 80 1352EF40	PLC_BIT_1353	VPOS25 change to 'OFF'	O
5A0101 80 1353EF40	PLC_BIT_1354	VPOS26 change to 'OFF'	O
5A0101 80 1354EF40	PLC_BIT_1355	VPOS27 change to 'OFF'	O
5A0101 80 1355EF40	PLC_BIT_1356	VPOS28 change to 'OFF'	O
5A0101 80 1356EF40	PLC_BIT_1357	VPOS29 change to 'OFF'	O
5A0101 80 1357EF40	PLC_BIT_1358	VPOS30 change to 'OFF'	O
5A0101 80 1358EF40	PLC_BIT_1359	VPOS31 change to 'OFF'	O
5A0101 80 1359EF40	PLC_BIT_1360	VPOS32 change to 'OFF'	O
5A0101 80 1360EF40	PLC_BIT_1361	VPOS33 change to 'OFF'	O
5A0101 80 1361EF40	PLC_BIT_1362	VPOS34 change to 'OFF'	O
5A0101 80 1362EF40	PLC_BIT_1363	VPOS35 change to 'OFF'	O
5A0101 80 1363EF40	PLC_BIT_1364	VPOS36 change to 'OFF'	O
5A0101 80 1364EF40	PLC_BIT_1365	VPOS37 change to 'OFF'	O
5A0101 80 1365EF40	PLC_BIT_1366	VPOS38 change to 'OFF'	O
5A0101 80 1366EF40	PLC_BIT_1367	VPOS39 change to 'OFF'	O
5A0101 80 1367EF40	PLC_BIT_1368	VPOS40 change to 'OFF'	O
5A0101 80 1368EF40	PLC_BIT_1369	VPOS41 change to 'OFF'	O
5A0101 80 1369EF40	PLC_BIT_1370	VPOS42 change to 'OFF'	O
5A0101 80 1370EF40	PLC_BIT_1371	VPOS43 change to 'OFF'	O
5A0101 80 1371EF40	PLC_BIT_1372	VPOS44 change to 'OFF'	O
5A0101 80 1372EF40	PLC_BIT_1373	VPOS45 change to 'OFF'	O
5A0101 80 1373EF40	PLC_BIT_1374	VPOS46 change to 'OFF'	O
5A0101 80 1374EF40	PLC_BIT_1375	VPOS47 change to 'OFF'	O
5A0101 80 1375EF40	PLC_BIT_1376	VPOS48 change to 'OFF'	O
5A0101 80 1376EF40	PLC_BIT_1377	VPOS49 change to 'OFF'	O
5A0101 80 1377EF40	PLC_BIT_1378	VPOS50 change to 'OFF'	O
5A0101 80 1378EF40	PLC_BIT_1379	VPOS51 change to 'OFF'	O
5A0101 80 1379EF40	PLC_BIT_1380	VPOS52 change to 'OFF'	O
5A0101 80 1380EF40	PLC_BIT_1381	VPOS53 change to 'OFF'	O
5A0101 80 1381EF40	PLC_BIT_1382	VPOS54 change to 'OFF'	O
5A0101 80 1382EF40	PLC_BIT_1383	VPOS55 change to 'OFF'	O
5A0101 80 1383EF40	PLC_BIT_1384	VPOS56 change to 'OFF'	O
5A0101 80 1384EF40	PLC_BIT_1385	VPOS57 change to 'OFF'	O
5A0101 80 1385EF40	PLC_BIT_1386	VPOS58 change to 'OFF'	O
5A0101 80 1386EF40	PLC_BIT_1387	VPOS59 change to 'OFF'	O
5A0101 80 1387EF40	PLC_BIT_1388	VPOS60 change to 'OFF'	O
5A0101 80 1388EF40	PLC_BIT_1389	VPOS61 change to 'OFF'	O
5A0101 80 1389EF40	PLC_BIT_1390	VPOS62 change to 'OFF'	O
5A0101 80 1390EF40	PLC_BIT_1391	VPOS63 change to 'OFF'	O
5A0101 80 1391EF40	PLC_BIT_1392	VPOS64 change to 'OFF'	O

Table 2.12-5 Mapping points for the command reception in VPOSxx

Signal Number	Signal Name	Description	M/O
522002 700A016D08	VPOS01-CONTROL-REQ	Control command received in VPOS1	M
522002 700A026D08	VPOS02-CONTROL-REQ	Control command received in VPOS2	M
522002 700A036D08	VPOS03-CONTROL-REQ	Control command received in VPOS3	M
522002 700A046D08	VPOS04-CONTROL-REQ	Control command received in VPOS4	M
522002 700A056D08	VPOS05-CONTROL-REQ	Control command received in VPOS5	M

Signal Number	Signal Name	Description	M/O
522002 700A066D08	VPOS06-CONTROL-REQ	Control command received in VPOS6	M
522002 700A076D08	VPOS07-CONTROL-REQ	Control command received in VPOS7	M
522002 700A086D08	VPOS08-CONTROL-REQ	Control command received in VPOS8	M
522002 700A096D08	VPOS09-CONTROL-REQ	Control command received in VPOS9	M
522002 700A0A6D08	VPOS10-CONTROL-REQ	Control command received in VPOS10	M
522002 700A0B6D08	VPOS11-CONTROL-REQ	Control command received in VPOS11	M
522002 700A0C6D08	VPOS12-CONTROL-REQ	Control command received in VPOS12	M
522002 700A0D6D08	VPOS13-CONTROL-REQ	Control command received in VPOS13	M
522002 700A0E6D08	VPOS14-CONTROL-REQ	Control command received in VPOS14	M
522002 700A0F6D08	VPOS15-CONTROL-REQ	Control command received in VPOS15	M
522002 700A106D08	VPOS16-CONTROL-REQ	Control command received in VPOS16	M
522002 700A116D08	VPOS17-CONTROL-REQ	Control command received in VPOS17	M
522002 700A126D08	VPOS18-CONTROL-REQ	Control command received in VPOS18	M
522002 700A136D08	VPOS19-CONTROL-REQ	Control command received in VPOS19	M
522002 700A146D08	VPOS20-CONTROL-REQ	Control command received in VPOS20	M
522002 700A156D08	VPOS21-CONTROL-REQ	Control command received in VPOS21	M
522002 700A166D08	VPOS22-CONTROL-REQ	Control command received in VPOS22	M
522002 700A176D08	VPOS23-CONTROL-REQ	Control command received in VPOS23	M
522002 700A186D08	VPOS24-CONTROL-REQ	Control command received in VPOS24	M
522002 700A196D08	VPOS25-CONTROL-REQ	Control command received in VPOS25	M
522002 700A1A6D08	VPOS26-CONTROL-REQ	Control command received in VPOS26	M
522002 700A1B6D08	VPOS27-CONTROL-REQ	Control command received in VPOS27	M
522002 700A1C6D08	VPOS28-CONTROL-REQ	Control command received in VPOS28	M
522002 700A1D6D08	VPOS29-CONTROL-REQ	Control command received in VPOS29	M
522002 700A1E6D08	VPOS30-CONTROL-REQ	Control command received in VPOS30	M
522002 700A1F6D08	VPOS31-CONTROL-REQ	Control command received in VPOS31	M
522002 700A206D08	VPOS32-CONTROL-REQ	Control command received in VPOS32	M
522002 700A216D08	VPOS33-CONTROL-REQ	Control command received in VPOS33	M
522002 700A226D08	VPOS34-CONTROL-REQ	Control command received in VPOS34	M
522002 700A236D08	VPOS35-CONTROL-REQ	Control command received in VPOS35	M
522002 700A246D08	VPOS36-CONTROL-REQ	Control command received in VPOS36	M
522002 700A256D08	VPOS37-CONTROL-REQ	Control command received in VPOS37	M
522002 700A266D08	VPOS38-CONTROL-REQ	Control command received in VPOS38	M
522002 700A276D08	VPOS39-CONTROL-REQ	Control command received in VPOS39	M
522002 700A286D08	VPOS40-CONTROL-REQ	Control command received in VPOS40	M
522002 700A296D08	VPOS41-CONTROL-REQ	Control command received in VPOS41	M
522002 700A2A6D08	VPOS42-CONTROL-REQ	Control command received in VPOS42	M
522002 700A2B6D08	VPOS43-CONTROL-REQ	Control command received in VPOS43	M
522002 700A2C6D08	VPOS44-CONTROL-REQ	Control command received in VPOS44	M
522002 700A2D6D08	VPOS45-CONTROL-REQ	Control command received in VPOS45	M
522002 700A2E6D08	VPOS46-CONTROL-REQ	Control command received in VPOS46	M
522002 700A2F6D08	VPOS47-CONTROL-REQ	Control command received in VPOS47	M
522002 700A306D08	VPOS48-CONTROL-REQ	Control command received in VPOS48	M
522002 700A316D08	VPOS49-CONTROL-REQ	Control command received in VPOS49	M
522002 700A326D08	VPOS50-CONTROL-REQ	Control command received in VPOS50	M
522002 700A336D08	VPOS51-CONTROL-REQ	Control command received in VPOS51	M
522002 700A346D08	VPOS52-CONTROL-REQ	Control command received in VPOS52	M
522002 700A356D08	VPOS53-CONTROL-REQ	Control command received in VPOS53	M
522002 700A366D08	VPOS54-CONTROL-REQ	Control command received in VPOS54	M
522002 700A376D08	VPOS55-CONTROL-REQ	Control command received in VPOS55	M
522002 700A386D08	VPOS56-CONTROL-REQ	Control command received in VPOS56	M
522002 700A396D08	VPOS57-CONTROL-REQ	Control command received in VPOS57	M
522002 700A3A6D08	VPOS58-CONTROL-REQ	Control command received in VPOS58	M
522002 700A3B6D08	VPOS59-CONTROL-REQ	Control command received in VPOS59	M
522002 700A3C6D08	VPOS60-CONTROL-REQ	Control command received in VPOS60	M

Signal Number	Signal Name	Description	M/O
522002 700A3D6D08	VPOS61-CONTROL-REQ	Control command received in VPOS61	M
522002 700A3E6D08	VPOS62-CONTROL-REQ	Control command received in VPOS62	M
522002 700A3F6D08	VPOS63-CONTROL-REQ	Control command received in VPOS63	M
522002 700A406D08	VPOS64-CONTROL-REQ	Control command received in VPOS64	M

Table 2.12-6 Mapping points for the output signals of VPOSxx

Signal Number	Signal Name	Description	M/O
522002 000A011D90	VPOS01-STSELD	Selection completed signal in VPOS1	M
522002 000A021D90	VPOS02-STSELD	Selection completed signal in VPOS2	M
522002 000A031D90	VPOS03-STSELD	Selection completed signal in VPOS3	M
522002 000A041D90	VPOS04-STSELD	Selection completed signal in VPOS4	M
522002 000A051D90	VPOS05-STSELD	Selection completed signal in VPOS5	M
522002 000A061D90	VPOS06-STSELD	Selection completed signal in VPOS6	M
522002 000A071D90	VPOS07-STSELD	Selection completed signal in VPOS7	M
522002 000A081D90	VPOS08-STSELD	Selection completed signal in VPOS8	M
522002 000A091D90	VPOS09-STSELD	Selection completed signal in VPOS9	M
522002 000A0A1D90	VPOS10-STSELD	Selection completed signal in VPOS10	M
522002 000A0B1D90	VPOS11-STSELD	Selection completed signal in VPOS11	M
522002 000A0C1D90	VPOS12-STSELD	Selection completed signal in VPOS12	M
522002 000A0D1D90	VPOS13-STSELD	Selection completed signal in VPOS13	M
522002 000A0E1D90	VPOS14-STSELD	Selection completed signal in VPOS14	M
522002 000A0F1D90	VPOS15-STSELD	Selection completed signal in VPOS15	M
522002 000A101D90	VPOS16-STSELD	Selection completed signal in VPOS16	M
522002 000A111D90	VPOS17-STSELD	Selection completed signal in VPOS17	M
522002 000A121D90	VPOS18-STSELD	Selection completed signal in VPOS18	M
522002 000A131D90	VPOS19-STSELD	Selection completed signal in VPOS19	M
522002 000A141D90	VPOS20-STSELD	Selection completed signal in VPOS20	M
522002 000A151D90	VPOS21-STSELD	Selection completed signal in VPOS21	M
522002 000A161D90	VPOS22-STSELD	Selection completed signal in VPOS22	M
522002 000A171D90	VPOS23-STSELD	Selection completed signal in VPOS23	M
522002 000A181D90	VPOS24-STSELD	Selection completed signal in VPOS24	M
522002 000A191D90	VPOS25-STSELD	Selection completed signal in VPOS25	M
522002 000A1A1D90	VPOS26-STSELD	Selection completed signal in VPOS26	M
522002 000A1B1D90	VPOS27-STSELD	Selection completed signal in VPOS27	M
522002 000A1C1D90	VPOS28-STSELD	Selection completed signal in VPOS28	M
522002 000A1D1D90	VPOS29-STSELD	Selection completed signal in VPOS29	M
522002 000A1E1D90	VPOS30-STSELD	Selection completed signal in VPOS30	M
522002 000A1F1D90	VPOS31-STSELD	Selection completed signal in VPOS31	M
522002 000A201D90	VPOS32-STSELD	Selection completed signal in VPOS32	M
522002 000A211D90	VPOS33-STSELD	Selection completed signal in VPOS33	M
522002 000A221D90	VPOS34-STSELD	Selection completed signal in VPOS34	M
522002 000A231D90	VPOS35-STSELD	Selection completed signal in VPOS35	M
522002 000A241D90	VPOS36-STSELD	Selection completed signal in VPOS36	M
522002 000A251D90	VPOS37-STSELD	Selection completed signal in VPOS37	M
522002 000A261D90	VPOS38-STSELD	Selection completed signal in VPOS38	M
522002 000A271D90	VPOS39-STSELD	Selection completed signal in VPOS39	M
522002 000A281D90	VPOS40-STSELD	Selection completed signal in VPOS40	M
522002 000A291D90	VPOS41-STSELD	Selection completed signal in VPOS41	M
522002 000A2A1D90	VPOS42-STSELD	Selection completed signal in VPOS42	M
522002 000A2B1D90	VPOS43-STSELD	Selection completed signal in VPOS43	M
522002 000A2C1D90	VPOS44-STSELD	Selection completed signal in VPOS44	M
522002 000A2D1D90	VPOS45-STSELD	Selection completed signal in VPOS45	M
522002 000A2E1D90	VPOS46-STSELD	Selection completed signal in VPOS46	M

Signal Number	Signal Name	Description	M/O
522002 000A2F1D90	VPOS47-STSELD	Selection completed signal in VPOS47	M
522002 000A301D90	VPOS48-STSELD	Selection completed signal in VPOS48	M
522002 000A311D90	VPOS49-STSELD	Selection completed signal in VPOS49	M
522002 000A321D90	VPOS50-STSELD	Selection completed signal in VPOS50	M
522002 000A331D90	VPOS51-STSELD	Selection completed signal in VPOS51	M
522002 000A341D90	VPOS52-STSELD	Selection completed signal in VPOS52	M
522002 000A351D90	VPOS53-STSELD	Selection completed signal in VPOS53	M
522002 000A361D90	VPOS54-STSELD	Selection completed signal in VPOS54	M
522002 000A371D90	VPOS55-STSELD	Selection completed signal in VPOS55	M
522002 000A381D90	VPOS56-STSELD	Selection completed signal in VPOS56	M
522002 000A391D90	VPOS57-STSELD	Selection completed signal in VPOS57	M
522002 000A3A1D90	VPOS58-STSELD	Selection completed signal in VPOS58	M
522002 000A3B1D90	VPOS59-STSELD	Selection completed signal in VPOS59	M
522002 000A3C1D90	VPOS60-STSELD	Selection completed signal in VPOS60	M
522002 000A3D1D90	VPOS61-STSELD	Selection completed signal in VPOS61	M
522002 000A3E1D90	VPOS62-STSELD	Selection completed signal in VPOS62	M
522002 000A3F1D90	VPOS63-STSELD	Selection completed signal in VPOS63	M
522002 000A401D90	VPOS64-STSELD	Selection completed signal in VPOS64	M

Table 2.12-7 Input signals for condition logic

Signal Number	Signal Name	Description	M/O
5A0101 3100001F43	SERI_ERR	Serious Error detected	N/A

(vi) Setting names

Table 2.12-8 Setting of VPOSxx control

Setting Name	Description	Default	Setting item or value
VPOSxx-EN	Function activation vin VPOSxx	On	Off/On
VPOSxx-CTRMENU	MENU activation in VPOSxx	Off	Off/On
VPOSxx-CTRAHMI	Selection of "SBO" or "DIR" for HMI of VPOSxx	SBO	DIR/SBO

2.12.3 Cancel logic for SBO mode

In the SBO control mode, the reception of a cancel command is possible; when the cancel conditions are satisfied, accordingly, the function can discard the select command.

(i) Receiving "Cancel" from the remote end

Figure 2.12-8 shows the logic when a "Cancel command (Remote-Cancel)" signal is applied to the VPOS1 function. The input-point "VPOS01-CONTROL-REQ" is the same as the "Selection command (Remote-On-Control)" signal.

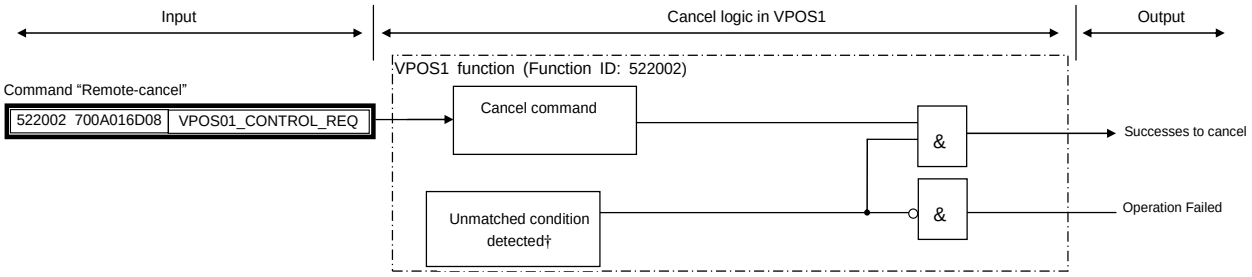


Figure 2.12-8 Cancel logic by the reception of the command from the remote end

†Note: The criteria "unmatched conditions" are determined when the "Test-bit status" in the 'cancel' command is not identical to the "IED test status".

(ii) Receiving "Cancel" from the front panel

Figure 2.12-9 shows the logic when a "Cancel command (Local-cancel)" signal is applied to the VPOS1 function. The input signal is provided when the "Cancel" key is pressed on the IED front panel; the user is not required to map it. When the logic receives "Local-cancel" signal, the logic is able to output a result signal, provided that the "unmatched condition detected" checking is satisfied.

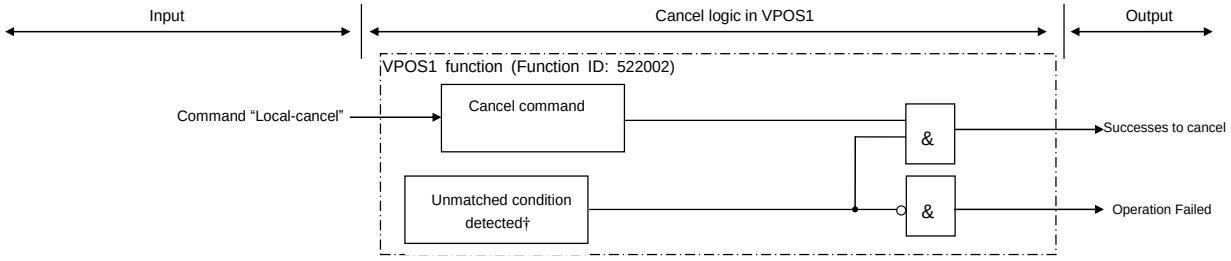


Figure 2.12-9 Cancel logic by the reception of the command at local end

†Note: The criteria "unmatched conditions" are determined when the "Test-bit status" in the 'cancel' command is not identical to the "IED test status".

2.12.4 Operate logic for SBO/DIR modes

The user should map the operation command to the operate logic. If the operation condition is satisfied, the IED is able to change the state in the VPOS1.

(i) Receiving "operate command On" from the remote end

Figure 2.12-10 shows the logic when an "Operate command (Remote-ON-Control)" signal is applied to the VPOS1 logic. The input-point "VPOS01-CONTROL-REQ" is used for the reception of the "Select command (Remote-On-Control)".

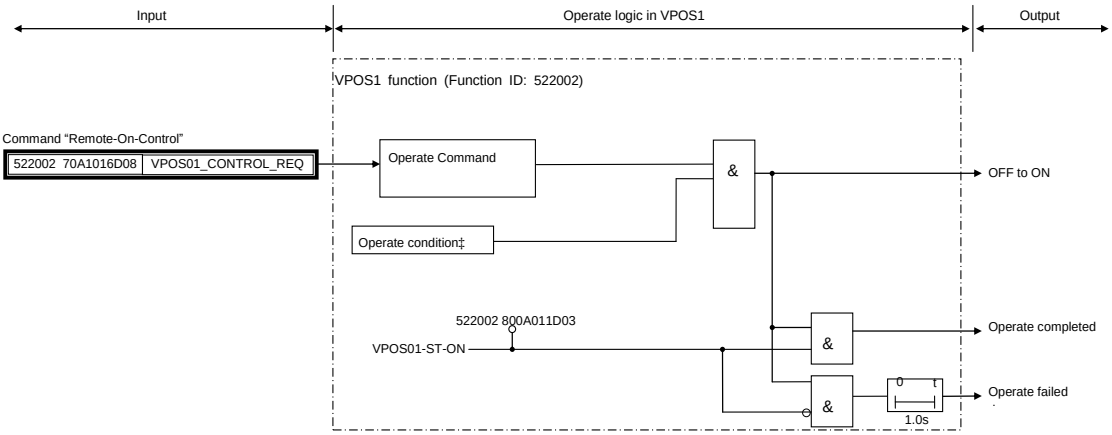


Figure 2.12-10 'ON' Operation logic by remote end in VPOS1†

†Note: To identify the input signal-points of the other VPOS logics, see Table 2.12-5 and Table 2.12-9.

‡Note:Signal "operate condition" is provided from operate condition scheme. For more information, see Figure 2.12-14.

(ii) Receiving "operate command Off" from the remote end

Figure 2.12-11 shows the logic when an "Operate command (Remote-Off-Control)" signal is applied to the VPOS1 logic. The input-point "VPOS01-CONTROL-REQ" is used for the reception of the signal "Operate command (Remote-Off-Control)".

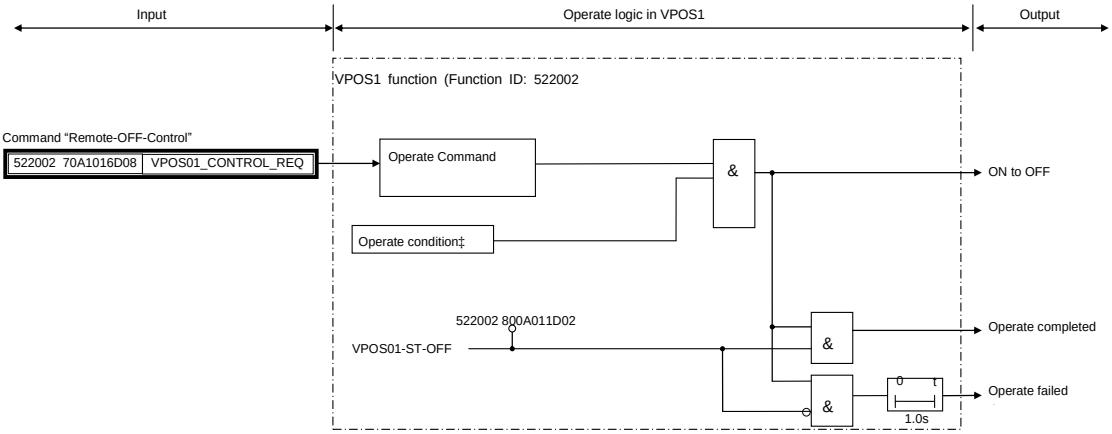


Figure 2.12-11 'OFF' Operation logic by remote end in VPOS1†

†Note: To identify the input signals of the other VPOS logics, see
Table 2.12-5 and Table 2.12-10.

‡Note:Signal "operate condition" is provided from operate condition scheme. For more information, see Figure 2.12-14.

(iii) Receiving "operate command On" from the front panel

Figure 2.12-12 shows the logic when an "Operate command (Local-ON-Control)" signal is applied to the VPOS1 logic. The input signal is provided when "Execution of On" key is pressed on the IED front panel.

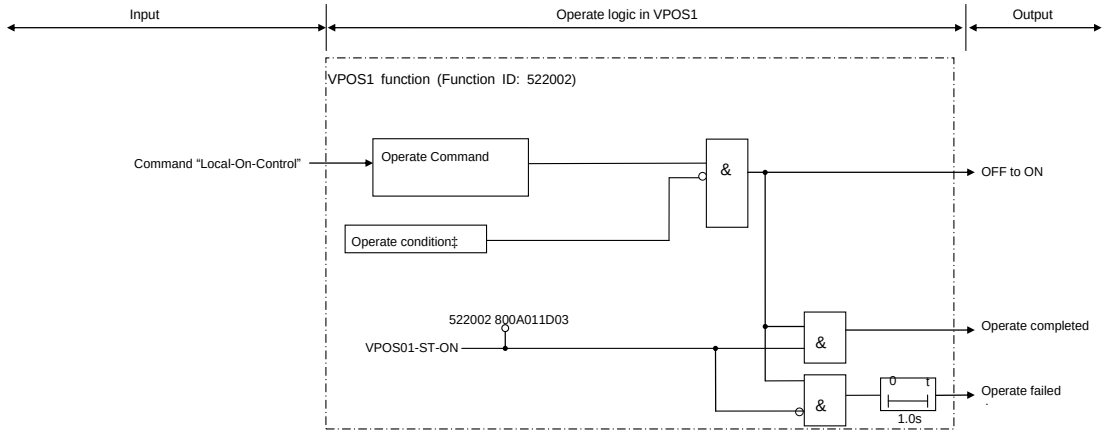


Figure 2.12-12 'ON' Operation logic at local in VPOS1†

†Note: To identify the input signal-points of the other VPOS logics, see Table 2.12-9.

‡Note:Signal "operate condition" is provided from operate condition scheme. For more information, see Figure 2.12-14.

(iv) Receiving "operate command Off" from the front panel

Figure 2.12-13 shows the logic when an "Operation command (Local-OFF-Control)" signal is applied to the VPOS1 logic. The input signal is provided when "Execution for Off" key is pressed on the IED front panel.

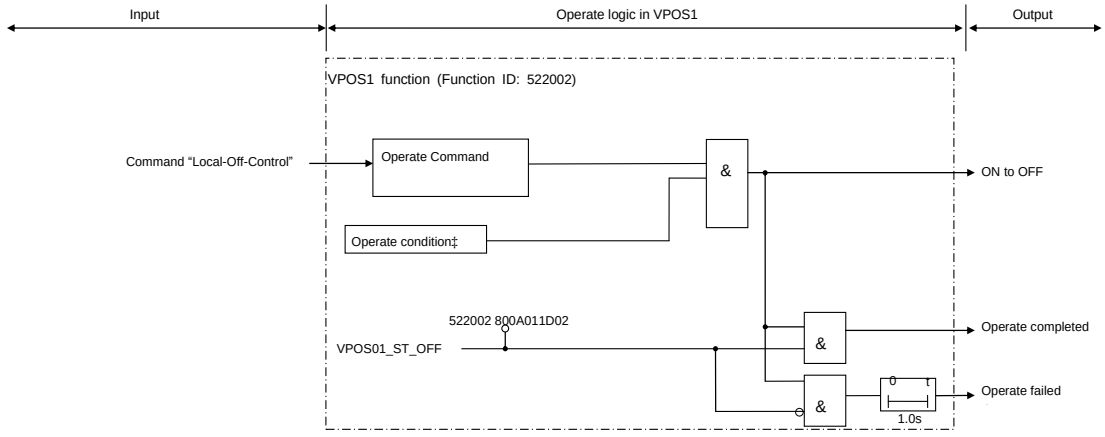


Figure 2.12-13 'OFF' Operation logic at local in VPOS1†

†Note: To identify the input signals of the other VPOS logics, see Table 2.12-10.

‡Note: Signal "operate condition" is provided from operate condition scheme. For more information, see Figure 2.12-14.

(v) Operate condition

Figure 2.12-14 shows the operate condition logic, which examines the operate condition in the VPOS1 function using the VPOS01_STATE signal.

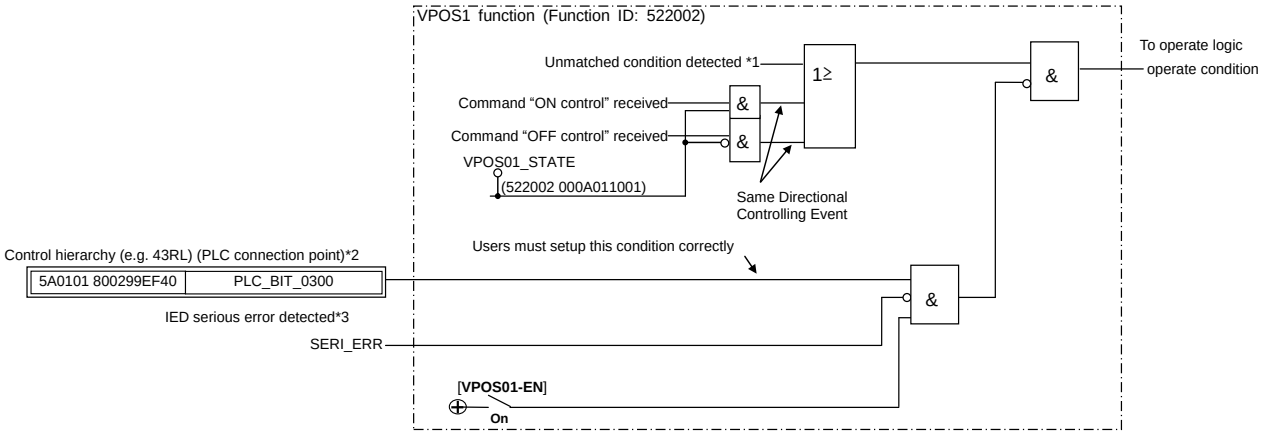


Figure 2.12-14 Operate condition logic for ON/OFF in VPOS1

[1]Note: The criteria "unmatched conditions" is determined when the "Test-bit status" in a command is not identical to the "IED test status".

[2]Note: The user must program the PLC logic "Control hierarchy condition", which is listed in Table 2.12-3.

[3]Note: The SERI_ERR is listed in Table 2.12-7.

(vi) Signal name and number

Note: The user should note the meaning of the following abbreviations as shown in column "M/O" of each table:

"O" indicates that the signal is provided for the optional use.

"M" indicates that the user should map/set/configure the signal; otherwise, the user may experience an operational failure if the default settings is used.

"N/A" indicates that the user cannot change the state of the signal.

Table 2.12-9 ON status signals on the operation

Signal Number	Signal Name	Description
522002 800A011D03	VPOS01-ST-ON	'On' state of VPOS1
522002 800A021D03	VPOS02-ST-ON	'On' state of VPOS2
522002 800A031D03	VPOS03-ST-ON	'On' state of VPOS3
522002 800A041D03	VPOS04-ST-ON	'On' state of VPOS4
522002 800A051D03	VPOS05-ST-ON	'On' state of VPOS5
522002 800A061D03	VPOS06-ST-ON	'On' state of VPOS6
522002 800A071D03	VPOS07-ST-ON	'On' state of VPOS7

Signal Number	Signal Name	Description
522002 800A081D03	VPOS08-ST-ON	'On' state of VPOS8
522002 800A091D03	VPOS09-ST-ON	'On' state of VPOS9
522002 800A0A1D03	VPOS10-ST-ON	'On' state of VPOS10
522002 800A0B1D03	VPOS11-ST-ON	'On' state of VPOS11
522002 800A0C1D03	VPOS12-ST-ON	'On' state of VPOS12
522002 800A0D1D03	VPOS13-ST-ON	'On' state of VPOS13
522002 800A0E1D03	VPOS14-ST-ON	'On' state of VPOS14
522002 800A0F1D03	VPOS15-ST-ON	'On' state of VPOS15
522002 800A101D03	VPOS16-ST-ON	'On' state of VPOS16
522002 800A111D03	VPOS17-ST-ON	'On' state of VPOS17
522002 800A121D03	VPOS18-ST-ON	'On' state of VPOS18
522002 800A131D03	VPOS19-ST-ON	'On' state of VPOS19
522002 800A141D03	VPOS20-ST-ON	'On' state of VPOS20
522002 800A151D03	VPOS21-ST-ON	'On' state of VPOS21
522002 800A161D03	VPOS22-ST-ON	'On' state of VPOS22
522002 800A171D03	VPOS23-ST-ON	'On' state of VPOS23
522002 800A181D03	VPOS24-ST-ON	'On' state of VPOS24
522002 800A191D03	VPOS25-ST-ON	'On' state of VPOS25
522002 800A1A1D03	VPOS26-ST-ON	'On' state of VPOS26
522002 800A1B1D03	VPOS27-ST-ON	'On' state of VPOS27
522002 800A1C1D03	VPOS28-ST-ON	'On' state of VPOS28
522002 800A1D1D03	VPOS29-ST-ON	'On' state of VPOS29
522002 800A1E1D03	VPOS30-ST-ON	'On' state of VPOS30
522002 800A1F1D03	VPOS31-ST-ON	'On' state of VPOS31
522002 800A201D03	VPOS32-ST-ON	'On' state of VPOS32
522002 800A211D03	VPOS33-ST-ON	'On' state of VPOS33
522002 800A221D03	VPOS34-ST-ON	'On' state of VPOS34
522002 800A231D03	VPOS35-ST-ON	'On' state of VPOS35
522002 800A241D03	VPOS36-ST-ON	'On' state of VPOS36
522002 800A251D03	VPOS37-ST-ON	'On' state of VPOS37
522002 800A261D03	VPOS38-ST-ON	'On' state of VPOS38
522002 800A271D03	VPOS39-ST-ON	'On' state of VPOS39
522002 800A281D03	VPOS40-ST-ON	'On' state of VPOS40
522002 800A291D03	VPOS41-ST-ON	'On' state of VPOS41
522002 800A2A1D03	VPOS42-ST-ON	'On' state of VPOS42
522002 800A2B1D03	VPOS43-ST-ON	'On' state of VPOS43
522002 800A2C1D03	VPOS44-ST-ON	'On' state of VPOS44
522002 800A2D1D03	VPOS45-ST-ON	'On' state of VPOS45
522002 800A2E1D03	VPOS46-ST-ON	'On' state of VPOS46
522002 800A2F1D03	VPOS47-ST-ON	'On' state of VPOS47
522002 800A301D03	VPOS48-ST-ON	'On' state of VPOS48
522002 800A311D03	VPOS49-ST-ON	'On' state of VPOS49
522002 800A321D03	VPOS50-ST-ON	'On' state of VPOS50
522002 800A331D03	VPOS51-ST-ON	'On' state of VPOS51
522002 800A341D03	VPOS52-ST-ON	'On' state of VPOS52
522002 800A351D03	VPOS53-ST-ON	'On' state of VPOS53
522002 800A361D03	VPOS54-ST-ON	'On' state of VPOS54
522002 800A371D03	VPOS55-ST-ON	'On' state of VPOS55
522002 800A381D03	VPOS56-ST-ON	'On' state of VPOS56
522002 800A391D03	VPOS57-ST-ON	'On' state of VPOS57
522002 800A3A1D03	VPOS58-ST-ON	'On' state of VPOS58
522002 800A3B1D03	VPOS59-ST-ON	'On' state of VPOS59
522002 800A3C1D03	VPOS60-ST-ON	'On' state of VPOS60
522002 800A3D1D03	VPOS61-ST-ON	'On' state of VPOS61
522002 800A3E1D03	VPOS62-ST-ON	'On' state of VPOS62

Signal Number	Signal Name	Description
522002 800A3F1D03	VPOS63-ST-ON	'On' state of VPOS63
522002 800A401D03	VPOS64-ST-ON	'On' state of VPOS64

Table 2.12-10 OFF status signals on the operation

Signal Number	Signal Name	Description
522002 800A011D02	VPOS01-ST-OFF	'Off' state of VPOS1
522002 800A021D02	VPOS02-ST-OFF	'Off' state of VPOS2
522002 800A031D02	VPOS03-ST-OFF	'Off' state of VPOS3
522002 800A041D02	VPOS04-ST-OFF	'Off' state of VPOS4
522002 800A051D02	VPOS05-ST-OFF	'Off' state of VPOS5
522002 800A061D02	VPOS06-ST-OFF	'Off' state of VPOS6
522002 800A071D02	VPOS07-ST-OFF	'Off' state of VPOS7
522002 800A081D02	VPOS08-ST-OFF	'Off' state of VPOS8
522002 800A091D02	VPOS09-ST-OFF	'Off' state of VPOS9
522002 800A0A1D02	VPOS10-ST-OFF	'Off' state of VPOS10
522002 800A0B1D02	VPOS11-ST-OFF	'Off' state of VPOS11
522002 800A0C1D02	VPOS12-ST-OFF	'Off' state of VPOS12
522002 800A0D1D02	VPOS13-ST-OFF	'Off' state of VPOS13
522002 800A0E1D02	VPOS14-ST-OFF	'Off' state of VPOS14
522002 800A0F1D02	VPOS15-ST-OFF	'Off' state of VPOS15
522002 800A101D02	VPOS16-ST-OFF	'Off' state of VPOS16
522002 800A111D02	VPOS17-ST-OFF	'Off' state of VPOS17
522002 800A121D02	VPOS18-ST-OFF	'Off' state of VPOS18
522002 800A131D02	VPOS19-ST-OFF	'Off' state of VPOS19
522002 800A141D02	VPOS20-ST-OFF	'Off' state of VPOS20
522002 800A151D02	VPOS21-ST-OFF	'Off' state of VPOS21
522002 800A161D02	VPOS22-ST-OFF	'Off' state of VPOS22
522002 800A171D02	VPOS23-ST-OFF	'Off' state of VPOS23
522002 800A181D02	VPOS24-ST-OFF	'Off' state of VPOS24
522002 800A191D02	VPOS25-ST-OFF	'Off' state of VPOS25
522002 800A1A1D02	VPOS26-ST-OFF	'Off' state of VPOS26
522002 800A1B1D02	VPOS27-ST-OFF	'Off' state of VPOS27
522002 800A1C1D02	VPOS28-ST-OFF	'Off' state of VPOS28
522002 800A1D1D02	VPOS29-ST-OFF	'Off' state of VPOS29
522002 800A1E1D02	VPOS30-ST-OFF	'Off' state of VPOS30
522002 800A1F1D02	VPOS31-ST-OFF	'Off' state of VPOS31
522002 800A201D02	VPOS32-ST-OFF	'Off' state of VPOS32
522002 800A211D02	VPOS33-ST-OFF	'Off' state of VPOS33
522002 800A221D02	VPOS34-ST-OFF	'Off' state of VPOS34
522002 800A231D02	VPOS35-ST-OFF	'Off' state of VPOS35
522002 800A241D02	VPOS36-ST-OFF	'Off' state of VPOS36
522002 800A251D02	VPOS37-ST-OFF	'Off' state of VPOS37
522002 800A261D02	VPOS38-ST-OFF	'Off' state of VPOS38
522002 800A271D02	VPOS39-ST-OFF	'Off' state of VPOS39
522002 800A281D02	VPOS40-ST-OFF	'Off' state of VPOS40
522002 800A291D02	VPOS41-ST-OFF	'Off' state of VPOS41
522002 800A2A1D02	VPOS42-ST-OFF	'Off' state of VPOS42
522002 800A2B1D02	VPOS43-ST-OFF	'Off' state of VPOS43
522002 800A2C1D02	VPOS44-ST-OFF	'Off' state of VPOS44
522002 800A2D1D02	VPOS45-ST-OFF	'Off' state of VPOS45
522002 800A2E1D02	VPOS46-ST-OFF	'Off' state of VPOS46
522002 800A2F1D02	VPOS47-ST-OFF	'Off' state of VPOS47
522002 800A301D02	VPOS48-ST-OFF	'Off' state of VPOS48

Signal Number	Signal Name	Description
522002 800A311D02	VPOS49-ST-OFF	'Off' state of VPOS49
522002 800A321D02	VPOS50-ST-OFF	'Off' state of VPOS50
522002 800A331D02	VPOS51-ST-OFF	'Off' state of VPOS51
522002 800A341D02	VPOS52-ST-OFF	'Off' state of VPOS52
522002 800A351D02	VPOS53-ST-OFF	'Off' state of VPOS53
522002 800A361D02	VPOS54-ST-OFF	'Off' state of VPOS54
522002 800A371D02	VPOS55-ST-OFF	'Off' state of VPOS55
522002 800A381D02	VPOS56-ST-OFF	'Off' state of VPOS56
522002 800A391D02	VPOS57-ST-OFF	'Off' state of VPOS57
522002 800A3A1D02	VPOS58-ST-OFF	'Off' state of VPOS58
522002 800A3B1D02	VPOS59-ST-OFF	'Off' state of VPOS59
522002 800A3C1D02	VPOS60-ST-OFF	'Off' state of VPOS60
522002 800A3D1D02	VPOS61-ST-OFF	'Off' state of VPOS61
522002 800A3E1D02	VPOS62-ST-OFF	'Off' state of VPOS62
522002 800A3F1D02	VPOS63-ST-OFF	'Off' state of VPOS63
522002 800A401D02	VPOS64-ST-OFF	'Off' state of VPOS64

2.12.5 Mapping for IEC 61850 communication

The user can operate the VPOS1 function over IEC 61850 communications following mapping using GR-TIEMS. Note that the VPOS1 function is designed for the class of "Single Point Controller (SPC)" in the IEC 61850 standard for communication. The user should follow these steps, each of which is discussed below:

Step1: Editing Logical Node

Step2: Mapping output data

Step3: Mapping input data

(i) Editing Logical Node

The user will need to create a logical node (LN) for the VPOS1 function. Figure 2.12-15 exemplifies the editing of a LN; the LN "General Input/Output (GGIO)" is chosen for the VPOS1 function for IEC 61850 communication. After the user has defined an object "SPCSO", the VPOS1 logical node can be saved with the name "GGIO" plus "LN Instance". Create a definition of the object "SPCSO" in VPOS1 logical node. Either the SBO mode or the DIR mode can be chosen in the editing for the LN.

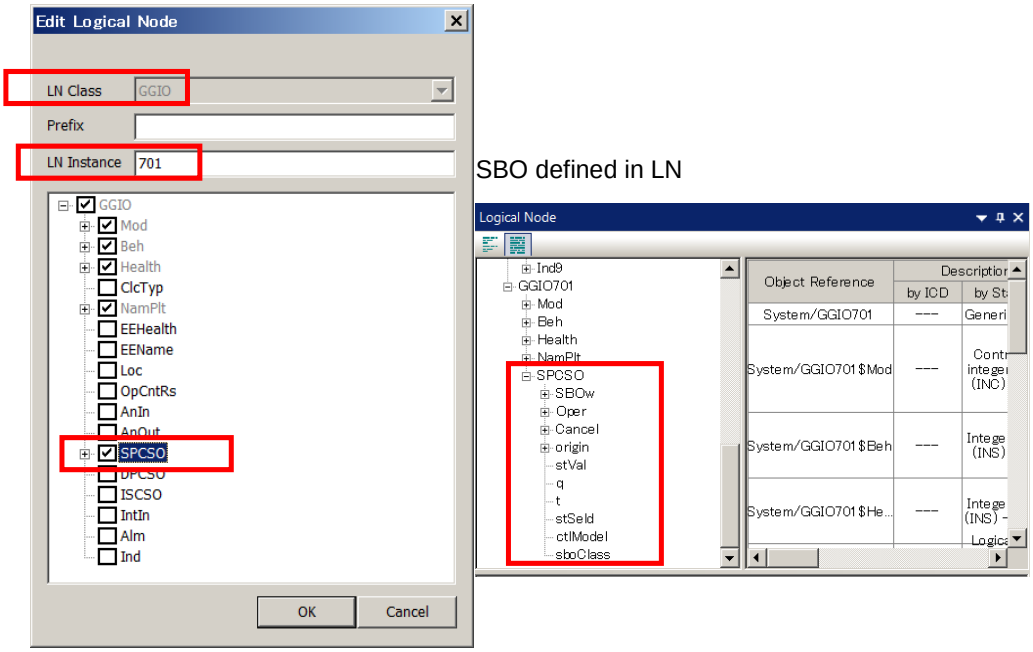
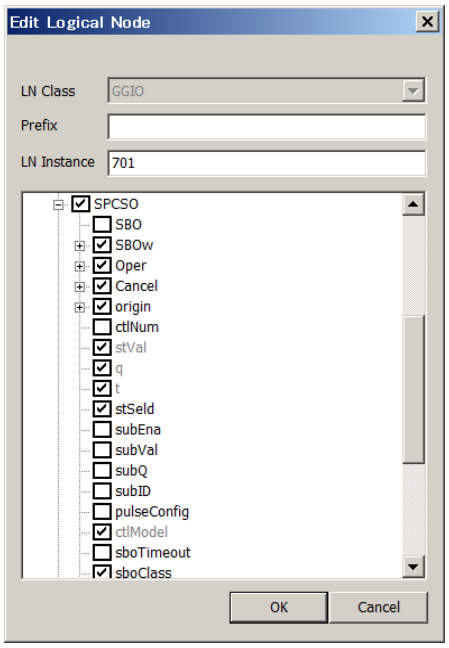


Figure 2.12-15 Defining "SPCSO" object in GGIO701 logic node

(i)-1 Defining SBO mode

Figure 2.12-16 exemplifies the settings in LN "GGIO701" when the SBO mode is required for the VPOS1 function. In the SBO control, the user should select the following items for the "GGIO701$SPCSO" using GR-TIEMS;

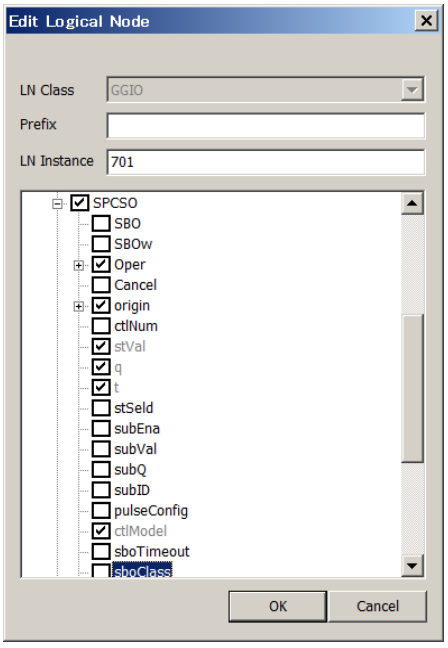


- ✓ SBOw
- ✓ Oper
- ✓ Cancel
- ✓ Origin
- ✓ stSeld
- ✓ sboClass (choice ”operate-once”)
- ✓ ctlmodel (choice ”SBOes or SBOns”)

Figure 2.12-16 LN editing screen for SBO mode (for example)

(i)-2 Defining DIR mode

Figure 2.12-17 exemplifies the settings in LN “GGIO701” when the DIR mode is required for the VPOS1 function. In the DIR mode, the following three items should be selected using GR-TIEMS:



- ✓ Oper
- ✓ origin
- ✓ ctlmodel (choice ”DOes or DOns”)

Figure 2.12-17 LN editing screen for DIR mode (for example)

(ii) Mapping output data

The user should group the VPOS1 (VPOS01) signals with regard to GOOSE and REPORT; the user should map them for IEC 61850 communication using GR-TIEMS.

Table 2.12-11 shows the required mapping signals in VPOS1 function to the IEC 61850 communications. Figure 2.12-18 shows how to map a signal.

Table 2.12-11 Mapping signals for SPCSO object.

Object_reference	Attribute	Type	FC	Signal Number	Signal Name
Ctrl/GGIO701$SPCSO$origin	orCat	orCategory	ST	522002 310A011008	VPOS01_ORCAT
Ctrl/GGIO701$SPCSO$origin	orIdent	Octet64	ST	522002 6A0A011009	VPOS01_ORIDENT
Ctrl/GGIO701$SPCSO	stVal	INT32	ST	522002 000A011001	VPOS01_STATE
Ctrl/GGIO701$SPCSO	q	Quality	ST	522002 310A011005	VPOS01_QUALITY
Ctrl/GGIO701$SPCSO	t	Timestamp	ST	522002 900A011006	VPOS01_TIME
Ctrl/GGIO701$SPCSO	stSeld	BOOLEAN	ST	522002 000A011D90	VPOS01_STSELD

Note: "Status (ST)" is defined in the function constraint (FC) of the IEC 61850 standard.

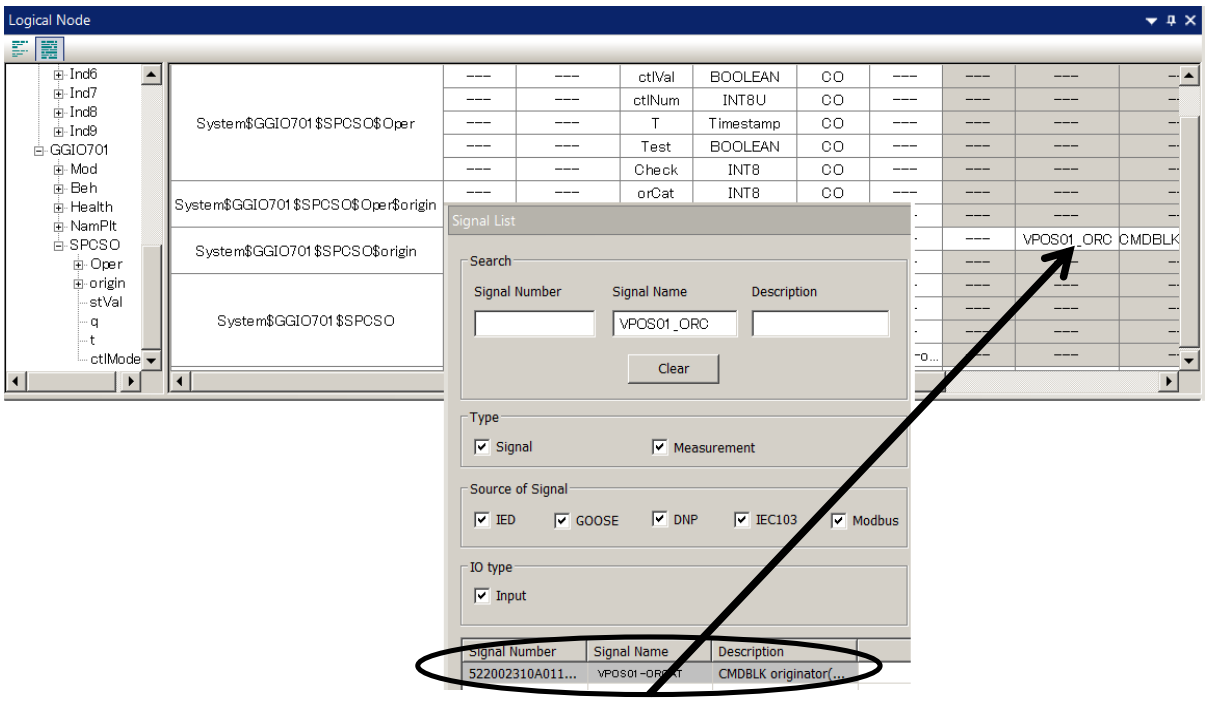


Figure 2.12-18 orCat attribute mapped into SPCSO object of GGIO701

(iii) Mapping input data

The VPOS1 function can receive three commands "select, operate, and cancel. Thus, the user should map the input-point "VPOS01-CONTROL-REQ". Table 2.12-12 shows the input-point "VPOS01-CONTROL-REQ" and the Object reference "Ctrl/GGIO701$SPCSO"; the user should map the Object reference having attributes CO and CF in FC† to the input-point. Figure 2.12-19 shows how to map a signal.

†Note: The attribute is defined in the IEC 61850 standard; "CO" stands for "Control" and "CF" stands for "Configuration" in the functional constraint (FC).

Table 2.12-12 Mapping signals required for SPCSO object in VPOS1 function

Object_reference	Attribute	Type	FC	Signal Number	Signal Name
Ctrl/GGIO701$SPCSO$SBOw	ctlVal	BOOLEAN	CO	522002 700A016D08	VPOS01-CONTROL-REQ
Ctrl/GGIO701$SPCSO$SBOw	ctlNum	INT8U	CO		
Ctrl/GGIO701$SPCSO$SBOw	T	Timestamp	CO		
Ctrl/GGIO701$SPCSO$SBOw	Test	BOOLEAN	CO		
Ctrl/GGIO701$SPCSO$SBOw	Check	Check	CO		
Ctrl/GGIO701$SPCSO$SBOw$origin	orCat	orCategory	CO		
Ctrl/GGIO701$SPCSO$SBOw$origin	orIdent	Octet64	CO		
Ctrl/GGIO701$SPCSO$Oper	ctlVal	BOOLEAN	CO		
Ctrl/GGIO701$SPCSO$Oper	ctlNum	INT8U	CO		
Ctrl/GGIO701$SPCSO$Oper	T	Timestamp	CO		
Ctrl/GGIO701$SPCSO$Oper	Test	BOOLEAN	CO		
Ctrl/GGIO701$SPCSO$Oper	Check	Check	CO		
Ctrl/GGIO701$SPCSO$Oper$origin	orCat	orCategory	CO		
Ctrl/GGIO701$SPCSO$Oper$origin	orIdent	Octet64	CO		
Ctrl/GGIO701$SPCSO$Cancel	ctlVal	BOOLEAN	CO		
Ctrl/GGIO701$SPCSO$Cancel	ctlNum	INT8U	CO		
Ctrl/GGIO701$SPCSO$Cancel	T	Timestamp	CO		
Ctrl/GGIO701$SPCSO$Cancel	Test	BOOLEAN	CO		
Ctrl/GGIO701$SPCSO$Cancel$origin	orCat	orCategory	CO		
Ctrl/GGIO701$SPCSO$Cancel$origin	orIdent	Octet64	CO		
Ctrl/GGIO701$SPCSO	ctlModel	ctlModel	CF		
Ctrl/GGIO701$SPCSO	sboClass	sboClass	CF		

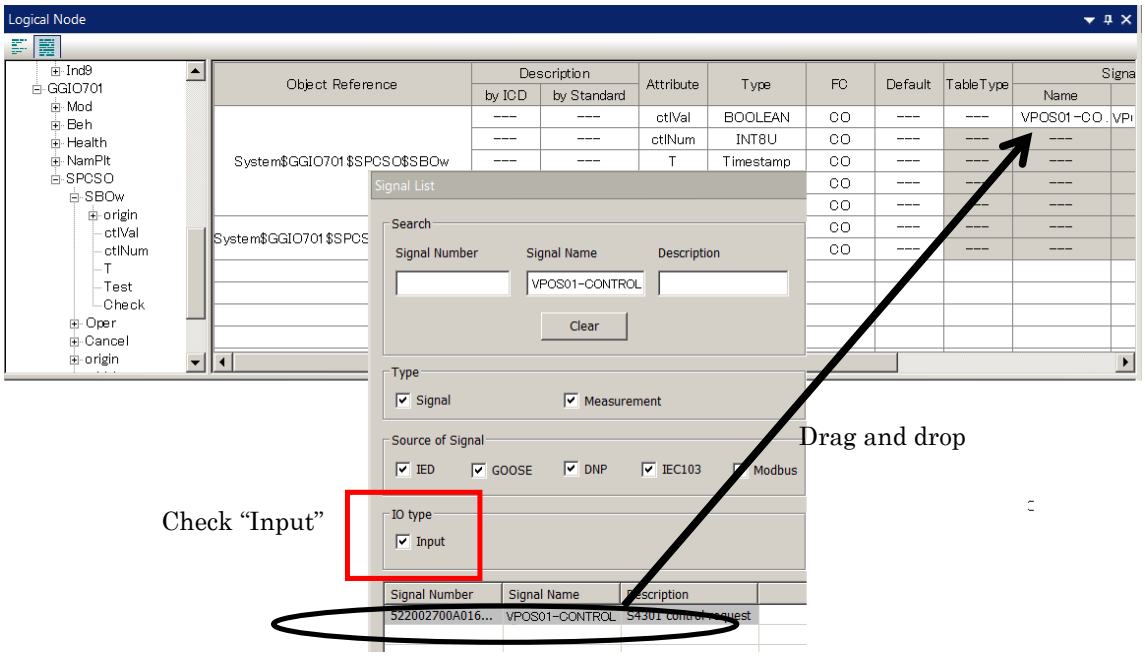


Figure 2.12-19 Input-point mapped for GGIO701

2.12.6 Setting

Settings list for the VPOS(FunctionID:522002)

Setting device		Range	Units	Contents	Default setting value	Notes
VPOS1	VPOS01-EN	Off / On	-	Enabling the function in VPOS1	Off	
	VPOS01-CTRMENU	Off / On	-	Enabling control menu in VPOS1	Off	
	VPOS01-CTRAHMI	DIR / SBO	-	Selection of control mode on the screen in VPOS1	DIR	
VPOS2	VPOS02-EN	Off / On	-	Enabling the function in VPOS2	Off	
	VPOS02-CTRMENU	Off / On	-	Enabling control menu in VPOS2	Off	
	VPOS02-CTRAHMI	DIR / SBO	-	Selection of control mode on the screen in VPOS2	DIR	
…	…	…		…	…	
…	…	…		…	…	
…	…	…		…	…	
…	…	…		…	…	
…	…	…		…	…	
…	…	…		…	…	
VPOS64	VPOS64-EN	Off / On	-	Enabling the function in VPOS64	Off	
	VPOS64-CTRMENU	Off / On	-	Enabling control menu in VPOS64	Off	
	VPOS64-CTRAHMI	DIR / SBO	-	Selection of control mode on the screen in VPOS64	DIR	

2.12.7 Signal

◆ Connection points in Control right for VPOS

VPOS(Function ID:522002)

Element ID	Name	Description
800A01ED50	VPOS01-CTRL-RIGHT	VPOS01 control right from PLC
800A02ED50	VPOS02-CTRL-RIGHT	VPOS02 control right from PLC
800A03ED50	VPOS03-CTRL-RIGHT	VPOS03 control right from PLC
800A04ED50	VPOS04-CTRL-RIGHT	VPOS04 control right from PLC
800A05ED50	VPOS05-CTRL-RIGHT	VPOS05 control right from PLC
800A06ED50	VPOS06-CTRL-RIGHT	VPOS06 control right from PLC
800A07ED50	VPOS07-CTRL-RIGHT	VPOS07 control right from PLC
800A08ED50	VPOS08-CTRL-RIGHT	VPOS08 control right from PLC
800A09ED50	VPOS09-CTRL-RIGHT	VPOS09 control right from PLC
800A0AED50	VPOS10-CTRL-RIGHT	VPOS10 control right from PLC
800A0BED50	VPOS11-CTRL-RIGHT	VPOS11 control right from PLC
800A0CED50	VPOS12-CTRL-RIGHT	VPOS12 control right from PLC
800A0DED50	VPOS13-CTRL-RIGHT	VPOS13 control right from PLC
800A0EED50	VPOS14-CTRL-RIGHT	VPOS14 control right from PLC
800A0FED50	VPOS15-CTRL-RIGHT	VPOS15 control right from PLC
800A10ED50	VPOS16-CTRL-RIGHT	VPOS16 control right from PLC
800A11ED50	VPOS17-CTRL-RIGHT	VPOS17 control right from PLC
800A12ED50	VPOS18-CTRL-RIGHT	VPOS18 control right from PLC
800A13ED50	VPOS19-CTRL-RIGHT	VPOS19 control right from PLC
800A14ED50	VPOS20-CTRL-RIGHT	VPOS20 control right from PLC
800A15ED50	VPOS21-CTRL-RIGHT	VPOS21 control right from PLC
800A16ED50	VPOS22-CTRL-RIGHT	VPOS22 control right from PLC
800A17ED50	VPOS23-CTRL-RIGHT	VPOS23 control right from PLC
800A18ED50	VPOS24-CTRL-RIGHT	VPOS24 control right from PLC
800A19ED50	VPOS25-CTRL-RIGHT	VPOS25 control right from PLC
800A1AED50	VPOS26-CTRL-RIGHT	VPOS26 control right from PLC
800A1BED50	VPOS27-CTRL-RIGHT	VPOS27 control right from PLC
800A1CED50	VPOS28-CTRL-RIGHT	VPOS28 control right from PLC
800A1DED50	VPOS29-CTRL-RIGHT	VPOS29 control right from PLC
800A1EED50	VPOS30-CTRL-RIGHT	VPOS30 control right from PLC
800A1FED50	VPOS31-CTRL-RIGHT	VPOS31 control right from PLC
800A20ED50	VPOS32-CTRL-RIGHT	VPOS32 control right from PLC
800A21ED50	VPOS33-CTRL-RIGHT	VPOS33 control right from PLC
800A22ED50	VPOS34-CTRL-RIGHT	VPOS34 control right from PLC
800A23ED50	VPOS35-CTRL-RIGHT	VPOS35 control right from PLC
800A24ED50	VPOS36-CTRL-RIGHT	VPOS36 control right from PLC
800A25ED50	VPOS37-CTRL-RIGHT	VPOS37 control right from PLC
800A26ED50	VPOS38-CTRL-RIGHT	VPOS38 control right from PLC
800A27ED50	VPOS39-CTRL-RIGHT	VPOS39 control right from PLC
800A28ED50	VPOS40-CTRL-RIGHT	VPOS40 control right from PLC
800A29ED50	VPOS41-CTRL-RIGHT	VPOS41 control right from PLC
800A2AED50	VPOS42-CTRL-RIGHT	VPOS42 control right from PLC
800A2BED50	VPOS43-CTRL-RIGHT	VPOS43 control right from PLC

◆ Connection points in Control right for VPOS

VPOS(Function ID:522002)

Element ID	Name	Description
800A2CED50	VPOS44-CTRL-RIGHT	VPOS44 control right from PLC
800A2DED50	VPOS45-CTRL-RIGHT	VPOS45 control right from PLC
800A2EED50	VPOS46-CTRL-RIGHT	VPOS46 control right from PLC
800A2FED50	VPOS47-CTRL-RIGHT	VPOS47 control right from PLC
800A30ED50	VPOS48-CTRL-RIGHT	VPOS48 control right from PLC
800A31ED50	VPOS49-CTRL-RIGHT	VPOS49 control right from PLC
800A32ED50	VPOS50-CTRL-RIGHT	VPOS50 control right from PLC
800A33ED50	VPOS51-CTRL-RIGHT	VPOS51 control right from PLC
800A34ED50	VPOS52-CTRL-RIGHT	VPOS52 control right from PLC
800A35ED50	VPOS53-CTRL-RIGHT	VPOS53 control right from PLC
800A36ED50	VPOS54-CTRL-RIGHT	VPOS54 control right from PLC
800A37ED50	VPOS55-CTRL-RIGHT	VPOS55 control right from PLC
800A38ED50	VPOS56-CTRL-RIGHT	VPOS56 control right from PLC
800A39ED50	VPOS57-CTRL-RIGHT	VPOS57 control right from PLC
800A3AED50	VPOS58-CTRL-RIGHT	VPOS58 control right from PLC
800A3BED50	VPOS59-CTRL-RIGHT	VPOS59 control right from PLC
800A3CED50	VPOS60-CTRL-RIGHT	VPOS60 control right from PLC
800A3DED50	VPOS61-CTRL-RIGHT	VPOS61 control right from PLC
800A3EED50	VPOS62-CTRL-RIGHT	VPOS62 control right from PLC
800A3FED50	VPOS63-CTRL-RIGHT	VPOS63 control right from PLC
800A40ED50	VPOS64-CTRL-RIGHT	VPOS64 control right from PLC

◆ Signal monitoring points for VPOS

VPOS(Function ID:522002)

Element ID	Name	Description
800A011D54	VPOS01-SC-LCD	VPOS01 switch select command by LCD
800A011D58	VPOS01-EC-LCD	VPOS01 switch operate command by LCD
800A011D57	VPOS01-EC	VPOS01 switch operate command by Remote
800A011D53	VPOS01-SC	VPOS01 switch select command by Remote
800A021D54	VPOS02-SC-LCD	VPOS02 switch select command by LCD
800A021D58	VPOS02-EC-LCD	VPOS2 switch operate command by LCD
800A021D57	VPOS02-EC	VPOS2 switch operate command by Remote
800A021D53	VPOS02-SC	VPOS2 switch select command by Remote
800A031D54	VPOS03-SC-LCD	VPOS03 switch select command by LCD
800A031D58	VPOS03-EC-LCD	VPOS3 switch operate command by LCD
800A031D57	VPOS03-EC	VPOS3 switch operate command by Remote
800A031D53	VPOS03-SC	VPOS3 switch select command by Remote
800A041D54	VPOS04-SC-LCD	VPOS04 switch select command by LCD
800A041D58	VPOS04-EC-LCD	VPOS4 switch operate command by LCD
800A041D57	VPOS04-EC	VPOS4 switch operate command by Remote
800A041D53	VPOS04-SC	VPOS4 switch select command by Remote
800A051D54	VPOS05-SC-LCD	VPOS05 switch select command by LCD
800A051D58	VPOS05-EC-LCD	VPOS5 switch operate command by LCD
800A051D57	VPOS05-EC	VPOS5 switch operate command by Remote
800A051D53	VPOS05-SC	VPOS5 switch select command by Remote
800A061D54	VPOS06-SC-LCD	VPOS06 switch select command by LCD
800A061D58	VPOS06-EC-LCD	VPOS6 switch operate command by LCD
800A061D57	VPOS06-EC	VPOS6 switch operate command by Remote
800A061D53	VPOS06-SC	VPOS6 switch select command by Remote
800A071D54	VPOS07-SC-LCD	VPOS07 switch select command by LCD
800A071D58	VPOS07-EC-LCD	VPOS7 switch operate command by LCD
800A071D57	VPOS07-EC	VPOS7 switch operate command by Remote
800A071D53	VPOS07-SC	VPOS7 switch select command by Remote
800A081D54	VPOS08-SC-LCD	VPOS08 switch select command by LCD
800A081D58	VPOS08-EC-LCD	VPOS8 switch operate command by LCD
800A081D57	VPOS08-EC	VPOS8 switch operate command by Remote
800A081D53	VPOS08-SC	VPOS8 switch select command by Remote
800A091D54	VPOS09-SC-LCD	VPOS09 switch select command by LCD
800A091D58	VPOS09-EC-LCD	VPOS9 switch operate command by LCD
800A091D57	VPOS09-EC	VPOS9 switch operate command by Remote
800A091D53	VPOS09-SC	VPOS9 switch select command by Remote
800A0A1D54	VPOS10-SC-LCD	VPOS10 switch select command by LCD
800A0A1D58	VPOS10-EC-LCD	VPOS10 switch operate command by LCD
800A0A1D57	VPOS10-EC	VPOS10 switch operate command by Remote
800A0A1D53	VPOS10-SC	VPOS10 switch select command by Remote
800A0B1D54	VPOS11-SC-LCD	VPOS11 switch select command by LCD
800A0B1D58	VPOS11-EC-LCD	VPOS11 switch operate command by LCD
800A0B1D57	VPOS11-EC	VPOS11 switch operate command by Remote
800A0B1D53	VPOS11-SC	VPOS11 switch select command by Remote

◆ Signal monitoring points for VPOS

VPOS(Function ID:522002)

Element ID	Name	Description
800A0C1D54	VPOS12-SC-LCD	VPOS12 switch select command by LCD
800A0C1D58	VPOS12-EC-LCD	VPOS12 switch operate command by LCD
800A0C1D57	VPOS12-EC	VPOS12 switch operate command by Remote
800A0C1D53	VPOS12-SC	VPOS12 switch select command by Remote
800A0D1D54	VPOS13-SC-LCD	VPOS13 switch select command by LCD
800A0D1D58	VPOS13-EC-LCD	VPOS13 switch operate command by LCD
800A0D1D57	VPOS13-EC	VPOS13 switch operate command by Remote
800A0D1D53	VPOS13-SC	VPOS13 switch select command by Remote
800A0E1D54	VPOS14-SC-LCD	VPOS14 switch select command by LCD
800A0E1D58	VPOS14-EC-LCD	VPOS14 switch operate command by LCD
800A0E1D57	VPOS14-EC	VPOS14 switch operate command by Remote
800A0E1D53	VPOS14-SC	VPOS14 switch select command by Remote
800A0F1D54	VPOS15-SC-LCD	VPOS15 switch select command by LCD
800A0F1D58	VPOS15-EC-LCD	VPOS15 switch operate command by LCD
800A0F1D57	VPOS15-EC	VPOS15 switch operate command by Remote
800A0F1D53	VPOS15-SC	VPOS15 switch select command by Remote
800A101D54	VPOS16-SC-LCD	VPOS16 switch select command by LCD
800A101D58	VPOS16-EC-LCD	VPOS16 switch operate command by LCD
800A101D57	VPOS16-EC	VPOS16 switch operate command by Remote
800A101D53	VPOS16-SC	VPOS16 switch select command by Remote
800A111D54	VPOS17-SC-LCD	VPOS17 switch select command by LCD
800A111D58	VPOS17-EC-LCD	VPOS17 switch operate command by LCD
800A111D57	VPOS17-EC	VPOS17 switch operate command by Remote
800A111D53	VPOS17-SC	VPOS17 switch select command by Remote
800A121D54	VPOS18-SC-LCD	VPOS18 switch select command by LCD
800A121D58	VPOS18-EC-LCD	VPOS18 switch operate command by LCD
800A121D57	VPOS18-EC	VPOS18 switch operate command by Remote
800A121D53	VPOS18-SC	VPOS18 switch select command by Remote
800A131D54	VPOS19-SC-LCD	VPOS19 switch select command by LCD
800A131D58	VPOS19-EC-LCD	VPOS19 switch operate command by LCD
800A131D57	VPOS19-EC	VPOS19 switch operate command by Remote
800A131D53	VPOS19-SC	VPOS19 switch select command by Remote
800A141D54	VPOS20-SC-LCD	VPOS20 switch select command by LCD
800A141D58	VPOS20-EC-LCD	VPOS20 switch operate command by LCD
800A141D57	VPOS20-EC	VPOS20 switch operate command by Remote
800A141D53	VPOS20-SC	VPOS20 switch select command by Remote
800A151D54	VPOS21-SC-LCD	VPOS21 switch select command by LCD
800A151D58	VPOS21-EC-LCD	VPOS21 switch operate command by LCD
800A151D57	VPOS21-EC	VPOS21 switch operate command by Remote
800A151D53	VPOS21-SC	VPOS21 switch select command by Remote
800A161D54	VPOS22-SC-LCD	VPOS22 switch select command by LCD
800A161D58	VPOS22-EC-LCD	VPOS22 switch operate command by LCD
800A161D57	VPOS22-EC	VPOS22 switch operate command by Remote
800A161D53	VPOS22-SC	VPOS22 switch select command by Remote

◆ Signal monitoring points for VPOS

VPOS(Function ID:522002)

Element ID	Name	Description
800A171D54	VPOS23-SC-LCD	VPOS23 switch select command by LCD
800A171D58	VPOS23-EC-LCD	VPOS23 switch operate command by LCD
800A171D57	VPOS23-EC	VPOS23 switch operate command by Remote
800A171D53	VPOS23-SC	VPOS23 switch select command by Remote
800A181D54	VPOS24-SC-LCD	VPOS24 switch select command by LCD
800A181D58	VPOS24-EC-LCD	VPOS24 switch operate command by LCD
800A181D57	VPOS24-EC	VPOS24 switch operate command by Remote
800A181D53	VPOS24-SC	VPOS24 switch select command by Remote
800A191D54	VPOS25-SC-LCD	VPOS25 switch select command by LCD
800A191D58	VPOS25-EC-LCD	VPOS25 switch operate command by LCD
800A191D57	VPOS25-EC	VPOS25 switch operate command by Remote
800A191D53	VPOS25-SC	VPOS25 switch select command by Remote
800A1A1D54	VPOS26-SC-LCD	VPOS26 switch select command by LCD
800A1A1D58	VPOS26-EC-LCD	VPOS26 switch operate command by LCD
800A1A1D57	VPOS26-EC	VPOS26 switch operate command by Remote
800A1A1D53	VPOS26-SC	VPOS26 switch select command by Remote
800A1B1D54	VPOS27-SC-LCD	VPOS27 switch select command by LCD
800A1B1D58	VPOS27-EC-LCD	VPOS27 switch operate command by LCD
800A1B1D57	VPOS27-EC	VPOS27 switch operate command by Remote
800A1B1D53	VPOS27-SC	VPOS27 switch select command by Remote
800A1C1D54	VPOS28-SC-LCD	VPOS28 switch select command by LCD
800A1C1D58	VPOS28-EC-LCD	VPOS28 switch operate command by LCD
800A1C1D57	VPOS28-EC	VPOS28 switch operate command by Remote
800A1C1D53	VPOS28-SC	VPOS28 switch select command by Remote
800A1D1D54	VPOS29-SC-LCD	VPOS29 switch select command by LCD
800A1D1D58	VPOS29-EC-LCD	VPOS29 switch operate command by LCD
800A1D1D57	VPOS29-EC	VPOS29 switch operate command by Remote
800A1D1D53	VPOS29-SC	VPOS29 switch select command by Remote
800A1E1D54	VPOS30-SC-LCD	VPOS30 switch select command by LCD
800A1E1D58	VPOS30-EC-LCD	VPOS30 switch operate command by LCD
800A1E1D57	VPOS30-EC	VPOS30 switch operate command by Remote
800A1E1D53	VPOS30-SC	VPOS30 switch select command by Remote
800A1F1D54	VPOS31-SC-LCD	VPOS31 switch select command by LCD
800A1F1D58	VPOS31-EC-LCD	VPOS31 switch operate command by LCD
800A1F1D57	VPOS31-EC	VPOS31 switch operate command by Remote
800A1F1D53	VPOS31-SC	VPOS31 switch select command by Remote
800A201D54	VPOS32-SC-LCD	VPOS32 switch select command by LCD
800A201D58	VPOS32-EC-LCD	VPOS32 switch operate command by LCD
800A201D57	VPOS32-EC	VPOS32 switch operate command by Remote
800A201D53	VPOS32-SC	VPOS32 switch select command by Remote
800A211D54	VPOS33-SC-LCD	VPOS33 switch select command by LCD
800A211D58	VPOS33-EC-LCD	VPOS33 switch operate command by LCD
800A211D57	VPOS33-EC	VPOS33 switch operate command by Remote
800A211D53	VPOS33-SC	VPOS33 switch select command by Remote

◆ Signal monitoring points for VPOS

VPOS(Function ID:522002)

Element ID	Name	Description
800A221D54	VPOS34-SC-LCD	VPOS34 switch select command by LCD
800A221D58	VPOS34-EC-LCD	VPOS34 switch operate command by LCD
800A221D57	VPOS34-EC	VPOS34 switch operate command by Remote
800A221D53	VPOS34-SC	VPOS34 switch select command by Remote
800A231D54	VPOS35-SC-LCD	VPOS35 switch select command by LCD
800A231D58	VPOS35-EC-LCD	VPOS35 switch operate command by LCD
800A231D57	VPOS35-EC	VPOS35 switch operate command by Remote
800A231D53	VPOS35-SC	VPOS35 switch select command by Remote
800A241D54	VPOS36-SC-LCD	VPOS36 switch select command by LCD
800A241D58	VPOS36-EC-LCD	VPOS36 switch operate command by LCD
800A241D57	VPOS36-EC	VPOS36 switch operate command by Remote
800A241D53	VPOS36-SC	VPOS36 switch select command by Remote
800A251D54	VPOS37-SC-LCD	VPOS37 switch select command by LCD
800A251D58	VPOS37-EC-LCD	VPOS37 switch operate command by LCD
800A251D57	VPOS37-EC	VPOS37 switch operate command by Remote
800A251D53	VPOS37-SC	VPOS37 switch select command by Remote
800A261D54	VPOS38-SC-LCD	VPOS38 switch select command by LCD
800A261D58	VPOS38-EC-LCD	VPOS38 switch operate command by LCD
800A261D57	VPOS38-EC	VPOS38 switch operate command by Remote
800A261D53	VPOS38-SC	VPOS38 switch select command by Remote
800A271D54	VPOS39-SC-LCD	VPOS39 switch select command by LCD
800A271D58	VPOS39-EC-LCD	VPOS39 switch operate command by LCD
800A271D57	VPOS39-EC	VPOS39 switch operate command by Remote
800A271D53	VPOS39-SC	VPOS39 switch select command by Remote
800A281D54	VPOS40-SC-LCD	VPOS40 switch select command by LCD
800A281D58	VPOS40-EC-LCD	VPOS40 switch operate command by LCD
800A281D57	VPOS40-EC	VPOS40 switch operate command by Remote
800A281D53	VPOS40-SC	VPOS40 switch select command by Remote
800A291D54	VPOS41-SC-LCD	VPOS41 switch select command by LCD
800A291D58	VPOS41-EC-LCD	VPOS41 switch operate command by LCD
800A291D57	VPOS41-EC	VPOS41 switch operate command by Remote
800A291D53	VPOS41-SC	VPOS41 switch select command by Remote
800A2A1D54	VPOS42-SC-LCD	VPOS42 switch select command by LCD
800A2A1D58	VPOS42-EC-LCD	VPOS42 switch operate command by LCD
800A2A1D57	VPOS42-EC	VPOS42 switch operate command by Remote
800A2A1D53	VPOS42-SC	VPOS42 switch select command by Remote
800A2B1D54	VPOS43-SC-LCD	VPOS43 switch select command by LCD
800A2B1D58	VPOS43-EC-LCD	VPOS43 switch operate command by LCD
800A2B1D57	VPOS43-EC	VPOS43 switch operate command by Remote
800A2B1D53	VPOS43-SC	VPOS43 switch select command by Remote
800A2C1D54	VPOS44-SC-LCD	VPOS44 switch select command by LCD
800A2C1D58	VPOS44-EC-LCD	VPOS44 switch operate command by LCD
800A2C1D57	VPOS44-EC	VPOS44 switch operate command by Remote
800A2C1D53	VPOS44-SC	VPOS44 switch select command by Remote

◆ Signal monitoring points for VPOS

VPOS(Function ID:522002)

Element ID	Name	Description
800A2D1D54	VPOS45-SC-LCD	VPOS45 switch select command by LCD
800A2D1D58	VPOS45-EC-LCD	VPOS45 switch operate command by LCD
800A2D1D57	VPOS45-EC	VPOS45 switch operate command by Remote
800A2D1D53	VPOS45-SC	VPOS45 switch select command by Remote
800A2E1D54	VPOS46-SC-LCD	VPOS46 switch select command by LCD
800A2E1D58	VPOS46-EC-LCD	VPOS46 switch operate command by LCD
800A2E1D57	VPOS46-EC	VPOS46 switch operate command by Remote
800A2E1D53	VPOS46-SC	VPOS46 switch select command by Remote
800A2F1D54	VPOS47-SC-LCD	VPOS47 switch select command by LCD
800A2F1D58	VPOS47-EC-LCD	VPOS47 switch operate command by LCD
800A2F1D57	VPOS47-EC	VPOS47 switch operate command by Remote
800A2F1D53	VPOS47-SC	VPOS47 switch select command by Remote
800A301D54	VPOS48-SC-LCD	VPOS48 switch select command by LCD
800A301D58	VPOS48-EC-LCD	VPOS48 switch operate command by LCD
800A301D57	VPOS48-EC	VPOS48 switch operate command by Remote
800A301D53	VPOS48-SC	VPOS48 switch select command by Remote
800A311D54	VPOS49-SC-LCD	VPOS49 switch select command by LCD
800A311D58	VPOS49-EC-LCD	VPOS49 switch operate command by LCD
800A311D57	VPOS49-EC	VPOS49 switch operate command by Remote
800A311D53	VPOS49-SC	VPOS49 switch select command by Remote
800A321D54	VPOS50-SC-LCD	VPOS50 switch select command by LCD
800A321D58	VPOS50-EC-LCD	VPOS50 switch operate command by LCD
800A321D57	VPOS50-EC	VPOS50 switch operate command by Remote
800A321D53	VPOS50-SC	VPOS50 switch select command by Remote
800A331D54	VPOS51-SC-LCD	VPOS51 switch select command by LCD
800A331D58	VPOS51-EC-LCD	VPOS51 switch operate command by LCD
800A331D57	VPOS51-EC	VPOS51 switch operate command by Remote
800A331D53	VPOS51-SC	VPOS51 switch select command by Remote
800A341D54	VPOS52-SC-LCD	VPOS52 switch select command by LCD
800A341D58	VPOS52-EC-LCD	VPOS52 switch operate command by LCD
800A341D57	VPOS52-EC	VPOS52 switch operate command by Remote
800A341D53	VPOS52-SC	VPOS52 switch select command by Remote
800A351D54	VPOS53-SC-LCD	VPOS53 switch select command by LCD
800A351D58	VPOS53-EC-LCD	VPOS53 switch operate command by LCD
800A351D57	VPOS53-EC	VPOS53 switch operate command by Remote
800A351D53	VPOS53-SC	VPOS53 switch select command by Remote
800A361D54	VPOS54-SC-LCD	VPOS54 switch select command by LCD
800A361D58	VPOS54-EC-LCD	VPOS54 switch operate command by LCD
800A361D57	VPOS54-EC	VPOS54 switch operate command by Remote
800A361D53	VPOS54-SC	VPOS54 switch select command by Remote
800A371D54	VPOS55-SC-LCD	VPOS55 switch select command by LCD
800A371D58	VPOS55-EC-LCD	VPOS55 switch operate command by LCD
800A371D57	VPOS55-EC	VPOS55 switch operate command by Remote
800A371D53	VPOS55-SC	VPOS55 switch select command by Remote

◆ Signal monitoring points for VPOS

VPOS(Function ID:522002)

Element ID	Name	Description
800A381D54	VPOS56-SC-LCD	VPOS56 switch select command by LCD
800A381D58	VPOS56-EC-LCD	VPOS56 switch operate command by LCD
800A381D57	VPOS56-EC	VPOS56 switch operate command by Remote
800A381D53	VPOS56-SC	VPOS56 switch select command by Remote
800A391D54	VPOS57-SC-LCD	VPOS57 switch select command by LCD
800A391D58	VPOS57-EC-LCD	VPOS57 switch operate command by LCD
800A391D57	VPOS57-EC	VPOS57 switch operate command by Remote
800A391D53	VPOS57-SC	VPOS57 switch select command by Remote
800A3A1D54	VPOS58-SC-LCD	VPOS58 switch select command by LCD
800A3A1D58	VPOS58-EC-LCD	VPOS58 switch operate command by LCD
800A3A1D57	VPOS58-EC	VPOS58 switch operate command by Remote
800A3A1D53	VPOS58-SC	VPOS58 switch select command by Remote
800A3B1D54	VPOS59-SC-LCD	VPOS59 switch select command by LCD
800A3B1D58	VPOS59-EC-LCD	VPOS59 switch operate command by LCD
800A3B1D57	VPOS59-EC	VPOS59 switch operate command by Remote
800A3B1D53	VPOS59-SC	VPOS59 switch select command by Remote
800A3C1D54	VPOS60-SC-LCD	VPOS60 switch select command by LCD
800A3C1D58	VPOS60-EC-LCD	VPOS60 switch operate command by LCD
800A3C1D57	VPOS60-EC	VPOS60 switch operate command by Remote
800A3C1D53	VPOS60-SC	VPOS60 switch select command by Remote
800A3D1D54	VPOS61-SC-LCD	VPOS61 switch select command by LCD
800A3D1D58	VPOS61-EC-LCD	VPOS61 switch operate command by LCD
800A3D1D57	VPOS61-EC	VPOS61 switch operate command by Remote
800A3D1D53	VPOS61-SC	VPOS61 switch select command by Remote
800A3E1D54	VPOS62-SC-LCD	VPOS62 switch select command by LCD
800A3E1D58	VPOS62-EC-LCD	VPOS62 switch operate command by LCD
800A3E1D57	VPOS62-EC	VPOS62 switch operate command by Remote
800A3E1D53	VPOS62-SC	VPOS62 switch select command by Remote
800A3F1D54	VPOS63-SC-LCD	VPOS63 switch select command by LCD
800A3F1D58	VPOS63-EC-LCD	VPOS63 switch operate command by LCD
800A3F1D57	VPOS63-EC	VPOS63 switch operate command by Remote
800A3F1D53	VPOS63-SC	VPOS63 switch select command by Remote
800A401D54	VPOS64-SC-LCD	VPOS64 switch select command by LCD
800A401D58	VPOS64-EC-LCD	VPOS64 switch operate command by LCD
800A401D57	VPOS64-EC	VPOS64 switch operate command by Remote
800A401D53	VPOS64-SC	VPOS64 switch select command by Remote

2.13 Tap controller (TAP-BCD)

2.13.1 Overview

A tap controller (TAP-BCD) function is provided for the control of an on-load-tap-changer (OLTC); the TAP-BCD function acquires tap-position values using binary coded decimal (BCD). The TAP-BCD function measures the tap-position values using five digits including a plus or minus sign. The user can also use the TAB-BCD function to measure the oil-temperature or the gas-pressure in addition to the tap-position indicator‡.

When a control command is issued, the tap position is tapped upwards if a “Rise command” has been issued; conversely, the tap position is tapped downwards if a “Lower command” has been issued by the TAP-BCD function.

Figure 2.13-1 provides an example; the TAP-BCD function is connected with the OLTC function via binary input/output modules (BIOs§). In the figure, the tap is located at Position-14; hence, the tap-value “14” is measured. The digit “4” is set at the one’s place and digit “1” is set at the ten’s place of the tap-value; therefore, the digit “4” is converted into “0,1,0,0” using 4-bits by the first digital-transducer; likewise the digit “1” is converted into “0,0,0,1” by the second digital-transducer. Binary input circuits (BIs§) are ready to receive the bit-signals; the TAP-BCD function issues a command using a binary output circuit (BO§). The user is required to make the connection using settings, which are discussed in later sections.

The user can control the TAP-BCD function from a remote terminal. For remote terminal operation, the user should setup the IEC 61850 communication. We shall see the parameters used in the IEC61850 communication later.

†Note: For transformers connected to the same busbar operating in parallel the transformer parallel interlocking (TPI) function can be used, the TAP-BCD function can collaborate using the TPI system such that changing the transformer tap-positions is mutually synchronized. The TPI function is discussed later.

‡Note:The TAP-BCD function is not only designed for the acquisition of the tap value of the OLTC. That is, the user can utilize the TAP-BCD function for a conventional object, such as a temperature, a pressure, and so on. On this account, the TAP-BCD function has a weighing factor (0.01, 0.1 or 1) to compensate the measured value. For example, when the user selects 0.01 as the weighing factor, the measured value is multiplied by 0.01. The TAP-BCD function can also provide the signed value, when a plus/minus transducer is available.

§Note: For more information concerning the BIO, BO and BI, see chapter Technical description: Binary IO module.

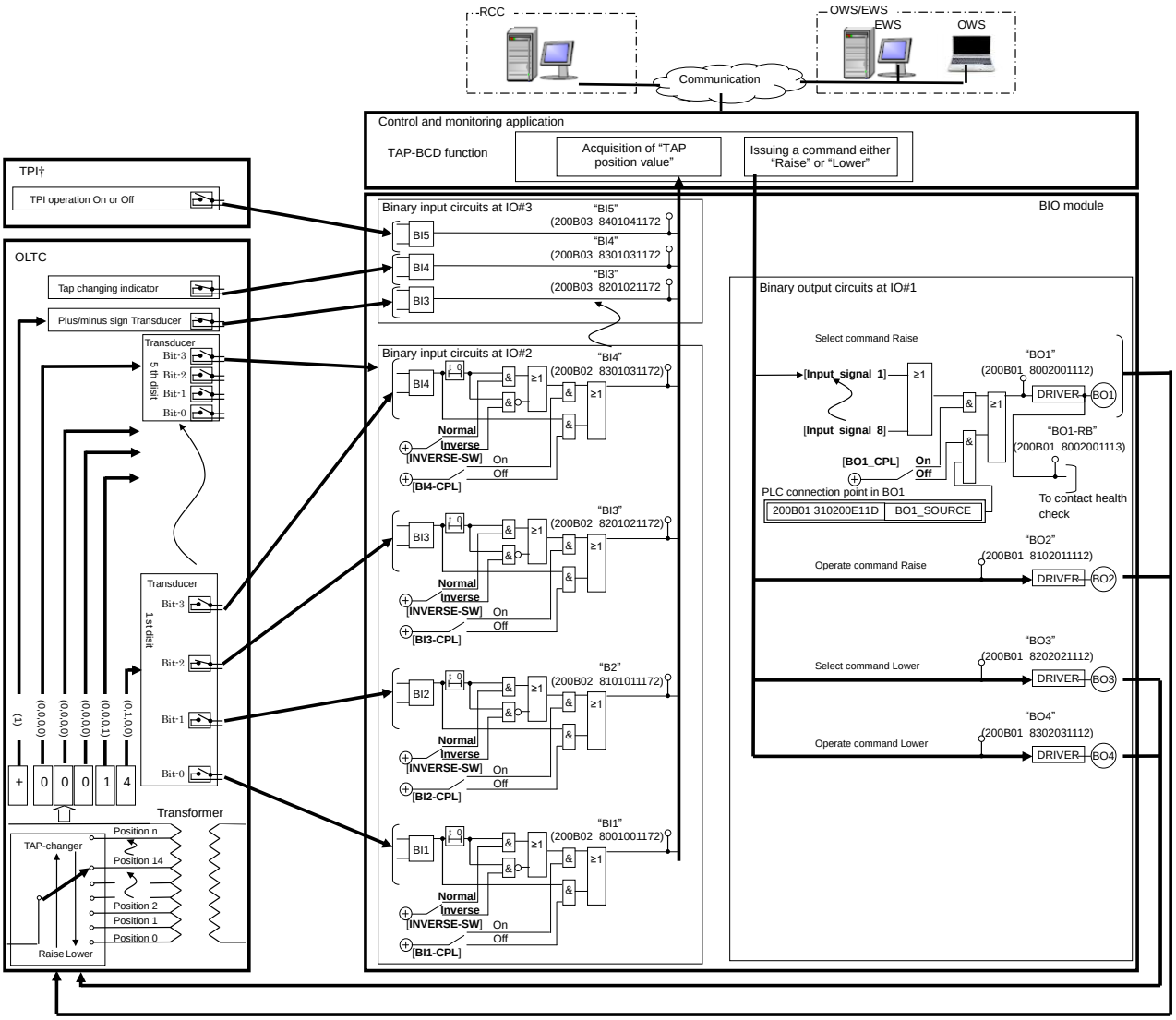


Figure 2.13-1 OLTC controlled by TAP-BCD via BIO

Note: The implementation of such features is dependent upon the selection of hardware and the configuration of functions. Several IED models do not support certain features. To determine whether a particular feature is implemented within an IED, identify the IED ordering number; and check the order number at the "G&T position" whilst referring to the comparison table below. For more information, see *Appendix: Ordering*.

Table 2.13-1 Comparative table in respective ordering numbers

Sec.	Feature	Ordering No. at "G&T"					
		BCU			BCPU		IFU
		11	13	1F	2N	2C	19
–	Main features	✓	✓	✓	✓	✓	NA
–	Number of functions	1	1	1	1	1	–

✓: Applicable NA: Not applicable

2.13.2 Select logics for SBO/DIR mode

The user should set scheme switch [**BCD01-CTREN**] to **On** prior to TAP-BCD operation. Table 2.13-10 shows all of the scheme switches in the TAP-BCD function.

(i) Receiving "Select command Raise" from the remote-end

Figure 2.13-2 outlines the reception of the "Select command Raise" from the remote end.

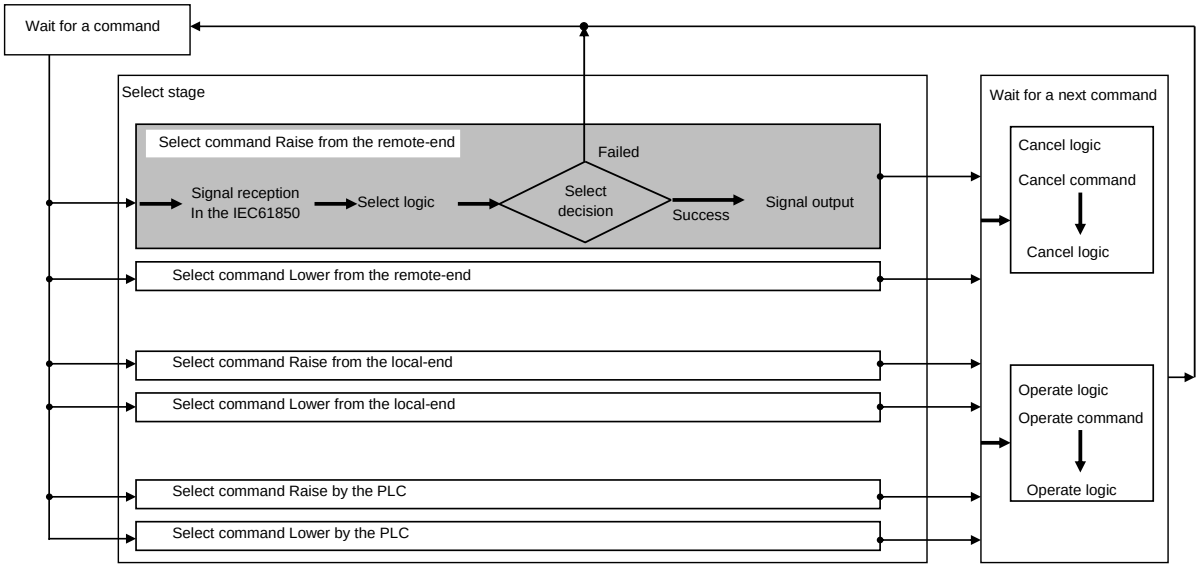


Figure 2.13-2 Outline of Select command 'Raise'

(i)-1 Input point required mapping

Figure 2.13-2 shows the select logic when a "Select command Raise (Remote-Raise-Control)" signal is applied to the TAP-BCD function.

This logic has the input-point "DEV01_CONTROL_REQ" for the reception of a select command. That is, the input-point must be mapped for communication. The IED will fail to operate if mapping is not performed correctly. We will discuss how to map the input-points to IEC 61850 communication in section 2.13.8.

(i)-2 Output signal to BO

The TAP-BCD function can issue an output signal "Select success" at the output point "BCD01_UPSL_BO_FLG", when the TAP-BCD function determines that the "Remote-Raise-Control" signal received is true. If the TAP-BCD function determines that the "Remote-Raise-Control" signal is not true, the TAP-BCD function returns to the "Wait for a command" stage.

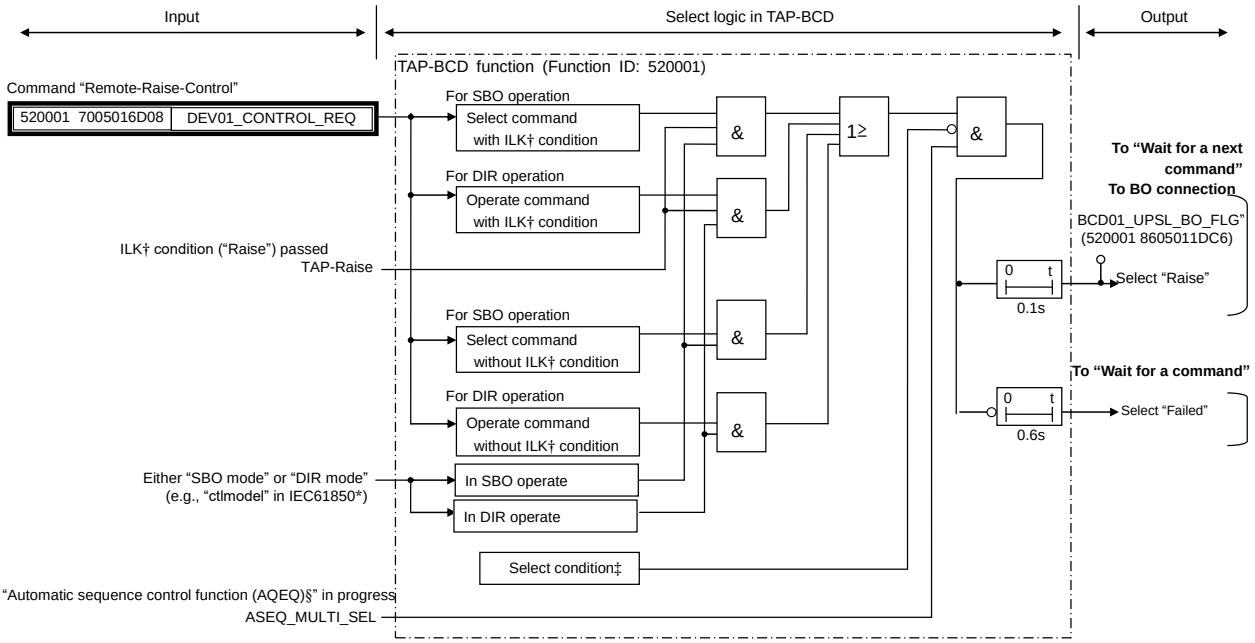


Figure 2.13-3 Select Raise from the remote-end

†Note: The software interlocking (ILK) function provides the operation criteria for "Raise" control. The ILK function is discussed separately; note that the condition is defined by the ILK function itself (i.e., the user cannot set the condition).

‡Note: A "select condition" signal is provided from the select condition scheme. For more information, see Figure 2.13-14.

§Note: An automatic sequence control (ASEQ) function can provide sequential signals for automatic control. The TAP-BCD operation is blocked for the ASEQ function being in operation. For more information of the ASEQ function, see Chapter *Control and monitoring application: Automatic sequence control function*.

*Note: The TAP-BCD function can run in either the "SBO mode" or the "DIR mode" using a signal called "ctlmodel" when communication is implemented using IEC61850. To use this signal the user must map it for IEC 61850 communication.

(ii) Receiving “Select command Lower” from the remote-end

Figure 2.13-4 outlines the reception of the select command ‘Lower’ from the remote-end.

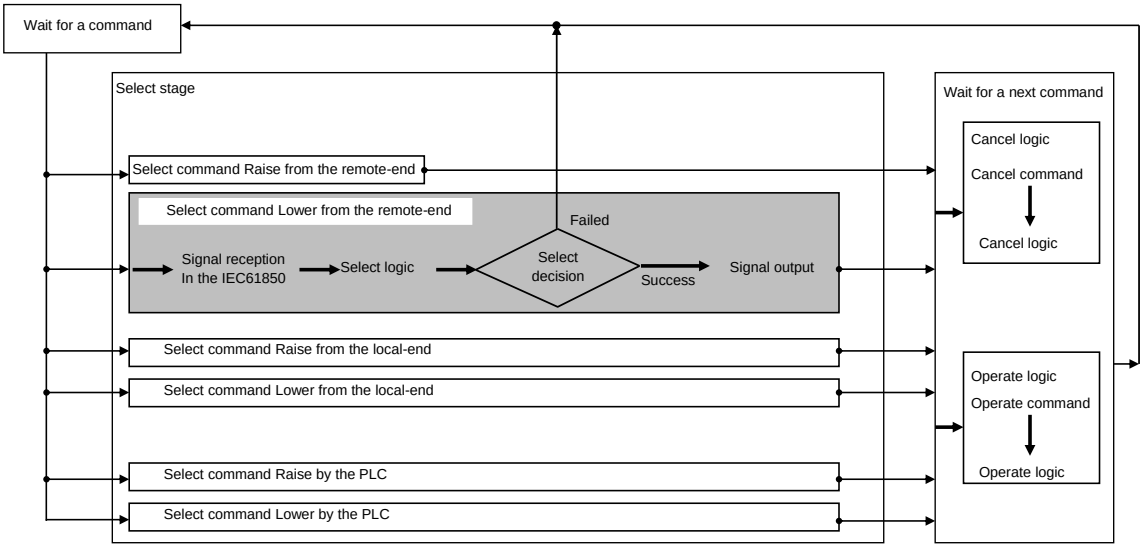


Figure 2.13-4 Outline of Select command ‘Lower’

(ii)-1 Input point mapped for the communication

Figure 2.13-5 shows the select logic when a “Select command Lower (Remote-Lower-Control)” signal is applied to the TAP-BCD function. The input-point “DEV01_CONTROL_REQ” is used for the reception of the “Select command (Remote-Lower-Control)” signal.

(ii)-2 Output signal to BO

The TAP-BCD function, in Figure 2.13-5, can issue a “Select success” signal at the output point “BCD01_DOWNSL_BO_FLG” when the BCD01 function determines that the received “Select command Lower (Remote-Lower-Control)” signal is true. If the TAP-BCD function determines that the “Remote-Lower-Control” signal is not true, the TAP-BCD function returns to the “Wait for a command” stage.

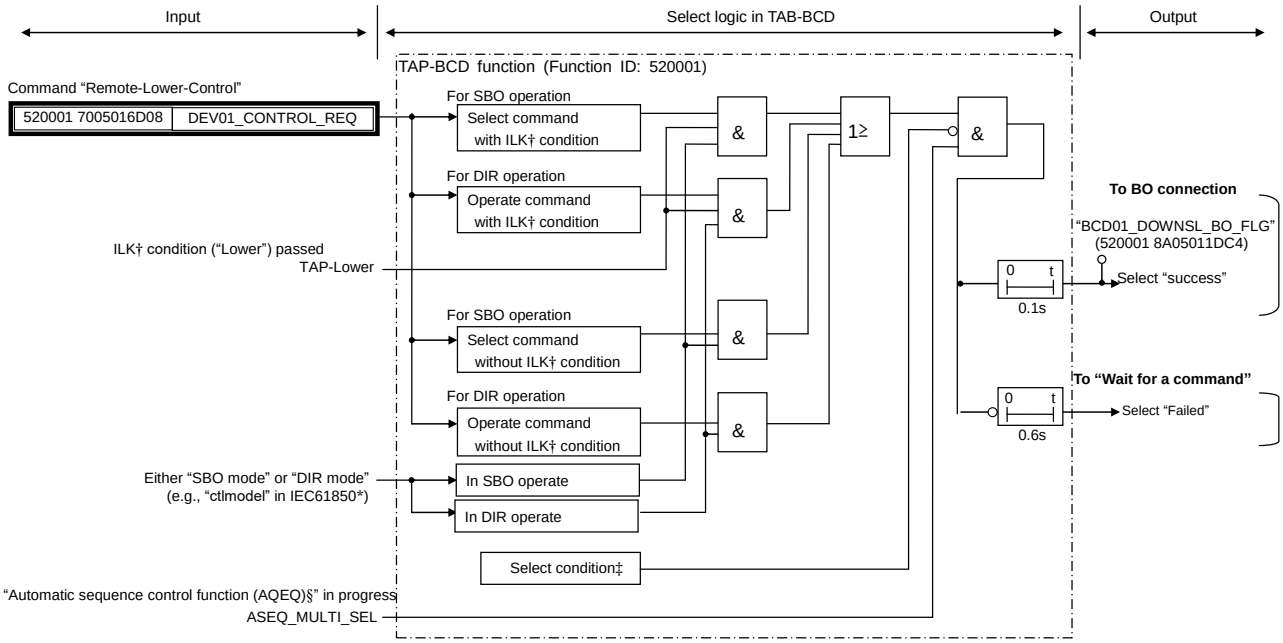


Figure 2.13-5 Select logic for Lower from the remote-end

†Note:The ILK function can provide the operation criteria for “Lower” control.

‡Note:The “select condition” signal is also provided. See Figure 2.13-14.

(iii) Receiving "Select command Raise" from the local-end

Figure 2.13-6 outlines the reception of the "select command Raise" from the local-end.

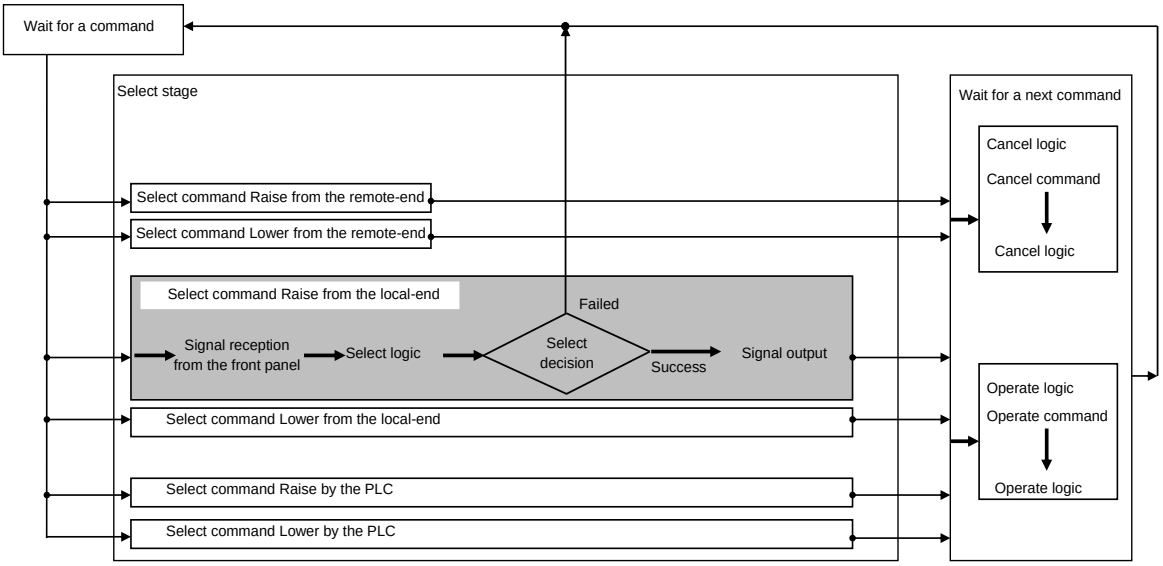


Figure 2.13-6 Outline of Select command 'Raise'

(iii)-1 Input signal generated at the local-end

Figure 2.13-7 shows the select logic when a "Select command Raise (Local-Raise-Control)" signal is applied to the TAP-BCD function. The signal is provided when a "Raise" key pressed on the IED front panel; the user is not required to map the signal from the IEC 61850 communication. Note that the user should set the scheme switch [**BCD01-CTRAHMI**] to **SBO** when operation from the IED front panel is required, we discuss how to set this in chapter *User interface: Control sub-menu*.

(iii)-2 Output signal to BO

When the signal "select condition" is true, the TAP-BCD function can issue a "Select success" signal at the output-point "BCD01_UPSL_BO_FLG".

Note: The signal "BCD01_UPSL_BO_CSF" is the same as the signal shown in Figure 2.13-3. If the, "Local-Raise-Control" signal is not true, the TAP-BCD function returns to the "Wait for a command" stage.

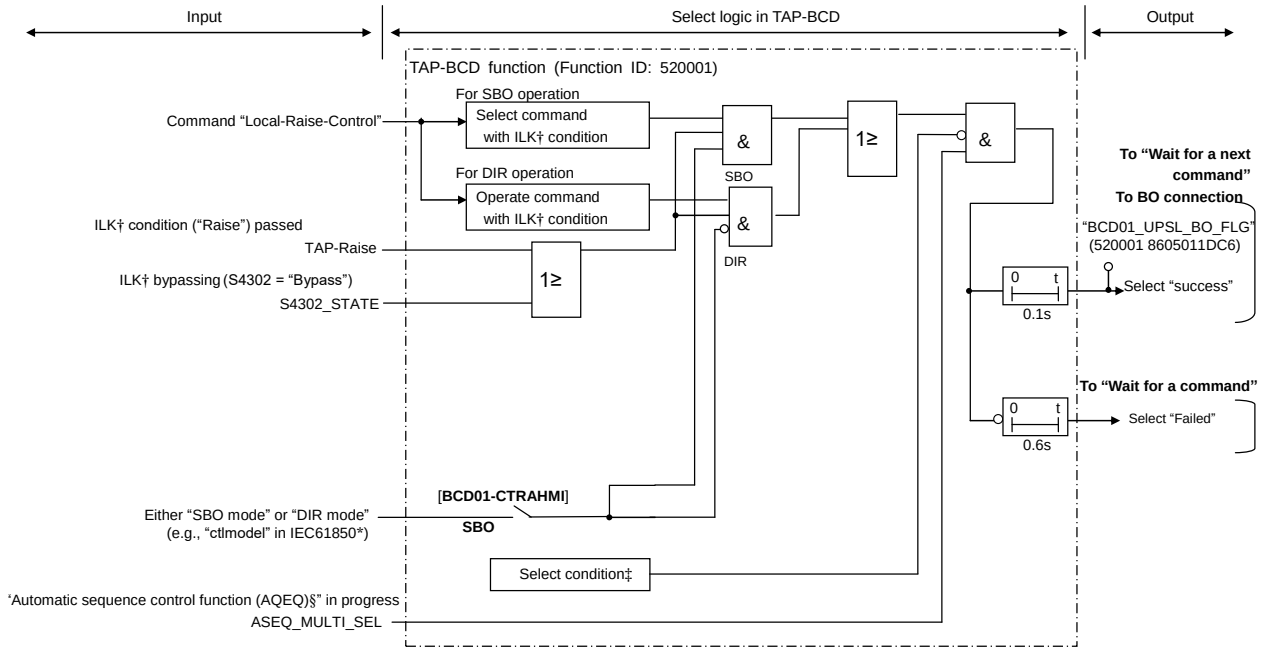


Figure 2.13-7 Select Raise on the front panel

†Note: The ILK function provides the operation criterion for "On". For testing, nullifying the ILK function is possible using "Interlock bypassing". "Interlock bypassing" is indicated by the status of "S4302" in a software switch controller (SOTFSW).

‡Note: A "select condition" signal is provided from the select condition scheme. For more information, see Figure 2.13-14.

§Note: The TAP-BCD operation is blocked for the ASEQ function when it is in operation.

(iv) Receiving “Select command Lower” from the local-end

Figure 2.13-8 outlines the reception of the select command ‘Lower’ from the local-end.

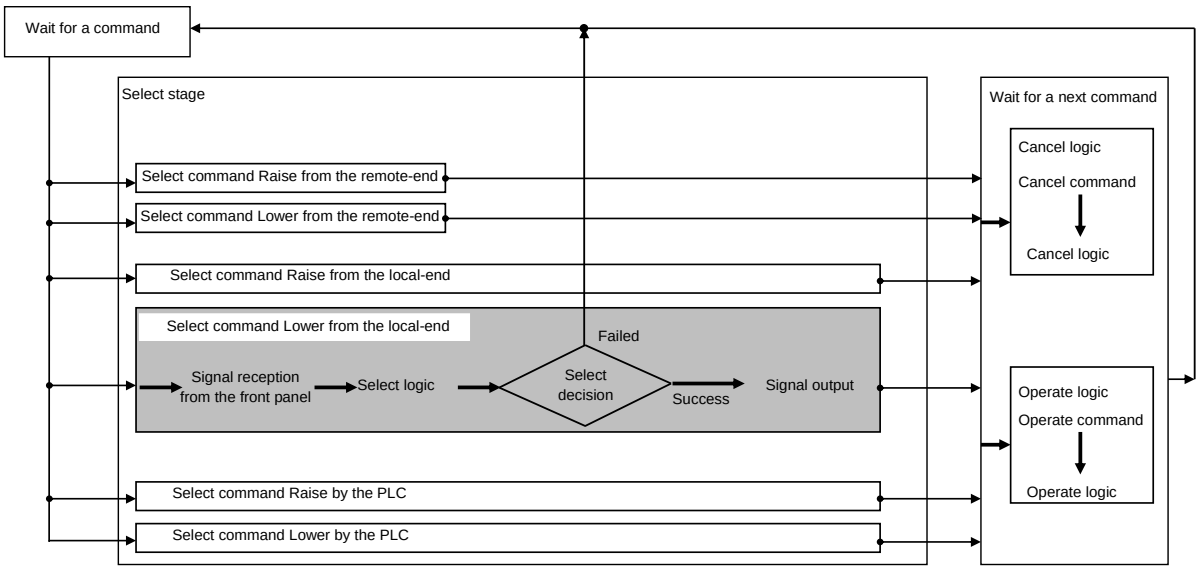


Figure 2.13-8 Outline of Select command ‘Lower’

(iv)-1 Input signal generated at the local-end

Figure 2.13-9 shows the selection logic when a “Select command Lower (Local-Lower-Control)” signal is applied to the TAP-BCD function. The signal is provided when the user presses a “Select command lower” key on the IED front panel; the user is not required to map the signal from IEC 61850 communication.

(iv)-2 Output signal to BO

When the “select condition” signal is true, the TAP-BCD function can issue a “Select success” signal at the output-point “BCD01_DOWNSL_BO_FLG”.

[1]Note: The signal “BCD01_DOWNSL_BO_FLG” is the same as the signal shown in Figure 2.13-5. If the signal “Local-Lower-Control” is not true, the TAP-BCD function returns to the “Wait for a command” stage.

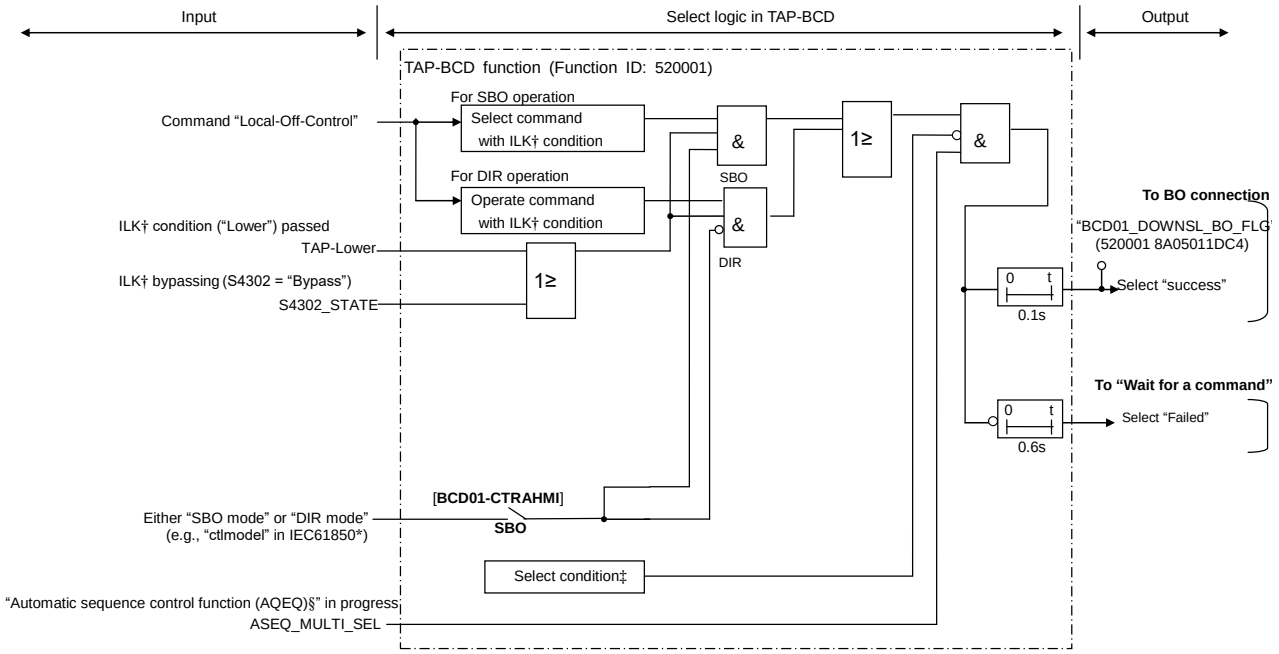


Figure 2.13-9 Select 'Lower' on the front panel

†Note: The ILK function provides the operation criteria for "Off".

‡Note: A "select condition" signal is provided from the select condition scheme. For more information, see Figure 2.13-14.

§Note: An automatic sequence control (ASEQ) function can provide sequential signals for automatic control. The TAP-BCD operation is blocked for the ASEQ function when it is in operation. For more information regarding the ASEQ function, see Chapter *Control and monitoring application: Automatic sequence control function*.

(v) Receiving "Select command Raise" using the PLC function

Figure 2.13-10 outlines the reception of the "select command Raise" using the PLC function.

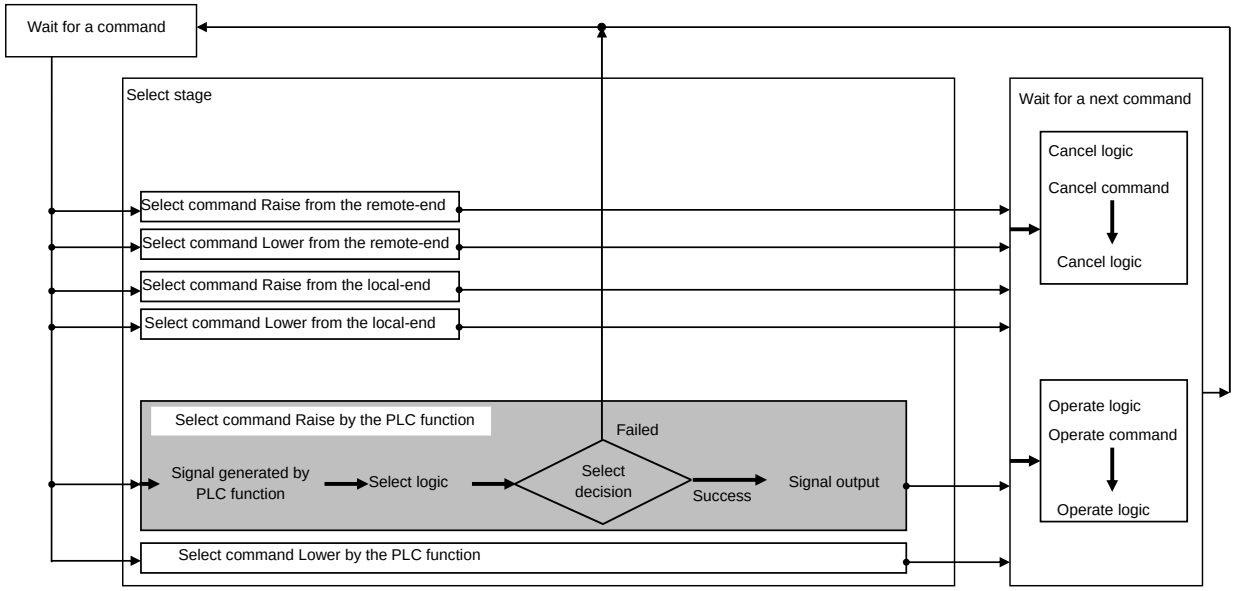


Figure 2.13-10 Outline of Select command 'Raise'

(v)-1 Input signal required to connect

Figure 2.13-11 shows that the select logic, when a "Select command Raise (PLC-Raise-Control)" is received in the TAP-BCD function. The signal is generated using the user- programmed PLC logic; the user is required to make the connection using connection point "PLC_BOOL_3" when the TAP-BCD operation does not require the ILK condition. Alternatively, the connection point "PLC_BOOL_4" is used when the ILK condition is required for the TAP-BCD operation.

(v)-2 Output signal to BO

The TAP-BCD function, in Figure 2.13-11, can issue a "Select success" signal at the output-point "BCD01_UPSL_BO_FLG"[1].

[1]Note: The signal "BCD01_UPSL_BO_FLG" is the same signal as that shown in Figure 2.13-3.

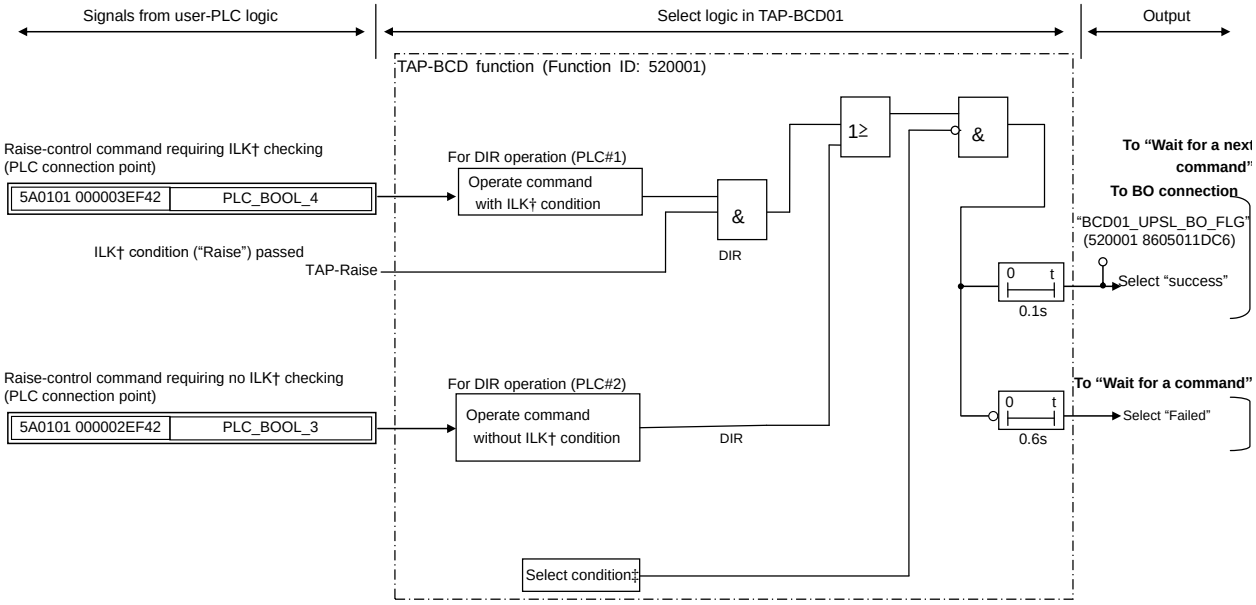


Figure 2.13-11 Select 'Raise' using the PLC function

(vi) Receiving "Select command Lower" using the PLC function

Figure 2.13-12 outlines the reception of the select command 'Lower' using the PLC function.

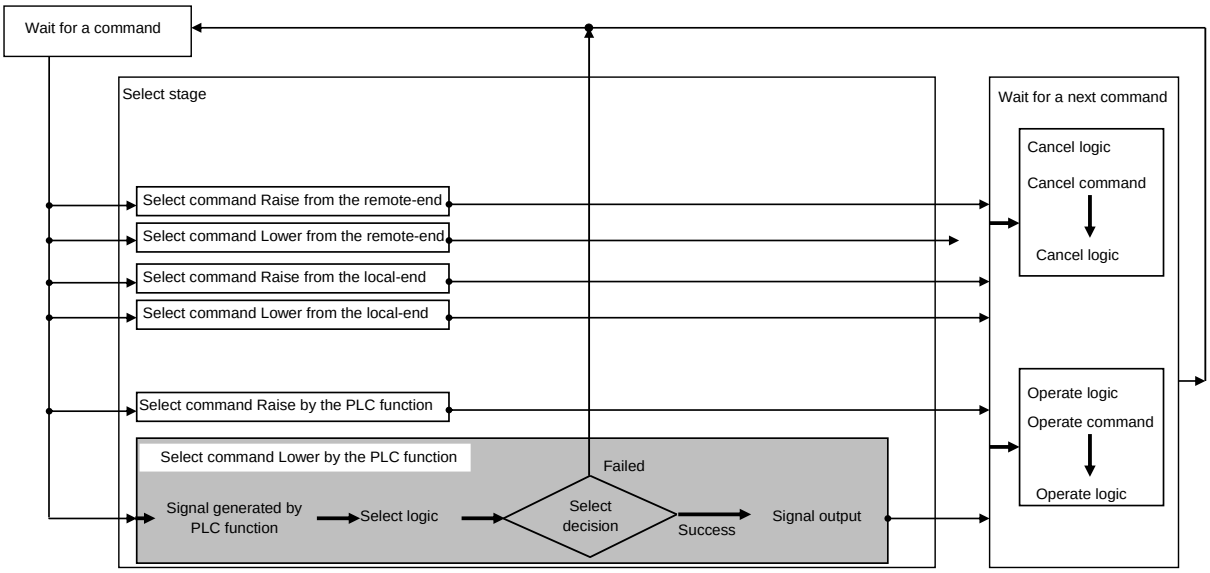


Figure 2.13-12 Outline of Select command 'Lower'

(vi)-1 Input signal required to connect

Figure 2.13-13 shows the TAP-BCD logic for the input signal "Select command Lower (PLC-Lower-Control)". The input signal is generated using the user- programmed PLC logic; the user can make the connection with the connection point "PLC_BOOL_1" when the TAP-BCD operation does not require the ILK condition. The user can make the connection using connection point "PLC_BOOL_2" when the ILK condition is required for the TAP-BCD operation.

(vi)-2 Output signal to BO

The TAP-BCD function, in Figure 2.13-13, can issue a "Select success" signal at the output point "BCD01_DOWNSL_BO_FLG"[1].

[1]Note: The output point "BCD01_DOWNSL_BO_FLG" is similar to the signal as shown in Figure 2.13-5.

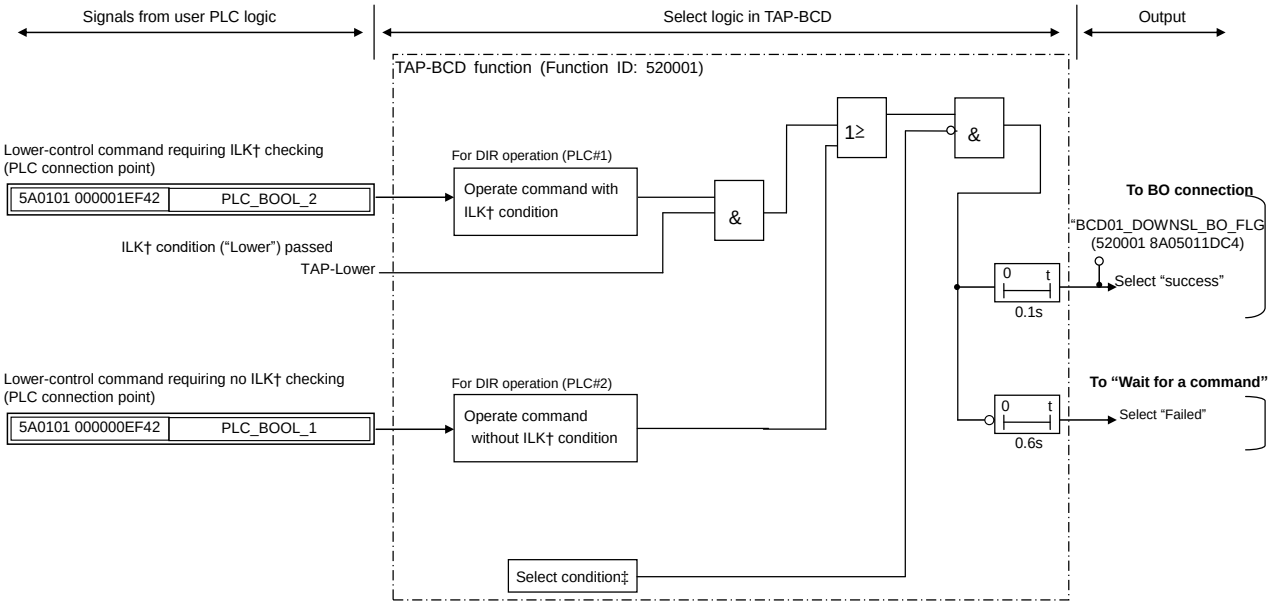


Figure 2.13-13 Select 'Lower' using the PLC function

(vii) Select-condition

Figure 2.13-14 shows the select condition logic in the TAP-BCD function. The TAP-BCD function checks the excess of a tap value using signals "UPPER LIMIT" and "LOWER LIMIT", which are set using the settings [**BCD01-UPLIMIT**] and [**BCD01-LOWLIMIT**]. If the original logic does not meet with the requirements of the user, the following alternatives are available:

1. The user can replace the original logic with alternative logic.
2. The user can add additional signal to the original logic.

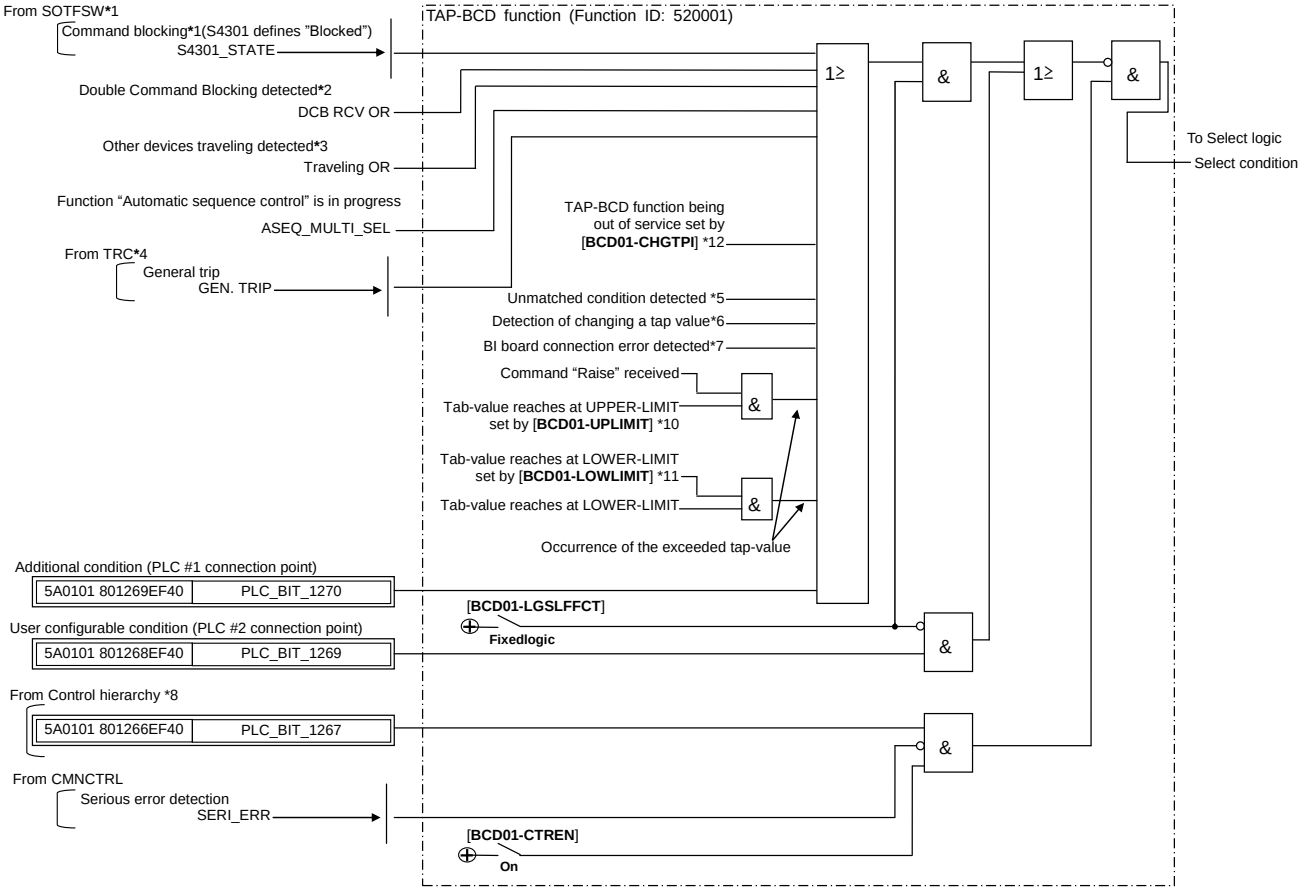


Figure 2.13-14 Select condition logic for Raise/Lower

(vii)-1 How to replace the original logic

If the user wishes to replace the select condition logic, the user can replace it using the PLC connection point "User configurable condition":

1. Connect the user-customized logic with PLC_BIT_1269, which is listed as PLC#2 in Table 2.13-7.
2. Set scheme switch [**BCD01-LGSLFFCT**] to **PLC**.

(vii)-2 How to add a user-preferred select condition signal

If adding another signal is required, for the original select condition logic, the user can add a signal to it using PLC connection point "Additional condition":

1. Add a user-preferred signal using PLC_BIT_1270, which is listed as PLC#1 in Table

2.13-7.

2. Set scheme switch [**BCD01-LGSLFFCT**] to **Fixedlogic**.

[1]Note: "Command Blocking" disables any operation except its own; the "Command blocking" is initiated by the status of "S4301" in a software switch controller (SOFTSW);. The IEC 61850 standard defines "Command Blocking" as "CmdBlk". For more information of "S4301", see Chapter *Control and monitoring application: Software switch control*. See the signal "S4301_STATE" of Table 2.13-6.

[2]Note: "Double Command Blocking" is an operation philosophy. It can be used to protect the substation. The user can program it using GR-TIEMS. (Table 2.13-6)

[3]Note: If the event "device-travelling" is detected, it indicates that another operator is changing the status of a device.. Thus, the IED should inhibit the operation of any device for the duration that the event is detected. The detecting signal is denoted as "Travelling OR" in Table 2.13-6.

[4]Note: If the issue of a trip command is executed by the IED, all control operation is blocked until the trip operation is completed. If an IED includes a relay application, the trip command is issued at the output-point "GEN.TRIP" in Table 2.13-6.

[5]Note: Criteria "unmatched conditions" are decided when "Test-bit status" in a command is not identical to "IED test status".

[6]Note: Tap change being in progress is detected using a signal coming from the OLTC. The TAP-BCD function can receive it by setting [**BCD01-CHG**], in which the user should key the BI signal number that is used for the reception. For more information, see section 2.13.6(i)-3.

[7]Note: A supervision of the Binary IO module can detect connection errors for BI circuits.

[8]Note: The user should program PLC logic "Control hierarchy" to distribute the control-right for the respective control applications. The control-hierarchy can be made of such as 43R/L. The user should connect the control-hierarchy with the select-condition logic using connection point "PLC_BIT_1267" of Figure 2.13-14, which is also found in Table 2.13-7. For more information, see Chapter *Control and monitoring application: Control hierarchy*.

[9]Note: To identify the input point of the TAP-BCD, see Table 2.13-7.

[10]Note: The maximum tap-value of the OLTC is defined using [**BCD01-UPLIMIT**]. (See section 2.13.5 and Table 2.13-22)

[11]Note: The minimum tap-value of the OLTC is defined using [**BCD01-LOWLIMIT**]. (See section 2.13.5 and Table 2.13-22)

[12]Note: When the OLTC is out of service, signal denoting "Out of service" is issued for the TPI via the BI circuit. The user should set the BI to send a signal using setting [**BCD01-CHGTPI**]. (See Table 2.13-31 for a setting; see section 2.13.7 for the

information for the TPI)

(viii) Signal name and number

Note: The user should note the following descriptions shown in the column "M/O" for each table:

"O" indicates that the signal is provided for optional use.

"M" indicates that the user should map/set/configure the signal; otherwise, the user may experience an operational failure if the default settings are used.

"N/A" indicates that the user cannot change the state of the signal.

Table 2.13-2 PLC connection points (Input points for Command 'Raise')

Signal Number	Signal Name	Description	M/O
5A0101 000002EF42	PLC_BOOL_3	Raise control without checking(PLC#2)	O
5A0101 000003EF42	PLC_BOOL_4	Raise-control checking with interlock(PLC#1)	O

Table 2.13-3 PLC connection points (Input points for Command 'Lower')

Signal Number	Signal Name	Description	M/O
5A010 1000000EF42	PLC_BOOL_1	Lower control without checking(PLC#2)	O
5A0101 000001EF42	PLC_BOOL_2	Lower control checking with interlock(PLC#1)	O

Table 2.13-4 PLC connection points (Interlock for 'Raise/Lower')

Signal Number	Signal Name	Description	M/O
570001 3105011DA2	TAP RAISE	Interlock condition for Raise control.	N/A
570001 3105011DA0	TAP LOWER	Interlock condition for Lower control.	N/A

Table 2.13-5 Mapping points for the reception of control commands

Signal Number	Signal Name	Description	M/O
520001 7005016D08	DEV01_CONTROL_REQ	TAP-BCD control command received.(Mapping Data)	M

Table 2.13-6 Input signals to condition logic

Signal Number	Signal Name	Description	M/O
522001 000A011001	S4301_STATE	Command Blocking status (Off / Blocked)	N/A
5A0001 0008001F41	DCB RCV OR	Double Command Blocking (DCB) is in progress.	N/A
5A0001 0008001F40	Traveling OR	Travelling events detected.	N/A
4A0001 8300001B6F	GEN. TRIP	General trip	N/A
5A0001 3108003F40	SDCEN	CMNCTRL function provides this signal.)	N/A
5A0101 3100001F43	SERI_ERR	Serious Error detected	N/A
523001 000D001F40	ASEQ_MULTI_SEL	Automatic sequence control is in progress.	N/A

Table 2.13-7 PLC connection points (Input points for select condition logic)

Signal Number	Signal Name	Description	M/O
5A0101 801269EF40	PLC_BIT_1270	Additional condition(PLC#1)	O
5A0101 801268EF40	PLC_BIT_1269	User configurable select condition(PLC#2)	O
5A0101 801266EF40	PLC_BIT_1267	Control right from Control hierarchy (PLC#3)	M

Table 2.13-8 PLC monitoring points (Output signals for select condition logic)

Signal Number	Signal Name	Description
520001 8005011F54	BCD01_SC_ST_ERR	Select command mode is invalid.
520001 8205011F59	BCD01_QLT_SPP	Event suppression detected
520001 8605011F5A	BCD01_BI_ERR	BI connection error detected

Table 2.13-9 PLC monitoring points (Output signals for BIO)

Signal Number	Signal Name	Description
520001 8605011DC6	BCD01_UPSL_BO_FLG	Raise command for BO circuit
520001 8A05011DC4	BCD01_DOWNSL_BO_FLG	Lower command for BO circuit

(ix) Setting names

Table 2.13-10 Settings for select logics

Setting Name	Description	Default	Setting item or value
BCD01-CTREN	Activation of TAP-BCD	On	Off / On
BCD01-LGSLFFCT	Logic selector for select condition	Fixedlogic	Fixedlogic / PLC

2.13.3 Cancel logics in SBO mode

In the SBO control mode the reception of a cancel command is possible; when the cancel conditions are satisfied, accordingly the function discards the select command; finally, the operation returns to the initial stage (i.e., "Wait for a command").

(i) Receiving "Cancel" from the remote-end

Figure 2.13-15 depicts the cancel command procedure for a cancel command initiated from the remote-end.

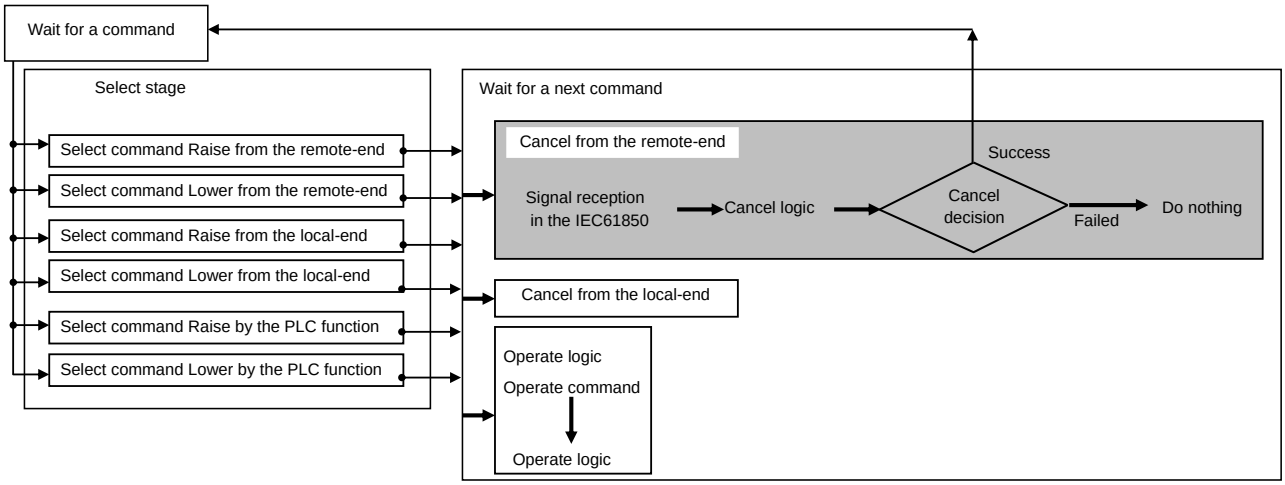


Figure 2.13-15 Outline of 'cancel' command from the remote-end

(i)-1 Input point required mapping

Figure 2.13-16 depicts a cancel-logic when a "Cancel command (Remote-Cancel)" signal is applied to the TAP-BCD function. The input-point "DEV01_CONTROL_REQ" is the same as that for the signal "Select command Raise (Remote-Raise-Control)".

(i)-2 Output signal to BO

The TAP-BCD function can issue a "Success to cancel" signal at the monitoring point "BCD01_CC_SS", when the TAP-BCD function has determined that the signal "Remote-cancel" is true. Another "Operation failed" signal is issued at monitoring point "BCD01_CC_FS" if the TAP-BCD function is able to determine that the signal "Remote-cancel" is not true.

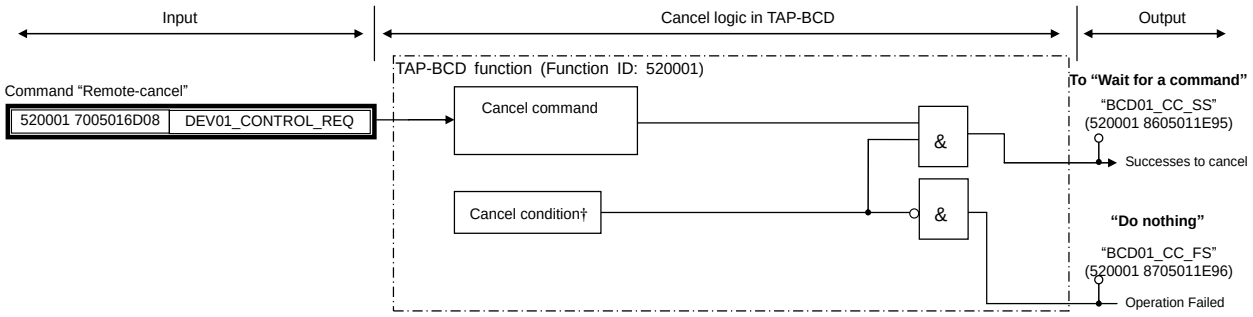


Figure 2.13-16 'Cancel'-logic by the remote-end

†Note:Figure 2.13-19 shows “cancel-condition” logic.

(ii) Receiving “Cancel” from the local-end

Figure 2.13-17 outlines the reception of the cancel command from the local-end.

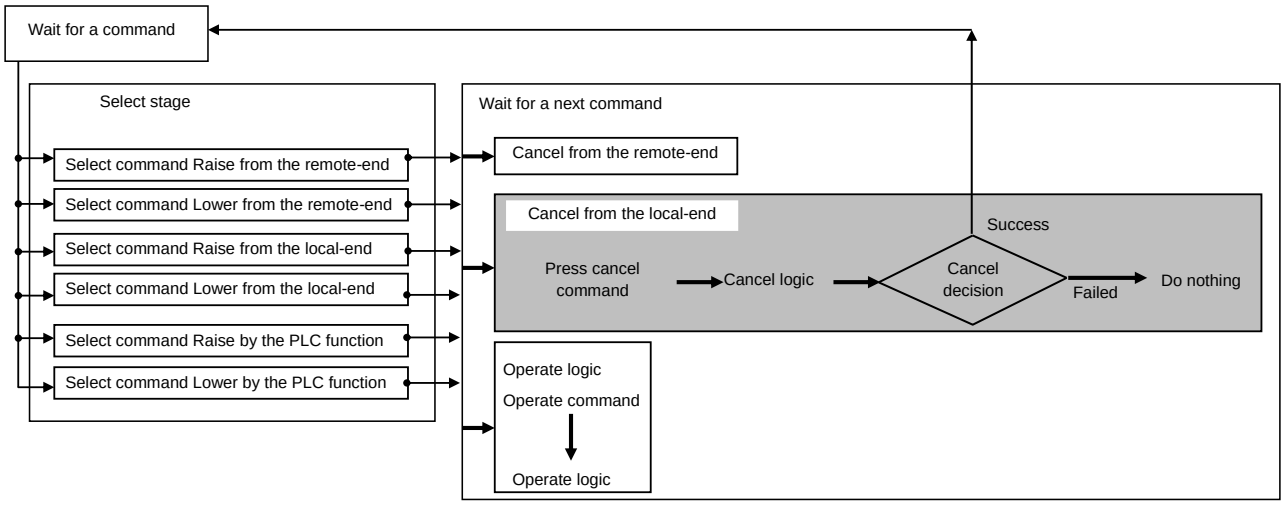


Figure 2.13-17 Outline of cancel command from the local-end

(ii)-1 Input signal generated at the local-end

Figure 2.13-18 depicts the cancel-logic when a “Cancel command (Local-cancel)” signal is applied to the TAP-BCD function. The signal is generated when the “Cancel” key is pressed on the IED front panel; the user is not required to take account of mapping. When the logic receives the signal “Local-cancel”, the logic is able to output a result signal, provided that the “cancel-condition” checking is satisfied.

(ii)-2 Output signal to BO

The TAP-BCD function, illustrated in Figure 2.13-18, is able to issue a “Selection to cancel” at the monitoring point “BCD01_CC_SS”, when the TAP-BCD function determines that the signal “Local-Cancel” is true.

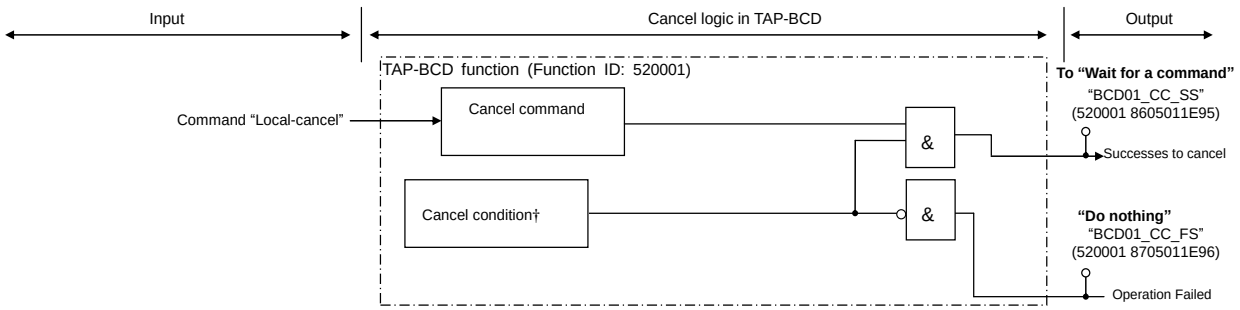


Figure 2.13-18 ‘Cancel’ from the front panel

(iii) Cancel-condition logic

Figure 2.13-19 shows the cancel-condition logic. As the criteria, "Unmatched condition detected" is connected normally for the cancel-condition logic, set **Fixedlogic** for the scheme switch [**BCD01-LGCNFFCT**].

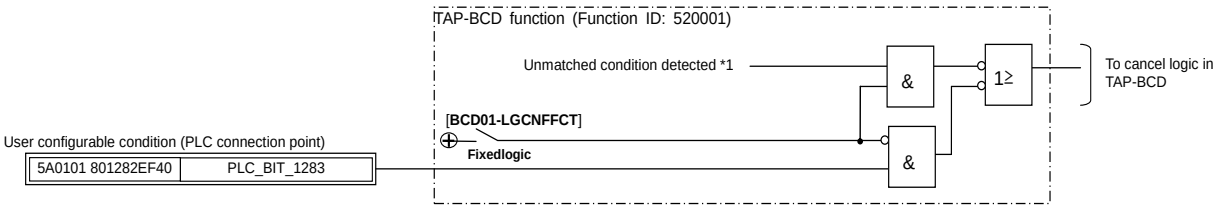


Figure 2.13-19 Logic "Cancel-condition" in TAP-BCD

When the user wishes to change the logic to a user-preferred logic, the user can change it using the connection point "PLC_BIT_1283"; and set **PLC** for scheme switch [**BCD01-LGCNFFCT**].

[1]Note: The criteria "unmatched conditions" are determined when the "Test-bit status" in the cancel command is not identical to the "IED test status" as in Figure 2.13-14.

[2]Note: with the exception of the above cancel-condition logic, there is an operate-condition logic with in the TAP-BCD function; the operate-condition logic will always checks conditions. That is, the user is not required to set either the "Operate-condition" or the "Cancel-condition" logic.

(iv) Signal name and number

Table 2.13-11 PLC connection point (Input signal for cancel-condition)

Signal Number	Signal Name	Description	M/O
5A0101801282EF40	PLC_BIT_1283	Point for user's programmed cancel condition logic	O

Note: "O" indicates that the signal is provided for optional use.

Table 2.13-12 PLC monitoring points (Output signals for cancel condition)

Signal Number	Signal Name	Description
5200018605011E95	BCD01_CC_SS	Cancel succeed
5200018705011E96	BCD01_CC_FS	Cancel failed

(v) Setting name

Table 2.13-13 Cancel setting in TAP-BCD

Setting Name	Description	Default	Setting item or value
BCD01-LGCNFFCT	Logic selector for cancel condition	Fixedlogic	Fixedlogic / PLC

2.13.4 Operate logics for SBO/DIR mode

Once the operation of the select logic is complete, the operate logic start to control the device.

(i) Receiving "operate-command Raise" from the remote-end

Figure 2.13-20 depicts the reception of the operate-command 'Raise' from the remote-end.

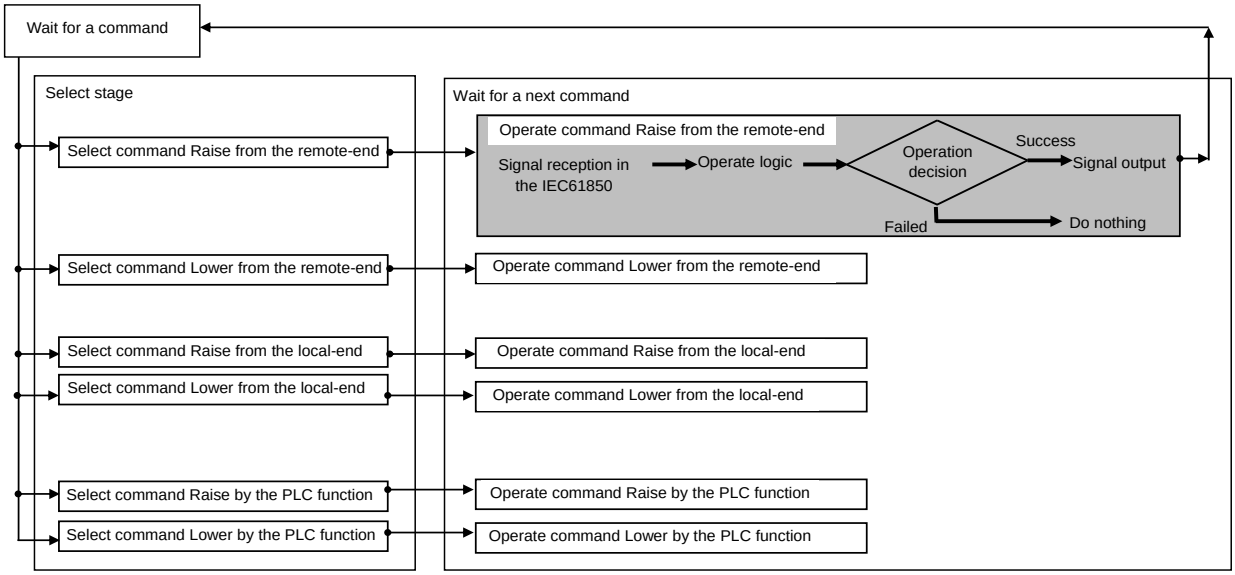


Figure 2.13-20 Outline of operate-command 'Raise'

(i)-1 Mapping required for Input point

Figure 2.13-21 illustrates the operate-logic, when an "Operate command Raise (Remote-Raise-Control)" signal is applied to the TAP-BCD function. The input-point "DEV01_CONTROL_REQ" is used for the reception of the "Operate command Raise (Remote-Raise-Control)".

(i)-2 Output signal to BO

The TAP-BCD function, in Figure 2.13-21, can issue an "Operate" signal at the output point "BCD01_UPEX_BO", when the TAP-BCD function determines that the input signal "Remote-Raise-Control" is true.

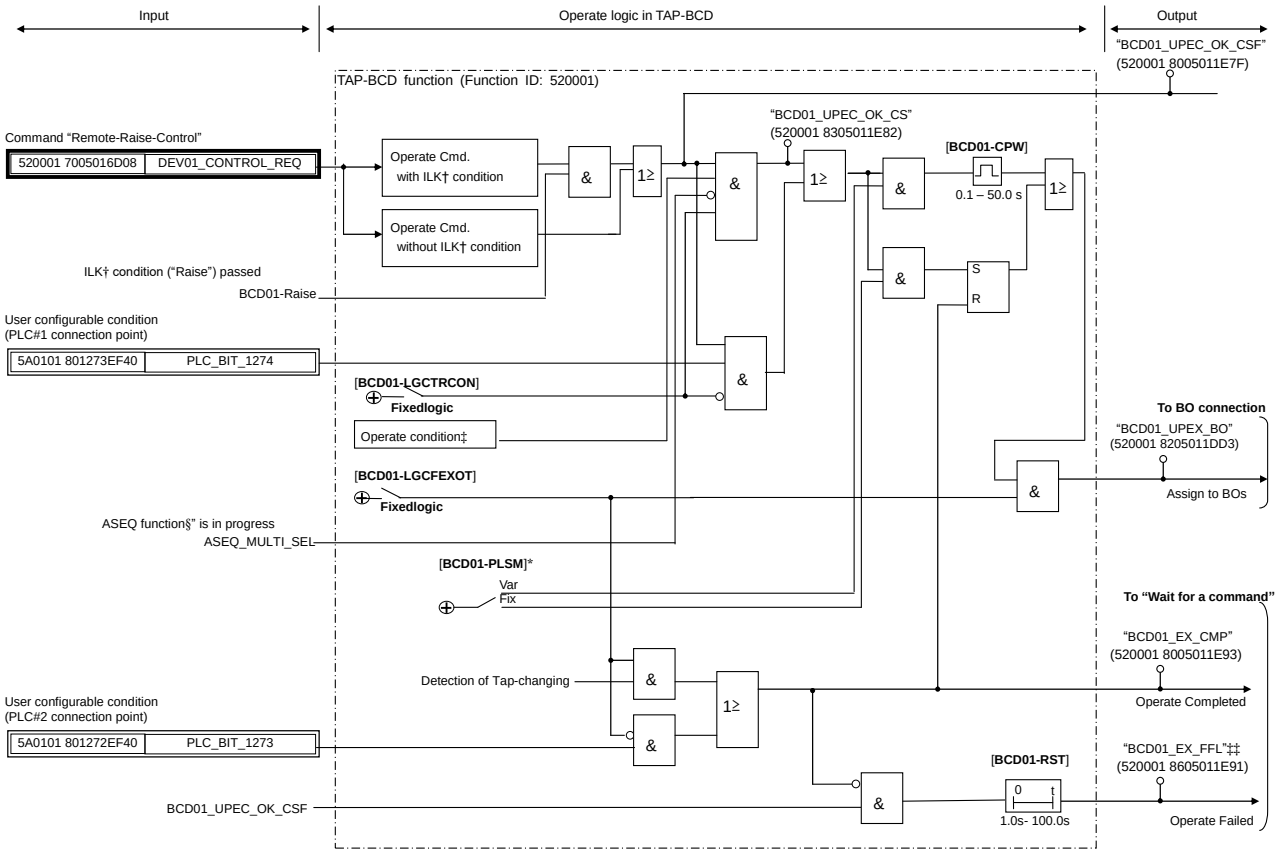


Figure 2.13-21 Operate 'Raise' from the remote-end

†Note: The ILK function can provide the operation criteria for "Raise" control.

‡Note: An "operate condition" signal is generated in the operate-condition logic (see Figure 2.13-32), when **Fixlogic** is set for scheme switch [**BCD01-LGCTRCON**]. If an alternative "operate-condition" is required, it can be programmed by the user and used to replace the signal generated by the original operate-condition logic. The alternative "operate-condition" can be connected to the above logic using connection point "#1" user configurable condition. That is set the scheme switch [**BCD01-LGCTRCON**] to PLC and use "PLC_BIT_1274".

§Note: The ASEQ function can provide sequential signals for automatic control.

*Note: The user can select a type of the output signal. When **Var** is set for scheme switch [**BCD01-PLSM**], the output period of the signal is defined by the setting [**BCD01-CPW**]. When **Fix** is set, the signal ceases when the tap-position is changed.

‡‡Note: The "BCD01_EX_FEL" signal is issued when the state-change is not detected when the time set by the [**BCD01-RST**] has been reached.

(ii) Receiving "operate command Lower" from the remote-end

Figure 2.13-22 depicts the reception of the operate command 'Lower' from the remote-end.

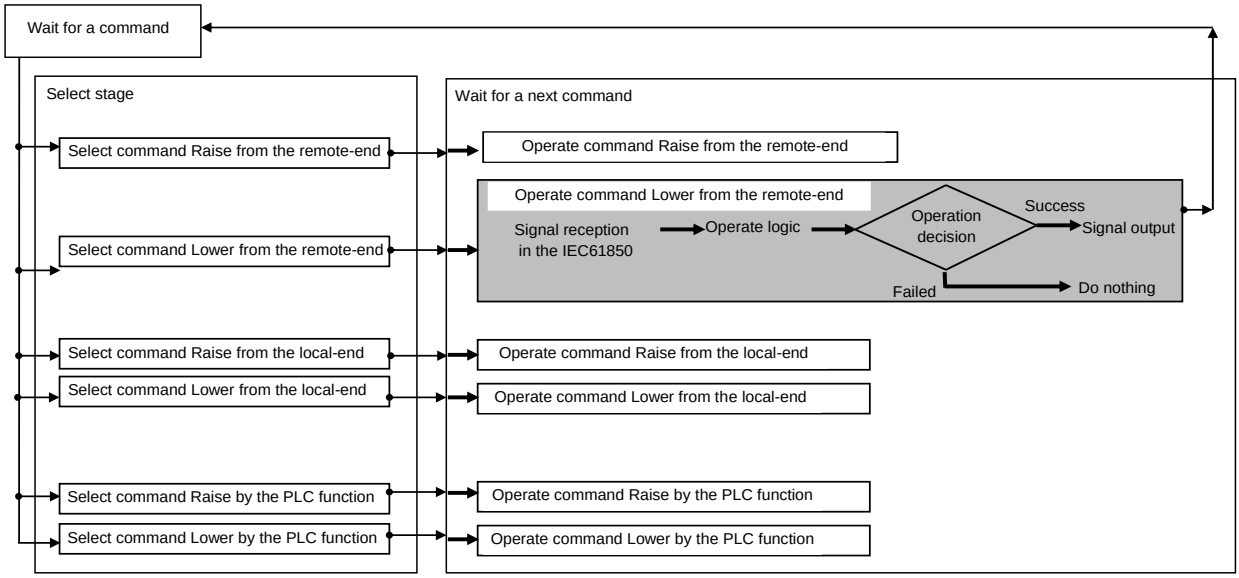


Figure 2.13-22 Outline of operate command 'Lower'

(ii)-1 Mapping required for Input point

Figure 2.13-23 illustrates the logic, when an "Operate command Lower (Remote-Lower-Control)" signal is applied to the TAP-BCD logic. The input-point "DEV01_CONTROL_REQ" is used for the reception of the "Operate command Lower (Remote-Lower-Control)".

(ii)-2 Output signal to BO

The TAP-BCD function, in Figure 2.13-23, can issue an "Operate" signal at the output-point "BCD01_DOWNEX_BO", when the TAP-BCD function determines that the input signal "Remote-Lower-Control" is true.

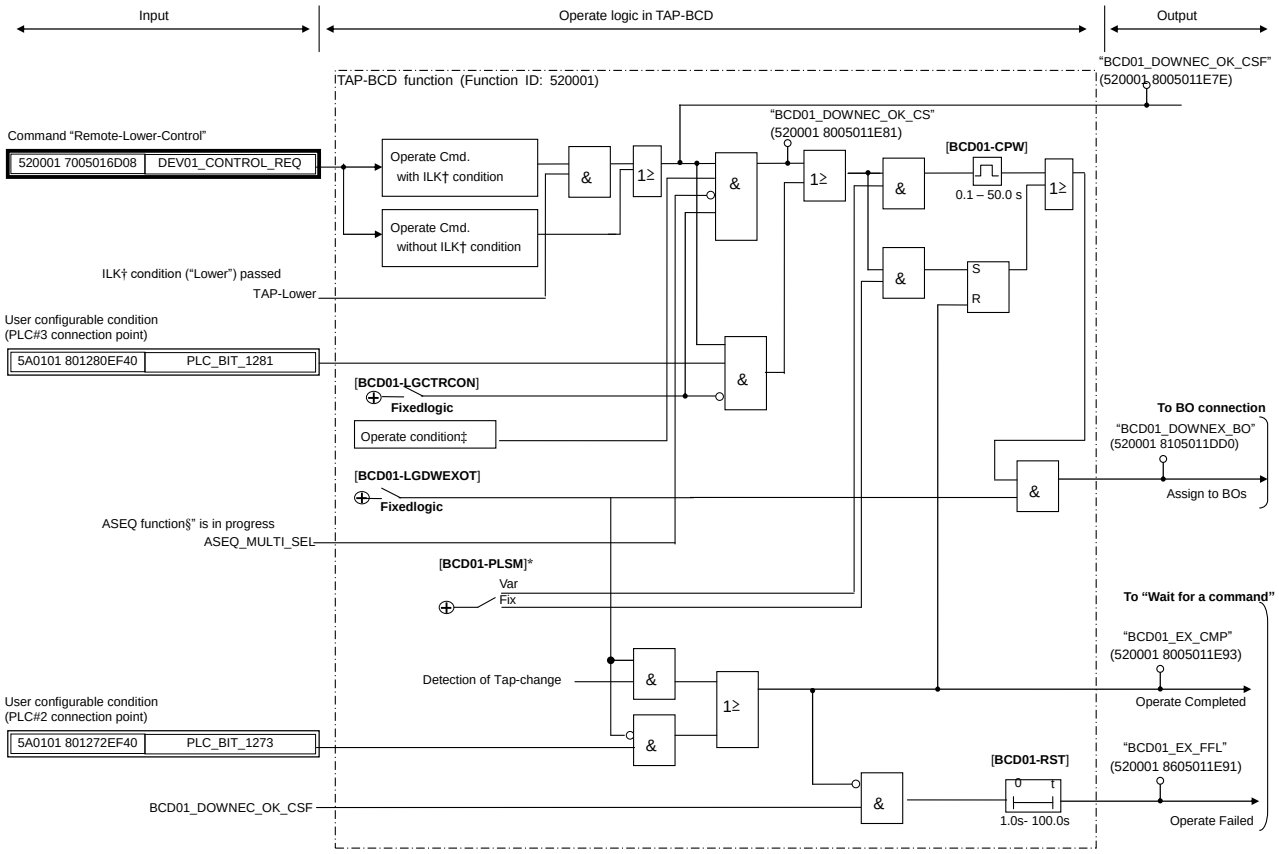


Figure 2.13-23 Operate 'Lower' from the remote-end

†Note:The ILK function can provide the operation criteria for "Lower" control.

‡Note:An "operate condition" signal is generated in the operate-condition logic (see Figure 2.13-32), when **Fixlogic** is set for scheme switch [**BCD01-LGCTRCON**]. If an alternative "operate-condition" is required, it can be programmed by the user and used to replace the signal generated by the original operate-condition logic. The alternative "operate-condition" can be connected to the above logic using connection point "#1" user configurable condition. That is set the scheme switch [**BCD01-LGCTRCON**] to **PLC** and use "PLC_BIT_1281".

§Note: The ASEQ function can provide sequential signals for automatic control.

*Note:The user can select the type of output signal. When **Var** is set for scheme switch [**BCD01-PLSM**], the output period of the signal is defined by the setting [**BCD01-CPW**]. When **Fix** is set, the output signal ceases when the tap-position is changed.

♯Note: The "BCD01_EX_FEL" signal is issued when the state-change is not detected when the time set by the [**BCD01-RST**] has been reached.

(iii) Receiving "operate command Raise" from the local-end

Figure 2.13-24 depicts the reception of the operate-command 'Raise' from the local-end.

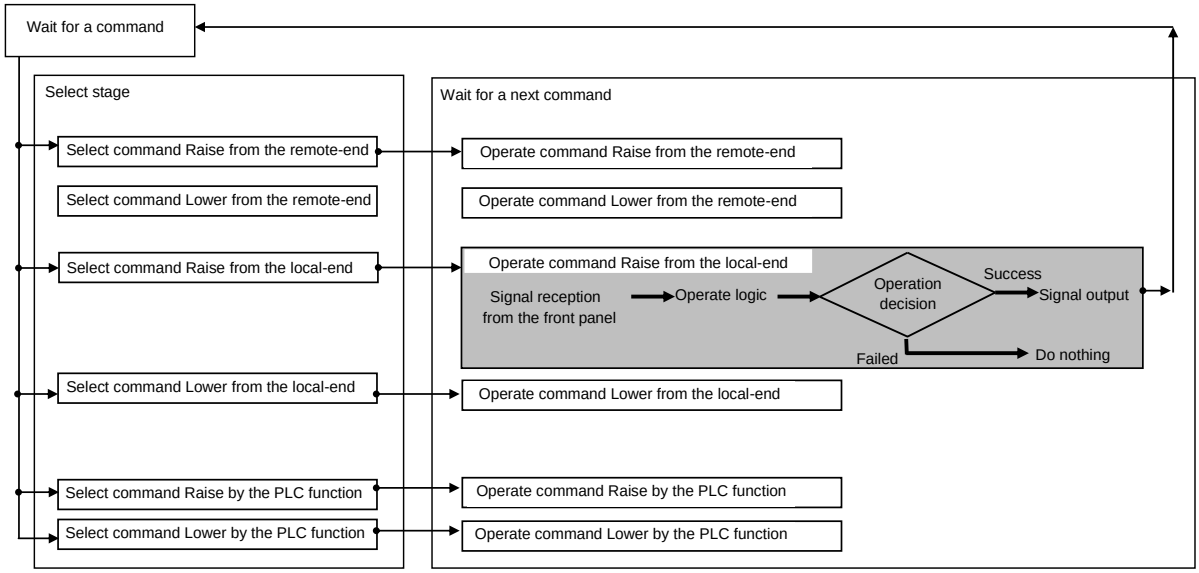


Figure 2.13-24 Outline of operate-command 'Raise'

(iii)-1 Input signal generated at the local-end

Figure 2.13-25 illustrates the operate logic, when an "Operate command signal Raise (Local-Raise-Control)" is applied to the TAP-BCD function. The input signal is generated when "Execution of Raise" key is pressed on the IED front panel.

(iii)-2 Output signal to BO

The TAP-BCD function, in Figure 2.13-25, can issue an "Operation" signal at the output point "BCD01_UPEX_BO", when the TAP-BCD function determines that the input signal "Local-Raise-Control" is true.

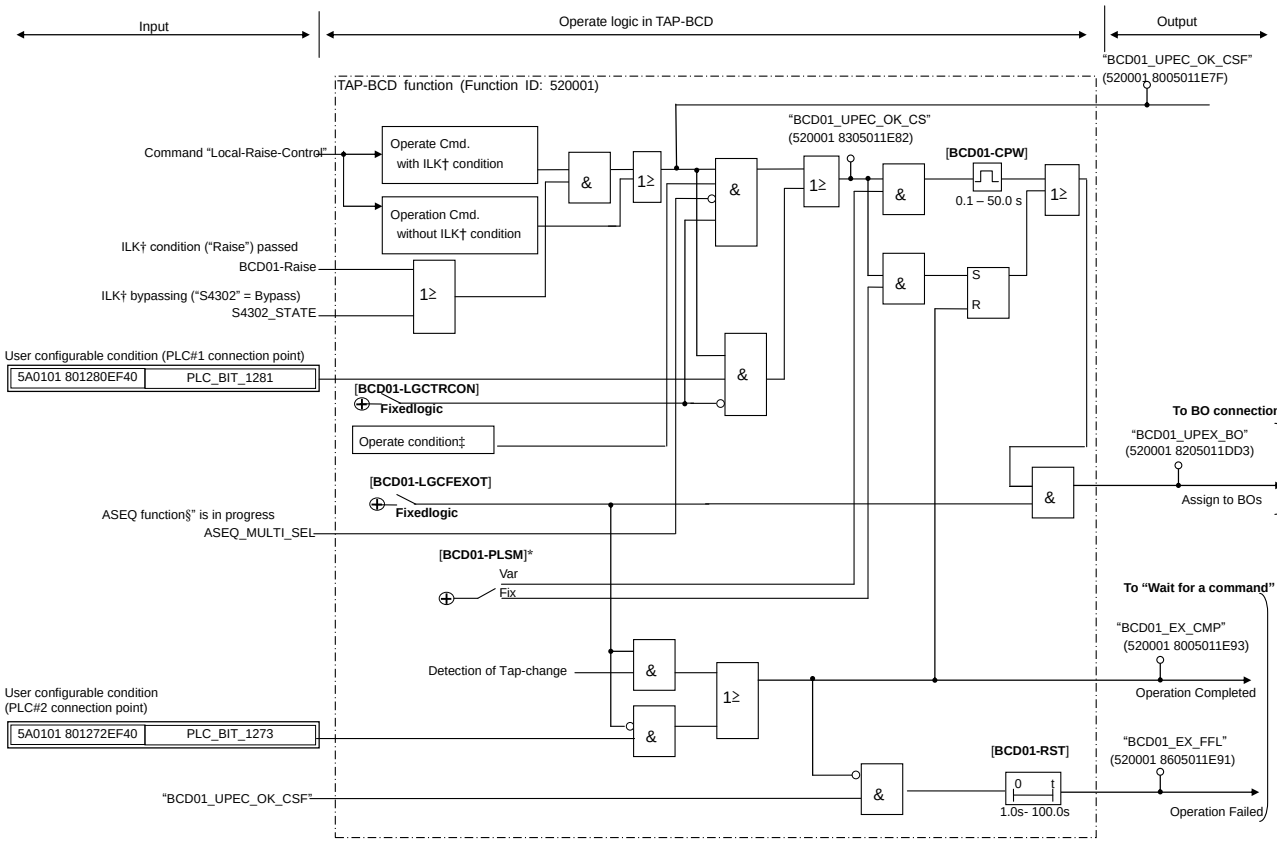


Figure 2.13-25 Operate 'Raise' on the front panel

†Note: The ILK function can provide the operation criteria for "Raise" control.

‡Note: An "operate condition" signal is generated in the operate condition logic when "**Fixlogic**" is set scheme switch [**BCD01-LGCTRCON**]. For more information, see Figure 2.13-32. If the user wishes a user-programmed operate-condition-logic to be used in place of the logic shown in Figure 2.13-32 logic, connect the user-programmed-operate-condition-logic with the above logic using "PLC_BIT_1281"; then set [**BCD01-LGCTRCON**] to **PLC**.

§Note: The ASEQ function can provide sequential signals for automatic control.

*Note: For an output signal, the user can select the type of output signal. When **Var** is set for scheme switch [**BCD01-PLSM**], the period of the output signal is set by setting [**BCD01-CPW**]. When **Fix** is set, the output signal ceases when the tap-position is changed.

♯Note: Signal BCD01_EX_FEL is issued when the state-change is not detected when the time set by the [**BCD01-RST**] has been reached.

(iv) Receiving "operate command Lower" from the local-end

Figure 2.13-26 depicts the reception of the operate command 'Lower' from the local-end.

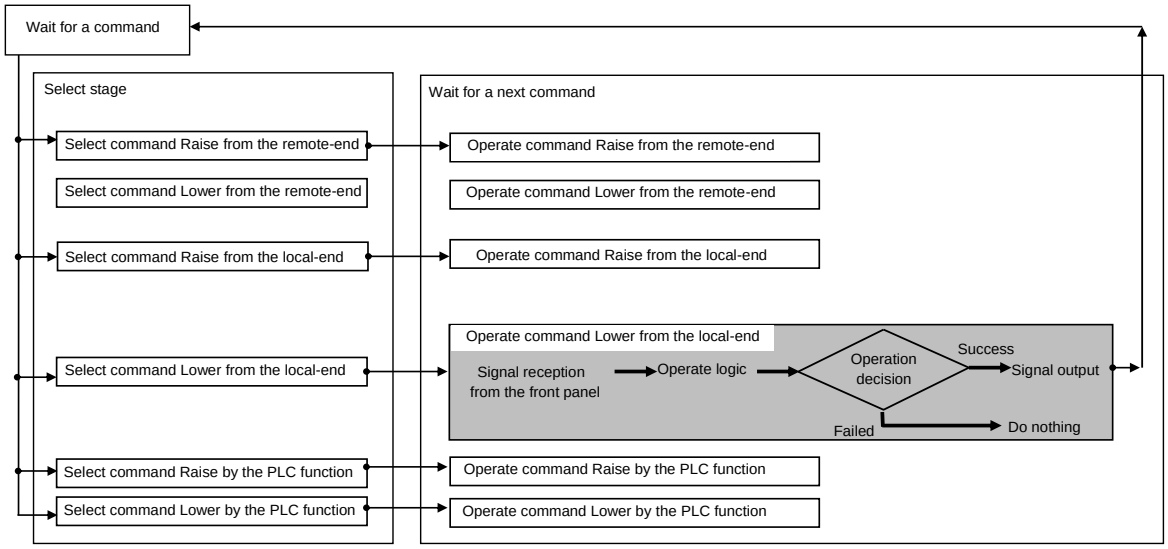


Figure 2.13-26 Outline of operate command 'Lower'

(iv)-1 Input signal generated at the local-end

Figure 2.13-27 illustrates the logic when an "Operate command Lower (Local-Lower-Control)" signal is applied the TAP-BCD logic. The input signal is provided when "Execution for Lower" is keyed on the IED front panel.

(iv)-2 Output signal to BO

The TAP-BCD function, in Figure 2.13-27, can issue an "Operation" signal at the output point "BCD01_DOWNEX_BO", when the TAP-BCD function determines that the input signal "Local-Lower-Control" is true.

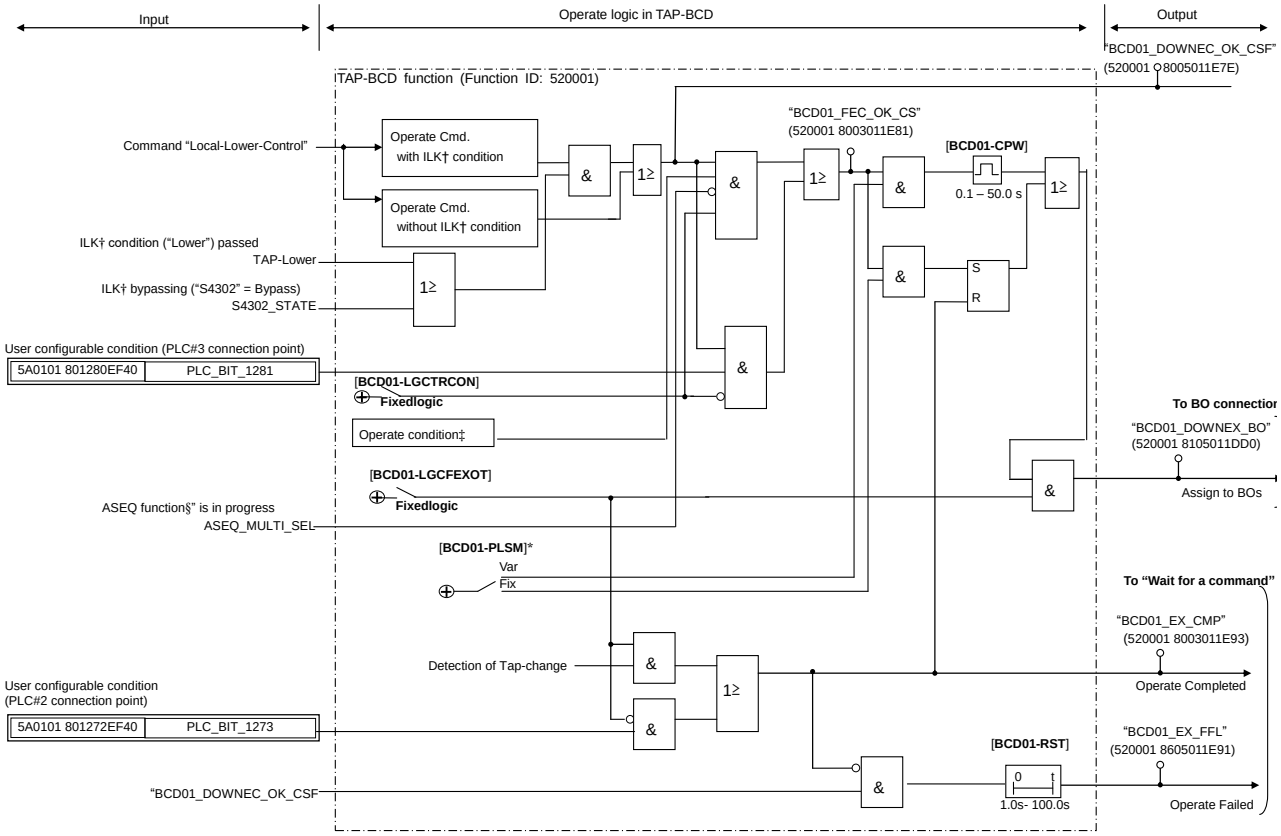


Figure 2.13-27 Operate 'Lower' on the front panel

†Note: The ILK function can provide the operation criteria for "Lower" control.

‡Note: Signal "operate condition" is provided from the operate condition logic when "**Fixlogic**" is set for scheme switch [**BCD01-LGCTRCON**]. For more information, see Figure 2.13-32. If the user wishes the user-programmed operate-condition-logic to be used in place of the logic shown in Figure 2.13-32 logic, connect the user-programmed operate-condition-logic with the above logic using PLC connection point "PLC_BIT_1281"; then set [**BCD01-LGCTRCON**] **PLC**.

§Note: The ASEQ function can provide sequential signals for automatic control.

*Note: For an output signal, the user can select the type of output signal. When **Var** is set for scheme switch [**BCD01-PLSM**], the period of the output signal is set by setting [**BCD01-CPW**]. When **Fix** is set, the output signal ceases when the tap-position is changed.

⌗Note: Signal BCD01_EX_FEL is issued when the state-change is not detected when the time set by the [**BCD01-RST**] has been reached.

(v) Receiving “operate command Raise” using the PLC logic

Figure 2.13-28 outlines the reception of the operate-command ‘Raise’ with the PLC function.

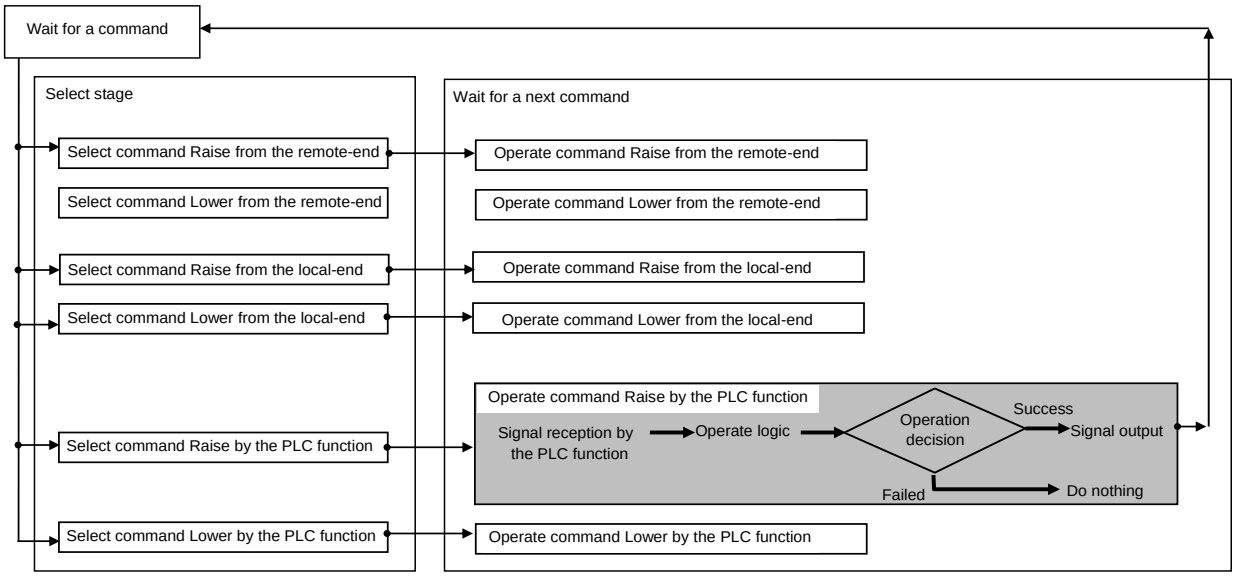


Figure 2.13-28 Outline of operate-command Raise

(v)-1 Input signal required to connect

Figure 2.13-29 describes the operate logic, when an “Operate command Raise (PLC-Raise-Control)” signal is generated by the PLC function. Connection-point “PLC_BOOL_4” is used when the TAP-BCD function is operated together with the ILK condition. Another connection-point “PLC_BOOL_3” is used when the TAP-BCD function is operated without the ILK condition.

(v)-2 Output signal to BO

The TAP-BCD function, in Figure 2.13-29, can issue an “Operation” signal at output point “BCD01_UPEX_BO”, when the TAP-BCD function determines that the input signal is true.

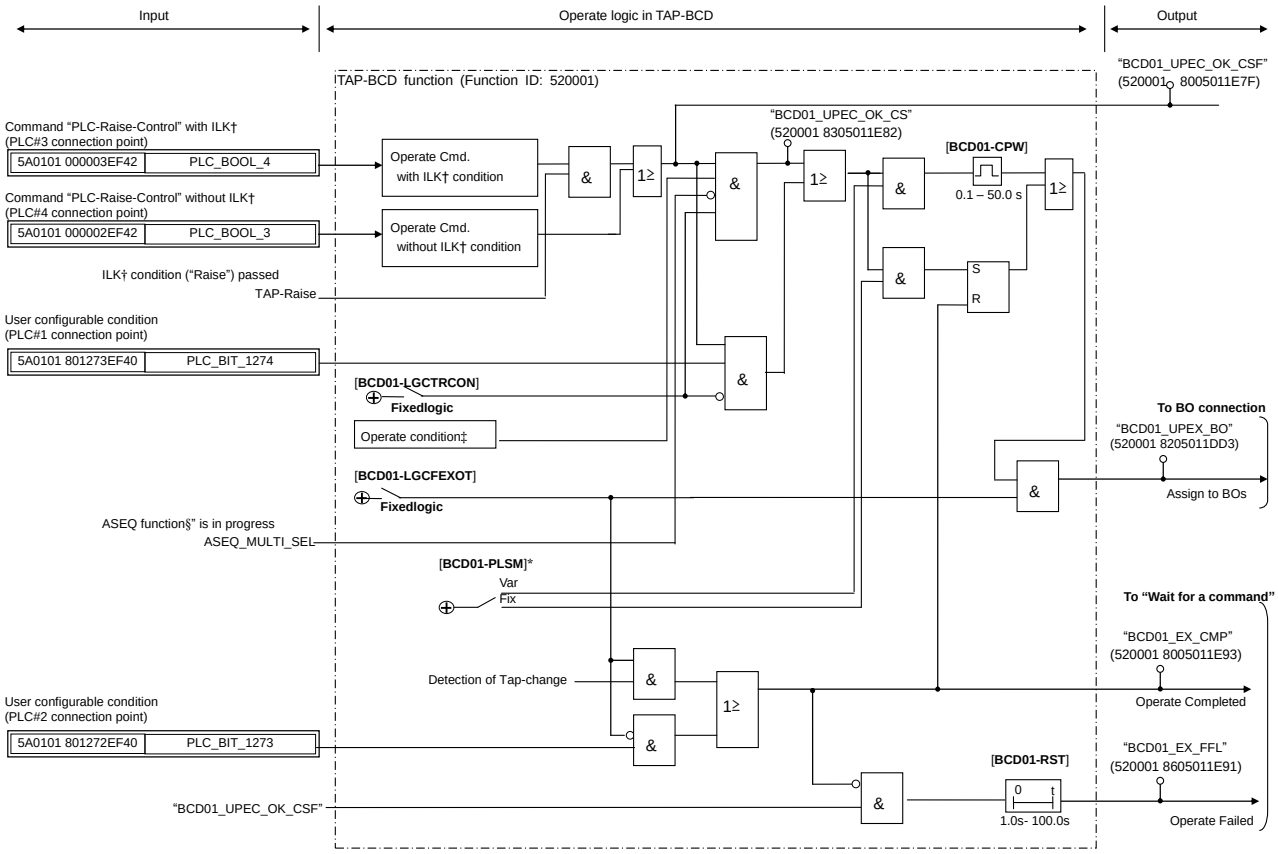


Figure 2.13-29 Operate Raise with the PLC function

†Note: The ILK function can provide the criteria for operation for "Raise" control.

‡Note: An "operate condition" signal is provided from the operate condition logic when "**Fix logic**" is set for scheme switch [**BCD01-LGCTRCON**]. For more information, see Figure 2.13-32. If the user wishes that user-programmed operate-condition-logic is used in place of the Figure 2.13-32 logic, connect the user-programmed-operate-condition-logic with the above logic using "PLC_BIT_1274"; then set the scheme switch [**BCD01-LGCTRCON**] to **PLC**.

§Note: The ASEQ function can provide sequential signals for automatic control.

*Note: For an output signal, the user can select the type of output signal. When **Var** is set for scheme switch [**BCD01-PLSM**], the period of the output signal is set by setting [**BCD01-CPW**]. When **Fix** is set, the output signal ceases when the tap-position is changed.

⌗Note: Signal BCD01_EX_FEL is issued when the state-change is not detected when the time set by the [**BCD01-RST**] has been reached.

(vi) Receiving “operate command Lower” using PLC logic

Figure 2.13-30 outlines the reception of the operate command Lower using the PLC function.

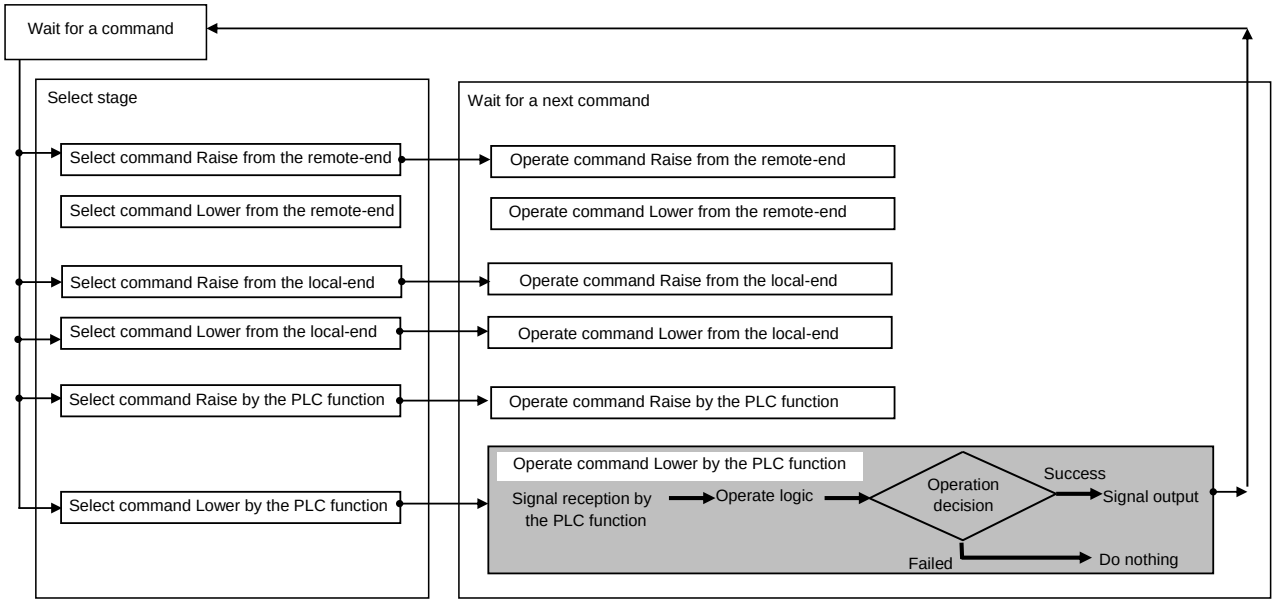


Figure 2.13-30 Outline of operate command Lower

(vi)-1 Input signal required to connect

Figure 2.13-31 depicts the operate logic when an “Operate command Lower (PLC-Lower-Control)” signal is generated by the PLC function. Connection-point “PLC_BOOL_2” is used when the TAP-BCD function is operated together with the ILK condition. Another connection-point “PLC_BOOL_1” is used when the TAP-BCD function is operated without the ILK condition.

(vi)-2 Output signal to BO

The TAP-BCD function, in Figure 2.13-31, can issue an “Operation” signal at output-point “BCD01_DOWNEX_BO”, when the TAP-BCD function determines that the input signal is true.

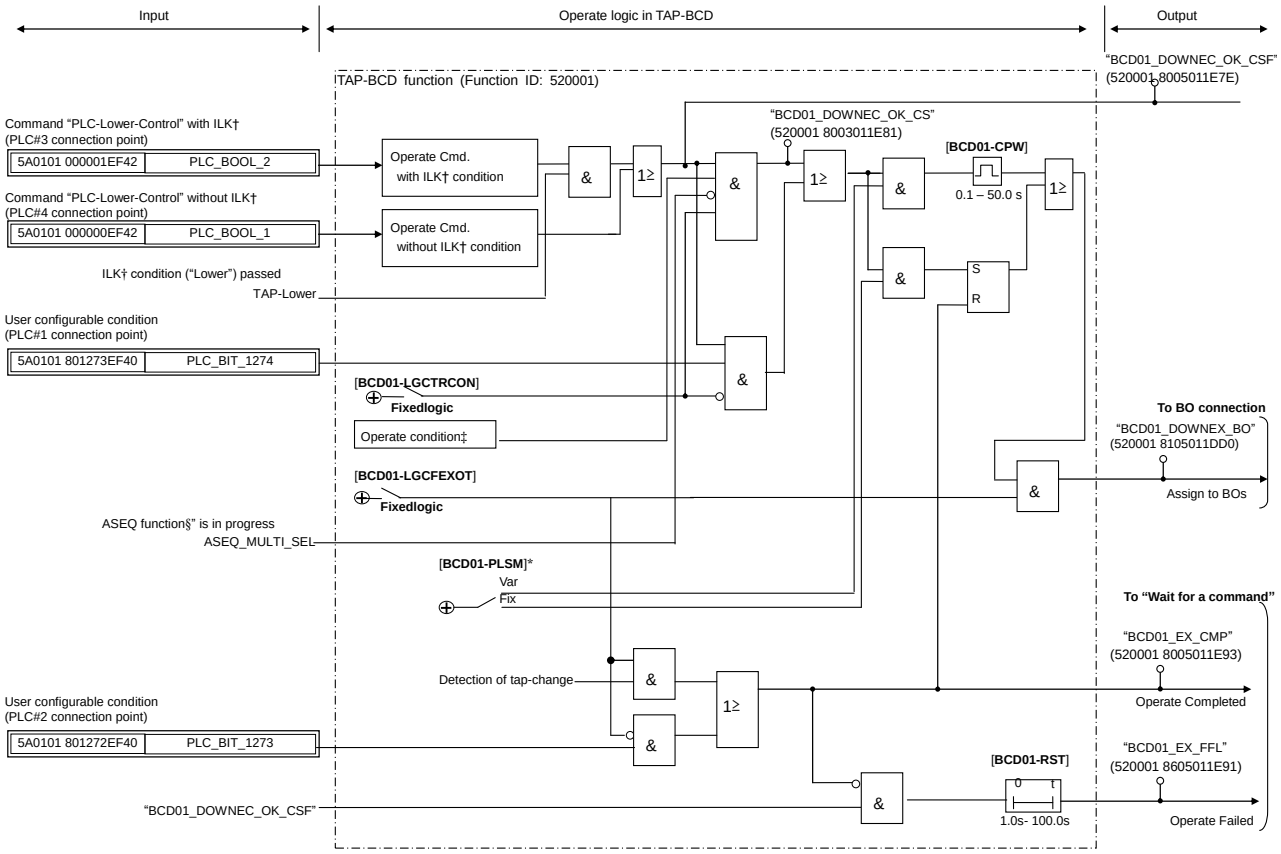


Figure 2.13-31 Operate Lower by the PLC function

†Note: The ILK function can provide the criteria for operation for "Lower" control.

‡Note: An "operate condition" signal is provided from the operate condition logic when "**Fixlogic**" is set for scheme switch [**BCD01-LGCTRCON**]. For more information, see Figure 2.13-32. If the user wishes that user-programmed operate-condition-logic is used in place of the Figure 2.13-32 logic, connect the user-programmed operate-condition-logic with the above logic using PLC connection point "PLC_BIT_1274"; then set [**BCD01-LGCTRCON**] **PLC**.

§Note: The ASEQ function can provide sequential signals for automatic control.

*Note: For an output signal, the user can select the type of output signal. When **Var** is set for scheme switch [**BCD01-PLSM**], the period of the output signal is set by setting [**BCD01-CPW**]. When **Fix** is set, the output signal ceases when the tap-position is changed.

⌗Note: Signal BCD01_EX_FEL is issued when the state-change is not detected when the timer set by [**BCD01-RST**] has been reached.

(vii) Operate condition

Figure 2.13-32 shows the operate condition logic of the TAP-BCD function. The TAP-BCD function examines the excess of a tap value using signals "UPPER LIMIT" and "LOWER LIMIT", which are set using the settings [**BCD01-UPLIMIT**] and [**BCD01-LOWLIMIT**]. If the functionality of the original logic does not meet with user-requirements, the following alternatives are available:

1. The user can replace the original logic with alternative logic.
2. The user can add another signal to the original logic.

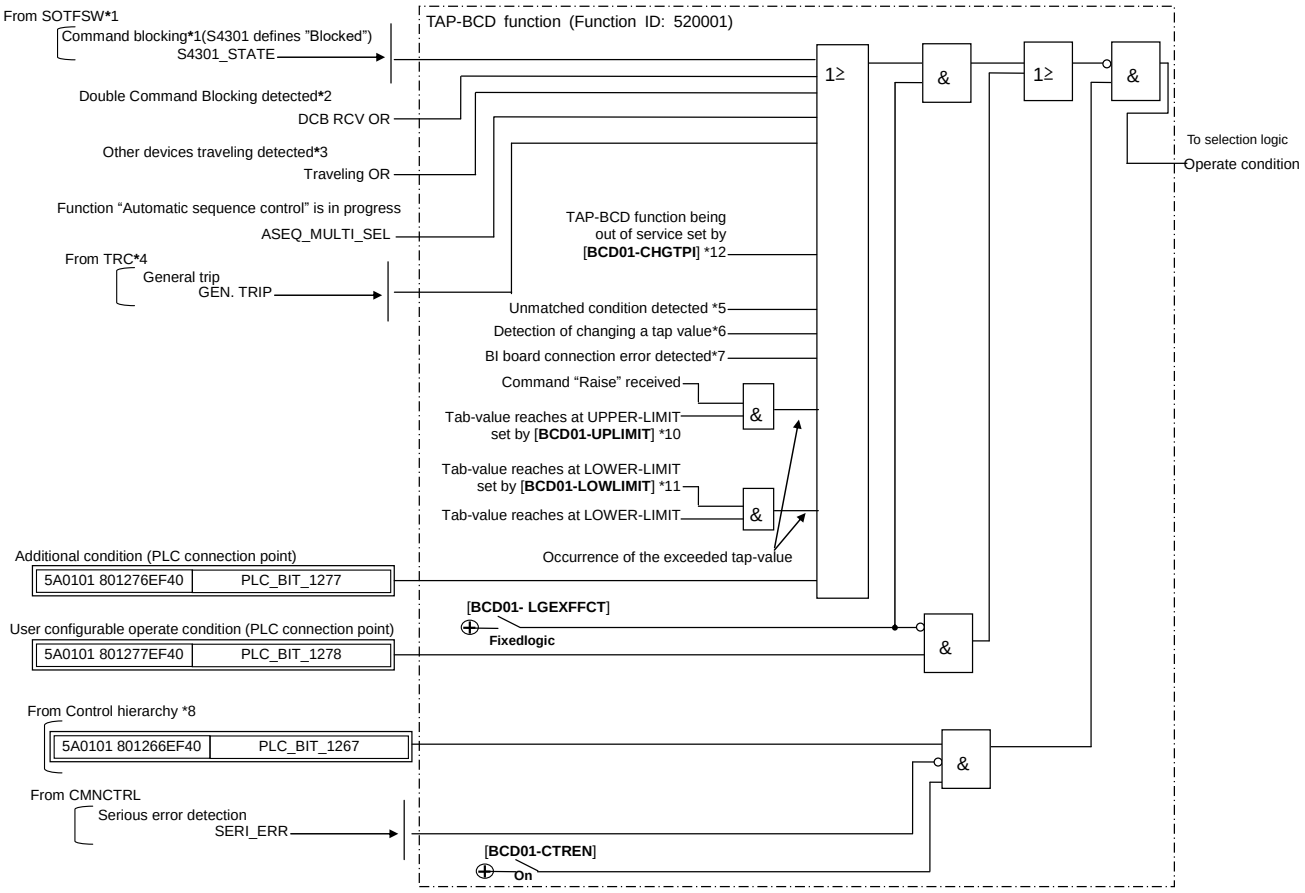


Figure 2.13-32 Operate condition logic for 'Raise/Lower' in TAP-BCD

(vii)-1 Replacing the original logic

If the user wishes to replace the operate condition logic completely, it can be achieved using PLC connection point "User configurable condition":

1. Connect the user-customized signal using "PLC_BIT_1278", listed as PLC#2 in Table 2.13-17.
2. Set scheme switch [**BCD01-LGEXFFCT**] to **PLC**.

(vii)-2 Adding another operate condition signal

If the addition of another operate condition is required, the user can add the signal to the operate condition using PLC connection point "Additional condition":

1. Add a user-preferred signal using "PLC_BIT_1277", listed as PLC#1 in Table 2.13-17.
2. Set scheme switch [**BCD01-LGEXFFCT**] to **Fixedlogic**.

[1]Note: "Command Blocking" disables any operation except for itself; "Command blocking" is implemented as "S4301" in a software switch controller (SOFTSW). The IEC 61850 standard defines the "Command Blocking" as "CmdBlk". For more information of "S4301", see Chapter *Control and monitoring application: Software switch control*. See the signal "S4301_STATE" in Table 2.13-6.

[2]Note: "Double Command Blocking" is an operation philosophy. It can be used to protect the substation. The user can program it using GR-TIEMS. (Table 2.13-6)

[3]Note: Detection of event "device-travelling" signifies that other operators are changing the status of one or more devices. Thus, device operation by the IED should be inhibited whilst ever the event is being detected. The detecting signal is denoted as "Travelling OR" in Table 2.13-6.

[4]Note: If an IED is in the process of issuing a trip command, all control operation is blocked until the trip operation has been completed. If the IED has a relay application, the trip command is issued at the output-point "GEN.TRIP" in Table 2.13-6.

[5]Note: The criteria "unmatched conditions" is determined when "Test-bit status" in a command is not identical to "IED test status".

[6]Note: Tap change being in progress is detected using a signal coming from the OLTC. The TAP-BCD function can receive it by setting [**BCD01-CHG**], in which the user should key the BI signal number that is used for the reception. For more information, see section 2.13.6(i)-3.

[7]Note: A supervision of the Binary IO module can detect connection errors for BI circuits.

[8]Note: The user must program the PLC logic for "Control hierarchy" to distribute the control-right for the respective control applications. The control-hierarchy can be made from 43R/L. The user must connect this control-hierarchy to the select-condition logic using connection point "PLC_BIT_1267" of Figure 2.13-14, which is also found in Table 2.13-7. For more information, see Chapter *Control and monitoring application: Control hierarchy*.

[9]Note: To identify the input point of the TAP-BCD, see Table 2.13-7.

[10]Note: The maximum tap-value of the OLTC is defined using [**BCD01-UPLIMIT**]. (See section 2.13.5 and Table 2.13-22)

[11]Note: The minimum tap-value of the OLTC is defined using [**BCD01-LOWLIMIT**]. (See section 2.13.5 and Table 2.13-22).

*Note: Note that the logic outputs are sent separately on the Raise-execution and the Lower-execution.

(viii) Signal name and number

Note: The user should note the meaning of the following abbreviations as shown in column "M/O" of each table:

"O" indicates that the signal is provided for optional use.

"M" indicates that the user should map/set/configure the signal; otherwise, the user may experience an operational failure if the default settings are used.

"N/A" indicates that the user cannot change the state of the signal.

Table 2.13-14 PLC connection point #1 (Input point for operate command Raise/Lower)

Signal Number	Signal Name	Description	M/O
5A0101801273EF40	PLC_BIT_1274	User configurable condition(PLC#1)	O

Table 2.13-15 PLC connection point #2 (Input point for operate command Raise/Lower)

Signal Number	Signal Name	Description	M/O
5A0101801272EF40	PLC_BIT_1273	User configurable condition(PLC#2)	O

Table 2.13-16 PLC connection point #3 (Input point for operate command Raise/Lower)

Signal Number	Signal Name	Description	M/O
5A0101801280EF40	PLC_BIT_1281	User configurable condition(PLC#3)	O

Table 2.13-17 PLC connection points (Input point for operate condition logic)

Signal Number	Signal Name	Description	M/O
5A0101 801276EF40	PLC_BIT_1277	Additional condition(PLC#1)	O
5A0101 801277EF40	PLC_BIT_1278	User configurable condition(PLC#2)	O

Table 2.13-18 PLC monitoring points (Output signal for BIO)

Signal Number	Signal Name	Description
5200018205011DD3	BCD01_UPEX_BO	Raise operation command
5200018105011DD0	BCD01_DOWNEX_BO	Lower operation command

Table 2.13-19 PLC monitoring points (Output signal of operate condition logic)

Signal Number	Signal Name	Description
520001 8005011E7F	BCD01_UPEC_OK_CSF	Execution signal in the raise direction
520001 8005011E7E	BCD01_DOWNEC_OK_CSF	Execution signal in the lower direction
520001 8305011E82	BCD01_UPEC_OK_CS	Another execution signal in the raise direction
520001 8005011E81	BCD01_DOWNEC_OK_CS	Another execution single in the lower direction

Table 2.13-20 PLC monitoring point (Output signal at execution failure)

Signal Number	Signal Name	Description
520001 8005011E93	BCD01_EX_CMP	Control completed signal

(ix) Setting names

Table 2.13-21 Setting of Operate logic

Setting Name	Description	Default	Setting item or value
BCD01-PLSM	Methods of command output (BCD1)	Fix	Fix/Var
BCD01-CPW	Duration of command output (BCD1)	1.0[sec]	0.1~50.0[sec]
BCD01-RST	Time for giving up to the control (BCD1)	30.0[sec]	0.1~100.0[sec]
BCD01-LGCTRCON	Logic selector for operate condition (BCD01)	Fixedlogic	Fixedlogic/PLC

Table 2.13-22 Setting for operate condition

Setting Name	Description	Default	Setting item or value
BCD01-LGEXFFCT	Logic selector for operate condition	Fixedlogic	Fixedlogic / PLC
BCD01-UPLIMIT	Allowed a tap-value at the highest	1	-99999 ~ +99999
BCD01-LOWLIMIT	Allowed a tap-value at the lowest	1	-99999 ~ +99999
BCD01-CHG	Tap changing signal	Preferred	BI signal number

2.13.5 Settings for numerical measurement

As cited earlier, the TAP-BCD function can acquire a 5-digit signed number (in other words, -9999 to +9999) when five OLTC transducers (plus a sign) are connected to the BIO module. The numerical measurement provided by the TAP-BCD function can be used to support the following features: erroneous, excessive, and warning detection; additionally, the user can adjust the reset level for excessive and warning detection when the measured value returns to within the specified limit.

The TAP-BCD function is able to receive an actual value, such as a tap-position number and other alternatives; in addition the TAP-BCD function can also receive a relative value, such as a signed variance -0.1 or +0.1. Subsection 2.13.5(i) describes the measurement of an actual value; another case describing the measurement of a relative value is explained in subsection 2.13.5(ii). For all cases, the TAP-BCD function can report a caution or an alarm for the user when the measuring value is exceeded; the TAP-BCD function inhibits the measurement function when a measuring value is in an erroneous area.

(i) Setting the measurement function for an actual value

Figure 2.13-33 shows the tap-value changing from point① to ⑩ on the time-axis. The user can set the areas for reporting a warning and an alarm. Additionally, the user can set the area for the detection of an erroneous value so that the TAP-BCD function can discard the measured data in the erroneous area. In order to set the actual measurement data, the user should set [**BCD01-HLABSREL**] to **rel**†.

†Note:The term "rel" stands for "relative value monitoring". That is, tap-position monitoring.

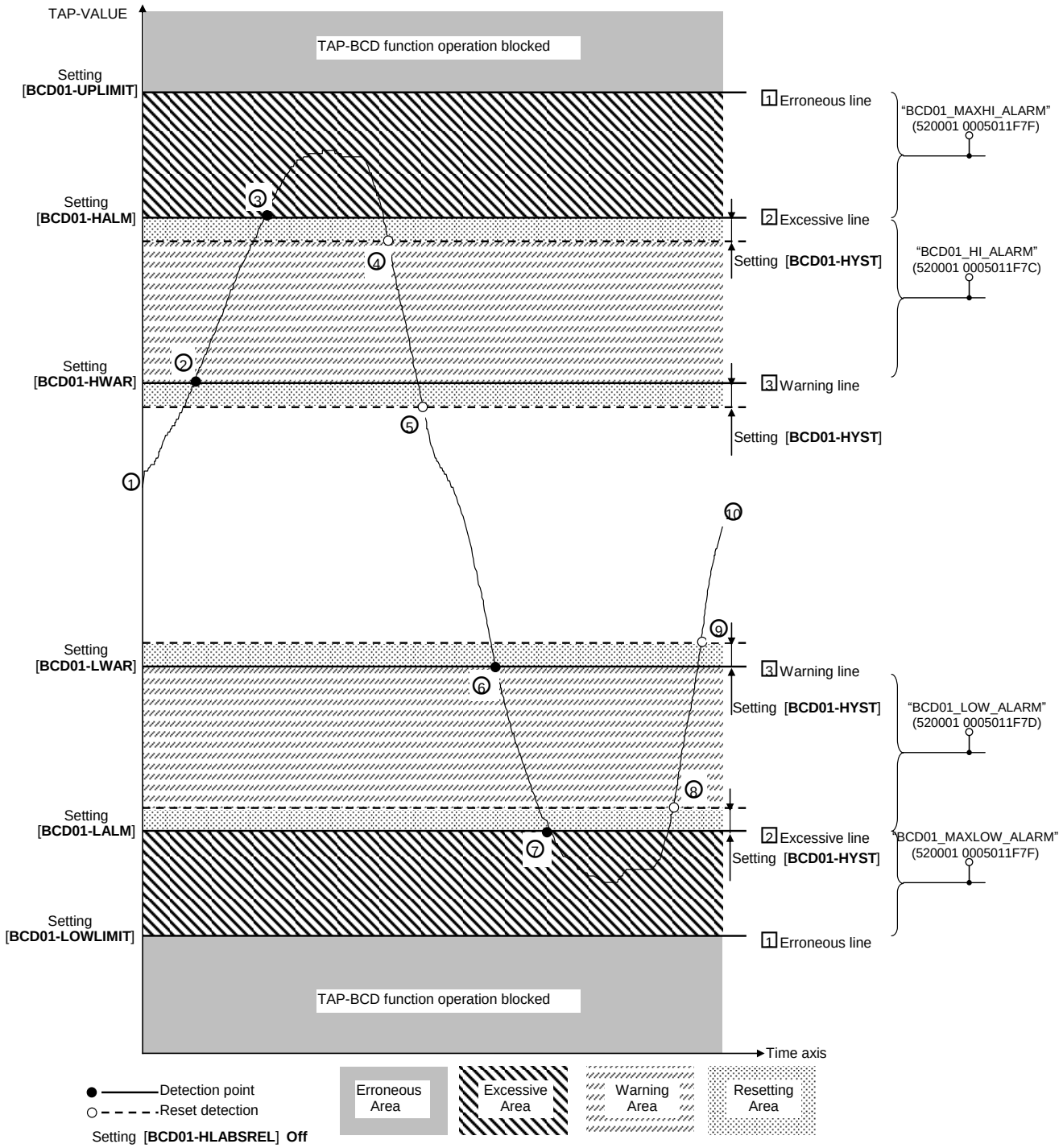


Figure 2.13-33 Example of Tap-position measurement for an actual value

(i)-1 Erroneous line1

The user can set two erroneous lines1 for the upper and lower sides using settings [**BCD01-UPLIMIT**] and [**BCD01-LOWLIMIT**]. (See Table 2.13-22)

(i)-2 Excessive line2

The user can program the alarm area using erroneous line1 and excessive line2; the excessive line2 for the upper side is set using [**BCD01-HALM**]. An additional excessive line2 can be set for the lower side with [**BCD01-LALM**]. (See Table 2.13-24)

The TAP-BCD function issues an alarm when a measured value traverses the excessive line. For example, when the measured value passes over excessive line2 on the upper side (i.e., point ③), the TAP-BCD function issues an alarm at the connection point "BCD01_MAXHI_ALARM". On the other hand, when the measured value passes over the excessive line on the lower side (i.e., point⑦), the TAP-BCD function issues an alarm at connection point "BCD01_MAXLOW_ALARM".

(i)-3 Warning line3

Similarly, the user can program a warning area using excessive line2 and warning line3 by programming the settings [**BCD01-HWAR**] and [**BCD01-LWAR**]. (See Table 2.13-24)

When the measured value passes over warning line3 on the upper side (i.e., point②), the TAP-BCD function issues a warning at connection point "BCD01_HI_ALARM". On the other hand, when the measured value passes over the warning line on the lower side (i.e., point⑥), the TAP-BCD function issues a warning at connection point "BCD01_LOW_ALARM".

(i)-4 Setting reset line

When a measuring value transits over warning line3 (i.e., on the way from point④ to ⑤), the TAP-BCD function should remove the issued warning. Similarly, when the measuring value transits over the excessive line2 (i.e., on the way from point③ to ④), the TAP-BCD function should remove the issued alarm. That is, the TAP-BCD function has a dead band for the resetting area so that unnecessary operation is not initiated. The user can set the width of the dead band using the setting [**BCD01-HYST**] (see Table 2.13-26); the setting is applied for both the warning and the alarm.

(ii) Setting the measurement function an absolute value

Figure 2.13-34 shows the tap-value changing from point① to ⑱ on the time-axis. In a similar way to the settings described in section 2.13.5(i), the user can set the limit lines for warning and alarm, and erroneous measurements. For measurement of an absolute value, the user should set [**BCD01-HLABSREL**] to **abs**†.

†Note:The term "abs" stands for "absolute value monitoring". That is, oil-temperature or gas-pressure monitoring.

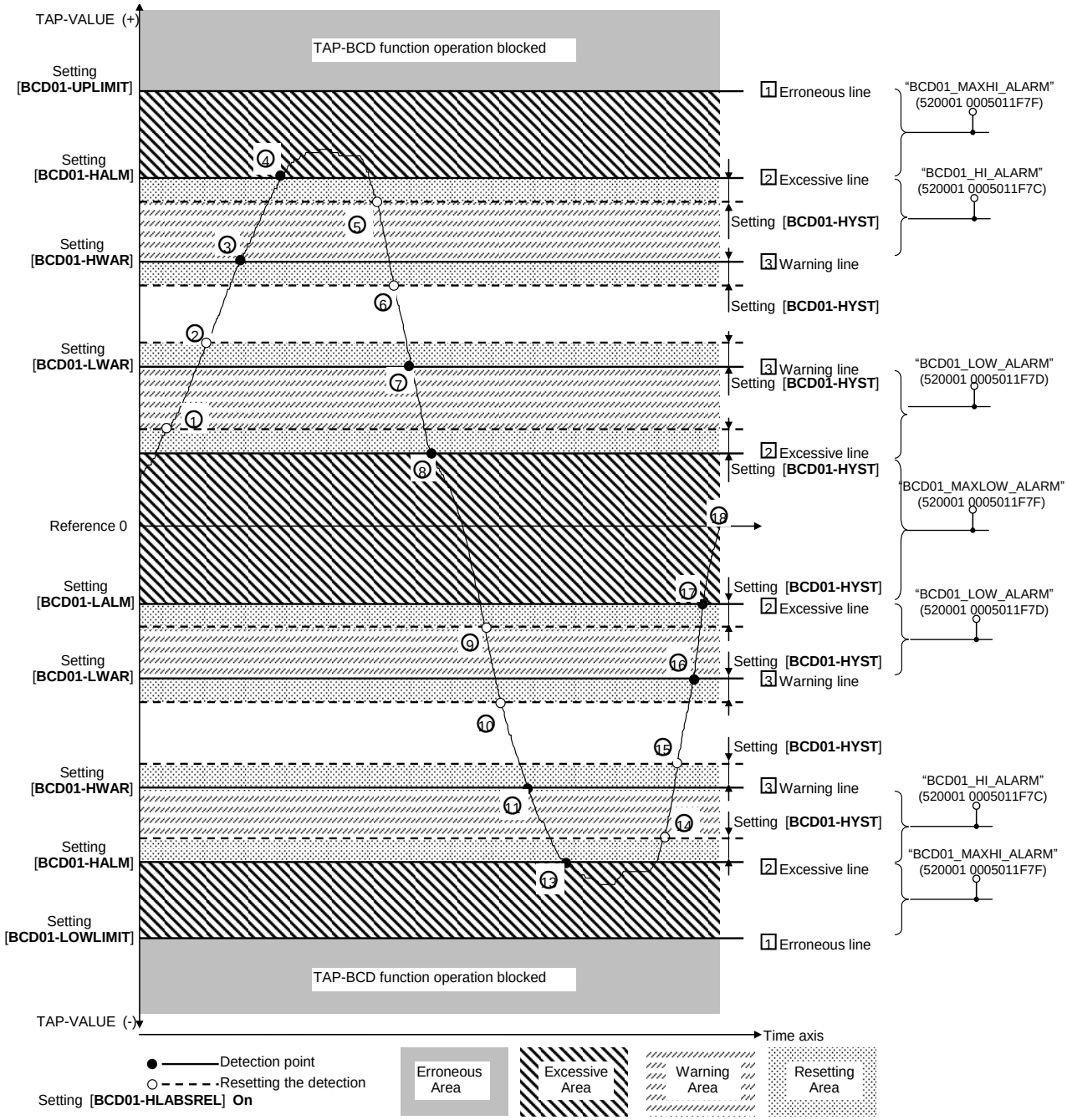


Figure 2.13-34 Example of value transition in the relative value of variance

(ii)-1 Erroneous line1

The user can set two erroneous lines1 for the upper side and the lower side using the settings [**BCD01-UPLIMIT**] and [**BCD01-LOWLIMIT**].

(ii)-2 Excessive line2

The user can program three alarm areas using erroneous line1 and excessive line2; use the settings [**BCD01-HALM**] and [**BCD01-LALM**] to define the excessive areas.

(ii)-3 Warning line3

Similarly, the user can program four warning area using the excessive line2 and the warning line3 by programming the settings [**BCD01-HWAR**] and [**BCD01-LWAR**].

(ii)-4 Setting reset line

The user can program the resetting areas using the setting [**BCD01-HYST**].

(iii) Setting of report sending for the remote-end

A new value is acquired periodically; the acquired value is updated cyclically. With regard to the reporting of the measured value for the remote-end (i.e., SAS), the TAP-BCD function can only report the value, if the difference from the last measured value is in excess of a setting. In other words, the TAP-BCD function does not report the new value for the remote-end when the degree of the change is less than the setting [**BCD01-SDBSAS**] (see Table 2.13-26).

(iv) Commencing TAB-BCD operation

The user should set **On** for scheme switch [**BCD01-EN**] so that the TAB-BCD function can start to operate.

(v) Signal names and numbers

Table 2.13-23 PLC monitoring points (Output signal for BIO)

Signal Number	Signal Name	Description
520001 0005011F7C	BCD01_HI_ALARM	Upper limit detected
520001 0005011F7D	BCD01_LOW_ALARM	Lower limit detected
520001 0005011F7E	BCD01_MAXLOW_ALARM	Maximum upper limit detected
520001 0005011F7F	BCD01_MAXHI_ALARM	Maximum lower limit detected

(vi) Setting names

Table 2.13-24 Settings for monitoring

Setting Name	Description	Default	Setting item or value
BCD01-UPLIMIT	BCD-Error upper threshold	99999	-99999 to +99999
BCD01-HALMEN	Activate maximum upper limit checking	On	Off/ On
BCD01-HALM	Maximum upper value	99999	-99999 to +99999
BCD01-HWANEN	Activate upper limit checking	On	Off/ On

Setting Name	Description	Default	Setting item or value
BCD01-HWAR	Upper value	99999	-99999 to +99999
BCD01-LWANEN	Activate lower limit checking	On	Off/ On
BCD01-LWAR	Lower value	-99999	-99999 to +99999
BCD01-LALMEN	Activate maximum lower limit checking	On	Off/ On
BCD01-LALM	Maximum lower value	-99999	-99999 to +99999

Table 2.13-25 Settings for checking limits

Setting Name	Description	Default	Setting item or value
BCD01- HLABSREL	Checking either relative or absolute limits	On	Off/On

Table 2.13-26 Settings for measurement and reporting

Setting Name	Description	Default	Setting item or value
BCD01-EN	Activate monitoring function of BCD010	On	Off / On
BCD01-HYST	Deadband to reset	0	0-100
BCD01-SDBSAS	Sending Deadband	0[%]	0 -50 [%]

2.13.6 Setup for BIO module

The user will need to connect the TAP-BCD output/input points with the BI and the BO circuits; consequently, the TAP-BCD function is able to issue select and operate commands. The user should use the following procedure.

i BI connection for value acquisition
ii BO connection for "Select command Raise/Lower"
iii BO connection for "Operate command Raise/Lower"
iv Contact health check

Note that the TAP-BCD function starts to operate when **On** is set for the scheme switch [**BCD01-EN**].

(i) BI connection for value acquisition

We shall again see the tap-value acquisition function shown in Figure 2.13-35. For tap-value acquisitions, the user is required to setup respective BIs corresponding to the OLTC and the TPI.

(i)-1 Tap indication signals

Suppose that we consider the BIs at slots IO#2 and IO#3 for tap-value acquisition shown in Figure 2.13-35. For example, at IO#2, BI1 receives a bit signal coming from the first transducer (Bit-0); thus, the user should set the signal number "200B02 8001001172" for scheme switch [**BCD01-BCD00001**]. Other BI signals also need to be set for scheme switch [**BCD01-BCDxxxxx**].

The plus/minus transducer is also provided; the transducer signal can be received at BI3 on IO#3. Hence, the user is required to set the signal number "200B03 8201021172"for the scheme switch [**BCD01-SIGN**]. Incidentally, when a signal instructing that the tap is being changed is provided, the TAP-BCD function should acquire the sign by setting the signal number "200B03 8301031172" for the scheme switch [**BCD01-CHG**].

(i)-2 Tap-value signals

The user can acquire a tap-value using the "BCD01_STATE‡" signal. On the other hand, when a digit belonging to the data is required, the user can access the digit using the respective corresponding output. For example, when the first digit is required, use the output signal on output-point "BCD01-ONE_DIGIT".

(i)-3 TPI signal

When the TAP-BCD function operates for transformers controlled by the TPI function, the TAP-BCD function should acquire a signal using the scheme switch [**BCD01-TAPCHG**]. This

signal is used to instruct the TAP-BCD function that the TPI function is in service. For more information, see section 2.13.7.

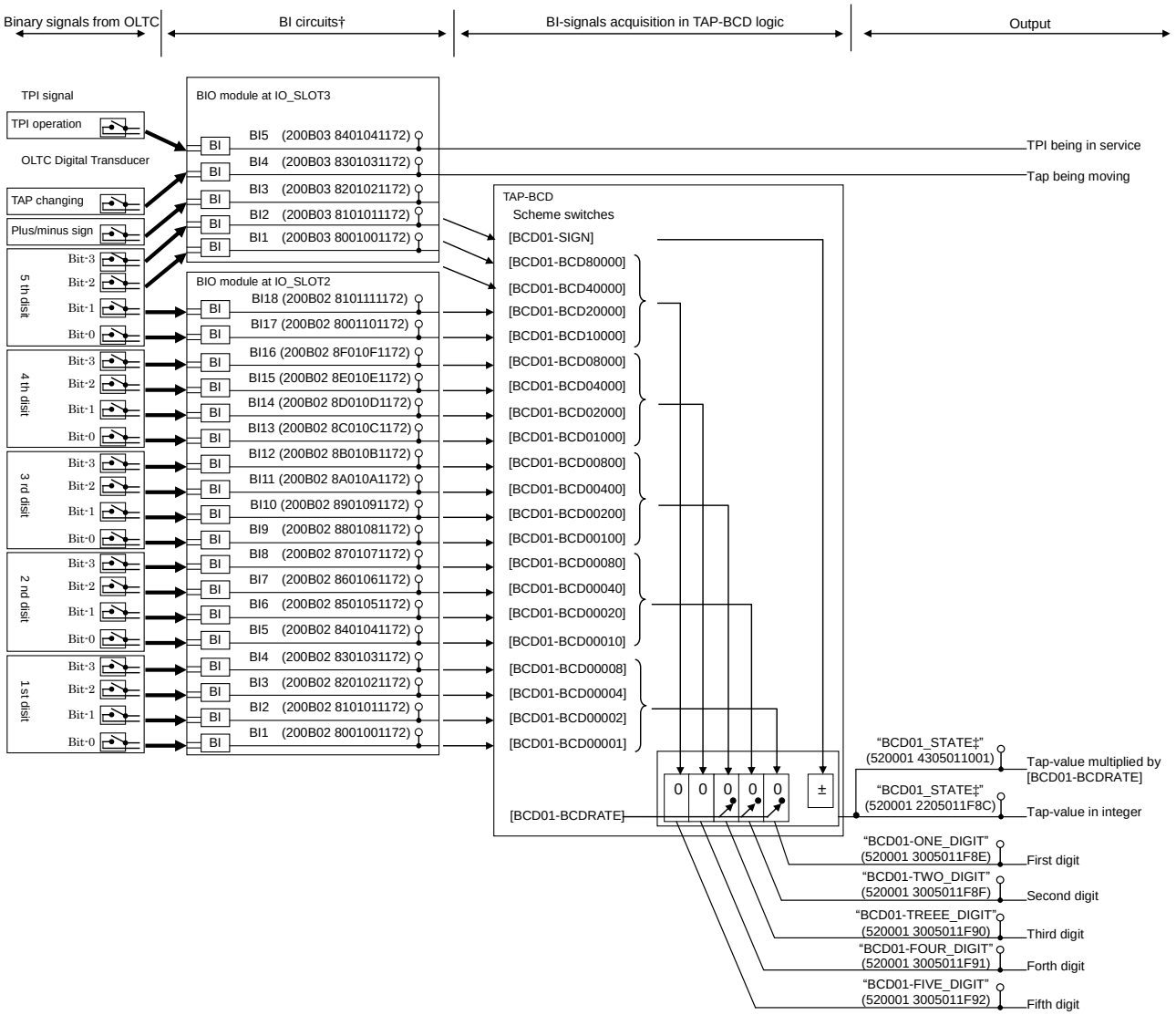


Figure 2.13-35 Acquisition of Tap-value in TAP-BCD

†Note: For the explanation, we take into account BI1—BI18 at IO#2 and BI1—BI3 at IO#3; thus, the user should group the actual signal numbers for the operation. For allocations of binary-input signals on the BIO module, see Chapter *Technical description: Binary IO module*.

‡Note: For the tap-value, two types are available; these are output at the output-signal "BCD01_STATE. The former type is represented in integer format and can be received at signal-number "520001 **2205011F8C**", the latter type is represented in a value with a decimal point and can be received at the alternative signal-umber "520001 **4305011001**". Either weighting factors "0.01" or "0.1" are available for the latter type; the user is required to set a weighting factor for the setting [**BCD01-BCDRATE**] so that the user can obtain the value with a decimal point. A weighting factor of "1" should be set when integer values are required i.e. when using the

former type of format.

(ii) BO connection for "Select command Raise/Lower"

Figure 2.13-36 exemplifies the connections for "Select command Raise" and "Select command Lower". Suppose that the connections are achieved using BO1 with connection point "BO1_SOURCE"; similarly the connections for BO2 are achieved using connection point "BO2_SOURCE". As a result, the "Select command Raise" is issued from BO1; and "Select command Lower" is issued from BO2.

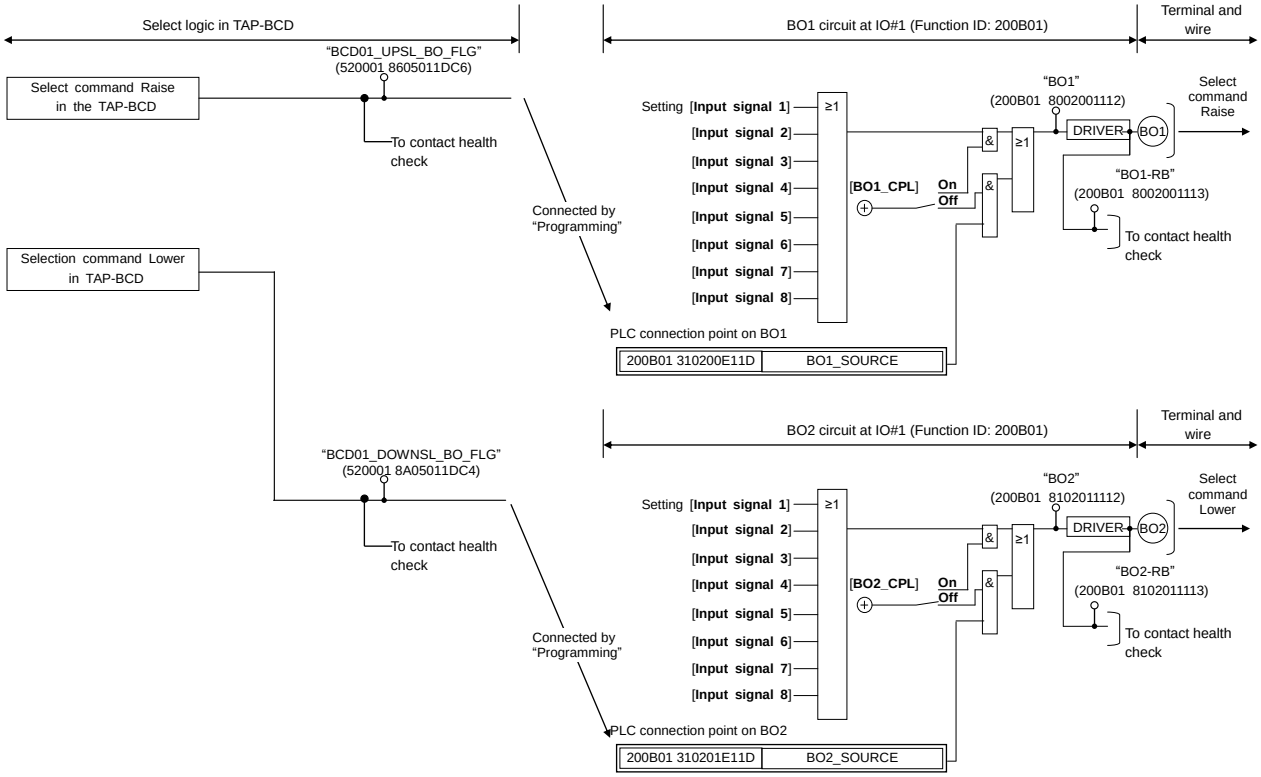


Figure 2.13-36 Example of select commands output by BO1 & BO2 at IO#1

(iii) BO connection for "Operate command Raise/Lower"

Figure 2.13-37 exemplifies the connection for "Operate command Raise" and "Operate command Lower". Suppose that the connections are achieved using BO3 with connection point "BO3_SOURCE"; similarly, the connections for BO4 are achieved using connection point "BO4_SOURCE". As a result, the "Operate command Raise" is issued from BO3; and the "Select command Lower" is issued from BO4.

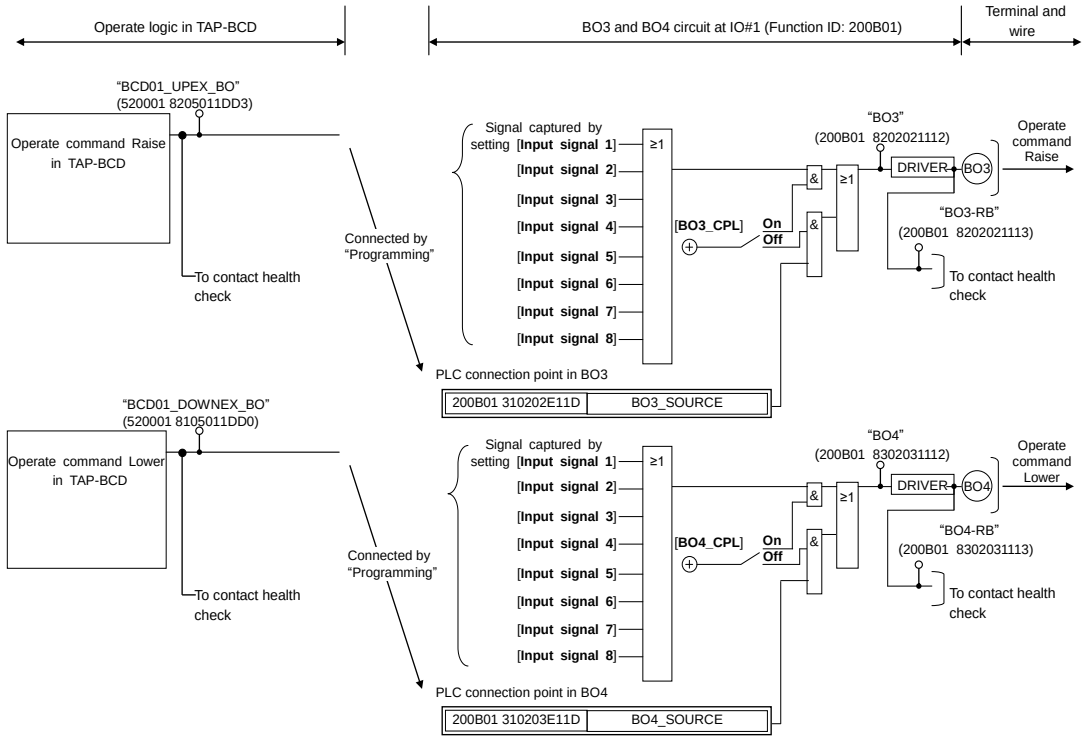


Figure 2.13-37 Example of TAP-BCD operate commands being output by BO3 & BO4 at IO#1

(iv) Contact health check

To detect incorrect signals appearing at the output of the BO circuit, the TAP-BCD function has a health check feature for the output contact. Hence, the user can connect an output signal with the health check function when **Fixedlogic** is set for the scheme switches [**BCD01-LGUPEXOT**] and [**BCD01-LGDWEXOT**]†. Consequently, the TAP-BCD function can distinguish whether the signal has been successfully output from the BO. If a failure is reported, the TAP-BCD function determines that the contact is unable to operate; then, the Raise- or Lower-commands are discarded immediately and the TAP-BCD function returns to the "Wait for a command" stage.

(iv)-1 Setting for Select command Raise

If we consider an example where the signal "Select command Raise" has been connected with the BO1 circuit for the check; the user is required to set the point "BO1-RB" using [**BCD01-P1SLBORD**]. Do not set the signal "BCD01_UPSL_BO_FLG"; this is because the signal "BCD01_UPSL_BO_FLG" is not generated in the BO1 circuit, but in the TAP-BCD function and hence would not be indicative of the health of the binary output circuit.

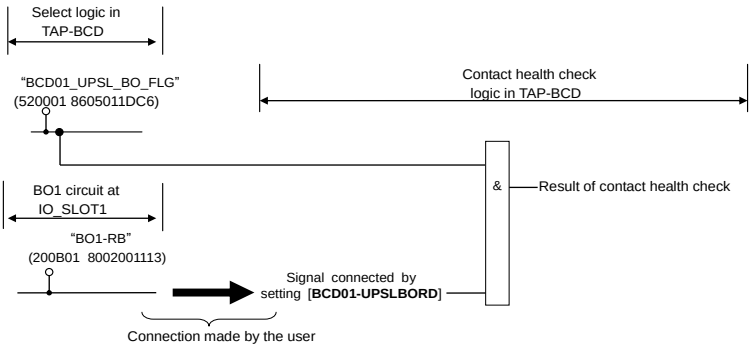


Figure 2.13-38 Example of contact health check for Select command Raise

(iv)-2 Setting for Select command Lower

In a similar way to "Select command Raise", the signal "Select command Lower" has been connected to the BO2 circuit; the user is required to set the point "BO2-RB" for [**BCD01-DWSLBORD**]. Do not set the signal "BCD01_DOWNSL_BO_FLG".

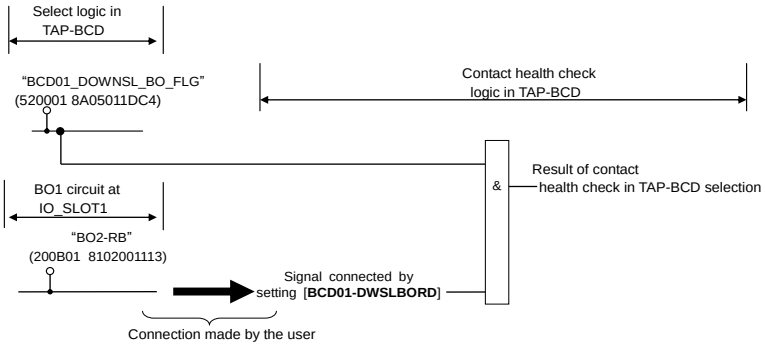


Figure 2.13-39 Example of contact health check for Select command Lower

(iv)-3 Setting for Operate command Raise

Similarly, point "BO3-RB" must be set for [**BCD01-UPEXBORD**].

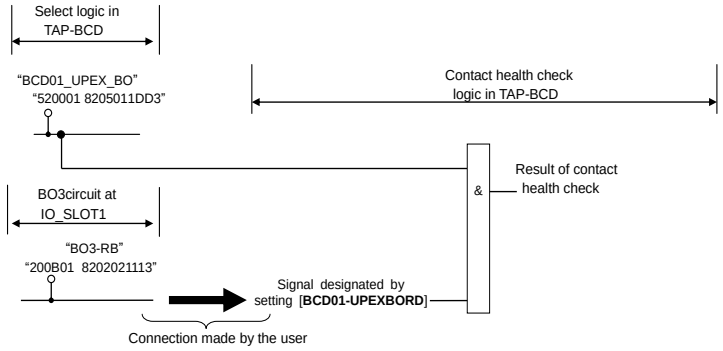


Figure 2.13-40 Example of contact health check for Operate command Raise

(iv)-4 Setting for Operate command Lower

Likewise, point "BO4-RB" must be set for [**BCD01-DWEXBORD**].

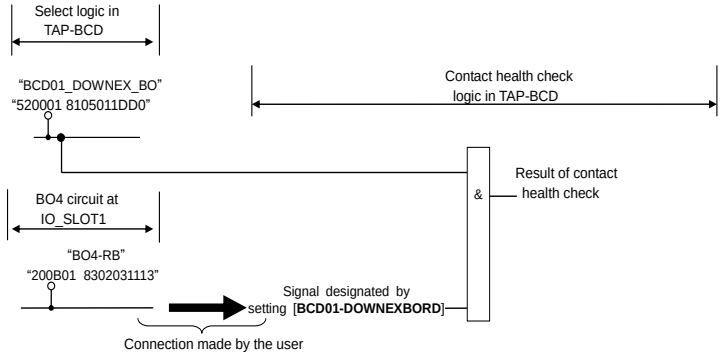


Figure 2.13-41 Example of contact health check for Operate command Lower

(iv)-5 Settings for correct contact health check (normal setting, example #1)

Figure 2.13-42 illustrates a setting example for the OLTC scheme. Select and operate commands drive BO1 to BO4 contacts. In order for the contact health check function to work correctly, the respective points for the BO-RBs should be connected, as shown in Table 2.13-27, this shows that the settings are matched physically with the BO contacts.

Table 2.13-27 Setting example for contact health check

Example #1		Contact health check setting for example #1	
"BCD01_OSL_BO_FLG" is connected to "BO1" at IO#1	⇨	200B01 8002001113(BO1-RB) set for [**BCD01_P1SLBORD**]	OK
"BCD01_DOWNSL_BO_FLG" is connected to "BO2" at IO#1	⇨	200B01 8102011113 (BO2-RB) set for [**BCD01-P2SLBORD**]	OK
"BCD01_UPEX_BO" is connected to "BO3" at IO#1	⇨	200B01 8202021113(BO3-RB) set for [**BCD01-P1EXBORD**]	OK
"BCD01_DOWNEX_BO" is connected to "BO4" at IO#1	⇨	200B01 8302031113(BO4-RB) set for [**BCD01-P2EXBORD**]	OK

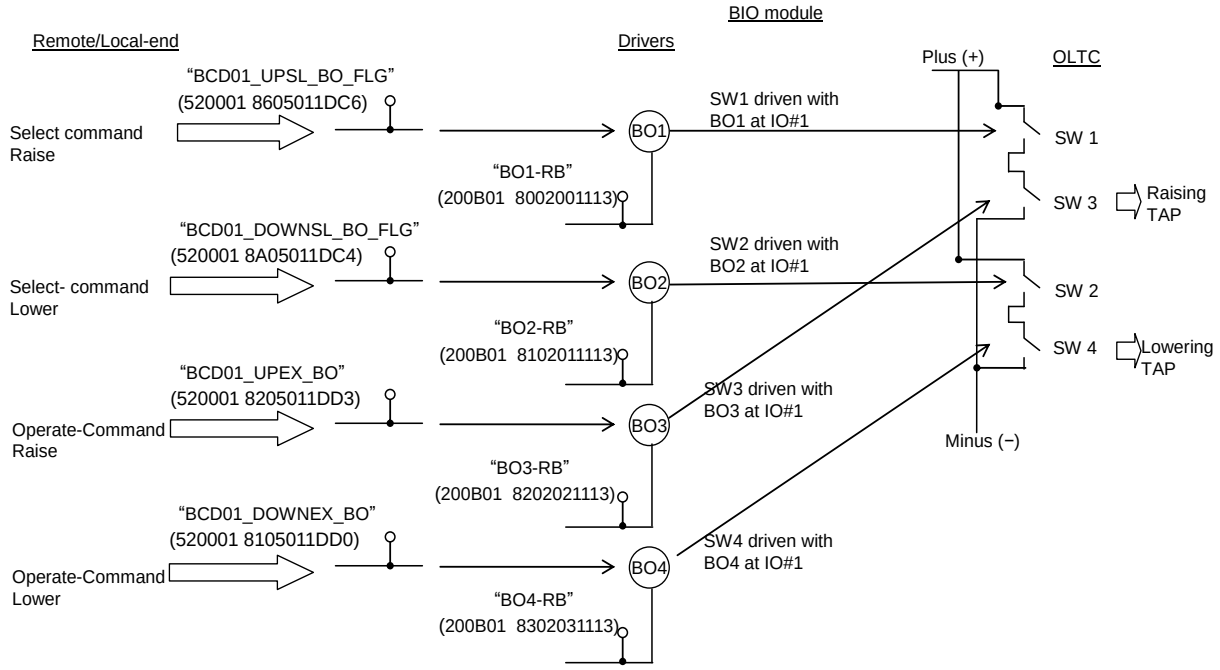


Figure 2.13-42 Contact health check setting and OLTC-TAP scheme for example #1

(iv)-6 Settings for Erroneous contact health check (improper setting, example #2)

Figure 2.13-43 illustrates an example for the erroneous settings feature for the OLTC scheme. The settings are implemented incorrectly: as shown in Table 2.13-28; BO1 is selected instead of BO1-RB. In this case, the setting [**BCD01-UPSLBORD**] has no meaning; hence, the issuing of a select command is blocked.

Table 2.13-28 Erroneous setting example for contact health check

Example #2	Contact health check setting for example #2	
"BCD01_UPSL_BO_FLG" is connected to "BO1" at IO#1	200B01 8002001112 (BO1) set for [**BCD01_P1SLBORD**]	NG
"BCD01_DOWNSL_BO_FLG" is connected to "BO2" at IO#1	200B01 8102011113 (BO2-RB) set for [**BCD01-P2SLBORD**]	OK
"BCD01_UPEX_BO" is connected to "BO3" at IO#1	200B01 8202021113(BO3-RB) set for [**BCD01-P1EXBORD**]	OK
"BCD01_DOWNEX_BO" is connected to "BO4" at IO#1	200B01 8302031113(BO4-RB) set for [**BCD01-P2EXBORD**]	OK

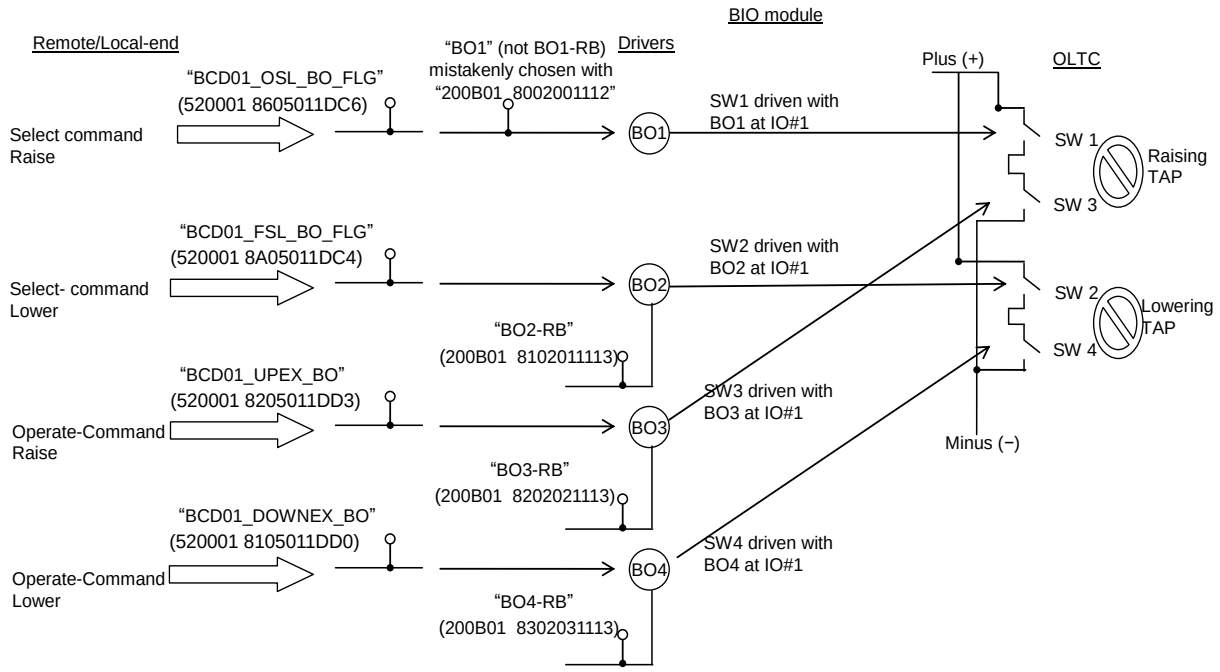


Figure 2.13-43 Contact health check setting and OLTC-TAP diagram for example #2

(iv)-7 Settings for extra contact health check (special setting, example #3)

Figure 2.13-44 illustrates an additional setting example for the OLTC scheme; one of the settings is made hypothetically. That is, the point "BCD01_**SL_BO_FLG" is chosen for the setting [**BCD01-SLBORD**]; BO1-RB is not selected. This extra example can issue a select command, which is called "operated by internal selection function". The user does not need a BO circuit for a select command if they do not have access to one of the BIO circuits.

Table 2.13-29 Extra setting example for contact health check

Example #3	Setting in example #3	
"BCD01_UPSL_BO_FLG" is not connected to any "BO"	"BCD01_UPSL_BO_FLG" set for [**BCD01-UPSLBORD**]	OK
"BCD01_DOWNSL_BO_FLG" is not connected to any "BO"	"BCD01_DOWNSL_BO_FLG" set for [**BCD01-DWSLBORD**]	OK
"BCD01_UPEX_BO" is connected to "BO3" at IO#1	200B01 8102011113(BO2-RB) set [**BCD01-UPEXBORD**]	OK
"BCD01_DOWNEX_BO" is connected to "BO4" at IO#1	200B01 8202021113 (BO3-RB) set [**BCD01-DWEXBORD**]	OK

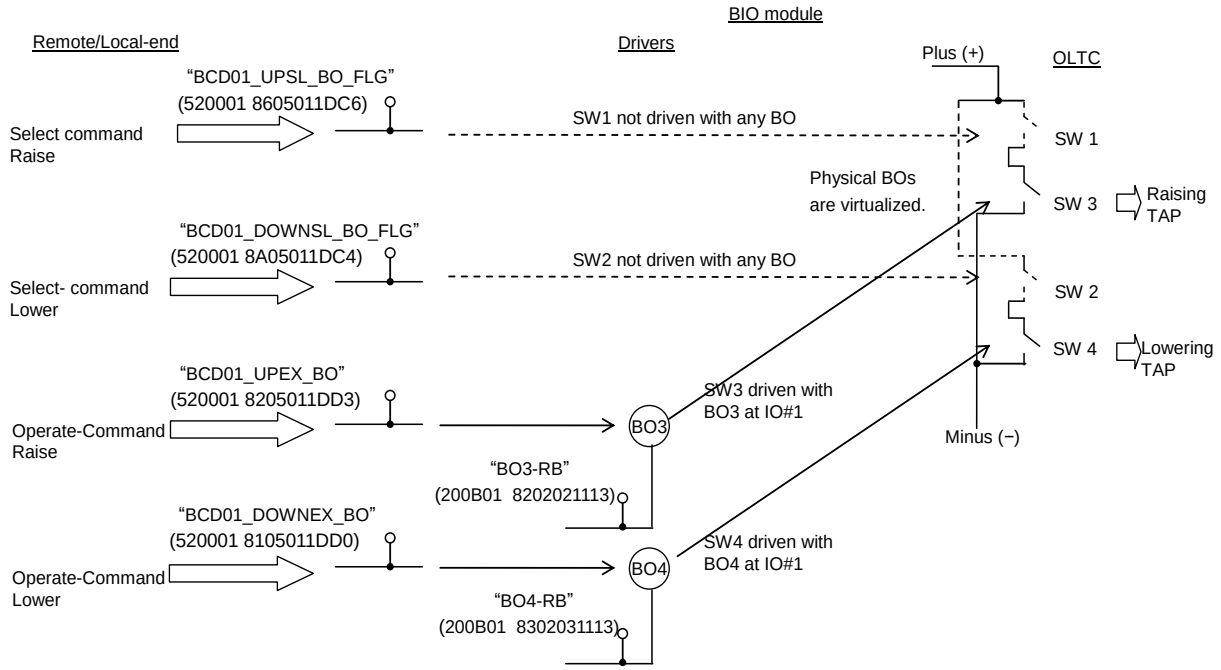


Figure 2.13-44 Contact health check setting and OLTC-TAP diagram in example #3

(v) Setting names

Table 2.13-30 Settings of health check function

Setting Name	Description	Default	Setting item or value
BCD01-UPSLBORD	Set signal number with regard to Select Raise	Preferred signal	BO-RB signal number
BCD01-DWSLBORD	Set signal number with regard to Select Lower	Preferred signal	BO-RB signal number
BCD01-UPEXBORD	Set signal number with regard to Operate Raise	Preferred signal	BO-RB signal number
BCD01-DWEXBORD	Set signal number with regard to Operate Lower	Preferred signal	BO-RB signal number
BCD01-LGUPEXOT	Logic selector for command output (BCD01)	Fixedlogic	Fixedlogic/PLC
BCD01-LGDWEXOT	Logic selector for command output (BCD01)	Fixedlogic	Fixedlogic/PLC

2.13.7 Setting for Transformer parallel interlocking system

Figure 2.13-45 shows six transformers placed in six banks; the transformers are controlled by the transformer parallel interlocking system (TPI). All transformers (T1 to T6) are operated in parallel by the TPI function; hence, the TAP-BCD function (including OLTC) is forbidden to control tap-positions individually. On this account, the TPI function sends the TAP-BCD function an inhibit signal so that the TAP-BCD function is not allowed to operate.

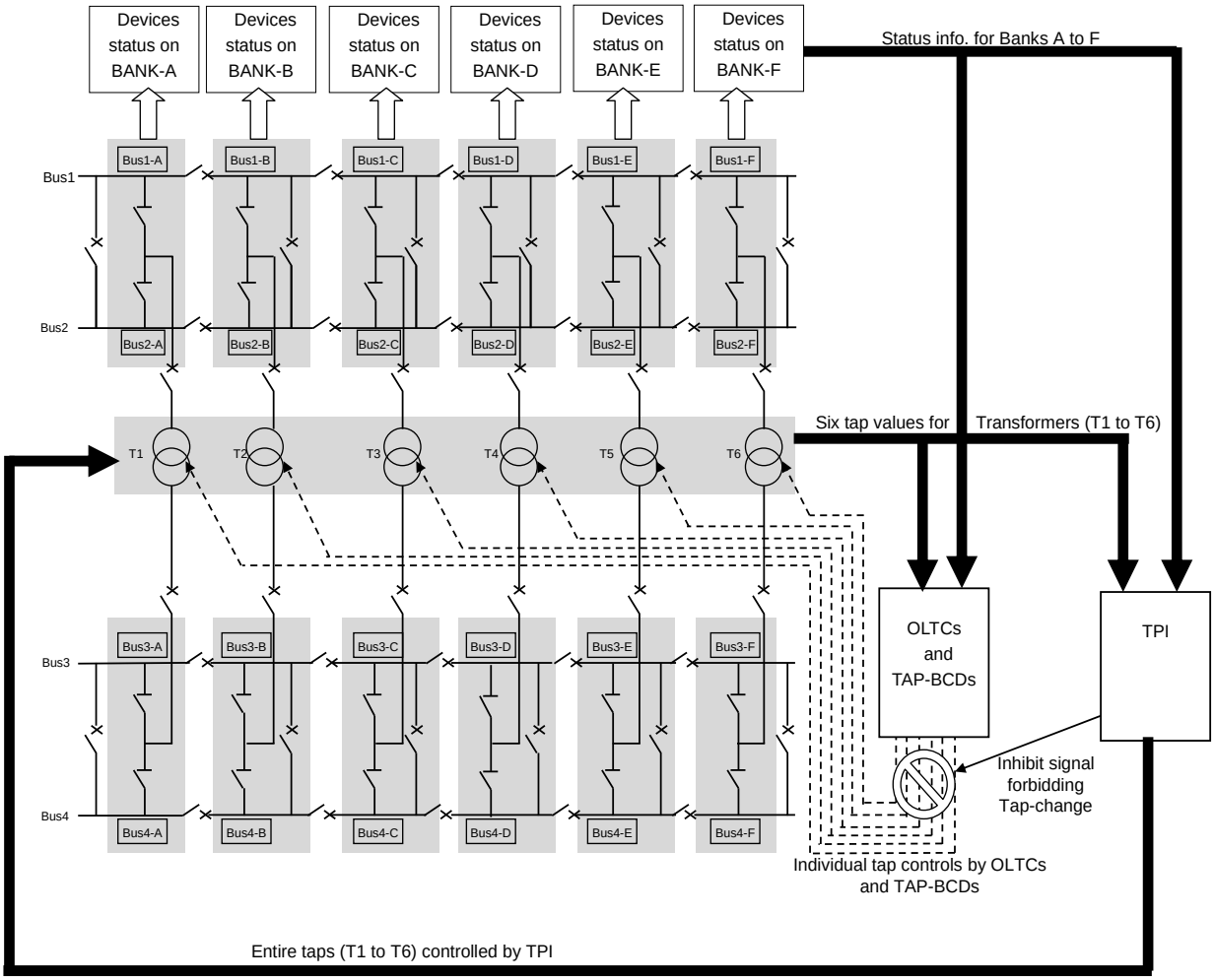


Figure 2.13-45 Transformers controlled by TPI function

For the above example, a inhibit signal is received on the BI4 circuit at IO#3; hence, the user should set the signal for BI4 (200B03_8301031172) for the setting [**BCD01-CHGTPI**].

Table 2.13-31 Settings for TPI system

Setting Name	Description	Default	Setting item or value
BCD01-CHGTPI	TPI operation signal	Preferred signal	Receipt signal on BI circuit

Note: Since the TPI function is a specialized system manufactured by TOSHIBA, the user should not attempt to perform the setting [**BCD01-CHGTPI**] on another system.

2.13.8 Mapping TAP-BCD function signals for IEC61850 communication

The user can operate the TAP-BCD function over IEC 61850 communication† following mapping using GR-TIEMS. Note that the TAP-BCD function is designed for the class of "Binary Step position Controller (BSC)" in the IEC 61850 standard communication. The user should follow these steps, each of which is discussed below:

Step1: Editing Logical Node

Step2: Mapping output data

Step3: Mapping input data

(i) Editing Logical Node

The user will need to create a logical node (LN) for the TAP-BCD function. Figure 2.13-46 exemplifies the editing of a LN; the LN "Automatic tap changer control (ATCC)" is chosen for the TAP-BCD function. After the user has defined an object "BSC", the TAP-BCD logical node can be saved with the name "ATCC$TapChg" plus "LN Instance". Create a definition of object "BSC" in the TAP-BCD logical. Either the SBO mode or the DIR mode can be chosen in the editing for the LN.

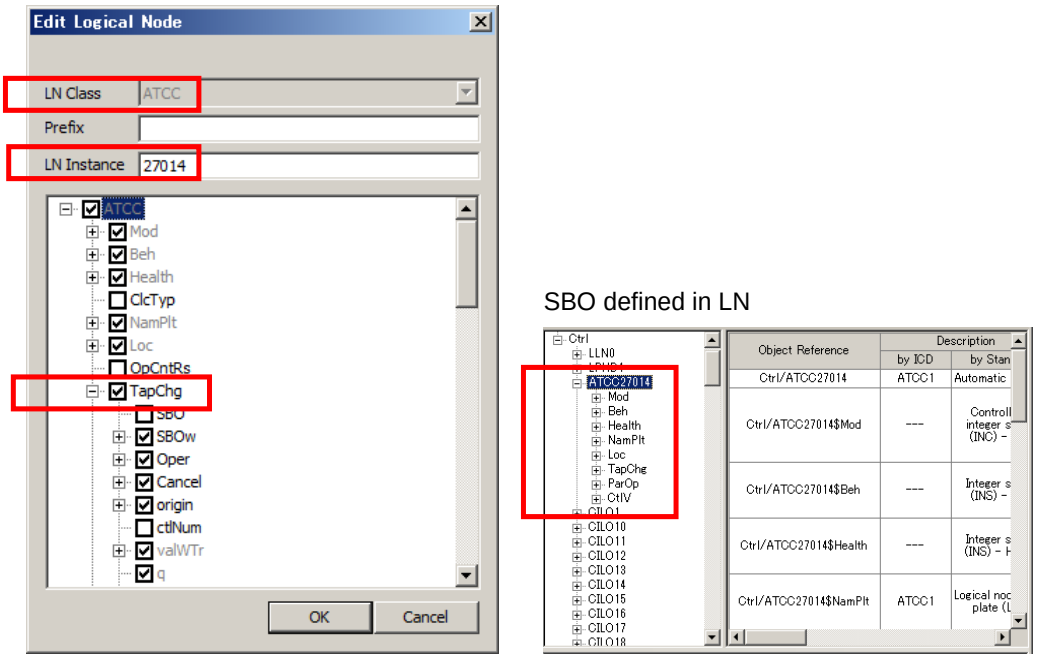
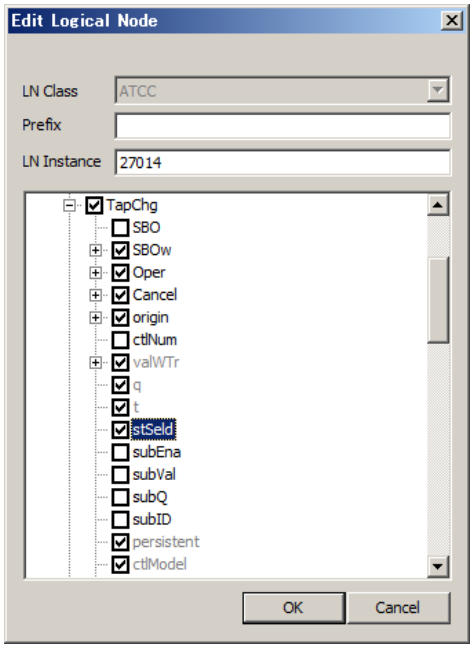


Figure 2.13-46 Defining "BSC" object in ATCC logic node

(i)-1 Defining SBO mode

Figure 2.13-47 exemplifies the TAP-BCD logic node saved as “ATCC$TapChg”. In the SBO mode, the user should select the following items for the “ATCC$TapChg” using GR-TIEMS:



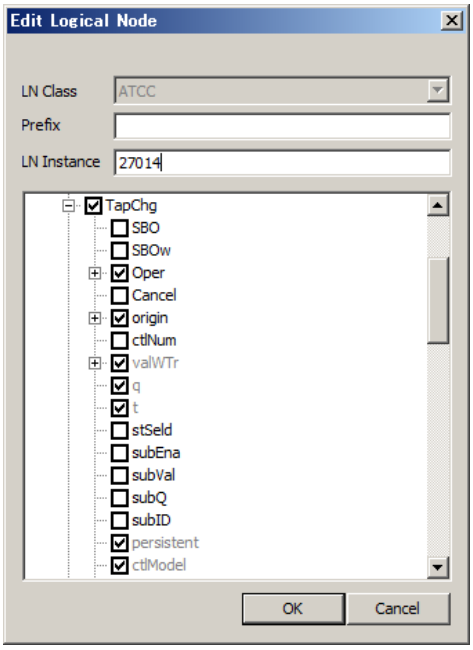
- ✓ SBOw
- ✓ Oper
- ✓ Cancel
- ✓ Origin
- ✓ stSeld
- ✓ sboClass† (choice ”operate-once”)
- ✓ ctlmodel (choice ”SBOes or SBOns”)

†”sboClass” can be found by scrolling down.

Figure 2.13-47 LN editing screen for SBO mode (for example)

(i)-2 Defining DIR mode

Figure 2.13-48 exemplifies the TAP-BCD logic node saved as save as “ATCC$TapChg”: In the DIR mode, the following three items should be selected using GR-TIEMS.



- ✓ Oper
- ✓ origin
- ✓ ctlmodel (choice ”DOes or DOns”)

Figure 2.13-48 LN editing screen for DIR mode (for example)

(ii) Mapping output data

The user should group the TAP-BCD signals with regard to GOOSE and REPORT; the user should map them for IEC61850 communication using GR-TIEMS. (Figure 2.13-49 illustrates how to map a signal); it indicates that the signals for the TAP-BCD function are required to map for IEC 61850 communications.

Table 2.13-32 Mapping signals required for ATCC object in TAP-BCD function

Object_reference	Attribute	Type	FC	Signal Number	Signal Name
Ctrl/ATCC27014$TapChg$origin	orCat	orCategory	ST	5200013105011008	BCD01_ORCAT
Ctrl/ATCC27014$TapChg$origin	orIdent	Octet64	ST	5200016A05011009	BCD01_ORIDENT
Ctrl/ATCC27014$TapChg	stVal	INT32	ST	5200014305011001	BCD01_STATE
Ctrl/ATCC27014$TapChg	q	Quality	ST	5200013105011005	BCD01_QUALITY
Ctrl/ATCC27014$TapChg	t	Timestamp	ST	5200019005011006	BCD01_TIMESTAMP
Ctrl/ATCC27014$TapChg	stSeld	BOOLEAN	ST	5200010005011D90	BCD01_SLD_RPT

Note: "Status (ST)" is defined in the function constraint (FC) of the IEC 61850.

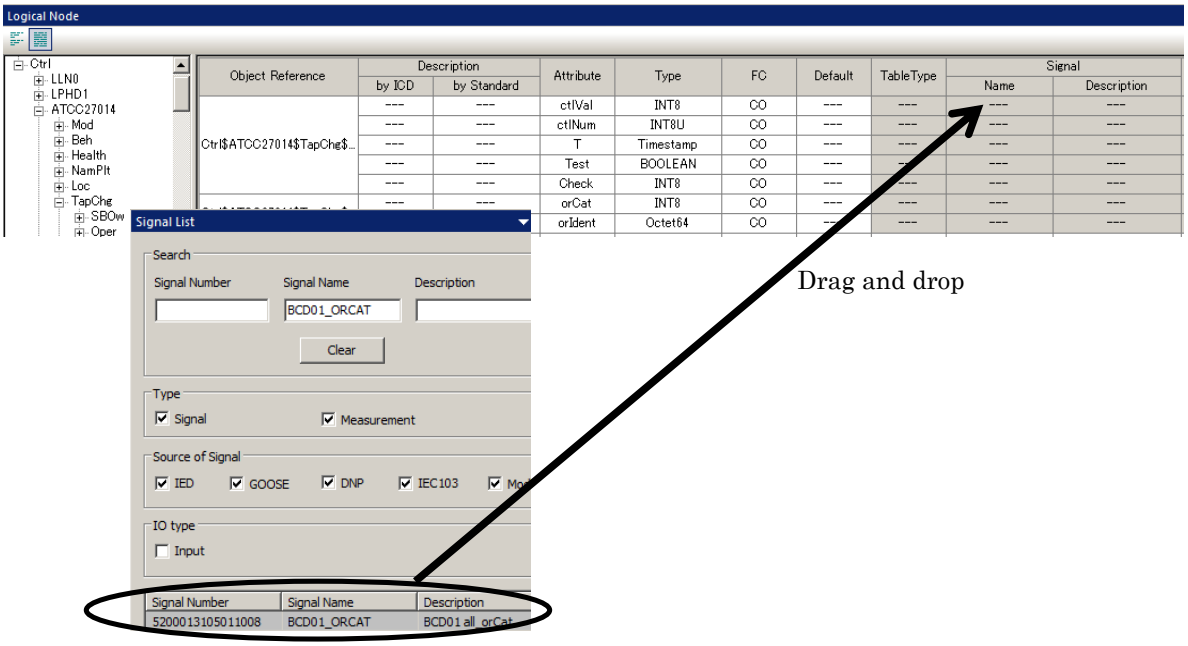


Figure 2.13-49 Attribute mapped into TapChg object of ATCC

(iii) Mapping input data

The TAP-BCD function can receive three commands "select, operate, and cancel". Thus, the user should map the input-point "DEV01_CONTROL_REQ" to the IEC61850 communication. Table 2.13-33 shows the input-point "DEV01_CONTROL_REQ" and the Object reference "TapChg"; the user should map the input-point to the Object references having attributes CO and CF†. Figure 2.13-50 shows how to map a signal.

†Note: The attribute is defined in the IEC 61850; "CO" stands for "Control" and "CF" stands for "Configuration" in the functional constraint (FC).

Table 2.13-33 Mapping signals required for DPC object for ATCC

Object_reference	Attribute	Type	FC	Signal Number	Signal Name
Ctrl/ATCC2701$TapChg$SBOw	ctlVal	INT32	CO	5200017005016D08	DEV01_CONTROL_REQ
Ctrl/ATCC2701$TapChg$SBOw	ctlNum	INT8U	CO		
Ctrl/ATCC2701$TapChg$SBOw	T	Timestamp	CO		
Ctrl/ATCC2701$TapChg$SBOw	Test	BOOLEAN	CO		
Ctrl/ATCC2701$TapChg$SBOw	Check	Check	CO		
Ctrl/ATCC2701$TapChg$SBOw$origin	orCat	orCategory	CO		
Ctrl/ATCC2701$TapChg$SBOw$origin	orIdent	Octet64	CO		
Ctrl/ATCC2701$TapChg$Oper	ctlVal	INT32	CO		
Ctrl/ATCC2701$TapChg$Oper	ctlNum	INT8U	CO		
Ctrl/ATCC2701$TapChg$Oper	T	Timestamp	CO		
Ctrl/ATCC2701$TapChg$Oper	Test	BOOLEAN	CO		
Ctrl/ATCC2701$TapChg$Oper	Check	Check	CO		
Ctrl/ATCC2701$TapChg$Oper$origin	orCat	orCategory	CO		
Ctrl/ATCC2701$TapChg$Oper$origin	orIdent	Octet64	CO		
Ctrl/ATCC2701$TapChg$Cancel	ctlVal	INT32	CO		
Ctrl/ATCC2701$TapChg$Cancel	ctlNum	INT8U	CO		
Ctrl/ATCC2701$TapChg$Cancel	T	Timestamp	CO		
Ctrl/ATCC2701$TapChg$Cancel	Test	BOOLEAN	CO		
Ctrl/ATCC2701$TapChg$Cancel$origin	orCat	orCategory	CO		
Ctrl/ATCC2701$TapChg$Cancel$origin	orIdent	Octet64	CO		
Ctrl/ATCC2701$TapChg	ctlModel	ctlModel	CF		
Ctrl/ATCC2701$TapChg	sboClass	sboClass	CF		

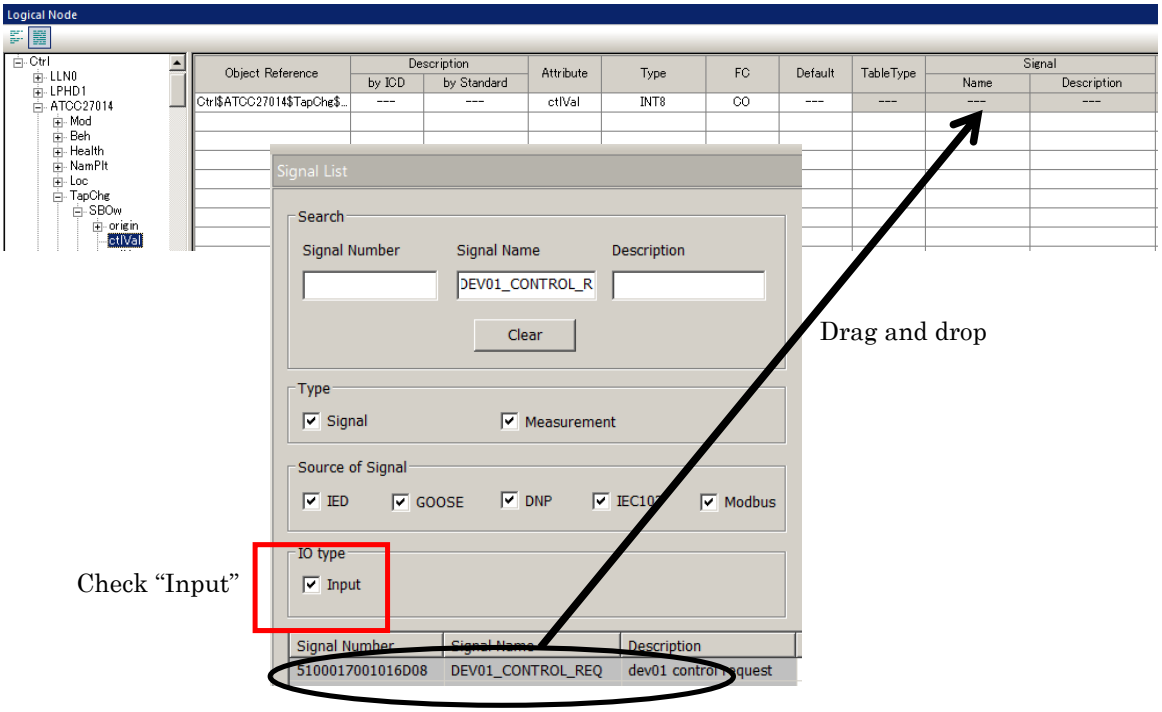


Figure 2.13-50 Input-point mapped for ATCC

2.13.9 Setting

Setting of TAP-BCD(Function ID:520001)

Setting device	Range	Units	Contents	Default setting value	Notes
BCD01-EN	Off/On		Activation switch for Monitoring[Off/On]	Off	
BCD01-BCD00001			Binary Coded Decimal #1-bit0(Assign BI signal)		
BCD01-BCD00002			Binary Coded Decimal #1-bit1(Assign BI signal)		
BCD01-BCD00004			Binary Coded Decimal #1-bit2(Assign BI signal)		
BCD01-BCD00008			Binary Coded Decimal #1-bit3(Assign BI signal)		
BCD01-BCD00010			Binary Coded Decimal #2-bit0(Assign BI signal)		
BCD01-BCD00020			Binary Coded Decimal #2-bit1(Assign BI signal)		
BCD01-BCD00040			Binary Coded Decimal #2-bit2(Assign BI signal)		
BCD01-BCD00080			Binary Coded Decimal #2-bit3(Assign BI signal)		
BCD01-BCD00100			Binary Coded Decimal #3-bit0(Assign BI signal)		
BCD01-BCD00200			Binary Coded Decimal #3-bit1(Assign BI signal)		
BCD01-BCD00400			Binary Coded Decimal #3-bit2(Assign BI signal)		
BCD01-BCD00800			Binary Coded Decimal #3-bit3(Assign BI signal)		
BCD01-BCD01000			Binary Coded Decimal #4-bit0(Assign BI signal)		
BCD01-BCD02000			Binary Coded Decimal #4-bit1(Assign BI signal)		
BCD01-BCD04000			Binary Coded Decimal #4-bit2(Assign BI signal)		
BCD01-BCD08000			Binary Coded Decimal #4-bit3(Assign BI signal)		
BCD01-BCD10000			Binary Coded Decimal #5-bit0(Assign BI signal)		
BCD01-BCD20000			Binary Coded Decimal #5-bit1(Assign BI signal)		
BCD01-BCD40000			Binary Coded Decimal #5-bit2(Assign BI signal)		
BCD01-BCD80000			Binary Coded Decimal #5-bit3(Assign BI signal)		
BCD01-SIGN			[-]minus indicator(If needed, assign BI signal)		
BCD01-CHG			Tap Changing signal(Assign BI signal)		
BCD01-CHGTPI			Master or Follower(M/F) condition (Assign BI signal)		
BCD01-CHGTIM	0.0-10.0	s	Waiting time for tap behavior	1	
BCD01-S43SPIND			Independent(Assign BI signal)		
BCD01-BCDRATE	1/0.1/0.01		Measurement Rate(multiplied factor)	0.01	
BCD01-UPLIMIT	-99999-99999	none	raise limit value(Out of control and monitoring)	99999	
BCD01-LOWLIMIT	-99999-99999	none	Lower limit value(Out of control and monitoring)	-99999	
BCD01-HALMEN	Off/On		Activation switch for high-alarm[Off/On]	On	
BCD01-HALM	-99999-99999	none	Threshold for high-alarm	99999	
BCD01-HWAREN	Off/On		Activation switch for high-warning[Off/On]	On	
BCD01-HWAR	-99999-99999	none	Threshold for high-warning	99999	
BCD01-LALMEN	Off/On		Activation switch for low-alarm[Off/On]	On	
BCD01-LALM	-99999-99999	none	Threshold for low-alarm	-99999	
BCD01-LWAREN	Off/On		Activation switch for low-warning[Off/On]	On	
BCD01-LWAR	-99999-99999	none	Threshold for low-warning	-99999	
BCD01-HYST	0-100	none	hysteresis(dead band) for resetting alarm/warning	0	
BCD01-HLABSREL	rel/abs		Alarming/Warning detection method[Absolute/Relative]	abs	
BCD01-SDBSAS	0.00-50.00	%	Sending Dead Band	0	

Setting of TAP-BCD(Function ID:520001)

Setting device	Range	Units	Contents	Default setting value	Notes
BCD01-CTREN	Off/On		Activation switch to control[Off/On]	Off	
BCD01-CTRMENU	Off/On		Activation switch for [Main-Menu-Control]	On	
BCD01-CTRAHMI	DIR/SBO		Local HMI controlling scheme [SBO/DO]	SBO	
BCD01-NSLBORD1			CCS(Contact Checking Supervision) for none-directional selection		
BCD01-NSLBORD2			CCS(Contact Checking Supervision) for none-directional selection		
BCD01-DWSLBORD			CCS(Contact Checking Supervision) for lower-directional selection		
BCD01-UPSLBORD			CCS(Contact Checking Supervision) for raise-directional selection		
BCD01-DWEXBORD			CCS(Contact Checking Supervision) for lower-directional execution		
BCD01-UPEXBORD			CCS(Contact Checking Supervision) for raise-directional execution		
BCD01-LGCTRCON	FixedLogic/PLC		Logic selector for [operate condition], Fixed or UnFixed(PLC).	PLC	
BCD01-LGSLFFCT	FixedLogic/PLC		Logic selector for [select condition], Fixed or UnFixed(PLC).	PLC	
BCD01-LGEXFFCT	FixedLogic/PLC		Logic selector for [operate condition], Fixed or UnFixed(PLC).	PLC	
BCD01-LGDWEXOT	FixedLogic/PLC		Logic selector for [lower-command], Fixed or UnFixed(PLC).	PLC	
BCD01-LGUPEXOT	FixedLogic/PLC		Logic selector for [raise-command], Fixed or UnFixed(PLC).	PLC	
BCD01-LGCNFFCT	FixedLogic/PLC		Logic selector for [cancel condition], Fixed or UnFixed(PLC).	PLC	
BCD01-PLSM	Fix/Var		Scheme to issue the command [F.F/OneShot] to primary equipment	Fix	
BCD01-CPW	0.1-50.0	s	Width of command issued(if [PLSM =Var] is set.)	1	
BCD01-RST	1.0-100.0	s	Response checking timer during controlling	30	

2.13.10 Signal

◆ Signal monitoring points

TAP-BCD(Function ID: 520001)

Element ID	Name	Description
4305011001	BCD01_STATE_FLOAT	BCD01 value(FLOAT type)
4305011D20	BCD01_DEADBAND	BCD01 Sending Dead Band
3105011D24	BCD01_CHECK COUNT	BCD01 Check Count
8005011D51	BCD01_SC_OWS	BCD01 SBO command received from OWS
8005011D52	BCD01_SC_RCC	BCD01 SBO command received from RCC
8005011D53	BCD01_SC_RMT	BCD01 SBO command received from Remote
8005011D54	BCD01_SC_LCD_SW	BCD01 SBO command received from LCD
8005011D55	BCD01_EC_OWS	BCD01 DIR command received from OWS
8005011D56	BCD01_EC_RCC	BCD01 DIR command received from RCC
8005011D57	BCD01_EC_RMT	BCD01 DIR command received from Remote
8005011D58	BCD01_EC_LCD_SW	BCD01 DIR command received from LCD
8005011D59	BCD01_EC_PLC	BCD01 DIR command received from PLC
0005011D97	BCD01_EX_BO_RPT	BCD01 Op OK(IEC61850)
3105011D80	BCD01_TMP_06	BCD01 selection success
3105011D81	BCD01_TMP_07	BCD01 selection failed
3105011D82	BCD01_TMP_08	BCD01 selection released
3105011D83	BCD01_TMP_09	BCD01 execution started
3105011D84	BCD01_TMP_10	BCD01 execution failed
3105011D86	BCD01_TMP_11	BCD01 execution failed
8305011E9D	BCD01_CTR_SGN	BCD01 unselected
8005011E9E	BCD01_CTR_SGC	BCD01 select condition checked
8005011E9F	BCD01_CTR_SGS	BCD01 selection success
8005011EA0	BCD01_CTR_SGE	BCD01 operate condition checked
8005011EA1	BCD01_CTR_SGW	BCD01 waiting for behavior of equipment
8B05011EA2	BCD01_CTR_SGU	BCD01 under selection
8905011DC0	BCD01_NSL_BO_FLG	BCD01 None directional selection command
8A05011DC4	BCD01_DWSL_BO_FLG	BCD01 Lower directional selection command
8605011DC6	BCD01_UPSL_BO_FLG	BCD01 Raise directional selection command
8105011DD0	BCD01_DOWNEX_BO	BCD01 Lower directional execution command
8205011DD3	BCD01_UPEX_BO	BCD01 Raise directional execution command
8005011E00	BCD01_NSC_RCV_RMT	BCD01 None directional SBO command received from remote
8105011E20	BCD01_NSC_RCV_LCD	BCD01 None directional SBO command received from LCD
8205011E01	BCD01_DOWNSC_RCV_RMT	BCD01 Lower directional SBO command received from remote
8005011E02	BCD01_DOWNSC_RCV_ICR	BCD01 Lower directional SBO command interlock check from remote
8305011E10	BCD01_DOWNEC_RCV_RMT	BCD01 Lower directional DIR command received from remote
8105011E11	BCD01_DOWNEC_RCV_ICR	BCD01 Lower directional DIR command interlock check from remote
8405011E21	BCD01_DOWNSC_RCV_LCD	BCD01 Lower directional SBO command received from LCD
8505011E24	BCD01_DOWNEC_RCV_LCD	BCD01 Lower directional DIR command received from LCD
8905011E30	BCD01_DOWNEC_RCV_PLC	BCD01 Lower directional DIR command received from PLC
8805011E31	BCD01_DOWNEC_RCV_ICP	BCD01 Lower directional DIR command interlock check from PLC
8205011E03	BCD01_UPSC_RCV_RMT	BCD01 Raise directional SBO command received from remote
8005011E04	BCD01_UPSC_RCV_ICR	BCD01 Raise directional SBO command interlock check from remote
8305011E12	BCD01_UPEC_RCV_RMT	BCD01 Raise directional DIR command received from remote

◆ Signal monitoring points

TAP-BCD(Function ID: 520001)

Element ID	Name	Description
8105011E13	BCD01_UPEC_RCV_ICR	BCD01 Raise directional DIR command interlock check from remote
8405011E22	BCD01_UPSC_RCV_LCD	BCD01 Raise directional SBO command received from LCD
8505011E25	BCD01_UPEC_RCV_LCD	BCD01 Raise directional DIR command received from LCD
8905011E32	BCD01_UPEC_RCV_PLC	BCD01 Raise directional DIR command received from PLC
8805011E33	BCD01_UPEC_RCV_ICP	BCD01 Raise directional DIR command interlock check from PLC
8005011E0D	BCD01_CC_RMT	BCD01 Releasing command form RMT
8105011E27	BCD01_CC_LCD	BCD01 Releasing command form LCD
8F05011E0A	BCD01_SBO_RMT	BCD01 SBO command form RMT
8F05011E0B	BCD01_DIR_RMT	BCD01 DIR command form LCD
8305011E72	BCD01_NSD_CSF	BCD01 None directional selection success(fixedlogic)
8D05011E73	BCD01_DOWNSD_CSF	BCD01 Lower directional selection success(fixedlogic)
8D05011E74	BCD01_UPSD_CSF	BCD01 Raise directional selection success(fixedlogic)
8005011E76	BCD01_SLD_CS	BCD01 selection success
8405011E77	BCD01_NSF_CSF	BCD01 None directional selection failed(fixedlogic)
8E05011E78	BCD01_DOWNSF_CSF	BCD01 Lower directional selection failed(fixedlogic)
8E05011E79	BCD01_UPSF_CSF	BCD01 Raise directional selection failed(fixedlogic)
8105011E7B	BCD01_SLF_CS	BCD01 None directional selection failed
8105011E7C	BCD01_SLR_CSF	BCD01 selection released(fixedlogic)
8005011E7D	BCD01_SLR_CS	BCD01 selection released
8005011E7E	BCD01_DOWNEC_OK_CSF	BCD01 Lower executing(fixedlogic)
8005011E7F	BCD01_UPEC_OK_CSF	BCD01 Raise executing(fixedlogic)
8005011E81	BCD01_DOWNEC_OK_CS	BCD01 Lower executing
8305011E82	BCD01_UPEC_OK_CS	BCD01 Raise executing
8105011E85	BCD01_DOWNEC_F_CSF	BCD01 Lower directional execution failed(fixedlogic)
8105011E86	BCD01_UPEC_F_CSF	BCD01 Raise directional execution failed(fixedlogic)
8205011E8B	BCD01_F_CS	BCD01 execution failed
8505011E8F	BCD01_EX_SFL	BCD01 execution success(fixedlogic)
8705011E90	BCD01_EX_SS	BCD01 execution success
8605011E91	BCD01_EX_FFL	BCD01 execution failed(fixedlogic)
8805011E92	BCD01_EX_FS	BCD01 execution failed
8005011E93	BCD01_EX_CMP	BCD01 control completed
8505011E94	BCD01_CC_EX	BCD01 Releasing selection(Start)
8605011E95	BCD01_CC_SS	BCD01 Releasing selection(Succeed)
8705011E96	BCD01_CC_FS	BCD01 Releasing selection(Failed)
8005011E97	BCD01_SLF_FCT_FLG	BCD01 selection failed factor detected(fixedlogic)
8705011E98	BCD01_SLF_FCT_EIS	BCD01 selection completed(without ILK)
8005011E99	BCD01_ECF_FCT_FLG	BCD01 execution failed factor detected(fixedlogic)
8105011E9A	BCD01_ECF_FCT_EIS	BCD01 execution completed(without ILK)
8805011E9B	BCD01_CC_ST_ERR	BCD01 Cancel command mode err
8305011E9C	BCD01_CCF_FCT_CS	BCD01 Releasing failed factor detected
8A05011E40	BCD01_NSC_RCV	BCD01 None directional selection command received
8205011E44	BCD01_DOWNSE_RCV	BCD01 Lower directional selection or execution command received
8005011E45	BCD01_UPSE_RCV	BCD01 Raise directional selection or execution command received
8A05011E47	BCD01_DOWNEC_RCV	BCD01 Lower directional execution command received

◆ Signal monitoring points

TAP-BCD(Function ID: 520001)

Element ID	Name	Description
8B05011E48	BCD01_UPEC_RCV	BCD01 Raise directional execution command received
8005011F54	BCD01_SC_ST_ERR	BCD01 selection command mode err
8005011F55	BCD01_EC_ST_ERR	BCD01 execution command mode err
8105011F56	BCD01_ST_SOE	BCD01 state (selection or execution)
8E05011F57	BCD01_SLD_TMO	BCD01 time out after selected
8F05011F58	BCD01_EX_CMP_TMO	BCD01 timeout after execution completion
8205011F59	BCD01_QLT_SPP	BCD01 event suppression start
8605011F5A	BCD01_BI_ERR	BCD01 BI board error detected
8305011D02	BCD01_ST_DOWN	TEMP36
8105011D03	BCD01_ST_UP	TEMP37
8605011F62	BCD01_SLF_FCT_FLG03	BCD01 selection fail factor signal by fixedlogic 03(for Testing)
8705011F63	BCD01_SLF_FCT_FLG04	BCD01 selection fail factor signal by fixedlogic 04(for Testing)
8005011F65	BCD01_SLF_FCT_FLG06	BCD01 selection fail factor signal by fixedlogic 06(for Testing)
8005011F66	BCD01_SLD_CS04	BCD01 selected condition signal 04(for Testing)
8105011F67	BCD01_SLD_CS05	BCD01 selected condition signal 05(for Testing)
8205011F68	BCD01_SLD_CS06	BCD01 selected condition signal 06(for Testing)
8805011F6D	BCD01_ANS_F_RMT	BCD01 Communication if answer API return value(for Testing)
8805011F6E	BCD01_SLF_FCT_FLG07	BCD01 selection fail timer(for Testing)
8905011F6F	BCD01_EX_CS01	BCD01 lower execution command fail timer before(for Testing)
8A05011F70	BCD01_EX_CS02	BCD01 raise execution command fail timer before(for Testing)
8905011F72	BCD01_EX_CS03	BCD01 lower execution command fail timer after(for Testing)
8A05011F73	BCD01_EX_CS04	BCD01 raise execution command fail timer after(for Testing)
8B05011F75	BCD01_SCR_LCD	BCD01 selection command received from LCD
8C05011F76	BCD01_ECR_LCD	BCD01 execution command received from LCD
0005011F77	BCD01_TRA	BCD01 travelling
8B05011F7A	BCD01_SC_LCD	BCD01 selection command by LCD
8C05011F7B	BCD01_EC_LCD	BCD01 execution command by LCD
0005011F7C	BCD01_HI_ALARM	BCD01 high alarm
0005011F7D	BCD01_LOW_ALARM	BCD01 low alarm
0005011F7E	BCD01_MAXLOW_ALARM	BCD01 max low alarm
0005011F7F	BCD01_MAXHI_ALARM	BCD01 max high alarm
8605011F80	BCD01_TMP07	BCD01 lower BO output one shot timer(for Testing)
8805011F81	BCD01_TMP08	BCD01 raise BO output one shot timer(for Testing)
4305011D01	BCD01_STATE_LCD	BCD01 BCD-value to LCD
8205011F83	BCD01_TMP01	BCD01 signal before KC BCD SA001(for Testing)
8005011F84	BCD01_TMP02	BCD01 signal before KC BCD SA002(for Testing)
8605011F85	BCD01_NSL_CS07	BCD01 signal after KC BCD SA002(for Testing)
8105011F86	BCD01_TMP03	BCD01 signal before KC BCD SA003(for Testing)
8505011F87	BCD01_TMP04	BCD01 signal before KC BCD SA004(for Testing)
8A05011F88	BCD01_FSL_CS19	BCD01 signal after KC BCD SA004(for Testing)
8505011F89	BCD01_TMP05	BCD01 signal before KC BCD SA005(for Testing)
8805011F8A	BCD01_OSL_CS41	BCD01 signal after KC BCD SA005(for Testing)
8505011F8B	BCD01_TMP06	BCD01 signal before KC BCD SA008(for Testing)
0005011D90	BCD01_SLD_RPT	BCD01 stSeld(IEC61850)

◆ Signal monitoring points

TAP-BCD(Function ID: 520001)

Element ID	Name	Description
3105001707	BCD	DataID for BCDCTRL Function(Setting)
2205011F8C	BCD01_STATE_INT	BCD01 bcd value(INT32 type)
3005011F8D	BCD01-SIGN_DIGIT	BCD01 Sign(-/+) value
3005011F8E	BCD01-1ST_DIGIT	BCD01 1st digit value
3005011F8F	BCD01-2ND_DIGIT	BCD01 2nd digit value
3005011F90	BCD01-3RD_DIGIT	BCD01 3rd digit value
3005011F91	BCD01-4TH_DIGIT	BCD01 4th digit value
3005011F92	BCD01-5TH_DIGIT	BCD01 5th digit value

2.14 LED reset function (LEDR)

A number of LEDs are lined on the IED front panel. For example, "TRIP" LED is lit when a tripping command is issued for the CB. "TRIP" LED is being illuminated until the user can confirm the tripped CB; hence, the user can reliably determine that tripping CB has been initiated by inspection. The following operations are possible to resetting the LED by the LED reset (LEDR) function, which is furnished in the IED:

1 Pushing "CLEAR" key[1]

2 Operation by GR-TIEMS[2]

3 Operation by the SAS

[1]Note: For the operation, see Chapter *User interface: Outline*. Note that pressing the "CLEAR" key causes the Reset of the LEDs.

[2]Note: For more information, see Chapter *Engineering tool.*

Note: The implementation of particular features is dependent upon the selection of hardware and the configuration of functions. Several IED models do not support certain features. To determine whether a particular feature has been implemented within an IED, identify the IED ordering number; and check the order number at the "G&T position" whilst referring to the comparison table below. For more information, see *Appendix: Ordering*.

Table 2.14-1 Comparative table in respective ordering numbers

Sec.	Feature	Ordering No. at "G&T"					
		BCU			BCPU		IFU
		11	13	1F	2N	2C	19
–	Main features	✓	✓	✓	✓	✓	✓

✓: Applicable NA: Not applicable

2.14.1 Select logic for resetting LEDs

The user should set scheme switch [**LEDDR1**] to **On** prior to the LEDR operation. Figure 2.14-1 shows selection logic in the LEDR function.

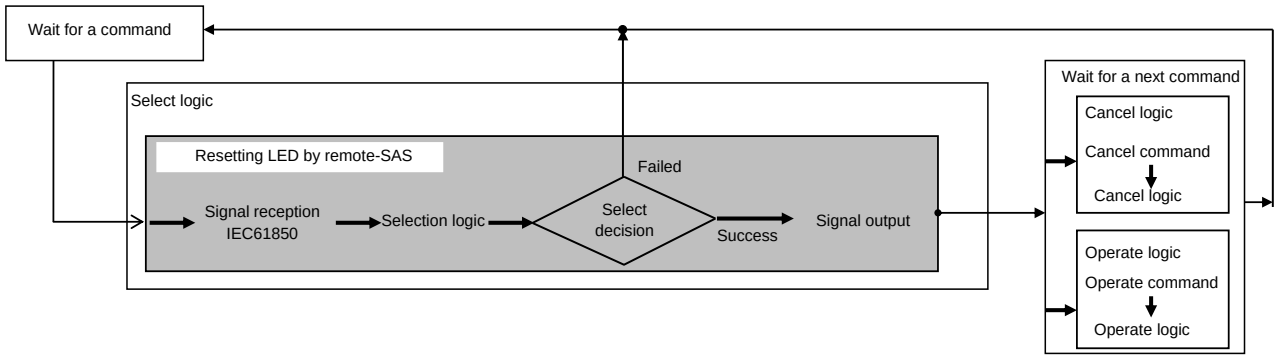


Figure 2.14-1 Outline of selection command for resetting LEDs

(i) Input signal required mapping

Figure 2.14-2 shows the select logic when a "Select command (reset)" signal is applied to the LEDR function. The logic has an input-point "LEDR01_CONTROL_REQ" for the reception; the input-point must be mapped for IEC61850 communication. The function will fail to operate if mapping is not performed correctly. We will discuss how to map the input points for the IEC61850 communication in section 2.14.5.

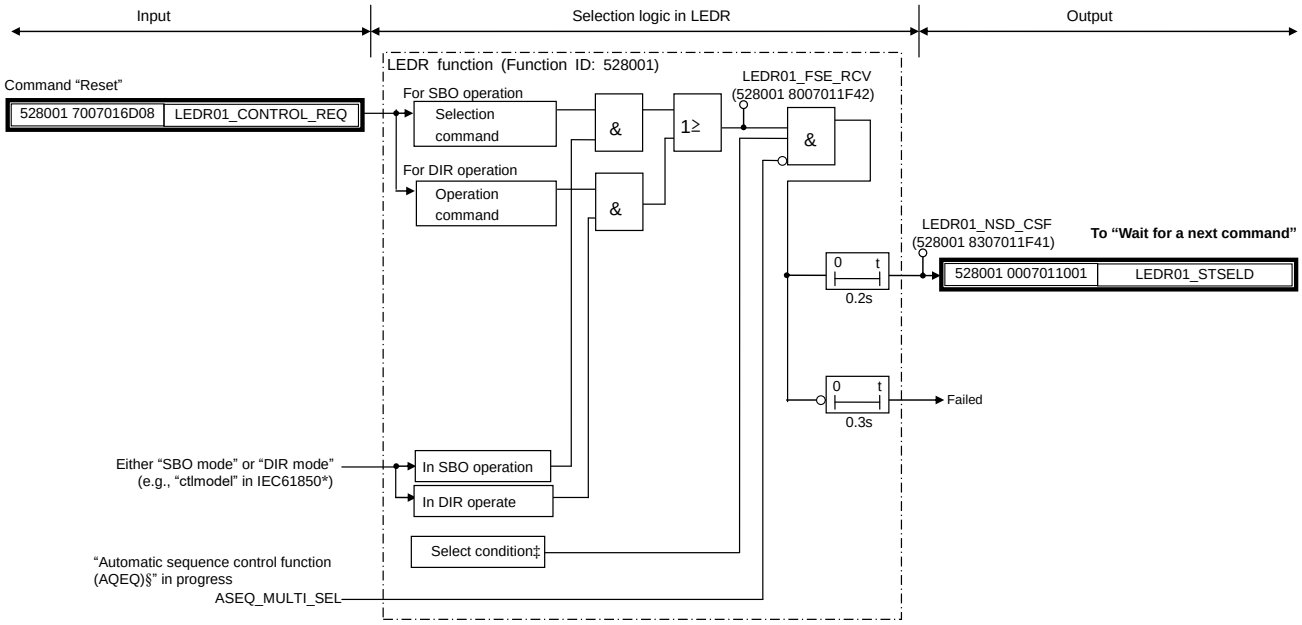


Figure 2.14-2 Selection logic for resetting LEDs

‡Note: A "select condition" signal is provided from the select condition scheme. For more information, see Figure 2.14-8.

§Note: An Automatic sequence control (ASEQ) function can provide sequential signals for automatic control. The LEDR function is blocked for the ASEQ function when it is in operation. For more information of the ASEQ function, see Chapter *Control*

and monitoring application: Automatic sequence control function.

*Note:The LEDR function can run on either "the SBO mode" or "the DIR mode" using a "ctlmodel" signal when the communication is carried out in the IEC61850; thus, mapping is required for the IEC61850 communication.

(ii) Output signal required mapping

The LEDR function can issue a "Select success" signal at the output point "LEDR01_NSD_CSF", when the LEDR function determines that the input signal "Select command (reset)" is true. If the LEDR function determines that the "LEDR01_NSD_CSF" is not true, the LEDR function returns to the "Wait for a next command" stage.

(iii) Select condition

Figure 2.14-3 shows the select condition logic in the LEDR function.

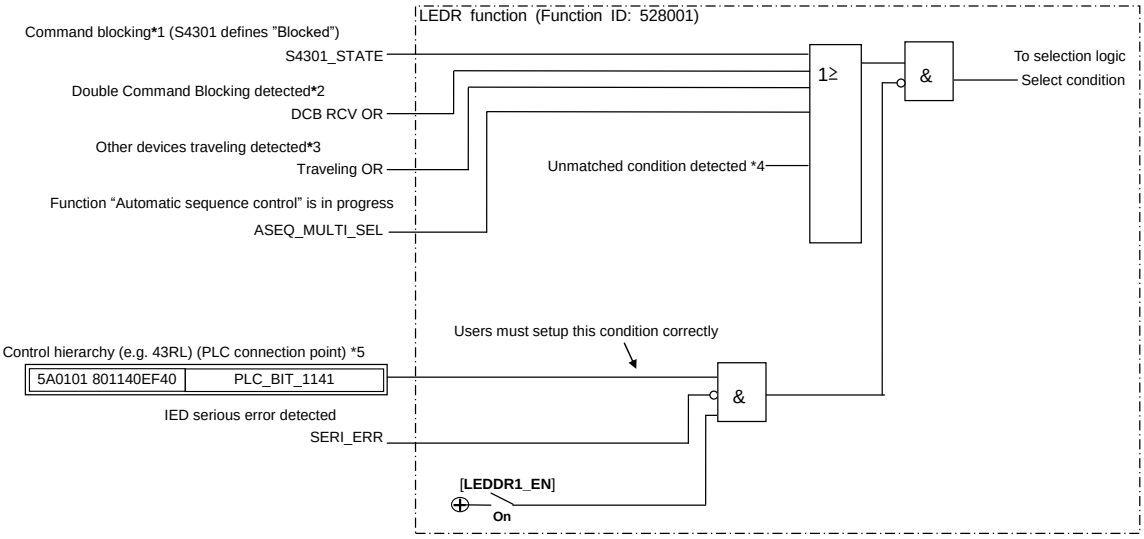


Figure 2.14-3 Select condition logic in LEDR*6

*1Note: "command blocking" disables any operation except its own: the "command blocking" is initiated by the status of "S4301" in a software controller (SOFTSW). The IEC 61850 standard defines "command blocking" as "CmdBlk". For more information on S4301, see Chapter *Control and monitoring application: Software switch control function*. See the signal "S4301_STATE" of Table 2.14-2.

*2Note: "Double Command Blocking (DCB)" is an operation philosophy in the common control function (CMNCTRL). It can be used to protect the substation. The user can program it using GR-TIEMS. The DCB operating signal is denoted as "DCB RCV_OR in Table 2.14-2. For more information, see Chapter *Control and monitoring application: Common controls*.

*3Note: If the event "device-travelling" is detected in the CMNCTRL function, it indicates that another operator is changing the status of a device. Thus, the IED should inhibit the operation of any device for the duration that the event is

detected. The detecting signal is denoted as “Traveling OR” in Table 2.14-2.

*4Note: Criteria “unmatched conditions” are decided when the “Test-bit status” in a command is not identical to the “IED test status”.

*5Note: The user will need to program the PLC logic “Control hierarchy condition”. The user is also required to connect the logic condition with the select condition logic using the connection point “PLC_BIT_1141”. For more information, see chapter *Control and monitoring application: Control hierarchy*. “PLC_BIT_1141” is provided in Table 2.14-3.

*6Note: To identify the input point of the LEDR function, see Table 2.14-2.

Table 2.14-2 Input signals for condition logic

Signal Number	Signal Name	Description	M/O
522001 000A011001	S4301_STATE	Command Blocking status (Off / Blocked)	N/A
5A0001 0008001F41	DCB RCV OR	Double Command Blocking(DCB) is in progress.	N/A
5A0001 0008001F40	Traveling OR	Travelling events are detected.	N/A
5A0101 3100001F43	SERI_ERR	Serious Error detected	N/A
523001 000D001F40	ASEQ_MULTI_SEL	Automatic sequence control is in progress.	N/A

Table 2.14-3 PLC connection point (Input point on select condition logic)

Signal Number	Signal Name	Description	M/O
5A0101 801140EF40	PLC_BIT_1141	LED Reset control hierarchy	M

Table 2.14-4 Setting of LEDR

Setting Name	Description	Default	Setting item or value
LEDDR1_EN	Activate LED reset control	On	Off / On

2.14.2 Cancel logic in SBO mode

In the SBO mode the reception of a cancel command is possible when the cancel conditions are satisfied. Accordingly, the function can discard the select command; finally, the operation returns to the initial stage (i.e., "Wait for a command".)

(i) Receiving "Cancel" from the remote-end

Figure 2.14-4 depicts the cancel command procedure for a cancel command initiated from the remote-end.

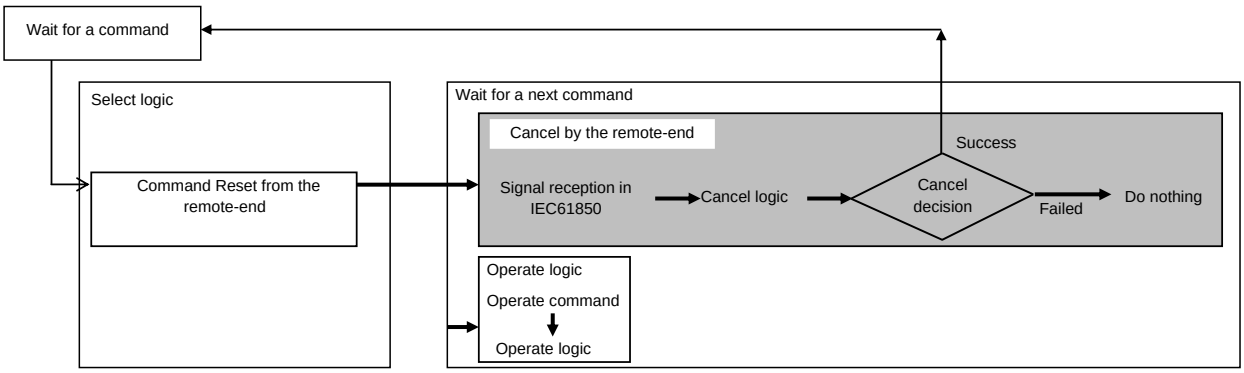


Figure 2.14-4 Outline of 'cancel' command from the remote-end

(ii) Input signal required mapping

Figure 2.14-6 depicts the cancel logic when a "Cancel command (Remote-Cancel)" signal is applied to the LEDR function. The input-point "LEDR01_CONTROL_REQ" is the same the same as that for the signal as shown in Figure 2.14-2.

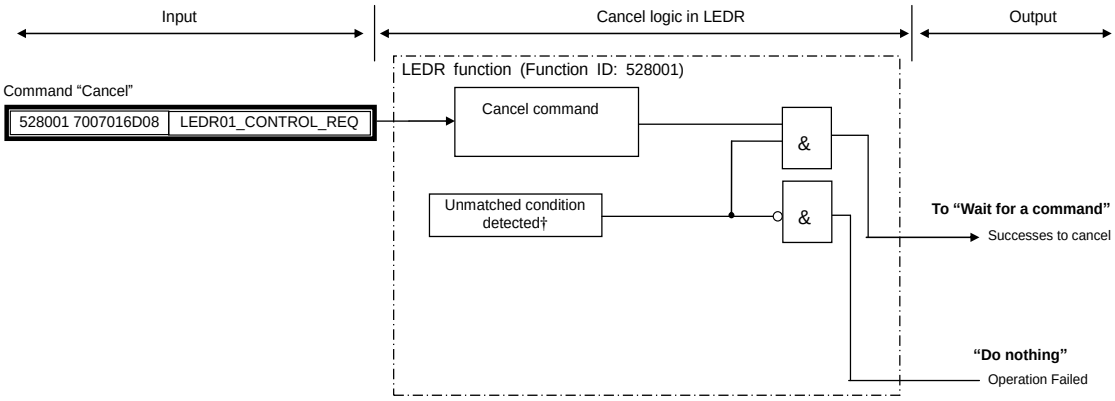


Figure 2.14-5 'Cancel' from the remote-end

†Note:The criteria "unmatched conditions" are determined when the "Test-bit status" in a command is not identical to the "IED test status".

2.14.3 Operate logic for SBO/DIR mode

Once the operation of the select logic is completed, the operate logic is applied to reset LEDs. Resetting LEDs is executed when the operate conditions are satisfied.

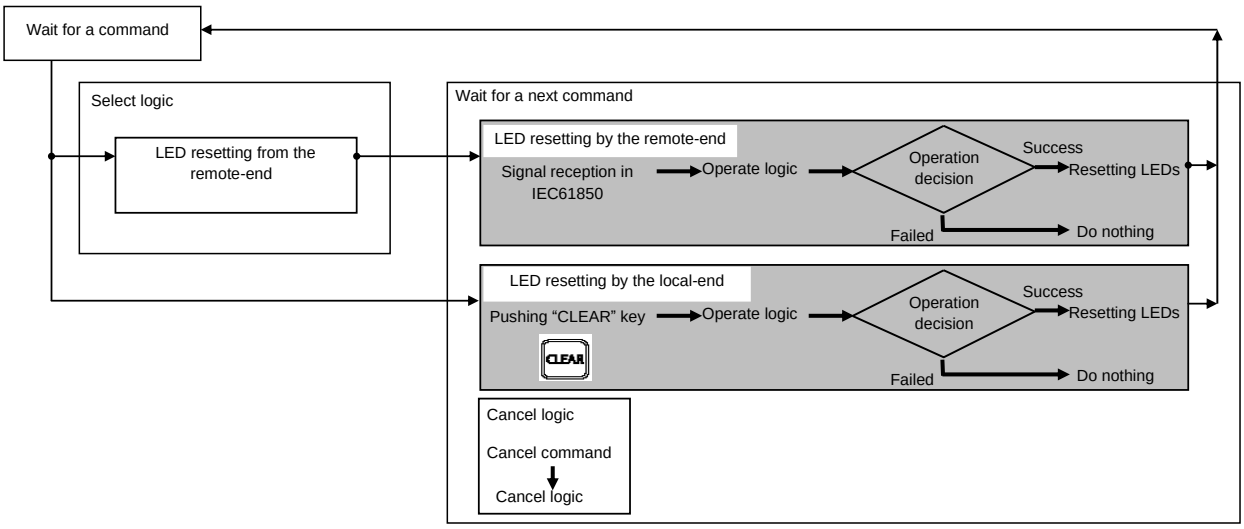


Figure 2.14-6 Outline of operation command for resetting LEDs

†Note: For more information, see Chapter *User interface: Outline*.

(i) Mapping required Input signal

Figure 2.14-7 illustrates the operate logic when an "Operation command (reset)" signal is applied to the LEDR function. The input-point "LEDR_CONTROL_REQ" is used for the reception of the "Operation command (reset)" signal. Pressing "CLEAR" key or the operation on GR-TIEMS will reset LEDs.

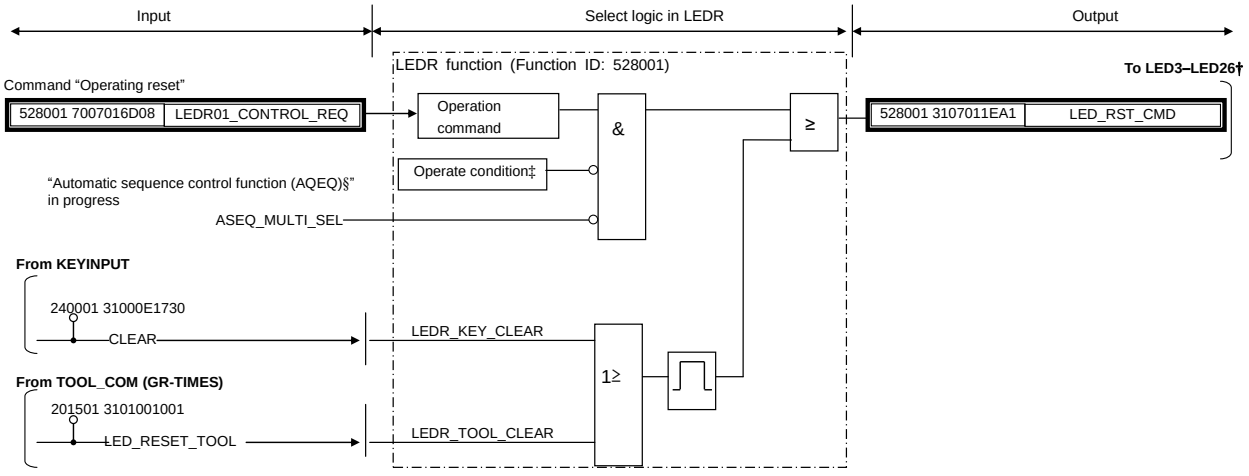


Figure 2.14-7 Operation logic for resetting LEDs

(ii) Output signal required mapping

The operation logic issues a "LED_RST_COM" signal to clear the LEDs†. The signal "LED_RST_COM" is also transferred to the remote-end, when signal mapping is executed in IEC61850 communication. (See section 2.14.5)

†Note: Although the "LED_RST_COM" signal is connected previously with several LEDs, by the manufacturer, user can also connect the signal with the LEDs. See section 2.14.4 for how to connect.

(iii) Operate condition

Figure 2.14-8 shows the operate condition logic of the LEDR function, which is used to determine a reset-condition for the operation.

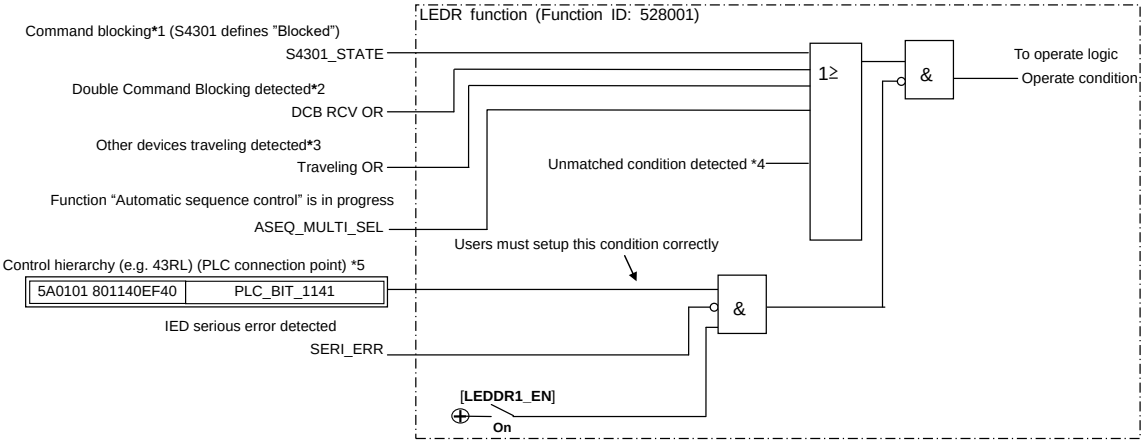


Figure 2.14-8 Operate condition logic in LEDR*6

*1Note: "Command blocking" disables all operation except for its own: the "command blocking" function is initiated by the status of "S4301" in a software controller (SOFTSW). The IEC 61850 standard defines the "command blocking" function as "CmdBlk". For more information on S4301, see Chapter *Control and monitoring application: Software switch control function*. See the signal "S4301_STATE" of Table 2.14-2.

*2Note: "Double Command Blocking (DCB)" is an operation philosophy in the common control function (CMNCTRL). It can be used to protect the substation. The user can program it using GR-TIEMS. The DCB operating signal is denoted as "DCB RCV_OR in Table 2.14-2. For more information, see Chapter *Control and monitoring application: Common controls*.

*3Note: If the event "device-travelling" is detected in the CMNCTRL function, it indicates that another operator is changing the status of a device. Thus, the IED should inhibit the operation of any device for the duration that the event is detected. The detecting signal is denoted as "Traveling OR" in Table 2.14-2.

*4Note: Criteria "unmatched conditions" are decided when the "Test-bit status" in a command is not identical to the "IED test status".

*5Note: The user must program the PLC logic for "Control hierarchy condition". The user must connect that to the select condition logic using the connection point "PLC_BIT_1141". For more information, see chapter *Control and monitoring*

application: Control hierarchy. "PLC_BIT_1141" is provided in Table 2.14-3.

2.14.4 Settings in LED logics

The user can program the status and the signal of the LED, so that the LEDs are possible to switch off upon occurrence of the reset. As shown in the logic relating to the LED†, each logic has a timer and a setting; accordingly, setting **Latch** should be set for the operation of the LEDR function. Additionally, the user should connect the signal LED_RST_CMD with the LED logic.

†Note: For more information on LED logics, see Chapter *Technical description: Human machine interface: LED indicators*.

(i) Settings using GR-TIEMS

Figure 2.14-9 shows how to connect the reset signal LED_RST_CMD for the LED-03 logic. The user can assign a reset signal for the respective LED logics by the drag and drop operation. The user should also select **Latch** for the behavior from the pull-down menu.

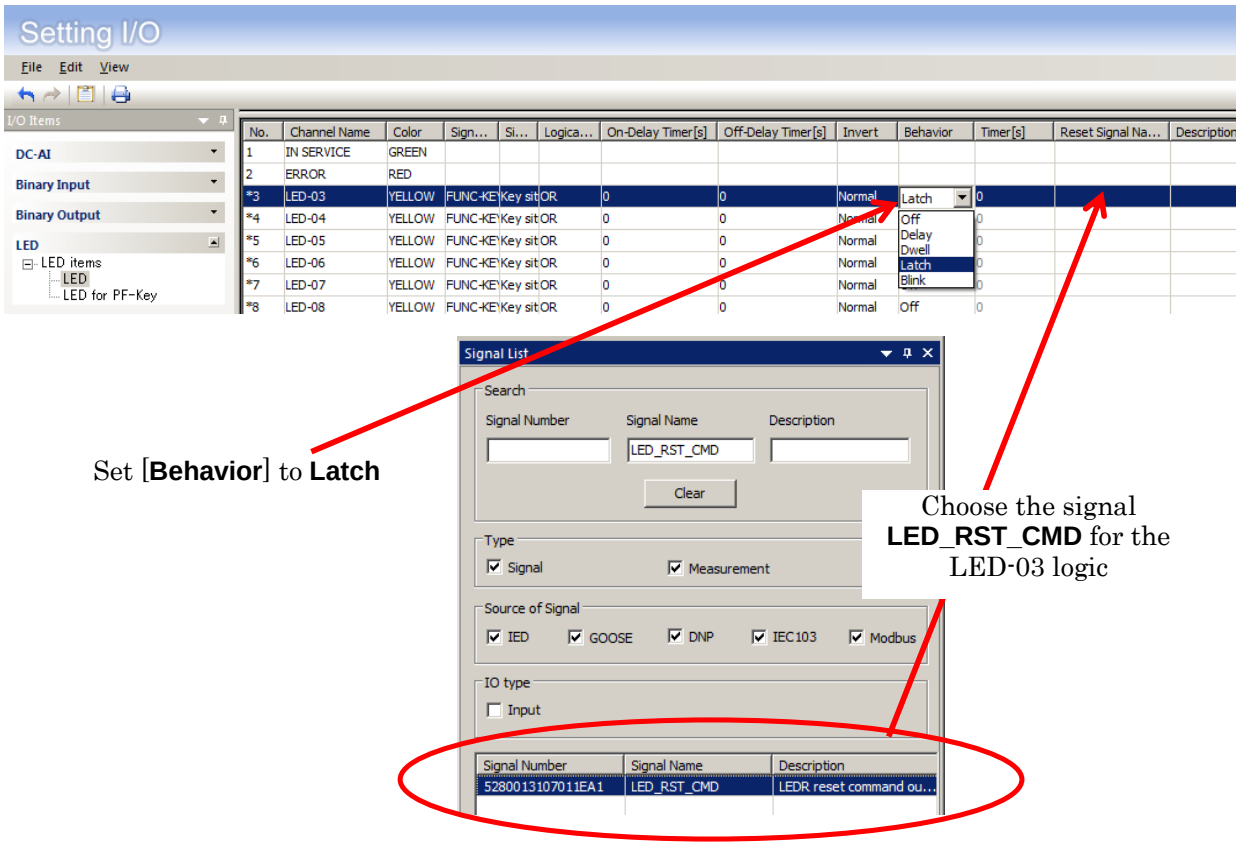


Figure 2.14-9 Settings for LED-03 circuit provided by "Setting I/O menu" of GR-TIEMS

(ii) Settings using IED screen

The operation from the IED screen can also be set. See Chapter *User interface: I/O setting sub-menu*.

2.14.5 Mapping for IEC61850 communication

The user can operate the LEDR function over IEC 61850 communication following mapping using GR-TIEMS. Note that the LEDR function is designed for "LEDRs" in the IEC 61850 standard for communication. The user should follow these steps, each of which is discussed below:

Step1: Editing Logical Node

Step2: Mapping output data

Step3: Mapping input data

(i) Editing Logical Node

The user will need to create a logical node (LN) for the LEDR function. Figure 2.14-10 exemplifies the editing of a LN; the LN "logical node zero (LLN0)" is chosen for the LERD function. Either the SBO mode or the DIR mode should be chosen in the editing for the LN.

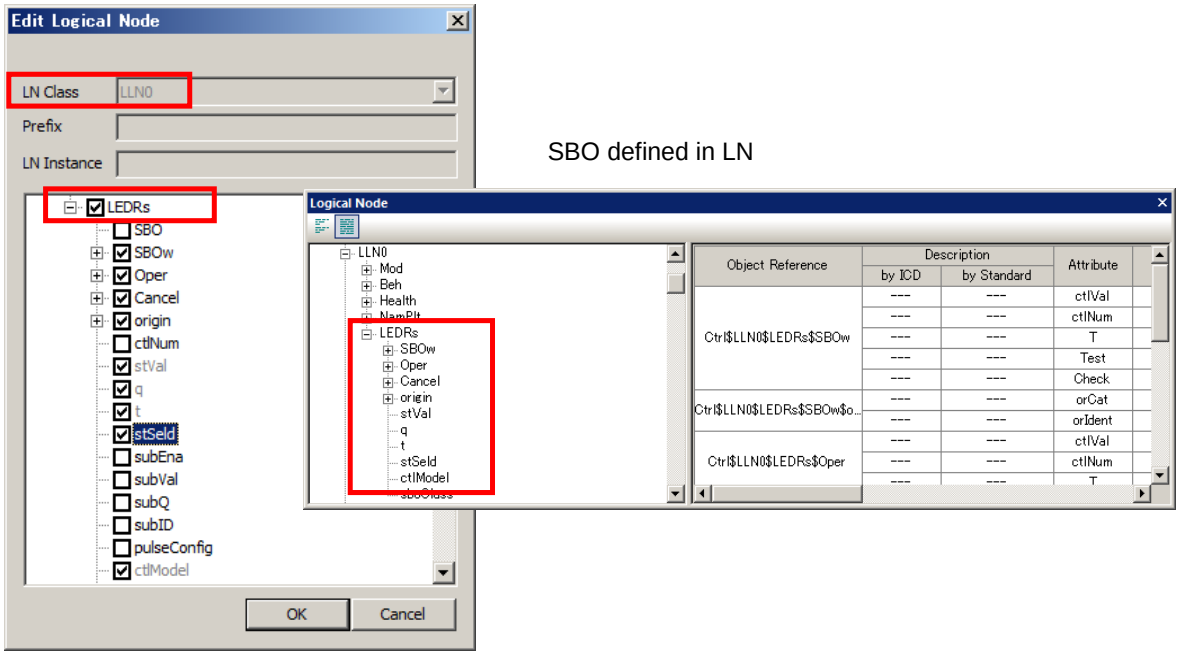
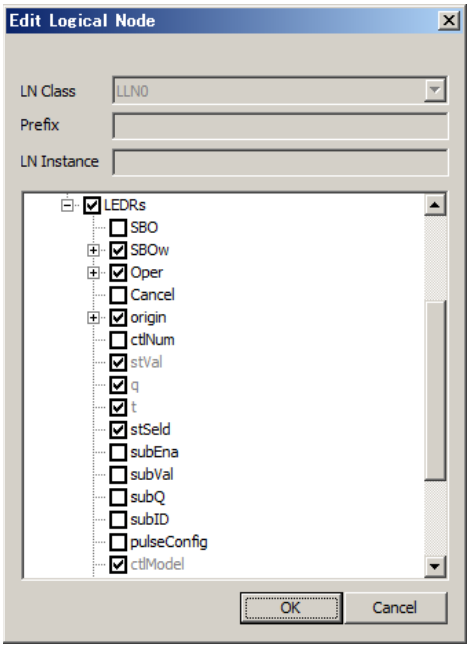


Figure 2.14-10 Defining "LEDRs" object in LLN0 logic node

(i)-1 Defining SBO mode

Figure 2.14-11 exemplifies the LEDR logic node saved as "LLN0". In the SBO mode, the user should select the following items in the "LLN0$LEDRs" using GR-TIEMS:



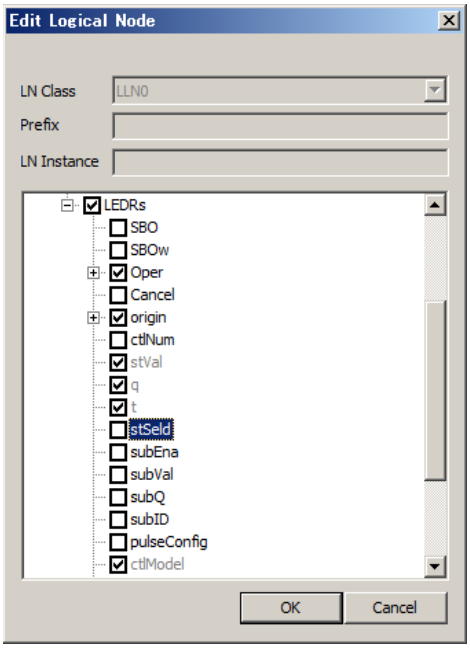
- ✓ SBOw
- ✓ Oper
- ✓ Cancel
- ✓ Origin
- ✓ stSeld
- ✓ sboClass† (choice ”operate-once”)
- ✓ ctlmodel (choice ”SBOes or SBOns”)

†”sboClass” can be found by scrolling down.

Figure 2.14-11 LN editing for SBO mode (for example)

(i)-2 Defining DIR mode

Figure 2.14-12 exemplifies the LEDR logic node saved as LLN0. In the DIR mode, the following three items should be selected using GR-TIEMS:



- ✓ Oper
- ✓ origin
- ✓ ctlmodel (choice ”DOes or DOns”)

Figure 2.14-12 LN editing for DIR mode (for example)

(ii) Mapping output data

The user should group the LEDR signals with regard to GOOSE and Report; the user should map them for IEC61850 communication using GR-TIEMS. Figure 2.14-13 illustrates how to map a signal for IEC61850 communication; it indicates that the signals for the LEDR function

are required to be mapped for IEC 61850 communication

Table 2.14-5 Mapping signals for SPC object

Object_reference	Attribute	Type	FC	Signal Number	Signal Name
Ctrl/LLN0$LEDRs$origin	orCat	orCategory	ST	5280013107011008	LEDR01_ORCAT
Ctrl/LLN0$LEDRs$origin	orIdent	Octet64	ST	5280016A07011009	LEDR01_ORIDENT
Ctrl/LLN0$LEDRs	stVal	BOOLEAN	ST	5280013107011EA1	LED_RST_CMD
Ctrl/LLN0$LEDRs	q	Quality	ST	3010013110041005	Qual_Val
Ctrl/LLN0$LEDRs	t	Timestamp	ST	2003019010001006	SYS_TIME
Ctrl/LLN0$LEDRs	stSeld	BOOLEAN	ST	5280010007011001	LEDR01_STSELD

Note: "Status (ST)" is defined in the function constraint (FC) of the IEC 61850.

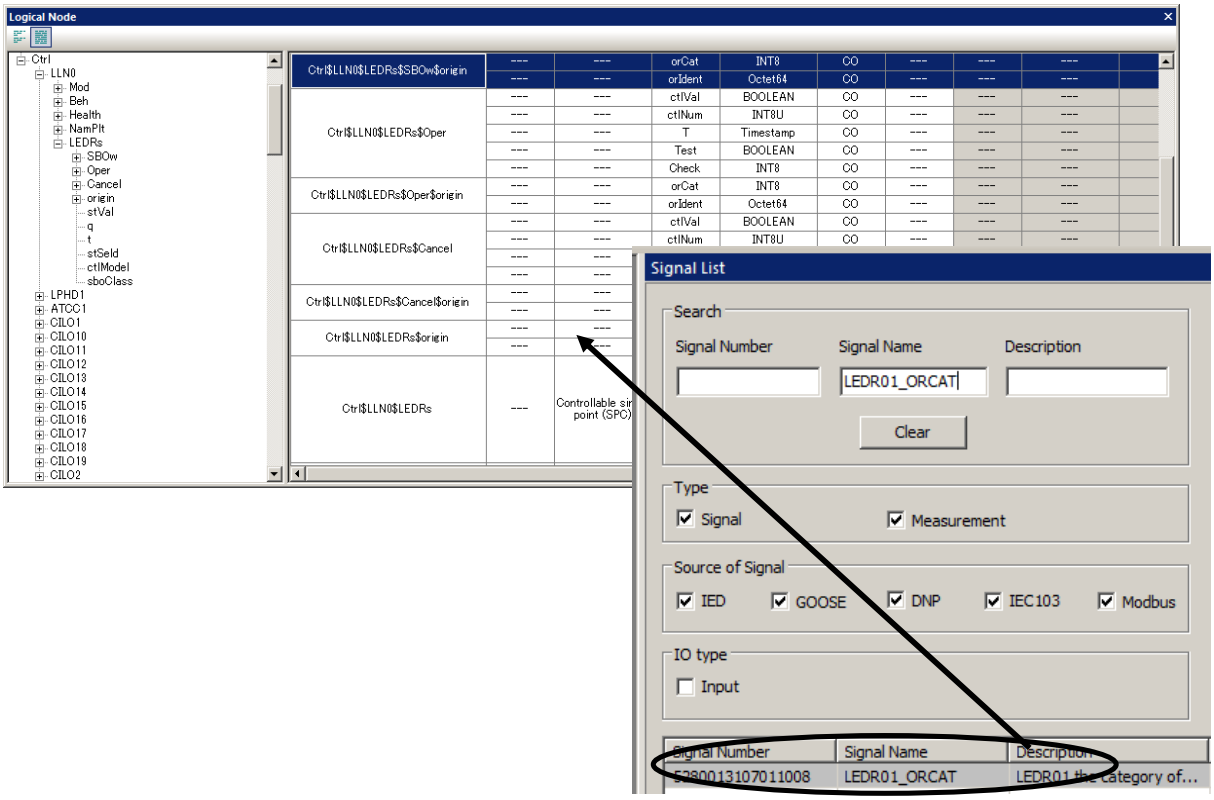


Figure 2.14-13 orCat attribute mapped for LEDRs object of LLN0

(iii) Mapping input data

The LEDR function can receive three commands "select, operate, and cancel". Thus, the user should map the input-point "LED01_CONTROL_REQ" to the IEC61850 communication. Table 2.14-6 shows the input-point "LED01_CONTROL_REQ" and the Object reference "Ctrl/LLN0$LEDRs"; the user should map the input-point to the Object references having attributes CO and CF†. Figure 2.14-14 shows how to map a signal.

†Note: The attribute is defined in the IEC 61850; "CO" stands for "Control" and "CF" stands for "Configuration" in the functional constraint (FC).

Table 2.14-6 Mapping signals required for LEDRs object for LLN0

Object_reference	Attribute	Type	FC	Signal Number	Signal Name
Ctrl/LLN0$LEDRs$Oper	ctlVal	BOOLEAN	CO	5280017007016D08	LEDR01_CONTROL_REQ
Ctrl/LLN0$LEDRs$Oper	ctlNum	INT8U	CO		
Ctrl/LLN0$LEDRs$Oper	T	Timestamp	CO		
Ctrl/LLN0$LEDRs$Oper	Test	BOOLEAN	CO		
Ctrl/LLN0$LEDRs$Oper	Check	Check	CO		
Ctrl/LLN0$LEDRs$Oper$origin	orCat	orCategory	CO		
Ctrl/LLN0$LEDRs$Oper$origin	orIdent	Octet64	CO		
Ctrl/LLN0$LEDRs	ctlModel	ctlModel	CF		
Ctrl/LLN0$LEDRs	sboClass	sboClass	CF		

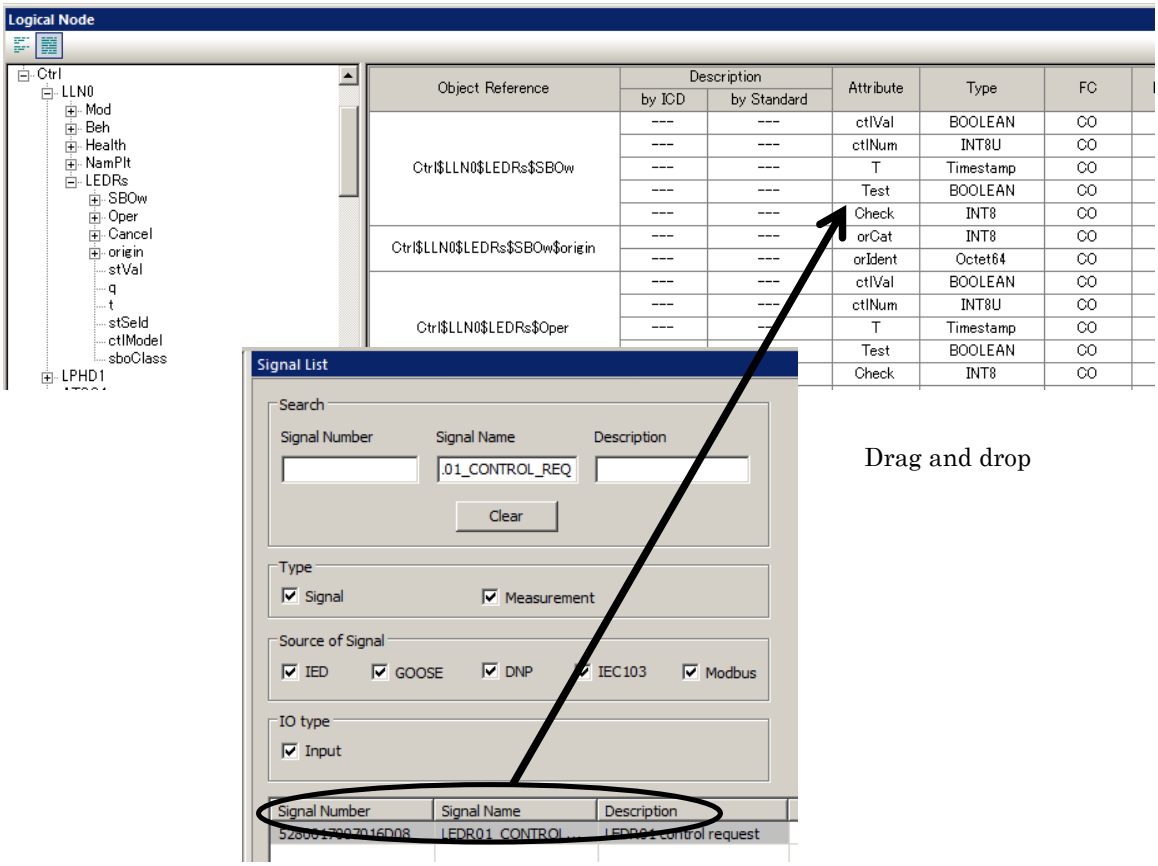


Figure 2.14-14 Input-point mapped for LLN0

2.14.6 Setting

Setting of LEDR (Function ID: 528001)

Setting item	Range	Units	Contents	Default setting value	Notes
LEDDR1-EN	Off / On	-	LEDR01 Reset Control Enable	Off	

2.14.7 Signal

◆ Signal monitoring points

LRST(Function ID: 528001)

Element ID	Name	Description
5280018007011D53	LEDR01_SC	LEDR01 select command
5280018007011D57	LEDR01_EC	LEDR01 execute command
5280018007011D51	LEDR01_SC_OWS	LEDR01 select command by OWS(HMI)
5280018007011D52	LEDR01_SC_RCC	LEDR01 select command by RCC
5280018007011D55	LEDR01_EC_OWS	LEDR01 execute command by OWS(HMI)
5280018007011D56	LEDR01_EC_RCC	LEDR01 execute command by RCC
5280018207011F40	LEDR01_TMP1	LEDR01 signal before KC_LEDR_SA001
5280018307011F41	LEDR01_NSD_CSF	LEDR01 signal after KC_LEDR_SA001
5280018007011F42	LEDR01_FSE_RCV	LEDR01 signal before LC_LEDR_SA002
5280018607011F43	LEDR01_TMP2	LEDR01 signal after KC_LEDR_SA002
5280018B07011F44	LEDR01_CTR_SGU	LEDR01 signal before KC_LEDR_SC001
5280018607011F45	LEDR01_TMP3	LEDR01 signal after KC_LEDR_SC001
5280018607011F46	LEDR01_SLF_FCT_FLG1	LEDR01 signal before MCTLEDR_SC001
5280018E07011F47	LEDR01_SLD_TM0	LEDR01 signal after MCTLEDR_SC001
5280018707011F48	LEDR01_SLF_FCT_FLG2	LEDR01 signal before MCTLEDR_SC002
5280018F07011F49	LEDR01_EX_CMP_TM0	LEDR01 signal after MCTLEDR_SC002

◆ Connection point in PLC logic

LRST(Function ID: 528001)

Element ID	Name	Description
820701ED50	LEDR01_CTRL_RIGHT	LEDR01 control right from PLC

2.15 Automatic sequence control function (ASEQ)

The function of the automatic sequence controller (ASEQ) is to control the PLC function that is used within the automatic sequence control function, which can be coded by the user. This control logic has software signals; the status of these software signals are changed by control commands that are sent from upstream devices. One of the upstream devices is a SAS server. Another is the front panel of the IED, which means that the user can operate the device locally using the ASEQ function. The ASEQ function is divided into 12 parts, these are referred to as "ASEQ01" to "ASEQ12" functions (i.e., ASEQ01, ASEQ02 …ASEQ12 functions). Therefore, 12 PLC functions are controlled by the 12 ASEQ functions at the same time. For simplicity, only the ASEQ01 function is discussed here, the features in the other ASEQ02-12 functions are identical to the ASEQ01 function.

Note: The implementation of such features is dependent upon the selection of hardware and the configuration of functions. Several IED models do not support certain features. To determine whether a particular feature has been implemented within an IED, identify the IED ordering number; and check the order number for the "G&T position" referring to the comparison table below. For more information, see *Appendix: Ordering*.

Table 2.15-1 Comparative table in respective ordering numbers

Sec.	Feature	Ordering No. at "G&T"					
		BCU			BCPU		IFU
		11	13	1F	2N	2C	19
–	Main features	✓	✓	✓	✓	✓	NA

✓: Applicable NA: Not applicable

2.15.1 Function setup

Figure 2.15-1 outlines the command reception in the ASEQ01 function. The ASEQ01 function can generate a start command at the PLC monitoring point "ASEQ01_EXEC_START" (see Table 2.15-5), when the start command is provided for the 'ASEQ01_CONTROL_REQ'. Similarly, when a stop command is received in the ASEQ01 function, the stop command will be generated at the PLC monitoring point "ASEQ01_EXEC_STOP" (see Table 2.15-6) †.

†Note: Create "**IN1**" and "**IN2**"points in the user programming logic; make the connection between the ASEQ01 function and the user programing logic. Refer to chapter *PLC function*. The user-programming logic is also required to have output points. For example, if the user wishes to control a CB using the logic, the logic should have two output points for two binary output circuits (BOs). Figure 2.15-1 shows how two BOs are used for CB closing and CB opening.

‡Note: The ASEQ01 function does not have the responsibility to restart the programmed logic after an emergency stop signal has been applied. Therefore, the user should program the logic to generate an operation result signal in case of the emergency stop signal being applied in the logic. See section 2.15.5 for the emergency operation.

‡Note: PLC connection point "ASEQ01_EXEC_RESET (PLC_BIT_0215)" is provided for stopping the ASEQ01 operation, as shown in Table 2.15-4.

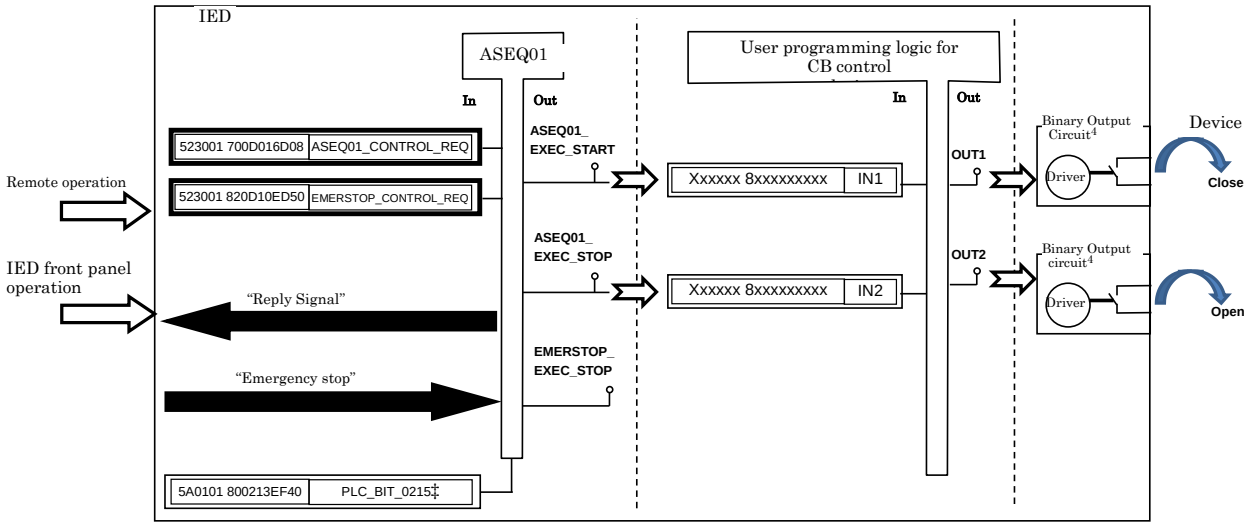


Figure 2.15-1 ASEQ01 controls the user programing logic to operate a CB

Table 2.15-2 Mapping points for the r remote control commands

Signal Number	Signal Name	Description	M/O
523001 700D016D08	ASEQ01_CONTROL_REQ	ASEQ01 control command received. (Mapping Data)	M
523001 700D026D08	ASEQ02_CONTROL_REQ	ASEQ02 control command received. (Mapping Data)	M
523001 700D036D08	ASEQ03_CONTROL_REQ	ASEQ03 control command received. (Mapping Data)	M
…	…	…	

Signal Number	Signal Name	Description	M/O
523001 700D0C6D08	ASEQ12_CONTROL_REQ	ASEQ12 control command received. (Mapping Data)	M

Table 2.15-3 Mapping points for Emergency command

Signal Number	Signal Name	Description	M/O
523001 820D10ED50	EMERSTOP_CONTROL_REQ	Emergency control for stopping the operation	M

Table 2.15-4 PLC connection points (Inputs for stopping ASEQ operation)

Signal Number	Signal Name	Description	M/O
5A0101 800214EF40	PLC_BIT_0215	Instruction to stop ASEQ01 operation	O
5A0101 800215EF40	PLC_BIT_0216	Instruction to stop ASEQ02 operation	O
5A0101 800216EF40	PLC_BIT_0217	Instruction to stop ASEQ03 operation	O
…	…	…	
5A0101 800225EF40	PLC_BIT_0226	Instruction to stop ASEQ12 operation	O

Table 2.15-5 PLC monitoring points (Outputs to start ASEQ operation)

Signal Number	Signal Name	Description
523001 820D011F50	ASEQ01_EXEC_START	Start instruction provided for ASEQ01 operation
523001 820D021F50	ASEQ02_EXEC_START	Start instruction provided for ASEQ02 operation
523001 820D031F50	ASEQ03_EXEC_START	Start instruction provided for ASEQ03 operation
…	…	…
523001 820D0C1F50	ASEQ12_EXEC_START	Start instruction provided for ASEQ12 operation

Table 2.15-6 PLC monitoring points (Outputs to stop ASEQ operation)

Signal Number	Signal Name	Description
523001 810D011F51	ASEQ01_EXEC_STOP	Stop instruction provided for ASEQ01 operation
523001 810D021F51	ASEQ02_EXEC_STOP	Stop instruction provided for ASEQ02 operation
523001 810D031F51	ASEQ03_EXEC_STOP	Stop instruction provided for ASEQ03 operation
…	…	…
523001 810D0C1F51	ASEQ12_EXEC_STOP	Stop instruction provided for ASEQ12 operation

Table 2.15-7 PLC monitoring points (Outputs of ASEQ operation status)

Signal Number	Signal Name	Description
523001 000D011001	ASEQ01_ACC_EXEC	Status of ASEQ01 operation
523001 000D021001	ASEQ02_ACC_EXEC	Status of ASEQ02 operation
523001 000D031001	ASEQ03_ACC_EXEC	Status of ASEQ03 operation
…	…	…
523001 000D0C1001	ASEQ12_ACC_EXEC	Status of ASEQ12 operation

2.15.2 Preparation of the operation

The ASEQ01 function has three scheme switches: [**ASEQ01-EN**], [**ASEQ01-CTRMENU**] and [**ASEQ01-CTRAHMI**].

The scheme switch [**ASEQ01-CTRMENU**] is used for a local operation (e.g., the front panel operation on the IED). When **On** is set for the scheme switch [**ASEQ01-CTRMENU**], the PLC

sequence #1 can be instructed locally. The scheme switch [**ASEQ01-CTRAHMI**] is used to select either a select-before-operation command (SBO) or a direct command (DIR) when the local instruction is applied.

2.15.3 Example of automatic sequence operation

Figure 2.15-2 exemplifies some sequence logic programmed using the PLC function; the logic is coded to operate two disconnector (DS1 and DS2) and a circuit breaker (CB). The logic can provide an instruction to close DS1 (i.e., device #2), close DS2 (i.e., device #3), and then close the CB (i.e., device #1) in a prescribed order.

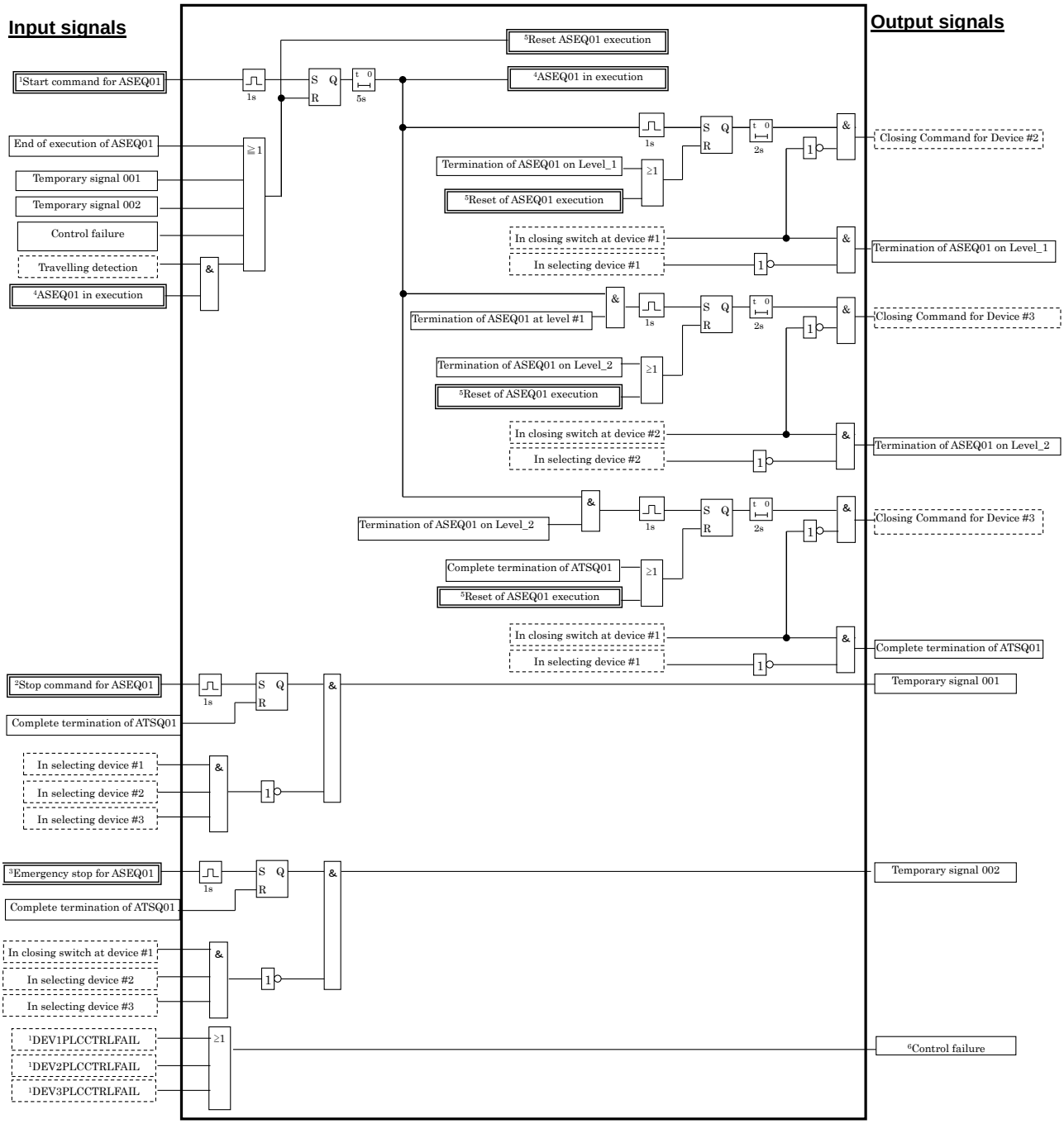


Figure 2.15-2 Example of control logic programmed for device #1 to #3

[1]Note: If a start command is applied to the ASEQ01 function, the control logic commences to operate the devices. Table 2.15-5 shows start commands.

[2]Note: If a stop command is applied to the ASEQ01 function, the operation of the control logic will be canceled promptly provided that the control logic is not operating the device. Alternatively, the control logic can wait for the operation being completed, if the control logic is able to determine to continue the operation. Table 2.15-4 shows the stop commands.

[3]Note: See section 2.15.5. Table 2.15-9 and Table 2.15-10 show the emergency commands.

[4]Note: After the reception of the start command, the execution state can be monitored. Table 2.15-7 shows the execution states.

[5]Note: The stop signal is provided for the logic. Table 2.15-6 shows the results of the stop signals.

[6]Note: Following the generation of a control command by the control logic, if the control command fails to initiate the operation of a device, the control logic determines that the control command has failed. The control logic will generate signals in order to express “Control failure”.

When a stop command is generated during the selection of Device #3, the control logic will clear the operation if the control logic can determine that the operation of Device #3 is complete. Figure 2.15-3 shows that Device #3 unable to operate following reception of the stop command.

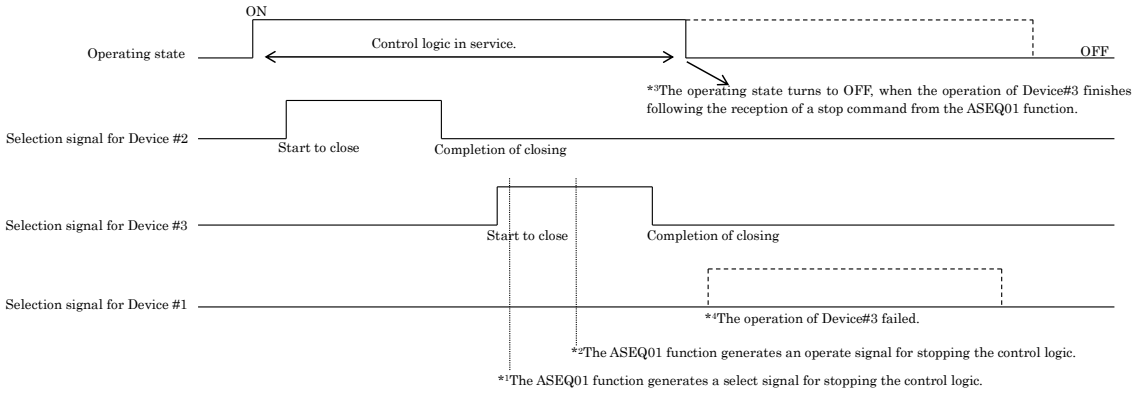


Figure 2.15-3 Timing chart for an automatic sequence when a stop command is injected during the operation of Device#3

Figure 2.15-4 depicts the operating sequence when an emergency command is input; the control logic will cancel the operation in accordance with the execution state given from a device. If the operation signal is not controlling the device, the control logic will clear the operation promptly. If the operation signal is controlling the device, the control logic will clear the operation when the control logic function can determine that the operation of the device is

complete, in this case Device#1.

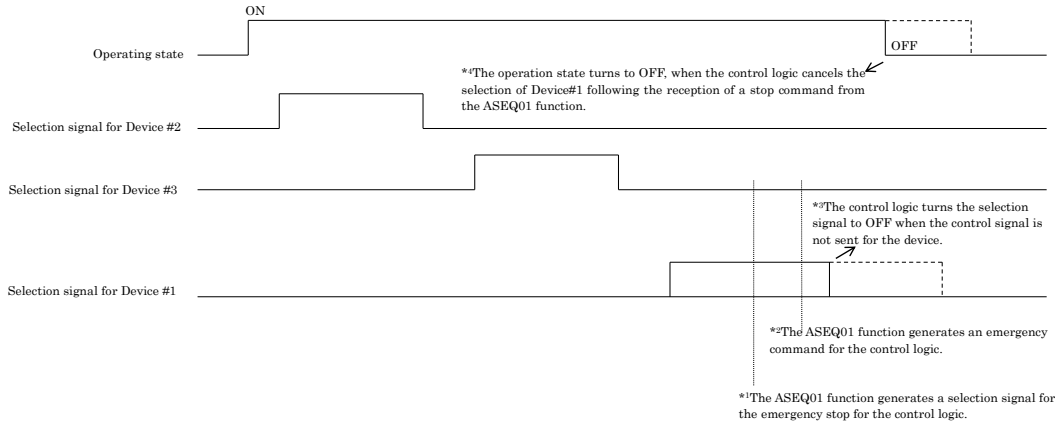


Figure 2.15-4 Time chart of automatic sequence when emergency stop command is applied during the operation of Device#1

2.15.4 Control hierarchy conditions

The user should program the "Control hierarchy" for the ASEQ01 function. The user should connect the condition with the select condition logic using the connection point "PLC_BIT_0202". For more information, see Chapter *Control and monitoring application: Control hierarchy*. Table 2.15-8 shows the respective points in the ASEQ functions.

Table 2.15-8 Control hierarchy points on ASEQ functions

Signal Number	Signal Name	Description	M/O
5A0101 800201EF40	PLC_BIT_0202	ASEQ01 control hierarchy condition	M
5A0101 800202EF40	PLC_BIT_0203	ASEQ02 control hierarchy condition	M
5A0101 800203EF40	PLC_BIT_0204	ASEQ03 control hierarchy condition	M
…	…	…	
5A0101 800212EF40	PLC_BIT_0213	ASEQ12 control hierarchy condition	M

Table 2.15-9 Control hierarchy point for Emergency stop

Signal Number	Signal Name	Description	M/O
5A0101 800213EF40	PLC_BIT_0214	Emergency control for stopping the operation	M

2.15.5 Input for emergency stop

The ASEQ functions are able to receive an "EMERSTOP_EXEC_STOP" command (see Table 2.15-3); the user should program to acquire the sign so that the ASEQ logics can abandon for controlling devices. The operation will stop instantly even if the control logic is waiting for some condition (i.e., synchronization or others).

Table 2.15-10 PLC monitoring points (Outputs for ASEQ emergency status)

Signal Number	Signal Name	Description
523001 000D0D1001	EMERSTOP_ACC_EXEC	Reception of an emergency signal
523001 800D0D1D58	EMERSTOP_EC_LCD	Emergency signal generated on the LCD scream
523001 800D0D1D55	EMERSTOP_EC_OWS	Emergency signal generated from OWS(HMI)
523001 800D0D1D56	EMERSTOP_EC_RCC	Emergency signal generated from RCC

523001 800D0D1D57	EMERSTOP_EC_RMT	Emergency signal generated at Remote
523001 810D0D1F50	EMERSTOP_EXEC_STOP	Command received for emergency stop
523001 310D0D1D01	EMERSTOP_LCD_ST	State signal about LCD screen
523001 310D0D1D00	EMERSTOP_MMC_ST	State signal about MIMIC screen
523001 800D0D1D54	EMERSTOP_SC_LCD	Select command generated on the LCD
523001 800D0D1D51	EMERSTOP_SC_OWS	Select command generated at OWS(HMI)
523001 800D0D1D52	EMERSTOP_SC_RCC	Select command generated at RCC
523001 800D0D1D53	EMERSTOP_SC_RMT	Select command generated at Remote

2.15.6 Mapping for IEC61850 communication

The user can operate the ASEQ function using IEC 61850 communications after first completing the appropriate mapping using the GR-TIEMS software. Note that the ASEQ01 function is designed for the "Single Point Controller (SPC) class" described in the IEC 61850 communications standard. The user should follow steps:

Step1: Editing Logical Node

Step2: Mapping output data

Step3: Mapping input data

(i) Editing Logical Node

The user should implement a logical node (LN) for the ASEQ01 function. Figure 2.15-5 exemplifies LN editing; the LN "(GAPC1)" is chosen for the ASEQ01 function. After the user has defined an object "SPCSO1", the ASEQ01 logical node is saved with the name "SPCSO1" plus "LN Instance". A definition for the object "SPCSO1" is made in the ASEQ01 logical node. Choose either the SBO mode or the DIR mode when editing the LN.

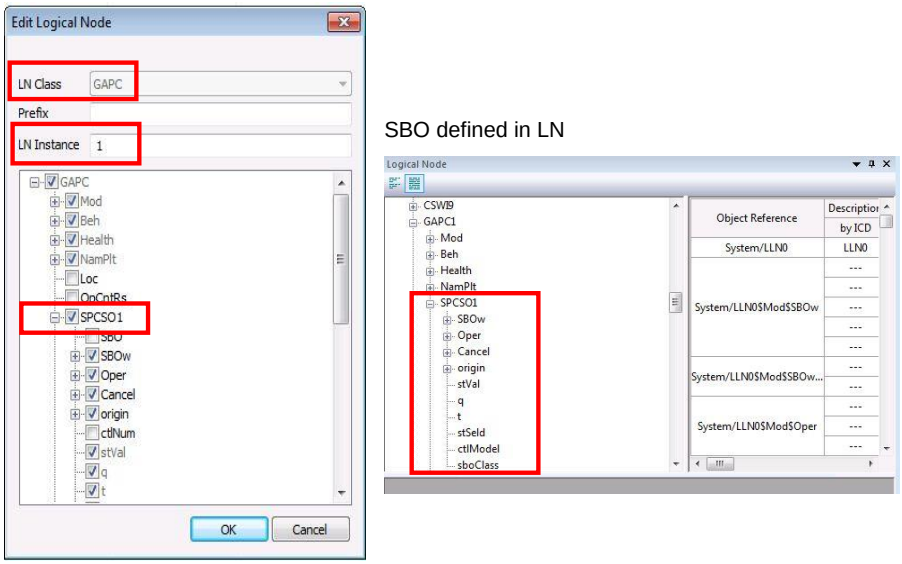
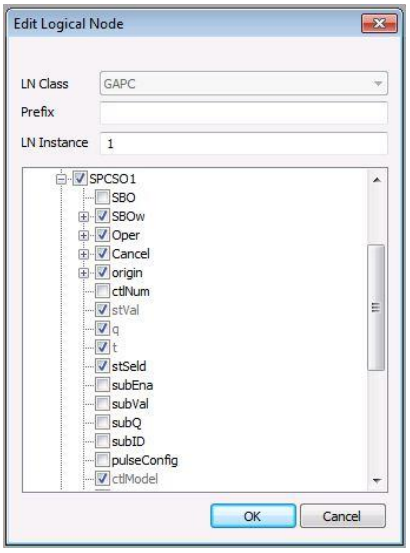


Figure 2.15-5 Defining "SPCSO1" object in GAPC1 logic node

(i)-1 Defining SBO mode

Figure 2.15-6 exemplifies the settings in LN "GAPC1" when the SBO mode is required for the ASEQ01 function. In SBO control, the user should select the following items for the object reference "GAPC1$SPCSO1" using the GR-TIEMS software;



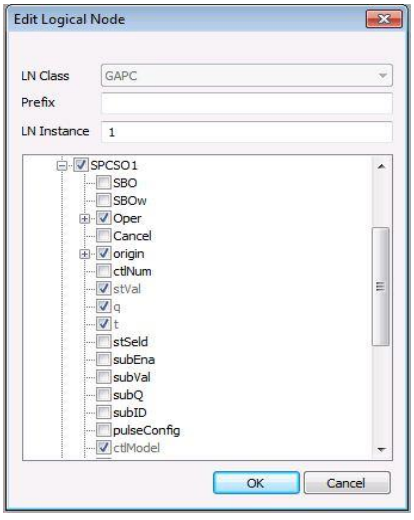
- SBOw
- Oper
- Cancel
- Origin
- stSeld
- sboClass† (choice ”operate-once”)
- ctlmodel (choice ”SBOes or SBOns”)

†”sboClass” can be found by scrolling down

Figure 2.15-6 LN editing screen for SBO mode (for example)

(i)-2 Defining DIR mode

Figure 2.15-7exemplifies the settings in LN “GAPC1” when the DIR mode is required for the ASEQ01 function. In the DIR mode, the following three items should be selected using the GR-TIEMS software:



- Oper
- Origin
- ctlmodel (choice ”DOes or DOns”)

Figure 2.15-7 LN editing screen for DIR mode (for example)

(ii) Mapping output data

The user should group the ASEQ01 signals with regard to GOOSE and REPORT; the user should map them for IEC61850 communication using GR-TIEMS.

Table 2.15-11 shows the signals in the ASEQ01 function that require mapping to the IEC 61850 communications. Figure 2.15-8 shows how to map a signal.

Table 2.15-11 Mapping signals for SPCSO1 object

Object_reference	Attribute	Type	FC	Signal Number	Signal Name
Ctrl/GAPC1$SPCSO1$origin	orCat	orCategory	ST	523001 300D011008	ASEQ01_ORCAT
Ctrl/GAPC1$SPCSO1$origin	orIdent	Octet64	ST	523001 6A0D011009	ASEQ01_ORIDENT
Ctrl/GAPC1$SPCSO1	stVal	BOOLEAN	ST	523001 000D011001	ASEQ01_ACC_EXEC
Ctrl/GAPC1$SPCSO1	q	Quality	ST	523001 310D011005	ASEQ01-QUALITY
Ctrl/GAPC1$SPCSO1	t	Timestamp	ST	523001 900D011006	ASEQ01_TIME
Ctrl/GAPC1$SPCSO1	stSeld	BOOLEAN	ST	523001 000D011D90	ASEQ01_STSELD

Note: "Status (ST)" is defined in the function constraint (FC) of the IEC 61850 standard.

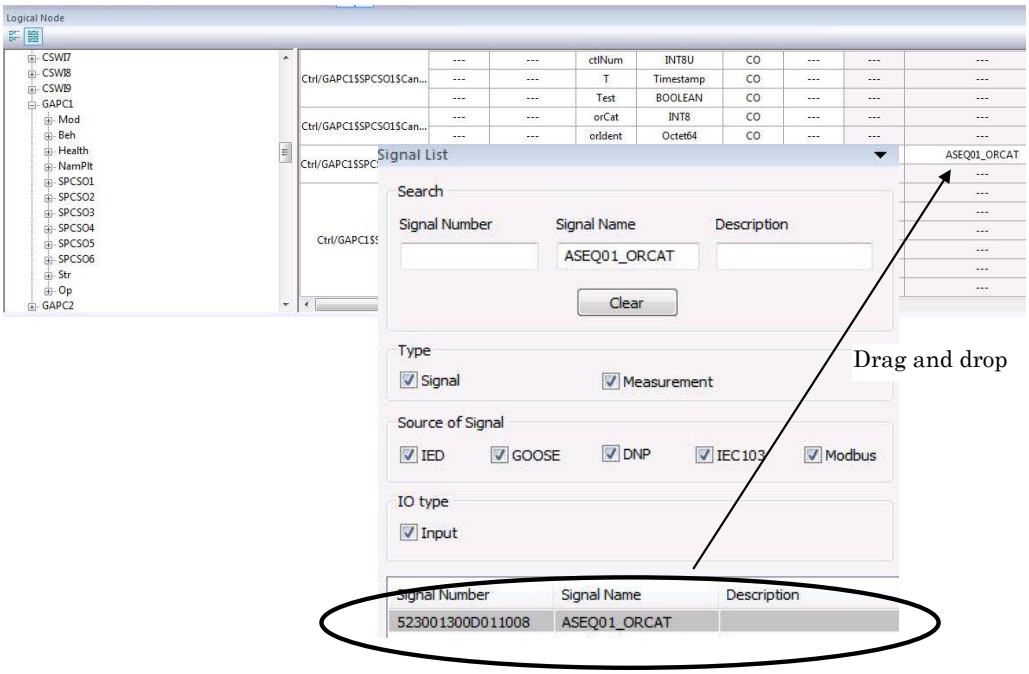


Figure 2.15-8 orCat attribute mapped into SPCSO1 object of GAPC1

(iii) Mapping input data

The ASEQ1 function can receive three commands "select, operate, and cancel". Thus, the user should map the input-point "ASEQ01_CONTROL_REQ". Table 2.15-12 shows the input-point "ASEQ01_CONTROL_REQ" and the Object reference "Ctrl/GAPC1$SPCSO1"; the user should map the input-point to the Object references with attributes CO and CF under FC†. Figure 2.15-9 shows how to map a signal.

†Note: The attribute is defined in the IEC 61850 standard; "CO" stands for "Control" and "CF" stands for "Configuration" in the functional constraint (FC).

Table 2.15-12 Mapping signals required for SPCSO1 object in ASEQ01 function

Object_reference	Attribute	Type	FC	Signal Number	Signal Name
Ctrl/GAPC1$SPCSO1$SBOw	ctlVal	BOOLEAN	CO	523001 700D016D08	ASEQ01_CONTROL_REQ
Ctrl/GAPC1$SPCSO1$SBOw	ctlNum	INT8U	CO		
Ctrl/GAPC1$SPCSO1$SBOw	T	Timestamp	CO		
Ctrl/GAPC1$SPCSO1$SBOw	Test	BOOLEAN	CO		
Ctrl/GAPC1$SPCSO1$SBOw	Check	Check	CO		
Ctrl/GAPC1$SPCSO1$SBOw$origin	orCat	orCategory	CO		
Ctrl/GAPC1$SPCSO1$SBOw$origin	orIdent	Octet64	CO		
Ctrl/GAPC1$SPCSO1$Oper	ctlVal	BOOLEAN	CO		
Ctrl/GAPC1$SPCSO1$Oper	ctlNum	INT8U	CO		
Ctrl/GAPC1$SPCSO1$Oper	T	Timestamp	CO		
Ctrl/GAPC1$SPCSO1$Oper	Test	BOOLEAN	CO		
Ctrl/GAPC1$SPCSO1$Oper	Check	Check	CO		
Ctrl/GAPC1$SPCSO1$Oper$origin	orCat	orCategory	CO		
Ctrl/GAPC1$SPCSO1$Oper$origin	orIdent	Octet64	CO		
Ctrl/GAPC1$SPCSO1$Cancel	ctlVal	BOOLEAN	CO		
Ctrl/GAPC1$SPCSO1$Cancel	ctlNum	INT8U	CO		
Ctrl/GAPC1$SPCSO1$Cancel	T	Timestamp	CO		
Ctrl/GAPC1$SPCSO1$Cancel	Test	BOOLEAN	CO		
Ctrl/GAPC1$SPCSO1$Cancel$origin	orCat	orCategory	CO		
Ctrl/GAPC1$SPCSO1$Cancel$origin	orIdent	Octet64	CO		
Ctrl/GAPC1$SPCSO1	ctlModel	ctlModel	CF		
Ctrl/GAPC1$SPCSO1	sboClass	sboClass	CF		

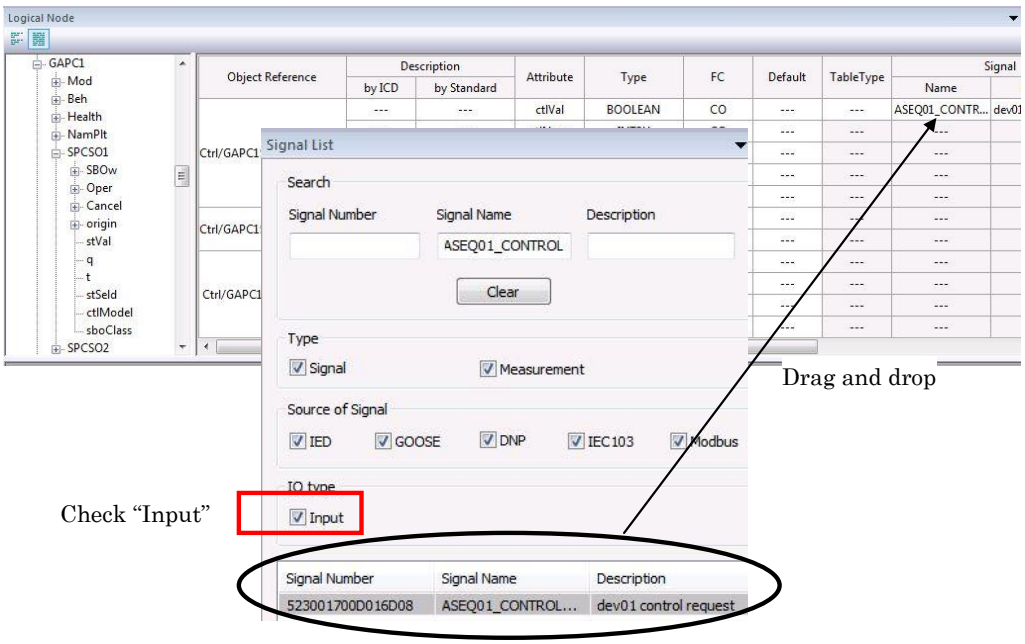


Figure 2.15-9 Input-point mapped for GAPC1

2.15.7 Setting

Settings of ASEQ(Function ID: 523001)

Setting item		Range	Units	Contents	Default setting value	Notes
Dev1	ASEQ01-EN	Off/On	-	CTRLSEQ01 Enable	Off	
	ASEQ01-CTRMENU	Off/On	-	control by MENU enable	Off	
	ASEQ01-CTRAHMI	DIR/SBO	-	control action (Direct or SBO) by HMI	SBO	
Dev2	ASEQ02-EN	Off/On	-	CTRLSEQ02 Enable	Off	
	ASEQ02-CTRMENU	Off/On	-	control by MENU enable	Off	
	ASEQ02-CTRAHMI	DIR/SBO	-	control action(Direct or SBO)by HMI	SBO	
Dev3	ASEQ03-EN	Off/On	-	CTRLSEQ03 Enable	Off	
	ASEQ03-CTRMENU	Off/On	-	control by MENU enable	Off	
	ASEQ03-CTRAHMI	DIR/SBO	-	control action (Direct or SBO) by HMI	SBO	
Dev4	ASEQ04-EN	Off/On	-	CTRLSEQ04 Enable	Off	
	ASEQ04-CTRMENU	Off/On	-	control by MENU enable	Off	
	ASEQ04-CTRAHMI	DIR/SBO	-	control action (Direct or SBO) by HMI	SBO	
Dev5	ASEQ05-EN	Off/On	-	CTRLSEQ05 Enable	Off	
	ASEQ05-CTRMENU	Off/On	-	control by MENU enable	Off	
	ASEQ05-CTRAHMI	DIR/SBO	-	control action (Direct or SBO) by HMI	SBO	
Dev6	ASEQ06-EN	Off/On	-	CTRLSEQ06 Enable	Off	
	ASEQ06-CTRMENU	Off/On	-	control by MENU enable	Off	
	ASEQ06-CTRAHMI	DIR/SBO	-	control action(Direct or SBO)by HMI	SBO	
Dev7	ASEQ07-EN	Off/On	-	CTRLSEQ07 Enable	Off	
	ASEQ07-CTRMENU	Off/On	-	control by MENU enable	Off	
	ASEQ07-CTRAHMI	DIR/SBO	-	control action (Direct or SBO) by HMI	SBO	
Dev8	ASEQ08-EN	Off/On	-	CTRLSEQ08 Enable	Off	
	ASEQ08-CTRMENU	Off/On	-	control by MENU enable	Off	
	ASEQ08-CTRAHMI	DIR/SBO	-	control action (Direct or SBO) by HMI	SBO	
Dev9	ASEQ09-EN	Off/On	-	CTRLSEQ09 Enable	Off	
	ASEQ09-CTRMENU	Off/On	-	control by MENU enable	Off	
	ASEQ09-CTRAHMI	DIR/SBO	-	control action (Direct or SBO) by HMI	SBO	
Dev10	ASEQ10-EN	Off/On	-	CTRLSEQ10 Enable	Off	
	ASEQ10-CTRMENU	Off/On	-	control by MENU enable	Off	
	ASEQ10-CTRAHMI	DIR/SBO	-	control action (Direct or SBO) by HMI	SBO	
Dev11	ASEQ11-EN	Off/On	-	CTRLSEQ11 Enable	Off	
	ASEQ11-CTRMENU	Off/On	-	control by MENU enable	Off	
	ASEQ11-CTRAHMI	DIR/SBO	-	control action (Direct or SBO) by HMI	SBO	
Dev12	ASEQ12-EN	Off/On	-	CTRLSEQ12 Enable	Off	
	ASEQ12-CTRMENU	Off/On	-	control by MENU enable	Off	
	ASEQ12-CTRAHMI	DIR/SBO	-	control action (Direct or SBO) by HMI	SBO	
Emar	EMERSTOP-EN	Off/On	-	CTRL EMERSTOP Enable	Off	
gency	EMERSTOP-CTRMENU	Off/On	-	control by MENU enable	Off	
	EMERSTOP-CTRAHMI	DIR/SBO	-	control action (Direct or SBO) by HMI	SBO	

2.15.8 Signal

◆ Signal monitoring points

ASEQ(Function ID: 523001)

Element ID	Name	Description
ASEQ01_ACC_EXEC	000D011001	Reception state of the automatic sequence instruction command
ASEQ01_EC_LCD	800D011D58	ASEQ01 execute command from LCD
ASEQ01_EC_OWS	800D011D55	ASEQ01 execute command from OWS(HMI)
ASEQ01_EC_RCC	800D011D56	ASEQ01 execute command from RCC
ASEQ01_EC_RMT	800D011D57	ASEQ01 execute command by Remote
ASEQ01_EXEC_START	820D011F50	Commencing command for automatic sequence
ASEQ01_EXEC_STOP	810D011F51	Stop command for automatic sequence
ASEQ01_LCD_ST	310D011D01	ASEQ01 state for LCD
ASEQ01_MMC_ST	310D011D00	ASEQ01 state for MIMIC
ASEQ01_SC_LCD	800D011D54	ASEQ01 select command from LCD
ASEQ01_SC_OWS	800D011D51	ASEQ01 select command from OWS(HMI)
ASEQ01_SC_RCC	800D011D52	ASEQ01 select command from RCC
ASEQ01_SC_RMT	800D011D53	ASEQ01 select command by Remote
ASEQ01_STSELD	000D011D90	ASEQ01 selected signal (stSeld) for SAS
ASEQ02_ACC_EXEC	000D021001	Reception state of the automatic sequence instruction command
ASEQ02_EC_LCD	800D021D58	ASEQ02 execute command from LCD
ASEQ02_EC_OWS	800D021D55	ASEQ02 execute command from OWS(HMI)
ASEQ02_EC_RCC	800D021D56	ASEQ02 execute command from RCC
ASEQ02_EC_RMT	800D021D57	ASEQ02 execute command by Remote
ASEQ02_EXEC_START	820D021F50	Commencing command for automatic sequence
ASEQ02_EXEC_STOP	810D021F51	Stop command for automatic sequence
ASEQ02_LCD_ST	310D021D01	ASEQ02 state for LCD
ASEQ02_MMC_ST	310D021D00	ASEQ02 state for MIMIC
ASEQ02_SC_LCD	800D021D54	ASEQ02 select command from LCD
ASEQ02_SC_OWS	800D021D51	ASEQ02 select command from OWS(HMI)
ASEQ02_SC_RCC	800D021D52	ASEQ02 select command from RCC
ASEQ02_SC_RMT	800D021D53	ASEQ02 select command by Remote
ASEQ02_STSELD	000D021D90	ASEQ02 selected signal (stSeld) for SAS
ASEQ03_ACC_EXEC	000D031001	Reception state of the automatic sequence instruction command
ASEQ03_EC_LCD	800D031D58	ASEQ03 execute command from LCD
ASEQ03_EC_OWS	800D031D55	ASEQ03 execute command from OWS(HMI)
ASEQ03_EC_RCC	800D031D56	ASEQ03 execute command from RCC
ASEQ03_EC_RMT	800D031D57	ASEQ03 execute command by Remote
ASEQ03_EXEC_START	820D031F50	Commencing command for automatic sequence
ASEQ03_EXEC_STOP	810D031F51	Stop command for automatic sequence
ASEQ03_LCD_ST	310D031D01	ASEQ03 state for LCD
ASEQ03_MMC_ST	310D031D00	ASEQ03 state for MIMIC
ASEQ03_SC_LCD	800D031D54	ASEQ03 select command from LCD
ASEQ03_SC_OWS	800D031D51	ASEQ03 select command from OWS(HMI)
ASEQ03_SC_RCC	800D031D52	ASEQ03 select command from RCC
ASEQ03_SC_RMT	800D031D53	ASEQ03 select command by Remote
ASEQ03_STSELD	000D031D90	ASEQ03 selected signal (stSeld) for SAS
ASEQ04_ACC_EXEC	000D041001	Reception state of the automatic sequence instruction command

◆ Signal monitoring points

ASEQ(Function ID: 523001)

Element ID	Name	Description
ASEQ04_EC_LCD	800D041D58	ASEQ04 execute command from LCD
ASEQ04_EC_OWS	800D041D55	ASEQ04 execute command from OWS(HMI)
ASEQ04_EC_RCC	800D041D56	ASEQ04 execute command from RCC
ASEQ04_EC_RMT	800D041D57	ASEQ04 execute command by Remote
ASEQ04_EXEC_START	820D041F50	Commencing command for automatic sequence
ASEQ04_EXEC_STOP	810D041F51	Stop command for automatic sequence
ASEQ04_LCD_ST	310D041D01	ASEQ04 state for LCD
ASEQ04_MMC_ST	310D041D00	ASEQ04 state for MIMIC
ASEQ04_SC_LCD	800D041D54	ASEQ04 select command from LCD
ASEQ04_SC_OWS	800D041D51	ASEQ04 select command from OWS(HMI)
ASEQ04_SC_RCC	800D041D52	ASEQ04 select command from RCC
ASEQ04_SC_RMT	800D041D53	ASEQ04 select command by Remote
ASEQ04_STSELD	000D041D90	ASEQ04 selected signal (stSeld) for SAS
ASEQ05_ACC_EXEC	000D051001	Reception state of the automatic sequence instruction command
ASEQ05_EC_LCD	800D051D58	ASEQ05 execute command from LCD
ASEQ05_EC_OWS	800D051D55	ASEQ05 execute command from OWS(HMI)
ASEQ05_EC_RCC	800D051D56	ASEQ05 execute command from RCC
ASEQ05_EC_RMT	800D051D57	ASEQ05 execute command by Remote
ASEQ05_EXEC_START	820D051F50	Commencing command for automatic sequence
ASEQ05_EXEC_STOP	810D051F51	Stop command for automatic sequence
ASEQ05_LCD_ST	310D051D01	ASEQ05 state for LCD
ASEQ05_MMC_ST	310D051D00	ASEQ05 state for MIMIC
ASEQ05_SC_LCD	800D051D54	ASEQ05 select command from LCD
ASEQ05_SC_OWS	800D051D51	ASEQ05 select command from OWS(HMI)
ASEQ05_SC_RCC	800D051D52	ASEQ05 select command from RCC
ASEQ05_SC_RMT	800D051D53	ASEQ05 select command by Remote
ASEQ05_STSELD	000D051D90	ASEQ05 selected signal (stSeld) for SAS
ASEQ06_ACC_EXEC	000D061001	Reception state of the automatic sequence instruction command
ASEQ06_EC_LCD	800D061D58	ASEQ06 execute command from LCD
ASEQ06_EC_OWS	800D061D55	ASEQ06 execute command from OWS(HMI)
ASEQ06_EC_RCC	800D061D56	ASEQ06 execute command from RCC
ASEQ06_EC_RMT	800D061D57	ASEQ06 execute command by Remote
ASEQ06_EXEC_START	820D061F50	Commencing command for automatic sequence
ASEQ06_EXEC_STOP	810D061F51	Stop command for automatic sequence
ASEQ06_LCD_ST	310D061D01	ASEQ06 state for LCD
ASEQ06_MMC_ST	310D061D00	ASEQ06 state for MIMIC
ASEQ06_SC_LCD	800D061D54	ASEQ06 select command from LCD
ASEQ06_SC_OWS	800D061D51	ASEQ06 select command from OWS(HMI)
ASEQ06_SC_RCC	800D061D52	ASEQ06 select command from RCC
ASEQ06_SC_RMT	800D061D53	ASEQ06 select command by Remote
ASEQ06_STSELD	000D061D90	ASEQ06 selected signal (stSeld) for SAS
ASEQ07_ACC_EXEC	000D071001	Reception state of the automatic sequence instruction command
ASEQ07_EC_LCD	800D071D58	ASEQ07 execute command from LCD
ASEQ07_EC_OWS	800D071D55	ASEQ07 execute command from OWS(HMI)

◆ Signal monitoring points

ASEQ(Function ID: 523001)

Element ID	Name	Description
ASEQ07_EC_RCC	800D071D56	ASEQ07 execute command from RCC
ASEQ07_EC_RMT	800D071D57	ASEQ07 execute command by Remote
ASEQ07_EXEC_START	820D071F50	Commencing command for automatic sequence
ASEQ07_EXEC_STOP	810D071F51	Stop command for automatic sequence
ASEQ07_LCD_ST	310D071D01	ASEQ07 state for LCD
ASEQ07_MMC_ST	310D071D00	ASEQ07 state for MIMIC
ASEQ07_SC_LCD	800D071D54	ASEQ07 select command from LCD
ASEQ07_SC_OWS	800D071D51	ASEQ07 select command from OWS(HMI)
ASEQ07_SC_RCC	800D071D52	ASEQ07 select command from RCC
ASEQ07_SC_RMT	800D071D53	ASEQ07 select command by Remote
ASEQ07_STSELD	000D071D90	ASEQ07 selected signal (stSeld) for SAS
ASEQ08_ACC_EXEC	000D081001	Reception state of the automatic sequence instruction command
ASEQ08_EC_LCD	800D081D58	ASEQ08 execute command from LCD
ASEQ08_EC_OWS	800D081D55	ASEQ08 execute command from OWS(HMI)
ASEQ08_EC_RCC	800D081D56	ASEQ08 execute command from RCC
ASEQ08_EC_RMT	800D081D57	ASEQ08 execute command by Remote
ASEQ08_EXEC_START	820D081F50	Commencing command for automatic sequence
ASEQ08_EXEC_STOP	810D081F51	Stop command for automatic sequence
ASEQ08_LCD_ST	310D081D01	ASEQ08 state for LCD
ASEQ08_MMC_ST	310D081D00	ASEQ08 state for MIMIC
ASEQ08_SC_LCD	800D081D54	ASEQ08 select command from LCD
ASEQ08_SC_OWS	800D081D51	ASEQ08 select command from OWS(HMI)
ASEQ08_SC_RCC	800D081D52	ASEQ08 select command from RCC
ASEQ08_SC_RMT	800D081D53	ASEQ08 select command by Remote
ASEQ08_STSELD	000D081D90	ASEQ08 selected signal (stSeld) for SAS
ASEQ09_ACC_EXEC	000D091001	Reception state of the automatic sequence instruction command
ASEQ09_EC_LCD	800D091D58	ASEQ09 execute command from LCD
ASEQ09_EC_OWS	800D091D55	ASEQ09 execute command from OWS(HMI)
ASEQ09_EC_RCC	800D091D56	ASEQ09 execute command from RCC
ASEQ09_EC_RMT	800D091D57	ASEQ09 execute command by Remote
ASEQ09_EXEC_START	820D091F50	Commencing command for automatic sequence
ASEQ09_EXEC_STOP	810D091F51	Stop command for automatic sequence
ASEQ09_LCD_ST	310D091D01	ASEQ09 state for LCD
ASEQ09_MMC_ST	310D091D00	ASEQ09 state for MIMIC
ASEQ09_SC_LCD	800D091D54	ASEQ09 select command from LCD
ASEQ09_SC_OWS	800D091D51	ASEQ09 select command from OWS(HMI)
ASEQ09_SC_RCC	800D091D52	ASEQ09 select command from RCC
ASEQ09_SC_RMT	800D091D53	ASEQ09 select command by Remote
ASEQ09_STSELD	000D091D90	ASEQ09 selected signal (stSeld) for SAS
ASEQ10_ACC_EXEC	000D0A1001	Reception state of the automatic sequence instruction command
ASEQ10_EC_LCD	800D0A1D58	ASEQ10 execute command from LCD
ASEQ10_EC_OWS	800D0A1D55	ASEQ10 execute command from OWS(HMI)
ASEQ10_EC_RCC	800D0A1D56	ASEQ10 execute command from RCC
ASEQ10_EC_RMT	800D0A1D57	ASEQ10 execute command by Remote

◆ Signal monitoring points

ASEQ(Function ID: 523001)

Element ID	Name	Description
ASEQ10_EXEC_START	820D0A1F50	Commencing command for automatic sequence
ASEQ10_EXEC_STOP	810D0A1F51	Stop command for automatic sequence
ASEQ10_LCD_ST	310D0A1D01	ASEQ10 state for LCD
ASEQ10_MMC_ST	310D0A1D00	ASEQ10 state for MIMIC
ASEQ10_SC_LCD	800D0A1D54	ASEQ10 select command from LCD
ASEQ10_SC_OWS	800D0A1D51	ASEQ10 select command from OWS(HMI)
ASEQ10_SC_RCC	800D0A1D52	ASEQ10 select command from RCC
ASEQ10_SC_RMT	800D0A1D53	ASEQ10 select command by Remote
ASEQ10_STSELD	000D0A1D90	ASEQ10 selected signal (stSeld) for SAS
ASEQ11_ACC_EXEC	000D0B1001	Reception state of the automatic sequence instruction command
ASEQ11_EC_LCD	800D0B1D58	ASEQ11 execute command from LCD
ASEQ11_EC_OWS	800D0B1D55	ASEQ11 execute command from OWS(HMI)
ASEQ11_EC_RCC	800D0B1D56	ASEQ11 execute command from RCC
ASEQ11_EC_RMT	800D0B1D57	ASEQ11 execute command by Remote
ASEQ11_EXEC_START	820D0B1F50	Commencing command for automatic sequence
ASEQ11_EXEC_STOP	810D0B1F51	Stop command for automatic sequence
ASEQ11_LCD_ST	310D0B1D01	ASEQ11 state for LCD
ASEQ11_MMC_ST	310D0B1D00	ASEQ11 state for MIMIC
ASEQ11_SC_LCD	800D0B1D54	ASEQ11 select command from LCD
ASEQ11_SC_OWS	800D0B1D51	ASEQ11 select command from OWS(HMI)
ASEQ11_SC_RCC	800D0B1D52	ASEQ11 select command from RCC
ASEQ11_SC_RMT	800D0B1D53	ASEQ11 select command from Remote
ASEQ11_STSELD	000D0B1D90	ASEQ11 selected signal (stSeld) for SAS
ASEQ12_ACC_EXEC	000D0C1001	Reception state of the automatic sequence instruction command
ASEQ12_EC_LCD	800D0C1D58	ASEQ12 execute command from LCD
ASEQ12_EC_OWS	800D0C1D55	ASEQ12 execute command from OWS(HMI)
ASEQ12_EC_RCC	800D0C1D56	ASEQ12 execute command from RCC
ASEQ12_EC_RMT	800D0C1D57	ASEQ12 execute command by Remote
ASEQ12_EXEC_START	820D0C1F50	Commencing command for automatic sequence
ASEQ12_EXEC_STOP	810D0C1F51	Stop command for automatic sequence
ASEQ12_LCD_ST	310D0C1D01	ASEQ12 state for LCD
ASEQ12_MMC_ST	310D0C1D00	ASEQ12 state for MIMIC
ASEQ12_SC_LCD	800D0C1D54	ASEQ12 select command from LCD
ASEQ12_SC_OWS	800D0C1D51	ASEQ12 select command from OWS(HMI)
ASEQ12_SC_RCC	800D0C1D52	ASEQ12 select command from RCC
ASEQ12_SC_RMT	800D0C1D53	ASEQ12 select command by Remote
ASEQ12_STSELD	000D0C1D90	ASEQ12 selected signal (stSeld) for SAS
ASEQ_MULTI_SEL	000D001F40	Status flag to not be selected for multiple operations
EMERSTOP_ACC_EXEC	000D0D1001	Reception state of an emergency signal to stop the operation
EMERSTOP_EC_LCD	800D0D1D58	EMERSTOP execute command from LCD
EMERSTOP_EC_OWS	800D0D1D55	EMERSTOP execute command from OWS(HMI)
EMERSTOP_EC_RCC	800D0D1D56	EMERSTOP execute command from RCC
EMERSTOP_EC_RMT	800D0D1D57	EMERSTOP execute command by Remote
EMERSTOP_EXEC_STOP	810D0D1F50	Commencing command for emergency stop

◆ Signal monitoring points

ASEQ(Function ID: 523001)

Element ID	Name	Description
EMERSTOP_LCD_ST	310D0D1D01	EMERSTOP state for LCD
EMERSTOP_MMC_ST	310D0D1D00	EMERSTOP state for MIMIC
EMERSTOP_SC_LCD	800D0D1D54	EMERSTOP select command from LCD
EMERSTOP_SC_OWS	800D0D1D51	EMERSTOP select command from OWS(HMI)
EMERSTOP_SC_RCC	800D0D1D52	EMERSTOP select command from RCC
EMERSTOP_SC_RMT	800D0D1D53	EMERSTOP select command by Remote
EMERSTOP_STSELD	000D0D1D90	EMERSTOP selected signal (stSeld) for SAS

◆ Connection points in PLC logic

ASEQ(Function ID: 523001)

Element ID	Name	Description
820D01ED50	ASEQ01IN_TMP_28	Reception of control right for ASEQ01
800D01EDF2	ASEQ01_EXEC_RESET	Reception of reset signal for ASEQ01 operation
820D02ED50	ASEQ02IN_TMP_28	Reception of control right for ASEQ02
800D02EDF2	ASEQ02_EXEC_RESET	Reception of reset signal for ASEQ02 operation
820D03ED50	ASEQ03IN_TMP_28	Reception of control right for ASEQ03
800D03EDF2	ASEQ03_EXEC_RESET	Reception of reset signal for ASEQ03 operation
820D04ED50	ASEQ04IN_TMP_28	Reception of control right for ASEQ04
800D04EDF2	ASEQ04_EXEC_RESET	Reception of reset signal for ASEQ05 operation
820D05ED50	ASEQ05IN_TMP_28	Reception of control right for ASEQ05
800D05EDF2	ASEQ05_EXEC_RESET	Reception of reset signal for ASEQ05 operation
820D06ED50	ASEQ06IN_TMP_28	Reception of control right for ASEQ06
800D06EDF2	ASEQ06_EXEC_RESET	Reception of reset signal for ASEQ06 operation
820D07ED50	ASEQ07IN_TMP_28	Reception of control right for ASEQ07
800D07EDF2	ASEQ07_EXEC_RESET	Reception of reset signal for ASEQ07 operation
820D08ED50	ASEQ08IN_TMP_28	Reception of control right for ASEQ08
800D08EDF2	ASEQ08_EXEC_RESET	Reception of reset signal for ASEQ08 operation
820D09ED50	ASEQ09IN_TMP_28	Reception of control right for ASEQ09
800D09EDF2	ASEQ09_EXEC_RESET	Reception of reset signal for ASEQ09 operation
820D0AED50	ASEQ10IN_TMP_28	Reception of control right for ASEQ10
800D0AEDF2	ASEQ10_EXEC_RESET	Reception of reset signal for ASEQ10 operation
820D0BED50	ASEQ11IN_TMP_28	Reception of control right for ASEQ11
800D0BEDF2	ASEQ11_EXEC_RESET	Reception of reset signal for ASEQ11 operation
820D0CED50	ASEQ12IN_TMP_28	Reception of control right for ASEQ12
800D0CEDF2	ASEQ12_EXEC_RESET	Reception of reset signal for ASEQ12 operation
820D0DED50	EMERSTOPIN_TMP_28	Reception of control right for all ASEQ functions

2.16 Software interlock function (ILK)

Devices must be controlled in accordance with the prevailing operational condition of the electric power system. If a device does not act or behave in accordance with the operational circumstances, inappropriate device control can result in outages or fatal incidents for the network. In order to avoid such circumstances, software interlock (ILK) function is provided that is able to examine the current operational situation and determine whether to permit the control of a particular device.

When using the ILK function, an interlock-check formula is required. The interlock-check formula examines the operational conditions for all devices, and is stored in the ILK database. The ILK function provides an output signal "OK/NG decision information"; the "OK/NG decision information" is transferred to the control functions†, which control the external devices. Following which, the control functions can commence with the control of the selected devices in response to the respective "OK/NG decision information".

†Note: Details of SPOS, DPSY and other features are discussed separately elsewhere in the instruction manual under the Chapter *Control and monitoring applications*.

Note: The implementation of such features depends on the selection of hardware and the configuration of functions. Several IED models do not support certain features. To determine whether a particular feature is implemented within an IED, identify the IED ordering number; and check the order number for the "G&T position" referring to the comparison table below. For more information, see *Appendix: Ordering*.

Table 2.16-1 Comparative table in respective ordering numbers

Sec.	Feature	Ordering No. at "G&T"					
		BCU			BCPU		IFU
		11	13	1F	2N	2C	19
–	Main features	✓	✓	✓	✓	✓	NA

✓: Applicable NA: Not applicable

Prior to controlling a device, the interlock-check function is used to determine whether the control of a device is correct or not. If the interlock-check finds that the conditions for device control have not been satisfied in accordance with the appropriate interlock condition, control of the device is forbidden. Figure 2.16-1 provides an overview of the interlock-check process. Formulae for interlock-check are stored in an ILK database; these formulae are used in order to enable the interlock-check function to output a decision. If the proposed operation of a particular device is deemed correct then an "OK-decision" is determined by the formulae, and device control is allowed. However, if the proposed operation of the device is deemed incorrect then an "NG-decision" is determined by the formulae, and device control is not allowed.

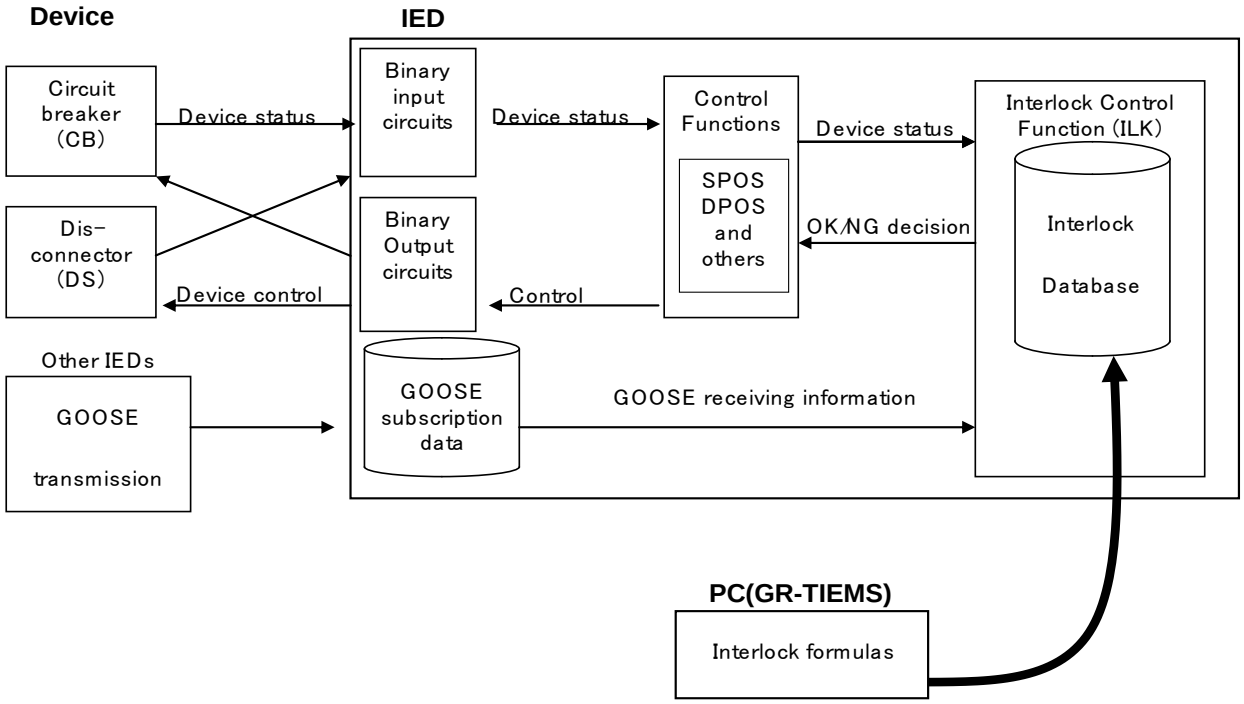


Figure 2.16-1 Interlock–check process

2.16.1 ILK specification

(i) Maximum number of interlock-checks

Since the maximum number of interlock-checks is 83, ILK can be used to supervise 83 control devices. An interlock-check can include up to 500 nodes; an interlock operator and input/output signals are configured for each node; a node can accept up to 64 input signals. (Nodes are discussed separately. See section 2.16.3)

(ii) GOOSE receiving information

When an interlock-check is required to determine an "OK/NG-decision", the interlock-check function collects the device status from all of the other IEDs during the interlock-check process. In this case, GOOSE subscription information is used to acquire the device status required; configuration of the interlock-check formula, including quality information corresponding to

other IEDs and GOOSE, is necessary.

2.16.2 Interlock-check formula

Figure 2.16-2 shows a device (Q0) in the feeder bay, if a control action to operate (Q0) is required, an interlock-check will be necessary. To control the device (Q0), the interlock-check must verify the status of several devices in the busbar and the bay.

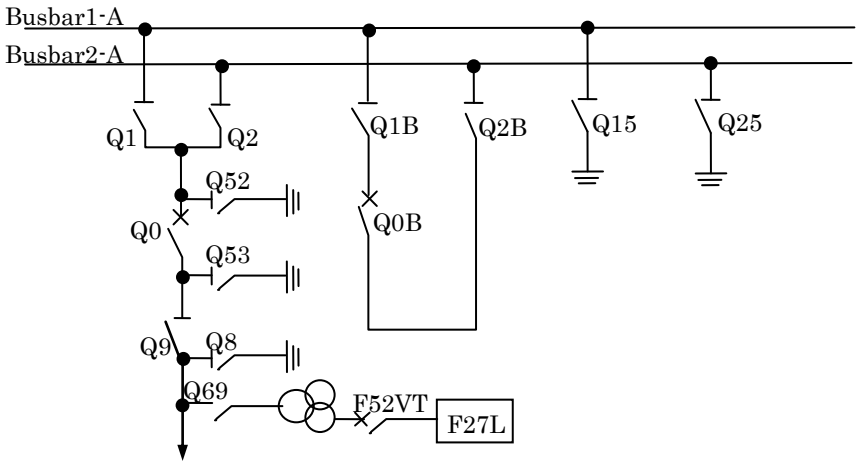


Figure 2.16-2 Example of device status and Interlock-check

In accordance with the arrangement of the devices shown in Figure 2.16-2, interlock-check formulae can be configured from equations (2.16-1) to (2.16-9). The status of respective devices, (stVal) and interlock operators ("•" and "+") are placed on the right-hand side of the equations; and the interlock condition (e.g. Q0(Closing)) is placed on the left-hand side of the equations. The interlock operators are also shown in Table 2.16-2.

$$Q1 = \left(\overline{Q0} \cdot \overline{Q2} \cdot \overline{Q15} \cdot \overline{Q52} \cdot \overline{Q53}\right) + (Q2 \cdot Q0 \cdot Q9 \cdot Q0B \cdot Q1B \cdot Q2B) \quad (2.16\text{-}1)$$

$$Q2 = \left(\overline{Q0} \cdot \overline{Q1} \cdot \overline{Q25} \cdot \overline{Q52} \cdot \overline{Q53}\right) + (Q1 \cdot Q0 \cdot Q9 \cdot Q0B \cdot Q1B \cdot Q2B) \quad (2.16\text{-}2)$$

$$Q9 = \left(\overline{Q0} \cdot \overline{Q52} \cdot \overline{Q53} \cdot \overline{Q8}\right) \quad (2.16\text{-}3)$$

$$Q0(\text{Closing}^{\ddagger}) = \overline{63QBE} \cdot \overline{63GBE} \cdot \left((\overline{Q1} \cdot \overline{Q2} \cdot \overline{Q9}) + \left((Q1 + Q2) \cdot Q9\right)\right) \cdot \text{Closing Blocking} \quad (2.16\text{-}4)$$

$$Q0(\text{Opening}^{\ddagger}) = \overline{63QBF} \cdot \overline{63GBE} \quad (2.16\text{-}5)$$

$$Q8 = (\overline{Q9} \cdot Q69 \cdot \text{F27L(No voltage)} \cdot \text{F52VT}) \quad (2.16\text{-}6)$$

$$Q52 = (\overline{Q9} \cdot \overline{Q1} \cdot \overline{Q2}) \quad (2.16\text{-}7)$$

$$Q53 = (\overline{Q9} \cdot \overline{Q1} \cdot \overline{Q2}) \quad (2.16\text{-}8)$$

$$Q69 = Q8 \quad (2.16\text{-}9)$$

where,

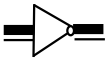
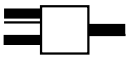
Q0:	Circuit breaker (CB)†
Q1, Q2, Q9:	Disconnecting switch (DS)
Q52, Q53, Q8, Q15, Q25:	Earthing switch (ES)
63QBE:	OIL Pressure switch (e.g., "Off" state is shown at 270 bar or above.)
63QBF:	OIL Pressure switch (e.g., "On" state is shown at 255 bar or below.)
63GBE:	GAS Pressure switch (e.g., "On" state is shown at 6.5 bar or below.)
Closing Blocking:	State of Protection lockout relay ("Off" state means active.)
F27L:	State of under voltage relay ("On" state means no voltage.)
F52VT:	State of VT MCB switch
Sign "•":	Interlock operator "AND"
Sign "+":	Interlock operator "OR"

†Note: When CB ($Q0$) is open, logic level of $\overline{Q0}$ is "1". On the other hand, when CB ($Q0$) is closed, logic level of $Q0$ is "1".

‡Note: For example, on the left-hand side of equation (2.16-5), "Opening" reflects the control direction of CB ($Q0$).

For example in equation (2.16-12), the interlock condition for DS (Q1) is satisfied when CB (Q0), DS (Q2), ES for the Bus-bar1-A (Q15), ES (Q52) and ES (Q53) are open. In addition, the interlock condition for DS (Q1) is also satisfied when DS (Q2), CB (Q0), DS (Q9), CB (Q0), DS (Q1), and DS (Q2) are closed.

Table 2.16-2 Names of operators used in the Interlock-check formulae

Interlock operator	Sign of interlock operator	Description‡	Example of interlock formula†
AND(・)		If both input signals are "1", the resultant output signal is "1". If not, the output signal is "0".	Q1 ・ Q2
OR(+)		If either input signals is "1", the resultant output signal is "1". If not, the output signal is "0".	Q1 + Q2
NOT(!)		If the input signal is "1", the resultant output signal is "0". If not, the output signal is "1".	!(Q1)
COMP		Two input signals are compared. If the input signals are identical, the output signal is "1". If not, the output signal is "0".	(Q1) COMP (1)

†Note: Q1 and Q2 represent controllable objects.

‡Note: For further information, see section 2.16.3(iii).

2.16.3 Interlock-check method

(i) Node and input/output signals

A node is represented by an interlock-operator, input signals (stVal and Quality), and output signals (stVal and Quality). For example, Figure 2.16-3 shows a node with an "OR" interlock-operator, input signals, and an output signal. When stVal and 'Quality' are applied to the inputs of the node, the resultant output signal is in accordance with the operation rule of "OR". (For details, see 2.16.3(iii)-2)

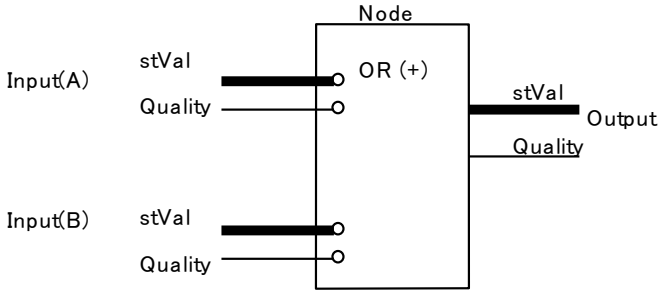


Figure 2.16-3 Input/output signals

Note: A bold line reflects a signal "stVal". A thin line reflects a signal "Quality". The user should note that the signal format generated by control functions should be transposed for the stVal format, as shown in Table 2.16-8.

(ii) Nodes and formulae for interlock-check

Figure 2.16-4 illustrates that an interlock-check is realized by using a number of nodes. For each node, the user is required to configure input signals, interlock-operators, and links between nodes. Following that, an interlock-check can be run.

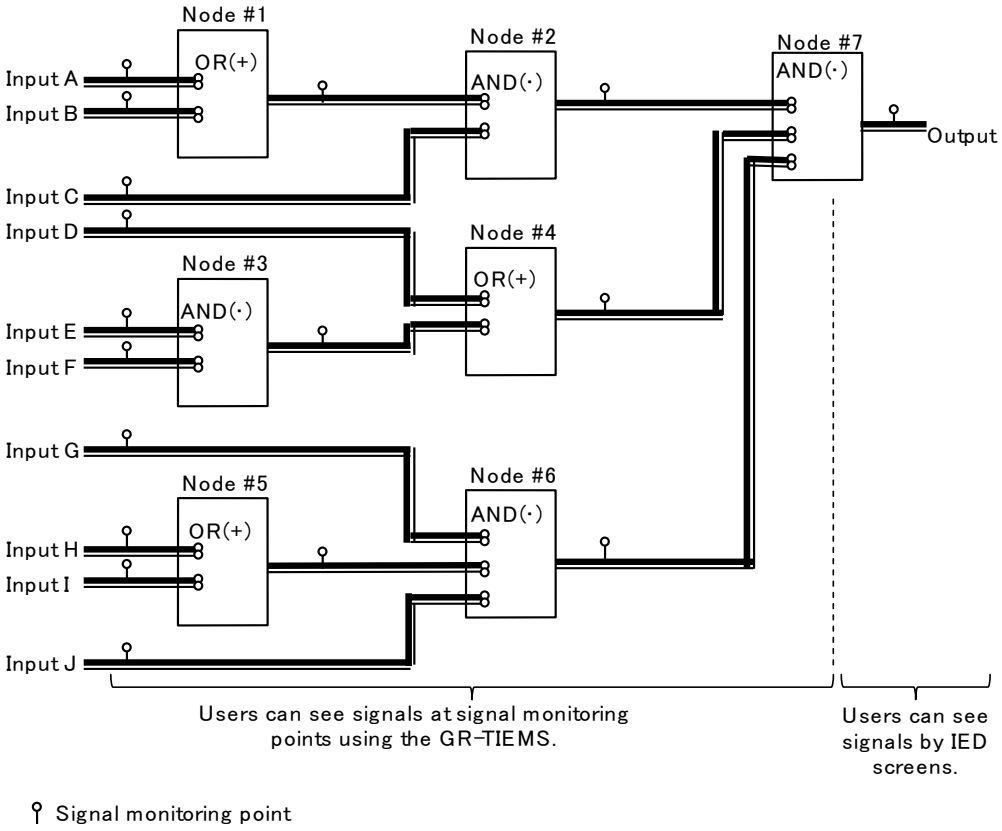


Figure 2.16-4 Operation of interlock-check

We can see that equation (2.16-10) is a representation of Figure 2.16-4. This equation is computed in accordance with the priority order of the interlock-operators: the first is parentheses [0], the second is AND [•], followed by OR [+].

$$\text{Output} = ((A+B) \cdot C) + (D+E \cdot F) + (G \cdot (H+I) \cdot J) \qquad (2.16\text{-}10)$$

(iii) Purpose of Quality information in the output signal

In the output signal, the quality information will affect the control of the device. Table 2.16-3 shows four types of output signal. When the quality information (Quality) of an output signal issued by a node is indicated as being "NG", it signifies that device control is forbidden. On the other hand, quality information (Quality) "OK" means that that device control is allowed.

Table 2.16-3 Device status, quality information in the output signal

Output signal (stVal–Quality)	Meaning
0–OK	Control forbidden
0–NG	Control forbidden
1–OK	Control allowed
1–NG	Control forbidden

Note: With regard to the value of 'Quality', we define "OK" as '0' and "NG" as '1' in the logic operation.

(iii)-1 AND interlock operator

When quality information (Quality) is applied to the interlock operator "AND", the "AND" operator outputs the quality information intact. That is, the output quality information is not affected by device status (stVal). Table 2.16-4 shows two-input-signals (A, B) and the output signal for "AND".

Table 2.16-4 Output signals (stVal–Quality) for AND

		Input B (stVal–Quality)			
		0–OK	0–NG	1–OK	1–NG
Input A (stVal–Quality)	0–OK	0–OK	–	–	–
	0–NG	0–OK	0–NG	–	–
	1–OK	0–OK	0–NG	1–OK	–
	1–NG	0–OK	0–NG	1–NG	1–NG

Figure 2.16-5 shows the logic symbol for the interlock operator "AND" with input signals and an output signal. Figure 2.16-5 can be represented by equations (2.16-11) and (2.16-12).

$$stVal = stVa(A) \cdot stVa(B) \quad (2.16\text{-}11)$$

$$Quality=(Quality(A)+Quality(B)) \cdot (stVa(A)+ Quality(A)) \cdot (stVa(B)+Quality(B)) \quad (2.16\text{-}12)$$

For example, when the interlock operator "AND" has two input signals (0–NG, 0–OK), it has to generate a signal (0–OK) using the equations (2.16-11) and (2.16-12). This is because the quality "NG (i.e., 1)" and the quality "OK (i.e., 0)" are entered into the AND operator; the AND operator produces zero (0) which is defined as "OK" in 'Quality'. A note regarding the

values used for 'Quality' can be found immediately below Table 2.16-3.

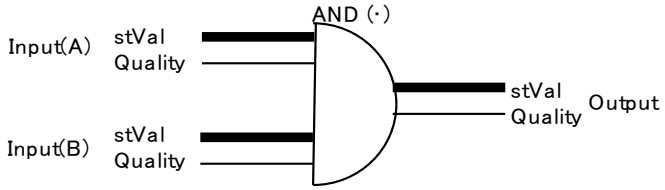


Figure 2.16-5 Logic of interlock operator (AND) and Input/Output signals

(iii)-2 OR interlock operator

When quality information (Quality) is applied to the interlock operator "OR", the quality information is affected by device status (stVal). Table 2.16-5 shows two-input-signals (A, B) and the output signal for "OR"

Table 2.16-5 Output signals (stVal–Quality) of OR

		Input B (stVal–Quality)			
		0–OK	0–NG	1–OK	1–NG
Input A (stVal–Quality)	0–OK	0–OK	–	–	–
	0–NG	0–NG	0–NG	–	–
	1–OK	1–OK	1–OK	1–OK	–
	1–NG	1–NG	1–NG	1–OK	1–NG

As shown in Table 2.16-5, if '0' represents the status value "stVal" for all input signals, and if the quality information of "NG" is given for an input signal, then the output signal "Quality" is represented as "NG". On the other hand, if all input signals "stVal" are represented by "1", and if the quality information for the input signals "stVal(1)" is given, then the representation "OK" can be weighted for the output signal "Quality" . Note that quality information (OK) for input signals with "stVal(1)" get priority if there are two or more input signals, which are represented as "stVal(1)".

Figure 2.16-6 shows the logic symbol for the interlock operator "OR" with input signals and an output signal, which can be represented by equations (2.16-13) and (2.16-14).

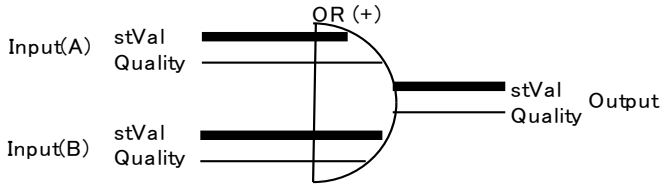


Figure 2.16-6 Interlock operator (OR) and Input/Output signals

$$stVal=stVa(A)+stVa(B) \quad (2.16\text{-}13)$$

$$Quality=!((stVal(A)\cdot!Quality(A))\cdot(stVa(B)\cdot!Quality(B))+!(stVal(A)+Quality(A)+stVal(B)+Quality(B))) \quad (2.16\text{-}14)$$

For example, when the interlock operator "OR" has two input signals (0–NG, 0–OK), it has to generate a signal (0–NG) using the equations (2.16-13) and (2.16-14). This is because the quality "NG (i.e., 1)" and the quality "OK (i.e., 0)" are entered into the OR operator; the OR operator produces one (1) which is defined as "NG" in 'Quality'. A note regarding the values used for Quality can be found immediately below Table 2.16-3

(iii)-3 NOR interlock operator

When quality information (Quality) is applied to the interlock operator "NOR", the "NOR" operator outputs the quality information intact. That is, the "NOR" interlock operator outputs quality information, which is not influenced by device status (stVal). Table 2.16-6 shows an input-signal (A) and the output signal for the "NOR" interlock operator.

Table 2.16-6 Output signals (stVal–Quality) of NOT

		Output (stVal–Quality)
Input A (stVal–Quality)	0–OK	1–OK
	0–NG	1–NG
	1–OK	0–OK
	1–NG	0–NG

Figure 2.16-7 depicts the logic symbol for the interlock operator "NOT" with input signals and an output signal, which can be represented by equations (2.16-15) and (2.16-16).

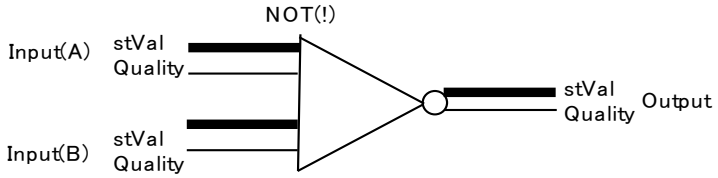


Figure 2.16-7 Interlock operator (NOT) and In/Output signals

stVal=!stVa(A) (2.16-15)

Quality=Quality(A) (2.16-16)

(iii)-4 COMP interlock operator

When quality information (Quality) is applied to the interlock operator "COMP", the "COMP" operator outputs the original quality information intact. That is, the "COMP" interlock operator outputs quality information, which is not influenced by device status (stVal). Table 2.16-7 shows two input-signals (A and B) and the output signal for the "COMP" interlock operator.

Table 2.16-7 Output signals (stVal–Quality) of COMP

		Input B (stVal)†	
		0	1
Input A (stVal–Quality)	0–OK	1–OK	0–OK
	0–NG	1–NG	0–NG
	1–OK	0–OK	1–OK
	1–NG	0–NG	1–NG

Figure 2.16-8 depicts the logic symbol for the interlock operator "COMP" with input signals and an output signal, which can be represented by equations (2.16-17) and (2.16-18).

stVal=stVa(A) COMP stVa(B) (2.16-17)

Quality=Quality(A) † (2.16-18)

†Note: Input signal (B) does not have quality information because its signal is a threshold value.

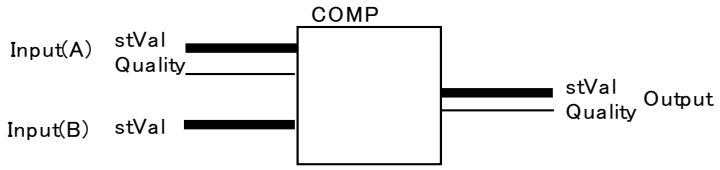


Figure 2.16-8 Interlock operator (COMP) and Input/Output signals

(iii)-5 Device status output by control functions transposed

As shown in Figure 2.16-3, a node inputs a value (stVal). The user should be aware that the node cannot directly read the value of device status generated by the control functions. This is because each control function generates the device status in a different format. Thus, for the ILK operation, the device status generated should be transposed to the stVal so that the node can read the device status. The right-hand column of Table 2.16-8 shows the transposed "stVal" in each node.

Table 2.16-8 Signals generated in control functions

Control function	Device status generated by the control function described on the left column	"stVal" transposed in the node		
SPOS	0(off)	0		
	1(on)	1		
DPOS	0x40(Open)	0†	0x40‡	1§
	0x80(Close)	1†	0x80‡	0§
	"device status" except "0x40" and "0x80"	0		
TPOS	0x01(P1)	1		
	0x02(P2)	2		
	0x04(P3)	4		
	"device status" except "0x01", "0x02" and "0x04"	0		
BI signal	0(off)	0		

†Note: Values are altered when "AND", "OR", or "NOT" is applied as an interlock operator.

‡Note: Values are altered when "COMP" is applied as an interlock operator.

§Note: Values are altered when the DPOS output is an inverted signal.

2.16.4 Configuration of Interlock formulae

Interlock-check formulae should be stored in the Interlock database, as shown in Figure 2.16-1. These formulae are configured using GR-TIEMS†, and are uploaded into the ILK interlock database.

†Note:The configuration of interlock-check formulae is discussed separately. See chapter *Engineering tool: Interlock configurator*.

2.16.5 Signals

◆ Signal monitoring point

ILK (Function ID: 570001)

Element ID	Name	Description
3103011DA2	DPOS01-CLOSE	interlock double POS DEV01 close directiclose judgment result
3103011DA0	DPOS01-OPEN	interlock double POS DEV01 open direction judgment result
3103021DA2	DPOS02-CLOSE	interlock double POS DEV02 close directiclose judgment result
3103021DA0	DPOS02-OPEN	interlock double POS DEV02 open direction judgment result
3103031DA2	DPOS03-CLOSE	interlock double POS DEV03 close directiclose judgment result
3103031DA0	DPOS03-OPEN	interlock double POS DEV03 open direction judgment result
3103041DA2	DPOS04-CLOSE	interlock double POS DEV04 close directiclose judgment result
3103041DA0	DPOS04-OPEN	interlock double POS DEV04 open direction judgment result
3103051DA2	DPOS05-CLOSE	interlock double POS DEV05 close directiclose judgment result
3103051DA0	DPOS05-OPEN	interlock double POS DEV05 open direction judgment result
3103061DA2	DPOS06-CLOSE	interlock double POS DEV06 close directiclose judgment result
3103061DA0	DPOS06-OPEN	interlock double POS DEV06 open direction judgment result
3103071DA2	DPOS07-CLOSE	interlock double POS DEV07 close directiclose judgment result
3103071DA0	DPOS07-OPEN	interlock double POS DEV07 open direction judgment result
3103081DA2	DPOS08-CLOSE	interlock double POS DEV08 close directiclose judgment result
3103081DA0	DPOS08-OPEN	interlock double POS DEV08 open direction judgment result
3103091DA2	DPOS09-CLOSE	interlock double POS DEV09 close direction judgment result
3103091DA0	DPOS09-OPEN	interlock double POS DEV09 open direction judgment result
31030A1DA2	DPOS10-CLOSE	interlock double POS DEV10 close direction judgment result
31030A1DA0	DPOS10-OPEN	interlock double POS DEV10 open direction judgment result
31030B1DA2	DPOS11-CLOSE	interlock double POS DEV11 close direction judgment result
31030B1DA0	DPOS11-OPEN	interlock double POS DEV11 open direction judgment result
31030C1DA2	DPOS12-CLOSE	interlock double POS DEV12 close direction judgment result
31030C1DA0	DPOS12-OPEN	interlock double POS DEV12 open direction judgment result
31030D1DA2	DPOS13-CLOSE	interlock double POS DEV13 close direction judgment result
31030D1DA0	DPOS13-OPEN	interlock double POS DEV13 open direction judgment result
31030E1DA2	DPOS14-CLOSE	interlock double POS DEV14 close direction judgment result
31030E1DA0	DPOS14-OPEN	interlock double POS DEV14 open direction judgment result
31030F1DA2	DPOS15-CLOSE	interlock double POS DEV15 close direction judgment result
31030F1DA0	DPOS15-OPEN	interlock double POS DEV15 open direction judgment result
3103101DA2	DPOS16-CLOSE	interlock double POS DEV16 close direction judgment result
3103101DA0	DPOS16-OPEN	interlock double POS DEV16 open direction judgment result
3103111DA2	DPOS17-CLOSE	interlock double POS DEV17 close direction judgment result
3103111DA0	DPOS17-OPEN	interlock double POS DEV17 open direction judgment result
3103121DA2	DPOS18-CLOSE	interlock double POS DEV18 close direction judgment result
3103121DA0	DPOS18-OPEN	interlock double POS DEV18 open direction judgment result
3103131DA2	DPOS19-CLOSE	interlock double POS DEV19 close direction judgment result
3103131DA0	DPOS19-OPEN	interlock double POS DEV19 open direction judgment result
3103141DA2	DPOS20-CLOSE	interlock double POS DEV20 close direction judgment result
3103141DA0	DPOS20-OPEN	interlock double POS DEV20 open direction judgment result
3102011DA2	DPSY1-CLOSE	interlock double POS with SYNC DEV01 close direction judgment result
3102011DA0	DPSY1-OPEN	interlock double POS with SYNC DEV01 open direction judgment result
3102021DA2	DPSY2-CLOSE	interlock double POS with SYNC DEV02 close direction judgment result

◆ Signal monitoring point

ILK (Function ID: 570001)

Element ID	Name	Description
3102021DA0	DPSY2-OPEN	interlock double POS with SYNC DEV02 open direction judgment result
3100A11001	ILK_MID_UPDATING	interlock conditional expression number middle signal updating
3101011DA0	SPOS01-OFF	interlock single POS DEV01 open direction judgment result
3101011DA2	SPOS01-ON	interlock single POS DEV01 close direction judgment result
3101021DA0	SPOS02-OFF	interlock single POS DEV02 open direction judgment result
3101021DA2	SPOS02-ON	interlock single POS DEV02 close direction judgment result
3101031DA0	SPOS03-OFF	interlock single POS DEV03 open direction judgment result
3101031DA2	SPOS03-ON	interlock single POS DEV03 close direction judgment result
3101041DA0	SPOS04-OFF	interlock single POS DEV04 open direction judgment result
3101041DA2	SPOS04-ON	interlock single POS DEV04 close direction judgment result
3101051DA0	SPOS05-OFF	interlock single POS DEV05 open direction judgment result
3101051DA2	SPOS05-ON	interlock single POS DEV05 close direction judgment result
3101061DA0	SPOS06-OFF	interlock single POS DEV06 open direction judgment result
3101061DA2	SPOS06-ON	interlock single POS DEV06 close direction judgment result
3101071DA0	SPOS07-OFF	interlock single POS DEV07 open direction judgment result
3101071DA2	SPOS07-ON	interlock single POS DEV07 close direction judgment result
3101081DA0	SPOS08-OFF	interlock single POS DEV08 open direction judgment result
3101081DA2	SPOS08-ON	interlock single POS DEV08 close direction judgment result
3101091DA0	SPOS09-OFF	interlock single POS DEV09 open direction judgment result
3101091DA2	SPOS09-ON	interlock single POS DEV09 close direction judgment result
31010A1DA0	SPOS10-OFF	interlock single POS DEV10 open direction judgment result
31010A1DA2	SPOS10-ON	interlock single POS DEV10 close direction judgment result
3105011DA0	TAP LOWER	interlock BCD POS DEV01 down direction judgment result
3105011DA2	TAP RAISE	interlock BCD POS DEV01 up direction judgment result
3104011DA0	TPOS1-P1	interlock triple POS DEV01 P1 direction judgment result
3104011DA2	TPOS1-P2	interlock triple POS DEV01 P2 direction judgment result
3104011DA4	TPOS1-P3	interlock triple POS DEV01 P3 direction judgment result
3104021DA0	TPOS2-P1	interlock triple POS DEV02 P1 direction judgment result
3104021DA2	TPOS2-P2	interlock triple POS DEV02 P2 direction judgment result
3104021DA4	TPOS2-P3	interlock triple POS DEV02 P3 direction judgment result
3104031DA0	TPOS3-P1	interlock triple POS DEV03 P1 direction judgment result
3104031DA2	TPOS3-P2	interlock triple POS DEV03 P2 direction judgment result
3104031DA4	TPOS3-P3	interlock triple POS DEV03 P3 direction judgment result

2.17 Software switch controller function (SOFTSW)

Eight single-position software-switches (S43-CBK, -ICB, -SCB, and -01 to -05) are provided in the IED memory as virtual switches; they are used to determine the operation of internal processes in the IED. Either the criteria "Enable (On)" or "Disable (Off)" may be applied for each software switch, S43. Three software switches, S43s (CBK, ICB, and SCB) have already been defined for special purposes; the three are controlled by command blocking (CBK), interlock bypassing (ICB), and synchronism bypass (SCB) functions. On the other hand, switches S43-01 to S43-05 are provided for general-purpose usage.

Note: The implementation of certain features is dependent upon the selection of hardware and the configuration of functions. Several IED models do not support certain features. To determine whether a particular feature has been implemented within an IED, identify the IED ordering number; and check the order number at the "G&T position" whilst referring to the comparison table below. For more information, see *Appendix: Ordering*.

Table 2.17-1 Comparative table in respective ordering numbers

Sec.	Feature	Ordering No. at "G&T"					
		BCU			BCPU		IFU
		11	13	1F	2N	2C	19
–	Main features	✓	✓	✓	✓	✓	✓

✓: Applicable NA: Not applicable

Figure 2.17-1 shows the eight switches and their controller functions. The statuses of the S43 switches are stored in the IED non-volatile memory; hence, the IED can retrieve their status while power is not being supplied to the IED.

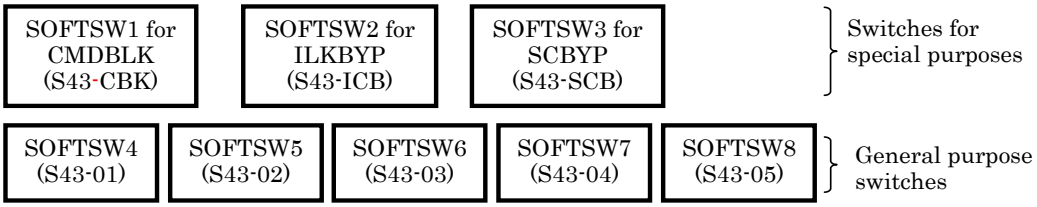


Figure 2.17-1 Software switches (S43s) and their controller

The SOFTSW function can control eight S43 software switches separately. To simplify the explanation provided below only the SOFTSW1 function is discussed. The features provided in the other SOFTSW2–8 switches are similar to the SOFTSW1 switch.

Tips: The user can set SOFTSW1 (S43-CBK), SOFTSW2 (S43-ICB) and SOFTSW3 (S43-SCB) without user programming. Jump to section 2.17.5 where we discuss how to map their signals for IEC61850 communication. When the user wishes to program the SOFTSW functions using the S43-01–S43-05 switches, the user is required to read from section 2.17.2 onwards.

2.17.1 SOFTSW controlling

(i) Command blocking (S43-CBK) provided by SOFTSW1

When the user wishes to avoid the control of devices by mistake during test and maintenance, the user can use the command blocking function so that mal-operation can be avoided. The execution of command blocking is available from the IED front panel. Additionally, the IEC 61850 standard provides command blocking (CmdBlk) for remote operation and the CBK function is defined at the logical node (LN) given in IEC 61850-7-1 (Edition 2.0). Thus, the IED can override all commands received when the command blocking function is engaged from the local-end and the remote-end. With regard to the command "CmdBlk" from the remote-end, the command is received at the input point "S4301_CONROL_REQ" of the SOFTSW1 function; the result of the SOFTSW1 function appears at output-point "S4301_STATE", as shown in Table 2.17-2. For SOFTSW1 operation, the user should set the scheme switch [**S43-CBKEN**] to **On**.

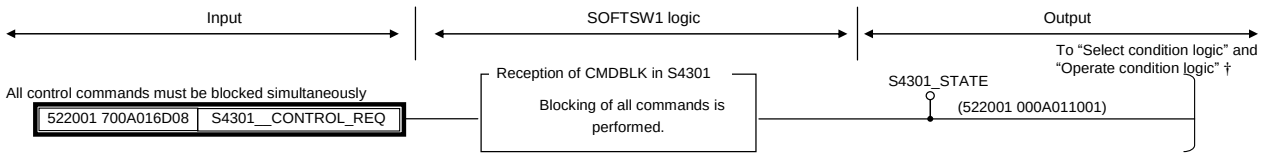


Figure 2.17-2 Logic "S43-CBK" and response "S4301_STATE"

†Note:The user is required to map a communication signal to the input-point. For

mapping, see section 2.17.5. The "S4301_STATE" signal is used in control applications so that control applications can determine their operational conditions. (See control and operation logic for the respective control applications.)

(ii) Interlock bypassing (S43-ICB) provided by SOFTSW2

When the user executes control applications from the IED front panel, the Interlock bypassing (ICB) function enables control applications to bypass their interlock conditions if required. When the ICB is engaged, all control processes, operated from the IED front panel, are able to bypass their interlock conditions. The user should note that operation of the ICB function is available for five minutes following its initiation. For operation of the ICB function, the user should set the scheme switch [**S43-ICBEN**] to **On**.

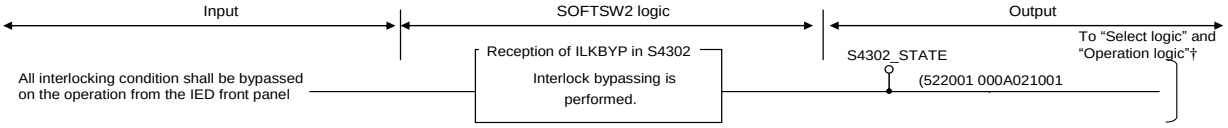


Figure 2.17-3 Logic "S43-ICB" and response "S4302_STATE"

†Note:The S4302_STATE is provided for the "Select logic" and "Operate logic" in the control applications.

(iii) Synchronism bypassing (S43-SCB) provided by SOFTSW3

Synchronism bypass (SCB) enables control applications to bypass synchronizing conditions if the user wishes control applications to bypass synchronizing conditions, if the user executes the control applications from the IED front panel. If the SCB is executed, all control processes, operated from the IED front panel, will bypass their respective synchronizing conditions. Note that the bypass operation is available for five minutes following initiation of the SCB function. For operation of the SCB function, the user should set the scheme switch [**S43-SCBEN**] to **On**.

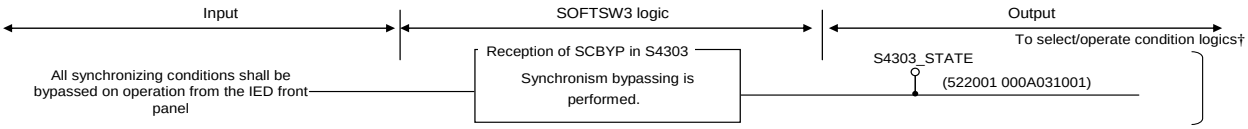


Figure 2.17-4 Logic "S43-SCB" and response "S4303_STATE"

†Note:The S4303_STATE is provided for the "Select logic" and "Operate logic" relating to the control applications including synchronism-check features.

(iv) S43-01 to S43-05 controlling provided by SOFTSW4 to SOFTSW8†

The SOFTSW4 to SOFTSW8 functions are provided for control of the S43-01 to S43-05 switches, as described previously. For example, Figure 2.17-5 shows the SOFTSW4 function controlling the S43-01 switch; control of the S43-01 switch is enabled when the user sets the scheme switch [**S4301-EN**]† to **On**. Likewise, the user is required to set **On** for scheme switches [**S4302-EN**] to [**S4305-EN**] with regard to the SOFTSW4–8 operations, respectively.

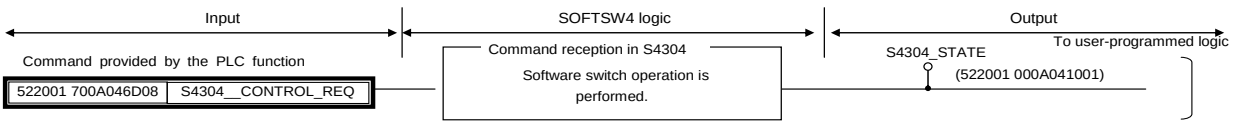


Figure 2.17-5 Logic "SOFTSW4" and response "S4304_STATE"

†Note:Although we are discussing the SOFTSW4 function, the name of the scheme switch in the figure above is represented by [**S4301-EN**]. The user should not confuse this scheme switch as being applied for the SOFTSW1 function.

(v) SOFTSW output-status

Table 2.17-2 shows the list of output signals of the SOFTSW functions.

Table 2.17-2 Output signals of SOFTSW function

Signal Number	Signal Name	Description
522001 000A011001	S4301_STATE	S43-CBK status (Off / Blocked)
522001 000A021001	S4302_STATE	S43-IBK switch status
522001 000A031001	S4303_STATE	S43-SCB switch status
522001 000A041001	S4304_STATE	S43-01 switch status
522001 000A051001	S4305_STATE	S43-02 switch status
522001 000A061001	S4306_STATE	S43-03 switch status
522001 000A071001	S4307_STATE	S43-04 switch status
522001 000A081001	S4308_STATE	S43-05 switch status

2.17.2 Control logics for SBO/DIR modes

For example, the user should set scheme switch [**S43-CBKEN**] to **On** when the SOFTSW1 function is required to be operated. Table 2.17-10 shows all scheme switches for the SOFTSW functions.

(i) Receiving "select command for On operation" from the remote-end

(i)-1 Input point required mapping

Figure 2.17-6 shows the logic when a "Select command (Remote-ON-Control)" signal is applied to the SOFTSW1 function. The logic has an input-point "S4301_CONTROL_REQ" for the reception of the select command. That is, the input-point should be mapped for the IEC61850 communication. The input-point "S4301_CONTROL_REQ" is significant for the SOFTSW1 operation; hence, an operation failure in the IED is indicated if mapping is not performed correctly. Section 2.17.5 discusses how to map the information of the IEC61850 to the input-points.

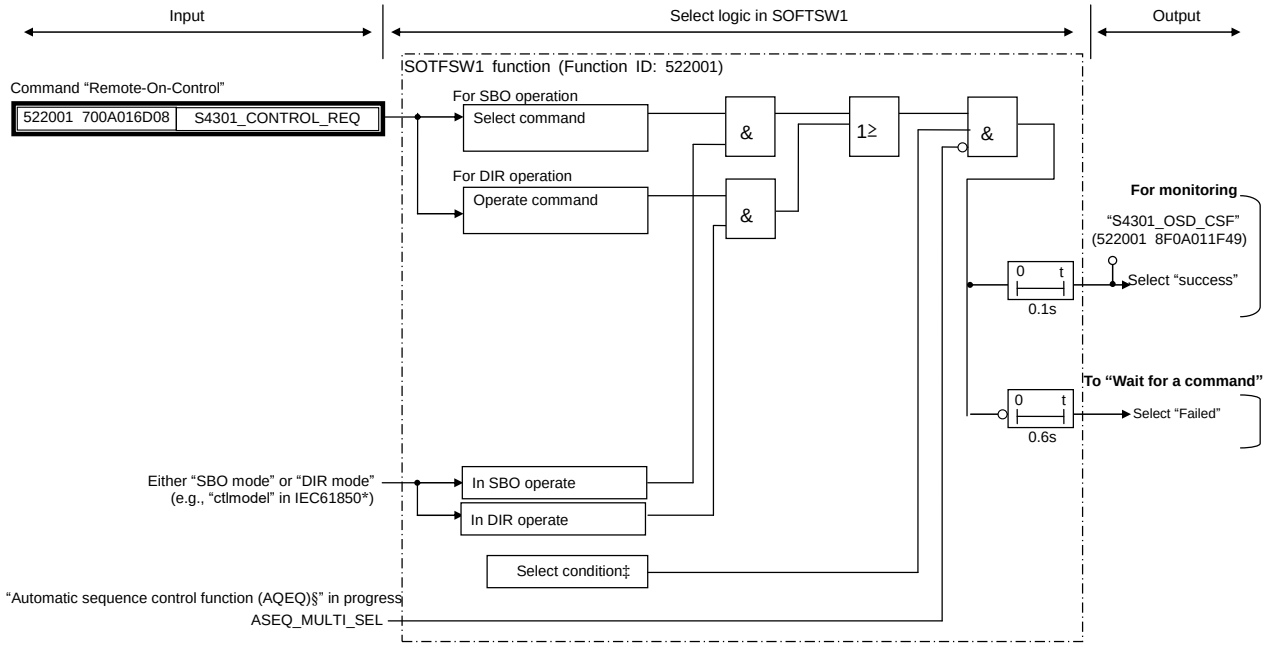


Figure 2.17-6 Select logic for 'ON' operation from remote end in SOFTSW1†

†Note: To identify the input and output points of the other SOFTSW logics, see Table 2.17-6 and Table 2.17-9.

‡Note:"Select condition" signal is provided from select condition scheme. For more information, see Figure 2.17-12.

§Note:An Automatic sequence control (ASEQ) function can provide sequential signals for automatic control. The SOFTSW1 function is blocked for the ASEQ function when it is in operation. For more information of the ASEQ function, see Chapter *Control and monitoring application: Automatic sequence control function*.

*Note:The SOFTSW1 function can run on either the "SBO mode" or the "DIR mode". The user can use the signal "ctlmodel" in the IEC61850 communication.

(i)-2 Output signal for monitoring

The user can monitor a "Select success" signal at the output point "S4301_OSL_CSF", when the SOFTSW1 function determines that the received "Remote-ON-Control" signal is true. If the SOFTSW1 function determines that the "Remote-ON-Control" is not true, the SOFTSW1 function returns to the "Wait for a command" stage.

(ii) Receiving "select command for Off operation" from the remote end

(ii)-1 Input point required mapping

Figure 2.17-7 shows the logic when a "Select command (Remote-OFF-Control)" signal is applied at the SOFTSW1 function. The input-point "S4301_CONTROL_REQ" is used for the reception of the select command (Remote-OFF-Control).

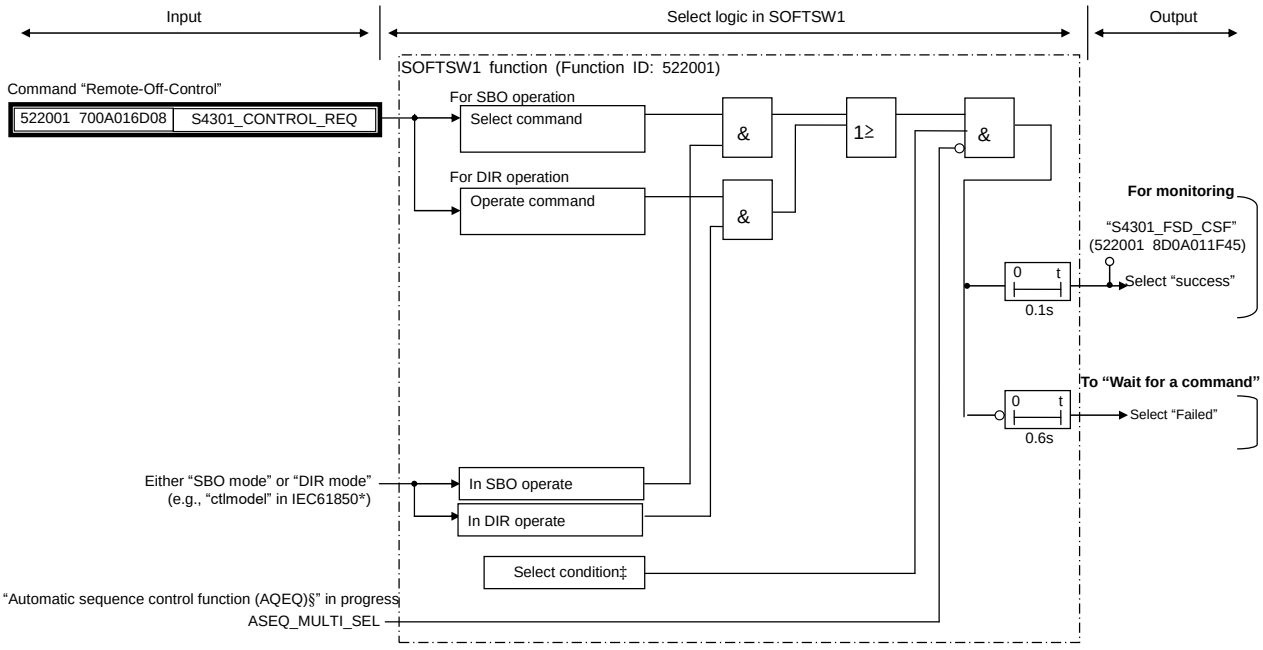


Figure 2.17-7 Select logic for 'OFF' operation from remote end in SOFTSW1†

†Note: To identify the input and output points of the other SOFTSW logics, see Table 2.17-6 and Table 2.17-9.

‡Note:"Select condition" signal is provided in Figure 2.17-12.

(ii)-2 Output signal for monitoring

The SOFTSW1 function, in Figure 2.17-7, can issue a "Select success" signal at output point "S4301_FSL_CSF" when the SOFTSW1 function determines that the input signal "Select command (Remote-OFF-Control)" is true. If the SOFTSW1 function determines that the "Remote-OFF-Control" is not true, the SOFTSW1 function returns to the "Wait for a command" stage.

(iii) Receiving "Selection command for On operation" from the front

panel

(iii)-1 Input signal

Figure 2.17-8 shows the logic when a "Select command (Local-ON-Control)" signal is applied to the SOFTSW1 function. The input signal is provided when "On" key is pressed on the IED front panel; the input-point is not required to be mapped. Note that the user should set scheme switch [**S4301-CTRAHMI**] to **SBO** when the operation from the IED front panel is performed; chapter *User interface: Control sub-menu* discusses how to operate.

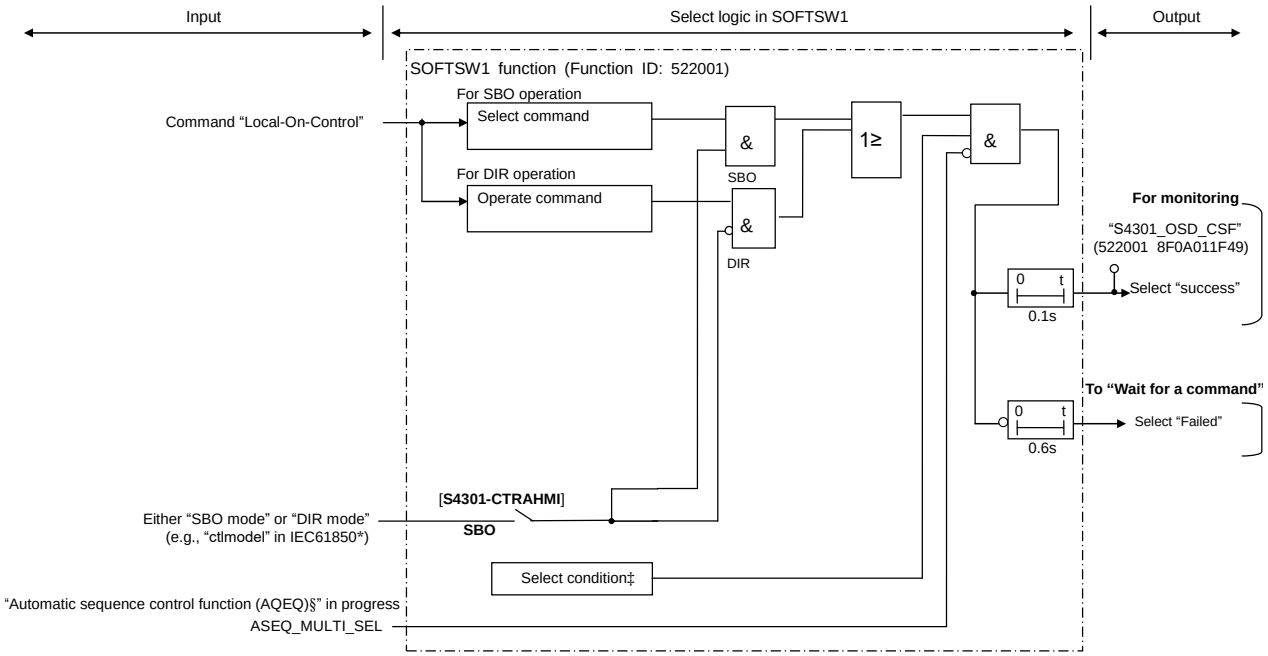


Figure 2.17-8 Select logic for 'ON' operation at the IED locally in SOFTSW1†

†Note: To identify the output points of the other SOFTSW logics, see Table 2.17-9.

‡Note:Signal "select condition" is provided. See Figure 2.17-12.

§Note:The SOFTSW1 function is blocked when the ASEQ function is in operation.

(iii)-2 Output signal for monitoring

When the state of "select condition" is true, the SOFTSW1 function can issue an output signal "Select success" at the output-point "S4301_OSD_CSF".

Note: The signal "S4301_OSD_CSF" is the same signal as shown in Figure 2.17-6. If the input signal "Local-ON-Control" is not true, the SOFTSW1 function returns to the "Wait for a command" stage.

(iv) Receiving "Select command for Off operation" from the front panel

(iv)-1 Input signal

Figure 2.17-9 shows the logic when a "Select command (Local-OFF-Control)" signal is applied to the SOFTSW1 logic. The input signal is provided when the user presses "OFF" key on the IED front panel; the input-point is not required to be mapped.

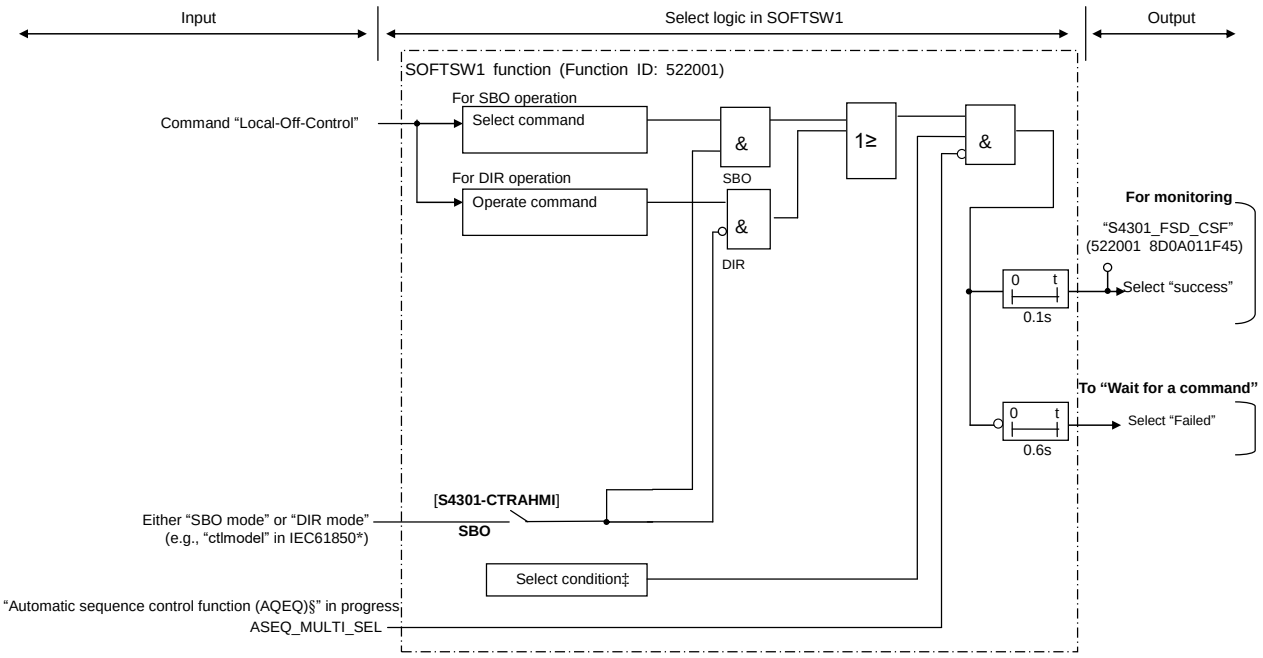


Figure 2.17-9 Select logic for 'OFF' operation at the IED locally in SOFTSW1†

†Note: Figure 2.17-9 is used for the discussion of SOFTSW1 logic. To identify the output points of the other SOFTSW logics, see Table 2.17-9.

‡Note:Signal "select condition" is provided. See Figure 2.17-12.

(iv)-2 Output signal for monitoring

When the state of "select condition" is true, the SOFTSW1 function can issue a "Select success" signal at the output-point "S4301_FSD_CSF".

Note: The "S4301_FSD_CSF" signal is the same as the signal shown in Figure 2.17-7. That is, this signal of the logic appears at the same PLC monitoring point. If the input signal "Local-OFF-Control" is not true, the SOFTSW1 function returns to the "Wait for a command" stage.

(v) Receiving "Select command for On operation" using the PLC function

(v)-1 Input signal required to connect

Figure 2.17-10 shows that the select logic when a "Select command (PLC-ON-Control)" signal is applied to the SOFTSW1 logic. The input signal is generated using the user-programmed PLC logic; the user can connect the signal for the PLC connection point "PLC_BIT_1125".

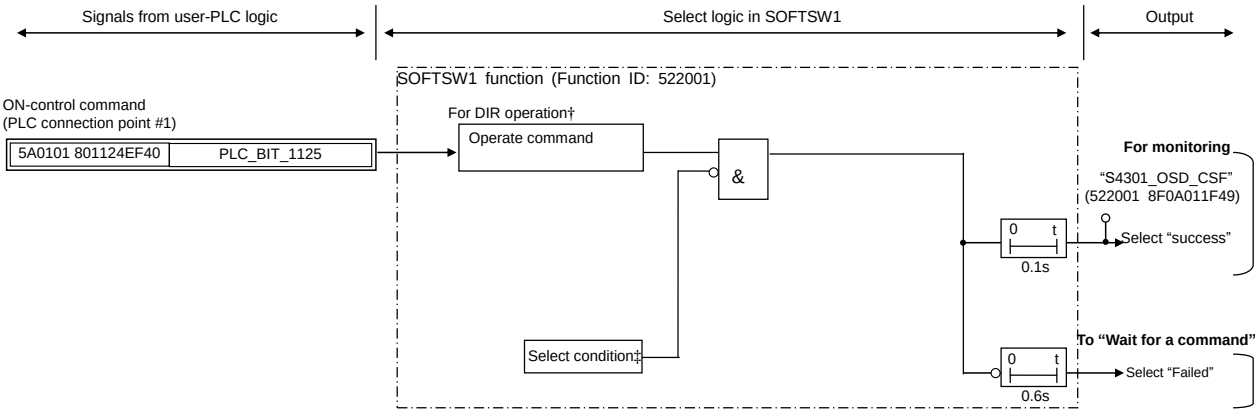


Figure 2.17-10 Select logic for ON operation by PLC in SOFTSW1††

†Note:Direct operation mode (DIR) is only available.

‡Note:"select condition" signal is provided. See Figure 2.17-12.

††Note: To identify the input and output points of the other SOFTSW logics, see Table 2.17-3 and Table 2.17-9.

(v)-2 Output signal for monitoring

The SOFTSW1 function shown in Figure 2.17-10, can issue a "Select success" signal at output-point "S4301_OSD_CSF".

Note: The signal "S4301_OSD_CSF" is the same as the signal shown in Figure 2.17-6.

(vi) Receiving "Select command for Off operation" using PLC function

(vi)-1 Input signal required to connect

Figure 2.17-11 shows the SOFTSW1 logic for a "Select command (PLC-OFF-Control)" signal. The input signal is generated using the user-programmed PLC logic; the user can connect the signal for the PLC connection point "PLC_BIT_1124".

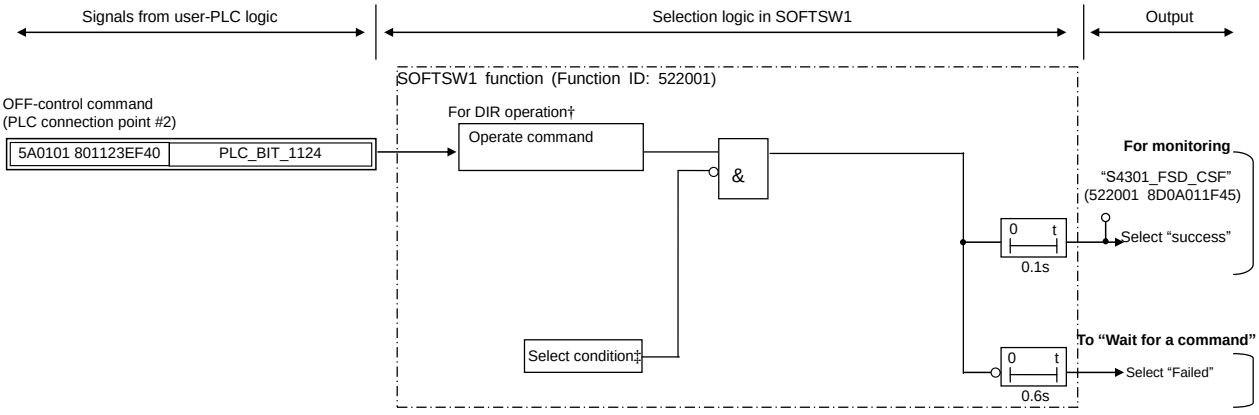


Figure 2.17-11 Select logic for OFF operation by PLC in SOFTSW1††

†Note:Direct operation mode (DIR) is available only.

‡Note:Signal "select condition" is provided. See Figure 2.17-12.

††Note: To identify the input and output points of the other SOFTSW logics, see Table 2.17-4 and Table 2.17-9.

(vi)-2 Output signal to monitoring

The SOFTSW1 function shown in Figure 2.17-11, can issue a "Select success" signal at the output point "S4301_FSD_CSF".

Note: The output point "S4301_FSD_CSF" is the same as the signal shown in Figure 2.17-7.

(vii) Select condition

Figure 2.17-12 shows the select condition logic of the SOFTSW1 function. The SOFTSW1 function can examine an operate-condition using "Command Blocking" signal[1].

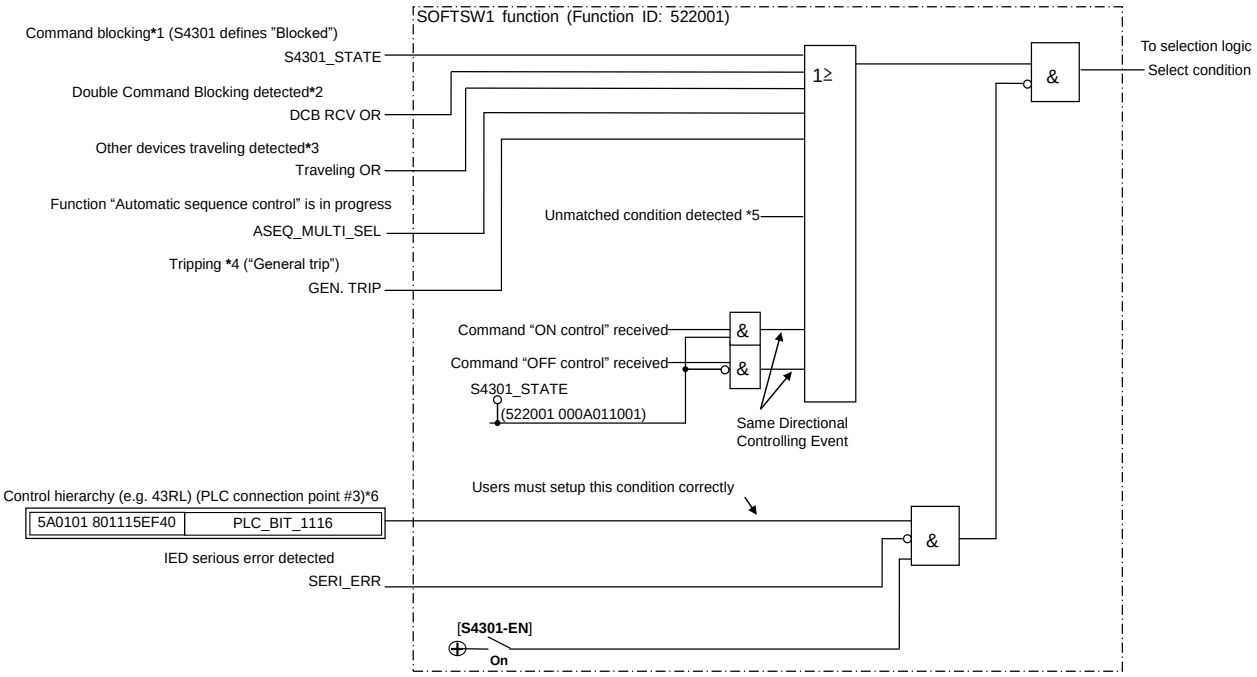


Figure 2.17-12 Select condition logic for 'ON/OFF' in SOFTSW1

[1]Note: "Command Blocking" disables any operation except its own; see the signal "S4301_STATE (Table 2.17-2)" as the state of "Command Blocking" in the SOFTSW function.

[2]Note: "Double Command Blocking (DCB_RCV_OR in Table 2.17-8)" is an operation philosophy. It can be used to protect a substation. The user can configure it using GR-TIEMS.

[3]Note: If the event "device-travelling (Traveling OR in Table 2.17-8)" is detected in the IED, it indicated that another operator is changing the status of a device. Thus, the IED should inhibit the operation of any device for the duration that the event is detected.

[4]Note: If tripping (GEN.TRIP in Table 2.17-8) is executed in the IED, any control operation is blocked upon the trip operation. Tripping can be introduced by the protection function if the IED has protection functions.

[5]Note: Criteria "unmatched conditions" are decided when "Test-bit status" in command is not identical to "IED test status".

[6]Note: The user will need to program the PLC logic "Control hierarchy condition". The Control hierarchy condition provided by the user-programmed PLC logic may be 43R/L; the user can connect it at PLC connection point "PLC_BIT_1116" of Table 2.17-5.

(viii) Signal name and number

Note: The user should note the following descriptions shown in the column "M/O" for each table:

"O" indicates that the signal is provided for optional use.

"M" indicates that the user should map/set/configure the signal; otherwise, the user may experience an operational failure if the default settings are used.

"N/A" indicates that the user cannot change the state of the signal.

Table 2.17-3 PLC connection point #1 (Inputs point for 'On' control)

Signal Number	Signal Name	Description	M/O
5A0101 801124EF40	PLC_BIT_1125	PLC ON control for SOFTSW1 (S43-CBK)	O
5A0101 801126EF40	PLC_BIT_1127	PLC ON control for SOFTSW2 (S43-ICB)	O
5A0101 801128EF40	PLC_BIT_1129	PLC ON control for SOFTSW3 (S43-SCB)	O
5A0101 801130EF40	PLC_BIT_1131	PLC ON control for SOFTSW4 (S43-01)	O
5A0101 801132EF40	PLC_BIT_1133	PLC ON control for SOFTSW5 (S43-02)	O
5A0101 801134EF40	PLC_BIT_1135	PLC ON control for SOFTSW6 (S43-03)	O
5A0101 801136EF40	PLC_BIT_1137	PLC ON control for SOFTSW7 (S43-04)	O
5A0101 801138EF40	PLC_BIT_1139	PLC ON control for SOFTSW8 (S43-05)	O

Table 2.17-4 PLC connection point #2 (Input points for 'Off' control)

Signal Number	Signal Name	Description	M/O
5A0101 801123EF40	PLC_BIT_1124	PLC OFF control for SOFTSW1 (S43-CBK)	O
5A0101 801125EF40	PLC_BIT_1126	PLC OFF control for SOFTSW2 (S43-ICB)	O
5A0101 801127EF40	PLC_BIT_1128	PLC OFF control for SOFTSW3 (S43-SCB)	O
5A0101 801129EF40	PLC_BIT_1130	PLC OFF control for SOFTSW4 (S43-01)	O
5A0101 801131EF40	PLC_BIT_1132	PLC OFF control for SOFTSW5 (S43-02)	O
5A0101 801133EF40	PLC_BIT_1134	PLC OFF control for SOFTSW6 (S43-03)	O
5A0101 801135EF40	PLC_BIT_1136	PLC OFF control for SOFTSW7 (S43-04)	O
5A0101 801137EF40	PLC_BIT_1138	PLC OFF control for SOFTSW8 (S43-05)	O

Table 2.17-5 PLC connection point #3 (Input points on select condition logic)

Signal Number	Signal Name	Description	M/O
5A0101 801115EF40	PLC_BIT_1116	Control hierarchy condition in SOFTSW1	M
5A0101 801116EF40	PLC_BIT_1117	Control hierarchy condition in SOFTSW2	M
5A0101 801117EF40	PLC_BIT_1118	Control hierarchy condition in SOFTSW3	M
5A0101 801118EF40	PLC_BIT_1119	Control hierarchy condition in SOFTSW4 (S43-01)	M
5A0101 801119EF40	PLC_BIT_1120	Control hierarchy condition in SOFTSW5 (S43-02)	M
5A0101 801120EF40	PLC_BIT_1121	Control hierarchy condition in SOFTSW6 (S43-03)	M
5A0101 801121EF40	PLC_BIT_1122	Control hierarchy condition in SOFTSW7 (S43-04)	M

Signal Number	Signal Name	Description	M/O
5A0101 801122EF40	PLC_BIT_1123	Control hierarchy condition in SOFTSW8 (S43-05)	M

Table 2.17-6 Mapping points for the command reception in SOFTSWx

Signal Number	Signal Name	Description	M/O
522001 700A016D08	S4301_CONTROL_REQ	Control command received in SOFTSW1 (S43-CBK)	M
522001 700A026D08	S4302_CONTROL_REQ	Control command received in SOFTSW2 (S43-ICB)	M
522001 700A036D08	S4303_CONTROL_REQ	Control command received in SOFTSW3 (S43-SCB)	M
522001 700A046D08	S4304_CONTROL_REQ	Control command received in SOFTSW4 (S43-01)	M
522001 700A056D08	S4305_CONTROL_REQ	Control command received in SOFTSW5 (S43-02)	M
522001 700A066D08	S4306_CONTROL_REQ	Control command received in SOFTSW6 (S43-03)	M
522001 700A076D08	S4307_CONTROL_REQ	Control command received in SOFTSW7 (S43-04)	M
522001 700A086D08	S4308_CONTROL_REQ	Control command received in SOFTSW8 (S43-05)	M

Table 2.17-7 Mapping points for the output signals of SOFTSWx

Signal Number	Signal Name	Description	M/O
522001 000A011D90	S4301_STSELD	Selection completed signal in SOFTSW1	M
522001 000A021D90	S4302_STSELD	Selection completed signal in SOFTSW2	M
522001 000A031D90	S4303_STSELD	Selection completed signal in SOFTSW3	M
522001 000A041D90	S4304_STSELD	Selection completed signal in SOFTSW4 (S43-01)	M
522001 000A051D90	S4305_STSELD	Selection completed signal in SOFTSW5 (S43-02)	M
522001 000A061D90	S4306_STSELD	Selection completed signal in SOFTSW6 (S43-03)	M
522001 000A071D90	S4307_STSELD	Selection completed signal in SOFTSW7 (S43-04)	M
522001 000A081D90	S4308_STSELD	Selection completed signal in SOFTSW8 (S43-05)	M

Table 2.17-8 Input signals for condition logic

Signal Number	Signal Name	Description	M/O
5A0001 0008001F41	DCB RCV OR	Double Command Blocking(DCB) is in progress.	N/A
5A0001 0008001F40	Traveling OR	Travelling events are detected.	N/A
4A0001 8300001B6F	GEN. TRIP	General trip	N/A
5A0001 3108003F40	SDCEN	(This is setting of CMNCTRL)	N/A
5A0101 3100001F43	SERI_ERR	Serious Error detected	N/A
523001 000D001F40	ASEQ_MULTI_SEL	Automatic sequence control is in progress.	N/A

Table 2.17-9 PLC monitoring points (ON and OFF selection completion)

Signal Number	Signal Name	Description
522001 8F0A011F49	S4301_OSD_CSF	On Selection completed in SOFTSW1 (S43-CBK)
522001 8F0A021F49	S4302_OSD_CSF	On Selection completed in SOFTSW2 (S43-ICB)
522001 8F0A031F49	S4303_OSD_CSF	On Selection completed in SOFTSW3 (S43-SCB)
522001 8F0A041F49	S4304_OSD_CSF	On Selection completed in SOFTSW4 (S43-01)
522001 8F0A051F49	S4305_OSD_CSF	On Selection completed in SOFTSW5 (S43-02)
522001 8F0A061F49	S4306_OSD_CSF	On Selection completed in SOFTSW6 (S43-03)
522001 8F0A071F49	S4307_OSD_CSF	On Selection completed in SOFTSW7 (S43-04)
522001 8F0A081F49	S4308_OSD_CSF	On Selection completed in SOFTSW8 (S43-05)
522001 8D0A011F45	S4301_FSD_CSF	Off Selection completed in SOFTSW1 (S43-CBK)
522001 8D0A021F45	S4302_FSD_CSF	Off Selection completed in SOFTSW2 (S43-ICB)
522001 8D0A031F45	S4303_FSD_CSF	Off Selection completed in SOFTSW3 (S43-SCB)
522001 8D0A041F45	S4304_FSD_CSF	Off Selection completed in SOFTSW4 (S43-01)
522001 8D0A051F45	S4305_FSD_CSF	Off Selection completed in SOFTSW5 (S43-02)
522001 8D0A061F45	S4306_FSD_CSF	Off Selection completed in SOFTSW6 (S43-03)

Signal Number	Signal Name	Description
522001 8D0A071F45	S4307_FSD_CSF	Off Selection completed in SOFTSW7 (S43-04)
522001 8D0A081F45	S4308_FSD_CSF	Off Selection completed in SOFTSW8 (S43-05)

(ix) Setting names

Table 2.17-10 Setting of SOFTSWx control

Setting Name	Description	Default	Setting item or value
S43-CBKEN	Function activation in SOFTSW1 (S43-CBK)	On	Off / On
S43-ICBEN	Function activation in SOFTSW2 (S43-ICB)	On	Off / On
S43-SCBEN	Function activation in SOFTSW3 (S43-SCB)	On	Off / On
S4301-EN†	Function activation in SOFTSW4 (S43-01†)	On	Off / On
S4302-EN†	Function activation in SOFTSW5 (S43-02†)	On	Off / On
S4303-EN†	Function activation in SOFTSW6 (S43-03†)	On	Off / On
S4304-EN†	Function activation in SOFTSW7 (S43-04†)	On	Off / On
S4305-EN†	Function activation in SOFTSW8 (S43-05†)	On	Off / On
S43-CBKCTRAHMI	HMI activation in SOFTSW1 (S43-CBK)	On	Off / On
S43-ICBCTRAHMI	HMI activation in SOFTSW2 (S43-ICB)	On	Off / On
S43-SCBCTRAHMI	HMI activation in SOFTSW3 (S43-SCB)	On	Off / On
S4301-CTRAHMI†	HMI activation in SOFTSW4 (S43-01†)	On	Off / On
S4302-CTRAHMI†	HMI activation in SOFTSW5 (S43-02†)	On	Off / On
S4303-CTRAHMI†	HMI activation in SOFTSW6 (S43-03†)	On	Off / On
S4304-CTRAHMI†	HMI activation in SOFTSW7 (S43-04†)	On	Off / On
S4305-CTRAHMI†	HMI activation in SOFTSW8 (S43-05†)	On	Off / On

†Note:There are inconsistency between the names of settings and switches, but the expression in Table 2.17-10 is true.

2.17.3 Cancel logic for SBO mode

In the SBO control mode, the reception of a cancel command is possible; when the cancel conditions are satisfied, accordingly, the function can discard the select command.

(i) Receiving "Cancel" from remote-end

Figure 2.17-13 shows the logic when a "Cancel command (Remote-Cancel)" signal is applied to the SOFTSW1 function. The input-point "S4301_CONTROL_REQ" is the same as the "Selection command (Remote-On-Control)" signal.

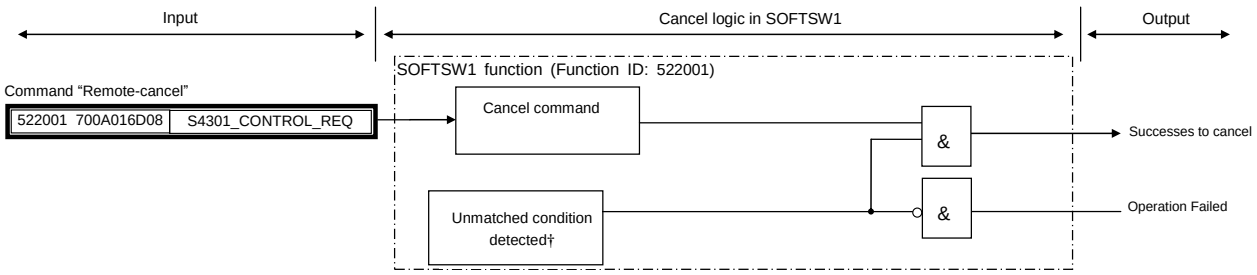


Figure 2.17-13 Cancel logic by the reception of the command from the remote end

†Note: The criteria "unmatched conditions" are determined when the "Test-bit status" in the 'cancel' command is not identical to the "IED test status".

(ii) Receiving "Cancel" from local-end

Figure 2.17-14 shows the logic when a "Cancel command (Local-cancel)" signal is applied to the SOFTSW1 function. The input signal is provided when the "Cancel" key is pressed on the IED front panel; the user is not required to map it. When the logic receives input "Local-cancel" signal, the logic is able to output a result signal, provided that the "unmatched condition detected" checking is satisfied.

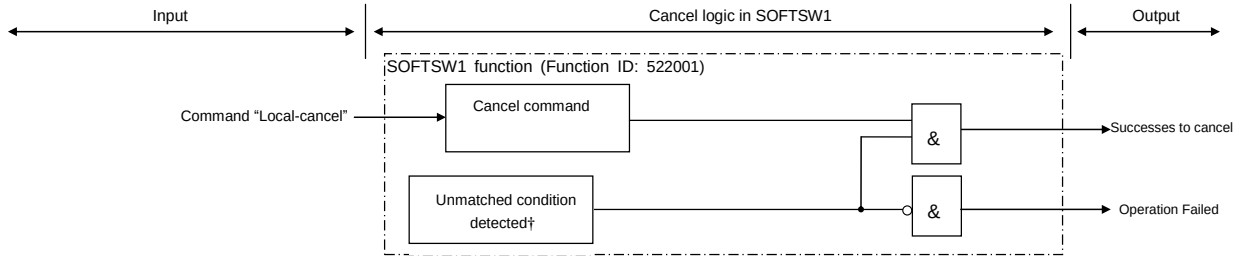


Figure 2.17-14 Cancel logic by the reception of the command at local end

†Note: The criteria "unmatched conditions" are determined when the "Test-bit status" in the 'cancel' command is not identical to the "IED test status".

2.17.4 Operate logic for SBO/DIR modes

The user should map the operation command to the operate logic. If the operation conditions are satisfied, the IED is able to change the state in the S4301 to S4308.

(i) Receiving “operate command On” from remote-end

Figure 2.17-15 shows the logic when an “Operate command (Remote-ON-Control)” signal is applied to the SOFTSW1 logic. The input-point “S4301_CONTROL_REQ” is used for the reception of the “Select command (Remote-On-Control)”.

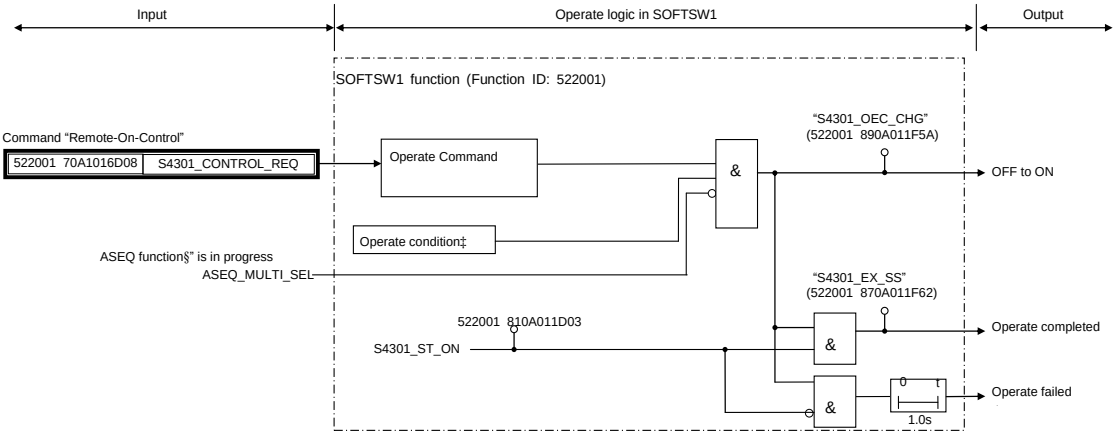


Figure 2.17-15 ‘ON’ Operation logic by remote end in SOFTSW1†

†Note: To identify the input and output signal-points of the other SOFTSW logics, see Table 2.17-6, Table 2.17-8, Table 2.17-11, Table 2.17-14, and Table 2.17-15.

‡Note:“operate condition” signal is provided from operate condition scheme. For more information, see Figure 2.17-21.

§Note:The ASEQ function can provide sequential signals for automatic control.

(ii) Receiving “operate command Off” from remote-end

Figure 2.17-16 shows the logic when an “Operate command (Remote-Off-Control)” signal is applied to the SOFTSW1 logic. The input-point “S4301_CONTROL_REQ” is used for the reception of the signal “Operate command (Remote-Off-Control)”.

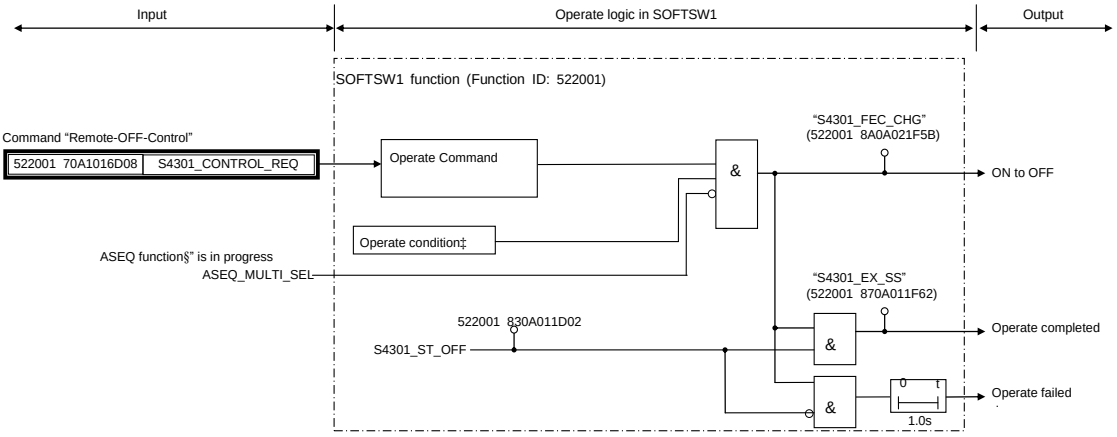


Figure 2.17-16 ‘OFF’ Operation logic by remote end in SOFTSW1†

†Note: To identify the input and output signals of the other SOFTSW logics, see Table 2.17-6, Table 2.17-12, Table 2.17-13, and Table 2.17-14.

‡Note:“operate condition” signal is provided from operate condition scheme. For more

information, see Figure 2.17-21.

§Note: The ASEQ function can provide sequential signals for automatic control.

(iii) Receiving "operate command On" from the local end

Figure 2.17-17 shows the logic when an "Operate command (Local-ON-Control)" signal is applied to the SOFTSW1 logic. The input signal is provided when "Execution of On" key is pressed on the IED front panel.

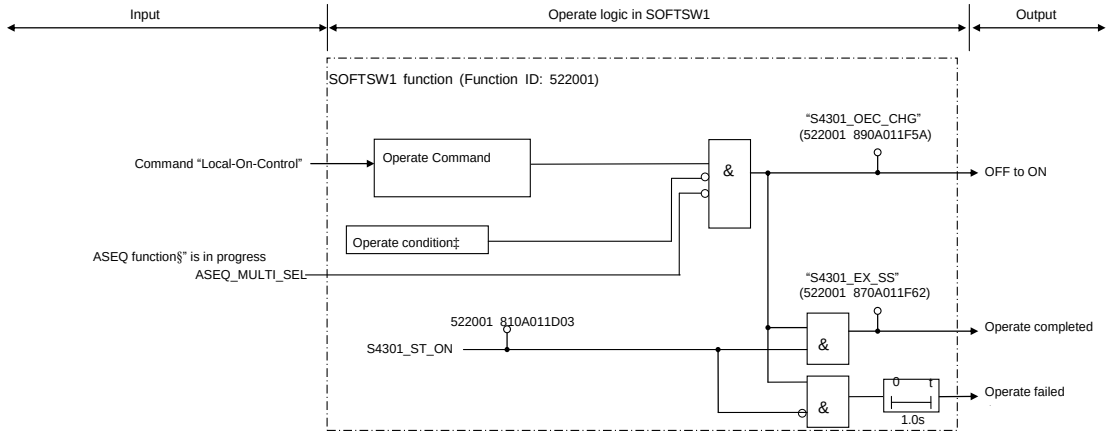


Figure 2.17-17 'ON' Operation logic at local in SOFTSW1†

†Note: To identify the input and output signal-points of the other SOFTSW logics, see Table 2.17-11, Table 2.17-13, and Table 2.17-15.

‡Note:"operate condition" signal is provided from operate condition scheme. For more information, see Figure 2.17-21.

§Note:The ASEQ function can provide sequential signals for automatic control.

(iv) Receiving "operate command Off" from the local end

Figure 2.17-18 shows the logic when an "Operation command (Local-OFF-Control)" signal is applied to the SOFTSW1 logic. The input signal is provided when "Execution for Off" key is pressed on the IED front panel.

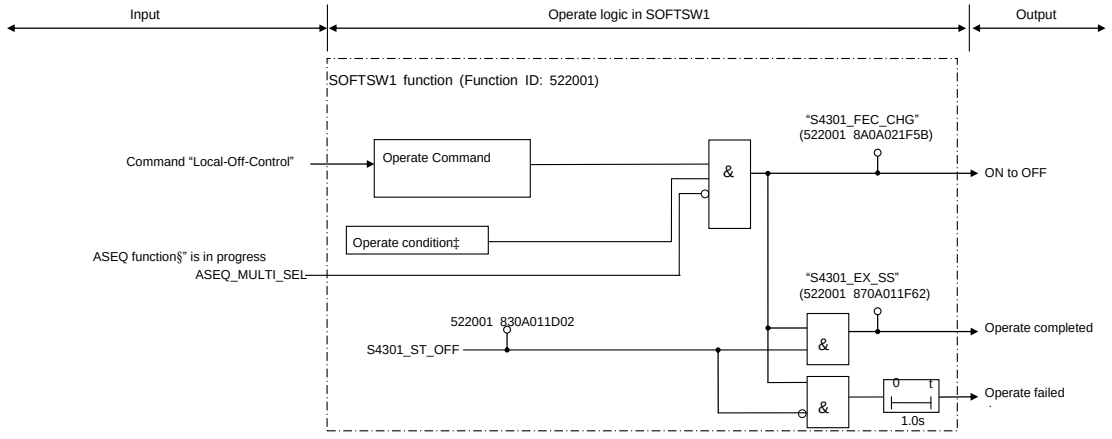


Figure 2.17-18 'OFF' Operation logic at local in SOFTSW1†

†Note: To identify the input and output signals of the other SOFTSW logics, see Table 2.17-12, Table 2.17-13, and Table 2.17-14.

‡Note: "operate condition" signal is provided from operate condition scheme. For more information, see Figure 2.17-21.

§Note: The ASEQ function can provide sequential signals for automatic control.

(v) Receiving "operate command On" using PLC logic

Figure 2.17-19 shows the logic when an "Operate command (PLC-ON-Control)" signal is applied to the SOFTSW1 logic. The input signal is generated using the user-programmed PLC logic; the user can connect the signal for the PLC connection point "PLC_BIT_1125".

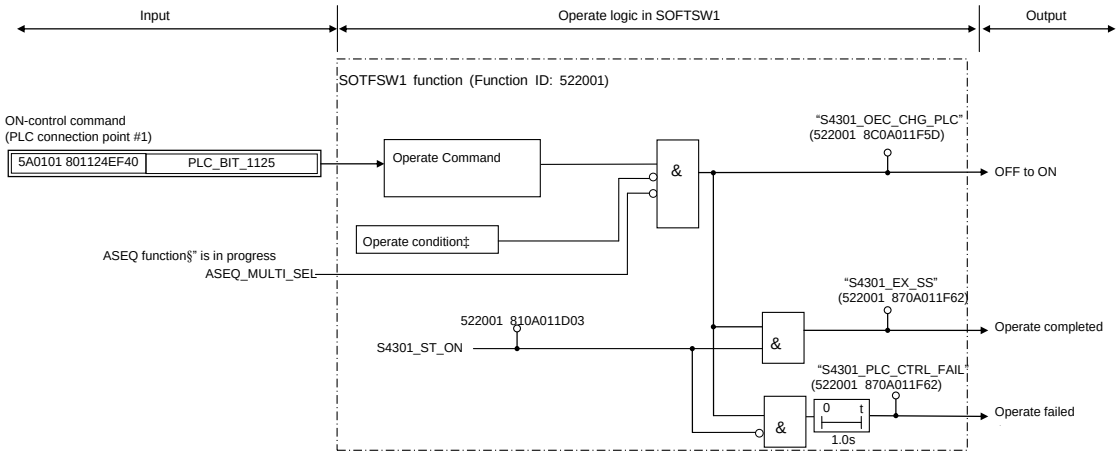


Figure 2.17-19 'ON' Operation logic using PLC logic†

†Note: To identify the input and output signal-points of the other SOFTSW logics, see Table 2.17-3, Table 2.17-13, Table 2.17-15, Table 2.17-16, and Table 2.17-17.

‡Note:"operate condition" signal is provided from operate condition scheme. For more information, see Figure 2.17-21.

§Note:The ASEQ function can provide sequential signals for automatic control.

(vi) Receiving "operate command Off" using PLC logic

Figure 2.17-20 shows the logic when an "Operation command (PLC-Off-Control)" signal is applied to the SOFTSW1 logic. The input signal is generated using the user-programmed PLC logic; the user can connect the signal for the PLC connection point "PLC_BIT_1124".

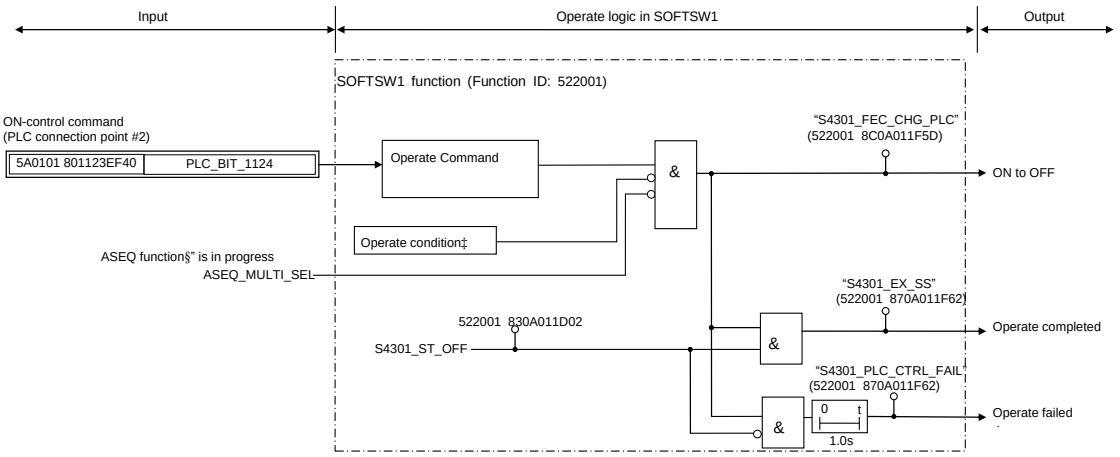


Figure 2.17-20 'Off' Operation logic using PLC logic†

†Note: To identify the input and output signal-points of the other SOFTSW logics, see Table 2.17-4, Table 2.17-13, Table 2.17-14, Table 2.17-16, and Table 2.17-18.

‡Note:"operate condition" signal is provided from operate condition scheme. For more information, see Figure 2.17-21.

§Note:The ASEQ function can provide sequential signals for automatic control.

(vii) Operate condition

Figure 2.17-21 shows the operate condition logic of the SOFTSW1 function. The SOFTSW1 function can examine an operate-condition using "Command Blocking" signal[1].

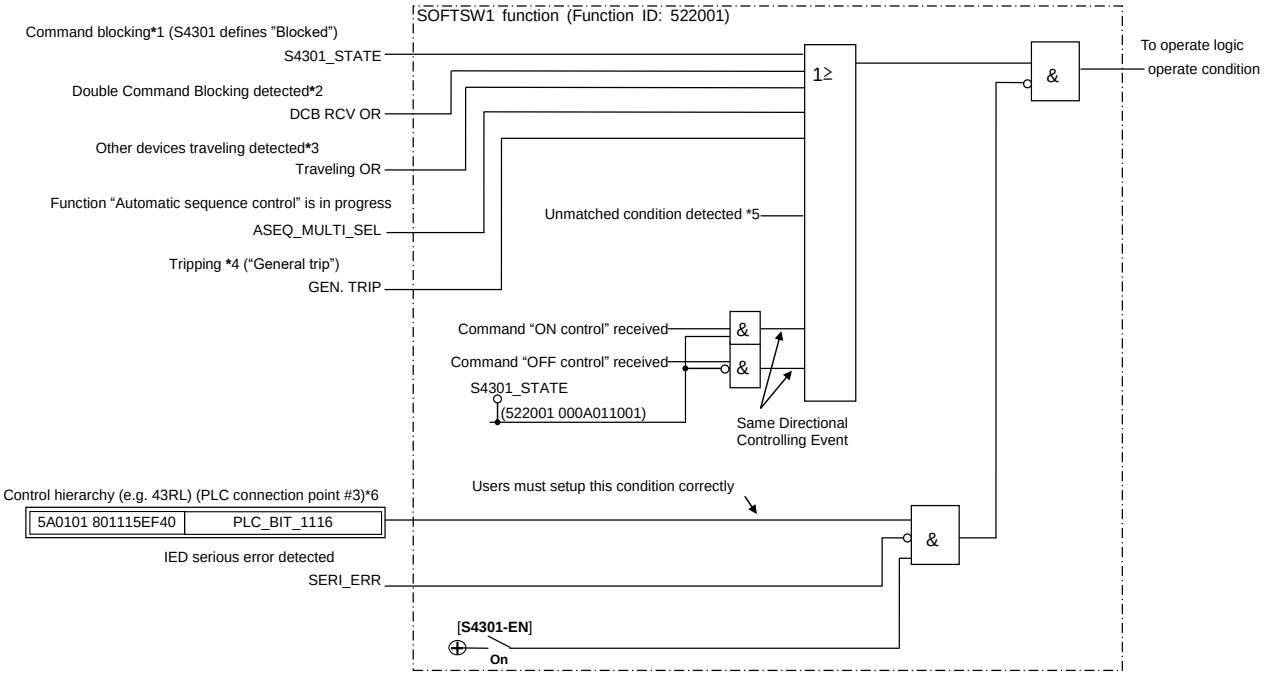


Figure 2.17-21 Operate condition logic for ON/OFF in SOFTSW1*7

[1]Note: "Command Blocking" disables any operation except for itself; See the signal "S4301_STATE (Table 2.17-2)" as the state of "Command Blocking" in the SOFTSW function.

[2]Note: "Double Command Blocking (DCB_RCV_OR in Table 2.17-8)" is an operation philosophy. It can be used to protect the substation. The user can configure it using GR-TIEMS.

[3]Note: Detection of event "device-travelling (Traveling OR in Table 2.17-8)" signifies that other operators are changing the status of one or more devices. Thus, device operation by the IED should be inhibited whilst the event is detected.

[4]Note: If an IED is in the process of issuing a trip (GEN.TRIP in Table 2.17-8) command, all control operation is blocked until the trip operation has been completed. Tripping can be introduced by the protection function if the IED has protection functions.

[5]Note: The criteria "unmatched conditions" is determined when the "Test-bit status" in a command is not identical to the "IED test status".

[6]Note: The user must program the PLC logic "Control hierarchy condition". The Control hierarchy condition provided by the user-programmed PLC logic may be 43R/L; the user can connect it with PLC connection point "PLC_BIT_1116" of Figure 2.17-21.

[7]Note: To identify the PLC connection points of the other SOFTSW logics, see Table 2.17-5.

(viii) Signal name and number

Note: The user should note the meaning of the following abbreviations as shown in column "M/O" of each table:

"O" indicates that the signal is provided for the optional use.

"M" indicates that the user should map/set/configure the signal; otherwise, the user may experience an operational failure if the default settings is used.

"N/A" indicates that the user cannot change the state of the signal.

Table 2.17-11 Output signals on starting operation "Off to On"

Signal Number	Signal Name	Description
522001 890A011F5A	S4301_OEC_CHG	"Off to On" operation start in SOFTSW1 (S43-CBK)
522001 890A021F5A	S4302_OEC_CHG	"Off to On" operation start in SOFTSW2 (S43-ICB)
522001 890A031F5A	S4303_OEC_CHG	"Off to On" operation start in SOFTSW3 (S43-SCB)
522001 890A041F5A	S4304_OEC_CHG	"Off to On" operation start in SOFTSW4 (S43-01)
522001 890A051F5A	S4305_OEC_CHG	"Off to On" operation start in SOFTSW5 (S43-02)
522001 890A061F5A	S4306_OEC_CHG	"Off to On" operation start in SOFTSW6 (S43-03)
522001 890A071F5A	S4307_OEC_CHG	"Off to On" operation start in SOFTSW7 (S43-04)
522001 890A081F5A	S4308_OEC_CHG	"Off to On" operation start in SOFTSW8 (S43-05)

Table 2.17-12 Output signals on starting operation "On to Off"

Signal Number	Signal Name	Description
522001 8A0A011F5B	S4301_FEC_CHG	"On to Off" operation start in SOFTSW1 (S43-CBK)
522001 8A0A021F5B	S4302_FEC_CHG	"On to Off" operation start in SOFTSW2 (S43-ICB)
522001 8A0A031F5B	S4303_FEC_CHG	"On to Off" operation start in SOFTSW3 (S43-SCB)

522001 8A0A041F5B	S4304_FEC_CHG	"On to Off" operation start in SOFTSW4 (S43-01)
522001 8A0A051F5B	S4305_FEC_CHG	"On to Off" operation start in SOFTSW5 (S43-02)
522001 8A0A061F5B	S4306_FEC_CHG	"On to Off" operation start in SOFTSW6 (S43-03)
522001 8A0A071F5B	S4307_FEC_CHG	"On to Off" operation start in SOFTSW7 (S43-04)
522001 8A0A081F5B	S4308_FEC_CHG	"On to Off" operation start in SOFTSW8 (S43-05)

Table 2.17-13 Success signals of the operation

Signal Number	Signal Name	Description
522001 870A011F62	S4301_EX_SS	Operation succeeded in SOFTSW1 (S43-CBK)
522001 870A021F62	S4302_EX_SS	Operation succeeded in SOFTSW2 (S43-ICB)
522001 870A031F62	S4303_EX_SS	Operation succeeded in SOFTSW3 (S43-SCB)
522001 870A041F62	S4304_EX_SS	Operation succeeded in SOFTSW4 (S43-01)
522001 870A051F62	S4305_EX_SS	Operation succeeded in SOFTSW5 (S43-02)
522001 870A061F62	S4306_EX_SS	Operation succeeded in SOFTSW6 (S43-03)
522001 870A071F62	S4307_EX_SS	Operation succeeded in SOFTSW7 (S43-04)
522001 870A081F62	S4308_EX_SS	Operation succeeded in SOFTSW8 (S43-05)

Table 2.17-14 OFF status signals on the operation

Signal Number	Signal Name	Description
522001 830A011D02	S4301_ST_OFF	"Off" status of SOFTSW1 (S43-CBK)
522001 830A021D02	S4302_ST_OFF	"Off" status of SOFTSW2 (S43-ICB)
522001 830A031D02	S4303_ST_OFF	"Off" status of SOFTSW3 (S43-SCB)
522001 830A041D02	S4304_ST_OFF	"Off" status of SOFTSW4 (S43-01)
522001 830A051D02	S4305_ST_OFF	"Off" status of SOFTSW5 (S43-02)
522001 830A061D02	S4306_ST_OFF	"Off" status of SOFTSW6 (S43-03)
522001 830A071D02	S4307_ST_OFF	"Off" status of SOFTSW7 (S43-04)
522001 830A081D02	S4308_ST_OFF	"Off" status of SOFTSW8 (S43-05)

Table 2.17-15 ON status signals on the operation

Signal Number	Signal Name	Description
522001 810A011D03	S4301_ST_ON	"On" status of SOFTSW1 (S43-CBK)
522001 810A021D03	S4302_ST_ON	"On" status of SOFTSW2 (S43-ICB)
522001 810A031D03	S4303_ST_ON	"On" status of SOFTSW3 (S43-SCB)
522001 810A041D03	S4304_ST_ON	"On" status of SOFTSW4 (S43-01)
522001 810A051D03	S4305_ST_ON	"On" status of SOFTSW5 (S43-02)
522001 810A061D03	S4306_ST_ON	"On" status of SOFTSW6 (S43-03)
522001 810A071D03	S4307_ST_ON	"On" status of SOFTSW7 (S43-04)
522001 810A081D03	S4308_ST_ON	"On" status of SOFTSW8 (S43-05)

Table 2.17-16 Failure signals generated by PLC control

Signal Number	Signal Name	Description
522001 800A011DE0	S4301_PLC_CTRL_FAIL	Control failure in SOFTSW1 (S43-CBK=CBK)
522001 800A021DE0	S4302_PLC_CTRL_FAIL	Control failure in SOFTSW2 (S43-ICB=ICB)
522001 800A031DE0	S4303_PLC_CTRL_FAIL	Control failure in SOFTSW3 (S43-SCB=SCB)
522001 800A041DE0	S4304_PLC_CTRL_FAIL	Control failure in SOFTSW4 (S43-01)
522001 800A051DE0	S4305_PLC_CTRL_FAIL	Control failure in SOFTSW5 (S43-02)
522001 800A061DE0	S4306_PLC_CTRL_FAIL	Control failure in SOFTSW6 (S43-03)
522001 800A071DE0	S4307_PLC_CTRL_FAIL	Control failure in SOFTSW7 (S43-04)
522001 800A081DE0	S4308_PLC_CTRL_FAIL	Control failure in SOFTSW8 (S43-05)

Table 2.17-17 Output signals on starting operation “Off to On” by PLC

Signal Number	Signal Name	Description
522001 8B0A011F5C	S4301_OEC_CHG_PLC	SOFTSW1 signal after KC_S43_SA022
522001 8B0A021F5C	S4302_OEC_CHG_PLC	SOFTSW2 signal after KC_S43_SA022
522001 8B0A031F5C	S4303_OEC_CHG_PLC	SOFTSW3 signal after KC_S43_SA022
522001 8B0A041F5C	S4304_OEC_CHG_PLC	SOFTSW4 signal after KC_S43_SA022
522001 8B0A051F6C	S4305_OEC_CHG_PLC	SOFTSW5 signal after KC_S43_SA022
522001 8B0A061F7C	S4306_OEC_CHG_PLC	SOFTSW6 signal after KC_S43_SA022
522001 8B0A071F8C	S4307_OEC_CHG_PLC	SOFTSW7 signal after KC_S43_SA022
522001 8B0A081F9C	S4308_OEC_CHG_PLC	SOFTSW8 signal after KC_S43_SA022

Table 2.17-18 Output signals on starting operation “On to Off” by PLC

Signal Number	Signal Name	Description
522001 8C0A011F5D	S4301_FEC_CHG_PLC	SOFTSW1 signal after KC_S43_SA023
522001 8C0A021F5D	S4302_FEC_CHG_PLC	SOFTSW2 signal after KC_S43_SA023
522001 8C0A031F5D	S4303_FEC_CHG_PLC	SOFTSW3 signal after KC_S43_SA023
522001 8C0A041F5D	S4304_FEC_CHG_PLC	SOFTSW4 signal after KC_S43_SA023
522001 8C0A051F5D	S4305_FEC_CHG_PLC	SOFTSW5 signal after KC_S43_SA023
522001 8C0A061F5D	S4306_FEC_CHG_PLC	SOFTSW6 signal after KC_S43_SA023
522001 8C0A071F5D	S4307_FEC_CHG_PLC	SOFTSW7 signal after KC_S43_SA023
522001 8C0A081F5D	S4308_FEC_CHG_PLC	SOFTSW8 signal after KC_S43_SA023

2.17.5 Mapping for IEC 61850 communication

The user can operate the SOFTSW1 function over IEC 61850 communications following mapping using GR-TIEMS. Note that the SOFTSW1 function is designed for the class of "Single Point Controller (SPC)" in the IEC 61850 standard for communication. The user should follow these steps, each of which is discussed below:

Step1: Editing Logical Node

Step2: Mapping output data

Step3: Mapping input data

(i) Editing Logical Node

The user will need to create a logical node (LN) for the SOFTSW1 function. Figure 2.17-22 exemplifies the editing of a LN; the LN "General Input/Output (GGIO)" is chosen for the SOFTSW1 function for IEC 61850 communication. After the user has defined an object "SPCSO", the SOFTSW1 logical node can be saved with the name "GGIO" plus "LN Instance". Create a definition of the object "SPCSO" in SOFTSW1 logical node. Either the SBO mode or the DIR mode can be chosen in the editing for the LN.

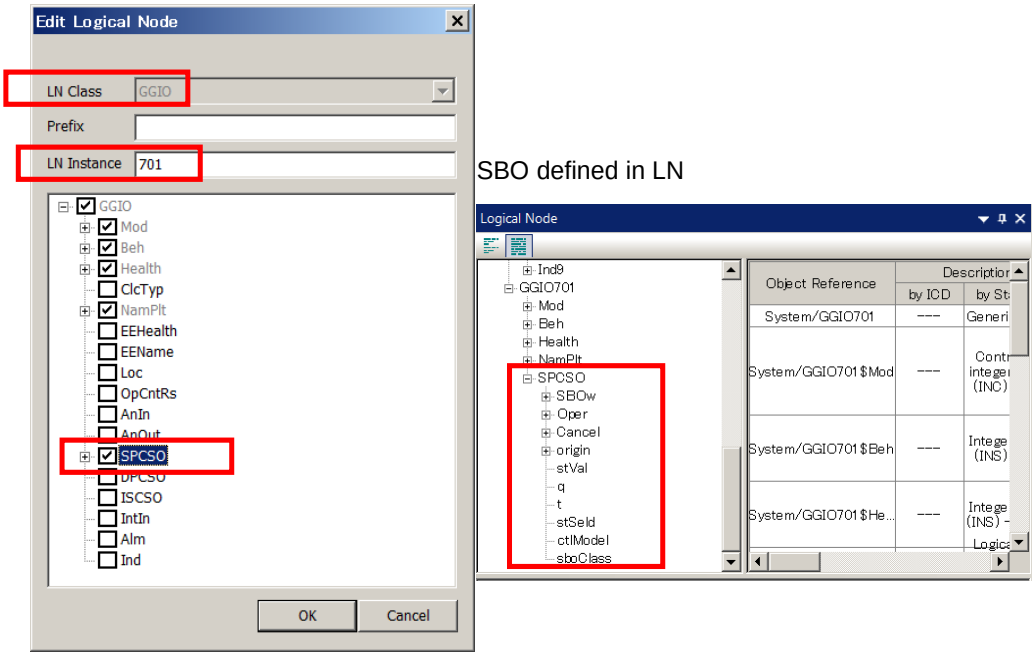
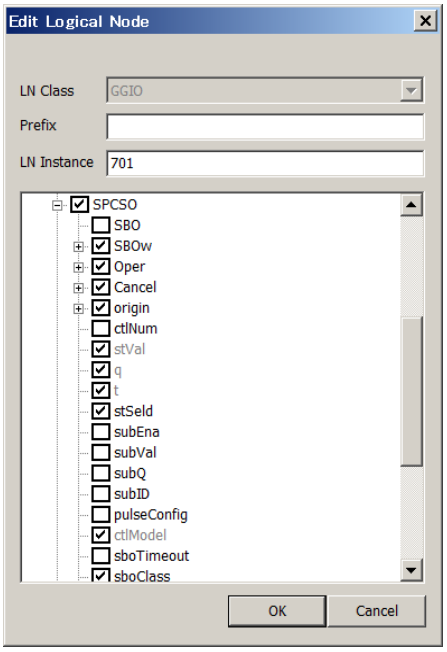


Figure 2.17-22 Defining "SPCSO" object in GGIO701 logic node

(i)-1 Defining SBO mode

Figure 2.17-23 exemplifies the settings in LN "GGIO701" when the SBO mode is required for the SOFTSW1 function. In the SBO control, the user should select the following items for the "GGIO701$SPCSO" using GR-TIEMS;

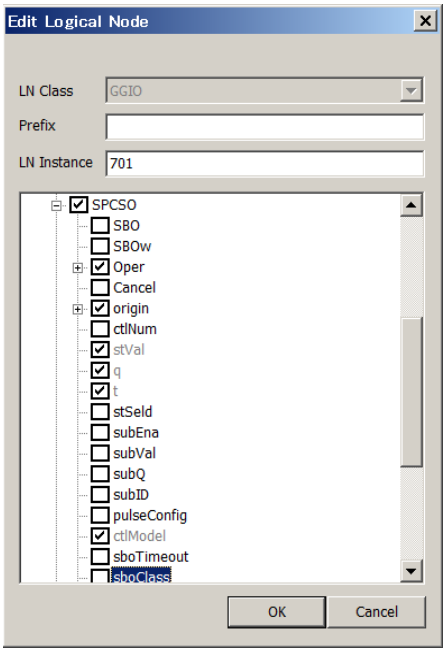


- ✓ SBOw
- ✓ Oper
- ✓ Cancel
- ✓ Origin
- ✓ stSeld
- ✓ sboClass (choice ”operate-once”)
- ✓ ctlmodel (choice ”SBOes or SBOns”)

Figure 2.17-23 LN editing screen for SBO mode (for example)

(i)-2 Defining DIR mode

Figure 2.17-24 exemplifies the settings in LN “GGIO701” when the DIR mode is required for the SOFTSW1 function. In the DIR mode, the following three items should be selected using GR-TIEMS:



- ✓ Oper
- ✓ origin
- ✓ ctlmodel (choice ”DOes or DOns”)

Figure 2.17-24 LN editing screen for DIR mode (for example)

(ii) Mapping output data

The user should group the SOFTSW1 (S4301) signals with regard to GOOSE and REPORT; the user should map them for IEC 61850 communication using GR-TIEMS.

Table 2.17-19 shows the required mapping signals in SOFTSW1 function to the IEC 61850 communications. Figure 2.17-25 shows how to map a signal.

Table 2.17-19 Mapping signals for SPCSO object.

Object_reference	Attribute	Type	FC	Signal Number	Signal Name
Ctrl/GGIO701$SPCSO$origin	orCat	orCategory	ST	522001 310A011008	S4301_ORCAT
Ctrl/GGIO701$SPCSO$origin	orIdent	Octet64	ST	522001 6A0A011009	S4301_ORIDENT
Ctrl/GGIO701$SPCSO	stVal	INT32	ST	522001 000A011001	S4301_STATE
Ctrl/GGIO701$SPCSO	q	Quality	ST	522001 310A011005	S4301_QUALITY
Ctrl/GGIO701$SPCSO	t	Timestamp	ST	522001 900A011006	S4301_TIMESTAMP
Ctrl/GGIO701$SPCSO	stSeld	BOOLEAN	ST	522001 000A011D90	S4301_STSELD

Note: "Status (ST)" is defined in the function constraint (FC) of the IEC 61850 standard.

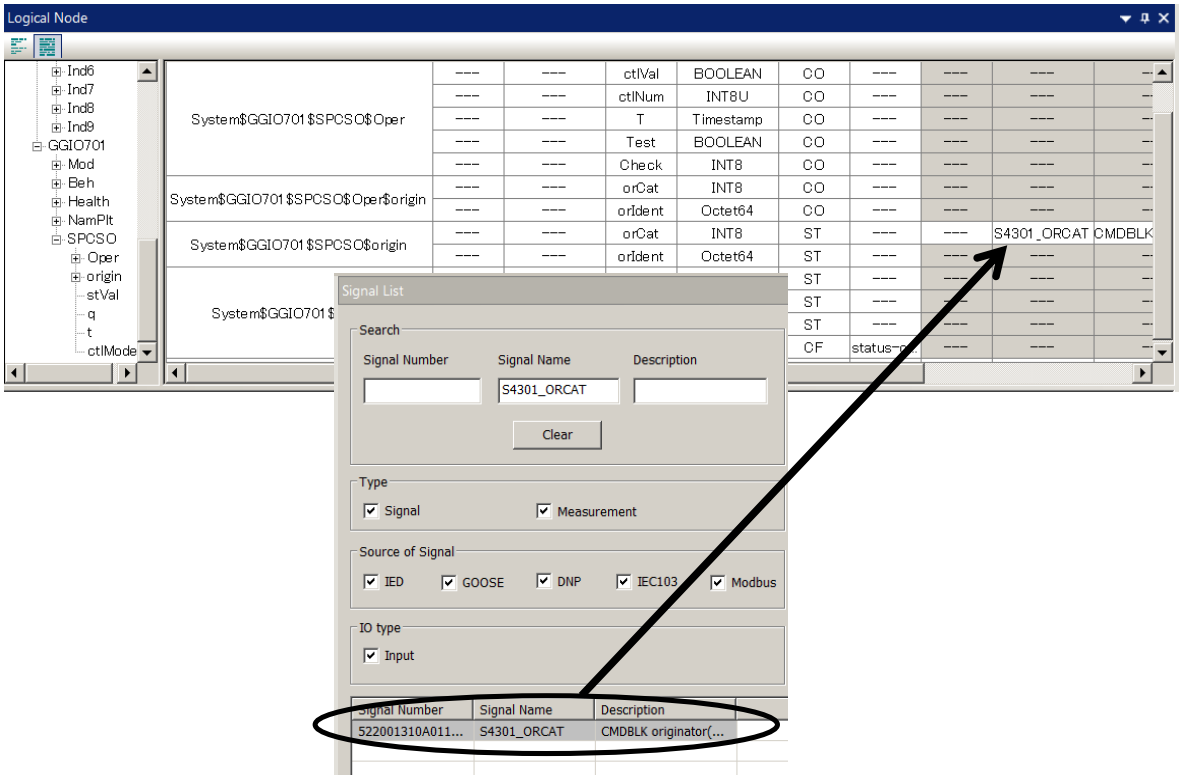


Figure 2.17-25 orCat attribute mapped into SPCSO object of GGIO701

(iii) Mapping input data

The SOFTSW1 function can receive three commands "select, operate, and cancel. Thus, the user should map the input-point "S4301_CONTROL_REQ". Table 2.17-20 shows the input-point "S4301_CONTROL_REQ" and the Object reference "Ctrl/GGIO701$SPCSO"; the user should map the Object reference having attributes CO and CF in FC† to the input-point. Figure 2.17-26 shows how to map a signal.

†Note: The attribute is defined in the IEC 61850 standard; "CO" stands for "Control" and "CF" stands for "Configuration" in the functional constraint (FC).

Table 2.17-20 Mapping signals required for SPCSO object in SOFTSW1 function

Object_reference	Attribute	Type	FC	Signal Number	Signal Name
Ctrl/GGIO701$SPCSO$SBOw	ctlVal	BOOLEAN	CO	522001 700A016D08	S4301_CONTROL_REQ
Ctrl/GGIO701$SPCSO$SBOw	ctlNum	INT8U	CO		
Ctrl/GGIO701$SPCSO$SBOw	T	Timestamp	CO		
Ctrl/GGIO701$SPCSO$SBOw	Test	BOOLEAN	CO		
Ctrl/GGIO701$SPCSO$SBOw	Check	Check	CO		
Ctrl/GGIO701$SPCSO$SBOw$origin	orCat	orCategory	CO		
Ctrl/GGIO701$SPCSO$SBOw$origin	orIdent	Octet64	CO		
Ctrl/GGIO701$SPCSO$Oper	ctlVal	BOOLEAN	CO		
Ctrl/GGIO701$SPCSO$Oper	ctlNum	INT8U	CO		
Ctrl/GGIO701$SPCSO$Oper	T	Timestamp	CO		
Ctrl/GGIO701$SPCSO$Oper	Test	BOOLEAN	CO		
Ctrl/GGIO701$SPCSO$Oper	Check	Check	CO		
Ctrl/GGIO701$SPCSO$Oper$origin	orCat	orCategory	CO		
Ctrl/GGIO701$SPCSO$Oper$origin	orIdent	Octet64	CO		
Ctrl/GGIO701$SPCSO$Cancel	ctlVal	BOOLEAN	CO		
Ctrl/GGIO701$SPCSO$Cancel	ctlNum	INT8U	CO		
Ctrl/GGIO701$SPCSO$Cancel	T	Timestamp	CO		
Ctrl/GGIO701$SPCSO$Cancel	Test	BOOLEAN	CO		
Ctrl/GGIO701$SPCSO$Cancel$origin	orCat	orCategory	CO		
Ctrl/GGIO701$SPCSO$Cancel$origin	orIdent	Octet64	CO		
Ctrl/GGIO701$SPCSO	ctlModel	ctlModel	CF		
Ctrl/GGIO701$SPCSO	sboClass	sboClass	CF		

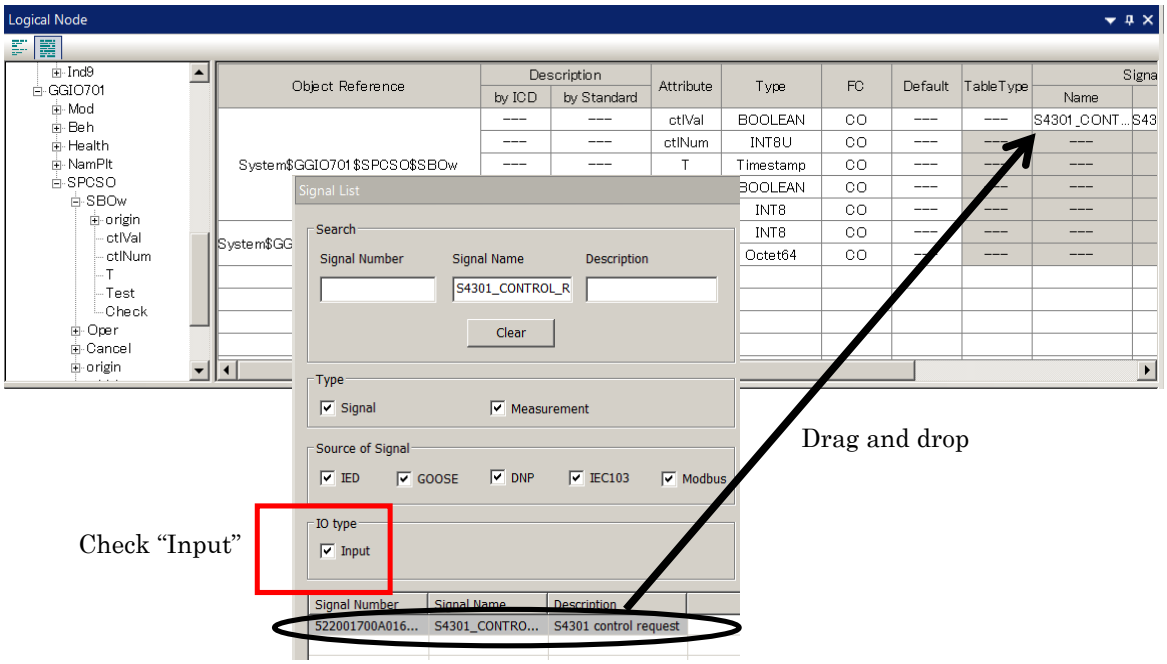


Figure 2.17-26 Input-point mapped for GGIO701

2.17.6 Setting

Settings list for the SOTFSW(FunctionID:522001)

Setting device			Range	Units	Contents	Default setting value	Notes
	CBK (S43-CBK)	S43-CBKEN	Off / On	-	Enabling control command block in SOFTSW1	Off	
		S43-CBKCTRMENU	Off / On	-	Enabling control menu in SOFTSW1	Off	
		S43-CBKCTRAHMI	DIR / SBO	-	Selection of control mode on the screen in SOTFSW1	DIR	
	ICB (S43-ICB)	S43-ICBEN	Off / On	-	Enabling interlock check bypass in SOFTSW2	Off	
		S43-ICBCTRMENU	Off / On	-	Enabling control menu in SOFTSW2	Off	
		S43-ICBCTRAHMI	DIR / SBO	-	Selection of control mode on the screen in SOTFSW2	DIR	
	SYNCBYP (S43-SCB)	S43-SCBEN	Off / On	-	Enabling synchronizing check bypass in SOTFSW3	Off	
		S43-SCBCTRMENU	Off / On	-	Enabling control menu in SOFTSW3	Off	
		S43-SCBCTRAHMI	DIR / SBO	-	Selection of control mode on the screen in SOTFSW3	DIR	
	Switch1 (S43-01)	S4301-EN	Off / On	-	Enabling the function in SOFTSW4	Off	
		S4301-CTRMENU	Off / On	-	Enabling control menu in SOTFSW4	Off	
		S4301-CTRAHMI	DIR / SBO	-	Selection of control mode on the screen in SOTFSW4	DIR	
	Switch2 (S43-02)	S4302-EN	Off / On	-	Enabling the function in SOFTSW5	Off	
		S4302-CTRMENU	Off / On	-	Enabling control menu in SOTFSW5	Off	
		S4302-CTRAHMI	DIR / SBO	-	Selection of control mode on the screen in SOTFSW5	DIR	
	Switch3 (S43-03)	S4303-EN	Off / On	-	Enabling the function in SOFTSW6	Off	
		S4303-CTRMENU	Off / On	-	Enabling control menu in SOTFSW6	Off	
		S4303-CTRAHMI	DIR / SBO	-	Selection of control mode on the screen in SOTFSW6	DIR	
	Switch4 (S43-04)	S4304-EN	Off / On	-	Enabling the function in SOFTSW7	Off	
		S4304-CTRMENU	Off / On	-	Enabling control menu in SOTFSW7	Off	
		S4304-CTRAHMI	DIR / SBO	-	Selection of control mode on the screen in SOTFSW7	DIR	
	Switch5 (S43-05)	S4305-EN	Off / On	-	Enabling the function in SOFTSW8	Off	
		S4305-CTRMENU	Off / On	-	Enabling control menu in SOTFSW8	Off	
		S4305-CTRAHMI	DIR / SBO	-	Selection of control mode on the screen in SOTFSW8	DIR	

2.17.7 Signal

◆ Connection points in PLC logic for S43-CBK

SOFTSW(Function ID:522001)

Element ID	Name	Description
860A01EDE0	S4301_CHG_TO_OFF	CBK change to off
850A01EDE1	S4301_CHG_TO_ON	CBK change to on
820A01ED50	S4301_CTRL_RIGHT	CBK control right from PLC

◆ Connection points in PLC logic for S43-ICB

SOFTSW(Function ID:522001)

Element ID	Name	Description
860A02EDE0	S4302_CHG_TO_OFF	ICB change to off
850A02EDE1	S4302_CHG_TO_ON	ICB change to on
820A02ED50	S4302_CTRL_RIGHT	ICB control right from PLC

◆ Connection points in PLC logic for S43-SCB

SOFTSW(Function ID:522001)

Element ID	Name	Description
860A03EDE0	S4303_CHG_TO_OFF	SCB change to off
850A03EDE1	S4303_CHG_TO_ON	SCB change to on
820A03ED50	S4303_CTRL_RIGHT	SCB control right from PLC

◆ Connection points in PLC logic for S43-01

SOFTSW(Function ID:522001)

Element ID	Name	Description
860A04EDE0	S4304_CHG_TO_OFF	S43-01 change to off
850A04EDE1	S4304_CHG_TO_ON	S43-01 change to on
820A04ED50	S4304_CTRL_RIGHT	S43-01 control right from PLC

◆ Connection points in PLC logic for S43-02

SOFTSW(Function ID:522001)

Element ID	Name	Description
860A05EDE0	S4305_CHG_TO_OFF	S43-02 change to off
850A05EDE1	S4305_CHG_TO_ON	S43-02 change to on
820A05ED50	S4305_CTRL_RIGHT	S43-02 control right from PLC

◆ Connection points in PLC logic for S43-03

SOFTSW(Function ID:522001)

Element ID	Name	Description
860A06EDE0	S4306_CHG_TO_OFF	S43-03 change to off
850A06EDE1	S4306_CHG_TO_ON	S43-03 change to on
820A06ED50	S4306_CTRL_RIGHT	S43-03 control right from PLC

◆ Connection points in PLC logic for S43-04

SOFTSW(Function ID:522001)

Element ID	Name	Description
860A07EDE0	S4307_CHG_TO_OFF	S43-04 change to off
850A07EDE1	S4307_CHG_TO_ON	S43-04 change to on
820A07ED50	S4307_CTRL_RIGHT	S43-04 control right from PLC

◆ Connection points in PLC logic for S43-05

SOFTSW(Function ID:522001)

Element ID	Name	Description
860A08EDE0	S4308_CHG_TO_OFF	S43-05 change to off
850A08EDE1	S4308_CHG_TO_ON	S43-05 change to on
820A08ED50	S4308_CTRL_RIGHT	S43-05 control right from PLC

◆ Signal monitoring points for S43-CBK

SOFTSW(Function ID:522001)

Element ID	Name	Description
8100011EC0	S4301_CBKEN	CBK control command block switch Enable
8500011E94	S4301_CC_EX	CBK cancel command execute
8700011E96	S4301_CC_FS	CBK cancel fail signal
8600011E95	S4301_CC_SS	CBK cancel success signal
8800011E9B	S4301_CC_ST_ERR	CBK cancel command mode error
8B00011EA2	S4301_CTR_SGU	CBK control logic stage(under selection)
8F00011E0B	S4301_DIR_RMT	CBK direct operate control setting received by remote
8C00011F45	S4301_EC_LCD	CBK execute command from LCD
8500011F44	S4301_EC_RMT	CBK execute command from REMOTE
8100011E85	S4301_ECF_FCT_EIS	CBK off direction execute command fail factor signal
8000011E8B	S4301_ECF_FCT_FLG	CBK execute command mode error
8000011E93	S4301_EX_CMP	CBK execute complete signal
8F00011F41	S4301_EX_CMP_TM0	CBK time limit over of execute complete
8800011E92	S4301_EX_FS	CBK execute fail signal
8700011E90	S4301_EX_SS	CBK execute success signal
8A00011F48	S4301_FEC_CHG	CBK off direction change signal
8000011E81	S4301_FEC_OK_CSF	CBK off direction execute success signal
8A00011E47	S4301_FEC_RCV	CBK off direction execute command received
8500011E24	S4301_FEC_RCV_LCD	CBK off direction execute command received from LCD
8300011E10	S4301_FEC_RCV_RMT	CBK off direction execute command received from remote
8400011E21	S4301_FSC_RCV_LCD	CBK off direction select command received from LCD
8000011E01	S4301_FSC_RCV_RMT	CBK off direction select command received from remote
8D00011E73	S4301_FSD_CSF	CBK off direction selected condition signal by fixedlogic
8200011E44	S4301_FSE_RCV	CBK off direction select and execute command received
8E00011E78	S4301_FSF_CSF	CBK off direction select fail condition signal by fixedlogic
8A00011E40	S4301_NSC_RCV	CBK no direction select command received
8100011E20	S4301_NSC_RCV_LCD	CBK no direction select command received from LCD
8000011E00	S4301_NSC_RCV_RMT	CBK no direction select command received from remote
8100011E86	S4301_OCF_FCT_EIS	CBK on direction execute command fail factor signal

◆ Signal monitoring points for S43-CBK

SOFTSW(Function ID:522001)

Element ID	Name	Description
8900011F47	S4301_OEC_CHG	CBK on direction change signal
8000011E82	S4301_OEC_OK_CSF	CBK on direction execute success signal
8B00011E48	S4301_OEC_RCV	CBK on direction execute command received
8100011E25	S4301_OEC_RCV_LCD	CBK on direction execute command received from LCD
8700011E12	S4301_OEC_RCV_RMT	CBK on direction execute command received from remote
8000011E22	S4301_OSC_RCV_LCD	CBK on direction select command received from LCD
8200011E03	S4301_OSC_RCV_RMT	CBK on direction select command received from remote
8F00011E74	S4301_OSD_CSF	CBK on direction selected condition signal by fixedlogic
8000011E45	S4301_OSE_RCV	CBK on direction select and execute command received
8F00011E79	S4301_OSF_CSF	CBK on direction select fail condition signal by fixedlogic
8F00011E0A	S4301_SBO_RMT	CBK select before operate control setting received by remote
8B00011F43	S4301_SC_LCD	CBK select command from LCD
8400011F42	S4301_SC_RMT	CBK select command from REMOTE
8000011E7B	S4301_SC_ST_ERR	CBK select command mode error
8000011E76	S4301_SLD_CS	CBK selected condition signal
8E00011F40	S4301_SLD_TM0	CBK time limit over of select complete
8100011E84	S4301_SLF_CS	CBK select fail condition signal
8700011E97	S4301_SLF_FCT_EIS	CBK select fail factor signal except check
8100011F46	S4301_SLR_CSF	CBK select cancel factor

◆ Signal monitoring points for S43-ICB

SOFTSW(Function ID:522001)

Element ID	Name	Description
8100021EC0	S4302_CBKEN	ICB control command block switch Enable
8500021E94	S4302_CC_EX	ICB cancel command execute
8700021E96	S4302_CC_FS	ICB cancel fail signal
8600021E95	S4302_CC_SS	ICB cancel success signal
8800021E9B	S4302_CC_ST_ERR	ICB cancel command mode error
8B00021EA2	S4302_CTR_SGU	ICB control logic stage(under selection)
8F00021E0B	S4302_DIR_RMT	ICB direct operate control setting received by remote
8C00021F45	S4302_EC_LCD	ICB execute command from LCD
8500021F44	S4302_EC_RMT	ICB execute command from REMOTE
8100021E85	S4302_ECF_FCT_EIS	ICB off direction execute command fail factor signal
8000021E8B	S4302_ECF_FCT_FLG	ICB execute command mode error
8000021E93	S4302_EX_CMP	ICB execute complete signal
8F00021F41	S4302_EX_CMP_TM0	ICB time limit over of execute complete
8800021E92	S4302_EX_FS	ICB execute fail signal
8700021E90	S4302_EX_SS	ICB execute success signal
8A00021F48	S4302_FEC_CHG	ICB off direction change signal
8000021E81	S4302_FEC_OK_CSF	ICB off direction execute success signal
8A00021E47	S4302_FEC_RCV	ICB off direction execute command received
8500021E24	S4302_FEC_RCV_LCD	ICB off direction execute command received from LCD
8300021E10	S4302_FEC_RCV_RMT	ICB off direction execute command received from remote
8400021E21	S4302_FSC_RCV_LCD	ICB off direction select command received from LCD
8000021E01	S4302_FSC_RCV_RMT	ICB off direction select command received from remote

◆ Signal monitoring points for S43-ICB

SOFTSW(Function ID:522001)

Element ID	Name	Description
8D00021E73	S4302_FSD_CSF	ICB off direction selected condition signal by fixedlogic
8200021E44	S4302_FSE_RCV	ICB off direction select and execute command received
8E00021E78	S4302_FSF_CSF	ICB off direction select fail condition signal by fixedlogic
8A00021E40	S4302_NSC_RCV	ICB no direction select command received
8100021E20	S4302_NSC_RCV_LCD	ICB no direction select command received from LCD
8000021E00	S4302_NSC_RCV_RMT	ICB no direction select command received from remote
8100021E86	S4302_OCF_FCT_EIS	ICB on direction execute command fail factor signal
8900021F47	S4302_OEC_CHG	ICB on direction change signal
8000021E82	S4302_OEC_OK_CSF	ICB on direction execute success signal
8B00021E48	S4302_OEC_RCV	ICB on direction execute command received
8100021E25	S4302_OEC_RCV_LCD	ICB on direction execute command received from LCD
8700021E12	S4302_OEC_RCV_RMT	ICB on direction execute command received from remote
8000021E22	S4302_OSC_RCV_LCD	ICB on direction select command received from LCD
8200021E03	S4302_OSC_RCV_RMT	ICB on direction select command received from remote
8F00021E74	S4302_OSD_CSF	ICB on direction selected condition signal by fixedlogic
8000021E45	S4302_OSE_RCV	ICB on direction select and execute command received
8F00021E79	S4302_OSF_CSF	ICB on direction select fail condition signal by fixedlogic
8F00021E0A	S4302_SBO_RMT	ICB select before operate control setting received by remote
8B00021F43	S4302_SC_LCD	ICB select command from LCD
8400021F42	S4302_SC_RMT	ICB select command from REMOTE
8000021E7B	S4302_SC_ST_ERR	ICB select command mode error
8000021E76	S4302_SLD_CS	ICB selected condition signal
8E00021F40	S4302_SLD_TM0	ICB time limit over of select complete
8100021E84	S4302_SLF_CS	ICB select fail condition signal
8700021E97	S4302_SLF_FCT_EIS	ICB select fail factor signal except check
8100021F46	S4302_SLR_CSF	ICB select cancel factor

◆ Signal monitoring points for S43-SCB

SOFTSW(Function ID:522001)

Element ID	Name	Description
8100031EC0	S4303_CBKEN	SCB control command block switch Enable
8500031E94	S4303_CC_EX	SCB cancel command execute
8700031E96	S4303_CC_FS	SCB cancel fail signal
8600031E95	S4303_CC_SS	SCB cancel success signal
8800031E9B	S4303_CC_ST_ERR	SCB cancel command mode error
8B00031EA2	S4303_CTR_SGU	SCB control logic stage(under selection)
8F00031E0B	S4303_DIR_RMT	SCB direct operate control setting received by remote
8C00031F45	S4303_EC_LCD	SCB execute command from LCD
8500031F44	S4303_EC_RMT	SCB execute command from REMOTE
8100031E85	S4303_ECF_FCT_EIS	SCB off direction execute command fail factor signal
8000031E8B	S4303_ECF_FCT_FLG	SCB execute command mode error
8000031E93	S4303_EX_CMP	SCB execute complete signal
8F00031F41	S4303_EX_CMP_TM0	SCB time limit over of execute complete
8800031E92	S4303_EX_FS	SCB execute fail signal
8700031E90	S4303_EX_SS	SCB execute success signal

◆ Signal monitoring points for S43-SCB

SOFTSW(Function ID:522001)

Element ID	Name	Description
8A00031F48	S4303_FEC_CHG	SCB off direction change signal
8000031E81	S4303_FEC_OK_CSF	SCB off direction execute success signal
8A00031E47	S4303_FEC_RCV	SCB off direction execute command received
8500031E24	S4303_FEC_RCV_LCD	SCB off direction execute command received from LCD
8300031E10	S4303_FEC_RCV_RMT	SCB off direction execute command received from remote
8400031E21	S4303_FSC_RCV_LCD	SCB off direction select command received from LCD
8000031E01	S4303_FSC_RCV_RMT	SCB off direction select command received from remote
8D00031E73	S4303_FSD_CSF	SCB off direction selected condition signal by fixedlogic
8200031E44	S4303_FSE_RCV	SCB off direction select and execute command received
8E00031E78	S4303_FSF_CSF	SCB off direction select fail condition signal by fixedlogic
8A00031E40	S4303_NSC_RCV	SCB no direction select command received
8100031E20	S4303_NSC_RCV_LCD	SCB no direction select command received from LCD
8000031E00	S4303_NSC_RCV_RMT	SCB no direction select command received from remote
8100031E86	S4303_OCF_FCT_EIS	SCB on direction execute command fail factor signal
8900031F47	S4303_OEC_CHG	SCB on direction change signal
8000031E82	S4303_OEC_OK_CSF	SCB on direction execute success signal
8B00031E48	S4303_OEC_RCV	SCB on direction execute command received
8100031E25	S4303_OEC_RCV_LCD	SCB on direction execute command received from LCD
8700031E12	S4303_OEC_RCV_RMT	SCB on direction execute command received from remote
8000031E22	S4303_OSC_RCV_LCD	SCB on direction select command received from LCD
8200031E03	S4303_OSC_RCV_RMT	SCB on direction select command received from remote
8F00031E74	S4303_OSD_CSF	SCB on direction selected condition signal by fixedlogic
8000031E45	S4303_OSE_RCV	SCB on direction select and execute command received
8F00031E79	S4303_OSF_CSF	SCB on direction select fail condition signal by fixedlogic
8F00031E0A	S4303_SBO_RMT	SCB select before operate control setting received by remote
8B00031F43	S4303_SC_LCD	SCB select command from LCD
8400031F42	S4303_SC_RMT	SCB select command from REMOTE
8000031E7B	S4303_SC_ST_ERR	SCB select command mode error
8000031E76	S4303_SLD_CS	SCB selected condition signal
8E00031F40	S4303_SLD_TM0	SCB time limit over of select complete
8100031E84	S4303_SLF_CS	SCB select fail condition signal
8700031E97	S4303_SLF_FCT_EIS	SCB select fail factor signal except check
8100031F46	S4303_SLR_CSF	SCB select cancel factor

◆ Signal monitoring points for S43-01

SOFTSW(Function ID:522001)

Element ID	Name	Description
8100041EC0	S4304_CBKEN	S43-01 control command block switch Enable
8500041E94	S4304_CC_EX	S43-01 cancel command execute
8700041E96	S4304_CC_FS	S43-01 cancel fail signal
8600041E95	S4304_CC_SS	S43-01 cancel success signal
8800041E9B	S4304_CC_ST_ERR	S43-01 cancel command mode error
8B00041EA2	S4304_CTR_SGU	S43-01 control logic stage(under selection)
8F00041E0B	S4304_DIR_RMT	S43-01 direct operate control setting received by remote
8C00041F45	S4304_EC_LCD	S43-01 execute command from LCD

◆ Signal monitoring points for S43-01

SOFTSW(Function ID:522001)

Element ID	Name	Description
8500041F44	S4304_EC_RMT	S43-01 execute command from REMOTE
8100041E85	S4304_ECF_FCT_EIS	S43-01 off direction execute command fail factor signal
8000041E8B	S4304_ECF_FCT_FLG	S43-01 execute command mode error
8000041E93	S4304_EX_CMP	S43-01 execute complete signal
8F00041F41	S4304_EX_CMP_TM0	S43-01 time limit over of execute complete
8800041E92	S4304_EX_FS	S43-01 execute fail signal
8700041E90	S4304_EX_SS	S43-01 execute success signal
8A00041F48	S4304_FEC_CHG	S43-01 off direction change signal
8000041E81	S4304_FEC_OK_CSF	S43-01 off direction execute success signal
8A00041E47	S4304_FEC_RCV	S43-01 off direction execute command received
8500041E24	S4304_FEC_RCV_LCD	S43-01 off direction execute command received from LCD
8300041E10	S4304_FEC_RCV_RMT	S43-01 off direction execute command received from remote
8400041E21	S4304_FSC_RCV_LCD	S43-01 off direction select command received from LCD
8000041E01	S4304_FSC_RCV_RMT	S43-01 off direction select command received from remote
8D00041E73	S4304_FSD_CSF	S43-01 off direction selected condition signal by fixedlogic
8200041E44	S4304_FSE_RCV	S43-01 off direction select and execute command received
8E00041E78	S4304_FSF_CSF	S43-01 off direction select fail condition signal by fixedlogic
8A00041E40	S4304_NSC_RCV	S43-01 no direction select command received
8100041E20	S4304_NSC_RCV_LCD	S43-01 no direction select command received from LCD
8000041E00	S4304_NSC_RCV_RMT	S43-01 no direction select command received from remote
8100041E86	S4304_OCF_FCT_EIS	S43-01 on direction execute command fail factor signal
8900041F47	S4304_OEC_CHG	S43-01 on direction change signal
8000041E82	S4304_OEC_OK_CSF	S43-01 on direction execute success signal
8B00041E48	S4304_OEC_RCV	S43-01 on direction execute command received
8100041E25	S4304_OEC_RCV_LCD	S43-01 on direction execute command received from LCD
8700041E12	S4304_OEC_RCV_RMT	S43-01 on direction execute command received from remote
8000041E22	S4304_OSC_RCV_LCD	S43-01 on direction select command received from LCD
8200041E03	S4304_OSC_RCV_RMT	S43-01 on direction select command received from remote
8F00041E74	S4304_OSD_CSF	S43-01 on direction selected condition signal by fixedlogic
8000041E45	S4304_OSE_RCV	S43-01 on direction select and execute command received
8F00041E79	S4304_OSF_CSF	S43-01 on direction select fail condition signal by fixedlogic
8F00041E0A	S4304_SBO_RMT	S43-01 select before operate control setting received by remote
8B00041F43	S4304_SC_LCD	S43-01 select command from LCD
8400041F42	S4304_SC_RMT	S43-01 select command from REMOTE
8000041E7B	S4304_SC_ST_ERR	S43-01 select command mode error
8000041E76	S4304_SLD_CS	S43-01 selected condition signal
8E00041F40	S4304_SLD_TM0	S43-01 time limit over of select complete
8100041E84	S4304_SLF_CS	S43-01 select fail condition signal
8700041E97	S4304_SLF_FCT_EIS	S43-01 select fail factor signal except check
8100041F46	S4304_SLR_CSF	S43-01 select cancel factor

◆ Signal monitoring points for S43-02

SOFTSW(Function ID:522001)

Element ID	Name	Description
8100051EC0	S4305_CBKEN	SOFT 43 switch2 control command block switch Enable

◆ Signal monitoring points for S43-02

SOFTSW(Function ID:522001)

Element ID	Name	Description
8500051E94	S4305_CC_EX	SOFT 43 switch2 cancel command execute
8700051E96	S4305_CC_FS	S43-02 cancel fail signal
8600051E95	S4305_CC_SS	S43-02 cancel success signal
8800051E9B	S4305_CC_ST_ERR	S43-02 cancel command mode error
8B00051EA2	S4305_CTR_SGU	S43-02 control logic stage(under selection)
8F00051E0B	S4305_DIR_RMT	S43-02 direct operate control setting received by remote
8C00051F45	S4305_EC_LCD	S43-02 execute command from LCD
8500051F44	S4305_EC_RMT	S43-02 execute command from REMOTE
8100051E85	S4305_ECF_FCT_EIS	S43-02 off direction execute command fail factor signal
8000051E8B	S4305_ECF_FCT_FLG	S43-02 execute command mode error
8000051E93	S4305_EX_CMP	S43-02 execute complete signal
8F00051F41	S4305_EX_CMP_TM0	S43-02 time limit over of execute complete
8800051E92	S4305_EX_FS	S43-02 execute fail signal
8700051E90	S4305_EX_SS	S43-02 execute success signal
8A00051F48	S4305_FEC_CHG	S43-02 off direction change signal
8000051E81	S4305_FEC_OK_CSF	S43-02 off direction execute success signal
8A00051E47	S4305_FEC_RCV	S43-02 off direction execute command received
8500051E24	S4305_FEC_RCV_LCD	S43-02 off direction execute command received from LCD
8300051E10	S4305_FEC_RCV_RMT	S43-02 off direction execute command received from remote
8400051E21	S4305_FSC_RCV_LCD	S43-02 off direction select command received from LCD
8000051E01	S4305_FSC_RCV_RMT	S43-02 off direction select command received from remote
8D00051E73	S4305_FSD_CSF	S43-02 off direction selected condition signal by fixedlogic
8200051E44	S4305_FSE_RCV	S43-02 off direction select and execute command received
8E00051E78	S4305_FSF_CSF	S43-02 off direction select fail condition signal by fixedlogic
8A00051E40	S4305_NSC_RCV	S43-02 no direction select command received
8100051E20	S4305_NSC_RCV_LCD	S43-02 no direction select command received from LCD
8000051E00	S4305_NSC_RCV_RMT	S43-02 no direction select command received from remote
8100051E86	S4305_OCF_FCT_EIS	S43-02 on direction execute command fail factor signal
8900051F47	S4305_OEC_CHG	S43-02 on direction change signal
8000051E82	S4305_OEC_OK_CSF	S43-02 on direction execute success signal
8B00051E48	S4305_OEC_RCV	S43-02 on direction execute command received
8100051E25	S4305_OEC_RCV_LCD	S43-02 on direction execute command received from LCD
8700051E12	S4305_OEC_RCV_RMT	S43-02 on direction execute command received from remote
8000051E22	S4305_OSC_RCV_LCD	S43-02 on direction select command received from LCD
8200051E03	S4305_OSC_RCV_RMT	S43-02 on direction select command received from remote
8F00051E74	S4305_OSD_CSF	S43-02 on direction selected condition signal by fixedlogic
8000051E45	S4305_OSE_RCV	S43-02 on direction select and execute command received
8F00051E79	S4305_OSF_CSF	S43-02 on direction select fail condition signal by fixedlogic
8F00051E0A	S4305_SBO_RMT	S43-02 select before operate control setting received by remote
8B00051F43	S4305_SC_LCD	S43-02 select command from LCD
8400051F42	S4305_SC_RMT	S43-02 select command from REMOTE
8000051E7B	S4305_SC_ST_ERR	S43-02 select command mode error
8000051E76	S4305_SLD_CS	S43-02 selected condition signal
8E00051F40	S4305_SLD_TM0	S43-02 time limit over of select complete
8100051E84	S4305_SLF_CS	S43-02 select fail condition signal

◆ Signal monitoring points for S43-02

SOFTSW(Function ID:522001)

Element ID	Name	Description
8700051E97	S4305_SLF_FCT_EIS	S43-02 select fail factor signal except check
8100051F46	S4305_SLR_CSF	S43-02 select cancel factor

◆ Signal monitoring points for S43-03

SOFTSW(Function ID:522001)

Element ID	Name	Description
8100061EC0	S4306_CBKEN	S43-03 control command block switch Enable
8500061E94	S4306_CC_EX	S43-03 cancel command execute
8700061E96	S4306_CC_FS	S43-03 cancel fail signal
8600061E95	S4306_CC_SS	S43-03 cancel success signal
8800061E9B	S4306_CC_ST_ERR	S43-03 cancel command mode error
8B00061EA2	S4306_CTR_SGU	S43-03 control logic stage(under selection)
8F00061E0B	S4306_DIR_RMT	S43-03 direct operate control setting received by remote
8C00061F45	S4306_EC_LCD	S43-03 execute command from LCD
8500061F44	S4306_EC_RMT	S43-03 execute command from REMOTE
8100061E85	S4306_ECF_FCT_EIS	S43-03 off direction execute command fail factor signal
8000061E8B	S4306_ECF_FCT_FLG	S43-03 execute command mode error
8000061E93	S4306_EX_CMP	S43-03 execute complete signal
8F00061F41	S4306_EX_CMP_TM0	S43-03 time limit over of execute complete
8800061E92	S4306_EX_FS	S43-03 execute fail signal
8700061E90	S4306_EX_SS	S43-03 execute success signal
8A00061F48	S4306_FEC_CHG	S43-03 off direction change signal
8000061E81	S4306_FEC_OK_CSF	S43-03 off direction execute success signal
8A00061E47	S4306_FEC_RCV	S43-03 off direction execute command received
8500061E24	S4306_FEC_RCV_LCD	S43-03 off direction execute command received from LCD
8300061E10	S4306_FEC_RCV_RMT	S43-03 off direction execute command received from remote
8400061E21	S4306_FSC_RCV_LCD	S43-03 off direction select command received from LCD
8000061E01	S4306_FSC_RCV_RMT	S43-03 off direction select command received from remote
8D00061E73	S4306_FSD_CSF	S43-03 off direction selected condition signal by fixedlogic
8200061E44	S4306_FSE_RCV	S43-03 off direction select and execute command received
8E00061E78	S4306_FSF_CSF	S43-03 off direction select fail condition signal by fixedlogic
8A00061E40	S4306_NSC_RCV	S43-03 no direction select command received
8100061E20	S4306_NSC_RCV_LCD	S43-03 no direction select command received from LCD
8000061E00	S4306_NSC_RCV_RMT	S43-03 no direction select command received from remote
8100061E86	S4306_OCF_FCT_EIS	S43-03 on direction execute command fail factor signal
8900061F47	S4306_OEC_CHG	S43-03 on direction change signal
8000061E82	S4306_OEC_OK_CSF	S43-03 on direction execute success signal
8B00061E48	S4306_OEC_RCV	S43-03 on direction execute command received
8100061E25	S4306_OEC_RCV_LCD	S43-03 on direction execute command received from LCD
8700061E12	S4306_OEC_RCV_RMT	S43-03 on direction execute command received from remote
8000061E22	S4306_OSC_RCV_LCD	S43-03 on direction select command received from LCD
8200061E03	S4306_OSC_RCV_RMT	S43-03 on direction select command received from remote
8F00061E74	S4306_OSD_CSF	S43-03 on direction selected condition signal by fixedlogic
8000061E45	S4306_OSE_RCV	S43-03 on direction select and execute command received
8F00061E79	S4306_OSF_CSF	S43-03 on direction select fail condition signal by fixedlogic

◆ Signal monitoring points for S43-03

SOFTSW(Function ID:522001)

Element ID	Name	Description
8F00061E0A	S4306_SBO_RMT	S43-03 select before operate control setting received by remote
8B00061F43	S4306_SC_LCD	S43-03 select command from LCD
8400061F42	S4306_SC_RMT	S43-03 select command from REMOTE
8000061E7B	S4306_SC_ST_ERR	S43-03 select command mode error
8000061E76	S4306_SLD_CS	S43-03 selected condition signal
8E00061F40	S4306_SLD_TM0	S43-03 time limit over of select complete
8100061E84	S4306_SLF_CS	S43-03 select fail condition signal
8700061E97	S4306_SLF_FCT_EIS	S43-03 select fail factor signal except check
8100061F46	S4306_SLR_CSF	S43-03 select cancel factor

◆ Signal monitoring points for S43-04

SOFTSW(Function ID:522001)

Element ID	Name	Description
8100071EC0	S4307_CBKEN	S43-04 control command block switch Enable
8500071E94	S4307_CC_EX	S43-04 cancel command execute
8700071E96	S4307_CC_FS	S43-04 cancel fail signal
8600071E95	S4307_CC_SS	S43-04 cancel success signal
8800071E9B	S4307_CC_ST_ERR	S43-04 cancel command mode error
8B00071EA2	S4307_CTR_SGU	S43-04 control logic stage(under selection)
8F00071E0B	S4307_DIR_RMT	S43-04 direct operate control setting received by remote
8C00071F45	S4307_EC_LCD	S43-04 execute command from LCD
8500071F44	S4307_EC_RMT	S43-04 execute command from REMOTE
8100071E85	S4307_ECF_FCT_EIS	S43-04 off direction execute command fail factor signal
8000071E8B	S4307_ECF_FCT_FLG	S43-04 execute command mode error
8000071E93	S4307_EX_CMP	S43-04 execute complete signal
8F00071F41	S4307_EX_CMP_TM0	S43-04 time limit over of execute complete
8800071E92	S4307_EX_FS	S43-04 execute fail signal
8700071E90	S4307_EX_SS	S43-04 execute success signal
8A00071F48	S4307_FEC_CHG	S43-04 off direction change signal
8000071E81	S4307_FEC_OK_CSF	S43-04 off direction execute success signal
8A00071E47	S4307_FEC_RCV	S43-04 off direction execute command received
8500071E24	S4307_FEC_RCV_LCD	S43-04 off direction execute command received from LCD
8300071E10	S4307_FEC_RCV_RMT	S43-04 off direction execute command received from remote
8400071E21	S4307_FSC_RCV_LCD	S43-04 off direction select command received from LCD
8000071E01	S4307_FSC_RCV_RMT	S43-04 off direction select command received from remote
8D00071E73	S4307_FSD_CSF	S43-04 off direction selected condition signal by fixedlogic
8200071E44	S4307_FSE_RCV	S43-04 off direction select and execute command received
8E00071E78	S4307_FSF_CSF	S43-04 off direction select fail condition signal by fixedlogic
8A00071E40	S4307_NSC_RCV	S43-04 no direction select command received
8100071E20	S4307_NSC_RCV_LCD	S43-04 no direction select command received from LCD
8000071E00	S4307_NSC_RCV_RMT	S43-04 no direction select command received from remote
8100071E86	S4307_OCF_FCT_EIS	S43-04 on direction execute command fail factor signal
8900071F47	S4307_OEC_CHG	S43-04 on direction change signal
8000071E82	S4307_OEC_OK_CSF	S43-04 on direction execute success signal
8B00071E48	S4307_OEC_RCV	S43-04 on direction execute command received

◆ Signal monitoring points for S43-04

SOFTSW(Function ID:522001)

Element ID	Name	Description
8100071E25	S4307_OEC_RCV_LCD	S43-04 on direction execute command received from LCD
8700071E12	S4307_OEC_RCV_RMT	S43-04 on direction execute command received from remote
8000071E22	S4307_OSC_RCV_LCD	S43-04 on direction select command received from LCD
8200071E03	S4307_OSC_RCV_RMT	S43-04 on direction select command received from remote
8F00071E74	S4307_OSD_CSF	S43-04 on direction selected condition signal by fixedlogic
8000071E45	S4307_OSE_RCV	S43-04 on direction select and execute command received
8F00071E79	S4307_OSF_CSF	S43-04 on direction select fail condition signal by fixedlogic
8F00071E0A	S4307_SBO_RMT	S43-04 select before operate control setting received by remote
8B00071F43	S4307_SC_LCD	S43-04 select command from LCD
8400071F42	S4307_SC_RMT	S43-04 select command from REMOTE
8000071E7B	S4307_SC_ST_ERR	S43-04 select command mode error
8000071E76	S4307_SLD_CS	S43-04 selected condition signal
8E00071F40	S4307_SLD_TM0	S43-04 time limit over of select complete
8100071E84	S4307_SLF_CS	S43-04 select fail condition signal
8700071E97	S4307_SLF_FCT_EIS	S43-04 select fail factor signal except check
8100071F46	S4307_SLR_CSF	S43-04 select cancel factor

◆ Signal monitoring points for S43-05

SOFTSW(Function ID:522001)

Element ID	Name	Description
8100081EC0	S4308_CBKEN	S43-05 control command block switch Enable
8500081E94	S4308_CC_EX	S43-05 cancel command execute
8700081E96	S4308_CC_FS	S43-05 cancel fail signal
8600081E95	S4308_CC_SS	S43-05 cancel success signal
8800081E9B	S4308_CC_ST_ERR	S43-05 cancel command mode error
8B00081EA2	S4308_CTR_SGU	S43-05 control logic stage(under selection)
8F00081E0B	S4308_DIR_RMT	S43-05 direct operate control setting received by remote
8C00081F45	S4308_EC_LCD	S43-05 execute command from LCD
8500081F44	S4308_EC_RMT	S43-05 execute command from REMOTE
8100081E85	S4308_ECF_FCT_EIS	S43-05 off direction execute command fail factor signal
8000081E8B	S4308_ECF_FCT_FLG	S43-05 execute command mode error
8000081E93	S4308_EX_CMP	S43-05 execute complete signal
8F00081F41	S4308_EX_CMP_TM0	S43-05 time limit over of execute complete
8800081E92	S4308_EX_FS	S43-05 execute fail signal
8700081E90	S4308_EX_SS	S43-05 execute success signal
8A00081F48	S4308_FEC_CHG	S43-05 off direction change signal
8000081E81	S4308_FEC_OK_CSF	S43-05 off direction execute success signal
8A00081E47	S4308_FEC_RCV	S43-05 off direction execute command received
8500081E24	S4308_FEC_RCV_LCD	S43-05 off direction execute command received from LCD
8300081E10	S4308_FEC_RCV_RMT	S43-05 off direction execute command received from remote
8400081E21	S4308_FSC_RCV_LCD	S43-05 off direction select command received from LCD
8000081E01	S4308_FSC_RCV_RMT	S43-05 off direction select command received from remote
8D00081E73	S4308_FSD_CSF	S43-05 off direction selected condition signal by fixedlogic
8200081E44	S4308_FSE_RCV	S43-05 off direction select and execute command received
8E00081E78	S4308_FSF_CSF	S43-05 off direction select fail condition signal by fixedlogic

◆ Signal monitoring points for S43-05

SOFTSW(Function ID:522001)

Element ID	Name	Description
8A00081E40	S4308_NSC_RCV	S43-05 no direction select command received
8100081E20	S4308_NSC_RCV_LCD	S43-05 no direction select command received from LCD
8000081E00	S4308_NSC_RCV_RMT	S43-05 no direction select command received from remote
8100081E86	S4308_OCF_FCT_EIS	S43-05 on direction execute command fail factor signal
8900081F47	S4308_OEC_CHG	S43-05 on direction change signal
8000081E82	S4308_OEC_OK_CSF	S43-05 on direction execute success signal
8B00081E48	S4308_OEC_RCV	S43-05 on direction execute command received
8100081E25	S4308_OEC_RCV_LCD	S43-05 on direction execute command received from LCD
8700081E12	S4308_OEC_RCV_RMT	S43-05 on direction execute command received from remote
8000081E22	S4308_OSC_RCV_LCD	S43-05 on direction select command received from LCD
8200081E03	S4308_OSC_RCV_RMT	S43-05 on direction select command received from remote
8F00081E74	S4308_OSD_CSF	S43-05 on direction selected condition signal by fixedlogic
8000081E45	S4308_OSE_RCV	S43-05 on direction select and execute command received
8F00081E79	S4308_OSF_CSF	S43-05 on direction select fail condition signal by fixedlogic
8F00081E0A	S4308_SBO_RMT	S43-05 select before operate control setting received by remote
8B00081F43	S4308_SC_LCD	S43-05 select command from LCD
8400081F42	S4308_SC_RMT	S43-05 select command from REMOTE
8000081E7B	S4308_SC_ST_ERR	S43-05 select command mode error
8000081E76	S4308_SLD_CS	S43-05 selected condition signal
8E00081F40	S4308_SLD_TM0	S43-05 time limit over of select complete
8100081E84	S4308_SLF_CS	S43-05 select fail condition signal
8700081E97	S4308_SLF_FCT_EIS	S43-05 select fail factor signal except check
8100081F46	S4308_SLR_CSF	S43-05 select cancel factor

2.18 Operation time reset controller (OPTR)

As shown in Figure 2.18-1, all operation-times measured by the DPOS, DPSY, and TPOS functions† can be cleared when the operation time reset controller (OPTR) function issues a reset command "OPTR01_RST_CMD". That is, within the respective functions the measured time intervals (OT1 and the others‡) are entirely cleared upon occurrence of the reset command.

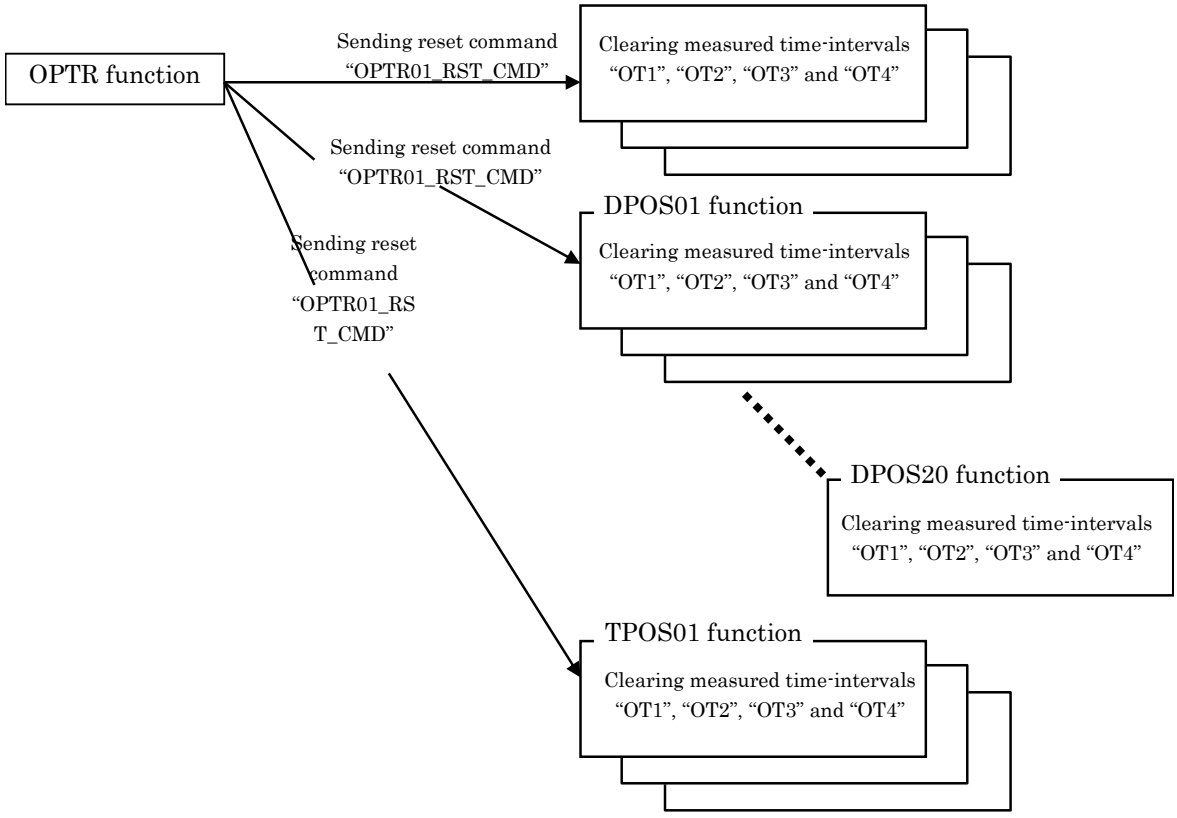


Figure 2.18-1 Reception of a reset command

†Note: For more information with regard to measurement, refer to the section "Measurement of operation intervals" for the respective DPOS, DPSY, and TPOS functions. The user should note that all interval OTs specific to a particular function are cleared by the OPTR reset command.

‡Note: The measurements in the DPOS and the DPSY functions are grouped into four intervals in each respective device. Measurement is possible by sensing the device events. The measured intervals are accumulated; they are grouped into four intervals (OT1–OT4), which the user can monitor from the IED screen. Figure 2.18-2 and Figure 2.18-3 exemplify the four intervals upon occurrence of On (Closing)-control event and Off (Open)-control event, provided that the DPOS function operates.

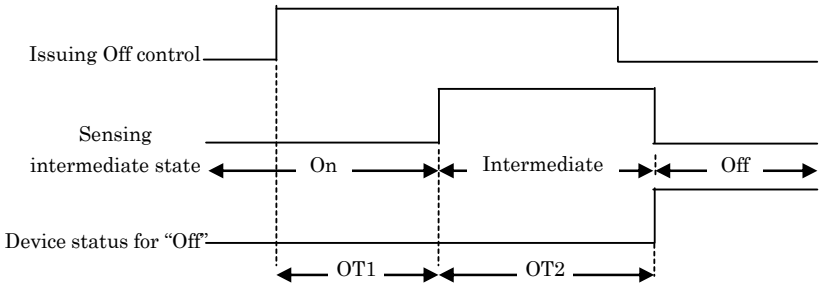


Figure 2.18-2 Two intervals (OT1 and OT2) for Off-control event

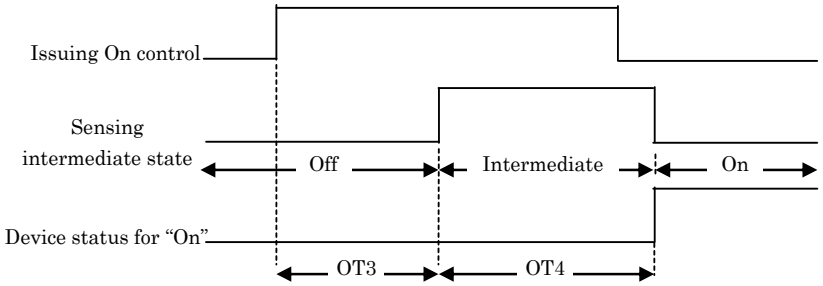


Figure 2.18-3 Two intervals (OT3 and OT4) for On-control event

Tips: If the user wishes to implement the OPTR function quickly, go to section 2.18.4, which discusses how to map signal-points for the IEC 61850 communication.

Note: The implementation of particular features is dependent upon the selection of hardware and the configuration of functions. Several IED models do not support certain features. To determine whether a particular feature has been implemented within an IED, identify the IED ordering number; and check the order number at the "G&T position" whilst referring to the comparison table below. For more information, see *Appendix: Ordering*.

Table 2.18-1 Comparative table in respective ordering numbers

Sec.	Feature	Ordering No. at "G&T"					
		BCU			BCPU		IFU
		11	13	1F	2N	2C	19
–	Main features	✓	✓	✓	✓	✓	NA

✓: Applicable NA: Not applicable

2.18.1 Select logic for SBO/DIR modes

The user should set the scheme switch [**OPTR01-EN**] to **On** prior to the OPTR operation. Figure 2.18-4 shows select logic in the OPTR function.

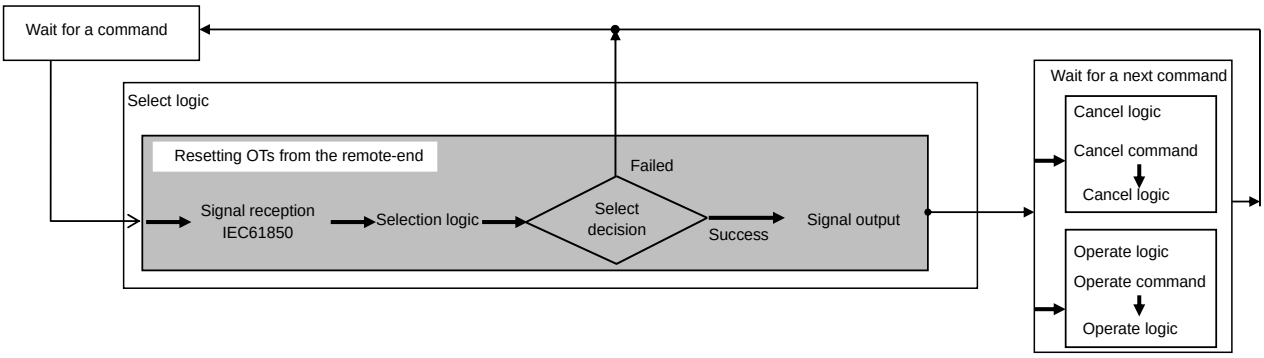


Figure 2.18-4 Outline of select command for resetting

(i) Input point required mapping

Figure 2.18-5 shows the select logic when a "Select command (Reset)" signal enters the OPTR function. The logic has the input-point "OPTR01_CONTROL_REQ" for the reception. That is, the input-point should be mapped for the IEC61850 communication. The function encounters an operation failure if mapping is not performed correctly. We discuss how to map the input-points for the IEC61850 communication in section 2.18.4.

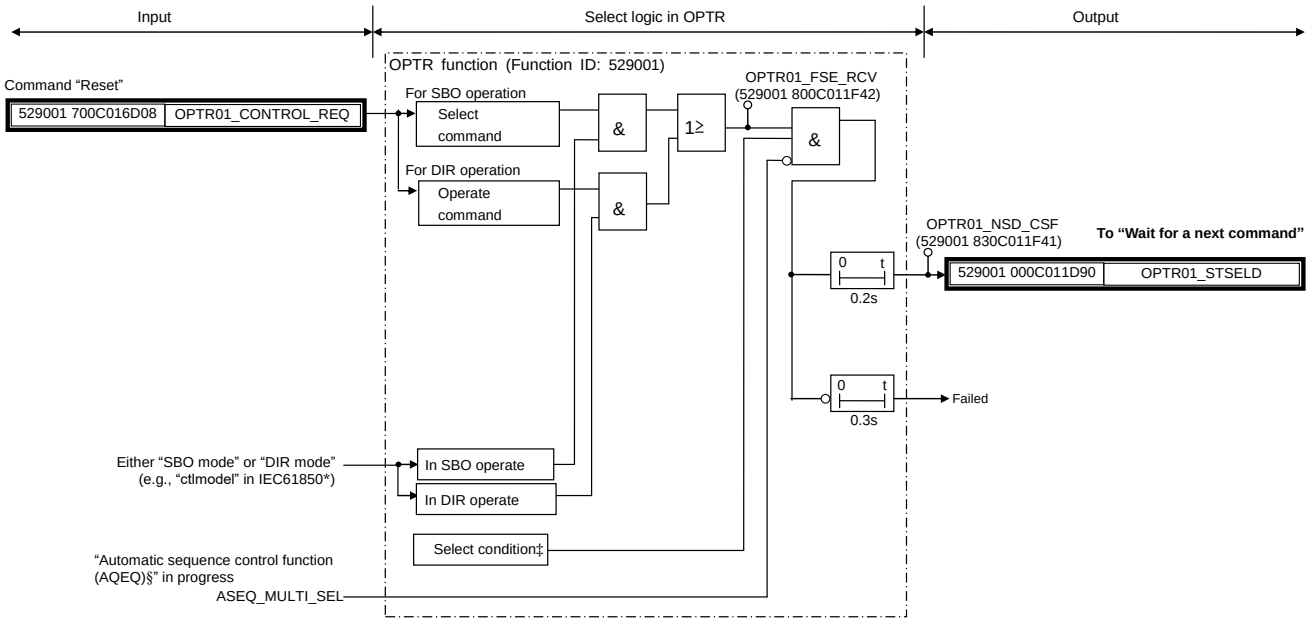


Figure 2.18-5 Select logic for resetting intervals OT1 to OT4

‡Note: A "select condition" signal is provided from the select condition scheme. For more information, see Figure 2.18-6.

§Note: An automatic sequence control (ASEQ) function can provide sequential signals for the automatic control. The OPTR operation is blocked for the ASEQ function being in the operation. For more information of the ASEQ function, see Chapter *Control and monitoring application: Automatic sequence control function*.

*Note: The OPTR function can run on either "the SBO mode" or "the DIR mode" using a signal "ctlmodel" when the communication is carried out in the IEC61850; thus, mapping is required for the IEC61850 communication.

(ii) Output signal required to map

The OPTR function can issue a "Select success" signal at the output point "OPTR01_NSD_CSF", when the OPTR function can decide that the input signal "Select command (Reset)" is true. If the OPTR function decides that the "Select command (Reset)" is not true, the OPTR function returns to the "Wait for a command" stage.

(iii) Select condition

Figure 2.18-6 shows the select condition logic in the OPTR function.

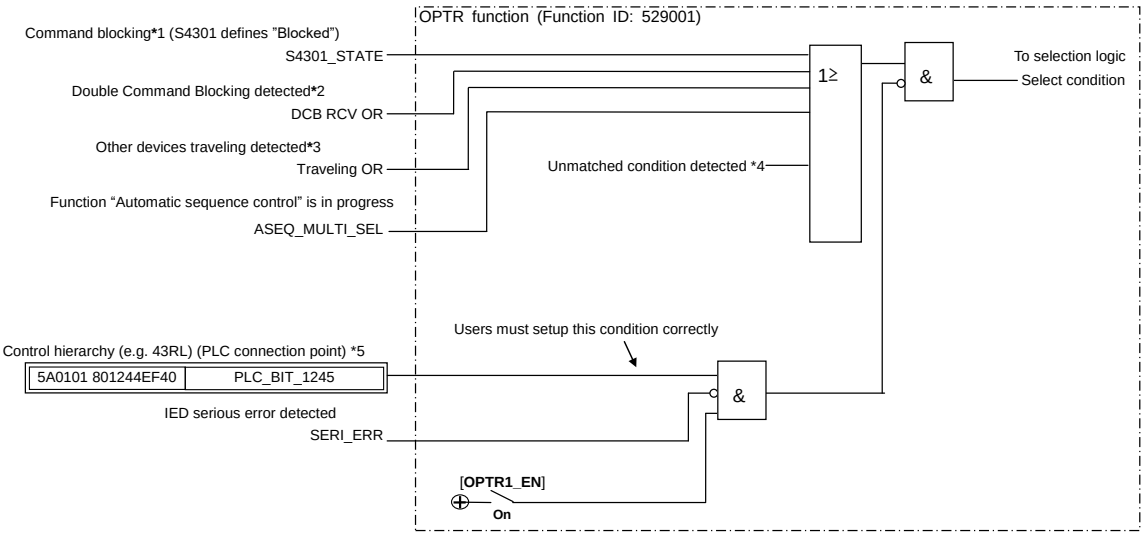


Figure 2.18-6 Select condition logic in the OPTR function*6

*1Note: The "command blocking" disables any operation except for itself: the "command blocking" is stated with "S4301" in a software controller (SOFTSW). The IEC61850 defines the "command blocking" as "CmdBlk". For more information on S4301, see Chapter *Control and monitoring application: Software switch control function*. See the signal "S4301_STATE" of Table 2.18-2.

*2Note: "Double Command Blocking (DCB)" is operation philosophy in the common control function (CMNCTRL). It can be used to protect the substation. The user should program it using the GR-TIEMS. The DCB operating signal is denoted as "DCB RCV_OR in Table 2.18-2. For more information, see Chapter *Control and monitoring application: Common controls*.

*3Note: If events "device-travelling" are detected in the CMNCTRL function, we can see that some statuses of the devices are being changed by other operators. Thus, the IED should stop any operation while the events are being detected. The detecting signal is denoted by "Traveling OR" in Table 2.18-2.

*4Note: Criteria “unmatched conditions” are decided when “Test-bit status” in a command is not identical to “IED test status”.

*5Note: The user should program the PLC logic “Control hierarchy condition”. The user should connect its condition with the select condition logic using the connection point “PLC_BIT_1245”. For more information, see chapter *Control and monitoring application: Control hierarchy*. “PLC_BIT_1245” is provided in Table 2.18-3.

*6Note: To know the input point of the OPTR function, see Table 2.18-3.

Table 2.18-2 Input signal for condition logic

Signal Number	Signal Name	Description	M/O
522001 000A011001	S4301_STATE	Command Blocking status (Off / Blocked)	N/A
5A0001 0008001F41	DCB RCV OR	Double Command Blocking(DCB) is in progress.	N/A
5A0001 0008001F40	Traveling OR	Travelling events are detected.	N/A
5A0101 3100001F43	SERI_ERR	Serious Error detected	N/A
523001 000D001F40	ASEQ_MULTI_SEL	Automatic sequence control is in progress.	N/A

Table 2.18-3 PLC connection point (Input point on select condition logic)

Signal Number	Signal Name	Description	M/O
5A0101 801244EF40	PLC_BIT_1245	OPTR control hierarchy	M

Table 2.18-4 Setting of the OPTR function

Setting Name	Description	Default	Setting item or value
OPTR01_EN	Enabling the OPTR function	On	Off / On

2.18.2 Cancel logic in SBO mode

In the SBO control mode the reception of the cancel command is possible when the cancel conditions are satisfied. Accordingly, the function can discard the select command; finally, the operation returns to the initial stage (i.e., "Wait for a command".)

(i) Receiving "Cancel" from the remote-end

Figure 2.18-7 outlines the reception of the cancel command from the remote end.

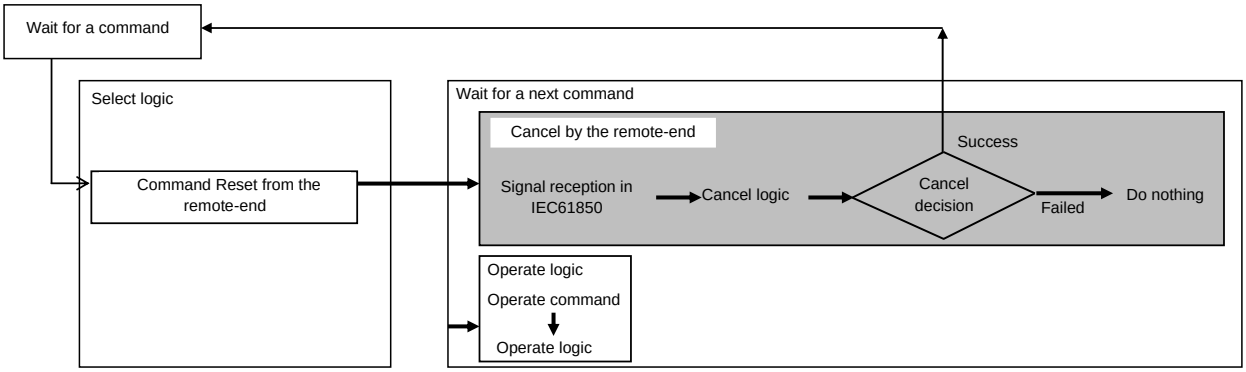


Figure 2.18-7 Outline of cancel command from the remote-end

(ii) Input point required mapping

Figure 2.18-8 shows the cancel logic when a "Cancel command (Remote-Cancel)" signal enters the OPTR function. The input-point "OPTR01_CONTROL_REQ" is the same point of the Figure 2.18-5.

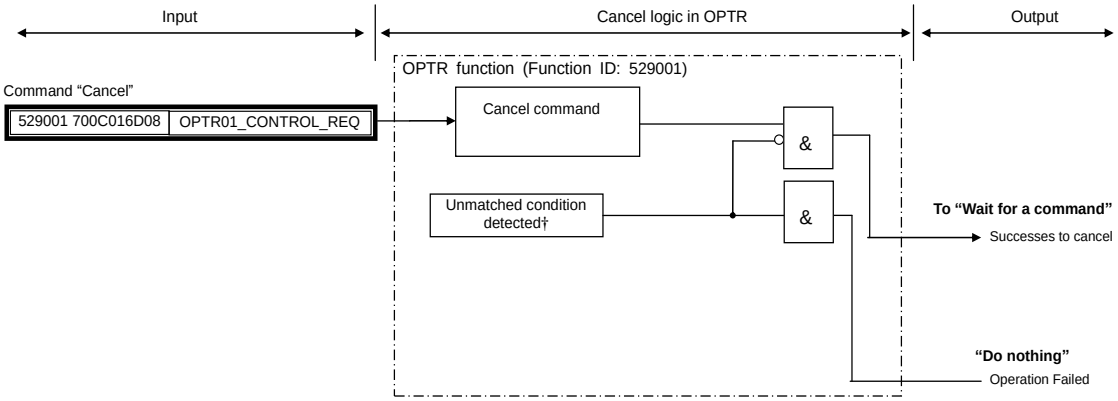


Figure 2.18-8 Cancel from the remote-end

†Note:The criteria "unmatched conditions" are determined when "Test-bit status" in a command is not identical to "IED test status".

2.18.3 Operate logic for SBO/DIR modes

After the completion of the operation of the select logic, the operate logic enters to clear all interval OTs.

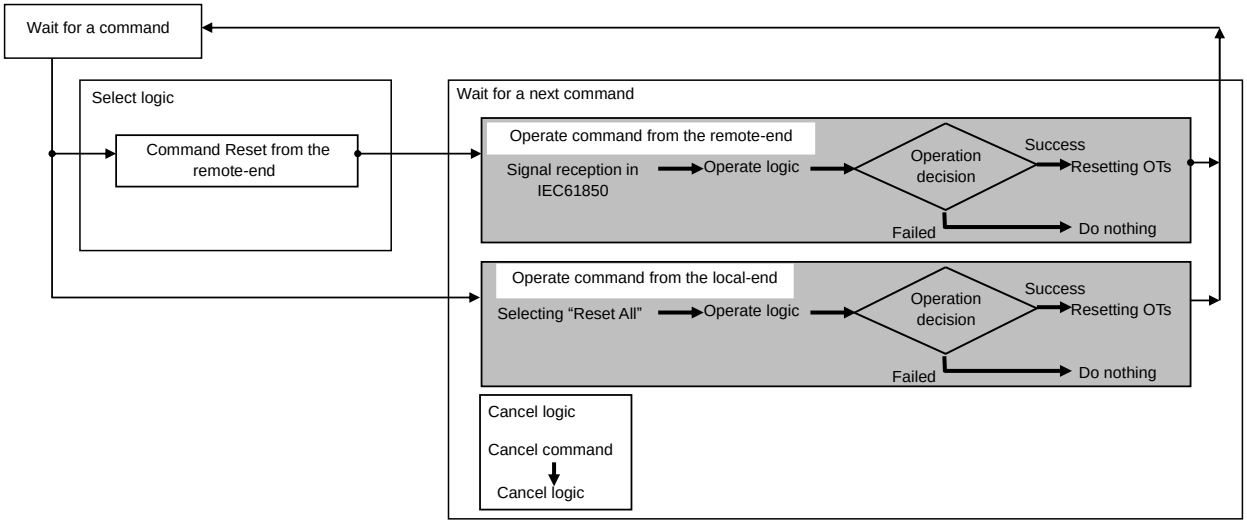


Figure 2.18-9 Outline of operate command for resetting intervals OT1 to OT4

(i) Input signal required mapping

Figure 2.18-10 shows the operate logic when an "Operation command (Reset)" signal enters the OPTR function. The input-point "OPTR_CONTROL_REQ" is used for the reception of the "Operation command (Reset)" signal, which is the same point of the select logic.

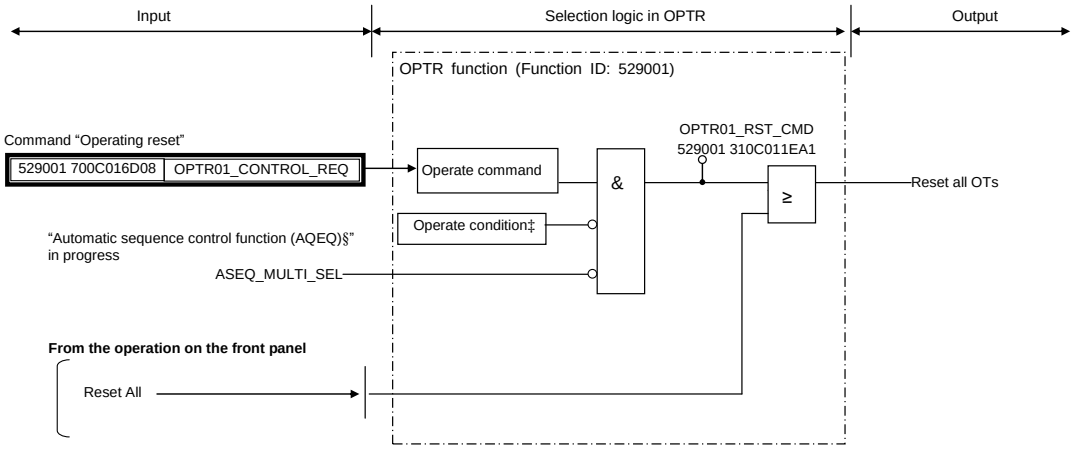


Figure 2.18-10 Operate logic for resetting intervals OT1 to OT4

(ii) Output signal required to map

The operate logic issues a "OPRT_RST_CMD" signal to clear all intervals OT1 to OT4. The signal "OTS_RST_CMD" can be transferred to the remote-end, when mapping the signal is carried out in the IEC61850 communication. (See section 2.18.4)

(iii) Operate condition

Figure 2.18-11 shows the operate condition logic of the OPTR function, which is used to examine a reset-condition in the OPRT function.

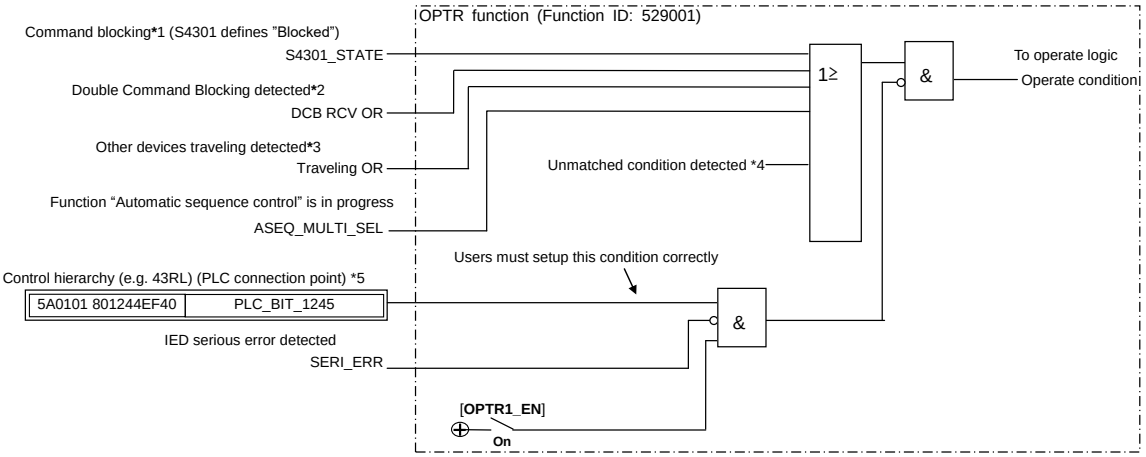


Figure 2.18-11 Operate condition logic in OPTR

*1to5Note: The signals and settings of the Figure 2.18-11 are same as the ones of the Figure 2.18-6.

2.18.4 Mapping for IEC61850 communication

The user can operate the OPTR function over the IEC61850 communication after the mapping using the GR-TIEMS. Note that the OPTR function is designed for “Single Point Controller (SPC) class” in the IEC61850 communication. The user should follow steps:

Step1: Editing Logical Node

Step2: Mapping output data

Step3: Mapping input data

(i) Editing Logical Node

The user should make a logical node (LN) for the OPTR function. Figure 2.18-12 exemplifies LN editing; the LN “General Input / Output (GGIO)” is chosen for the OPTR function. After the user defining an object “SPCSO”, the OPTR logical node can be saved with the name “GIGO” plus “LN Instance”. Make a definition of the object “SPCSO” in the OPTR logical node. “Either the SBO mode or the DIR mode can be chosen in the LN editing.

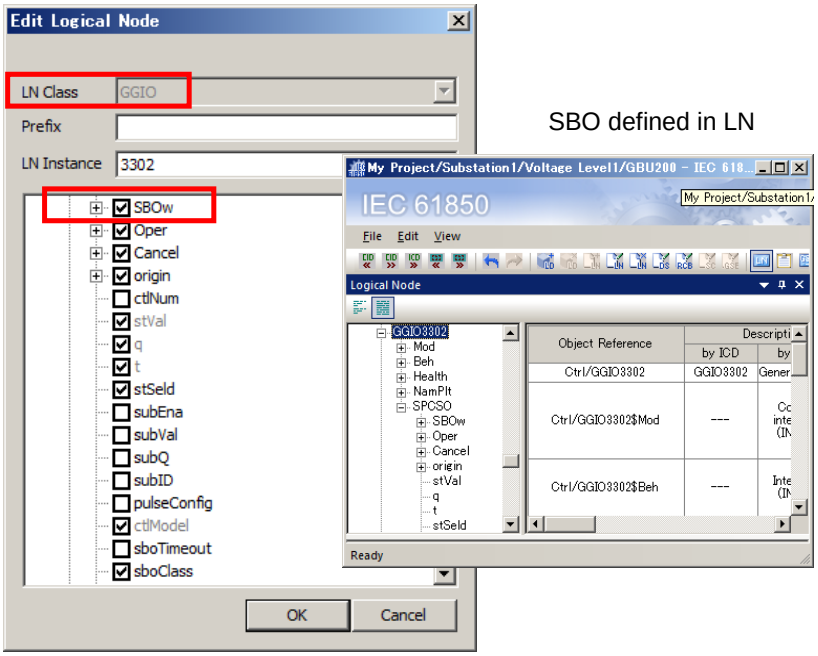
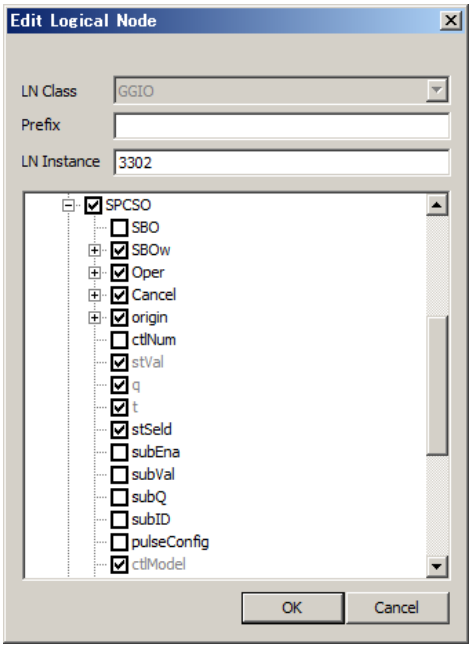


Figure 2.18-12 Defining “SPCSO” object in GIGO3302 logic node

(i)-1 Defining SBO mode

Figure 2.18-13 exemplifies the OPTR logic node saved as “GGIO3302”. In the SBO mode, the user should select the following items for the “GGIO3302$SCPSO” using the GR-TIEMS:



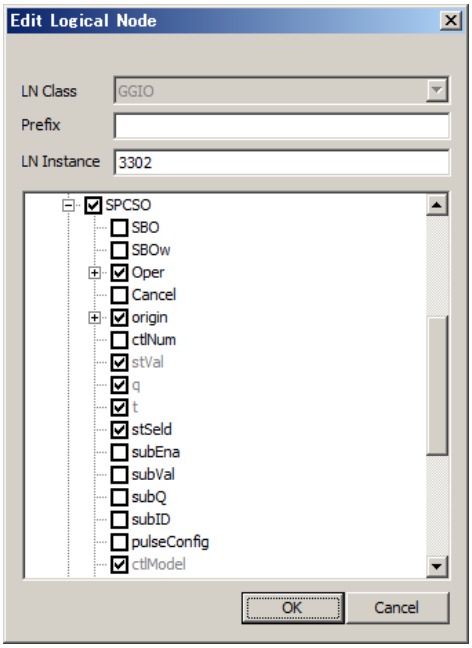
- ✓ SBOw
- ✓ Oper
- ✓ Cancel
- ✓ Origin
- ✓ stSeld
- ✓ sboClass† (choice ”operate-once”)
- ✓ ctlmodel (choice ”SBOes or SBOns”)

†”sboClass” can be found by scrolling down.

Figure 2.18-13 LN editing for SBO (for example)

(i)-2 Defining DIR mode

Figure 2.18-14 exemplifies the OPTR logic node saved as GGIO3302. In the DIR mode, the following three items should be selected using the GR-TIEMS:



- ✓ Oper
- ✓ origin
- ✓ ctlmodel (choice ”DOes or DOns”)

Figure 2.18-14 LN editing for DIR mode (for example)

(ii) Mapping output data

The user should group the OPTR signals with regard to GOOSE and REPORT; the user should map them for the IEC61850 communication using the GR-TIEMS. Figure 2.18-15 shows how to map a signal; it shows that the signals of the OPTR function are required to map for the IEC61850 communication.

Table 2.18-5 Mapping signals for SPC object

Object_reference	Attribute	Type	FC	Signal Number	Signal Name
Ctrl/GGIO3302$SPCSO1$origin	orCat	orCategory	ST	529001 200C011008	OPTR01_ORCAT
Ctrl/GGIO3302$SPCSO1$origin	orIdent	Octet64	ST	529001 310C01170A	OPTR01_ORIDENT
Ctrl/GGIO3302$SPCSO1	stVal	BOOLEAN	ST	529001 310C011EA1	OPT_RST_CMD
Ctrl/GGIO3302$SPCSO1	Q	Quality	ST	301001 3110041005	Qual_Val
Ctrl/GGIO3302$SPCSO1	T	Timestamp	ST	200301 9010001006	SYS_TIME
Ctrl/GGIO3302$SPCSO1	stSeld	BOOLEAN	ST	529001 000C011D90	OPTR01_STSELD

Note: "Status (ST)" is defined in the function constraint (FC) of the IEC 61850 standard.

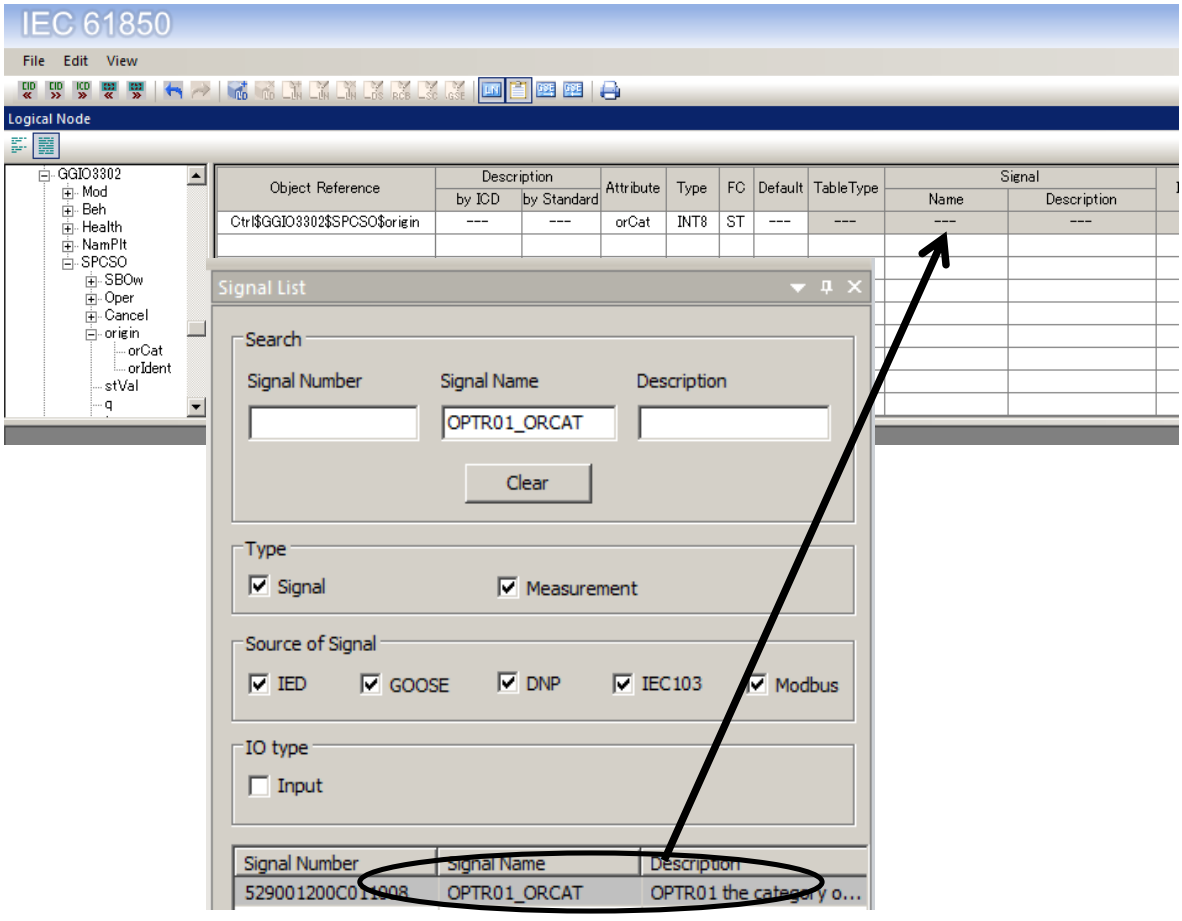


Figure 2.18-15 orCat attribute mapped into SPCSO object of GGIO3302

(iii) Mapping input data

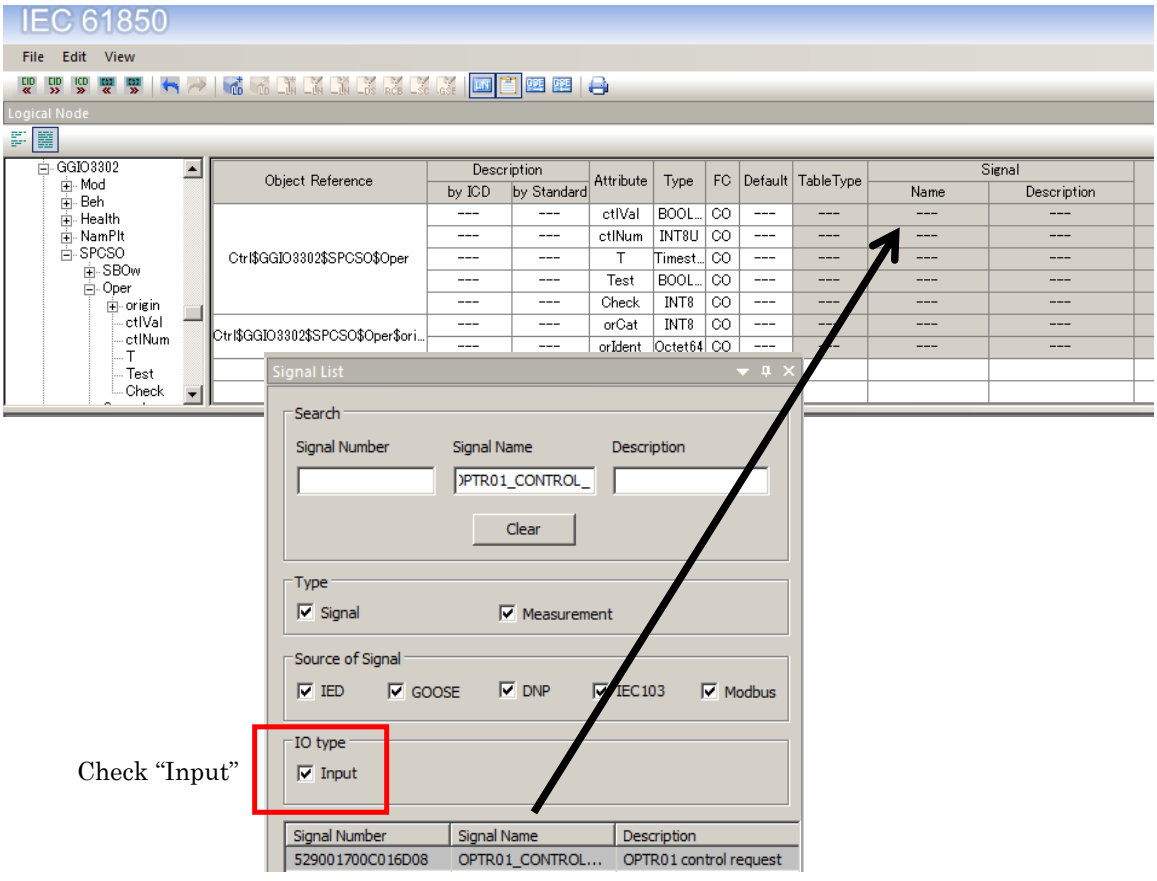
The OPTR function can receive three commands "select, operate, and cancel". Thus, the user should map the input-point "OPTR01_CONTROL_REQ". Table 2.18-6 shows the input-point "OPTR01_CONTROL_REQ" and the Object reference "Ctrl/GGIO3302$SCPSO"; the user should

map the input-point to the Object references having attributes CO and CF†. Figure 2.18-16 shows how to map a signal.

†Note: The attribute is defined in the IEC 61850; "CO" stands for "Control" and "CF" stands for "Configuration" in the functional constraint (FC).

Table 2.18-6 Mapping signals required for SPCSO object of GGIO3302

Object_reference	Attribute	Type	FC	Signal Number	Signal Name
Ctrl/GGIO3302$SPCSO1$Oper	ctlVal	BOOLEAN	CO	529001 700C016D08	OPTR01_CONTROL_REQ
Ctrl/GGIO3302$SPCSO1$Oper	ctlNum	INT8U	CO		
Ctrl/GGIO3302$SPCSO1$Oper	T	Timestamp	CO		
Ctrl/GGIO3302$SPCSO1$Oper	Test	BOOLEAN	CO		
Ctrl/GGIO3302$SPCSO1$Oper	Check	Check	CO		
Ctrl/GGIO3302$SPCSO1$Oper$origin	orCat	orCategory	CO		
Ctrl/GGIO3302$SPCSO1$Oper$origin	orIdent	Octet64	CO		
Ctrl/GGIO3302$SPCSO1	ctlModel	ctlModel	CF		
Ctrl/GGIO3302$SPCSO1	sboClass	sboClass	CF		



Check "Input"

Figure 2.18-16 Input-point mapped for GGIO3302

2.18.5 Setting

Setting list of OPTR (Function ID: 529001)

Setting device		Range	Units	Contents	Default setting value	Notes
	OPTR01-EN	Off / On	-	OPTR01 Reset Control Enable	Off	

2.18.6 Signal

◆ Signal monitoring point

OPTR (Function ID: 529001)

Element ID	Name	Description
820C01ED50	OPTR01_CTRL_RIGHT	OPTR01 control right from PLC

◆ Connection point in PLC logic

OPTR (Function ID: 529001)

Element ID	Name	Description
800C011D53	OPTR01_SC	OPTR01 select command
800C011D57	OPTR01_EC	OPTR01 execute command
800C011D51	OPTR01_SC_OWS	OPTR01 select command by OWS(HMI)
800C011D52	OPTR01_SC_RCC	OPTR01 select command by RCC
800C011D55	OPTR01_EC_OWS	OPTR01 execute command by OWS(HMI)
800C011D56	OPTR01_EC_RCC	OPTR01 execute command by RCC
820C011F40	OPTR01_TMP1	OPTR01 signal before KC_OPTR_SA001
830C011F41	OPTR01_NSD_CSF	OPTR01 signal after KC_OPTR_SA001
800C011F42	OPTR01_FSE_RCV	OPTR01 signal before LC_OPTR_SA002
860C011F43	OPTR01_TMP2	OPTR01 signal after KC_OPTR_SA002
8B0C011F44	OPTR01_CTR_SGU	OPTR01 signal before KC_OPTR_SC001
860C011F45	OPTR01_TMP3	OPTR01 signal after KC_OPTR_SC001
860C011F46	OPTR01_SLF_FCT_FLG1	OPTR01 signal before MCTOPTR_SC001
8E0C011F47	OPTR01_SLD_TM0	OPTR01 signal after MCTOPTR_SC001
870C011F48	OPTR01_SLF_FCT_FLG2	OPTR01 signal before MCTOPTR_SC002
8F0C011F49	OPTR01_EX_CMP_TM0	OPTR01 signal after MCTOPTR_SC002

2.19 Counter function for the general (GCNT)

When a signal is generated and it is received by the generic counter function (GCNT), the GCNT function can count the transition of signals. For example, as shown in Figure 2.19-1, a signal is issued repeatedly and if it is required that the number of signals is reported, the GCNT function is able to count the number of signal transitions and report them. When an object is in a device state, a binary input-circuit (BI) is provided to receive the signal.

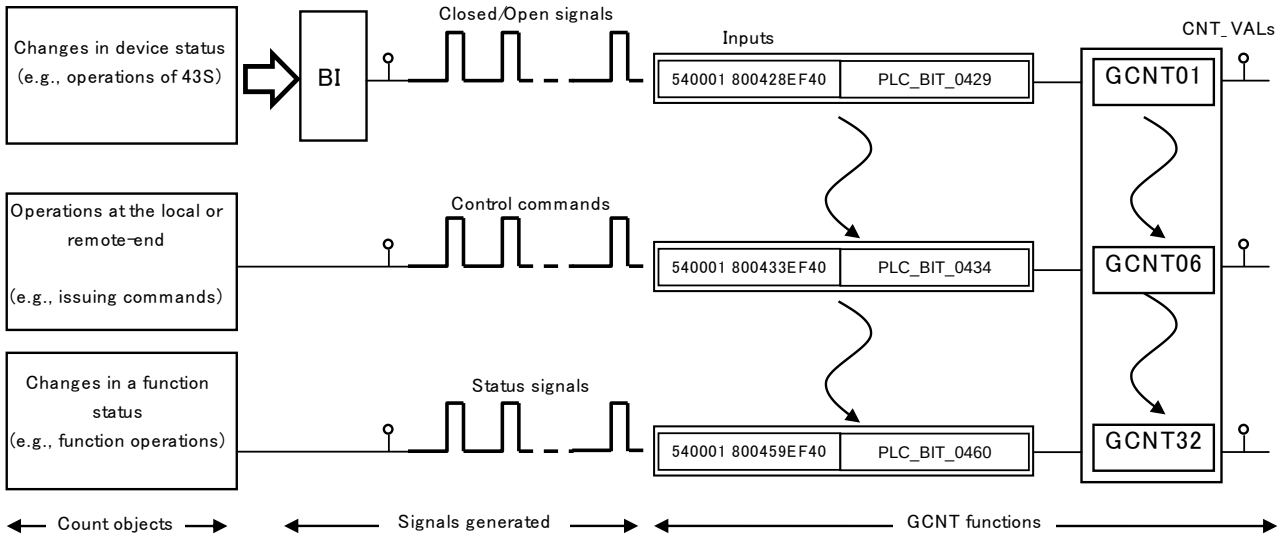


Figure 2.19-1 Reception of signals at the GCNT functions

Note: The implementation of certain features is dependent upon the selection of hardware and the configuration of functions. Several IED models do not support certain features. To determine whether a particular feature has been implemented within an IED, identify the IED ordering number; and check the order number at the "G&T position" whilst referring to the comparison table below. For more information, see *Appendix: Ordering*.

Table 2.19-1 Comparative table in respective ordering numbers

Sec.	Feature	Ordering No. at "G&T"					
		BCU			BCPU		IFU
		11	13	1F	2N	2C	19
–	Main features	✓	✓	✓	✓	✓	✓

✓: Applicable NA: Not applicable

Signal acquisition timing must be adjusted in accordance with the application, in that the acquisition should be regulated for the nature of the signal; hence, several settings are provided in the GCNT functions. Thirty-two independent GCNT counters† are available. That is, counters GCNT01 to GCNT32† can operate simultaneously. The values counted are stored in the non-volatile memory so that they are not erased if the power supply to the IED is interrupted.

†Note: The number of counters provided in GCNT functions depends on the model. Several models are limited to having six counters.

For simplicity, only the GCNT01 function is discussed; the features in the remaining GCNT02–GCNT32 functions are identical to the GCNT01 function.

2.19.1 Counter setting for a signal

(i) Setting for count timing

In the GCNT01 function count timing is grouped into three, as shown in Figure 2.19-2 (a, b, and c). When the user wishes to count the On(Closed), set **On** for the scheme switch [**GCNT01-CNTS**]; conversely, set **Off** for the scheme switch when the Off(Open) is to be counted. Additionally, **OnOff** is provided for counting the number of pulses. If the GCNT01 function is not required, set **NA** for the scheme switch.

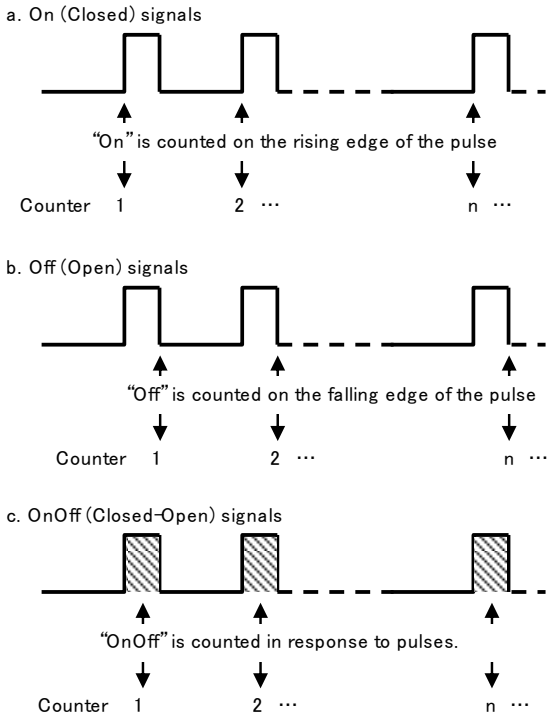


Figure 2.19-2 Count types

(ii) Setting the maximum value

The GCNT01 function is able to count to 2147483647 (=$2^{31}-1$). When the count-value reaches the value "2147483647", the count-value returns to an initial-value. If the user wishes to set a different maximum number in place of "2147483647", the user can use the setting [**GCNT01-CNTMAX**] and set a user-preferred value. Note that the user can set the maximum number from 9 to 2147483647.

(iii) Setting the initial-value

The counter returns to an initial-value when the counter reaches the maximum value; generally, the initial-value is set to either zero or one (0 or 1); hence, the number is re-counted from either "0 (or 1)" following the maximum value. If the user wishes to set an alternative initial number, setting [**GCNT01-CNTRV**] can be used. Note that the user can select the initial-value from zero (0) to 999999.

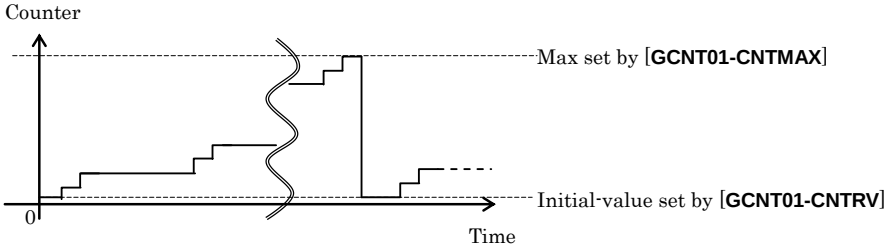


Figure 2.19-3 Maximum-value and initial-value

(iv) Setting for the report (Dead band)

The counter-value can be reported to the remote-end; the user can set the report-timing using the setting [**GCNT01-SDB**]. For example, if the counter-value is to be reported for every change, the user should set **0** for the setting [**GCNT01-SDB**]. When five(5) is set for the [**GCNT01-SDB**], reporting is performed when the counter has incremented by six(6) following the previously reported counter-value.

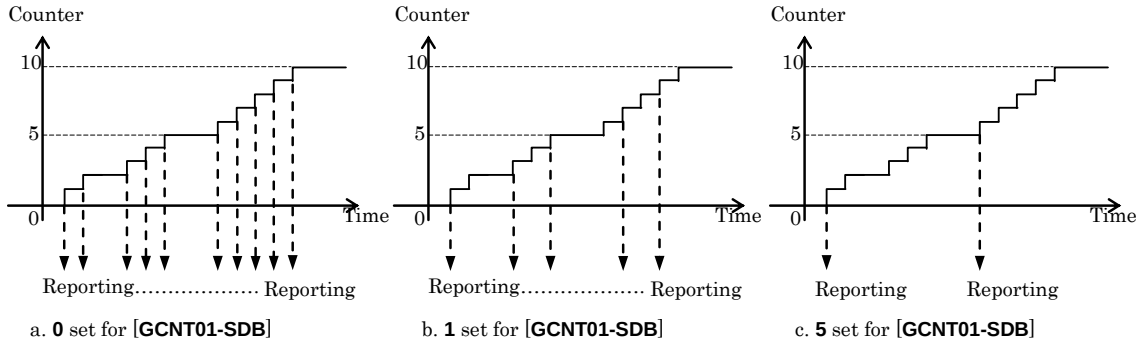


Figure 2.19-4 Counter value and report timing

2.19.1 Select logics for SBO/DIR modes

The user should set scheme switch [**GCNT01-EN**] to **On** prior to counting.

(i) Receiving "Select command Reset" from the remote-end

Figure 2.19-5 outlines the reception of the Select command 'Reset' from the remote-end.

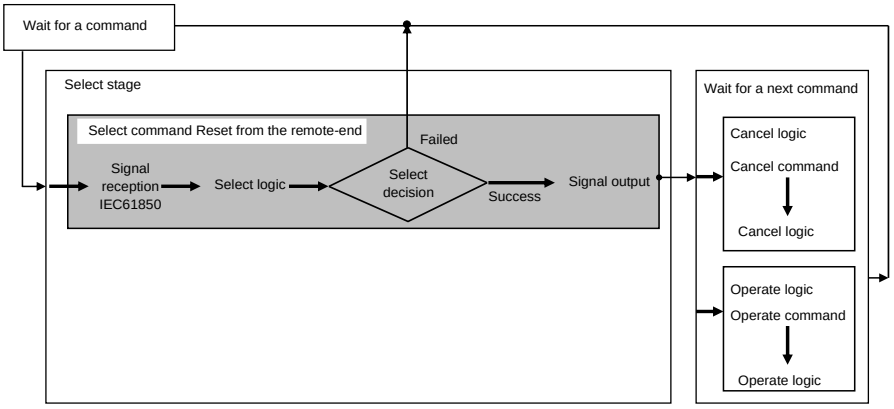


Figure 2.19-5 Outline of Select command 'Reset'

(i)-1 Input point required mapping

Figure 2.19-6 shows the select logic when a "Select command Reset (Remote-Reset-Control)" signal is applied to the GCNT01 function. The logic has an input-point "GCNT01_CMM_REQ" for the reception of the select command. That is, the input-point must be mapped for IEC61850 communication. The function will fail to operate if mapping is not performed correctly. We will discuss how to map the input-points for IEC61850 communication in section 2.19.4.

(i)-2 Output signal to BO

The GCNT01 function can issue a "Complete" signal at the output point "GCNT01_SLD_CSCN", when the GCNT01 function determines that the input signal "Remote-Reset-Control" is true. If the GCNT01 function determines that the "Remote-Reset-Control" is not true, the GCNTS01 function returns to the "Wait for a command" stage.

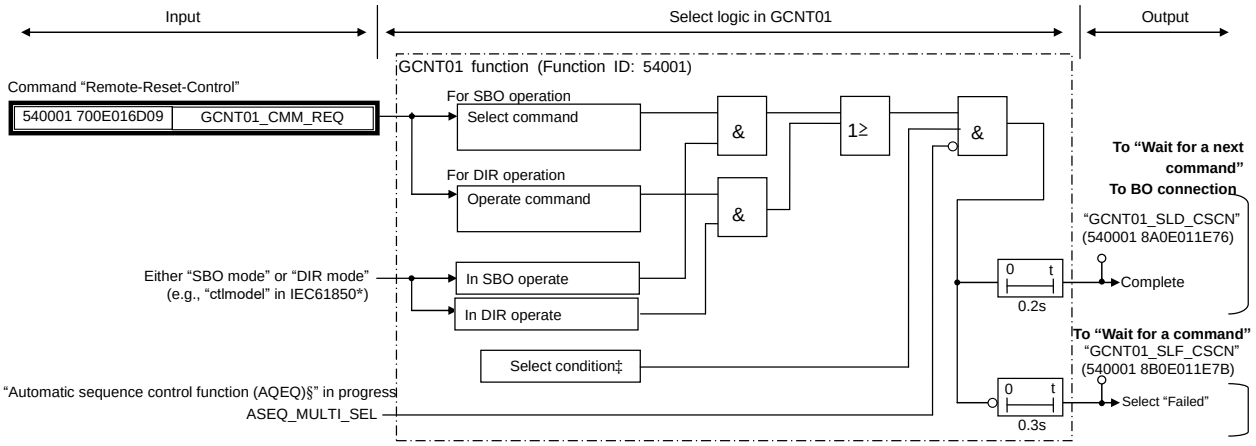


Figure 2.19-6 Select 'Reset' in GCNT01††

‡Note: A "select condition" signal is provided from the select condition logic. For more information, see Figure 2.19-7.

§Note: An automatic sequence control (ASEQ) function can provide sequential signals for automatic control. The GCNT01 operation is blocked for the ASEQ function when it is in operation. For more information on the ASEQ function, see Chapter *Control and monitoring application: Automatic sequence control function*.

*Note: The GNCT01 function can run in either the "SBO mode" or the "DIR mode" using a signal called "ctlmodel" when communication is implemented using IEC61850. To use this signal, the user should map it for IEC61850 communication.

††Note: To identify the input and output points of the other GCNT02–GCNT32 logics, see Table 2.19-2 for the inputs and Table 2.19-5 for the outputs.

(ii) Select condition

Figure 2.19-8 shows the select condition logic in the GCNT01 function. The GCNT01 function checks the condition for the select command using the signal "S4301_STATE" and other signals. When resetting the counter is performed from the "Statics sub-menu" in the HMI operation†, the user should set **On** for scheme switch [**GCNT01-HMI**].

†Note: The HMI operation is discussed in *Chapter User interface: Monitoring sub-menu*.

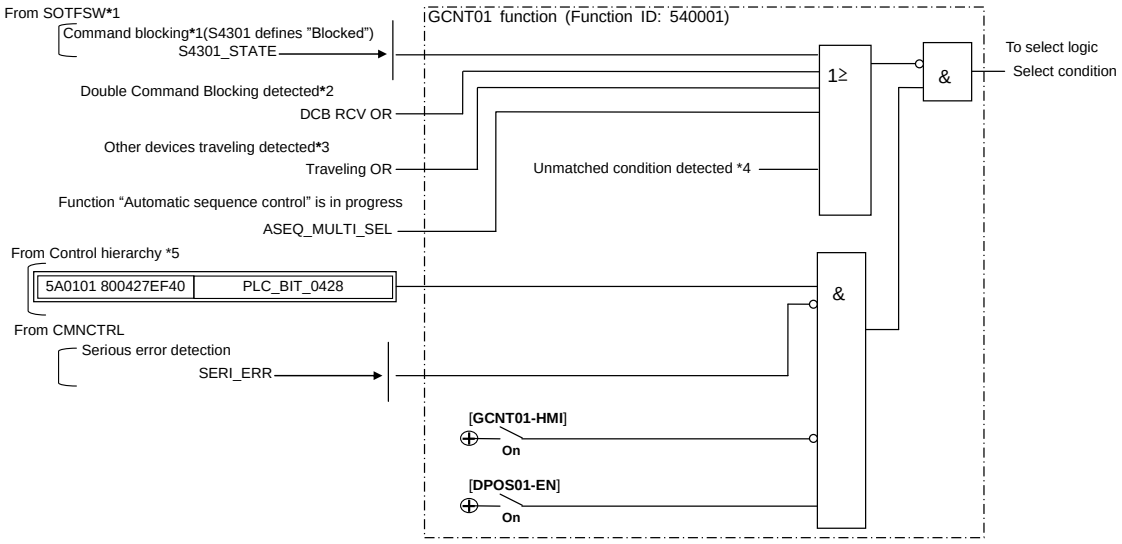


Figure 2.19-7 Select condition logic for Reset in GCNT01

[1]Note: "Command blocking" disables any operation except its own; the "command blocking" is initiated by the status of "S4301" in a software switch controller function (SOFTSW). The IEC 61850 standard defines "Command Blocking" as "CmdBlk". For more information on "S4301", see Chapter *Control and monitoring application: Software switch control function*. (Table 2.19-3)

[2]Note: "Double Command Blocking (DCB)" is an operation philosophy. It can be used to protect the substation. The user can program it using GR-TIEMS. The DCB operating signal is denoted as "DCB RCB OR" in Table 2.19-3.

[3]Note: If the event "device-travelling" is detected, it indicates that another operator is changing the status of a device. Thus, the IED should inhibit the operation of any device for the duration that the event is detected. The detected signal is denoted as "Traveling OR" in Table 2.19-3.

[4]Note: Criteria "unmatched conditions" are decided when the "Test-bit status" in a command is not identical to the "IED test status".

[5]Note: The user will need to program the PLC logic "Control hierarchy condition". The user is also required to connect the logic condition with the select condition logic using the connection pint "PLC_BIT_0428" (see Table 2.19-4). For more information, see Chapter *Control and monitoring application: Control hierarchy*.

(iii) Signal name and number

Note: The user should note the following descriptions shown in the column "M/O" for each table:

"O" indicates that the signal is provided for optional use.

"M" indicates that the user should map/set/configure the signal; otherwise, the user may experience an operational failure if the default settings are used.

"N/A" indicates that the user cannot change the state of the signal.

Table 2.19-2 Mapping points for the reception of control command

Signal Number	Signal Name	Description	M/O
540001 700E016D09	GCNT01_CMM_REQ	GCNT01 control request(Mapping data)	M
540001 700E026D09	GCNT02_CMM_REQ	GCNT02 control request(Mapping data)	M
540001 700E036D09	GCNT03_CMM_REQ	GCNT03 control request(Mapping data)	M
540001 700E046D09	GCNT04_CMM_REQ	GCNT04 control request(Mapping data)	M
540001 700E056D09	GCNT05_CMM_REQ	GCNT05 control request(Mapping data)	M
540001 700E066D09	GCNT06_CMM_REQ	GCNT06 control request(Mapping data)	M
540001 700E076D09	GCNT07_CMM_REQ	GCNT07 control request(Mapping data)	M
540001 700E086D09	GCNT08_CMM_REQ	GCNT08 control request(Mapping data)	M
540001 700E096D09	GCNT09_CMM_REQ	GCNT09 control request(Mapping data)	M
540001 700E0A6D09	GCNT10_CMM_REQ	GCNT10 control request(Mapping data)	M
540001 700E0B6D09	GCNT11_CMM_REQ	GCNT11 control request(Mapping data)	M
540001 700E0C6D09	GCNT12_CMM_REQ	GCNT12 control request(Mapping data)	M
540001 700E0D6D09	GCNT13_CMM_REQ	GCNT13 control request(Mapping data)	M
540001 700E0E6D09	GCNT14_CMM_REQ	GCNT14 control request(Mapping data)	M
540001 700E0F6D09	GCNT15_CMM_REQ	GCNT15 control request(Mapping data)	M
540001 700E106D09	GCNT16_CMM_REQ	GCNT16 control request(Mapping data)	M
540001 700E116D09	GCNT17_CMM_REQ	GCNT17 control request(Mapping data)	M
540001 700E126D09	GCNT18_CMM_REQ	GCNT18 control request(Mapping data)	M
540001 700E136D09	GCNT19_CMM_REQ	GCNT19 control request(Mapping data)	M
540001 700E146D09	GCNT20_CMM_REQ	GCNT20 control request(Mapping data)	M
540001 700E156D09	GCNT21_CMM_REQ	GCNT21 control request(Mapping data)	M
540001 700E166D09	GCNT22_CMM_REQ	GCNT22 control request(Mapping data)	M
540001 700E176D09	GCNT23_CMM_REQ	GCNT23 control request(Mapping data)	M
540001 700E186D09	GCNT24_CMM_REQ	GCNT24 control request(Mapping data)	M
540001 700E196D09	GCNT25_CMM_REQ	GCNT25 control request(Mapping data)	M
540001 700E1A6D09	GCNT26_CMM_REQ	GCNT26 control request(Mapping data)	M
540001 700E1B6D09	GCNT27_CMM_REQ	GCNT27 control request(Mapping data)	M
540001 700E1C6D09	GCNT28_CMM_REQ	GCNT28 control request(Mapping data)	M
540001 700E1D6D09	GCNT29_CMM_REQ	GCNT29 control request(Mapping data)	M
540001 700E1E6D09	GCNT30_CMM_REQ	GCNT30 control request(Mapping data)	M
540001 700E1F6D09	GCNT31_CMM_REQ	GCNT31 control request(Mapping data)	M
540001 700E206D09	GCNT32_CMM_REQ	GCNT32 control request(Mapping data)	M

Table 2.19-3 Input signals to condition logic

Signal Number	Signal Name	Description	M/O
522001 000A011001	S4301_STATE	Command Blocking status (Off / Blocked)	N/A
523001 000D001F40	ASEQ_MULTI_SEL	Automatic sequence control is in progress.	N/A
5A0001 0008001F41	DCB RCV OR	Double Command Blocking(DCB) is in progress.	N/A
5A0001 0008001F40	Traveling OR	Travelling events are detected.	N/A
5A0101 3100001F43	SERI_ERR	Serious Error detected	N/A

Table 2.19-4 PLC Connection point (Input signals from the control hierarchy logic)

Signal Number	Signal Name	Description	M/O
5A0101800427EF40	PLC_BIT_0428	Control hierarchy for GCNT01–32	M

Table 2.19-5 PLC Monitoring points (Signal "select complete/ failed" for BIO)

Signal Number	Signal Name	Description
540001 8A0E011E76	GCNT01_SLD_CSCN	GCNT01 Selection completed (Mapping)
540001 8A0E021E76	GCNT02_SLD_CSCN	GCNT02 Selection completed (Mapping)
540001 8A0E031E76	GCNT03_SLD_CSCN	GCNT03 Selection completed (Mapping)
540001 8A0E041E76	GCNT04_SLD_CSCN	GCNT04 Selection completed (Mapping)
540001 8A0E051E76	GCNT05_SLD_CSCN	GCNT05 Selection completed (Mapping)
540001 8A0E061E76	GCNT06_SLD_CSCN	GCNT06 Selection completed (Mapping)
540001 8A0E071E76	GCNT07_SLD_CSCN	GCNT07 Selection completed (Mapping)
540001 8A0E081E76	GCNT08_SLD_CSCN	GCNT08 Selection completed (Mapping)
540001 8A0E091E76	GCNT09_SLD_CSCN	GCNT09 Selection completed (Mapping)
540001 8A0E0A1E76	GCNT10_SLD_CSCN	GCNT10 Selection completed (Mapping)
540001 8A0E0B1E76	GCNT11_SLD_CSCN	GCNT11 Selection completed (Mapping)
540001 8A0E0C1E76	GCNT12_SLD_CSCN	GCNT12 Selection completed (Mapping)
540001 8A0E0d1E76	GCNT13_SLD_CSCN	GCNT13 Selection completed (Mapping)
540001 8A0E0E1E76	GCNT14_SLD_CSCN	GCNT14 Selection completed (Mapping)
540001 8A0E0F1E76	GCNT15_SLD_CSCN	GCNT15 Selection completed (Mapping)
540001 8A0E101E76	GCNT16_SLD_CSCN	GCNT16 Selection completed (Mapping)
540001 8A0E111E76	GCNT17_SLD_CSCN	GCNT17 Selection completed (Mapping)
540001 8A0E121E76	GCNT18_SLD_CSCN	GCNT18 Selection completed (Mapping)
540001 8A0E131E76	GCNT19_SLD_CSCN	GCNT19 Selection completed (Mapping)
540001 8A0E141E76	GCNT20_SLD_CSCN	GCNT20 Selection completed (Mapping)
540001 8A0E151E76	GCNT21_SLD_CSCN	GCNT21 Selection completed (Mapping)
540001 8A0E161E76	GCNT22_SLD_CSCN	GCNT22 Selection completed (Mapping)
540001 8A0E171E76	GCNT23_SLD_CSCN	GCNT23 Selection completed (Mapping)
540001 8A0E181E76	GCNT24_SLD_CSCN	GCNT24 Selection completed (Mapping)
540001 8A0E191E76	GCNT25_SLD_CSCN	GCNT25 Selection completed (Mapping)
540001 8A0E1A1E76	GCNT26_SLD_CSCN	GCNT26 Selection completed (Mapping)
540001 8A0E1B1E76	GCNT27_SLD_CSCN	GCNT27 Selection completed (Mapping)
540001 8A0E1C1E76	GCNT28_SLD_CSCN	GCNT28 Selection completed (Mapping)
540001 8A0E1d1E76	GCNT29_SLD_CSCN	GCNT29 Selection completed (Mapping)
540001 8A0E1E1E76	GCNT30_SLD_CSCN	GCNT30 Selection completed (Mapping)
540001 8A0E1F1E76	GCNT31_SLD_CSCN	GCNT31 Selection completed (Mapping)
540001 8A0E201E76	GCNT32_SLD_CSCN	GCNT32 Selection completed (Mapping)
5400018B0E011E7B	GCNT01_SLF_CSCN	GCNT01 select failed
5400018B0E021E7B	GCNT02_SLF_CSCN	GCNT02 select failed
5400018B0E031E7B	GCNT03_SLF_CSCN	GCNT03 select failed
5400018B0E041E7B	GCNT04_SLF_CSCN	GCNT04 select failed
5400018B0E051E7B	GCNT05_SLF_CSCN	GCNT05 select failed
5400018B0E061E7B	GCNT06_SLF_CSCN	GCNT06 select failed
5400018B0E071E7B	GCNT07_SLF_CSCN	GCNT07 select failed
5400018B0E081E7B	GCNT08_SLF_CSCN	GCNT08 select failed
5400018B0E091E7B	GCNT09_SLF_CSCN	GCNT09 select failed
5400018B0E0A1E7B	GCNT10_SLF_CSCN	GCNT10 select failed
5400018B0E0B1E7B	GCNT11_SLF_CSCN	GCNT11 select failed
5400018B0E0C1E7B	GCNT12_SLF_CSCN	GCNT12 select failed
5400018B0E0D1E7B	GCNT13_SLF_CSCN	GCNT13 select failed
5400018B0E0E1E7B	GCNT14_SLF_CSCN	GCNT14 select failed

Signal Number	Signal Name	Description
5400018B0E0F1E7B	GCNT15_SLF_CSCN	GCNT15 select failed
5400018B0E101E7B	GCNT16_SLF_CSCN	GCNT16 select failed
5400018B0E111E7B	GCNT17_SLF_CSCN	GCNT17 select failed
5400018B0E121E7B	GCNT18_SLF_CSCN	GCNT18 select failed
5400018B0E131E7B	GCNT19_SLF_CSCN	GCNT19 select failed
5400018B0E141E7B	GCNT20_SLF_CSCN	GCNT20 select failed
5400018B0E151E7B	GCNT21_SLF_CSCN	GCNT21 select failed
5400018B0E161E7B	GCNT22_SLF_CSCN	GCNT22 select failed
5400018B0E171E7B	GCNT23_SLF_CSCN	GCNT23 select failed
5400018B0E181E7B	GCNT24_SLF_CSCN	GCNT24 select failed
5400018B0E191E7B	GCNT25_SLF_CSCN	GCNT25 select failed
5400018B0E1A1E7B	GCNT26_SLF_CSCN	GCNT26 select failed
5400018B0E1B1E7B	GCNT27_SLF_CSCN	GCNT27 select failed
5400018B0E1C1E7B	GCNT28_SLF_CSCN	GCNT28 select failed
5400018B0E1D1E7B	GCNT29_SLF_CSCN	GCNT29 select failed
5400018B0E1E1E7B	GCNT30_SLF_CSCN	GCNT30 select failed
5400018B0E1F1E7B	GCNT31_SLF_CSCN	GCNT31 select failed
5400018B0E201E7B	GCNT32_SLF_CSCN	GCNT32 select failed

Table 2.19-6 PLC Monitoring points (Signal "stSeld" for BIO)

Signal Number	Signal Name	Description
540001 000E011D91	GCNT01_TMP_01	GCNT01 count change selected signal(stSeld) for SAS
540001 000E021D91	GCNT02_TMP_01	GCNT02 count change selected signal(stSeld) for SAS
540001 000E031D91	GCNT03_TMP_01	GCNT03 count change selected signal(stSeld) for SAS
540001 000E041D91	GCNT04_TMP_01	GCNT04 count change selected signal(stSeld) for SAS
540001 000E051D91	GCNT05_TMP_01	GCNT05 count change selected signal(stSeld) for SAS
540001 000E061D91	GCNT06_TMP_01	GCNT06 count change selected signal(stSeld) for SAS
540001 000E071D91	GCNT07_TMP_01	GCNT07 count change selected signal(stSeld) for SAS
540001 000E081D91	GCNT08_TMP_01	GCNT08 count change selected signal(stSeld) for SAS
540001 000E091D91	GCNT09_TMP_01	GCNT09 count change selected signal(stSeld) for SAS
540001 000E0A1D91	GCNT10_TMP_01	GCNT10 count change selected signal(stSeld) for SAS
540001 000E0B1D91	GCNT11_TMP_01	GCNT11 count change selected signal(stSeld) for SAS
540001 000E0C1D91	GCNT12_TMP_01	GCNT12 count change selected signal(stSeld) for SAS
540001 000E0D1D91	GCNT13_TMP_01	GCNT13 count change selected signal(stSeld) for SAS
540001 000E0E1D91	GCNT14_TMP_01	GCNT14 count change selected signal(stSeld) for SAS
540001 000E0F1D91	GCNT15_TMP_01	GCNT15 count change selected signal(stSeld) for SAS
540001 000E101D91	GCNT16_TMP_01	GCNT16 count change selected signal(stSeld) for SAS
540001 000E111D91	GCNT17_TMP_01	GCNT17 count change selected signal(stSeld) for SAS
540001 000E121D91	GCNT18_TMP_01	GCNT18 count change selected signal(stSeld) for SAS
540001 000E131D91	GCNT19_TMP_01	GCNT19 count change selected signal(stSeld) for SAS
540001 000E141D91	GCNT20_TMP_01	GCNT20 count change selected signal(stSeld) for SAS
540001 000E151D91	GCNT21_TMP_01	GCNT21 count change selected signal(stSeld) for SAS
540001 000E161D91	GCNT22_TMP_01	GCNT22 count change selected signal(stSeld) for SAS
540001 000E171D91	GCNT23_TMP_01	GCNT23 count change selected signal(stSeld) for SAS
540001 000E181D91	GCNT24_TMP_01	GCNT24 count change selected signal(stSeld) for SAS
540001 000E191D91	GCNT25_TMP_01	GCNT25 count change selected signal(stSeld) for SAS
540001 000E1A1D91	GCNT26_TMP_01	GCNT26 count change selected signal(stSeld) for SAS
540001 000E1B1D91	GCNT27_TMP_01	GCNT27 count change selected signal(stSeld) for SAS
540001 000E1C1D91	GCNT28_TMP_01	GCNT28 count change selected signal(stSeld) for SAS
540001 000E1D1D91	GCNT29_TMP_01	GCNT29 count change selected signal(stSeld) for SAS
540001 000E1E1D91	GCNT30_TMP_01	GCNT30 count change selected signal(stSeld) for SAS
540001 000E1F1D91	GCNT31_TMP_01	GCNT31 count change selected signal(stSeld) for SAS
540001 000E201D91	GCNT32_TMP_01	GCNT32 count change selected signal(stSeld) for SAS

(iv) Setting names

Table 2.19-7 Settings of select logics for GCNT01 to GCNT32

Setting Name	Description	Default	Setting item or value
GCNTxx-EN	Activation of the GCNTxx function	On	Off / On
GCNTxx-HMI	Counter is used for the HMI operation in the GCNTxx function	Off	Off / On

2.19.2 Cancel logic for SBO mode

In the SBO control mode the reception of a cancel command is possible when the cancel conditions are satisfied; accordingly, the function can discard the select command; finally, the operation returns to the initial stage (i.e., "Wait for a command".)

(i) Receiving "Cancel" from the remote-end

Figure 2.19-8 depicts the cancel command procedure for a cancel command initiated from the remote-end.

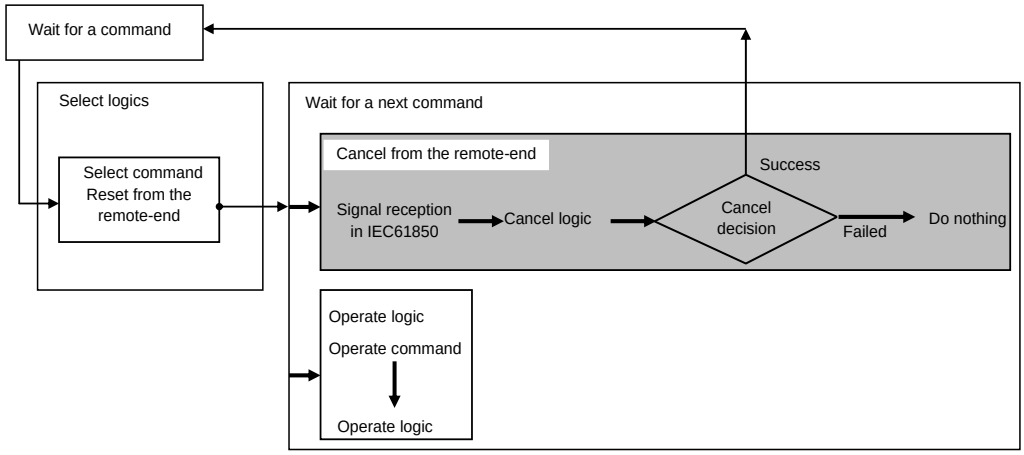


Figure 2.19-8 Outline of 'cancel' command from the remote-end

(i)-1 Input point required mapping

Figure 2.19-9 depicts the cancel logic when a "Cancel command (Remote-Cancel)" signal is applied to the GCNT01 function. The input-point "GCNT01_CMM_REQ" is the same as that for the signal "Select command Reset (Remote-Reset-Control)".

(i)-2 Output signal to BO

The GCNT01 function can issue a "Success to cancel" signal at the monitoring point "GCNT01_CC_SSCN", when the GCNT01 function has determined that the signal "Remote-cancel" is true. Another signal "Operation failed" is issued if the function is able to determine that the signal "Remote-cancel" is not true.

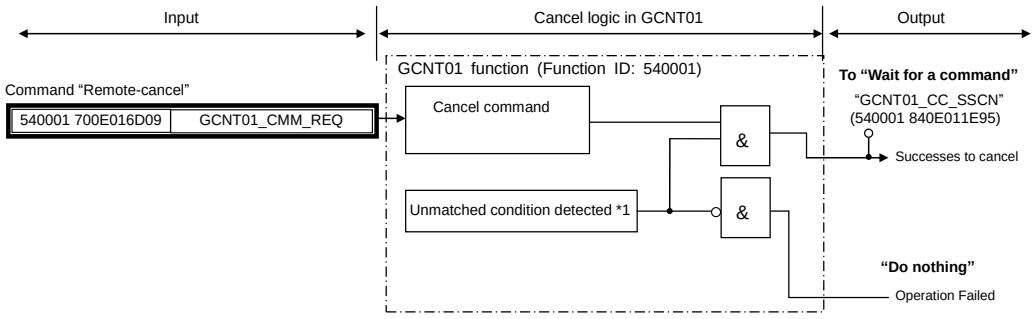


Figure 2.19-9 'Cancel' from the remote-end in GCNT01

[1]Note: The criteria "unmatched conditions" are determined when the "Test-bit status" in

a command is not identical to the “IED test status”.

(ii) Signal name and number

Table 2.19-8 PLC monitoring points (Output signal for ‘cancel’ logic)

Signal Number	Signal Name	Description
540001 840E011E95	GCNT01_CC_SSCN	GCNT01 cancel success signal
540001 840E021E95	GCNT02_CC_SSCN	GCNT02 cancel success signal
540001 840E031E95	GCNT03_CC_SSCN	GCNT03 cancel success signal
540001 840E041E95	GCNT04_CC_SSCN	GCNT04 cancel success signal
540001 840E051E95	GCNT05_CC_SSCN	GCNT05 cancel success signal
540001 840E061E95	GCNT06_CC_SSCN	GCNT06 cancel success signal
540001 840E071E95	GCNT07_CC_SSCN	GCNT07 cancel success signal
540001 840E081E95	GCNT08_CC_SSCN	GCNT08 cancel success signal
540001 840E091E95	GCNT09_CC_SSCN	GCNT09 cancel success signal
540001 840E0A1E95	GCNT10_CC_SSCN	GCNT10 cancel success signal
540001 840E0B1E95	GCNT11_CC_SSCN	GCNT11 cancel success signal
540001 840E0C1E95	GCNT12_CC_SSCN	GCNT12 cancel success signal
540001 840E0D1E95	GCNT13_CC_SSCN	GCNT13 cancel success signal
540001 840E0E1E95	GCNT14_CC_SSCN	GCNT14 cancel success signal
540001 840E0F1E95	GCNT15_CC_SSCN	GCNT15 cancel success signal
540001 840E101E95	GCNT16_CC_SSCN	GCNT16 cancel success signal
540001 840E111E95	GCNT17_CC_SSCN	GCNT17 cancel success signal
540001 840E121E95	GCNT18_CC_SSCN	GCNT18 cancel success signal
540001 840E131E95	GCNT19_CC_SSCN	GCNT19 cancel success signal
540001 840E141E95	GCNT20_CC_SSCN	GCNT20 cancel success signal
540001 840E151E95	GCNT21_CC_SSCN	GCNT21 cancel success signal
540001 840E161E95	GCNT22_CC_SSCN	GCNT22 cancel success signal
540001 840E171E95	GCNT23_CC_SSCN	GCNT23 cancel success signal
540001 840E181E95	GCNT24_CC_SSCN	GCNT24 cancel success signal
540001 840E191E95	GCNT25_CC_SSCN	GCNT25 cancel success signal
540001 840E1A1E95	GCNT26_CC_SSCN	GCNT26 cancel success signal
540001 840E1B1E95	GCNT27_CC_SSCN	GCNT27 cancel success signal
540001 840E1C1E95	GCNT28_CC_SSCN	GCNT28 cancel success signal
540001 840E1D1E95	GCNT29_CC_SSCN	GCNT29 cancel success signal
540001 840E1E1E95	GCNT30_CC_SSCN	GCNT30 cancel success signal
540001 840E1F1E95	GCNT31_CC_SSCN	GCNT31 cancel success signal
540001 840E201E95	GCNT32_CC_SSCN	GCNT32 cancel success signal

2.19.3 Operate logic for SBO/DIR modes

After the operation of the select logic, the operate logic starts to clear the counters.

(i) Receiving "Operate command Reset" from the remote-end

Figure 2.19-10 depicts the reception of the operate command 'Reset' from the remote-end.

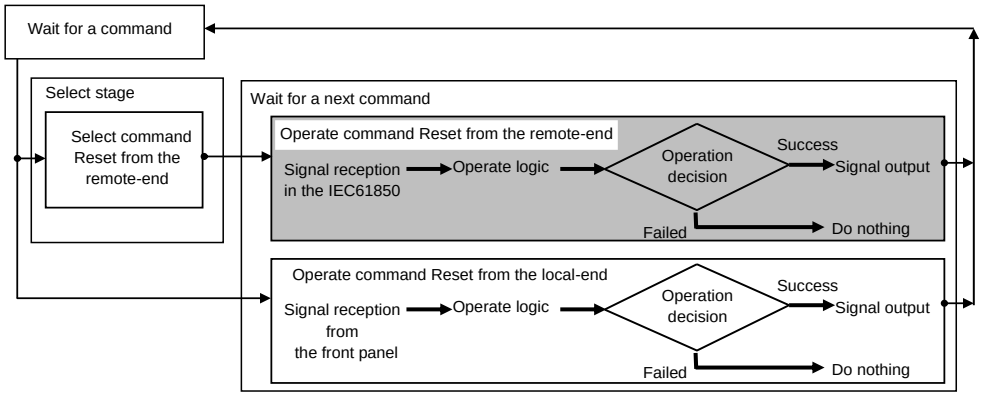


Figure 2.19-10 Outline of Operate command 'Reset'

(i)-1 Mapping required for Input point

Figure 2.19-11 illustrates the operation logic when an "Operate command Reset (Remote-Reset-Control)" signal is applied to the GCNT01 function. The input-point "GCNT01_CMM_REQ" is used for the reception of the "Operate command Reset (Remote-Reset-Control)".

(i)-2 Output signal to BO

The GCNT01 function, in Figure 2.19-11, can provide a signal at the point "GCNT01_OK_CSC", when the GCNT01 function determines that the signal "Remote-Reset-Control" is true.

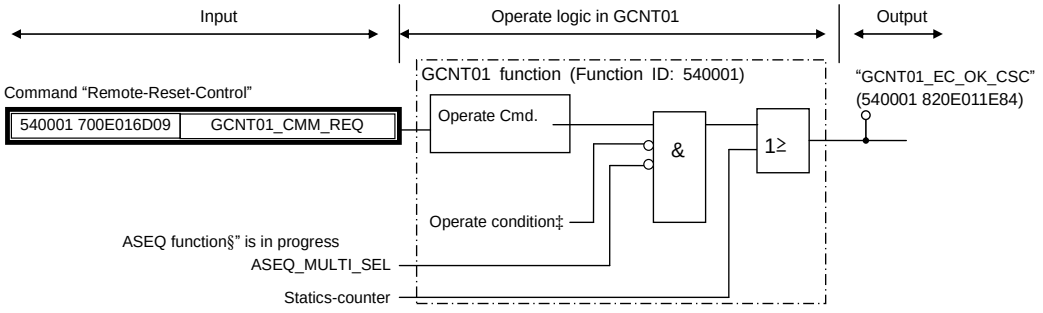


Figure 2.19-11 Operate 'On' from the remote-end ††

§Note:The ASEQ function can provide sequential signals for automatic control.

††Note: To identify the input and output signal-points of the GCNT02–32 logics, see Table 2.19-2 for the mapping points, Table 2.19-9 for the outputs.

(ii) Receiving "Operate command Reset" from the local-end

Figure 2.19-12 depicts the reception of the operate command 'Reset' from the local-end.

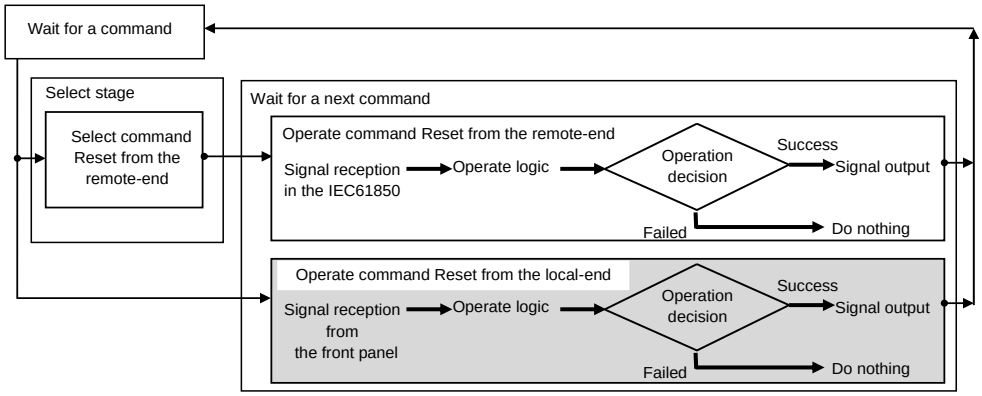


Figure 2.19-12 Outline of Operate command 'Reset'

(ii)-1 New counter value

Figure 2.19-13 shows that the user can set a new value for the counter using the statics sub-menu†. The new value is applied into "Statics counter" point in Figure 2.19-11.

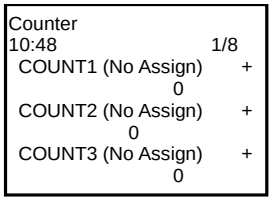


Figure 2.19-13 Counter menu in the statics sub-menu

†Note: For the operation, see *Chapter User interface: Monitoring sub-menu*.

(ii)-2 Output signal to BO

The GCNT01 function can provide a signal at the point "GCNT01_OK_CSC", when the new value applied from the sub-menu is appropriate.

(iii) Select condition

Similar to the select condition (see sec.2.19.1(ii)), the GCNT01 function has an operate-condition logic. Figure 2.19-14 shows the operate-condition logic.

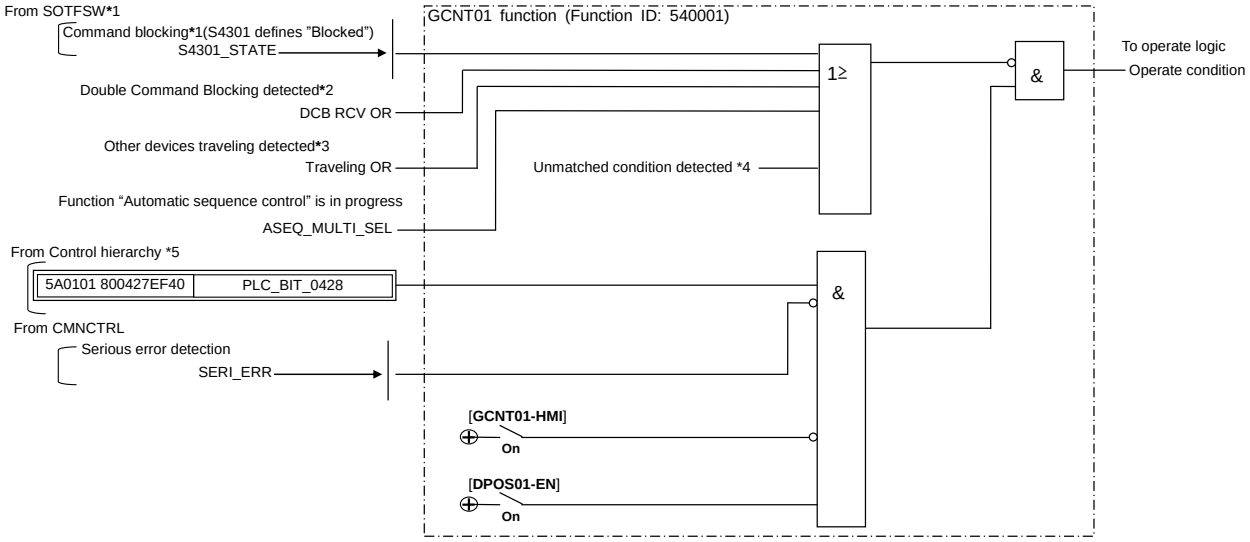


Figure 2.19-14 Operate condition logic for GCNT01

[1–5]Note: The signals and settings in Figure 2.19-14 are same as the signals shown in Figure 2.19-7.

(iv) Signal names and number

Table 2.19-9 PLC monitoring points (Output signal for BIO)

Signal Number	Signal Name	Description
540001 820E011E84	GCNT01_EC_OK_CSCN	GCNT01 execute command OK condition signal
540001 820E021E84	GCNT02_EC_OK_CSCN	GCNT02 execute command OK condition signal
540001 820E031E84	GCNT03_EC_OK_CSCN	GCNT03 execute command OK condition signal
540001 820E041E84	GCNT04_EC_OK_CSCN	GCNT04 execute command OK condition signal
540001 820E051E84	GCNT05_EC_OK_CSCN	GCNT05 execute command OK condition signal
540001 820E061E84	GCNT06_EC_OK_CSCN	GCNT06 execute command OK condition signal
540001 820E071E84	GCNT07_EC_OK_CSCN	GCNT07 execute command OK condition signal
540001 820E081E84	GCNT08_EC_OK_CSCN	GCNT08 execute command OK condition signal
540001 820E091E84	GCNT09_EC_OK_CSCN	GCNT09 execute command OK condition signal
540001 820E0A1E84	GCNT10_EC_OK_CSCN	GCNT10 execute command OK condition signal
540001 820E0B1E84	GCNT11_EC_OK_CSCN	GCNT11 execute command OK condition signal
540001 820E0C1E84	GCNT12_EC_OK_CSCN	GCNT12 execute command OK condition signal
540001 820E0D1E84	GCNT13_EC_OK_CSCN	GCNT13 execute command OK condition signal
540001 820E0E1E84	GCNT14_EC_OK_CSCN	GCNT14 execute command OK condition signal
540001 820E0F1E84	GCNT15_EC_OK_CSCN	GCNT15 execute command OK condition signal
540001 820E101E84	GCNT16_EC_OK_CSCN	GCNT16 execute command OK condition signal
540001 820E111E84	GCNT17_EC_OK_CSCN	GCNT17 execute command OK condition signal
540001 820E121E84	GCNT18_EC_OK_CSCN	GCNT18 execute command OK condition signal
540001 820E131E84	GCNT19_EC_OK_CSCN	GCNT19 execute command OK condition signal
540001 820E141E84	GCNT20_EC_OK_CSCN	GCNT20 execute command OK condition signal
540001 820E151E84	GCNT21_EC_OK_CSCN	GCNT21 execute command OK condition signal
540001 820E161E84	GCNT22_EC_OK_CSCN	GCNT22 execute command OK condition signal
540001 820E171E84	GCNT23_EC_OK_CSCN	GCNT23 execute command OK condition signal
540001 820E181E84	GCNT24_EC_OK_CSCN	GCNT24 execute command OK condition signal
540001 820E191E84	GCNT25_EC_OK_CSCN	GCNT25 execute command OK condition signal
540001 820E1A1E84	GCNT26_EC_OK_CSCN	GCNT26 execute command OK condition signal
540001 820E1B1E84	GCNT27_EC_OK_CSCN	GCNT27 execute command OK condition signal
540001 820E1C1E84	GCNT28_EC_OK_CSCN	GCNT28 execute command OK condition signal
540001 820E1D1E84	GCNT29_EC_OK_CSCN	GCNT29 execute command OK condition signal
540001 820E1E1E84	GCNT30_EC_OK_CSCN	GCNT30 execute command OK condition signal
540001 820E1F1E84	GCNT31_EC_OK_CSCN	GCNT31 execute command OK condition signal
540001 820E201E84	GCNT32_EC_OK_CSCN	GCNT32 execute command OK condition signal

2.19.4 Mapping for IEC61850 communication

The user can operate the GCNT function over IEC 61850 communication following mapping using GR-TIEMS. Note that the GCNT function is designed for the class of "Integer Status Controller (ISC)" in the IEC 61850 standard for communication. The user should follow these steps, each of which is discussed below:

Step1: Editing Logical Node

Step2: Mapping output data

Step3: Mapping input data

(i) Editing Logical Node

The user will need to create a logical node (LN) for the GCNT01 function. Figure 2.19-15 exemplifies the editing of a LN; the LN "Integer Status controller (ISCSO)" is chosen for the GCNT01 function. After the user has defined an object "ISCSO", the GCNT01 logical node can be saved with the name "GIGO" plus "LN Instance". Create a definition of the object "ISCSO" in the GGIO logical node. Either the SBO mode or the DIR mode can be chosen in the editing for the LN.

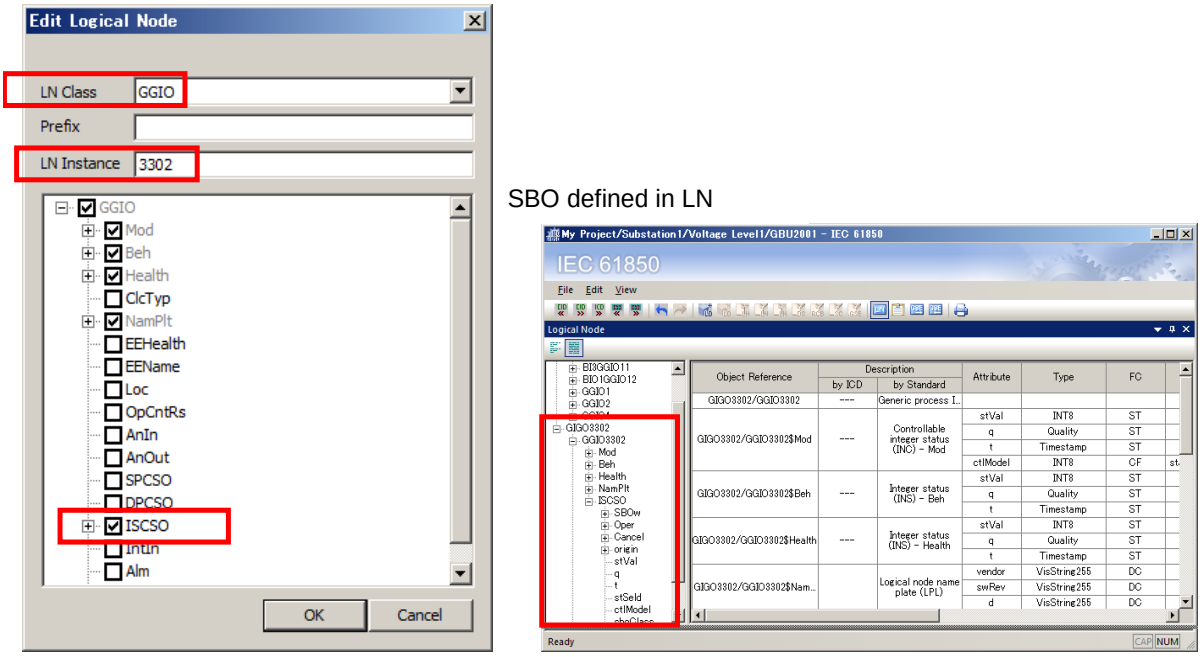
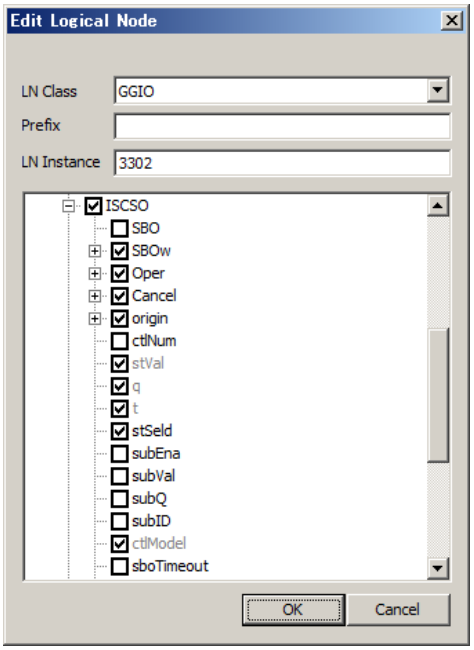


Figure 2.19-15 Defining "ISCSO" object in GIGO3302 logic node

(i)-1 Defining SBO mode

Figure 2.19-16 exemplifies the GCNT01 logic node saved as “GIGO3302”; in the SBO mode, the user should select the following items for the “GIGO3302$ISCSO” using GR-TIEMS:



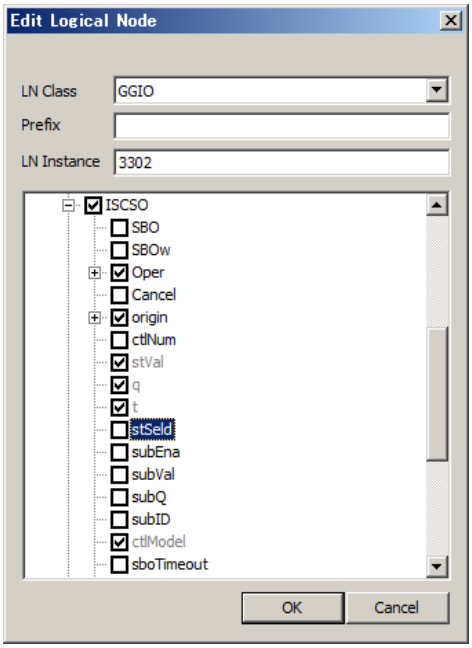
- ✓ SBOw
- ✓ Oper
- ✓ Cancel
- ✓ Origin
- ✓ stSeld
- ✓ sboClass† (choice ”operate-once”)
- ✓ ctlmodel (choice ”SBOes or SBOns”)

†”sboClass” can be found by scrolling down.

Figure 2.19-16 LN editing screen for SBO mode (for example)

(i)-2 Defining DIR mode

Figure 2.19-17 exemplifies the GCNT01 logic node saved as save as “GIGO3302”; in the DIR mode, the following three items should be selected using GR-TIEMS.



- ✓ Oper
- ✓ Origin
- ✓ ctlmodel (choice ”SBOes or SBOns”)

Figure 2.19-17 LN editing screen for DIR mode (for example)

(ii) Mapping output data

The user should group the GCNT01 signals with regard to GOOSE and REPORT; the user should map them for IEC61850 communication using GR-TIEMS (Figure 2.19-18 illustrates how to map a signal); it indicates that the signals for the GCNT01 function are required to map the IEC 61850 communications.

Table 2.19-10 Mapping signals required for GIGO3302 object in GCNT01 function

Object_reference	Attribute	Type	FC	Signal Number	Signal Name
Ctrl/GGIO3302$ISCSO$origin	orCat	orCategory	ST	540001300e011D23	GCNT01_CNT_ORCAT
Ctrl/GGIO3302$ISCSO$origin	orIdent	Octet64	ST	5400016A0e011FA7	GCNT01_CNT_ORIDENT
Ctrl/GGIO3302$ISCSO	stVal	INT32	ST	540001320e011D20	GCNT01_CNT_VAL
Ctrl/GGIO3302$ISCSO	q	Quality	ST	3010013110041005	Qual_Val
Ctrl/GGIO3302$ISCSO	t	Timestamp	ST	2003019010001006	SYS_TIME
Ctrl/GGIO3302$ISCSO	stSeld	BOOLEAN	ST	540001000E011D91	GCNT01_TMP_01

Note: "Status (ST)" is defined in the function constraint (FC) of the IEC 61850.

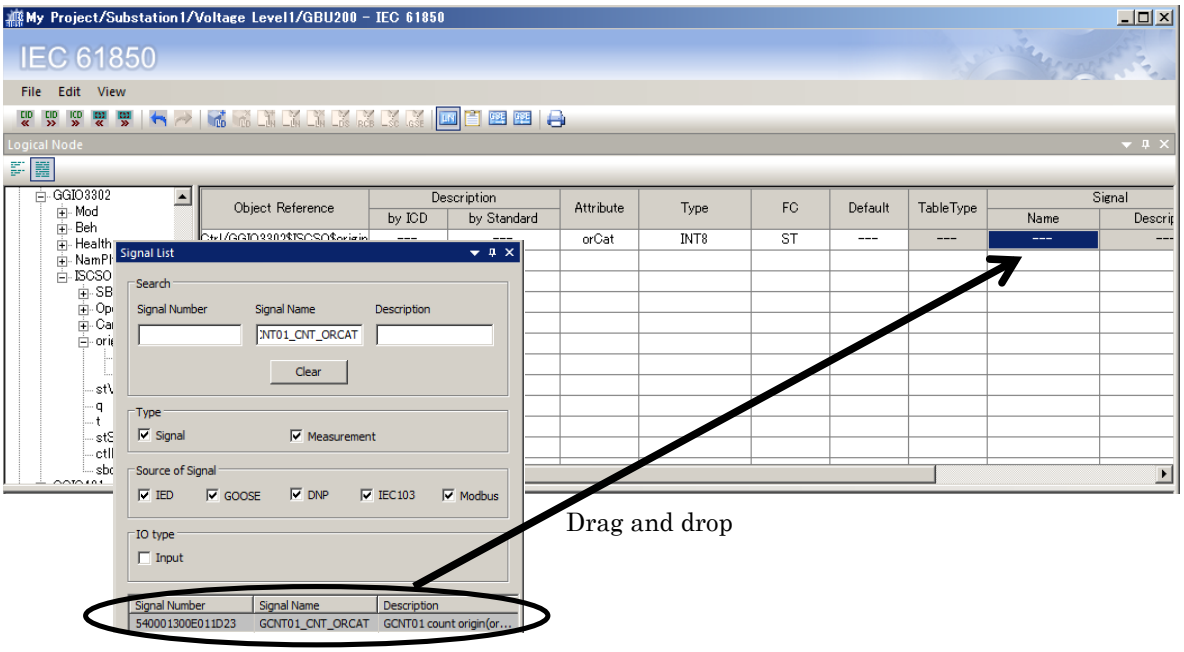


Figure 2.19-18 orCat attribute mapped into ISCSO object of GIGO3302

(iii) Mapping input data

The GCNT01 function can receive three commands "select, operate, and cancel". Thus, the user should map the input-point "GCNT01_CMM_REQ". Table 2.19-11 shows the input-point "GCNT01_CMM_REQ" and the Object reference "Ctrl/GIGO3302$ISCSO1"; the user should map the input-point to the Object reference having attributes CO and CF in FC†. Figure 2.19-19 shows how to map a signal.

†Note: The attribute is defined in the IEC 61850; "CO" stands for "Control" in the functional constraint (FC).

Table 2.19-11 Mapping signals required for ISCSO object for GIGO3302

Object_reference	Attribute	Type	FC	Signal Number	Signal Name
Ctrl/GGIO3302$ISCSO$Oper	ctlVal	INT32	CO	540001 700E016D09	GCNT01_CMM_REQ
Ctrl/GGIO3302$ISCSO$Oper	ctlNum	INT8U	CO		
Ctrl/GGIO3302$ISCSO$Oper	T	Timestamp	CO		
Ctrl/GGIO3302$ISCSO$Oper	Test	BOOLEAN	CO		
Ctrl/GGIO3302$ISCSO$Oper	Check	Check	CO		
Ctrl/GGIO3302$ISCSO$Oper$origin	orCat	orCategory	CO		
Ctrl/GGIO3302$ISCSO$Oper$origin	orIdent	Octet64	CO		
Ctrl/GGIO3302$ISCSO	ctlModel	ctlModel	CF		
Ctrl/GGIO3302$ISCSO	sboClass	sboClass	CF		

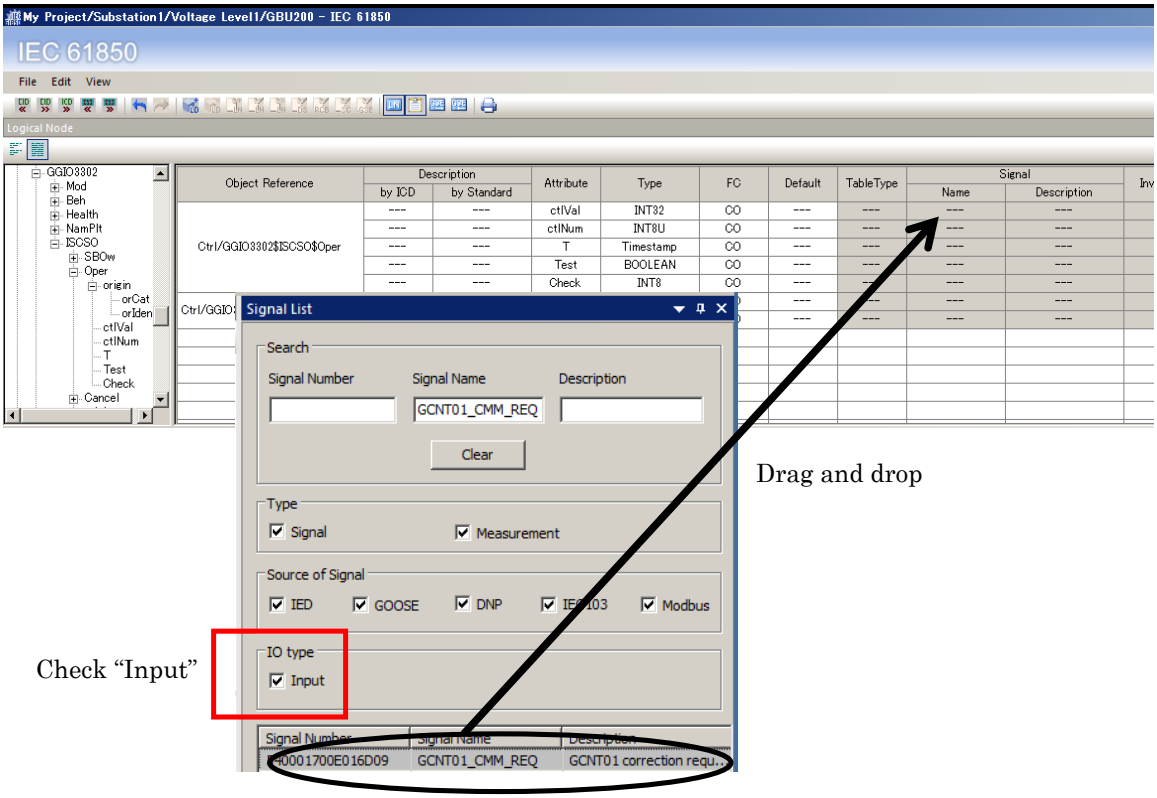


Figure 2.19-19 Input-point mapped for GIGO3302

2.19.5 Setting

Setting list for the GCNT (Function ID: 540001)

Setting device			Range	Units	Contents	Default setting value	Notes
G_CNT	CNT1	GCNT01-EN	Off / On		Counter1 Enable	Off	
		GCNT01-CNTS	NA / On / Off / OnOff		count status	NA	
		GCNT01-SDB	0 to 999	none	Counter1 Sending Dead Band	0	
		GCNT01-CNTRV	0/1		Return value at counter roll up	0	
		GCNT01-CNTMAX	9 to 2147483647	none	counter value maximum	999999	
		GCNT01-HMI	Off/On		Counter1 for HMI	Off	
	CNT2	GCNT02-EN	Off / On		Counter2 Enable	Off	
		GCNT02-CNTS	NA / On / Off / OnOff		count status	NA	
		GCNT02-SDB	0 to 999	none	Counter2 Sending Dead Band	0	
		GCNT02-CNTRV	0/1		Return value at counter roll up	0	
		GCNT02-CNTMAX	9 to 2147483647	none	counter value maximum	999999	
		GCNT02-HMI	Off/On		Counter2 for HMI	Off	
	.....	.....	.....		.....	.....	
	CNTxx	GCNTxx-EN	Off / On		Counter xx Enable	Off	
		GCNTxx-CNTS	NA / On / Off / OnOff		count status	NA	
		GCNTxx-SDB	0 to 999	none	Counter xx Sending Dead Band	0	
		GCNTxx-CNTRV	0/1		Return value at counter roll up	0	
		GCNTxx-CNTMAX	9 to 2147483647	none	counter value maximum	999999	
		GCNTxx-HMI	Off/On		Counter xx for HMI	Off	

Note: The number of counters in the GCNT depends on IED model. We omit the setting tables of GCNT03 to GGNTxx because the setting items are the same except the device number.

2.19.6 Data ID

◆ Connection points in PLC logics

GCNT (Function ID: 540001)

Element ID	Name	Description
800E00ED5A	GCNT00IN_TMP_51	GCNT00IN_TMP_51
800E01EDE0	GCNT01_PLC_SGNL	GCNT01 PLC signal
800E02EDE0	GCNT02_PLC_SGNL	GCNT02 PLC signal
800E03EDE0	GCNT03_PLC_SGNL	GCNT03 PLC signal
800E04EDE0	GCNT04_PLC_SGNL	GCNT04 PLC signal
800E05EDE0	GCNT05_PLC_SGNL	GCNT05 PLC signal
800E06EDE0	GCNT06_PLC_SGNL	GCNT06 PLC signal
800E07EDE0	GCNT07_PLC_SGNL	GCNT07 PLC signal
800E08EDE0	GCNT08_PLC_SGNL	GCNT08 PLC signal
800E09EDE0	GCNT09_PLC_SGNL	GCNT09 PLC signal
800E0AEDE0	GCNT10_PLC_SGNL	GCNT10 PLC signal
800E0BEDE0	GCNT11_PLC_SGNL	GCNT11 PLC signal
800E0CEDE0	GCNT12_PLC_SGNL	GCNT12 PLC signal
800E0DEDE0	GCNT13_PLC_SGNL	GCNT13 PLC signal
800E0EEDE0	GCNT14_PLC_SGNL	GCNT14 PLC signal
800E0FEDE0	GCNT15_PLC_SGNL	GCNT15 PLC signal
800E10EDE0	GCNT16_PLC_SGNL	GCNT16 PLC signal
800E11EDE0	GCNT17_PLC_SGNL	GCNT17 PLC signal
800E12EDE0	GCNT18_PLC_SGNL	GCNT18 PLC signal
800E13EDE0	GCNT19_PLC_SGNL	GCNT19 PLC signal
800E14EDE0	GCNT20_PLC_SGNL	GCNT20 PLC signal
800E15EDE0	GCNT21_PLC_SGNL	GCNT21 PLC signal
800E16EDE0	GCNT22_PLC_SGNL	GCNT22 PLC signal
800E17EDE0	GCNT23_PLC_SGNL	GCNT23 PLC signal
800E18EDE0	GCNT24_PLC_SGNL	GCNT24 PLC signal
800E19EDE0	GCNT25_PLC_SGNL	GCNT25 PLC signal
800E1AEDE0	GCNT26_PLC_SGNL	GCNT26 PLC signal
800E1BEDE0	GCNT27_PLC_SGNL	GCNT27 PLC signal
800E1CEDE0	GCNT28_PLC_SGNL	GCNT28 PLC signal
800E1DEDE0	GCNT29_PLC_SGNL	GCNT29 PLC signal
800E1EEDE0	GCNT30_PLC_SGNL	GCNT30 PLC signal
800E1FEDE0	GCNT31_PLC_SGNL	GCNT31 PLC signal
800E20EDE0	GCNT32_PLC_SGNL	GCNT32 PLC signal

◆ Signal monitoring points for the common terms

GCNT (Function ID: 540001)

Element ID	Name	Description
000E001F41	GCNT00_CCTRL_COUNTER	GCNT00 cmnctrl counter correction summarize
800E001D5B	GCNT00_CH_SC_OWS	GCNT00 count change select command by OWS(HMI)
800E001D5D	GCNT00_CH_SC_RCC	GCNT00 count change select command by RCC
800E001D5D	GCNT00_CH_SC_RMT	GCNT00 count change select command by Remote
800E001D54	GCNT00_CH_SC_LCD	GCNT00 count change select command by LCD
800E001D5E	GCNT00_CH_EC_OWS	GCNT00 count change execute command by OWS(HMI)

◆ Signal monitoring points for the common terms

GCNT (Function ID: 540001)

Element ID	Name	Description
800E001D5F	GCNT00_CH_EC_RCC	GCNT00 count change execute command by RCC
800E001D60	GCNT00_CH_EC_RMT	GCNT00 count change execute command by Remote
800E001D58	GCNT00_CH_EC_LCD	GCNT00 count change execute command by LCD
310E001707	Counter	DataID for GCNT Function(Setting)

◆ Signal monitoring points for respective counters (GCNT01 to GCNT32)

GCNT (Function ID: 540001)

Element ID	Name	Description
320E011D20	GCNT01_CNT_VAL	GCNT01 count value
310E011D21	GCNT01_CNT_QLT	GCNT01 count quality
000E011F42	GCNT01_CORR_INS	GCNT01 correction instruction
000E011D91	GCNT01_TMP_01	GCNT01 count change selected signal(stSeld) for SAS
890E011EA2	GCNT01_CTR_SGUCN	GCNT01 control logic stage(under selection)
8A0E011E76	GCNT01_SLD_CSCN	GCNT01 selected condition signal
8B0E011E7B	GCNT01_SLF_CSCN	GCNT01 select fail condition signal
820E011E84	GCNT01_EC_OK_CSCN	GCNT01 execute command OK condition signal
830E011E8B	GCNT01_EC_F_CSCN	GCNT01 execute command fail condition signal
840E011E95	GCNT01_CC_SSCN	GCNT01 cancel success signal
320E021D20	GCNT02_CNT_VAL	GCNT02 count value
310E021D21	GCNT02_CNT_QLT	GCNT02 count quality
000E021F42	GCNT02_CORR_INS	GCNT02 correction instruction
000E021D91	GCNT02_TMP_01	GCNT02 count change selected signal(stSeld) for SAS
890E021EA2	GCNT02_CTR_SGUCN	GCNT02 control logic stage(under selection)
8A0E021E76	GCNT02_SLD_CSCN	GCNT02 selected condition signal
8B0E021E7B	GCNT02_SLF_CSCN	GCNT02 select fail condition signal
820E021E84	GCNT02_EC_OK_CSCN	GCNT02 execute command OK condition signal
830E021E8B	GCNT02_EC_F_CSCN	GCNT02 execute command fail condition signal
840E021E95	GCNT02_CC_SSCN	GCNT02 cancel success signal
320E031D20	GCNT03_CNT_VAL	GCNT03 count value
310E031D21	GCNT03_CNT_QLT	GCNT03 count quality
000E031F42	GCNT03_CORR_INS	GCNT03 correction instruction
000E031D91	GCNT03_TMP_01	GCNT03 count change selected signal(stSeld) for SAS
890E031EA2	GCNT03_CTR_SGUCN	GCNT03 control logic stage(under selection)
8A0E031E76	GCNT03_SLD_CSCN	GCNT03 selected condition signal
8B0E031E7B	GCNT03_SLF_CSCN	GCNT03 select fail condition signal
820E031E84	GCNT03_EC_OK_CSCN	GCNT03 execute command OK condition signal
830E031E8B	GCNT03_EC_F_CSCN	GCNT03 execute command fail condition signal
840E031E95	GCNT03_CC_SSCN	GCNT03 cancel success signal
320E041D20	GCNT04_CNT_VAL	GCNT04 count value
310E041D21	GCNT04_CNT_QLT	GCNT04 count quality
000E041F42	GCNT04_CORR_INS	GCNT04 correction instruction
000E041D91	GCNT04_TMP_01	GCNT04 count change selected signal(stSeld) for SAS
890E041EA2	GCNT04_CTR_SGUCN	GCNT04 control logic stage(under selection)
8A0E041E76	GCNT04_SLD_CSCN	GCNT04 selected condition signal

◆ Signal monitoring points for respective counters (GCNT01 to GCNT32)

GCNT (Function ID: 540001)

Element ID	Name	Description
8B0E041E7B	GCNT04_SLF_CSCN	GCNT04 select fail condition signal
820E041E84	GCNT04_EC_OK_CSCN	GCNT04 execute command OK condition signal
830E041E8B	GCNT04_EC_F_CSCN	GCNT04 execute command fail condition signal
840E041E95	GCNT04_CC_SSCN	GCNT04 cancel success signal
320E051D20	GCNT05_CNT_VAL	GCNT05 count value
310E051D21	GCNT05_CNT_QLT	GCNT05 count quality
000E051F42	GCNT05_CORR_INS	GCNT05 correction instruction
000E051D91	GCNT05_TMP_01	GCNT05 count change selected signal(stSeld) for SAS
890E051EA2	GCNT05_CTR_SGUCN	GCNT05 control logic stage(under selection)
8A0E051E76	GCNT05_SLD_CSCN	GCNT05 selected condition signal
8B0E051E7B	GCNT05_SLF_CSCN	GCNT05 select fail condition signal
820E051E84	GCNT05_EC_OK_CSCN	GCNT05 execute command OK condition signal
830E051E8B	GCNT05_EC_F_CSCN	GCNT05 execute command fail condition signal
840E051E95	GCNT05_CC_SSCN	GCNT05 cancel success signal
320E061D20	GCNT06_CNT_VAL	GCNT06 count value
310E061D21	GCNT06_CNT_QLT	GCNT06 count quality
000E061F42	GCNT06_CORR_INS	GCNT06 correction instruction
000E061D91	GCNT06_TMP_01	GCNT06 count change selected signal(stSeld) for SAS
890E061EA2	GCNT06_CTR_SGUCN	GCNT06 control logic stage(under selection)
8A0E061E76	GCNT06_SLD_CSCN	GCNT06 selected condition signal
8B0E061E7B	GCNT06_SLF_CSCN	GCNT06 select fail condition signal
820E061E84	GCNT06_EC_OK_CSCN	GCNT06 execute command OK condition signal
830E061E8B	GCNT06_EC_F_CSCN	GCNT06 execute command fail condition signal
840E061E95	GCNT06_CC_SSCN	GCNT06 cancel success signal
320E071D20	GCNT07_CNT_VAL	GCNT07 count value
310E071D21	GCNT07_CNT_QLT	GCNT07 count quality
000E071F42	GCNT07_CORR_INS	GCNT07 correction instruction
000E071D91	GCNT07_TMP_01	GCNT07 count change selected signal(stSeld) for SAS
890E071EA2	GCNT07_CTR_SGUCN	GCNT07 control logic stage(under selection)
8A0E071E76	GCNT07_SLD_CSCN	GCNT07 selected condition signal
8B0E071E7B	GCNT07_SLF_CSCN	GCNT07 select fail condition signal
820E071E84	GCNT07_EC_OK_CSCN	GCNT07 execute command OK condition signal
830E071E8B	GCNT07_EC_F_CSCN	GCNT07 execute command fail condition signal
840E071E95	GCNT07_CC_SSCN	GCNT07 cancel success signal
320E081D20	GCNT08_CNT_VAL	GCNT08 count value
310E081D21	GCNT08_CNT_QLT	GCNT08 count quality
000E081F42	GCNT08_CORR_INS	GCNT08 correction instruction
000E081D91	GCNT08_TMP_01	GCNT08 count change selected signal(stSeld) for SAS
890E081EA2	GCNT08_CTR_SGUCN	GCNT08 control logic stage(under selection)
8A0E081E76	GCNT08_SLD_CSCN	GCNT08 selected condition signal
8B0E081E7B	GCNT08_SLF_CSCN	GCNT08 select fail condition signal
820E081E84	GCNT08_EC_OK_CSCN	GCNT08 execute command OK condition signal
830E081E8B	GCNT08_EC_F_CSCN	GCNT08 execute command fail condition signal
840E081E95	GCNT08_CC_SSCN	GCNT08 cancel success signal

◆ Signal monitoring points for respective counters (GCNT01 to GCNT32)

GCNT (Function ID: 540001)

Element ID	Name	Description
320E091D20	GCNT09_CNT_VAL	GCNT09 count value
310E091D21	GCNT09_CNT_QLT	GCNT09 count quality
000E091F42	GCNT09_CORR_INS	GCNT09 correction instruction
000E091D91	GCNT09_TMP_01	GCNT09 count change selected signal(stSeld) for SAS
890E091EA2	GCNT09_CTR_SGUCN	GCNT09 control logic stage(under selection)
8A0E091E76	GCNT09_SLD_CSCN	GCNT09 selected condition signal
8B0E091E7B	GCNT09_SLF_CSCN	GCNT09 select fail condition signal
820E091E84	GCNT09_EC_OK_CSCN	GCNT09 execute command OK condition signal
830E091E8B	GCNT09_EC_F_CSCN	GCNT09 execute command fail condition signal
840E091E95	GCNT09_CC_SSCN	GCNT09 cancel success signal
320E0A1D20	GCNT10_CNT_VAL	GCNT10 count value
310E0A1D21	GCNT10_CNT_QLT	GCNT10 count quality
000E0A1F42	GCNT10_CORR_INS	GCNT10 correction instruction
000E0A1D91	GCNT10_TMP_01	GCNT10 count change selected signal(stSeld) for SAS
890E0A1EA2	GCNT10_CTR_SGUCN	GCNT10 control logic stage(under selection)
8A0E0A1E76	GCNT10_SLD_CSCN	GCNT10 selected condition signal
8B0E0A1E7B	GCNT10_SLF_CSCN	GCNT10 select fail condition signal
820E0A1E84	GCNT10_EC_OK_CSCN	GCNT10 execute command OK condition signal
830E0A1E8B	GCNT10_EC_F_CSCN	GCNT10 execute command fail condition signal
840E0A1E95	GCNT10_CC_SSCN	GCNT10 cancel success signal
320E0B1D20	GCNT11_CNT_VAL	GCNT11 count value
310E0B1D21	GCNT11_CNT_QLT	GCNT11 count quality
000E0B1F42	GCNT11_CORR_INS	GCNT11 correction instruction
000E0B1D91	GCNT11_TMP_01	GCNT11 count change selected signal(stSeld) for SAS
890E0B1EA2	GCNT11_CTR_SGUCN	GCNT11 control logic stage(under selection)
8A0E0B1E76	GCNT11_SLD_CSCN	GCNT11 selected condition signal
8B0E0B1E7B	GCNT11_SLF_CSCN	GCNT11 select fail condition signal
820E0B1E84	GCNT11_EC_OK_CSCN	GCNT11 execute command OK condition signal
830E0B1E8B	GCNT11_EC_F_CSCN	GCNT11 execute command fail condition signal
840E0B1E95	GCNT11_CC_SSCN	GCNT11 cancel success signal
320E0D1D20	GCNT12_CNT_VAL	GCNT12 count value
310E0D1D21	GCNT12_CNT_QLT	GCNT12 count quality
000E0D1F42	GCNT12_CORR_INS	GCNT12 correction instruction
000E0D1D91	GCNT12_TMP_01	GCNT12 count change selected signal(stSeld) for SAS
890E0D1EA2	GCNT12_CTR_SGUCN	GCNT12 control logic stage(under selection)
8A0E0D1E76	GCNT12_SLD_CSCN	GCNT12 selected condition signal
8B0E0D1E7B	GCNT12_SLF_CSCN	GCNT12 select fail condition signal
820E0D1E84	GCNT12_EC_OK_CSCN	GCNT12 execute command OK condition signal
830E0D1E8B	GCNT12_EC_F_CSCN	GCNT12 execute command fail condition signal
840E0D1E95	GCNT12_CC_SSCN	GCNT12 cancel success signal
320E0D1D20	GCNT13_CNT_VAL	GCNT13 count value
310E0D1D21	GCNT13_CNT_QLT	GCNT13 count quality
000E0D1F42	GCNT13_CORR_INS	GCNT13 correction instruction
000E0D1D91	GCNT13_TMP_01	GCNT13 count change selected signal(stSeld) for SAS

◆ Signal monitoring points for respective counters (GCNT01 to GCNT32)

GCNT (Function ID: 540001)

Element ID	Name	Description
890E0D1EA2	GCNT13_CTR_SGUCN	GCNT13 control logic stage(under selection)
8A0E0D1E76	GCNT13_SLD_CSCN	GCNT13 selected condition signal
8B0E0D1E7B	GCNT13_SLF_CSCN	GCNT13 select fail condition signal
820E0D1E84	GCNT13_EC_OK_CSCN	GCNT13 execute command OK condition signal
830E0D1E8B	GCNT13_EC_F_CSCN	GCNT13 execute command fail condition signal
840E0D1E95	GCNT13_CC_SSCN	GCNT13 cancel success signal
320E0E1D20	GCNT14_CNT_VAL	GCNT14 count value
310E0E1D21	GCNT14_CNT_QLT	GCNT14 count quality
000E0E1F42	GCNT14_CORR_INS	GCNT14 correction instruction
000E0E1D91	GCNT14_TMP_01	GCNT14 count change selected signal(stSeld) for SAS
890E0E1EA2	GCNT14_CTR_SGUCN	GCNT14 control logic stage(under selection)
8A0E0E1E76	GCNT14_SLD_CSCN	GCNT14 selected condition signal
8B0E0E1E7B	GCNT14_SLF_CSCN	GCNT14 select fail condition signal
820E0E1E84	GCNT14_EC_OK_CSCN	GCNT14 execute command OK condition signal
830E0E1E8B	GCNT14_EC_F_CSCN	GCNT14 execute command fail condition signal
840E0E1E95	GCNT14_CC_SSCN	GCNT14 cancel success signal
320E0F1D20	GCNT15_CNT_VAL	GCNT15 count value
310E0F1D21	GCNT15_CNT_QLT	GCNT15 count quality
000E0F1F42	GCNT15_CORR_INS	GCNT15 correction instruction
000E0F1D91	GCNT15_TMP_01	GCNT15 count change selected signal(stSeld) for SAS
890E0F1EA2	GCNT15_CTR_SGUCN	GCNT15 control logic stage(under selection)
8A0E0F1E76	GCNT15_SLD_CSCN	GCNT15 selected condition signal
8B0E0F1E7B	GCNT15_SLF_CSCN	GCNT15 select fail condition signal
820E0F1E84	GCNT15_EC_OK_CSCN	GCNT15 execute command OK condition signal
830E0F1E8B	GCNT15_EC_F_CSCN	GCNT15 execute command fail condition signal
840E0F1E95	GCNT15_CC_SSCN	GCNT15 cancel success signal
320E101D20	GCNT16_CNT_VAL	GCNT16 count value
310E101D21	GCNT16_CNT_QLT	GCNT16 count quality
000E101F42	GCNT16_CORR_INS	GCNT16 correction instruction
000E101D91	GCNT16_TMP_01	GCNT16 count change selected signal(stSeld) for SAS
890E101EA2	GCNT16_CTR_SGUCN	GCNT16 control logic stage(under selection)
8A0E101E76	GCNT16_SLD_CSCN	GCNT16 selected condition signal
8B0E101E7B	GCNT16_SLF_CSCN	GCNT16 select fail condition signal
820E101E84	GCNT16_EC_OK_CSCN	GCNT16 execute command OK condition signal
830E101E8B	GCNT16_EC_F_CSCN	GCNT16 execute command fail condition signal
840E101E95	GCNT16_CC_SSCN	GCNT16 cancel success signal
320E111D20	GCNT17_CNT_VAL	GCNT17 count value
310E111D21	GCNT17_CNT_QLT	GCNT17 count quality
000E111F42	GCNT17_CORR_INS	GCNT17 correction instruction
000E111D91	GCNT17_TMP_01	GCNT17 count change selected signal(stSeld) for SAS
890E111EA2	GCNT17_CTR_SGUCN	GCNT17 control logic stage(under selection)
8A0E111E76	GCNT17_SLD_CSCN	GCNT17 selected condition signal
8B0E111E7B	GCNT17_SLF_CSCN	GCNT17 select fail condition signal
820E111E84	GCNT17_EC_OK_CSCN	GCNT17 execute command OK condition signal

◆ Signal monitoring points for respective counters (GCNT01 to GCNT32)

GCNT (Function ID: 540001)

Element ID	Name	Description
830E111E8B	GCNT17_EC_F_CSCN	GCNT17 execute command fail condition signal
840E111E95	GCNT17_CC_SSCN	GCNT17 cancel success signal
310E121D21	GCNT18_CNT_QLT	GCNT18 count quality
000E121F42	GCNT18_CORR_INS	GCNT18 correction instruction
000E121D91	GCNT18_TMP_01	GCNT18 count change selected signal(stSeld) for SAS
890E121EA2	GCNT18_CTR_SGUCN	GCNT18 control logic stage(under selection)
8A0E121E76	GCNT18_SLD_CSCN	GCNT18 selected condition signal
8B0E121E7B	GCNT18_SLF_CSCN	GCNT18 select fail condition signal
820E121E84	GCNT18_EC_OK_CSCN	GCNT18 execute command OK condition signal
830E121E8B	GCNT18_EC_F_CSCN	GCNT18 execute command fail condition signal
840E121E95	GCNT18_CC_SSCN	GCNT18 cancel success signal
320E131D20	GCNT19_CNT_VAL	GCNT19 count value
310E131D21	GCNT19_CNT_QLT	GCNT19 count quality
000E131F42	GCNT19_CORR_INS	GCNT19 correction instruction
000E131D91	GCNT19_TMP_01	GCNT19 count change selected signal(stSeld) for SAS
890E131EA2	GCNT19_CTR_SGUCN	GCNT19 control logic stage(under selection)
8A0E131E76	GCNT19_SLD_CSCN	GCNT19 selected condition signal
8B0E131E7B	GCNT19_SLF_CSCN	GCNT19 select fail condition signal
820E131E84	GCNT19_EC_OK_CSCN	GCNT19 execute command OK condition signal
830E131E8B	GCNT19_EC_F_CSCN	GCNT19 execute command fail condition signal
840E131E95	GCNT19_CC_SSCN	GCNT19 cancel success signal
320E141D20	GCNT20_CNT_VAL	GCNT20 count value
310E141D21	GCNT20_CNT_QLT	GCNT20 count quality
000E141F42	GCNT20_CORR_INS	GCNT20 correction instruction
000E141D91	GCNT20_TMP_01	GCNT20 count change selected signal(stSeld) for SAS
890E141EA2	GCNT20_CTR_SGUCN	GCNT20 control logic stage(under selection)
8A0E141E76	GCNT20_SLD_CSCN	GCNT20 selected condition signal
8B0E141E7B	GCNT20_SLF_CSCN	GCNT20 select fail condition signal
820E141E84	GCNT20_EC_OK_CSCN	GCNT20 execute command OK condition signal
830E141E8B	GCNT20_EC_F_CSCN	GCNT20 execute command fail condition signal
840E141E95	GCNT20_CC_SSCN	GCNT20 cancel success signal
320E151D20	GCNT21_CNT_VAL	GCNT21 count value
310E151D21	GCNT21_CNT_QLT	GCNT21 count quality
000E151F42	GCNT21_CORR_INS	GCNT21 correction instruction
000E151D91	GCNT21_TMP_01	GCNT21 count change selected signal(stSeld) for SAS
890E151EA2	GCNT21_CTR_SGUCN	GCNT21 control logic stage(under selection)
8A0E151E76	GCNT21_SLD_CSCN	GCNT21 selected condition signal
8B0E151E7B	GCNT21_SLF_CSCN	GCNT21 select fail condition signal
820E151E84	GCNT21_EC_OK_CSCN	GCNT21 execute command OK condition signal
830E151E8B	GCNT21_EC_F_CSCN	GCNT21 execute command fail condition signal
840E151E95	GCNT21_CC_SSCN	GCNT21 cancel success signal
320E161D20	GCNT22_CNT_VAL	GCNT22 count value
310E161D21	GCNT22_CNT_QLT	GCNT22 count quality
000E161F42	GCNT22_CORR_INS	GCNT22 correction instruction

◆ Signal monitoring points for respective counters (GCNT01 to GCNT32)

GCNT (Function ID: 540001)

Element ID	Name	Description
000E161D91	GCNT22_TMP_01	GCNT22 count change selected signal(stSeld) for SAS
890E161EA2	GCNT22_CTR_SGUCN	GCNT22 control logic stage(under selection)
8A0E161E76	GCNT22_SLD_CSCN	GCNT22 selected condition signal
8B0E161E7B	GCNT22_SLF_CSCN	GCNT22 select fail condition signal
820E161E84	GCNT22_EC_OK_CSCN	GCNT22 execute command OK condition signal
830E161E8B	GCNT22_EC_F_CSCN	GCNT22 execute command fail condition signal
840E161E95	GCNT22_CC_SSCN	GCNT22 cancel success signal
320E171D20	GCNT23_CNT_VAL	GCNT23 count value
310E171D21	GCNT23_CNT_QLT	GCNT23 count quality
000E171F42	GCNT23_CORR_INS	GCNT23 correction instruction
000E171D91	GCNT23_TMP_01	GCNT23 count change selected signal(stSeld) for SAS
890E171EA2	GCNT23_CTR_SGUCN	GCNT23 control logic stage(under selection)
8A0E171E76	GCNT23_SLD_CSCN	GCNT23 selected condition signal
8B0E171E7B	GCNT23_SLF_CSCN	GCNT23 select fail condition signal
820E171E84	GCNT23_EC_OK_CSCN	GCNT23 execute command OK condition signal
830E171E8B	GCNT23_EC_F_CSCN	GCNT23 execute command fail condition signal
840E171E95	GCNT23_CC_SSCN	GCNT23 cancel success signal
320E181D20	GCNT24_CNT_VAL	GCNT24 count value
310E181D21	GCNT24_CNT_QLT	GCNT24 count quality
000E181F42	GCNT24_CORR_INS	GCNT24 correction instruction
000E181D91	GCNT24_TMP_01	GCNT24 count change selected signal(stSeld) for SAS
890E181EA2	GCNT24_CTR_SGUCN	GCNT24 control logic stage(under selection)
8A0E181E76	GCNT24_SLD_CSCN	GCNT24 selected condition signal
8B0E181E7B	GCNT24_SLF_CSCN	GCNT24 select fail condition signal
820E181E84	GCNT24_EC_OK_CSCN	GCNT24 execute command OK condition signal
830E181E8B	GCNT24_EC_F_CSCN	GCNT24 execute command fail condition signal
840E181E95	GCNT24_CC_SSCN	GCNT24 cancel success signal
320E191D20	GCNT25_CNT_VAL	GCNT25 count value
310E191D21	GCNT25_CNT_QLT	GCNT25 count quality
000E191F42	GCNT25_CORR_INS	GCNT25 correction instruction
000E191D91	GCNT25_TMP_01	GCNT25 count change selected signal(stSeld) for SAS
890E191EA2	GCNT25_CTR_SGUCN	GCNT25 control logic stage(under selection)
8A0E191E76	GCNT25_SLD_CSCN	GCNT25 selected condition signal
8B0E191E7B	GCNT25_SLF_CSCN	GCNT25 select fail condition signal
820E191E84	GCNT25_EC_OK_CSCN	GCNT25 execute command OK condition signal
830E191E8B	GCNT25_EC_F_CSCN	GCNT25 execute command fail condition signal
840E191E95	GCNT25_CC_SSCN	GCNT25 cancel success signal
320E1A1D20	GCNT26_CNT_VAL	GCNT26 count value
310E1A1D21	GCNT26_CNT_QLT	GCNT26 count quality
000E1A1F42	GCNT26_CORR_INS	GCNT26 correction instruction
000E1A1D91	GCNT26_TMP_01	GCNT26 count change selected signal(stSeld) for SAS
890E1A1EA2	GCNT26_CTR_SGUCN	GCNT26 control logic stage(under selection)
8A0E1A1E76	GCNT26_SLD_CSCN	GCNT26 selected condition signal
8B0E1A1E7B	GCNT26_SLF_CSCN	GCNT26 select fail condition signal

◆ Signal monitoring points for respective counters (GCNT01 to GCNT32)

GCNT (Function ID: 540001)

Element ID	Name	Description
820E1A1E84	GCNT26_EC_OK_CSCN	GCNT26 execute command OK condition signal
830E1A1E8B	GCNT26_EC_F_CSCN	GCNT26 execute command fail condition signal
840E1A1E95	GCNT26_CC_SSCN	GCNT26 cancel success signal
320E1B1D20	GCNT27_CNT_VAL	GCNT27 count value
310E1B1D21	GCNT27_CNT_QLT	GCNT27 count quality
000E1B1F42	GCNT27_CORR_INS	GCNT27 correction instruction
000E1B1D91	GCNT27_TMP_01	GCNT27 count change selected signal(stSeld) for SAS
890E1B1EA2	GCNT27_CTR_SGUCN	GCNT27 control logic stage(under selection)
8A0E1B1E76	GCNT27_SLD_CSCN	GCNT27 selected condition signal
8B0E1B1E7B	GCNT27_SLF_CSCN	GCNT27 select fail condition signal
820E1B1E84	GCNT27_EC_OK_CSCN	GCNT27 execute command OK condition signal
830E1B1E8B	GCNT27_EC_F_CSCN	GCNT27 execute command fail condition signal
840E1B1E95	GCNT27_CC_SSCN	GCNT27 cancel success signal
320E1D1D20	GCNT28_CNT_VAL	GCNT28 count value
310E1D1D21	GCNT28_CNT_QLT	GCNT28 count quality
000E1D1F42	GCNT28_CORR_INS	GCNT28 correction instruction
000E1D1D91	GCNT28_TMP_01	GCNT28 count change selected signal(stSeld) for SAS
890E1D1EA2	GCNT28_CTR_SGUCN	GCNT28 control logic stage(under selection)
8A0E1D1E76	GCNT28_SLD_CSCN	GCNT28 selected condition signal
8B0E1D1E7B	GCNT28_SLF_CSCN	GCNT28 select fail condition signal
820E1D1E84	GCNT28_EC_OK_CSCN	GCNT28 execute command OK condition signal
830E1D1E8B	GCNT28_EC_F_CSCN	GCNT28 execute command fail condition signal
840E1D1E95	GCNT28_CC_SSCN	GCNT28 cancel success signal
320E1D1D20	GCNT29_CNT_VAL	GCNT29 count value
310E1D1D21	GCNT29_CNT_QLT	GCNT29 count quality
000E1D1F42	GCNT29_CORR_INS	GCNT29 correction instruction
000E1D1D91	GCNT29_TMP_01	GCNT29 count change selected signal(stSeld) for SAS
890E1D1EA2	GCNT29_CTR_SGUCN	GCNT29 control logic stage(under selection)
8A0E1D1E76	GCNT29_SLD_CSCN	GCNT29 selected condition signal
8B0E1D1E7B	GCNT29_SLF_CSCN	GCNT29 select fail condition signal
820E1D1E84	GCNT29_EC_OK_CSCN	GCNT29 execute command OK condition signal
830E1D1E8B	GCNT29_EC_F_CSCN	GCNT29 execute command fail condition signal
840E1D1E95	GCNT29_CC_SSCN	GCNT29 cancel success signal
320E1E1D20	GCNT30_CNT_VAL	GCNT30 count value
310E1E1D21	GCNT30_CNT_QLT	GCNT30 count quality
000E1E1F42	GCNT30_CORR_INS	GCNT30 correction instruction
000E1E1D91	GCNT30_TMP_01	GCNT30 count change selected signal(stSeld) for SAS
890E1E1EA2	GCNT30_CTR_SGUCN	GCNT30 control logic stage(under selection)
8A0E1E1E76	GCNT30_SLD_CSCN	GCNT30 selected condition signal
8B0E1E1E7B	GCNT30_SLF_CSCN	GCNT30 select fail condition signal
820E1E1E84	GCNT30_EC_OK_CSCN	GCNT30 execute command OK condition signal
830E1E1E8B	GCNT30_EC_F_CSCN	GCNT30 execute command fail condition signal
840E1E1E95	GCNT30_CC_SSCN	GCNT30 cancel success signal
320E1F1D20	GCNT31_CNT_VAL	GCNT31 count value

◆ Signal monitoring points for respective counters (GCNT01 to GCNT32)

GCNT (Function ID: 540001)

Element ID	Name	Description
310E1F1D21	GCNT31_CNT_QLT	GCNT31 count quality
000E1F1F42	GCNT31_CORR_INS	GCNT31 correction instruction
000E1F1D91	GCNT31_TMP_01	GCNT31 count change selected signal(stSeld) for SAS
890E1F1EA2	GCNT31_CTR_SGUCN	GCNT31 control logic stage(under selection)
8A0E1F1E76	GCNT31_SLD_CSCN	GCNT31 selected condition signal
8B0E1F1E7B	GCNT31_SLF_CSCN	GCNT31 select fail condition signal
820E1F1E84	GCNT31_EC_OK_CSCN	GCNT31 execute command OK condition signal
830E1F1E8B	GCNT31_EC_F_CSCN	GCNT31 execute command fail condition signal
840E1F1E95	GCNT31_CC_SSCN	GCNT31 cancel success signal
320E201D20	GCNT32_CNT_VAL	GCNT32 count value
310E201D21	GCNT32_CNT_QLT	GCNT32 count quality
000E201F42	GCNT32_CORR_INS	GCNT32 correction instruction
000E201D91	GCNT32_TMP_01	GCNT32 count change selected signal(stSeld) for SAS
890E201EA2	GCNT32_CTR_SGUCN	GCNT32 control logic stage(under selection)
8A0E201E76	GCNT32_SLD_CSCN	GCNT32 selected condition signal
8B0E201E7B	GCNT32_SLF_CSCN	GCNT32 select fail condition signal
820E201E84	GCNT32_EC_OK_CSCN	GCNT32 execute command OK condition signal
830E201E8B	GCNT32_EC_F_CSCN	GCNT32 execute command fail condition signal
840E201E95	GCNT32_CC_SSCN	GCNT32 cancel success signal

2.20 Dummy CB Function (DMYCB)

The dummy CB function (DMYCB) is designed to verify the reliability of the communications between the IED and a SAS. Thus, a remote operator can either close or open a dummy CB provided within the IED using the SAS; the operator will have confirmation that communication is healthy when the response signal provided by the dummy CB is received.

Note: The implementation of particular features is dependent upon the selection of hardware and the configuration of functions. Several IED models do not support certain features. To determine whether a particular feature has been implemented within an IED, identify the IED ordering number; and check the order number at the "G&T position" whilst referring to the comparison table below. For more information, see *Appendix: Ordering*.

Table 2.20-1 Comparative table in respective ordering numbers

Sec.	Feature	Ordering No. at "G&T"					
		BCU			BCPU		IFU
		11	13	1F	2N	2C	19
–	Main features	✓	✓	✓	✓	✓	NA

✓: Applicable NA: Not applicable

2.20.1 Control of dummy CB

Figure 2.20-1 shows the control flow for the DMYCB function.

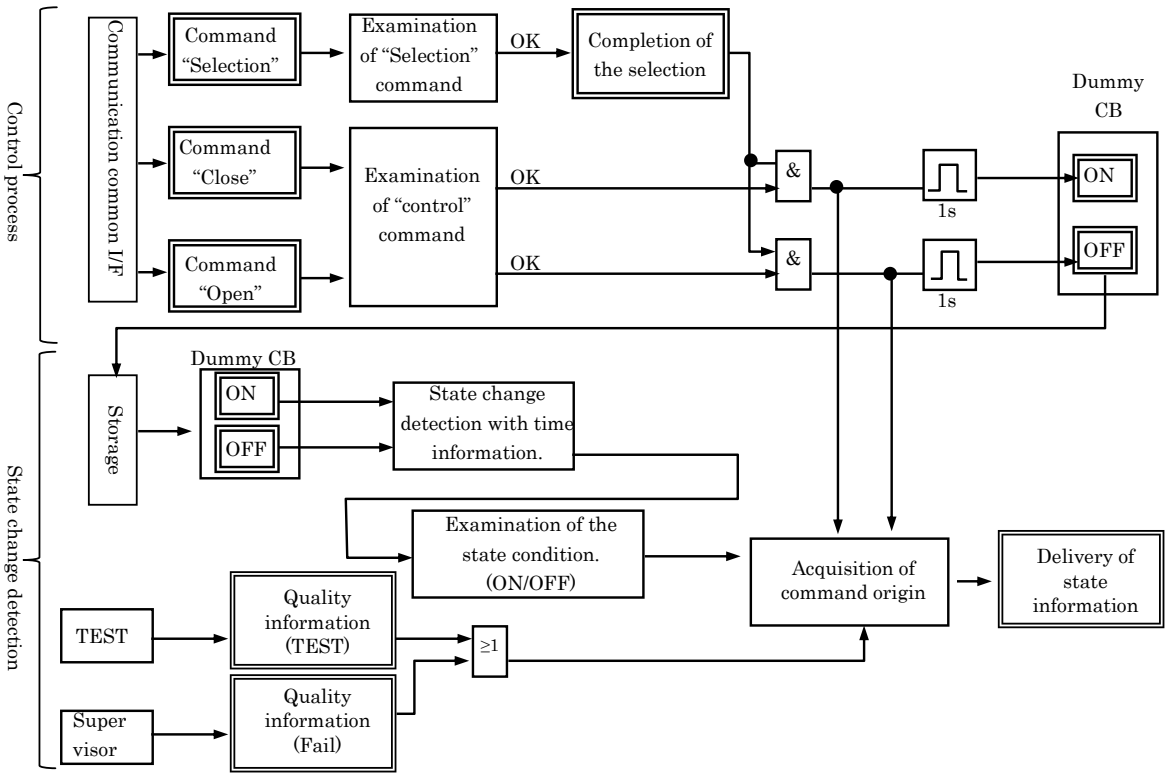


Figure 2.20-1 Operation flow for Dummy CB

The DMYCB function is provided when **On** is set of for the scheme switch [**DMCB-EN**].

Table 2.20-2 Settings for DMYCB operation

Scheme switch	Set	Comment
DMCB-EN	Off / On	DMYCB Enable
DMCB-CTRMENU	Off / On	Front panel operation enable
DMCB-CTRAHMI	DIR / SBO	Selection of control mode on the HMI

When the user wishes to use the DMYCB function locally, set **On** for the scheme switch [**DMCB-CTRMENU**]; set either DIR or SBO for the scheme switch [**DMCB-CTRAHMI**].

Since the DYMCB is a fictional CB implemented within the IED memory, note that the operation of the DMYCB function is a function provided purely for control and verification. Properties of the DMYCB function that are different from the properties found within conventional devices are listed as follows:

1. The DMYCB function does not have an interface to a binary input circuit (BI) and a binary-output circuit (BO).
2. The DMYCB function will not change state independently.
3. The event suppression function and the contact inconsistency check are not

available for the DMYCB function.

4. The counter feature and the measurement feature are available to the DMYCB function.
5. Time information is generated by the DMYCB function when the state of the dummy CB is changed.
6. The DMYCB function monitors the state of a dummy CB every 100ms.
7. The software interlock (ILK) and synchronizing check (SYNDIF) functions cannot be bypassed in the operation of the DMYCB function.

Note that the signal Control hierarchy" is required to operate the DMYCB function; the user should note that the connection with the Control hierarchy is made using the connection point "PLC_BIT_1262" (see Table 2.8-7). For more information, see chapter *Control and monitoring application: Control hierarchy*.

Table 2.20-3 PLC connection point (Input signal for select condition logic)

Signal Number	Signal Name	Description	M/O
5A0101 801261EF40	PLC_BIT_1262	DMYCB control hierarchy condition	M

2.20.2 Mapping for IEC61850 communication

The user can operate the DMYCB function over IEC 61850 communications after first mapping using GR-TIEMS. The user should proceed using the following steps,

Step1: Editing Logical Node

Step2: Mapping output data

Step3: Mapping input data

(i) Editing Logical Node

The user should implement a logical node (LN) for the DMYCB function. Figure 2.20-2 exemplifies the editing of the LN; the LN "CSWI3" is chosen for the DMYCB for IEC 61850 communication. After the user has defined an object "POS", the DMYCB logical node can be saved with the name "CSWI3". Either the SBO mode or the DIR mode can be chosen in the LN editing.

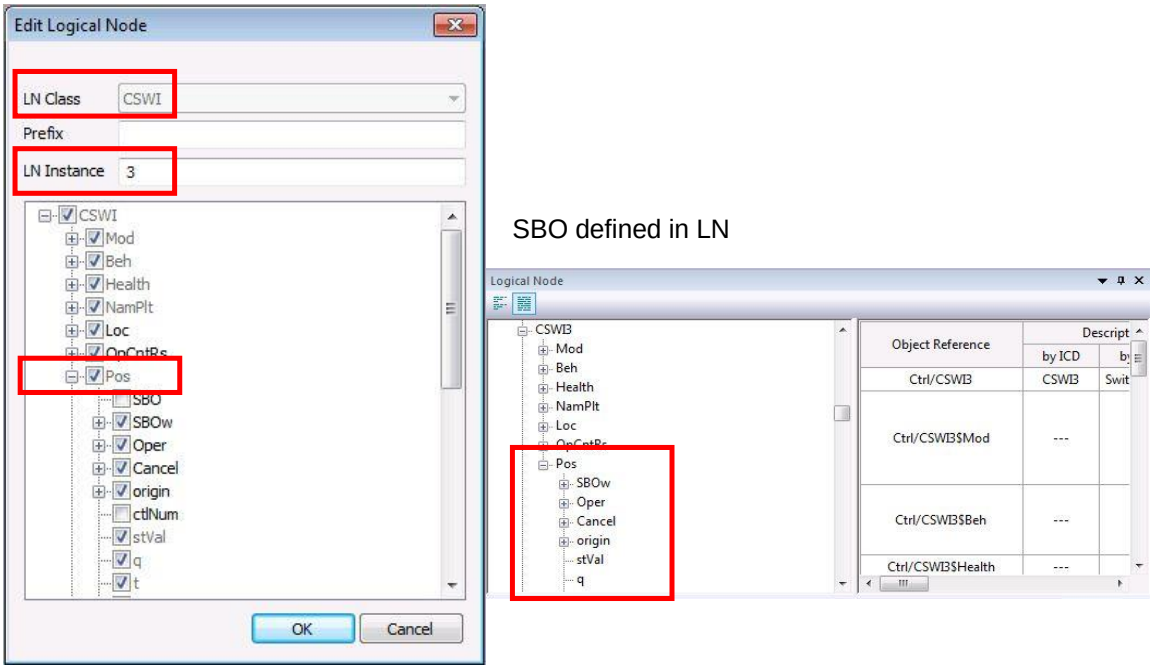
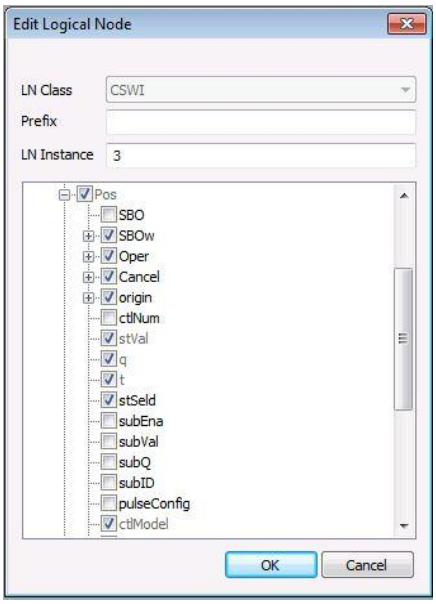


Figure 2.20-2 Defining "POS" object in CSWI3 logic node

(i)-1 Defining SBO mode

Figure 2.20-3 exemplifies the settings in LN "CSWI3" when the SBO mode is required for the DMYCB function. With SBO control, the user should select the following items for the "CSWI3$POS" using the GR-TIEMS;



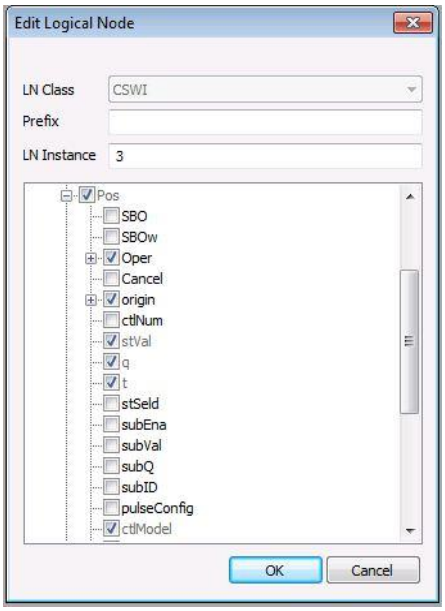
- ✓ SBOw
- ✓ Oper
- ✓ Cancel
- ✓ Origin
- ✓ stSeld
- ✓ sboClass† (choice "operate-once")
- ✓ ctlmodel (choice "SBOes or SBOns")

†"sboClass" can be found by scrolling down.

Figure 2.20-3 LN editing screen for SBO mode (for example)

(i)-2 Defining DIR mode

Figure 2.20-4 exemplifies the settings in LN "CSWI3" when the DIR mode is required for the DMYCB function. In the DIR mode, the following three items should be selected using the GR-TIEMS:



- ✓ Oper
- ✓ origin
- ✓ ctlmodel (choice "DOes or DOns")

Figure 2.20-4 LN editing screen for DIR mode (for example)

(ii) Mapping output data

The user should group the DMYCB signals for GOOSE and REPORT and map them for IEC 61850 communication using GR-TIEMS.

Table 2.20-4 shows the signals that require mapping in the DMYCB function for IEC

61850 communications. Figure 2.20-5 shows how to map a signal. Note that the signal name used in Table 2.20-4 is “DMCB” but this refers to the signal of the DMYCB function.

Table 2.20-4 Mapping signals for POS object.

Object_reference	Attribute	Type	FC	Signal Number	Signal Name
Ctrl/CSWI3Posorigin	orCat	orCategory	ST	524001 2111011008	DMCB_ORCAT
Ctrl/CSWI3Posorigin	orIdent	Octet64	ST	524001 6A11011009	DMCB_ORIDENT
Ctrl/CSWI3$Pos	stVal	Dbpos	ST	524001 3211011001	DMCB_STATE
Ctrl/CSWI3$Pos	q	Quality	ST	524001 3111011005	DMCB_QUALITY
Ctrl/CSWI3$Pos	t	Timestamp	ST	524001 9011011006	DMCB_TIME
Ctrl/CSWI3$Pos	stSeld	BOOLEAN	ST	524001 0011011D90	DMCB01_SLD_RPT

Note: “Status (ST)” is defined in the function constraint (FC) of the IEC 61850 standard.

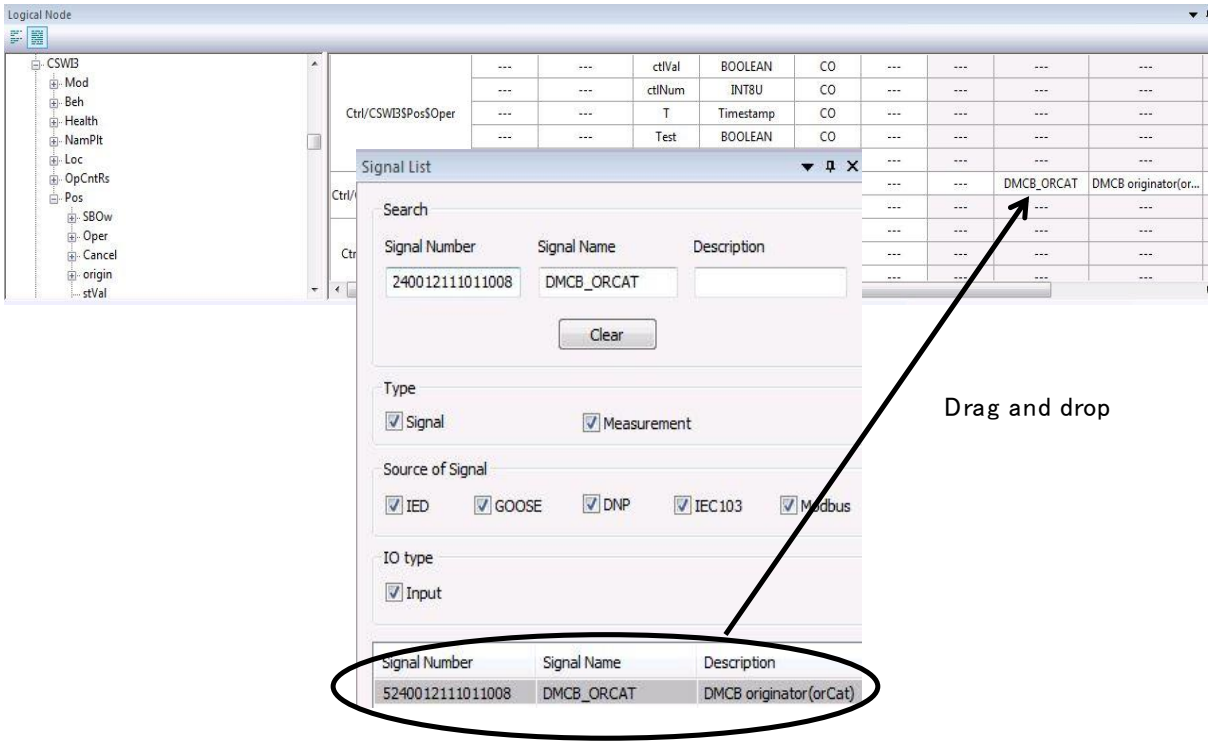


Figure 2.20-5 orCat attribute mapped into POS object of CSWI3

(iii) Mapping input data

The DMYCB function can receive three commands “select, operate, and cancel. Thus, the user should map the input-point “DEV01_CONTROL_REQ”. Table 2.20-5 shows the input-point “DEV01_CONTROL_REQ” and the Object reference “Ctrl/CSWI3POS”; the user should map the input-point to the Object reference having the attributes CO and CF in FC†. Figure 2.20-6 shows how to map a signal.

†Note: The attribute is defined in the IEC 61850 standard; “CO” stands for “Control” in the functional constraint (FC).

Table 2.20-5 Mapping signals required for CSWI3 object in DMYCB function

Object_reference	Attribute	Type	FC	Signal Number	Signal Name
Ctrl/CSWI3PosSBOw	ctlVal	BOOLEAN	CO	524001 7011016D08	DEV01_CONTROL_REQ
Ctrl/CSWI3PosSBOw	ctlNum	INT8U	CO		
Ctrl/CSWI3PosSBOw	T	Timestamp	CO		
Ctrl/CSWI3PosSBOw	Test	BOOLEAN	CO		
Ctrl/CSWI3PosSBOw	Check	Check	CO		
Ctrl/CSWI3PosSBOw$origin	orCat	orCategory	CO		
Ctrl/CSWI3PosSBOw$origin	orIdent	Octet64	CO		
Ctrl/CSWI3PosOper	ctlVal	BOOLEAN	CO		
Ctrl/CSWI3PosOper	ctlNum	INT8U	CO		
Ctrl/CSWI3PosOper	T	Timestamp	CO		
Ctrl/CSWI3PosOper	Test	BOOLEAN	CO		
Ctrl/CSWI3PosOper	Check	Check	CO		
Ctrl/CSWI3PosOper$origin	orCat	orCategory	CO		
Ctrl/CSWI3PosOper$origin	orIdent	Octet64	CO		
Ctrl/CSWI3PosCancel	ctlVal	BOOLEAN	CO		
Ctrl/CSWI3PosCancel	ctlNum	INT8U	CO		
Ctrl/CSWI3PosCancel	T	Timestamp	CO		
Ctrl/CSWI3PosCancel	Test	BOOLEAN	CO		
Ctrl/CSWI3PosCancel$origin	orCat	orCategory	CO		
Ctrl/CSWI3PosCancel$origin	orIdent	Octet64	CO		
Ctrl/CSWI3$Pos	ctlPOSel	ctlPOSel	CF		
Ctrl/CSWI3$Pos	sboClass	sboClass	CF		

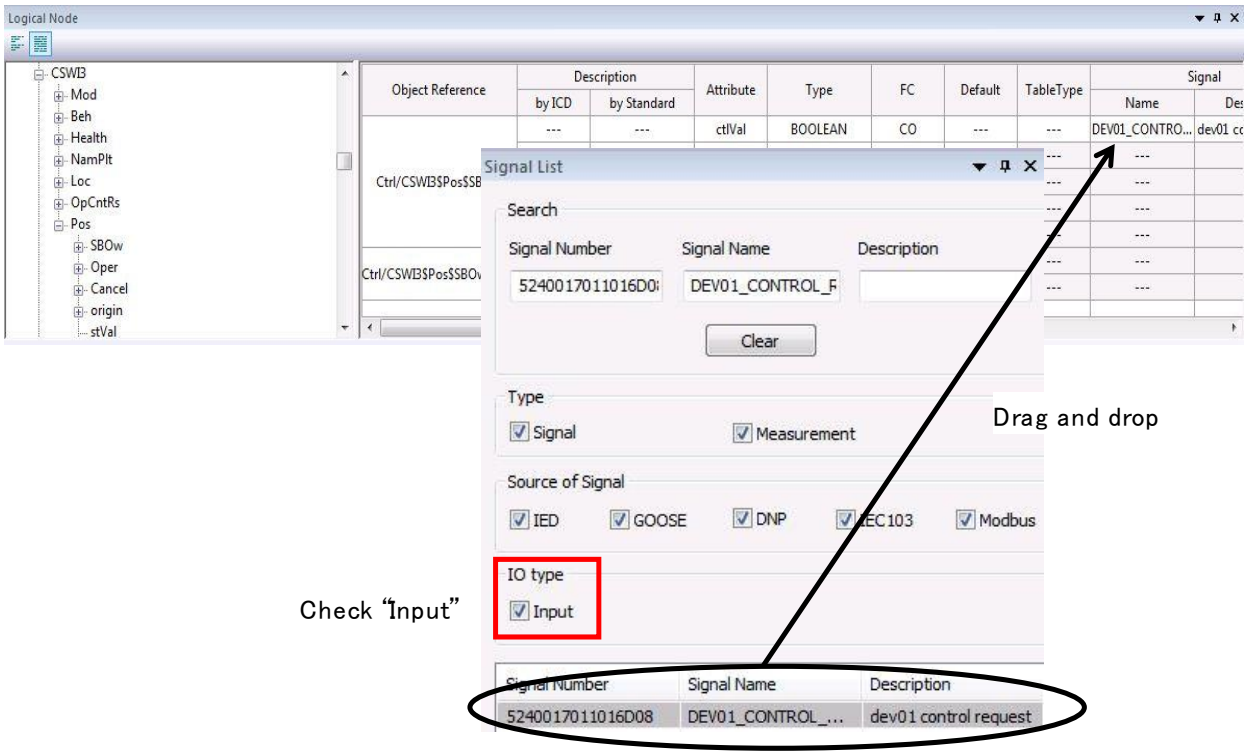


Figure 2.20-6 Input-point mapped for CSWI3

2.20.3 Setting

Setting list of DMYCB（FunctionID: 524001)

Setting device		Range	Units	Contents	Default setting value	Notes
DMYCB	DMYCB-EN	Off / On	-	DMYCB Enable	On	
	DMCB-CTRMENU	Off / On	-	control by MENU enable	On	
	DMCB-CTRAHMI	DIR/SBO	-	control action(Direct or SBO)by HMI	SBO	

2.20.4 Signal

◆ Signal monitoring point

DMYCB(Function ID: 524001)

Element ID	Name	Description
8B11011F42	DMCB01_CTR_SGU	DMCB01 selected signal
8011011D58	DMCB01_EC_LCD	DMCB01 execute command by LCD
8011011D55	DMCB01_EC_OWS	DMCB01 execute command by OWS(HMI)
8011011D59	DMCB01_EC_PLC	DMCB01 execute command by PLC
8011011D56	DMCB01_EC_RCC	DMCB01 execute command by RCC
8011011D57	DMCB01_EC_RMT	DMCB01 execute command by Remote
0011011D97	DMCB01_EX_BO_RPT	DMCB01 execute binary output signal for SAS
8F11011F46	DMCB01_EX_CMP_TMO	DMCB01 timeout after execute completion
8611011E91	DMCB01_EX_FFL	DMCB01 execute fail signal by fixedlogic
8011011E81	DMCB01_FEC_OK_SIG	DMCB01 off direction execute command OK condition signal
8011011E44	DMCB01_FSE_RCV	DMCB01 select or execute command received
8611011F41	DMCB01_NSL_CS07	DMCB01 select or execute command received
8111011E82	DMCB01_OEC_OK_SIG	DMCB01 on direction execute command OK condition signal
8011011D54	DMCB01_SC_LCD	DMCB01 select command by LCD
8011011D51	DMCB01_SC_OWS	DMCB01 select command by OWS(HMI)
8011011D52	DMCB01_SC_RCC	DMCB01 select command by RCC
8011011D53	DMCB01_SC_RMT	DMCB01 select command by Remote
8311011E72	DMCB01_SLD_CS	DMCB01 selected condition signal
0011011D90	DMCB01_SLD_RPT	DMCB01 selected signal(stSeld) for SAS
8E11011F44	DMCB01_SLD_TMO	DMCB01 time out after selected
8611011E97	DMCB01_SLF_FCT_FLG1	DMCB01 select fail factor signal by fixedlogic
8711011F45	DMCB01_SLF_FCT_FLG2	DMCB01 select fail factor signal by fixedlogic
8211011F40	DMCB01_TMP01	TEMP01
8611011F43	DMCB01_TMP02	TEMP02
8511011F47	DMCB01_TMP03	TEMP03
3111011D80	DMCB01_TMP_06	DMCB01 control event data (selected)
3111011D81	DMCB01_TMP_07	DMCB01 control event data (select fail)
3111011D82	DMCB01_TMP_08	DMCB01 control event data (select release)
3111011D83	DMCB01_TMP_09	DMCB01 control event data (execute output on)
3111011D84	DMCB01_TMP_10	DMCB01 control event data (execute command ng)
3111011D86	DMCB01_TMP_11	DMCB01 control event data (execute fail)
2211011004	DMCB_CTLVAL	DMCB originator(ctlVal)
3111011D00	DMCB_MMC_ST	DMCB01 MIMIC status
3211011001	DMCB_STATE	DMCB dummy CB status

◆ Connection point in PLC logic

DMYCB(Function ID: 524001)

Element ID	Name	Description
821101ED50	DMCB01IN_TMP_28	DMCB01IN_TMP_28

2.21 Telemetering using DC analog input (DCAITM)

When DC currents generated by sensors at the remote-end are injected into the DCAI2A module†, the telemetering using the DC analog input function (DCAITM) can convert the value of the DC currents into numerical data. DC analog currents are provided by measurements taken for air temperature, oil temperature or oil pressure sensors; thereby the DCAITM function is used to convert the DC analog currents to numerical data which is suitable for measurement; the DCAITM function can send the numerical date for the SAS at the remote-end using the communication.

†Note:The DCAI2A module is discussed separately. See chapter *Technical description: DC analog input module*.

Note: The implementation of such features is dependent upon the selection of hardware and the configuration of functions. Several IED models do not support certain features. To determine whether a particular feature has been implemented within an IED, identify the IED ordering number; and check the order number at the "G&T position" whilst referring to the comparison table below. For more information, see *Appendix: Ordering*.

Table 2.21-1 Comparative table in respective ordering numbers

Sec.	Feature	Ordering No. at "G&T"					
		BCU			BCPU		IFU
		11	13	1F	2N	2C	19
–	Main features	○1	○1	○1	○1	○1	NA

○1: Applicable (when DCAI module applied) NA: Not applicable

The DCAITM function exhibits the following features:

1. The DCAITM function is not available until the initialization in the IED is complete.
2. The measuring data obtained in the DCAI2A module is renewed every second.
3. The DCAITM function can monitor the connection between the DCAI2 module and the I/O bus of the IED; the connection state generated in the DCAITM function is provided in the form of quality information.
4. The DCAITM function can check the accuracy of the analog to digital converter (A/D); the accuracy is supplied with the quality information.
5. The DCAITM function can compensate data when the DC current exceeds the extent of the input range. Using the compensation function, the measured data is revised using setting values, which the user can set in the DCAITM function.
6. The DCAITM function can convert the DC current into a measured value using an algorithmic function.
7. The DCAITM function can convert the DC current to zero unconditionally, when the value of the DC current is close to zero. The user can select the degree to which it is in close proximity to zero using a setting.
8. The DCAITM function can monitor the degree of deviation in a measured value specified by a setting; the DCAITM function generates an alarm signal when the deviation is out of the range specified by a setting.
9. The DCAITM function monitors fluctuations in the data measured; the number of fluctuations are counted in the DCAITM function. If the total number of fluctuations is larger than a setting, the DCAITM function will adopt the value of the new measured data.

2.21.1 Setting

Settings list for all channels of DCAI (Function ID: 542001)

Setting item			Range	Unit	Contents	Default setting value	Notes
		DCAI_DISPLAY	Primary / Secondary	-	Display selection for primary or secondary	Primary	

Setting items	Range	Unit	Contents	Default	Notes
DCAI1_1_EN	Off / On	-	Operation enable at channel#1 of DCAI module at IO#5	On	
DCAI1_1_RN	+-1mA / +-20mA / 0-10mA / 4-20mA / 0-20mA / +-1V / +-5V / +-10V	-	Selection of the operation range at channel#1	0-20mA	
DCAI1_1_CFFX2M	-999999999 - 999999999	-	Coefficient at the squared valuable(x^2) item	0	
DCAI1_1_CFFX2E	-9 - 9	-	Exponent at the squared valuable(x^2) item	0	
DCAI1_1_CFFXM	-999999999 - 999999999	-	Coefficient at the valuable(x) item	1	
DCAI1_1_CFFXE	-9 - 9	-	Exponent at the valuable(x) item	0	
DCAI1_1_YINTCPTM	-999999999 - 999999999	-	Coefficient at the valuable(y) item	0	
DCAI1_1_YINTCPTE	-9 - 9	-	Exponent at the valuable(y) item	0	
DCAI1_1_NUMFLD	0 - 4	-	decimal point for channel#1	2	
DCAI1_1_SDB	0.00 - 50.00	%	sending dead band for channel#1	0.00	
DCAI1_1_RDZERODA	0.0 - 50.0	%	Input range for outputting zero unconditionally	0.0	
DCAI1_1_HLDOPEN	Off / On	-	Range setting for outputting zero unconditionally	On	
DCAI1_1_OG_1MA	0.00 - 0.05	mA	No sensing area for range 1mA	0.00	
DCAI1_1_OH_1MA	-1.00 - 1.00	mA	Set of forcible output value on upper limit deviation for range 1mA	1.00	
DCAI1_1_UH_1MA	-1.00 - 1.00	mA	Set of forcible output value on lower limit deviation for range 1mA	-1.00	
DCAI1_1_OG_20MA	0.00 - 1.00	mA	No sensing area for range 20mA	0.00	
DCAI1_1_OH_20MA	-20.00 - 20.00	mA	Set of forcible output value on upper limit deviation for range 20mA	20.00	
DCAI1_1_UH_20MA	-20.00 - 20.00	mA	Set of forcible output value on lower limit deviation for range 20mA	-20.00	
DCAI1_1_OG_0_10MA	0.00 - 0.50	mA	No sensing area for range 0-10mA	0.00	
DCAI1_1_OH_0_10MA	0.00 - 10.00	mA	Set of forcible output value on upper limit deviation for range 0-10mA	10.00	
DCAI1_1_UH_0_10MA	0.00 - 10.00	mA	Set of forcible output value on lower limit deviation for range 0-10mA	0.00	
DCAI1_1_OG_4_20MA	0.00 - 1.00	mA	No sensing area for range 4-20mA	0.00	
DCAI1_1_OH_4_20MA	4.00 - 20.00	mA	Set of forcible output value on upper limit deviation for range 4-20mA	20.00	
DCAI1_1_UH_4_20MA	4.00 - 20.00	mA	Set of forcible output value on over limit deviation for range 4-20mA	4.00	
DCAI1_1_OG_0_20MA	0.00 - 1.00	mA	No sensing area for range 0-20mA	0.00	
DCAI1_1_OH_0_20MA	0.00 - 20.00	mA	Set of forcible output value on upper limit deviation for range 0-20mA	20.00	
DCAI1_1_UH_0_20MA	0.00 - 20.00	mA	Set of forcible output value on lower limit deviation for range 0-20mA	0.00	
DCAI1_1_OG_1V	0.00 - 0.05	V	No sensing area for range 1V	0.00	
DCAI1_1_OH_1V	-1.00 - 1.00	V	Set of forcible output value on upper limit deviation for range 1V	1.00	
DCAI1_1_UH_1V	-1.00 - 1.00	V	Set of forcible output value on lower limit deviation for range 1V	-1.00	
DCAI1_1_OG_5V	0.00 - 0.25	V	No sensing area for range 5V	0.00	
DCAI1_1_OH_5V	-5.00 - 5.00	V	Set of forcible output value on upper limit deviation for range 5V	5.00	
DCAI1_1_UH_5V	-5.00 - 5.00	V	Set of forcible output value on lower limit deviation for range 5V	-5.00	
DCAI1_1_OG_10V	0.00 - 0.50	V	No sensing area for range 10V	0.00	
DCAI1_1_OH_10V	-10.00 - 10.00	V	Set of forcible output value on upper limit deviation for range 10V	10.00	
DCAI1_1_UH_10V	-10.00 - 10.00	V	Set of forcible output value on lower limit deviation for range 10V	-10.00	
DCAI1_1_HHLIM_EN	Off / On	-	HHLIM_Enable at channel#1	Off	
DCAI1_1_HHLIM	-105.00 - 105.00	%	high alarm for limit deviation	0.00	
DCAI1_1_HLIM_EN	Off / On	-	HLIM_Enable at channel#1	Off	
DCAI1_1_HLIM	-105.00 - 105.00	%	high warning for limit deviation	0.00	
DCAI1_1_LLIM_EN	Off / On	-	LLLIM_Enable at channel#1	Off	
DCAI1_1_LLIM	-105.00 - 105.00	%	low alarm for upper limit deviation	0.00	
DCAI1_1_LLLIM_EN	Off / On	-	LLIM_Enable at channel#1	Off	
DCAI1_1_LLLIM	-105.00 - 105.00	%	low warning for upper limit deviation	0.00	
DCAI1_1_HYST	0.00 - 50.00	%	No sensing area for limit check	0.00	
DCAI1_1_ABS	rel / abs	-	limit check method change for Channel#1	abs	

Setting list at channel#2 of DCAI at IO#5 (Function ID: 542001)

Setting items	Range	Unit	Contents	Default	Notes
DCAI1_2_EN	Off / On	-	Operation enable at channel#1 of DCAI module at IO#5	On	
DCAI1_2_RN	+-1mA / +-20mA / 0-10mA / 4-20mA / 0-20mA / +-1V / +-5V / +-10V	-	Selection of the operation range at channel#1	0-20mA	
DCAI1_2_CFFX2M	-999999999 - 999999999	-	Coefficient at the squared valuable(x^2) item	0	
DCAI1_2_CFFX2E	-9 - 9	-	Exponent at the squared valuable(x^2) item	0	
DCAI1_2_CFFXM	-999999999 - 999999999	-	Coefficient at the valuable(x) item	1	
DCAI1_2_CFFXE	-9 - 9	-	Exponent at the valuable(x) item	0	
DCAI1_2_YINTCPTM	-999999999 - 999999999	-	Coefficient at the valuable(y) item	0	
DCAI1_2_YINTCPTE	-9 - 9	-	Exponent at the valuable(y) item	0	
DCAI1_2_NUMFLD	0 - 4	-	decimal point for channel#1	2	
DCAI1_2_SDB	0.00 - 50.00	%	sending dead band for channel#1	0.00	
DCAI1_2_RDZERODA	0.0 - 50.0	%	Input range for outputting zero unconditionally	0.0	
DCAI1_2_HLDOPEN	Off / On	-	Range setting for outputting zero unconditionally	On	
DCAI1_2_OG_1MA	0.00 - 0.05	mA	No sensing area for range 1mA	0.00	
DCAI1_2_OH_1MA	-1.00 - 1.00	mA	Set of forcible output value on upper limit deviation for range 1mA	1.00	
DCAI1_2_UH_1MA	-1.00 - 1.00	mA	Set of forcible output value on lower limit deviation for range 1mA	-1.00	
DCAI1_2_OG_20MA	0.00 - 1.00	mA	No sensing area for range 20mA	0.00	
DCAI1_2_OH_20MA	-20.00 - 20.00	mA	Set of forcible output value on upper limit deviation for range 20mA	20.00	
DCAI1_2_UH_20MA	-20.00 - 20.00	mA	Set of forcible output value on lower limit deviation for range 20mA	-20.00	
DCAI1_2_OG_0_10MA	0.00 - 0.50	mA	No sensing area for range 0-10mA	0.00	
DCAI1_2_OH_0_10MA	0.00 - 10.00	mA	Set of forcible output value on upper limit deviation for range 0-10mA	10.00	
DCAI1_2_UH_0_10MA	0.00 - 10.00	mA	Set of forcible output value on lower limit deviation for range 0-10mA	0.00	
DCAI1_2_OG_4_20MA	0.00 - 1.00	mA	No sensing area for range 4-20mA	0.00	
DCAI1_2_OH_4_20MA	4.00 - 20.00	mA	Set of forcible output value on upper limit deviation for range 4-20mA	20.00	
DCAI1_2_UH_4_20MA	4.00 - 20.00	mA	Set of forcible output value on over limit deviation for range 4-20mA	4.00	
DCAI1_2_OG_0_20MA	0.00 - 1.00	mA	No sensing area for range 0-20mA	0.00	
DCAI1_2_OH_0_20MA	0.00 - 20.00	mA	Set of forcible output value on upper limit deviation for range 0-20mA	20.00	
DCAI1_2_UH_0_20MA	0.00 - 20.00	mA	Set of forcible output value on lower limit deviation for range 0-20mA	0.00	
DCAI1_2_OG_1V	0.00 - 0.05	V	No sensing area for range 1V	0.00	
DCAI1_2_OH_1V	-1.00 - 1.00	V	Set of forcible output value on upper limit deviation for range 1V	1.00	
DCAI1_2_UH_1V	-1.00 - 1.00	V	Set of forcible output value on lower limit deviation for range 1V	-1.00	
DCAI1_2_OG_5V	0.00 - 0.25	V	No sensing area for range 5V	0.00	
DCAI1_2_OH_5V	-5.00 - 5.00	V	Set of forcible output value on upper limit deviation for range 5V	5.00	
DCAI1_2_UH_5V	-5.00 - 5.00	V	Set of forcible output value on limit deviation for range 5V	-5.00	
DCAI1_2_OG_10V	0.00 - 0.50	V	No sensing area for range 10V	0.00	
DCAI1_2_OH_10V	-10.00 - 10.00	V	Set of forcible output value on upper limit deviation for range 10V	10.00	
DCAI1_2_UH_10V	-10.00 - 10.00	V	Set of forcible output value on lower limit deviation for range 10V	-10.00	
DCAI1_2_HHLIM_EN	Off / On	-	HHLIM_Enable at channel#2	Off	
DCAI1_2_HHLIM	-105.00 - 105.00	%	high alarm for limit deviation	0.00	
DCAI1_2_HLIM_EN	Off / On	-	HLIM_Enable at channel#2	Off	
DCAI1_2_HLIM	-105.00 - 105.00	%	high warning for limit deviation	0.00	
DCAI1_2_LLIM_EN	Off / On	-	LLLIM_Enable at channel#2	Off	
DCAI1_2_LLIM	-105.00 - 105.00	%	low alarm for upper limit deviation	0.00	
DCAI1_2_LLLIM_EN	Off / On	-	LLIM_Enable at channel#2	Off	
DCAI1_2_LLLIM	-105.00 - 105.00	%	low warning for upper limit deviation	0.00	
DCAI1_2_HYST	0.00 - 50.00	%	No sensing area for limit check	0.00	
DCAI1_2_ABS	rel / abs	-	limit check method change for Channel#1	abs	

(Setting items for channel#3 to channel#10 at IO#5 are the same as the items for channel#1 except for the device number which is omitted)

Setting list at channel#1 of DCAI at IO#6 (Function ID: 542001)

Setting items	Range	Unit	Contents	Default	Notes
DCAI2_1_EN	Off / On	-	Operation enable at channel#1 of DCAI module at IO#6	On	
DCAI2_1_RN	+-1mA / +-20mA / 0-10mA / 4-20mA / 0-20mA / +-1V / +-5V / +-10V	-	Selection of the operation range at channel#1	0-20mA	
DCAI2_1_CFFX2M	-999999999 - 999999999	-	Coefficient at the squared valuable(x^2) item	0	
DCAI2_1_CFFX2E	-9 - 9	-	Exponent at the squared valuable(x^2) item	0	
DCAI2_1_CFFXM	-999999999 - 999999999	-	Coefficient at the valuable(x) item	1	
DCAI2_1_CFFXE	-9 - 9	-	Exponent at the valuable(x) item	0	
DCAI2_1_YINTCPTM	-999999999 - 999999999	-	Coefficient at the valuable(y) item	0	
DCAI2_1_YINTCPTE	-9 - 9	-	Exponent at the valuable(y) item	0	
DCAI2_1_NUMFLD	0 - 4	-	decimal point for channel#1	2	
DCAI2_1_SDB	0.00 - 50.00	%	sending dead band for channel#1	0.00	
DCAI2_1_RDZERODA	0.0 - 50.0	%	Input range for outputting zero unconditionally	0.0	
DCAI2_1_HLDOPEN	Off / On	-	Range setting for outputting zero unconditionally	On	
DCAI2_1_OG_1MA	0.00 - 0.05	mA	No sensing area for range 1mA	0.00	
DCAI2_1_OH_1MA	-1.00 - 1.00	mA	Set of forcible output value on upper limit deviation for range 1mA	1.00	
DCAI2_1_UH_1MA	-1.00 - 1.00	mA	Set of forcible output value on lower limit deviation for range 1mA	-1.00	
DCAI2_1_OG_20MA	0.00 - 1.00	mA	No sensing area for range 20mA	0.00	
DCAI2_1_OH_20MA	-20.00 - 20.00	mA	Set of forcible output value on upper limit deviation for range 20mA	20.00	
DCAI2_1_UH_20MA	-20.00 - 20.00	mA	Set of forcible output value on lower limit deviation for range 20mA	-20.00	
DCAI2_1_OG_0_10MA	0.00 - 0.50	mA	No sensing area for range 0-10mA	0.00	
DCAI2_1_OH_0_10MA	0.00 - 10.00	mA	Set of forcible output value on upper limit deviation for range 0-10mA	10.00	
DCAI2_1_UH_0_10MA	0.00 - 10.00	mA	Set of forcible output value on lower limit deviation for range 0-10mA	0.00	
DCAI2_1_OG_4_20MA	0.00 - 1.00	mA	No sensing area for range 4-20mA	0.00	
DCAI2_1_OH_4_20MA	4.00 - 20.00	mA	Set of forcible output value on upper limit deviation for range 4-20mA	20.00	
DCAI2_1_UH_4_20MA	4.00 - 20.00	mA	Set of forcible output value on over limit deviation for range 4-20mA	4.00	
DCAI2_1_OG_0_20MA	0.00 - 1.00	mA	No sensing area for range 0-20mA	0.00	
DCAI2_1_OH_0_20MA	0.00 - 20.00	mA	Set of forcible output value on upper limit deviation for range 0-20mA	20.00	
DCAI2_1_UH_0_20MA	0.00 - 20.00	mA	Set of forcible output value on lower limit deviation for range 0-20mA	0.00	
DCAI2_1_OG_1V	0.00 - 0.05	V	No sensing area for range 1V	0.00	
DCAI2_1_OH_1V	-1.00 - 1.00	V	Set of forcible output value on upper limit deviation for range 1V	1.00	
DCAI2_1_UH_1V	-1.00 - 1.00	V	Set of forcible output value on lower limit deviation for range 1V	-1.00	
DCAI2_1_OG_5V	0.00 - 0.25	V	No sensing area for range 5V	0.00	
DCAI2_1_OH_5V	-5.00 - 5.00	V	Set of forcible output value on upper limit deviation for range 5V	5.00	
DCAI2_1_UH_5V	-5.00 - 5.00	V	revision of lower limit deviation for range 5V	-5.00	
DCAI2_1_OG_10V	0.00 - 0.50	V	No sensing area for range 10V	0.00	
DCAI2_1_OH_10V	-10.00 - 10.00	V	Set of forcible output value on upper limit deviation for range 10V	10.00	
DCAI2_1_UH_10V	-10.00 - 10.00	V	Set of forcible output value on lower limit deviation for range 10V	-10.00	
DCAI2_1_HHLIM_EN	Off / On	-	HHLIM_Enable at channel#1	Off	
DCAI2_1_HHLIM	-105.00 - 105.00	%	high alarm for limit deviation	0.00	
DCAI2_1_HLIM_EN	Off / On	-	HLIM_Enable at channel#1	Off	
DCAI2_1_HLIM	-105.00 - 105.00	%	high warning for limit deviation	0.00	
DCAI2_1_LLIM_EN	Off / On	-	LLLIM_Enable at channel#1	Off	
DCAI2_1_LLIM	-105.00 - 105.00	%	low alarm for upper limit deviation	0.00	
DCAI2_1_LLLIM_EN	Off / On	-	LLIM_Enable at channel#1	Off	
DCAI2_1_LLLIM	-105.00 - 105.00	%	low warning for upper limit deviation	0.00	
DCAI2_1_HYST	0.00 - 50.00	%	No sensing area for limit check	0.00	
DCAI2_1_ABS	rel / abs	-	limit check method change for Channel#1	abs	

(Setting items for channel#2 to #10 at IO#6 are the same as the setting items for channel#1 except for the device number; which is omitted)

Setting list at channel#1 of DCAI at IO#7 (Function ID: 542001)

Setting items	Range	Unit	Contents	Default	Notes
DCAI3_1_EN	Off / On	-	Operation enable at channel#1 of DCAI module at IO#7	On	
DCAI3_1_RN	+-1mA / +-20mA / 0-10mA / 4-20mA / 0-20mA / +-1V / +-5V / +-10V	-	Selection of the operation range at channel#1	0-20mA	
DCAI3_1_CFFX2M	-999999999 - 999999999	-	Coefficient at the squared valuable(x^2) item	0	
DCAI3_1_CFFX2E	-9 - 9	-	Exponent at the squared valuable(x^2) item	0	
DCAI3_1_CFFXM	-999999999 - 999999999	-	Coefficient at the valuable(x) item	1	
DCAI3_1_CFFXE	-9 - 9	-	Exponent at the valuable(x) item	0	
DCAI3_1_YINTCPTM	-999999999 - 999999999	-	Coefficient at the valuable(y) item	0	
DCAI3_1_YINTCPTE	-9 - 9	-	Exponent at the valuable(y) item	0	
DCAI3_1_NUMFLD	0 - 4	-	decimal point for channel#1	2	
DCAI3_1_SDB	0.00 - 50.00	%	sending dead band for channel#1	0.00	
DCAI3_1_RDZERODA	0.0 - 50.0	%	Input range for outputting zero unconditionally	0.0	
DCAI3_1_HLDOPEN	Off / On	-	Range setting for outputting zero unconditionally	On	
DCAI3_1_OG_1MA	0.00 - 0.05	mA	No sensing area for range 1mA	0.00	
DCAI3_1_OH_1MA	-1.00 - 1.00	mA	Set of forcible output value on upper limit deviation for range 1mA	1.00	
DCAI3_1_UH_1MA	-1.00 - 1.00	mA	Set of forcible output value on lower limit deviation for range 1mA	-1.00	
DCAI3_1_OG_20MA	0.00 - 1.00	mA	No sensing area for range 20mA	0.00	
DCAI3_1_OH_20MA	-20.00 - 20.00	mA	Set of forcible output value on upper limit deviation for range 20mA	20.00	
DCAI3_1_UH_20MA	-20.00 - 20.00	mA	Set of forcible output value on lower limit deviation for range 20mA	-20.00	
DCAI3_1_OG_0_10MA	0.00 - 0.50	mA	No sensing area for range 0-10mA	0.00	
DCAI3_1_OH_0_10MA	0.00 - 10.00	mA	Set of forcible output value on upper limit deviation for range 0-10mA	10.00	
DCAI3_1_UH_0_10MA	0.00 - 10.00	mA	Set of forcible output value on lower limit deviation for range 0-10mA	0.00	
DCAI3_1_OG_4_20MA	0.00 - 1.00	mA	No sensing area for range 4-20mA	0.00	
DCAI3_1_OH_4_20MA	4.00 - 20.00	mA	Set of forcible output value on upper limit deviation for range 4-20mA	20.00	
DCAI3_1_UH_4_20MA	4.00 - 20.00	mA	Set of forcible output value on over limit deviation for range 4-20mA	4.00	
DCAI3_1_OG_0_20MA	0.00 - 1.00	mA	No sensing area for range 0-20mA	0.00	
DCAI3_1_OH_0_20MA	0.00 - 20.00	mA	Set of forcible output value on upper limit deviation for range 0-20mA	20.00	
DCAI3_1_UH_0_20MA	0.00 - 20.00	mA	Set of forcible output value on lower limit deviation for range 0-20mA	0.00	
DCAI3_1_OG_1V	0.00 - 0.05	V	No sensing area for range 1V	0.00	
DCAI3_1_OH_1V	-1.00 - 1.00	V	Set of forcible output value on upper limit deviation for range 1V	1.00	
DCAI3_1_UH_1V	-1.00 - 1.00	V	Set of forcible output value on lower limit deviation for range 1V	-1.00	
DCAI3_1_OG_5V	0.00 - 0.25	V	No sensing area for range 5V	0.00	
DCAI3_1_OH_5V	-5.00 - 5.00	V	Set of forcible output value on upper limit deviation for range 5V	5.00	
DCAI3_1_UH_5V	-5.00 - 5.00	V	Set of forcible output value on lower limit deviation for range 5V	-5.00	
DCAI3_1_OG_10V	0.00 - 0.50	V	No sensing area for range 10V	0.00	
DCAI3_1_OH_10V	-10.00 - 10.00	V	Set of forcible output value on upper limit deviation for range 10V	10.00	
DCAI3_1_UH_10V	-10.00 - 10.00	V	Set of forcible output value on lower limit deviation for range 10V	-10.00	
DCAI3_1_HHLIM_EN	Off / On	-	HHLIM_Enable at channel#1	Off	
DCAI3_1_HHLIM	-105.00 - 105.00	%	high alarm for limit deviation	0.00	
DCAI3_1_HLIM_EN	Off / On	-	HLIM_Enable at channel#1	Off	
DCAI3_1_HLIM	-105.00 - 105.00	%	high warning for limit deviation	0.00	
DCAI3_1_LLIM_EN	Off / On	-	LLLIM_Enable at channel#1	Off	
DCAI3_1_LLIM	-105.00 - 105.00	%	low alarm for upper limit deviation	0.00	
DCAI3_1_LLLIM_EN	Off / On	-	LLIM_Enable at channel#1	Off	
DCAI3_1_LLLIM	-105.00 - 105.00	%	low warning for upper limit deviation	0.00	
DCAI3_1_HYST	0.00 - 50.00	%	No sensing area for limit check	0.00	
DCAI3_1_ABS	rel / abs	-	limit check method change for Channel#1	abs	

(Setting items for channel#2 to #10 at IO#7 are the same as the setting items for channel#1 except for the device number: which is omitted)

2.22 Energy metering with pulse signals (PLS_ERGY_MEA)

The energy metering pulse function (PLS_ERGY_MEA) is designed to count a pulse train. This function can measure a pulse train in units of Watt-hour (Wh) or VAr-hour (VArh). Compensation features are provided with the function; these enable corrections to be made to the number of pulses in the pulse train and checks to detect counting failures.

Note: The implementation of such features is dependent upon the selection of hardware and the configuration of functions. Several IED models do not support certain features. To determine whether a particular feature has been implemented within an IED, identify the IED ordering number; and check the order number at the "G&T position" whilst referring to the comparison table below. For more information, see *Appendix: Ordering*.

Table 2.22-1 Comparative table in respective ordering numbers

Sec.	Feature	Ordering No. at "G&T"					
		BCU			BCPU		IFU
		11	13	1F	2N	2C	19
–	Main features	✓	✓	✓	✓	✓	NA

✓: Applicable NA: Not applicable

2.22.1 Function features

The PLS_ERGY_MEA function can observe eight-pulse trains obtained via binary input circuits (BIs). The pluses received are transferred to the PLS_ERGY_MEA function; they are then converted into power quantities: watt-hour (+Wh1, −Wh1, +Wh2, and –Wh2), VAr-hour (+VArh1, −VArh1, +VArh2, and –VArh2) and others.

(i) Acquisition of pulse train

The user must make the connections to the PLS_ERGY_MEA function prior to operation. Figure 2.22-1 shows eight pulse trains provided from external devices. For example, if binary input circuit BI1† is used to receive pulse train1, then the user must connect signal monitoring point "BI1" for acquisition of the signal by making the connection between "BI1" and PLSM01 using the PLC function‡, which is required to program the transfer logic for the PLS_ERGY_MER function.

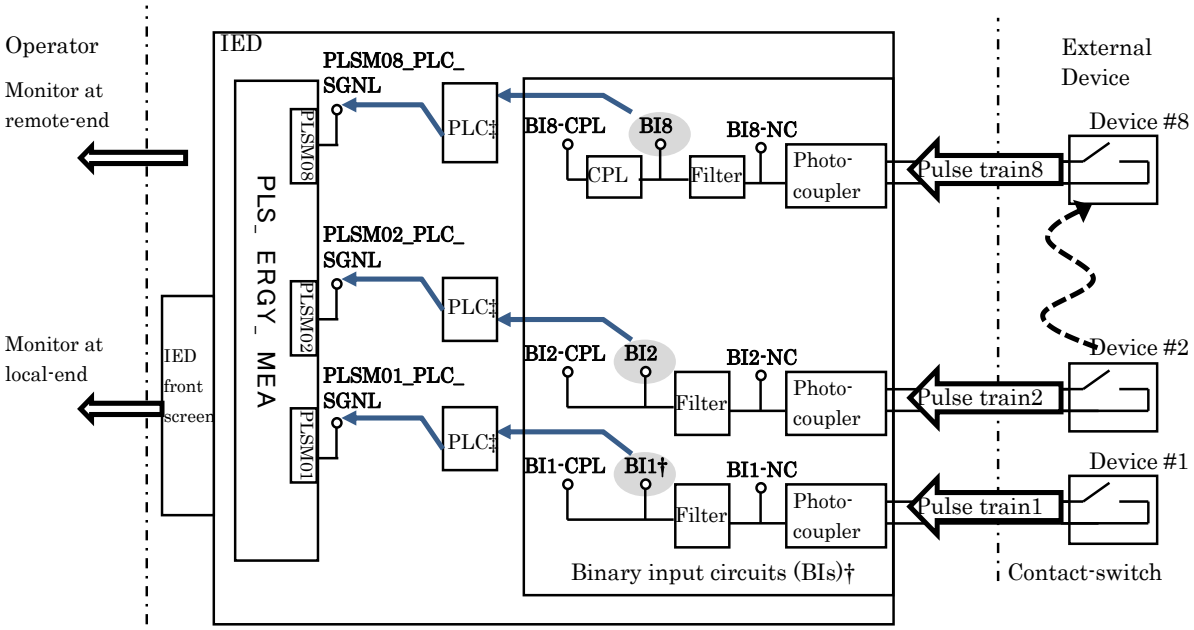


Figure 2.22-1 Measurement of power quantities using pulse trains

†Note: For simplicity, we only discuss the PLS_ERGY_MER function using BI1. BI1-CPL and BI-NC1 points are also available for this function. For more information with regard to BIs, see Chapter *Technical description: Binary IO module.*

‡Note: The user can implement the PLC logic using the PLC function. For more information, see chapter *PLC function*.

(ii) Count process

The pulses obtained by the PLS_ERGY_MEA function are converted into a power quantity that is multiplied by a coefficient. The coefficient is provided as "**kWh**", "**0.1MWh**", and "**MWh**" and the user can select one of these coefficients. The selection is performed using scheme switch [**PLSM*-PM**]. For example, when the coefficient of "**kWh**" is required for the pulse train of

device#1, the user should set **kWh** for the scheme switch [**PLSM01-PM**].

Table 2.22-2 Setting for coefficient

Scheme switch	Set	Comment
PLSM01-PM	kWh / 0.1MWh / MWh	counter weight for #1
PLSM02-PM	kWh / 0.1MWh / MWh	counter weight for #2
(omitted)	(omitted)	(omitted)
PLSM08-PM	kWh / 0.1MWh / MWh	counter weight for #8

The counters for the PLS_ERGY_MEA function are implemented as ring-counters; the roll-over for each counter should be performed when the counter value reaches a cumulative maximum. For each counter, the maximum value of the cumulative number is prescribed by the setting [**PLSM*-CNTMAX**].

Table 2.22-3 Setting for maximum number

Scheme switch	Set	Comment
PLSM01-CNTMAX	2000–999999999999000	counter value maximum for #1
PLSM02-CNTMAX	2000–999999999999000	counter value maximum for #2
(omitted)	(omitted)	(omitted)
PLSM08-CNTMAX	2000–999999999999000	counter value maximum for #8

When roll-over of the counter is not required, the counter number is kept at the maximum value after the counter reaches the cumulative number. This mode of operation is carried out when **Residual** is set for the scheme switch [**PLSM*-CNTRV**].

Table 2.22-4 Setting for roll-over

Scheme switch	Set	Comment
PLSM01-CNTRV	Zero/Residual	Return value at counter roll up for #1
PLSM02-CNTRV	Zero/Residual	Return value at counter roll up for #2
(omitted)	(omitted)	(omitted)
PLSM08-CNTRV	Zero/Residual	Return value at counter roll up for #8

For example, if the pulse train received from device#1 is considered and the signal reference is 1kWh, when the cumulative value of the counter is prescribed as 999,999kWh, the roll-over will take place when the counter PLSM01 reaches 999999.

(iii) Data correction

The user can correct the measured values within the PLS_ERGY_MEA function. The

correction is available using either IED front panel operation† or GR-TIEMS operation‡.

†Note:For IED screen operation, see Chapter *User interface*.

‡Note:For GR-TIEMS operation, see Chapter *Engineering tool*.

(iv) Data revision

The PLS_ERGY_MEA function reintroduces data when the data variation between the past and the present value is larger than a prescribed variation specified using a dead band. The width of the dead band is specified by a value applied for setting [**PLSM*-SDB**] multiplied by the value of the setting [**PLSM*-CNTMAX**]. Suppose the coefficient of "**kWh**" is selected, if 10MWh is considered as the maximum value, the reintroduction of data is performed each time the counter reaches a value of 10,000. Suppose that either the coefficient of "**MWh**" is selected or the coefficient "**0.1MWh**" is selected, if 10MWh is considered as the maximum value, the reintroduction of data is performed each time the counter reaches a value of 10.

Table 2.22-5 Setting for data revision

Scheme switch	Set	Comment
PLSM01-SDB	0.00 to 50.0%	Counter1 Sending Dead Band
PLSM02-SDB	0.00 to 50.0%	Counter2 Sending Dead Band
(omitted)	(omitted)	(omitted)
PLSM08-SDB	0.00 to 50.0%	Counter8 Sending Dead Band

2.22.2 Preparation for PLS_ERGY_MEA operation

The PLS_ERGY_MEA function operates when **On** is set for the scheme switch [**PLSM*-EN**]. For example, the user should set **On** for the scheme switch [**PLSM01-EN**] when time accumulation is required from an external device #1 using BI1.

Table 2.22-6 PLS_ERGY_MEA operation

Scheme switch	Set	Comment
PLSM01-EN	On / Off	Counter1 Enable
PLSM02-EN	On / Off	Counter2 Enable
(omitted)	(omitted)	(omitted)
PLSM08-EN	On / Off	Counter8 Enable

2.22.3 Mapping for IEC 61850 communication

The user can operate the PLSM01 function using IEC61850 communications after first mapping the function using GR-TIEMS. The user should proceed as follows,

Step1: Editing Logical Node

Step2: Mapping output data

Step3: Mapping input data

(i) Editing Logical Node

The user must make a logical node (LN) for the PLSM function. Figure 2.20-2 exemplifies LN editing; LN "GGIO1401" is selected for the PLSM01 function for IEC 61850 communication. After the user has defined an object "ISCSO1", the PLSM01 logical node can be saved with the name "GGIO1401". Define the object "ISCSO1" in the PLSM01 logical node. Either the SBO mode or the DIR mode can be chosen when editing the LN.

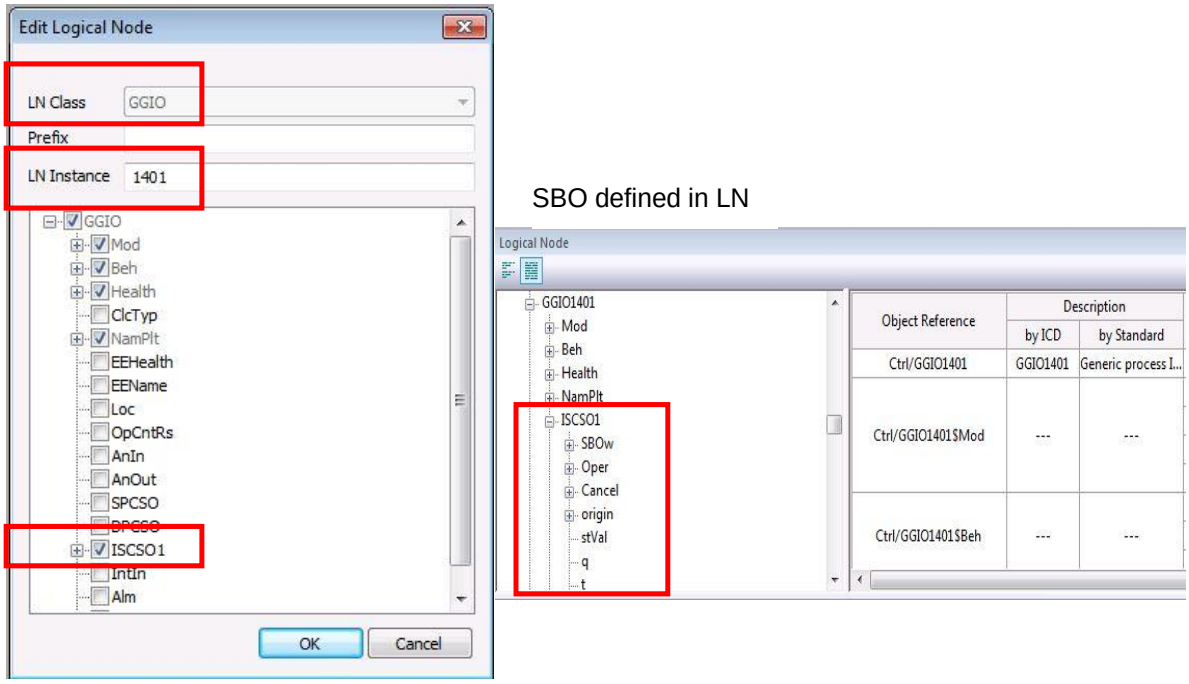
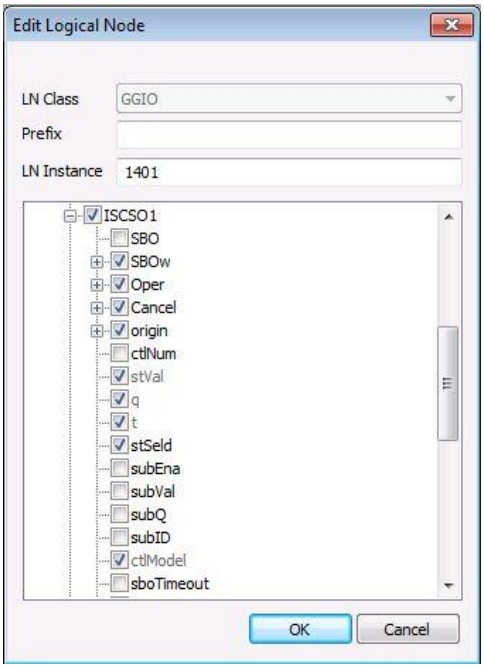


Figure 2.22-2 Defining "ISCSO1" object in GGIO1401 logic node

(i)-1 Defining SBO mode

Figure 2.20-3 exemplifies the settings in LN "GGIO1401" when the SBO mode is required for the DEV01 function. For SBO control, the user should select the following items for the "GGIO1401$ISCSO1" using GR-TIEMS;



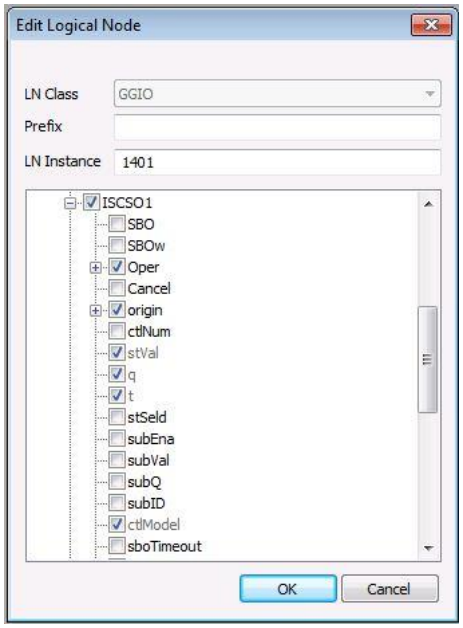
✓ SBOw
✓ Oper
✓ Cancel
✓ Origin
✓ stSeld
✓ sboClass† (choice "operate-once")
✓ ctlmodel (choice "SBOes or SBOns")

†"sboClass" can be found by scrolling down.

Figure 2.22-3 LN editing screen for SBO mode (for example)

(i)-2 Defining DIR mode

Figure 2.20-4 exemplifies the settings in LN "GGIO1401" when the DIR mode is required for the PLSM01 function. In the DIR mode, the following three items should be selected using GR-TIEMS:



✓ Oper
✓ origin
✓ ctlmodel (choice "DOes or DOns")

Figure 2.22-4 LN editing screen for DIR mode (for example)

(ii) Mapping output data

The user should group the PLSM01 signals with regard to GOOSE and REPORT; the user

should map them for IEC 61850 communication using GR-TIEMS. Table 2.20-4 shows the mapping signals within the PLSM01 function required for IEC 61850 communication. Figure 2.20-5 shows how to map a signal.

Table 2.22-7 Mapping signals for ISCSO1 object.

Object_reference	Attribute	Type	FC	Signal Number	Signal Name
Ctrl/GGIO1401$ISCSO1$origin	orCat	orCategory	ST	5480013014011D23	PLSM01_CNT_ORCAT
Ctrl/GGIO1401$ISCSO1$origin	orIdent	Octet64	ST	5480013014011D23	PLSM01_CNT_ORIDENT
Ctrl/GGIO1401$ISCSO1	stVal	INT32	ST	5480012214011D20	PLSM01_CNT_VAL
Ctrl/GGIO1401$ISCSO1	q	Quality	ST	5480013114011D21	PLSM01_CNT_QLT
Ctrl/GGIO1401$ISCSO1	t	Timestamp	ST	5480019014011D22	PLSM01_CNT_TIM
Ctrl/GGIO1401$ISCSO1	stSeld	BOOLEAN	ST	5480010014011D91	PLSM01_TMP_01

Note: "Status (ST)" is defined in the function constraint (FC) of the IEC 61850 standard.

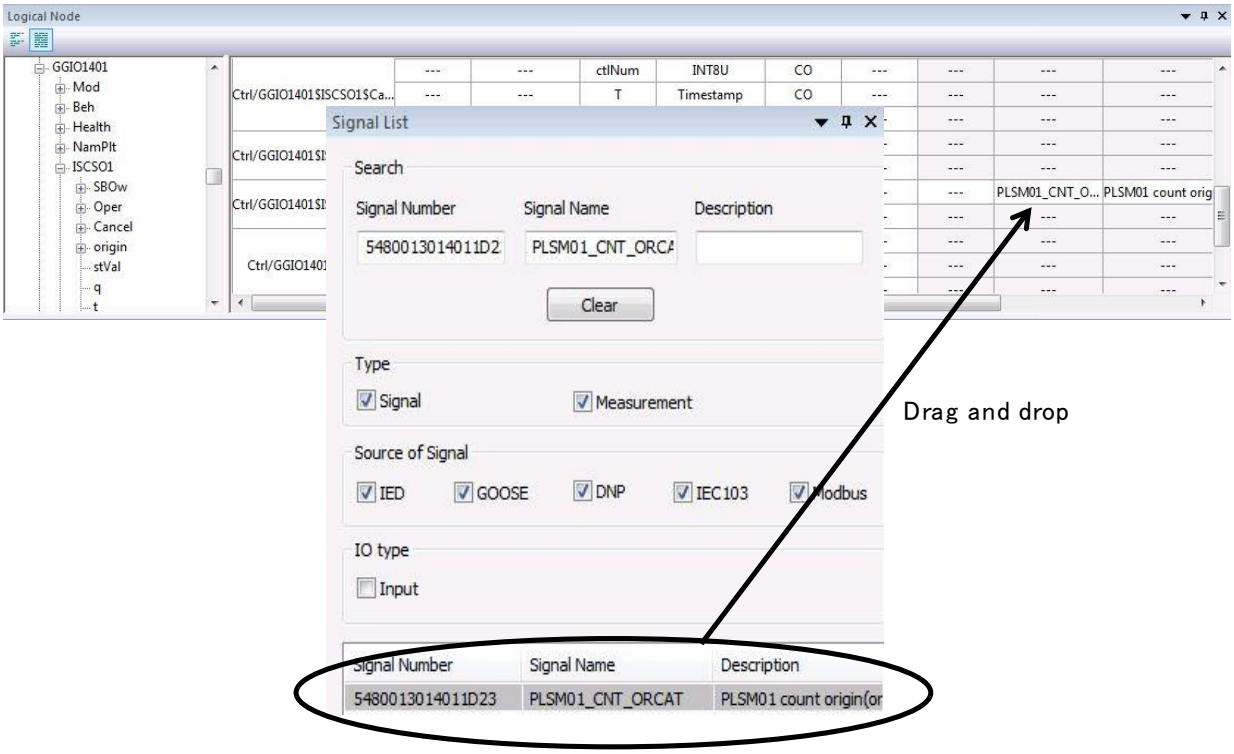


Figure 2.22-5 orCat attribute mapped into ISCSO1 object of GGIO1401

(iii) Mapping input data

The PLSM01 function can receive three commands "select, operate, and cancel. Thus, the user will need to map the input-point "PLSM01_CMM_REQ". Table 2.20-5 shows the input-point "PLSM01_CMM_REQ" and the Object reference "Ctrl/GGIO1401$ISCSO1$"; the user should map the Object reference having attributes CO and CF in FC† to the input-point. Note that the user should map the input-point to all attributes having CO and CF. Figure 2.20-6 shows how to map a signal.

†Note: The attribute is defined in the IEC 61850 standard; "CO" stands for "Control" and "CF" stands for "Configuration" in functional constraint (FC).

Table 2.22-8 Mapping signals required for GGIO1401 object in PLSM01 function

Object_reference	Attribute	Type	FC	Signal Number	Signal Name
Ctrl/GGIO1401$ISCSO1$SBOw	ctlVal	INT32	CO	5480017014016D09	PLSM01_CMM_REQ
Ctrl/GGIO1401$ISCSO1$SBOw	ctlNum	INT8U	CO		
Ctrl/GGIO1401$ISCSO1$SBOw	T	Timestamp	CO		
Ctrl/GGIO1401$ISCSO1$SBOw	Test	BOOLEAN	CO		
Ctrl/GGIO1401$ISCSO1$SBOw	Check	Check	CO		
Ctrl/GGIO1401$ISCSO1$SBOw$origin	orCat	orCategory	CO		
Ctrl/GGIO1401$ISCSO1$SBOw$origin	orIdent	Octet64	CO		
Ctrl/GGIO1401$ISCSO1$Oper	ctlVal	INT32	CO		
Ctrl/GGIO1401$ISCSO1$Oper	ctlNum	INT8U	CO		
Ctrl/GGIO1401$ISCSO1$Oper	T	Timestamp	CO		
Ctrl/GGIO1401$ISCSO1$Oper	Test	BOOLEAN	CO		
Ctrl/GGIO1401$ISCSO1$Oper	Check	Check	CO		
Ctrl/GGIO1401$ISCSO1$Oper$origin	orCat	orCategory	CO		
Ctrl/GGIO1401$ISCSO1$Oper$origin	orIdent	Octet64	CO		
Ctrl/GGIO1401$ISCSO1$Cancel	ctlVal	INT32	CO		
Ctrl/GGIO1401$ISCSO1$Cancel	ctlNum	INT8U	CO		
Ctrl/GGIO1401$ISCSO1$Cancel	T	Timestamp	CO		
Ctrl/GGIO1401$ISCSO1$Cancel	Test	BOOLEAN	CO		
Ctrl/GGIO1401$ISCSO1$Cancel$origin	orCat	orCategory	CO		
Ctrl/GGIO1401$ISCSO1$Cancel$origin	orIdent	Octet64	CO		
Ctrl/GGIO1401$ISCSO1	ctlModel	ctlModel	CF		
Ctrl/GGIO1401$ISCSO1	sboClass	sboClass	CF		

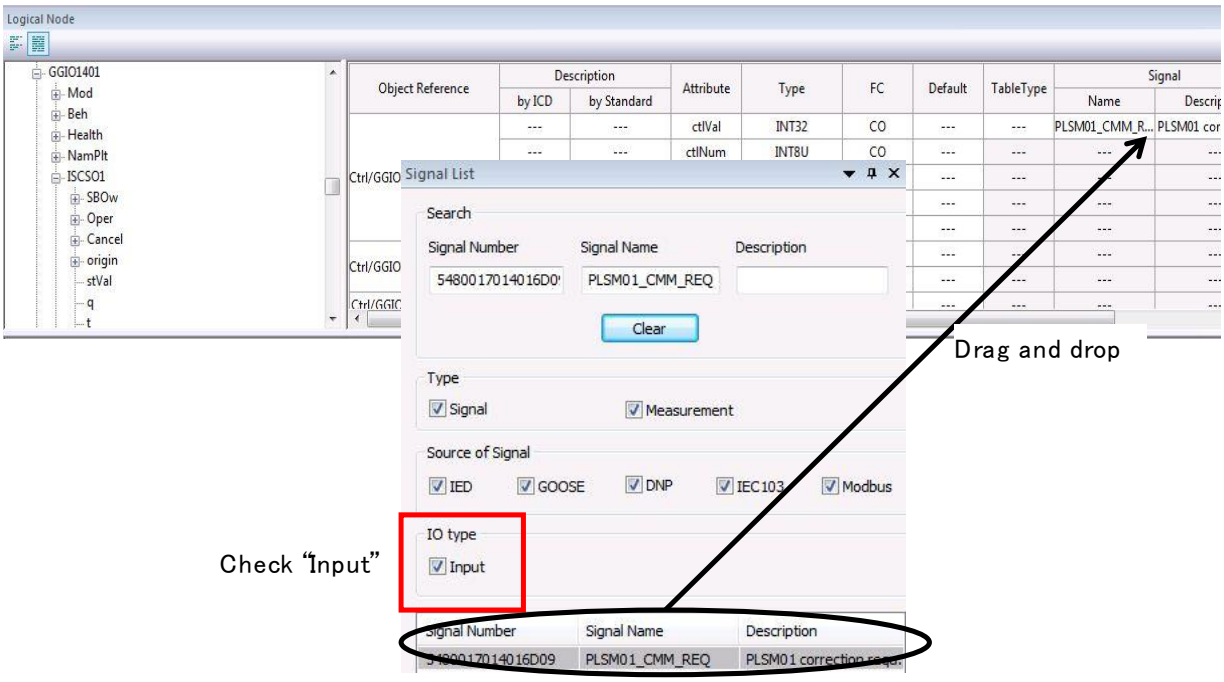


Figure 2.22-6 Input-point mapped for GGIO1401

2.22.4 Setting

Setting list for PLS_ERGY_MEA（Function ID: 548001)

Setting device			Range	Units	Contents	Default setting value	Notes
	Wh_PulseIN1	PLSM01-EN	Off/On		Counter1 Enable	Off	
		PLSM01-CNTMAX	2000–999999999999000	N/A	counter value maximum		
		PLSM01-PM	kWh / 0.1MWh / MWh		counter weight	kWh	
		PLSM01-SDB		%	Counter1 Sending Dead Band	0	
		PLSM01-CNTRV	Zero/Residual		Return value at counter roll up	Zero	
	Wh_PulseIN2	PLSM02-EN	Off/On		Counter2 Enable	Off	
		PLSM02-CNTMAX	2000–999999999999000	N/A	counter value maximum		
		PLSM02-PM	kWh / 0.1MWh / MWh		counter weight	kWh	
		PLSM02-SDB		%	Counter2 Sending Dead Band	0	
		PLSM02-CNTRV	Zero/Residual		Return value at counter roll up	Zero	
	Wh_PulseIN3	PLSM03-EN	Off/On		Counter3 Enable	Off	
		PLSM03-CNTMAX	2000–999999999999000	N/A	counter value maximum		
		PLSM03-PM	kWh / 0.1MWh / MWh		counter weight	kWh	
		PLSM03-SDB		%	Counter3 Sending Dead Band	0	
		PLSM03-CNTRV	Zero/Residual		Return value at counter roll up	Zero	
	Wh_PulseIN4	PLSM04-EN	Off/On		Counter4 Enable	Off	
		PLSM04-CNTMAX	2000–999999999999000	N/A	counter value maximum		
		PLSM04-PM	kWh / 0.1MWh / MWh		counter weight	kWh	
		PLSM04-SDB		%	Counter4 Sending Dead Band	0	
		PLSM04-CNTRV	Zero/Residual		Return value at counter roll up	Zero	
	Wh_PulseIN5	PLSM05-EN	Off/On		Counter5 Enable	Off	
		PLSM05-CNTMAX	2000–999999999999000	N/A	counter value maximum		
		PLSM05-PM	kWh / 0.1MWh / MWh		counter weight	kWh	
		PLSM05-SDB		%	Counter5 Sending Dead Band	0	
		PLSM05-CNTRV	Zero/Residual		Return value at counter roll up	Zero	
	Wh_PulseIN6	PLSM06-EN	Off/On		Counter6 Enable	Off	
		PLSM06-CNTMAX	2000–999999999999000	N/A	counter value maximum		
		PLSM06-PM	kWh / 0.1MWh / MWh		counter weight	kWh	
		PLSM06-SDB		%	Counter6 Sending Dead Band	0	
		PLSM06-CNTRV	Zero/Residual		Return value at counter roll up	Zero	
	Wh_PulseIN7	PLSM07-EN	Off/On		Counter7 Enable	Off	
		PLSM07-CNTMAX	2000–999999999999000	N/A	counter value maximum		
		PLSM07-PM	kWh / 0.1MWh / MWh		counter weight	kWh	
		PLSM07-SDB		%	Counter7 Sending Dead Band	0	
		PLSM07-CNTRV	Zero/Residual		Return value at counter roll up	Zero	
	Wh_PulseIN8	PLSM08-EN	Off/On		Counter8 Enable	Off	
		PLSM08-CNTMAX	2000–999999999999000	N/A	counter value maximum		
		PLSM08-PM	kWh / 0.1MWh / MWh		counter weight	kWh	
		PLSM08-SDB		%	Counter8 Sending Dead Band	0	
		PLSM08-CNTRV	Zero/Residual		Return value at counter roll up	Zero	

2.22.5 Signal

◆ Signal monitoring points in PLSM01

PLS_ERGY_MEA (Function ID: 548001)

Element ID	Name	Description
0014001F41	PLSM00_CCTRL_COUNTER	PLSM00 cmnctrl counter correction summarize
8014001D58	PLSM00_CH_EC_LCD	PLSM00 count change execute command by LCD
8014001D5E	PLSM00_CH_EC_OWS	PLSM00 count change execute command by OWS(HMI)
8014001D5F	PLSM00_CH_EC_RCC	PLSM00 count change execute command by RCC
8014001D60	PLSM00_CH_EC_RMT	PLSM00 count change execute command by Remote
8014001D54	PLSM00_CH_SC_LCD	PLSM00 count change select command by LCD
8014001D5B	PLSM00_CH_SC_OWS	PLSM00 count change select command by OWS(HMI)
8014001D5C	PLSM00_CH_SC_RCC	PLSM00 count change select command by RCC
8014001D5D	PLSM00_CH_SC_RMT	PLSM00 count change select command by Remote
8414011E95	PLSM01_CC_SSCN	PLSM01 cancel success signal
8914011EA2	PLSM01_CTR_SGUCN	PLSM01 control logic stage(under selection)
8314011E8B	PLSM01_EC_F_CSCN	PLSM01 execute command fail condition signal
8214011E84	PLSM01_EC_OK_CSCN	PLSM01 execute command OK condition signal
8A14011E76	PLSM01_SLD_CSCN	PLSM01 selected condition signal
8B14011E7B	PLSM01_SLF_CSCN	PLSM01 select fail condition signal
0014011D91	PLSM01_TMP_01	PLSM01 count change selected signal(stSeld) for SAS

◆ Connection points in PLC logic in PLSM01

PLS_ERGY_MEA (Function ID: 548001)

Element ID	Name	Description
801400ED5A	PLSM00IN_TMP_51	PLSM00IN_TMP_51
311401E005	PLSM01_PLC_QUALITY	PLSM01 plc quality

◆ Mapping point in PLSM01

PLS_ERGY_MEA (Function ID: 548001)

Element ID	Name	Description
7014016D09	PLSM01_CMM_REQ	PLSM01 correction request from upstream

Note: In the table above, the user will only find Element IDs and their names for the 1st device, but a 2nd and other devices are also provided in the PLS_ERGY_MEA function. We have omitted the Element IDs and their names for the other devices to improve readability. Use the rule described below when the user wishes to obtain the Element IDs and their names for the other devices.

Rule: The same types of signal monitoring points are provided in every device; hence, the user can find the same ones for all of the other devices. For example, when the user wishes to find the “PLSM02_EC_F_CSCN” point for the 2nd device, use the description of “PLSM01_EC_F_CSCN in place of “PLSM01_EC_F_CSCN ”. The user can obtain the ID value of “PLSM02_EC_F_CSCN ” by using the following steps:

Step 1 Find the element ID for PLSM01_EC_F_CSCN (i.e., "8314011E8B")

Step 2 Identify the number at the fifth digit from the ID. (i.e., "1")

Step 3 Choose a new device number. (i.e., pick the number "2" for the 2nd device)

Step 4 Replace the number that occurs at the fifth digit with the new device number. (i.e., get new ID "8314021E8B" of "PLSM02_EC_F_CSCN") The ID is expressed in hexadecimal notation. Thus, the user must change the device number from decimal notation to hexadecimal notation.

2.23 Total time measurement function (TOTALTIM)

The total time measurement function (TOTALTIM) measures the time of the On state using a signal which is selected with the logic programmed by the PLC function. The TOTALTIM function increments the time for which the signal is in the "ON" state and stores it as a cumulative time. The TOTALTIM function can monitor up to 12 signals simultaneously. This function also has correction processes.

Note: The implementation of such features is dependent upon the selection of hardware and the configuration of functions. Several IED models do not have certain features. To determine whether a particular feature is implemented within the IED, identify the IED ordering number; and check the order number at the "G&T position" whilst referring to the comparison table below. For more information, see *Appendix: Ordering*.

Table 2.23-1 Comparative table in respective ordering numbers

Sec.	Feature	Ordering No. at "G&T"					
		BCU			BCPU		IFU
		11	13	1F	2N	2C	19
–	Main features	✓	✓	✓	✓	✓	NA

✓: Applicable NA: Not applicable

2.23.1 Operation feature

(i) Time accumulation process

Figure 2.23-1 outlines the time accumulation process within the TOTALTIM function. The TOTALTIM function accumulates the time for which the state of the operating signal is in the "ON" status every second. The accumulation process continues until the maximum accumulated time reaches 10,000 days (almost 27 years).

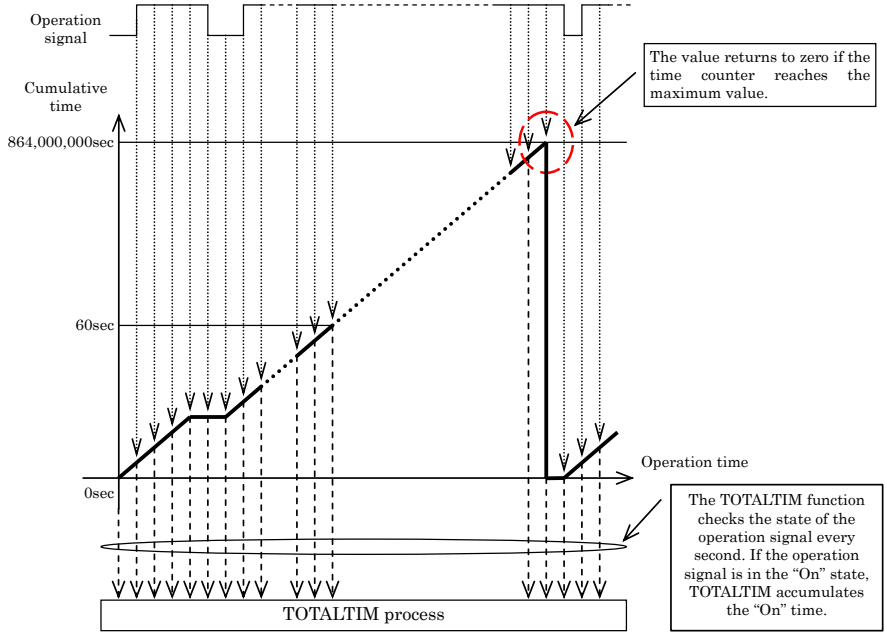


Figure 2.23-1 Cumulative time process

(ii) Acquisition of operation signal

The user should connect the binary input circuit (BI) to the TOTALTIM function.

Figure 2.23-2 illustrates that 12 signals can be accommodated from external devices using BIs. For example, when binary input circuit BI1 receives operating signal1, provided signal-monitoring point "BI1" is applied for the acquisition of the signal, the user can make the logic to connect "BI1" with TT01 of the TOTALTIM function using the PLC function.

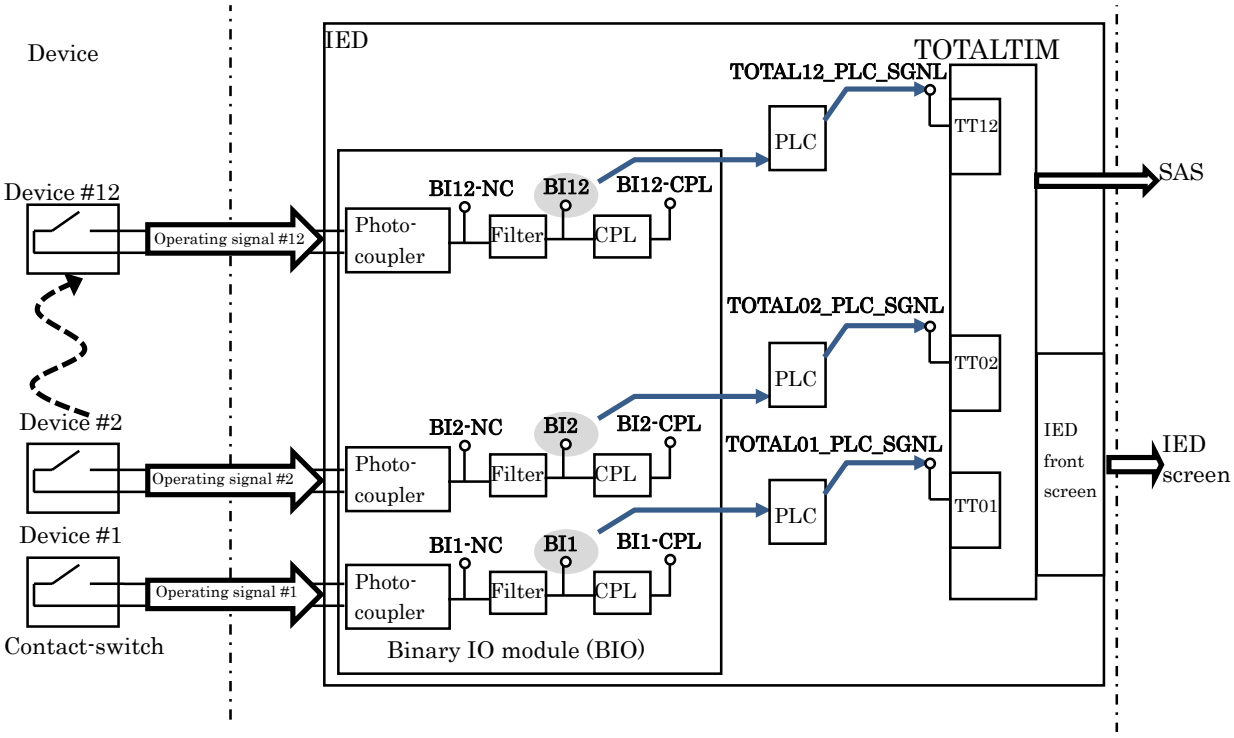


Figure 2.23-2 Acquisition of operation signals

(iii) Setting for the report (Dead band)

For sending data for the network, the TOTALTIM function will get a new accumulated data every cycle that is defined with the setting [**TTIM*-SDB**]. For example, if the user wishes to report the operation time about the device #1, the user should set '1' to the setting [**TTIM01-SDB**], provided the report cycle is required every one second.

Table 2.23-2 Setting for data revision

Scheme switch	Set	Comment
TTIM01-SDB	1 to 720sec	Data revision period for operating signal 1
TTIM02-SDB	1 to 720sec	Data revision period for operating signal 2
(omitted)	(omitted)	(omitted)
TTIM12-SDB	1 to 720sec	Data revision period for operating signal 12

(iv) Data correction

In the TOTALTIM function the user can correct the accumulation time using either IED front panel operation or GR-TIEMS operation (For IED screen operation, see Chapter *User interface*. For GR-TIEMS operation, see Chapter *Engineering tool*)

2.23.2 Preparation for operation

The TOTALTIM function is enabled when the user sets [**TTIM*-EN**] **On**.

Table 2.23-3 TOTALTIM operation

Scheme switch	Set	Comment
TTIM01-EN	On / Off	Operation enable for operating signal #1
TTIM02-EN	On / Off	Operation enable for operating signal #2
(omitted)	(omitted)	(omitted)
TTIM12-EN	On / Off	Operation enable for operating signal #12

2.23.3 Mapping for IEC 61850 communication

The user can operate the TTIM01 function using IEC 61850 communications after first mapping the function using GR-TIEMS. The user should proceed as follows

Step1: Editing Logical Node

Step2: Mapping output data

Step3: Mapping input data

(i) Editing Logical Node

The user must make a logical node (LN) for the TTIM01 function. Figure 2.23-3 exemplifies LN editing; LN "GGIO1301" is selected for the TTIM01 function for IEC 61850 communication. After the user has defined an object "ISCSO1", the TTIM01 logical node can be saved with the name "GGIO1301". Define the object "ISCSO1" in the TTIM01 logical node. Either the SBO mode or the DIR mode can be chosen when editing the LN.

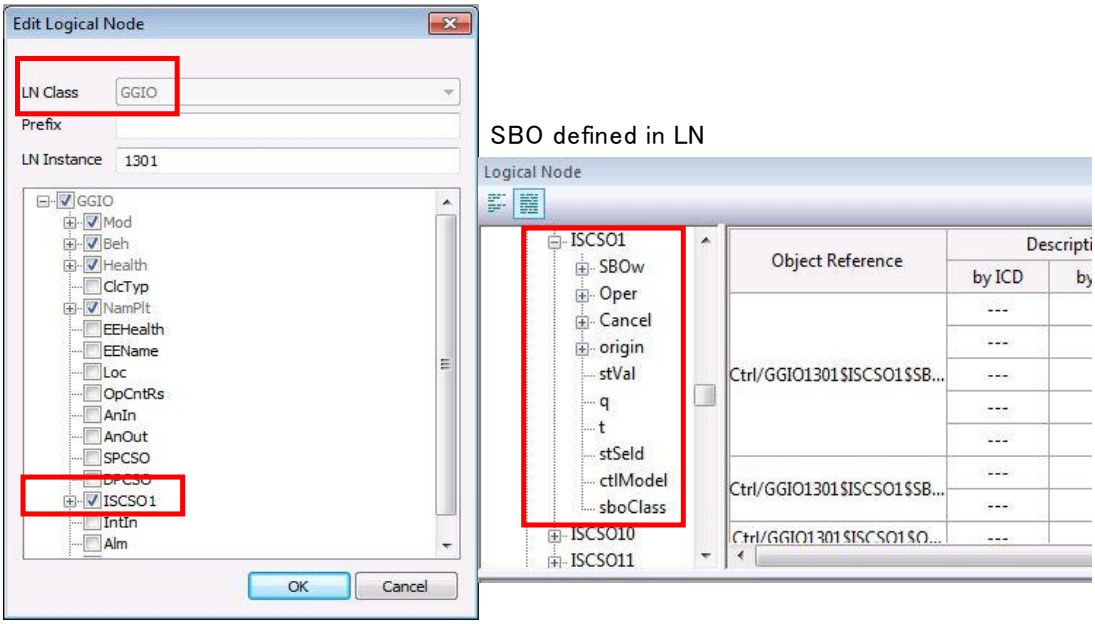
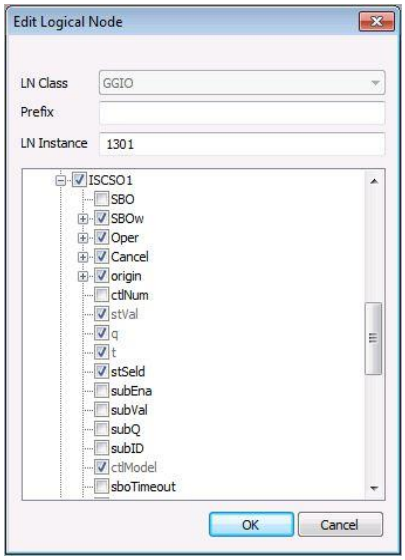


Figure 2.23-3 Defining "ISCSO1" object in GGIO1301 logic node

(i)-1 Defining SBO mode

Figure 2.23-4 exemplifies the settings in LN "GGIO1301" when the SBO mode is required for the TTIM01 function. For SBO control, the user should select the following items for the "GGIO1301$ISCSO1" using GR-TIEMS;



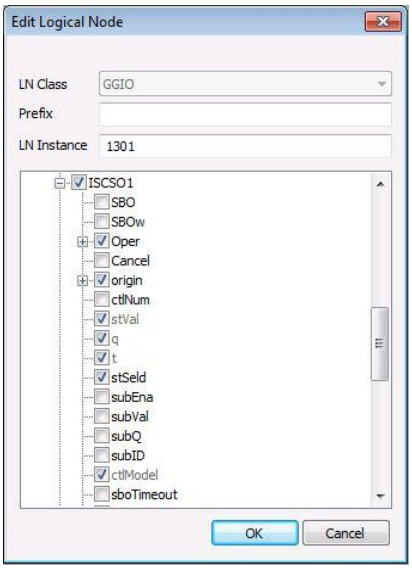
✓ SBOw
✓ Oper
✓ Cancel
✓ Origin
✓ stSeld
✓ sboClass† (choice "operate-once")
✓ ctlmodel (choice "SBOes or SBOns")

†"sboClass" can be found by scrolling down.

Figure 2.23-4 LN editing screen for SBO mode (for example)

(i)-2 Defining DIR mode

Figure 2.23-5 exemplifies the settings in LN "GGIO1301" when the DIR mode is required for the TTIM01 function. In the DIR mode, the following three items should be selected using GR-TIEMS:



✓ Oper
✓ origin
✓ ctlmodel (choice "DOes or DOns")

Figure 2.23-5 LN editing screen for DIR mode (for example)

(ii) Mapping output data

The user should group the TTIM01 signals with regard to GOOSE and REPORT; the user should map them for IEC 61850 communication using GR-TIEMS.

Table 2.23-4 shows the mapping signals within the TTIM01 function required for IEC 61850 communication. Figure 2.23-6 shows how to map a signal.

Table 2.23-4 Mapping signals for ISCSO1 object.

Object_reference	Attribute	Type	FC	Signal Number	Signal Name
Ctrl/GGIO1301$ISCSO1$origin	orCat	orCategory	ST	5410013015011D23	TTIM01_TIM_ORCAT
Ctrl/GGIO1301$ISCSO1$origin	orIdent	Octet64	ST	5410016A15011FA7	TTIM01_TIM_ORIDENT
Ctrl/GGIO1301$ISCSO1	stVal	INT32	ST	5410013215011D20	TTIM01_TIM_SEC_VAL
Ctrl/GGIO1301$ISCSO1	q	Quality	ST	5410013115011D21	TTIM01_TIM_QLT
Ctrl/GGIO1301$ISCSO1	t	Timestamp	ST	5410019015011D22	TTIM01_TIM_TIM
Ctrl/GGIO1301$ISCSO1	stSeld	BOOLEAN	ST	5410010015011D91	TTIM01_TMP_01
Ctrl/GGIO1301$AnIn1$mag	f	FLOAT32	MX	5410013215011D20	TTIM01_TIM_SEC_VAL
Ctrl/GGIO1301$AnIn1	q	Quality	MX	5410013115011D21	TTIM01_TIM_QLT
Ctrl/GGIO1301$AnIn1	t	Timestamp	MX	5410019015011D22	TTIM01_TIM_TIM

Note: "Status (ST)" and "Measurement (MX)" are defined in the function constraint (FC) of the IEC 61850 standard.

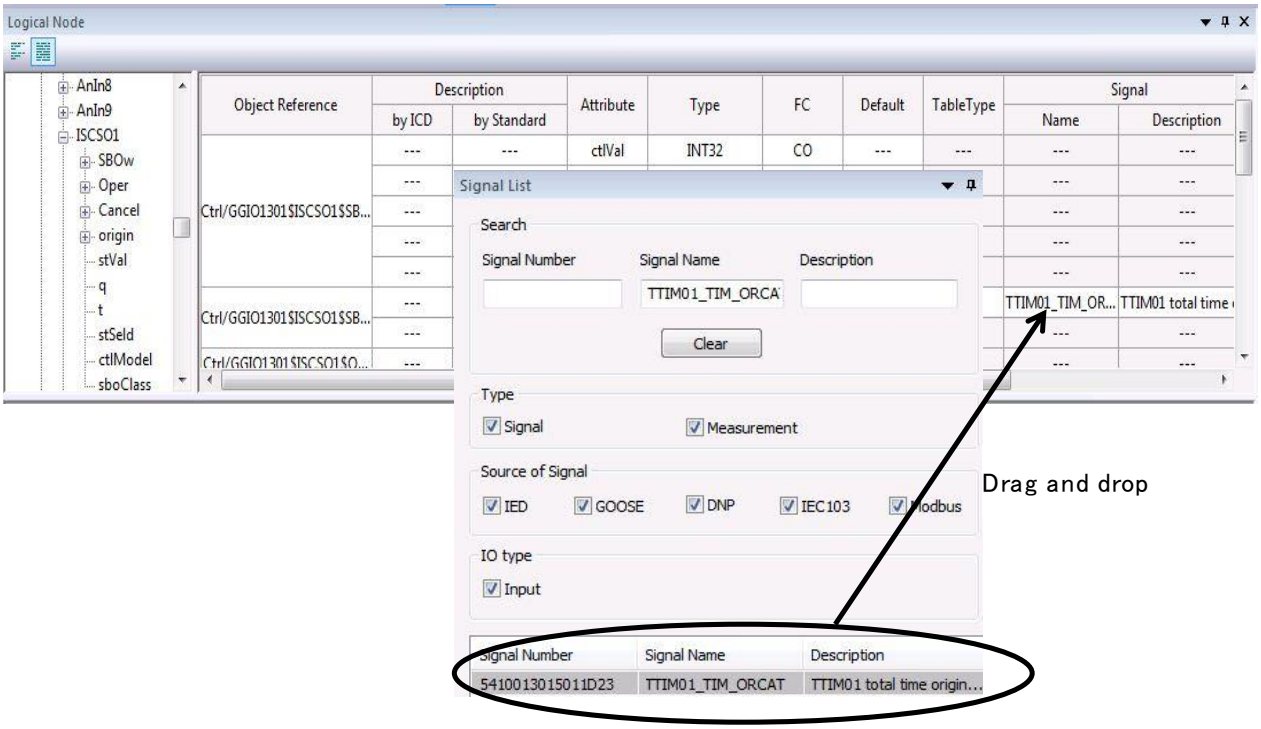


Figure 2.23-6 orCat attribute mapped into ISCSO1 object of GGIO1301

(iii) Mapping input data

The TTIM01 function can receive three commands "select, operate, and cancel. Thus, the user will need to map the input-point "TOTAL01_CMM_REQ". Table 2.23-5 shows the input-point "TOTAL01_CMM_REQ" and the Object reference "Ctrl/GGIO1301$ISCSO1$"; the user should map the input-point to the Object reference having attributes CO and CF in FC†. Figure 2.23-7 shows how to map a signal.

†Note: The attribute is defined in the IEC 61850 standard; "CO" stands for "Control" and "CF" stands for "Configuration" in the functional constraint (FC).

Table 2.23-5 Mapping signals required for GGIO1301 object in TTIM01 function

Object_reference	Attribute	Type	FC	Signal Number	Signal Name
Ctrl/GGIO1301$ISCSO1$SBOw	ctlVal	INT32	CO	5410017015016D08	TOTAL01_CMM_REQ
Ctrl/GGIO1301$ISCSO1$SBOw	ctlNum	INT8U	CO		
Ctrl/GGIO1301$ISCSO1$SBOw	T	Timestamp	CO		
Ctrl/GGIO1301$ISCSO1$SBOw	Test	BOOLEAN	CO		
Ctrl/GGIO1301$ISCSO1$SBOw	Check	Check	CO		
Ctrl/GGIO1301$ISCSO1$SBOw$origin	orCat	orCategory	CO		
Ctrl/GGIO1301$ISCSO1$SBOw$origin	orIdent	Octet64	CO		
Ctrl/GGIO1301$ISCSO1$Oper	ctlVal	INT32	CO		
Ctrl/GGIO1301$ISCSO1$Oper	ctlNum	INT8U	CO		
Ctrl/GGIO1301$ISCSO1$Oper	T	Timestamp	CO		
Ctrl/GGIO1301$ISCSO1$Oper	Test	BOOLEAN	CO		
Ctrl/GGIO1301$ISCSO1$Oper	Check	Check	CO		
Ctrl/GGIO1301$ISCSO1$Oper$origin	orCat	orCategory	CO		
Ctrl/GGIO1301$ISCSO1$Oper$origin	orIdent	Octet64	CO		
Ctrl/GGIO1301$ISCSO1$Cancel	ctlVal	INT32	CO		
Ctrl/GGIO1301$ISCSO1$Cancel	ctlNum	INT8U	CO		
Ctrl/GGIO1301$ISCSO1$Cancel	T	Timestamp	CO		
Ctrl/GGIO1301$ISCSO1$Cancel	Test	BOOLEAN	CO		
Ctrl/GGIO1301$ISCSO1$Cancel$origin	orCat	orCategory	CO		
Ctrl/GGIO1301$ISCSO1$Cancel$origin	orIdent	Octet64	CO		
Ctrl/GGIO1301$ISCSO1	ctlModel	ctlModel	CF		
Ctrl/GGIO1301$ISCSO1	sboClass	sboClass	CF		

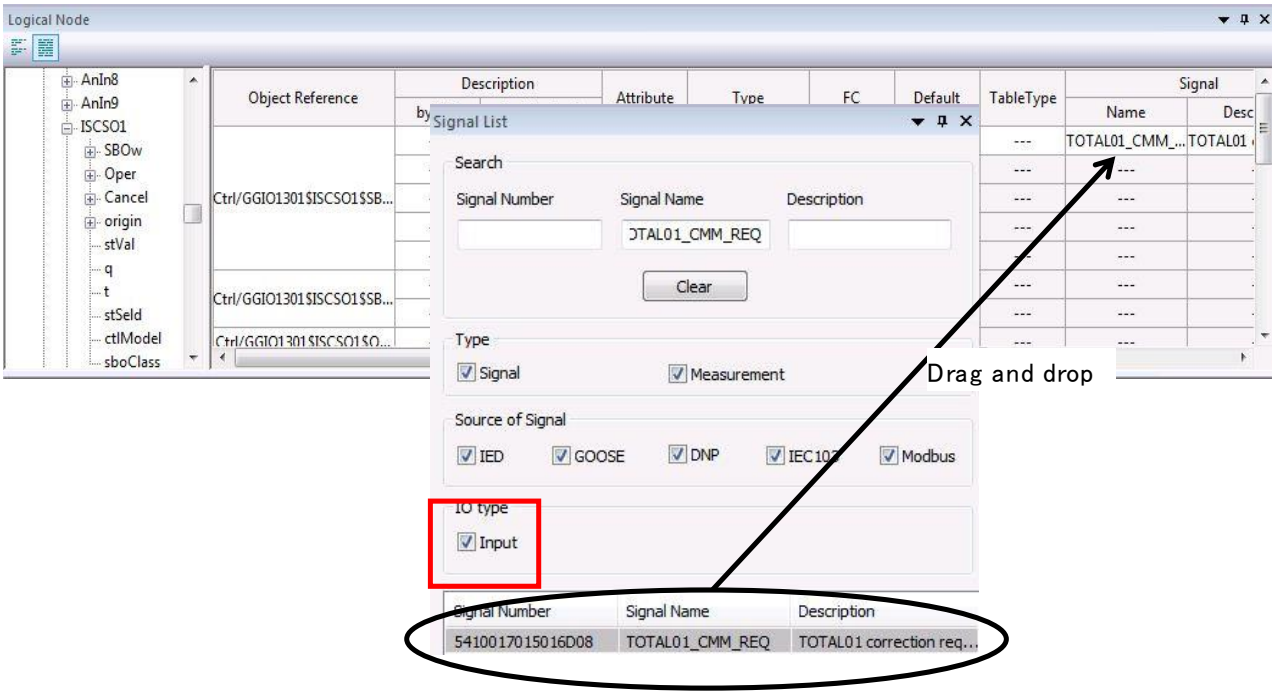


Figure 2.23-7 Input-point mapped for GGIO1301

2.23.4 Setting

Setting list for TOTALTIM（Function ID: 541001)

Setting device			Range	Units	Contents	Default setting value	Notes
	TT1	TTIM01-EN	Off / On	-	TotalTimer1 Enable	Off	
		TTIM01-SDB	1-720	min	TotalTimer1 Sending Dead Band	0	
	TT2	TTIM02-EN	Off / On	-	TotalTimer2 Enable	Off	
		TTIM02-SDB	1-720	min	TotalTimer2 Sending Dead Band	0	
	TT3	TTIM03-EN	Off / On	-	TotalTimer3 Enable	Off	
		TTIM03-SDB	1-720	min	TotalTimer3 Sending Dead Band	0	
	TT4	TTIM04-EN	Off / On	-	TotalTimer4 Enable	Off	
		TTIM04-SDB	1-720	min	TotalTimer4 Sending Dead Band	0	
	TT5	TTIM05-EN	Off / On	-	TotalTimer5 Enable	Off	
		TTIM05-SDB	1-720	min	TotalTimer5 Sending Dead Band	0	
	TT6	TTIM06-EN	Off / On	-	TotalTimer6 Enable	Off	
		TTIM06-SDB	1-720	min	TotalTimer6 Sending Dead Band	0	
	TT7	TTIM07-EN	Off / On	-	TotalTimer7 Enable	Off	
		TTIM07-SDB	1-720	min	TotalTimer7 Sending Dead Band	0	
	TT8	TTIM08-EN	Off / On	-	TotalTimer8 Enable	Off	
		TTIM08-SDB	1-720	min	TotalTimer8 Sending Dead Band	0	
	TT9	TTIM09-EN	Off / On	-	TotalTimer9 Enable	Off	
		TTIM09-SDB	1-720	min	TotalTimer9 Sending Dead Band	0	
	TT10	TTIM10-EN	Off / On	-	TotalTimer10 Enable	Off	
		TTIM10-SDB	1-720	min	TotalTimer10 Sending Dead Band	0	
	TT11	TTIM11-EN	Off / On	-	TotalTimer11 Enable	Off	
		TTIM11-SDB	1-720	min	TotalTimer11 Sending Dead Band	0	
	TT12	TTIM12-EN	Off / On	-	TotalTimer12 Enable	Off	
		TTIM12-SDB	1-720	min	TotalTimer12 Sending Dead Band	0	

2.23.5 Signal

◆ Signal monitoring points

TOTALTIM(Function ID: 541001)

Element ID	Name	Description
8015001D51	TTIM00_CH_SC_OWS	TTIM00 total time change select command by OWS(HMI)
8015001D52	TTIM00_CH_SC_RCC	TTIM00 total time change select command by RCC
8015001D53	TTIM00_CH_SC_RMT	TTIM00 total time change select command by Remote
8015001D54	TTIM00_CH_SC_LCD	TTIM00 total time change select command by LCD
8015001D55	TTIM00_CH_EC_OWS	TTIM00 total time change execute command by OWS(HMI)
8015001D56	TTIM00_CH_EC_RCC	TTIM00 total time change execute command by RCC
8015001D57	TTIM00_CH_EC_RMT	TTIM00 total time change execute command by Remote
8015001D58	TTIM00_CH_EC_LCD	TTIM00 total time change execute command by LCD
8915011EA2	TTIM01_CTR_SGU	TTIM01 control logic stage(under selection)
8A15011E76	TTIM01_SLD_CS	TTIM01 selected condition signal
8B15011E7B	TTIM01_SLF_CS	TTIM01 select fail condition signal
8215011E84	TTIM01_EC_OK_CS	TTIM01 execute command OK condition signal
8315011E8B	TTIM01_EC_F_CN	TTIM01 execute command fail condition signal
8415011E95	TTIM01_CC_SS	TTIM01 cancel success signal
8915021EA2	TTIM02_CTR_SGU	TTIM02 control logic stage(under selection)
8A15021E76	TTIM02_SLD_CS	TTIM02 selected condition signal
8B15021E7B	TTIM02_SLF_CS	TTIM02 select fail condition signal
8215021E84	TTIM02_EC_OK_CS	TTIM02 execute command OK condition signal
8315021E8B	TTIM02_EC_F_CS	TTIM02 execute command fail condition signal
8415021E95	TTIM02_CC_SS	TTIM02 cancel success signal
8915031EA2	TTIM03_CTR_SGU	TTIM03 control logic stage(under selection)
8A15031E76	TTIM03_SLD_CS	TTIM03 selected condition signal
8B15031E7B	TTIM03_SLF_CS	TTIM03 select fail condition signal
8215031E84	TTIM03_EC_OK_CS	TTIM03 execute command OK condition signal
8315031E8B	TTIM03_EC_F_CS	TTIM03 execute command fail condition signal
8415031E95	TTIM03_CC_SS	TTIM03 cancel success signal
8915041EA2	TTIM04_CTR_SGU	TTIM04 control logic stage(under selection)
8A15041E76	TTIM04_SLD_CS	TTIM04 selected condition signal
8B15041E7B	TTIM04_SLF_CS	TTIM04 select fail condition signal
8215041E84	TTIM04_EC_OK_CS	TTIM04 execute command OK condition signal
8315041E8B	TTIM04_EC_F_CS	TTIM04 execute command fail condition signal
8415041E95	TTIM04_CC_SS	TTIM04 cancel success signal
8915051EA2	TTIM05_CTR_SGU	TTIM05 control logic stage(under selection)
8A15051E76	TTIM05_SLD_CS	TTIM05 selected condition signal
8B15051E7B	TTIM05_SLF_CS	TTIM05 select fail condition signal
8215051E84	TTIM05_EC_OK_CS	TTIM05 execute command OK condition signal
8315051E8B	TTIM05_EC_F_CS	TTIM05 execute command fail condition signal
8415051E95	TTIM05_CC_SS	TTIM05 cancel success signal
8915061EA2	TTIM06_CTR_SGU	TTIM06 control logic stage(under selection)
8A15061E76	TTIM06_SLD_CS	TTIM06 selected condition signal
8B15061E7B	TTIM06_SLF_CS	TTIM06 select fail condition signal
8215061E84	TTIM06_EC_OK_CS	TTIM06 execute command OK condition signal
8315061E8B	TTIM06_EC_F_CS	TTIM06 execute command fail condition signal

◆ Signal monitoring points

TOTALTIM(Function ID: 541001)

Element ID	Name	Description
8415061E95	TTIM06_CC_SS	TTIM06 cancel success signal
8915071EA2	TTIM07_CTR_SGU	TTIM07 control logic stage(under selection)
8A15071E76	TTIM07_SLD_CS	TTIM07 selected condition signal
8B15071E7B	TTIM07_SLF_CS	TTIM07 select fail condition signal
8215071E84	TTIM07_EC_OK_CS	TTIM07 execute command OK condition signal
8315071E8B	TTIM07_EC_F_CS	TTIM07 execute command fail condition signal
8415071E95	TTIM07_CC_SS	TTIM07 cancel success signal
8915081EA2	TTIM08_CTR_SGU	TTIM08 control logic stage(under selection)
8A15081E76	TTIM08_SLD_CS	TTIM08 selected condition signal
8B15081E7B	TTIM08_SLF_CS	TTIM08 select fail condition signal
8215081E84	TTIM08_EC_OK_CS	TTIM08 execute command OK condition signal
8315081E8B	TTIM08_EC_F_CS	TTIM08 execute command fail condition signal
8415081E95	TTIM08_CC_SS	TTIM08 cancel success signal
8915091EA2	TTIM09_CTR_SGU	TTIM09 control logic stage(under selection)
8A15091E76	TTIM09_SLD_CS	TTIM09 selected condition signal
8B15091E7B	TTIM09_SLF_CS	TTIM09 select fail condition signal
8215091E84	TTIM09_EC_OK_CS	TTIM09 execute command OK condition signal
8315091E8B	TTIM09_EC_F_CS	TTIM09 execute command fail condition signal
8415091E95	TTIM09_CC_SS	TTIM09 cancel success signal
89150A1EA2	TTIM10_CTR_SGU	TTIM10 control logic stage(under selection)
8A150A1E76	TTIM10_SLD_CS	TTIM10 selected condition signal
8B150A1E7B	TTIM10_SLF_CS	TTIM10 select fail condition signal
82150A1E84	TTIM10_EC_OK_CS	TTIM10 execute command OK condition signal
83150A1E8B	TTIM10_EC_F_CS	TTIM10 execute command fail condition signal
84150A1E95	TTIM10_CC_SS	TTIM10 cancel success signal
89150B1EA2	TTIM11_CTR_SGU	TTIM11 control logic stage(under selection)
8A150B1E76	TTIM11_SLD_CS	TTIM11 selected condition signal
8B150B1E7B	TTIM11_SLF_CS	TTIM11 select fail condition signal
82150B1E84	TTIM11_EC_OK_CS	TTIM11 execute command OK condition signal
83150B1E8B	TTIM11_EC_F_CS	TTIM11 execute command fail condition signal
84150B1E95	TTIM11_CC_SS	TTIM11 cancel success signal
89150C1EA2	TTIM12_CTR_SGU	TTIM12 control logic stage(under selection)
8A150C1E76	TTIM12_SLD_CS	TTIM12 selected condition signal
8B150C1E7B	TTIM12_SLF_CS	TTIM12 select fail condition signal
82150C1E84	TTIM12_EC_OK_CS	TTIM12 execute command OK condition signal
83150C1E8B	TTIM12_EC_F_CS	TTIM12 execute command fail condition signal
84150C1E95	TTIM12_CC_SS	TTIM12 cancel success signal

◆ Connection points in PLC logic

TOTALTIM(Function ID: 541001)

Element ID	Name	Description
801500ED5	TOTAL00IN_TMP_51	TOTAL00IN_TMP_51
801501EDE0	TOTAL01_PLC_SGNL	TOTAL01 plc signal
801502EDE0	TOTAL02_PLC_SGNL	TOTAL02 plc signal

◆ Connection points in PLC logic

TOTALTIM(Function ID: 541001)

Element ID	Name	Description
801503EDE0	TOTAL03_PLC_SGNL	TOTAL03 plc signal
801504EDE0	TOTAL04_PLC_SGNL	TOTAL04 plc signal
801505EDE0	TOTAL05_PLC_SGNL	TOTAL05 plc signal
801506EDE0	TOTAL06_PLC_SGNL	TOTAL06 plc signal
801507EDE0	TOTAL07_PLC_SGNL	TOTAL07 plc signal
801508EDE0	TOTAL08_PLC_SGNL	TOTAL08 plc signal
801509EDE0	TOTAL09_PLC_SGNL	TOTAL09 plc signal
80150EDE0	TOTAL10_PLC_SGNL	TOTAL10 plc signal
80150BEDE0	TOTAL11_PLC_SGNL	TOTAL11 plc signal
80150CEDE0	TOTAL12_PLC_SGNL	TOTAL12 plc signal

2.24 Mode control function (MDCTRL)

For the user, mode control (MDCTRL) function can provide test function (TEST-FB) interface, which is a command to change the mode in the function. MDCTRL function consists of two parts: (1) On-mode or Test-mode sensing in IED and (2) interface between IED and SAS.

Note: The implementation of such features depends on the selection of hardware and the configuration of functions. Several IED models do not have the features. To determine whether the features are implemented in the IED, locate the IED ordering number; and check the order number at the "G&T position" referring to the comparison table below. For more information, see *Appendix: Ordering*.

Table 2.24-1 Comparative table in respective ordering numbers

Sec.	Feature	Ordering No. at "G&T"					
		BCU			BCPU		IFU
		11	13	1F	2N	2C	19
–	Main features	✓	✓	✓	✓	✓	✓

✓: Applicable NA: Not applicable

2.24.1 Function

(i) Mode sensor

The MDCTRL function can monitor the state change (On to TEST / TEST to Off) in the IED. To use this monitoring function, **On** should be set for the scheme switch [**MDCTRL-EN**] prior to operation. During the operation, a select signal and an operate signal are provided for the TEST-FB when the SAS provides a test command for the IED; hence, the MDCTRL function comes with two time-out timers. Setting [**MDCTRL-SELRST**] provides a time-out timer for canceling a select command; setting [**MDCTRL-EXERST**] provides a time-out timer for canceling an operate command.

(ii) Interface for IEC61850

The MDCTRL function can fulfil the two operation modes (On and Test) specified in the IEC 61850 communication, as shown in Table 2.24-2; the MDCTRL function can carry a signal for changing for the TEST-FB; the signal is generated in the select and control logics in the MDCTRL function. The change signal is initiated by the mode change command that is received at the communication interface. Note that control operations from a SAS is only taken account.

Table 2.24-2 Values of mode and behavior in IEC 61850

Value	Mode	Definition in IEC 61850
1	On	The application represented by the LN works. All communication services work and get updated values.
3	Test	The application represented by the LN works. All communication services work and get updated values. Data objects will be transmitted with quality "test". Control commands with quality test will be accepted only by LNs in "test" or "test-blocked" mode. "Processed as valid" means that the application should react in the manner what is foreseen for "test".

(iii) Input signal from control hierarchy

Note PLC logic "Control hierarchy condition" is required to operate the MDCTRL function; the user should notice that the connection with the Control hierarchy is made using the connection point "PLC_BIT_1288" (see Table 2.24-3). For more information, see chapter *Control and monitoring application: Control hierarchy*.

Table 2.24-3 PLC connection point (Input signal for select condition logic)

Signal Number	Signal Name	Description	M/O
5A0101 801287EF40	PLC_BIT_1288	MDCTRL control hierarchy condition	M

2.24.2 Mapping for IEC61850 communication

The user can operate the MDCTRL function over the IEC61850 communication after the mapping using GR-TIEMS. The user should follow steps,

Step1: Editing Logical Node

Step2: Mapping output data

Step3: Mapping input data

(i) Editing Logical Node

The user should make a logical node (LN) for the MDCTRL function. Figure 2.24-1exemplifies LN editing; the LN "LLNO" is chosen for the MDCTRL01 for IEC61850 communication. After the user defining an object "MOD", the MDCTRL01 logical node can be saved with the name "LLNO". Make a definition of the object "MOD" in MDCTRL01 logical node. Either the SBO mode or the DIR mode can be chosen in the LN editing.

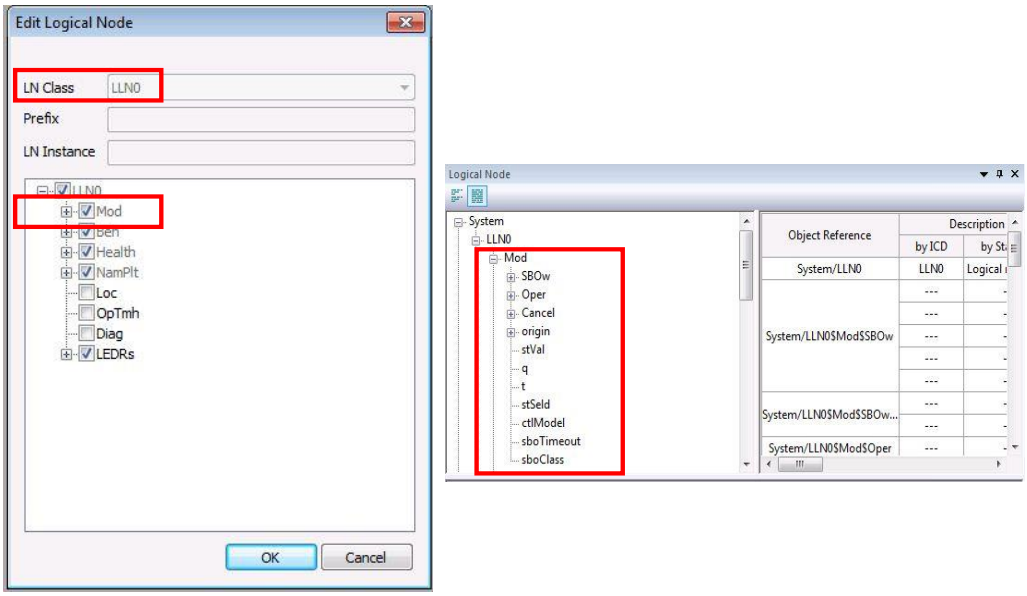
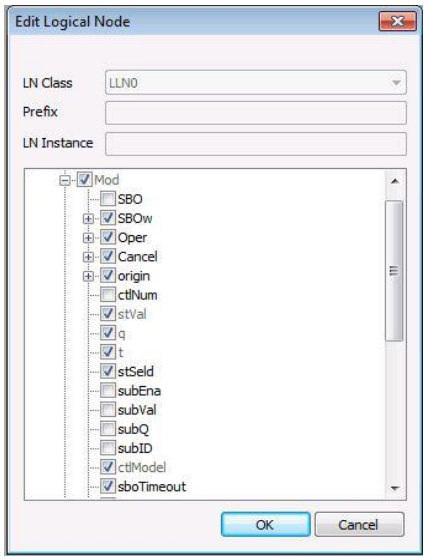


Figure 2.24-1 Defining "MOD" object in LLNO logic node

(i)-1 Defining SBO mode

Figure 2.24-2 exemplifies the settings in LN "LLNO" when the SBO mode is required for the MDCTRL01 function. In the SBO control, the user should select the following items for the "LLNO$MOD" using the GR-TIEMS;



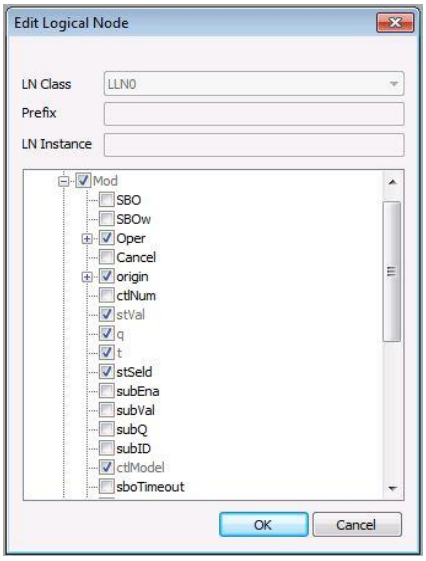
SBOw
Oper
Cancel
Origin
stSeld
sboClass† (choice "operate-once")
ctlmodel (choice "SBOes or SBOns")

†"sboClass" can be found by scrolling down.

Figure 2.24-2 LN editing screen for SBO mode (for example)

(i)-2 Defining DIR mode

Figure 2.24-3 exemplifies the settings in LN "LLNO" when the DIR mode is required for the MDCTRL01 function. In the DIR mode, the following three items should be selected using the GR-TIEMS:



Oper
origin
ctlmodel (choice "DOes or DOns")

Figure 2.24-3 LN editing screen for DIR mode (for example)

(ii) Mapping output data

The user should group the MDCTRL01 signals with regard to GOOSE and REPORT; the user should map them for the IEC 61850 communication using GR-TIEMS.

Table 2.24-4 shows the required mapping signals in MDCTRL01 function to the IEC 61850 communications. Figure below shows how to map a signal.

Note: "Status (ST)" is defined in the function constraint (FC) of the IEC 61850 standard.

Table 2.24-4 Mapping signals for MOD object.

Object_reference	Attribute	Type	FC	Signal Number	Signal Name
System/LLN0Modorigin	orCat	orCategory	ST	5500013013011000	MDCTRL01_ORCAT
System/LLN0Modorigin	orIdent	Octet64	ST	5500016A13011009	MDCTRL01_ORIDENT
System/LLN0$Mod	stSeld	BOOLEAN	ST	5500010013011D90	MDCTRL01_SLD_RPT

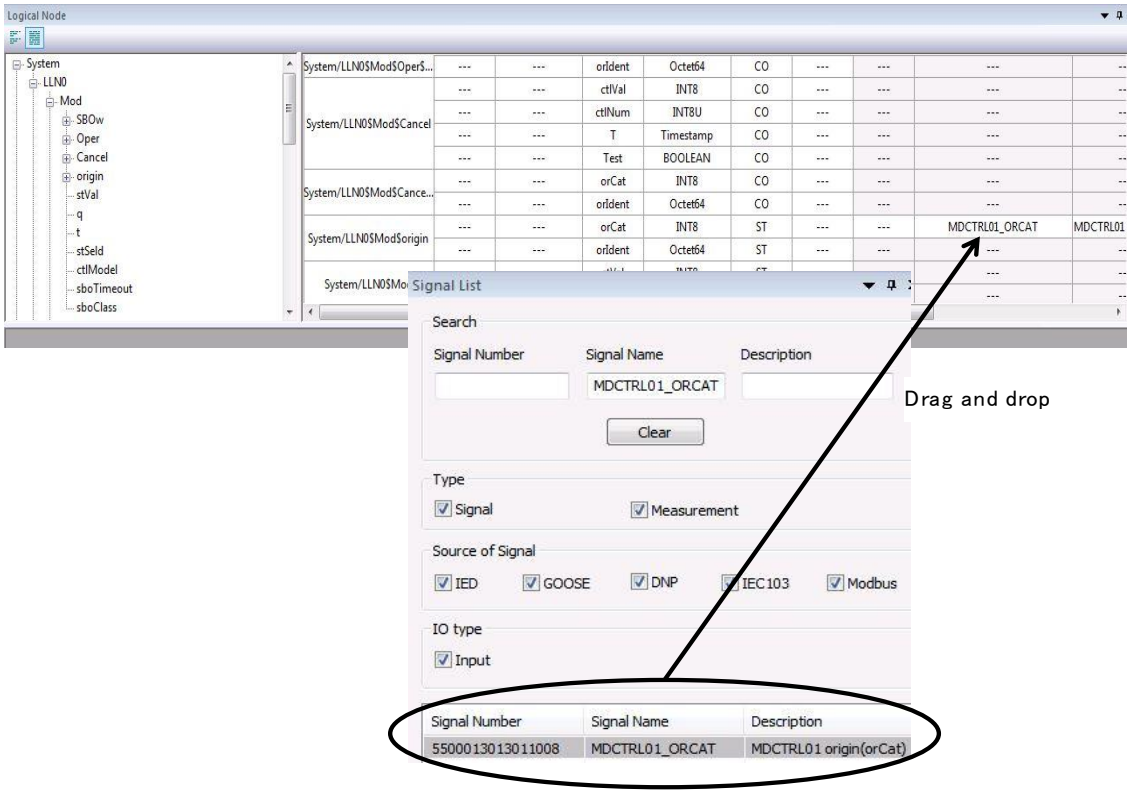


Figure 2.24-4 orCat attribute mapped into MOD object of LLNO

(iii) Mapping input data

The MDCTRL01 function can receive three commands “select, operate, and cancel. Thus, the user should map the input-point “MDCTRL01_CONTROL_REQ”. Table 2.24-5 shows the input-point “MDCTRL01_CONTROL_REQ” and the Object reference “System/LLN0Mod”; the user should map the Object reference having attributes CO and CF in FC to the input-point. Note that the user should map the input-point to all attributes having CO and CF. Figure below shows how to map a signal.

Table 2.24-5 Mapping signals required for LLNO object in MDCTRL01 function

Object_reference	Attribute	Type	FC	Signal Number	Signal Name
System/LLN0ModSBOw	ctlVal	Mod	CO		
System/LLN0ModSBOw	ctlNum	INT8U	CO		
System/LLN0ModSBOw	T	Timestamp	CO		
System/LLN0ModSBOw	Test	BOOLEAN	CO		
System/LLN0ModSBOw	Check	Check	CO		
System/LLN0ModSBOw$origin	orCat	orCategory	CO		
System/LLN0ModSBOw$origin	orIdent	Octet64	CO		
System/LLN0ModOper	ctlVal	Mod	CO		
System/LLN0ModOper	ctlNum	INT8U	CO		
System/LLN0ModOper	T	Timestamp	CO		
System/LLN0ModOper	Test	BOOLEAN	CO		
System/LLN0ModOper	Check	Check	CO	5500017013016D08	MDCTRL01_CONTROL_REQ
System/LLN0ModOper$origin	orCat	orCategory	CO		
System/LLN0ModOper$origin	orIdent	Octet64	CO		
System/LLN0ModCancel	ctlVal	Mod	CO		
System/LLN0ModCancel	ctlNum	INT8U	CO		
System/LLN0ModCancel	T	Timestamp	CO		
System/LLN0ModCancel	Test	BOOLEAN	CO		
System/LLN0ModCancel$origin	orCat	orCategory	CO		
System/LLN0ModCancel$origin	orIdent	Octet64	CO		
System/LLN0$Mod	ctlModel	ctlModel	CF		
System/LLN0$Mod	sboTimeout	INT32U	CF		
System/LLN0$Mod	sboClass	sboClass	CF		

†Note: The attribute is defined in the IEC 61850 standard; "CO" stands for "Control" and "CF" stands for "Configuration" in the functional constraint (FC).

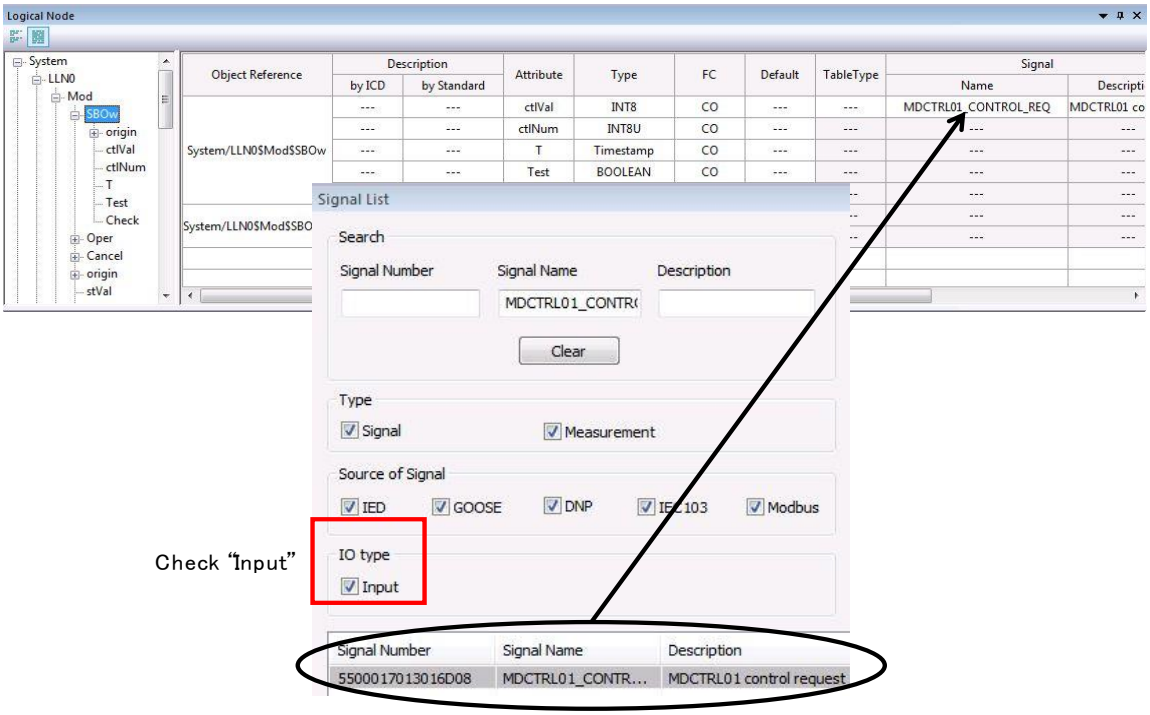


Figure 2.24-5 Input-point mapped for LLNO

2.24.3 Setting

Setting of MDCTRL (Function ID: 550001)

Setting item		Range	Unit s	Contents	Default setting value	Notes
	MDCTRL-EN	Off/On	–	Switch for operation	On	
	MDCTRL-SELRST	10-100	s	Selection cancel time-out timer	30	
	MDCTRL-EXERST	10-100	s	Waiting execute operation time-out timer	30	

2.24.4 Signal

◆ Signal monitoring point

MDCTRL(Function ID: 550001)

Element ID	Name	Description
8013011D51	MDCTRL01_SC_OWS	MDCTRL01 select command by OWS(HMI)
8013011D52	MDCTRL01_SC_RCC	MDCTRL01 select command by RCC
8013011D53	MDCTRL01_SC_RMT	MDCTRL01 select command by Remote
8013011D55	MDCTRL01_EC_OWS	MDCTRL01 execute command by OWS(HMI)
8013011D56	MDCTRL01_EC_RCC	MDCTRL01 execute command by RCC
8013011D57	MDCTRL01_EC_RMT	MDCTRL01 execute command by Remote
8713011E98	MODE01_SLF_FCT_EIS	MDCTRL01 select fail factor signal
8013011F56	MODE01_NSL_CS06	MDCTRL01 no direction select condition signal 06
8613011F5E	MODE01_NSL_CS07	MDCTRL01 no direction select condition signal 07
8B13011EA2	MODE01_CTR_SGU	MDCTRL01 control logic stage(under selection)
8213011F5F	MODE01_NSL_CS10	MDCTRL01 no direction select condition signal 10
8313011F41	MODE01_NSD_CSF	MDCTRL01 no direction selected condition signal
8513011F60	MODE01_FSL_CS19	MDCTRL01 On direction select condition signal 19
8A13011F61	MODE01_FSL_CS20	MDCTRL01 On direction select condition signal 20
8113011F64	MODE01_FSL_CS21	MDCTRL01 On direction select condition signal 21
8D13011F42	MODE01_FSD_CSF	MDCTRL01 On direction selected condition signal
8513011F65	MODE01_OSL_CS40	MDCTRL01 Test direction select condition signal 40
8813011F5D	MODE01_OSL_CS41	MDCTRL01 Test direction select condition signal 41
8513011F5B	MODE01_OSL_CS42	MDCTRL01 Test direction select condition signal 42
8F13011F43	MODE01_OSD_CSF	MDCTRL01 Test direction selected condition signal
8013011E76	MODE01_SLD_CS	MDCTRL01 selected condition signal
8113011E7B	MODE01_SLF_CS	MDCTRL01 select fail condition signal
8013011F54	MODE01_SC_ST_ERR	MDCTRL01 select command mode err
8813011F6B	MODE01_SLF_FCT_FLG07	MDCTRL01 select fail factor signal by fixed logic 07
8613011F62	MODE01_SLF_FCT_FLG03	MDCTRL01 select fail factor signal by fixed logic 03
8713011F63	MODE01_SLF_FCT_FLG04	MDCTRL01 select fail factor signal by fixed logic 04
8E13011F57	MODE01_SLD_TMO	MDCTRL01 time out after selected
8F13011F58	MODE01_EX_CMP_TMO	MDCTRL01 timeout after execute completion
8313011E9D	MODE01_CTR_SGN	MDCTRL01 control logic stage(unselected)
8013011F66	MODE01_SLD_CS04	MDCTRL01 selected condition signal 04
8013011E7D	MODE01_SLR_CS	MDCTRL01 select release condition signal
8113011E9A	MODE01_ECF_FCT_EIS	MDCTRL01 execute command fail factor signal check
8013011E81	MODE01_FEC_OK_CS	MDCTRL01 On direction execute command OK condition signal
8113011E82	MODE01_OEC_OK_CS	MDCTRL01 Test direction execute command OK condition signal
8213011E88	MODE01_FEC_F_CS	MDCTRL01 On direction execute command fail condition signal
8313011E89	MODE01_OEC_F_CS	MDCTRL01 Test direction execute command fail condition signal
8013011F55	MODE01_EC_ST_ERR	MDCTRL01 execute command mode err
8213011F44	MODE01_EX_OUT	MDCTRL01 execute output signal
8913011F6C	MODE01_EX_CS01	MDCTRL01 execute condition signal 01
8A13011F6D	MODE01_EX_CS02	MDCTRL01 execute condition signal 02
8513011E8F	MODE01_EX_SFL	MDCTRL01 execute success signal
8613011E91	MODE01_EX_FFL	MDCTRL01 execute fail signal
8013011E93	MODE01_EX_CMP	MDCTRL01 execute complete signal

◆ Signal monitoring point

MDCTRL(Function ID: 550001)

Element ID	Name	Description
8913011F72	MODE01_SLF_FCT_FLG08	MDCTRL01 select fail factor signal by fixed logic 08
8B13011F6E	MODE01_EX_CS03	MDCTRL01 execute condition signal 03
8813011E9B	MODE01_CC_ST_ERR	MDCTRL01 cancel command mode err
8313011E9C	MODE01_CCF_FCT_CS	MDCTRL01 cancel command fail factor condition signal
8613011E95	MODE01_CC_SS	MDCTRL01 cancel command success signal
8713011E96	MODE01_CC_FS	MDCTRL01 cancel command fail signal

◆ Connection point in PLC logic

MDCTRL(Function ID: 550001)

Element ID	Name	Description
8313002F52	MDCTRL00IN_TMP_16	MDCTRL00IN_TMP_16
821301ED50	MDCTRL01IN_TMP_28	MDCTRL01IN_TMP_28

2.25 Event detection function for general BIs (GENBI)

The general BI event detection (GENBI) function examines the signals generated on the binary input circuits (BIs); the GENBI function verifies the signals generated in terms of time, state, and quality. Accordingly, the GENBI function can elevate the value of the BI signals that are generated using external devices; the GENBI function can provide the IED functions with a variety of information. Figure 2.25-1 shows the block diagram of the GENBI function; it shows signals from external devices received at the BI circuits. The operation of the GENBI function is available for all BI circuits. For simplicity, hereafter, the setting and operation of the GENBI function is discussed for binary input circuit #1 (BI1) at IO#1 slot in the IED.

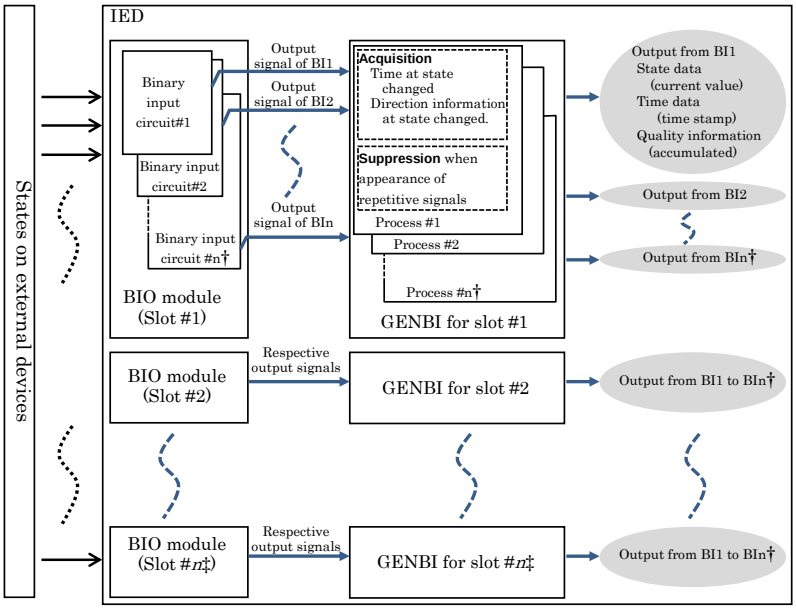


Figure 2.25-1 Block diagram of GENBI

Note: The implementation of such features is dependent upon the selection of hardware and the configuration of functions. Several IED models do not support certain features. To determine whether a particular feature has been implemented within an IED, identify the IED ordering number; and check the order number at the "G&T position" whilst referring to the comparison table below. For more information, see *Appendix: Ordering*.

Table 2.25-1 Comparative table in respective ordering numbers

Sec.	Feature	Ordering No. at "G&T"					
		BCU			BCPU		IFU
		11	13	1F	2N	2C	19
–	Main features	✓	✓	✓	✓	✓	✓

✓: Applicable NA: Not applicable

2.25.1 Operation features

The operation process of the GENBI function is divided into an acquisition part and a suppression part.

(i) Signal acquisition process

The acquisition process checks for the occurrence of state changes in each BI circuit. If a state change is detected, the acquisition process determines the direction of the state change and observes the time that the state change occurred.

The user needs to apply a signal as a setting so that signal acquisition will be carried out. Figure 2.25-1 outlines the settings when BI1 circuits at IO#1 are considered. For example, when a signal is received at BI1, the GENBI function can acquire the signal when the user has set **200B001 8001001110**† for the setting [**SLOT1 GB01-SG**]. After acquisition, the GENBI function generates "SLOT1 GBI01_STATE (580001 0010001001)" signal in Boolean form; it consists of "time stamp information" and "quality information".

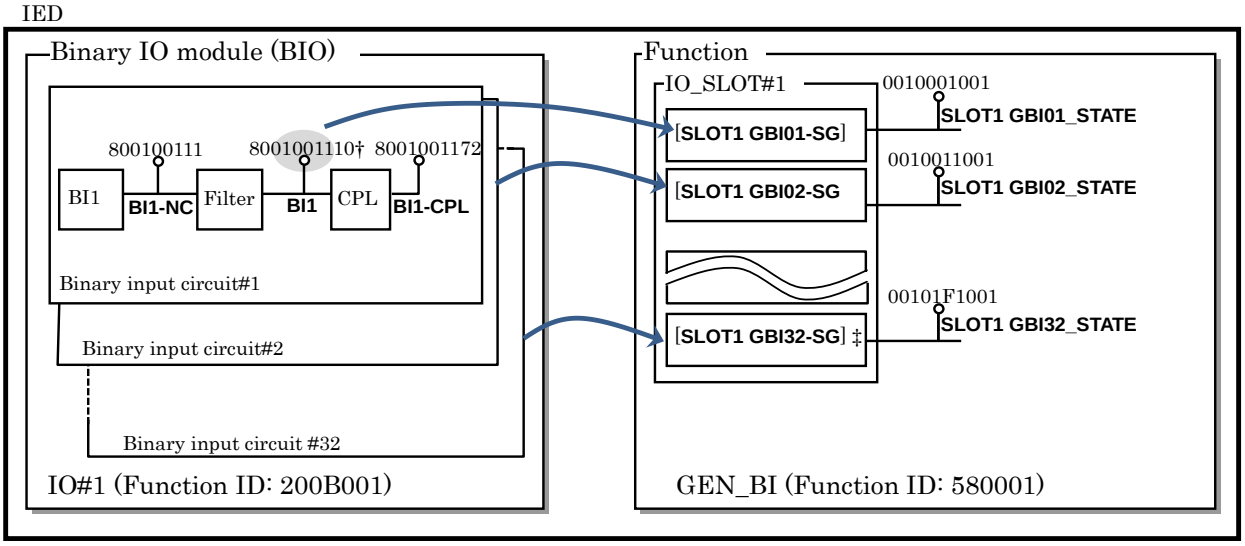


Figure 2.25-2 Setting method with Data ID at BI1 at IO#1

†Note:The BI1 (200B001 8001001110) is used purely by way of explanation; the user can select either BI1-NC, BI1, or BI1-CPL so that the GENBI function acquire the received signal. For more information of the signal acquisition points and the meaning of the BI logic, see chapter *Technical description: Binary IO module.*

(ii) Event suppression process

When the signal switches between the "On" and "Off" state frequently over a short period of time, the GENBI function will receive these repetitive signals. When these repetitive signals are converted into event information, repetitive events are issued on occurrence of the repetitive signals. The event suppression function is provided to suppress event appearance

when the GENBI function determines that the signal is being generated repetitively.

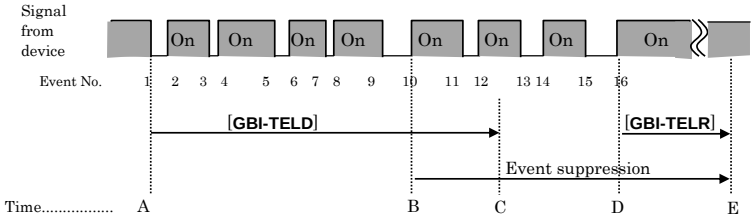


Figure 2.25-3 Example of signals and events suppressed by setting

Figure 2.25-3 illustrates the case where a device produces repetitive signals. From this figure, it can be seen that the start of event suppression occurs at the tenth state-change (point B) because the GENBI function counts the number of state-changes. The GENBI function detects the commencement of the signal repeated from the signal initiation point 'A'. Scheme switch [**GBI-NELD**] is provided to set the number of state-changes so that this function will start to suppress the signal from this point. The user can set [**GBI-TELD**] pertaining to the detection period of the repetitive signals (point A to point C). For example, the user can set the value "10" for the scheme switch [**GBI-NELD**]; period A–C is set for the setting [**GBI-TELD**].

The GENBI function should remove event suppressed operation when the repetitive signals disappear, (that is, the operation of the device is steady); event suppression operation is cleared when no repetitive signal is found for a set period. The user can set the period using scheme switch [**GBI-TELR**]; this reset operation clears the event suppression function at point E when the last state change is confirmed at point D. Here, the period D–E is set for the Scheme switch [**GBI-TELR**].

The event suppression function is provided for every device; the user should set **On** for the scheme switch [**SLOT1 GBI01-SPPEN**], for example.

Table 2.25-2 Example of event list screened

Event	Event contents screened
Off	No.1 event
On	No.2 event
Off	No.3 event
On	No.4 event
Off	No.5 event
On	No.6 event
Off	No.7 event
On	No.8 event
Off	No.9 event
On	No.10 event suppression SET
On	Event suppression RESET

Table 2.25-2 shows the event list screen. This event list is in response to the signals shown in Figure 2.25-3. Table 2.25-3 lists the common settings for event suppression. Table 2.25-4 shows the settings for a particular slot.

Table 2.25-3 Common settings for event suppression

Scheme switch	Set	Comment
GBI-NELD	0 – 99 sec	Number of Event lock detect time
GBI-TELD	1 – 99 sec	Timer of detect event lock
GBI-TELR	1 – 99 sec	Timer of recovery from event lock

Table 2.25-4 Sets for event suppression in each slot

Scheme switch	Set	Comment
SLOT1 GBI01-SPPEN	Off / On	SLOT#1 BI-1 Automatic event suppression function
SLOT1 GBI02-SPPEN	Off / On	SLOT#1 BI-2 Automatic event suppression function
. . .	. . .	. . .
SLOT1 GBI32-SPPEN	Off / On	SLOT#1 BI-32 Automatic event suppression function
SLOT2 GBI01-SPPEN	Off / On	SLOT#2 BI-1 Automatic event suppression function
SLOT2 GBI02-SPPEN	Off / On	SLOT#2 BI-2 Automatic event suppression function
. . .	. . .	. . .
SLOT2 GBI32-SPPEN	Off / On	SLOT#2 BI-32 Automatic event suppression function
. . .	. . .	. . .
SLOT*n*GBI01-SPPEN	Off / On	SLOT#*n* BI-1 Automatic event suppression function‡
SLOT*n*GBI02-SPPEN	Off / On	SLOT#*n* BI-2 Automatic event suppression function‡
. . .	. . .	. . .
SLOT*n*GBI32-SPPEN	Off / On	SLOT#*n* BI-32 Automatic event suppression function‡

†Note: The specification and the number of binary input circuits depend upon the model of BIO module. One of the BIO modules can provide 32 input circuits; thus, the total number (n) for the process and the circuit is represented up to 32.

‡Note: The number of slots and the structure of the binary input circuits is influenced by the IED model and the size of the case. For example, when a 1/1 case size is available, eight slots are furnished within the IED. When the 1/3 case size is used, two slots are provided in the IED. Hence, the user should distinguish these configurations in accordance with the number of slots and the type of BIO modules. (For further information, see Chapter *Technical description: Binary IO module*)

2.25.2 Mapping for IEC61850 communication

Sending a report to the client is possible after the mapping is performed for IEC 61850 communication using GR-TIEMS. The user should proceed as follows,

Step1: Editing Logical Node
Step2: Mapping output data

(i) Editing Logical Node

The user must make a logical node (LN) for the GENBI function. Figure 2.25-4 exemplifies LN making; LN "GGIO101" is selected for the GENBI function. After editing, the GENBI logical node can be saved with the name "GGIO101". Object "Ind1" is defined in the GENBI function.

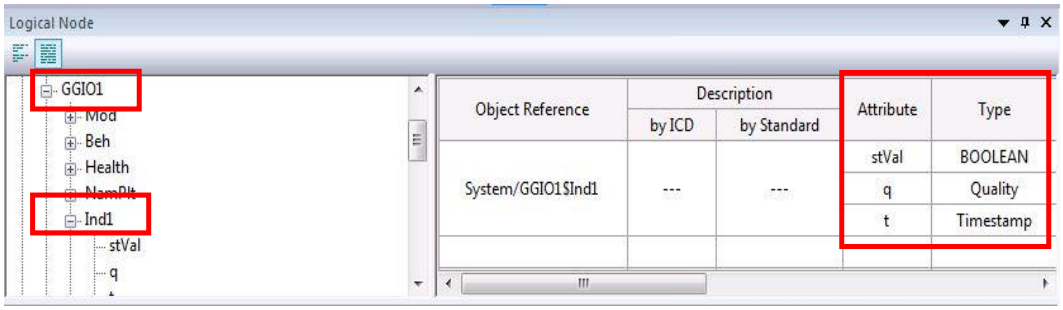


Figure 2.25-4 Defining "Ind1" object in GGIO101 logic node

(ii) Mapping output data

With the IEC 61850 communications standard a GOOSE message can be used to send a signal to a client. The user will need to collect the signals corresponding to the GENBI function and then map them for IEC 61850 communication using GR-TIEMS.

Table 2.25-5 shows the mapping signals that are required within the GENBI function for IEC 61850 communications. Figure 2.25-5 shows how to map a signal.

Table 2.25-5 Mapping signals for Ind1 object in GENBI function

Object_reference	Attribute	Type	FC	Signal Number	Signal Name
Ctrl/GGIO101$Ind1	stVal	BOOLEAN	ST	580001 0010001001	SLOT1 GBI01_STATE
Ctrl/GGIO101$Ind1	q	Quality	ST	580001 3110001005	SLOT1 GBI01_QUALITY
Ctrl/GGIO101$Ind1	t	Timestamp	ST	580001 9010001006	SLOT1 GBI01_TIMESTAM

Note: "Status (ST)" is defined in the function constraint (FC) of the IEC 61850 standard.

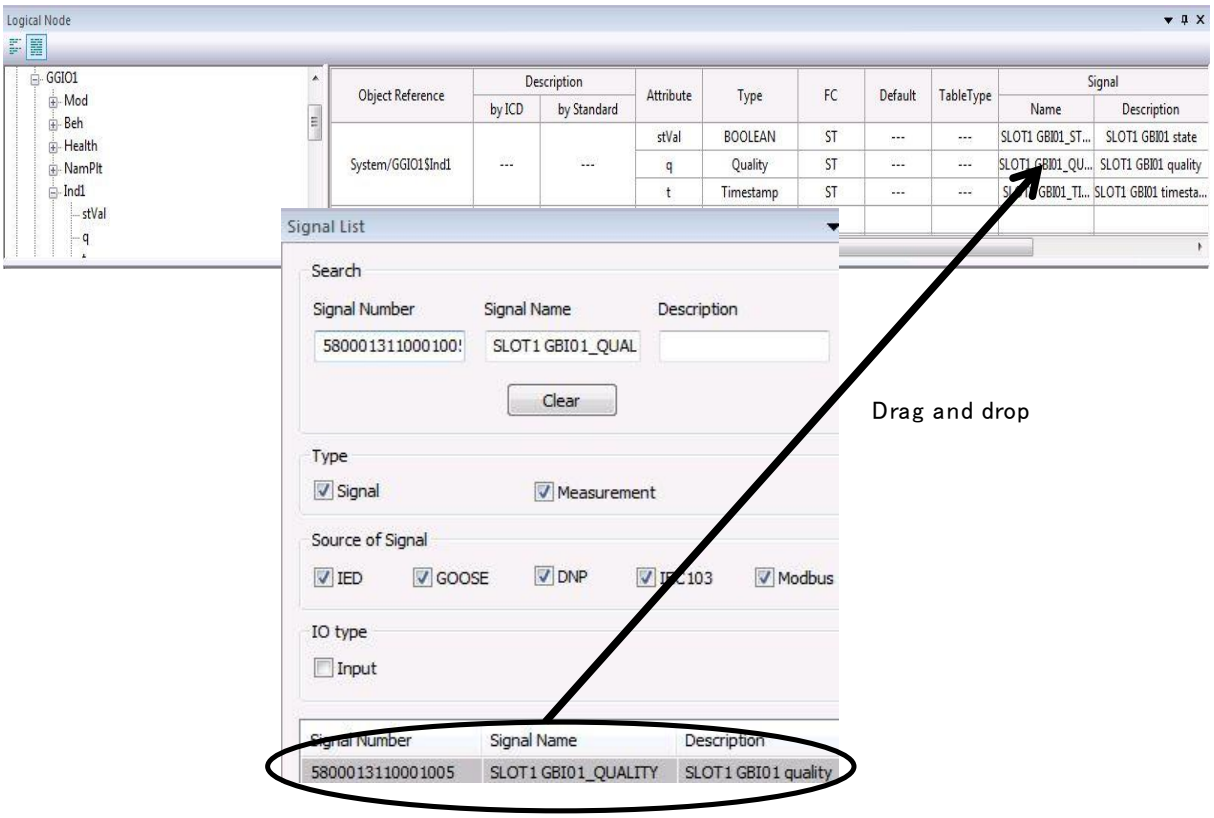


Figure 2.25-5 Quality signal being mapped into Ind1 object of GGIO101

2.25.3 Setting

Settings list for GENBI (Function ID: 580001)

Setting device			Range	Units	Contents	Default setting value	Notes
	common	GBI-NELD	0 - 99	-	Number of Event lock detect time	10	
		GBI-TELD	1 - 99	s	Timer of detect event lock	10	
		GBI-TELR	1 - 99	s	Timer recovery from event lock	10	
	Slot 1	SLOT1 GBI01-BIEVT	Off / On	-	SLOT1 BI-1 Event Enable	Off	
		SLOT1 GBI01-SPPEN	Off / On	-	SLOT1 BI-1 Automatic event suppression function	Off	
		SLOT1 GBI01-SG		-	SLOT1 BI-1 Signal Data ID		
		SLOT1 GBI02-BIEVT	Off / On	-	SLOT1 BI-2 Event Enable	Off	
		SLOT1 GBI02-SPPEN	Off / On	-	SLOT1 BI-2 Automatic event suppression function	Off	
		SLOT1 GBI02-SG		-	SLOT1 BI-2 Signal Data ID		
		SLOT1 GBI03-BIEVT	Off / On	-	SLOT1 BI-3 Event Enable	Off	
		SLOT1 GBI03-SPPEN	Off / On	-	SLOT1 BI-3 Automatic event suppression function	Off	
		SLOT1 GBI03-SG		-	SLOT1 BI-3 Signal Data ID		
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		.	.	.	.	.	
		SLOT1 GBI32-BIEVT	Off / On	-	SLOT1 BI-32 Event Enable	Off	
		SLOT1 GBI32-SPPEN	Off / On	-	SLOT1 BI-32 Automatic event suppression function	Off	
	Slot 2	SLOT2 GBI01-BIEVT	Off / On	-	SLOT2 BI-1 Event Enable	Off	
		SLOT2 GBI01-SPPEN	Off / On	-	SLOT2 BI-1 Automatic event suppression function	Off	
		SLOT2 GBI01-SG		-	SLOT2 BI-1 Signal Data ID		
		SLOT2 GBI02-BIEVT	Off / On	-	SLOT2 BI-2 Event Enable	Off	
		SLOT2 GBI02-SPPEN	Off / On	-	SLOT2 BI-2 Automatic event suppression function	Off	
		SLOT2 GBI02-SG		-	SLOT2 BI-2 Signal Data ID		
		SLOT2 GBI03-BIEVT	Off / On	-	SLOT2 BI-3 Event Enable	Off	
		SLOT2 GBI03-SPPEN	Off / On	-	SLOT2 BI-3 Automatic event suppression function	Off	
		SLOT2 GBI03-SG		-	SLOT2 BI-3 Signal Data ID		
		.	.	.	.	.	
		.	.	.	.	.	
		.	.	.	.	.	
		SLOT2 GBI32-BIEVT	Off / On	-	SLOT2 BI-32 Event Enable	Off	
		SLOT2 GBI32-SPPEN	Off / On	-	SLOT2 BI-32 Automatic event suppression function	Off	
	Slot 3	SLOT3 GBI01-BIEVT	Off / On	-	SLOT3 BI-1 Event Enable	Off	
		SLOT3 GBI01-SPPEN	Off / On	-	SLOT3 BI-1 Automatic event suppression function	Off	
		SLOT3 GBI01-SG		-	SLOT3 BI-1 Signal Data ID		
		SLOT3 GBI02-BIEVT	Off / On	-	SLOT3 BI-2 Event Enable	Off	
		SLOT3 GBI02-SPPEN	Off / On	-	SLOT3 BI-2 Automatic event suppression function	Off	
		SLOT3 GBI02-SG		-	SLOT3 BI-2 Signal Data ID		
		SLOT3 GBI03-BIEVT	Off / On	-	SLOT3 BI-3 Event Enable	Off	
		SLOT3 GBI03-SPPEN	Off / On	-	SLOT3 BI-3 Automatic event suppression function	Off	
		SLOT3 GBI03-SG		-	SLOT3 BI-3 Signal Data ID		
		.	.	.	.	.	
		.	.	.	.	.	
		.	.	.	.	.	
		SLOT3 GBI32-BIEVT	Off / On	-	SLOT3 BI-32 Event Enable	Off	
		SLOT3 GBI32-SPPEN	Off / On	-	SLOT3 BI-32 Automatic event suppression function	Off	
	Slot 4	SLOT4 GBI01-BIEVT	Off / On	-	SLOT4 BI-1 Event Enable	Off	
		SLOT4 GBI01-SPPEN	Off / On	-	SLOT4 BI-1 Automatic event suppression function	Off	
		SLOT4 GBI01-SG		-	SLOT4 BI-1 Signal Data ID		
		SLOT4 GBI02-BIEVT	Off / On	-	SLOT4 BI-2 Event Enable	Off	
		SLOT4 GBI02-SPPEN	Off / On	-	SLOT4 BI-2 Automatic event suppression function	Off	
		SLOT4 GBI02-SG		-	SLOT4 BI-2 Signal Data ID		

Settings list for GENBI (Function ID: 580001)

Setting device			Range	Units	Contents	Default setting value	Notes
		SLOT4 GBI03-BIEVT	Off / On	-	SLOT4 BI-3 Event Enable	Off	
		SLOT4 GBI03-SPPEN	Off / On	-	SLOT4 BI-3 Automatic event suppression function	Off	
		SLOT4 GBI03-SG		-	SLOT4 BI-3 Signal Data ID		
		・	・	・	・	・	
		・	・	・	・	・	
		・	・	・	・	・	
		SLOT4 GBI32-BIEVT	Off / On	-	SLOT4 BI-32 Event Enable	Off	
		SLOT4 GBI32-SPPEN	Off / On	-	SLOT4 BI-32 Automatic event suppression function	Off	
	Slot 5	SLOT5 GBI01-BIEVT	Off / On	-	SLOT5 BI-1 Event Enable	Off	
		SLOT5 GBI01-SPPEN	Off / On	-	SLOT5 BI-1 Automatic event suppression function	Off	
		SLOT5 GBI01-SG		-	SLOT5 BI-1 Signal Data ID		
		SLOT5 GBI02-BIEVT	Off / On	-	SLOT5 BI-2 Event Enable	Off	
		SLOT5 GBI02-SPPEN	Off / On	-	SLOT5 BI-2 Automatic event suppression function	Off	
		SLOT5 GBI02-SG		-	SLOT5 BI-2 Signal Data ID		
		SLOT5 GBI03-BIEVT	Off / On	-	SLOT5 BI-3 Event Enable	Off	
		SLOT5 GBI03-SPPEN	Off / On	-	SLOT5 BI-3 Automatic event suppression function	Off	
		SLOT5 GBI03-SG		-	SLOT5 BI-3 Signal Data ID		
		・	・	・	・	・	
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		・	・	・	・	・	
		SLOT5 GBI32-BIEVT	Off / On	-	SLOT5 BI-32 Event Enable	Off	
		SLOT5 GBI32-SPPEN	Off / On	-	SLOT5 BI-32 Automatic event suppression function	Off	
	Slot 6	SLOT6 GBI01-BIEVT	Off / On	-	SLOT6 BI-1 Event Enable	Off	
		SLOT6 GBI01-SPPEN	Off / On	-	SLOT6 BI-1 Automatic event suppression function	Off	
		SLOT6 GBI01-SG		-	SLOT6 BI-1 Signal Data ID		
		SLOT6 GBI02-BIEVT	Off / On	-	SLOT6 BI-2 Event Enable	Off	
		SLOT6 GBI02-SPPEN	Off / On	-	SLOT6 BI-2 Automatic event suppression function	Off	
		SLOT6 GBI02-SG		-	SLOT6 BI-2 Signal Data ID		
		SLOT6 GBI03-BIEVT	Off / On	-	SLOT6 BI-3 Event Enable	Off	
		SLOT6 GBI03-SPPEN	Off / On	-	SLOT6 BI-3 Automatic event suppression function	Off	
		SLOT6 GBI03-SG		-	SLOT6 BI-3 Signal Data ID		
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		SLOT6 GBI32-BIEVT	Off / On	-	SLOT6 BI-32 Event Enable	Off	
		SLOT6 GBI32-SPPEN	Off / On	-	SLOT6 BI-32 Automatic event suppression function	Off	
	Slot 7	SLOT7 GBI01-BIEVT	Off / On	-	SLOT7 BI-1 Event Enable	Off	
		SLOT7 GBI01-SPPEN	Off / On	-	SLOT7 BI-1 Automatic event suppression function	Off	
		SLOT7 GBI01-SG		-	SLOT7 BI-1 Signal Data ID		
		SLOT7 GBI02-BIEVT	Off / On	-	SLOT7 BI-2 Event Enable	Off	
		SLOT7 GBI02-SPPEN	Off / On	-	SLOT7 BI-2 Automatic event suppression function	Off	
		SLOT7 GBI02-SG		-	SLOT7 BI-2 Signal Data ID		
		SLOT7 GBI03-BIEVT	Off / On	-	SLOT7 BI-3 Event Enable	Off	
		SLOT7 GBI03-SPPEN	Off / On	-	SLOT7 BI-3 Automatic event suppression function	Off	
		SLOT7 GBI03-SG		-	SLOT7 BI-3 Signal Data ID		
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		・	・	・	・	・	
		SLOT7 GBI32-BIEVT	Off / On	-	SLOT7 BI-32 Event Enable	Off	
		SLOT7 GBI32-SPPEN	Off / On	-	SLOT7 BI-32 Automatic event suppression function	Off	
	Slot 8	SLOT8 GBI01-BIEVT	Off / On	-	SLOT8 BI-1 Event Enable	Off	
		SLOT8 GBI01-SPPEN	Off / On	-	SLOT8 BI-1 Automatic event suppression function	Off	

Settings list for GENBI (Function ID: 580001)

Setting device			Range	Units	Contents	Default setting value	Notes
		SLOT8 GBI01-SG		-	SLOT8 BI-1 Signal Data ID		
		SLOT8 GBI02-BIEVT	Off / On	-	SLOT8 BI-2 Event Enable	Off	
		SLOT8 GBI02-SPPEN	Off / On	-	SLOT8 BI-2 Automatic event suppression function	Off	
		SLOT8 GBI02-SG		-	SLOT8 BI-2 Signal Data ID		
		SLOT8 GBI03-BIEVT	Off / On	-	SLOT8 BI-3 Event Enable	Off	
		SLOT8 GBI03-SPPEN	Off / On	-	SLOT8 BI-3 Automatic event suppression function	Off	
		SLOT8 GBI03-SG		-	SLOT8 BI-3 Signal Data ID		
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		.	.	.	.	.	
		SLOT8 GBI32-BIEVT	Off / On	-	SLOT8 BI-32 Event Enable	Off	
		SLOT8 GBI32-SPPEN	Off / On	-	SLOT8 BI-32 Automatic event suppression function	Off	

2.26 Change of Measurements (TMCHG)

Note: The implementation of such features depends on the selection of hardware and the configuration of functions. Several IED models do not have the features. To determine whether the features are implemented in the IED, locate the IED ordering number; and check the order number at the "G&T position" referring to the comparison table below. For more information, see *Appendix: Ordering*.

Table 2.26-1 Comparative table in respective ordering numbers

Sec.	Feature	Ordering No. at "G&T"					
		BCU			BCPU		IFU
		11	13	1F	2N	2C	19
–	Main features	✓	✓	✓	✓	✓	NA

✓: Applicable NA: Not applicable

The function of change of measurements (TMCHG) receives correction information from a device at upper stream and sends this information to measurement functions. These are consisted of respective measurement items, which are listed in Table 2.26-2.

Table 2.26-2 measurement items and correction information

Measurement item	Correction
Power quantity (for analogue computation)	The correction information is sent from a device at upper stream. The correction information will be sent to a measurement function. The correction information are subject to the following items: ➢ Measured value (+Wh1, −Wh1) ➢ Measured value (+varh1, −varh1) ➢ Measured value (+Wh2, −Wh2) ➢ Measured value (+varh2, −varh2)
Total breaking current	The correction information is sent from a device at upper stream. The correction information will be sent to a measurement function. The correction information are subject to the following items: ➢ Total breaking current in phase-A ➢ Total breaking current in phase-B ➢ Total breaking current in phase-C
Demand value	A Reset command, which is sent from a device at upper stream, will be set to a measurement function. The reset command will remove all demanded measurement values, which consists of minimum values minimum values, average values.
Peak-demand value	A Reset command, which is sent from a device at upper stream, will be set to a measurement function. The reset command will remove all peak-demand measurement values, which consists of minimum values minimum values, average values.

2.26.1 Setting

Setting of TMCHG(Function ID: 52C001)

Setting item			Range	Units	Contents	Default setting value	Notes
		WHAI01-EN	Off / On	–	TMCHG_DEV1 Enable	Off	
		WHAI02-EN	Off / On	–	TMCHG_DEV2 Enable	Off	
		WHAI03-EN	Off / On	–	TMCHG_DEV3 Enable	Off	
		WHAI04-EN	Off / On	–	TMCHG_DEV4 Enable	Off	
		WHAI05-EN	Off / On	–	TMCHG_DEV5 Enable	Off	
		WHAI06-EN	Off / On	–	TMCHG_DEV6 Enable	Off	
		WHAI07-EN	Off / On	–	TMCHG_DEV7 Enable	Off	
		WHAI08-EN	Off / On	–	TMCHG_DEV8 Enable	Off	
		TRIPCURRENTA-EN	Off / On	–	Trip current in phase-A	Off	
		TRIPCURRENTB-EN	Off / On	–	Trip current in phase-B	Off	
		TRIPCURRENTC-EN	Off / On	–	Trip current in phase-C	Off	
		DEMANDRST-EN	Off / On	–	Demand reset	Off	
		PKDEMANDRST-EN	Off / On	–	Peak demand reset	Off	

2.26.2 Signal

◆ Signal monitoring point

TMCHG(Function ID: 52C001)

Element ID	Name	Description
820F01ED50	DEV01_CTRL_RIGHT	DEV01 control right from PLC
820F02ED50	DEV02_CTRL_RIGHT	DEV02 control right from PLC
820F03ED50	DEV03_CTRL_RIGHT	DEV03 control right from PLC
820F04ED50	DEV04_CTRL_RIGHT	DEV04 control right from PLC
820F05ED50	DEV05_CTRL_RIGHT	DEV05 control right from PLC
820F06ED50	DEV06_CTRL_RIGHT	DEV06 control right from PLC
820F07ED50	DEV07_CTRL_RIGHT	DEV07 control right from PLC
820F08ED50	DEV08_CTRL_RIGHT	DEV08 control right from PLC
820F09ED50	DEV09_CTRL_RIGHT	DEV09 control right from PLC
820F0AED50	DEV10_CTRL_RIGHT	DEV10 control right from PLC
820F0BED50	DEV11_CTRL_RIGHT	DEV11 control right from PLC
820F0CED50	DEV12_CTRL_RIGHT	DEV12 control right from PLC
820F0DED50	DEV13_CTRL_RIGHT	DEV13 control right from PLC

◆ Connection point in PLC logic

TMCHG(Function ID: 52C001)

Element ID	Name	Description
800F011D53	TCHG01_SC	TCHG01 select command
800F011D57	TCHG01_EC	TCHG01 execute command
800F011D51	TCHG01_SC_OWS	TCHG01 select command by OWS(HMI)
800F011D52	TCHG01_SC_RCC	TCHG01 select command by RCC
800F011D55	TCHG01_EC_OWS	TCHG01 execute command by OWS(HMI)
800F011D56	TCHG01_EC_RCC	TCHG01 execute command by RCC
820F011F40	TCHG01_TMP1	TCHG01 signal before KC_TCHG_SA001
830F011F41	TCHG01_NSD_CSF	TCHG01 signal after KC_TCHG_SA001
800F011F42	TCHG01_FSE_RCV	TCHG01 signal before LC_TCHG_SA002
860F011F43	TCHG01_TMP2	TCHG01 signal after KC_TCHG_SA002
8B0F011F44	TCHG01_CTR_SGU	TCHG01 signal before KC_TCHG_SC001
860F011F45	TCHG01_TMP3	TCHG01 signal after KC_TCHG_SC001
860F011F46	TCHG01_SLF_FCT_FLG1	TCHG01 signal before MCTTCHG_SC001
8E0F011F47	TCHG01_SLD_TM0	TCHG01 signal after MCTTCHG_SC001
870F011F48	TCHG01_SLF_FCT_FLG2	TCHG01 signal before MCTTCHG_SC002
8F0F011F49	TCHG01_EX_CMP_TM0	TCHG01 signal after MCTTCHG_SC002
800F021D53	TCHG02_SC	TCHG02 select command
800F021D57	TCHG02_EC	TCHG02 execute command
800F021D51	TCHG02_SC_OWS	TCHG02 select command by OWS(HMI)
800F021D52	TCHG02_SC_RCC	TCHG02 select command by RCC
800F021D55	TCHG02_EC_OWS	TCHG02 execute command by OWS(HMI)
800F021D56	TCHG02_EC_RCC	TCHG02 execute command by RCC
820F021F40	TCHG02_TMP1	TCHG02 signal before KC_TCHG_SA001
830F021F41	TCHG02_NSD_CSF	TCHG02 signal after KC_TCHG_SA001
800F021F42	TCHG02_FSE_RCV	TCHG02 signal before LC_TCHG_SA002
860F021F43	TCHG02_TMP2	TCHG02 signal after KC_TCHG_SA002

◆ Connection point in PLC logic

TMCHG(Function ID: 52C001)

Element ID	Name	Description
8B0F021F44	TCHG02_CTR_SGU	TCHG02 signal before KC_TCHG_SC001
860F021F45	TCHG02_TMP3	TCHG02 signal after KC_TCHG_SC001
860F021F46	TCHG02_SLF_FCT_FLG1	TCHG02 signal before MCTTCHG_SC001
8E0F021F47	TCHG02_SLD_TM0	TCHG02 signal after MCTTCHG_SC001
870F021F48	TCHG02_SLF_FCT_FLG2	TCHG02 signal before MCTTCHG_SC002
8F0F021F49	TCHG02_EX_CMP_TM0	TCHG02 signal after MCTTCHG_SC002
800F031D53	TCHG03_SC	TCHG03 select command
800F031D57	TCHG03_EC	TCHG03 execute command
800F031D51	TCHG03_SC_OWS	TCHG03 select command by OWS(HMI)
800F031D52	TCHG03_SC_RCC	TCHG03 select command by RCC
800F031D55	TCHG03_EC_OWS	TCHG03 execute command by OWS(HMI)
800F031D56	TCHG03_EC_RCC	TCHG03 execute command by RCC
820F031F40	TCHG03_TMP1	TCHG03 signal before KC_TCHG_SA001
830F031F41	TCHG03_NSD_CSF	TCHG03 signal after KC_TCHG_SA001
800F031F42	TCHG03_FSE_RCV	TCHG03 signal before LC_TCHG_SA002
860F031F43	TCHG03_TMP2	TCHG03 signal after KC_TCHG_SA002
8B0F031F44	TCHG03_CTR_SGU	TCHG03 signal before KC_TCHG_SC001
860F031F45	TCHG03_TMP3	TCHG03 signal after KC_TCHG_SC001
860F031F46	TCHG03_SLF_FCT_FLG1	TCHG03 signal before MCTTCHG_SC001
8E0F031F47	TCHG03_SLD_TM0	TCHG03 signal after MCTTCHG_SC001
870F031F48	TCHG03_SLF_FCT_FLG2	TCHG03 signal before MCTTCHG_SC002
8F0F031F49	TCHG03_EX_CMP_TM0	TCHG03 signal after MCTTCHG_SC002
800F041D53	TCHG04_SC	TCHG04 select command
800F041D57	TCHG04_EC	TCHG04 execute command
800F041D51	TCHG04_SC_OWS	TCHG04 select command by OWS(HMI)
800F041D52	TCHG04_SC_RCC	TCHG04 select command by RCC
800F041D55	TCHG04_EC_OWS	TCHG04 execute command by OWS(HMI)
800F041D56	TCHG04_EC_RCC	TCHG04 execute command by RCC
820F041F40	TCHG04_TMP1	TCHG04 signal before KC_TCHG_SA001
830F041F41	TCHG04_NSD_CSF	TCHG04 signal after KC_TCHG_SA001
800F041F42	TCHG04_FSE_RCV	TCHG04 signal before LC_TCHG_SA002
860F041F43	TCHG04_TMP2	TCHG04 signal after KC_TCHG_SA002
8B0F041F44	TCHG04_CTR_SGU	TCHG04 signal before KC_TCHG_SC001
860F041F45	TCHG04_TMP3	TCHG04 signal after KC_TCHG_SC001
860F041F46	TCHG04_SLF_FCT_FLG1	TCHG04 signal before MCTTCHG_SC001
8E0F041F47	TCHG04_SLD_TM0	TCHG04 signal after MCTTCHG_SC001
870F041F48	TCHG04_SLF_FCT_FLG2	TCHG04 signal before MCTTCHG_SC002
8F0F041F49	TCHG04_EX_CMP_TM0	TCHG04 signal after MCTTCHG_SC002
800F051D53	TCHG05_SC	TCHG05 select command
800F051D57	TCHG05_EC	TCHG05 execute command
800F051D51	TCHG05_SC_OWS	TCHG05 select command by OWS(HMI)
800F051D52	TCHG05_SC_RCC	TCHG05 select command by RCC
800F051D55	TCHG05_EC_OWS	TCHG05 execute command by OWS(HMI)
800F051D56	TCHG05_EC_RCC	TCHG05 execute command by RCC

◆ Connection point in PLC logic

TMCHG(Function ID: 52C001)

Element ID	Name	Description
820F051F40	TCHG05_TMP1	TCHG05 signal before KC_TCHG_SA001
830F051F41	TCHG05_NSD_CSF	TCHG05 signal after KC_TCHG_SA001
800F051F42	TCHG05_FSE_RCV	TCHG05 signal before LC_TCHG_SA002
860F051F43	TCHG05_TMP2	TCHG05 signal after KC_TCHG_SA002
8B0F051F44	TCHG05_CTR_SGU	TCHG05 signal before KC_TCHG_SC001
860F051F45	TCHG05_TMP3	TCHG05 signal after KC_TCHG_SC001
860F051F46	TCHG05_SLF_FCT_FLG1	TCHG05 signal before MCTTCHG_SC001
8E0F051F47	TCHG05_SLD_TM0	TCHG05 signal after MCTTCHG_SC001
870F051F48	TCHG05_SLF_FCT_FLG2	TCHG05 signal before MCTTCHG_SC002
8F0F051F49	TCHG05_EX_CMP_TM0	TCHG05 signal after MCTTCHG_SC002
800F061D53	TCHG06_SC	TCHG06 select command
800F061D57	TCHG06_EC	TCHG06 execute command
800F061D51	TCHG06_SC_OWS	TCHG06 select command by OWS(HMI)
800F061D52	TCHG06_SC_RCC	TCHG06 select command by RCC
800F061D55	TCHG06_EC_OWS	TCHG06 execute command by OWS(HMI)
800F061D56	TCHG06_EC_RCC	TCHG06 execute command by RCC
820F061F40	TCHG06_TMP1	TCHG06 signal before KC_TCHG_SA001
830F061F41	TCHG06_NSD_CSF	TCHG06 signal after KC_TCHG_SA001
800F061F42	TCHG06_FSE_RCV	TCHG06 signal before LC_TCHG_SA002
860F061F43	TCHG06_TMP2	TCHG06 signal after KC_TCHG_SA002
8B0F061F44	TCHG06_CTR_SGU	TCHG06 signal before KC_TCHG_SC001
860F061F45	TCHG06_TMP3	TCHG06 signal after KC_TCHG_SC001
860F061F46	TCHG06_SLF_FCT_FLG1	TCHG06 signal before MCTTCHG_SC001
8E0F061F47	TCHG06_SLD_TM0	TCHG06 signal after MCTTCHG_SC001
870F061F48	TCHG06_SLF_FCT_FLG2	TCHG06 signal before MCTTCHG_SC002
8F0F061F49	TCHG06_EX_CMP_TM0	TCHG06 signal after MCTTCHG_SC002
800F071D53	TCHG07_SC	TCHG07 select command
800F071D57	TCHG07_EC	TCHG07 execute command
800F071D51	TCHG07_SC_OWS	TCHG07 select command by OWS(HMI)
800F071D52	TCHG07_SC_RCC	TCHG07 select command by RCC
800F071D55	TCHG07_EC_OWS	TCHG07 execute command by OWS(HMI)
800F071D56	TCHG07_EC_RCC	TCHG07 execute command by RCC
820F071F40	TCHG07_TMP1	TCHG07 signal before KC_TCHG_SA001
830F071F41	TCHG07_NSD_CSF	TCHG07 signal after KC_TCHG_SA001
800F071F42	TCHG07_FSE_RCV	TCHG07 signal before LC_TCHG_SA002
860F071F43	TCHG07_TMP2	TCHG07 signal after KC_TCHG_SA002
8B0F071F44	TCHG07_CTR_SGU	TCHG07 signal before KC_TCHG_SC001
860F071F45	TCHG07_TMP3	TCHG07 signal after KC_TCHG_SC001
860F071F46	TCHG07_SLF_FCT_FLG1	TCHG07 signal before MCTTCHG_SC001
8E0F071F47	TCHG07_SLD_TM0	TCHG07 signal after MCTTCHG_SC001
870F071F48	TCHG07_SLF_FCT_FLG2	TCHG07 signal before MCTTCHG_SC002
8F0F071F49	TCHG07_EX_CMP_TM0	TCHG07 signal after MCTTCHG_SC002
800F081D53	TCHG08_SC	TCHG08 select command
800F081D57	TCHG08_EC	TCHG08 execute command

◆ Connection point in PLC logic

TMCHG(Function ID: 52C001)

Element ID	Name	Description
800F081D51	TCHG08_SC_OWS	TCHG08 select command by OWS(HMI)
800F081D52	TCHG08_SC_RCC	TCHG08 select command by RCC
800F081D55	TCHG08_EC_OWS	TCHG08 execute command by OWS(HMI)
800F081D56	TCHG08_EC_RCC	TCHG08 execute command by RCC
820F081F40	TCHG08_TMP1	TCHG08 signal before KC_TCHG_SA001
830F081F41	TCHG08_NSD_CSF	TCHG08 signal after KC_TCHG_SA001
800F081F42	TCHG08_FSE_RCV	TCHG08 signal before LC_TCHG_SA002
860F081F43	TCHG08_TMP2	TCHG08 signal after KC_TCHG_SA002
8B0F081F44	TCHG08_CTR_SGU	TCHG08 signal before KC_TCHG_SC001
860F081F45	TCHG08_TMP3	TCHG08 signal after KC_TCHG_SC001
860F081F46	TCHG08_SLF_FCT_FLG1	TCHG08 signal before MCTTCHG_SC001
8E0F081F47	TCHG08_SLD_TM0	TCHG08 signal after MCTTCHG_SC001
870F081F48	TCHG08_SLF_FCT_FLG2	TCHG08 signal before MCTTCHG_SC002
8F0F081F49	TCHG08_EX_CMP_TM0	TCHG08 signal after MCTTCHG_SC002
800F091D53	TCHG09_SC	TCHG09 select command
800F091D57	TCHG09_EC	TCHG09 execute command
800F091D51	TCHG09_SC_OWS	TCHG09 select command by OWS(HMI)
800F091D52	TCHG09_SC_RCC	TCHG09 select command by RCC
800F091D55	TCHG09_EC_OWS	TCHG09 execute command by OWS(HMI)
800F091D56	TCHG09_EC_RCC	TCHG09 execute command by RCC
820F091F40	TCHG09_TMP1	TCHG09 signal before KC_TCHG_SA001
830F091F41	TCHG09_NSD_CSF	TCHG09 signal after KC_TCHG_SA001
800F091F42	TCHG09_FSE_RCV	TCHG09 signal before LC_TCHG_SA002
860F091F43	TCHG09_TMP2	TCHG09 signal after KC_TCHG_SA002
8B0F091F44	TCHG09_CTR_SGU	TCHG09 signal before KC_TCHG_SC001
860F091F45	TCHG09_TMP3	TCHG09 signal after KC_TCHG_SC001
860F091F46	TCHG09_SLF_FCT_FLG1	TCHG09 signal before MCTTCHG_SC001
8E0F091F47	TCHG09_SLD_TM0	TCHG09 signal after MCTTCHG_SC001
870F091F48	TCHG09_SLF_FCT_FLG2	TCHG09 signal before MCTTCHG_SC002
8F0F091F49	TCHG09_EX_CMP_TM0	TCHG09 signal after MCTTCHG_SC002
800F0A1D53	TCHG10_SC	TCHG10 select command
800F0A1D57	TCHG10_EC	TCHG10 execute command
800F0A1D51	TCHG10_SC_OWS	TCHG10 select command by OWS(HMI)
800F0A1D52	TCHG10_SC_RCC	TCHG10 select command by RCC
800F0A1D55	TCHG10_EC_OWS	TCHG10 execute command by OWS(HMI)
800F0A1D56	TCHG10_EC_RCC	TCHG10 execute command by RCC
820F0A1F40	TCHG10_TMP1	TCHG10 signal before KC_TCHG_SA001
830F0A1F41	TCHG10_NSD_CSF	TCHG10 signal after KC_TCHG_SA001
800F0A1F42	TCHG10_FSE_RCV	TCHG10 signal before LC_TCHG_SA002
860F0A1F43	TCHG10_TMP2	TCHG10 signal after KC_TCHG_SA002
8B0F0A1F44	TCHG10_CTR_SGU	TCHG10 signal before KC_TCHG_SC001
860F0A1F45	TCHG10_TMP3	TCHG10 signal after KC_TCHG_SC001
860F0A1F46	TCHG10_SLF_FCT_FLG1	TCHG10 signal before MCTTCHG_SC001
8E0F0A1F47	TCHG10_SLD_TM0	TCHG10 signal after MCTTCHG_SC001

◆ Connection point in PLC logic

TMCHG(Function ID: 52C001)

Element ID	Name	Description
870F0A1F48	TCHG10_SLF_FCT_FLG2	TCHG10 signal before MCTTCHG_SC002
8F0F0A1F49	TCHG10_EX_CMP_TM0	TCHG10 signal after MCTTCHG_SC002
800F0B1D53	TCHG11_SC	TCHG11 select command
800F0B1D57	TCHG11_EC	TCHG11 execute command
800F0B1D51	TCHG11_SC_OWS	TCHG11 select command by OWS(HMI)
800F0B1D52	TCHG11_SC_RCC	TCHG11 select command by RCC
800F0B1D55	TCHG11_EC_OWS	TCHG11 execute command by OWS(HMI)
800F0B1D56	TCHG11_EC_RCC	TCHG11 execute command by RCC
820F0B1F40	TCHG11_TMP1	TCHG11 signal before KC_TCHG_SA001
830F0B1F41	TCHG11_NSD_CSF	TCHG11 signal after KC_TCHG_SA001
800F0B1F42	TCHG11_FSE_RCV	TCHG11 signal before LC_TCHG_SA002
860F0B1F43	TCHG11_TMP2	TCHG11 signal after KC_TCHG_SA002
8B0F0B1F44	TCHG11_CTR_SGU	TCHG11 signal before KC_TCHG_SC001
860F0B1F45	TCHG11_TMP3	TCHG11 signal after KC_TCHG_SC001
860F0B1F46	TCHG11_SLF_FCT_FLG1	TCHG11 signal before MCTTCHG_SC001
8E0F0B1F47	TCHG11_SLD_TM0	TCHG11 signal after MCTTCHG_SC001
870F0B1F48	TCHG11_SLF_FCT_FLG2	TCHG11 signal before MCTTCHG_SC002
8F0F0B1F49	TCHG11_EX_CMP_TM0	TCHG11 signal after MCTTCHG_SC002
800F0C1D53	TCHG12_SC	TCHG12 select command
800F0C1D57	TCHG12_EC	TCHG12 execute command
800F0C1D51	TCHG12_SC_OWS	TCHG12 select command by OWS(HMI)
800F0C1D52	TCHG12_SC_RCC	TCHG12 select command by RCC
800F0C1D55	TCHG12_EC_OWS	TCHG12 execute command by OWS(HMI)
800F0C1D56	TCHG12_EC_RCC	TCHG12 execute command by RCC
820F0C1F40	TCHG12_TMP1	TCHG12 signal before KC_TCHG_SA001
830F0C1F41	TCHG12_NSD_CSF	TCHG12 signal after KC_TCHG_SA001
800F0C1F42	TCHG12_FSE_RCV	TCHG12 signal before LC_TCHG_SA002
860F0C1F43	TCHG12_TMP2	TCHG12 signal after KC_TCHG_SA002
8B0F0C1F44	TCHG12_CTR_SGU	TCHG12 signal before KC_TCHG_SC001
860F0C1F45	TCHG12_TMP3	TCHG12 signal after KC_TCHG_SC001
860F0C1F46	TCHG12_SLF_FCT_FLG1	TCHG12 signal before MCTTCHG_SC001
8E0F0C1F47	TCHG12_SLD_TM0	TCHG12 signal after MCTTCHG_SC001
870F0C1F48	TCHG12_SLF_FCT_FLG2	TCHG12 signal before MCTTCHG_SC002
8F0F0C1F49	TCHG12_EX_CMP_TM0	TCHG12 signal after MCTTCHG_SC002
800F0D1D53	TCHG13_SC	TCHG13 select command
800F0D1D57	TCHG13_EC	TCHG13 execute command
800F0D1D51	TCHG13_SC_OWS	TCHG13 select command by OWS(HMI)
800F0D1D52	TCHG13_SC_RCC	TCHG13 select command by RCC
800F0D1D55	TCHG13_EC_OWS	TCHG13 execute command by OWS(HMI)
800F0D1D56	TCHG13_EC_RCC	TCHG13 execute command by RCC
820F0D1F40	TCHG13_TMP1	TCHG13 signal before KC_TCHG_SA001
830F0D1F41	TCHG13_NSD_CSF	TCHG13 signal after KC_TCHG_SA001
800F0D1F42	TCHG13_FSE_RCV	TCHG13 signal before LC_TCHG_SA002
860F0D1F43	TCHG13_TMP2	TCHG13 signal after KC_TCHG_SA002

◆ Connection point in PLC logic

TMCHG(Function ID: 52C001)

Element ID	Name	Description
8B0F0D1F44	TCHG13_CTR_SGU	TCHG13 signal before KC_TCHG_SC001
860F0D1F45	TCHG13_TMP3	TCHG13 signal after KC_TCHG_SC001
860F0D1F46	TCHG13_SLF_FCT_FLG1	TCHG13 signal before MCTTCHG_SC001
8E0F0D1F47	TCHG13_SLD_TM0	TCHG13 signal after MCTTCHG_SC001
870F0D1F48	TCHG13_SLF_FCT_FLG2	TCHG13 signal before MCTTCHG_SC002
8F0F0D1F49	TCHG13_EX_CMP_TM0	TCHG13 signal after MCTTCHG_SC002

2.27 Synchronizing check for different network (SYNDIF)

The Synchronizing check function (SYNCHK) is provided for checking for the presence of voltage or the voltage/frequency-variance when connection between two parts of a network is required. The SYNCHK function is of benefit where the "Double position controller with synchronizing-check (DPSY†)" function is used for connection between two parts of a network. This is because operation of the DPSY function to close the circuit breaker is inhibited until the SYNCHK function gives permission. The SYNCHK function is made up of two group functions (SYNCHK01 and SYNCHK02‡). The group function consists of two logic elements: the former part is to check for the voltage-presence (or absence) on an incoming line and a running line; the latter part is to check the synchronizing condition between two energized lines.

Note: The implementation of particular features is dependent upon the selection of hardware and the configuration of functions. Several IED models do not support certain features. To determine whether a particular feature has been implemented within an IED, identify the IED ordering number; and check the order number for the "G&T position" referring to the comparison table below. For more information, see *Appendix: Ordering*.

Table 2.27-1 Comparative table with respect to ordering numbers

Sec.	Feature	Ordering No. at "G&T"					
		BCU			BCPU		IFU
		11	13	1F	2N	2C	19
–	Main features	✓	✓	✓	✓	✓	NA

✓: Applicable NA: Not applicable

The SYNCHK_RY function consists of several over-voltage and under-voltage and synchronizing relays (OV, UV, and SyncRys) integrated within the synchronization check feature (SYNCHK). The SYNCHK function issues permissive signals to the DPSY functions; hence, ensuring that the DPSY functions are only able to close the CB when the required conditions for closure have been satisfied.

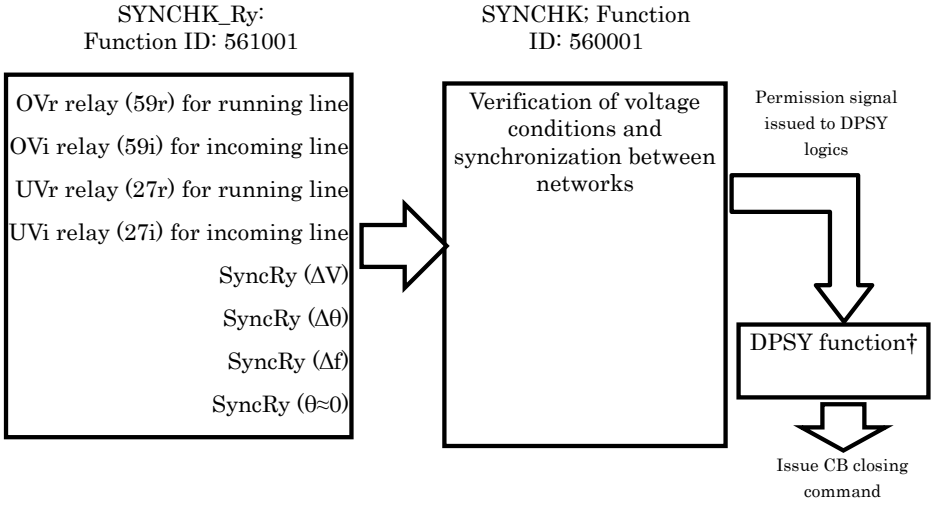


Figure Outline of SYNCHK function

†Note:The DPSY function is discussed separately. See Chapter *Control and monitoring application: Double position controller with synchronizing-check*.

‡Note:To simplify the description, only the SYNCHK1 (SYNCHK_Ry1) function is discussed; however, the same description is applicable to the SYNCHK2 (SYNCHK_Ry2) function. The user should read the expression for SYNCHK1 as SYNCHK2 unless a special explanation or instruction has been provided (e.g., the user can reason by analogy that the feature in the OVr2 relay is identical to the OVr1 relay).

2.27.1 Relays to check line-outage

The voltage condition for either line being out of service or being in service is verified using OV and UV relays in the SYNCHK_Ry1 function.

Table 2.27-2 Settings in SYNCHK_Ry1

Setting Name	Description	Default	Range
OVR1	Checking Live-Running Voltage	51V	10 to 150 V
UVR1	Checking Dead-Running Voltage	13V	10 to 150 V
OVI1	Checking Live-Incoming Voltage	51V	10 to 150 V
UVI1	Checking Dead-Incoming Voltage	13V	10 to 150 V

(i) Overvoltage-relay elements (OVr1, OVi1)

Two overvoltage-relay elements (OVr1 and OVi1) are provided to determine the voltage presence between running and incoming lines. In Figure 2.27-1 the hatched area depicts the

operating area of OV characteristic. The OVr1 element is used to check for the presence of voltage on the running-line; similarly, the OVi1 element is used to check for the presence of voltage on the incoming-line. The user can set pick-up thresholds using the settings [**OVR1**] and [**OVI1**].

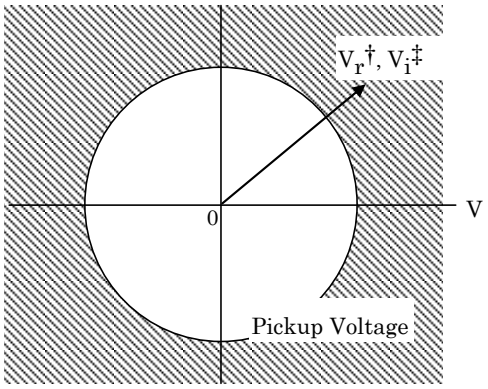


Figure 2.27-1 Characteristics of OVr1 and OVi1

(ii) Undervoltage-relay elements (UVr1, UVi1)

Two undervoltage-relay elements (UVr1 and UVi1) are provided to determine the absence of voltage on the running and incoming lines. In Figure 2.27-2 the hatched area depicts the operating area of the UV characteristic. The UVr1 element is used to check for the absence of voltage on the running-line; similarly, the UVi1 element is used to check for the absence of voltage on the incoming-line. The user can set drop-off thresholds using the settings [**UVR1**] and [**UVI1**].

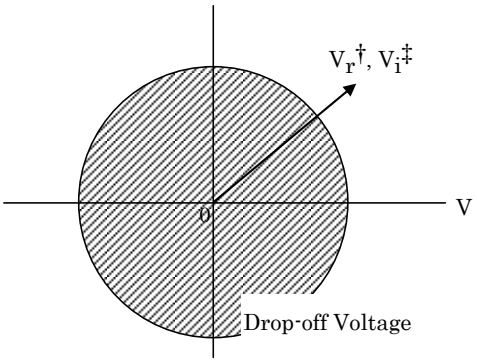


Figure 2.27-2 Characteristics of UVr1 and UVi1

†Note: Settings [**OVR1**] and [**UVR1**] are applied for the measurement of voltage on the running line (Vr).

‡Note: Settings [**OVI1**] and [**UVI1**] are applied for the measurement of voltage on the incoming line (Vi).

2.27.2 Synchronization check relays

Figure 2.27-3 shows the variance of voltages, phase-angles and frequencies for Vr and Vi.

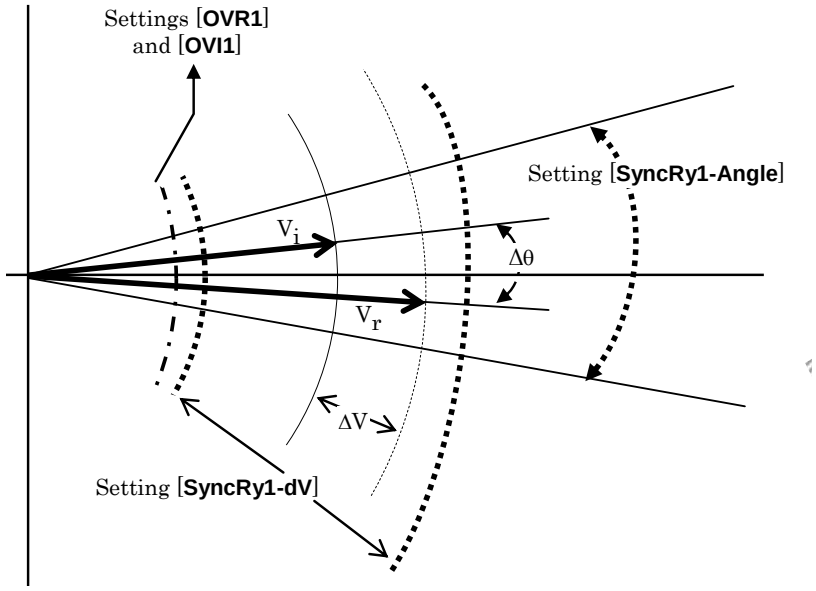


Figure 2.27-3 Permissible ranges for connections between synchronous networks

The provision of a signal for CB closure between two networks may be required subject to the variance of the two voltages, phase-angles and frequencies being small. Therefore, the SYNCHK function continuously monitors the Δθ, ΔV and Δf; subsequently the SYNCHK function issues an operate-permission signal to the DPSY function when the variance is less than the permissible range. For this purpose, synchronism-relays (SyncRy1-dV, SyncRy1-df, SyncRy1-dθ) are provided; the user can set them in accordance with their specific requirements.

Figure 2.27-4 shows the angle-variance between Vi and Vr; the increment or decrement of the angle-variance (Δθ) is shown based upon the running voltage Vr.

When connection between asynchronous networks is required, the split-synchronism-check elements (SyncRy-θ=0 and SyncRy-θless) are used so that the connection will be performed when the angle-variance Δθ is small.

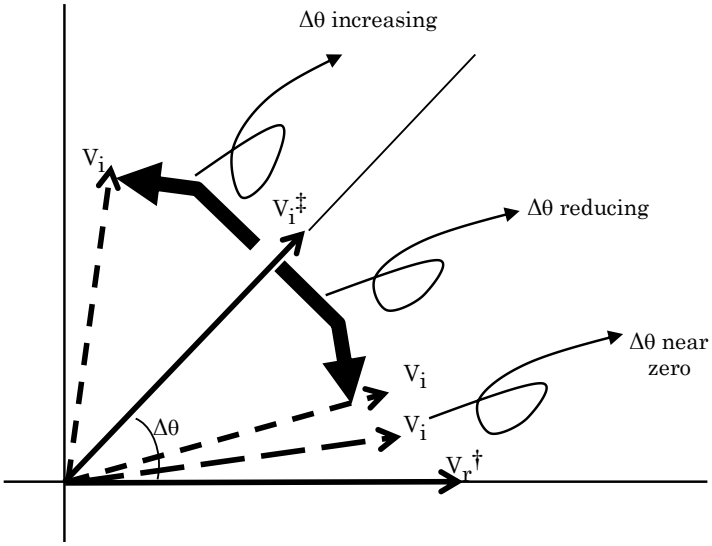


Figure 2.27-4 Permissible ranges for connections between asynchronous networks

†Note: Vr is the voltage on a running line.

‡Note: Vi is the voltage on an incoming line.

Table 2.27-3 Settings in SYNCHK_Ry1

Setting Name	Description	Default	Setting item or value
SyncRy1-Angle	Checking angle variance	30 degrees	0 to 75 degrees
SyncRy1-dV	Checking voltage variance	150V	0 to 150 V
SyncRy1-df	Checking frequency variance	1Hz	0.01 to 2 Hz
SyncRy1-TCB	Advance time for SYNCHK01	–	Seconds
SYNC01_TSYN	Sync check timer for loop system	10s	0.00 to 100.00 s

(i) Synchronism-relays (SyncRy1-dV, SyncRy1-df, SyncRy1-dθ)

Synchronism-relays, SyncRy1-dV, SyncRy1-df, and SyncRy1-dθ are provided; the setting ranges for these relays are shown in Table 2.27-3.

(i)-1 Voltage-variance (ΔV) (see Figure 2.27-3)

The voltage-variance between Vr and Vi ($|V_r - V_i|$) is measured by the voltage-variance relay-element having a setting [**SyncRy1-dV**]. If equation (2.27-3) is satisfied together with the conditions stipulated in equations (2.27-2) and (2.27-3), the SyncRy1-dV relay determines that the voltage-variance is inside the permissible range.

$$V_r \geq \text{Setting [OVR1]} \qquad (2.27\text{-}1)$$

$$V_i \geq \text{Setting [OVI1]} \qquad (2.27\text{-}2)$$

$$|V_r - V_i| \leq \text{Setting [SyncRy1-dV]} \qquad (2.27\text{-}3)$$

(i)-2 Phase-angle variance (Δθ) (see Figure 2.27-4)

The phase-angle variance of Vr and Vi (Δθ) is measured by the phase-angle variance-relay having the setting [**SyncRy1-Angle**]. If the following equations are satisfied, the SyncRy1-Angle relay determines that the phase-angle variance is inside the permissible range.

$$V_r \times V_i \cos \Delta\theta > 0 \qquad (2.27\text{-}4)$$

$$V_r \times V_i \sin(\text{setting}[\textbf{SyncRy1-Angle}]) \geq V_r \times V_i \sin \Delta\theta \qquad (2.27\text{-}5)$$

(i)-3 Frequency-variance (Δf)

The frequency-variance of Vr and Vi (Δf) is measured by the frequency-variance relay having the setting [**SyncRy1-df**]. If the following equations are satisfied, the SyncRy1-df relay determines that the frequency-variance is inside the permissible range.

$$\Delta f = |f_{Vi} - f_{Vr}| \leq \text{setting } [\textbf{SyncRy1-df}] \qquad (2.27\text{-}6)$$

where,

f_{Vr}	Frequency of Vr
f_{Vi}	Frequency of Vi
Δf	Frequency-variance between Vr and Vi

(i)-4 Tips

The SYNCHK relay could detect the frequency-variance between the Vr and the Vi, although the SYNCHK relay does not have the setting [**SyncRy1-df**]. To detect the frequency-variance with the absent of the [**SyncRy1-df**], set both the settings [**SyncR1-Angle**] and [**SYNC01_TSYN**]; then, the frequency-variance (i.e., detected maximum slip cycle) is given with Equation:

$$\Delta f > \frac{\text{Setting } [\textbf{SyncR1-Angle}]}{180° \times \text{Setting } [\textbf{SYNC01_TSYN}]} \qquad (2.27\text{-}7)$$

where,

Δf= cycle-slip in Hertz

(ii) Split-synchronism-check element (SyncRy1-θ=0, SyncRy1-θless)

With regard to the connection of asynchronous networks, it is necessary to use the technique of split synchronism to avoid the occurrence of cycle-slip on the system. The technique consists of three parts: (1) calculation of the synchronization point (SyncRy1-θ=0), (2) check for slip cycle (SyncRy1-θless), and (3) advance time for issuing the closure command.

(ii)-1 Calculation of synchronization point

Issuing a closure command for the CB is appropriate when the variance of Vr and Vi is small. Hence, the timing of when it should be issued is calculated in the SyncRy1-θ=0 element so that the prediction of coincident timing between the running, (Vr) and the incoming, (Vi) voltages can be introduced. Figure 2.27-5(c) shows the coincident point (zero point).

(ii)-2 Check for slip cycle

Checking the decrease in Δθ is a suitable means for controlling the issue of a closure command to a CB at the requisite timing. The SyncRy1-θless element calculates the for reducing Δθ; it assists in the computation of the SyncRy1-θ=0 element.

(ii)-3 Advance time

The user shall consider the actual device operation time. For an asynchronous network, the issue of the CB closure command should be initiated such that it is coordinated with the actual closing. Figure 2.27-5 shows the advancing time; it is introduced with setting [**SyncRy1-TCB**], closing time (Tcb) and compensation time:

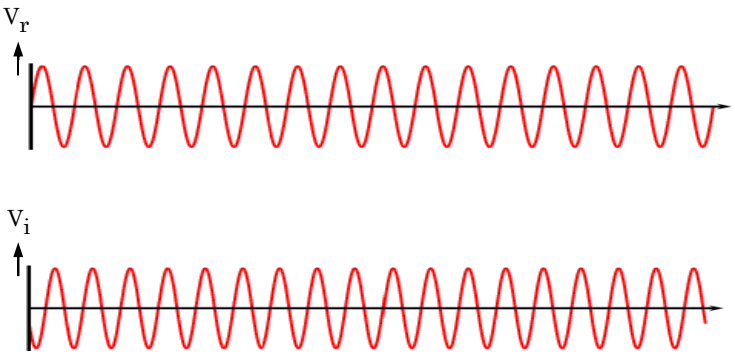
$$\text{Setting}[\textbf{SyncRy1-TCB}] = \alpha + T_{CB} + \beta \qquad (2.27\text{-}8)$$

where,

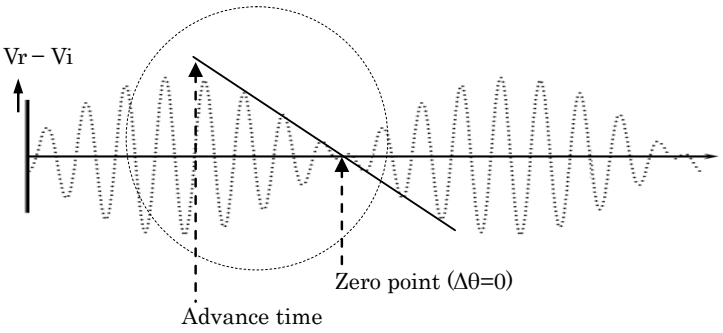
α: Operation time of the element

ß: Compensation (i.e., tolerance) time

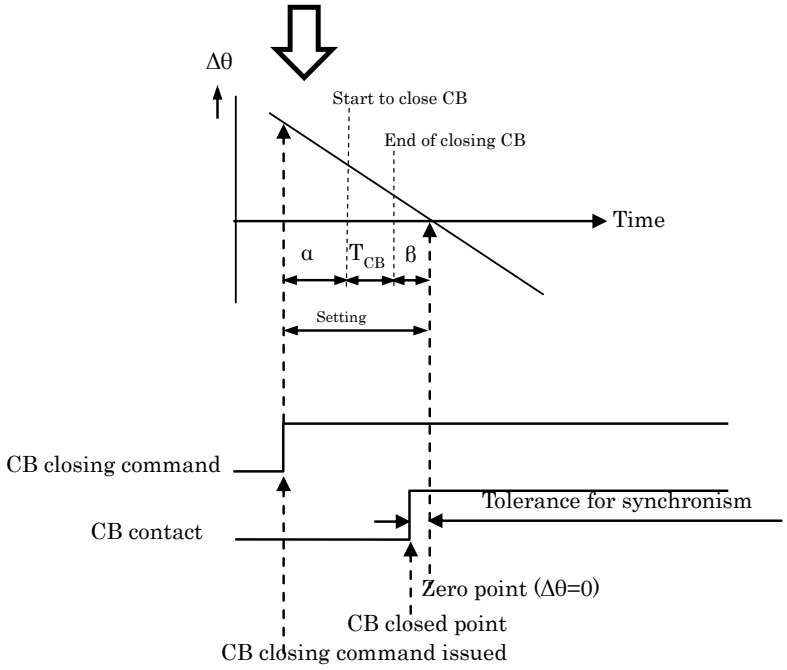
Tcb: Closing time of CB



(b) Incoming voltage (V_i)



(c) Beat wave provided by $V_r + V_i$



(d) Advance time and CB closing command

Figure 2.27-5 Advance time to close CB for an asynchronous system

2.27.3 Line-outage check

(i) Voltage conditions

In the SYNCHK function the OVr, OVi, UVr, and UVi elements are used to verify the line-condition. For example, when the user wishes to connect an incoming-line (i.e., transmission line) with the running-line (i.e., a busbar), the voltage conditions on either lines may be examined prior to connection. Alternatively, the absence of voltage on both lines may be required before connection. In order to provide this functionality, the SYNCHK function has four check zones to test for the line being either in-service or out-of-service; the four zones are illustrated in Figure 2.27-6.

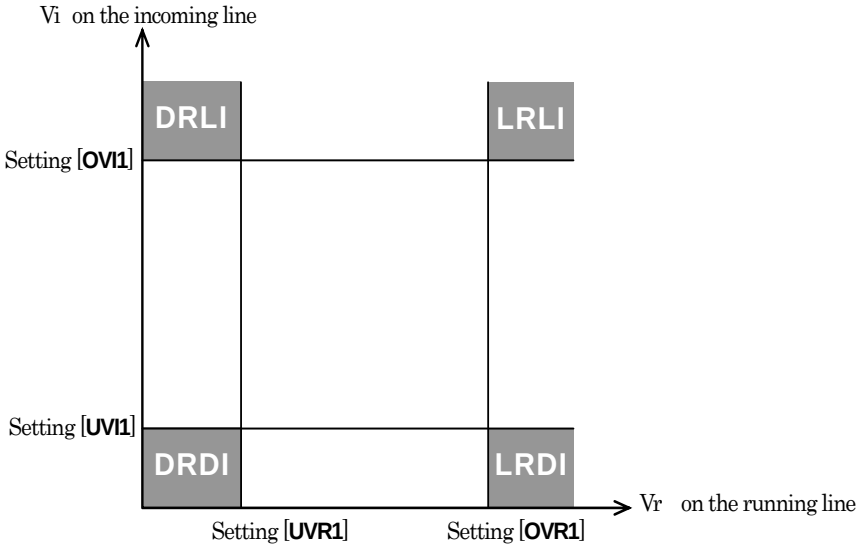


Figure 2.27-6 Four voltage conditions examined in SYNCHK_Ry1

For example, "DRLI" zone covers the case when the running-line is out-of-service (DR) and the incoming-line is in-service (LI). Table 2.27-4 exemplifies the areas in accordance with the voltage conditions.

Table 2.27-4 Four voltage conditions and zones

Voltage condition	1	2	3	4
Area	DⓇLⒾ	LⓇLⒾ	DⓇDⒾ	LⓇDⒾ
Ⓡunning line (Vr)	(Dead)	(Live)	(Dead)	(Live)
Ⓘncoming line (Vi)	(Live)	(Live)	(Dead)	(Dead)

Figure 2.27-7 and Figure 2.27-8 show the voltage-presence (or voltage-absence) check logic used in the SYNCHK_Ry1 and Ry2 functions.

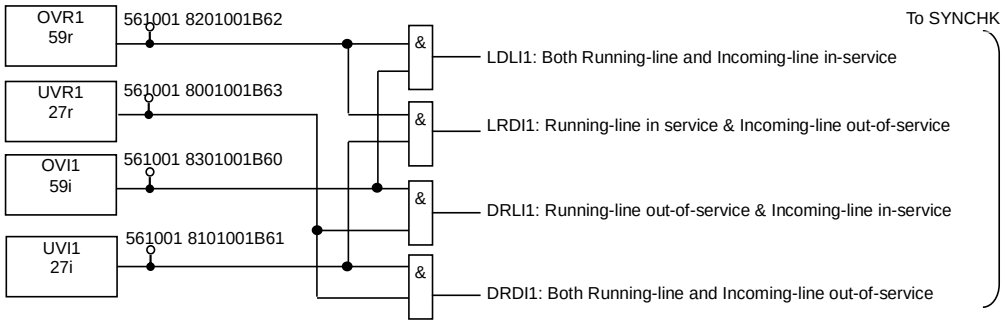


Figure 2.27-7 Line-outage check logic in SYNCHK_Ry1

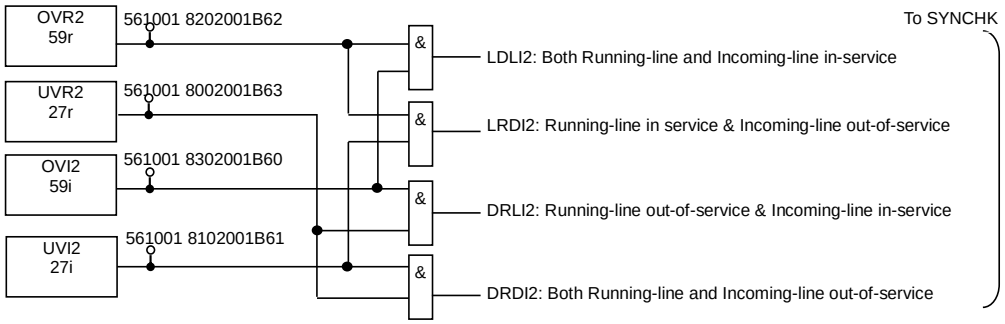


Figure 2.27-8 Line-outage check logic in SYNCHK_Ry2

Table 2.27-5 Voltage condition settings in SYNCHK1

Setting Name	Description	Default	Setting item or value
SYNC01_TLRDIDRLI	Voltage check timer (LRDI, DRLI)	5s	0.00 to 5.00s
SYNC01_TDRDI	Voltage check timer (DRDI)	5s	0.00 to 5.00s
SYNC01_LRDIEN	CB close enable for LRDI	On	Off/On
SYNC01_DRLIEN	CB close enable for DRLI	On	Off/On
SYNC01_DRDIEN	CB close enable for DRDI	On	Off/On

(ii) Check logic and settings

Figure 2.27-9 shows the SYNCHK1 logic. When the DPSY01 function confirms the reception of a selection-command, the DPSY01 function issues a “DPSY01_OSE_RCV” signal to the SYNCHK1 function. Then the SYNCHK1 function commences with the check for the voltage condition by introducing the results of the SYNCHK_Ry function. As described previously, four voltage conditions are considered, the user should select the voltage-conditions required by the application. The SYNCHK1 logic provides two permissive signals: “SYNC01_SLD_VCS” signal and “SYNC01_SYN_CLC” signal.

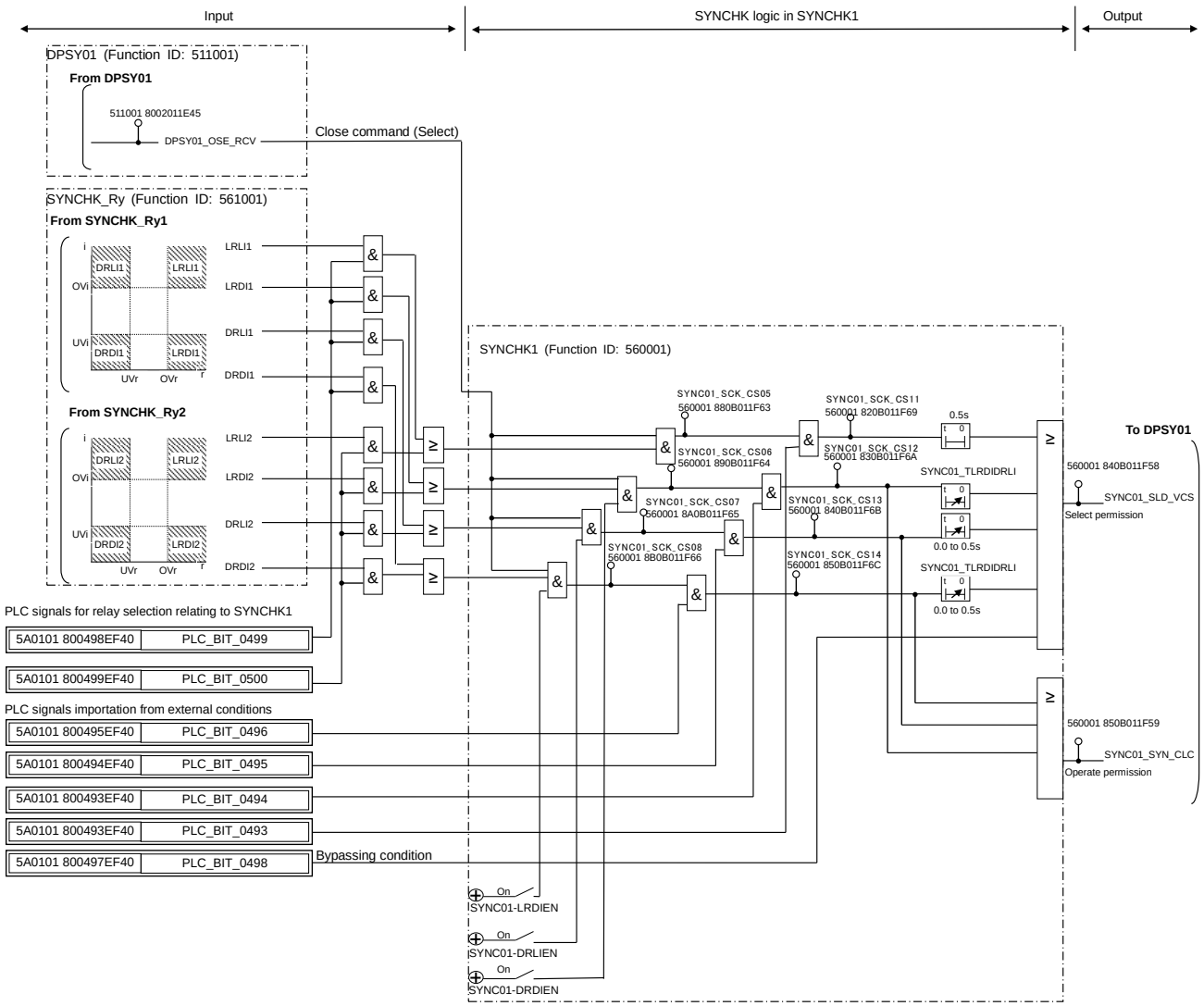


Figure 2.27-9 Voltage-condition check logic in SYNCHK1

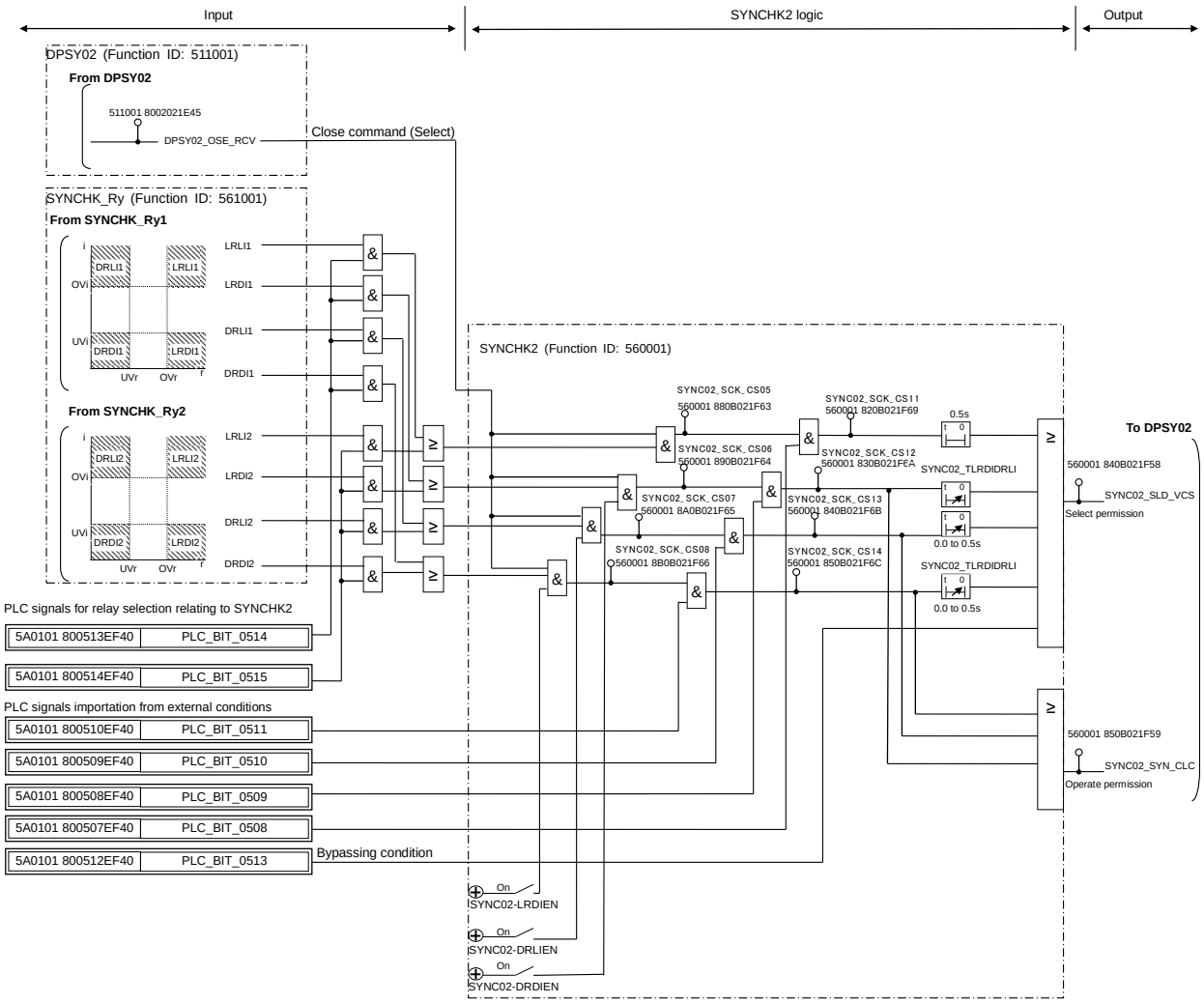


Figure 2.27-10 Voltage-condition check logic in SYNCHK2

(ii)-1 Permission signal "SYNC01_SLD_VCS"†

The "SYNC01_SLD_VCS" signal is transferred to the DPSY01 select-logic. For example, suppose the DPSY01 function is given permission to operate when any voltage-condition is satisfied, then the user should set **On** for the scheme switches [**SYNCHK01-LRDIEN**], [**SYNCHK01-DRLIEN**], and [**SYNCHK01-DRDIEN**].

For example, if the DPSY01 function is required to operate when the voltage condition "LRDI" is confirmed (Table 2.27-4.(4)), just set **On** for the scheme switch [**SYNCHK01-LRDIEN**].

User programmable pick-up delay timers are available for the conditions "LRDI" and "DRLI" (Table 2.27-4.(1 and 4)); hence the user can set a desired value for the setting [**SYNC01_TLRDIDRLI**]; similarly, a desired value can be applied for the setting [**SYNC01_TDRDI**] for the condition "DRDI" (Table 2.27-4.(3)).

†Note: This signal is required for CB closing in the select logic. For more information, see separate section *DPSY: Control logics*.

(ii)-2 Permission signal "SYNC01_SYN_CLC"‡

The "SYNC01_SYN_CLC" signal is input to the DPSY01 operate-closing-logic as a permissive signal. The DPSY01 function is allowed to operate when any voltage-conditions except "LRLI" is satisfied in the DPSY01 operation.

‡Note: This signal is required only for CB closing in the operate-closing logic. For more information, see separate section *DPSY: Operate logics*.

(iii) Adding other voltage-conditions using PLC signals

The user can add a user-preferred condition to the logic signal using PLC connection points. In the SYNCHK1 logic, points "PLC_BIT_0493 to PLC_BIT_0495" are provided†. Similarly, points "PLC_BIT_0508 to PLC_BIT_0511" are provided in the SYNCHK2 function.

†Note: For more information on PLC programing, see chapter *PLC function*, separately.

(iv) Relay selection using PLC signals

Either SYNCHK_Ry1 or SYNCHK_Ry2 function can be chosen for SYNCHK1 operation. On this account, points "PLC_BIT_0499" and "PLC_BIT_0500" are provided and the user can choose either for use in conjunction with SYNCHK1 operation; similarly, "PLC_BIT_0514" and "PLC_BIT_0515" are provided for SYNCHK2 operation. The purpose of the choice is discussed in section 2.27.5.

2.27.4 Synchronization check

The user should set **On** for scheme switch [**SYNC01-SYNCHK1EN**] when synchronization check is required.

(i) Synchronization conditions

The synchronizing relays are used to check the respective conditions of the incoming-line and the running-line. For example, the ΔV, Δθ, and Δf variances of Vi and Vr may be examined when the SYNCHK function is used in a synchronous network. Conversely, the Δθ reducing-degree feature can be applied for asynchronous networks; the SYNCHK function can use signals 'Δθ1≈0' and 'Δθ1_less' in order to decide whether the difference-angle is reducing. Thus, the SYNCHK function is required to have two sets of check logic covering both (1) synchronous conditions and (2) asynchronous conditions.

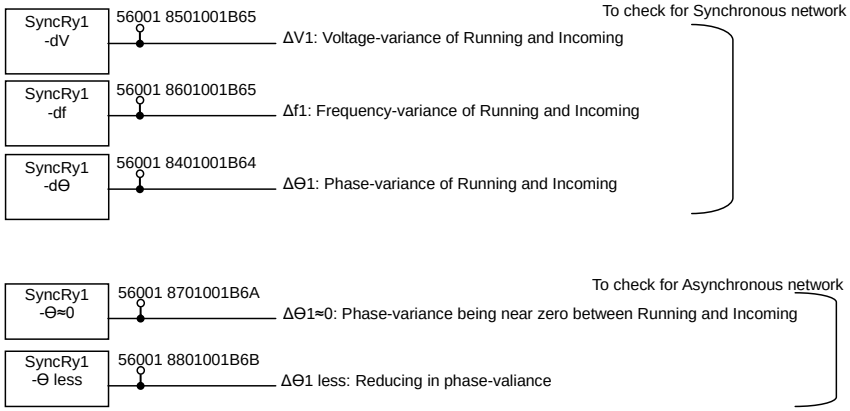


Figure 2.27-11 Synchronization check relays in SYNCHK_Ry1

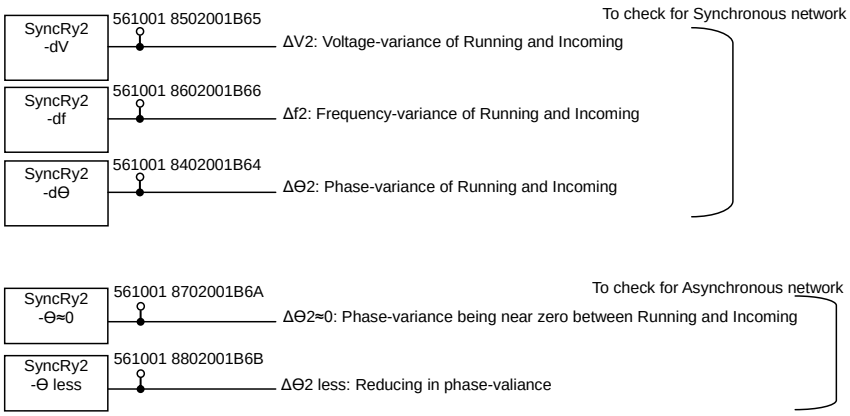


Figure 2.27-12 Synchronization check relays in SYNCHK_Ry2

Figure 2.27-13 shows the synchronization check logic in the SYNCHK1 function. The user should note that the logic has been separated for (1) the synchronous condition and (2) the asynchronous condition; the synchronization check logic is initiated when the "DPSY01_OEC_RCV" signal is received, which is identical to an operate-command in the On-direction.

Table 2.27-6 Synchronization settings in SYNCHK1

Setting Name	Description	Default	Setting item or value
SYNC01_SYNCHK1EN	SYNCHK1 synchronization checking enable	Off	On / Off
SYNC01_TSYN	Synchronism check timer for synchronous system	10s	0.00–100.00s
SYNC01_TSYN2	Timer to give up the synchronization	60s	30.0–1800.0s
SYNC01_Split_EN	SYNCHK1 async. checking enable	Off	Off/On
SYNC01_SYNCTEST	Test in SYNCHK1 synchronism check	Off	Off/On

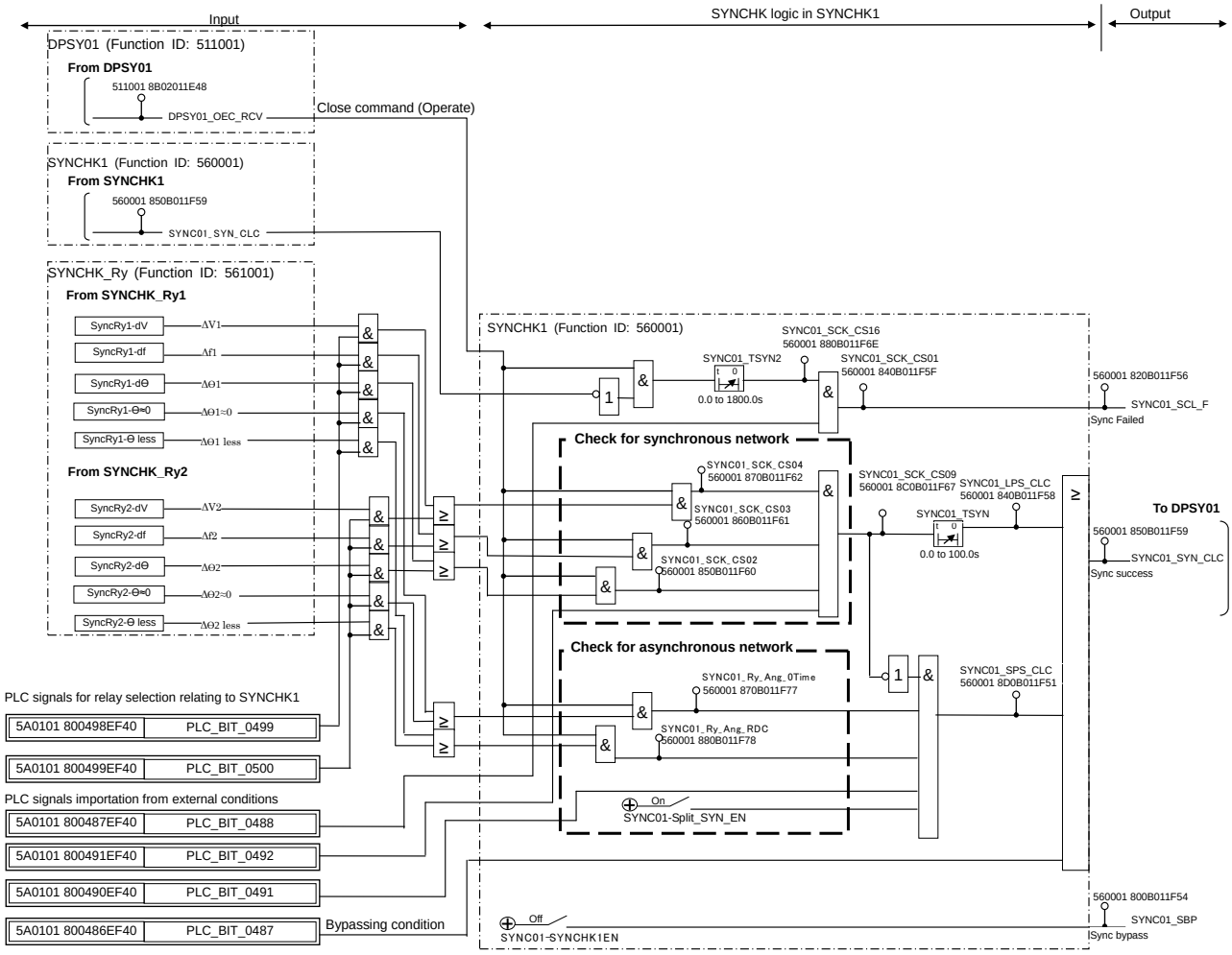


Figure 2.27-13 Synchronization check logic in SYNCHK1

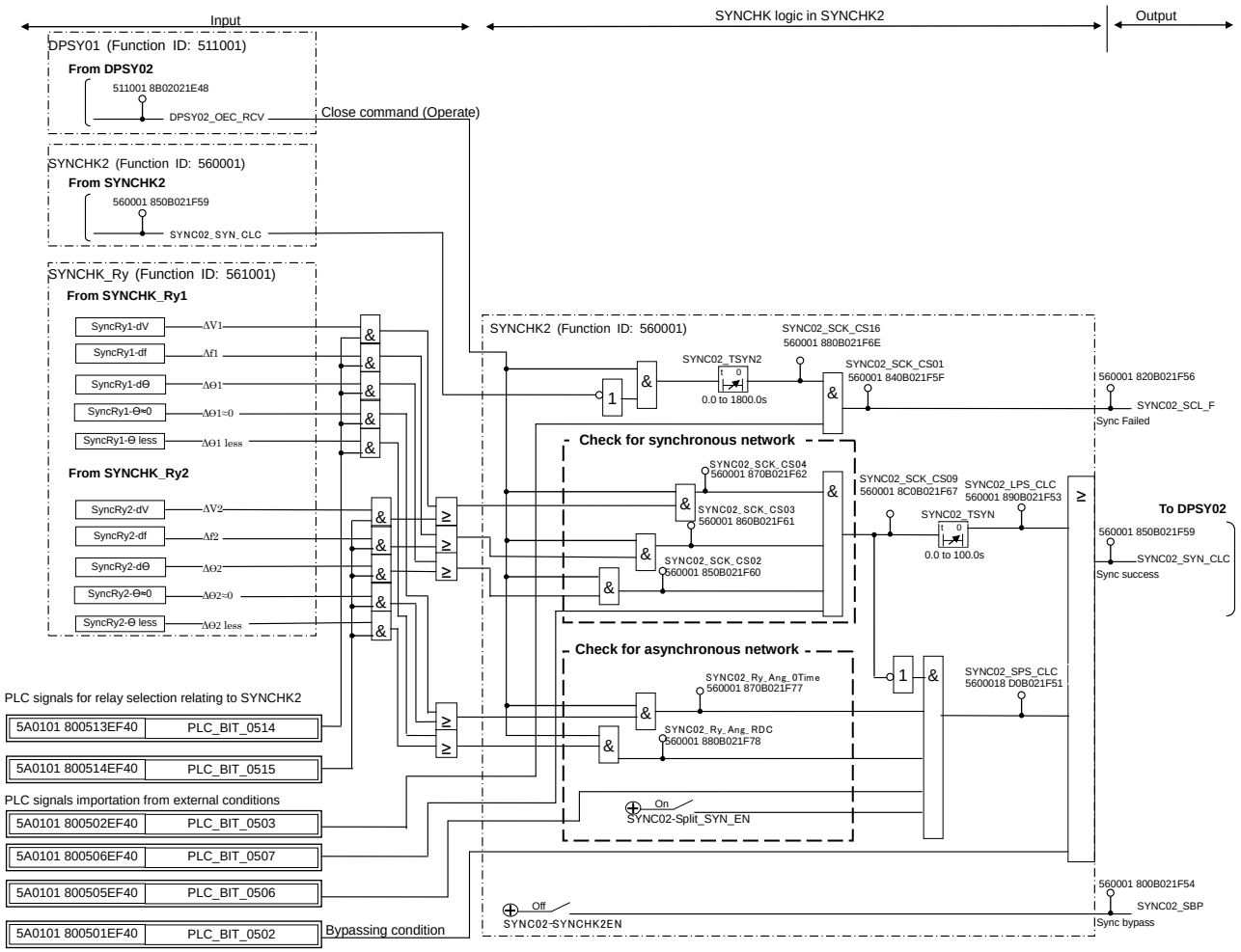


Figure 2.27-14 Synchronization check logic in SYNCHK2

(ii) Check logic and settings for synchronous network

As shown in Figure 2.27-13, the ΔV, Δθ, and Δf signals are required to check the synchronous condition; the three signals are input to the logic. The sync-success signal "SYNC01_SYN_CLC" is provided after the operation of the delay timer "SYNC01_TSYN". The user can regulate the timer using the setting [**SYNC01_TSYN**].

(iii) Check logic and settings for asynchronous network

In Figure 2.27-13, the 'Δθ1≈0' and 'Δθ1_less' signals are used to check the synchronization condition when the user sets **On** for scheme switch [**SYNC01-Split_SYN_EN**]; subsequently sequentially the sync-success signal "SYNC01_SYN_CLC" is issued for the DPSY01 function.

(iv) Bypassing synchronization check

If the user wishes to remove the synchronization check, set **Off** for the scheme switch [**SYNC01-SYNCHK1EN**]. The DPSY01 function can operate with the absence of the sync-success signal "SYNC01_SYN_CLC".

(v) Unsuccessful synchronization check

If the injected signal "DPSY01_OEC_RCV" persists for longer than a pre-determined time, the check logic determines that synchronization has not occurred; hence, the check logic can issue a failure signal for the DPSY01 function. Consequently, the DPSY01 function abandons the attempt to close the CB due to the failure in the synchronization process. The user can set the time using the setting [**SYNC01_TSYN2**].

(vi) Adding other sync-conditions using PLC signals

When required, a user-preferred sync-condition can be added to the SYNCHK function using the PLC connection points. For the SYNCHK1 logic, points "PLC_BIT_0488", "0492", and "0491" are provided. Similar points are also provided in the SYNCHK2 function.

(vii) Relay selection using PLC signals

As described in 2.27.3(iv), either the SYNCHK_Ry1 or SYNCHK_Ry2 function can be chosen for check synchronization in addition to checking the voltage condition. For the purpose of the choice provided, see section 2.27.5.

(viii) Synchronization logic test

When required, a hypothetical sync-success signal can be issued for testing, the user can set **On** for the scheme switch [**SYNC01_SYNCTEST**]. Note that **Off** should be set for the scheme switch after testing.

2.27.5 Relay selection for checking synchronization

Figure 2.27-15 exemplifies a bus-bar arrangement used as an example for check synchronization. In this example, the SYNCHK_Ry1 relays require the voltage signals† V3, V4, and V1. This is because DS1 and DS3 are closed, but DS2 is open; the selection of SYNCHK_Ry1 is initiated by the reception of the "SYNCHK_Ry1_selection" signal. The "SYNCHK_Ry1_selection" and "SYNCHK_Ry2_selection" signals are generated by logic programmed by the user; hence, here the signal "SYNCHK_Ry1_selection" is connected with the PLC connection point "PLC_BIT_0499"‡.

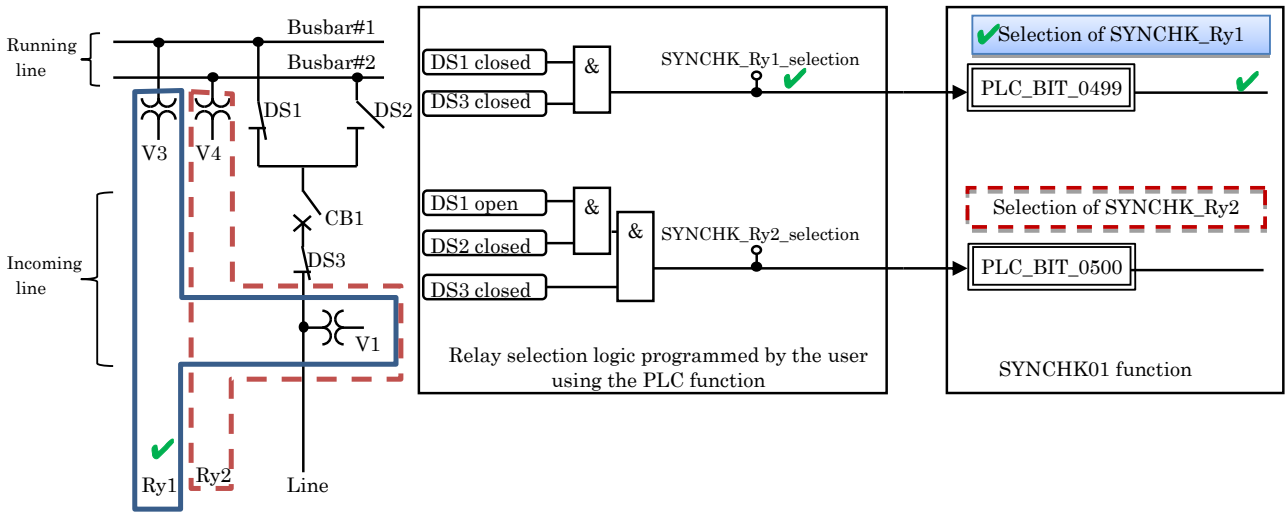


Figure 2.27-15 Relay-selection-signal provided by DPSY function (an example)

†Note: The relationship between the injected voltage-signals and the SYNCHK_Ry function is discussed in section 2.27.6.

‡Note: The user should also connect the "SYNCHK_Ry2_selection" signal with the PLC connection point "PLC_BIT_0500". Users should note that Figure 2.27-15 is provided for explanation/information; the user is required to program relay-selection logic using the PLC function that responds dynamically to configuration changes that occur as a consequence of CB and DS operations.

In Figure 2.27-15 , two signals are used for relay selection, but the user should note that the selection-signals are provided in accordance with the actual line and bus-bar arrangement. Figure 2.27-16 shows the overall logic used for the selection. The user can program the selection-signals using the PLC function.

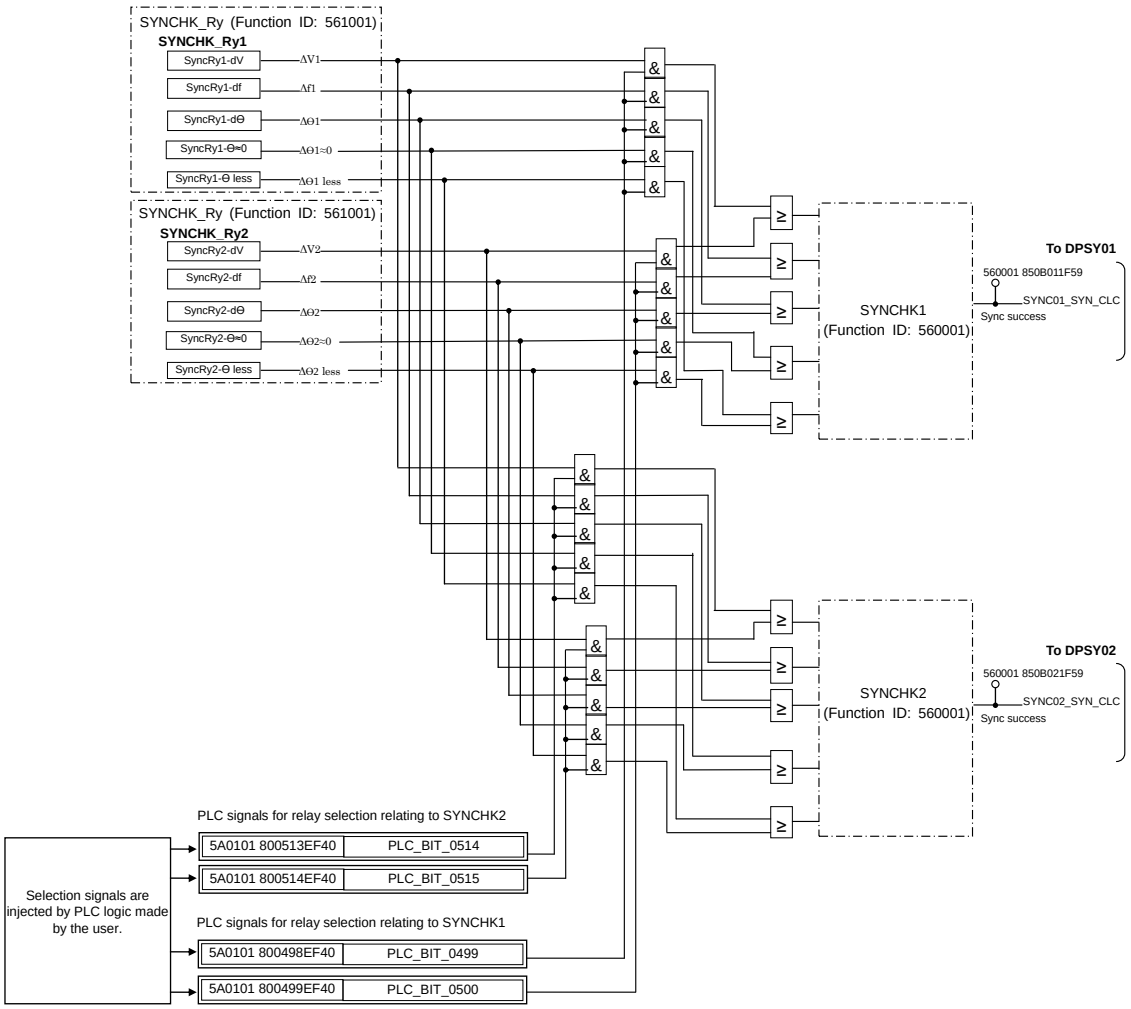


Figure 2.27-16 Relay selection made using PLC signals

Table 2.27-7 PLC connection point (Relay selection)

Signal Number	Signal Name	Description	M/O
5A0101 800498EF40	PLC_BIT_0499	SYNCHK1 use SYNCHK_RY1	M
5A0101 800499EF40	PLC_BIT_0500	SYNCHK1 use SYNCHK_RY2	M
5A0101 800513EF40	PLC_BIT_0514	SYNCHK2 use SYNCHK_RY1	M
5A0101 800514EF40	PLC_BIT_0515	SYNCHK2 use SYNCHK_RY2	M

2.27.6 Voltage selection for line arrangement

As shown in Figure 2.27-15, input-voltage signals are required in response to the line and bus-bar arrangement. Incidentally, the input-voltage signals supplied by the VTs are applied to the IED via the transformer module (VCT†); hence, the input-voltage signal should correspond with the required relay-element. On this account, settings are provided in the SYNCHK_Ry function.

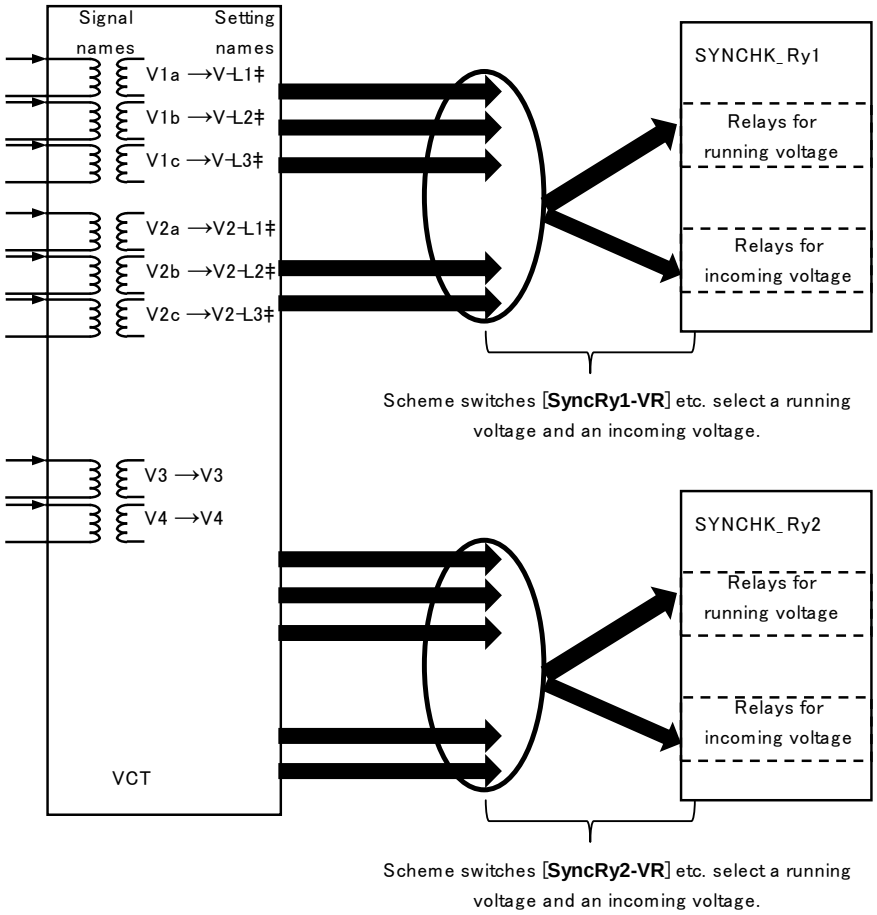


Figure 2.27-17 Voltage signals selected using scheme switches

†Note: For the actual terminal arrangement and signals injected, see chapter *Technical description: Transformer module for AC analog input.*

‡Note: The user is required to change the terminal names when setting. For example, the V1a terminal must be read as "V-L1" when setting is performed.

Figure 2.27-17 illustrates that the signals injected are distributed using scheme switches: [**SyncRy1-VR**], [**SyncRy1-VI**], [**SyncRy1-VR**], and [**SyncRy1-VI**]. Examples below show how to apply a voltage signal for the required relay-element.

(i) Setting example setting 1

Suppose the bus-bar arrangement of Figure 2.27-15 is applied for the SYNDIF function. Voltages V3 and V4 represent the running voltage (V_R) for the respective busbars; thus, the

user should set **V3** and **V4** for both scheme switches [**SyncRy1-VR**] and [**SyncRy2-VR**], respectively. The incoming voltage (V_I) is provided by the Line voltage (V1), therefore either **V-L1, V-L2,** or **V-L3** can be set for scheme switches [**SyncRy1-VI**] and [**SyncRy2-VI**]. Table 2.27-8 shows the setting example for this arrangement.

Table 2.27-8 Settings in Example1

Setting Name	Description	Default	Setting item or value
SyncRy1-VR	Selection of running voltage	V3	Either V3 / V4
SyncRy1-VI	Selection of incoming voltage	V-L1	Either V-L1 / V-L2 / V-L3
SyncRy2-VR	Selection of running voltage	V4	Either V3 / V4
SyncRy2-VI	Selection of incoming voltage	V-L1	Either V-L1 / V-L2 / V-L3

(ii) Setting example 2

Figure 2.27-18 depicts an example of a busbar arrangement and S43P logic programmed by the user. In this case, only the SYNCHK_Ry1 function is used; therefore, the user need only select the signal provided by the S43P logic for the SYNCHK_Ry1 function.

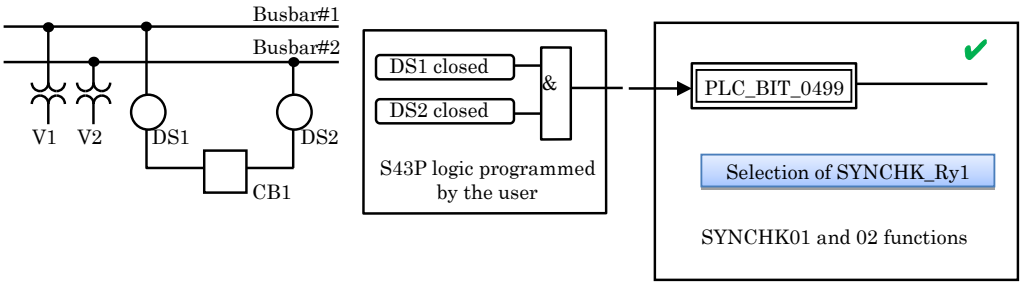


Figure 2.27-18 Bus-bar arrangement and PLC setting

Voltage selection should be considered in accordance with the arrangement of VTs. Voltages V1 and V2 represent the running voltage (V_R) and the incoming voltage (V_I), respectively. Consequently, **V-L1** and **V2-L1** are set for the scheme switches [**SyncRy1-VR**] and [**SyncRy1-VI**], respectively. Table 2.27-8 shows the setting example for this arrangement.

Table 2.27-9 Setting example

Setting Name	Description	Default	Setting item or value
SyncRy1-VR	Selection of running voltage	V-L1	Either of V-L1 / V-L2 / V-L3
SyncRy1-VI	Selection of incoming voltage	V2-L1	Either of V2-L1 / V2-L2 / V2-L3
SyncRy2-VR	Selection of running voltage	N.A	N.A
SyncRy2-VI	Selection of incoming voltage	N.A	N.A

2.27.7 Setting

Main settings for SYNCHK (Function ID: 560001)

Setting item		Range	Units	Contents	Default setting value	Notes
SYNCHK1	SYNC01_SYNCHK1EN	On / Off	–	SYNC DEV1 synchronism check mode enable	Off	
	SYNC01_TLRDIDRLI	0.00–5.00	s	V check timer(Live Running & Dead Incoming Dead Running & Live Incoming)	5.00	
	SYNC01_TDRDI	0.00–5.00	s	V check timer (Dead Running & Dead Incoming)	5.00	
	SYNC01_TSYN	0.00–100.00	s	synchronism check timer (Loop)	10.00	
	SYNC01_TSYN2	30.0–1800.0	s	Synchronism check time up	60	
	SYNC01_Split_EN	Off/On	–	SYNC DEV1 split synchronism check mode enable	Off	
	SYNC01_LRDIEN	Off/On	–	SYNC DEV1 Live Running & Dead Incoming close mode enable	On	
	SYNC01_DRLIEN	Off/On	–	SYNC DEV1 Dead Runing & Live Incoming close mode enable	On	
	SYNC01_DRDIEN	Off/On	–	SYNC DEV1 Dead Running & Dead Incoming close mode enable	On	
	SYNC01_SYNCTEST	Off/On	–	SYNC DEV1 synchronism check test mode	Off	
SYNCHK2	SYNC02_SYNCHK2EN	On / Off	–	SYNC DEV2 synchronism check mode enable	Off	
	SYNC02_TLRDIDRLI	0.00–5.00	s	V check timer (Live Running & Dead Incoming Dead Running & Live Incoming)	5.00	
	SYNC02_TDRDI	0.00–5.00	s	V check timer (Dead Run. & Dead Incoming)	5.00	
	SYNC02_TSYN	0.00–100.00	s	synchronism check timer(Loop)	10.00	
	SYNC02_TSYN2	30.0–1800.0	s	Synchronism check time up	60	
	SYNC02_Split_EN	Off/On	–	SYNC DEV2 split synchronism check mode enable	Off	
	SYNC02_LRDIEN	Off/On	–	SYNC DEV2 Live Running & Dead Incoming close mode enable	On	
	SYNC02_DRLIEN	Off/On	–	SYNC DEV2 Dead Running & Live Incoming close mode enable	On	
	SYNC02_DRDIEN	Off/On	–	SYNC DEV2 Dead Running. & Dead Incoming close mode enable	On	
	SYNC02_SYNCTEST	Off/On	–	SYNC DEV2 synchronism check test mode	Off	

Relay settings for SYNCHK (Function ID: 561001)

Setting item		Range	Units	Contents	Default setting value	Notes
Ry1	SyncRy1-VR	V-L1/V-L2/V-L3/V-L12/V-L23/V-L31/V2-L1/V2-L2/V2-L3/V2-L12/V2-L23/V2-L31/V3/V4		Running Voltage		
	SyncRy1-VI	V-L1/V-L2/V-L3/V-L12/V-L23/V-L31/V2-L1/V2-L2/V2-L3/V2-L12/V2-L23/V2-L31/V3/V4		Incoming Voltage	V-L1	
	OVR1	10-150	V	Voltage for checking Live-Running Voltage	51	
	UVR1	10-150	V	Voltage for checking Dead-Running Voltage	13	
	OVI1	10-150	V	Voltage for checking Live-Incoming Voltage	51	
	UVI1	10-150	V	Voltage for checking Dead-Incoming Voltage	13	
	SyncRy1-Angle	0-75	degrees	Angle valiance for checking SyncRy1	30	
	SyncRy1-dV	0-150	V	Voltage valiance for checking SyncRy1	150	
	SyncRy1-df	0.01-2.00	Hz	Frequency valiance for checking SyncRy1	1.00	
	SyncRy1-TCB		s	CB Operate timer for SyncRy1		
Ry2	SyncRy2-VR	V-L1/V-L2/V-L3/V-L12/V-L23/V-L31/V2-L1/V2-L2/V2-L3/V2-L12/V2-L23/V2-L31/V3/V4		Running Voltage		
	SyncRy2-VI	V-L1/V-L2/V-L3/V-L12/V-L23/V-L31/V2-L1/V2-L2/V2-L3/V2-L12/V2-L23/V2-L31/V3/V4		Incoming Voltage	V-L1	
	OVR2	10-150	V	Voltage for checking Live-Running Voltage	51	
	UVR2	10-150	V	Voltage for checking Dead-Running Voltage	13	
	OVI2	10-150	V	Voltage for checking Live-Incoming Voltage	51	
	UVI2	10-150	V	Voltage for checking Dead-Incoming Voltage	13	
	SyncRy2-Angle	0-75	degrees	Angle valiance for checking SyncRy2	30	
	SyncRy2-dV	0-150	V	Voltage valiance for checking SyncRy2	150	
	SyncRy2-df	0.01-2.00	Hz	Frequency valiance for checking SyncRy2	1.00	
	SyncRy2-TCB		s	CB Operate timer for SyncRy2		

2.27.8 Signal

◆ Signal monitoring points

SYNCHK (Function ID: 560001)

Element ID	Name	Description
8D0B011F51	SYNC01_SPS_CLC	SYNC DEV1 split synchronism close command
860B011F52	SYNC01_SLF_VCS	SYNC DEV1 select fail voltage condition signal
890B011F53	SYNC01_LPS_CLC	SYNC DEV1 loop synchronism close command
800B011F54	SYNC01_SBP	SYNC DEV1 synchronism bypass
810B011F55	SYNC01_SCK_STA	SYNC DEV1 synchronism check start command
820B011F56	SYNC01_SCL_F	SYNC DEV1 synchronism closed fail
830B011F57	SYNC01_SCD_CS	SYNC DEV1 synchronism checked condition signal
840B011F58	SYNC01_SLD_VCS	SYNC DEV1 selected voltage condition signal
850B011F59	SYNC01_SYN_CLC	SYNC DEV1 synchronism close command
860B011F5A	SYNC01_LLV_CS	SYNC DEV1 84Vr & 84Vi condition signal
870B011F5B	SYNC01_DLV_CS	SYNC DEV1 27Vr & 84Vi condition signal
880B011F5C	SYNC01_DDV_CS	SYNC DEV1 27Vr & 27Vi condition signal
890B011F5D	SYNC01_LDV_CS	SYNC DEV1 84Vr & 27Vi condition signal
840B011F5F	SYNC01_SCK_CS01	SYNC DEV1 synchronism check condition signal 01
850B011F60	SYNC01_SCK_CS02	SYNC DEV1 synchronism check condition signal 02
860B011F61	SYNC01_SCK_CS03	SYNC DEV1 synchronism check condition signal 03
870B011F62	SYNC01_SCK_CS04	SYNC DEV1 synchronism check condition signal 04
880B011F63	SYNC01_SCK_CS05	SYNC DEV1 synchronism check condition signal 05
890B011F64	SYNC01_SCK_CS06	SYNC DEV1 synchronism check condition signal 06
8A0B011F65	SYNC01_SCK_CS07	SYNC DEV1 synchronism check condition signal 07
8B0B011F66	SYNC01_SCK_CS08	SYNC DEV1 synchronism check condition signal 08
8C0B011F67	SYNC01_SCK_CS09	SYNC DEV1 synchronism check condition signal 09
8E0B011F68	SYNC01_SCK_CS10	SYNC DEV1 synchronism check condition signal 10
820B011F69	SYNC01_SCK_CS11	SYNC DEV1 synchronism check condition signal 11
830B011F6A	SYNC01_SCK_CS12	SYNC DEV1 synchronism check condition signal 12
840B011F6B	SYNC01_SCK_CS13	SYNC DEV1 synchronism check condition signal 13
850B011F6C	SYNC01_SCK_CS14	SYNC DEV1 synchronism check condition signal 14
870B011F6D	SYNC01_SCK_CS15	SYNC DEV1 synchronism check condition signal 15
880B011F6E	SYNC01_SCK_CS16	SYNC DEV1 synchronism check condition signal 16
8A0B011F6F	SYNC01_SCK_CS17	SYNC DEV1 synchronism check condition signal 17
8B0B011F70	SYNC01_SCK_CS18	SYNC DEV1 synchronism check condition signal 18
8C0B011F71	SYNC01_SCK_CS19	SYNC DEV1 synchronism check condition signal 19
8D0B011F72	SYNC01_SCK_CS20	SYNC DEV1 synchronism check condition signal 20
8A0B011F73	SYNC01_SCK_CS21	SYNC DEV1 synchronism check condition signal 21
8B0B011F74	SYNC01_SCK_CS22	SYNC DEV1 synchronism check condition signal 22
8C0B011F75	SYNC01_SCK_CS23	SYNC DEV1 synchronism check condition signal 23
8D0B011F76	SYNC01_SCK_CS24	SYNC DEV1 synchronism check condition signal 24
810B011F85	SYNC01_SCK_CS25	SYNC DEV1 synchronism check condition signal 25
820B011F86	SYNC01_SCK_CS26	SYNC DEV1 synchronism check condition signal 26
870B011F77	SYNC01_Ry_Ang_0Time	SYNC DEV1 Relay Output(Ang 0Time)
880B011F78	SYNC01_Ry_Ang_RDC	SYNC DEV1 Relay Output(Ang RDC)
800B011F80	SYNC01_SS_VCS_PLC	SYNC DEV1 successful voltage condition signal from PLC
800B011F81	SYNC01_RY1_USE_STS	SYNC DEV1 Relay Module1 use status from PLC

◆ Signal monitoring points

SYNCHK (Function ID: 560001)

Element ID	Name	Description
800B011F82	SYNC01_RY2_USE_STS	SYNC DEV1 Relay Module2 use status received from PLC
8D0B021F51	SYNC02_SPS_CLC	SYNC DEV2 split synchronism close command
860B021F52	SYNC02_SLF_VCS	SYNC DEV2 select fail voltage condition signal
890B021F53	SYNC02_LPS_CLC	SYNC DEV2 loop synchronism close command
800B021F54	SYNC02_SBP	SYNC DEV2 synchronism bypass
810B021F55	SYNC02_SCK_STA	SYNC DEV2 synchronism check start command
820B021F56	SYNC02_SCL_F	SYNC DEV2 synchronism closed fail
830B021F57	SYNC02_SCD_CS	SYNC DEV2 synchronism checked condition signal
840B021F58	SYNC02_SLD_VCS	SYNC DEV2 selected voltage condition signal
850B021F59	SYNC02_SYN_CLC	SYNC DEV2 synchronism close command
860B021F5A	SYNC02_LLV_CS	SYNC DEV2 84Vr & 84Vi condition signal
870B021F5B	SYNC02_DLV_CS	SYNC DEV2 27Vr & 84Vi condition signal
880B021F5C	SYNC02_DDV_CS	SYNC DEV2 27Vr & 27Vi condition signal
890B021F5D	SYNC02_LDV_CS	SYNC DEV2 84Vr & 27Vi condition signal
840B021F5F	SYNC02_SCK_CS01	SYNC DEV2 synchronism check condition signal 01
850B021F60	SYNC02_SCK_CS02	SYNC DEV2 synchronism check condition signal 02
860B021F61	SYNC02_SCK_CS03	SYNC DEV2 synchronism check condition signal 03
870B021F62	SYNC02_SCK_CS04	SYNC DEV2 synchronism check condition signal 04
880B021F63	SYNC02_SCK_CS05	SYNC DEV2 synchronism check condition signal 05
890B021F64	SYNC02_SCK_CS06	SYNC DEV2 synchronism check condition signal 06
8A0B021F65	SYNC02_SCK_CS07	SYNC DEV2 synchronism check condition signal 07
8B0B021F66	SYNC02_SCK_CS08	SYNC DEV2 synchronism check condition signal 08
8C0B021F67	SYNC02_SCK_CS09	SYNC DEV2 synchronism check condition signal 09
8E0B021F68	SYNC02_SCK_CS10	SYNC DEV2 synchronism check condition signal 10
820B021F69	SYNC02_SCK_CS11	SYNC DEV2 synchronism check condition signal 11
830B021F6A	SYNC02_SCK_CS12	SYNC DEV2 synchronism check condition signal 12
840B021F6B	SYNC02_SCK_CS13	SYNC DEV2 synchronism check condition signal 13
850B021F6C	SYNC02_SCK_CS14	SYNC DEV2 synchronism check condition signal 14
870B021F6D	SYNC02_SCK_CS15	SYNC DEV2 synchronism check condition signal 15
880B021F6E	SYNC02_SCK_CS16	SYNC DEV2 synchronism check condition signal 16
8A0B021F6F	SYNC02_SCK_CS17	SYNC DEV2 synchronism check condition signal 17
8B0B021F70	SYNC02_SCK_CS18	SYNC DEV2 synchronism check condition signal 18
8C0B021F71	SYNC02_SCK_CS19	SYNC DEV2 synchronism check condition signal 19
8D0B021F72	SYNC02_SCK_CS20	SYNC DEV2 synchronism check condition signal 20
8A0B021F73	SYNC02_SCK_CS21	SYNC DEV2 synchronism check condition signal 21
8B0B021F74	SYNC02_SCK_CS22	SYNC DEV2 synchronism check condition signal 22
8C0B021F75	SYNC02_SCK_CS23	SYNC DEV2 synchronism check condition signal 23
8D0B021F76	SYNC02_SCK_CS24	SYNC DEV2 synchronism check condition signal 24
810B021F85	SYNC02_SCK_CS25	SYNC DEV2 synchronism check condition signal 25
820B021F86	SYNC02_SCK_CS26	SYNC DEV2 synchronism check condition signal 26
870B021F77	SYNC02_Ry_Ang_0Time	SYNC DEV2 Relay Output(Ang 0Time)
880B021F78	SYNC02_Ry_Ang_RDC	SYNC DEV2 Relay Output(Ang RDC)
800B021F80	SYNC02_SS_VCS_PLC	SYNC DEV2 successful voltage condition signal from PLC
800B021F81	SYNC02_RY1_USE_STS	SYNC DEV2 Relay Module1 use status from PLC

◆ Signal monitoring points

SYNCHK (Function ID: 560001)

Element ID	Name	Description
800B021F82	SYNC02_RY2_USE_STS	SYNC DEV2 Relay Module2 use status from PLC

◆ Connection points in PLC logic

SYNCHK (Function ID: 560001)

Element ID	Name	Description
800B012E45	SYNC01_OSC	SYNC DEV1 on direction select command
810B012E48	SYNC01_OEC	SYNC DEV1 on direction execute command
820B012E9D	SYNC01_SLR_NO_SLD	SYNC DEV1 select release (no selected)
8B0B012EA2	SYNC01_SLD	SYNC DEV1 selected
850B012E93	SYNC01_CEC	SYNC DEV1 control execute completed
800B01EDE0	SYNC01_SBP_ECP	SYNC DEV1 synchronism bypass enable condition signal from PLC
800B01EDE1	SYNC01_SBP_SSP	SYNC DEV1 synchronism bypass success condition signal from PLC
800B01EDE2	SYNC01_SCL_F_ECP	SYNC DEV1 synchronism close fail condition signal from PLC
800B01EDE3	SYNC01_SCL_SSP	SYNC DEV1 synchronism close success condition signal from PLC
800B01EDE4	SYNC01_SCL_CSP	SYNC DEV1 synchronism close condition signal from PLC
800B01EDE5	SYNC01_SPS_CL_ECP	SYNC DEV1 split SYNC. close enable condition signal from PLC
800B01EDE6	SYNC01_LPS_CL_ECP	SYNC DEV1 loop synchronism close enable condition signal from PLC
800B01EDE7	SYNC01_LLV_CL_ECP	SYNC DEV1 84Vr & 84Vi close enable condition signal from PLC
800B01EDE8	SYNC01_LDV_CL_ECP	SYNC DEV1 84Vr & 27Vi close enable condition signal from PLC
800B01EDE9	SYNC01_DLV_CL_ECP	SYNC DEV1 27Vr & 84Vi close enable condition signal from PLC
800B01EDEA	SYNC01_DDV_CL_ECP	SYNC DEV1 27Vr & 27Vi close enable condition signal from PLC
800B01EDEB	SYNC01_SBK_CSP	SYNC DEV1 synchronism block condition signal from PLC
800B01EDEC	SYNC01_SS_VCS_PLC	SYNC DEV1 successful voltage condition signal from PLC
800B01EDED	SYNC01_RY1_USE_STS	SYNC DEV1 Relay Module1 use status from PLC
800B01EDEE	SYNC01_RY2_USE_STS	SYNC DEV1 Relay Module2 use status from PLC
800B022E45	SYNC02_OSC	SYNC DEV2 on direction select command
810B022E48	SYNC02_OEC	SYNC DEV2 on direction execute command
820B022E9D	SYNC02_SLR_NO_SLD	SYNC DEV2 select release (no selected)
8B0B022EA2	SYNC02_SLD	SYNC DEV2 selected
850B022E93	SYNC02_CEC	SYNC DEV2 control execute completed
800B02EDE0	SYNC02_SBP_ECP	SYNC DEV2 synchronism bypath enable condition signal from PLC
800B02EDE1	SYNC02_SBP_SSP	SYNC DEV2 synchronism bypath success condition signal from PLC
800B02EDE2	SYNC02_SCL_F_ECP	SYNC DEV2 synchronism close fail condition signal from PLC
800B02EDE3	SYNC02_SCL_SSP	SYNC DEV2 synchronism close success condition signal from PLC
800B02EDE4	SYNC02_SCL_CSP	SYNC DEV2 synchronism close condition signal from PLC
800B02EDE5	SYNC02_SPS_CL_ECP	SYNC DEV2 split SYNC. close enable condition signal from PLC
800B02EDE6	SYNC02_LPS_CL_ECP	SYNC DEV2 loop synchronism close enable condition signal from PLC
800B02EDE7	SYNC02_LLV_CL_ECP	SYNC DEV2 84Vr & 84Vi close enable condition signal from PLC
800B02EDE8	SYNC02_LDV_CL_ECP	SYNC DEV2 84Vr & 27Vi close enable condition signal from PLC
800B02EDE9	SYNC02_DLV_CL_ECP	SYNC DEV2 27Vr & 84Vi close enable condition signal from PLC
800B02EDEA	SYNC02_DDV_CL_ECP	SYNC DEV2 27Vr & 27Vi close enable condition signal from PLC
800B02EDEB	SYNC02_SBK_CSP	SYNC DEV2 synchronism block condition signal from PLC
800B02EDEC	SYNC02_SS_VCS_PLC	SYNC DEV2 successful voltage condition signal from PLC
800B02EDED	SYNC02_RY1_USE_STS	SYNC DEV2 Relay Module1 use status from PLC

◆ Connection points in PLC logic

SYNCHK (Function ID: 560001)

Element ID	Name	Description
800B02EDEE	SYNC02_RY2_USE_STS	SYNC DEV2 Relay Module2 use status from PLC

◆ Connection point in PLC logic

SYNCHK_Ry (Function ID: 561001)

Element ID	Name	Description
8000012A60	SYNC01_SCK_STA	SYNC DEV1 synchronism check start command
8000012A61	SYNC01_RY1_USE_STS	SYNC DEV1 Relay Module1 use status from PLC
8000012A62	SYNC01_RY2_USE_STS	SYNC DEV1 Relay Module2 use status from PLC
8000022A60	SYNC02_SCK_STA	SYNC DEV2 synchronism check start command
8000022A61	SYNC02_RY1_USE_STS	SYNC DEV2 Relay Module1 use status from PLC
8000022A62	SYNC02_RY2_USE_STS	SYNC DEV2 Relay Module2 use status from PLC

3 Relay application

3.1 Overcurrent protection (OC)

The phase overcurrent (OC) protection is the major protection function and has both time characteristic and directional elements. Four stages (elements) are available in the OC protection. The user can select various features using the scheme switches provided. The elements are named OC1, OC2, OC3, and OC4; and they operate independently.

To simplify the description, only OC1 is discussed but is applicable to the other OCs; hence, read the expression for OC1 as OC2, OC3, and OC4 at each stage unless a special explanation or instruction has been provided.

Note: The implementation of the feature depends on the selection of both the hardware and the software. Note that the feature is not supplied for the several models; hence, the user has to check the implementation for the model. Locate the ordering number and check it at the "G&T position" referring to the comparison table below. For more information, see *Appendix: Ordering*.

Table 3.1-1 Comparative table in respective ordering numbers

Sec.	Feature	Ordering No. at "G&T"					
		BCU			BCPU		IFU
		11	13	1F	2C	2N	19
–	Main features	NA	NA	NA	✓	✓	NA
–	Number of stages	NA	NA	NA	4	4	NA
3.1.9	PLC driver	NA	NA	NA	✓	✓	NA

✓: Applicable NA: Not applicable

3.1.1 Relay polarity

The user can choose either non-directional OC or directional OC for each OC stage. In addition, the user can further select either the forward or the reverse direction for each of the directional OC elements selected.

(i) Characteristic of non-directional OC

The characteristic of the non-directional type OC is a circle that has a center at the origin. A setting and a scheme switch is used to configure each non-directional OC element; i.e., the user can set the threshold value of the non-directional OC element for stage 1 using setting [**OC1-DT**], provided time characteristic is required for define time delay (DT) described in section 3.1.2(i). **Nondir** is set for the scheme switch [**OC1-Dir**].

(ii) Characteristic of directional-OC element in the forward direction

As shown in Figure 3.1-1, the characteristic of the directional-OC elements in the forward direction is a semi-circle based upon the border-line; the hatched area shows the operating region of a directional-OC element.

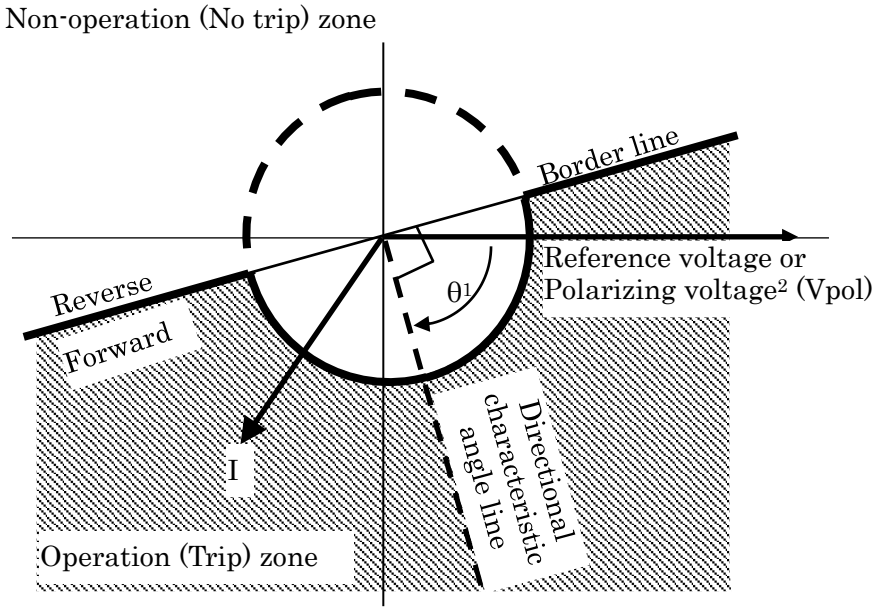


Figure 3.1-1 Characteristic of the directional-OC element in the forward direction

[1]Note: Directional characteristic angle (θ) forms the angle between the reference quantity and the directional characteristic angle line. The half plane represents the zone of operation bordered on one side by the border line and extending in the direction that contains both the reference (polarizing) and operating quantities.

[2]Note: For the polarizing voltage (Vpol), greater than 1.0 voltage should be applied for sensing.

A reference signal, that is, a polarization signal is required by the directional OC element, the reference signal is derived from a phase-to-phase voltage: for example, the directional OC

element for phase-A (OC-A) uses the phase-B-to-phase-C voltage rotated by 90° ($V_{BC}\angle 90°$) in the leading direction, this reference signal is illustrated in Figure 3.1-2. The direction of the current in the protected circuit, in this case the phase-A current (I_A), is determined from the angle measured for I_A against $V_{BC}\angle 90°$. The purpose of using V_{BC} in the 90° leading position is so that the reference voltage ($V_{BC}\angle 90°$) takes the same direction as the phase-A voltage (V_A) because the directional-sensing element requires a reference quantity that is reasonably constant against which the current in the protected circuit can be compared. As a result, when a fault occurs, the fault current I_A will lag $V_{BC}\angle 90°$. Similarly, for the phase-B directional OC element (OC-B) where the object current is (I_B) the reference voltage ($V_{CA}\angle 90°$) is adopted. The phase-C directional element (OC-C) uses the same approach as the OC-A and OC-B elements. Table 3.1-2 shows the relationship between each current and its respective reference voltage.

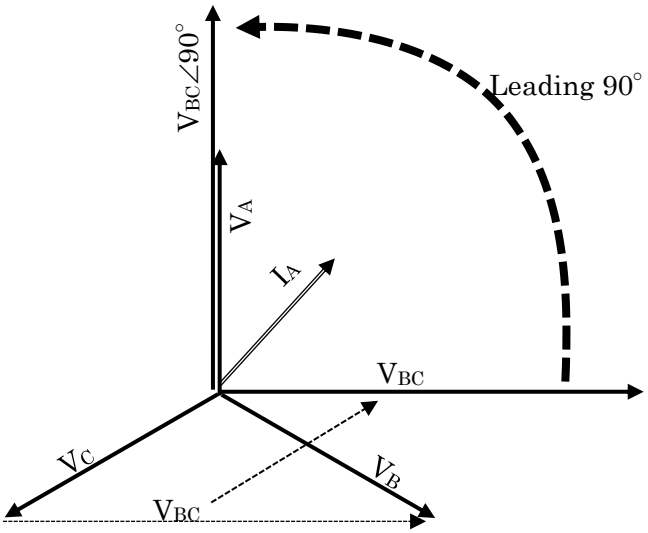


Figure 3.1-2 Object current (I_A) and reference voltage ($V_{BC}\angle 90°$)

Table 3.1-2 Directional polarizing signal

Directional element	Object current	Reference voltage
OC-A	I_A	$V_{BC}\angle 90°$
OC-B	I_B	$V_{CA}\angle 90°$
OC-C	I_C	$V_{AB}\angle 90°$

For a close-in three-phase fault, the three reference voltages $V_{BC}\angle 90°$, $V_{CA}\angle 90°$ and $V_{AB}\angle 90°$ may fall below the minimum threshold voltage for the directional OC element. In order to cover this case, a voltage memory function is used to provide a polarizing signal. The polarizing signals are provided during three-phase faults so that the OC element is able to determine the direction of the fault. In addition, the directional element function determines its output based on the loss of voltage memory and is effective while the fault current flows in accordance with Figure 3.1-3.

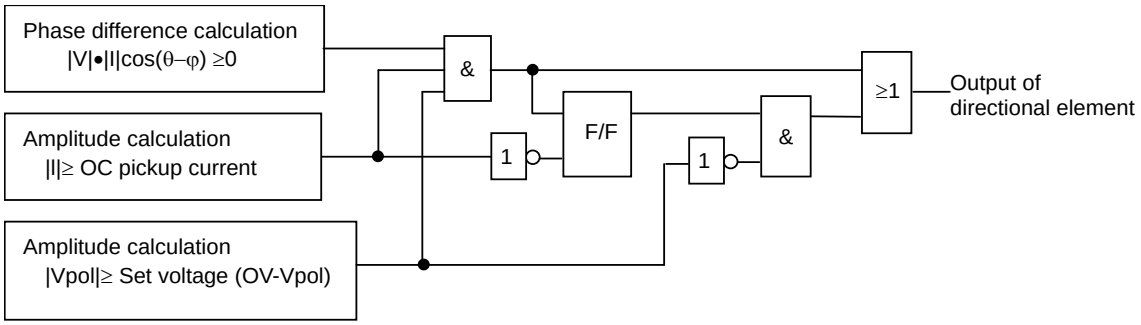


Figure 3.1-3 Direction determination after loss of voltage memory

If a single phase is connected to a heavy load, and the other phases are not connected to heavy loads, the user can program separately the directional OC element such that OC will send a trip signal only when the fault current detected is in the same direction among two phases or more of the three-phases.

A setting and a scheme switch, as well as the non-directional OC element, provide the settings for the directional OC element: for example, the user can set the threshold value of the OC at stage 1 with the setting [**OC1-DT**] and **Forward** can be set for the scheme switch [**OC1-Dir**]. Setting of the sensing angle (θ) is configured by the setting [**OC1-Angle**] with the value of θ set in the range of 0–180°. Figure 3.1-4 shows an example of an angle and a characteristic set with θ.

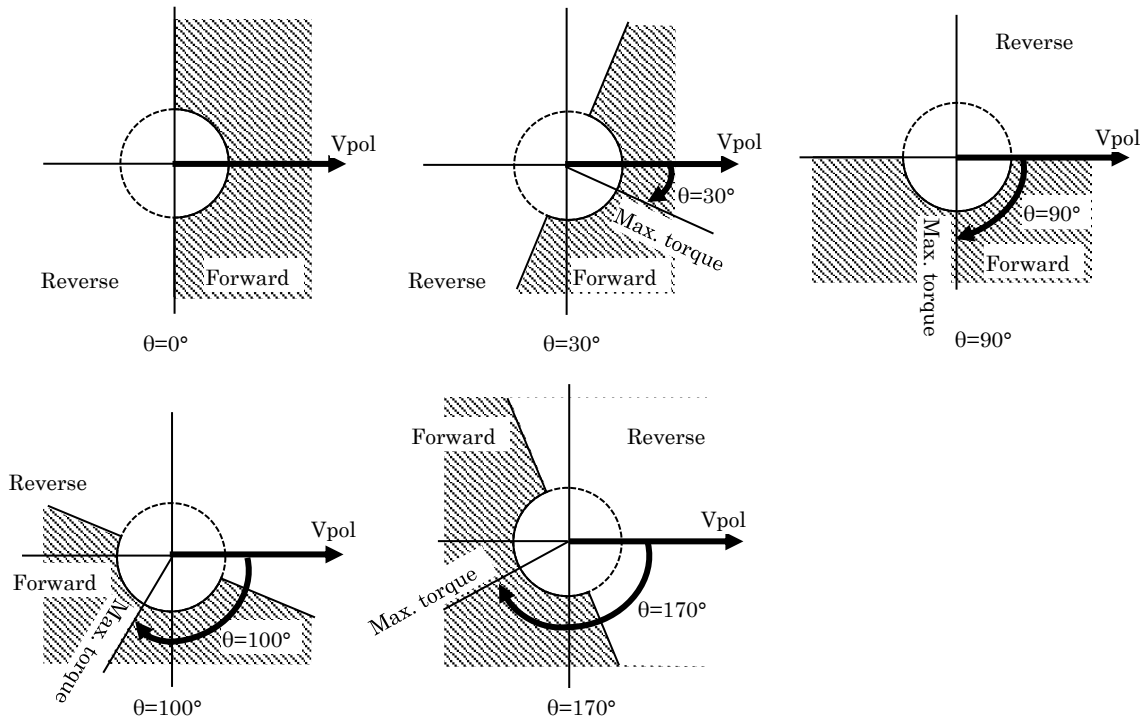


Figure 3.1-4 Examples of directional characteristic angle (θ)

(iii) Characteristic of directional OC in the reverse direction

The reverse characteristic is a mirror image of the forward characteristic. The setting and the scheme switch, as well as the setting of the directional OC element in the forward direction, provides the setting of the directional OC element in the reverse direction: for example, **Reverse** is set for the scheme switch [**OC1-Dir**] when the direction of the OC on stage 1 is considered.

3.1.2 Inverse definite mean time and definite time characteristic

The OC element monitors the currents; when one of the currents is beyond the threshold of operation, the OC element will operate within a period that is defined by the time characteristic feature. The user can choose the OC operate time delay characteristics, either dependent (inverse) time characteristic delay (i.e., IDMT) or independent (definite) time characteristic delay (i.e., DT). The operate time of the IDMT depends upon the level of the energizing current, and the operate time in the DT is a constant.

For the reset-time-delay in the IDMT, either inverse (dependent)-time-reset or definite (independent)-time-reset is characterized by setting..

The user can select which characteristic will be applied to each stage of the OC element by setting a scheme switch. We shall see the scheme switch later.

(i) DT characteristic

The operate time in the DT characteristic will be a constant time and is not affected by the level of current. The reset time is set to zero so that resetting is performed immediately. The user can set the operate time using a setting; it is discussed in in sections (v) and (vi).

(ii) IDMT characteristic

The operate time in the IDMT characteristic is inversely proportional to the level of the fault current. The user can determine the operate time from a preset curve. Ten characteristic curves are available; i.e. nine pre-installed curves covering IEC, IEEE, US and UK standard characteristic curves and one original (user programmable) characteristic curve for which the user can set the equation parameters. The IDMT curve equation and parameters will be explained in section (iii).

The reset time in the IDMT is user-selectable; either inverse-time-reset or definite-time-reset is selected. For the inverse-time-reset, the user can choose the reset time for the preset characteristic from six characteristic curves; i.e. IEEE and US standard five pre-installed characteristic curves and one user original characteristic curve where the user can set the equation parameters. The inverse-time-reset curve equation and parameters will be discussed

in section (v).

(iii) Operate time of IDMT

The operate time in the IDMT is defined by Equation (3.1-1). (ref. IEC 60255-151):

$$t(I) = TMS \times \left\{ \left[\frac{k}{\left(I/I_s \right)^{\alpha} - 1} \right] + c \right\} \qquad (3.1\text{-}1)$$

where:

t = operate time with constant current I (seconds),

I = operate (energizing) current (amperes),

Is = overcurrent setting (amperes),

TMS = time multiplier setting number,

k, α, c = constants defining curve.

The nine pre-programmed standard characteristic curves are defined in Table 3.1-3. In addition, one original (user-programmable) curve can be applied. One curve can be chosen for each OC stage. Figure 3.1-5 illustrates these characteristic curves. For example, the user should set one for the scheme switch [**OC1-Type**]. ("**IEC-NI**" is for IEC Normal Inverse characteristic; "**IEC-VI**" for IEC Very inverse; "**IEC-EI**" for IEC Extremely Inverse; "**UK-LTI**" for UK Long Time Inverse; "**IEEE-MI**" for IEEE Moderately Inverse; "**IEEE-VI**" for IEEE Very Inverse; "**IEEE-EI**" for IEEE Extremely Inverse; "**US-CO8**" for US CO8 Inverse; "**US-CO2**" for US CO2 Short Time Inverse, and "**Original**" for user-programmable characteristic.)

In the IDMT, the user can also program the characteristic using time-multiplier-setting (TMS) for the required operate time. For example, when the IEC characteristic is selected, the user can set the TMS value using the setting [**OC1-TMS-IEC**] (incidentally, the default value for the TMS is 1.00). The other TMSs are also available by the [**OC1-TMS-UK**], [**OC1-TMS-IEEE**], [**OC1-TMS-US**] and [**OC1-TMS-ORG**].

Table 3.1-3 Constants for IDMT

Curve type (IEC 60255-151)	Curve Description	k sec	α	c sec
A	IEC Normal Inverse (IEC-NI)	0.14	0.02	0
B	IEC Very Inverse (IEC-VI)	13.5	1	0
C	IEC Extremely Inverse (IEC-EI)	80	2	0
-	UK Long Time Inverse (UK-LTI)	120	1	0
D	IEEE Moderately Inverse (IEEE-MI)	0.0515	0.02	0.114
E	IEEE Very Inverse (IEEE-VI)	19.61	2	0.491
F	IEEE Extremely Inverse (IEEE-EI)	28.2	2	0.1217
-	US CO8 inverse (US-CO8)	5.95	2	0.18
-	US CO2 short time inverse (US-CO2)	0.02394	0.02	0.01694

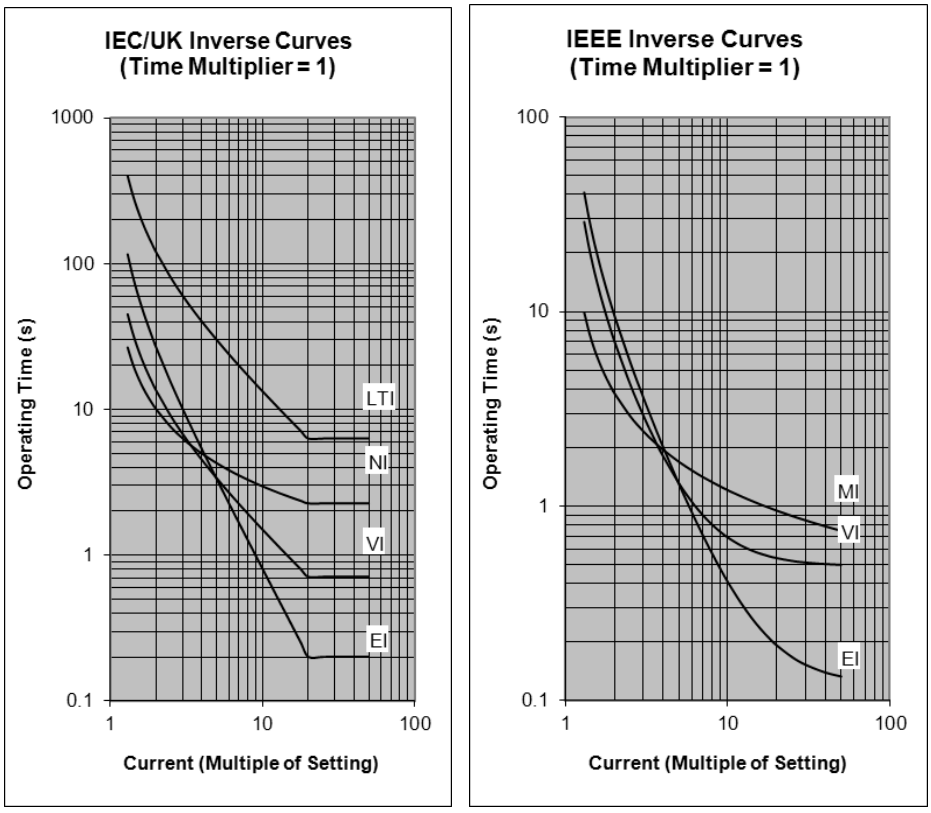


Figure 3.1-5 IDMT characteristic curves

(iv) Operate time of DT

The operate time in the DT is a constant.

(iv)-1 Time characteristic

The user should set **DT** for the scheme switches [**OC1-Type**]. The value of the required operate time is set for the setting [**TOC1**] in the range 0.00–300.00s.

(iv)-2 Instantaneous activation

The operate time of the instantaneous characteristic is achieved by setting zero for the [**TOC1**], but the instantaneous one can also obtained when the logic signal '1(High)' is programmed to be injected at PLC connection point "OC1_INST_OP".

(v) Reset time of IDMT

Programming the reset time characteristic is available for the IEEE standard, US standard and original (user-programmable) inverse-time-reset characteristic†. In the IEEE standard, for example, the user should set **DEP** for the scheme switch [**OC1-Rtype**]. The following equation defines the reset time for the inverse-time-reset characteristic. (ref. IEC 60255-151):

$$t(I) = RTMS \times \left[\frac{kr}{1 - \left(I / I_s \right)^{\beta}} \right] \qquad (3.1\text{-}2)$$

where,

t = time required for the element to reset fully after complete operation (seconds),

I = energizing current (amperes),

I_S = overcurrent setting (amperes),

RTMS = time multiplier setting for resetting,

kr = time required to reset fully after complete operation when the energizing current is zero (seconds),

ß = constants defining curve.

For setting the RTMS for the IEEE standard, the user can use the setting [**OC1-RTMS-IEEE**] (incidentally, the default value is 1.000). Similarly, setting [**OC1-RTMS-US**] and setting [**OC1-RTMS-ORG**] are provided for the US standard and the original, respectively (For more information w.r.t the value for kr and ß, see Table 3.1-4; Figure 3.1-6 shows the characteristic curves).

Table 3.1-4 Constants for inverse-time-reset characteristics

Curve Type IEC 60255-151	Curve Description	kr sec	ß
A	IEC Normal Inverse (IEC-NI‡)	N/A	N/A
B	IEC Very Inverse (IEC-VI‡)	N/A	N/A
C	IEC Extremely Inverse (IEC-EI‡)	N/A	N/A
-	UK Long Time Inverse (UK-LTI‡)	N/A	N/A
D	IEEE Moderately Inverse (IEEE-MI)	4.85	2
E	IEEE Very Inverse (IEEE-VI)	21.6	2
F	IEEE Extremely Inverse (IEEE-EI)	29.1	2
-	US CO8 inverse (US-CO8)	5.95	2
-	US CO2 short time inverse (US-CO2)	2.261	2

†Note:The user can set **DEF** for the scheme switch [**OC1-Rtype**] when the definite-time-reset characteristic is preferred. The definite-time-reset is available in all IDMTs (see Table 3.1-5). After that, the user should set an intentional delay reset time for the setting [**TOC1R**].

‡Note:The user should set **DEF** for the scheme switch [**OC1-Rtype**] when the IEC and the UK standards are selected.

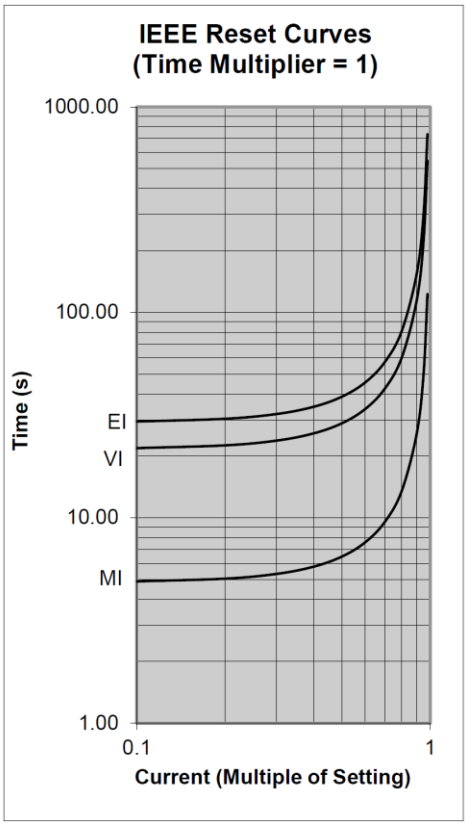


Figure 3.1-6 Inverse-time-reset characteristics curves

Figure 3.1-7 illustrates the effect of inverse-time-reset on the internal time delay counter. An object current (I), where I is greater than a setting (I_S) provides an energizing quantity for the function which continues to flow for a cumulative period causing the operation of the function. If the operating quantity falls below the I_S setting, the function will return to its reset state after the time t(I). The time t(I) is calculated using Equation (3.1-2).

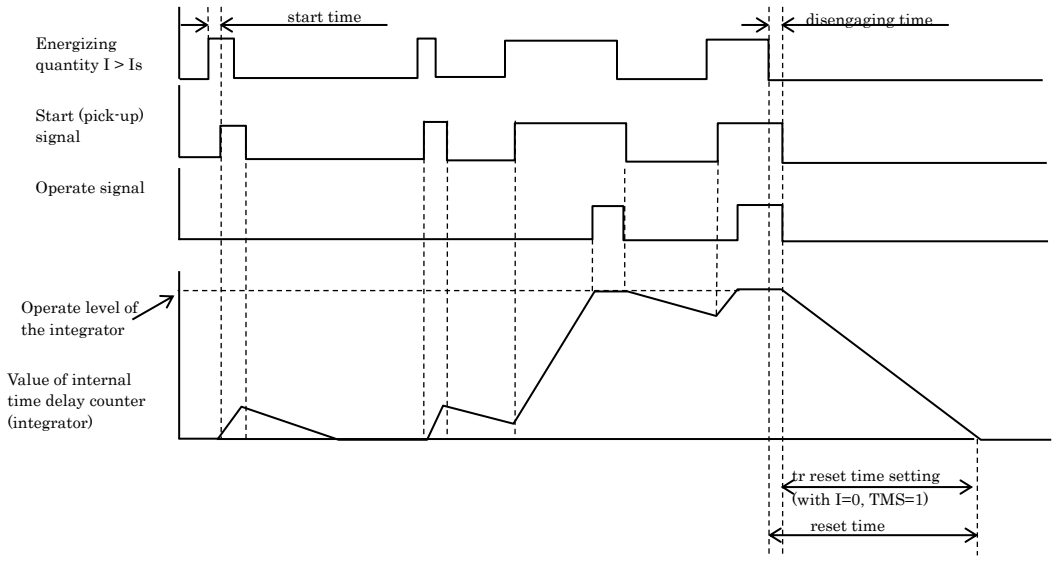


Figure 3.1-7 Inverse-time-reset characteristics

(vi) Reset time of DT

In the DT characteristic, the reset time is designed to be instant. Thus, the user has no points for the settings [**OC1-Rtype**] and [**TOC1R**].

(vii) Summary of OC operation

Table 3.1-5 shows the summary of OC operation.

Table 3.1-5 Type and standard board in the OC1 (A tick shows a selectable function)

Characteristics		DT	IDMT									
			IEC-NI	IEC-VI	IEC-EI	UK-LTI	IEEE-MI	IEEE-VI	IEEE-EI	US-CO2	US-CO8	Original
Scheme switch [OC1-Type]	DT	✓										
	IEC-NI		✓									
	IEC-VI			✓								
	IEC-EI				✓							
	UK LTI					✓						
	IEEE-MI						✓					
	IEEE-VI							✓				
	IEEE-EI								✓			
	US-CO2									✓		
	US-CO8										✓	
	Original											✓
Scheme switch [OC1-Rtype]	DEF	N.A	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	DEP	N.A					✓					
		N.A						✓				
		N.A							✓			
		N.A								✓		
		N.A									✓	
		N.A										✓

3.1.3 Threshold value for operation

The value of threshold current at which the OC element will pick-up is configured by settings; the settings [**OC1-IDMT**] and [**OC1-DT**] are provided for both the IDMT and DT characteristics. Note that the settings of the threshold levels are allowed to have distinct values in the respective OC elements. A rating current for the input is defined either 1A or 5A; the input rating is defined on a VCT. (For more information about the VCT, see Chapter *Technical description: Transformer module for AC analogue input*).

3.1.4 Reset Ratio

The ratio of the threshold current for pick-up to reset is applied using a setting; for example, the ratio for the OC1 element is set using the setting [**OC1-DPR**]. The reset ratios for the other OC elements are also provided.

3.1.5 Miscellaneous functions

(i) Trip mode

Every OC element has a selectable tripping mode; the mode is selected using a scheme switch. For the OC1 element, for example, a scheme switch [**OC1-OPMD**] is provided. When a trip is required for any faults that are detected, **3POR** (a fault occurs in one or more phases) is set for the scheme switch [**OC1-OPMD**]. Conversely, when a trip is only required for faults that occur in two or more phases, **2OUTOF3** (a fault occurs in two or more phases) is set for the scheme switch [**OC1-OPMD**].

Table 3.1-6 Fault type and tripping mode

Fault type			Setting [OC1-OPMD]	
Phase-A	Phase-B	Phase-C	3POR	2OUTOF3
X	–	–	✓	No trip
–	X	–	✓	No trip
–	–	X	✓	No trip
X	X	–	✓	✓
–	X	X	✓	✓
X	–	X	✓	✓
X	X	X	✓	✓

Note: A tick (✓) indicates that a trip is issued when faults are detected.
A mark (X) indicates the occurrence of a fault on a particular phase. A mark shown thus (–) indicates that no fault has occurred on that particular phase.

(ii) Blocking OC by ICD

The operation of each OC element can be blocked if the ICD function detects a second harmonic current caused by the magnetizing inrush current phenomenon when a transformer is energized. For example, for the OC1 element, the scheme switch [**OC1-2fBlk**] is provided, and **Block-3P** should be set when the user wishes to block all three-phases of the OC1 element when the second harmonic associated with the magnetizing inrush current is present. Alternatively, **Block-PerP** is set if blocking is just required for a single phase concerting to the phenomenon. **Non** is set for the scheme switch [**OC1-2fBlk**] as the default setting. For more information about the ICD function, see Chapter *Relay application: Inrush current detection function*.

(iii) Blocking OC by VTF

The operation of the OC element can be blocked by the voltage transformer failure (VTF) function via a scheme switch. For example, **Block** can be set for the scheme switch [**OC1-VTFBlk**] to block the operation of the OC1 element during a VTF condition. **Non** is set for the scheme switch [**OC1-VTFBlk**] as a default. For more information about the VTF, see Chapter *Relay application: VT failure detection*.

(iv) OC operation for auto-reclose

The OC element activates the auto-reclose (ARC) function. However, if for example ARC

is not required, **Block** is set for the scheme switch [**OC1-ARCBlk**]. **Block** is set for the scheme switch [**OC1-ARCBlk**] as a default.

(v) Signal of OC trip

When a user requires an alarm signal in place of the trip signal; for example, set **Alarm** for the scheme switch [**OC1-UseFor**]. **Trip** is set for the scheme switch [**OC1-UseFor**] for the normal trip operation.

3.1.6 Scheme logic

The scheme logic for both the non-directional and the directional OC1 element is illustrated in Figure 3.1-8; Figure 3.1-9 shows grouping commands for the trip circuit (TRC). Each phase of the OC1 element issues a pick-up when a current has been exceeded over the setting; then the pick-up signal is transferred to into the TRC as trip signals. (For more information, see Chapter *Relay application: Trip circuit function*)

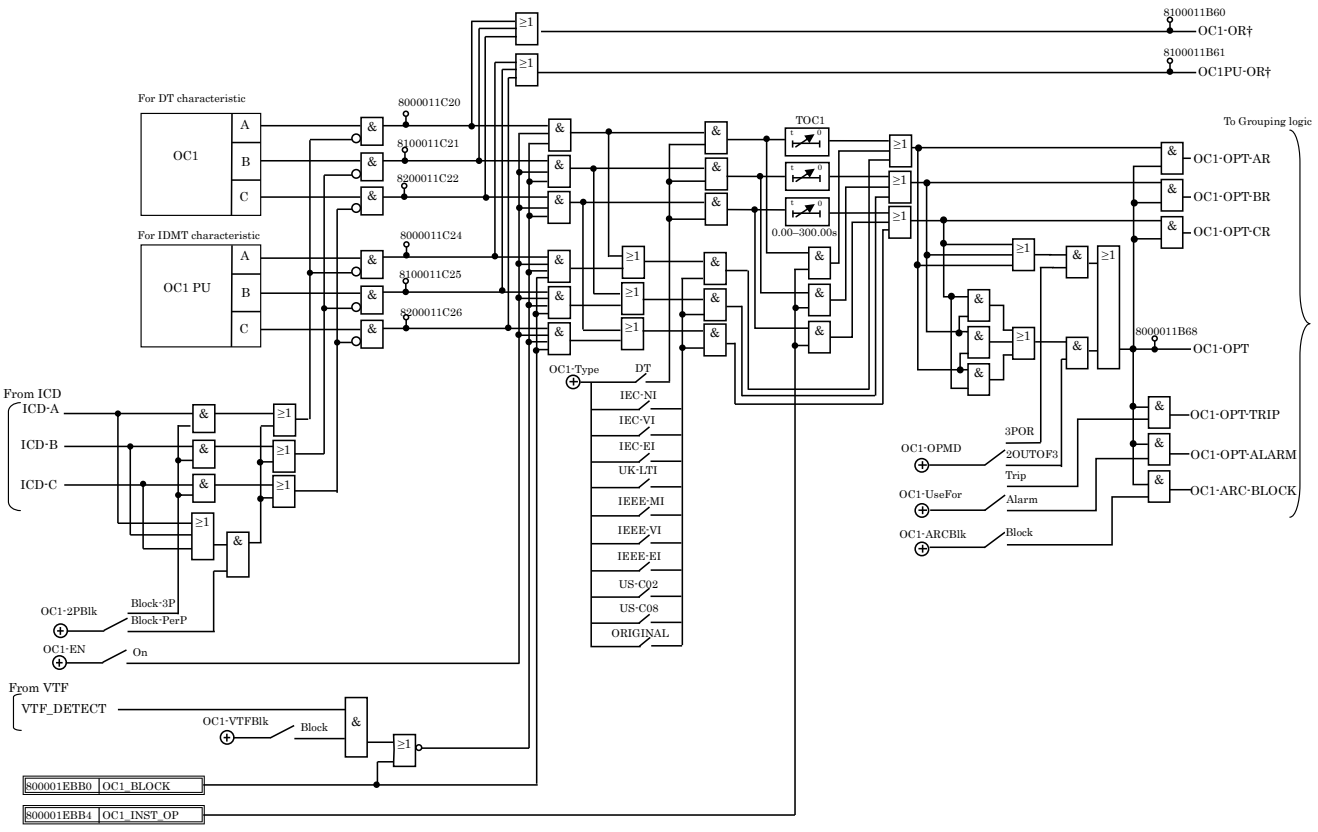


Figure 3.1-8 Scheme logic for the OC1

†Note:The presence of 'OC1-OR' and 'OC1PU-OR' signals depends on the operation characteristic defined with setting [**OC1_Type**], as shown in Table 3.1-7.

Table 3.1-7 Signal behaviors of PLC monitoring points 'OC1-OR' and 'OC1PU-OR'

PLC monitoring points	Setting [**OC1_Type**]

	DT	IEC-NT,VI,EI, UK-LTI, IEET-MI,VI,EI, US-CO2,CO8, ORIGINAL
OC1-OR	①	③
OC1PU-OR	②	④

①: A pick-up signal is generated instantly when the element operates.

②: No signal due that the PU element is killed. Use 'OC1-OR' in place of this.

③: A pick-up signal is generated, but delayed with the IDMT characteristic.

④: A pick-up signal is generated instantly.

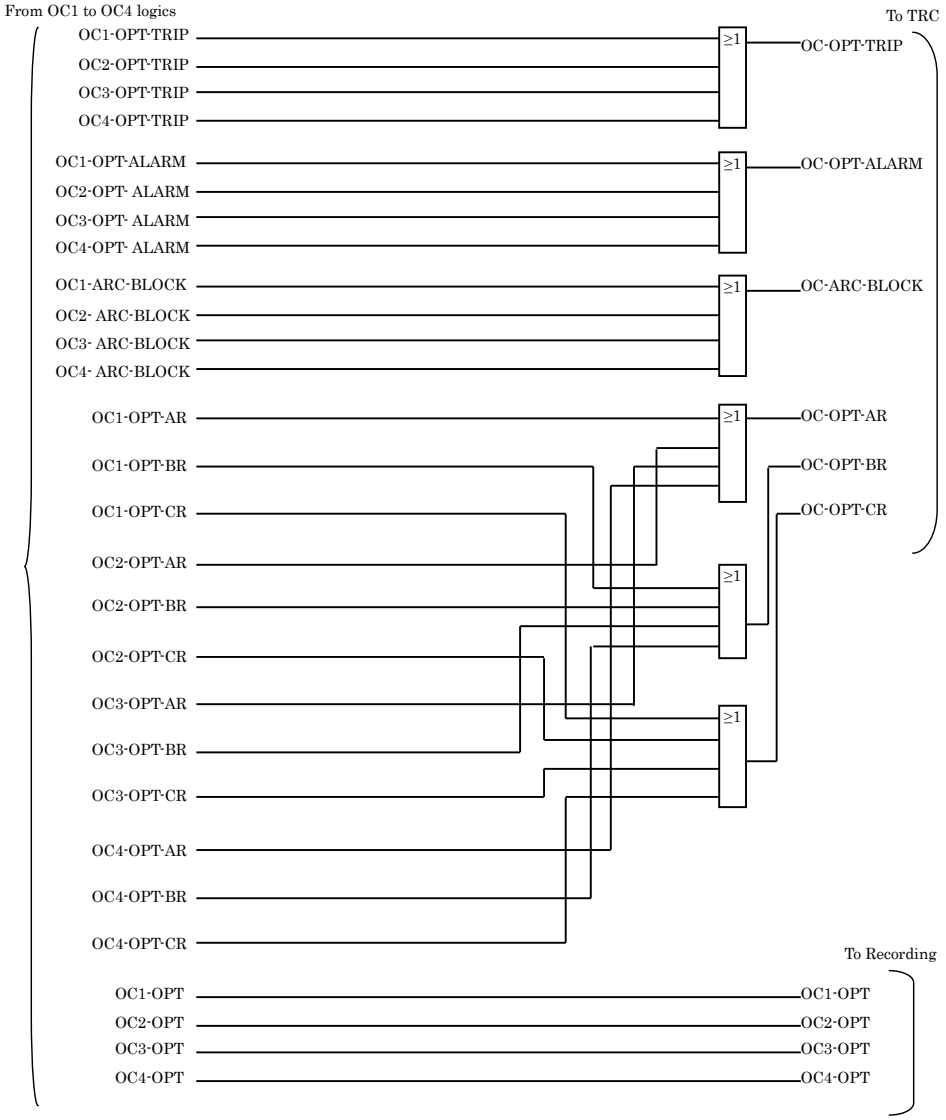


Figure 3.1-9 Grouping logic for TRC/Recording functions

3.1.7 Setting

Setting of OC (Function ID: 440001)

Setting item		Range		Units	Contents	Default setting value		Notes
		1A rating	5A rating			1A rating	5A rating	
Common	OC-Vpol	(1.0)		V	Polarizing voltage (fixed)	-----		
OC1	OC1-EN	Off / On		-	OC1 protection enable	Off		
	OC1-Dir	NonDir / Forward / Reverse		-	OC1 directional characteristic	NonDir		
	OC1-Angle	0 – 180		deg	OC1 directional characteristic angle	45		
	OC1-Type	DT / IEC-NI / IEC-VI / IEC-EI/ UK-LTI / IEEE-MI / IEEE-VI / IEEE-EI / US-CO2 / US-CO8 / Original		-	OC1 delay type	DT		
	OC1-DT	0.02 - 50.00	0.10 - 250.00	A	OC1 threshold (in DT mode)	1.00	5.00	
	OC1-IDMT	0.02 - 5.00	0.10 - 25.00	A	OC1 threshold (in IDMT mode)	1.00	5.00	
	OC1-DPR	10 – 100		%	OC1 drop-out/pick-up ratio	100		
	TOC1	0.00 - 300.00		s	OC1 operating delay time (in DT mode)	1.00		
	OC1-TMS-IEC	0.010 - 50.000		-	OC1 time multiplier for IEC inverse curve	1.000		
	OC1-TMS-UK	0.010 - 50.000		-	OC1 time multiplier for UK inverse curve	1.000		
	OC1-TMS-IEEE	0.010 - 50.000		-	OC1 time multiplier for IEEE inverse curve	1.000		
	OC1-TMS-US	0.010 - 50.000		-	OC1 time multiplier for US inverse curve	1.000		
	OC1-TMS-ORG	0.010 - 50.000		-	OC1 time multiplier for user-defined 'Original' inverse curve	1.000		
	OC1-Rtype	DEF / DEP		-	OC1 reset delay type	DEF		
	TOC1R	0.00 - 300.00		s	OC1 definite time reset delay	0.00		
	OC1-RTMS-IEEE	0.010 - 50.000		-	OC1 dependent reset time multiplier for IEEE inverse curve	1.000		
	OC1-RTMS-US	0.010 - 50.000		-	OC1 dependent reset time multiplier for US inverse curve	1.000		
	OC1-RTMS-ORG	0.010 - 50.000		-	OC1 dependent reset time multiplier for Original inverse curve	1.000		
	OC1-k	0.00000 - 500.00000		-	OC1 user original curve coefficient	0.00000		
	OC1-a	0.00000 - 10.00000		-	OC1 user original curve coefficient	0.00000		
	OC1-c	0.00000 - 10.00000		-	OC1 user original curve coefficient	0.00000		
	OC1-kr	0.00000 - 500.00000		-	OC1 user original curve coefficient	0.00000		
	OC1-b	0.00000 - 10.00000		-	OC1 user original curve coefficient	0.00000		
	OC1-2fBlk	Non / Block-3P / Block-PerP		-	OC1 operation block by 2f-detection	Non		
	OC1-VTFBlk	Non / Block		-	OC1 operation block by VTF	Non		
	OC1-OPMD	3POR / 2OUTOF3		-	OC1 operation mode	3POR		
	OC1-UseFor	Trip / Alarm		-	OC1 used for trip or alarm	Trip		
	OC1-ARCBlk	Non / Block		-	Autoreclose block by OC1	Block		
OC2	OC2-EN	Off / On		-	OC2 protection enable	Off		
	OC2-Dir	NonDir / Forward / Reverse		-	OC2 directional characteristic	NonDir		
	OC2-Angle	0 – 180		deg	OC2 directional characteristic angle	45		
	OC2-Type	DT / IEC-NI / IEC-VI / IEC-EI/ UK-LTI / IEEE-MI / IEEE-VI / IEEE-EI / US-CO2 / US-CO8 / Original		-	OC2 delay type	DT		
	OC2-DT	0.02 - 50.00	0.10 - 250.00	A	OC2 threshold (in DT mode)	1.00	5.00	
	OC2-IDMT	0.02 - 5.00	0.10 - 25.00	A	OC2 threshold (in IDMT mode)	1.00	5.00	
	OC2-DPR	10 - 100		%	OC2 drop-out/pick-up ratio	100		
	TOC2	0.00 - 300.00		s	OC2 operating delay time (in DT mode)	1.00		

Setting of OC (Function ID: 440001)

Setting item			Range		Units	Contents	Default setting value		Notes
			1A rating	5A rating			1A rating	5A rating	
		OC2-TMS-IEC	0.010 - 50.000		-	OC2 time multiplier for IEC inverse curve	1.000		
		OC2-TMS-UK	0.010 - 50.000		-	OC2 time multiplier for UK inverse curve	1.000		
		OC2-TMS-IEEE	0.010 - 50.000		-	OC2 time multiplier for IEEE inverse curve	1.000		
		OC2-TMS-US	0.010 - 50.000		-	OC2 time multiplier for US inverse curve	1.000		
		OC2-TMS-ORG	0.010 - 50.000		-	OC2 time multiplier for user-defined 'Original' inverse curve	1.000		
		OC2-Rtype	DEF / DEP		-	OC2 reset delay type	DEF		
		TOC2R	0.00 - 300.00		s	OC2 definite time reset delay	0.00		
		OC2-RTMS-IEEE	0.010 - 50.000		-	OC2 dependent reset time multiplier for IEEE inverse curve	1.000		
		OC2-RTMS-US	0.010 - 50.000		-	OC2 dependent reset time multiplier for US inverse curve	1.000		
		OC2-RTMS-ORG	0.010 - 50.000		-	OC2 dependent reset time multiplier for user-defined 'Original' inverse curve	1.000		
		OC2-k	0.00000 - 500.00000		-	OC2 user-defined 'original' curve coefficient	0.00000		
		OC2-a	0.00000 - 10.00000		-	OC2 user-defined 'original' curve coefficient	0.00000		
		OC2-c	0.00000 - 10.00000		-	OC2 user-defined 'original' curve coefficient	0.00000		
		OC2-kr	0.00000 - 500.00000		-	OC2 user-defined 'original' curve coefficient	0.00000		
		OC2-b	0.00000 - 10.00000		-	OC2 user-defined 'original' curve coefficient	0.00000		
		OC2-2fBlk	Non / Block-3P / Block-PerP		-	OC2 operation block by 2f-detection	Non		
		OC2-VTFBlk	Non / Block		-	OC2 operation block by VTF	Non		
		OC2-OPMD	3POR / 2OUTOF3		-	OC2 operation mode	3POR		
		OC2-UseFor	Trip / Alarm		-	OC2 used for trip or alarm	Trip		
		OC2-ARCBlk	Non / Block		-	Auto-reclose block by OC2	Block		
	OC3	OC3-EN	Off / On		-	OC3 protection enable	Off		
		OC3-Dir	NonDir / Forward / Reverse		-	OC3 directional characteristic	NonDir		
		OC3-Angle	0 - 180		deg	OC3 directional characteristic angle	45		
		OC3-Type	DT / IEC-NI / IEC-VI / IEC-EI/ UK-LTI / IEEE-MI / IEEE-VI / IEEE-EI / US-CO2 / US-CO8 / Original		-	OC3 delay type	DT		
		OC3-DT	0.02 - 50.00	0.10 - 250.00	A	OC3 threshold (in DT mode)	1.00	5.00	
		OC3-IDMT	0.02 - 5.00	0.10 - 25.00	A	OC3 threshold (in IDMT mode)	1.00	5.00	
		OC3-DPR	10 - 100		%	OC3 drop-out/pick-up ratio	100		
		TOC3	0.00 - 300.00		s	OC3 operating delay time (in DT mode)	1.00		
		OC3-TMS-IEC	0.010 - 50.000		-	OC3 time multiplier for IEC inverse curve	1.000		
		OC3-TMS-UK	0.010 - 50.000		-	OC3 time multiplier for UK inverse curve	1.000		
		OC3-TMS-IEEE	0.010 - 50.000		-	OC3 time multiplier for IEEE inverse curve	1.000		
		OC3-TMS-US	0.010 - 50.000		-	OC3 time multiplier for US inverse curve	1.000		
		OC3-TMS-ORG	0.010 - 50.000		-	OC3 time multiplier for user-defined 'Original' inverse curve	1.000		
		OC3-Rtype	DEF / DEP		-	OC3 reset delay type	DEF		
		TOC3R	0.00 - 300.00		s	OC3 definite time reset delay	0.00		
		OC3-RTMS-IEEE	0.010 - 50.000		-	OC3 dependent reset time multiplier for IEEE inverse curve	1.000		
		OC3-RTMS-US	0.010 - 50.000		-	OC3 dependent reset time multiplier for US inverse curve	1.000		
		OC3-RTMS-ORG	0.010 - 50.000		-	OC3 dependent reset time multiplier for user-defined 'Original' inverse curve	1.000		
		OC3-k	0.00000 - 500.00000		-	OC3 user-defined 'original' curve coefficient	0.00000		

Setting of OC (Function ID: 440001)

Setting item			Range		Units	Contents	Default setting value		Notes
			1A rating	5A rating			1A rating	5A rating	
		OC3-a	0.00000 - 10.00000		-	OC3 user-defined 'original' curve coefficient	0.00000		
		OC3-c	0.00000 - 10.00000		-	OC3 user-defined 'original' curve coefficient	0.00000		
		OC3-kr	0.00000 - 500.00000		-	OC3 user-defined 'original' curve coefficient	0.00000		
		OC3-b	0.00000 - 10.00000		-	OC3 user-defined 'original' curve coefficient	0.00000		
		OC3-2fBlk	Non / Block-3P / Block-PerP		-	OC3 operation block by 2f-detection	Non		
		OC3-VTFBlk	Non / Block		-	OC3 operation block by VTF	Non		
		OC3-OPMD	3POR / 2OUTOF3		-	OC3 operation mode	3POR		
		OC3-UseFor	Trip / Alarm		-	OC3 used for trip or alarm	Trip		
		OC3-ARCBlk	Non / Block		-	Autoreclose block by OC3	Block		
	OC4	OC4-EN	Off / On		-	OC4 protection enable	Off		
		OC4-Dir	NonDir / Forward / Reverse		-	OC4 directional characteristic	NonDir		
		OC4-Angle	0 - 180		deg	OC4 directional characteristic angle	45		
		OC4-Type	DT / IEC-NI / IEC-VI / IEC-EI/ UK-LTI / IEEE-MI / IEEE-VI / IEEE-EI / US-CO2 / US-CO8 / Original		-	OC4 delay type	DT		
		OC4-DT	0.02 - 50.00	0.10 - 250.00	A	OC4 threshold (in DT mode)	1.00	5.00	
		OC4-IDMT	0.02 - 5.00	0.10 - 25.00	A	OC4 threshold (in IDMT mode)	1.00	5.00	
		OC4-DPR	10 - 100		%	OC4 drop-out/pick-up ratio	100		
		TOC4	0.00 - 300.00		s	OC4 operating delay time (in DT mode)	1.00		
		OC4-TMS-IEC	0.010 - 50.000		-	OC4 time multiplier for IEC inverse curve	1.000		
		OC4-TMS-UK	0.010 - 50.000		-	OC4 time multiplier for UK inverse curve	1.000		
		OC4-TMS-IEEE	0.010 - 50.000		-	OC4 time multiplier for IEEE inverse curve	1.000		
		OC4-TMS-US	0.010 - 50.000		-	OC4 time multiplier for US inverse curve	1.000		
		OC4-TMS-ORG	0.010 - 50.000		-	OC4 time multiplier for user-defined 'Original' inverse curve	1.000		
		OC4-Rtype	DEF / DEP		-	OC4 reset delay type	DEF		
		TOC4R	0.00 - 300.00		s	OC4 definite time reset delay	0.00		
		OC4-RTMS-IEEE	0.010 - 50.000		-	OC4 dependent reset time multiplier for IEEE inverse curve	1.000		
		OC4-RTMS-US	0.010 - 50.000		-	OC4 dependent reset time multiplier for US inverse curve	1.000		
		OC4-RTMS-ORG	0.010 - 50.000		-	OC4 dependent reset time multiplier for user-defined 'Original' inverse curve	1.000		
		OC4-k	0.00000 - 500.00000		-	OC4 user-defined 'original' curve coefficient	0.00000		
		OC4-a	0.00000 - 10.00000		-	OC4 user-defined 'original' curve coefficient	0.00000		
		OC4-c	0.00000 - 10.00000		-	OC4 user-defined 'original' curve coefficient	0.00000		
		OC4-kr	0.00000 - 500.00000		-	OC4 user-defined 'original' curve coefficient	0.00000		
		OC4-b	0.00000 - 10.00000		-	OC4 user-defined 'original' curve coefficient	0.00000		
		OC4-2fBlk	Non / Block-3P / Block-PerP		-	OC4 operation block by 2f-detection	Non		
		OC4-VTFBlk	Non / Block		-	OC4 operation block by VTF	Non		
		OC4-OPMD	3POR / 2OUTOF3		-	OC4 operation mode	3POR		
		OC4-UseFor	Trip / Alarm		-	OC4 used for trip or alarm	Trip		
		OC4-ARCBlk	Non / Block		-	Auto-reclose block by OC4	Block		

3.1.8 Data ID

◆ Signal monitoring points

OC(Function ID: 440001)

Element ID	Name	Description
8000011C20	OC1-A	OC1 relay element operated (phase-A)
8100011C21	OC1-B	OC1 relay element operated (phase-B)
8200011C22	OC1-C	OC1 relay element operated (phase-C)
8000011B60	OC1-OR	OC1 relay element operated (3-phases OR)
8000011C24	OC1PU-A	OC1 relay operation level pick up (phase-A)
8100011C25	OC1PU-B	OC1 relay operation level pick up (phase-B)
8200011C26	OC1PU-C	OC1 relay operation level pick up (phase-C)
8000011B61	OC1PU-OR	OC1 relay operation level pick up (3-phases OR)
8000011B62	OC1-OPT-A	OC1 protection operated (phase-A)
8100011B63	OC1-OPT-B	OC1 protection operated (phase-B)
8200011B64	OC1-OPT-C	OC1 protection operated (phase-C)
8000011B68	OC1-OPT	OC1 protection operated
8400021C20	OC2-A	OC2 relay element operated (phase-A)
8500021C21	OC2-B	OC2 relay element operated (phase-B)
8600021C22	OC2-C	OC2 relay element operated (phase-C)
8100021B60	OC2-OR	OC2 relay element operated (3-phases OR)
8400021C24	OC2PU-A	OC2 relay operation level pick up (phase-A)
8500021C25	OC2PU-B	OC2 relay operation level pick up (phase-B)
8600021C26	OC2PU-C	OC2 relay operation level pick up (phase-C)
8100021B61	OC2PU-OR	OC2 relay operation level pick up (3-phases OR)
8400021B62	OC2-OPT-A	OC2 protection operated (phase-A)
8500021B63	OC2-OPT-B	OC2 protection operated (phase-B)
8600021B64	OC2-OPT-C	OC2 protection operated (phase-C)
8100021B68	OC2-OPT	OC2 protection operated
8800031C20	OC3-A	OC3 relay element operated (phase-A)
8900031C21	OC3-B	OC3 relay element operated (phase-B)
8A00031C22	OC3-C	OC3 relay element operated (phase-C)
8200031B60	OC3-OR	OC3 relay element operated (3-phases OR)
8800031C24	OC3PU-A	OC3 relay operation level pick up (phase-A)
8900031C25	OC3PU-B	OC3 relay operation level pick up (phase-B)
8A00031C26	OC3PU-C	OC3 relay operation level pick up (phase-C)
8200031B61	OC3PU-OR	OC3 relay operation level pick up (3-phases OR)
8800031B62	OC3-OPT-A	OC3 protection operated (phase-A)
8900031B63	OC3-OPT-B	OC3 protection operated (phase-B)
8A00031B64	OC3-OPT-C	OC3 protection operated (phase-C)
8200031B68	OC3-OPT	OC3 protection operated
8C00041C20	OC4-A	OC4 relay element operated (phase-A)
8D00041C21	OC4-B	OC4 relay element operated (phase-B)
8E00041C22	OC4-C	OC4 relay element operated (phase-C)
8300041B60	OC4-OR	OC4 relay element operated (3-phases OR)
8C00041C24	OC4PU-A	OC4 relay operation level pick up (phase-A)
8D00041C25	OC4PU-B	OC4 relay operation level pick up (phase-B)
8E00041C26	OC4PU-C	OC4 relay operation level pick up (phase-C)

◆ Signal monitoring points

OC(Function ID: 440001)

Element ID	Name	Description
8300041B61	OC4PU-OR	OC4 relay operation level pick up (3-phases OR)
8C00041B62	OC4-OPT-A	OC4 protection operated (phase-A)
8D00041B63	OC4-OPT-B	OC4 protection operated (phase-B)
8E00041B64	OC4-OPT-C	OC4 protection operated (phase-C)
8300041B68	OC4-OPT	OC4 protection operated

◆ Connection point in PLC logic

OC(Function ID: 440001)

Element ID	Name	Description
800001EBB0	OC1_BLOCK	OC1 protection block command
810002EBB1	OC2_BLOCK	OC2 protection block command
820003EBB2	OC3_BLOCK	OC3 protection block command
830004EBB3	OC4_BLOCK	OC4 protection block command
800001EBB4	OC1_INST_OP	OC1 protection instant operation command
810002EBB5	OC2_INST_OP	OC2 protection instant operation command
820003EBB6	OC3_INST_OP	OC3 protection instant operation command
830004EBB7	OC4_INST_OP	OC4 protection instant operation command

3.1.9 PLC driver

◆ Connection point at PLC Driver

PLC_DRV (Function ID: 230301) to OC(Function ID: 440001)

PLC Driver	Element ID	to	Destination	PLC connection point
PMX3_0_0	8810001BB0	→	OC1_BLOCK	800001EBB0
PMX3_0_1	8910001BB1	→	OC2_BLOCK	810002EBB1
PMX3_0_2	8A10001BB2	→	OC3_BLOCK	820003EBB2
PMX3_0_3	8B10001BB3	→	OC4_BLOCK	830004EBB3
PMX3_0_4	8C10001BB4	→	OC1_INST_OP	800001EBB4
PMX3_0_5	8D10001BB5	→	OC2_INST_OP	810002EBB5
PMX3_0_6	8E10001BB6	→	OC3_INST_OP	820003EBB6
PMX3_0_7	8F10001BB7	→	OC4_INST_OP	830004EBB7

3.2 Earth fault protection (EF)

The earth fault protection (EF) function has four stages (elements); each element can have either a directional characteristic or non-directional characteristic.

To simplify the description, only EF1 is discussed but is applicable to the other EFs; hence, read the expression for EF1 as EF2, EF3 and EF4 at each EF stage unless a special explanation or instruction has been provided.

Note: The implementation of the feature depends on the selection of both the hardware and the software. Note that the feature is not supplied for the several models; hence, the user has to check the implementation for the model. Locate the ordering number and check it at the "G&T position" referring to the comparison table below. For more information, see *Appendix: Ordering*.

Table 3.2-1 Comparative table in respective ordering numbers

Sec.	Feature	Ordering No. at "G&T"					
		BCU			BCPU		IFU
		11	13	1F	2C	2N	19
–	Main features	NA	NA	NA	✓	✓	NA
–	Number of stages	NA	NA	NA	4	4	NA
3.2.9	PLC driver	NA	NA	NA	✓	✓	NA

✓: Applicable NA: Not applicable

3.2.1 Relay polarity

The user can choose either non-directional EF or directional EF for each EF stage. In addition, the user can further select either the forward or the reverse for each of the directional EF elements selected.

(i) Characteristic of non-directional EF

The characteristic of the non-directional type EF function is a circle at the origin. A setting and a scheme switch is used to configure each non-directional EF element; i.e., the user can set the threshold value of the non-directional EF element for stage1 using setting [**EF1-DT**], provided time characteristic is required for define time delay (DT) described in section 3.2.2(i). The user should set **NonDir** for the scheme switch [**EF1-Dir**].

(ii) Characteristic of directional-EF in the forward direction

As shown in Figure 3.2-1, the characteristic of the directional-EF elements in the forward direction is a semi-circle based upon the border-line; the hatched area shows the operating region of the directional-EF element.

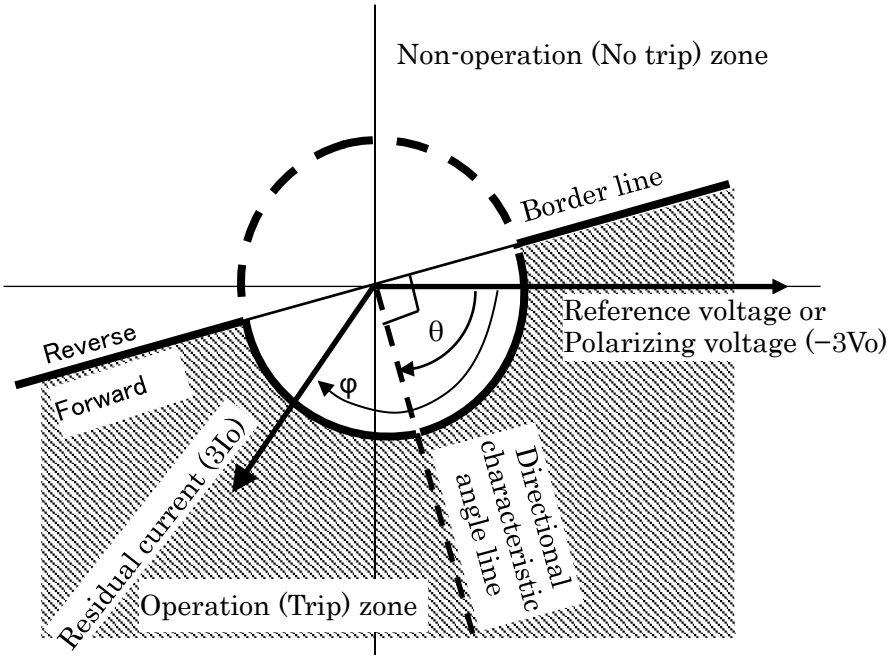


Figure 3.2-1 Characteristic of the directional-EF element in the forward direction

Note: Directional characteristic angle (θ) forms the angle between the reference quantity and the directional characteristic angle line. The half plane represents the zone of operation bordered on one side by the border line and extending in the direction that contains both the reference (polarizing) and operating quantities.

A setting and a scheme switch, as well as the non-directional EF element, provide the settings for the directional EF element. For example, the user can set the threshold value (I_{EF}) for stage 1 with the setting [**EF1-DT**]; **Forward** can be set for the scheme switch [**EF1-Dir**].

Setting of the sensing angle (θ) is configured by the setting [**EF1-Angle**] with the value of θ set in the range of 0–180°. Figure 3.2-2 shows an example of an angle and a characteristic using the θ.

The operation of the EF element is based upon the following equation.

$$3I_0 \geq I_{EF} \quad (3.2\text{-}1)$$

$$3I_0 \times \cos(\varphi - \theta) \geq 0 \quad (3.2\text{-}2)$$

$$3V_0 \geq EF_Vpol \quad (3.2\text{-}3)$$

where

3Io = residual current

3Vo = residual voltage

−3Vo = reference voltage (or polarizing voltage)

φ= lagging angle

θ = EF setting angle

I_{EF} = Setting value of the EF element ([**EF1-DT**] and the others)

EF_Vpol = Setting value of the polarizing voltage ([**EF-Vpol**])

Note: In the case of an internal fault, the phase angle is equal to the angle of the zero-sequence impedance of the system, in a directly-earthed system this value is in the range of approximately 50° to 90°. The sensing angle θ of the EF element can be set between 0° to 180°. The minimum voltage necessary to maintain directionality can be set from 0.5 to 100.0 V.

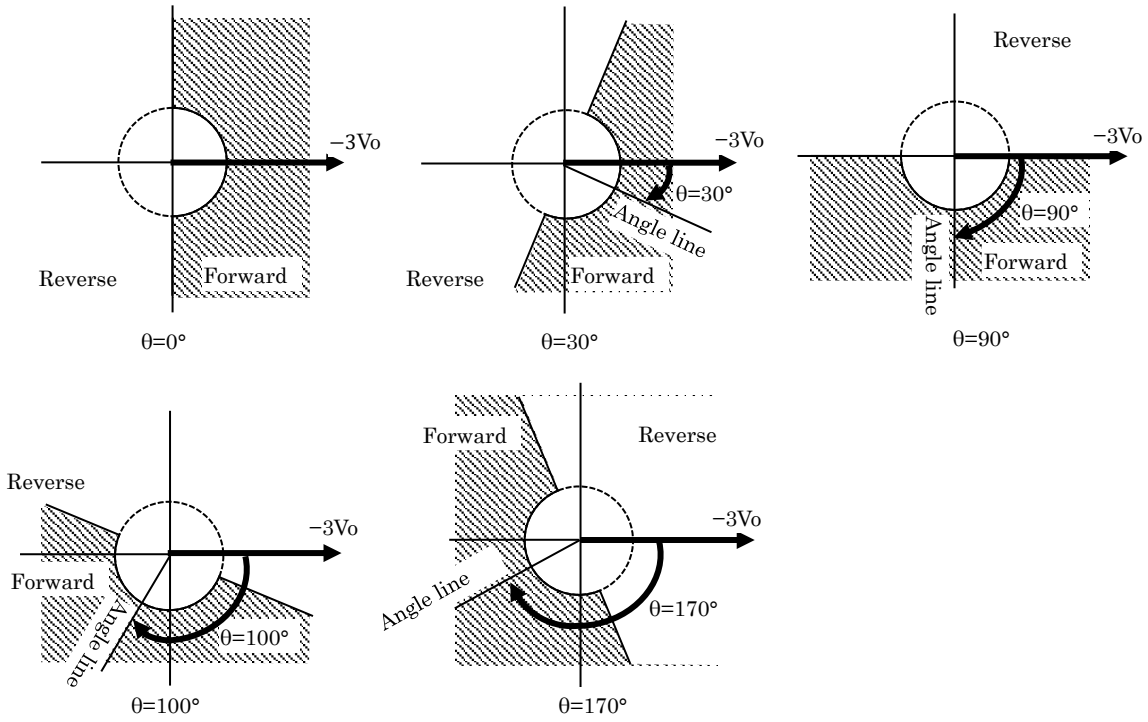


Figure 3.2-2 Examples of directional characteristic angle (θ)

(iii) Characteristic of directional EF in the reverse direction

The reverse characteristic is a mirror image of the forward characteristic. The setting and the scheme switch, in addition to providing the setting of the directional EF element in the forward direction, provides the setting of the directional EF element in the reverse direction: for example, **Reverse** is set for the scheme switch [**EF1-Dir**] when the direction of the EF element for stage 1 is considered.

3.2.2 Inverse time and definite time delay characteristic

The EF element monitors the earth-fault currents; when one of the currents is beyond the threshold for the operation, the EF element will operate within a period that is defined by the time characteristic feature. The user can choose the EF operate time delay characteristics, either dependent (inverse) time characteristic delay (i.e., IDMT) or independent (definite) time characteristic delay (i.e., DT). The operate time of the IDMT depends upon the level of the energizing current, and the operate time in the DT is a constant.

For the reset time delay in the IDMT, either inverse(dependent)-time-reset or definite(independent)-time-reset is characterized by the setting.

The user can select which characteristic will be applied to each stage of the EF element by setting a scheme switch. We shall see the scheme switches later.

(i) DT characteristic

The operate time in the DT characteristic will be a constant time and is not affected by the level of current. The reset time is set to zero so that resetting is performed immediately. The user can set the operate time using a setting; it is discussed in section (iv).

(ii) IDMT characteristic

The operate time in the IDMT characteristic is inversely proportional to the level of the fault current. The user can choose the operate time from a preset curve. Ten characteristic curves are available; i.e. nine pre-installed curves covering IEC, IEEE, US and UK standard characteristic curves and one original (user programmable) characteristic curve for which the user can set the equation parameters. The IDMT curve equation and parameters will be explained in section (iii).

The reset time of the IDMT is user selectable; either inverse-time-reset or definite-time-reset is selected. For the inverse-time-rest, the user can choose the reset time for the preset characteristic from six characteristic curves; i.e. IEEE and US standard five pre-installed characteristic curves and one user original characteristic carver where the user can set the equation parameters. The inverse-time-reset curve equation and parameters will be discussed in section (v).

(iii) Operate time of IDMT

The dependent time in the IDMT is defined by Equation (3.2-4). (ref IEC 60255-151):

$$t(I) = TMS \times \left\{ \left[\frac{\mathrm{k}}{\left({}^{\mathrm{I}}/_{\mathrm{I_s}} \right)^{\alpha} - 1} \right] + \mathrm{c} \right\} \qquad (3.2\text{-}4)$$

where:

t = operating time for constant current I (seconds),

I = energizing current (amperes),

Is = earth fault current setting (amperes),

TMS = time multiplier setting,

k, α, c = constants defining curve.

The nine pre-programmed standard characteristic curve are defined in Table 3.2-2. In addition, one original (user-programmable) curve can be applied. One curve can be chosen for each EF stage. Figure 3.2-3 illustrates these characteristic curves. For example, the user should set one for the scheme switches [**EF1-Type**]. (That is, "**IEC-NI**" is for IEC Normal Inverse, "**IEC-VI**" for IEC Very Inverse, "**IEC-EI**" for IEC Extremely Inverse, "**UK-LTI**" for UK Long Time Inverse, "**IEEE-MI** " for IEEE Moderately Inverse, "**IEEE-VI**" for IEEE Very Inverse, "**IEEE-EI**" for IEEE Extremely Inverse, "**US-CO2**" for US CO2 short time inverse, "**US-CO8**" for US CO8 inverse, and "**Original**" for user-programmable characteristic.)

In the IDMT operation, the user can also program the characteristic using time-multiplier-setting (TMS) for the required operate time. For example, the IEC characteristic is selected, the user can set the TMS value using the setting [**EF1-TMS-IEC**] (incidentally, the default value of the TMS is 1.00). The other TMSs are also available by the [**EF1-TMS-UK**], [**EF1-TMS-IEEE**], [**EF1-TMS-US**] and [**EF1-TMS-ORG**].

Table 3.2-2 Constants for IDMT

Curve type (IEC 60255-151)	Curve Description	k	α	c
A	IEC Normal Inverse (IEC-NI)	0.14	0.02	0
B	IEC Very Inverse (IEC-VI)	13.5	1	0
C	IEC Extremely Inverse (IEC-EI)	80	2	0
-	UK Long Time Inverse (UK-LTI)	120	1	0
D	IEEE Moderately Inverse (IEEE-MI)	0.0515	0.02	0.114
E	IEEE Very Inverse (IEEE-VI)	19.61	2	0.491
F	IEEE Extremely Inverse (IEEE-EI)	28.2	2	0.1217
-	US CO8 inverse (US-CO8)	5.95	2	0.18
-	US CO2 short time inverse (US-CO2)	0.02394	0.02	0.01694

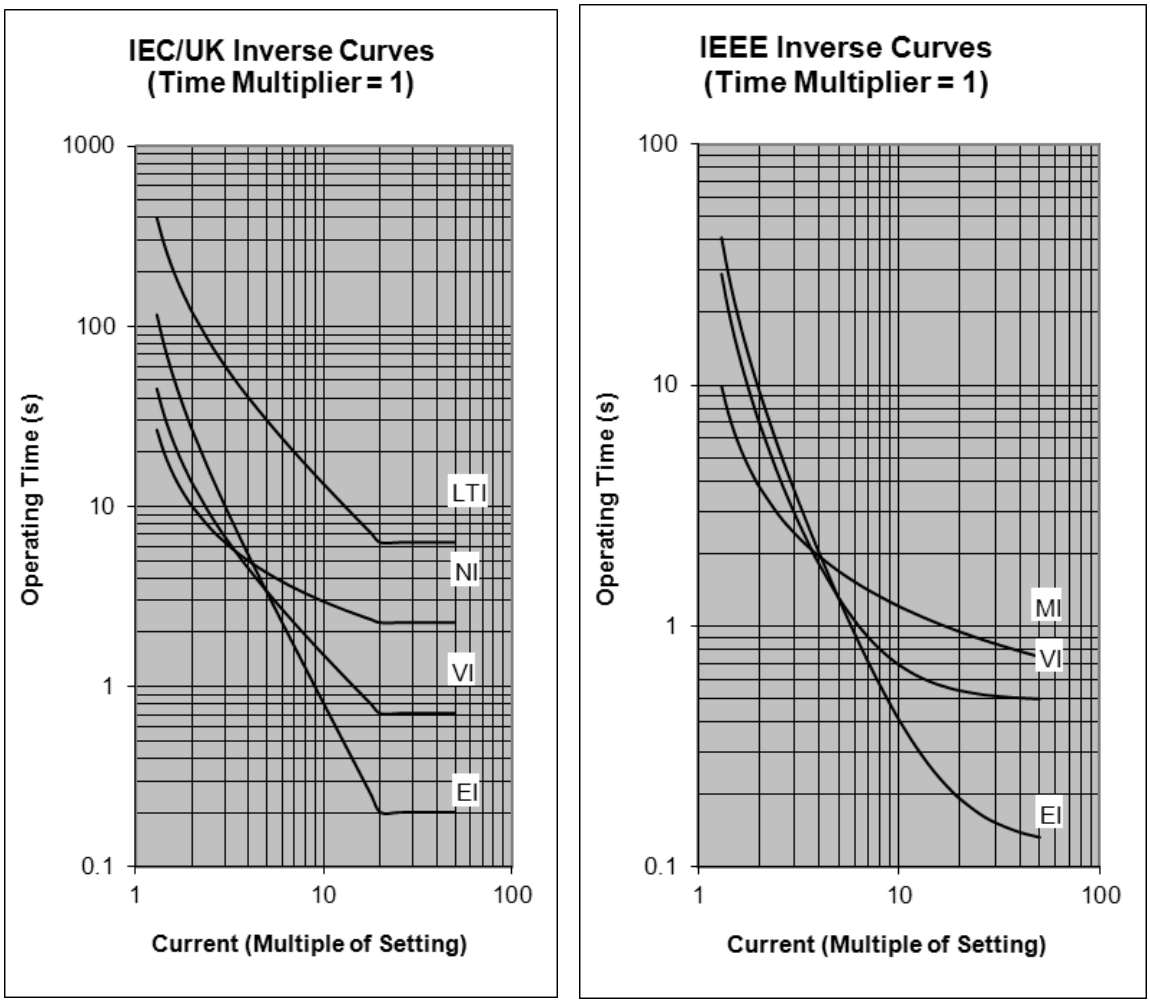


Figure 3.2-3 IDMT Characteristics curves

(iv) Operate time of DT

The operate time in the DT is a constant.

(iv)-1 Time characteristic

The user should set **DT** for the scheme switch [**EF1-Type**]. The value of the required operate time is set for the setting [**TEF1**] in the range 0.00–300.00s.

(iv)-2 Instantaneous activation

The instantaneous operation characteristic is achieved by setting zero for the [**TEF1**], but the instantaneous one can be also obtained when the logic signal '1(High)" is programmed to be injected at the PLC connection point "EF1_INST_OP".

(v) Reset time for IDMT

Programming the reset time characteristic is available for the IEEE standard, US standard and original (user-programmable) dependent time characteristic†. In the IEEE standard, for

example, the user should set **DEP** for the scheme switch [**EF1-Rtype**]. The following equation defines the reset time for the inverse-time-reset characteristic (ref. IEC 60255-151):

$$t(\mathrm{I}) = RTMS \times \left[\frac{\mathrm{kr}}{1 - \left({}^{\mathrm{I}}/_{\mathrm{I_s}} \right)^{\beta}} \right] \qquad (3.2\text{-}2)$$

where:

t = time required for the element to reset fully after complete operation (seconds),

I = energizing current (amperes),

Is = earth fault current setting (amperes),

kr = time required to reset fully after complete operation when the energizing current is zero

RTMS = time multiplier setting for resetting.

ß = constants defining curve.

For setting the RTMS for the IEEE standard, the user can use setting [**EF1-RTMS-IEEE**] (incidentally, the default value is 1.000). Similarly, settings [**EF1-RTMS-US**] and [**EF1-RTMS-ORG**] are provided for the US standard and the original, respectively (For more information w.r.t the values for the kr and ß, see Table 3.2-3; Figure 3.2-4 shows the characteristic curves).

Table 3.2-3 Constants for inverse-time-reset characteristics

Curve Type IEC 60255-151	Curve Description	kr sec	ß
A	IEC Normal Inverse (IEC-NI‡)	N/A	N/A
B	IEC Very Inverse (IEC-VI‡)	N/A	N/A
C	IEC Extremely Inverse (IEC-EI‡)	N/A	N/A
-	UK Long Time Inverse (UK-LTI‡)	N/A	N/A
D	IEEE Moderately Inverse (IEEE-MI)	4.85	2
E	IEEE Very Inverse (IEEE-VI)	21.6	2
F	IEEE Extremely Inverse (IEEE-EI)	29.1	2
-	US CO8 inverse (US-CO8)	5.95	2
-	US CO2 short time inverse (US-CO2)	2.261	2

†Note: **DEF** is set for scheme switch [**EF1-Rtype**] when the definite-time-reset characteristic is preferred. The definite-reset-time characteristic is available in all IDMTs characteristic (See Table 3.2-4). After that, the user should set an intentional delay reset time for the setting [**TEF1R**].

‡Note: The user should set **DEF** for scheme switch [**EF1-Rtype**] when the IEC and the UK standard is selected.

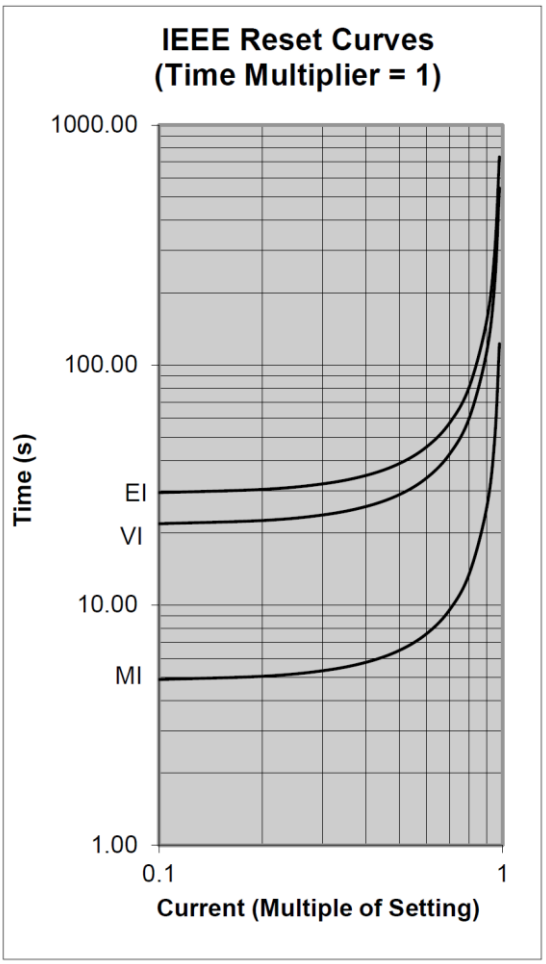


Figure 3.2-4 Inverse-time-reset characteristics curves

Figure 3.2-5 illustrates the effect of invers-time-reset on the internal time delay counter. An object current (I), where I is greater than a setting (I_S) provides an energizing quantity for the function which continues to flow for a cumulative period causing the operation of the function. If the operating quantity falls below the value of I_S setting, the function will return to its reset state after time t(I). Time t(I) is calculated using equation (3.2-2).

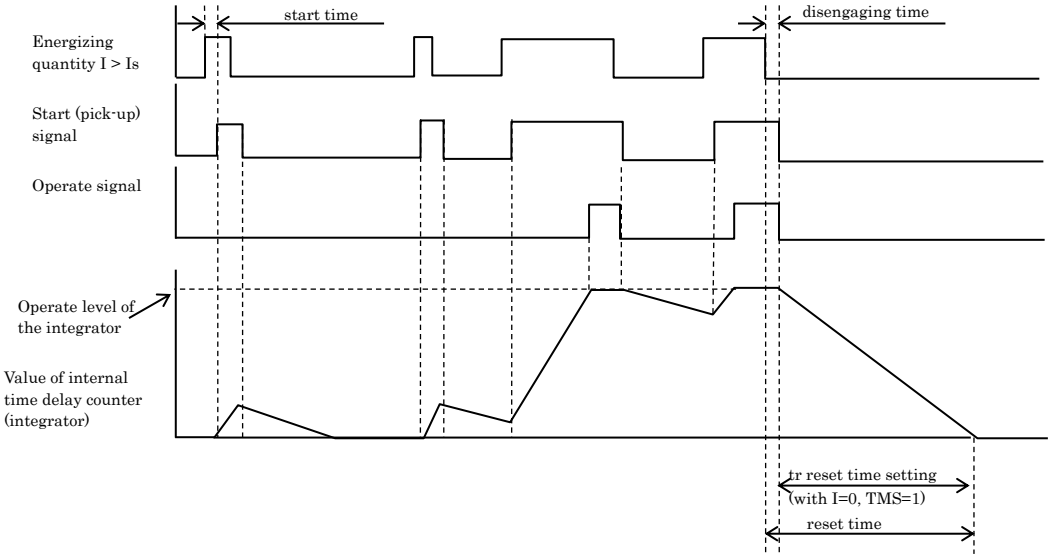


Figure 3.2-5 Inverse-time-reset characteristics

(vi) Reset time of DT

In the DT characteristic, the reset time is designed to be instant. Thus, the user has no points for settings [**EF1-Rtype**] and [**TEF1R**].

(vii) Summary of EF operation

Table 3.2-4 shows a summary for EF operation.

Table 3.2-4 Type and standard board in the EF (A tick represents a selectable function)

Characteristics		DT	IDMT									
			IEC-NI	IEC-VI	IEC-EI	UK-LTI	IEEE-MI	IEEE-VI	IEEE-EI	US-CO2	US-CO8	Original
Scheme switch [EF1-Type]	DT	✓										
	IEC-NI		✓									
	IEC-VI			✓								
	IEC-EI				✓							
	UK LTI					✓						
	IEEE-MI						✓					
	IEEE-VI							✓				
	IEEE-EI								✓			
	US-CO2									✓		
	US-CO8										✓	
	Original											✓
Scheme switch [EF1-Rtype]	DEF	N.A	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	DEP	N.A					✓					
		N.A						✓				
		N.A							✓			
		N.A								✓		
		N.A									✓	
		N.A										✓

3.2.3 Threshold level for operation

The value of threshold current at which the EF (I_{EF}) element will pick-up is configured by settings; the settings [**EF1-IDMT**] and [**EF1-DT**] are provided for both the IDMT and the DT characteristic. Note that the settings of the threshold levels are allowed to have distinct values in the respective EF elements. A rating current for the input is defined either 1A or 5A; the input rating is defined on a VCT. (For more information about the VCT, see Chapter *Technical description: Transformer module for AC analogue input*).

3.2.4 Reset Ratio

The ratio of the threshold current for pick-up to reset is applied using a setting; for example, the ratio for the EF1 element is set using the setting [**EF1-DPR**]. The reset ratios for the other EF elements are also provided.

3.2.5 Miscellaneous functions

(i) Blocking EF by ICD

The operation of each EF element can be blocked if the ICD function detects a second harmonic current caused by the magnetizing inrush current phenomenon when a transformer is energized. For example, for the EF1 element, the scheme switch [**EF1-2fBlk**] is provided, and **Block** should be set when the user wishes to block the EF1 element when the second harmonic

associated with magnetizing inrush is present. **Non** is set for the scheme switch [**EF1-2fBlk**] as the default setting. For more information about the ICD function, see Chapter *Relay application: Inrush current detection function*.

(ii) Blocking EF by VTF

The operation of the EF element can be blocked by the voltage transformer failure (VTF) function via a scheme switch. For example, **Block** is set for the scheme switch [**EF1-VTFBlk**] to block the operation of the EF1 element during a VTF condition. **Non** is set for the scheme switch [**EF1-VTFBlk**] as a default.

(iii) Blocking EF by CTF

The operation of the EF element can be blocked by the current transformer failure (CTF) function via a scheme switch. For example, **Block** is set for the scheme switch [**EF1-CTFBlk**] to block the operation of the EF1 element during a CTF condition. **Non** is set for the scheme switch [**EF1-CTFBlk**] as a default.

(iv) EF operation for autoreclose

The EF element activates the auto-reclose (ARC) function. However, if ARC is not required, **Block** is set for the scheme switch [**EF1-ARCBlk**]. **Block** is set for the scheme switch [**EF1-ARCBlk**] as a default.

(v) Signal of EF trip

When a user requires an alarm signal in place of the trip signal; for example, set **Alarm** for the scheme switch [**EF1-UseFor**]. **Trip** is set for the scheme switch [**EF1-UseFor**] for the normal trip operation.

3.2.6 Scheme logic

The scheme logic for both the non-directional and the directional EF1 element is illustrated in Figure 3.2-6; Figure 3.2-7 shows grouping commands for the trip circuit (TRC). The EF1 signal is generated when the pickup current exceeds a threshold, and then trip signals are injected into the TRC. (For more information, see Chapter *Relay application: Trip circuit function*)

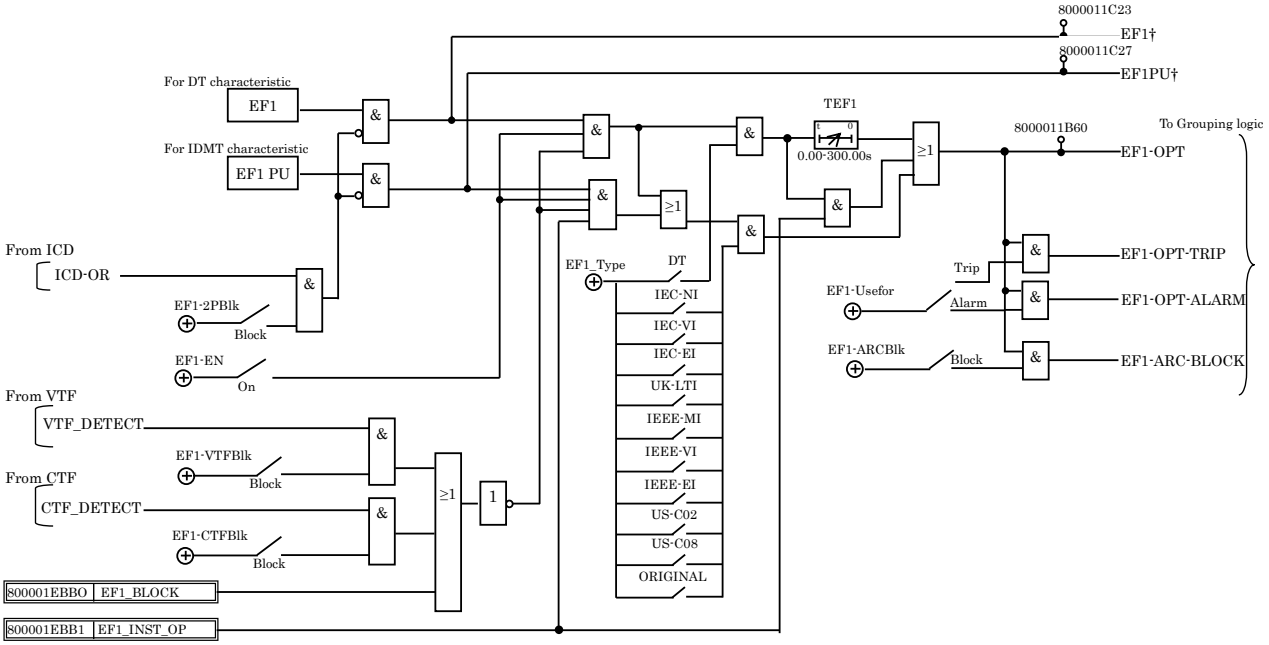


Figure 3.2-6 Scheme logic for the EF1

†Note:The presence of 'EF1' and 'EF1PU' signals depends on the operation characteristic defined with setting [**EF1_Type**], as shown in Table 3.1-7.

Table 3.2-5 Signal behaviors of PLC monitoring points 'EF1' and 'EF1PU'

PLC monitoring points	Setting [**EF1_Type**]	
	DT	**IEC-NT,VI,EI, UK-LTI, IEET-MI,VI,EI, US-CO2,CO8, ORIGINAL**
EF1	①	③
EF1PU	②	④

①: A pick-up signal is generated instantly when the element operates.

②: No signal due that the PU element is killed. Use 'EF1' in place of this.

③: A pick-up signal is generated, but delayed with the IDMT characteristic.

④: A pick-up signal is generated instantly.

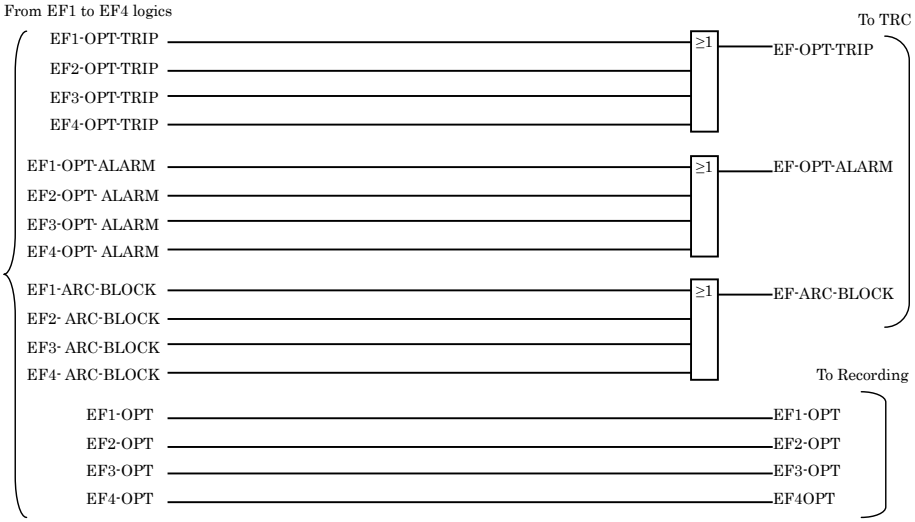


Figure 3.2-7 Grouping logic for TRC/Recording

3.2.7 Setting

Setting of EF(Function ID: 441001)

Setting item		Range		Units	Contents	Default setting value		Notes
		1A rating	5A rating			1A rating	5A rating	
Common	EF-Vpol	0.5 - 100.0		V	The polarizing voltage level of EF directional characteristic	3.0		
EF1	EF1-EN	Off / On		-	EF1 protection enable	Off		
	EF1-Dir	NonDir / Forward / Reverse		-	EF1 directional characteristic	NonDir		
	EF1-Angle	0 - 180		deg	EF1 directional characteristic angle	45		
	EF1-Type	DT / IEC-NI / IEC-VI / IEC-EI/ UK-LTI / IEEE-MI / IEEE-VI / IEEE-EI / US-CO2 / US-CO8 / Original		-	EF1 delay type	DT		
	EF1-DT	0.02 - 50.00	0.10 - 250.00	A	EF1 threshold (in DT mode)	0.30	1.50	
	EF1-IDMT	0.02 - 5.00	0.10 - 25.00	A	EF1 threshold (in IDMT mode)	0.30	1.50	
	EF1-DPR	10 - 100		%	EF1 drop-out/pick-up ratio	100		
	TEF1	0.00 - 300.00		s	EF1 operating delay time (in DT mode)	1.00		
	EF1-TMS-IEC	0.010 - 50.000		-	EF1 time multiplier of IEC inverse curve	1.000		
	EF1-TMS-UK	0.010 - 50.000		-	EF1 time multiplier of UK inverse curve	1.000		
	EF1-TMS-IEEE	0.010 - 50.000		-	EF1 time multiplier of IEEE inverse curve	1.000		
	EF1-TMS-US	0.010 - 50.000		-	EF1 time multiplier of US inverse curve	1.000		
	EF1-TMS-ORG	0.010 - 50.000		-	EF1 time multiplier of Original inverse curve	1.000		
	EF1-Rtype	DEF / DEP		-	EF1 reset delay type	DEF		
	TEF1R	0.00 - 300.00		s	EF1 definite time reset delay	0.00		
	EF1-RTMS-IEEE	0.010 - 50.000		-	EF1 dependent reset time multiplier of IEEE inverse curve	1.000		
	EF1-RTMS-US	0.010 - 50.000		-	EF1 dependent reset time multiplier of US inverse curve	1.000		
	EF1-RTMS-ORG	0.010 - 50.000		-	EF1 dependent reset time multiplier of Original inverse curve	1.000		
	EF1-k	0.00000 - 500.00000		-	EF1 user original curve coefficient	0.00000		
	EF1-a	0.00000 - 10.00000		-	EF1 user original curve coefficient	0.00000		
	EF1-c	0.00000 - 10.00000		-	EF1 user original curve coefficient	0.00000		
	EF1-kr	0.00000 - 500.00000		-	EF1 user original curve coefficient	0.00000		
	EF1-b	0.00000 - 10.00000		-	EF1 user original curve coefficient	0.00000		
	EF1-2fBlk	Non / Block		-	EF1 operation block by 2f-detection	Non		
	EF1-VTFBlk	Non / Block		-	EF1 operation block by VTF	Non		
	EF1-CTFBlk	Non / Block		-	EF1 operation block by CTF	Non		
	EF1-UseFor	Trip / Alarm		-	EF1 used for trip or alarm	Trip		
	EF1-ARCBlk	Non / Block		-	Autoreclose block by EF1	Block		
EF2	EF2-EN	Off / On		-	EF2 protection enable	Off		
	EF2-Dir	NonDir / Forward / Reverse		-	EF2 directional characteristic	NonDir		
	EF2-Angle	0 - 180		deg	EF2 directional characteristic angle	45		
	EF2-Type	DT / IEC-NI / IEC-VI / IEC-EI / UK-LTI / IEEE-MI / IEEE-VI / IEEE-EI / US-CO2 / US-CO8 / Original		-	EF2 delay type	DT		
	EF2-DT	0.02 - 50.00	0.10 - 250.00	A	EF2 threshold (in DT mode)	0.30	1.50	

Setting of EF(Function ID: 441001)

Setting item			Range		Units	Contents	Default setting value		Notes
			1A rating	5A rating			1A rating	5A rating	
		EF2-IDMT	0.02 - 5.00	0.10 - 25.00	A	EF2 threshold (in IDMT mode)	0.30	1.50	
		EF2-DPR	10 - 100		%	EF2 drop-out/pick-up ratio	100		
		TEF2	0.00 - 300.00		s	EF2 operating delay time (in DT mode)	1.00		
		EF2-TMS-IEC	0.010 - 50.000		-	EF2 time multiplier of IEC inverse curve	1.000		
		EF2-TMS-UK	0.010 - 50.000		-	EF2 time multiplier of UK inverse curve	1.000		
		EF2-TMS-IEEE	0.010 - 50.000		-	EF2 time multiplier of IEEE inverse curve	1.000		
		EF2-TMS-US	0.010 - 50.000		-	EF2 time multiplier of US inverse curve	1.000		
		EF2-TMS-ORG	0.010 - 50.000		-	EF2 time multiplier of Original inverse curve	1.000		
		EF2-Rtype	DEF / DEP		-	EF2 reset delay type	DEF		
		TEF2R	0.00 - 300.00		s	EF2 definite time reset delay	0.00		
		EF2-RTMS-IEEE	0.010 - 50.000		-	EF2 dependent reset time multiplier of IEEE inverse curve	1.000		
		EF2-RTMS-US	0.010 - 50.000		-	EF2 dependent reset time multiplier of US inverse curve	1.000		
		EF2-RTMS-ORG	0.010 - 50.000		-	EF2 dependent reset time multiplier of Original inverse curve	1.000		
		EF2-k	0.00000 - 500.00000		-	EF2 user original curve coefficient	0.00000		
		EF2-a	0.00000 - 10.00000		-	EF2 user original curve coefficient	0.00000		
		EF2-c	0.00000 - 10.00000		-	EF2 user original curve coefficient	0.00000		
		EF2-kr	0.00000 - 500.00000		-	EF2 user original curve coefficient	0.00000		
		EF2-b	0.00000 - 10.00000		-	EF2 user original curve coefficient	0.00000		
		EF2-2fBlk	Non / Block		-	EF2 operation block by 2f-detection	Non		
		EF2-VTFBlk	Non / Block		-	EF2 operation block by VTF	Non		
		EF2-CTFBlk	Non / Block		-	EF2 operation block by CTF	Non		
		EF2-UseFor	Trip / Alarm		-	EF2 used for trip or alarm	Trip		
		EF2-ARCBlk	Non / Block		-	Autoreclose block by EF2	Block		
	EF3	EF3-EN	Off / On		-	EF3 protection enable	Off		
		EF3-Dir	NonDir / Forward / Reverse		-	EF3 directional characteristic	NonDir		
		EF3-Angle	0 - 180		deg	EF3 directional characteristic angle	45		
		EF3-Type	DT / IEC-NI / IEC-VI / IEC-EI / UK-LTI / IEEE-MI / IEEE-VI / IEEE-EI / US-CO2 / US-CO8 / Original		-	EF3 delay type	DT		
		EF3-DT	0.02 - 50.00	0.10 - 250.00	A	EF3 threshold (in DT mode)	0.30	1.50	
		EF3-IDMT	0.02 - 5.00	0.10 - 25.00	A	EF3 threshold (in IDMT mode)	0.30	1.50	
		EF3-DPR	10 - 100		%	EF3 drop-out/pick-up ratio	100		
		TEF3	0.00 - 300.00		s	EF3 operating delay time (in DT mode)	1.00		
		EF3-TMS-IEC	0.010 - 50.000		-	EF3 time multiplier of IEC inverse curve	1.000		
		EF3-TMS-UK	0.010 - 50.000		-	EF3 time multiplier of UK inverse curve	1.000		
		EF3-TMS-IEEE	0.010 - 50.000		-	EF3 time multiplier of IEEE inverse curve	1.000		
		EF3-TMS-US	0.010 - 50.000		-	EF3 time multiplier of US inverse curve	1.000		

Setting of EF(Function ID: 441001)

Setting item			Range		Units	Contents	Default setting value		Notes
			1A rating	5A rating			1A rating	5A rating	
		EF3-TMS-ORG	0.010 - 50.000		-	EF3 time multiplier of Original inverse curve	1.000		
		EF3-Rtype	DEF / DEP		-	EF3 reset delay type	DEF		
		TEF3R	0.00 - 300.00		s	EF3 definite time reset delay	0.00		
		EF3-RTMS-IEEE	0.010 - 50.000		-	EF3 dependent reset time multiplier of IEEE inverse curve	1.000		
		EF3-RTMS-US	0.010 - 50.000		-	EF3 dependent reset time multiplier of US inverse curve	1.000		
		EF3-RTMS-ORG	0.010 - 50.000		-	EF3 dependent reset time multiplier of Original inverse curve	1.000		
		EF3-k	0.00000 - 500.00000		-	EF3 user original curve coefficient	0.00000		
		EF3-a	0.00000 - 10.00000		-	EF3 user original curve coefficient	0.00000		
		EF3-c	0.00000 - 10.00000		-	EF3 user original curve coefficient	0.00000		
		EF3-kr	0.00000 - 500.00000		-	EF3 user original curve coefficient	0.00000		
		EF3-b	0.00000 - 10.00000		-	EF3 user original curve coefficient	0.00000		
		EF3-2fBlk	Non / Block		-	EF3 operation block by 2f-detection	Non		
		EF3-VTFBlk	Non / Block		-	EF3 operation block by VTF	Non		
		EF3-CTFBlk	Non / Block		-	EF3 operation block by CTF	Non		
		EF3-UseFor	Trip / Alarm		-	EF3 used for trip or alarm	Trip		
		EF3-ARCBlk	Non / Block		-	Autoreclose block by EF3	Block		
	EF4	EF4-EN	Off / On		-	EF4 protection enable	Off		
		EF4-Dir	NonDir / Forward / Reverse		-	EF4 directional characteristic	NonDir		
		EF4-Angle	0 - 180		deg	EF4 directional characteristic angle	45		
		EF4-Type	DT / IEC-NI / IEC-VI / IEC-EI/ UK-LTI / IEEE-MI / IEEE-VI / IEEE-EI / US-CO2 / US-CO8 / Original		-	EF4 delay type	DT		
		EF4-DT	0.02 - 50.00	0.10 - 250.00	A	EF4 threshold (in DT mode)	0.30	1.50	
		EF4-IDMT	0.02 - 5.00	0.10 - 25.00	A	EF4 threshold (in IDMT mode)	0.30	1.50	
		EF4-DPR	10 - 100		%	EF4 drop-out/pick-up ratio	100		
		TEF4	0.00 - 300.00		s	EF4 operating delay time (in DT mode)	1.00		
		EF4-TMS-IEC	0.010 - 50.000		-	EF4 time multiplier of IEC inverse curve	1.000		
		EF4-TMS-UK	0.010 - 50.000		-	EF4 time multiplier of UK inverse curve	1.000		
		EF4-TMS-IEEE	0.010 - 50.000		-	EF4 time multiplier of IEEE inverse curve	1.000		
		EF4-TMS-US	0.010 - 50.000		-	EF4 time multiplier of US inverse curve	1.000		
		EF4-TMS-ORG	0.010 - 50.000		-	EF4 time multiplier of Original inverse curve	1.000		
		EF4-Rtype	DEF / DEP		-	EF4 reset delay type	DEF		
		TEF4R	0.00 - 300.00		s	EF4 definite time reset delay	0.00		
		EF4-RTMS-IEEE	0.010 - 50.000		-	EF4 dependent reset time multiplier of IEEE inverse curve	1.000		
		EF4-RTMS-US	0.010 - 50.000		-	EF4 dependent reset time multiplier of US inverse curve	1.000		
		EF4-RTMS-ORG	0.010 - 50.000		-	EF4 dependent reset time multiplier of Original inverse curve	1.000		
		EF4-k	0.00000 - 500.00000		-	EF4 user original curve coefficient	0.00000		
		EF4-a	0.00000 - 10.00000		-	EF4 user original curve coefficient	0.00000		

Setting of EF(Function ID: 441001)

Setting item			Range		Units	Contents	Default setting value		Notes
			1A rating	5A rating			1A rating	5A rating	
		EF4-c	0.00000 - 10.00000		-	EF4 user original curve coefficient	0.00000		
		EF4-kr	0.00000 - 500.00000		-	EF4 user original curve coefficient	0.00000		
		EF4-b	0.00000 - 10.00000		-	EF4 user original curve coefficient	0.00000		
		EF4-2fBlk	Non / Block		-	EF4 operation block by 2f-detection	Non		
		EF4-VTFBlk	Non / Block		-	EF4 operation block by VTF	Non		
		EF4-CTFBlk	Non / Block		-	EF4 operation block by CTF	Non		
		EF4-UseFor	Trip / Alarm		-	EF4 used for trip or alarm	Trip		
		EF4-ARCBlk	Non / Block		-	Autoreclose block by EF4	Block		

3.2.8 Data ID

◆ Signal monitoring point

EF(Function ID: 441001)

Element ID	Name	Description
8000011C23	EF1	EF1 relay element operated
8000011C27	EF1PU	EF1 relay operation level pick up
8000011B60	EF1-OPT	EF1 protection operated
8100021C23	EF2	EF2 relay element operated
8100021C27	EF2PU	EF2 relay operation level pick up
8100021B60	EF2-OPT	EF2 protection operated
8200031C23	EF3	EF3 relay element operated
8200031C27	EF3PU	EF3 relay operation level pick up
8200031B60	EF3-OPT	EF3 protection operated
8300041C23	EF4	EF4 relay element operated
8300041C27	EF4PU	EF4 relay operation level pick up
8300041B60	EF4-OPT	EF4 protection operated

◆ Connection point on PLC logic

EF(Function ID: 440001)

Element ID	Name	Description
800001EBB0	EF1_BLOCK	EF1 protection block command
810002EBB0	EF2_BLOCK	EF2 protection block command
820003EBB0	EF3_BLOCK	EF3 protection block command
830004EBB0	EF4_BLOCK	EF4 protection block command
800001EBB1	EF1_INST_OP	EF1 protection instantaneous operation command
810002EBB1	EF2_INST_OP	EF2 protection instantaneous operation command
820003EBB1	EF3_INST_OP	EF3 protection instantaneous operation command
830004EBB1	EF4_INST_OP	EF4 protection instantaneous operation command

3.2.9 PLC driver

◆ Connection point at PLC Driver

PLC_DRV (Function ID: 230301) to EF (Function ID: 441001)

PLC Driver	Element ID	to	Destination	PLC connection point
PMX3_1_0	8010001BB8	→	EF1_BLOCK	800001EBB0
PMX3_1_1	8110001BB9	→	EF2_BLOCK	810002EBB0
PMX3_1_2	8210001BBA	→	EF3_BLOCK	820003EBB0
PMX3_1_3	8310001BBB	→	EF4_BLOCK	830004EBB0
PMX3_1_4	8410001BBC	→	EF1_INST_OP	800001EBB1
PMX3_1_5	8510001BBD	→	EF2_INST_OP	810002EBB1
PMX3_1_6	8610001BBE	→	EF3_INST_OP	820003EBB1
PMX3_1_7	8710001BBF	→	EF4_INST_OP	830004EBB1

3.3 Sensitive earth fault protection (SEF)

If an earth fault occurs, a sensitive earth fault (SEF) function is appropriate in which a fault current flows very small, in which case there is a distribution system earthed with a high-impedance. The SEF function is also appropriate for protections such as “standby earth fault” or “high impedance restricted earth fault in a transformer†”. Some directional/non-directional stages (i.e., SEF1 and other elements) are provided. For simplicity, the SEF1 element is only discussed, but the characteristic of the other elements are identical to the one of the SEF1 element; hence, the user should understand the expression for the SEF1 as the others unless a special explanation or instruction has been provided.

†Note:The relay for the restricted earth fault in the transformer can use such quantity supplied from the core-balanced CT, when Metrosils (varistors) and setting-resistors are used externally.

Note: The implementation of particular features is dependent upon the selection of hardware and the configuration of functions. Several IED models do not support certain features. To determine whether a particular feature has been implemented within an IED, identify the IED ordering number; and check the order number for the “G&T position” whilst referring to the comparison table below. For more information, see Appendix: Ordering.

Table 3.3-1 Comparative table in respective ordering numbers

Sec.	Feature	Ordering No. at “G&T”					
		BCU			BCPU		IFU
		11	13	1F	2C	2N	19
–	Main features	NA	NA	NA	✓	✓	NA
–	Number of stages	NA	NA	NA	2	2	NA

✓: Applicable NA: Not applicable

3.3.1 Relay polarity

The user can choose either non-directional SEF or directional SEF for each SEF stage. In addition, the user can further select either the forward or the direction for each of the directional SEF elements selected.

(i) Characteristic of non-directional SEF

The characteristic of the non-directional type SEF function is a circle at the origin. A setting and a scheme switch is used to configure each non-directional SEF element; i.e., the user can set the threshold value of the non-directional SEF element for stage1 using setting [**SEF1-DT**], provided time characteristic is required for define time delay (DT) described in section 3.2.2(i). **NonDir** is set for the scheme switch [**SEF1-Dir**].

(ii) Characteristic of directional-SEF in the forward direction

As shown in Figure 3.2-1, the characteristic of the directional-SEF elements in the forward direction is a semi-circle based upon the border-line; the hatched area shows the operating region of the directional-SEF element.

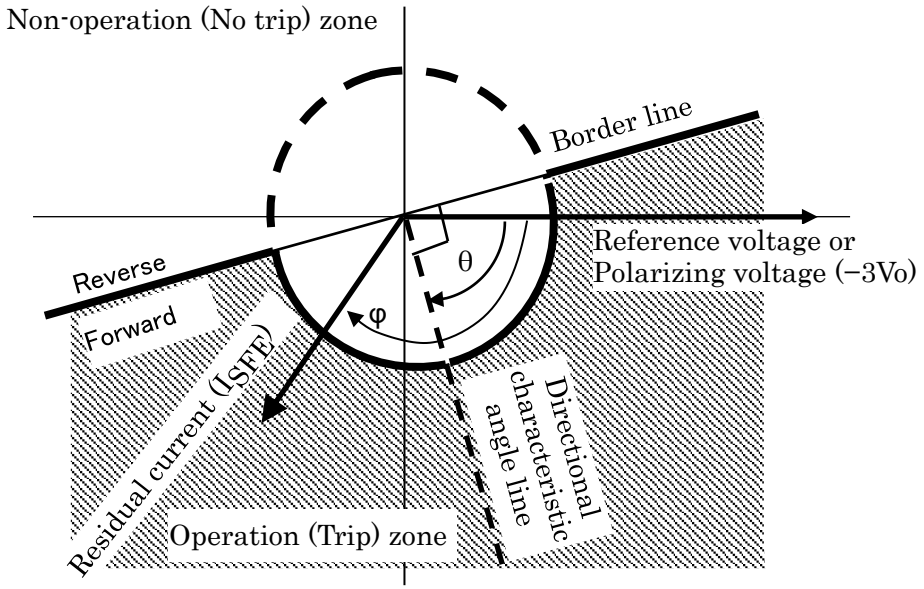


Figure 3.3-1 Characteristic of the directional-SEF element in the forward direction

Note: Directional characteristic angle (θ) forms the angle between the reference quantity and the directional characteristic angle line. The half plane represents the zone of operation bordered on one side by the border-line and extending in the direction that contains both the reference (polarizing) and operating quantities.

A setting and a scheme switch, as well as the non-directional SEF element, provide the settings for the directional SEF element: for example, the user can set the threshold value (I_{SEF}) for stage 1 with the setting [**SEF1-DT**] and **Forward** can be set for the scheme switch [**SEF1-Dir**]. Setting of the sensing angle (θ) is configured by the setting [**SEF1-Angle**] with the

value of θ set in the range of 0–180°. Figure 3.2-2 shows an example of an angle and a characteristic using the θ.

The operation of the EF element is based upon the following equation.

$$3I_0 \geq I_{SEF} \quad (3.3\text{-}1)$$

$$3I_0 \times \cos(\varphi - \theta) \geq 0 \quad (3.3\text{-}2)$$

$$3V_0 \geq SEF_Vpol \quad (3.3\text{-}3)$$

where

3Io = residual current

3Vo = residual voltage

−3Vo = reference voltage (or polarizing voltage)

φ= lagging angle

θ = EF setting angle

I_{SEF} = Setting value of the EF element ([**SEF1-DT**] and the others)

SEF_Vpol = Setting value of the polarizing voltage ([**SEF-Vpol**])

Note: In the case of an internal fault, the phase angle is equal to the angle of the zero-sequence impedance of the system, in a directly-earthed system this value is in the range of approximately 50° to 90°. The sensing angle θ of the SEF element can be set between 0° to 180°. The minimum voltage necessary to maintain directionality can be set from 0.5 to 100.0 V.

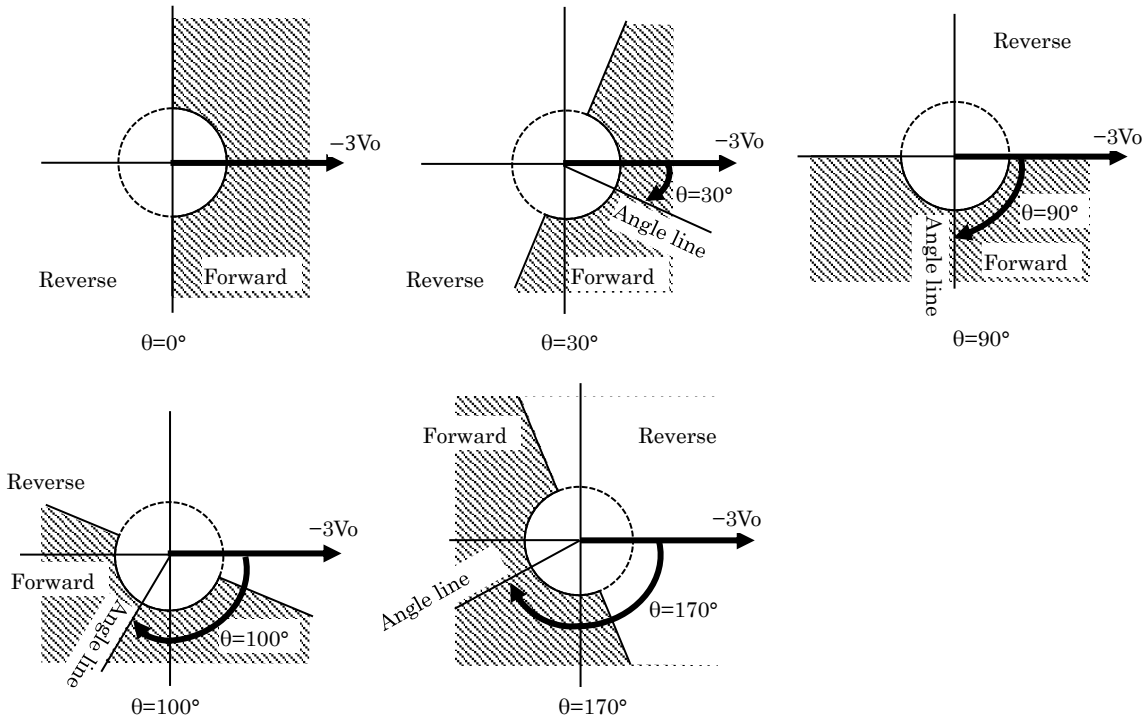


Figure 3.3-2 Examples of directional characteristic angle (θ)

(iii) Characteristic of directional SEF in the reverse direction

The reverse characteristic is a mirror image of the forward characteristic. The setting and the scheme switch, in addition to providing the setting of the directional SEF element in the forward direction, provides the setting of the directional SEF element in the reverse direction: for example, **Reverse** is set for the scheme switch [**SEF1-Dir**] when the direction of the SEF element for stage 1 is considered.

3.3.2 Inverse time and definite time delay characteristic

The SEF element monitors the currents; when one of the currents cross the threshold of operation, the SEF element will operate within a period that is defined by the time characteristic feature. The user can choose the SEF operate time delay characteristics, either dependent (inverse) time characteristic delay (i.e., IDMT) or independent (definite) time characteristic delay (i.e., DT). The operate time of the IDMT depends upon the level of the energizing current, and the operate time in the DT is a constant.

For the reset time delay in the IDMT, either inverse (dependent)-time-reset or definite(independent)-time-reset is characterized by the setting.

The user can select which characteristic will be applied to each stage of the SEF element by setting a scheme switch that will be explained later in this section.

(i) DT characteristic

The operate time in the DT characteristic will be a constant time and is not affected by the level of current. The reset time is set to be zero so that resetting is performed immediately. The user can set the operate time using a setting; it is discussed in section (vi).

(ii) IDMT characteristic

The operate time in the IDMT characteristic is inversely proportional to the level of the fault current. The user can choose the operate time from a preset curve. Ten characteristic curves are available; i.e. nine pre-installed curves covering IEC, IEEE, US and UK standard characteristic curves and one original (user programmable) characteristic curve for which the user can set the equation parameters. The IDMT curve equation and parameters will be explained in section (iii).

The reset time of the IDMT is user selectable; either inverse-time-reset or definite-time-reset is selected. For the inverse-time-rest, the user can choose the reset time for the preset characteristic from six characteristic curves; i.e. IEEE and US standard five pre-installed

characteristic curves and one user original characteristic carver where the user can set the equation parameters. The inverse-time-reset curve equation and parameters will be explained in section (v).

(iii) Operate time of IDMT

The dependent time in the IDMT are defined by Equation (3.2-4). (ref IEC 60255-151):

$$t(I) = TMS \times \left\{ \left[\frac{k}{\left({}^{I}/_{I_s} \right)^{\alpha} - 1} \right] + c \right\} \qquad (3.3\text{-}4)$$

where:

t = operating time for constant current I (seconds),

I = energizing current (amperes),

Is = earth fault current setting (amperes),

TMS = time multiplier setting,

k, α, c = constants defining curve.

The nine pre-programmed standard characteristic curve are defined in Table 3.2-2. In addition, one original (user-programmable) curve can be applied. One curve can be chosen for each EF stage. Figure 3.2-3 illustrates these characteristic curves. For example, the user should set one for the scheme switch [**SEF1-Type**]. (That is, "**IEC-NI**" for IEC Normal Inverse, "**IEC-VI**" for IEC Very Inverse, "**IEC-EI**" for IEC Extremely Inverse, "**UK-LTI**" for UK Long Time Inverse, "**IEEE-MI** " for IEEE Moderately Inverse, "**IEEE-VI**" for IEEE Very Inverse, "**IEEE-EI**" for IEEE Extremely Inverse, "**US-CO2**" for US CO2 short time inverse, "**US-CO8**" for US CO8 inverse, and "**Original**" for user-programmable characteristic.)

In the IDMT, the user can also program the characteristic using time-multiplier-setting (TMS) for the required operate time. The value of TMS is set for a characteristic: for example, the user can set the TMS value using the setting [**SEF1-TMS-IEC**] (incidentally, the default value of the TMS is 1.00). The other TMSs are also available by the [**SEF1-TMS-UK**], [**SEF1-TMS-IEEE**], [**SEF1-TMS-US**] and [**SEF1-TMS-ORG**].

Table 3.3-2 Constants for IDMT

Curve type (IEC 60255-151)	Curve Description	k	α	c
A	IEC Normal Inverse (IEC-NI)	0.14	0.02	0
B	IEC Very Inverse (IEC-VI)	13.5	1	0
C	IEC Extremely Inverse (IEC-EI)	80	2	0
-	UK Long Time Inverse (UK-LTI)	120	1	0
D	IEEE Moderately Inverse (IEEE-MI)	0.0515	0.02	0.114
E	IEEE Very Inverse (IEEE-VI)	19.61	2	0.491
F	IEEE Extremely Inverse (IEEE-EI)	28.2	2	0.1217
-	US CO8 inverse (US-CO8)	5.95	2	0.18
-	US CO2 short time inverse (US-CO2)	0.02394	0.02	0.01694

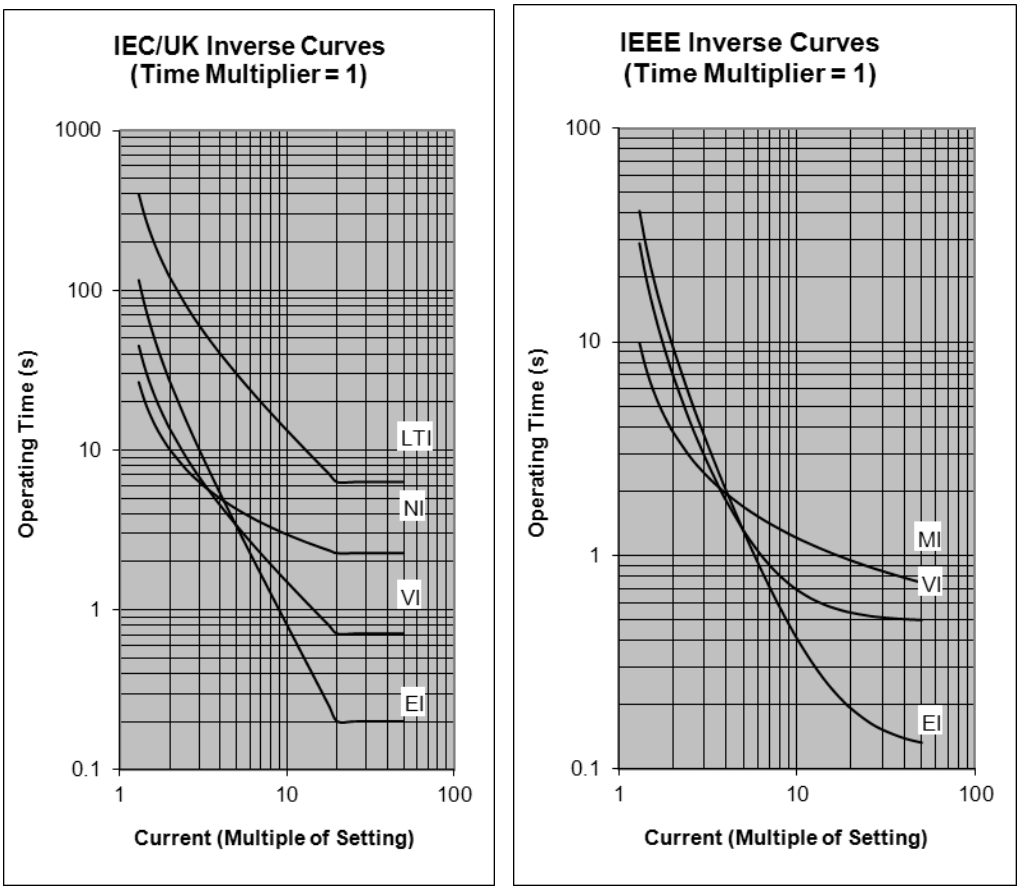


Figure 3.3-3 IDMT Characteristics curves

(iv) Operate time of DT

The operate time in the DT is a constant.

(iv)-1 Time characteristic

The user should set **DT** for the scheme switch [**SEF1-Type**]. The value of the required operate time is set for the setting [**TSEF1**] in the range 0.00–300.00s.

(iv)-2 Instantaneous activation

The operate time of the instantaneous characteristic is achieved by setting zero for the [**TEF1**], but the instantaneous one can be also obtained when the logic signal '1(High)" is programmed to be injected at the PLC connection point "SEF1_INST_OP".

(v) Reset time for IDMT

Programming the reset time characteristic is available for the IEEE standard, US standard and original (user-programmable) dependent time characteristic†. In the IEEE standard, for example, the user should set **DEP** for scheme switch [**SEF1-Rtype**]. The following equation

defines the reset time for the inverse-time-reset characteristic (ref. IEC 60255-151):

$$t(\mathrm{I}) = RTMS \times \left[\frac{\mathrm{kr}}{1 - \left(\mathrm{I}/\mathrm{I_s}\right)^{\beta}}\right] \qquad (3.3\text{-}2)$$

where:

t = time required for the element to reset fully after complete operation (seconds),

I = energizing current (amperes),

Is = earth fault current setting (amperes),

kr = time required to reset fully after complete operation when the energizing current is zero

RTMS = time multiplier setting for resetting.

ß = constants defining curve.

For example, with regard to the RTMS for the IEEE characteristic, the user should use setting [**SEF1-RTMS-IEEE**] (incidentally, the default value is 1.000). Similarly, setting [**SEF1-RTMS-US**] and [**SEF1-RTMS-ORG**] are provided for the US standard characteristic and the original, respectively (For more information w.r.t the values for the kr and ß, see Table 3.2-3; Figure 3.2-4 shows the characteristic curves)

Table 3.3-3 Constants for inverse-time-reset characteristics

Curve Type IEC 60255-151	Curve Description	kr sec	ß
A	IEC Normal Inverse (IEC-NI‡)	N/A	N/A
B	IEC Very Inverse (IEC-VI‡)	N/A	N/A
C	IEC Extremely Inverse (IEC-EI‡)	N/A	N/A
-	UK Long Time Inverse (UK-LTI‡)	N/A	N/A
D	IEEE Moderately Inverse (IEEE-MI)	4.85	2
E	IEEE Very Inverse (IEEE-VI)	21.6	2
F	IEEE Extremely Inverse (IEEE-EI)	29.1	2
-	US CO8 inverse (US-CO8)	5.95	2
-	US CO2 short time inverse (US-CO2)	2.261	2

†Note:The user can set **DEF** for scheme switch [**SEF1-Rtype**] when the definite-time-reset characteristic is preferred. The definite-reset-time characteristic is available in all IDMTs characteristic (See Table 3.2-4). After that, the user should set an intentional delay reset time for the setting [**TSEF1R**].

‡Note: The user should set **DEF** for scheme switch [**SEF1-Rtype**] when the IEC and the UK standard is selected.

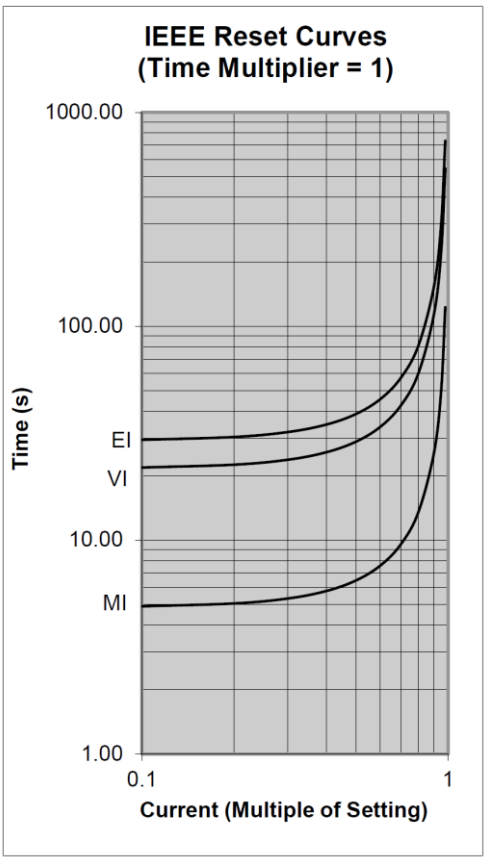


Figure 3.3-4 Inverse-time-reset characteristics curves

Figure 3.2-5 illustrates the effect of invers-time-reset on the internal time delay counter. An object current (I), where I is greater than a setting (Is) provides an energizing quantity for the function which continues to flow for a cumulative period causing the operation of the function. If the operating quantity falls below the value of I_S setting, the function will return to its reset state after time t(I). Time t(I) is calculated using equation (3.2-2).

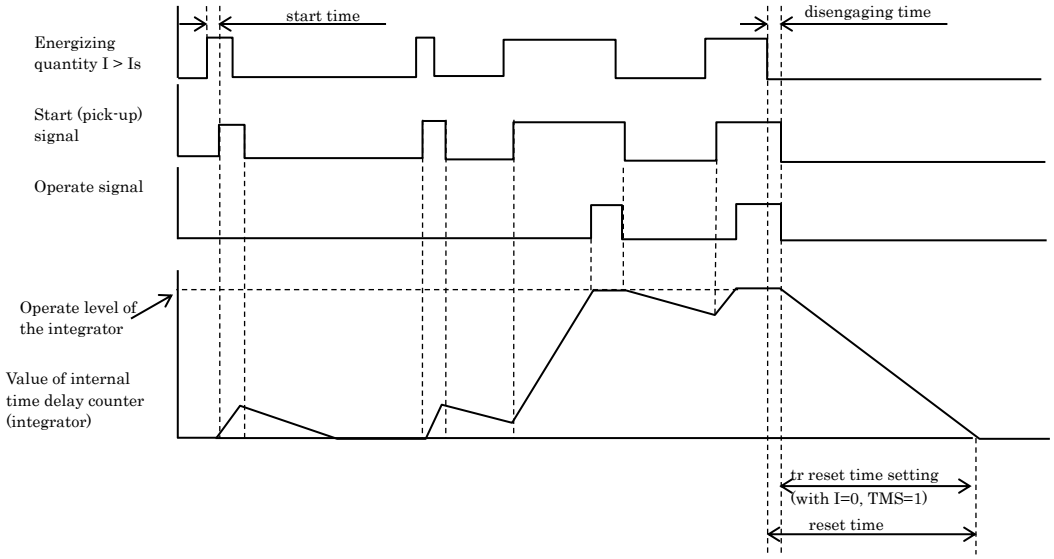


Figure 3.3-5 Inverse-time-reset characteristics

(vi) Reset time of DT

In the DT characteristic, the reset time is designed to be instant. Thus, the user has no points for settings [**SEF1-Rtype**] and [**TSEF1R**].

(vii) Summary of SEF operation

Table 3.2-4 shows a summary for SEF operation.

Table 3.3-4 Type and standard board in the SEF1 (A tick represents a selectable function)

Characteristics		DT	IDMT									
			IEC-NI	IEC-VI	IEC-EI	UK-LTI	IEEE-MI	IEEE-VI	IEEE-EI	US-CO2	US-CO8	Original
Scheme switch [SEF1-Type]	DT	✓										
	IEC-NI		✓									
	IEC-VI			✓								
	IEC-EI				✓							
	UK LTI					✓						
	IEEE-MI						✓					
	IEEE-VI							✓				
	IEEE-EI								✓			
	US-CO2									✓		
	US-CO8										✓	
	Original											✓
Scheme switch [SEF1-Rtype]	DEF	N.A	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	DEP	N.A					✓					
		N.A						✓				
		N.A							✓			
		N.A								✓		
		N.A									✓	
		N.A										✓

3.3.3 Threshold level for operation

The value of threshold current at which the SEF (I_{SEF}) element will pick-up is configured by settings; the settings [**SEF1-IDMT**] and [**SEF1-DT**] are provided for both the IDMT and the DT characteristic. Note that the settings of the threshold levels are allowed to have distinct values in the respective SEF elements. (For more information about the VCT, see Chapter *Technical description: Transformer module for AC analogue input*).

3.3.4 Reset Ratio

The ratio of the threshold current for pick-up to reset is applied using a setting; for example, the ratio for the SEF1 element is set using the setting [**SEF1-DPR**]. The reset ratios for the other EF elements are also provided.

3.3.5 Miscellaneous functions

(i) Blocking SEF by ICD

The operation of each SEF element can be blocked if the ICD function detects a second

harmonic current caused by the magnetizing inrush current phenomenon when a transformer is energized. For example, for the SEF1 element, the scheme switch [**SEF1-2fBlk**] is provided, and **Block** should be set when the user wishes to block the SEF1 element when the second harmonic associated with magnetizing inrush is present. **Non** is set for the scheme switch [**SEF1-2fBlk**] as the default setting. For more information about the ICD function, see Chapter *Relay application: Inrush current detection function*.

(ii) Blocking SEF by VTF

The operation of the SEF element can be blocked by the voltage transformer failure (VTF) function via a scheme switch. For example, **Block** is set for the scheme switch [**SEF1-VTFBlk**] to block the operation of the SEF1 element during a VTF condition. **Non** is set for the scheme switch [**SEF1-VTFBlk**] as a default. For more information about the VTF, see Chapter *Relay application: VT failure detection*.

(iii) Blocking SEF by CTF

The operation of the SEF element can be blocked by the current transformer failure (CTF) function via a scheme switch. For example, **Block** is set for the scheme switch [**SEF1-CTFBlk**] to block the operation of the SEF1 element during a CTF condition. **Non** is set for the scheme switch [**SEF1-CTFBlk**] as a default. For more information about the CTF, see Chapter *Relay application: CT failure detection*.

(iv) SEF operation for autoreclose

The SEF element activates the auto-reclose (ARC) function. However, if ARC is not required, **Block** is set for the scheme switch [**SEF1-ARCBlk**]. **Block** is set for the scheme switch [**SEF1-ARCBlk**] as a default.

(v) Signal of SEF trip

When a user requires an alarm signal in place of the trip signal; for example, set **Alarm** for the scheme switch [**SEF1-UseFor**]. **Trip** is set for the scheme switch [**SEF1-UseFor**] for the normal trip operation.

3.3.6 Element setting for residual power

When a restraint operation is required in the SEF function, the user can program the restraint using setting [**RP**], in which case the system is earthed with the resonant (Petersen coil) method.

3.3.7 Setting of standby earth-fault

In which case the residual current is injected from the neutral circuit at the lower side of a

transformer, the standby earth-fault protection can trip the CB located at the lower side of the transformer; the trip command is issued by the SEF1 element, but issuing is retarded by setting [**TSEF1S2**] compared with the original SEF1 issuing. The user should set **On** for the scheme switch [**SEF1S2-EN**]†.

†Note:The standby earth-fault protection is only available for the SEF1 element.

3.3.8 Scheme logic

The scheme logic for both the non-directional and the directional SEF1 element is illustrated in Figure 3.3-6; Figure 3.3-7 shows grouping commands for the trip circuit (TRC). The SEF1 signal is generated when the pickup current exceeds a threshold, and then trip signals are injected into the TRC. (For more information, see Chapter *Relay application: Trip circuit function*)

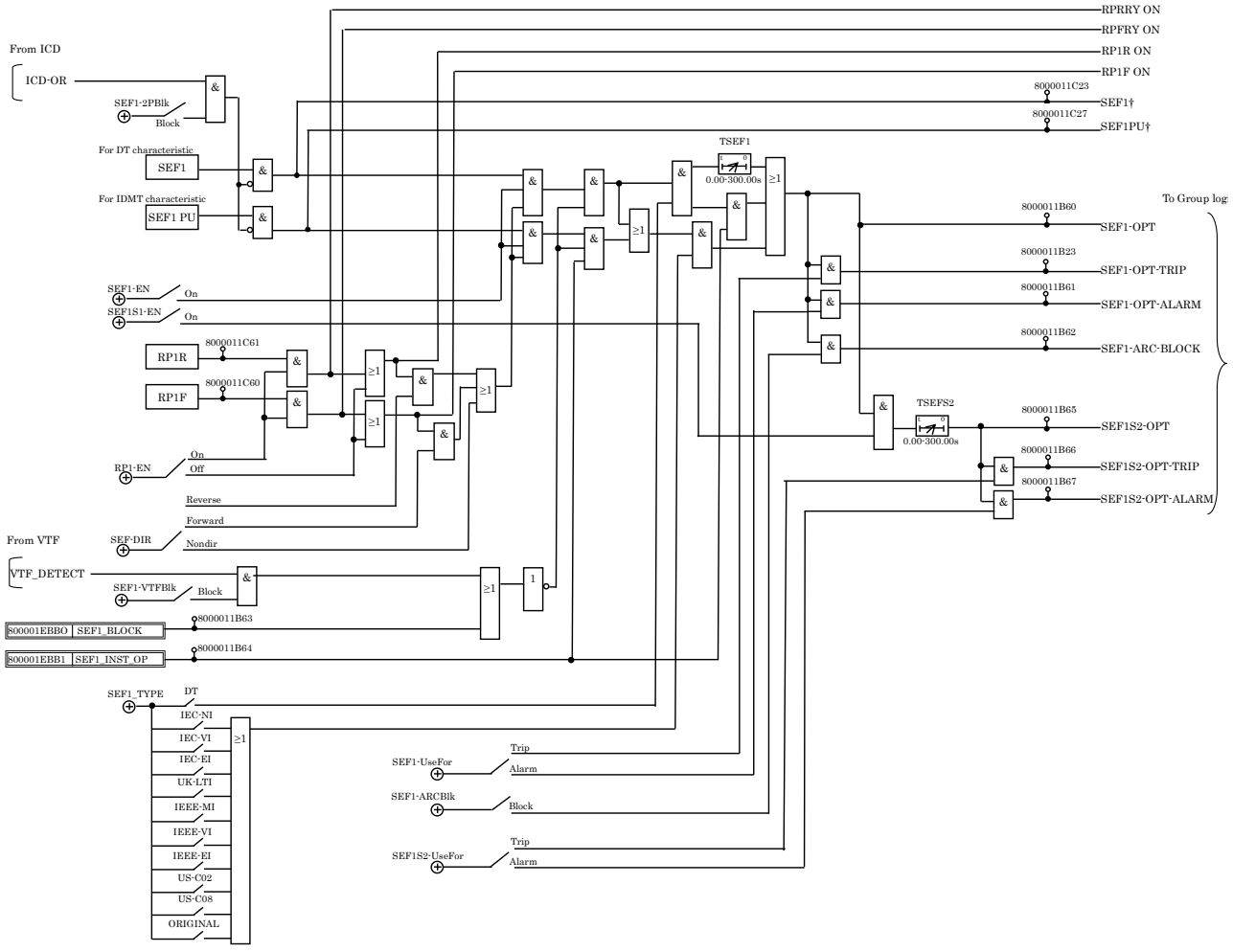


Figure 3.3-6 Scheme logic for the SEF1

†Note:The presence of 'SEF1' and 'SEF1PU' signals depends on the operation characteristic defined with setting [**EF1_Type**], as shown below.

Table 3.3-5 Signal behaviors of PLC monitoring points 'SEF1' and 'SEF1PU'

PLC monitoring points	Setting [**SEF1_Type**]	
	DT	**IEC-NT,VI,EI, UK-LTI, IEET-MI,VI,EI, US-CO2,CO8, ORIGINAL**
SEF1	①	③
SEF1PU	②	④

①: A pick-up signal is generated instantly when the element operates.

②: No signal due that the PU element is killed. Use 'SEF1' in place of that.

③: A pick-up signal is generated, but delayed with the IDMT characteristic.

④: A pick-up signal is generated instantly.

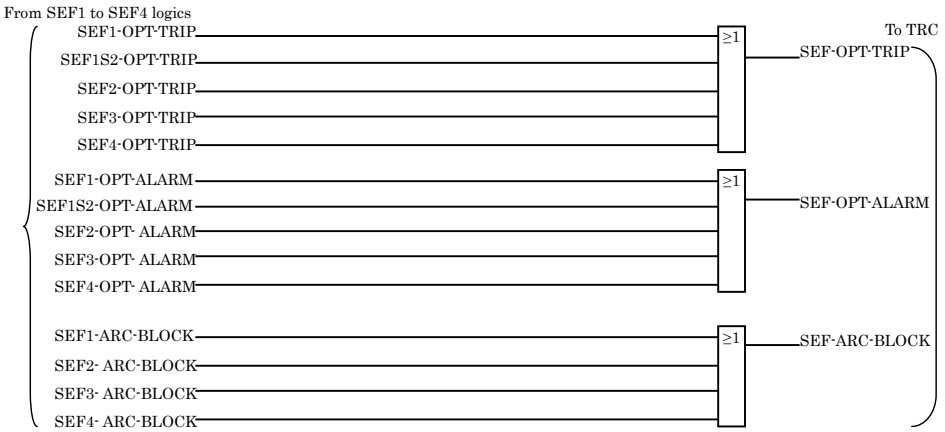


Figure 3.3-7 Grouping logic for TRC

3.3.9 Setting

Setting of SEF(Function ID: 442001)

Setting item		Range	Units	Contents	Default setting value	Notes
	SEF-Vpol	0.5-100	V	The polarizing voltage level of SEF directional characteristic	3.0	
	RP	0-100	W	RP threshold	0	
SEF1	SEF1-EN	Off/On		SEF1 protection enable	Off	
	SEF1-Dir	NonDir/Forward/Reverse		SEF1 directional characteristic	NonDir	
	SEF1-Angle	0-180	deg	SEF1 directional characteristic angle	45	
	SEF1-Type	DT/IEC-NI/IEC-VI/IEC-EI/UK-LTI/IEEE-MI/ IEEE-VI/IEEE-EI/US-CO2/US-CO8/Original		SEF1 delay type	DT	
	SEF1-DT	0.002-1	A	SEF1 threshold (in DT mode)	0.01	
	SEF1-IDMT	0.002-0.1	A	SEF1 threshold (in IDMT mode)	0.01	
	SEF1-DPR	10-100	%	SEF1 drop-out/pick-up ratio	100	
	TSEF1	0-300	s	SEF1 operating delay time (in DT mode)	1	
	SEF1S2-EN	Off/On		SEF1S2 protection enable	Off	
	TSEF1S2	0-300	s	SEF1 stage2 operating delay time (in DT mode)	1.00	
	SEF1-TMS-IEC	0.01-50		SEF1 time multiplier of IEC inverse curve	1.00	
	SEF1-TMS-UK	0.01-50		SEF1 time multiplier of UK inverse curve	1.00	
	SEF1-TMS-IEEE	0.01-50		SEF1 time multiplier of IEEE inverse curve	1.00	
	SEF1-TMS-US	0.01-50		SEF1 time multiplier of US inverse curve	1.00	
	SEF1-TMS-ORG	0.01-50		SEF1 time multiplier of Original inverse curve	1.00	
	SEF1-Rtype	DEF/DEP		SEF1 reset delay type	DEF	
	TSEF1R	0-300	s	SEF1 definite time reset delay	0	
	SEF1-RTMS-IEEE	0.01-50		SEF1 dependent reset time multiplier of IEEE inverse curve	1.00	
	SEF1-RTMS-US	0.01-50		SEF1 dependent reset time multiplier of US inverse curve	1.00	
	SEF1-RTMS-ORG	0.01-50		SEF1 dependent reset time multiplier of Original inverse curve	1.00	
	SEF1-k	0-500		SEF1 user original curve coefficient	0	
	SEF1-a	0-10		SEF1 user original curve coefficient	0	
	SEF1-c	0-10		SEF1 user original curve coefficient	0	
	SEF1-kr	0-500		SEF1 user original curve coefficient	0	
	SEF1-b	0-10		SEF1 user original curve coefficient	0	
	SEF1-2fBlk	Non/Block		SEF1 operation block by 2f-detection	Non	
	SEF1-VTFBlk	Non/Block		SEF1 operation block by VTF	Non	
	SEF1-UseFor	Trip/Alarm		SEF1 used for trip or alarm	Trip	
	SEF1-ARCBlk	Non/Block		Autoreclose block by SEF1	Block	
	SEF1S2-UseFor	Trip/Alarm		SEF1 stage2 used for trip or alarm	Trip	
	RP1-EN	Off/On		RP1 protection enable	Off	
SEF2	SEF2-EN	Off/On		SEF2 protection enable	Off	
	SEF2-Dir	NonDir/Forward/Reverse		SEF2 directional characteristic	NonDir	
	SEF2-Angle	0-180	deg	SEF2 directional characteristic angle	45	
	SEF2-Type	DT/IEC-NI/IEC-VI/IEC-EI/UK-LTI/IEEE-MI/ IEEE-VI/IEEE-EI/US-CO2/US-CO8/Original		SEF2 delay type	DT	
	SEF2-DT	0.002-1	A	SEF2 threshold (in DT mode)	0.01	
	SEF2-IDMT	0.002-0.1	A	SEF2 threshold (in IDMT mode)	0.01	
	SEF2-DPR	10-100	%	SEF2 drop-out/pick-up ratio	100	
	TSEF2	0-300	s	SEF2 operating delay time (in DT mode)	1	
	SEF2-TMS-IEC	0.01-50		SEF2 time multiplier of IEC inverse curve	1.00	
	SEF2-TMS-UK	0.01-50		SEF2 time multiplier of UK inverse curve	1.00	

Setting of SEF(Function ID: 442001)

Setting item		Range	Units	Contents	Default setting value	Notes
	SEF2-TMS-IEEE	0.01-50		SEF2 time multiplier of IEEE inverse curve	1.00	
	SEF2-TMS-US	0.01-50		SEF2 time multiplier of US inverse curve	1.00	
	SEF2-TMS-ORG	0.01-50		SEF2 time multiplier of Original inverse curve	1.00	
	SEF2-Rtype	DEF/DEP		SEF2 reset delay type	DEF	
	TSEF2R	0-300	s	SEF2 definite time reset delay	0	
	SEF2-RTMS-IEEE	0.01-50		SEF2 dependent reset time multiplier of IEEE inverse curve	1.00	
	SEF2-RTMS-US	0.01-50		SEF2 dependent reset time multiplier of US inverse curve	1.00	
	SEF2-RTMS-ORG	0.01-50		SEF2 dependent reset time multiplier of Original inverse curve	1.00	
	SEF2-k	0-500		SEF2 user original curve coefficient	0	
	SEF2-a	0-10		SEF2 user original curve coefficient	0	
	SEF2-c	0-10		SEF2 user original curve coefficient	0	
	SEF2-kr	0-500		SEF2 user original curve coefficient	0	
	SEF2-b	0-10		SEF2 user original curve coefficient	0	
	SEF2-2fBlk	Non/Block		SEF2 operation block by 2f-detection	Non	
	SEF2-VTFBlk	Non/Block		SEF2 operation block by VTF	Non	
	SEF2-UseFor	Trip/Alarm		SEF2 used for trip or alarm	Trip	
	SEF2-ARCBlk	Non/Block		Autoreclose block by SEF2	Block	
	SEF2S2-UseFor	Trip/Alarm		SEF2 stage2 used for trip or alarm	Trip	
	RP2-EN	Off/On		RP2 protection enable	Off	

3.3.10 Data ID

◆ Signal monitoring point

SEF(Function ID: 442001)

Element ID	Name	Description
8000011C23	SEF1	SEF1 relay element operated
8000011C27	SEF1PU	SEF1 relay operation level pick up
8000011B60	SEF1-OPT	SEF1 protection operated
8000011B23	SEF1-OPT-TRIP	Trip signal by SEF1 protection
8100011B61	SEF1-OPT-ALARM	Alarm signal by SEF1 protection
8200011B62	SEF1-ARC-BLOCK	Autoreclose block signal by SEF1 protection
8000011B63	SEF1_BLOCK	SEF1 protection block command
8000011B64	SEF1_INST_OP	SEF1 protection instant operation command
8000011B65	SEF1S2-OPT	SEF1 stage2 protection operated
8000011B66	SEF1S2-OPT-TRIP	Trip signal by SEF2 stage2 protection
8100011B67	SEF1S2-OPT-ALARM	Alarm signal by SEF2 stage2 protection
8000011C60	RP1F	RP1F relay element operated
8000011C61	RP1R	RP1R relay element operated
8100021C23	SEF2	SEF2 relay element operated
8100021C27	SEF2PU	SEF2 relay operation level pick up
8100021B60	SEF2-OPT	SEF2 protection operated
8000021B23	SEF2-OPT-TRIP	Trip signal by SEF2 protection
8100021B61	SEF2-OPT-ALARM	Alarm signal by SEF2 protection
8200021B62	SEF2-ARC-BLOCK	Autoreclose block signal by SEF2 protection
8100021B63	SEF2_BLOCK	SEF2 protection block command
8100021B64	SEF2_INST_OP	SEF2 protection instant operation command
8100021C60	RP2F	RP2F relay element operated
8100021C61	RP2R	RP2R relay element operated
8300001B23	SEF-OPT-TRIP	Trip signal
8400001B61	SEF-OPT-ALARM	Alarm signal
8500001B62	SEF-ARC-BLOCK	Block signal for ARC
3100001708	Common	Data ID for Setting hierarchy (4420013100001708)
3100001703	SEF	Data ID for SEF Function(Output)
3100001707	SEF	Data ID for SEF Function(Setting)

◆ Connection point in PLC logic

SEF(Function ID: 442001)

Element ID	Name	Description
800001EBB0	SEF1_BLOCK	SEF1 protection block command
810002EBB0	SEF2_BLOCK	SEF2 protection block command
800001EBB1	SEF1_INST_OP	SEF1 protection instant operation command
810002EBB1	SEF2_INST_OP	SEF2 protection instant operation command

3.4 Negative sequence overcurrent protection (OCN)

Negative-sequence overcurrent protection (OCN) function has both time characteristic and directional elements. Four stages (elements) are available in the OCN function. The user can select various features using the scheme switches provided. The elements are named OCN1, OCN2, and others; and they operate independently.

To simplify the description, only OCN1 is discussed but is applicable to the other OCNs; hence, read the expression for OCN1 as OCN2, OCN3, and OCN4 at each stage unless a special explanation or instruction has been provided.

Note: The implementation of the feature depends on the selection of both the hardware and the software. Note that the feature is not supplied for the several models; hence, the user has to check the implementation for the model. Locate the ordering number and check it at the "G&T position" referring to the comparison table below. For more information, see *Appendix: Ordering*.

Table 3.4-1 Comparative table in respective ordering numbers

Sec.	Feature	Ordering No. at "G&T"					
		BCU			BCPU		IFU
		11	13	1F	2C	2N	19
–	Main features	NA	NA	NA	✓	✓	NA
–	Num. of stages	NA	NA	NA	4	4	NA
3.4.9	PLC driver	NA	NA	NA	✓	✓	NA

✓: Applicable NA: Not applicable

3.4.1 Relay polarity

The user can choose either non-directional OCN or directional OCN for each OCN stage. In addition, the user can further select either the forward or the direction for each of the directional OCN elements selected.

(i) Characteristic of a non-directional OCN

The characteristic of the non-directional type (non-directional OCN) is a circle at the origin. A setting and a scheme switch is used to configure each non-directional OCN element; i.e., the user can set the threshold value of non-directional OCN element for state 1 using setting [**OCN1-DT**], provided time characteristic is required for define time delay (DT) described in section 3.4.2(i). **NonDir** is set for the scheme switch [**OCN1-Dir**].

(ii) Characteristic of directional OCN in the forward

As shown in Figure 3.4-1, the characteristic of the directional-OCN elements in the forward direction is a semi-circle based upon the border-line; the hatched area shows the operating region of the directional-OCN.

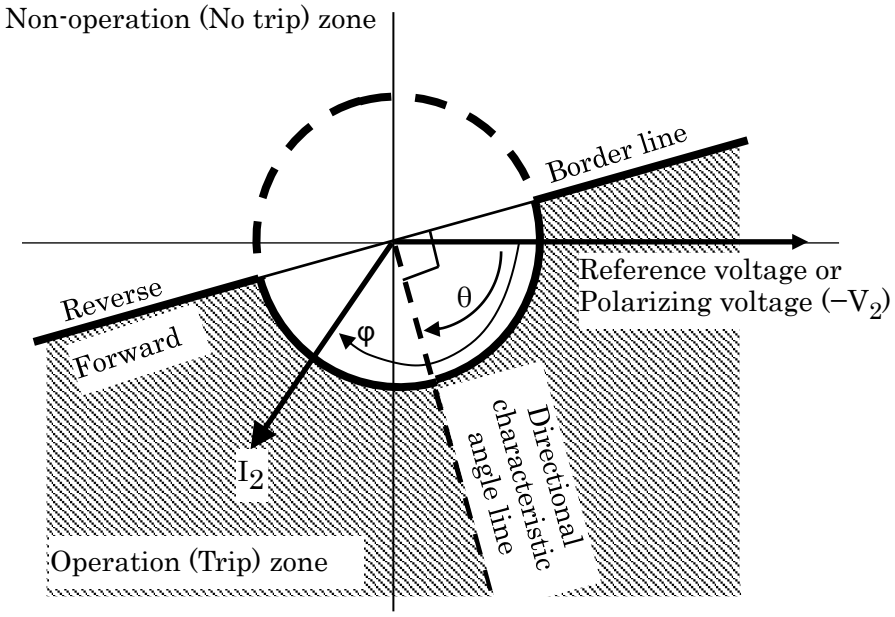


Figure 3.4-1 Characteristic of the directional-OCN element in the forward direction

Note: Directional characteristic angle (θ) forms the angle between the reference quantity and the directional characteristic angle line. The half plane represents the zone of operation bordered on one side by the border line and extending in the direction that contains both the reference (polarizing) and operating quantities.

A setting and a scheme switch, as well as the non-directional OCN element, provide the settings for the directional OCN element: for example, the user can set the threshold value

(I_{OCN}) for stage 1 with the setting [**OCN1-DT**] and **Forward** can be set for the scheme switch [**OCN1-Dir**]. Setting of the sensing angle (θ) is configured by the setting [**OCN1-Angle**] with the value of θ in the range of 0–180°. Figure 3.4-2 shows an example of an angle and a characteristic using the θ.

The operation decision of OCN uses the following equation:

$$I_2 \geq I_{OCN} \quad (3.4\text{-}1)$$

$$I_2 \times \cos(\varphi - \theta) \geq 0 \quad (3.4\text{-}2)$$

$$V_2 \geq OCN_Vpol \quad (3.4\text{-}3)$$

where

I_2 = Negative phase sequence current
V_2 = Negative phase sequence voltage
$-V_2$ = reference voltage (or polarizing voltage)
Φ = lagging angle
θ = OCN setting angle ([**OCN1-Angle**])
I_{OCN} = Setting value of OCN ([**OCN1-DT**] and the others])
OCN_Vpol = Setting value of the polarizing voltage ([**OCN-Vpol**])

Note: The phase angle in the event of an internal fault is equal to the angle of the zero-sequence impedance of the system; this value ranges approximately from 50° to 90°. The θ of OCN can be set from 0° to 180°. The minimum voltage necessary to maintain directionality can be set from 0.5 to 180 V.

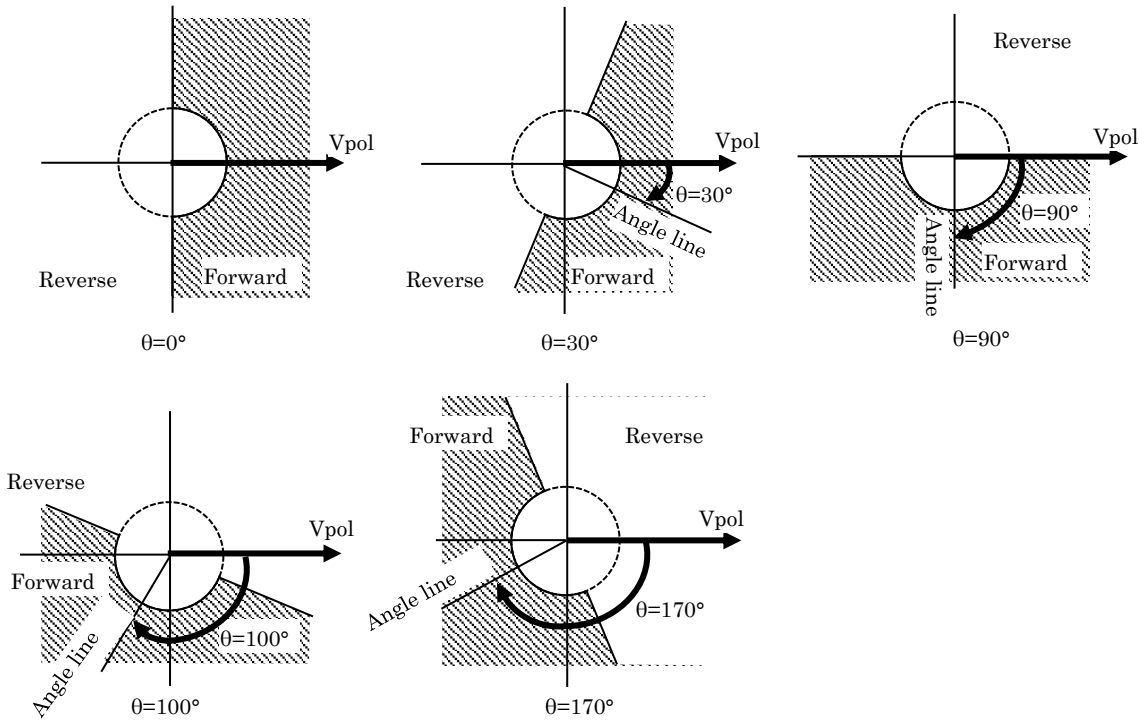


Figure 3.4-2 Examples of directional characteristic angle (θ)

(iii) Characteristic of directional OCN in the reverse

The reverse characteristic is a mirror image of the forward characteristic. The setting and the scheme switch, in addition to providing the setting of the directional OCN element in the forward direction, provides the setting of the directional EF element in the reverse direction: for example, **Reverse** is set for the scheme switch [**OCN1-Dir**] when the direction of the OCN element for stage 1 is considered.

3.4.2 Inverse time and definite time delay characteristic

The OCN element monitors the negative-sequence current; when the negative-sequence current is beyond the threshold for the operation, the OCN element will operate within a period that is defined by the time characteristic feature. The user can choose the one of the operate time delay characteristics: (i) dependent (inverse) time characteristic delay (i.e., IDMT) or (ii) independent (definite) time characteristic delay (i.e., DT). The operate time of the IDMT depends upon the level of the negative-sequence current, whereas the operate time in the DT is a constant.

For the reset time delay in the IDMT, either inverse (dependent)-time-reset or definite(independent)-time-reset is characterized by the setting.

The user can select which characteristic will be applied to each stage of the OCN element using scheme switches. We shall see the scheme switches later.

(i) DT characteristic

The operate time in the DT characteristic will be a constant time; it is not affected by the level of the negative-sequence current. The reset time is set to zero so that resetting is performed immediately. The user can set the operate time using a setting; it is discussed in sections (iv).

(ii) IDMT characteristic

The operate time in the IDMT characteristic is inversely proportional to the level of the fault current. The user can choose the operate time from a preset curve. Ten characteristic curves are available; i.e. nine pre-installed curves covering IEC, IEEE, US and UK standard characteristic curves and one original (user programmable) characteristic curve for which the user can set the equation parameters. The IDMT curve equation and parameters will be explained in section (iii).

The reset time of the IDMT is also user-selectable; either inverse-time-reset or definite-time-reset is selected. For the inverse-time-rest, the user can choose the reset time for the preset characteristic from six characteristic curves; i.e. IEEE and US standard five pre-

installed characteristic curves and one user-original characteristic carver where the user can set the equation parameters. The inverse-time-reset curve equation and parameters will be discussed in section (v).

(iii) Operate time of IDMT

The dependent time in the IDMT is defined by Equation (3.4-4). (ref IEC 60255-151):

$$t(I) = TMS \times \left\{ \left[\frac{k}{\left(I/I_s \right)^{\alpha} - 1} \right] + c \right\} \qquad (3.4\text{-}4)$$

where:

t = operating time for constant current I (seconds),

I = energizing current (amperes),

Is = earth fault current setting (amperes),

TMS = time multiplier setting,

k, α, c = constants defining curve.

The nine pre-programmed standard characteristic curve are tabulated in Table 3.4-2; additionally, one original (user-programmable) curve can be applied. One curve can be chosen for each OCN stage by setting. Figure 3.4-3 illustrates these characteristic curves. For example, the user should set one for the scheme switch [**OCN1-Type**]: "**IEC-NI**" for IEC Normal Inverse, "**IEC-VI**" for IEC Very Inverse, "**IEC-EI**" for IEC Extremely Inverse, "**UK-LTI**" for UK Long Time Inverse, "**IEEE-MI** " for IEEE Moderately Inverse, "**IEEE-VI**" for IEEE Very Inverse, "**IEEE-EI**" for IEEE Extremely Inverse, "**US-CO2**" for US CO2 short time inverse, "**US-CO8**" for US CO8 inverse, and "**Original**" for user-programmable characteristic.

In the IDMT operation, the user can also program the characteristic using time-multiplier-setting (TMS) for the required operate time. For example, when the IEC characteristic is selected, the user can set the TMS value using the setting [**OCN1-TMS-IEC**] (incidentally, the default value of the TMS is 1.00). The other TMSs are also available by the [**OCN1-TMS-UK**], [**OCN1-TMS-IEEE**], [**OCN1-TMS-US**] and [**OCN1-TMS-ORG**].

Table 3.4-2 Constants for IDMT

Curve type (IEC 60255-151)	Curve Description	k	α	c
A	IEC Normal Inverse (IEC-NI)	0.14	0.02	0
B	IEC Very Inverse (IEC-VI)	13.5	1	0
C	IEC Extremely Inverse (IEC-EI)	80	2	0
-	UK Long Time Inverse (UK-LTI)	120	1	0
D	IEEE Moderately Inverse (IEEE-MI)	0.0515	0.02	0.114
E	IEEE Very Inverse (IEEE-VI)	19.61	2	0.491
F	IEEE Extremely Inverse (IEEE-EI)	28.2	2	0.1217
-	US CO8 inverse (US-CO8)	5.95	2	0.18
-	US CO2 short time inverse (US-CO2)	0.02394	0.02	0.01694

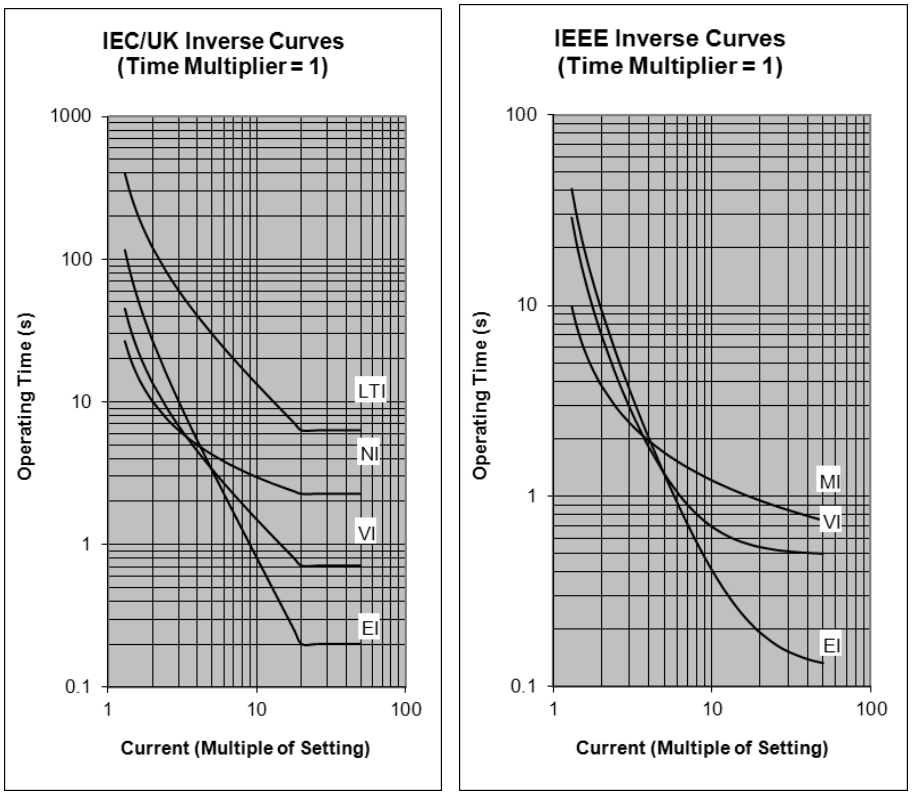


Figure 3.4-3 IDMT Characteristics curves

(iv) Operate time of DT

The operate time in the DT is a constant.

(iv)-1 Time characteristic

The user should set **DT** for the scheme switch [**OCN1-Type**]. The value of the required operate time is set for the setting [**TOCN1**] in the range 0.00–300.00s.

(iv)-2 Instantaneous activation

The instantaneous operation characteristic is achieved by setting zero for the [**TOCN1**], but the instantaneous one can be also obtained when the logic signal "1 (High)" is programmed to be injected at PLC connection point "OCN1_INST_OP".

(v) Reset time of IDMT

Programming the reset time characteristic is available for the IEEE standard, US standard and original (user-programmable) dependent time characteristic†. In the IEEE standard, for example, the user should set **DEP** for the scheme switch [**OCN1-Rtype**]. The following equation defines the reset time for the inverse-time-reset characteristic (ref. IEC 60255-151):

$$t(\mathrm{I}) = RTMS \times \left[\frac{\mathrm{kr}}{1 - \left({}^{\mathrm{I}}/_{\mathrm{I_s}} \right)^{\beta}} \right] \qquad (3.4\text{-}2)$$

where:

t = time required for the element to reset fully after complete operation (seconds),

I = energizing current (amperes),

Is = earth fault current setting (amperes),

kr = time required to reset fully after complete operation when the energizing current is zero

RTMS = time multiplier setting for resetting.

ß = constants defining curve.

For setting the RTMS for the IEEE standard, the user can use setting [**OCN1-RTMS-IEEE**] (incidentally, the default value is 1.000). Similarly, settings [**OCN1-RTMS-US**] and [**OCN1-RTMS-ORG**] are provided for the US standard and the original, respectively (For more information w.r.t the values for kr and ß, see Table 3.4-3; Figure 3.4-4 shows the characteristic curves).

Table 3.4-3 Constants for inverse-time-reset characteristics

Curve Type IEC 60255-151	Curve Description	kr (sec)	ß
A	IEC Normal Inverse (IEC-NI‡)	N/A	N/A
B	IEC Very Inverse (IEC-VI‡)	N/A	N/A
C	IEC Extremely Inverse (IEC-EI‡)	N/A	N/A
-	UK Long Time Inverse (UK-LTI‡)	N/A	N/A
D	IEEE Moderately Inverse (IEEE-MI)	4.85	2
E	IEEE Very Inverse (IEEE-VI)	21.6	2
F	IEEE Extremely Inverse (IEEE-EI)	29.1	2
-	US CO8 inverse (US-CO8)	5.95	2
-	US CO2 short time inverse (US-CO2)	2.261	2

†Note: The user can set **DEF** for scheme switch [**OCN1-Rtype**] when the definite-time-reset characteristic is preferred. The definite-reset-time characteristic is available in all IDMT characteristics (see Table 3.4-4). After that, the user should set an intentional delay reset time for the setting [**TOCN1R**].

‡Note: The user should set **DEF** is for scheme switch [**OCN1-Rtype**] when the IEC and the UK standards are selected.

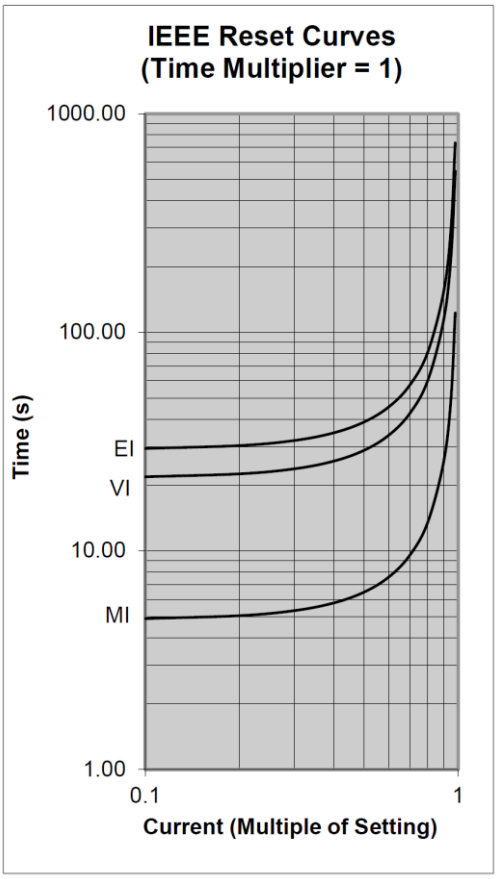


Figure 3.4-4 Inverse-time-reset characteristics curves

Figure 3.4-5 illustrates the effect of invers-time-reset on the internal time delay counter. An object current (I), where I is greater than a setting (Is) provides an energizing quantity for the function which continues to flow for a cumulative period causing the operation of the function. If the operating quantity falls below the value of the I_S, the function will return to its reset state after time t(I), which is calculated using Equation (3.4-2).

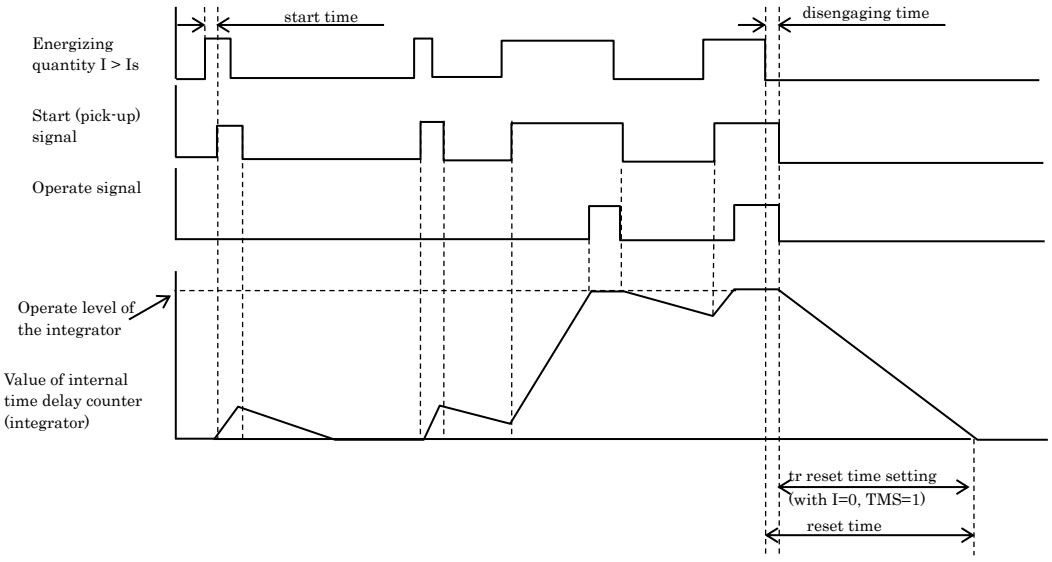


Figure 3.4-5 Inverse-time-reset characteristics

(vi) Reset time of DT

In the DT characteristic, the reset time is designed to be instant. Thus, the user has no points for the settings [**OC1-Rtype**] and [**TOC1R**].

(vii) Summary of OCN operation

Table 3.4-4 shows a summary for OCN operation.

Table 3.4-4 Type and standard board in the OCN1 (A tick represents a selectable function)

Characteristics		DT	IDMT									
			IEC-NI	IEC-VI	IEC-EI	UK-LTI	IEEE-MI	IEEE-VI	IEEE-EI	US-CO2	US-CO8	Original
Scheme switch [OCN1-Type]	DT	✓										
	IEC-NI		✓									
	IEC-VI			✓								
	IEC-EI				✓							
	UK LTI					✓						
	IEEE-MI						✓					
	IEEE-VI							✓				
	IEEE-EI								✓			
	US-CO2									✓		
	US-CO8										✓	
	Original											✓
Scheme switch [OCN1-Rtype]	DEF	N.A	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	DEP	N.A					✓					
		N.A						✓				
		N.A							✓			
		N.A								✓		
		N.A									✓	
		N.A										✓

3.4.3 Threshold value

The value of threshold current at which the OCN (I_2) element will pick-up is configured by settings; the settings [**OCN1-IDMT**] and [**OCN1-DT**] are provided for both the IDMT and the DT characteristic. Note that the settings of the threshold levels are allowed to have distinct values in the respective OCN elements. A rating current for the input is defined either 1A or 5A; the input rating is defined on a VCT. (For more information about the VCT, see Chapter *Technical description: Transformer module for AC analogue input*).

3.4.4 Reset Ratio

The ratio of the threshold current for pick-up to reset is applied using a setting; for example, the ratio for the OCN1 element is set using the setting [**OCN1-DPR**]. The reset ratios for the other OCN elements are also provided.

3.4.5 Miscellaneous functions

(i) Harmonic detection

The operation of each OCN element can be blocked using a scheme switch, if the ICD function detects a second harmonic current caused by the magnetizing inrush current phenomenon when a transformer is energized. For example, for the OCN1 element, the scheme switch [**OCN1-2fBlk**] is provided, and **Block** should be set when the user wishes to block the OCN1 element when the second harmonic associated with magnetizing inrush is present. **Non** is set for the scheme switch [**OCN1-2fBlk**] as the default setting. For more information about the ICD function, see Chapter *Relay application: Inrush current detection function*.

(ii) Blocking OCN by VTF

The operation of the OCN element can be blocked by the voltage transformer failure (VTF) function via a scheme switch. For example, **Block** is set for the scheme switch [**OCN1-VTFBlk**] to block the operation of the OCN1 element during a VTF condition. **Non** is set for the scheme switch [**OCN1-VTFBlk**] as a default. For more information about the VTF, see Chapter *Relay application: VT failure detection*.

(iii) Blocking OCN by CTF

The operation of the OCN element can be blocked by the current transformer failure (CTF) function via a scheme switch. For example, **Block** should be set for the scheme switch [**OCN1-CTFBlk**] to block the operation of the OCN1 element during a CTF condition. **Non** is set for the scheme switch [**OCN1-CTFBlk**] as a default. For more information about the CTF, see Chapter *Relay application: CT failure detection*.

(iv) OCN operation for autoreclose

The OCN element activates the auto-reclose (ARC) function. However, if ARC is not required, **Block** is set for the scheme switch [**OCN1-ARCBlk**]. **Block** is set for the scheme switch [**OCN1-ARCBlk**] as a default.

(v) Signal of OCN trip

When a user requires an alarm signal in place of the trip signal; for example, set **Alarm** for the scheme switch [**OCN1-UseFor**]. **Trip** is set for the scheme switch [**OCN1-UseFor**] for the normal trip operation.

3.4.6 Scheme logic

The scheme logic of both the non-directional and the directional OCN1 is illustrated in Figure 3.4-6; Figure 3.4-7 shows grouping commands for the trip circuit (TRC). The OCN1 signal is generated when the pickup current exceeds a threshold, and then trip signals are injected into the TRC. (For more information, see Chapter *Relay application: Trip circuit function*)

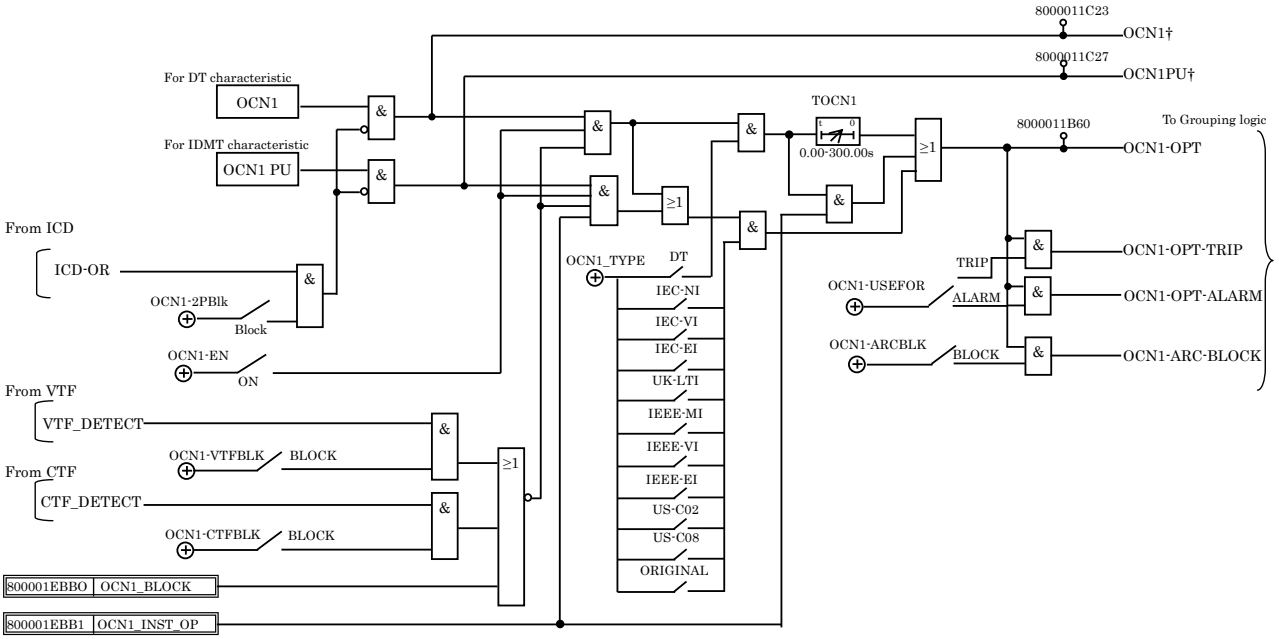


Figure 3.4-6 Scheme logic of OCN1

†Note:The presence of 'OCN1' and 'OCN1PU' signals depends on the operation characteristic defined with setting [**OCN1_Type**], as shown in Table 3.1-7.

Table 3.4-5 Signal behaviors of PLC monitoring points 'OCN1' and 'OCN1PU'

PLC monitoring points	Setting [**OCN1_Type**]	
	DT	**IEC-NT,VI,EI, UK-LTI, IEET-MI,VI,EI, US-CO2,CO8, ORIGINAL**
OCN1	①	③
OCN1PU	②	④

①: A pick-up signal is generated instantly when the element operates.

②: No signal due that the PU element is killed. Use 'OCN1' in place of this.

③: A pick-up signal is generated, but delayed with the IDMT characteristic.

④: A pick-up signal is generated instantly.

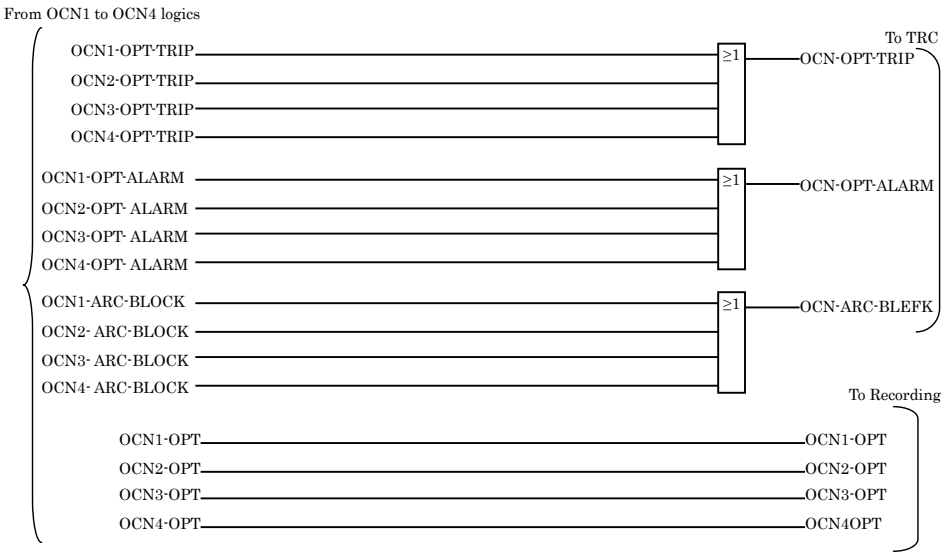


Figure 3.4-7 Grouping logic for TRC/Recording

3.4.7 Setting

Setting of OCN(Function ID:443001)

Setting item			Range		Units	Contents	Default setting value		Notes
			1A rating	5A rating			1A	5A	
OCN	Common	OCN-Vpol	0.5 - 25.0		V	The polarizing voltage level of OCN directional characteristic	3.0		
	OCN1	OCN1-EN	Off / On		-	OCN1 protection enable	Off		
		OCN1-Dir	NonDir / Forward / Reverse		-	OCN1 directional characteristic	NonDir		
		OCN1-Angle	0 - 180		deg	OCN1 directional characteristic angle	45		
		OCN1-Type	DT / IEC-NI / IEC-VI / IEC-EI/ UK-LTI / IEEE-MI / IEEE-VI / IEEE-EI / US-CO2 / US-CO8 / Original		-	OCN1 delay type	DT		
		OCN1-DT	0.02 - 50.00	0.10 - 250.00	A	OCN1 threshold (in DT mode)	0.40	2.00	
		OCN1-IDMT	0.02 - 5.00	0.10 - 25.00	A	OCN1 threshold (in IDMT mode)	0.40	2.00	
		OCN1-DPR	10 - 100		%	OCN1 drop-out/pick-up ratio	100		
		TOCN1	0.00 - 300.00		s	OCN1 operating delay time	1.00		
		OCN1-TMS-IEC	0.010 - 50.000		-	OCN1 time multiplier of IEC inverse curve	1.000		
		OCN1-TMS-UK	0.010 - 50.000		-	OCN1 time multiplier of UK inverse curve	1.000		
		OCN1-TMS-IEEE	0.010 - 50.000		-	OCN1 time multiplier of IEEE inverse curve	1.000		
		OCN1-TMS-US	0.010 - 50.000		-	OCN1 time multiplier of US inverse curve	1.000		
		OCN1-TMS-ORG	0.010 - 50.000		-	OCN1 time multiplier of Original inverse curve	1.000		
		OCN1-Rtype	DEF / DEP		-	OCN1 reset delay type	DEF		
		TOCN1R	0.00 - 300.00		s	OCN1 definite time reset delay	0.00		
		OCN1-RTMS-IEEE	0.010 - 50.000		-	OCN1 dependent reset time multiplier of IEEE inverse curve	1.000		
		OCN1-RTMS-US	0.010 - 50.000		-	OCN1 dependent reset time multiplier of US inverse curve	1.000		
		OCN1-RTMS-ORG	0.010 - 50.000		-	OCN1 dependent reset time multiplier of Original inverse curve	1.000		
		OCN1-k	0.00000 - 500.00000		-	OCN1 user original curve coefficient	0.00000		
		OCN1-a	0.00000 - 10.00000		-	OCN1 user original curve coefficient	0.00000		
		OCN1-c	0.00000 - 10.00000		-	OCN1 user original curve coefficient	0.00000		
		OCN1-kr	0.00000 - 500.00000		-	OCN1 user original curve coefficient	0.00000		
		OCN1-b	0.00000 - 10.00000		-	OCN1 user original curve coefficient	0.00000		
		OCN1-2fBlk	Non / Block		-	OCN1 operation block by 2f-detection	Non		
		OCN1-VTFBlk	Non / Block		-	OCN1 operation block by VTF	Non		
		OCN1-CTFBlk	Non / Block		-	OCN1 operation block by CTF	Non		
		OCN1-UseFor	Trip / Alarm		-	OCN1 used for trip or alarm	Trip		
		OCN1-ARCBlk	Non / Block		-	Autoreclose block by OCN1	Block		
	OCN2	OCN2-EN	Off / On		-	OCN2 protection enable	Off		
		OCN2-Dir	NonDir / Forward / Reverse		-	OCN2 directional characteristic	NonDir		
		OCN2-Angle	0 - 180		deg	OCN2 directional characteristic angle	45		
		OCN2-Type	DT / IEC-NI / IEC-VI / IEC-EI/ UK-LTI / IEEE-MI / IEEE-VI / IEEE-EI / US-CO2 / US-CO8 / Original		-	OCN2 delay type	DT		
		OCN2-DT	0.02 - 50.00	0.10 - 250.00	A	OCN2 threshold (in DT mode)	0.40	2.00	

Setting of OCN(Function ID:443001)

Setting item			Range		Units	Contents	Default setting value		Notes
			1A rating	5A rating			1A	5A	
		OCN2-IDMT	0.02 - 5.00	0.10 - 25.00	A	OCN2 threshold (in IDMT mode)	0.40	2.00	
		OCN2-DPR	10 - 100		%	OCN2 drop-out/pick-up ratio	100		
		TOCN2	0.00 - 300.00		s	OCN2 operating delay time	1.00		
		OCN2-TMS-IEC	0.010 - 50.000		-	OCN2 time multiplier of IEC inverse curve	1.000		
		OCN2-TMS-UK	0.010 - 50.000		-	OCN2 time multiplier of UK inverse curve	1.000		
		OCN2-TMS-IEEE	0.010 - 50.000		-	OCN2 time multiplier of IEEE inverse curve	1.000		
		OCN2-TMS-US	0.010 - 50.000		-	OCN2 time multiplier of US inverse curve	1.000		
		OCN2-TMS-ORG	0.010 - 50.000		-	OCN2 time multiplier of Original inverse curve	1.000		
		OCN2-Rtype	DEF / DEP		-	OCN2 reset delay type	DEF		
		TOCN2R	0.00 - 300.00		s	OCN2 definite time reset delay	0.00		
		OCN2-RTMS-IEEE	0.010 - 50.000		-	OCN2 dependent reset time multiplier of IEEE inverse curve	1.000		
		OCN2-RTMS-US	0.010 - 50.000		-	OCN2 dependent reset time multiplier of US inverse curve	1.000		
		OCN2-RTMS-ORG	0.010 - 50.000		-	OCN2 dependent reset time multiplier of Original inverse curve	1.000		
		OCN2-k	0.00000 - 500.00000		-	OCN2 user original curve coefficient	0.00000		
		OCN2-a	0.00000 - 10.00000		-	OCN2 user original curve coefficient	0.00000		
		OCN2-c	0.00000 - 10.00000		-	OCN2 user original curve coefficient	0.00000		
		OCN2-kr	0.00000 - 500.00000		-	OCN2 user original curve coefficient	0.00000		
		OCN2-b	0.00000 - 10.00000		-	OCN2 user original curve coefficient	0.00000		
		OCN2-2fBlk	Non / Block		-	OCN2 operation block by 2f-detection	Non		
		OCN2-VTFBlk	Non / Block		-	OCN2 operation block by VTF	Non		
		OCN2-CTFBlk	Non / Block		-	OCN2 operation block by CTF	Non		
		OCN2-UseFor	Trip / Alarm		-	OCN2 used for trip or alarm	Trip		
		OCN2-ARCBlk	Non / Block		-	Autoreclose block by OCN2	Block		
	OCN3	OCN3-EN	Off / On		-	OCN3 protection enable	Off		
		OCN3-Dir	NonDir / Forward / Reverse		-	OCN3 directional characteristic	NonDir		
		OCN3-Angle	0 - 180		deg	OCN3 directional characteristic angle	45		
		OCN3-Type	DT / IEC-NI / IEC-VI / IEC-EI/ UK-LTI / IEEE-MI / IEEE-VI / IEEE-EI / US-CO2 / US-CO8 / Original		-	OCN3 delay type	DT		
		OCN3-DT	0.02 - 50.00	0.10 - 250.00	A	OCN3 threshold (in DT mode)	0.40	2.00	
		OCN3-IDMT	0.02 - 5.00	0.10 - 25.00	A	OCN3 threshold (in IDMT mode)	0.40	2.00	
		OCN3-DPR	10 - 100		%	OCN3 drop-out/pick-up ratio	100		
		TOCN3	0.00 - 300.00		s	OCN3 operating delay time	1.00		
		OCN3-TMS-IEC	0.010 - 50.000		-	OCN3 time multiplier of IEC inverse curve	1.000		
		OCN3-TMS-UK	0.010 - 50.000		-	OCN3 time multiplier of UK inverse curve	1.000		
		OCN3-TMS-IEEE	0.010 - 50.000		-	OCN3 time multiplier of IEEE inverse curve	1.000		
		OCN3-TMS-US	0.010 - 50.000		-	OCN3 time multiplier of US inverse curve	1.000		
		OCN3-TMS-ORG	0.010 - 50.000		-	OCN3 time multiplier of Original inverse curve	1.000		

Setting of OCN(Function ID:443001)

Setting item			Range		Units	Contents	Default setting value		Notes
			1A rating	5A rating			1A	5A	
		OCN3-Rtype	DEF / DEP		-	OCN3 reset delay type	DEF		
		TOCN3R	0.00 - 300.00		s	OCN3 definite time reset delay	0.00		
		OCN3-RTMS-IEEE	0.010 - 50.000		-	OCN3 dependent reset time multiplier of IEEE inverse curve	1.000		
		OCN3-RTMS-US	0.010 - 50.000		-	OCN3 dependent reset time multiplier of US inverse curve	1.000		
		OCN3-RTMS-ORG	0.010 - 50.000		-	OCN3 dependent reset time multiplier of Original inverse curve	1.000		
		OCN3-k	0.00000 - 500.00000		-	OCN3 user original curve coefficient	0.00000		
		OCN3-a	0.00000 - 10.00000		-	OCN3 user original curve coefficient	0.00000		
		OCN3-c	0.00000 - 10.00000		-	OCN3 user original curve coefficient	0.00000		
		OCN3-kr	0.00000 - 500.00000		-	OCN3 user original curve coefficient	0.00000		
		OCN3-b	0.00000 - 10.00000		-	OCN3 user original curve coefficient	0.00000		
		OCN3-2fBlk	Non / Block		-	OCN3 operation block by 2f-detection	Non		
		OCN3-VTFBlk	Non / Block		-	OCN3 operation block by VTF	Non		
		OCN3-CTFBlk	Non / Block		-	OCN3 operation block by CTF	Non		
		OCN3-UseFor	Trip / Alarm		-	OCN3 used for trip or alarm	Trip		
		OCN3-ARCBlk	Non / Block		-	Autoreclose block by OCN3	Block		
	OCN4	OCN4-EN	Off / On		-	OCN4 protection enable	Off		
		OCN4-Dir	NonDir / Forward / Reverse		-	OCN4 directional characteristic	NonDir		
		OCN4-Angle	0 - 180		deg	OCN4 directional characteristic angle	45		
		OCN4-Type	DT / IEC-NI / IEC-VI / IEC-EI/ UK-LTI / IEEE-MI / IEEE-VI / IEEE-EI / US-CO2 / US-CO8 / Original		-	OCN4 delay type	DT		
		OCN4-DT	0.02 - 50.00	0.10 - 250.00	A	OCN4 threshold (in DT mode)	0.40	2.00	
		OCN4-IDMT	0.02 - 5.00	0.10 - 25.00	A	OCN4 threshold (in IDMT mode)	0.40	2.00	
		OCN4-DPR	10 - 100		%	OCN4 drop-out/pick-up ratio	100		
		TOCN4	0.00 - 300.00		s	OCN4 operating delay time	1.00		
		OCN4-TMS-IEC	0.010 - 50.000		-	OCN4 time multiplier of IEC inverse curve	1.000		
		OCN4-TMS-UK	0.010 - 50.000		-	OCN4 time multiplier of UK inverse curve	1.000		
		OCN4-TMS-IEEE	0.010 - 50.000		-	OCN4 time multiplier of IEEE inverse curve	1.000		
		OCN4-TMS-US	0.010 - 50.000		-	OCN4 time multiplier of US inverse curve	1.000		
		OCN4-TMS-ORG	0.010 - 50.000		-	OCN4 time multiplier of Original inverse curve	1.000		
		OCN4-Rtype	DEF / DEP		-	OCN4 reset delay type	DEF		
		TOCN4R	0.00 - 300.00		s	OCN4 definite time reset delay	0.00		
		OCN4-RTMS-IEEE	0.010 - 50.000		-	OCN4 dependent reset time multiplier of IEEE inverse curve	1.000		
		OCN4-RTMS-US	0.010 - 50.000		-	OCN4 dependent reset time multiplier of US inverse curve	1.000		
		OCN4-RTMS-ORG	0.010 - 50.000		-	OCN4 dependent reset time multiplier of Original inverse curve	1.000		
		OCN4-k	0.00000 - 500.00000		-	OCN4 user original curve coefficient	0.00000		
		OCN4-a	0.00000 - 10.00000		-	OCN4 user original curve coefficient	0.00000		
		OCN4-c	0.00000 - 10.00000		-	OCN4 user original curve coefficient	0.00000		
		OCN4-kr	0.00000 - 500.00000		-	OCN4 user original curve coefficient	0.00000		
		OCN4-b	0.00000 - 10.00000		-	OCN4 user original curve coefficient	0.00000		

Setting of OCN(Function ID:443001)

Setting item			Range		Units	Contents	Default setting value		Notes
			1A rating	5A rating			1A	5A	
		OCN4-2fBlk	Non / Block		-	OCN4 operation block by 2f-detection	Non		
		OCN4-VTFBlk	Non / Block		-	OCN4 operation block by VTF	Non		
		OCN4-CTFBlk	Non / Block		-	OCN4 operation block by CTF	Non		
		OCN4-UseFor	Trip / Alarm		-	OCN4 used for trip or alarm	Trip		
		OCN4-ARCBlk	Non / Block		-	Autoreclose block by OCN4	Block		

3.4.8 Data ID

◆ Signal monitoring point

OCN(Function ID: 443001)

Element ID	Name	Description
8000011C23	OCN1	OCN1 relay element operated
8000011C27	OCN1PU	OCN1 relay operation level pick up
8000011B60	OCN1-OPT	OCN1 protection operated
8100021C23	OCN2	OCN2 relay element operated
8100021C27	OCN2PU	OCN2 relay operation level pick up
8100021B60	OCN2-OPT	OCN2 protection operated
8200031C23	OCN3	OCN3 relay element operated
8200031C27	OCN3PU	OCN3 relay operation level pick up
8200031B60	OCN3-OPT	OCN3 protection operated
8300041C23	OCN4	OCN4 relay element operated
8300041C27	OCN4PU	OCN4 relay operation level pick up
8300041B60	OCN4-OPT	OCN4 protection operated

◆ Connection point on PLC logic

OCN(Function ID: 443001)

Element ID	Name	Description
800001EBB0	OCN1_BLOCK	OCN1 protection block command
800001EBB1	OCN1_INST_OP	OCN1 protection instant operation command
810002EBB0	OCN2_BLOCK	OCN2 protection block command
810002EBB1	OCN2_INST_OP	OCN2 protection instant operation command
820003EBB0	OCN3_BLOCK	OCN3 protection block command
820003EBB1	OCN3_INST_OP	OCN3 protection instant operation command
830004EBB0	OCN4_BLOCK	OCN4 protection block command
830004EBB1	OCN4_INST_OP	OCN4 protection instant operation command

3.4.9 PLC driver

◆ Connection point at PLC Driver

PLC_DRV (Function ID: 230301) to OCN (Function ID: 443001)

PLC Driver	Element ID	to	Destination	PLC connection point
PMX3_2_0	8810011BB0	→	OCN1_BLOCK	800001EBB0
PMX3_2_1	8910011BB1	→	OCN2_BLOCK	810002EBB0
PMX3_2_2	8A10011BB2	→	OCN3_BLOCK	820003EBB0
PMX3_2_3	8B10011BB3	→	OCN4_BLOCK	830004EBB0
PMX3_2_4	8C10011BB4	→	OCN1_INST_OP	800001EBB1
PMX3_2_5	8D10011BB5	→	OCN2_INST_OP	810002EBB1
PMX3_2_6	8E10011BB6	→	OCN3_INST_OP	820003EBB1
PMX3_2_7	8F10011BB7	→	OCN4_INST_OP	830004EBB1

3.5 Voltage-dependent overcurrent protection (OCV)

With regard to a certain type of faults, the voltage controlled or voltage restrained inverse overcurrent (OCV) function is useful for a fault occurring on the lower voltage side of the transformer. For example, the fault current in the certain type is lower than the normal fault current; the OCV function is used to back up the operation of the conventional protection relays.

In the OCV function one of two features is selected during the operation: (1) the voltage controlled OCV and (2) the voltage restraint OCV. The OCV function works as (1) when an input voltage is lower than the OCV setting, whereas the sensitivity of the OCV function is adjusted proportionally in response to an input voltage when the OCV function works as (2). The user can set an operating value using the OCV setting; the value can be chosen from 20% to 100% of the input voltage.

The OCV function consists of four stages (i.e., OCV1 element to OCV4 element). For simplicity, the OCV1 element is discussed, but the other elements are identical to the OCV1 element.

Note: The implementation of the feature depends on the selection of both the hardware and the software. Note that the feature is not supplied for the several models; hence, the user has to check the implementation for the model. Locate the ordering number and check it at the "G&T position" referring to the comparison table below. For more information, see *Appendix: Ordering*.

Table 3.5-1 Comparative table in respective ordering numbers

Sec.	Feature	Ordering No. at "G&T"					
		BCU			BCPU		IFU
		11	13	1F	2C	2N	19
–	Main features	NA	NA	NA	✓	✓	NA
–	Num. of stages	NA	NA	NA	4	4	NA
3.5.9	PLC driver	NA	NA	NA	✓	✓	NA

✓: Applicable NA: Not applicable

3.5.1 Relay polarity

The user can choose either non-directional element or directional element in the OCV1 function using setting [**OCV1-Dir**].

(i) Characteristic of non-directional OC

The characteristic of the non-directional type OCV is a circle that has a center at the origin. The boundary of the circle is the threshold value of the non-directional OCV and the hatched area shows the area of operation of the non-directional OC element.

The user can set the threshold value of the non-directional OC element for stage 1 using setting [**OCV1-I**]. **Nondir** is set for the scheme switch [**OCV1-Dir**].

(ii) Characteristic of directional-OCV element in the forward direction

As shown in Figure 3.5-1, the characteristic of the directional-OCV elements in the forward direction is a semi-circle based upon the zero torque line; the hatched area shows the operating region of a directional-OCV element. Table 3.5-2 shows the relationship between each current and its respective reference voltage.

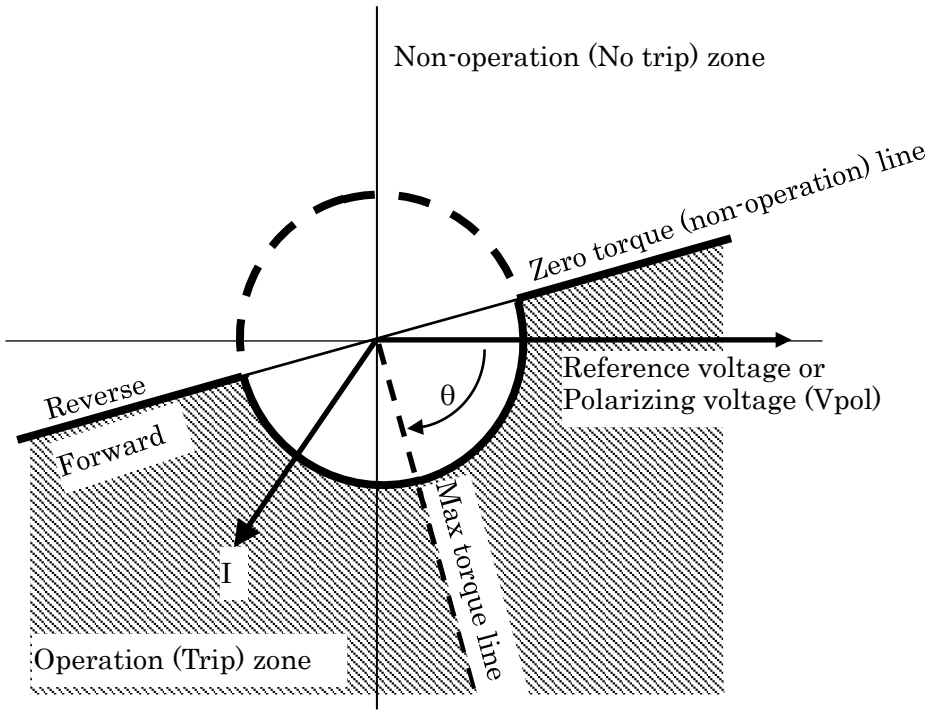


Figure 3.5-1 Characteristic of the directional-OCV element in the forward direction

Note: A sensing angle (θ) forms the angle between the reference quantity and the maximum torque line. The half plane represents the zone of operation bordered on one side by the zero torque line, (non-operating) line and extending in the direction that contains both the reference (polarizing) and operating quantities.

Table 3.5-2 Directional polarizing signal

Current	Polarizing voltage
Ia∠0°	Vbc∠-90°
Ib∠0°	Vca∠-90°
Ic∠0°	Vab∠-90°

(iii) Characteristic of directional OCV in the reverse direction

The reverse characteristic is a mirror image of the forward characteristic. The setting and the scheme switch, as well as the setting of the directional OCV element in the forward direction, provides the setting of the directional OCV element in the reverse direction: for example, **Reverse** is set for the scheme switch [**OCV1-Dir**] when the direction of the OCV1 element is considered.

3.5.2 Inverse time and definite time delay characteristic

The OCV element monitors the currents and when one of the currents cross the threshold of operation, the OCV element will operate within a period that is defined by the time characteristic feature. The user can choose the OCV operate time delay characteristics, either dependent (inverse) time characteristic delay or independent (definite) time characteristic delay. The operate time of the dependent time characteristic delay depends upon the level of the energizing current, and the operate time in the definite time characteristic delay is a constant.

The OCV element reset time delay characteristic will be either dependent time reset or definite time reset.

The user can select which characteristic will be applied to each stage of the OCV element by setting a scheme switch that will be explained later in this section.

(i) Operation principle

(i)-1 Dependent time characteristic (inverse time delay)

The inverse time OCV element has an inverse time feature for both operation and resetting; for resetting, both definite time and dependent time resetting are available.

With inverse time operation, provided that the fault current has the magnitude required to enable the determination of the location of the fault and provided that the fluctuation in the impedance of the power source does not affect the correct determination, an inverse time OCV function provides an effective protection. With regard to the inverse time characteristic, for example, the function can provide a fast trip for close-in faults, but will enable a delayed trip for remote faults. The characteristic curve of the inverse time element can be selected from among 10 characteristic curves† in conformance with IEC, IEEE, US, and UK standards.

†Note: A user-defined '**Original**' curve can also be applied in addition to the 10 predefined characteristics provided.

With dependent time resetting selected, if during the resetting period the energizing current exceeds the threshold current of the OCV element, then the OCV element will pick-up. The OCV element will reset later in a period determined by the characteristics of dependent time resetting. In other words, the user can choose the behavior of the OCV element for either faults that are repetitive intermittent or faults that occur in rapid succession. The characteristic for dependent time resetting is selectable from five dependent time characteristics in conformance with IEEE and US standards.

When definite time resetting is selected with the operation of the inverse time OCV selection and the reset time set to zero (instantaneous), no intentional delay is added for the resetting: that is, when the energizing current falls below the reset threshold of the OCV element, the OCV element returns to its reset condition. If a value is set to the reset time in seconds, the resetting of the OCV element is delayed by the reset time.

(i)-2 Definite time delay (independent time characteristic)

In a system in which the fault current does not vary a great deal relative to the location of the fault, definite time overcurrent protection is usually applied. Because the fault current does not change greatly with respect to fault position the previous advantages described with regard to the inverse time function are not applicable. Therefore, the definite time OCV element is used instead of the inverse time OCV element. The definite time OCV element has a fixed operating time regardless of the magnitude of the fault current.

The operating time of the definite time OCV element is set depending on the distance from the power source and should be set shorter for relays furthest from the power source. Definite time OCV protection provides selectivity dependent on the difference between relay operating times. It is limited to use in networks with a power source at one side only i.e. in radial networks. The threshold values can be set identically at each terminal, but preferably, the threshold value is reduced, little-by-little to provide a margin in terms of the current sensitivity of the OCV element. Moreover, a higher sensitivity of threshold current is required for a protective relay that is located remote from the power source, that is, the threshold of the definite time OCV element is required to be lower than the ordinary threshold.

The operate time of the definite time OCV element is constant irrespective of the magnitude of the fault current and the threshold level of operation of the definite time OCV

element with an on-delay timer provides a selective protection. As a result, the circuit breaker (CB) at the remote terminal far from the power source can be tripped in the shortest time. The on-delay timer, which generates a delay in starting the operation of the OCV element, provides a time grading margin (Tc); Tc is discussed later.

Definite time resetting as well as the on-delay starting setting of the definite time OCV element is provided. The operate time for the on-delay timer for starting and for the resetting time is set using the OCV element settings.

(ii) Independent time characteristic (definite time delay)

The operate time of the independent time characteristic OCV element will be a constant time and is not affected by the level of current. The reset time is also set to a constant time. The user can set the operate time and reset time using a setting switch; descriptions of how to apply these settings are provided in sections (vi) and (vii).

(iii) Dependent time characteristic (inverse time delay)

The operate time of the dependent time characteristic V element is inversely proportional to the level of the fault current. The user can determine the operate time from a preset curve. Ten characteristic curves are available; i.e. nine pre-installed curves covering IEC, IEEE, US and UK standard characteristic curves and one original (user programmable) characteristic curve for which the user can set the equation parameters. The dependent time characteristic curve equation and parameters will be explained in section (iv).

The reset time of the dependent time delay OCV element is user selectable; the reset time options are dependent time reset characteristics or definite time reset characteristic. For dependent time reset, the user can choose the reset time for the preset characteristic from six characteristic curves; i.e. IEEE and US standard five pre-installed characteristic curves and one user original characteristic curve where the user can set the equation parameters. The dependent time reset characteristic curve equation and parameters will be explained in section (vi). The definite time reset characteristic ones will be explained in section (vii).

(iv) Operate time of dependent time characteristic

The operate time of the dependent time characteristics are defined in the IEC 60255-151 (we shall see Equations (3.5-2) and (3.5-3) later).

The nine pre-programmed standard characteristic curves are defined in Table 3.5-3. In addition, one original (user-programmable) curve can be applied. One curve can be chosen for each OCV stage. Figure 3.5-2 illustrates these characteristic curves. For example, the user should set one of the following scheme switches to [**OCV1-Type**]. The scheme switches are "**IEC-**

NI" for IEC Normal Inverse characteristic, "**IEC-VI**" for IEC Very inverse, "**IEC-EI**" for IEC Extremely Inverse, "**UK-LTI**" for UK Long Time Inverse, "**IEEE-MI**" for IEEE Moderately Inverse, "**IEEE-VI**" for IEEE Very Inverse, "**IEEE-EI**" for IEEE Extremely Inverse, "**US-CO8**" for US CO8 Inverse, "**US-CO2**" for US CO2 Short Time Inverse and "**Original**" for user-programmable characteristic.

A time multiplier (TMS) setting is required for the inverse time delay and the value of TMS can be set for the required operate time. The value of TMS is set for a characteristic: for example, the user can set TMS in the OCV1 element according to the IEC standard using the scheme switch [**OCV1-TMS-IEC**]; the default value for the TMS is 1.00. The other TMSs for the OC1 element are also set using the scheme switches [**OCV1-TMS-UK**], [**OCV1-TMS-IEEE**], [**OCV1-TMS-US**] and [**OCV1-TMS-ORG**].

Table 3.5-3 Constants for dependent operate time characteristics

Curve type (IEC 60255-151)	Curve Description	k sec	α	c sec
A	IEC Normal Inverse (IEC-NI)	0.14	0.02	0
B	IEC Very Inverse (IEC-VI)	13.5	1	0
C	IEC Extremely Inverse (IEC-EI)	80	2	0
-	UK Long Time Inverse (UK-LTI)	120	1	0
D	IEEE Moderately Inverse (IEEE-MI)	0.0515	0.02	0.114
E	IEEE Very Inverse (IEEE-VI)	19.61	2	0.491
F	IEEE Extremely Inverse (IEEE-EI)	28.2	2	0.1217
-	US CO8 inverse (US-CO8)	5.95	2	0.18
-	US CO2 short time inverse (US-CO2)	0.02394	0.02	0.01694

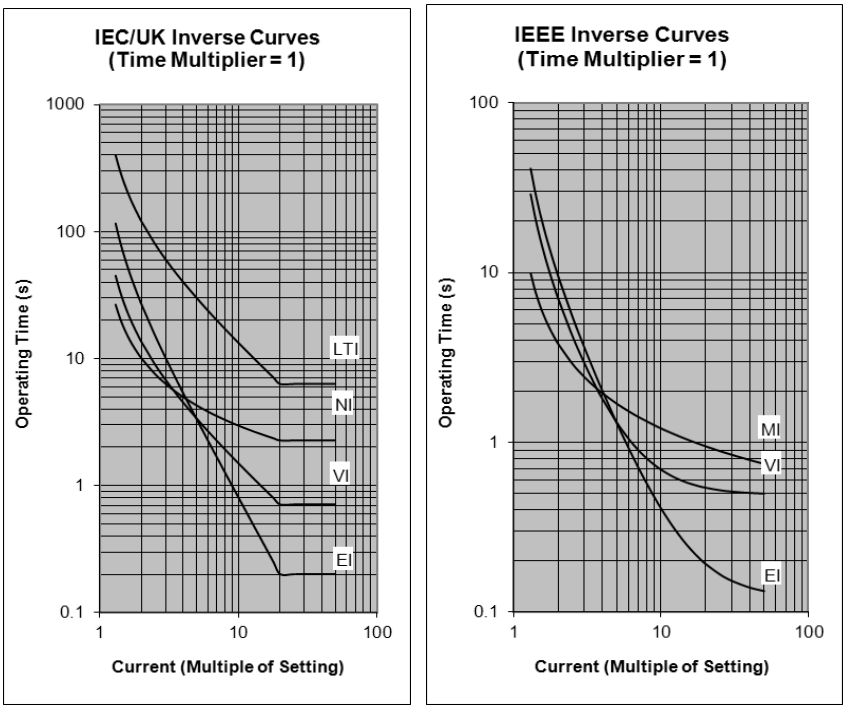


Figure 3.5-2 Inverse Definite Mean Time (IDMT) Characteristics

(v) Operate time of independent time characteristic

The operate time of the independent time characteristic is a constant.

(v)-1 Time characteristic

The user should set scheme switches [**OCV1-Type**] **DT** (Definite Time) to select the independent time characteristic. The value of the required operate time is set using the setting **TOCV1** in the range 0.00–300.00s.

(v)-2 Instantaneous activation

The operate time of the instantaneous characteristic is achieved by setting the independent time setting to zero as described above.

(vi) Reset time for dependent time characteristic

The reset time of the dependent time characteristic is available for the IEEE standard, US standard and original (user-programmable) dependent time characteristic. For example, the user should set scheme switch [**OCV1-Rtype**] "**DEP**" for OCV1 stage to set the dependent time reset characteristic†. The following equation defines the reset time for the dependent time characteristic. (ref. IEC 60255-151):

$$t_{re} = \text{RTMS} \times \left[\frac{\text{kr}}{1 - \left({}^{I}/_{I_s} \right)^{\beta}} \right] \qquad (3.5\text{-}1)$$

where,

t_{re} = time required for the element to reset fully after complete operation (seconds)

I = energizing current (amperes)

I_S = overcurrent setting (amperes)

RTMS = time multiplier setting for resetting

kr = time required to reset fully after complete operation when the energizing current is zero (seconds)

ß = constants defining curve

For example, on the OCV1 stage, with regard to the RTMS for the IEEE characteristic, the user should set a value in [**OCV1-RTMS-IEEE**]; the default value is 1.000. Similarly, [**OCV1-RTMS-US**] is for the US standard characteristic curve and [**OCV1-RTMS-ORG**] is for an original (user-programmable) characteristic curve. (See Table 3.5-4 for the values of kr and ß; the characteristic curves are shown in Figure 3.5-3.)

Table 3.5-4 Constants for dependent reset time characteristics

Curve Type IEC 60255-151	Curve Description	kr sec	ß
A	IEC Normal Inverse (IEC-NI)	N/A	N/A
B	IEC Very Inverse (IEC-VI)	N/A	N/A
C	IEC Extremely Inverse (IEC-EI)	N/A	N/A
-	UK Long Time Inverse (UK-LTI)	N/A	N/A
D	IEEE Moderately Inverse (IEEE-MI)	4.85	2
E	IEEE Very Inverse (IEEE-VI)	21.6	2
F	IEEE Extremely Inverse (IEEE-EI)	29.1	2
-	US CO8 inverse (US-CO8)	5.95	2
-	US CO2 short time inverse (US-CO2)	2.261	2

†Note:Alternatively, set scheme switch [**OCV*-Rtype**] to "**DEF**" for each stage to set the definite reset time charact

eristic. The definite reset time characteristic is available for all dependent time characteristics including the IEC standard, UK standard, IEEE standard, US standard and original (user-programmable) characteristic. The definite time reset characteristic is also available for the independent time characteristic.

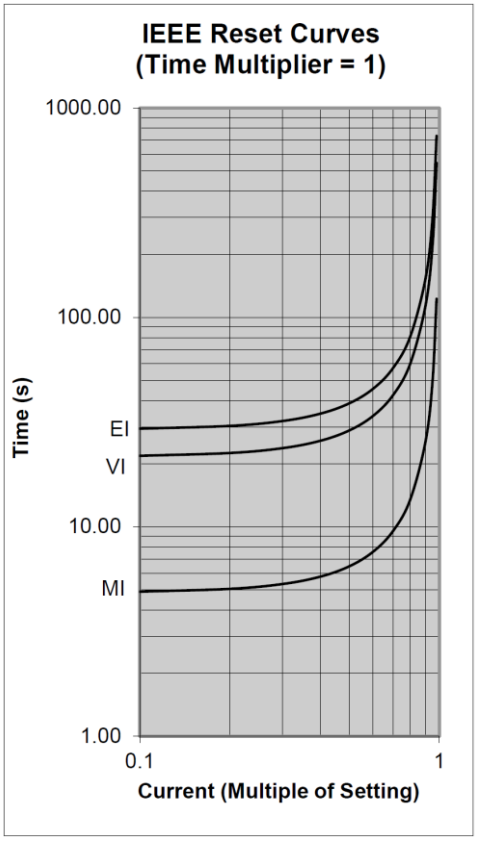


Figure 3.5-3 Dependent reset time characteristics curves

Figure 3.5-3 illustrates the effect of dependent time resetting on the internal time delay

counter. An object current (I), where I is greater than a setting (I_S) provides an energizing quantity for the function which continues to flow for a cumulative period causing the operation of the function. If the operating quantity falls below the I_S setting, the function will return to its reset state after the time t(I). The time t(I) is calculated using Equation (3.5-1).

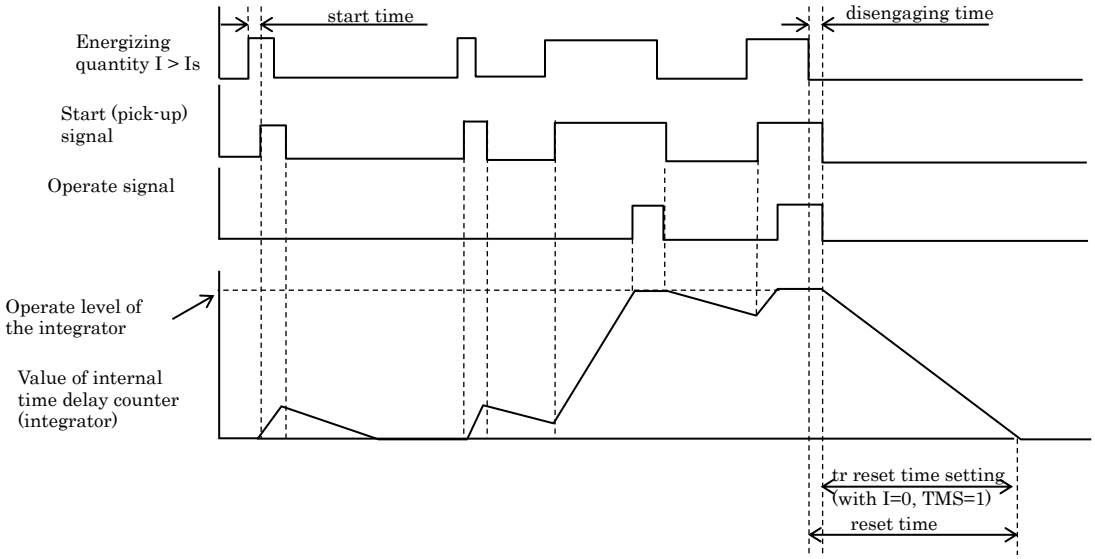


Figure 3.5-4 Dependent reset time characteristics

(vii) Reset time for definite time (instantaneous) characteristic

The user can choose either definite time reset or instantaneous reset (no intentional delay on reset) for all OCV characteristics.

(vii)-1 Reset time characteristic

The reset time for the definite time characteristic is available for all OCV characteristics whether it is a dependent time or independent time characteristic. The user is able to set scheme switch [**OCV1-Rtype**] **DEF** for OCV1 stage to set the definite time reset characteristic. Then, set an intentional delay reset time of [**TOCV1R**] in seconds for the OCV1 stage.

(vii)-2 Instantaneous reset operation

The reset time for instantaneous reset is a case of no intentional delay on reset within definite time reset. The user should set the delay time value to 0.00.

3.5.3 Characteristic of voltage-controlled OCV

The voltage-controlled OCV function is enabled by programming the operating zone using the settings [**OCV1-I**] and [**OCV1-V**]. The user should set **Controlled** for the scheme switch [**OCV1-EN**].

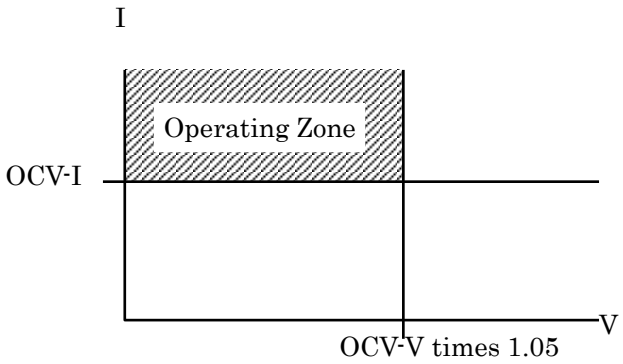


Figure 3.5-5 Pick-up zone in voltage-controlled OCV

Note: An error may exist in the computation of the OCV relay. That is, integrated value in the computation should not be reset unnecessarily when the computation is carried out, using the setting of restrained voltage in the OCV relay. Therefore, the setting value is multiplied by 1.05, so that the resetting of the integrated value is not done unnecessarily. The figure above shows the OCV characteristic in response to the controlled function. When the input voltage is lower than the setting value times 1.05, the integration process is performed. When the input voltage is higher than the setting value times 1.05, the integration process is reset.

3.5.4 Characteristic of voltage-restrained OCV

The sensitivity in the OCV relay is controlled in response to the input-voltage. As shown in Figure 3.5-6, the characteristic is set by settings [**OCV1-I**] and [**OCV1-V**]. The OCV1-I sensitivity is increased in response to the input voltage. The equations for the OCV operation and the OCV resetting are shown below.

For operation

$$t_{op} = \mathrm{TMS} \times \left\{ \left[\frac{\mathrm{k}}{\left({}^{I}/_{I_s \times V_{res}} \right)^{\alpha} - 1} \right] + c \right\} \qquad (3.5\text{-}2)$$

For resetting

$$t_{re} = \mathrm{RTMS} \times \left[\frac{\mathrm{kr}}{1 - \left({}^{I}/_{I_s \times V_{res}} \right)^{\beta}} \right] \qquad (3.5\text{-}3)$$

where:

t_{op} = operate time with constant current I (seconds)

t_{re} = reset time with constant current I (seconds)

I = operate (energizing) current (amperes)

Is = overcurrent setting (amperes); set by [**OCV1-I**]

Vs= voltage setting; set by [**OCV1-V**]

TMS = time multiplier setting number

k, α, c = constants defining curve

Vres = calculated in accordance with the ratio "V/Vs" and "Is". That is,

$1 \leq V/Vs$: Vres = Is × 1.00

$0.2 \leq V/Vs \leq 1$: Vres = Is × ratio "V/Vs"

$V/Vs \leq 0.2$: Vres = Is × 0.2

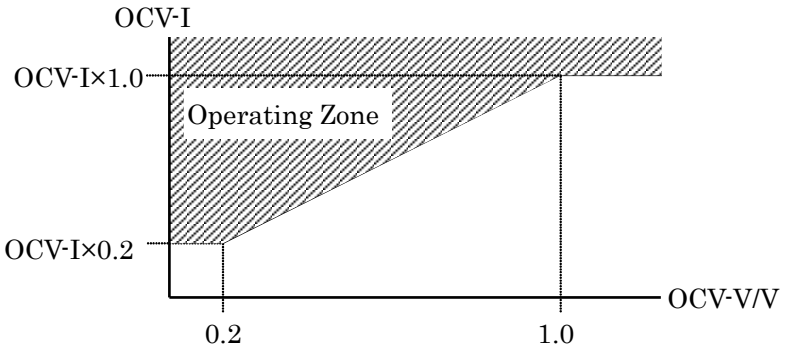


Figure 3.5-6 Pick-up zone of voltage-restrained OCV

3.5.5 Miscellaneous functions

(i) Trip mode

Every OCV element has a selectable tripping mode; the mode is selected using a scheme switch. For the OC1 element, for example, a scheme switch [**OCV1-OPMD**] is provided. When a trip is required for all faults that are detected, **3POR** (a fault in one or more phases occurs) is set for the scheme switch [**OCV1-OPMD**]. On the other hand, when a trip is only required for faults that occur in two or more phases, **2OUTOF3** (a fault in two or more phases occurs) is set for the scheme switch [**OCV1-OPMD**].

Table 3.5-5 Fault type and tripping mode

Fault type			Setting [OCV1-OPMD]	
Phase-A	Phase-B	Phase-C	3POR	2OUTOF3
–	–	–	✓	No trip
–	X	–	✓	No trip
–	–	X	✓	No trip
X	X	–	✓	✓
–	X	X	✓	✓
X	X	X	✓	✓
X	X	X	✓	✓

Note: A tick (✓) indicates that a trip is issued when faults are detected.
A mark (X) indicates the occurrence of a fault on a particular phase. A (–) mark indicates that no fault has occurred on that particular phase.

(ii) Harmonic detection

The operation of each OCV element can be blocked using a scheme switch, if the relay detects a harmonic caused by the magnetizing inrush current phenomenon when a transformer is energized. For example, for the OCV1 element, the scheme switch [**OCV1-2fBlk**] is provided, and **Block-3P** is set when the user wishes to block all three-phases of the OC1 element when the harmonic associated with magnetizing inrush occurs. Alternatively, **Block-PerP** is set if single phase blocking is required. **Non** is set for the scheme switch [**OCV1-2fBlk**] as the default setting.

(iii) Blocking OCV by VTF

The operation of the OCV element can be blocked by the voltage transformer failure (VTF) function via a scheme switch. For example, **Block** is set for the scheme switch [**OCV1-VTFBlk**] to block the operation of the OC1 element during a VTF condition. **Non** is set for the scheme switch [**OCV1-VTFBlk**] as a default.

(iv) OCV operation for auto-reclose

The OCV element activates the auto-reclose (ARC) function. However, if for example ARC

is not required, **Block** is set for the scheme switch [**OCV1-ARCBlk**]. **Block** is set for the scheme switch [**OCV1-ARCBlk**] as a default.

(v) Signal of OCV trip

When a user requires an alarm signal in place of the trip signal; for example, set **Alarm** for the scheme switch [**OCV1-UseFor**]. **Trip** is set for the scheme switch [**OCV1-UseFor**] for the normal trip operation.

3.5.6 Scheme logic

The scheme logic for both the non-directional and the directional OCV1 element is illustrated in Figure 3.5-7 and Figure 3.5-8. Each phase of the OCV1 element indicates when a pick-up current has exceeded a setting, and then trip signals are fed into the TRC circuit, which is discussed separately. (See Chapter *Relay application: Trip circuit function*)

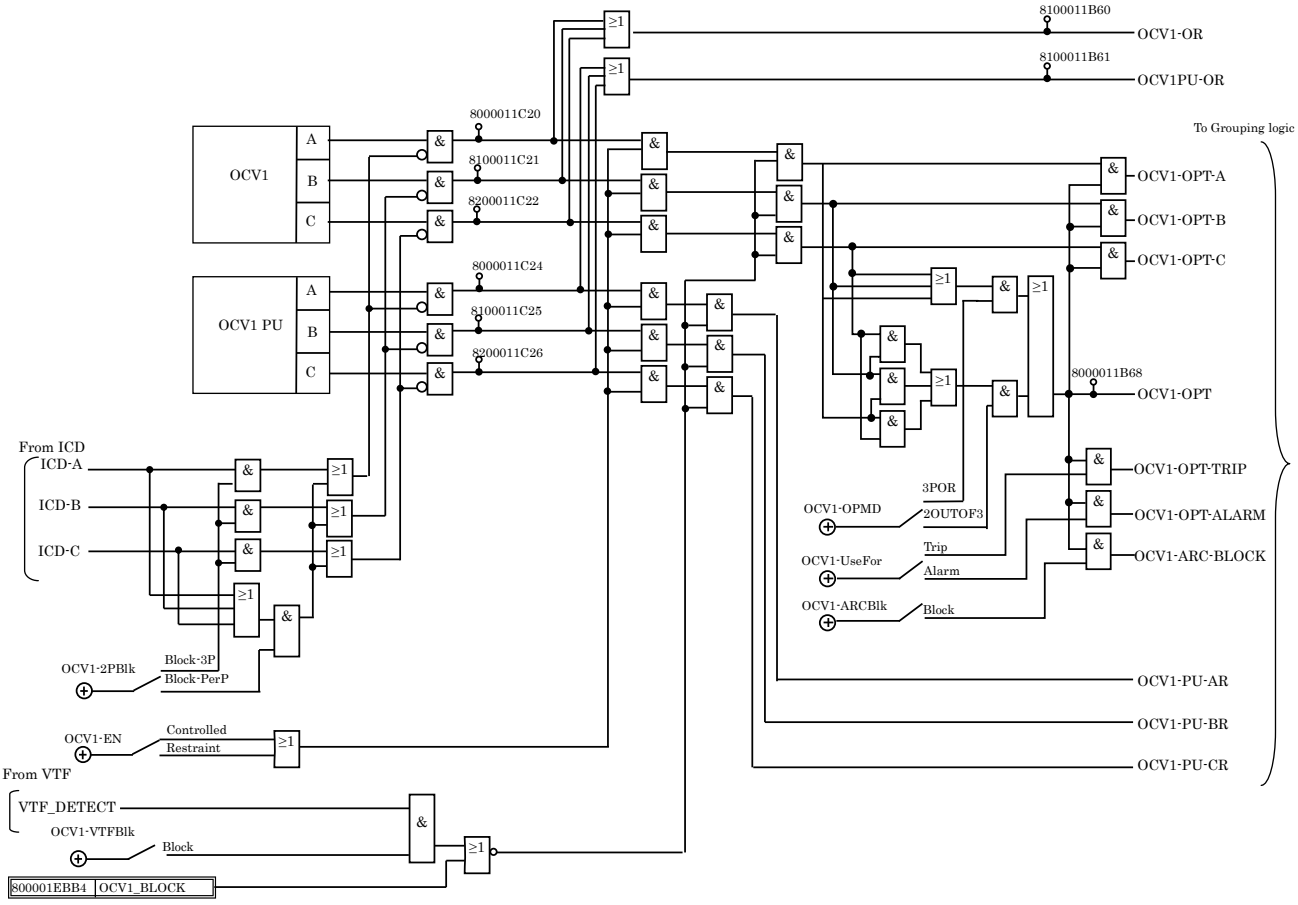


Figure 3.5-7 Scheme logic for the OCV1

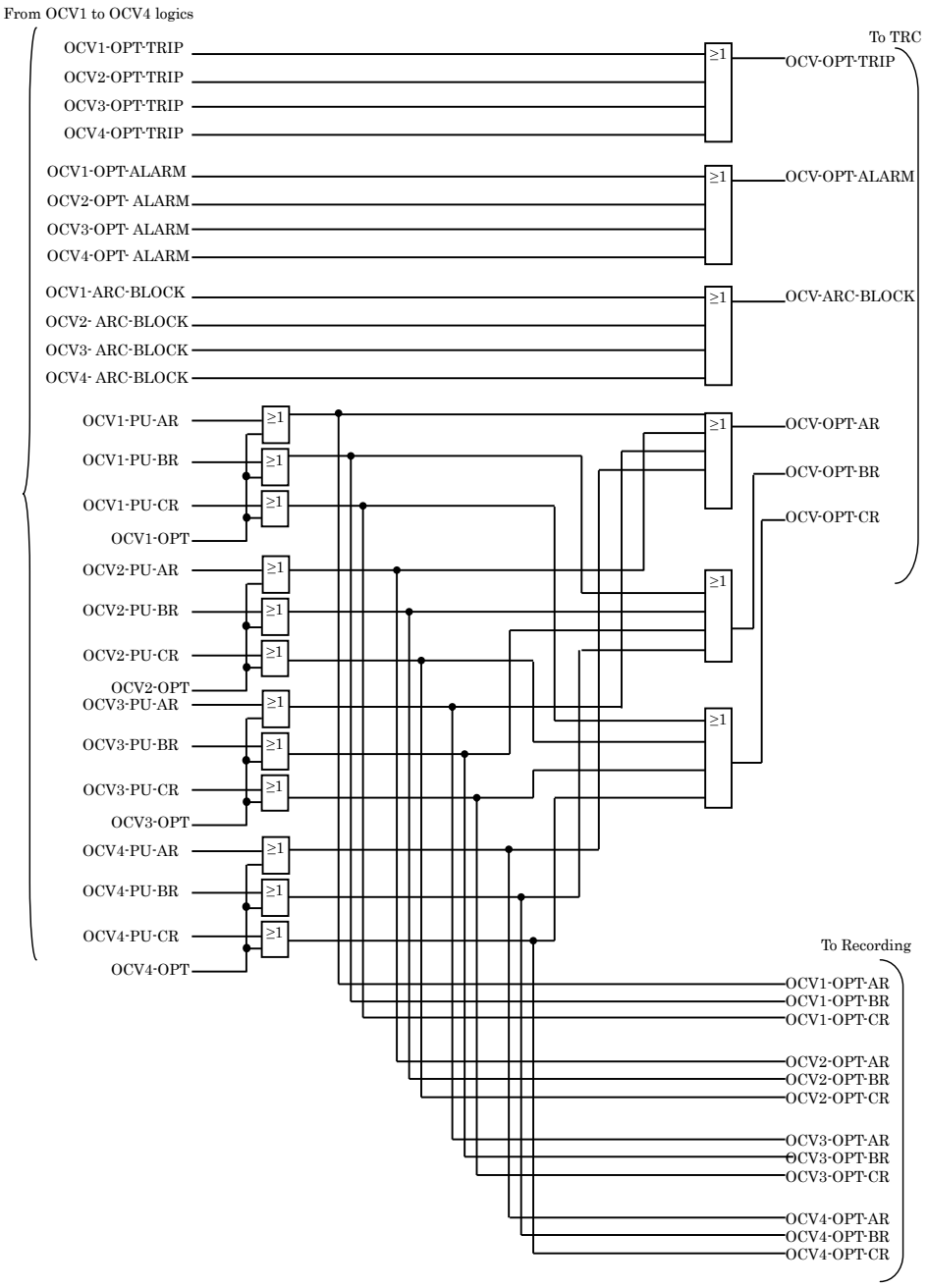


Figure 3.5-8 Grouping logic for TRC/Recording functions

3.5.7 Setting

Setting of OCV (Function ID: 444001)

Setting item		Range		Unit s	Contents	Default setting value		Notes
		1A rating	5A rating			1A rating	5A rating	
1	OCV1-EN	Off/Controlled/Restraint			OCV1 protection enable			
	OCV1-VTFBlk	Non/Block			OCV1 operation block by VTF	Non		
	OCV1-OPMD	3POR/2OUTOF3			OCV1 operation mode	3POR		
	OCV1-UseFor	Trip/Alarm			OCV1 used for trip or alarm	Trip		
	OCV1-ARCBlk	Non/Block			Autoreclose block by OCV1	Block		
	OCV1-Dir	NonDir/Forward/Reverse			OCV1 directional characteristic	NonDir		
	OCV1-Angle	0-180		deg	OCV1 directional characteristic angle	45		
	OCV1-Type	IEC-NI/IEC-VI/IEC-EI/UK-LTI/IEEE-MI/IEEE-VI/IEEE-EI/US-CO2/US-CO8/ Original			OCV1 delay type	IEC-NI		
	OCV1-I	0.02-5	0.1-25	A	OCV1 I threshold	1	5	
	OCV1-V	10-220		V	OCV1 V threshold	70		
	OCV1-TMS-IEC	0.01-50			OCV1 time multiplier of IEC inverse curve	1		
	OCV1-TMS-UK	0.01-50			OCV1 time multiplier of UK inverse curve	1		
	OCV1-TMS-IEEE	0.01-50			OCV1 time multiplier of IEEE inverse curve	1		
	OCV1-TMS-US	0.01-50			OCV1 time multiplier of US inverse curve	1		
	OCV1-TMS-ORG	0.01-50			OCV1 time multiplier of Original inverse curve	1		
	OCV1-Rtype	DEF/DEP			OCV1 reset delay type	DEF		
	TOCV1R	0-300		s	OCV1 definite time reset delay	0		
	OCV1-RTMS-IEEE	0.01-50			OCV1 dependent reset time multiplier of IEEE inverse curve	1		
	OCV1-RTMS-US	0.01-50			OCV1 dependent reset time multiplier of US inverse curve	1		
	OCV1-RTMS-ORG	0.01-50			OCV1 dependent reset time multiplier of Original inverse curve	1		
	OCV1-k	0-500			OCV1 user original curve coefficient	0		
	OCV1-a	0-10			OCV1 user original curve coefficient	0		
	OCV1-c	0-10			OCV1 user original curve coefficient	0		
	OCV1-kr	0-500			OCV1 user original curve coefficient	0		
	OCV1-b	0-10			OCV1 user original curve coefficient	0		
	OCV1-2fBlk	Non/Block-3P/Block-PerP			OCV1 operation block by 2f-detection			
2	OCV2-EN	Off/Controlled/Restraint			OCV2 protection enable			
	OCV2-VTFBlk	Non/Block			OCV2 operation block by VTF	Non		
	OCV2-OPMD	3POR/2OUTOF3			OCV2 operation mode	3POR		
	OCV2-UseFor	Trip/Alarm			OCV2 used for trip or alarm	Trip		
	OCV2-ARCBlk	Non/Block			Autoreclose block by OCV2	Block		
	OCV2-Dir	NonDir/Forward/Reverse			OCV2 directional characteristic	NonDir		
	OCV2-Angle	0-180		deg	OCV2 directional characteristic angle	45		
	OCV2-Type	IEC-NI/IEC-VI/IEC-EI/UK-LTI/IEEE-MI/IEEE-VI/IEEE-EI/US-CO2/US-CO8/ Original			OCV2 delay type	IEC-NI		

Setting of OCV (Function ID: 444001)

Setting item			Range		Unit s	Contents	Default setting value		Notes
			1A rating	5A rating			1A rating	5A rating	
		OCV2-I	0.02-5	0.1-25	A	OCV2 I threshold	1	5	
		OCV2-V	10-220		V	OCV2 V threshold	70		
		OCV2-TMS-IEC	0.01-50			OCV2 time multiplier of IEC inverse curve	1		
		OCV2-TMS-UK	0.01-50			OCV2 time multiplier of UK inverse curve	1		
		OCV2-TMS-IEEE	0.01-50			OCV2 time multiplier of IEEE inverse curve	1		
		OCV2-TMS-US	0.01-50			OCV2 time multiplier of US inverse curve	1		
		OCV2-TMS-ORG	0.01-50			OCV2 time multiplier of Original inverse curve	1		
		OCV2-Rtype	DEF/DEP			OCV2 reset delay type	DEF		
		TOCV2R	0-300		s	OCV2 definite time reset delay	0		
		OCV2-RTMS-IEEE	0.01-50			OCV2 dependent reset time multiplier of IEEE inverse curve	1		
		OCV2-RTMS-US	0.01-50			OCV2 dependent reset time multiplier of US inverse curve	1		
		OCV2-RTMS-ORG	0.01-50			OCV2 dependent reset time multiplier of Original inverse curve	1		
		OCV2-k	0-500			OCV2 user original curve coefficient	0		
		OCV2-a	0-10			OCV2 user original curve coefficient	0		
		OCV2-c	0-10			OCV2 user original curve coefficient	0		
		OCV2-kr	0-500			OCV2 user original curve coefficient	0		
		OCV2-b	0-10			OCV2 user original curve coefficient	0		
		OCV2-2fBlk	Non/Block-3P/Block-PerP			OCV2 operation block by 2f-detection			
	3	OCV3-EN	Off/Controlled/Restraint			OCV3 protection enable			
		OCV3-VTFBlk	Non/Block			OCV3 operation block by VTF	Non		
		OCV3-OPMD	3POR/2OUTOF3			OCV3 operation mode	3POR		
		OCV3-UseFor	Trip/Alarm			OCV3 used for trip or alarm	Trip		
		OCV3-ARCBlk	Non/Block			Autoreclose block by OCV3	Block		
		OCV3-Dir	NonDir/Forward/Reverse			OCV3 directional characteristic	NonDir		
		OCV3-Angle	0-180		deg	OCV3 directional characteristic angle	45		
		OCV3-Type	IEC-NI/IEC-VI/IEC-EI/UK-LTI/IEEE-MI/IEEE-VI/IEEE-EI/US-CO2/US-CO8/ Original			OCV3 delay type	IEC-NI		
		OCV3-I	0.02-5	0.1-25	A	OCV3 I threshold	1	5	
		OCV3-V	10-220		V	OCV3 V threshold	70		
		OCV3-TMS-IEC	0.01-50			OCV3 time multiplier of IEC inverse curve	1		
		OCV3-TMS-UK	0.01-50			OCV3 time multiplier of UK inverse curve	1		
		OCV3-TMS-IEEE	0.01-50			OCV3 time multiplier of IEEE inverse curve	1		
		OCV3-TMS-US	0.01-50			OCV3 time multiplier of US inverse curve	1		
		OCV3-TMS-ORG	0.01-50			OCV3 time multiplier of Original inverse curve	1		
		OCV3-Rtype	DEF/DEP			OCV3 reset delay type	DEF		
		TOCV3R	0-300		s	OCV3 definite time reset delay	0		

Setting of OCV (Function ID: 444001)

Setting item			Range		Unit s	Contents	Default setting value		Notes
			1A rating	5A rating			1A rating	5A rating	
		OCV3-RTMS-IEEE	0.01-50			OCV3 dependent reset time multiplier of IEEE inverse curve	1		
		OCV3-RTMS-US	0.01-50			OCV3 dependent reset time multiplier of US inverse curve	1		
		OCV3-RTMS-ORG	0.01-50			OCV3 dependent reset time multiplier of Original inverse curve	1		
		OCV3-k	0-500			OCV3 user original curve coefficient	0		
		OCV3-a	0-10			OCV3 user original curve coefficient	0		
		OCV3-c	0-10			OCV3 user original curve coefficient	0		
		OCV3-kr	0-500			OCV3 user original curve coefficient	0		
		OCV3-b	0-10			OCV3 user original curve coefficient	0		
		OCV3-2fBlk	Non/Block-3P/Block-PerP			OCV3 operation block by 2f-detection			
	4	OCV4-EN	Off/Controlled/Restraint			OCV4 protection enable			
		OCV4-VTFBlk	Non/Block			OCV4 operation block by VTF	Non		
		OCV4-OPMD	3POR/2OUTOF3			OCV4 operation mode	3POR		
		OCV4-UseFor	Trip/Alarm			OCV4 used for trip or alarm	Trip		
		OCV4-ARCBlk	Non/Block			Autoreclose block by OCV4	Block		
		OCV4-Dir	NonDir/Forward/Reverse			OCV4 directional characteristic	NonDir		
		OCV4-Angle	0-180		deg	OCV4 directional characteristic angle	45		
		OCV4-Type	IEC-NI/IEC-VI/IEC-EI/UK-LTI/IEEE-MI/IEEE-VI/IEEE-EI/US-CO2/US-CO8/ Original			OCV4 delay type	IEC-NI		
		OCV4-I	0.02-5	0.1-25	A	OCV4 I threshold	1	5	
		OCV4-V	10-220		V	OCV4 V threshold	70		
		OCV4-TMS-IEC	0.01-50			OCV4 time multiplier of IEC inverse curve	1		
		OCV4-TMS-UK	0.01-50			OCV4 time multiplier of UK inverse curve	1		
		OCV4-TMS-IEEE	0.01-50			OCV4 time multiplier of IEEE inverse curve	1		
		OCV4-TMS-US	0.01-50			OCV4 time multiplier of US inverse curve	1		
		OCV4-TMS-ORG	0.01-50			OCV4 time multiplier of Original inverse curve	1		
		OCV4-Rtype	DEF/DEP			OCV4 reset delay type	DEF		
		TOCV4R	0-300		s	OCV4 definite time reset delay	0		
		OCV4-RTMS-IEEE	0.01-50			OCV4 dependent reset time multiplier of IEEE inverse curve	1		
		OCV4-RTMS-US	0.01-50			OCV4 dependent reset time multiplier of US inverse curve	1		
		OCV4-RTMS-ORG	0.01-50			OCV4 dependent reset time multiplier of Original inverse curve	1		
		OCV4-k	0-500			OCV4 user original curve coefficient	0		
		OCV4-a	0-10			OCV4 user original curve coefficient	0		
		OCV4-c	0-10			OCV4 user original curve coefficient	0		
		OCV4-kr	0-500			OCV4 user original curve coefficient	0		
		OCV4-b	0-10			OCV4 user original curve coefficient	0		
		OCV4-2fBlk	Non/Block-3P/Block-PerP			OCV4 operation block by 2f-detection			

3.5.8 Data ID

◆ Signal monitoring points

OCV(Function ID: 444001)

Element ID	Name	Description
8000011C20	OCV1-A	OCV1 relay element operated (phase-A)
8100011C21	OCV1-B	OCV1 relay element operated (phase-B)
8200011C22	OCV1-C	OCV1 relay element operated (phase-C)
8000011B60	OCV1-OR	OCV1 relay element operated (3-phases OR)
8000011C24	OCV1PU-A	OCV1 relay operation level pick up (phase-A)
8100011C25	OCV1PU-B	OCV1 relay operation level pick up (phase-B)
8200011C26	OCV1PU-C	OCV1 relay operation level pick up (phase-C)
8000011B61	OCV1PU-OR	OCV1 relay operation level pick up (3-phases OR)
8000011B62	OCV1-OPT-A	OCV1 protection operated (phase-A)
8100011B63	OCV1-OPT-B	OCV1 protection operated (phase-B)
8200011B64	OCV1-OPT-C	OCV1 protection operated (phase-C)
8000011B68	OCV1-OPT	OCV1 protection operated
8400021C20	OCV2-A	OCV2 relay element operated (phase-A)
8500021C21	OCV2-B	OCV2 relay element operated (phase-B)
8600021C22	OCV2-C	OCV2 relay element operated (phase-C)
8100021B60	OCV2-OR	OCV2 relay element operated (3-phases OR)
8400021C24	OCV2PU-A	OCV2 relay operation level pick up (phase-A)
8500021C25	OCV2PU-B	OCV2 relay operation level pick up (phase-B)
8600021C26	OCV2PU-C	OCV2 relay operation level pick up (phase-C)
8100021B61	OCV2PU-OR	OCV2 relay operation level pick up (3-phases OR)
8400021B62	OCV2-OPT-A	OCV2 protection operated (phase-A)
8500021B63	OCV2-OPT-B	OCV2 protection operated (phase-B)
8600021B64	OCV2-OPT-C	OCV2 protection operated (phase-C)
8100021B68	OCV2-OPT	OCV2 protection operated
8800031C20	OCV3-A	OCV3 relay element operated (phase-A)
8900031C21	OCV3-B	OCV3 relay element operated (phase-B)
8A00031C22	OCV3-C	OCV3 relay element operated (phase-C)
8200031B60	OCV3-OR	OCV3 relay element operated (3-phases OR)
8800031C24	OCV3PU-A	OCV3 relay operation level pick up (phase-A)
8900031C25	OCV3PU-B	OCV3 relay operation level pick up (phase-B)
8A00031C26	OCV3PU-C	OCV3 relay operation level pick up (phase-C)
8200031B61	OCV3PU-OR	OCV3 relay operation level pick up (3-phases OR)
8800031B62	OCV3-OPT-A	OCV3 protection operated (phase-A)
8900031B63	OCV3-OPT-B	OCV3 protection operated (phase-B)
8A00031B64	OCV3-OPT-C	OCV3 protection operated (phase-C)
8200031B68	OCV3-OPT	OCV3 protection operated
8C00041C20	OCV4-A	OCV4 relay element operated (phase-A)
8D00041C21	OCV4-B	OCV4 relay element operated (phase-B)
8E00041C22	OCV4-C	OCV4 relay element operated (phase-C)
8300041B60	OCV4-OR	OCV4 relay element operated (3-phases OR)
8C00041C24	OCV4PU-A	OCV4 relay operation level pick up (phase-A)
8D00041C25	OCV4PU-B	OCV4 relay operation level pick up (phase-B)
8E00041C26	OCV4PU-C	OCV4 relay operation level pick up (phase-C)

◆ Signal monitoring points

OCV(Function ID: 444001)

Element ID	Name	Description
8300041B61	OCV4PU-OR	OCV4 relay operation level pick up (3-phases OR)
8C00041B62	OCV4-OPT-A	OCV4 protection operated (phase-A)
8D00041B63	OCV4-OPT-B	OCV4 protection operated (phase-B)
8E00041B64	OCV4-OPT-C	OCV4 protection operated (phase-C)
8300041B68	OCV4-OPT	OCV4 protection operated

◆ Connection point in PLC logic

OCV(Function ID: 444001)

Element ID	Name	Description
800001EBB0	OCV1_BLOCK	OCV1 protection block command
810002EBB1	OCV2_BLOCK	OCV2 protection block command
820003EBB2	OCV3_BLOCK	OCV3 protection block command
830004EBB3	OCV4_BLOCK	OCV4 protection block command

3.5.9 PLC driver

◆ Connection point at PLC Driver

PLC_DRV (Function ID: 230301) to OCV (Function ID: 444001)

PLC Driver	Element ID	to	Destination	PLC connection point
PMX3_3_0	8010011BB8	→	OCV1_BLOCK	800001EBB0
PMX3_3_1	8110011BB9	→	OCV2_BLOCK	810002EBB1
PMX3_3_2	8210011BBA	→	OCV3_BLOCK	820003EBB2
PMX3_3_3	8310011BBB	→	OCV4_BLOCK	830004EBB3

3.6 Undercurrent protection (UC)

Undercurrent protection (UC) is provided per phase and is used to detect a decrease in current caused by a loss of load. The UC protection consists of two independent stages—stage 1 (UC1) and stage 2 (UC2). Each stage is provided for all phases and employs a definite time delay programmed.

Note: The implementation of the feature depends on the selection of both the hardware and the software. Note that the feature is not supplied for the several models; hence, the user has to check the implementation for the model. Locate the ordering number and check it at the "G&T position" referring to the comparison table below. For more information, see *Appendix: Ordering*.

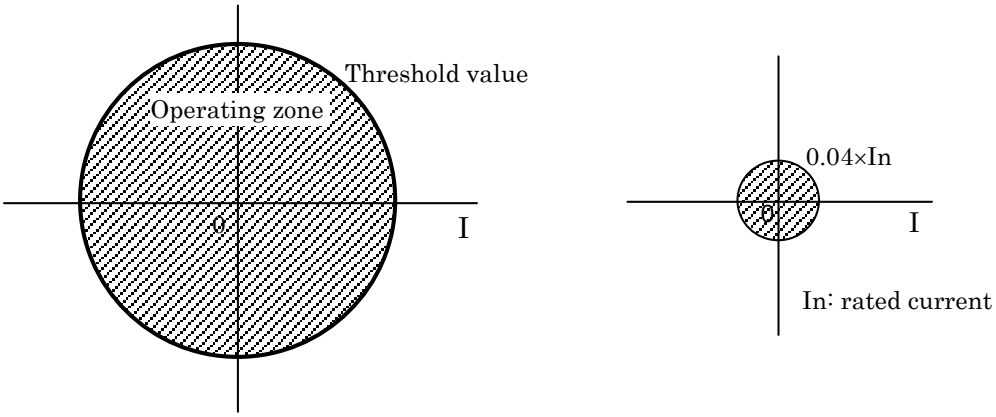
Table 3.6-1 Comparative table in respective ordering numbers

Sec.	Feature	Ordering No. at "G&T"					
		BCU			BCPU		IFU
		11	13	1F	2C	2N	19
–	Main features	NA	NA	NA	✓	✓	NA
–	Number of stages	NA	NA	NA	2	2	NA
3.6.6	PLC driver	NA	NA	NA	✓	✓	NA

✓: Applicable NA: Not applicable

3.6.1 Operation and characteristic

Each stage of the UC protection will operate when a current is under a threshold level, as illustrated in Figure 3.6-1(a). The threshold levels of the UC protection are set by using settings [**UC1**] or [**UC2**]. The operation of the UC protection, however, is blocked as the current falls below 4 % of the CT secondary rating, below which the loss of load cannot be distinguished from that of a trip operation performed by other protective functions. This discrimination is introduced by another under current element (UCDO) that is set at 0.04 times rated current. The UCDO characteristic is drawn in Figure 3.6-1(b).



(a) UC1 and UC2 (b) UCDO

Figure 3.6-1 Element characteristics of UC and UCDO

A definite time delay can be programmed by applying a value of delay time using setting [**TUC1**], the user can choose a value between 0 and 300s.

These features are described for the UC1 function, UC2 is exactly the same as UC1.

3.6.2 Miscellaneous functions

(i) Signal of UC trip

The UC protection will issue a trip command for the trip function, but can be used to signal an alarm, depending upon the application to which is has been applied, when **Alarm** is set for scheme switches [**UC1-UseFor**] or [**UC2-UseFor**]. In practice, **Trip** is set as the default setting.

(ii) Blocking UC by CTF

If the operation of the UC protection is not required when the failure of current transformer (CTF) occurs, the user should set **Block** for scheme switch [**UC1-CTFBlk**] or [**UC2-CTFBlk**].

3.6.3 Scheme switch

Figure 3.6-2 shows the scheme logic for UC1. As noted earlier, the operation of UC1 is removed when the input current falls below the rated current of 4%. A flip-flop circuit and the UCDO element are used to remove the operation of UC1 in each phase. Scheme switch [**UC1-EN**] **Off** is provided when the operation of UC1 is not required.

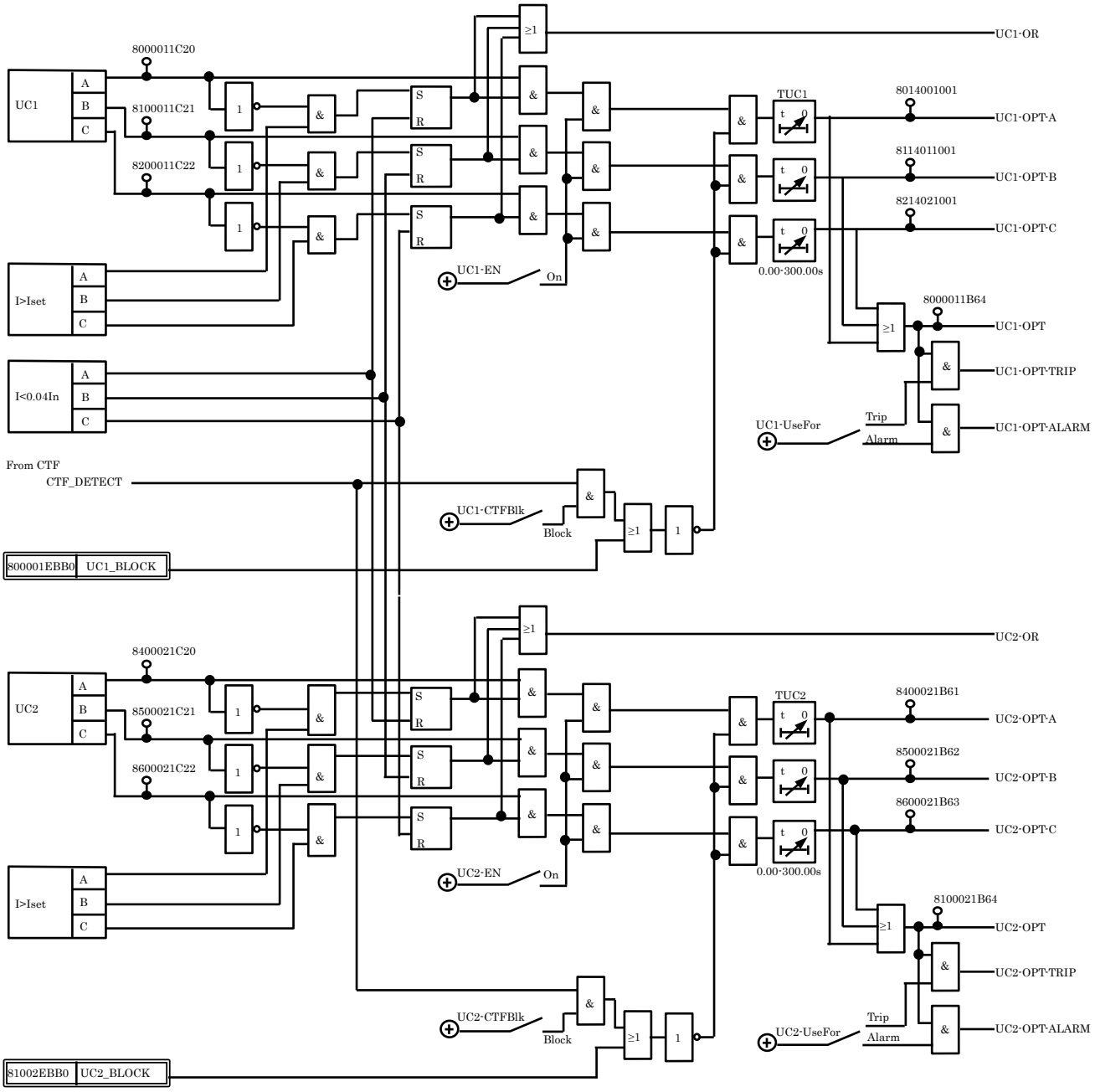


Figure 3.6-2 Scheme logic of UC

3.6.4 Setting

Setting of UC(Function ID: 450001)

Setting item			Range		Units	Contents	Default setting value		Notes
			1A rating	5A rating			1A rating	5A rating	
UC	UC1	UC1-EN	Off / On		-	UC1 protection enable	Off		
		UC1	0.10 - 2.00/0.50 - 10.00		A	UC1 threshold	0.20 / 1.00		
		TUC1	0.00 - 300.00		s	UC1 operating delay time	1.00		
		UC1-CTFBlk	Non / Block		-	UC1 operation blocked by CTF	Non		
		UC1-UseFor	Trip / Alarm		-	UC1 used for trip or alarm	Trip		
	UC2	UC2-EN	Off / On		-	UC2 protection enable	Off		
		UC2	0.10 - 2.00/0.50 - 10.00		A	UC2 threshold	0.20 / 1.00		
		TUC2	0.00 - 300.00		s	UC2 operating delay time	1.00		
		UC2-CTFBlk	Non / Block		-	UC2 operation blocked by CTF	Non		
		UC2-UseFor	Trip / Alarm		-	UC2 used for trip or alarm	Trip		

3.6.5 Data ID

◆ Signal monitoring point

UC(Function ID: 450001)

Element ID	Name	Description
8000011C20	UC1-A	UC1 relay element operated (phase-A)
8100011C21	UC1-B	UC1 relay element operated (phase-B)
8200011C22	UC1-C	UC1 relay element operated (phase-C)
8000011B64	UC1-OPT	OC1 protection operated
8000011B61	UC1-OPT-A	UC1 protection operated (phase-A)
8100011B62	UC1-OPT-B	UC1 protection operated (phase-B)
8200011B63	UC1-OPT-C	UC1 protection operated (phase-C)
8000011B60	UC1-OR	UC1 relay element operated (3-phases OR)
8400021C20	UC2-A	UC2 relay element operated (phase-A)
8500021C21	UC2-B	UC2 relay element operated (phase-B)
8600021C22	UC2-C	UC2 relay element operated (phase-C)
8100021B64	UC2-OPT	UC2 protection operated
8400021B61	UC2-OPT-A	UC2 protection operated (phase-A)
8500021B62	UC2-OPT-B	UC2 protection operated (phase-B)
8600021B63	UC2-OPT-C	UC2 protection operated (phase-C)
8100021B60	UC2-OR	UC2 relay element operated (3-phases OR)

◆ Connection point on PLC logic

UC(Function ID: 450001)

Element ID	Name	Description
800001EBB0	UC1_BLOCK	UC1 protection block command
810002EBB0	UC2_BLOCK	UC2 protection block command

3.6.6 PLC driver

◆ Connection point at PLC Driver

PLC_DRV (Function ID: 230301) to UC (Function ID: 450001)

PLC Driver	Element ID	to	Destination	PLC connection point
PMX3_3_4	8410011BBC	→	UC1_BLOCK	800001EBB0
PMX3_3_5	8510011BBD	→	UC2_BLOCK	810002EBB0

3.7 Thermal overload function (THM)

Apparatus such as cables, transformers, generators and others can become overheated when overloaded beyond their respective design limits due to excessive demands being placed on the system. The thermal overload function (THM) works by determining the temperature rise in an item of primary equipment by monitoring the current in order to detect the thermal overload of the apparatus.

THM has an exponential characteristics in accordance with the IEC 60255-149 standard. THM determines both the I^2R loss and the cooling effect of the coolant simultaneously; THM also determines the pre-load condition and signals a trip signal when an overload condition arises.

THM issues a trip signal in accordance with an alarm stage that reflects the temperature of the thermal overload condition. The alarm stage is configured using a setting; hence, the user should determine the appropriate setting so that a trip signal can be issued before the apparatus is overheated

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Note: The implementation of the feature depends on the selection of both the hardware and the software. Note that the feature is not supplied for the several models; hence, the user has to check the implementation for the model. Locate the ordering number and check it at the "G&T position" referring to the comparison table below. For more information, see *Appendix: Ordering*.

Table 3.7-1 Comparative table in respective ordering numbers

Sec.	Feature	Ordering No. at "G&T"					
		BCU			BCPU		IFU
		11	13	1F	2C	2N	19
–	Main features	NA	NA	NA	✓	✓	NA
3.1.9	PLC driver	NA	NA	NA	✓	✓	NA

✓: Applicable NA: Not applicable

3.7.1 Thermal state determination

THM simulates the change of thermal state using an algorithm; THM can detect an overload condition. Thermal state (θ) is determined with the following equation:

$$\theta = \frac{I^2}{I_{AOL}^2}\left(1 - e^{-t/\tau}\right) \times 100 \ (\%) \qquad (3.7\text{-}1)$$

where I is the load current applied; I_{AOL} is the allowable overload current; τ is the thermal time constant. The value of τ is set using setting [**TTHM**].

Thermal state 0% is the cold state, whereas 100% reflects the thermal limit—which is the point at which no further temperature rise can be tolerated safely and the system should be disconnected. The thermal limit for any given system is subject to setting [**THM**], which determines the value of overload current. The THM signals a trip when the value of θ is at 100%.

THM determines I using the positive-sequence current (I_1) and negative-sequence current (I_2) using Equation (3.7-2); and operates according to the characteristics defined in IEC 60255-149† when the user has set scheme switch [**THM-Ieq**] **On**.

$$I = \sqrt{I_1^2 + q \times I_2^2} \qquad (3.7\text{-}2)$$

where,

q: Unbalance factor; the unbalance factor is used for motor/generator protection; the user should set q=0 when setting [**THM-q**] except when it is applied to motor/generator protection.

†Note: If the user prefers to use the thermal characteristic for the THM function specified in IEC 60255-8, set **Off** for the scheme switch [**THM-Ieq**]. In this case, THM is determined using the largest of the three-phase currents.

The period of time for a trip to occur depends not only on the degree of overload, but also on the degree of load current as far as reaching the overload state. The period of the trip, that is, depends on whether the overload is applied from 'cold' or 'hot'. THM has thresholds for alarm and trip; hence, the two thresholds exist independently.

3.7.2 Thermal characteristic

THM characteristics are determined with two equations. Equation (3.7-3) is used to define the cold state. Equation (3.7-4) is used to define the hot state:

$$t = \tau \cdot \mathrm{Ln}\left[\frac{I^2}{I^2 - I_{AOL}^2}\right] \qquad (3.7\text{-}3)$$

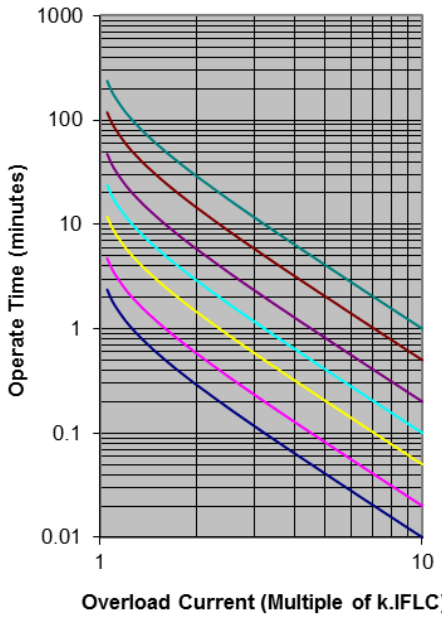
$$t = \tau \cdot \mathrm{Ln}\left[\frac{I^2 - I_P^2}{I^2 - I_{AOL}^2}\right] \qquad (3.7\text{-}4)$$

where t is time to trip for a constant overload current of I (minutes), I is the overload current (largest phase current in amperes), I_{AOL} is the permitted overload current (amperes), Ip is the pre-load current (amperes), τ is the thermal time constant (minutes), and Ln is the natural logarithm.

In Equation (3.7-3), cold curves are special versions of the hot curves where Ip is zero, catering for the situation where a cold system is switched onto an immediate overload.

Figure 3.7-1.a shows the cold state where an overload has been switched onto a previously un-loaded system. Figure 3.7-1.b shows the hot state where an overload is switched onto a system that has previously been loaded to 90% of its capacity. The figures are in conformity with the IEC 60255-149 curves, and these curves are drawn in a range of settings of the time constant (τ).

a.Thermal Curves (Cold Curve −no prior load)



b. Thermal Curves (Hot Curve −90% prior load))

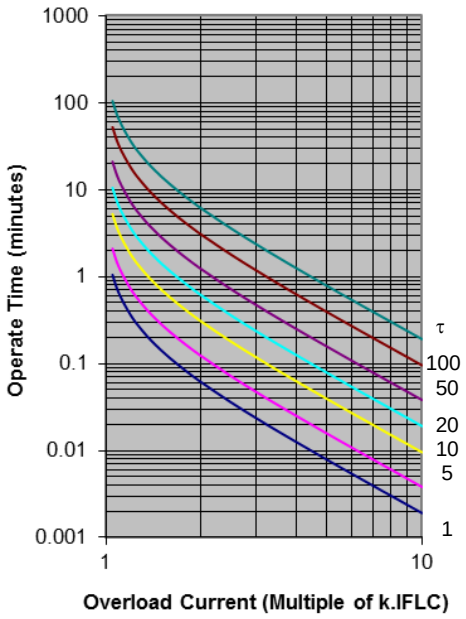


Figure 3.7-1 Thermal curves

3.7.3 Scheme logic

Figure 3.7-2 shows the scheme logic for THM. THM has two thresholds; threshold "A" is used for alarming, threshold "T" for tripping. The name of the output signal for the alarm is termed THM-OPT-ALARM and that of the output signal for tripping is termed "THM-OPT-TRIP".

The threshold level for the alarm is set using setting [**THM-Alarm**] as a percentage of the tripping threshold. The alarm signal is disabled when **Off** is set for scheme switch [**THMA-EN**]. The trip signal is prevented when **Off** is set for scheme switch [**THMT-EN**]. PLC signals THMA_BLOCK and THMT_BLOCK are used to block the operation of THM.

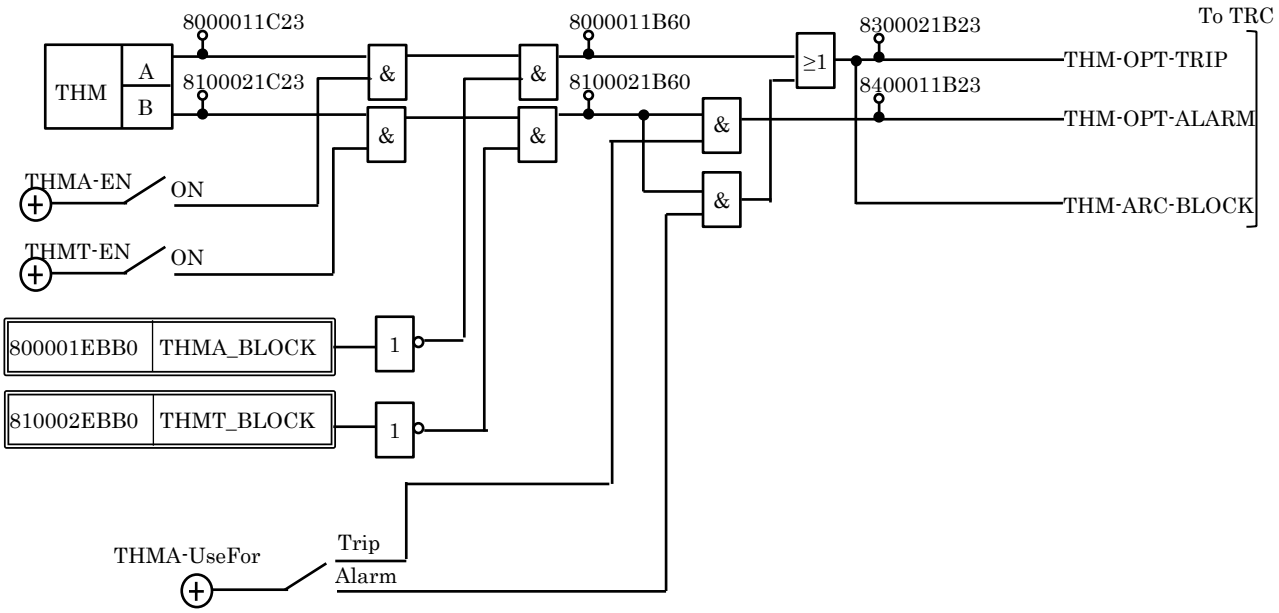


Figure 3.7-2 THM Logic

When wishing to have a test about pre-load current (Ip), the user should set a test value for the setting [**THM-IP**] followed by setting [**THM-Test**]=**On**.

3.7.4 Setting

Setting of THM(Function ID: 451001)

Setting item		Range		Units	Contents	Default setting value		Notes
		1A rating	5A rating			1A rating	5A rating	
Thermal setting	THMT-EN	Off / On		-	Thermal protection enable	Off		
	THMA-EN	Off / On		-	Thermal alarm enable	Off		
	THM	0.4 – 2.0	2.0 – 10.0	A	Thermal overload current	1.0	5.0	
	TTHM	0.5 – 500.0		min	Thermal time constant	10.0		
	THM-Alarm	50 – 100		%	Thermal alarm level multiplier (Percentage of [THM] setting)	80		
	THM-q	0 – 10		-	Thermal unbalance factor from I2	0		
	THM-Ieq	Off / On		-	Thermal equivalent heating current used	On		
	TFM-UseFor	Trip / Alarm		-	THM used for trip or alarm	Trip		
Test setting	THM-Test	Off / On		-	To utilize the setting[THM-IP], and To change the reset delay to instantaneous reset	Off		
	THM-IP	0.00 - 1.00	0.00 - 5.00	A	Previous load current for thermal testing	0.00/0.00		

3.7.5 Data ID

◆ Signal monitoring point

THM(Function ID: 451001)

Element ID	Name	Description
8000011C23	THM-A	THM relay element operated (Alarm)
8000011B60	THM-ALARM	THM protection Alarm signal
8400011B23	THM-OPT-ALARM	THM protection operated (Alarm)
8300021B23	THM-OPT-TRIP	THM protection operated (Trip)
8100021C23	THM-T	THM relay element operated (Trip)
8100021B60	THM-TRIP	THM protection Trip signal

◆ Connection point on PLC logic

THM(Function ID: 451001)

Element ID	Name	Description
800001EBB0	THMA_BLOCK	THM protection for Alarm block command
810002EBB0	THMT_BLOCK	THM protection for Trip block command

3.7.6 PLC driver

◆ Connection point at PLC Driver

PLC_DRV (Function ID: 230301) to THM (Function ID: 451001)

PLC Driver	Element ID	to	Destination	PLC connection point
PMX3_3_6	8610011BBE	→	THMA_BLOCK	800001EBB0
PMX3_3_7	8710011BBF	→	THMT_BLOCK	810002EBB0

3.8 Broken conductor protection (BCD)

A series fault or an open circuit fault can be caused by circuit breaker contact failure, the operation of fuses, and false operation of single-phase switchgear. IEC60050 defines a series fault as having impedances in each of three-phases that are not equal; hence, the series fault is typified by the interruption of one or two phases, as a rule. The function of broken conductor protection (BCD) is to detect series faults and signal a trip signal to the trip circuit.

Note: The implementation of the feature depends on the selection of both the hardware and the software. Note that the feature is not supplied for the several models; hence, the user has to check the implementation for the model. Locate the ordering number and check it at the "G&T position" referring to the comparison table below. For more information, see *Appendix: Ordering*.

Table 3.8-1 Comparative table in respective ordering numbers

Sec.	Feature	Ordering No. at "G&T"					
		BCU			BCPU		IFU
		11	13	1F	2C	2N	19
–	Main features	NA	NA	NA	✓	✓	NA
3.1.9	PLC driver	NA	NA	NA	✓	✓	NA

✓: Applicable NA: Not applicable

3.8.1 Equivalent circuit for a one-phase series fault

Figure 3.8-1 shows the sequence diagram of the network connection when a single-phase series fault occurs. We can represent the series fault by the positive sequence, negative sequence and zero sequence impedances; the impedances are distributed to the left and right as shown in the diagram of the primary circuit below. The ratio of the left to the right is determined by the fault location such as k1:1-k1, k2:1-k2, and k0:1-k0.

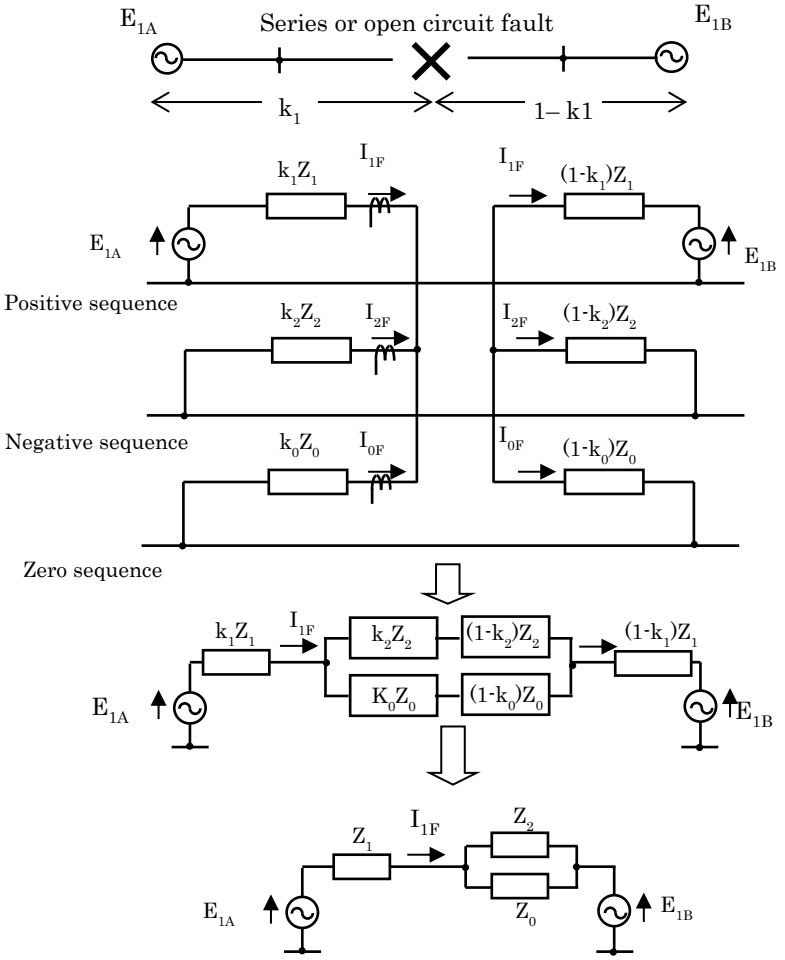


Figure 3.8-1 Equivalent circuit for a single-phase fault

The series fault results in positive sequence current (I_{1F}), negative sequence current (I_{2F}) and zero phase sequence current (I_{0F}) in the single-phase. These are given by

$$I_{1F} + I_{2F} + I_{0F} = 0 \quad (3.8\text{-}1)$$

$$Z_{2F}I_{2F} \cdot Z_{0F}I_{0F} = 0 \quad (3.8\text{-}2)$$

$$E_{1A} \cdot E_{1B} = Z_{1F}I_{1F} \cdot Z_{2F}I_{2F} \quad (3.8\text{-}3)$$

where,

E_{1A}, E_{1B}: power source voltage

Z_1: positive sequence impedance

Z_2: negative sequence impedance

Z_0: zero sequence impedance

From Equation (3.8-1), (3.8-2), and (3.8-3), the following equations are derived:

$$I_{1F} = \frac{Z_2 + Z_0}{Z_1Z_2 + Z_1Z_0 + Z_2Z_0}(E_{1A} - E_{1B}) \quad (3.8\text{-}4)$$

$$I_{2F} = \frac{-Z_0}{Z_1Z_2 + Z_1Z_0 + Z_2Z_0}(E_{1A} - E_{1B}) \quad (3.8\text{-}5)$$

$$I_{0F} = \frac{-Z_2}{Z_1Z_2 + Z_1Z_0 + Z_2Z_0}(E_{1A} - E_{1B}) \quad (3.8\text{-}6)$$

The magnitude of the fault current depends on the impedance across the system, the difference in phase angle, and the magnitude between the power source voltages behind both ends.

As noted earlier, the BCD element detects the presence of a fault by measuring the ratio between the negative sequence current and the positive sequence current (I_{2F}/I_{1F}). The ratio is obtained from the negative sequence impedance (Z_2) and the zero sequence impedance (Z_0); hence, the equation of the ratio is expressed as follows:

$$\frac{I_{2F}}{I_{1F}} = \frac{|I_{2F}|}{|I_{1F}|} = \frac{Z_0}{Z_2 + Z_0} \quad (3.8\text{-}7)$$

A ratio value of 0.5 or higher is obtained when the zero sequence impedance is larger than the negative sequence impedance. The ratio, thus, is close to 1.0 if the system is high-impedance earthed or a single-end earthed system.

3.8.2 Characteristic and setting

The hatched area of Figure 3.8-2 illustrates the BCD characteristic; the BCD function will operate when the positive sequence current (I1) is larger than 0.04×In, the negative sequence current (I2) is larger than 0.01×In, and the ratio $|I_2/I_1|$ is higher than setting [**BCD**].

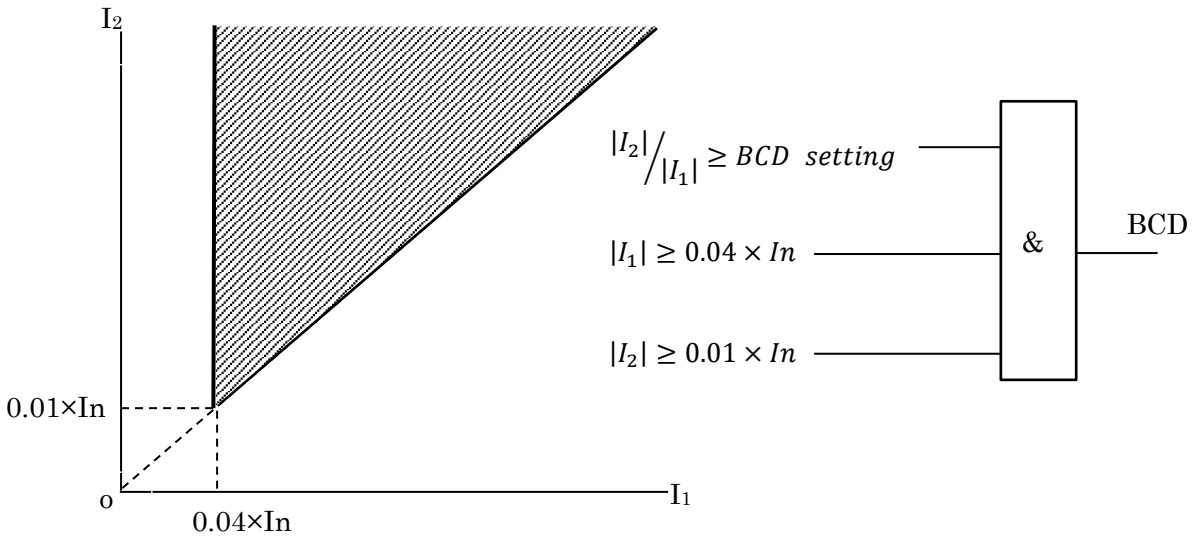


Figure 3.8-2 Characteristic of BCD

3.8.3 Miscellaneous functions

(i) Harmonic detection function

The operation of BCD can be blocked when the IED detects 2nd harmonic caused by the phenomenon of magnetizing inrush current when a transformer is energized. To block the operation of the BCD function during the occurrence of the harmonic, set scheme switch [**BCD-2fBlk**] **Block**.

(ii) Block operation of CTF for BCD

The operation of the BCD function can be blocked by the current transformer failure (CTF) function using a scheme switch. **Block** is set for scheme switch [**BCD-CTFBlk**] if the user wishes to disable the operation of the BCD function when a current transformer failure occurs.

3.8.4 Scheme logic

Figure 3.8-3 shows the scheme logic for the BCD function. The BCD function issues a trip signal through a delayed pick-up timer, the value of which is set for [**TBCD**]. The operation of the BCD function can be disabled using scheme switch [**BCD-EN**] **Off**.

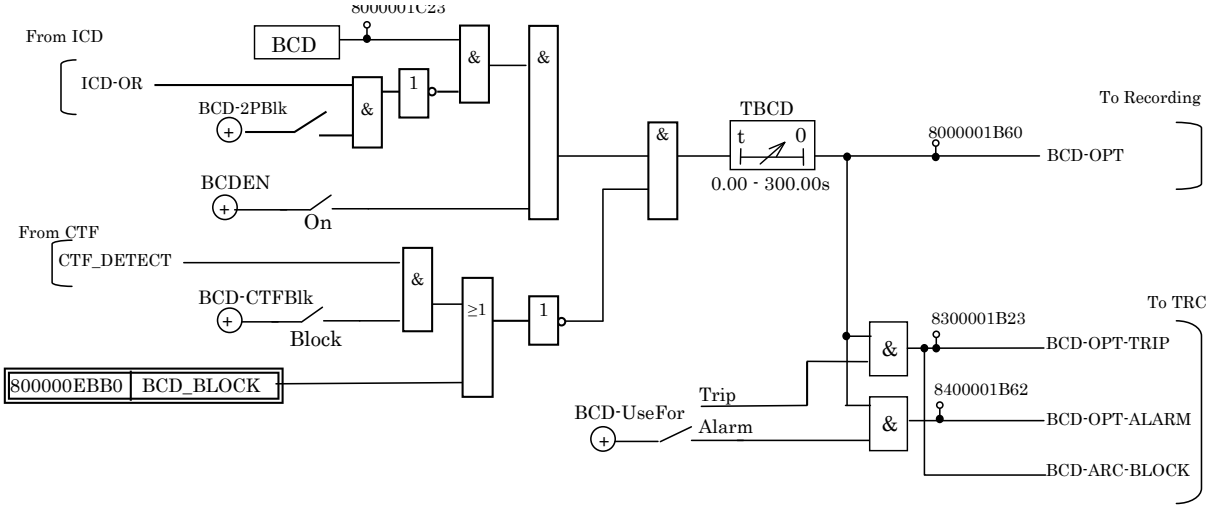


Figure 3.8-3 Broken conductor protection scheme logic

Normal power system levels of negative phase sequence restrict the setting value of [**BCD**]. The BCD function continuously determines the ratio (I_{2F}/I_{1F}). User can check the present ratio along with the maximum value (I_{21} max) that has been examined for 15 minutes ago. We recommend that user should distinguish the present ratio against the value on commissioning stage; and user should set a value for [**BCD**] from 130% to 150% of the ratio has been checked.

Note: The ratio (I_{2F}/ I_{1F}) is displayed only when the current in positive-sequence (or load current) on the secondary circuit is larger than 2% of the rated current on secondary circuit.

3.8.5 Setting

Setting of BCD(Function ID: 452001)

Setting item		Range	Units	Contents	Default setting value	Notes
BCD	BCD-EN	Off / On	-	BCD protection enable	Off	
	BCD	0.10 - 1.00	-	BCD relay operating value (I2/I1)	0.20	
	TBCD	0.00 - 300.00	s	BCD operating delay time	1.00	
	BCD-2fBlk	Non / Block	-	BCD operation block by 2f-detection	Non	
	BCD-CTFBlk	Non / Block	-	BCD operation block by CTF	Non	
	BCD-UseFor	Trip / Alarm	-	BCD used for trip or alarm	Trip	

3.8.6 Data ID

◆ Signal monitoring point

BCD(Function ID: 452001)

Element ID	Name	Description
8000001C23	BCD	BCD relay element operated
8000001B60	BCD-OPT	BCD protection operated

◆ Connection point on PLC logic

BCD(Function ID: 452001)

Element ID	Name	Description
800000EBB0	BCD_BLOCK	BCD1 protection block command

3.8.7 PLC driver

◆ Connection point at PLC Driver

PLC_DRV (Function ID: 230301) to BCD (Function ID: 452001)

PLC Driver	Element ID	to	Destination	PLC connection point
PMX3_4_0	8810021BB0	→	BCD_BLOCK	800000EBB0

3.9 Circuit breaker fail protection (CBF)

When a circuit breaker (CB) fails to remove a fault as a consequence of the CB failing to open, the function of circuit breaker fail protection (CBF) is to remove the fault by the back-tripping of other CBs. For example, if a fault current continues to flow following the issue of a trip signal, the CBF function determines that a CB failure has occurred and issues another trip signal to the adjacent CB(s) and/or the upstream CB.

Although a trip signal will have been issued by other protection functions, CBF protection has relay elements and timers that are used to detect the continuing presence of a fault following the issuance of a trip signal. The relay elements are termed OCCBF† and EFCBF†, which run as protection functions within CBF.

†Note: The CBF function consists of two stages and their stages are operated independently. Thus, the settings/switches/logics for two stages are provided separately. To simply the description, only settings/switches/logics for the stage 1 are discussed as a representative, but the ones for the stage 2 are applicable in the CBF function; hence the user can read the expression for the stage 1 as for the stage 2 unless a special explanation or instructions has been provided.

Note: The implementation of the feature depends on the selection of both the hardware and the software. Note that the feature is not supplied for the several models; hence, the user has to check the implementation for the model. Locate the ordering number and check it at the "G&T position" referring to the comparison table below. For more information, see *Appendix: Ordering*.

Table 3.9-1 Comparative table in respective ordering numbers

Sec.	Feature	Ordering No. at "G&T"					
		BCU			BCPU		IFU
		11	13	1F	2C	2N	19
–	Main features	NA	NA	NA	✓	✓	NA
–	Number of stages	–	–	–	2	2	–
3.1.9	PLC driver	NA	NA	NA	✓	✓	NA

✓: Applicable NA: Not applicable

3.9.1 CBF operation and its elements

The operation of CBF is initiated by the operation of OCCBF and EFCBF, which monitors fault current after the issuance of a trip signal by other protection functions. OCCBF or EFCBF monitor the fault current so that the CBF feature can determine the failure of the CB to operate. For CBF, the respective phase currents in three-phase system are monitored by the OCCBF-A, OCCBF-B and OCCBF-C elements, while the zero-sequence current is monitored by the EFCBF element.

The operation of these elements is reset if the threshold values of currents, applied by the setting of [**OCCBF1**] and [**EFCBF1**], are below 80% of their setting value.

3.9.2 Re-trip feature

Once a CB failure occurs, the CBF protection would normally issue a back-trip signal to the adjacent CB(s) and/or the upstream CB. However, the CBF protection is able to issue a further trip signal to the faulted CB before issuing the back-trip signal. The second trip signal is termed “re-trip”; “re-trip,” confirms the occurrence of a CB failure. In the event of an erroneous CBF operation, the use of “re-trip” has the advantage of avoiding the issue of the back-trip signal to the adjacent CB(s) or the upstream CB. The timing chart for “re-trip” and back-trip are discussed later. (See Figure 3.9-1)

There are two operation modes (internal and external mode) for “re-trip”; the user can select the desired mode using scheme switch [**CBF1-Retrip**]:

- Internal mode

  If **On** is set for scheme switch [**CBF1-Retrip**] the CBF function is armed for issuing a “re-trip” command. OCCBF and EFCBF control the “re-trip” signal along with trip signals coming from other functions.

- External mode

  When **On-T** is set for scheme switch [**CBF1-Retrip**], the CBF function is armed forissuing a “re-trip” following tripping by external protection functions only. The external protection functions can operate using PLC connection points in the TRC function. If external mode is selected, an external CBF start signal must be present continuously for as long as the fault is present.

For the re-trip operation, **On** should be set for both scheme switches [**OCCBF1**] and [**EFCBF1**]. When a delay timer is needed for “re-trip”, a setting [**TCBF1-RE**] is available. A setting time can be chosen between 0 and 300.000sec, the time setting to be applied must be determined in accordance with the response time of the CB. The setting time is addressed later. (section 3.9.5)

One of the benefits of the "re-trip" function is that it can used to avoid accidental tripping of an adjacent CB or an upstream CB. This is particularly requisite during maintenance and testing of the system.

3.9.3 Backup feature

As cited above, "re-trip" issues a further trip signal so that the CB receives an instruction to trip again. If "re-trip" cannot remove the fault, CBF will issue a "back-trip" command. Back-tripping is used as a last resort to remove the fault.

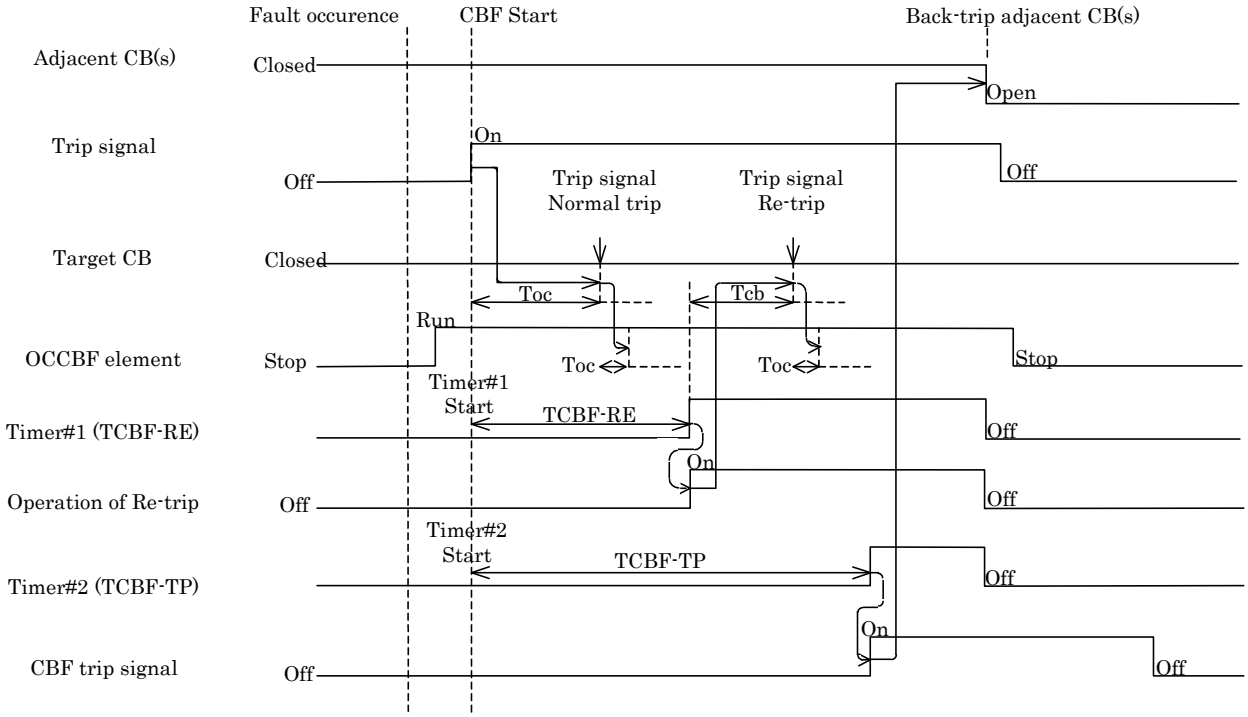


Figure 3.9-1 Timing chart for re-trip and back trip during CBF operation

Figure 3.9-1 is a sequence diagram for the CBF function; the overall sequence illustrated shows a target CB failing to remove a fault with the consequence that back tripping of the adjacent CB(s) is required following operation of the CBF protection to finally clear the fault. The CBF function is initiated via a signal from other protection functions.

If the target CB is tripped normally on receipt of a trip signal so that the fault is removed, both OCCBF and EFCBF will reset before the time settings of timer #1 and timer #2 have elapsed.

Following the issue of the first trip signal, if either OCCBF or EFCBF were to continue to operate and if timer #1 were to time out according to the timer setting value [**TCBF1-RE**], a "re-trip" command would be issued to the target CB. If the target CB were to open to clear the

fault in response to the "re-trip" command, OCCBF and EFCBF would reset and the CBF sequence is stopped.

If the target CB were to fail to remove the fault with the "re-trip" command, and if OCCBF or EFCBF continued to operate and if the timer #2 were to time out in accordance with the setting time applied [**TCBF1-TP**], CBF will issue a trip signal to the adjacent CB(s) to clear the fault, as a last resort.

3.9.4 Scheme logic

Figure 3.9-2 illustrates that the CBF function can issue a trip signal in each phase. A trip signal will be generated in the trip circuit (TRC) when the trip signal is provided for the TRC function.

CBF issues trip signals (CBF1-RETRIP) when OCCBF1 and EFCBF1 operate continuously until expiration of timer settings [**TCBF1-RE**] and [**TCBF1-TP**]. Setting [**TCBF1-RE**] is overridden when **On-AftRe** is set for scheme switch [**CBF1-TRIP**]. When **On** is set for scheme switch [**CBF1-TRIP**], timer setting [**TCBF1-RE**] is bypassed and [**TCBF1-TP**] is applied for backup CBF trip.

Figure 3.9-2 shows that the CBF will operate with OCCBF1, EFCBF1, and PLC signal "EXT.CBF-START" (internal mode).

It is possible to run with PLC signal EXT.CBF1-START only. PLC signal "EXT.CBF1-START" is required. Signal "EXT.CBF1-START" must be present continuously for as long as the fault is present (external mode).

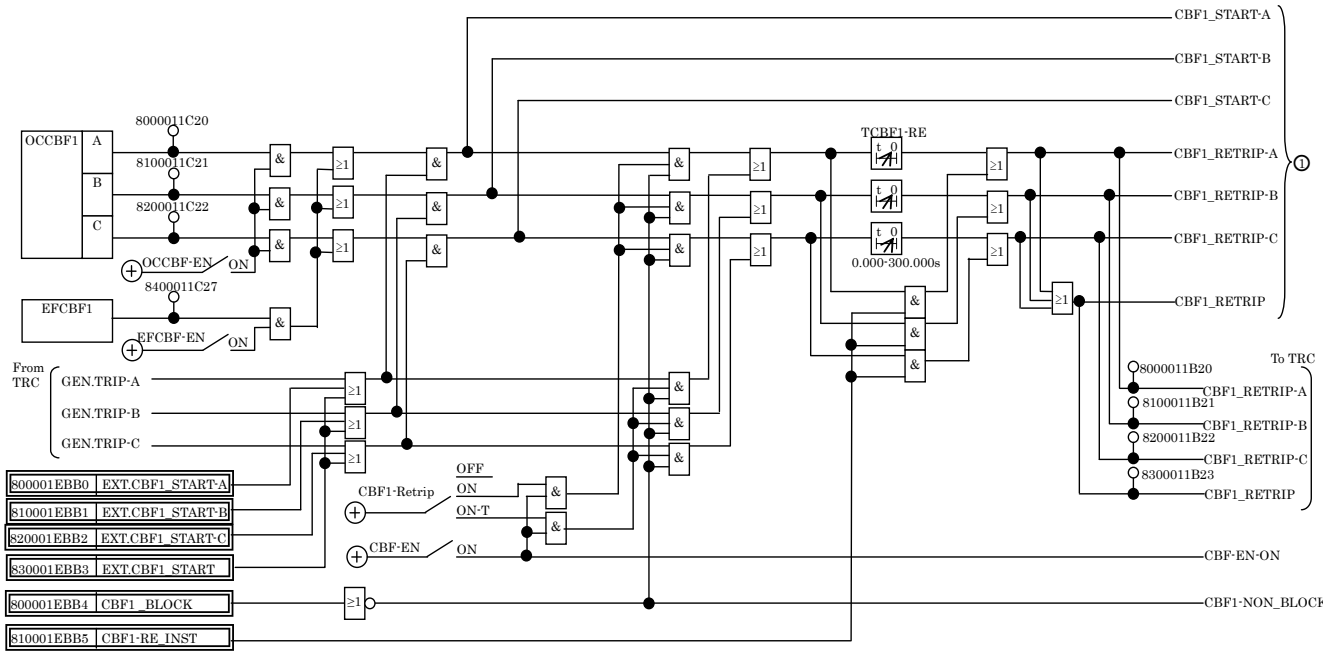


Figure 3.9-2 Elements logic in CBF1

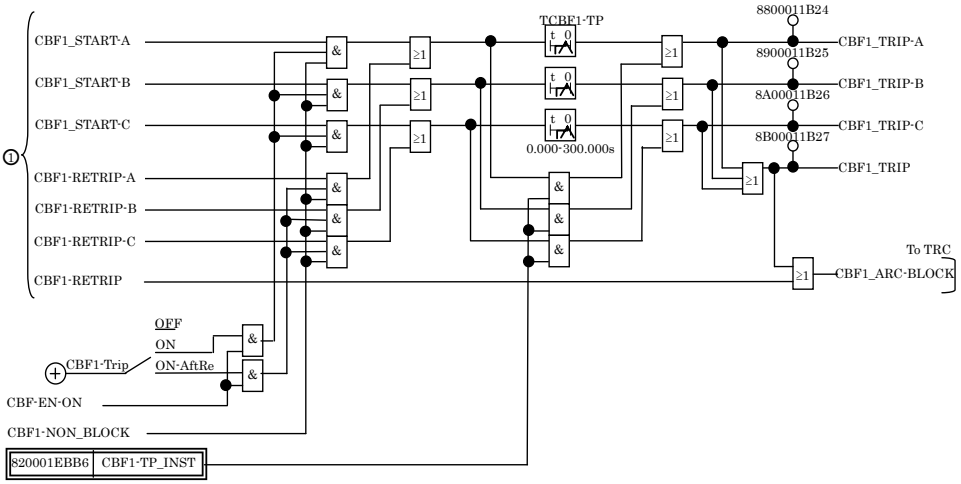


Figure 3.9-3 CBF1 logics (continued from Figure 3.9-2)

3.9.5 Operation timing

The OCCBF and EFCBF elements can check that the target CB has opened normally and that the fault current has disappeared completely. Because load current is usually present, the OCCBF and EFCBF settings should be account for between 10% and 200% of the rated current.

The time settings [**TCBF1-RE**] and [**TCBF1-TP**] are determined in relation to the opening time of the target CB and the reset time of the OCCBF or EFCBF elements (see Toc and Tcb in Figure 3.9-1). The following description illustrates a setting calculation example when "re-trip" is used:

Setting of TCBF-RE =Breaker opening time + OCCBF/EFCBF reset time + Margin
=40ms + 10ms + 20ms
=70ms

Setting of TCBF-TP =TCBF-RE + Output relay operating time + Breaker opening time + OCCBF/EFCBF reset time + Margin
=70ms + 10ms + 40ms + 10ms + 10ms
=140ms

3.9.6 Setting

Setting of CBF(Function ID: 453001)

Setting item			Range	Units	Contents	Default setting value	Notes
CBF	Common	CBF-EN	Off / On	-	CBF protection enable	Off	
		OCCBF-EN	Off / On	-	Current flow is judged by OC relay operation	On	
		EFCBF-EN	Off / On	-	Current flow is judged by EF relay operation	Off	
	CBF1	OCCBF1	0.02 - 5.00/0.10 - 25.00	A	OCCBF relay operating level (Current flow judgment)	1.00/5.00	
		EFCBF1	0.02 - 5.00/0.10 - 25.00	A	EFCBF relay operating level (Current flow judgment)	1.00/5.00	
		CBF1-Retrip	Off / On / On-T	-	CBF retrip operation mode	On	
		TCBF1-RE	0.000 - 300.000	s	CBF retrip timer	0.150	
		CBF1-Trip	Off / On / On-AftRe	-	CBF trip operation mode	On	
		TCBF1-TP	0.000 - 300.000	s	CBF trip timer	0.200	
	CBF2	OCCBF2	0.02 - 5.00/0.10 - 25.00	A	OCCBF relay operating level (Current flow judgment)	1.00/5.00	
		EFCBF2	0.02 - 5.00/0.10 - 25.00	A	EFCBF relay operating level (Current flow judgment)	1.00/5.00	
		CBF2-Retrip	Off / On / On-T	-	CBF retrip operation mode	On	
		TCBF2-RE	0.000 - 300.000	s	CBF retrip timer	0.150	
		CBF2-Trip	Off / On / On-AftRe	-	CBF trip operation mode	On	
		TCBF2-TP	0.000 - 300.000	s	CBF trip timer	0.200	

3.9.7 Data ID

◆ Signal monitoring points

CBF(Function ID: 453001)

Element ID	Name	Description
8000011C20	OCCBF1-A	OCCBF1 relay element operated (phase-A)
8100011C21	OCCBF1-B	OCCBF1 relay element operated (phase-B)
8200011C22	OCCBF1-C	OCCBF1 relay element operated (phase-C)
8400011C27	EFCBF1	EFCBF1 relay element operated
8000011B20	CBF1_RETRIP-A	OCCBF1 Retrip (phase-A)
8100011B21	CBF1_RETRIP-B	OCCBF1 Retrip (phase-B)
8200011B22	CBF1_RETRIP-C	OCCBF1 Retrip (phase-C)
8300011B23	CBF1_RETRIP	OCCBF1 Retrip
8800011B24	CBF1_TRIP-A	OCCBF1 trip (phase-A)
8900011B25	CBF1_TRIP-B	OCCBF1 trip (phase-B)
8A00011B26	CBF1_TRIP-C	OCCBF1 trip (phase-C)
8B00011B27	CBF1_TRIP	OCCBF1 trip
8000011BB0	EXT.CBF1_START-A	External CBF1 start(phase-A)
8100011BB1	EXT.CBF1_START-B	External CBF1 start(phase-B)
8200011BB2	EXT.CBF1_START-C	External CBF1 start(phase-C)
8300011BB3	EXT.CBF1_START	External CBF1 start
8000021C20	OCCBF2-A	OCCBF2 relay element operated (phase-A)
8100021C21	OCCBF2-B	OCCBF2 relay element operated (phase-B)
8200021C22	OCCBF2-C	OCCBF2 relay element operated (phase-C)
8400021C27	EFCBF2	EFCBF2 relay element operated
8000021B20	CBF2_RETRIP-A	OCCBF2 Retrip (phase-A)
8100021B21	CBF2_RETRIP-B	OCCBF2 Retrip (phase-B)
8200021B22	CBF2_RETRIP-C	OCCBF2 Retrip (phase-C)
8300021B23	CBF2_RETRIP	OCCBF2 Retrip
8800021B24	CBF2_TRIP-A	OCCBF2 trip (phase-A)
8900021B25	CBF2_TRIP-B	OCCBF2 trip (phase-B)
8A00021B26	CBF2_TRIP-C	OCCBF2 trip (phase-C)
8B00021B27	CBF2_TRIP	OCCBF2 trip
8000021BB0	EXT.CBF2_START-A	External CBF2 start(phase-A)
8100021BB1	EXT.CBF2_START-B	External CBF2 start(phase-B)
8200021BB2	EXT.CBF2_START-C	External CBF2 start(phase-C)
8300021BB3	EXT.CBF2_START	External CBF2 start

◆ Connection point in PLC logic

CBF(Function ID: 453001)

Element ID	Name	Description
800001EBB0	EXT.CBF1_START-A	External CBF1 start(phase-A)
810001EBB1	EXT.CBF1_START-B	External CBF1 start(phase-B)
820001EBB2	EXT.CBF1_START-C	External CBF1 start(phase-C)
830001EBB3	EXT.CBF1_START	External CBF1 start
800001EBB4	CBF1_BLOCK	CBF1 protection block command
810001EBB5	CBF1-RE_INST	CBF1 instantaneous retrip
820001EBB6	CBF1-TP_INST	CBF1 instantaneous trip

◆ Connection point in PLC logic

CBF(Function ID: 453001)

Element ID	Name	Description
800002EBB0	EXT.CBF2_START-A	External CBF2 start(phase-A)
810002EBB1	EXT.CBF2_START-B	External CBF2 start(phase-B)
820002EBB2	EXT.CBF2_START-C	External CBF2 start(phase-C)
830002EBB3	EXT.CBF2_START	External CBF2 start
800002EBB4	CBF2_BLOCK	CBF2 protection block command
810002EBB5	CBF2-RE_INST	CBF2 instantaneous retrip
820002EBB6	CBF2-TP_INST	CBF2 instantaneous trip

3.9.8 PLC driver

◆ Connection point at PLC Driver

PLC_DRV (Function ID: 230301) to CBF (Function ID: 453001)

PLC Driver	Element ID	to	Destination	PLC connection point
PMX3_4_1	8910021BB1	→	EXT.CBF1_START-A	800001EBB0
PMX3_4_2	8A10021BB2	→	EXT.CBF1_START-B	810001EBB1
PMX3_4_3	8B10021BB3	→	EXT.CBF1_START-C	820001EBB2
PMX3_4_4	8C10021BB4	→	EXT.CBF1_START	830001EBB3
PMX3_4_5	8D10021BB5	→	CBF1_BLOCK	800001EBB4
PMX3_4_6	8E10021BB6	→	CBF1-RE_INST	810001EBB5
PMX3_4_7	8F10021BB7	→	CBF1-TP_INST	820001EBB6
PMX3_5_0	8010021BB8	→	EXT.CBF2_START-A	800002EBB0
PMX3_5_1	8110021BB9	→	EXT.CBF2_START-B	810002EBB1
PMX3_5_2	8210021BBA	→	EXT.CBF2_START-C	820002EBB2
PMX3_5_3	8310021BBB	→	EXT.CBF2_START	830002EBB3
PMX3_5_4	8410021BBC	→	CBF2_BLOCK	800002EBB4
PMX3_5_5	8510021BBD	→	CBF2-RE_INST	810002EBB5
PMX3_5_6	8610021BBE	→	CBF2-TP_INST	820002EBB6

3.10 Switch on to fault (SOTF-OC)

The switch-onto-fault function (SOTF-OC) is used to detect and rapidly clear faults when circuit breakers (CBs) are closed onto a pre-existing fault in the protected zone. If a circuit breaker is closed onto a permanent fault, the memory circuit in the IED will be unable to memorize the voltage data required to retain the pre-fault values. This is because the voltage input to distance measuring elements is absent continuously prior to and after the fault particularly with voltage transformers installed on the line side; as a result, the fault cannot be detected by conventional standard protection functions. Therefore, in order to avoid such failures, SOTF-OC is applied so that the fault can be detected for a specific period following the closure of the CB.

Note: The implementation of the feature depends on the selection of both the hardware and the software. Note that the feature is not supplied for the several models; hence, the user has to check the implementation for the model. Locate the ordering number and check it at the "G&T position" referring to the comparison table below. For more information, see *Appendix: Ordering*.

Table 3.10-1 Comparative table in respective ordering numbers

Sec.	Feature	Ordering No. at "G&T"					
		BCU			BCPU		IFU
		11	13	1F	2C	2N	19
–	Main features	NA	NA	NA	✓	✓	NA
3.1.9	PLC driver	NA	NA	NA	✓	✓	NA

✓: Applicable NA: Not applicable

3.10.1 Scheme logic

The SOTF-OC function provides signals to the TRC function: SOTFOC-OPT-A,-B,-C, SOTFOC-TRIP, and SOTFOC-ARC-BLOCK. The SOTF-OC function issues a trip signal upon the operation of the OCSOTF element if CBs are closed onto a fault when energizing a transmission line following a period of non-operation. The criterion for the transmission line being in the non-operation state are when (1) the CBs are open for more than 0.5 seconds and (2) the undervoltage elements in the PROT COMMON function remain operated for more than 0.5 seconds. The TRIP and PROT COMMON functions are discussed separately. (See chapter *Relay application: Trip circuit and Protection common*.)

Setting [**OCSOTF**] is provided to determine the SOTF threshold. Setting [**OCSOTF-2fBlk**] is used to override the SOTF function when the SOTF-OC detects a second harmonic. If **Block-3P** is set for the setting [**OCSOTF-2fBlk**], all of the OCSOTF elements are overridden when second harmonic is present. Alternatively, if **Block-PerP** is set for the setting [**OCSOTF-2fBlk**], each individual OCSOTF element of the SOTF function is overridden for second harmonic currents. The detection of the second harmonic is determined by the function of the inrush current detector (ICD). The ICD function is discussed separately. (See chapter *Relay application: Inrush current detection function*.)

The SOTF-OC function is active when **On** is set for the setting [**SOTFOC-EN**]. Setting [**SOTF-test**] is used for the mandatory condition of cold load when testing. When wishing to add another condition into the logic for the SOTF operation, the user can inject the signal using PLC connection point “ADD.SOTF.EN”.

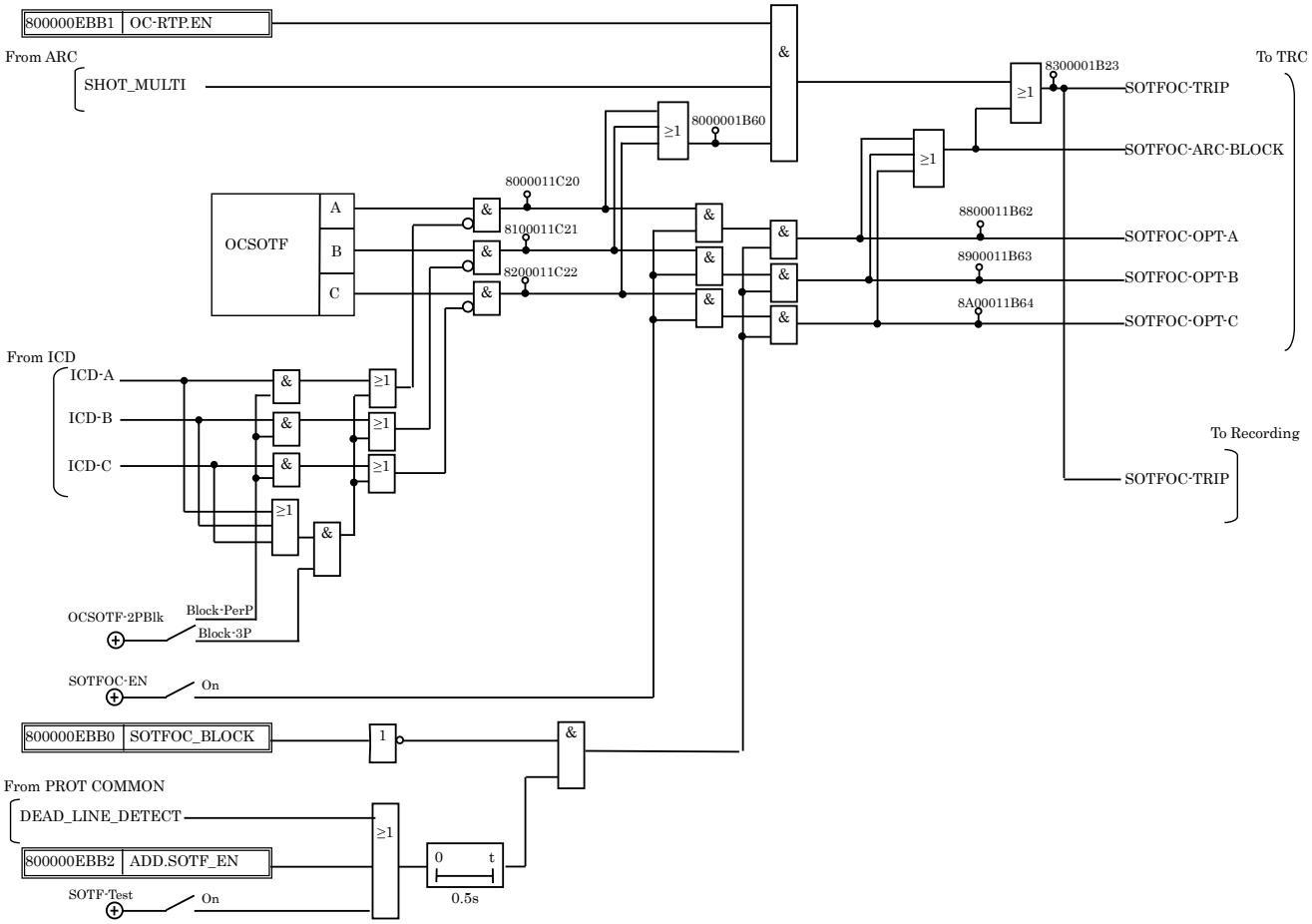


Figure 3.10-1 Scheme logic in SOTF-OC

3.10.2 Setting

Setting of SOTF-OC(Function ID: 454001)

Setting item		Range		Units	Contents	Default setting value		Notes
		1A rating	5A rating			1A rating	5A rating	
SOTF-OC	SOTFOC-EN	Off / On		-	SOTF-OC protection enable	Off		
	OCSOTF	0.02 - 3.00	0.10 - 15.00	A	OC relay for SOTF threshold	1.20	6.00	
	OCSOTF-2fBlk	Non / Block-3P / Block-PerP		-	OCSOTF operation block by 2f-detection	Non		
	SOTF-Test	Off / On		-	Forcibly establishing the cold load condition	Off		

3.10.3 Data ID

◆ Monitoring point for operation

SOTF-OC(Function ID: 454001)

Element ID	Name	Description
8000001B67	OC-RETRIP	OC-RETRIP
8000001C20	OCSOTF-A	SOTFOC relay element operated (phase-A)
8100001C21	OCSOTF-B	SOTFOC relay element operated (phase-B)
8200001C22	OCSOTF-C	SOTFOC relay element operated (phase-C)
8000001B60	OCSOTF-OR	SOTFOC relay element operated (3-phases OR)
8800001B62	SOTFOC-OPT-A	SOTFOC protection operated (phase-A)
8900001B63	SOTFOC-OPT-B	SOTFOC protection operated (phase-B)
8A00001B64	SOTFOC-OPT-C	SOTFOC protection operated (phase-C)
8300001B23	SOTFOC-TRIP	Trip signal by SOTFOC protection operation

◆ Connection point on PLC logic

SOTF-OC(Function ID: 454001)

Element ID	Name	Description
800000EBB2	ADD.SOTF_EN	Additional SOTFOC enable
800000EBB1	OC-RTP.EN	OC-Retrip enable
800000EBB0	SOTFOC_BLOCK	SOTFOC protection block command

3.10.4 PLC driver

◆ Connection point at PLC Driver

PLC_DRV (Function ID: 230301) to SOTF-OC (Function ID: 454001)

PLC Driver	Element ID	to	Destination	PLC connection point
PMX3_5_7	8710021BBF	→	SOTFOC_BLOCK	800000EBB0
PMX3_14_2	8A10071BB2	→	OC-RPT.EN	800000EBB1
PMX3_14_3	8B10071BB3	→	ADD.SOFT_EN	800000EBB2

3.11 Overvoltage protection for phase-to-neutral (OV)

The over voltage protection function for phase (OV) detects an over voltage condition that phase-to-neutral voltage is larger than a setting and operates accordingly. The OV function has four stages (elements; OV1, OV2, OV3, and OV4), which operate independently. The OV element has a time delay characteristic; and the user can select either (1) independent (definite) time characteristic delay or (2) dependent (inverse) time characteristic delay. The OV element is configured both the setting of a pickup voltage (PU) and the setting of a drop-off voltage (DO).

To simplify the description, only OV1 is discussed, but the expression is applicable to other OVs; hence, read the expression for OV1 as the other stages unless a special explanation or instruction has been provided.

Note: The implementation of the feature depends on the selection of both the hardware and the software. Note that the feature is not supplied for the several models; hence, the user has to check the implementation for the model. Locate the ordering number and check it at the "G&T position" referring to the comparison table below. For more information, see *Appendix: Ordering*.

Table 3.11-1 Comparative table in respective ordering numbers

Sec.	Feature	Ordering No. at "G&T"					
		BCU			BCPU		IFU
		11	13	1F	2C	2N	19
–	Main features	NA	NA	NA	✓	✓	NA
–	Number of stages	NA	NA	NA	4	4	NA
3.11.8	PLC driver	NA	NA	NA	✓	✓	NA

✓: Applicable NA: Not applicable

3.11.1 Drop-off and pickup characteristic

Figure 3.11-1 shows the characteristic of the OV element. The outer circle shows the threshold of pick-up threshold voltage (PU), whereas the inner dotted circle shows drop-off voltage point (DO). The hatched area shows the operation area of the OV.

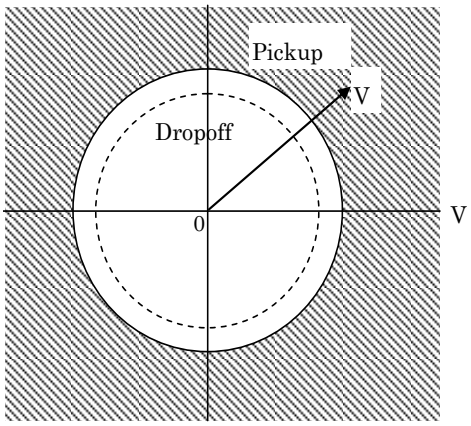


Figure 3.11-1 Characteristic of OV element

For example, with regard to the OV1 element, suppose the user sets a pick-up value in P.U for setting [**OV1**]. Then the user should set a drop-off value using setting [**OV1-DPR**], which configures the ratio of the PU to the DO.

3.11.2 Delay for the operation of the OV element

The OV element has a delay timer for the operation. For the OV1 element, the user can set a delay time using setting [**TOV1**]. The user can find the delay timer in the OV function logic. (See section 3.11.5)

3.11.3 Time characteristic

The OV element has two characteristics between a voltage condition and an operation time; hence, the user should select a mode either (i) definite (independent) time characteristic delay or (ii) inverse (dependent) time characteristic delay. For the definite time characteristic delay, the operation time is a constant. In the inverse time characteristic delay, the operation time depends upon the level of the voltage condition.

(i) Definite time characteristic (DT)

To operate the definite (independent) time delay, set **DT** for scheme switch [**OV1-Type**]. Resetting the OV element is performed when a voltage falls below the drop-off voltage.

(ii) Invers time characteristic (IDMT)

To operate the dependent (invers) time delay, set **IDMT** for scheme switch [**OV1-Type**].

(ii)-1 Pick-up characteristic

The operate time of the inverse (dependent) time characteristic is inversely proportional to the

level of the voltage condition. Figure 3.11-2 shows the invers time characteristic of the OV element when a multiplier setting [**OV1-TMS**] is used. The OV element uses Equation (3.11-1) to be in conformity to IEC 60255-127:

$$t(G) = TMS \times \left\{ \left[\frac{k}{\left({}^{V}/_{V_s} \right)^{a} - 1} \right] + c \right\} \qquad (3.11\text{-}1)$$

where,

t = operating time (seconds),

V = energizing voltage (voltage),

Vs = pickup voltage setting (voltage), and

TMS = time multiplier setting to adjust a curve

If the user will require a user-programmable (original) curve in the inverse time characteristic, it is provided when the constants of k, a, c are set, as shown in Table 3.11-2. For example, the user-programmable (original) curve in the OV1 element will be acquired when **Original** is set for the scheme switch [**OV1-Type**], and when values of respective constants are set for [**OV1-k**], [**OV1-a**], and [**OV1-C**].

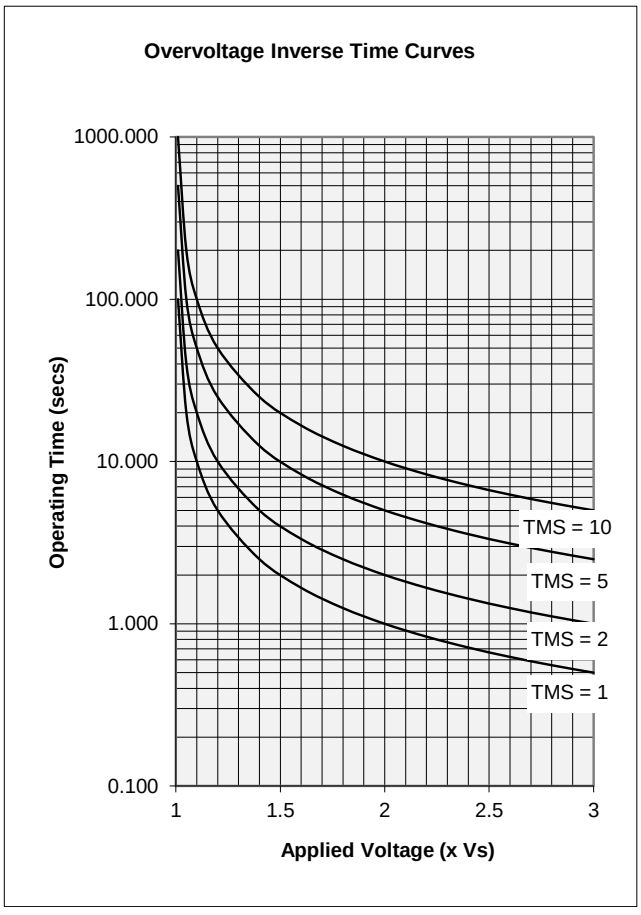


Figure 3.11-2 IDMT characteristic of OV element

Table 3.11-2 Constant value at each setting of IDMT curve

Set item	k	a	C
IDMT	1	1	0
User-programmable (Original)	0.00000 – 500.00000 by 0.00001 step	0.00000 – 10.00000 by 0.00001 step	0.00000 – 10.00000 by 0.00001 step

(ii)-2 Reset feature

The user should set the time for resetting. Figure 3.11-3 shows that examples of the pick-up and the drop-off relevant to both the fault occurrences and the operation time. The value of the time counter furnished in the OV1 element is incremented if faults occur.

As for an intermittent fault (the former in the figure), the time counter will not reach the trip level. In the other words, the operation of the OV1 element is paralyzed in the reset time set by [**TOV1R**].

If a series of fault occurs repeatedly (the latter in the figure), and if the value of the time counter reaches at trip level, the OV1 element will issue a trip command after a certain delay. After issuing the trip command, if a series of fault completely disappears after issuing the trip command, the value of the time counter will be expired after the reset time [**TOV1R**].

When the user requires resetting the operation of the OV1 element immediately, setting zero for the settings [**TOV1R**] is needed. Consequently, when a voltage falls below the reset threshold (drop-off), the operation of the OV1 element is reset promptly.

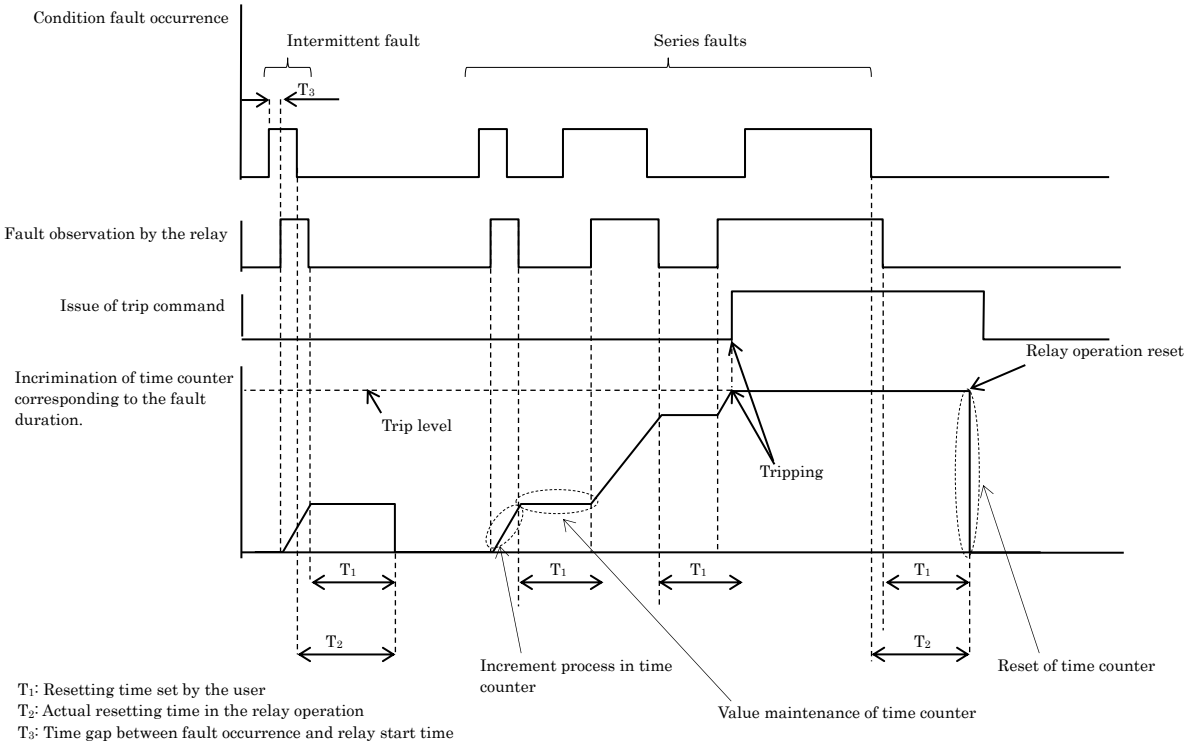


Figure 3.11-3 Faults occurrences and reset operation when IDMT being applied

3.11.4 Miscellaneous functions

(i) OV operation blocked by the occurrence of VT failure

Blocking the OV function may be required when a failure in the voltage transformer occurs. In this case, the user shall set **Block** for scheme switch [**OV1-VTFBlk**]. **Non** (as a default) is set for scheme switch [**OV1-VTFBlk**] in order that the OV function is not blocked by the failure.

(ii) OV trip signal

The OV function issues a trip command for the trip circuit (TRC†) when **Trip** is set for scheme switch [**OV1-UseFor**] as the normal trip operation. However, when an alarm signal in place of the trip command is required, the user can set **Alarm** for the scheme switch [**OV1-UseFor**].

†Note: For more information about the trip circuit, see Chapter *Relay application: Trip circuit*.

(iii) Execution of OV function

Set **On** for scheme switch [**OV1-EN**]. Otherwise, set **Off** for the scheme switch [**OV1-EN**] if the OV1 element is not required to operate.

3.11.5 Scheme logic

Figure 3.11-4 shows the OV1 logic. Signal connection points "OV1_BLOCK" are provided for the block of the operation of the OV1 element. For testing, the OV1-PU element is provided; it generates a pick-up signal when the entering voltage is excesses of the threshold anytime. For example, in the IDMT characteristic, the user can measure the pickup time after the excess using both PLC monitoring points "8000011C20" and "8000011C24".

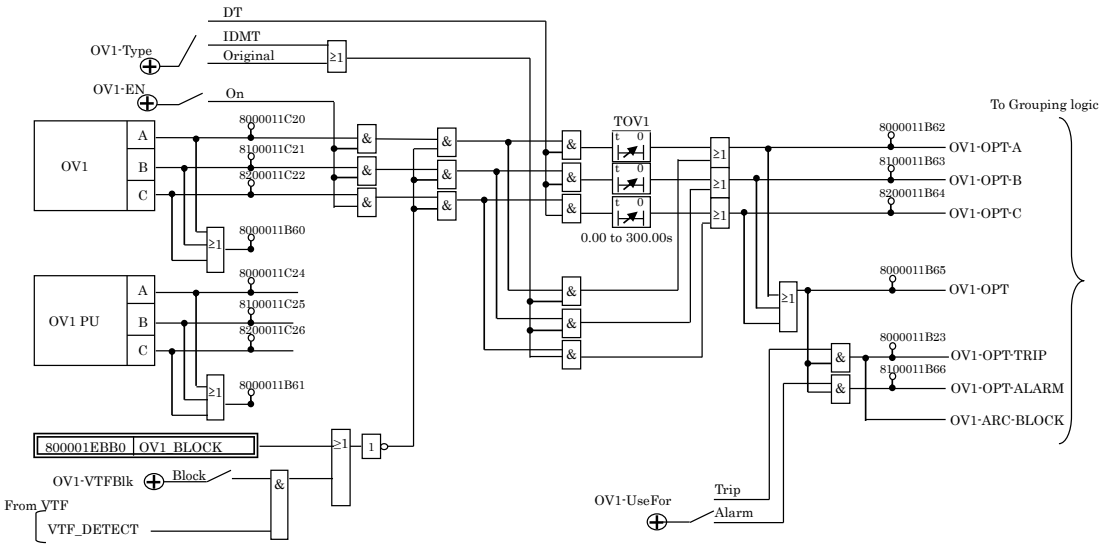


Figure 3.11-4 OV1 logic

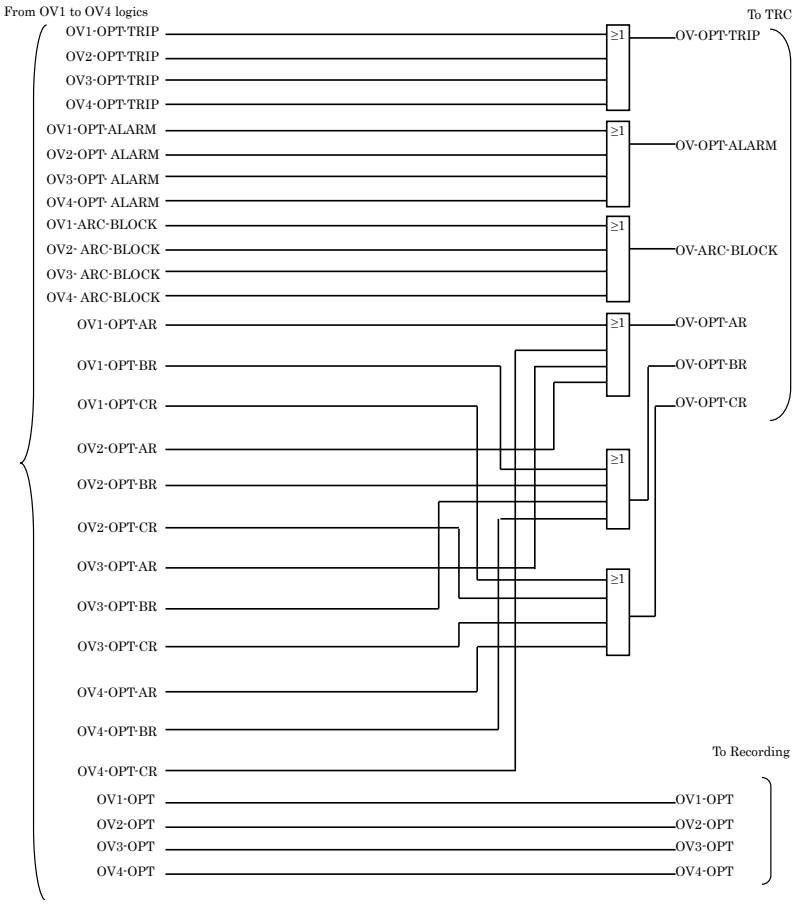


Figure 3.11-5 Grouping logic for TRC/Recording functions

3.11.6 Setting list

Setting of OV(Function ID: 460101)

Setting item		Range	Units	Contents	Default setting value	Notes
OV1	OV1-EN	Off/On	-	OV1 protection enable	Off	
	OV1-Type	DT/IDMT/Original	-	OV1 delay type	DT	
	OV1	1.0-220.0	V	OV1 threshold	120.0	
	OV1-DPR	10-100	%	OV1 drop-out/pick-up ratio	100	
	TOV1	0.00-300.00	s	OV1 operating delay time (in DT mode)	1	
	OV1-TMS	0.010-100.000	-	OV1 time multiplier (in IDMT mode)	1.00	
	TOV1R	0.0-300.0	s	OV1 definite time reset delay	0.0	
	OV1-k	0.00000-500.00000	-	OV1 user original curve coefficient	0.00000	
	OV1-a	0.00000-10.00000	-	OV1 user original curve coefficient	0.00000	
	OV1-c	0.00000-10.00000	-	OV1 user original curve coefficient	0.00000	
	OV1-VTFBlk	Non/Block	-	OV1 operation block by VTF	Non	
	OV1-UseFor	Trip/Alarm	-	OV1 used for trip or alarm	Trip	
OV2	OV2-EN	Off/On		OV2 protection enable	Off	
	OV2-Type	DT/IDMT/Original		OV2 delay type	DT	
	OV2	1.0-220.0	V	OV2 threshold	120.0	
	OV2-DPR	10-100	%	OV2 drop-out/pick-up ratio	100	
	TOV2	0.00-300.00	s	OV2 operating delay time (in DT mode)	1	
	OV2-TMS	0.010-100.000		OV2 time multiplier (in IDMT mode)	1.00	
	TOV2R	0.0-300.0	s	OV2 definite time reset delay	0.0	
	OV2-k	0.00000-500.00000		OV2 user original curve coefficient	0.00000	
	OV2-a	0.00000-10.00000		OV2 user original curve coefficient	0.00000	
	OV2-c	0.00000-10.00000		OV2 user original curve coefficient	0.00000	
	OV2-VTFBlk	Non/Block		OV2 operation block by VTF	Non	
	OV2-UseFor	Trip/Alarm		OV2 used for trip or alarm	Trip	
OV3	OV3-EN	Off/On		OV3 protection enable	Off	
	OV3-Type	DT/IDMT/Original		OV3 delay type	DT	
	OV3	1.0-220.0	V	OV3 threshold	120.0	
	OV3-DPR	10-100	%	OV3 drop-out/pick-up ratio	100	
	TOV3	0.00-300.00	s	OV3 operating delay time (in DT mode)	1	
	OV3-TMS	0.010-100.000		OV3 time multiplier (in IDMT mode)	1.00	
	TOV3R	0.0-300.0	s	OV3 definite time reset delay	0.0	
	OV3-k	0.00000-500.00000		OV3 user original curve coefficient	0.00000	
	OV3-a	0.00000-10.00000		OV3 user original curve coefficient	0.00000	
	OV3-c	0.00000-10.00000		OV3 user original curve coefficient	0.00000	
	OV3-VTFBlk	Non/Block		OV3 operation block by VTF	Non	
	OV3-UseFor	Trip/Alarm		OV3 used for trip or alarm	Trip	
OV4	OV4-EN	Off/On		OV4 protection enable	Off	
	OV4-Type	DT/IDMT/Original		OV4 delay type	DT	
	OV4	1.0-220.0	V	OV4 threshold	120.0	
	OV4-DPR	10-100	%	OV4 drop-out/pick-up ratio	100	
	TOV4	0.00-300.00	s	OV4 operating delay time (in DT mode)	1	
	OV4-TMS	0.010-100.000		OV4 time multiplier (in IDMT mode)	1.00	
	TOV4R	0.0-300.0	s	OV4 definite time reset delay	0.0	
	OV4-k	0.00000-500.00000		OV4 user original curve coefficient	0.00000	
	OV4-a	0.00000-10.00000		OV4 user original curve coefficient	0.00000	
	OV4-c	0.00000-10.00000		OV4 user original curve coefficient	0.00000	
	OV4-VTFBlk	Non/Block		OV4 operation block by VTF	Non	
	OV4-UseFor	Trip/Alarm		OV4 used for trip or alarm	Trip	

3.11.7 Data ID

◆ Signal monitoring point

OV(Function ID: 460101)

Element ID	Name	Description
8000011C20	OV1-A	OV1 relay element operated (phase-A)
8100011C21	OV1-B	OV1 relay element operated (phase-B)
8200011C22	OV1-C	OV1 relay element operated (phase-C)
8000011B65	OV1-OPT	OV1 protection operated
8000011B62	OV1-OPT-A	OV1 protection operated (phase-A)
8100011B63	OV1-OPT-B	OV1 protection operated (phase-B)
8200011B64	OV1-OPT-C	OV1 protection operated (phase-C)
8000011B60	OV1-OR	OV1 relay element operated (3-phases OR)
8000011C24	OV1PU-A	OV1 relay operation level pick up (phase-A)
8100011C25	OV1PU-B	OV1 relay operation level pick up (phase-B)
8200011C26	OV1PU-C	OV1 relay operation level pick up (phase-C)
8000011B61	OV1PU-OR	OV1 relay operation level pick up (3-phases OR)
8400021C20	OV2-A	OV2 relay element operated (phase-A)
8500021C21	OV2-B	OV2 relay element operated (phase-B)
8600021C22	OV2-C	OV2 relay element operated (phase-C)
8100021B65	OV2-OPT	OV2 protection operated
8400021B62	OV2-OPT-A	OV2 protection operated (phase-A)
8500021B63	OV2-OPT-B	OV2 protection operated (phase-B)
8600021B64	OV2-OPT-C	OV2 protection operated (phase-C)
8100021B60	OV2-OR	OV2 relay element operated (3-phases OR)
8400021C24	OV2PU-A	OV2 relay operation level pick up (phase-A)
8500021C25	OV2PU-B	OV2 relay operation level pick up (phase-B)
8600021C26	OV2PU-C	OV2 relay operation level pick up (phase-C)
8100021B61	OV2PU-OR	OV2 relay operation level pick up (3-phases OR)
8800031C20	OV3-A	OV3 relay element operated (phase-A)
8900031C21	OV3-B	OV3 relay element operated (phase-B)
8A00031C22	OV3-C	OV3 relay element operated (phase-C)
8200031B65	OV3-OPT	OV3 protection operated
8800031B62	OV3-OPT-A	OV3 protection operated (phase-A)
8900031B63	OV3-OPT-B	OV3 protection operated (phase-B)
8A00031B64	OV3-OPT-C	OV3 protection operated (phase-C)
8200031B60	OV3-OR	OV3 relay element operated (3-phases OR)
8800031C24	OV3PU-A	OV3 relay operation level pick up (phase-A)
8900031C25	OV3PU-B	OV3 relay operation level pick up (phase-B)
8A00031C26	OV3PU-C	OV3 relay operation level pick up (phase-C)
8200031B61	OV3PU-OR	OV3 relay operation level pick up (3-phases OR)
8C00041C20	OV4-A	OV4 relay element operated (phase-A)
8D00041C21	OV4-B	OV4 relay element operated (phase-B)
8E00041C22	OV4-C	OV4 relay element operated (phase-C)
8300041B65	OV4-OPT	OV4 protection operated
8C00041B62	OV4-OPT-A	OV4 protection operated (phase-A)
8D00041B63	OV4-OPT-B	OV4 protection operated (phase-B)
8E00041B64	OV4-OPT-C	OV4 protection operated (phase-C)

◆ Signal monitoring point

OV(Function ID: 460101)

Element ID	Name	Description
8300041B60	OV4-OR	OV4 relay element operated (3-phases OR)
8C00041C24	OV4PU-A	OV4 relay operation level pick up (phase-A)
8D00041C25	OV4PU-B	OV4 relay operation level pick up (phase-B)
8E00041C26	OV4PU-C	OV4 relay operation level pick up (phase-C)
8300041B61	OV4PU-OR	OV4 relay operation level pick up (3-phases OR)

◆ Connection point on PLC logic

OV(Function ID: 460101)

Element ID	Name	Description
800001EBB0	OV1_BLOCK	OV1 protection block command
810002EBB0	OV2_BLOCK	OV2 protection block command
820003EBB0	OV3_BLOCK	OV3 protection block command
830004EBB0	OV4_BLOCK	OV4 protection block command

3.11.8 PLC driver

◆ Connection point at PLC Driver

PLC_DRV (Function ID: 230301) to OV (Function ID: 460101)

PLC Driver	Element ID	to	Destination	PLC connection point
PMX3_6_0	8810031BB0	→	OV1_BLOCK	800001EBB0
PMX3_6_1	8910031BB1	→	OV2_BLOCK	810002EBB0
PMX3_6_2	8A10031BB2	→	OV3_BLOCK	820003EBB0
PMX3_6_3	8B10031BB3	→	OV4_BLOCK	830004EBB0

3.12 Overvoltage protection for phase-to-phase (OVS)

The over voltage protection function in phase-to-phase (OVS) detects an over voltage condition that phase-to-neutral voltage is larger than a setting and operates accordingly. The OVS function has four stages (elements; OVS1, OVS2, OVS3, and OVS4), which operate independently. The OVS element has a time delay characteristic; and the user can select either (1) independent (definite) time characteristic delay or (2) dependent (inverse) time characteristic delay. The OVS element is configured both the setting of a pickup voltage (PU) and the setting of a drop-off voltage (DO).

To simplify the description, only OVS1 is discussed, but the expression is applicable to other OVSs; hence, read the expression for OVS1 as the other stages unless a special explanation or instruction has been provided.

Note: The implementation of the feature depends on the selection of both the hardware and the software. Note that the feature is not supplied for the several models; hence, the user has to check the implementation for the model. Locate the ordering number and check it at the "G&T position" referring to the comparison table below. For more information, see *Appendix: Ordering*.

Table 3.12-1 Comparative table in respective ordering numbers

Sec.	Feature	Ordering No. at "G&T"					
		BCU			BCPU		IFU
		11	13	1F	2C	2N	19
–	Main features	NA	NA	NA	✓	✓	NA
–	Number of stages	NA	NA	NA	4	4	NA
3.1.9	PLC driver	NA	NA	NA	✓	✓	NA

✓: Applicable NA: Not applicable

3.12.1 Drop-off and pickup setting

Figure 3.12-1 shows the characteristic of the OVS element. The outer circle shows the threshold of pick-up threshold voltage (PU), whereas the inner circle shows drop-off voltage point (DO). The hatched area shows the operation area of the OVS.

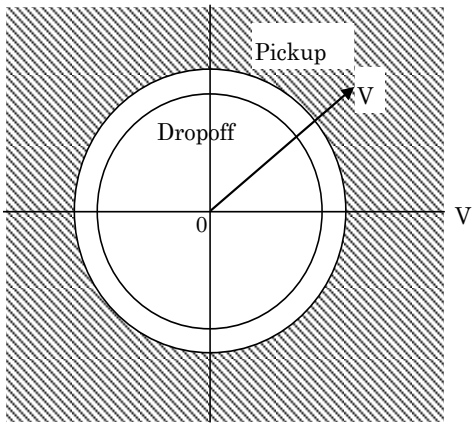


Figure 3.12-1 Characteristic of OVS element

For example, with regard to the OVS1 element, suppose the user sets a pick-up value in P.U for setting [**OVS1**]. Then the user should set a drop-off value using setting [**OVS1-DPR**], which configures the ratio of the PU to the DO.

3.12.2 Delay for the operation of the OVS element

The OVS element has a delay timer for the operation. For the OVS1 element, the user can set a delay time using setting [**TOVS1**]. The user can find the delay timer in the OVS function logic. (See section 3.12.5)

3.12.3 Time characteristic

The OVS element has two characteristics between a voltage condition and an operation time; hence, the user should select a mode either (i) definite (independent) time characteristic delay or (ii) inverse (dependent) time characteristic delay. For the definite time characteristic delay, the operation time is a constant. In the inverse time characteristic delay, the operation time depends upon the level of the voltage condition.

(i) Definite time characteristic (DT)

To operate the definite (independent) time delay, set scheme switch [**OVS1-Type**] **DT.** Resetting the OVS element is performed when a voltage falls below the drop-off voltage.

(ii) Invers time characteristic (IDMT)

To operate the dependent (invers) time delay, set scheme switch [**OVS1-Type**] **IDMT**.

(ii)-1 Operation feature

The operate time of the inverse (dependent) time characteristic is inversely proportional to the level of the voltage condition. Figure 3.12-2 shows the invers time characteristic of the OVS element when a multiplier setting is used. The OVS element uses Equation (3.12-1) to be in conformity to IEC 60255-127:

$$t(G) = TMS \times \left\{ \left[\frac{k}{\left({}^{V}/_{V_s} \right)^{a} - 1} \right] + c \right\} \qquad (3.12\text{-}1)$$

where,

t = operating time (seconds),

V = energizing voltage (voltage),

Vs = pickup voltage setting (voltage), and

TMS = time multiplier setting to adjust a curve

If the user will require a user-programmable (original) curve in the inverse time characteristic, it is provided when the constants of k, a, c are set, as shown in Table 3.12-2. For example, the user-programmable (original) curve in the OVS1 element will be acquired when **Original** is set for the scheme switch [**OVS1-Type**], and when values of respective constants are set for [**OVS1-k**], [**OVS1-a**], and [**OVS1-C**].

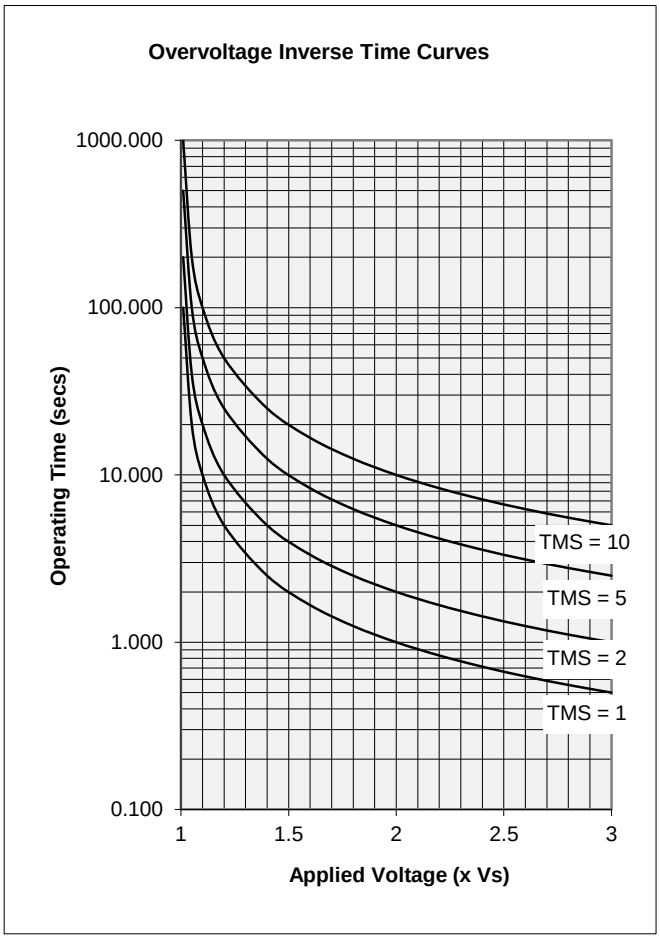


Figure 3.12-2 IDMT characteristic of OVS element

Table 3.12-2 Constant value at each setting of IDMT curve

Set item	k	a	C
IDMT	1	1	0
User-programmable (Original)	0.00000 – 500.00000 by 0.00001 step	0.00000 – 10.00000 by 0.00001 step	0.00000 – 10.00000 by 0.00001 step

(ii)-2 Reset feature

The user should set the time for resetting. Figure 3.12-3 shows that examples of the pick-up and the drop-off relevant to both the fault occurrences and the operation time. The value of the time counter furnished in the OVS1 element is incremented if faults occur.

As for an intermittent fault (the former in the figure), the time counter will not reach the trip level. In the other words, the operation of the OVS1 element is paralyzed in the reset time set by [**TOVS1R**].

If a series of fault occurs repeatedly (the latter in the figure), and if the value of the time counter reaches at trip level, the OVS1 element will issue a trip signal after a certain delay. After issuing the trip signal, if a series of fault completely disappears after issuing the trip signal, the value of the time counter will be expired after the reset time [**TOVS1R**].

When the user requires resetting the operation of the OVS1 element immediately, setting zero for the settings [**TOVS1R**] is needed. Consequently, when a voltage falls below the reset threshold (drop-off), the operation of the OVS1 element is reset promptly.

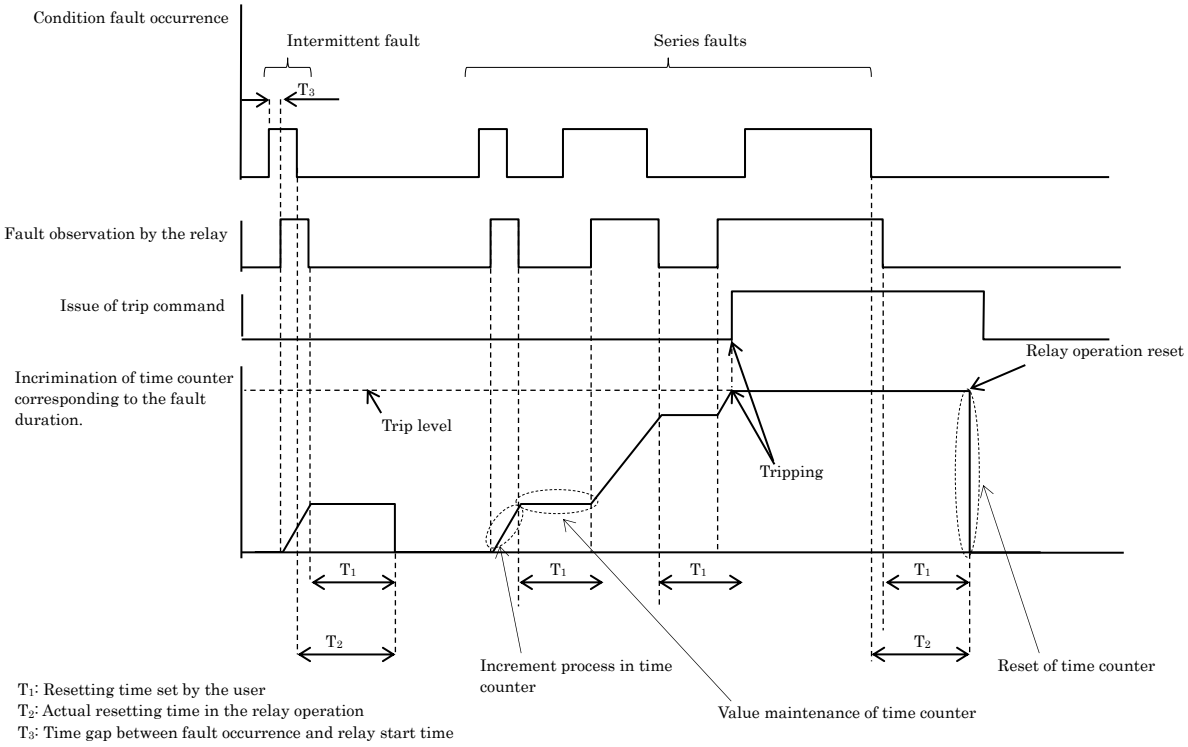


Figure 3.12-3 Faults occurrences and reset operation when IDMT being applied

3.12.4 Miscellaneous functions

(i) OVS operation blocked by the occurrence of VT failure

Blocking the OVS function may be required when a failure in the voltage transformer occurs. In this case, the user shall set **Block** for scheme switch [**OVS1-VTFBlk**]. **Non** (as a default) is set for scheme switch [**OVS1-VTFBlk**] in order that the OVS function is not blocked by the failure.

(ii) Switch of OVS trip signal

The OVS function issues a trip signal for the trip circuit (TRC†) when **Trip** is set for scheme switch [**OVS1-UseFor**] as the normal trip operation. However, when an alarm signal in place of the trip signal is required, the user can set **Alarm** for the scheme switch [**OVS1-UseFor**].

†Note: For more information of the trip circuit, see Chapter *Relay application: Trip circuit*.

(iii) Execution of OVS function

Set **On** for scheme switch [**OVS1-EN**]. Otherwise, set **Off** for the scheme switch [**OVS1-EN**] if the OVS1 element is not required to operate.

3.12.5 Scheme logic

Figure 3.12-4 shows the OVS function logic. Signal connection points "OVS*_BLOCK" are provided for the block of the operation of the OVS elements. For testing, the OVS1-PU element is provided; it generates a pick-up signal when the entering voltage is excesses of the threshold anytime. For example, in the IDMT characteristic, using both monitoring points "8000011C20" and "8000011C24" can facilitate to measure the pickup time after the excess.

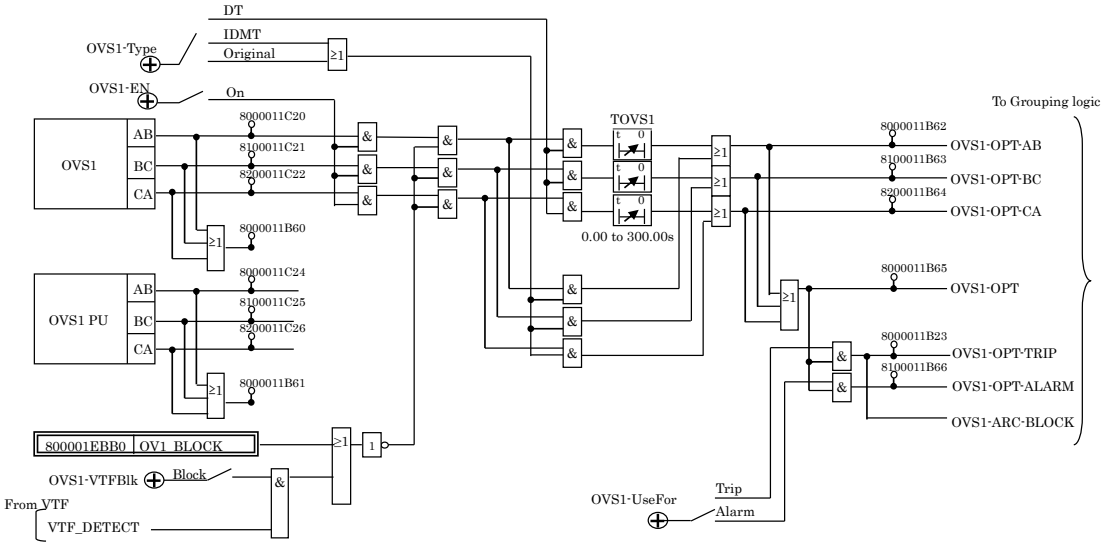


Figure 3.12-4 OVS1 logic

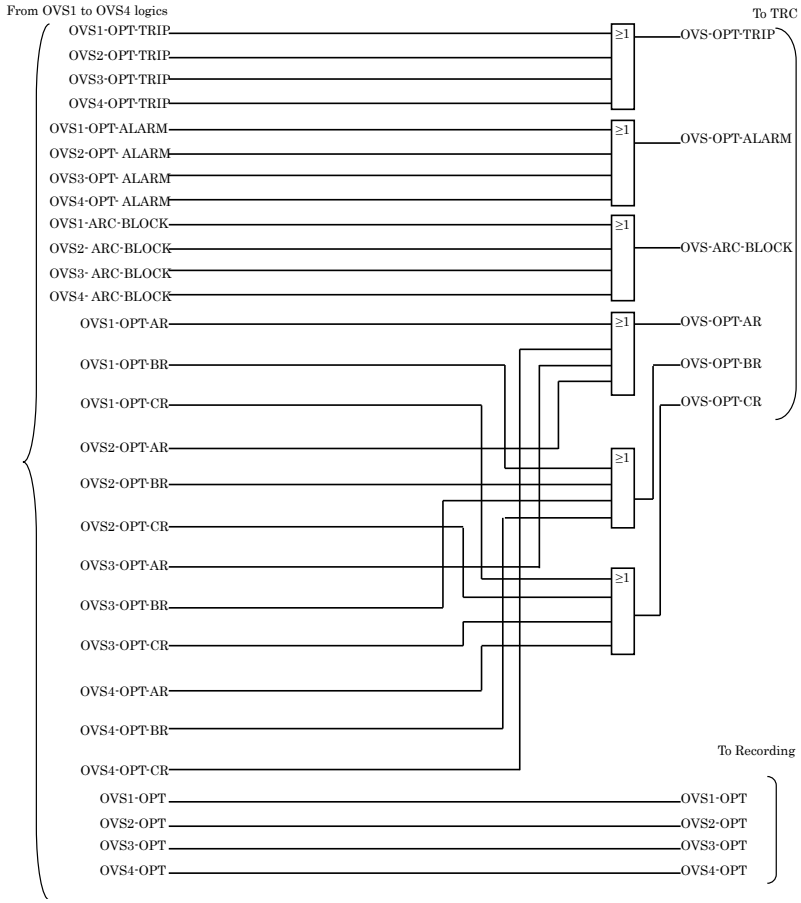


Figure 3.12-5 Grouping logic for TRC/Recording functions

3.12.6 Setting list

Setting of OVS(Function ID: 461101)

Setting item			Range	Unit s	Contents	Default setting value	Notes
	OVS1	OVS1-EN	Off/On	-	OVS1 protection enable	Off	
		OVS1-Type	DT/IDMT/Original	-	OVS1 delay type	DT	
		OVS1	1.0-220.0	V	OVS1 threshold	120.0	
		OVS1-DPR	10-100	%	OVS1 drop-out/pick-up ratio	100	
		TOVS1	0.00-300.00	s	OVS1 operating delay time (in DT mode)	1.00	
		OVS1-TMS	0.010-100.000	-	OVS1 time multiplier (in IDMT mode)	1.000	
		TOVS1R	0.0-300.0	s	OVS1 definite time reset delay	0.0	
		OVS1-k	0.00000-500.00000	-	OVS1 user original curve coefficient	0.00000	
		OVS1-a	0.00000-10.00000	-	OVS1 user original curve coefficient	0.00000	
		OVS1-c	0.00000-10.00000	-	OVS1 user original curve coefficient	0.00000	
		OVS1-VTFBlk	Non/Block	-	OVS1 operation block by VTF	Non	
		OVS1-UseFor	Trip/Alarm	-	OVS1 used for trip or alarm	Trip	
	OVS2	OVS2-EN	Off/On	-	OVS2 protection enable	Off	
		OVS2-Type	DT/IDMT/Original	-	OVS2 delay type	DT	
		OVS2	1.0-220.0	V	OVS2 threshold	120.0	
		OVS2-DPR	10-100	%	OVS2 drop-out/pick-up ratio	100	
		TOVS2	0.00-300.00	s	OVS2 operating delay time (in DT mode)	1.00	
		OVS2-TMS	0.010-100.000	-	OVS2 time multiplier (in IDMT mode)	1.000	
		TOVS2R	0.0-300.0	s	OVS2 definite time reset delay	0.0	
		OVS2-k	0.00000-500.00000	-	OVS2 user original curve coefficient	0.00000	
		OVS2-a	0.00000-10.00000	-	OVS2 user original curve coefficient	0.00000	
		OVS2-c	0.00000-10.00000	-	OVS2 user original curve coefficient	0.00000	
		OVS2-VTFBlk	Non/Block	-	OVS2 operation block by VTF	Non	
		OVS2-UseFor	Trip/Alarm	-	OVS2 used for trip or alarm	Trip	
	OVS3	OVS3-EN	Off/On	-	OVS3 protection enable	Off	
		OVS3-Type	DT/IDMT/Original	-	OVS3 delay type	DT	
		OVS3	1.0-220.0	V	OVS3 threshold	120.0	
		OVS3-DPR	10-100	%	OVS3 drop-out/pick-up ratio	100	
		TOVS3	0.00-300.00	s	OVS3 operating delay time (in DT mode)	1.00	
		OVS3-TMS	0.010-100.000	-	OVS3 time multiplier (in IDMT mode)	1.000	
		TOVS3R	0.0-300.0	s	OVS3 definite time reset delay	0.0	
		OVS3-k	0.00000-500.00000	-	OVS3 user original curve coefficient	0.00000	
		OVS3-a	0.00000-10.00000	-	OVS3 user original curve coefficient	0.00000	
		OVS3-c	0.00000-10.00000	-	OVS3 user original curve coefficient	0.00000	
		OVS3-VTFBlk	Non/Block	-	OVS3 operation block by VTF	Non	
		OVS3-UseFor	Trip/Alarm	-	OVS3 used for trip or alarm	Trip	
	OVS4	OVS4-EN	Off/On	-	OVS4 protection enable	Off	
		OVS4-Type	DT/IDMT/Original	-	OVS4 delay type	DT	
		OVS4	1.0-220.0	V	OVS4 threshold	120.0	
		OVS4-DPR	10-100	%	OVS4 drop-out/pick-up ratio	100	
		TOVS4	0.00-300.00	s	OVS4 operating delay time (in DT mode)	1.00	
		OVS4-TMS	0.010-100.000	-	OVS4 time multiplier (in IDMT mode)	1.000	
		TOVS4R	0.0-300.0	s	OVS4 definite time reset delay	0.0	
		OVS4-k	0.00000-500.00000	-	OVS4 user original curve coefficient	0.00000	
		OVS4-a	0.00000-10.00000	-	OVS4 user original curve coefficient	0.00000	
		OVS4-c	0.00000-10.00000	-	OVS4 user original curve coefficient	0.00000	
		OVS4-VTFBlk	Non/Block	-	OVS4 operation block by VTF	Non	
		OVS4-UseFor	Trip/Alarm	-	OVS4 used for trip or alarm	Trip	

3.12.7 Data ID

◆ Signal monitoring point

OVS(Function ID: 461101)

Element ID	Name	Description
8000011C20	OVS1-AB	OVS1 relay element operated (phase-AB)
8100011C21	OVS1-BC	OVS1 relay element operated (phase-BC)
8200011C22	OVS1-CA	OVS1 relay element operated (phase-CA)
8000011B65	OVS1-OPT	OVS1 protection operated
8000011B62	OVS1-OPT-AB	OVS1 protection operated (phase-AB)
8100011B63	OVS1-OPT-BC	OVS1 protection operated (phase-BC)
8200011B64	OVS1-OPT-CA	OVS1 protection operated (phase-CA)
8000011B60	OVS1-OR	OVS1 relay element operated (3-phases OR)
8000011C24	OVS1PU-AB	OVS1 relay operation level pick up (phase-AB)
8100011C25	OVS1PU-BC	OVS1 relay operation level pick up (phase-BC)
8200011C26	OVS1PU-CA	OVS1 relay operation level pick up (phase-CA)
8000011B61	OVS1PU-OR	OVS1 relay operation level pick up (3-phases OR)
8400021C20	OVS2-AB	OVS2 relay element operated (phase-AB)
8500021C21	OVS2-BC	OVS2 relay element operated (phase-BC)
8600021C22	OVS2-CA	OVS2 relay element operated (phase-CA)
8100021B65	OVS2-OPT	OVS2 protection operated
8400021B62	OVS2-OPT-AB	OVS2 protection operated (phase-AB)
8500021B63	OVS2-OPT-BC	OVS2 protection operated (phase-BC)
8600021B64	OVS2-OPT-CA	OVS2 protection operated (phase-CA)
8100021B60	OVS2-OR	OVS2 relay element operated (3-phases OR)
8400021C24	OVS2PU-AB	OVS2 relay operation level pick up (phase-AB)
8500021C25	OVS2PU-BC	OVS2 relay operation level pick up (phase-BC)
8600021C26	OVS2PU-CA	OVS2 relay operation level pick up (phase-CA)
8100021B61	OVS2PU-OR	OVS2 relay operation level pick up (3-phases OR)
8800031C20	OVS3-AB	OVS3 relay element operated (phase-AB)
8900031C21	OVS3-BC	OVS3 relay element operated (phase-BC)
8A00031C22	OVS3-CA	OVS3 relay element operated (phase-CA)
8200031B65	OVS3-OPT	OVS3 protection operated
8800031B62	OVS3-OPT-AB	OVS3 protection operated (phase-AB)
8900031B63	OVS3-OPT-BC	OVS3 protection operated (phase-BC)
8A00031B64	OVS3-OPT-CA	OVS3 protection operated (phase-CA)
8200031B60	OVS3-OR	OVS3 relay element operated (3-phases OR)
8800031C24	OVS3PU-AB	OVS3 relay operation level pick up (phase-AB)
8900031C25	OVS3PU-BC	OVS3 relay operation level pick up (phase-BC)
8A00031C26	OVS3PU-CA	OVS3 relay operation level pick up (phase-CA)
8200031B61	OVS3PU-OR	OVS3 relay operation level pick up (3-phases OR)
8C00041C20	OVS4-AB	OVS4 relay element operated (phase-AB)
8D00041C21	OVS4-BC	OVS4 relay element operated (phase-BC)
8E00041C22	OVS4-CA	OVS4 relay element operated (phase-CA)
8300041B65	OVS4-OPT	OVS4 protection operated
8C00041B62	OVS4-OPT-AB	OVS4 protection operated (phase-AB)
8D00041B63	OVS4-OPT-BC	OVS4 protection operated (phase-BC)
8E00041B64	OVS4-OPT-CA	OVS4 protection operated (phase-CA)

◆ Signal monitoring point

OVS(Function ID: 461101)

Element ID	Name	Description
8300041B60	OVS4-OR	OVS4 relay element operated (3-phases OR)
8C00041C24	OVS4PU-AB	OVS4 relay operation level pick up (phase-AB)
8D00041C25	OVS4PU-BC	OVS4 relay operation level pick up (phase-BC)
8E00041C26	OVS4PU-CA	OVS4 relay operation level pick up (phase-CA)
8300041B61	OVS4PU-OR	OVS4 relay operation level pick up (3-phases OR)

◆ Connection point on PLC logic

OVS(Function ID: 461101)

Element ID	Name	Description
800001EBB0	OVS1_BLOCK	OVS1 protection block command
810002EBB0	OVS2_BLOCK	OVS2 protection block command
820003EBB0	OVS3_BLOCK	OVS3 protection block command
830004EBB0	OVS4_BLOCK	OVS4 protection block command

3.12.8 PLC driver

◆ Connection point at PLC Driver

PLC_DRV (Function ID: 230301) to OVS (Function ID: 461101)

PLC Driver	Element ID	to	Destination	PLC connection point
PMX3_6_4	8C10031BB4	→	OVS1_BLOCK	800001EBB0
PMX3_6_5	8D10031BB5	→	OVS2_BLOCK	810002EBB0
PMX3_6_6	8E10031BB6	→	OVS3_BLOCK	820003EBB0
PMX3_6_7	8F10031BB7	→	OVS4_BLOCK	830004EBB0

3.13 Earth fault overvoltage protection (OVG)

Earth fault overvoltage protection (OVG) function has four stages (OVG1, OVG2, OVG3, and OVG4); and the time characteristic of each stage can be taken from either definite time or inverse definite minimum time. The purpose of each stage of the OVG is to detect earth fault on unearthed, resistance-earthed system or AC generators.

The low voltage settings, which may be applied for OVG elements, are susceptible to any third harmonic component that may be superimposed on input signals. Therefore, the function incorporates filters to suppress the third harmonic component.

To simplify the description, only OVG1 is discussed but is applicable to OVG2 and the others; hence, read the expression for OVG1 as other stages unless a special explanation or instruction has been provided.

Note: The implementation of the feature depends on the selection of both the hardware and the software. Note that the feature is not supplied for the several models; hence, the user has to check the implementation for the model. Locate the ordering number and check it at the "G&T position" referring to the comparison table below. For more information, see *Appendix: Ordering*.

Table 3.13-1 Comparative table in respective ordering numbers

Sec.	Feature	Ordering No. at "G&T"					
		BCU			BCPU		IFU
		11	13	1F	2C	2N	19
–	Main features	NA	NA	NA	✓	✓	NA
–	Number of stages	NA	NA	NA	4	4	NA
3.1.9	PLC driver	NA	NA	NA	✓	✓	NA

✓: Applicable NA: Not applicable

3.13.1 Drop-off and pickup setting

Figure 3.13-1 shows the characteristic of the OVG element. The outer circle shows the threshold of pick-up threshold voltage (PU), whereas the inner circle shows drop-off voltage point (DO). The hatched area shows the operation area of the OVG.

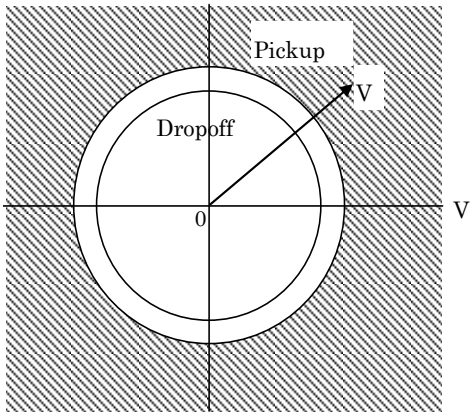


Figure 3.13-1 Setting points of OVG

For example, with regard to the OVG1 element, suppose the user sets a pick-up value in P.U for setting [**OVG1**]. Then the user should set a drop-off value using setting [**OVG1-DPR**], which configures the ratio of the PU to the DO.

3.13.2 Delay of the operation of the OVG element

The OVG element has a delay timer for the operation. For the OVG1 element, the user can set a delay time using setting [**TOVG1**]. The user can find the delay timer in the OVG function logic. (See section 3.13.5)

3.13.3 Time characteristic

The OVG element has two characteristics between a voltage condition and an operation time; hence, the user should select a mode either (i) definite (independent) time characteristic delay or (ii) inverse (dependent) time characteristic delay. For the definite time characteristic delay, the operation time is a constant. In the inverse time characteristic delay, the operation time depends upon the level of the voltage condition.

(i) Definite time characteristic (DT)

To operate the definite (independent) time delay, set **DT** for scheme switch [**OVG1-Type**]**.** Resetting the OVG element is performed when a voltage falls below the drop-off voltage.

(ii) Invers time delay (IDMT)

To operate the dependent (invers) time delay, set **IDMT** for scheme switch [**OVG1-Type**].

(ii)-1 Operation feature

The operate time of the inverse (dependent) time characteristic is inversely proportional to the level of the voltage condition. Figure 3.13-2 shows the invers time characteristic of the OVG element when a multiplier setting is used. The OVG element uses Equation (3.13-1) to be in conformity to IEC 60255-127:

$$t(G) = TMS \times \left\{ \left[\frac{k}{\left(V/V_s \right)^a - 1} \right] + c \right\} \qquad (3.13\text{-}1)$$

where,

t = operating time (seconds),

V = energizing voltage (voltage),

Vs = pickup voltage setting (voltage), and

TMS = time multiplier setting to adjust a curve

If the user will require a user-programmable (original) curve in the inverse time characteristic, it is provided when the constants of k, a, c are set, as shown in Table 3.13-2. For example, the user-programmable (original) curve in the OVG1 element will be acquired when **Original** is set for the scheme switch [**OVG1-Type**], and when values of respective constants are set for [**OVG1-k**], [**OVG1-a**], and [**OVG1-C**].

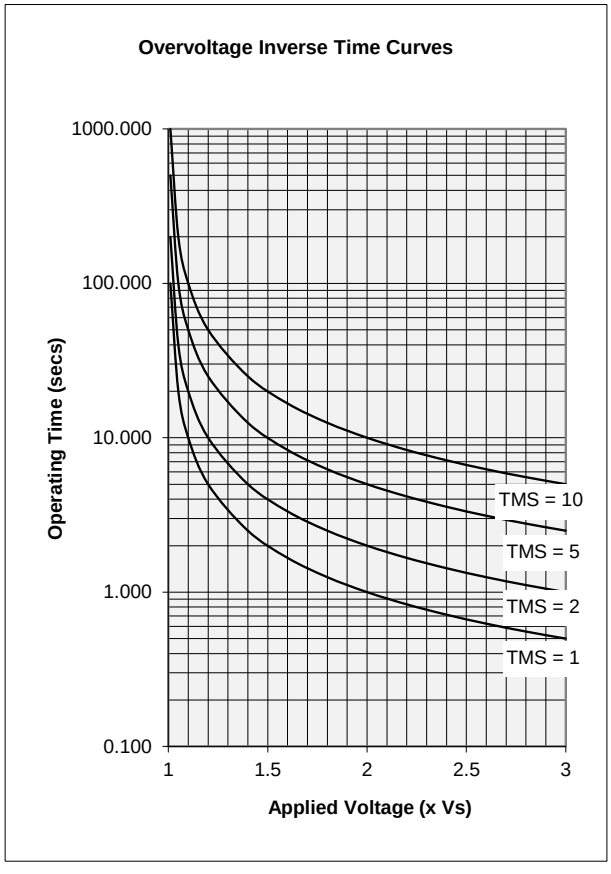


Figure 3.13-2 IDMT characteristic of OVG element

Table 3.13-2 Constant value at each setting of IDMT curve

Set item	k	a	C
IDMT	1	1	0
User-programmable (Original)	0.00000 – 500.00000 by 0.00001 step	0.00000 – 10.00000 by 0.00001 step	0.00000 – 10.00000 by 0.00001 step

(ii)-2 Reset feature

The user should set the time for resetting. Figure 3.13-3 shows that examples of the pick-up and the drop-off relevant to both the fault occurrences and the operation time. The value of the time counter furnished in the OVG1 element is incremented if faults occur.

As for an intermittent fault (the former in the figure), the time counter will not reach the trip level. In the other words, the operation of the OVG1 element is paralyzed in the reset time set by [**TOVG1R**].

If a series of fault occurs repeatedly (the latter in the figure), and if the value of the time counter reaches at trip level, the OVG1 element will issue a trip command after a certain delay. After issuing the trip command, if a series of fault completely disappears after issuing the trip command, the value of the time counter will be expired after the reset time [**TOVG1R**].

When the user requires resetting the operation of the OVG1 element immediately, setting zero for the settings [**TOVG1R**] is needed. Consequently, when a voltage falls below the reset threshold (drop-off), the operation of the OVG1 element is reset promptly.

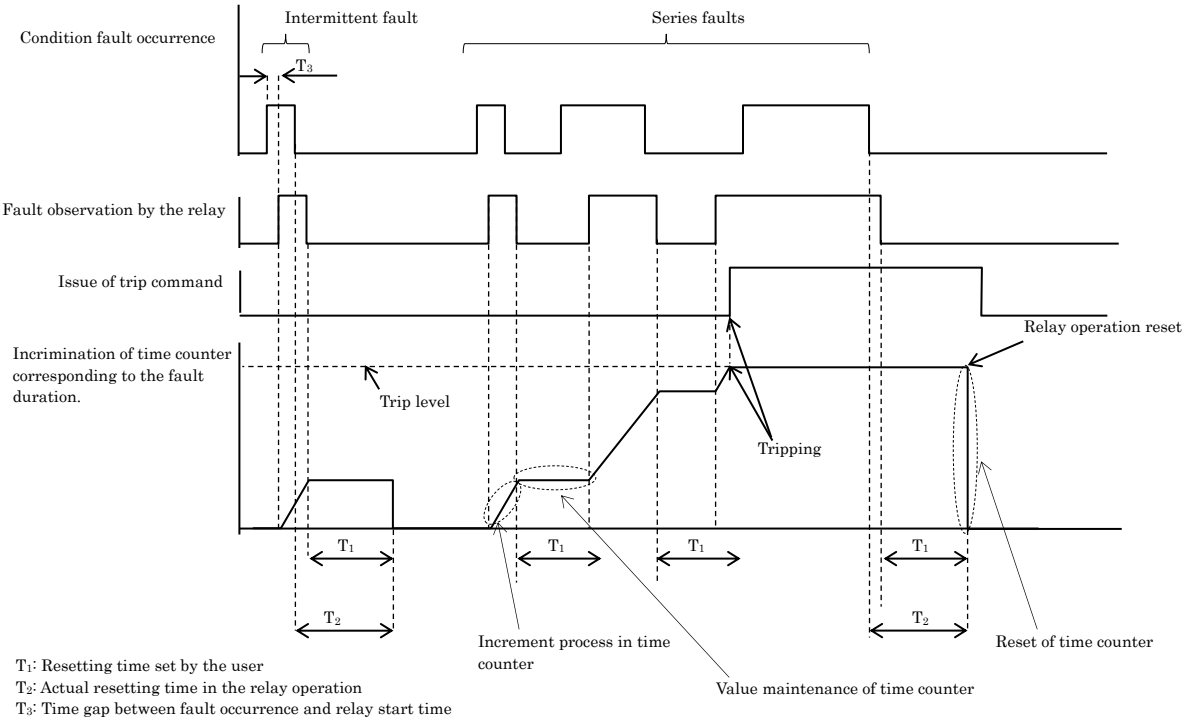


Figure 3.13-3 Faults occurrences and reset operation when IDMT being applied

3.13.4 Miscellaneous functions

(i) OVG operation blocked by the occurrence of VT failure

Blocking the OVG function may be required when a failure in the voltage transformer occurs. In this case, the user shall set **Block** for scheme switch [**OVG1-VTFBlk**]. **Non** (as a default) is set for scheme switch [**OVG1-VTFBlk**] in order that the OVG function is not blocked by the failure.

(ii) Switch of OVG trip command

The OVG function issues a trip command for the trip circuit (TRC†) when **Trip** is set for scheme switch [**OVG1-UseFor**] as the normal trip operation. However, when an alarm signal in place of the trip command is required, the user can set **Alarm** for the scheme switch [**OVG1-UseFor**].

†Note: For more information of the trip circuit, see Chapter *Relay application: Trip circuit*.

(iii) Execution of OVG function

Set **On** for scheme switch [**OVG1-EN**]. Otherwise, set **Off** for the scheme switch [**OVG1-EN**] if the OVG1 element is not required to operate.

3.13.5 Scheme logic

Figure 3.13-4 shows the OVG1 function logic. Signal connection point "OVG1_BLOCK" is provided for the block of the operation of the OVG1 element. For testing, the OVG1-PU element is provided; it generates a pick-up signal when the entering voltage is excesses of the threshold anytime. Thereby, in the IDMT characteristic, using both monitoring points "8000011C23" and "8000011C27" can facilitate to measure the pickup time after the excess.

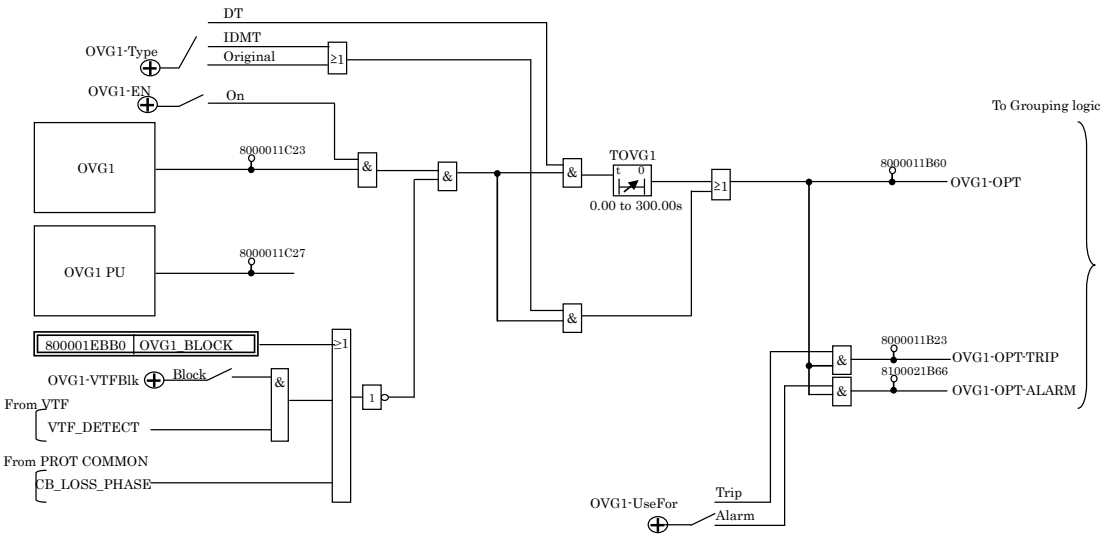


Figure 3.13-4 OVG1 logic

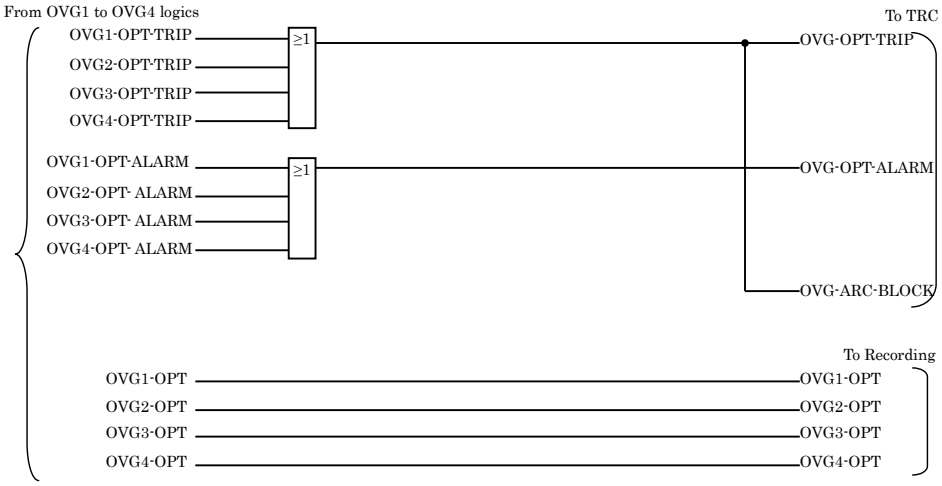


Figure 3.13-5 Grouping logic for TRC/Recording

3.13.6 Setting

Setting of OVG(Function ID: 462101)

Setting item			Range	Units	Contents	Default setting value	Notes
	OVG1	OVG1-EN	Off / On	-	OVG1 protection enable	Off	
		OVG1-Type	DT / IDMT / Original	-	OVG1 delay type	DT	
		TOVG1	0.00 - 300.00	s	OVG1 threshold	1.00	
		OVG1-VTFBlk	Non / Block	-	OVG1 drop-out/pick-up ratio	Non	
		OVG1-UseFor	Trip / Alarm	-	OVG1 operating delay time (in DT mode)	Trip	
		OVG1	1.0 - 220.0	V	OVG1 time multiplier (in IDMT mode)	20.0	
		OVG1-DPR	10 - 100	%	OVG1 definite time reset delay	100	
		OVG1-TMS	0.010 - 100.000	-	OVG1 user original curve coefficient	1.000	
		TOVG1R	0.0 - 300.0	s	OVG1 user original curve coefficient	0.0	
		OVG1-k	0.00000 - 500.00000	-	OVG1 user original curve coefficient	0.00000	
		OVG1-a	0.00000 - 10.00000	-	OVG1 operation block by VTF	0.00000	
		OVG1-c	0.00000 - 10.00000	-	OVG1 used for trip or alarm	0.00000	
	OVG2	OVG2-EN	Off / On	-	OVG2 protection enable	Off	
		OVG2-Type	DT / IDMT / Original	-	OVG2 delay type	DT	
		TOVG2	0.00 - 300.00	s	OVG2 threshold	1.00	
		OVG2-VTFBlk	Non / Block	-	OVG2 drop-out/pick-up ratio	Non	
		OVG2-UseFor	Trip / Alarm	-	OVG2 operating delay time (in DT mode)	Trip	
		OVG2	1.0 - 220.0	V	OVG2 time multiplier (in IDMT mode)	20.0	
		OVG2-DPR	10 - 100	%	OVG2 definite time reset delay	100	
		OVG2-TMS	0.010 - 100.000	-	OVG2 user original curve coefficient	1.000	
		TOVG2R	0.0 - 300.0	s	OVG2 user original curve coefficient	0.0	
		OVG2-k	0.00000 - 500.00000	-	OVG2 user original curve coefficient	0.00000	
		OVG2-a	0.00000 - 10.00000	-	OVG2 operation block by VTF	0.00000	
		OVG2-c	0.00000 - 10.00000	-	OVG2 used for trip or alarm	0.00000	
	OVG3	OVG3-EN	Off / On	-	OVG3 protection enable	Off	
		OVG3-Type	DT / IDMT / Original	-	OVG3 delay type	DT	
		TOVG3	0.00 - 300.00	s	OVG3 threshold	1.00	
		OVG3-VTFBlk	Non / Block	-	OVG3 drop-out/pick-up ratio	Non	
		OVG3-UseFor	Trip / Alarm	-	OVG3 operating delay time (in DT mode)	Trip	
		OVG3	1.0 - 220.0	V	OVG3 time multiplier (in IDMT mode)	20.0	
		OVG3-DPR	10 - 100	%	OVG3 definite time reset delay	100	
		OVG3-TMS	0.010 - 100.000	-	OVG3 user original curve coefficient	1.000	
		TOVG3R	0.0 - 300.0	s	OVG3 user original curve coefficient	0.0	
		OVG3-k	0.00000 - 500.00000	-	OVG3 user original curve coefficient	0.00000	
		OVG3-a	0.00000 - 10.00000	-	OVG3 operation block by VTF	0.00000	
		OVG3-c	0.00000 - 10.00000	-	OVG3 used for trip or alarm	0.00000	
	OVG4	OVG4-EN	Off / On	-	OVG4 protection enable	Off	
		OVG4-Type	DT / IDMT / Original	-	OVG4 delay type	DT	
		TOVG4	0.00 - 300.00	s	OVG4 threshold	1.00	
		OVG4-VTFBlk	Non / Block	-	OVG4 drop-out/pick-up ratio	Non	
		OVG4-UseFor	Trip / Alarm	-	OVG4 operating delay time (in DT mode)	Trip	
		OVG4	1.0 - 220.0	V	OVG4 time multiplier (in IDMT mode)	20.0	
		OVG4-DPR	10 - 100	%	OVG4 definite time reset delay	100	
		OVG4-TMS	0.010 - 100.000	-	OVG4 user original curve coefficient	1.000	
		TOVG4R	0.0 - 300.0	s	OVG4 user original curve coefficient	0.0	
		OVG4-k	0.00000 - 500.00000	-	OVG4 user original curve coefficient	0.00000	
		OVG4-a	0.00000 - 10.00000	-	OVG4 operation block by VTF	0.00000	
		OVG4-c	0.00000 - 10.00000	-	OVG4 used for trip or alarm	0.00000	

3.13.7 Data ID

◆ Signal monitoring point

OVG(Function ID: 462101)

Element ID	Name	Description
8000011C23	OVG1	OVG1 relay element operated
8000011B60	OVG1-OPT	OVG1 protection operated
8000011C27	OVG1PU	OVG1 relay operation level pick up
8100021C23	OVG2	OVG2 relay element operated
8100021B60	OVG2-OPT	OVG2 protection operated
8100021C27	OVG2PU	OVG2 relay operation level pick up
8200031C23	OVG3	OVG3 relay element operated
8200031B60	OVG3-OPT	OVG3 protection operated
8200031C27	OVG3PU	OVG3 relay operation level pick up
8300041C23	OVG4	OVG4 relay element operated
8300041B60	OVG4-OPT	OVG4 protection operated
8300041C27	OVG4PU	OVG4 relay operation level pick up

◆ Connection point on PLC logic

OVG(Function ID: 462101)

Element ID	Name	Description
800001EBB0	OVG1_BLOCK	OVG1 protection block command
810002EBB0	OVG2_BLOCK	OVG2 protection block command
820003EBB0	OVG3_BLOCK	OVG3 protection block command
830004EBB0	OVG4_BLOCK	OVG4 protection block command

3.13.8 PLC driver

◆ Connection point at PLC Driver

PLC_DRV (Function ID: 230301) to OVG (Function ID: 462101)

PLC Driver	Element ID	to	Destination	PLC connection point
PMX3_7_0	8010031BB8	→	OVG1_BLOCK	800001EBB0
PMX3_7_1	8110031BB9	→	OVG2_BLOCK	810002EBB0
PMX3_7_2	8210031BBA	→	OVG3_BLOCK	820003EBB0
PMX3_7_3	8310031BBB	→	OVG4_BLOCK	830004EBB0

3.14 Negative sequence overvoltage protection (OVN)

Negative sequence voltage, in the supply or source circuits, is used to detect phase unbalance and phase reversal. The function of overvoltage protection of negative sequence (OVN) has four stages (OVN1 to OVN4) and the time characteristic of each stage can be obtained from definite time or inverse definite minimum time either.

To simplify the description, only OVN1 is discussed but is applicable to the other OVNs; hence, read the expression for OVN1 as OVN2, OVN3 and OVN4 at each OVN stage unless a special explanation or instruction has been provided.

Note: The implementation of the feature depends on the selection of both the hardware and the software. Note that the feature is not supplied for the several models; hence, the user has to check the implementation for the model. Locate the ordering number and check it at the "G&T position" referring to the comparison table below. For more information, see *Appendix: Ordering*.

Table 3.14-1 Comparative table in respective ordering numbers

Sec.	Feature	Ordering No. at "G&T"					
		BCU			BCPU		IFU
		11	13	1F	2C	2N	19
–	Main features	NA	NA	NA	✓	✓	NA
–	Number of stages	NA	NA	NA	4	4	NA
3.1.9	PLC driver	NA	NA	NA	✓	✓	NA

✓: Applicable NA: Not applicable

3.14.1 Drop-off and pickup setting

Figure 3.13-1 shows the characteristic of the OVN element. The outer circle shows the threshold of pick-up threshold voltage (PU), whereas the inner circle shows drop-off voltage point (DO). The hatched area shows the operation area of the OVN.

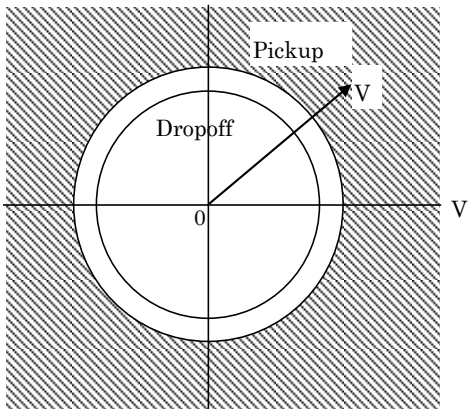


Figure 3.14-1 Setting points of OVN

For example, with regard to the OVN1 element, suppose the user sets a pick-up value in P.U for setting [**OVN1**]. Then the user should set a drop-off value using setting [**OVN1-DPR**], which configures the ratio of the PU to the DO.

3.14.2 Delay of the operation of the OVN element

The OVN element has a delay timer for the operation. For the OVN1 element, the user can set a delay time using setting [**TOVN1**]. The user can find the delay timer in the OVN function logic. (See section 3.13.5)

3.14.3 Time characteristic

The OVN element has two characteristics between a voltage condition and an operation time; hence, the user should select a mode either (i) definite (independent) time characteristic delay or (ii) inverse (dependent) time characteristic delay. For the definite time characteristic delay, the operation time is a constant. In the inverse time characteristic delay, the operation time depends upon the level of the voltage condition.

(i) Definite time characteristic (DT)

To operate the definite (independent) time delay, set scheme switch [**OVN1-Type**] **DT.** Resetting the OVN element is performed when a voltage falls below the drop-off voltage.

(ii) Invers time delay (IDMT)

To operate the dependent (invers) time delay, set scheme switch [**OVN1-Type**] **IDMT**.

(ii)-1 Operation feature

The operate time of the inverse (dependent) time characteristic is inversely proportional to the level of the voltage condition. Figure 3.12-2 shows the invers time characteristic of the OVN element when a multiplier setting is used. The OVN element uses Equation (3.12-1) to be in conformity to IEC 60255-127:

$$t(G) = TMS \times \left\{ \left[\frac{k}{\left(V/V_s \right)^a - 1} \right] + c \right\} \qquad (3.14\text{-}1)$$

where,

t = operating time (seconds),

V = energizing voltage (voltage),

Vs = pickup voltage setting (voltage), and

TMS = time multiplier setting to adjust a curve

If the user will require a user-programmable (original) curve in the inverse time characteristic, it is provided when the constants of k, a, c are set, as shown in Table 3.12-2. For example, the user-programmable (original) curve in the OVN1 element will be acquired when **Original** is set for the scheme switch [**OVN1-Type**], and when values of respective constants are set for [**OVN1-k**], [**OVN1-a**], and [**OVN1-C**].

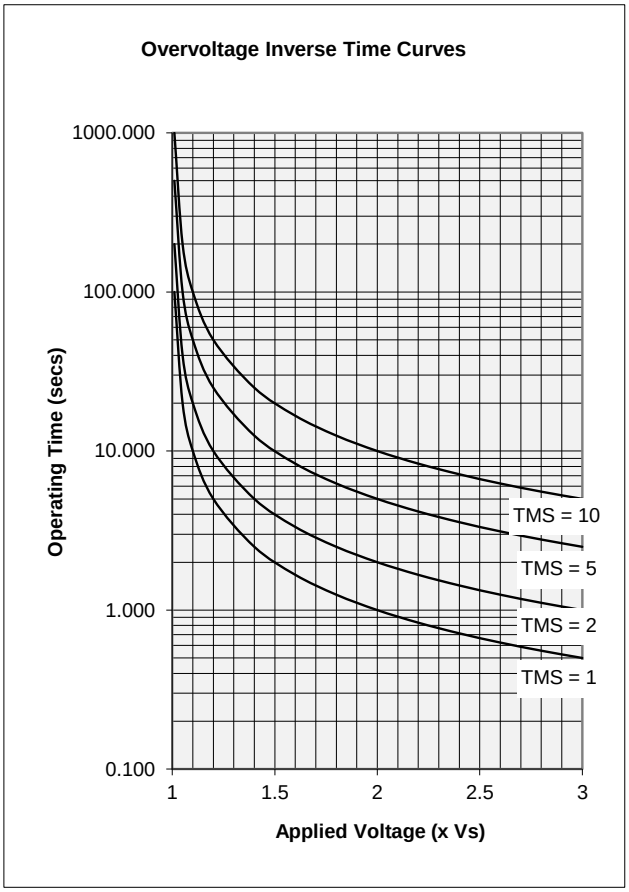


Figure 3.14-2 IDMT characteristic of OVN element

Table 3.14-2 Constant value at each setting of IDMT curve

Set item	k	a	C
IDMT	1	1	0
User-programmable (Original)	0.00000 – 500.00000 by 0.00001 step	0.00000 – 10.00000 by 0.00001 step	0.00000 – 10.00000 by 0.00001 step

(ii)-2 Reset feature

The user should set the time for resetting. Figure 3.12-3 shows that examples of the pick-up and the drop-off relevant to both the fault occurrences and the operation time. The value of the time counter furnished in the OVN1 element is incremented if faults occur.

As for an intermittent fault (the former in the figure), the time counter will not reach the trip level. In the other words, the operation of the OVN1 element is paralyzed in the reset time set by [**TOVN1R**].

If a series of fault occurs repeatedly (the latter in the figure), and if the value of the time counter reaches at trip level, the OVN1 element will issue a trip command after a certain delay. After issuing the trip command, if a series of fault completely disappears after issuing the trip command, the value of the time counter will be expired after the reset time [**TOVN1R**].

When the user requires resetting the operation of the OVN1 element immediately, setting zero for the settings [**TOVN1R**] is needed. Consequently, when a voltage falls below the reset threshold (drop-off), the operation of the OVN1 element is reset promptly.

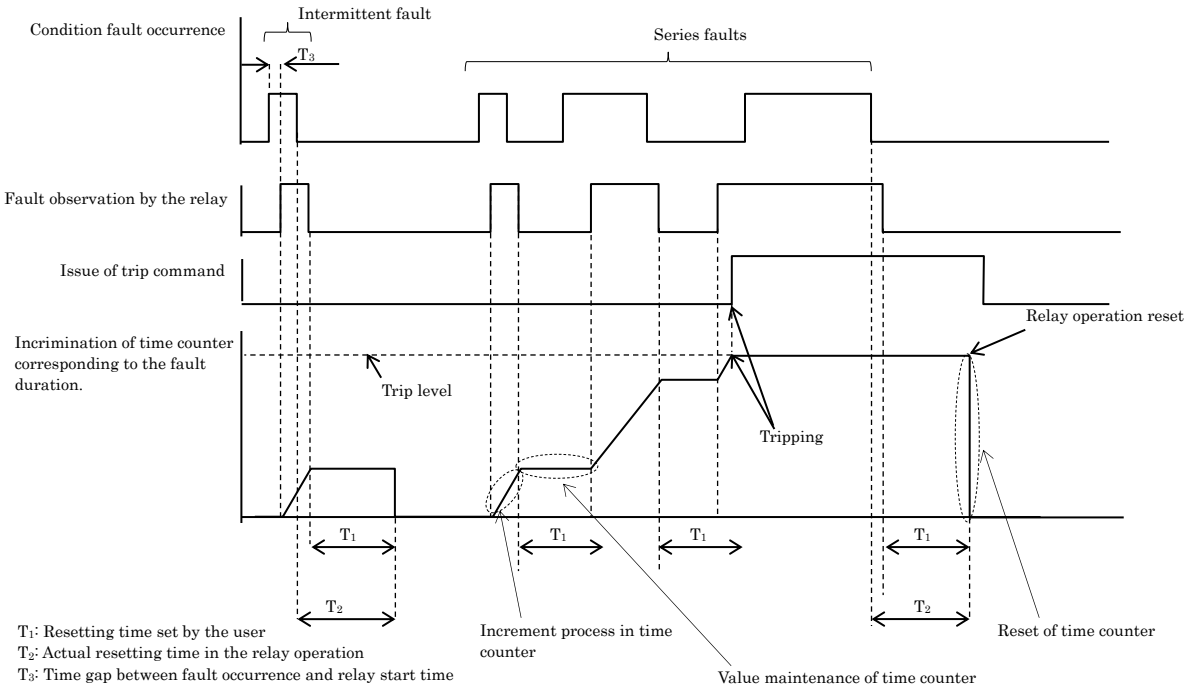


Figure 3.14-3 Faults occurrences and reset operation when IDMT being applied

3.14.4 Miscellaneous functions

(i) OVN operation blocked by the occurrence of VT failure

Blocking the OVN function may be required when a failure in the voltage transformer occurs. In this case, the user shall set **Block** for scheme switch [**OVN1-VTFBlk**]. **Non** (as a default) is set for scheme switch [**OVN1-VTFBlk**] in order that the OVN function is not blocked by the failure.

(ii) Switch of OVN trip command

The OVN function issues a trip command for the trip circuit (TRC†) when **Trip** is set for scheme switch [**OVN1-UseFor**] as the normal trip operation. However, when an alarm signal in place of the trip command is required, the user can set **Alarm** for the scheme switch [**OVN1-UseFor**].

†Note: For more information of the trip circuit, see Chapter *Relay application: Trip circuit*.

(iii) Execution of OVN function

Set **On** for scheme switch [**OVN1-EN**]. Otherwise, set **Off** for the scheme switch [**OVN1-EN**] if the OVN1 element is not required to operate.

3.14.5 Scheme logic

Figure 3.14-4 and Figure 3.14-5 show the OVN function logic. Signal connection points "OVN*_BLOCK" are provided for the block of the operation of the OVN elements.

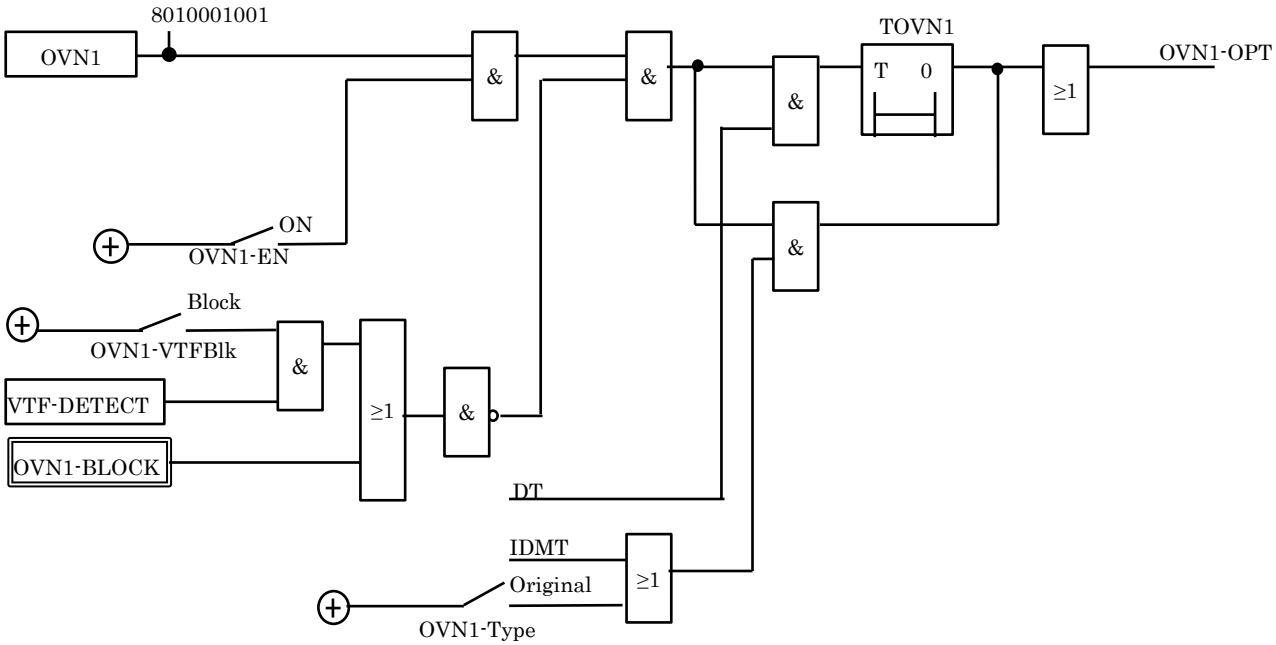


Figure 3.14-4 Scheme logic of OVN1

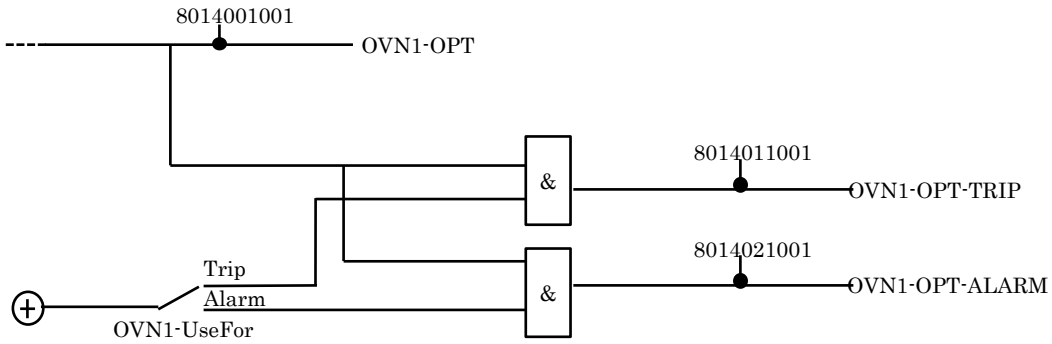


Figure 3.14-5 Scheme logic of OVN1 (continued from Figure 3.14-4)

3.14.6 Application

Negative sequence voltage is used to detect unbalance in the system, such as three-phase motor. When a loss of phase occurs, the motor results in the state of voltage unbalance. The voltage unbalance produces negative sequence currents; the appearance of the negative sequence brings the influence of its raising temperature on the motor. Another influence of the negative sequence produces magnetic flux in air gap of the motor, and makes the motor to rotate in the opposite direction. Thereby, the OVN is used to prevent its damage, and the feature of the OVN detects the negative sequence.

3.14.7 Setting

Setting of OVN(Function ID: 464101)

Setting item			Range	Unit s	Contents	Default setting value	Notes
	OVN1	OVN1-EN	Off / On	-	OVN1 protection enable	Off	
		OVN1-Type	DT / IDMT / Original	-	OVN1 delay type	DT	
		OVN1	1.0 - 220.0	V	OVN1 threshold	130.0	
		OVN1-DPR	10 - 100	%	OVN1 drop-out/pick-up ratio	100	
		TOVN1	0.00 - 300.00	s	OVN1 operating delay time	1.00	
		OVN1-TMS	0.010 - 100.000	-	OVN1 time multiplier (in IDMT mode)	1.000	
		TOVN1R	0.0 - 300.0	s	OVN1 definite time reset delay	0.0	
		OVN1-k	0.00000 - 500.00000	-	OVN1 user original curve coefficient	0.00000	
		OVN1-a	0.00000 - 10.00000	-	OVN1 user original curve coefficient	0.00000	
		OVN1-c	0.00000 - 10.00000	-	OVN1 user original curve coefficient	0.00000	
		OVN1-VTFBlk	Non / Block	-	OVN1 operation block by VTF	Non	
		OVN1-UseFor	Trip / Alarm	-	OVN1 used for trip or alarm	Trip	
	OVN2	OVN2-EN	Off / On	-	OVN2 protection enable	Off	
		OVN2-Type	DT / IDMT / Original	-	OVN2 delay type	DT	
		OVN2	1.0 - 220.0	V	OVN2 threshold	130.0	
		OVN2-DPR	10 - 100	%	OVN2 drop-out/pick-up ratio	100	
		TOVN2	0.00 - 300.00	s	OVN2 operating delay time	1.00	
		OVN2-TMS	0.010 - 100.000	-	OVN2 time multiplier (in IDMT mode)	1.000	
		TOVN2R	0.0 - 300.0	s	OVN2 definite time reset delay	0.0	
		OVN2-k	0.00000 - 500.00000	-	OVN2 user original curve coefficient	0.00000	
		OVN2-a	0.00000 - 10.00000	-	OVN2 user original curve coefficient	0.00000	
		OVN2-c	0.00000 - 10.00000	-	OVN2 user original curve coefficient	0.00000	
		OVN2-VTFBlk	Non / Block	-	OVN2 operation block by VTF	Non	
		OVN2-UseFor	Trip / Alarm	-	OVN2 used for trip or alarm	Trip	
	OVN3	OVN3-EN	Off / On	-	OVN3 protection enable	Off	
		OVN3-Type	DT / IDMT / Original	-	OVN3 delay type	DT	
		OVN3	1.0 - 220.0	V	OVN3 threshold	130.0	
		OVN3-DPR	10 - 100	%	OVN3 drop-out/pick-up ratio	100	
		TOVN3	0.00 - 300.00	s	OVN3 operating delay time	1.00	
		OVN3-TMS	0.010 - 100.000	-	OVN3 time multiplier (in IDMT mode)	1.000	
		TOVN3R	0.0 - 300.0	s	OVN3 definite time reset delay	0.0	
		OVN3-k	0.00000 - 500.00000	-	OVN3 user original curve coefficient	0.00000	
		OVN3-a	0.00000 - 10.00000	-	OVN3 user original curve coefficient	0.00000	
		OVN3-c	0.00000 - 10.00000	-	OVN3 user original curve coefficient	0.00000	
		OVN3-VTFBlk	Non / Block	-	OVN3 operation block by VTF	Non	
		OVN3-UseFor	Trip / Alarm	-	OVN3 used for trip or alarm	Trip	
	OVN4	OVN4-EN	Off / On	-	OVN4 protection enable	Off	
		OVN4-Type	DT / IDMT / Original	-	OVN4 delay type	DT	
		OVN4	1.0 - 220.0	V	OVN4 threshold	130.0	
		OVN4-DPR	10 - 100	%	OVN4 drop-out/pick-up ratio	100	
		TOVN4	0.00 - 300.00	s	OVN4 operating delay time	1.00	
		OVN4-TMS	0.010 - 100.000	-	OVN4 time multiplier (in IDMT mode)	1.000	
		TOVN4R	0.0 - 300.0	s	OVN4 definite time reset delay	0.0	
		OVN4-k	0.00000 - 500.00000	-	OVN4 user original curve coefficient	0.00000	
		OVN4-a	0.00000 - 10.00000	-	OVN4 user original curve coefficient	0.00000	
		OVN4-c	0.00000 - 10.00000	-	OVN4 user original curve coefficient	0.00000	
		OVN4-VTFBlk	Non / Block	-	OVN4 operation block by VTF	Non	
		OVN4-UseFor	Trip / Alarm	-	OVN4 used for trip or alarm	Trip	

3.14.8 Data ID

◆ Signal monitoring point

OVN(Function ID: 464101)

Element ID	Name	Description
8000011C23	OVN1	OVN1 relay element operated
8000011B60	OVN1-OPT	OVN1 protection operated
8000011C27	OVN1PU	OVN1 relay operation level pick up
8100021C23	OVN2	OVN2 relay element operated
8100021B60	OVN2-OPT	OVN2 protection operated
8100021C27	OVN2PU	OVN2 relay operation level pick up
8200031C23	OVN3	OVN3 relay element operated
8200031B60	OVN3-OPT	OVN3 protection operated
8200031C27	OVN3PU	OVN3 relay operation level pick up
8300041C23	OVN4	OVN4 relay element operated
8300041B60	OVN4-OPT	OVN4 protection operated
8300041C27	OVN4PU	OVN4 relay operation level pick up

◆ Connection point on PLC logic

OVN(Function ID: 464101)

Element ID	Name	Description
800001EBB0	OVN1_BLOCK	OVN1 protection block command
810002EBB0	OVN2_BLOCK	OVN2 protection block command
820003EBB0	OVN3_BLOCK	OVN3 protection block command
830004EBB0	OVN4_BLOCK	OVN4 protection block command

3.14.9 PLC driver

◆ Connection point at PLC Driver

PLC_DRV (Function ID: 230301) to OVN (Function ID: 464101)

PLC Driver	Element ID	to	Destination	PLC connection point
PMX3_7_4	8410031BBC	→	OVN1_BLOCK	800001EBB0
PMX3_7_5	8510031BBD	→	OVN2_BLOCK	810002EBB0
PMX3_7_6	8610031BBE	→	OVN3_BLOCK	820003EBB0
PMX3_7_7	8710031BBF	→	OVN4_BLOCK	830004EBB0

3.15 Phase under-voltage protection (UV)

The under-voltage protection function for phase-to-earth (UV) consists of four stages (elements) independently: UV1 to UV4. The time characteristic of the UV element is configured either definite time (DT) or inverse definite minimum time (IDMT) using settings.

Each UV stage (element) detects the under-voltage condition of phase-to-earth. The user can set a threshold and the ratio of a drip-out voltage (DO) to a pick-up voltage (PU) in the UV element. To simplify the description, only the UV1 element is described, but the expression is applicable to the other elements; hence, read the expression for the UV1 element as the others unless a special explanation or instruction has been provided.

Note: The implementation of the feature depends on the selection of both the hardware and the software. Note that the feature is not supplied for the several models; hence, the user has to check the implementation for the model. Locate the ordering number and check it at the "G&T position" referring to the comparison table below. For more information, see *Appendix: Ordering*.

Table 3.15-1 Comparative table in respective ordering numbers

Sec.	Feature	Ordering No. at "G&T"					
		BCU			BCPU		IFU
		11	13	1F	2C	2N	19
–	Main features	NA	NA	NA	✓	✓	NA
–	Number of stages	NA	NA	NA	4	4	NA
3.15.7	PLC driver	NA	NA	NA	✓	✓	NA

✓: Applicable NA: Not applicable

3.15.1 Drop-off and pick-up characteristic

Figure 3.15-1 shows the UV characteristic as hatched area with concentric circles. The pick-up threshold voltage (PU) is represented the outer circle; the drop-off voltage point (DO) is represented the dotted circle. The PU voltage of the UV1 element is set using [**UV1**]. The DO voltage of the UV1 element is set using [**UV1-DPR**].

The inner circle shows the area in which the UV function is blocked when the value of the block voltage is set for [**UVBLK**]. Setting [**TUVBLK**] is also provided so that the user can delay blocking the UV1 and UV2 elements using the setting.

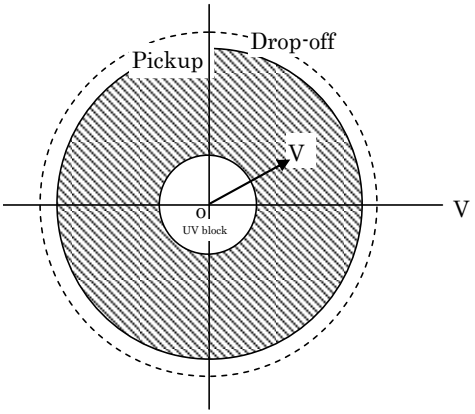


Figure 3.15-1 UV1 element characteristic

3.15.2 Time characteristic

The UV element has the relationship between an input voltage and an operation time; the relationship is divided into two time characteristics: (i) the definite time (DT) and (ii) the inverse definite minimum time (IDMT).

(i) Definite time characteristic (DT)

(i)-1 Setting pick-up operation

The user is required to set **DT** for scheme switch [**UV1-Type**] when the UV1 element should operate in the DT characteristic. The UV1 element has a delay timer for the pick-up operation; the user can set a delay time using setting [**TUV1**]. The user can find the delay timer in the UV function logic. (See section 3.15.4)

(i)-2 Setting drop-off operation

Resetting the UV1 element is performed instantly when a voltage exceeds over the drop-off voltage.

(ii) Inverse definite minimum time (IDMT) characteristic

To operate the IDMT characteristic in the UV1 element, set scheme switch [**UV1-Type**] **IDMT.**

(ii)-1 Setting pick-up operation

The IDMT characteristic is applied when the operation of the UV1 element is required inversely in accordance with the level of input voltage. The IDMT characteristic curve is illustrated in Figure 3.15-2 using a value of time multiplier is set for [**UV1-TMS**]. It is followed to Equation (3.15-1) in conformed in IEC 60255-127

$$t(G) = TMS \times \left\{ \left[\frac{k}{1 - \left({}^{V}/_{V_s} \right)^{a}} \right] + c \right\} \qquad (3.15\text{-}1)$$

where,

t = operating time (seconds),

V = energizing voltage (voltage),

Vs = pickup voltage setting (voltage),

TMS = time multiplier setting.

Except for pre-programmed characteristics, the user can have a user-programmable (original) characteristic curve. The user-programmable (original) curve is obtained when the constants of k, a, c, as shown in Table 3.15-2, are set, and when **Original** is set for scheme switch [**UV1-Timer**]. The constants are set with settings [**UV1-k**], [**UV1-a**], and [**UV1-C**].

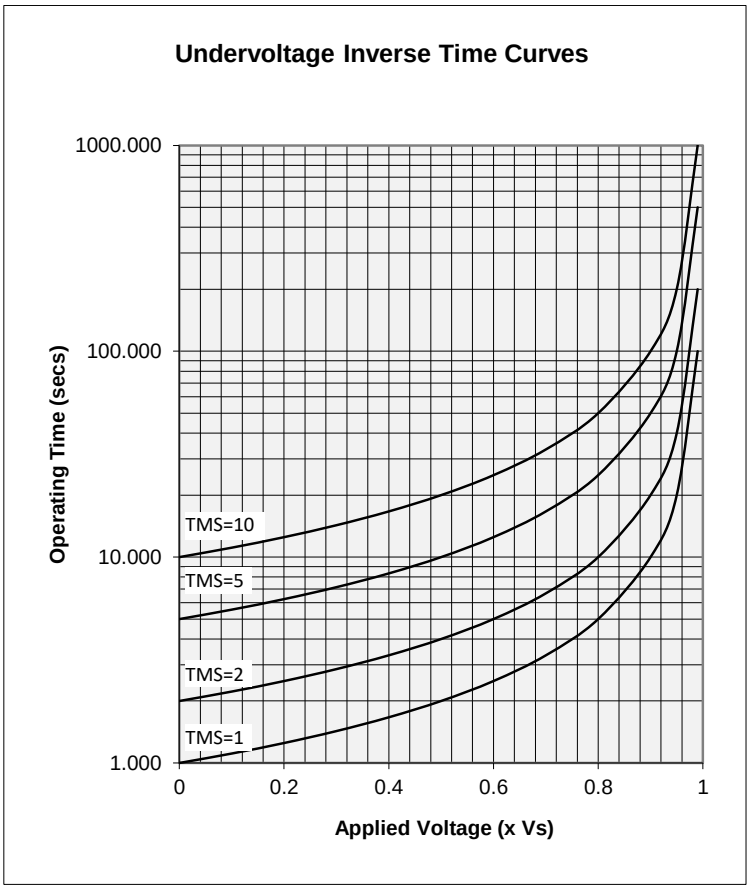


Figure 3.15-2 IDMT characteristics curves depending on TMS

Table 3.15-2 Values k, a, c for pre-programmable IDMT and user-programmable IDMT

Set item	k	a	C
IDMT	1	1	0
User-programmable (Original)	0.00000 – 500.00000 by 0.00001 step	0.00000 – 10.00000 by 0.00001 step	0.00000 – 10.00000 by 0.00001 step

(ii)-2 Setting drop-off operation

The user should set the time for resetting in the IDMT characteristic. Figure 3.15-3 shows examples of the pick-up and the drop-off relevant to both the fault occurrences and the operation time. The UV1 element has a time counter that increases in response to the fault occurrence and duration. This figure also shows the increment degree of the time counter for the fault occurrences.

As for an intermittent fault (the former in the figure), the time counter does not reach the trip level. In the other word, the UV1 element will be paralyzed in the reset time [**TUV1R**].

If a series of fault occurs, the time counter increase corresponding to the duration of series faults. When the time counter reaches the trip level, then the UV1 element issues a trip command after a certain delay. After issuing the trip command, if a series of fault disappears completely, the operation of the UV1 element is expired after the reset time [**TUV1R**].

When the user requires resetting the operation of the UV1 element immediately, setting zero for the settings [**TUV1R**] is needed. Consequently, when a voltage is recovered over the reset threshold (drop-off), the operation of the UV1 element is reset promptly.

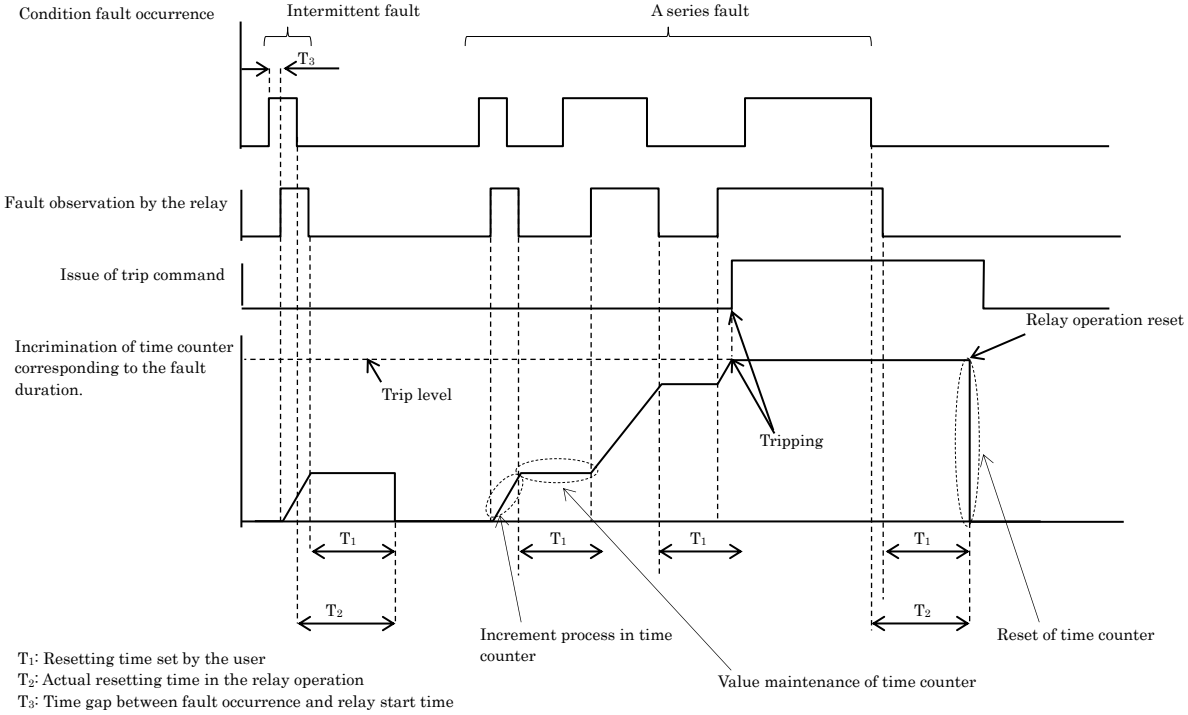


Figure 3.15-3 Faults occurrences and reset operation when IDMT being applied

3.15.3 Miscellaneous functions

(i) Blocking UV operation

Blocking the UV function may be required when a failure in the voltage transformer occurs. In this case, the user shall set **Block** for scheme switch [**UV1-VTFBlk**]. **Non** (as a default) is set for scheme switch [**UV1-VTFBlk**] in order that the UV function is not blocked by the failure.

(ii) UV trip signal

The UV1 element issues a trip command for the trip circuit (TRC†) when **Trip** is set for scheme switch [**UV1-UseFor**] as the normal tripping. However, when an alarm signal in place of the trip command is required, the user can set **Alarm** for the scheme switch [**UV1-UseFor**].

†Note:For more information about tripping, see Chapter *Relay application: Trip circuit*.

(iii) Operation of UV element

The user should set **On** for scheme switch [**UV1-EN**] for the operation of the UV1 element. Otherwise, set **Off** for the scheme switch if the UV1 element is not required to operate.

(iv) Under voltage test

Setting [**UV-Test**] =**On** is not to operate UV blocking element (UVBLK) for testing.

3.15.4 Scheme logic

Figure 3.15-4 show the logic of the UV function. PLC connection points “UV1_BLOCK” is provided for blocking the operation of the UV elements. Other PLC connection points “CB_APH_OPEN” etc. are provided so that the UV function can determine its operation using the open/closed information of a circuit breaker (CB). For testing, the UV1-PU element is provided; it generates a pick-up signal when the entering voltage is below the threshold anytime. For example, in the IDMT characteristic, using both PLC monitoring points “8000011B20” and “8000011B24” can facilitate to measure the pickup time after the deficiency.

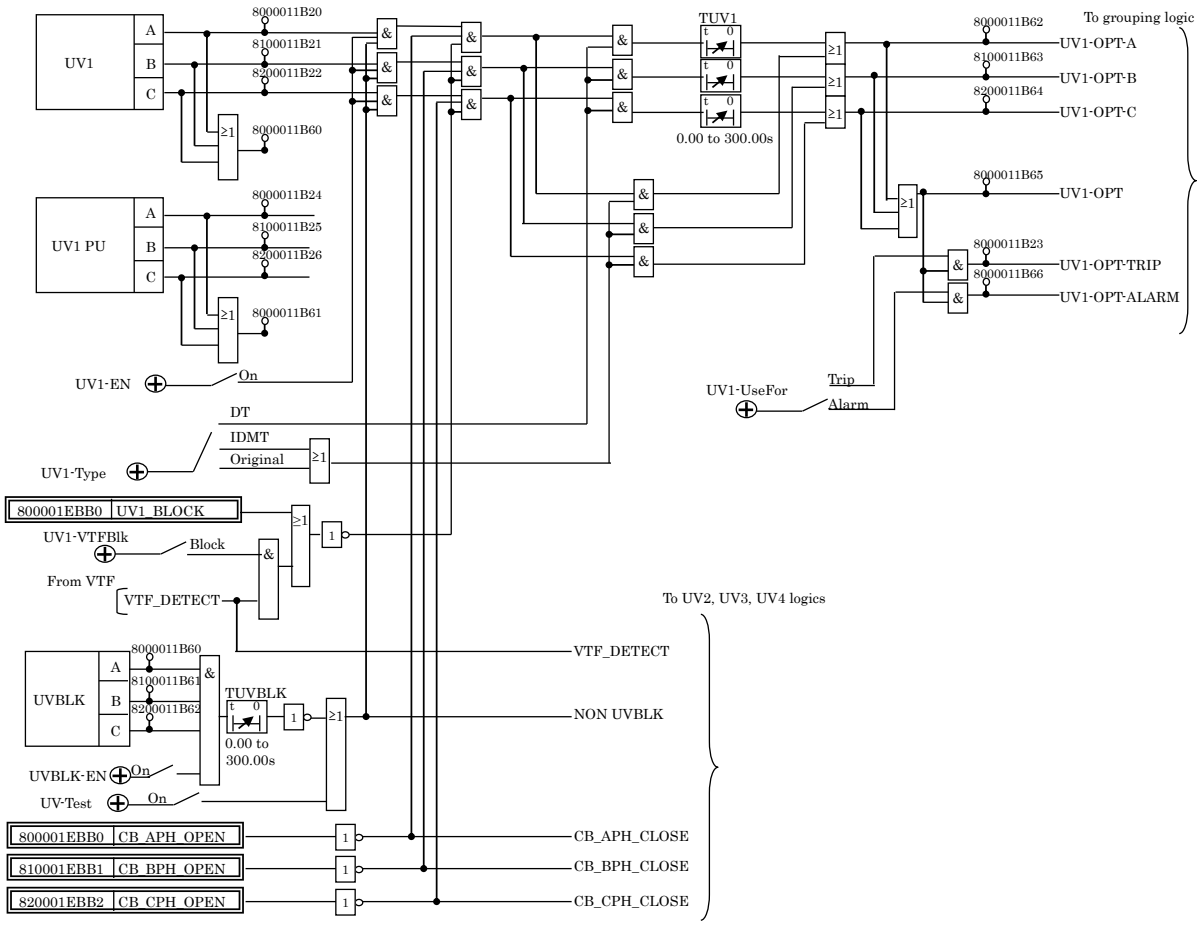


Figure 3.15-4 UV1 logic

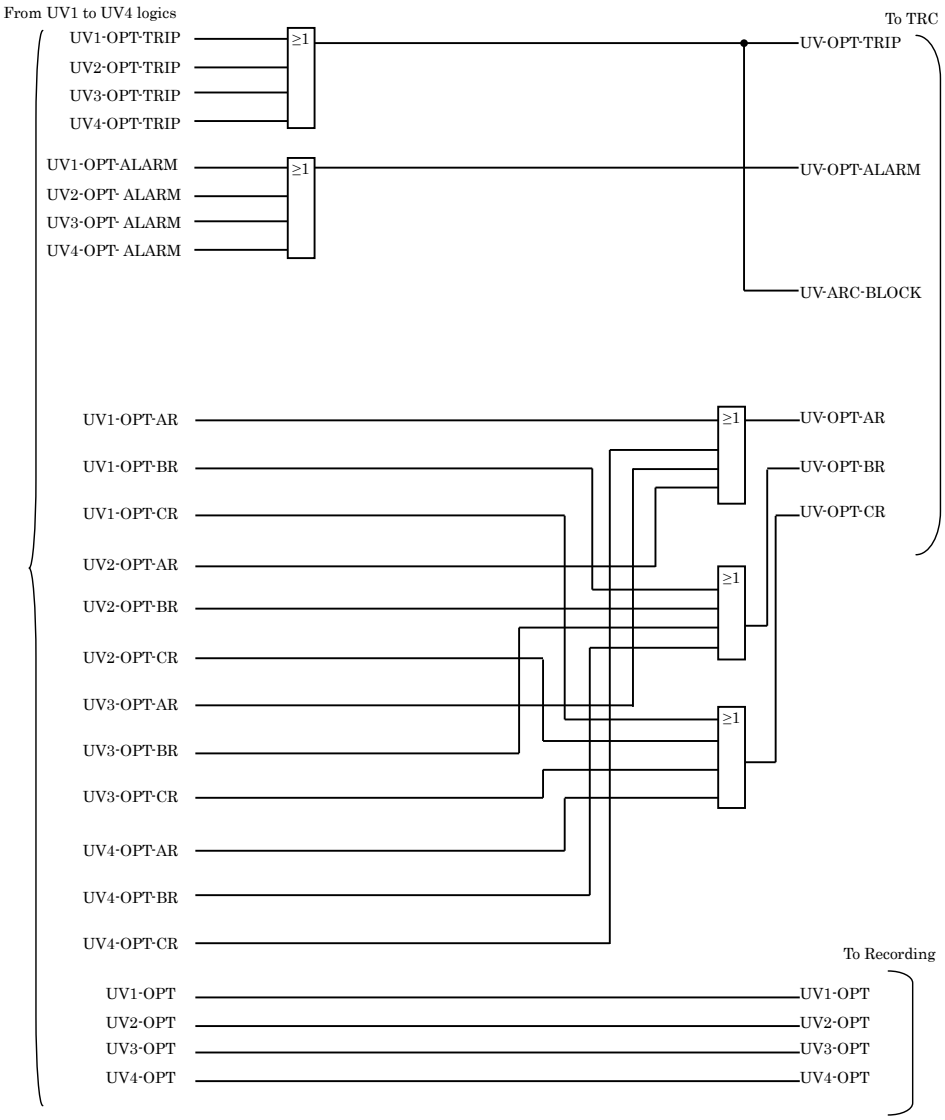


Figure 3.15-5 Grouping logic for TRC/Recording

3.15.5 Setting

Setting of UV(Function ID: 470101)

Setting item		Range	Unit s	Contents	Default setting value	Notes
	UVBLK-EN	Off/On	-	UV block function enable	Off	
	UVBLK	5-20	V	UV block threshold	10	
	TUVBLK	0-300	s	UV block delay time	10	
	UV-Test	Off/On	-	Not to execute UV block function	Off	
UV1	UV1-EN	Off/On	-	UV1 protection enable	Off	
	UV1-Type	DT/IDMT/Original	-	UV1 delay type	DT	
	UV1	5.0-130.0	V	UV1 threshold	60.0	
	UV1-DPR	100-120	%	UV1 drop-out/pick-up ratio	100	
	TUV1	0.00-300.00	s	UV1 operating delay time (in DT mode)	1.00	
	UV1-TMS	0.010-100.00	-	UV1 time multiplier (in IDMT mode)	1.000	
	TUV1R	0.0-300.0	s	UV1 definite time reset delay	0.0	
	UV1-k	0.00000-500.00000	-	UV1 user original curve coefficient	0.00000	
	UV1-a	0.00000-10.00000	-	UV1 user original curve coefficient	0.00000	
	UV1-c	0.00000-10.00000	-	UV1 user original curve coefficient	0.00000	
	UV1-VTFBlk	Non/Block	-	UV1 operation block by VTF	Non	
	UV1-UseFor	Trip/Alarm	-	UV1 used for trip or alarm	Trip	
UV2	UV2-EN	Off/On		UV2 protection enable	Off	
	UV2-Type	DT/IDMT/Original		UV2 delay type	DT	
	UV2	5.0-130.0	V	UV2 threshold	60.0	
	UV2-DPR	100-120	%	UV2 drop-out/pick-up ratio	100	
	TUV2	0.00-300.00	s	UV2 operating delay time (in DT mode)	1.00	
	UV2-TMS	0.010-100.00		UV2 time multiplier (in IDMT mode)	1.000	
	TUV2R	0.0-300.0	s	UV2 definite time reset delay	0.0	
	UV2-k	0.00000-500.00000		UV2 user original curve coefficient	0.00000	
	UV2-a	0.00000-10.00000		UV2 user original curve coefficient	0.00000	
	UV2-c	0.00000-10.00000		UV2 user original curve coefficient	0.00000	
	UV2-VTFBlk	Non/Block		UV2 operation block by VTF	Non	
	UV2-UseFor	Trip/Alarm		UV2 used for trip or alarm	Trip	
UV3	UV3-EN	Off/On		UV3 protection enable	Off	
	UV3-Type	DT/IDMT/Original		UV3 delay type	DT	
	UV3	5.0-130.0	V	UV3 threshold	60.0	
	UV3-DPR	100-120	%	UV3 drop-out/pick-up ratio	100	
	TUV3	0.00-300.00	s	UV3 operating delay time (in DT mode)	1.00	
	UV3-TMS	0.010-100.00		UV3 time multiplier (in IDMT mode)	1.000	
	TUV3R	0.0-300.0	s	UV3 definite time reset delay	0.0	
	UV3-k	0.00000-500.00000		UV3 user original curve coefficient	0.00000	
	UV3-a	0.00000-10.00000		UV3 user original curve coefficient	0.00000	
	UV3-c	0.00000-10.00000		UV3 user original curve coefficient	0.00000	
	UV3-VTFBlk	Non/Block		UV3 operation block by VTF	Non	
	UV3-UseFor	Trip/Alarm		UV3 used for trip or alarm	Trip	
UV4	UV4-EN	Off/On		UV4 protection enable	Off	
	UV4-Type	DT/IDMT/Original		UV4 delay type	DT	
	UV4	5.0-130.0	V	UV4 threshold	60.0	
	UV4-DPR	100-120	%	UV4 drop-out/pick-up ratio	100	
	TUV4	0.00-300.00	s	UV4 operating delay time (in DT mode)	1.00	
	UV4-TMS	0.010-100.00		UV4 time multiplier (in IDMT mode)	1.000	
	TUV4R	0.0-300.0	s	UV4 definite time reset delay	0.0	
	UV4-k	0.00000-500.00000		UV4 user original curve coefficient	0.00000	
	UV4-a	0.00000-10.00000		UV4 user original curve coefficient	0.00000	
	UV4-c	0.00000-10.00000		UV4 user original curve coefficient	0.00000	
	UV4-VTFBlk	Non/Block		UV4 operation block by VTF	Non	
	UV4-UseFor	Trip/Alarm		UV4 used for trip or alarm	Trip	

3.15.6 Data ID

◆ Signal monitoring point

UV(Function ID: 470101)

Element ID	Name	Description
8000011C20	UV1-A	UV1 relay element operated (phase-A)
8100011C21	UV1-B	UV1 relay element operated (phase-B)
8200011C22	UV1-C	UV1 relay element operated (phase-C)
8000011B65	UV1-OPT	UV1 protection operated
8000011B62	UV1-OPT-A	UV1 protection operated (phase-A)
8100011B63	UV1-OPT-B	UV1 protection operated (phase-B)
8200011B64	UV1-OPT-C	UV1 protection operated (phase-C)
8000011B60	UV1-OR	UV1 relay element operated (3-phases OR)
8000011C24	UV1PU-A	UV1 PU relay operation level pick up (phase-A)
8100011C25	UV1PU-B	UV1 PU relay operation level pick up (phase-B)
8200011C26	UV1PU-C	UV1 PU relay operation level pick up (phase-C)
8000011B61	UV1PU-OR	UV1 PU relay operation level pick up (3-phases OR)
8400021C20	UV2-A	UV2 relay element operated (phase-A)
8500021C21	UV2-B	UV2 relay element operated (phase-B)
8600021C22	UV2-C	UV2 relay element operated (phase-C)
8100021B65	UV2-OPT	UV2 protection operated
8400021B62	UV2-OPT-A	UV2 protection operated (phase-A)
8500021B63	UV2-OPT-B	UV2 protection operated (phase-B)
8600021B64	UV2-OPT-C	UV2 protection operated (phase-C)
8100021B60	UV2-OR	UV2 relay element operated (3-phases OR)
8400021C24	UV2PU-A	UV2 PU relay operation level pick up (phase-A)
8500021C25	UV2PU-B	UV2 PU relay operation level pick up (phase-B)
8600021C26	UV2PU-C	UV2 PU relay operation level pick up (phase-C)
8100021B61	UV2PU-OR	UV2 PU relay operation level pick up (3-phases OR)
8800031C20	UV3-A	UV3 relay element operated (phase-A)
8900031C21	UV3-B	UV3 relay element operated (phase-B)
8A00031C22	UV3-C	UV3 relay element operated (phase-C)
8200031B65	UV3-OPT	UV3 protection operated
8800031B62	UV3-OPT-A	UV3 protection operated (phase-A)
8900031B63	UV3-OPT-B	UV3 protection operated (phase-B)
8A00031B64	UV3-OPT-C	UV3 protection operated (phase-C)
8200031B60	UV3-OR	UV3 relay element operated (3-phases OR)
8800031C24	UV3PU-A	UV3 PU relay operation level pick up (phase-A)
8900031C25	UV3PU-B	UV3 PU relay operation level pick up (phase-B)
8A00031C26	UV3PU-C	UV3 PU relay operation level pick up (phase-C)
8200031B61	UV3PU-OR	UV3 PU relay operation level pick up (3-phases OR)
8C00041C20	UV4-A	UV4 relay element operated (phase-A)
8D00041C21	UV4-B	UV4 relay element operated (phase-B)
8E00041C22	UV4-C	UV4 relay element operated (phase-C)
8300041B65	UV4-OPT	UV4 protection operated
8C00041B62	UV4-OPT-A	UV4 protection operated (phase-A)
8D00041B63	UV4-OPT-B	UV4 protection operated (phase-B)
8E00041B64	UV4-OPT-C	UV4 protection operated (phase-C)

◆ Signal monitoring point

UV(Function ID: 470101)

Element ID	Name	Description
8300041B60	UV4-OR	UV4 relay element operated (3-phases OR)
8C00041C24	UV4PU-A	UV4 PU relay operation level pick up (phase-A)
8D00041C25	UV4PU-B	UV4 PU relay operation level pick up (phase-B)
8E00041C26	UV4PU-C	UV4 PU relay operation level pick up (phase-C)
8300041B61	UV4PU-OR	UV4 PU relay operation level pick up (3-phases OR)
8000001B60	UVBLK-A	UVBLK relay operation level pick up (phase-A)
8100001B61	UVBLK-B	UVBLK relay operation level pick up (phase-B)
8200001B62	UVBLK-C	UVBLK relay operation level pick up (phase-C)

◆ Connection point in PLC logic

UV(Function ID: 470101)

Element ID	Name	Description
800001EBB0	UV1_BLOCK	UV1 protection block command
810002EBB0	UV2_BLOCK	UV2 protection block command
820003EBB0	UV3_BLOCK	UV3 protection block command
830004EBB0	UV4_BLOCK	UV4 protection block command
800000EBB0	CB_APH_OPEN	Circuit Breaker detection (phase-A)
810000EBB1	CB_BPH_OPEN	Circuit Breaker detection (phase-B)
820000EBB2	CB_CPH_OPEN	Circuit Breaker detection (phase-C)

3.15.7 PLC driver

◆ Connection point at PLC Driver

PLC_DRV (Function ID: 230301) to UV (Function ID: 470101)

PLC Driver	Element ID	to	Destination	PLC connection point
PMX3_8_0	8810041BB0	→	UV1_BLOCK	800001EBB0
PMX3_8_1	8910041BB1	→	UV2_BLOCK	810002EBB0
PMX3_8_2	8A10041BB2	→	UV3_BLOCK	820003EBB0
PMX3_8_3	8B10041BB3	→	UV4_BLOCK	830004EBB0
PMX3_8_4	8C10041BB4	→	CB_APH_OPEN	800000EBB0
PMX3_8_5	8D10041BB5	→	CB_BPH_OPEN	810000EBB1
PMX3_8_6	8E10041BB6	→	CB_CPH_OPEN	820000EBB2

3.16 Phase-to-phase under-voltage protection (UVS)

The under-voltage protection function for phase-to-phase (UVS) consists of four stages (elements) independently: UVS1 to UVS4. The time characteristic of the UVS element is configured either definite time (DT) or inverse definite minimum time (IDMT) using settings.

Each UVS element detects the under-voltage condition of phase-to-phase. The user can set a threshold and the ratio of a drip-out voltage (DO) to a pick-up voltage (PU) in the UVS element. To simplify the description, only the UVS1 element is described, but the expression is applicable to the other elements; hence, read the expression for the UVS1 element as the others unless a special explanation or instruction has been provided.

Note: The implementation of the feature depends on the selection of both the hardware and the software. Note that the feature is not supplied for the several models; hence, the user has to check the implementation for the model. Locate the ordering number and check it at the "G&T position" referring to the comparison table below. For more information, see *Appendix: Ordering*.

Table 3.16-1 Comparative table in respective ordering numbers

Sec.	Feature	Ordering No. at "G&T"					
		BCU			BCPU		IFU
		11	13	1F	2C	2N	19
–	Main features	NA	NA	NA	✓	✓	NA
–	Number of stages	NA	NA	NA	4	4	NA
3.16.7	PLC driver	NA	NA	NA	✓	✓	NA

✓: Applicable NA: Not applicable

3.16.1 Drop-off and pick-up characteristic

Figure 3.16-1 shows the UVS characteristic as hatched area with concentric circles. The pick-up threshold voltage (PU) is represented the outer circle; the drop-off voltage point (DO) is represented the dotted circle. The PU voltage of the UVS1 element is set using [**UVS1**]. The DO voltage of the UVS1 element is set using [**UVS1-DPR**].

The inner circle shows the area in which the UVS function is blocked when the value of the block voltage is set for [**UVSBLK**]. Setting [**TUVSBLK**] is also provided so that the user can delay blocking the UVS1 and UVS2 elements using the setting.

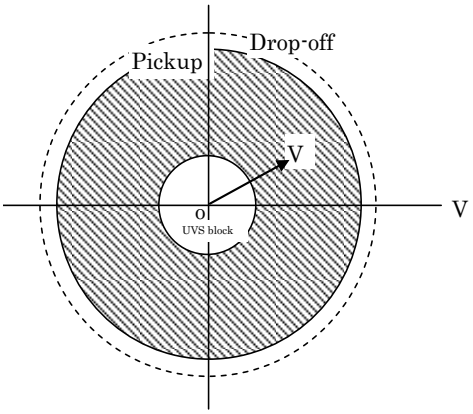


Figure 3.16-1 UVS1 element characteristic

3.16.2 Time characteristic

The UVS element has the relationship between an input voltage and an operation time; the relationship is divided into two time characteristics: (i) the definite time (DT) and (ii) the inverse definite minimum time (IDMT).

(i) Definite time characteristic (DT)

(i)-1 Setting pick-up operation

The user is required to set **DT** for scheme switch [**UVS1-Type**] when the UVS1 element should run in the DT characteristic. The UVS1 element has a delay timer for the operation; the user can set a delay time using setting [**TUVS1**]. The user can find the delay timer in the UVS function logic. (See section 3.16.4)

(i)-2 Setting drop-off operation

Resetting the UVS1 element is performed instantly when a voltage exceeds over the drop-off voltage.

(ii) Inverse definite minimum time (IDMT) characteristic

To operate the inverse definite minimum time (IDMT), set scheme switch [**UVS1-Type**] **IDMT.**

(ii)-1 Pick-up characteristic

The IDMT characteristic is applied when the operation of the UVS1 element is required inversely in accordance with the level of input voltage. The IDMT characteristic curve is illustrated in Figure 3.16-2 using a value of time multiplier is set for [**UV1-TMS**]. It is followed to Equation (3.16-1) in conformed in IEC 60255-127

$$t(G) = TMS \times \left\{ \left[\frac{k}{1 - \left({}^{V}/_{V_s} \right)^{a}} \right] + c \right\} \qquad (3.16\text{-}1)$$

where,

t = operating time (seconds),

V = energizing voltage (voltage),

Vs = pickup voltage setting (voltage),

TMS = time multiplier setting.

Except for pre-programmed characteristics, the user can have a user-programmable (original) characteristic curve. The user-programmable (original) curve is obtained when the constants of k, a, c, as shown in Table 3.16-2, are set, and when **Original** is set for scheme switch [**UVS1-Type**]. The constants are set with settings [**UVS1-k**], [**UVS1-a**], and [**UVS1-C**].

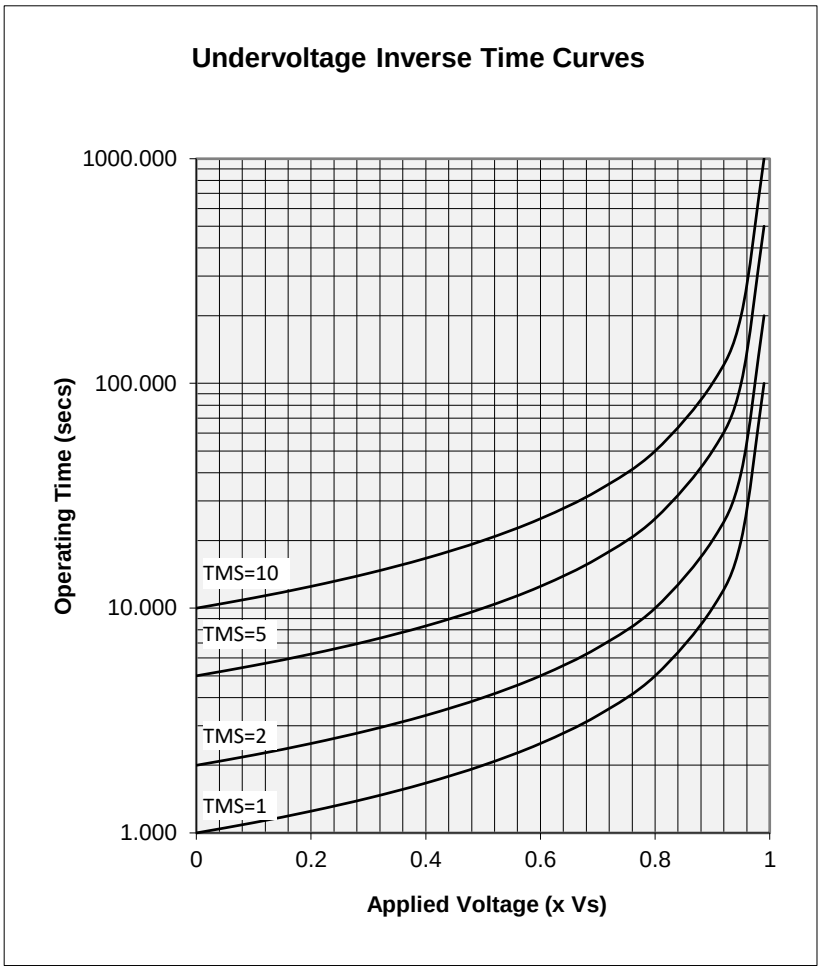


Figure 3.16-2 IDMT characteristics curves depending on TMS

Table 3.16-2 Values k, a, c for pre-programmable IDMT and user-programmable IDMT

Set item	k	a	C
IDMT	1	1	0
User-programmable (Original)	0.00000 – 500.00000 by 0.00001 step	0.00000 – 10.00000 by 0.00001 step	0.00000 – 10.00000 by 0.00001 step

(ii)-2 Drop-off characteristic

The user should set the time for resetting in the IDMT characteristic. Figure 3.16-3 shows examples of the pick-up and the drop-off relevant to both the fault occurrences and the operation time. The UVS1 element has a time counter that increases in response to the fault occurrence and duration. This figure also shows the increment degree of the time counter for the fault occurrences.

As for an intermittent fault (the former in the figure), the time counter does not reach the trip level. In the other word, the UVS1 element will be paralyzed in the reset time [**TUVS1R**].

If a series of fault occurs, the time counter increase corresponding to the duration of series faults. When the time counter reaches the trip level, then the UVS1 element issues a trip command after a certain delay. After issuing the trip command, if a series of fault disappears completely, the operation of the UVS1 element is expired after the reset time [**TUVS1R**].

When the user requires resetting the operation of the UVS1 element immediately, setting zero for the settings [**TUVS1R**] is needed. Consequently, when a voltage is recovered over the reset threshold (drop-off), the operation of the UVS1 element is reset promptly.

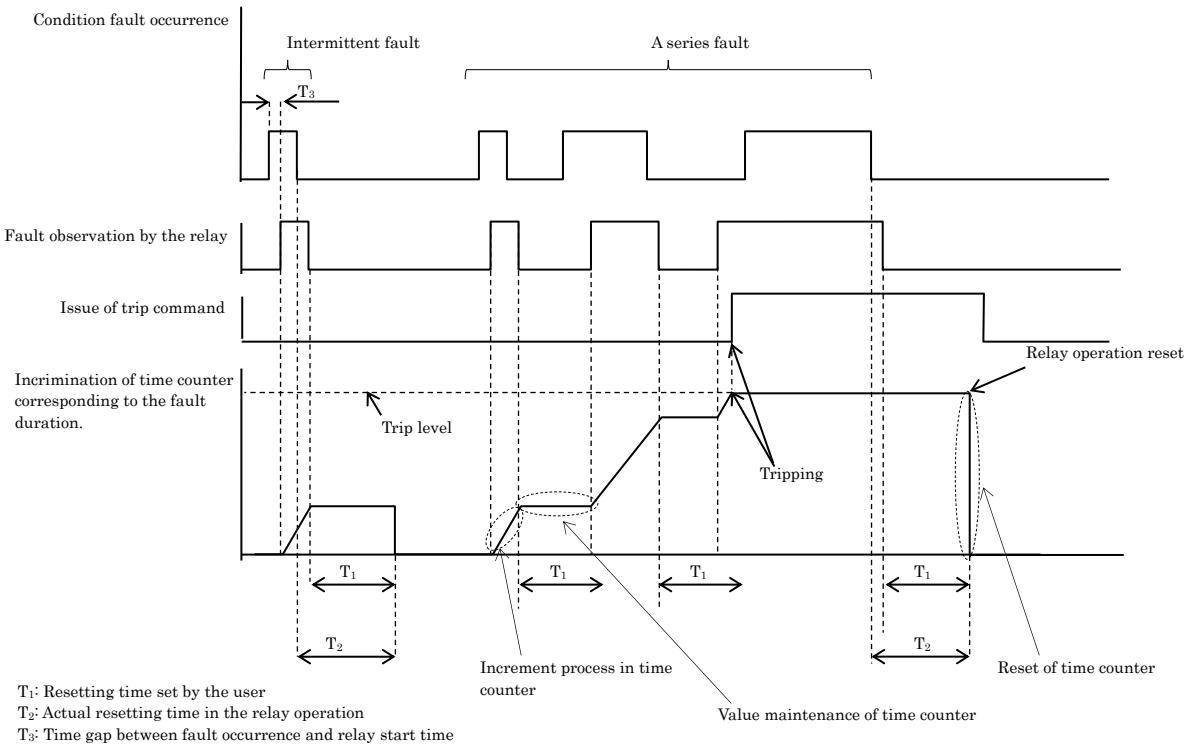


Figure 3.16-3 Faults occurrences and reset operation when DT being applied

3.16.3 Miscellaneous functions

(i) Block of UVS operation

Blocking the UVS function may be required when a failure in the voltage transformer occurs. In this case, the user shall set **Block** for scheme switch [**UVS1-VTFBlk**]. **Non** (as a default) is set for scheme switch [**UVS1-VTFBlk**] in order that the UVS function is not blocked by the failure.

(ii) UVS trip signal

The UVS1 element issues a trip command for the trip circuit (TRC†) when **Trip** is set for scheme switch [**UVS1-UseFor**] as the normal tripping. However, when an alarm signal in place of the trip command is required, the user can set **Alarm** for the scheme switch [**UVS1-UseFor**].

†Note:For more information about tripping, see Chapter *Relay application: Trip circuit*.

(iii) Operation of UVS function

Set **On** for scheme switch [**UVS1-EN**]. Otherwise, set **Off** for the scheme switch [**UVS1-EN**] if the UVS1 element is not required to operate.

(iv) Under voltage test

Setting [**UVS-Test**] =**On** is not to operate UVS blocking element (UVSBLK) for testing.

3.16.4 Scheme logic

Figure 3.16-4 show the logic of the UVS function. PLC connection points "UVS1_BLOCK" is provided for blocking the operation of the UVS1 element. Other PLC connection points "CB_APH_OPEN" etc. are provided so that the UVS1 function can determine its operation using the open/closed information of a circuit breaker (CB). For testing, the UVS1-PU element is provided; it generates a pick-up signal when the entering voltage is below the threshold anytime. For example, in the IDMT characteristic, using both PLC monitoring points "8000011B20" and "8000011B24" can facilitate to measure the pickup time after the deficiency.

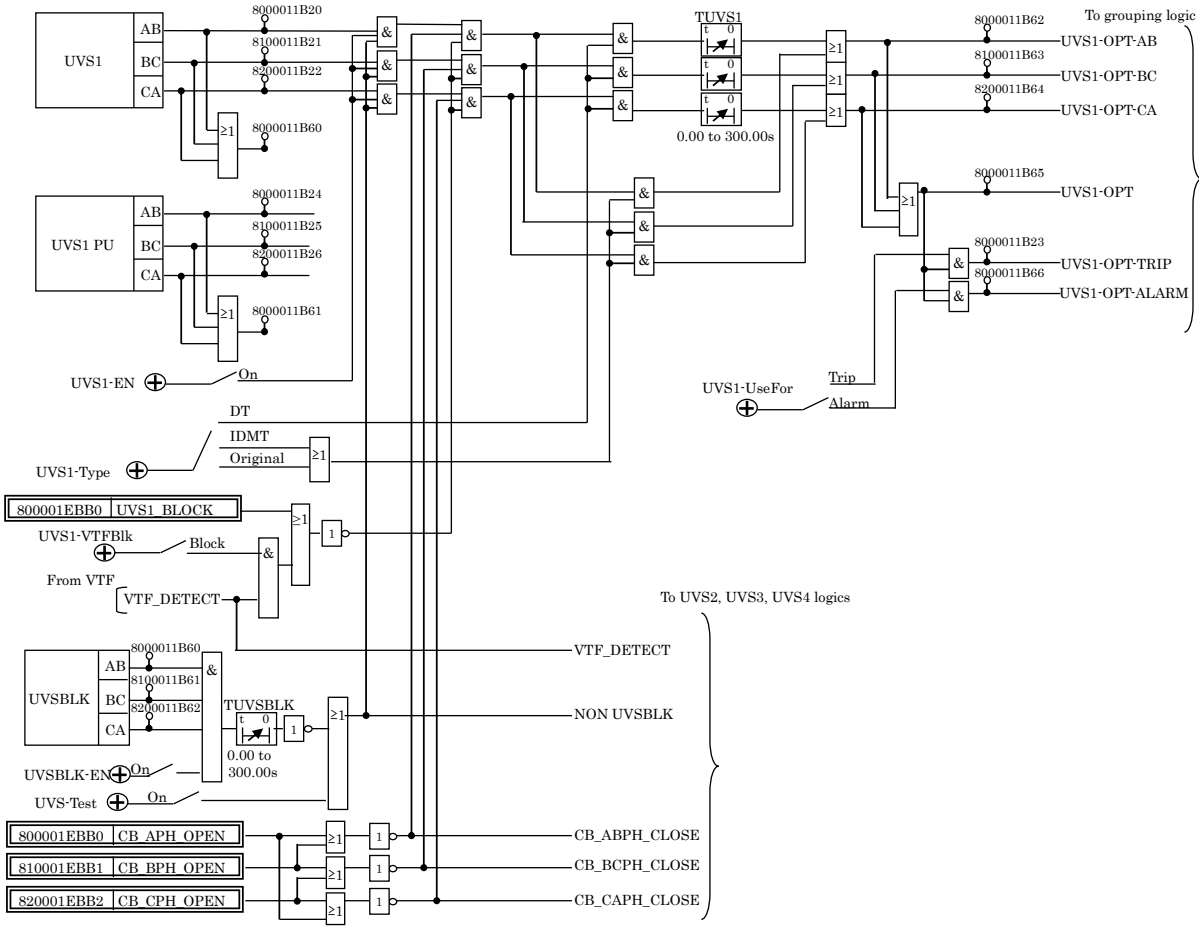


Figure 3.16-4 UVS1 logic

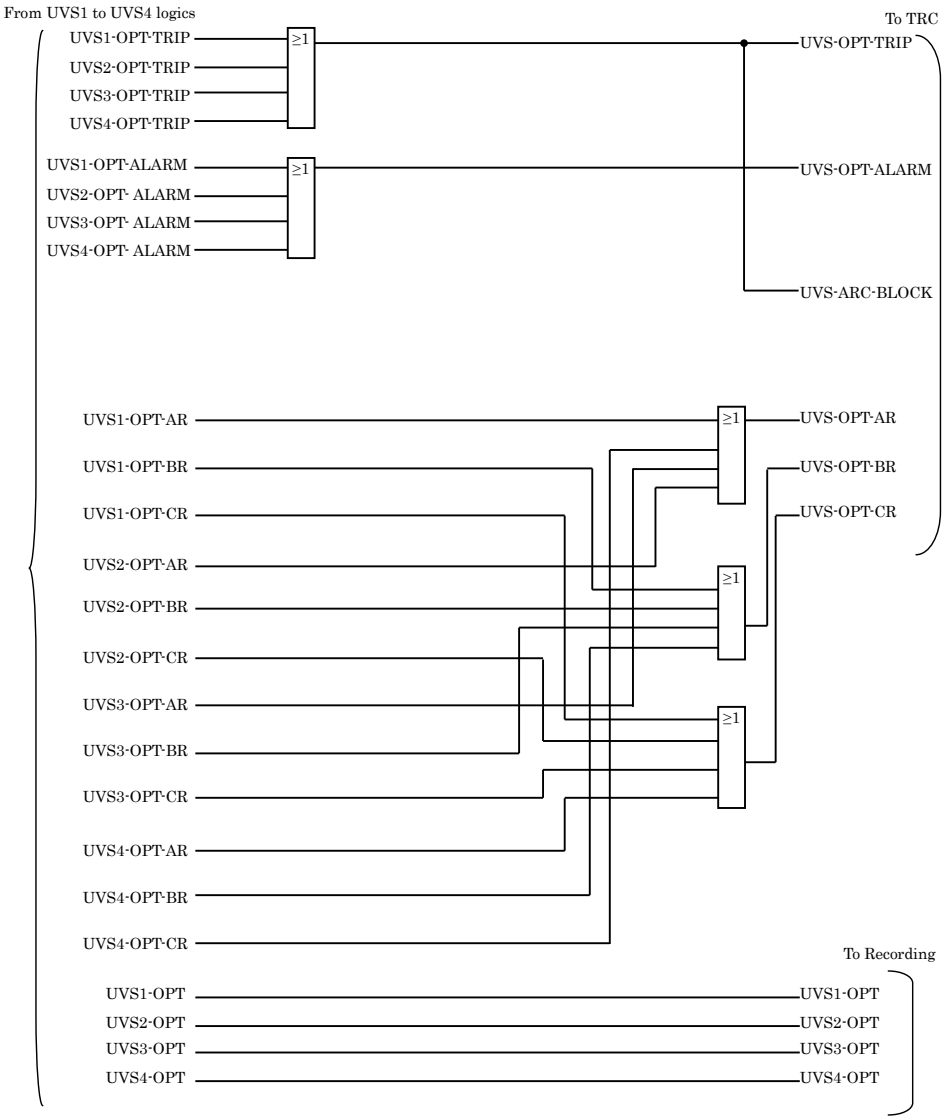


Figure 3.16-5 Grouping logic for TRC/Recording

3.16.5 Setting

Setting of UVS(Function ID: 471101)

Setting item		Range	Unit s	Contents	Default setting value	Notes
	UVSBLK-EN	Off/On	-	UVS block function enable	Off	
	UVSBLK	5.0-20.0	V	UVS block threshold	10.0	
	TUVSBLK	0.00-300.00	s	UVS block delay time	10.00	
	UVS-Test	Off/On	-	Not to execute UVS block function	Off	
UVS1	UVS1-EN	Off/On	-	UVS1 protection enable	Off	
	UVS1-Type	DT/IDMT/Original	-	UVS1 delay type	DT	
	UVS1	5.0-130.0	V	UVS1 threshold (in DT mode)	60.0	
	UVS1-DPR	100-120	%	UVS1 drop-out/pick-up ratio	100	
	TUVS1	0.00-300.00	S	UVS1 operating delay time (in DT mode)	1.00	
	UVS1-TMS	0.010-100.000	-	UVS1 time multiplier (in IDMT mode)	1.000	
	TUVS1R	0.0-300.0	s	UVS1 definite time reset delay	0.0	
	UVS1-k	0.00000-500.00000	-	UVS1 user original curve coefficient	0.00000	
	UVS1-a	0.00000-10.00000	-	UVS1 user original curve coefficient	0.00000	
	UVS1-c	0.00000-10.00000	-	UVS1 user original curve coefficient	0.00000	
	UVS1-VTFBlk	Non/Block	-	UVS1 operation block by VTF	Non	
	UVS1-UseFor	Trip/Alarm	-	UVS1 used for trip or alarm	Trip	
UVS2	UVS2-EN	Off/On	-	UVS2 protection enable	Off	
	UVS2-Type	DT/IDMT/Original	-	UVS2 delay type	DT	
	UVS2	5.0-130.0	V	UVS2 threshold (in DT mode)	60.0	
	UVS2-DPR	100-120	%	UVS2 drop-out/pick-up ratio	100	
	TUVS2	0.00-300.00	S	UVS2 operating delay time (in DT mode)	1.00	
	UVS2-TMS	0.010-100.000	-	UVS2 time multiplier (in IDMT mode)	1.000	
	TUVS2R	0.0-300.0	s	UVS2 definite time reset delay	0.0	
	UVS2-k	0.00000-500.00000	-	UVS2 user original curve coefficient	0.00000	
	UVS2-a	0.00000-10.00000	-	UVS2 user original curve coefficient	0.00000	
	UVS2-c	0.00000-10.00000	-	UVS2 user original curve coefficient	0.00000	
	UVS2-VTFBlk	Non/Block	-	UVS2 operation block by VTF	Non	
	UVS2-UseFor	Trip/Alarm	-	UVS2 used for trip or alarm	Trip	
UVS3	UVS3-EN	Off/On	-	UVS3 protection enable	Off	
	UVS3-Type	DT/IDMT/Original	-	UVS3 delay type	DT	
	UVS3	5.0-130.0	V	UVS3 threshold (in DT mode)	60.0	
	UVS3-DPR	100-120	%	UVS3 drop-out/pick-up ratio	100	
	TUVS3	0.00-300.00	S	UVS3 operating delay time (in DT mode)	1.00	
	UVS3-TMS	0.010-100.000	-	UVS3 time multiplier (in IDMT mode)	1.000	
	TUVS3R	0.0-300.0	s	UVS3 definite time reset delay	0.0	
	UVS3-k	0.00000-500.00000	-	UVS3 user original curve coefficient	0.00000	
	UVS3-a	0.00000-10.00000	-	UVS3 user original curve coefficient	0.00000	
	UVS3-c	0.00000-10.00000	-	UVS3 user original curve coefficient	0.00000	
	UVS3-VTFBlk	Non/Block	-	UVS3 operation block by VTF	Non	
	UVS3-UseFor	Trip/Alarm	-	UVS3 used for trip or alarm	Trip	
UVS4	UVS4-EN	Off/On	-	UVS4 protection enable	Off	
	UVS4-Type	DT/IDMT/Original	-	UVS4 delay type	DT	
	UVS4	5.0-130.0	V	UVS4 threshold (in DT mode)	60.0	
	UVS4-DPR	100-120	%	UVS4 drop-out/pick-up ratio	100	
	TUVS4	0.00-300.00	S	UVS4 operating delay time (in DT mode)	1.00	
	UVS4-TMS	0.010-100.000	-	UVS4 time multiplier (in IDMT mode)	1.000	
	TUVS4R	0.0-300.0	s	UVS4 definite time reset delay	0.0	
	UVS4-k	0.00000-500.00000	-	UVS4 user original curve coefficient	0.00000	

Setting of UVS(Function ID: 471101)

Setting item			Range	Units	Contents	Default setting value	Notes
		UVS4-a	0.00000-10.00000	-	UVS4 user original curve coefficient	0.00000	
		UVS4-c	0.00000-10.00000	-	UVS4 user original curve coefficient	0.00000	
		UVS4-VTFBlk	Non/Block	-	UVS4 operation block by VTF	Non	
		UVS4-UseFor	Trip/Alarm	-	UVS4 used for trip or alarm	Trip	

3.16.6 Data ID

◆ Signal monitoring point

UVS(Function ID: 471101)

Element ID	Name	Description
8000011C20	UVS1-AB	UVS1 relay element operated (phase-AB)
8100011C21	UVS1-BC	UVS1 relay element operated (phase-BC)
8200011C22	UVS1-CA	UVS1 relay element operated (phase-CA)
8000011B65	UVS1-OPT	UVS1 protection operated
8000011B62	UVS1-OPT-AB	UVS1 protection operated (phase-AB)
8100011B63	UVS1-OPT-BC	UVS1 protection operated (phase-BC)
8200011B64	UVS1-OPT-CA	UVS1 protection operated (phase-CA)
8000011B60	UVS1-OR	UVS1 relay element operated (3-phases OR)
8000011C24	UVS1PU-AB	UVS1 PU relay operation level pick up (phase-AB)
8100011C25	UVS1PU-BC	UVS1 PU relay operation level pick up (phase-BC)
8200011C26	UVS1PU-CA	UVS1 PU relay operation level pick up (phase-CA)
8000011B61	UVS1PU-OR	UVS1 PU relay operation level pick up (3-phases OR)
8400021C20	UVS2-AB	UVS2 relay element operated (phase-AB)
8500021C21	UVS2-BC	UVS2 relay element operated (phase-BC)
8600021C22	UVS2-CA	UVS2 relay element operated (phase-CA)
8100021B65	UVS2-OPT	UVS2 protection operated
8400021B62	UVS2-OPT-AB	UVS2 protection operated (phase-AB)
8500021B63	UVS2-OPT-BC	UVS2 protection operated (phase-BC)
8600021B64	UVS2-OPT-CA	UVS2 protection operated (phase-CA)
8100021B60	UVS2-OR	UVS2 relay element operated (3-phases OR)
8400021C24	UVS2PU-AB	UVS2 PU relay operation level pick up (phase-AB)
8500021C25	UVS2PU-BC	UVS2 PU relay operation level pick up (phase-BC)
8600021C26	UVS2PU-CA	UVS2 PU relay operation level pick up (phase-CA)
8100021B61	UVS2PU-OR	UVS2 PU relay operation level pick up (3-phases OR)
8800031C20	UVS3-AB	UVS3 relay element operated (phase-AB)
8900031C21	UVS3-BC	UVS3 relay element operated (phase-BC)
8A00031C22	UVS3-CA	UVS3 relay element operated (phase-CA)
8200031B65	UVS3-OPT	UVS3 protection operated
8800031B62	UVS3-OPT-AB	UVS3 protection operated (phase-AB)
8900031B63	UVS3-OPT-BC	UVS3 protection operated (phase-BC)
8A00031B64	UVS3-OPT-CA	UVS3 protection operated (phase-CA)
8200031B60	UVS3-OR	UVS3 relay element operated (3-phases OR)
8800031C24	UVS3PU-AB	UVS3 PU relay operation level pick up (phase-AB)
8900031C25	UVS3PU-BC	UVS3 PU relay operation level pick up (phase-BC)
8A00031C26	UVS3PU-CA	UVS3 PU relay operation level pick up (phase-CA)
8200031B61	UVS3PU-OR	UVS3 PU relay operation level pick up (3-phases OR)
8C00041C20	UVS4-AB	UVS4 relay element operated (phase-AB)
8D00041C21	UVS4-BC	UVS4 relay element operated (phase-BC)
8E00041C22	UVS4-CA	UVS4 relay element operated (phase-CA)
8300041B65	UVS4-OPT	UVS4 protection operated
8C00041B62	UVS4-OPT-AB	UVS4 protection operated (phase-AB)
8D00041B63	UVS4-OPT-BC	UVS4 protection operated (phase-BC)
8E00041B64	UVS4-OPT-CA	UVS4 protection operated (phase-CA)

◆ Signal monitoring point

UVS(Function ID: 471101)

Element ID	Name	Description
8300041B60	UVS4-OR	UVS4 relay element operated (3-phases OR)
8C00041C24	UVS4PU-AB	UVS4 PU relay operation level pick up (phase-AB)
8D00041C25	UVS4PU-BC	UVS4 PU relay operation level pick up (phase-BC)
8E00041C26	UVS4PU-CA	UVS4 PU relay operation level pick up (phase-CA)
8300041B61	UVS4PU-OR	UVS4 PU relay operation level pick up (3-phases OR)
8000001B60	UVSBLK-AB	UVSBLK relay operation level pick up (phase-AB)
8100001B61	UVSBLK-BC	UVSBLK relay operation level pick up (phase-BC)
8200001B62	UVSBLK-CA	UVSBLK relay operation level pick up (phase-CA)

◆ Connection point in PLC logic

UVS(Function ID: 471101)

Element ID	Name	Description
800000EBB0	CB_APH_OPEN	A phase CB open
810000EBB1	CB_BPH_OPEN	B phase CB open
820000EBB2	CB_CPH_OPEN	C phase CB open
800001EBB0	UVS1_BLOCK	UVS1 protection block command
810002EBB0	UVS2_BLOCK	UVS2 protection block command
820003EBB0	UVS3_BLOCK	UVS3 protection block command
830004EBB0	UVS4_BLOCK	UVS4 protection block command

3.16.7 PLC driver

◆ Connection point at PLC Driver

PLC_DRV (Function ID: 230301) to UVS (Function ID: 471101)

PLC Driver	Element ID	to	Destination	PLC connection point
PMX3_8_7	8F10041BB7	→	UVS1_BLOCK	800001EBB0
PMX3_9_0	8010041BB8	→	UVS2_BLOCK	810002EBB0
PMX3_9_1	8110041BB9	→	UVS3_BLOCK	820003EBB0
PMX3_9_2	8210041BBA	→	UVS4_BLOCK	830004EBB0
PMX3_9_3	8310041BBB	→	CB_APH_OPEN	800000EBB0
PMX3_9_4	8410041BBC	→	CB_BPH_OPEN	810000EBB1
PMX3_9_5	8510041BBD	→	CB_CPH_OPEN	820000EBB2

3.17 Frequency protection (FRQ/DFRQ)

The frequency protection (FRQ and DFRQ) functions have six frequency elements (stages) to detect frequency-deviations and frequency-changes, respectively. If the deviations or changes are appeared, the FRQ and DFRQ function can issue a trip signal (or an alarm signal) in response to the degree of the frequency-deviation and the frequency-change.

With respect to monitoring the frequency-deviation, either an under-frequency element (UF) or an over-frequency element (OF) is used to monitor a frequency. The user can set the degree of frequency deviation at each frequency. Generally, the UF element is applied to monitor the balance between the power generation capability and the loads. The OF element is used monitor the frequency to be within the normal range by load shedding; the OF element is used to protect synchronous machines from possible damage owing to over-frequency conditions.

With respect to monitoring the frequency-changes, either a frequency-rise element (RISE) or a frequency-down element (DOWN) is used to monitor the frequency-change. To monitor the frequency-change, the user should select either the RISE element or the DOWN element at respective frequencies. The DFRQ is used to ensure the operation of load shedding promptly when the change of frequency is very rapid.

To simplify the description, only stage 1 is discussed, but is applicable to the other stages; hence, read the express for stage 1 as the other stages unless a special explanation or instruction has been produced.

Note: The implementation of the feature depends on the selection of both the hardware and the software. Note that the feature is not supplied for the several models; hence, the user has to check the implementation for the model. Locate the ordering number and check it at the "G&T position" referring to the comparison table below. For more information, see *Appendix: Ordering*.

Table 3.17-1 Comparative table in respective ordering numbers

Sec.	Feature	Ordering No. at "G&T"					
		BCU			BCPU		IFU
		11	13	1F	2C	2N	19
–	Main features	NA	NA	NA	✓	✓	NA
–	Number of stages	NA	NA	NA	6	6	NA
3.17.5	PLC driver	NA	NA	NA	✓	✓	NA

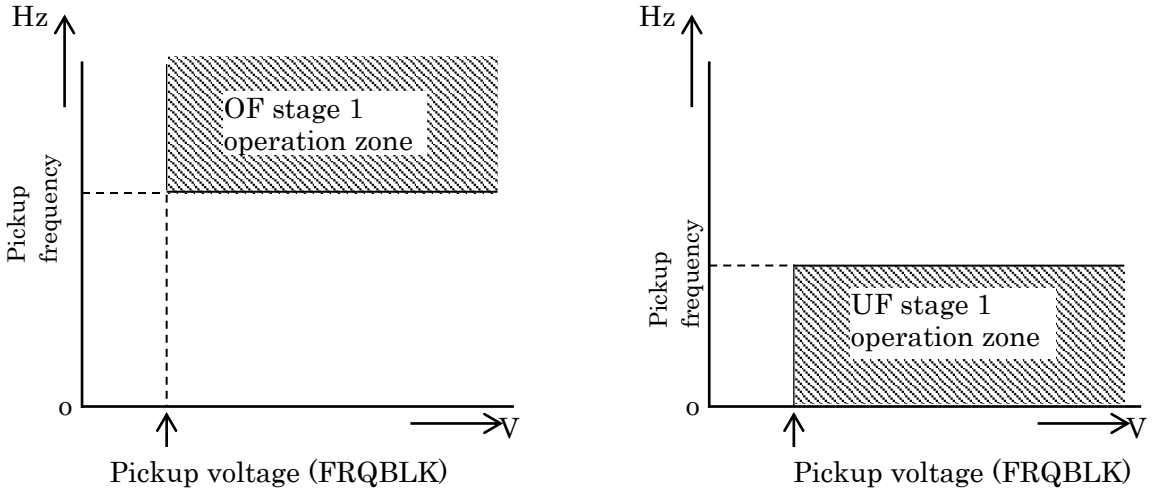
✓: Applicable NA: Not applicable

3.17.1 FRQ features and characteristics

(i) UF/OF characteristic

The UF and OF elements check the frequency every 5msec; they determines the frequency-deviations whether the frequency is in under-frequency or over-frequency. Figure 3.17-1(a) shows the UF characteristic; Figure 3.17-1(b) shows the OF characteristic; hatched area reflects operation zone of the UF and the OF elements.

The user can select the stage 1 to detect either over-frequency state or under-frequency state using scheme switch [**FRQ1-Chara**]. For example, If **OverFrq** is set for the scheme switch [**FRQ1-Chara**], the stage 1 determines the over-frequency state when an over frequency is observed (Figure 3.17-1(a)); the user can set the threshold value into [**FRQ1**]. Conversely, if **UnderFrq** is set for the scheme switch, the stage 1 determines the under-frequency state when an under frequency is observed (Figure 3.17-1(b)). The user can use a delay timer to postpone to issue a trip signal using setting [**TFRQ1**].



a. Over frequency element at Stage 1 b. Under frequency element at Stage 1

Figure 3.17-1 Characteristics of UF and OF elements (e.g. Stage 1 of FRQ)

Regarding the operation of the UF and OF elements, the user should notice the element not to pick-up when the measured voltage is below the threshold value set with the [**FRQBLK**] in positive sequence. Any operation of the FRQ function is blocked when an acquired voltage is smaller than the pickup voltage to be set.

(ii) Enabling FRQ function

The user should set **On** to enable the FRQ function using scheme switch [**FRQ1-EN**]. If the user do not require the FRQ operation, **Off** should be set for the scheme switch.

(iii) FRQ trip signal

The FRQ can issue a trip signal for the function of trip circuit (TRC) when **Trip** is set for scheme switch [**FRQ1-UseFor**]. However, when an alarm signal is required in place of the trip signal, the user should set **Alarm** for scheme switch [**FRQ1-UseFor**]. The TRC function is discussed separately. (See Chapter *Relay application: Trip circuit.*)

(iv) UF/OF scheme logic

Figure 3.17-2 shows the scheme logic for the UF and OF functions. Each stage operates independently. PLC connection point "FRQ1-BLOCK" is provided to block the stage1 when blocking is required by an external signal. The user can connect the PLC connection point with an external signal using PLC function. (For more information of PLC function, see Chapter *PLC function*)

The under-voltage block (FRQBLK) element is used to block the FRQ operation, as mentioned earlier (section 3.17.1(i)).

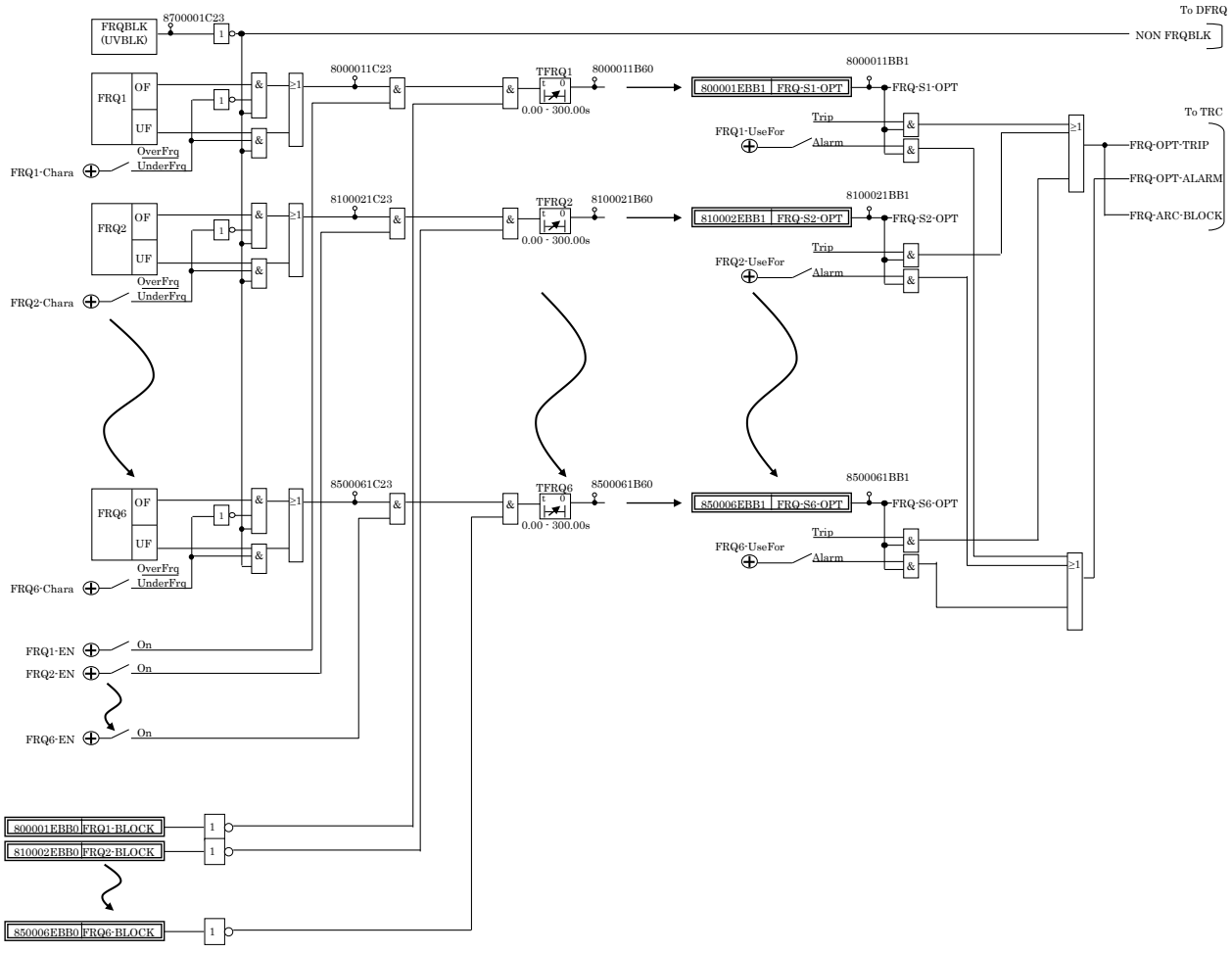


Figure 3.17-2 Scheme logic for FRQ function

3.17.2 DFRQ features and characteristics

(i) RISE/DOWN characteristic

The RISE and DOWN elements calculate the gradient of frequency-change (Δf/Δt) every 5msec. Figure 3.17-3 shows how to calculate the gradient using Δf and Δt: the change of frequency (Δf) over a time interval and Δt equals to 100ms. Six elements are provided for the DFRQ function; each element can operate independently. Each stage of the DFRQ function issues a trip signal if Δf exceeds the setting value of 50 consecutive times.

The user can set the state 1 to detect whether a frequency to be rising or to be descending using scheme switch [**DFRQ1-Chara**]. For example, when **Rise** is set for the scheme switch [**DFRQ1-Chara**], the DFRQ examines the gradient of frequency-change (Δf/Δt) in up. Conversely, when **Down** is set for the scheme switch, the DFRQ examines the gradient of frequency-change (Δf/Δt) in down. Setting [**DFREQ1**] is used to configure an operation threshold; the operation threshold is configured with Hertz per second.

The operation of the RISE/DOWN elements is blocked when the FRQBLK element runs. That is, if an obtained voltage is below the setting [**FRQBLK**], any operation of the DFRQ function is blocked. The FRQBLK element is discussed in section 3.17.1(i).

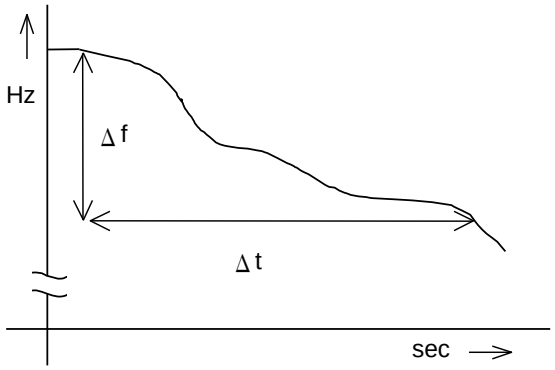


Figure 3.17-3 Gradient of frequency rate-of-change

(ii) Enabling DFRQ function

The user should set On to enable the DFRQ function using scheme switch [**DFRQ1-EN**]. If the user is not to operate the DFRQ function, Off should be set for the scheme switch.

(iii) DFRQ trip signal

The DFRQ can issue a trip signal for the function of trip circuit (TRC) when **Trip** is set for scheme switch [**DFRQ1-UseFor**]. However, when an alarm signal is required in place of the trip signal, the user should set **Alarm** for scheme switch [**DFRQ1-UseFor**]. The TRC function is discussed separately. (See Chapter *Relay application: Trip circuit*)

(iv) DFRQ scheme logic

Figure 3.17-4 shows the scheme logic of the DFRQ function. Each stage operates independently. PLC connection point "DFRQ1-BLOCK" is provided to block the stage1; hence the user can connect an external signal to this PLC connection point when the external signal is provided to block the stage 1. (For more information of PLC function, see Chapter PLC function)

The signal of the under-voltage block (FRQBLK) element is provided from the FRQ logic.

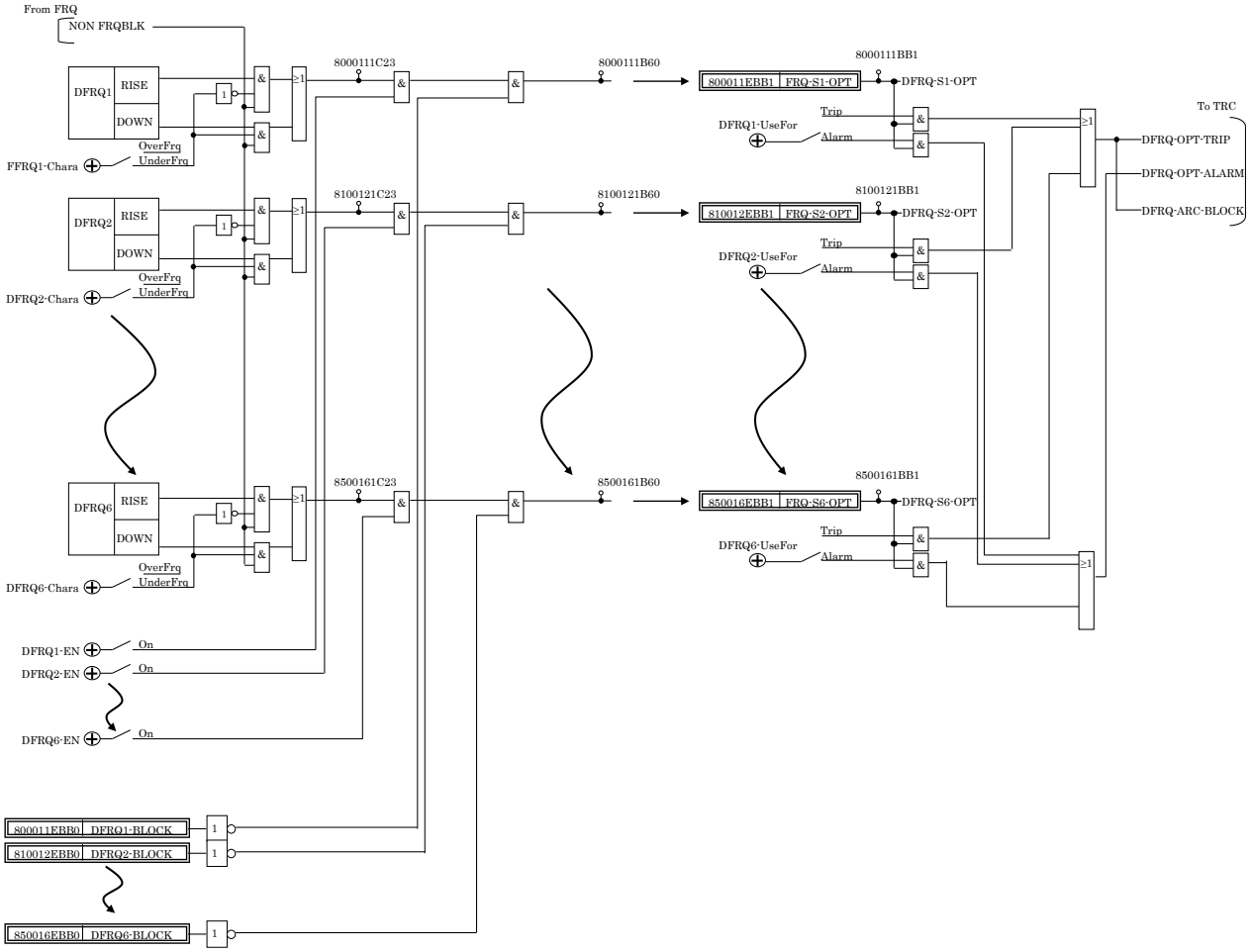


Figure 3.17-4 Scheme Logic of Frequency Rate-of-change Protection

3.17.3 Setting

Setting of FRQ(Function ID: 475001)

Setting item			Range	Unit s	Contents	Default setting value	Notes
	Common	FRQBLK	40.0 to 100.0	V	Set for blocking in positive sequence	40.0	
	FRQ1	FRQ1-EN	Off/On	–	FRQ1 protection enable	Off	
		FRQ1-Chara	OverFrq/UnderFrq	–	The selection of FRQ1 character	UnderFrq	
		FRQ1	-10.00 to 10.00	Hz	FRQ1 threshold	-1.00	
		TFRQ1	0.00 to 300.00	S	FRQ1 operating delay time	1.00	
		FRQ1-UseFor	Trip/Alarm	–	FRQ1 used for trip or alarm	Trip	
	FRQ2	FRQ2-EN	Off/On	–	FRQ1 protection enable	Off	
		FRQ2-Chara	OverFrq/UnderFrq	–	The selection of FRQ1 character	UnderFrq	
		FRQ2	-10.00 to 10.00	Hz	FRQ1 threshold	-1.00	
		TFRQ2	0.00 to 300.00	S	FRQ1 operating delay time	1.00	
		FRQ2-UseFor	Trip/Alarm	–	FRQ1 used for trip or alarm	Trip	
	FRQ3	FRQ3-EN	Off/On	–	FRQ1 protection enable	Off	
		FRQ3-Chara	OverFrq/UnderFrq	–	The selection of FRQ1 character	UnderFrq	
		FRQ3	-10.00 to 10.00	Hz	FRQ1 threshold	-1.00	
		TFRQ3	0.00 to 300.00	S	FRQ1 operating delay time	1.00	
		FRQ3-UseFor	Trip/Alarm	–	FRQ1 used for trip or alarm	Trip	
	FRQ4	FRQ4-EN	Off/On	–	FRQ1 protection enable	Off	
		FRQ4-Chara	OverFrq/UnderFrq	–	The selection of FRQ1 character	UnderFrq	
		FRQ4	-10.00 to 10.00	Hz	FRQ1 threshold	-1.00	
		TFRQ4	0.00 to 300.00	S	FRQ1 operating delay time	1.00	
		FRQ4-UseFor	Trip/Alarm	–	FRQ1 used for trip or alarm	Trip	
	FRQ5	FRQ5-EN	Off/On	–	FRQ1 protection enable	Off	
		FRQ5-Chara	OverFrq/UnderFrq	–	The selection of FRQ1 character	UnderFrq	
		FRQ5	-10.00 to 10.00	Hz	FRQ1 threshold	-1.00	
		TFRQ5	0.00 to 300.00	S	FRQ1 operating delay time	1.00	
		FRQ5-UseFor	Trip/Alarm	–	FRQ1 used for trip or alarm	Trip	
	FRQ6	FRQ6-EN	Off/On	–	FRQ1 protection enable	Off	
		FRQ6-Chara	OverFrq/UnderFrq	–	The selection of FRQ1 character	UnderFrq	
		FRQ6	-10.00 to 10.00	Hz	FRQ1 threshold	-1.00	
		TFRQ6	0.00 to 300.00	S	FRQ1 operating delay time	1.00	
		FRQ6-UseFor	Trip/Alarm	–	FRQ1 used for trip or alarm	Trip	
	DFRQ1	DFRQ1-EN	Off/On	–	DFRQ1 protection enable	Off	
		DFRQ1-Chara	Rise/Down	–	The selection of DFRQ1 character	Down	
		DFRQ1	0.1 to 15.0	Hz /s	DFRQ1 threshold	0.5	
		DFRQ1-UseFor	Trip/Alarm	–	DFRQ1 used for trip or alarm	Trip	
	DFRQ2	DFRQ2-EN	Off/On	–	DFRQ2 protection enable	Off	
		DFRQ2-Chara	Rise/Down	–	The selection of DFRQ2 character	Down	
		DFRQ2	0.1 to 15.0	Hz /s	DFRQ2 threshold	0.5	
		DFRQ2-UseFor	Trip/Alarm	–	DFRQ2 used for trip or alarm	Trip	
	DFRQ3	DFRQ3-EN	Off/On	–	DFRQ3 protection enable	Off	
		DFRQ3-Chara	Rise/Down	–	The selection of DFRQ3 character	Down	
		DFRQ3	0.1 to 15.0	Hz /s	DFRQ3 threshold	0.5	
		DFRQ3-UseFor	Trip/Alarm	–	DFRQ3 used for trip or alarm	Trip	
	DFRQ4	DFRQ4-EN	Off/On	–	DFRQ4 protection enable	Off	
		DFRQ4-Chara	Rise/Down	–	The selection of DFRQ4 character	Down	
		DFRQ4	0.1 to 15.0	Hz /s	DFRQ4 threshold	0.5	
		DFRQ4-UseFor	Trip/Alarm	–	DFRQ4 used for trip or alarm	Trip	
	DFRQ5	DFRQ5-EN	Off/On	–	DFRQ5 protection enable	Off	
		DFRQ5-Chara	Rise/Down	–	The selection of DFRQ5 character	Down	
		DFRQ5	0.1 to 15.0	Hz /s	DFRQ5 threshold	0.5	

Setting of FRQ(Function ID: 475001)

Setting item			Range	Units	Contents	Default setting value	Notes
	DFRQ6	DFRQ5-UseFor	Trip/Alarm	–	DFRQ5 used for trip or alarm	Trip	
		DFRQ6-EN	Off/On	–	DFRQ6 protection enable	Off	
		DFRQ6-Chara	Rise/Down	–	The selection of DFRQ6 character	Down	
		DFRQ6	0.1 to 15.0	Hz /s	DFRQ6 threshold	0.5	
		DFRQ6-UseFor	Trip/Alarm	–	DFRQ6 used for trip or alarm	Trip	

3.17.4 Data ID

◆ Signal monitoring point

FRQ(Function ID: 475001)

Element ID	Name	Description
8000011C23	FRQ1	FRQ1 relay element operated
8000111C23	DFRQ1	DFRQ1 relay element operated
8000011B60	FRQ1-OPT	FRQ1 element operated
8000111B60	DFRQ1-OPT	DFRQ1 element operated
8000011BB1	FRQ-S1-OPT	FRQ1 protection operated
8000111BB1	DFRQ-S1-OPT	DFRQ1 protection operated
8100021C23	FRQ2	FRQ2 relay element operated
8100121C23	DFRQ2	DFRQ2 relay element operated
8100021B60	FRQ2-OPT	FRQ2 element operated
8100121B60	DFRQ2-OPT	DFRQ2 element operated
8100021BB1	FRQ-S2-OPT	FRQ2 protection operated
8100121BB1	DFRQ-S2-OPT	DFRQ2 protection operated
8200031C23	FRQ3	FRQ3 relay element operated
8200131C23	DFRQ3	DFRQ3 relay element operated
8200031B60	FRQ3-OPT	FRQ3 element operated
8200131B60	DFRQ3-OPT	DFRQ3 element operated
8200031BB1	FRQ-S3-OPT	FRQ3 protection operated
8200131BB1	DFRQ-S3-OPT	DFRQ3 protection operated
8300041C23	FRQ4	FRQ4 relay element operated
8300141C23	DFRQ4	DFRQ4 relay element operated
8300041B60	FRQ4-OPT	FRQ4 element operated
8300141B60	DFRQ4-OPT	DFRQ4 element operated
8300041BB1	FRQ-S4-OPT	FRQ4 protection operated
8300141BB1	DFRQ-S4-OPT	DFRQ4 protection operated
8400051C23	FRQ5	FRQ5 relay element operated
8400151C23	DFRQ5	DFRQ5 relay element operated
8400051B60	FRQ5-OPT	FRQ5 element operated
8400151B60	DFRQ5-OPT	DFRQ5 element operated
8400051BB1	FRQ-S5-OPT	FRQ5 protection operated
8400151BB1	DFRQ-S5-OPT	DFRQ5 protection operated
8500061C23	FRQ6	FRQ6 relay element operated
8500161C23	DFRQ6	DFRQ6 relay element operated
8500061B60	FRQ6-OPT	FRQ6 element operated
8500161B60	DFRQ6-OPT	DFRQ6 element operated
8500061BB1	FRQ-S6-OPT	FRQ6 protection operated
8500161BB1	DFRQ-S6-OPT	DFRQ6 protection operated
8700001C23	FRQBLK	FRQBLK relay element operated

◆ Connection point in PLC logic

FRQ(Function ID: 475001)

Element ID	Name	Description
800011EBB1	DFRQ-S1-OPT	DFRQ1 protection operated
810012EBB1	DFRQ-S2-OPT	DFRQ2 protection operated

◆ Connection point in PLC logic

FRQ(Function ID: 475001)

Element ID	Name	Description
820013EBB1	DFRQ-S3-OPT	DFRQ3 protection operated
830014EBB1	DFRQ-S4-OPT	DFRQ4 protection operated
840015EBB1	DFRQ-S5-OPT	DFRQ5 protection operated
850016EBB1	DFRQ-S6-OPT	DFRQ6 protection operated
800011EBB0	DFRQ1_BLOCK	DFRQ1 protection block command
810012EBB0	DFRQ2_BLOCK	DFRQ2 protection block command
820013EBB0	DFRQ3_BLOCK	DFRQ3 protection block command
830014EBB0	DFRQ4_BLOCK	DFRQ4 protection block command
840015EBB0	DFRQ5_BLOCK	DFRQ5 protection block command
850016EBB0	DFRQ6_BLOCK	DFRQ6 protection block command
800001EBB1	FRQ-S1-OPT	FRQ1 protection operated
810002EBB1	FRQ-S2-OPT	FRQ2 protection operated
820003EBB1	FRQ-S3-OPT	FRQ3 protection operated
830004EBB1	FRQ-S4-OPT	FRQ4 protection operated
840005EBB1	FRQ-S5-OPT	FRQ5 protection operated
850006EBB1	FRQ-S6-OPT	FRQ6 protection operated
800001EBB0	FRQ1_BLOCK	FRQ1 protection block command
810002EBB0	FRQ2_BLOCK	FRQ2 protection block command
820003EBB0	FRQ3_BLOCK	FRQ3 protection block command
830004EBB0	FRQ4_BLOCK	FRQ4 protection block command
840005EBB0	FRQ5_BLOCK	FRQ5 protection block command
850006EBB0	FRQ6_BLOCK	FRQ6 protection block command

3.17.5 PLC driver

◆ Connection point at PLC Driver

PLC_DRV (Function ID: 230301) to FRQ (Function ID: 475001)

PLC Driver	Element ID	to	Destination	PLC connection point
PMX3_9_6	8610041BBE	→	FRQ1_BLOCK	800001EBB0
PMX3_9_7	8710041BBF	→	FRQ2_BLOCK	810002EBB0
PMX3_10_0	8810051BB0	→	FRQ3_BLOCK	820003EBB0
PMX3_10_1	8910051BB1	→	FRQ4_BLOCK	830004EBB0
PMX3_10_2	8A10051BB2	→	FRQ5_BLOCK	840005EBB0
PMX3_10_3	8B10051BB3	→	FRQ6_BLOCK	850006EBB0
PMX3_10_4	8C10051BB4	→	FRQ-S1-OPT	800001EBB1
PMX3_10_5	8D10051BB5	→	FRQ-S2-OPT	810002EBB1
PMX3_10_6	8E10051BB6	→	FRQ-S3-OPT	820003EBB1
PMX3_10_7	8F10051BB7	→	FRQ-S4-OPT	830004EBB1
PMX3_11_0	8010051BB8	→	FRQ-S5-OPT	840005EBB1
PMX3_11_1	8110051BB9	→	FRQ-S6-OPT	850006EBB1
PMX3_11_2	8210051BBA	→	DFRQ1_BLOCK	800011EBB0
PMX3_11_3	8310051BBB	→	DFRQ2_BLOCK	810012EBB0
PMX3_11_4	8410051BBC	→	DFRQ3_BLOCK	820013EBB0
PMX3_11_5	8510051BBD	→	DFRQ4_BLOCK	830014EBB0
PMX3_11_6	8610051BBE	→	DFRQ5_BLOCK	840015EBB0
PMX3_11_7	8710051BBF	→	DFRQ6_BLOCK	850016EBB0
PMX3_12_0	8810061BB0	→	DFRQ-S1-OPT	800011EBB1
PMX3_12_1	8910061BB1	→	DFRQ-S2-OPT	810012EBB1
PMX3_12_2	8A10061BB2	→	DFRQ-S3-OPT	820013EBB1
PMX3_12_3	8B10061BB3	→	DFRQ-S4-OPT	830014EBB1
PMX3_12_4	8C10061BB4	→	DFRQ-S5-OPT	840015EBB1
PMX3_12_5	8D10061BB5	→	DFRQ-S6-OPT	850016EBB1

3.18 Inrush current detection function (ICD)

When a current transformer (CT) is first energized, an inrush current flows into the CT transiently to establish the magnetic field. The magnitude of the inrush current can greater than the full load current so much; thus, the protection function can issue trip signals falsely. That is, the inrush current is required to detected and the protection functions shall not operate during CT energizing. Inrush current detection (ICD) function is designed to detect a second harmonic inrush current. This is because, the inrush current has all order of harmonics, but the second harmonics is the greatest†. Signals generated in the ICD function are transferred to other protection functions to block their operations.

†Note:The second harmonic current is present all inrush currents in three-phases. The proportion of the second harmonic current varies with the degree of the energizing, but the ratio of the second harmonic current to the fundamental current can be about 20% or greater during energizing.

Note: The implementation of the feature depends on the selection of both the hardware and the software. Note that the feature is not supplied for the several models; hence, the user has to check the implementation for the model. Locate the ordering number and check it at the "G&T position" referring to the comparison table below. For more information, see *Appendix: Ordering*.

Table 3.18-1 Comparative table in respective ordering numbers

Sec.	Feature	Ordering No. at "G&T"					
		BCU			BCPU		IFU
		11	13	1F	2C	2N	19
–	Main features	NA	NA	NA	✓	✓	NA

✓: Applicable NA: Not applicable

3.18.1 Operation and characteristic

The ICD function examines the ratio of a second harmonic current (I2f) to the fundamental current (I1f) in each phase. If the ratio$|I_{2f}|/|I_{1f}|$ is larger than the setting [**ICD-2f**], the ICD function is able to identify the presence of inrush currents. Figure 3.18-1 illustrates the characteristic; the operation region is designated by the hatched area; the operation threshold is set with the [**ICD-OC**].

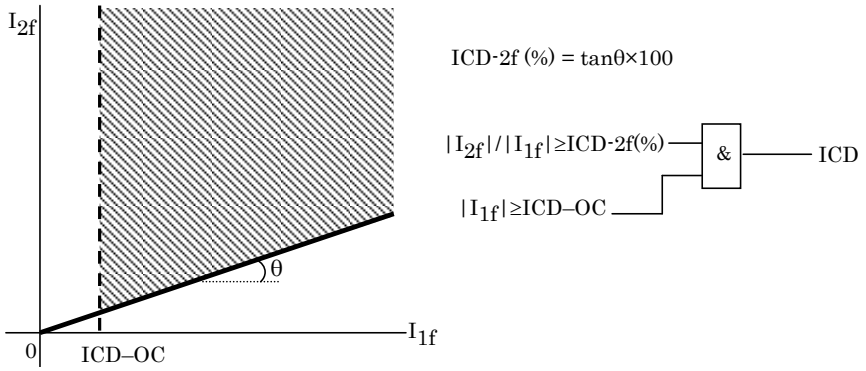


Figure 3.18-1 ICD characteristic and operation region

As shown in Figure 3.18-1, the user should set both the [**ICD-2f**] and [**ICD-OC**] when the second harmonic inrush current should be detected. The user should set **On** for the scheme switch [**ICD-EN**] to enable the ICD operation.

3.18.2 Scheme logic

Figure 3.18-2 illustrates the ICD logic. When second harmonic inrush current is detected, the ICD signal will be received by other protection functional elements.

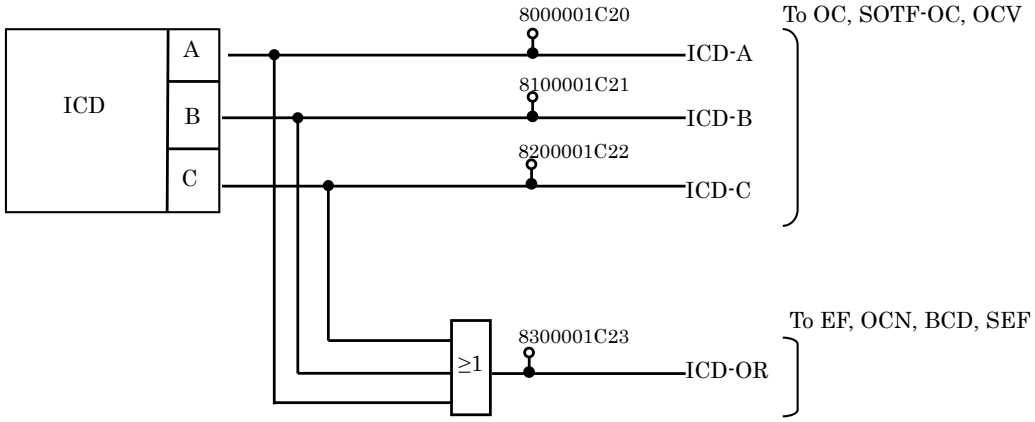


Figure 3.18-2 ICD logic

3.18.3 Setting

Setting of ICD(Function ID: 480001)

Setting item		Range		Units	Contents	Default setting value		Notes
		1A rating	5A rating			1A rating	5A rating	
	ICD-EN	On /Off		–	ICD function enable			
	ICD-2f	10 – 50		%	Second harmonic detection	15%		
	ICD-OC	0.10 – 5.00	0.5 – 25.0	0.01A / 0.1 A	ICD threshold setting	0.10A	0.5A	

3.18.4 Data ID

◆ Signal monitoring point

ICD(Function ID: 480001)

Element ID	Name	Description
8000001C20	ICD-A	ICD relay element operated (phase-A)
8100001C21	ICD-B	ICD relay element operated (phase-B)
8200001C22	ICD-C	ICD relay element operated (phase-C)
8300001C23	ICD-OR	ICD relay element operated (3-phases OR)

3.19 Protection common (PROT_COMMON)

The contact states of the circuit breaker (CB) and the disconnector (DS) provided are grouped in the protection common function (PROT_COMMON) and are used in a number of relay applications to decide conditions. The PROT_COMMON function also examines whether a line is dead (de-energizing), as the PROT_COMMON has an under-voltage detection (UV) relay. The PROT_COMMON function is operated as the common function.

Note: The implementation of the feature depends on the selection of both the hardware and the software. Note that the feature is not supplied for the several models; hence, the user has to check the implementation for the model. Locate the ordering number and check it at the "G&T position" referring to the comparison table below. For more information, see *Appendix: Ordering*.

Table 3.19-1 Comparative table in respective ordering numbers

Sec.	Feature	Ordering No. at "G&T"					
		BCU			BCPU		IFU
		11	13	1F	2C	2N	19
–	Main features	NA	NA	NA	✓	✓	NA

✓: Applicable NA: Not applicable.

3.19.1 Decision of CB open/close status

Circuit-breaker auxiliary-contact is used to state the CB status; a normal-open contact (N/O) and a normal-close contact (N/C) can be furnished in the CB. Thus, as to the phase-A contact of the CB, signals "CB1-A_NO_CONT" and "CB1-A_NC_CONT" can be used to represent the CB status in phase-A (i.e., tripped or closed in phase-A). The PROT_COMM function can decide the CB status using the both signals; the decision generated will be provided for other protection functions so that the IED can operate in accordance with the CB status.

(i) Signal option

As the CB auxiliary-contacts (N/O and/or N/C) may generate the signals, the user should set the rule for the decision. When the N/O signal is generated but the N/C signal is not generated, set **NO** for the scheme switch [**CB1-Contact**] so that the PROT_COMMON function can decide the CB state using only the N/O. Conversely, the decision should be made with only the N/C, **NC** is set for this scheme switch. When both N/O and the N/C used, set **Both** for the scheme switch [**CB1-Contact**].

(ii) Contact supervision

Table 3.19-2 exemplifies the rules between the CB main-contact and the CB auxiliary-contact. Given that the main-contact is open, the N/O is open and the N/C is closed; however if the both are open when the main contact is open, we should decide the information generated in the PROT_COMMON is not true (say, an incorrect signal is generated). The contact supervision can find the inconsistency in the decisions using the rule of Table 3.19-2.

Table 3.19-2 Main and Auxiliary contacts within CB

		Main contact	
		OPEN	CLOSED
Auxiliary contacts	N/O	OPEN	CLOSED
	N/C	CLOSED	OPEN

The user should set **On** for the scheme switch [**CB-SV**] when the operation of the contact supervision feature is required; set the time for the setting [**TCBSV**] to define the monitoring period, which the user can have an option among 0 to 100 sec.

(iii) CB decision logic

Figure 3.19-1 shows the decision logic of the PROT_COMMON and outputs the decision state of the CB: CB-A_CLOSE, CB-B_CLOSE, and others.

For the operation, the user should inject signals of CB states for the following PLC connection points: 'CB1-A NO CONT', 'CB1-A NC CONT' and others. Note that a common point is ready for the CB designed to three-phase tripping: CB1-NO CONT' and 'CB1-NC CONT'.

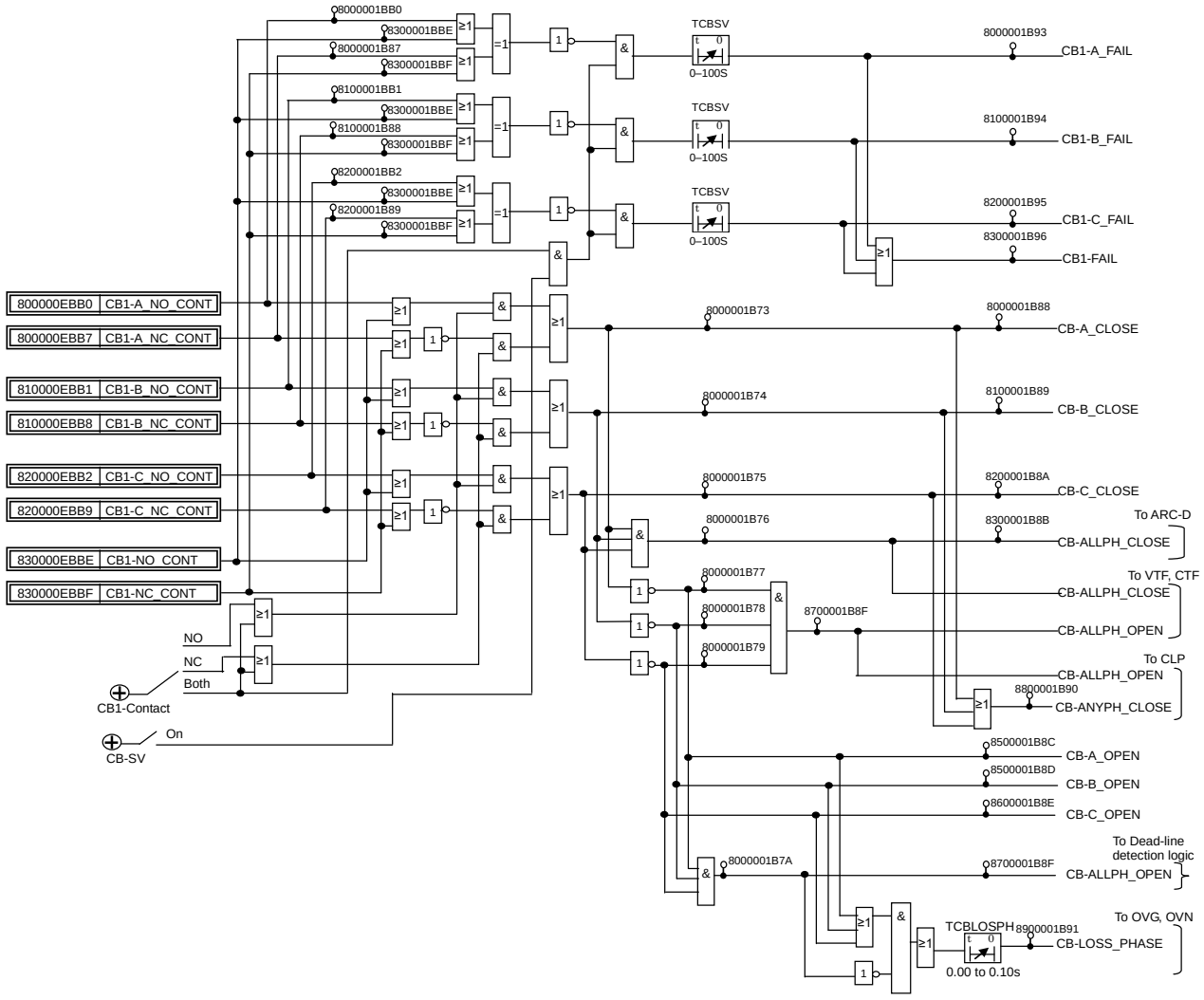


Figure 3.19-1 CB decision logic with supervision feature

3.19.2 Decision of DS open/close status

The PROT_COMMON function can determine the behavior and position status of a DS. Signal configuration and settings for the DS position status are similar to that of the CB. Note that settings and logics cited below are just available for the DS.

(i) Signal selection

Set either **NO**, **NC**, or **Both** for scheme switch [**DS-Contact**].

(ii) Contact supervision

When **Both** is set for scheme switch [**DS-Contact**], the auxiliary switch contact state of the DS is supervised. Set **On** for scheme switch [**DS-SV**] when contact supervision is required. The supervision period has to be set between 0 to 100 seconds for the setting [**TDSSV**].

(iii) Logic

Figure 3.19-2 shows the logic used to determine DS status and generates the output signal of the DS state: DS_CLOSE or DS_OPEN. The supervision scheme logic to supervise the status of the DS auxiliary switch contacts. This scheme logic is applied when **BOTH** is set for the scheme switch [**DS-Contact**]. For the operation, the user should inject signals of DS states for the following PLC connection points: 'DS-NO CONT', 'DS NC CONT' and others.

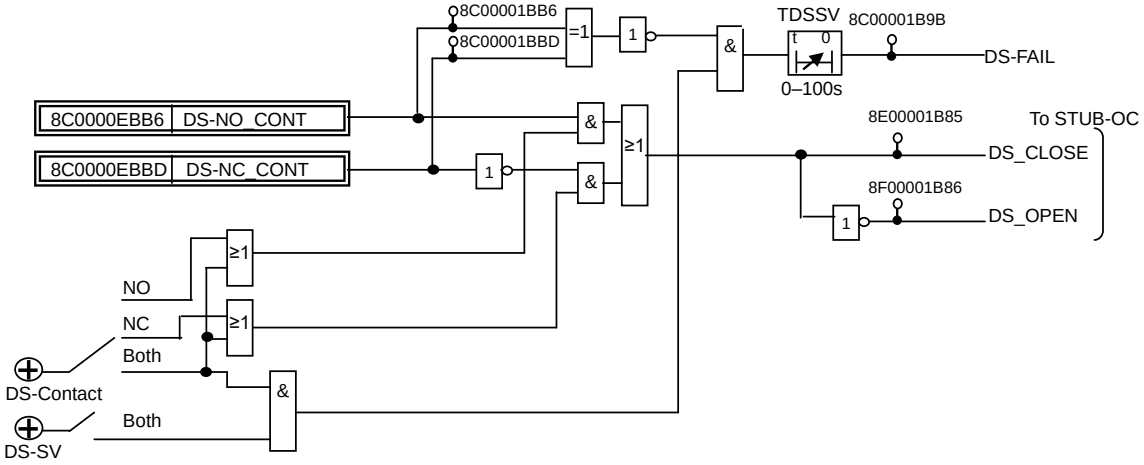


Figure 3.19-2 Scheme logic to determine DS status

3.19.3 Dead line detection

The dead line detection (DLD) determinates whether the line is out-of-service or not. Checking for the voltage existence in three-phase is required when all CBs are closed; hence, the output signal of the DLD is being checked. (2.84.3)

(i) Under-voltage relay

A phase-to-phase (UVLS) element and a phase-to-ground (UVLG) element are provide in the UV relay. Both elements operate when **On** is set for scheme switch [**DLDbyUV**]. (2.84.3.5)

(ii) Decision of CB operation

Deciding the dead line state is carried out by examining the CB position. The user should set **On** for the scheme switch [**DLDbyCB**] for the decision. (2.84.3.2)

(iii) Detection time

The examining period for DLD detection is required to set using the setting [**TDSSV**], the value of the detection time can be set between 0 to 100 seconds. (2.84.3.3)

(iv) Dead line detection logic

Figure 3.19-3 shows the scheme logic for the detection of an under voltage condition. It is also used to determine whether the line is dead or not.

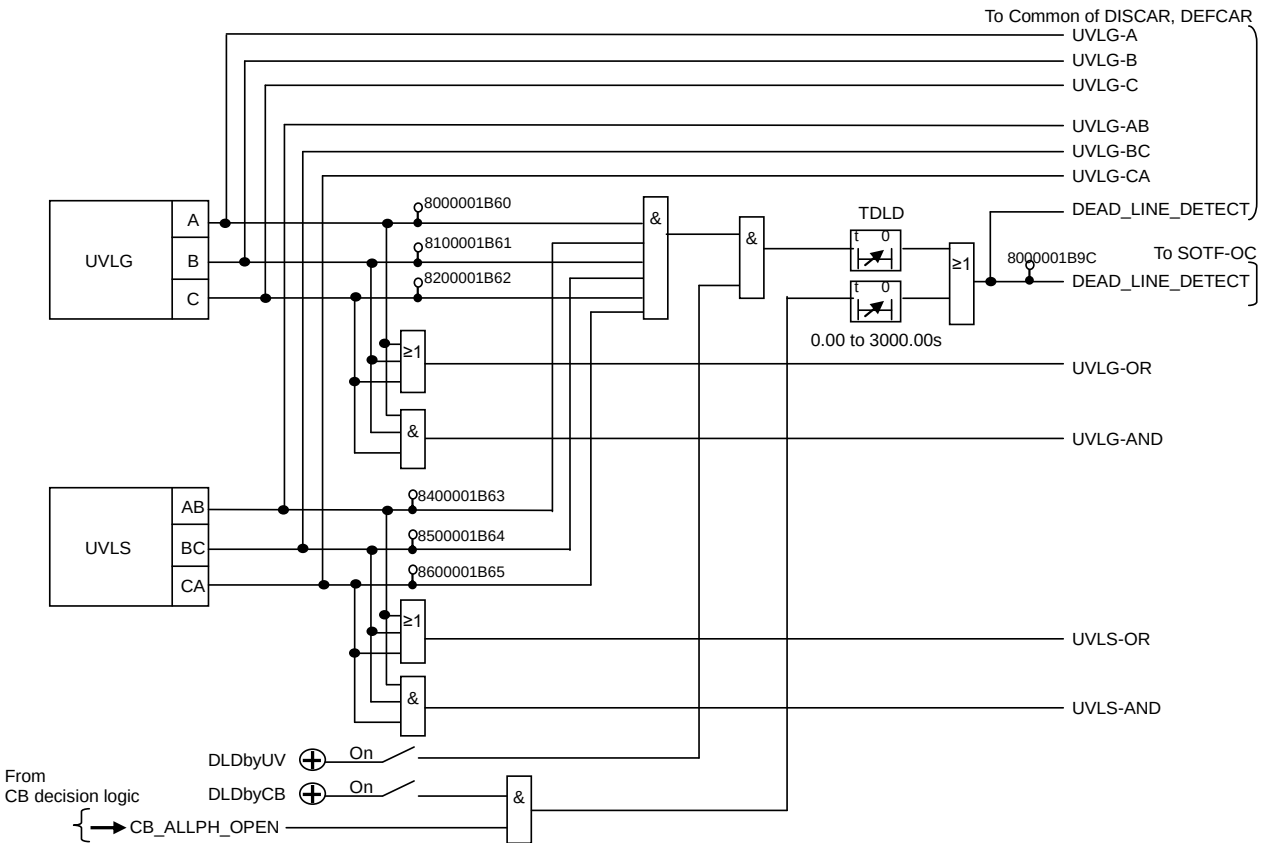


Figure 3.19-3 Dead line detection logic with under voltage relays

3.19.4 Detection of current change (OCD)

(i) Current change detection relay

Suppose that the difference exists between the latest current vector (I_M) and the last current vector (I_N). The OCD function will operate if the difference is larger than the setting. The I_N is measured for the last two-cycles; the difference is decided using Equation (3.19-1):

$$|I_M - I_N| > I_s \qquad (3.19\text{-}1)$$

where a criteria for the decision is given by the pick-up threshold value (I_S).

The pick-up threshold is defined using setting [**OCD**], which is from 0.05 A to 0.20 A at 1 A rating†. At 5 A rating, 0.25 A to 1.00 A is applied.

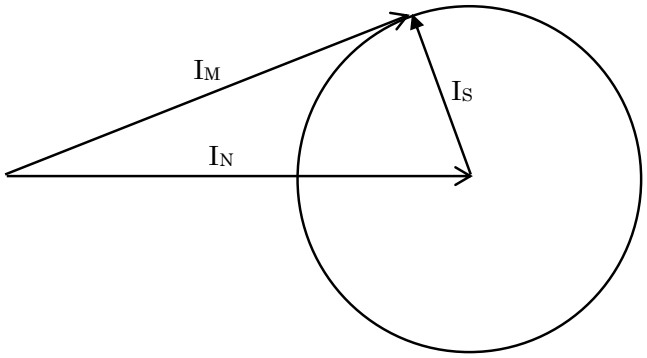


Figure 3.19-4 Current change detection

(ii) OCD logic

Figure 3.19-5 shows the OCD logic and its output signals.

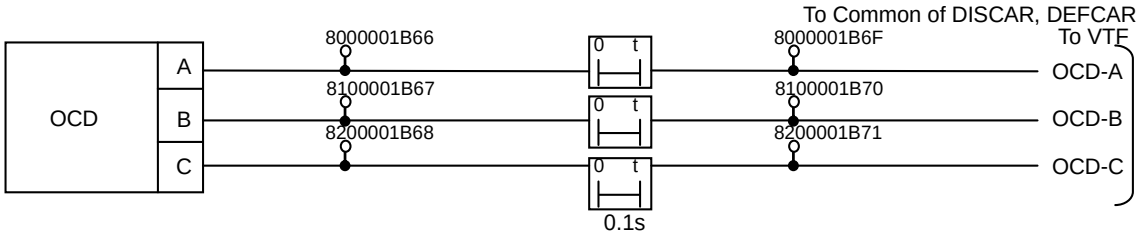


Figure 3.19-5 Scheme logic for current change check

(2.84.4)

3.19.5 Setting

Setting of PROT_COMMON (Function ID: 48A001)

Setting item			Range		Units	Contents	Default setting value		Notes
			1A rating	5A rating			1A rating	5A rating	
		UVLS	5.0 - 130.0		V	UV phase-phase relay operating value	77.0		
		UVLG	5.0 - 130.0		V	UV phase-ground relay operating value	45.0		
		OCD	0.05 - 0.20	0.25 - 1.00	A	OCD relay operating value	0.10	0.50	
	CB	CB1-Contact	NO / NC / Both		-	Normally open contact, Normally closed contact or Both.	NO		
		TCBLOSPH	0.00 – 0.10		s	CB loss phase time	0.03		
		CB-SV	Off / On		-	CB contact supervision enable	Off		
		TCBSV	0 - 100		s	CB contact supervision time	10		
	DS	DS-Contact	NO / NC / Both		-	Normally open contact, Normally closed contact or Both.	NO		
		DS-SV	Off / On		-	DS contact super visor enable	Off		
		TDSSV	0 - 100		s	DS contact super vision time	60		
	Dead-line detection	DLDbyUV	Off / On		-	Dead line detection using under voltage	Off		
		DLDbyCB	Off / On		-	Dead line detection using CB open	Off		
		TDLD	0.00 - 300.00		s	Dead line detection timer	10.00		

3.19.6 Data ID

◆ Signal monitoring point

PROT_COMMON(48A001)

Element ID	Name	Description
8000001B88	CB-A_CLOSE	Main contact closed in phase-A of CB1 and CB2
8400001B8C	CB-A_OPEN	Main contact opening in phase-A of CB1 and CB2
8100001B89	CB-B_CLOSE	Main contact closed in phase-B of CB1 and CB2
8500001B8D	CB-B_OPEN	Main contact opening in phase-B of CB1 and CB2
8200001B8A	CB-C_CLOSE	Main contact closed in phase-C of CB1 and CB2
8600001B8E	CB-C_OPEN	Main contact opening in phase-C of CB1 and CB2
8000001B73	CB1-A_CLOSE	Main contact closed in phase-A of CB1
8000001B93	CB1-A_FAIL	States of the CB1 not to be defined in phase-A
8000001BB7	CB1-A_NC_CONT	Aux normally-close-contact in phase-A of CB1
8000001BB0	CB1-A_NO_CONT	Aux normally-open-contact in phase-A of CB1
2200001BA6	CB1-A_OPCNT	IEC61850 OpCnt of CB1-A in XCBR
8400001B77	CB1-A_OPEN	Main contact opening in phase-A of CB1
3000001B9E	CB1-A_POS	IEC61580 Pos-signal of CB1-A in XCBR of LN
8100001B74	CB1-B_CLOSE	Main contact closed in phase-B of CB1
8100001B94	CB1-B_FAIL	States of the CB1 not to be defined in phase-B
8100001BB8	CB1-B_NC_CONT	Aux normally-close-contact in phase-B of CB1
8100001BB1	CB1-B_NO_CONT	Aux normally-open-contact in phase-B of CB1
2200001BA7	CB1-B_OPCNT	IEC61850 OpCnt of CB1-B in XCBR
8500001B78	CB1-B_OPEN	Main contact opening in phase-B of CB1
3000001B9F	CB1-B_POS	IEC61580 Pos-signal of CB1-B in XCBR of LN
8200001B75	CB1-C_CLOSE	Main contact closed in phase-C of CB1
8200001B95	CB1-C_FAIL	States of the CB1 not to be defined in phase-C
8200001BB9	CB1-C_NC_CONT	Aux normally-close-contact in phase-C of CB1
8200001BB2	CB1-C_NO_CONT	Aux normally-open-contact in phase-C of CB1
2200001BA8	CB1-C_OPCNT	IEC61850 OpCnt of CB1-C in XCBR
8600001B79	CB1-C_OPEN	Main contact opening in phase-C of CB1
3000001BA0	CB1-C_POS	IEC61580 Pos-signal of CB1-C in XCBR of LN
8300001B76	CB1_ALLPH_CLOSE	Main contact closed in three-phases of CB1
8700001B7A	CB1_ALLPH_OPEN	Main contact opening in three-phases of CB1
8300001B96	CB1_FAIL	States of the CB1 not to be defined in three-phase
8300001BBF	CB1_NC_CONT	Aux normally-close-contact in three-phase of CB1
8300001BBE	CB1_NO_CONT	Aux normally-open-contact in three-phase of CB1
2200001BA9	CB1_OPCNT	IEC61850 OpCnt in three-phase of CB1 in XCBR
3000001BA1	CB1_POS	LN Pos-signal of three-phase of CB1 in XCBR
8300001B8B	CB_ALLPH_CLOSE	Three-phase contacts closed in CB
8700001B8F	CB_ALLPH_OPEN	Three-phase contacts not closed in CB
8800001B90	CB_ANYPH_CLOSE	Any one of three-phase contacts closed in CB
8900001B91	CB_LOSS_PHASE	Any one of three-phase contacts opening in CB
8000001B9C	DEAD_LINE_DETECT	Detected the line not being energized
8E00001B85	DS_CLOSE	Main contacts closed in DS
8C00001B9B	DS_FAIL	States of the DS not to be defined
8C00001BBD	DS_NC_CONT	Aux normally-close-contact in DS
8C00001BB6	DS_NO_CONT	Aux normally-open-contact in DS

◆ Signal monitoring point

PROT_COMMON(48A001)

Element ID	Name	Description
8F00001B86	DS_OPEN	Main contact opening in DS
8000001B66	OCD-A	OCD element operated in phase-A
8000001B6F	OCD-AT	Off-delay timer after OCD element in phase-A
8100001B67	OCD-B	OCD element operated in phase-B
8100001B70	OCD-BT	Off-delay timer after OCD element in phase-B
8200001B68	OCD-C	OCD element operated in phase-C
8200001B71	OCD-CT	Off-delay timer after OCD element in phase-C
8000001B60	UVLG-A	UVLG element operated in phase-A
8900001B6B	UVLG-AND	UVLG elements operated in three-phase
8100001B61	UVLG-B	UVLG element operated in phase-B
8200001B62	UVLG-C	UVLG element operated in phase-C
8800001B6A	UVLG-OR	Any UVLG element operated in three-phases
8400001B63	UVLS-AB	UVLS elements operated in phase-AB
8D00001B6D	UVLS-AND	UVLS elements operated in three-phase
8500001B64	UVLS-BC	UVLS elements operated in phase-BC
8600001B65	UVLS-CA	UVLS elements operated in phase-CA
8C00001B6C	UVLS-OR	Any UVLS element operated in three-phase

◆ Connection point on PLC logic

PROT_COMMON(48A001)

Element ID	Name	Description
800000EBB7	CB1-A_NC_CONT	CB1-A normally close contact
800000EBB0	CB1-A_NO_CONT	CB1-A normally open contact
810000EBB8	CB1-B_NC_CONT	CB1-B normally close contact
810000EBB1	CB1-B_NO_CONT	CB1-B normally open contact
820000EBB9	CB1-C_NC_CONT	CB1-C normally close contact
820000EBB2	CB1-C_NO_CONT	CB1-C normally open contact
830000EBBF	CB1_NC_CONT	CB1 normally close contact
830000EBBE	CB1_NO_CONT	CB1 normally open contact
8C0000EBBD	DS_NC_CONT	DS normally close contact
8C0000EBB6	DS_NO_CONT	DS normally open contact

3.20 VT failure detection (VTF)

If a failure occurs on the secondary circuit in the voltage transformer (VT), the operation in relays cannot be obtained properly because the relays do not measure voltages correctly. Therefore, the VT failure detection (VTF) function is provided to block operating the relays upon occurrence of the VT failure. Accordingly, if a VT failure is detected by the VTF function, an alarm signal is issued for the relays upon occurrence of the VT failure. Accordingly, an alarm signal is issued if a VT failure is detected by the VTF function; a detection signal by the VTF function blocks operating the relay for the voltage monitor [1].

After the disappearance of the VT failure, the VTF function can take account of the VT secondary circuit being in healthy condition in the three-phase; the operation of the VTF function is reset[2]. Thus, the blocked relays are allowed to operate again. Incidentally, issuing the VTF alarm is automatically removed and then the user can find resetting the VTF alarm.

[1]Note: The VTF function can block the operation in several relays, but it does not block the operation in other relays. To know the blocking, refer sections of the respective protection functions.

[2]Note: The user can programmable the operation using the setting and the PLC signals.

(2.62.0)

Note: The implementation of the feature depends on the selection of both the hardware and the software. Note that the feature is not supplied for the several models; hence, the user has to check the implementation for the model. Locate the ordering number and check it at the "G&T position" referring to the comparison table below. For more information, see *Appendix: Ordering*.

Table 3.20-1 Comparative table in respective ordering numbers

Sec.	Feature	Ordering No. at "G&T"					
		BCU			BCPU		IFU
		11	13	1F	2C	2N	19
–	Main features	NA	NA	NA	✓	✓	NA
3.20.6	PLC driver	NA	NA	NA	✓	✓	NA

✓: Applicable NA: Not applicable

3.20.1 VTF features

The VTF function has three relay elements in order to decide the failure in the VT; hence two criterions (i.e., for VTF1 and VTF2) exist to detect the failure in the VT.

(i) Phase-to-earth under voltage element (UVVTF)

For the VTF1 function, the under-voltage element (UVVTF) monitors the under voltage. The threshold of the UVVTF relay is set using the [**UVVTF**].

(ii) Earth fault overcurrent element (EFVTF)

For the VTF2 function, the earth fault overcurrent element (EFVTF) monitors the overcurrent in zero-sequence. The threshold of the EFVTF relay is set using the [**EFVTF**].

(iii) Earth fault overvoltage element (OVGVTF)

For the VTF2 function, the earth fault overvoltage element (OVGVTF) monitors the over voltage in zero-sequence. The threshold of the OVGVTF relay is set the using [**OVGVTF**].

(iv) Detection criterion for the VTF1

The criterion for the VTF1 function is defined when the UVVTF relay operates whereas the OCD relay does not operate.

(v) Detection criterion for the VTF2

The criterion for the VTF2 function is defined when both the EFVTF relay and the OCD relay are not operated whereas the OVGVTF relay is operated.

3.20.2 Operation for the VTF function

When the VTF function detects the failure, issuing the VTF1_DETECT signal is continuing regardless of the operation of the OCD relay, provided **On** is set for both the [**VTF1EN**] and the [**VTF2EN**]. Issuing the VTF2_DETECT signal is also continuing regardless of the operation of both the OCD and the EFVTF relays. Note that issuing the VTF_DETECT signal is cleared when the operations of the UVVTF relay and the OVGVTF relay are reset.

However, nonetheless the OCD/EFVTF relay is still running after the VTF detection, issuing the VTF_DETECT signal is cleared, provided **OPT-On** is set for the settings [**VTF1-EN**] and the [**VTF2EN**].

When issuing the VTF_DETECT signal continues longer than ten seconds, the signal VTF_DETCT clears to generate the VTF_ALARM signal.

3.20.3 VTF Logic

Figure 3.20-1 shows the logics of the VTF function. As described earlier, the VT failure is grouped into the VTF1 criterion (VTF1_DETECT) and the VTF2 criterion (VTF2_DETECT). When we consider the VTF1 criterion, the upper logic in Figure 3.20-1 is used; whereas we consider the VTF2 criterion, lower one is used.

The user can select either the VTF1 or VTF2 criteria using the using the scheme switch [**VTF1EN**] or [**VTF2EN**].

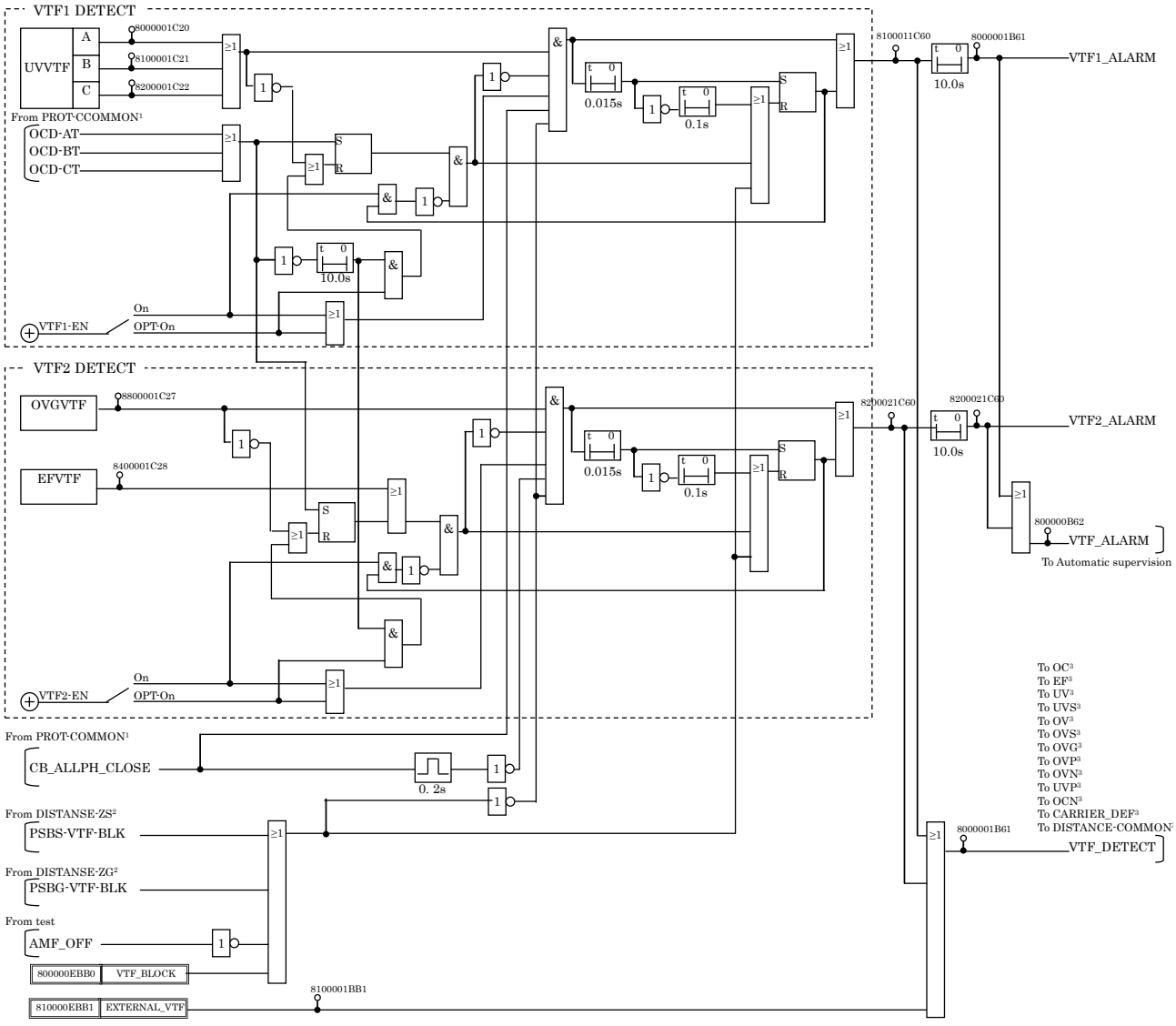


Figure 3.20-1 Scheme logic in the VTF function

[1]Note: Signal CB_ALLPH_CLOSE is provided from Protection common function (PROT_COMMON). The OCD relay is used for both the VTF1 DETECT and the VTF2 DETECT. For more information, see Chapter *Relay application: Protection common*.

[2]Note: Entering signals coming from distance protections (ZS/ZG) are available if the ZS/ZG protections are provided in the IED. For more information with regard to

the ZS/ZG protections, see Chapter *Relay application: Distance protection,* when available.

[3]Note: Output signals are provided for respective relays when the relays are available. See *Appendix: Ordering* whether the relays are supplied into the IED.

[4]Note: AMF feature is used for the test. To generate the AMF signal, see chapter *User interface: test-submenu*.

If a PLC signal is injected at the PLC connection point "VTF_BLOCK", the operation of the VTF function is blocked. The user can program to inject an external signal for the failure detection using the PLC connection point EXTERNAL_VTF; the VTF_DETECT signal is generated when the signal is injected at the EXTERNAL_VTF. (2.62.1)

3.20.4 Setting

Setting of VTF(Function ID: 490001)

Setting item			Range		Units	Contents	Default setting value		Notes
			1A rating	5A rating			1A rating	5A rating	
VTF	VTF 1	VTF1-EN	Off / On / OPT-On		-	VTF1 enable	On		
		UVVTF	1.0 - 220.0		V	Phase under voltage level for VTF1 detection	20.0		
	VTF 2	VTF2-EN	Off / On / OPT-On		-	VTF2 enable	On		
		OVGVTF	1.0 - 220.0		V	Zero phase over voltage level for VTF2 detection	20.0		
		EFVTF	0.10 - 50.00	0.50 - 250.00	A	Zero phase over current level for VTF2 detection block	0.20	1.00	

3.20.5 Data ID

◆ Signal monitoring point

VTF(Function ID: 490001)

Element ID	Name	Description
8400001C2B	EFVTF	EFVTF relay element operated
8100001BB1	EXTERNAL VTF	External VTF receive
8800001C27	OVGVTF	OVGVTF relay element operated
8000001C20	UVVTF-A	UVVTF relay element operated(Phase-A)
8100001C21	UVVTF-B	UVVTF relay element operated(Phase-B)
8200001C22	UVVTF-C	UVVTF relay element operated(Phase-C)
8000001B62	VTF ALARM	VTF alarm (VTF1 ALARM/VTF2 ALARM OR)
8000001B61	VTF DETECT	VTF detected (VTF1 DET/VTF2 DET OR)
8100011C61	VTF1 ALARM	VTF1 alarm (10s timer)
8100011C60	VTF1 DET	VTF1 detected
8200021C61	VTF2 ALARM	VTF2 alarm (10s timer)
8200021C60	VTF2 DET	VTF2 detected

◆ Connection point on PLC logic

VTF(Function ID: 490001)

Element ID	Name	Description
800000EBB0	VTF BLOCK	VTF block signal
810000EBB1	EXTERNAL VTF	External VTF receive

3.20.6 PLC driver

◆ Connection point at PLC Driver

PLC_DRV (Function ID: 230301) to VTF (Function ID: 490001)

PLC Driver	Element ID	to	Destination	PLC connection point
PMX3_12_6	8E10061BB6	→	VTF BLOCK	800000EBB0
PMX3_12_7	8F10061BB7	→	EXTERNAL VTF	810000EBB1

3.21 CT failure detection (CTF)

If a failure occurs on the secondary circuit in the current transformer (CT), the operation in relays cannot be obtained properly because the relays do not measure incoming currents correctly. Therefore, the CT failure detection (CTF) function is provided to block operating the relays[1] upon occurrence of the CT failure. Accordingly, an alarm signal is issued if a CT failure is detected by the CTF function; a detection signal by the CTF function blocks operating the relay for the current monitor[1].

After the disappearance of the CT failure, the CTF function can take account of the CT secondary circuit being in healthy condition in the three-phase; the operation of the CTF function is reset[2]. Thus, the blocked relays are allowed to operate again. Incidentally, issuing the CTF alarm is automatically removed and then the user can find resetting the CTF alarm.

[1]Note: The CTF function can block the operation in several relays, but it does not block the operation in other relays. To know the blocking, refer sections of the respective protection functions.

[2]Note: The user can programmable the operation using the setting and the PLC signals.

(2.63.0)

Note: The implementation of the feature depends on the selection of both the hardware and the software. Note that the feature is not supplied for the several models; hence, the user has to check the implementation for the model. Locate the ordering number and check it at the "G&T position" referring to the comparison table below. For more information, see *Appendix: Ordering*.

Table 3.21-1 Comparative table in respective ordering numbers

Sec.	Feature	Ordering No. at "G&T"					
		BCU			BCPU		IFU
		11	13	1F	2C	2N	19
–	Main features	NA	NA	NA	✓	✓	NA
3.21.6	PLC driver	NA	NA	NA	✓	✓	NA

✓: Applicable NA: Not applicable

3.21.1 CTF features

The CTF function has two relay elements in order to decide the failure in the CT; hence two criterions exist to detect the failure in the CT in the CTF function.

(i) Earth fault overcurrent element (EFCTF)

The earth fault overcurrent element (EFCTF) monitors the zero-sequence current for the failure in the CT. The threshold of the EFCTF element is set using the [**EFCTF**].

(ii) Earth fault overvoltage element (OVGCTF)

The earth fault overvoltage element (OVGCTF) monitors the zero-sequence voltage for the failure in the CT. The OVGCTF element is set using the [**OVGCTF**].

(iii) Detection criterion (CTF_DETECT)

When the EFCTF element operates whereas the OVGCTF element does not operate, the detection criterion (CTF_DETECT) is applied.

3.21.2 Operation for the CTF function

When the CTF function detects the failure, issuing the CTF_DETECT signal is continuing regardless of the operation of the OVGCTF relay, provided **On** is set for the scheme switch [**CTF-EN**]. Issuing the CTF _DETECT is continued until the operation of the EFCTF relay is reset.

However, nonetheless the OVGCTF relay is still running after the CTF detection, issuing the CTF_DETECT signal is cleared, provided **OPT-On** is set for the scheme switch [**CTF-EN**].

When issuing the CTF_DETECT signal continues longer than ten seconds, the signal CTF_DETECT clears to generate the CTF_ALARM signal.

3.21.3 Scheme logic

Figure 3.21-1 shows the logic of the CTF function. CTF_DET signal is issued when the EFCTF element is running and the OVGCTF element is not running.

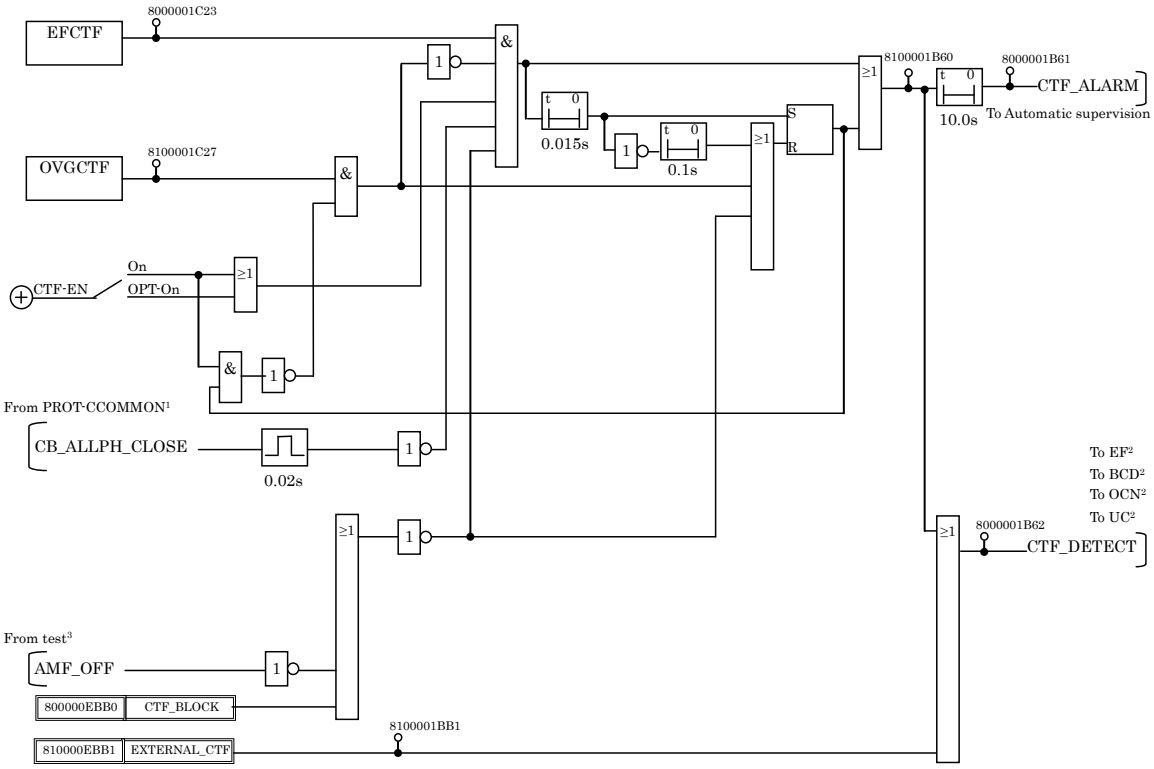


Figure 3.21-1 Scheme logic in the CTF function

[1]Note: Signal CB_ALLPH_CLOSE is provided from Protection common function (PROT_COMMON). For more information, see Chapter *Relay application: Protection common*.

[2]Note: Output signals are provided for respective relays when the relays are available. See *Appendix: Ordering* whether the relays are supplied into the IED.

[3]Note: AMF feature is used for the test. To generate the AMF signal, see chapter *User interface: test-submenu*.

If a PLC signal is injected at the PLC connection point "CTF_BLOCK", the operation of the CTF function is blocked. The user can program to inject an external signal for the failure detection using the PLC connection point EXTERNAL_CTF; the CTF_DETECT signal is generated when the signal is injected at the EXTERNAL_CTF.

3.21.4 Setting

Setting of CTF(Function ID: 491001)

Setting item		Range		Units	Contents	Default setting value		Notes
		1A rating	5A rating			1A rating	5A rating	
CTF	CTF-EN	Off / On / OPT-On		-	CTF enable	On		
	EFCTF	0.10 - 50.00	0.50 - 250.00	A	Zero phase over current level for CTF detection	0.20	1.00	
	OVGCTF	1.0 - 220.0		V	Zero phase over voltage level for CTF detection block	20.0		

3.21.5 Data ID

◆ Signal monitoring point

CTF(Function ID: 491001)

Element ID	Name	Description
8000001B61	CTF ALARM	CTF alarm operated
8100001B60	CTF DET	CTF det
8000001B62	CTF DETECT	CTF detect
8000001C23	EFCTF	EFCTF relay element operated
8100001BB1	EXTERNAL CTF	External CTF receive
8100001C27	OVGCTF	OVGCTF relay element operated

◆ Connection point in PLC logic

CTF(Function ID: 491001)

Element ID	Name	Description
800000EBB0	CTF BLOCK	CTF block signal
810000EBB1	EXTERNAL CTF	External CTF receive

3.21.6 PLC driver

◆ Connection point at PLC Driver

PLC_DRV (Function ID: 230301) to CTF (Function ID: 491001)

PLC Driver	Element ID	to	Destination	PLC connection point
PMX3_13_0	8010061BB8	→	CTF BLOCK	800000EBB0
PMX3_13_1	8110061BB9	→	EXTERNAL CTF	810000EBB1

3.22 Single-end fault locator (FL)

The function of the single-end fault locator (FL) is to determine the location of faults that occur on a transmission line with a high degree of reliability. Determination of the location of faults provides a useful contribution to the recovery of circuits in the event of power system failures. Fault location is provided by the FL function; computation is based on impedance-based algorithms using information at the local end of the line only.

Note: The implementation of the feature depends on the selection of both the hardware and the software. Note that the feature is not supplied for the several models; hence, the user has to check the implementation for the model. Locate the ordering number and check it at the "G&T position" referring to the comparison table below. For more information, see *Appendix: Ordering*.

Table 3.22-1 Comparative table in respective ordering numbers

Sec.	Feature	Ordering No. at "G&T"					
		BCU			BCPU		IFU
		11	13	1F	2C	2N	19
–	Main features	NA	NA	NA	✓	✓	NA
–	PLC driver	NA	NA	NA	NA	NA	NA

✓: Applicable NA: Not applicable

3.22.1 Computation method

The FL calculation requires more than three cycles of power system information to determine the location of the fault. The FL calculation uses a reference current (I_f') obtained by measuring the change in the current before and after the occurrence of a fault. The reference current (I_f') removes the influence of load current (I_L) and arc voltage.

The accuracy† of the FL calculation is influenced by both the line impedance (Z) and the fault current (I_f). Thus, the user should note that the FL computation maintains an accuracy of better than ± 2.5 km (1.6 mile) for the distance GF shown in Figure 1.1-1 for up to 100km (62 mile)‡ of the length of the line regardless of the setting of the length of the line GH (0 to 500 km (310 mile)). The accuracy of the FL calculation is better than ± 2.5% when the fault is located 100 km to 500 km from the FL function, provided that the length of the line GH is between 100 km to 500 km.

The FL calculation runs separately for phase-to-phase faults and earth-faults. Hence, the selection of algorithm depends upon the type of fault that occurs.

†Note: Both line impedance and rated-current affect the accuracy of the FL computation. If the VCT is set for 1 ampere rated-current operation, the accuracy of the FL computation can be maintained provided that the ratio of the reactance of the series-impedance per unit-length is greater than 0.05, provided that the fault current that flows is greater than 2 ampere on the secondary side of the CT circuit. For the VCT being set for 5 ampere rated-current, the same FL accuracy can be kept when the ratio of the reactance of the series-impedance per-unit-length is greater than 0.01, provided that the fault current that flows is greater than 10 ampere. For more information on the rated-current of the VCT, see chapter *Technical description: Transformer module*.

‡Note: In order to maintain the accuracy of the FL computation, the user can use compensation factors when unbalanced impedances are occurred in the transmission line. (2.66.1.0)

(i) Equations for earth faults

Figure 3.22-1 shows an earth fault occurring in phase-a on transmission line GH. The fault distance (GF = χ) can be determined using the following equations:

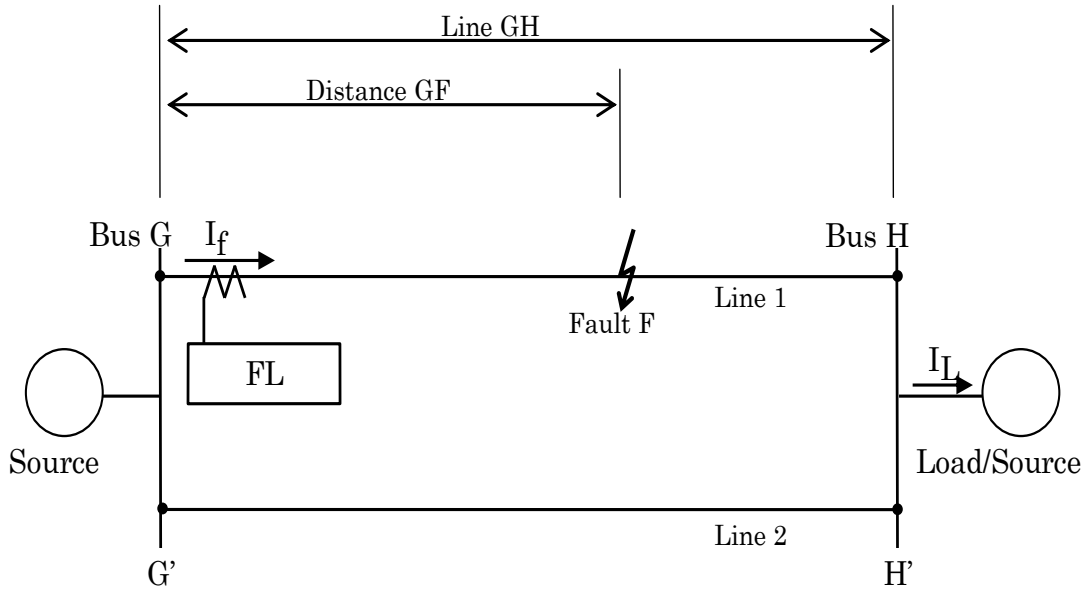


Figure 3.22-1 Relationship between fault location and local IED in parallel line

$$I_\alpha = \frac{2I_a - I_b - I_c}{3} \quad (3.22\text{-}1)$$

$$I_\alpha' = \frac{2I_a - I_b - I_c}{3} - \frac{2I_{La} - I_{Lb} - I_{Lc}}{3} \quad (3.22\text{-}2)$$

$$\chi = \frac{\mathrm{Im}(V_a \cdot I_\alpha'') \times L}{\{\mathrm{Im}(R_1 \cdot I_\alpha \cdot I_\alpha'' + R_0 \cdot I_{0s} \cdot I_\alpha'') + \mathrm{Re}(X_1 \cdot I_\alpha \cdot I_\alpha'' + X_0 \cdot I_{0s} \cdot I_\alpha'')\} \times K_a} \quad (3.22\text{-}3)$$

where,

V_α:	Fault voltage (=V_{a0})
I_α:	Fault current
I_α':	Current change before and after fault occurrence
Iα":	Complex conjugate of Iα'
I_a, I_b, I_c:	Fault currents in phase-'a', phase-'b', and phase-'c'
I_{La}, I_{Lb}, I_{Lc}:	Load currents in phase-'a', phase-'b', and phase-'c'
I_{0s}:	Zero-sequence current on the local line i.e. 'Line 1'
R_1:	Resistance component of positive-sequence self-impedance (Z_1), [**FL_R1**]
X_1:	Reactance component of positive-sequence self-impedance (Z_1), [**FL_X1**]
R_0:	Resistance component of zero-sequence self-impedance (Z_0), [**FL_R0**]
X_0:	Reactance component of zero-sequence self-impedance (Z_0), [**FL_X0**]
K_a:	Compensation factor for phase-'a' in an unbalanced 3-phase line,

[**FL_Ka**]

Im( ): Imaginary part when a value is placed in parentheses

Re( ): Real part when a value is placed in parentheses

L: Length of line GH in kilometers or miles, [**FL_line_km**] / [**FL_line_mile**]

・: Symbol of Vector product

Equation (3.22-3) is used generally when the transmission lines are treated as having lumped constants. The user should consider the influence of the distributed capacitance of the transmission line. Therefore, when the distance to the fault (GF) is greater than 100km (62 mile), the FL computation introduces another fault distance (GF = χ") using Equation (3.22-4).

$$\chi'' = \chi - k^2 \times \frac{\chi^3}{3} \qquad (3.22\text{-}4)$$

where,

k: Propagation constant is pre-fixed by the manufacturer of the transmission line. (k=0.001km^{-1}).

(ii) Equation for phase-to-phase faults

When the occurrence of a phase-'b'-to-phase-'c' fault is considered, the distance to the fault (GF = χ) is computed using the following equations:

$$I_{bc} = I_b - I_c \qquad (3.22\text{-}5)$$

$$V_{bc} = V_b - V_c \qquad (3.22\text{-}6)$$

$$I_f' = I_{bc} - (I_{Lb} - I_{Lc}) \qquad (3.22\text{-}7)$$

$$\chi = \frac{Im(V_{bc} \cdot I_f'') \times L}{\{Re(R_1 \cdot I_{bc} \cdot I_f'') + Im(X_1 \cdot I_{bc} \cdot I_f'')\} \times K_{bc}} \qquad (3.22\text{-}8)$$

where,

I_f': Current change before and after fault occurrence

I_f'': Complex conjugate of I_f'

I_{bc}: Fault current in phase-'b'-to-phase-'c'

V_{bc}: Fault voltage in phase-'b'-to-phase-'c'

I_{Lb}, I_{Lc}: Load currents in phase-'b' and phase-'c' before fault occurrence

K_{bc}: Compensation factor for phase-bc in an unbalanced 3-phase line, [**FL_Kbc**]

・: Symbol of Vector product

Equation (3.22-8) is a general expression used when the transmission lines are treated

as having lumped constants; Equation (3.22-8) is sufficient to compute the fault distance (GF = χ) for faults that occur within 100km (62 mile) of the length of the transmission line. When the fault distance is greater than 100km (62 mile), Equation (3.22-4) is used to obtain a compensated value for the fault distance (GF = χ''). (2.66.1.2)

3.22.2 Output of FL computation on display

Although the display screens and operations in the standard IED are discussed separately in the Chapter *Recording function*, the display screen for the FL function is described here because the FL output is unique compared to that of the standard display screens. Figure 3.22-2 shows an example of the FL display screen.

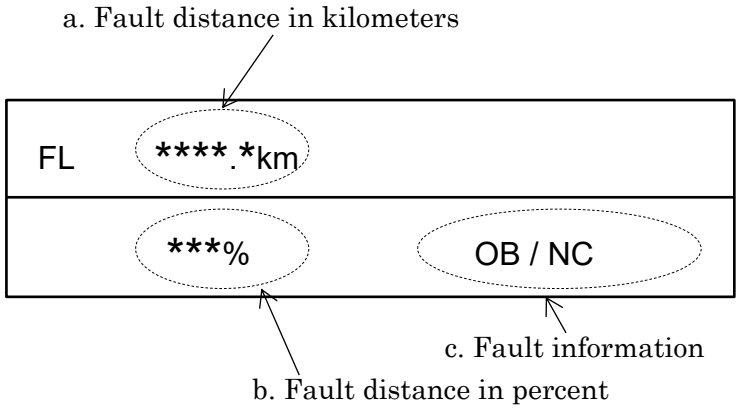


Figure 3.22-2 FL information in km and percent (%) on the screen

Note: If there is an error in the setting information with regard to the length of the transmission line, the FL computation does not start (a dash sign "—" is displayed on the screen).

(i) Fault distance expressed in kilometers or miles

The fault distance can be displayed in the user-preferred unit† (see Figure 3.22-2.a). Additionally, the FL computation does not output the fault distance until a trigger signal‡ has been removed for the FL function.

†Note: The user should note that the fault distance is based on the location of the local IED (see Figure 3.22-1). Figure 3.22-2 is shown in kilometers, but the user can change that so that the fault distance is expressed in miles. The setting is discussed later. (See section 3.22.3(iv))

‡Note: We shall discuss the trigger signal in the succeeding section.

(ii) Fault distance in percentage

The user can view the fault distance as a percentage value (see Figure 3.22-2.b).

As shown in Figure 3.22-1, a single IED is located near Bus G. When a fault (F) occurs on the line GH, the fault distance (GF) is calculated in percent using the following equation.

$$\text{Fault distance (\%)} = \frac{\text{Distance to fault F}}{\text{Length of Line GH}} \times 100 \qquad (3.22\text{-}9)$$

(iii) Fault information

Detailed information is displayed along with the distance to the fault (see Figure 3.22-2.c). The output of the FL information is simplified by means of notations; these are summarized in Table 3.22-2.

Table 3.22-2 Notation of fault information on screen

Fault info. notation	Meaning	Comment
OB	Outside boundary	The FL function determines a fault location as being outside of the boundary. The boundary is defined with setting [**FL_Line_km**] or [**FL_Line_mile**].
NC	No convergence†	If a number of computation results are scattered, the FL function will select one of the resulting values from where the scattering is minimal.

†Note: The FL function can determine the convergence in the computation when the difference between the maximum value and the minimum value is less than 0.2 km. For the convergence decision, the values are calculated three times: a value calculated for the current samples, a value three samples prior to the current samples and a value six samples prior to the current samples. (2.66.2)

3.22.3 Setting and operation

To run the FL function, the user must provide several setting items: the direction for which the fault location is required, the mode selection for impedance settings, the impedances† of the local and adjacent lines, imbalance-impedances and compensation factors, distance-unit for the FL function, and others.

†Note: For impedance settings, the user should convert the primary values to secondary values with regard to the line VT and CT. Set impedances as total-impedances; do not set impedances as impedance per distance-unit.

(i) Impedance setting using symmetrical components

Provided the self-impedances and the mutual-impedances are symmetrically balanced (that is,

$Z_{aa}=Z_{bb}=Z_{cc}$ and $Z_{ab}=Z_{bc}=Z_{ca}$), then symmetrical setting is applicable. If the impedance unbalances cannot be ignored, the user shall set a compensation factor (section (i)-4) or use a matrix setting (section (ii)).The following equations are used to acquire the zero-sequence and positive-sequence impedances.

$$Z_1 = \frac{Z_{aa} + Z_{bb} + Z_{cc} - (Z_{ab}+Z_{bc} + Z_{ca})}{3} \qquad (3.22\text{-}10)$$

$$Z_0 = \frac{Z_{aa} + Z_{bb} + Z_{cc} + 2(Z_{ab} + Z_{bc} + Z_{ca})}{3} \qquad (3.22\text{-}11)$$

where,

Z_1:	Positive-sequence series-impedance
Z_0:	Zero-sequence series-impedance
Z_{aa}, Z_{bb}, Z_{cc}:	Self-impedances for each phase conductor
Z_{ab}, Z_{bc}, Z_{ca}:	Mutual-impedances between phases

(i)-1 Selection of symmetrical setting mode

Prior to setting, the user should set the scheme switch [**FL_ImpSet**] to **Symmetrical**.

(i)-2 Setting zero-sequence impedance

With regard to the zero-sequence-impedance (Z_{0GH}), the user should set the value of resistance for setting [**FL_R0**] and the value of reactance for setting [**FL_X0**]. (See Figure 3.22-1)

(i)-3 Setting positive-sequence impedance

With regard to the positive-sequence-impedance (Z_{1GH}), the user should set the value of resistance for setting [**FL_R1**] and the value of reactance for setting [**FL_X1**]. (See Figure 3.22-1)

(i)-4 Setting compensation factors

Set 100% for the settings when the impedance unbalances can be ignored in each of phases. If the self- and mutual-impedances are unbalanced, then the user should adjust the FL results using compensation factors expressed using Equations (3.22-12) to (3.22-17) below. The user can set the values of the compensation factors using settings [**FL_Kab**] to [**FL_Kc**] in the symmetrical setting mode.

$$K_{ab} = \frac{\frac{Z_{aa} + Z_{bb}}{2} - Z_{ab}}{Z_1} \quad (3.22\text{-}12)$$

$$K_{bc} = \frac{\frac{Z_{bb} + Z_{cc}}{2} - Z_{bc}}{Z_1} \quad (3.22\text{-}13)$$

$$K_{ca} = \frac{\frac{Z_{cc} + Z_{aa}}{2} - Z_{ca}}{Z_1} \quad (3.22\text{-}14)$$

$$K_{a} = \frac{Z_{aa} - \frac{Z_{ab} + Z_{ca}}{2}}{Z_1} \quad (3.22\text{-}15)$$

$$K_{b} = \frac{Z_{bb} - \frac{Z_{bc} + Z_{ab}}{2}}{Z_1} \quad (3.22\text{-}16)$$

$$K_{c} = \frac{Z_{cc} - \frac{Z_{ca} + Z_{bc}}{2}}{Z_1} \quad (3.22\text{-}17)$$

(ii) Impedance setting using matrix components

With regard to Figure 3.22-1, when the voltage and current on a transmission line can be expressed using matrix components, the user can select the following matrix setting:

$$\begin{bmatrix} V_a \\ V_b \\ V_c \end{bmatrix} = \begin{bmatrix} Z_{aa} & Z_{ab} & Z_{ac} \\ Z_{ba} & Z_{bb} & Z_{bc} \\ Z_{ca} & Z_{cb} & Z_{cc} \end{bmatrix} \begin{bmatrix} I_a \\ I_b \\ I_c \end{bmatrix} \quad (3.22\text{-}18)$$

where,

Z_{aa}: Phase-'a' self-impedance on line GH ($=Z_{bb}=Z_{cc}$)

Z_{ab}: Mutual-impedances between phase-'a' and phase-'b' on line GH ($=Z_{bc}=Z_{ca}$)

(ii)-1 Selection of matrix setting mode

Prior to applying the matrix settings, the user should set the scheme switch [**FL_ImpSet**] **Matrix**.

(ii)-2 Setting self-impedances

With regard to the self-impedances, the user should set the resistance of the self-impedances for settings [**FL_Raa**], [**FL_Rbb**] and [**FL_Rcc**] and set the reactance of the self-impedances for settings [**FL_Xaa**], [**FL_Xbb**] and [**FL_Xcc**].

(ii)-3 Setting mutual-impedances

With regard to setting the mutual-impedances, the user should set the resistance of the mutual-impedance for settings [**FL_Rab**], [**FL_Rbc**] and [**FL_Rca**] and set the reactance of the mutual-impedances for settings [**FL_Xab**], [**FL_Xbc**], and [**FL_Xca**].

(ii)-4 Setting compensation factors

If imbalanced impedances are considered, Equations (3.22-10) and (3.22-11) are used to acquire the zero-sequence and positive-sequence impedances. The calculations are executed internally by the FL function; thus, the user does not need to consider them in the matrix setting mode.

(iii) Assumption of fault direction

The user can select the direction for the FL computation to be in either the forward or the reverse direction. When the forward direction is selected, other protection elements related to the FL computation should have the same direction If the user selects the reverse direction, other corresponding functions should have the reverse direction. Otherwise, the FL computation will fail to start.

Figure 3.22-3 illustrates the relationship between the location of faults relative to the direction of FL computations. The user should set the scheme switch [**FL_Dir**] **Forward** if the fault location computation is required for faults that occur in the forward direction. Conversely, set [**FL_Dir**] **Reverse** if the fault location computation is required for faults that occur in the reverse direction.

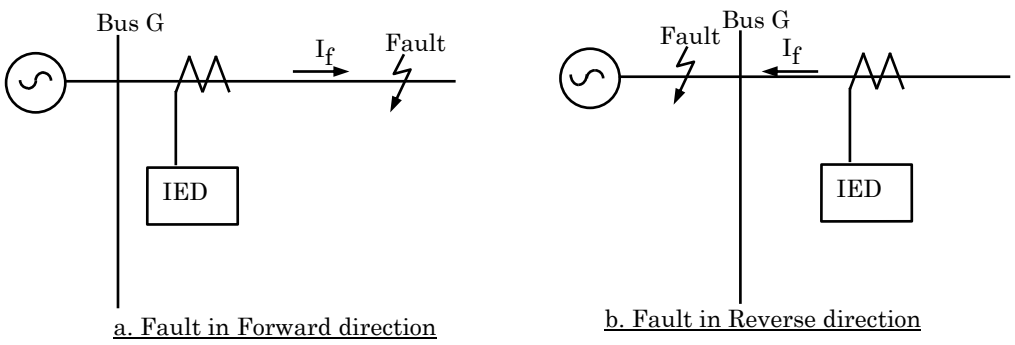


Figure 3.22-3 Forward fault and reverse fault

Table 3.22-3 Setting [FL_DIR] corresponding to the setting of OC and other relay elements

Direction of the relay (OC element etc)	Scheme switch [FL_DIR]
Forward	**Forward**
Reverse	**Reverse**
Non-dir	**Forward / Reverse**

(iv) Setting the unit of length/distance

As shown in Figure 3.22-2, the fault location is displayed in kilometers when **km** is set for scheme switch [**FL_Unit**]. On the other hand, if the preference is to display the fault location in miles, the user should set **mile** for the scheme switch [**FL_Unit**]. In the case that **km** is set using scheme switch [**FL_Unit**], the user can apply a value to set the line length using [**FL_Line_km**]. In the case that **mile** is selected in setting [**FL_Unit**], the value of setting [**FL_Line_mile**] is used to apply the line length value.

(v) Setting of FL execution

The FL computation is ready when **On** is set for setting [**FL_EN**].

3.22.4 Scheme logic

Figure 3.22-4 shows the trigger signals for FL data recording and computation. The elements of the overcurrent protection function, (OC) output signals when their respective elements operate. As it is necessary to match the direction of both the FL calculation and the elements of the protection functions, the user must set the direction of the protection elements and the direction of the FL computation to be the same.

The trigger signals are provided by the following functions: (a) Over current protection function and (b) External protection function. With regard to the signals from external protection function, the user is allowed to program triggers for data-saving and calculation using Data IDs. The following Data IDs (i.e. PLC connection points) are provided in order that the trigger is able to initiate the start of the FL calculation.

Data ID “FL_RecF” and “FL_RecR”: Trigger for data save

Data ID “FL_LocF” and “FL_LocR”: Trigger for of calculation

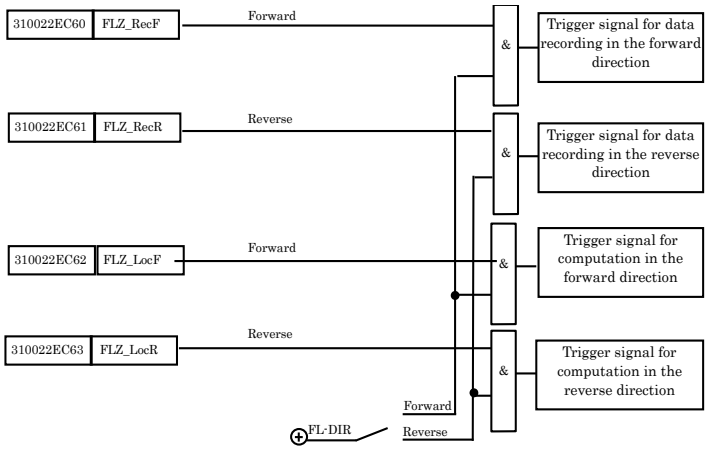


Figure 3.22-4 Trigger signals from OC function and PLC

3.22.5 Setting

Setting of FL-Z (Function ID: 495001)

Setting item		Range		Units	Contents	Default setting value		Notes
		1A rating	5A rating			1A rating	5A rating	
Switch	FL_EN	Off / On		—	Fault locator enable	On		
	FL_Dir	Forward / Reverse		—	Selection of the direction for fault location	Forward		
	FL_ImpSet	Symmetrical / Matrix		—	Selection in the setting mode for impedance	Symmetrical		
	FL_Unit	km / mile		—	Selection of line length unit	km		
Line1_Element	FL_Line_km	0.0 – 500.0		km	Line length (km)	50.0		
	FL_line_mile	0.0 – 310.0		mi	Line length (mile)	0		
	FL_Xaa	0–1000	0–200	Ω	Reactance component of line (Xaa)	10.5	2.1	
	FL_Xbb	0–1000	0–200	Ω	Reactance component of line (Xbb)	10.5	2.1	
	FL_Xcc	0–1000	0–200	Ω	Reactance component of line (Xcc)	10.5	2.1	
	FL_Xab	0–1000	0–200	Ω	Reactance component of line (Xab)	0.5	0.1	
	FL_Xbc	0–1000	0–200	Ω	Reactance component of line (Xbc)	0.5	0.1	
	FL_Xca	0–1000	0–200	Ω	Reactance component of line (Xac)	0.5	0.1	
	FL_Raa	0–1000	0–200	Ω	Resistance component of line (Raa)	1.1	0.21	
	FL_Rbb	0–1000	0–200	Ω	Resistance component of line (Rbb)	1.1	0.21	
	FL_Rcc	0–1000	0–200	Ω	Resistance component of line (Rcc)	1.1	0.21	
	FL_Rab	0–1000	0–200	Ω	Resistance component of line (Rab)	0.1	0.01	
	FL_Rbc	0–1000	0–200	Ω	Resistance component of line (Rbc)	0.1	0.01	
	FL_Rca	0–1000	0–200	Ω	Resistance component of line (Rac)	0.1	0.01	
	FL_X1	0–1000	0–200	Ω	Reactance component of line positive sequence impedance	10	2	
	FL_R1	0–1000	0–200	Ω	Resistance component of line positive sequence impedance	1	0.2	
	FL_X0	0–1000	0–200	Ω	Reactance component of line zero sequence impedance	34	6.8	
	FL_R0	0–1000	0–200	Ω	Resistance component of line zero sequence impedance	3.5	0.7	
	FL_Kab	50–150		%	Impedance imbalance compensation factors	100		
	FL_Kbc	50–150		%	Impedance imbalance compensation factors	100		
	FL_Kca	50–150		%	Impedance imbalance compensation factors	100		
	FL_Ka	50–150		%	Impedance imbalance compensation factors	100		
	FL_Kb	50–150		%	Impedance imbalance compensation factors	100		
	FL_Kc	50–150		%	Impedance imbalance compensation factors	100		

3.22.6 Data ID

◆ Signal monitoring point

FL-Z (Function ID: 495001)

Element ID	Name	Description
8000101349	FLTFLAG	Fault locator update flag
3100101348	FLTLOOP	Fault loop
3100101005	FLTQUALITY	Quality of fault locator

◆ Connection point on PLC logic

FL-Z (Function ID: 495001)

Element ID	Name	Description
310002EC62	FL_LOCF	Fault locate start signal (forward)
310002EC63	FL_LOCR	Fault locate start signal (Reverse)
310002EC60	FL_RECF	Record start signal (forward)
310002EC61	FL_RECR	Record start signal (reverse)

3.23 Trip circuit (TRC-D)

The trip circuit (TRC-D) scheme will issue a trip command to the circuit breaker (CB) when it receives trip signals from the protection functions (which are identified with 'FC18', 'FC19', etc. to represent OC, EF relay, etc.). The TRC-D function can also receive an alternate trip signal generated by an additional relay external to the IED using PLC connection points via the binary IO module (BIO)†. If the additional relay can provide a check-signal to condition tripping, increased reliability can be achieved within the IED when using the check-signal as an input to the TRC-D logic (i.e., fail-safe operation is realized by the operation of the additional relay).

Note: The implementation of the feature depends on the selection of both the hardware and the software. Note that the feature is not supplied for the several models; hence, the user has to check the implementation for the model. Locate the ordering number and check it at the "G&T position" referring to the comparison table below. For more information, see *Appendix: Ordering*.

Table 3.23-1 Comparative table in respective ordering numbers

Sec.	Feature	Ordering No. at "G&T"					
		BCU			BCPU		IFU
		11	13	1F	2C	2N	19
–	Main features	NA	NA	NA	✓	✓	NA
–	PLC driver	NA	NA	NA	NA	NA	NA

✓: Applicable NA: Not applicable

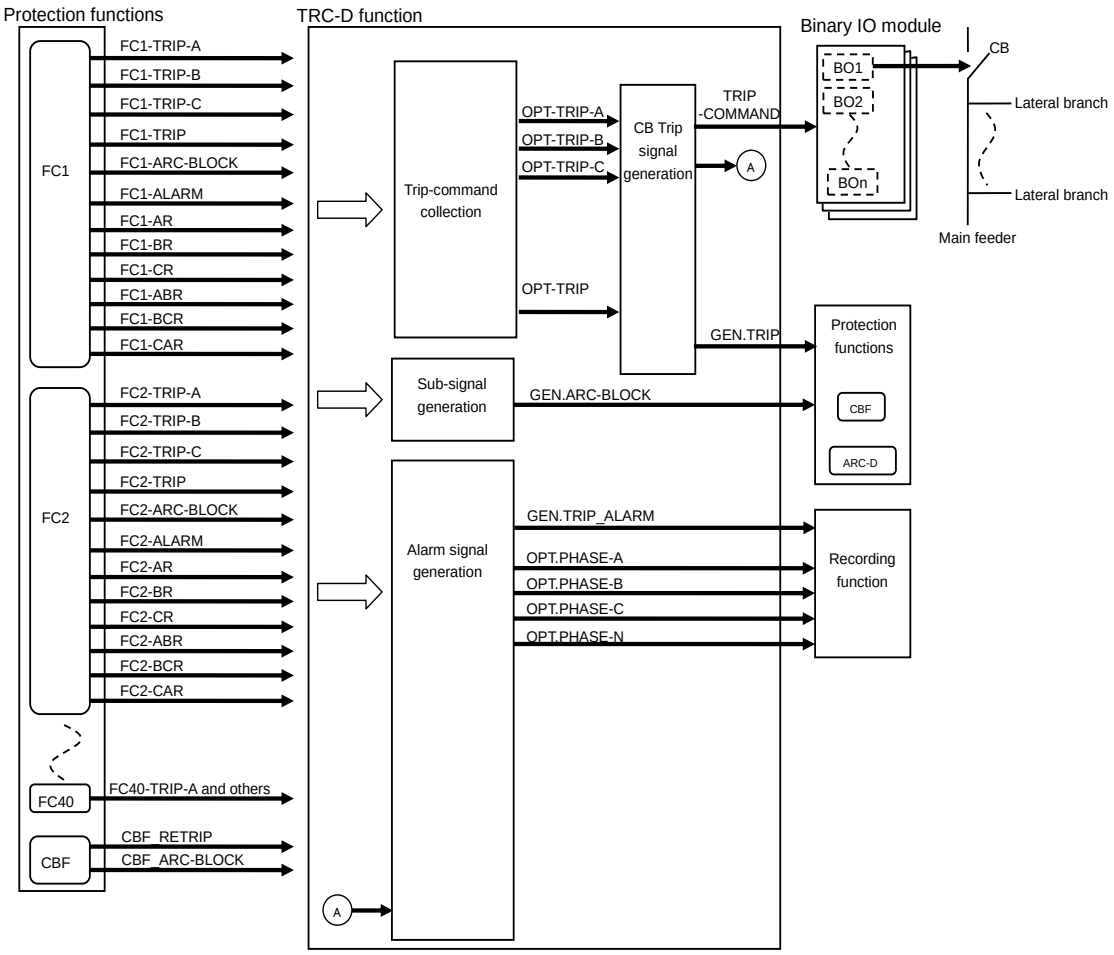


Figure 3.23-1 TRC-D block diagram

Figure 3.23-1 shows that the function is made with following logics:

Collection: The signals, received from the various protection functions (shown as 'FC18' and others; see Table 3.23-2 and Table 3.23-4), are gathered in the Trip-command collection logic.

Generation: CB trip signal generation, Sub-signal generation for blocking ARC§, and Alarm-signal generation logics are provided.

A binary output (BO†) circuit must be selected in order to energize the trip coil of the CB. That is, the user should make the connection between the CB trip coil and the BO; the drive signal should be outputted (i.e., 'TRIP COMMAND' †). The Alarm-signal generation logic operates to provide a trigger signal for the recording function‡.

†Note:The internal connection between the TRC-D function and the BIO should be performed in the BIO settings or the PLC programming. As the PLC monitoring point "TRIP COMMAND" is designated using Element ID '8300001B78', the user must program it for a preferred BO circuit using the settings [**Input signal1**] to [**Input signal8**] for each BO and for each binary IO module. The externally wired

connection between the BIO module and trip coil circuit is made at the IED terminals. For more information with regard to the BO circuit concerning the Element ID (Data ID), see Chapter *Technical description: Binary IO module*.

§Note: ARC and CBF functions are discussed separately. See Chapter *Relay application*.

‡Note: For information on recording, see *Chapter Recording function*.

3.23.1 Command for tripping CB and signal to block reclosing CB

The TRC logic is designed to issue a three-pole trip command for any fault. Table 3.23-2 shows the receipt of trip signals in the TRC function. Note that the three-pole trip command 'TRIP-COMMAND' is generated even if a single-phase fault occurs.

Table 3.23-2 Trip/ARC block signal inputs to the TRC function

Protection function number (FC*)	Trip and ARC-block signals provided by the protection functions							
	Signal origin (Protection relay)	FC*_OPT_						
		TRIP-A	TRIP-B	TRIP-C	TRIP (3-pole)	ARC-BLOCK	Note	
1	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.		
2	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.		
3	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.		
4	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.		
5	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.		
6	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.		
7	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.		
8	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.		
9	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.		
10	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.		
11	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.		
12	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.		
13	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.		
14	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.		
15	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.		
16	SOTF-OC	–	–	–	X	X		
17	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.		
18	OC	–	–	–	X	X		
19	EF	–	–	–	X	X		
20	OCN	–	–	–	X	X		
21	UC	–	–	–	X	X		
22	THM	–	–	–	X	X		
23	BCD	–	–	–	X	X		
24	OCV	–	–	–	X	X		
25	OV	–	–	–	X	X		
26	OVS	–	–	–	X	X		
27	OVG	–	–	–	X	X		
28	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.		
29	OVN	–	–	–	X	X		
30	UV	–	–	–	X	X		
31	UVS	–	–	–	X	X		
32	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.		
33	FRQ	–	–	–	X	X		
34	DFRQ	–	–	–	X	X		
35	SEF	–	–	–	X	X		
36	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.		
37	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.		
38	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.		
39	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.		
40	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.		

Note: 'N.A.' represents 'Not available for the IED', 'X' represents a 'Valid signal for the

TRC function', '–' represents an 'Invalid signal for the TRC function'. '**FC*_OPT_TRIP**' represents a three-pole trip command. 'ARC-BLOCK' represents a signal used to block the operation of the ARC function; the 'ARC-BLOCK' signal is transferred to the autoreclose function (ARC). Incidentally, the term 'FC*' represents one of the relay elements connected to the TRC function.

The TRC logic can accept a re-trip signal from the CBF function and an ARC-BLOCK signal, as shown in Table 3.23-3.

Table 3.23-3 Signals coming from CBF function

Protection function	Signals issued in the CBF		Note
	CBF1_RETRIP	**CBF1_ARC-BLOCK**	
CBF	X	X	

Note: 'X' represents a Valid signal for the TRC'. The 'CBF1_ARC-BLOCK' signal is grouped with the 'FC*_OPT_ARC-BLOCK' signal in the Sub-signal generation scheme.

3.23.2 Recording identifiers for respective fault types

Table 3.23-4 shows the signals that indicate the respective relay element that has operated when a fault is detected. These identifiers are generated in the respective protection function (relay elements) and are transferred to the recording function.

Table 3.23-4 Recording identifiers for relay operating elements for different faults

FC *	Identifier for relay element operated for each fault							
	Signal origin (Protection relay)	FC*_OPT_						
		ALARM	AR Phase-A faulted	BR Phase-B faulted	CR Phase-C faulted	ABR Phase-AB faulted	BCR Phase-BC faulted	CAR Phase-CA faulted
1	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
2	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
3	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
4	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
5	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
6	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
7	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
8	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
9	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
10	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
11	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
12	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
13	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
14	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
15	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
16	SOTF-OC	X	X	X	X	–	–	–
17	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
18	OC	X	X	X	X	–	–	–
19	EF	X	–	–	–	–	–	–
20	OCN	X	–	–	–	–	–	–
21	UC	X	X	X	X	–	–	–
22	THM	X	–	–	–	–	–	–
23	BCD	X	–	–	–	–	–	–
24	OCV	X	X	X	X	–	–	–
25	OV	X	X	X	X	–	–	–
26	OVS	X	–	–	–	X	X	X
27	OVG	X	–	–	–	–	–	–
28	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
29	OVN	X	–	–	–	–	–	–
30	UV	X	X	X	X	–	–	–
31	UVS	X	–	–	–	X	X	X
32	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
33	FRQ	X	–	–	–	–	–	–
34	DFRQ	X	–	–	–	–	–	–
35	SEF	X	–	–	–	–	–	–
36	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
37	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
38	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
39	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
40	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.

Note: 'X' represents a 'Valid signal' for recording. '–' is left blank.

3.23.3 Scheme logic

(i) Trip-command collection

Trip-command grouping gathers the trip signals provided by each protection function and groups them to the trip operation commands “OPT-TRIP”, “OPT-TRIP-A”, “OPT-TRIP-B”, and “OPT-TRIP-C” for trip-signal generation, as shown in Figure 3.23-2.

The TRC-D logic has PLC connection points, which the user can program for issuing the trip command. For example, if the user wishes to trip the CB using signals generated by external relays, the signals can be connected to the TRC-D logic using the following PLC connection points: TRIP-A_ADD, TRIP-B_ADD, TRIP-C_ADD and TRIP_ADD.

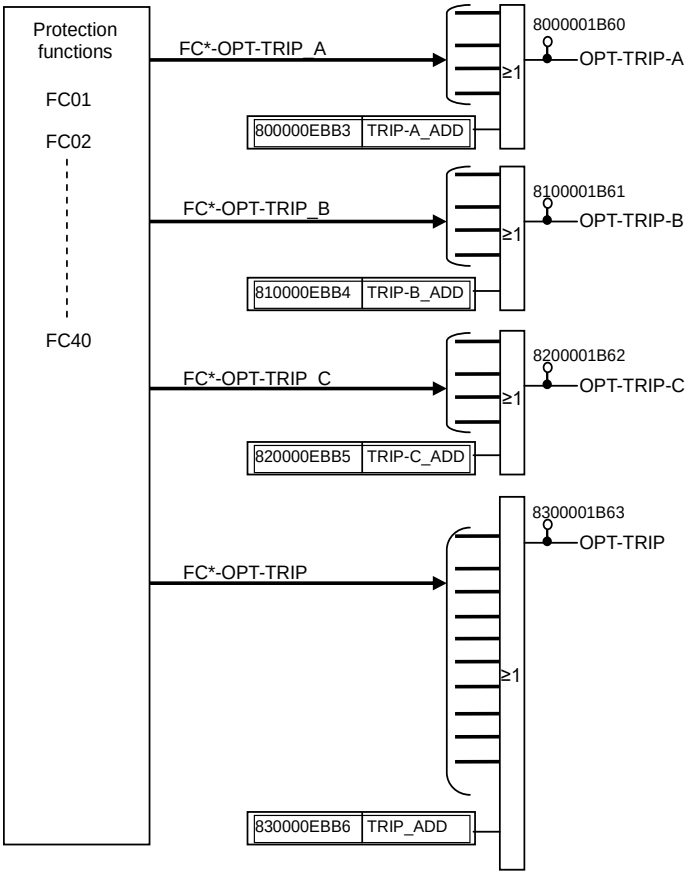


Figure 3.23-2 Scheme logic for Trip-command collection

(ii) General-trip-signal production

Figure 3.23-3 illustrates the trip-signal generation logic within the TRC-D logic. The user can program the generation of a trip signal using the PLC connection point “ADD_OPT_COM”, when trip signals are not available from the relay functions.

The “GEN.TRIP” signal is transferred to the ARC-D function to initiate the reclose operation of the CB.

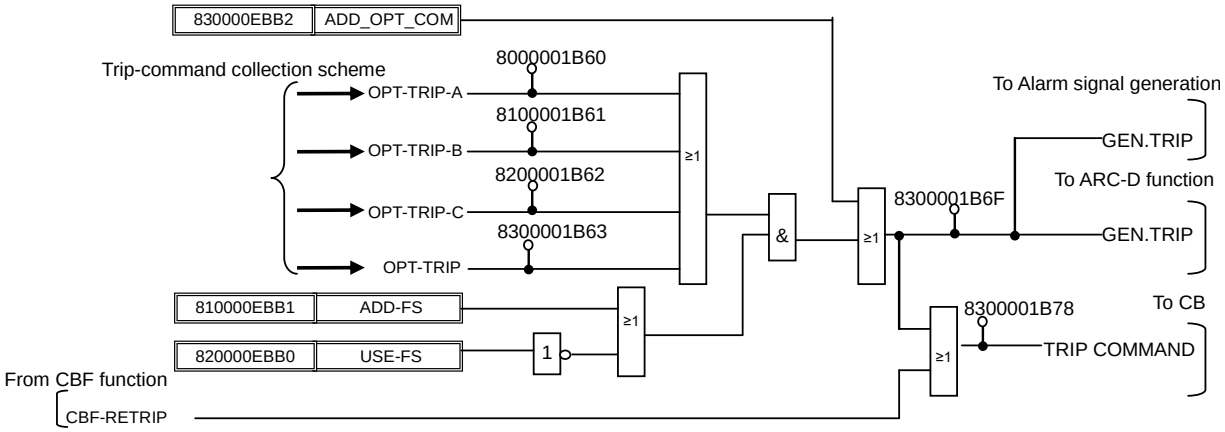


Figure 3.23-3 Logic for general trip and CB trip signal

(ii)-1 Acquisition of fail-safe signal provided externally

If an external relay is available to provide a fail-safe check for the internal operation of the IED, and the user wishes to use the output of the external relay in order to enhance the reliability of tripping further, then the PLC connection points 'ADD-FS' and 'USE-FS' can be used in the Trip-signal generation scheme. That is, the external check signal is connected at the 'ADD-FS' point; the 'On/Off' state of the external relay should also be connected using 'USE-FS'.

(ii)-2 Acquisition of external trip command

As the PLC connection point 'ADD_OPT_COM' is provided, the TRC function can accept a trip command that is generated externally.

(iii) CB trip signal production

As illustrated in Figure 3.23-3, the 'TRIP COMMMAND' signal is transferred to trip coils of the CB when the signals "OPT-TRIP-A, -B, and -C" or "OPT-TRIP" enter into the TRC-D function.

Table 3.23-5 Output signals for CB

Output signals	Usage of signals
TRIP-COMMMAND	CB trip in three-phase

(iv) Sub-signal generation

In a similar way to Trip-command collection, the Sub-signal generation scheme groups the blocking signals for ARC-D operation; it groups them into "GEN.ARC-BLOCK" as shown in Figure 3.23-4. A block signal from the CBF function is also integrated into the "GEN.ARC-BLOCK"; then it is transferred to the ARC-D function.

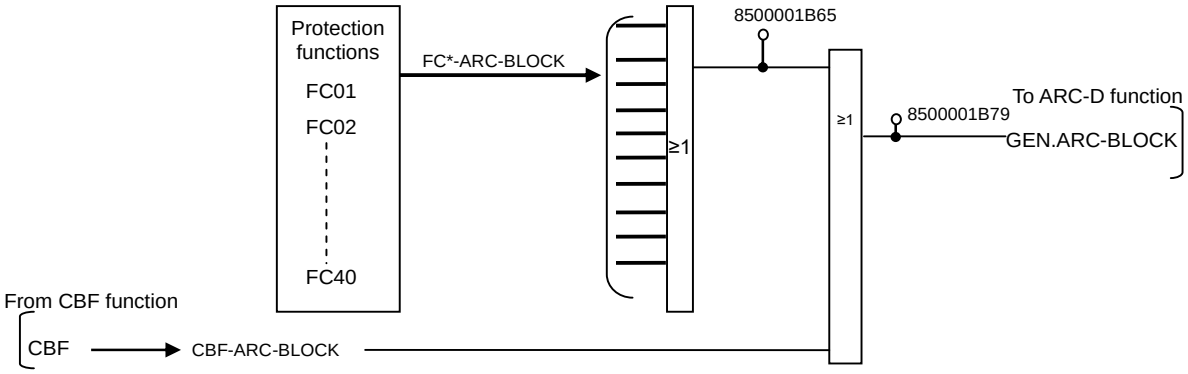


Figure 3.23-4 Scheme logic for Sub-signal generation

(v) Alarm signal generation

Figure 3.23-5 shows the alarm-signal grouping scheme within the TRC-D logic. The following signals are generated for the recording functions outside the TRC-D logic: OPT.PHASE-A, OPT.PHASE-B, OPT.PHASE-C, OPT.PHASE-N, and GEN.TRIP_ALARM.

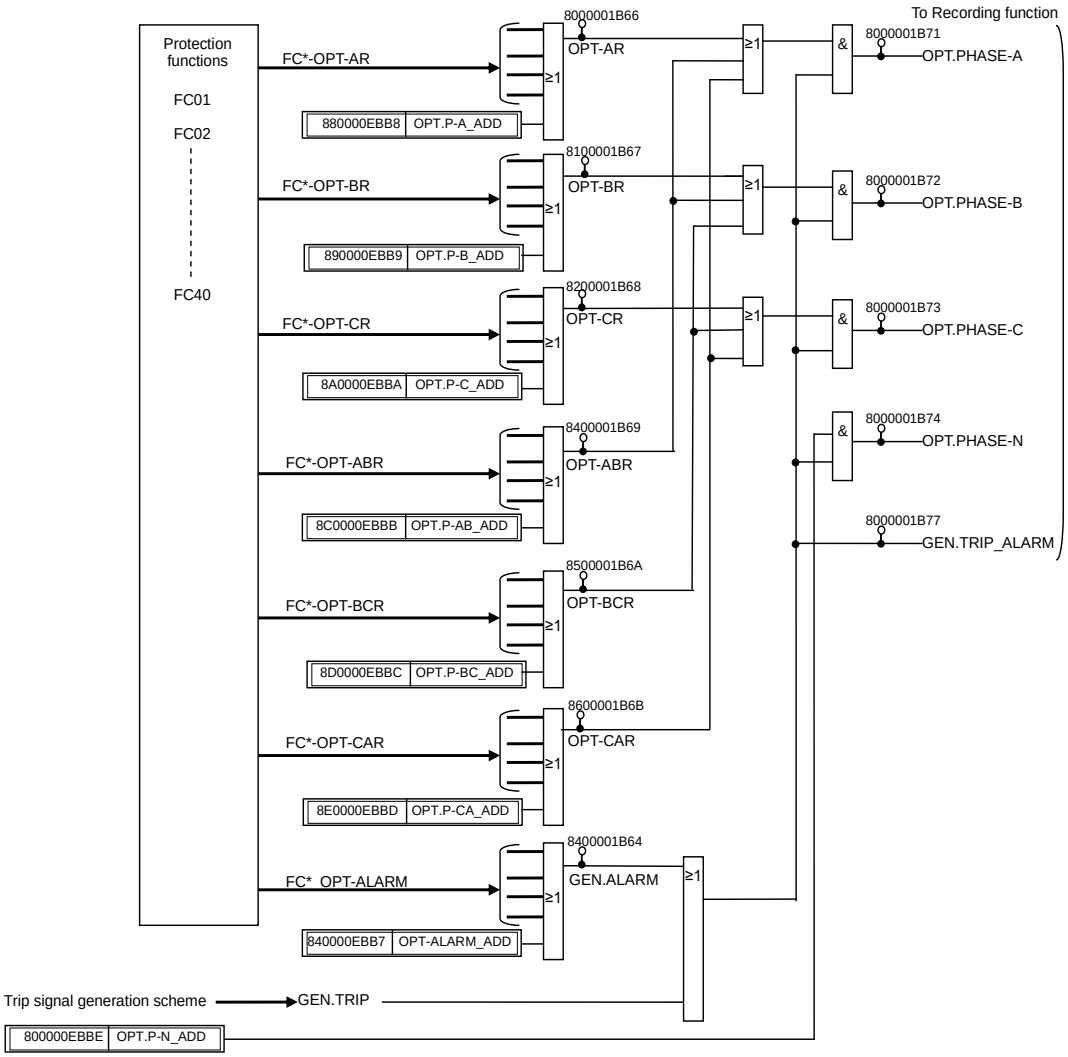


Figure 3.23-5 Scheme logic for Alarm-signal generation

When an additional relay, external to the IED is utilized, an alarm signal can be provided, indicating for example a Line-to-Line (LL) fault and others. If the user wishes to record the alarm, then PLC connection points 'OPT.P-A_ADD' and others can be used. If the additional relay is designed to operate for a ground fault, use the alternative PLC connection point 'OPT.P-N_ADD'

3.23.4 Setting

(No setting items exist)

3.23.5 Data ID

◆ Signal monitoring points

TRC-D (Function ID: 4A1001)

Element ID	Name	Description
8000001B60	OPT-TRIP-A	Trip operation phase-A
8100001B61	OPT-TRIP-B	Trip operation phase-B
8200001B62	OPT-TRIP-C	Trip operation phase-C
8300001B63	OPT-TRIP	Trip operation three-phase
8400001B64	GEN.ALARM	Alarm signals generated for recording
8500001B65	OPT-ARC-BLOCK	Signal to block the ARC operation generated by the protection functions
8000001B66	OPT-AR	Alarm signal phase-A for recording
8100001B67	OPT-BR	Alarm signal phase-B for recording
8200001B68	OPT-CR	Alarm signal phase-C for recording
8400001B69	OPT-ABR	Alarm signal phase-AB for recording
8500001B6A	OPT-BCR	Alarm signal phase-BC for recording
8600001B6B	OPT-CAR	Alarm signal phase-CA for recording
8300001B6F	GEN.TRIP	Trip signal generated for recording
8000001B71	OPT.PHASE-A	Alarm signal for recording 'Phase-A operated in relay'
8100001B72	OPT.PHASE-B	Alarm signal for recording 'Phase-B operated in relay'
8200001B73	OPT.PHASE-C	Alarm signal for recording 'Phase-C operated in relay'
8300001B74	OPT.PHASE-N	Alarm signal for recording 'Phase-N operated in relay'
8000001B77	GEN.TRIP_ALARM	Alarm signal generated for recording
8300001B78	TRIP COMMAND	Command to energize the circuit breaker trip-coil
8500001B79	GEN.ARC-BLOCK	Signal to block the ARC operation with the protection functions and CBF

◆ Connection points in PLC logic

TRC-D (Function ID: 4A1001)

Element ID	Name	Description
820000EBB0	USE_FS	Introduction of the result of the check relay (fail-safe) existing externally
810000EBB1	ADD_FS	Reception of the result signal of the check relay (fail-safe)
830000EBB2	ADD_OPT_COM	Reception of manual tripping
800000EBB3	TRIP-A_ADD	Reception for tripping in phase-A additionally
810000EBB4	TRIP-B_ADD	Reception for tripping in phase-B additionally
820000EBB5	TRIP-C_ADD	Reception for tripping in phase-C additionally
830000EBB6	TRIP_ADD	Reception for three-poles tripping additionally
840000EBB7	OPT-ALARM_ADD	Reception of alarm signal additionally
880000EBB8	OPT.P-A_ADD	Reception of alarm signal in phase-A additionally
890000EBB9	OPT.P-B_ADD	Reception of alarm signal in phase-B additionally
8A0000EBBA	OPT.P-C_ADD	Reception of alarm signal in phase-C additionally
8C0000EBBB	OPT.P-AB_ADD	Reception of alarm signal in phase-AB additionally
8D0000EBBC	OPT.P-BC_ADD	Reception of alarm signal in phase-BC additionally
8E0000EBBD	OPT.P-CA_ADD	Reception of alarm signal in phase-CA additionally
800000EBBE	OPT.P-N_ADD	Reception of alarm signal in neutral additionally

3.24 Autoreclose (ARC-D)

The purpose of the autoreclose function (ARC) is to provide an efficient means of restoring service following the tripping of circuit breakers (CBs) for temporary faults. The ARC function is used to maintain the stability and synchronism of the system, whilst at the same time secure the continuity of supply. The ARC function provides both a single-shot and multi-shot schemes; the ARC function is designed for radial distribution lines, which can be protected together with the overcurrent relays, sectionalizers, and fuses; the ARC function is designed to reclose a single CB.

In reclosing, whenever a fault occurs on the line, a CB is tripped to clear the fault and recloses after a time delay. Generally, 80 to 90% of faults that do occur on lines are temporary or transient faults, which can be cleared by the tripping and subsequent reclosing of the CB. The remaining 10 to 20% of faults are either semi-permanent or permanent faults, such as open conductor faults etc., which cannot be cleared by the opening and subsequent closing of the CB.

Given the important purpose of autoreclose and the very significant problems mentioned above, it is extremely important to distinguish between the temporary/transient fault and the permanent fault and hence, we must select either the single-shot scheme or the multi-shot scheme.

Note: The implementation of the feature depends on the selection of both the hardware and the software. Note that the feature is not supplied for the several models; hence, the user has to check the implementation for the model. Locate the ordering number and check it at the "G&T position" referring to the comparison table below. For more information, see *Appendix: Ordering*.

Table 3.24-1 Comparative table in respective ordering numbers

Sec.	Feature	Ordering No. at "G&T"					
		BCU			BCPU		IFU
		11	13	1F	2C	2N	19
–	Main features	NA	NA	NA	✓	✓	NA
–	PLC driver	NA	NA	NA	NA	NA	NA

✓: Applicable NA: Not applicable.

3.24.1 Outline

The ARC function provides the following features mainly for sub-transmission and distribution lines:

1. **Three-phase autoreclosing** command, this can be issued upon the reception of a trip signal from the trip circuit (TRC) designed for three-phase tripping. Note that the ARC function here is not designed to reclose the CB on a per-phase tripping basis. The ARC function will operate regardless of the faulted phases, whether it is for a single-phase fault or a multi-phase fault.

2. **Evaluation for successful autoreclosing operation,** an autoreclosing failure is determined when the CB fails to close when the ARC function is in progress

3. **Single-shot/Multi-shot schemes** are provided; it is possible to set autoreclose shot numbers from 'shot1 to shot5' for the multi-shot scheme. For the single-shot scheme, the shot number is set to 'shot1'.

4. **Permissive voltage check and check synchronism,** the reclosing command for 'shot1' is issued following the reception of a permissive signal from the voltage check function (VCHK), this function checks for the existence, absence and synchronism of voltages on the line. The user can program the generation of the permissible signal using settings in the VCHK function.

5. **Shot number coordination**, if as shown in Figure 3.24-1, we consider two circuit breakers, CB(G) and CB(H) on a radial distribution feeder, and a fault occurs remote from busbar H, the shot number coordination function will enable the matching of the shot number between Relay(G) and Relay(H) for a fault occurring downstream of busbar H. For example, two coordination steps are executed, as follows:

   Step1:
   Two instantaneous trips and two subsequent reclosures for CB(G) and CB(H). Step1 ensures the integrity and reliability of the power system for temporary faults.

   Step2:
   One coordinated IDMT/DT time delayed trip is performed for the CBs by Relay(G) and Relay(H). Coordinated tripping provides time delayed clearing of a semi-permanent Fault F, which may be caused by a foreign object that has fallen across the line (e.g. a twig from a tree branch), and which may be burnt out/dislodged to clear the fault.

   During step2 of the scheme above, Relay(G) should not incorrectly determine that the

auto-reclose was successful, i.e. 'ARC close success' and reset its ARC function. Shot number coordination ensures that this does not occur and synchronizes the shot numbers of Relay(A) and Relay(H).

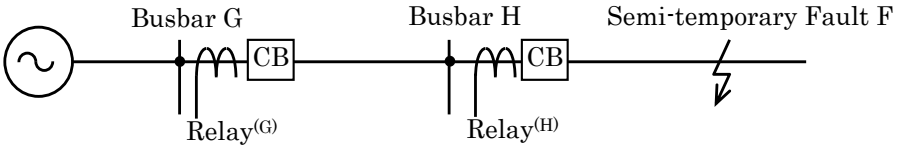


Figure 3.24-1 Semi-temporary Fault F and locations of relays

3.24.2 Terminology

(i) Relay operation period

The time interval commencing from the instant of the relay picking-up for the fault current to the instant of the relay dropping-off following the cessation of the fault current.

(ii) Temporary/transient/Arc fault

A temporary/transient fault, the main cause of which is often due to lightning, (an over voltage induced in a line due to the static electricity caused by the lightning may cause a flash over across the insulator string), temporary contact with foreign objects, conductor clashing as a consequence of strong wind.

(iii) Arcing time of CB

When the CB contacts separate during tripping, an arc is produced between the CB contacts; the arc is extinguished by the interrupting medium in the CB. The duration of arcing is called the 'Arcing time', which is the time between the instant of separation of the circuit breaker contacts and the instant of the extinction of the fault arc.

(iv) Permanent fault (signal 'ARC FT')

Fallen conductors, tree growth, tree branches that have fallen across lines, as well as other causes, may all produce permanent faults. As the operation of the ARC function is unable to restore power transmission for permanent faults, the ARC function abandons the reclosing of the CB, defined as the 'Final trip (FT)' stage. If the ARC function gets into the FT stage, closing the CB is only possible by the manual operation.

(v) Signal shot scheme (signal 'ARC SHOT1')

The ARC function issues a first auto-reclosing signal 'ARC SHOT1' when a 'GEN.TRIP' signal is issued in the trip circuit (TRC) by the first relay operation. When the user programs the ARC function not to provide subsequent reclosures, this operating sequence provides only one reclosing operation; then, lockout will occur on subsequent tripping, i.e. the 'Final trip (FT)'

stage.

(vi) Multi shot scheme (signals 'ARC SHOT2–5')

Signals 'ARC SHOT2' to 'ARC SHOT5' may be issued after the 'ARC SHOT1' signal when a persistent fault occurs.

(vii) Dead time (delay timers TSHOT, TSHOT_SUB, and TD_MS2–5)

The dead time is the time interval from relay operation i.e. the initiation of the auto-reclose scheme, to the inception of the 'ARC CLOSE COMMAND' used to energize the circuit breaker closing circuit and is provided by delay timer [**TSHOT**]. A substitute delay timer [**TSHOT_SUB**] is also available when the user wishes to program the inception of the 'ARC SHOT1' signal using the PLC function instead of [**TSHOT**], this feature is only provided in the event that the user wishes to replace the original logic.

The dead times for sequential operation of the autoreclose scheme 'ARC SHOT2' to 'ARC SHOT5', are provided by delay timers [**TD_MS2**]–[**TD_MS5**], respectively.

(viii) Pulse width of 'ARC CLOSE COMMAND' (setting TCCW)

An 'ARC CLOSE COMMAND' signal is issued after the dead time. Setting [**TCCW**] is used to define the pulse-widths of the reclosing commands for respective shot1–5.

(ix) Final trip stage to abandon CB reclosure (signal 'ARC FT' and setting TRR)

TRR is the time interval from the initiation of an ARC to abandoning the issue of 'ARC SHOT1'. That is, the permissive signal 'ARC-VCHK1' must be issued by the VCHK function within the time interval of **TRR** at the end of the dead time (i.e. **TRR** has not timed out), otherwise the ARC function abandons the reclosure of the CB. That is, if **TSHOT** has timed out and the 'ARC-VCHK1' permissive signal has not been issued within **TRR** time, the TRR signal ends up in 'Final Trip (FT)'. Note that the timer setting of the [**TRR**] timer should be set greater than that applied to the dead time delay timer [**TSHOT**] to ensure that the dead time has fully expired, see 3.24.4(iii).

(x) Reset for tripping failure (signal 'ARC RESET' and setting TRESET)

Subsequent to the reception of the 'GEN.TRIP' signal, a check is required to determine whether the CB has opened. If the CB has not opened within the time setting of timer [**TRESET**], then "CB fail to open" is indicated by the 'ARC RESET' signal, which also resets the operation of the ARC. The duration of the setting applied to the [**TRESET**] timer must be less than the setting applied to the ARC dead time delay timers (e.g. [**TSHOT**]).

(xi) Decision time for ARC successful operation or failure (setting TARCDSUC and signal 'ARC CLOSE FAIL')

The [**TARCDSUC**] timer provides the following functionality depending on the setting of scheme switch [**ARC-SucChk**].

(xi)-1 Scheme switch [**ARC-SucChk**]=**On**

With [**ARC-SucChk**] set to **On**, timer [**TARCDSUC**] is used to define the checkpoint at which the CB is closed successfully after issuing the 'ARC CLOSE COMMAND' signal following which, an 'ARC CLOSE SUCCESS' signal is issued. If the CB fails to close within the setting of timer [**TARCDSUC**], an 'ARC CLOSE FAIL' signal is issued and the ARC function moves to the 'Final trip (FT)' stage.

Successful reclosure of the CB (subsequent to fault clearance) is checked by the 'Success check' logic, which checks for the signal 'CB-ALLPH-CLOSE' provided by the protection common function (PROT_COMMON). Clearing the fault automatically resets the ARC operation.

(xi)-2 Scheme switch [**ARC-SucChk**]=**Off**

With [**ARC-SucChk**] set to **Off**, timer [**TARCDSUC**] may be used to check for a successful closure following the issue of the 'ARC SHOT' command. The 'ARC SHOT RS' signal is generated which is used for resetting the ARC function.

Note: a CB failure to close condition will not be detected by this logic. The user will have to incorporate this check externally.

(xii) Progress of ARC operation (signals 'ARC IN-PROG' and 'ARC START')

Information regarding the progress of an ARC operation is provided following the reception of the 'GEN.TRIP' signal as follows:

(xii)-1 Entire ARC progress for all shots (signal 'ARC IN-PROG')

The 'ARC IN-PROG' signal is defined as the time interval from issuing the first 'GEN.TRIP' to the confirmation of the ARC successful operation or the final trip.

(xii)-2 Respective progress for respective shots (signal 'ARC* IN-PROG')

Respective signals 'ARC* IN-PROG' are defined for the operation of respective shots.

(xii)-3 Trigger for ARC operation (signal 'ARC_START')

The 'ARC_START' signal indicates the instant at which the 'GEN.TRIP' signal is issued by the

TRC function. If an external relay can generate an 'ARC_START' signal, the user can adopt it by programing the binary input circuit (BI) in the PLC function.

(xiii) 'TREADY' Reclaim Timer

Certain considerations are required to ensure that the ARC function is ready for the next cycle of operation; the reclaim timer 'TREADY' is provided within the ARC function to accommodate this requirement. When a CB is closed for the first time subsequent to the maintenance of a distribution line, the closure would normally be expected to be successful (that is, the CB is closed on to a healthy line). Then the minimum time setting of the [**TREADY**] reclaim timer should be longer than the time required to judge that the CB has closed successfully.

Another consideration required for this setting is that after the CB has gone through a successful ARC cycle; the maximum allowable successive close-open operations are achieved with the setting. In this case, the minimum time delay required before the CB is ready for the next ARC cycle becomes the setting criteria for the [**TREADY**] timer.

Where the incidence of recurrent lightning strikes is experienced, a shorter reclaim time will prevent the ARC function going into an unnecessary lock out. On the other hand, caution is required when considering the exposure of the CB to an excessive number of ARC cycles caused by recurrent faults which will result in an increase in the frequency of the maintenance cycle.

In summary, the time required for the CB to be ready for the next cycle of ARC is the minimum setting that can be applied to the reclaim timer [**TREADY**] in the ARC function. The criteria for setting the reclaim timer is described in the Application Guidelines in section 3.24.8 and includes the setting example under 3.24.8(ii)-3.

3.24.3 Function block diagram

The 'ARC_START' signal is initiated by the 'GEN.TRIP' signal from the TRC; issue of 'ARC SHOT1' and others is enabled by the permissive 'ARC1-VCHK' signal. Figure 3.24-2 illustrates the outline of the ARC function. If the multi-shot scheme ('ARC SHOT1' and 'ARC SHOT2)' is required for the fault, the signals 'CB_ALLPH_CLOSE' and 'CB-ARC READY' are required to issue an 'ARC READY' signal. The overall logic is grouped into seven internal logic blocks; (i). Start-up, (ii). Initiation, (iii). SHOT1, (iv). SHOT2, (v). Issuing command, (vi). Success check, and (vii). Shot counter. Their respective logic blocks are mutually connected. Issue of either the 'ARC SHOT1' signal or the 'ARC SHOT2' signal generates the CB, 'ARC CLOSE COMMAND'. Note that for simplicity Figure 3.24-2 is drawn as a guide to illustrate a two-shot example of a multi-shot scheme but the multi-shot scheme is capable of issuing up to five shots. Thus, setting **S2** for [**ARC-NUM**] results in the scheme depicted in Figure 3.24-2, hence three

or more multi-shot schemes (i.e. 'ARC SHOT3–5') are not illustrated. That is, the schemes for 'ARC SHOT3–5' are similar in operation but are not illustrated

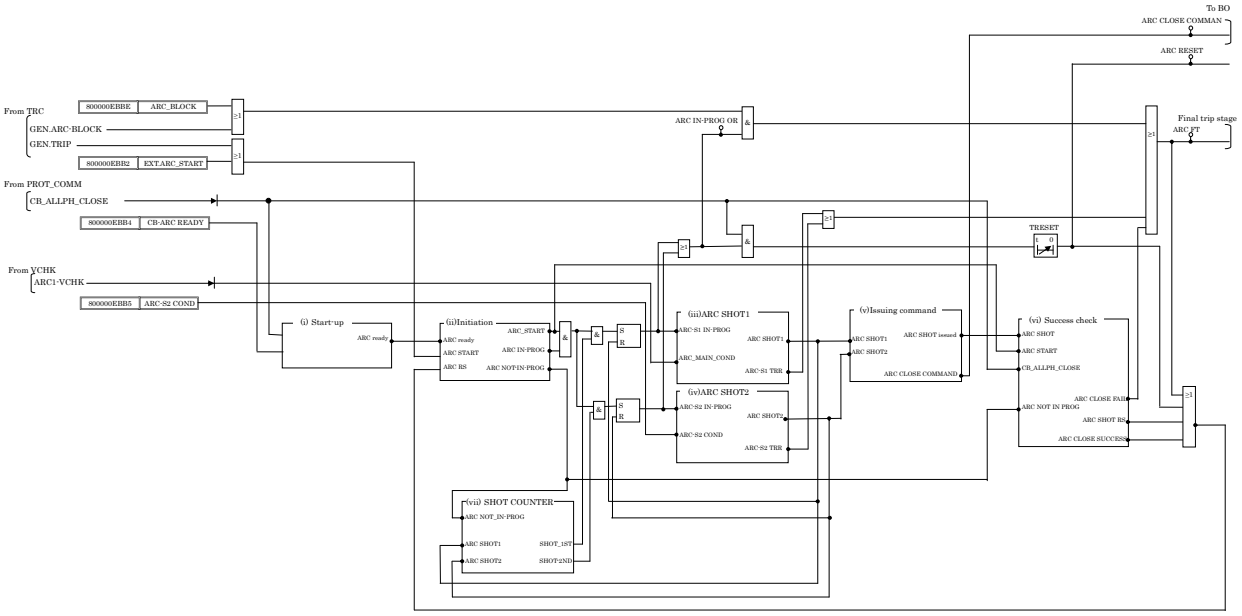


Figure 3.24-2 Overall logic of ARC function for issue of 'ARC SHOT1' and 'ARC SHOT2'

3.24.4 Logics for autoreclosing

(i) Start-up logic - settings

Referring to Figure 3.24-3, the ARC function is in operation when **On** is set for scheme switch [**ARC-EN**]. Note that **Off** should be set for scheme switch [**ARC-EN**], when the ARC function is not required.

If it is required that the ARC function be removed from service by the operation of an external signal, the PLC connection point 'ARC-OFF' is provided so that the user can introduce an 'Off" signal. One more external signal can place the ARC function in service using the PLC connection point 'ARC-ON'. For example, the user may wish to select '**On**' or '**Off**' by pressing buttons mounted on a relay/control panel, using these PLC connection points. Note that either of the signals introduced at the PLC connection points overrides the selection made by the scheme switch [**ARC-EN**].

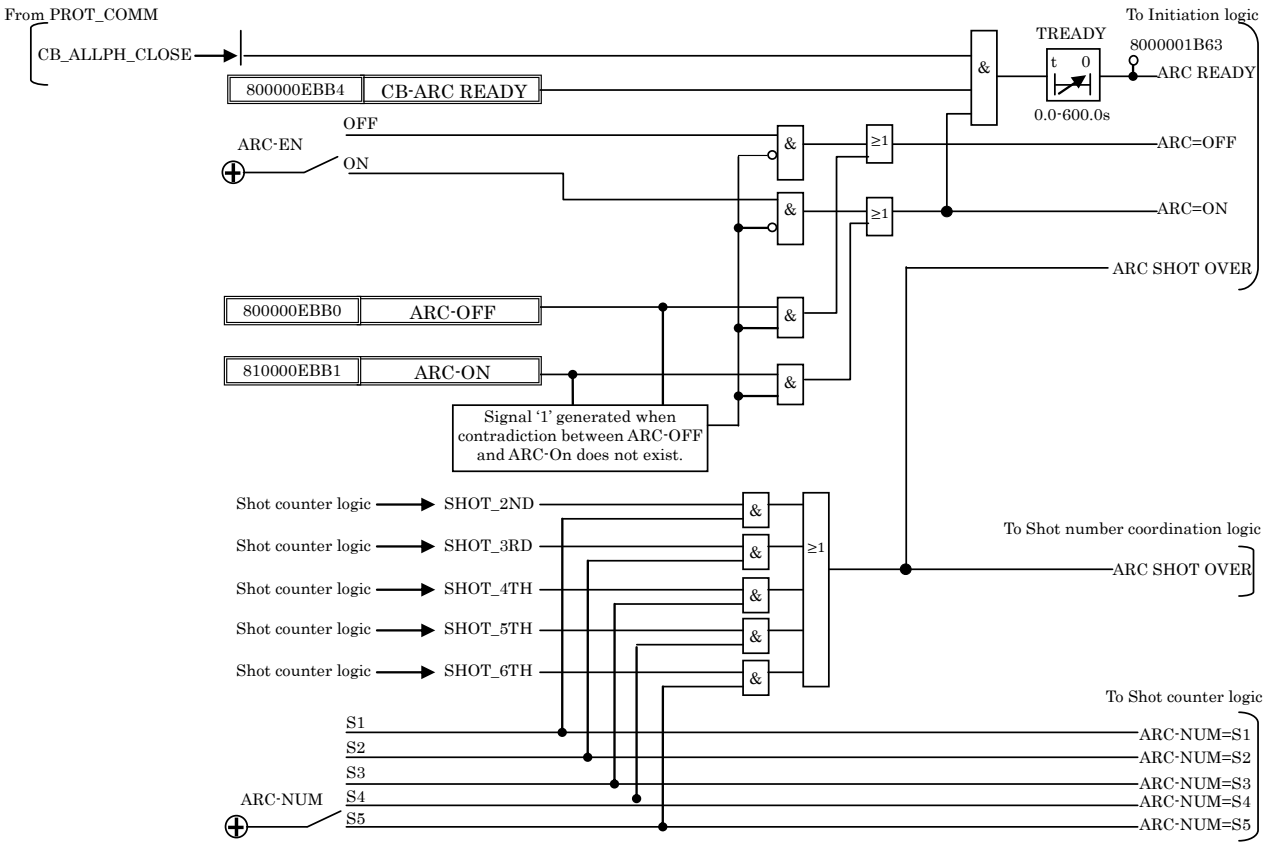


Figure 3.24-3 Start-up logic

The timer [**TREADY**] shown in Figure 3.24-3 is the reclaim timer and is used to delay the operation of the ARC, as discussed in section 3.24.2(xiii).

If the 'ARC READY' signal is not generated while signals 'ARC_START' and 'SHOT_1ST' are set to TRUE, (Logic level being high'1') in the Initiation logic, see Figure 3.24-2, the ARC operation is locked out, (indicated by signal 'ARC FT' in Figure 3.24-2). The 'CB_ALLPH_CLOSE' signal is used so that the CB closed condition is determined. The PLC connection point 'CB-ARC READY' is active when the CB provides the ready signal.

(ii) Initiation logic - settings

Figure 3.24-4 shows the Initiation logic. The TRC function sends a 'GEN.TRIP' signal to the ARC function to start the autoreclosing. If an external relay is able to provide a start signal, it can be introduced to the ARC function using the PLC connection point 'EXT.ARC_START'. The PLC connection point 'ARC NO ACT' is provided to inhibit ARC operation; the user can use it to stop the ARC function when required by the use of an external relay.

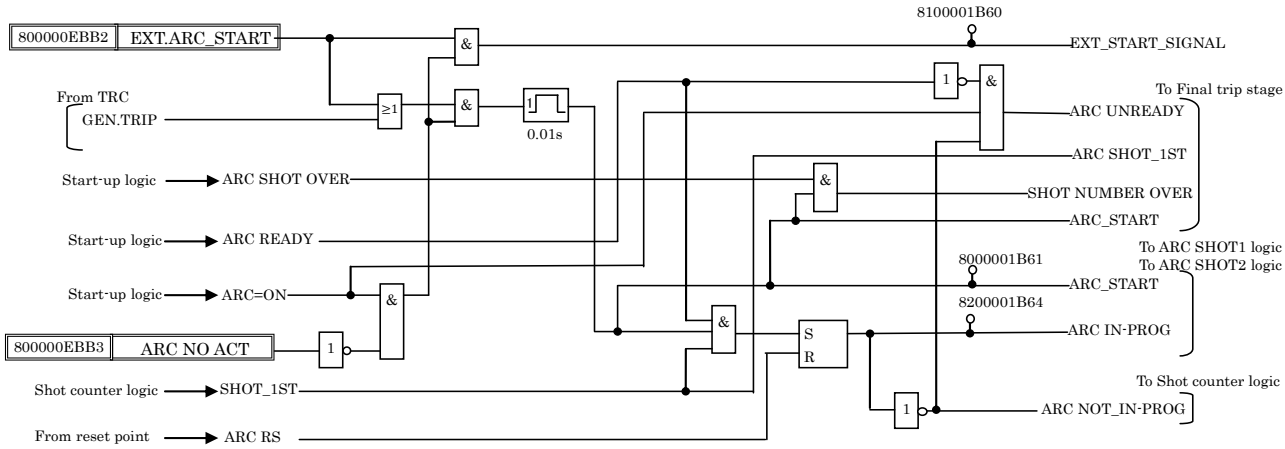


Figure 3.24-4 Initiation logic

When the input signals 'ARC_START', 'SHOT_1ST' and 'ARC READY' are active at the same time, a flip-flop circuit issues the 'ARC IN-PROG' signal. The signals 'ARC IN-PROG' and 'ARC_START' will be issued when the 'SHOT_1ST' shot is issued from the Shot counter logic.

(iii) SHOT1 logic - settings

Figure 3.24-5 shows the SHOT1 logic, which is used for issuing the first reclosing command. As shown in Figure 3.24-2, the 'ARC SHOT1' signal is generated by the reception of the 'ARC-S1 IN-PROG' signal from a flip-flop triggered by the signals 'ARC_START' and 'ARC IN-PROG'. The user is required to provide settings for the [**TSHOT**] and [**TRR**] timers for this logic, as previously discussed in section 3.24.2 (incidentally, a setting for [**TSHOT_SUB**] may be required when a user PLC program is accommodated).

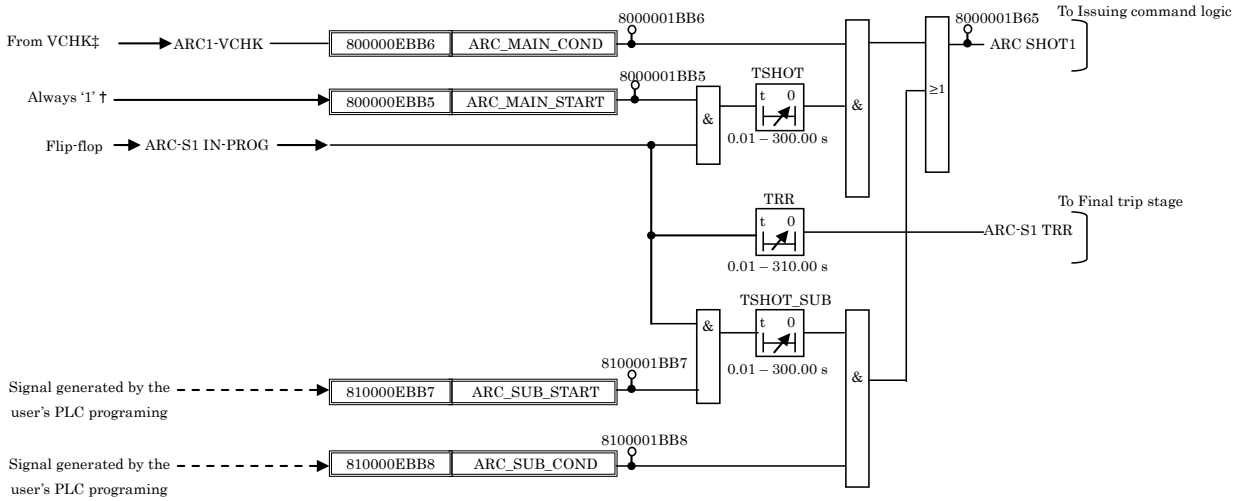


Figure 3.24-5 SHOT1 logic

†Note: As a default, a Logic '1' signal (Always high(TRUE)) is applied at the PLC connection point 'ARC_MAIN_START'.

‡Note: As a default, signal 'ARC1-VCHK' is introduced at the PLC connection point

'ARC_MAIN_COND'.

§Note:In terms of setting, the value applied to the [**TRR**] timer should be longer than that applied to the [**TSHOT**] timer. Setting [**TSHOT_SUB**] timer may be required if the PLC signal is injected by the user programing.

(iv) SHOT2 logic - settings

Figure 3.24-6 shows the SHOT2 logic for the second reclosing command. Similar to the SHOT1 logic, the SHOT2 logic begins to generate the 'ARC SHOT2' signal when a further flip-flop circuit issues the 'ARC-S2 IN-PROG' signal, as shown in Figure 3.24-2 previously. The user is required to provide settings for timers [**TD_MS2**] and [**TRR_MS2**] in this logic, as explained in section 3.24.2(vii). Note that the SHOT2 logic must meet a user specified criterion before the 'ARC SHOT2' command can be issued; a signal injection point is provided at the PLC connection point 'ARC-S2 COND'; the user must program the criterion using the PLC function.

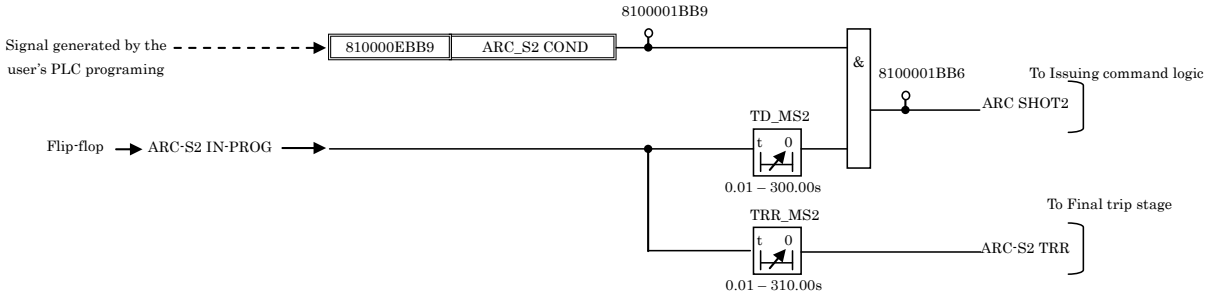


Figure 3.24-6 SHOT2 logic

†Note:The requirement to fulfil the criterion for issuing the 'ARC SHOT2' signal is dependent upon user applications; note that the user can also program a Logic '1' signal (Always high(TRUE)) if no criteria are required.

(v) Issuing command logic - settings

Figure 3.24-7 shows that the ARC function can issue a reclose signal 'ARC CLOSE COMMAND' triggered by SHOT1 and SHOT2 logic blocks. Setting [**TCCW**] is provided to set the pulse width of the 'ARC CLOSE COMMAND' signal.

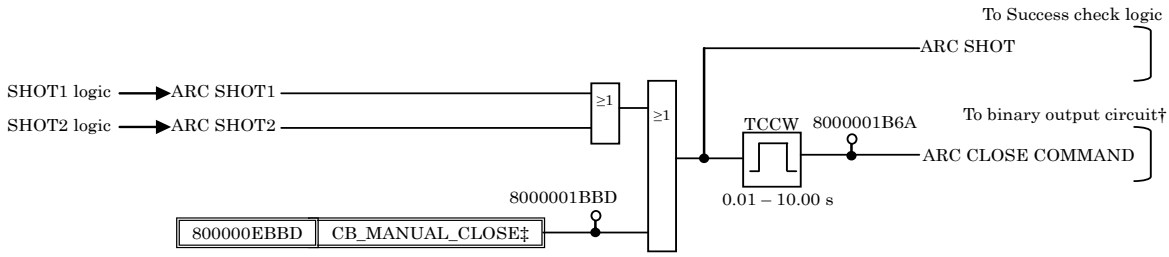


Figure 3.24-7 Issuing command logic

†Note: For more information, see Chapter *Technical description: Binary IO module*.

‡Note: PLC connection point 'CB_MANUAL_CLOSE' is provided so that the user can

utilize the ARC function to close the CB manually if an external switch (such as a push button on a relay/control panel) is required for manual operation.

(vi) Success check logic - settings

Figure 3.24-8 illustrates the Success check logic that determines whether the CB closed successfully for the ARC function reclose operation. When this check is required, **On** should be set for scheme switch [**ARC-SucChk**].

If it is determined that all CB phases were closed successfully, (i.e. the 'CB_ALLPH_CLOSE' signal remains high for a sufficient duration after the 'ARC SHOT' signal is issued by the Issuing command logic), an 'ARC CLOSE SUCCESS' signal is issued. On the other hand, if the 'ARC SHOT' single is issued but the CB has failed to close, then on the timeout of the [**TARCDSUC**] timer, an 'ARC CLOSE FAIL' signal is issued.

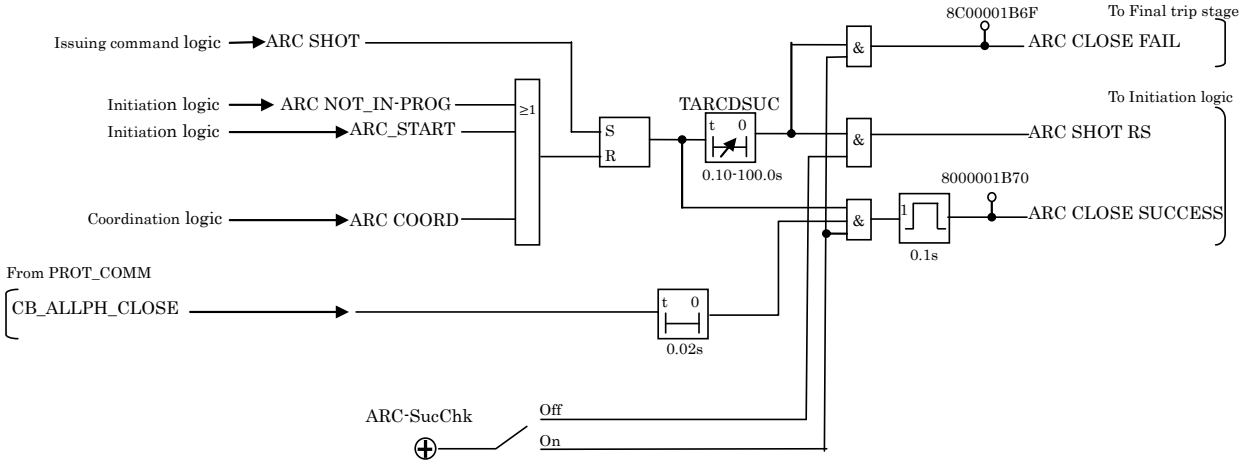


Figure 3.24-8 Success check logic

Note: When the scheme switch ([**ARC-SucChk**]=**Off)**, the functionality of the [**TARCDSUC**] timer is explained in section 3.24.2(xi)-2.

(vii) Shot counter logic behavior

The Shot counter logic is shown in Figure 3.24-9. The following rule applies in Table 3.24-2; the 'SHOT_1ST' signal is issued to the flip-flop logic unconditionally; the 'SHOT_2ND' signal is issued to the flip-flop when the 'ARC SHOT1' signal is issued, see Figure 3.24-2.

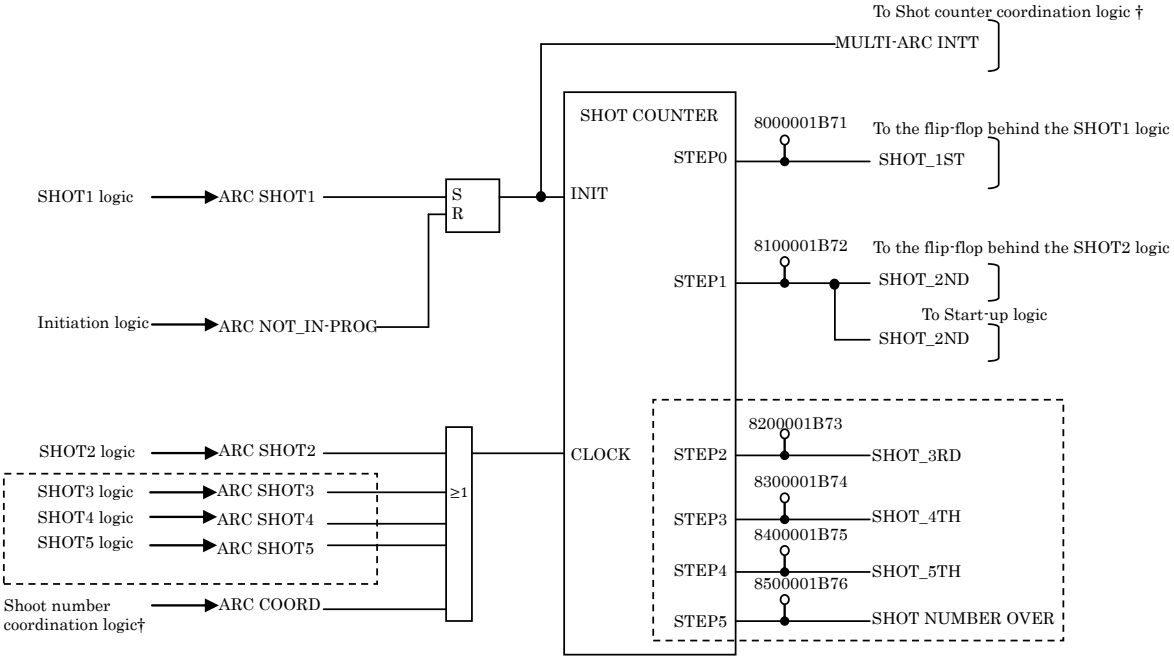


Figure 3.24-9 Shot counter logic for SHOT1 and SHOT2 logic blocks

Table 3.24-2 Counting in Shot counter logic†

Input signals for Shot counter logic		Output signals for SHOT1–5 logics					
		SHOT_1ST	SHOT_2ND	SHOT_3RD	SHOT_4TH	SHOT_5TH	SHOT NUMBER OVER
INIT	CLOCK	STEP0	STEP1	STEP2‡	STEP3‡	STEP4‡	STEP5‡
0	(Undefined)	X					
1	Not running		X				
	First cycle			X			
	Second cycle				X		
	Third cycle					X	
	Fourth cycle						X

†Note: we shall discuss the Shot counter coordination logic later.

‡Note: the actual Shot counter logic can increment the count to six, but we have omitted the discussion after the second cycle for clarity.

The user can select the number of shots desired for autoreclosing using the scheme switch [**ARC-NUM**], as cited in section 3.24.4(i). When a single-shot scheme (**S1**) is preferred, setting **S1** is used to generate only a single shot (SHOT_1ST). When a multi-shot scheme is required (e.g. **S2** is preferred), the Shot counter logic will increment the count until the issue of the 'SHOT_2ND' signal is complete (that is, when **S2** is set, the 'ARC CLOSE COMMAND' signal will be issued at the first and second sequence). If after the second sequence the fault persists, the final trip (signal 'ARC FT') is issued by the ARC function, see Figure 3.24-2.

3.24.5 Timing diagrams

(i) Single shot scheme for an Arcing fault (Shot1 and successful operation)

Figure 3.24-10 illustrates an example for which the single shot scheme has been selected (i.e. [**ARCNUM**]=S1); an arcing fault is cleared following the operation of the protection relay and the issue of the 'GEN.TRIP' signal for the tripping of the CB. The 'GEN.TRIP' also initiates the ARC function and an 'ARC CLOSE COMMAND' signal is issued following the expiration of the dead time set for [**TSHOT**]. When **On** is set for [**ARC-SucChk**], this scheme will determine that the ARC was successful when the 'CB ALLPH CLOSE' signal is detected following the issuing of the 'ARC CLOSE COMMAND' signal; the operation of the ARC function is reset if it operates successfully (i.e., the 'ARC IN-PROG' signal is turned off).

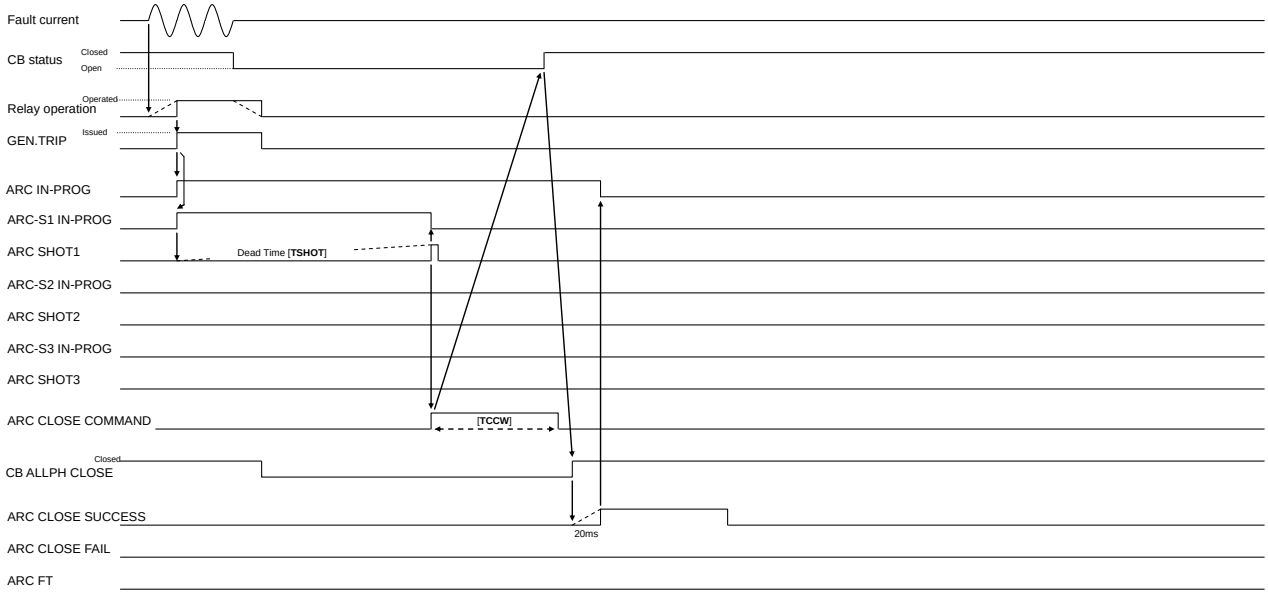


Figure 3.24-10 Single shot scheme [ARCNUM]=S1 for an Arcing fault; operation is successful

Note: As cited in section 3.24.4(iii), the permissive signal 'ARC1-VCHK' is required for operation, but is omitted here for the sake of clarity. The pulse width of the 'ARC CLOSE COMMAND' signal is defined using the setting [**TCCW**].

(ii) Single shot scheme for an Arcing fault; CB fails to reclose

Figure 3.24-11 also shows the single shot scheme. However, the CB fails to reclose on receiving the 'ARC CLOSE COMMAND' so that the ARC function initiates the 'ARC CLOSE FAIL' signal within the setting time [**TARCDSUC**]. Consequently, the ARC function goes to the final trip (FT) stage so that the ARC will not issue another 'ARC CLOSE COMMAND' signal hereafter.

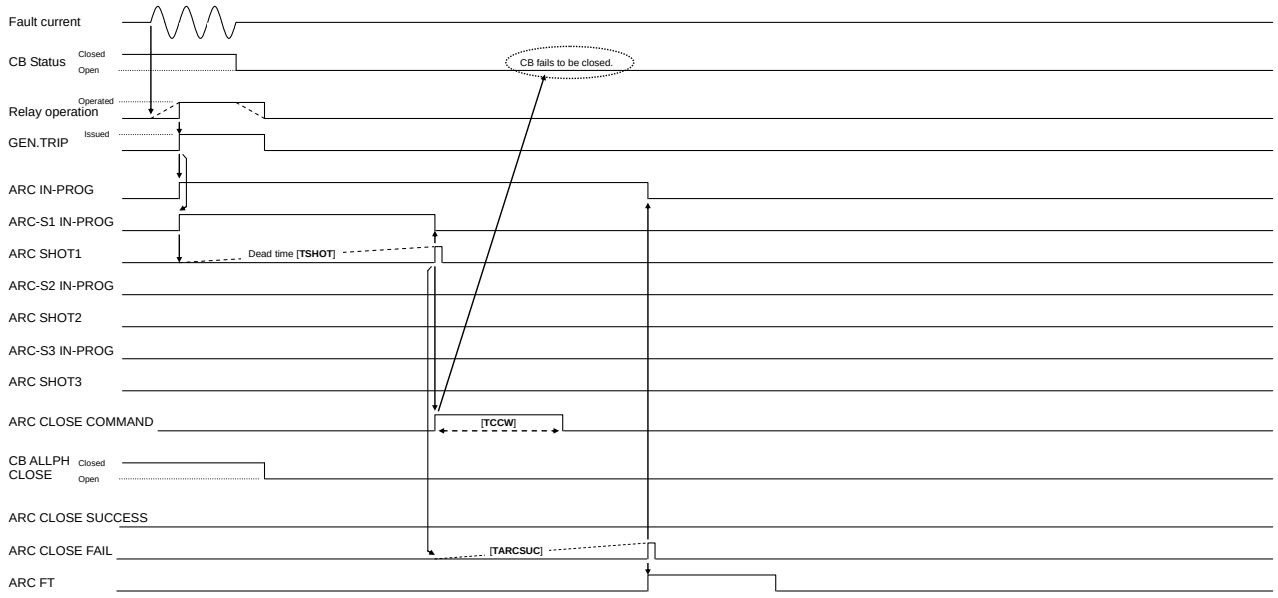


Figure 3.24-11 Single shot scheme [ARCNUM]=S1 for an Arcing fault; CB fails to reclose

Note: As described in section 3.24.4(iii), the permissive signal 'ARC1-VCHK' is required for the ARC SHOT1 operation, but is omitted here for the sake of clarity.

(iii) Single shot scheme for Permanent fault

Figure 3.24-12 illustrates the behavior of the single shot scheme for a permanent fault. Tripping of the CB is executed correctly, but a further trip occurs following the reclosure of the CB. Accordingly, the ARC function determines that the ARC operation cannot restore power transmission in the single shot scheme; subsequently the ARC function goes to the final trip (FT) stage.

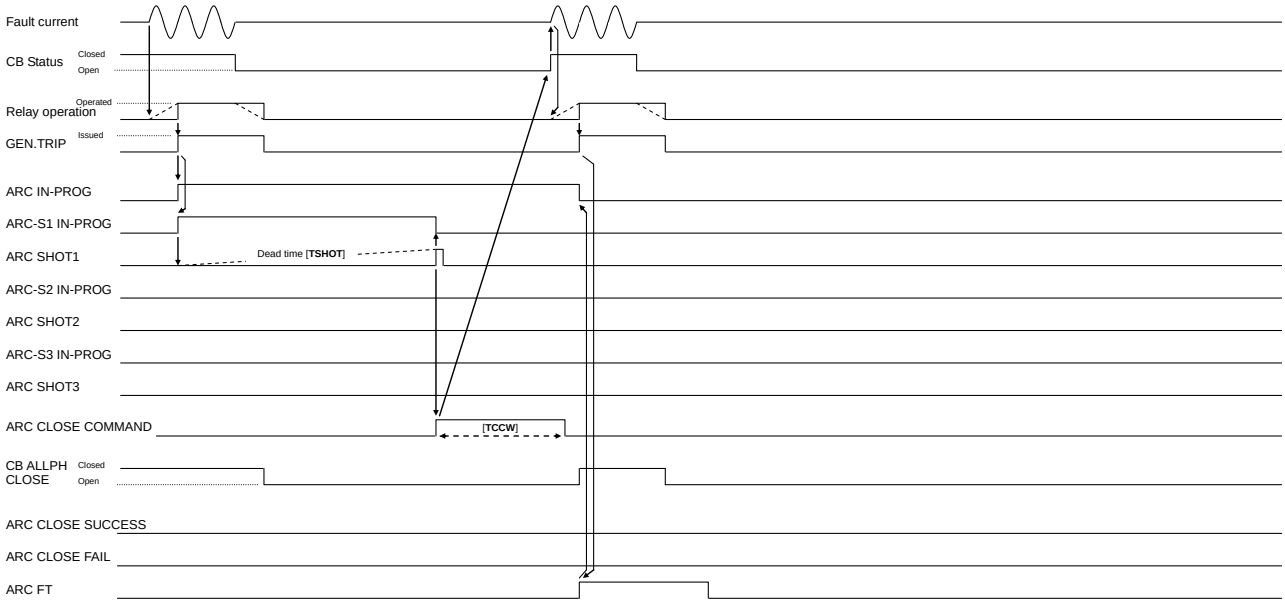


Figure 3.24-12 Single shot ARC scheme [ARCNUM]=S1 for Permanent fault

Note: As described in section 3.24.4(iii), the permissive signal 'ARC1-VCHK' is required for the ARC SHOT1 operation, but is omitted here for the sake of clarity.

(iv) Single shot scheme for an Arcing fault; fault removed by a backup CB

Figure 3.24-13 shows the single shot scheme for an Arcing fault, but tripping is not executed due to the failure of the CB. Therefore, the operation of the ARC function is reset in the setting time [**TRESET**] before the duration of dead timer [**TSHOT**] expires. Consequently, the ARC function determines that the local CB cannot be tripped to clear the fault.

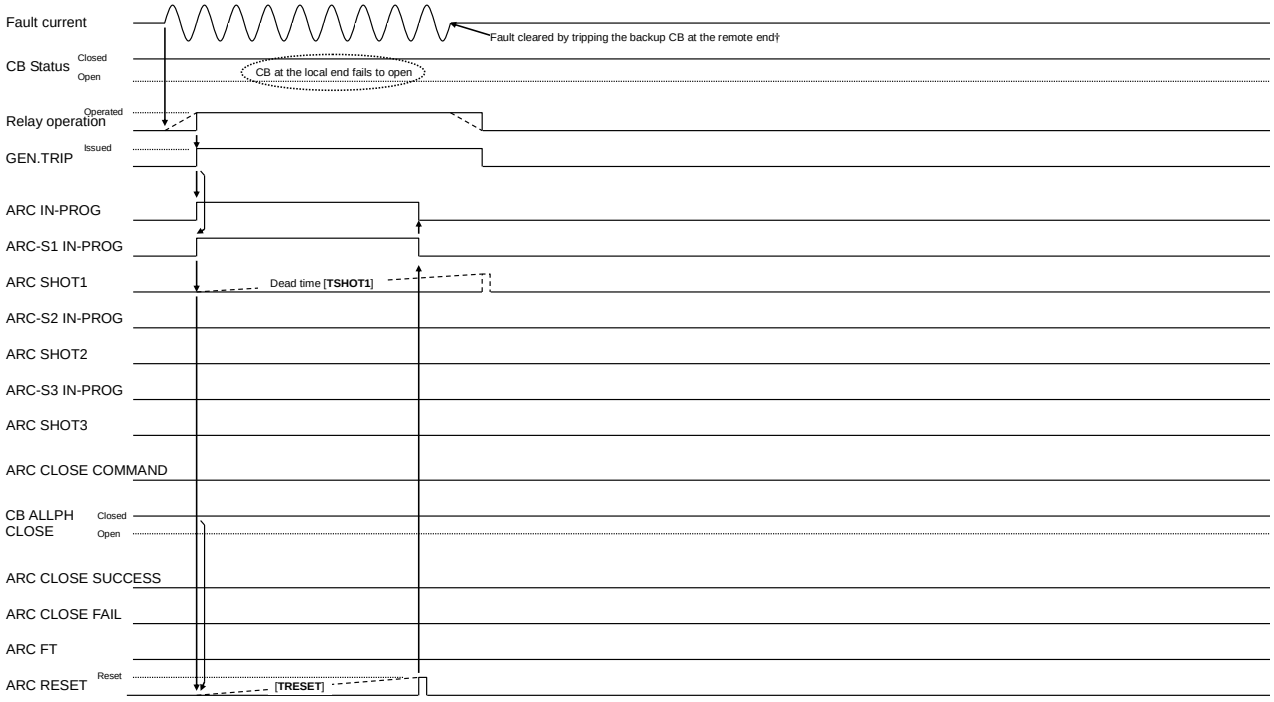


Figure 3.24-13 Single shot scheme [ARCNUM]=S1 for an Arcing fault; remote CB† tripped

†Note: the fault is removed by the tripping of the CB at the remote end; hence, the fault current will no longer flow.

(v) Multi shot scheme for Permanent fault

Figure 3.24-14 illustrates the multi-shot scheme (**S3**); triple reclosing of the CB by the ARC function is required and executed correctly. However, the ARC function determines that the fault is permanent as the fault persists after the third tripping (i.e. the shot counter logic reaches its maximum value and the fault persists). Consequently, the ARC function moves to the final trip (FT) stage so that the ARC will not issue an 'ARC CLOSE COMMAND' signal hereafter.

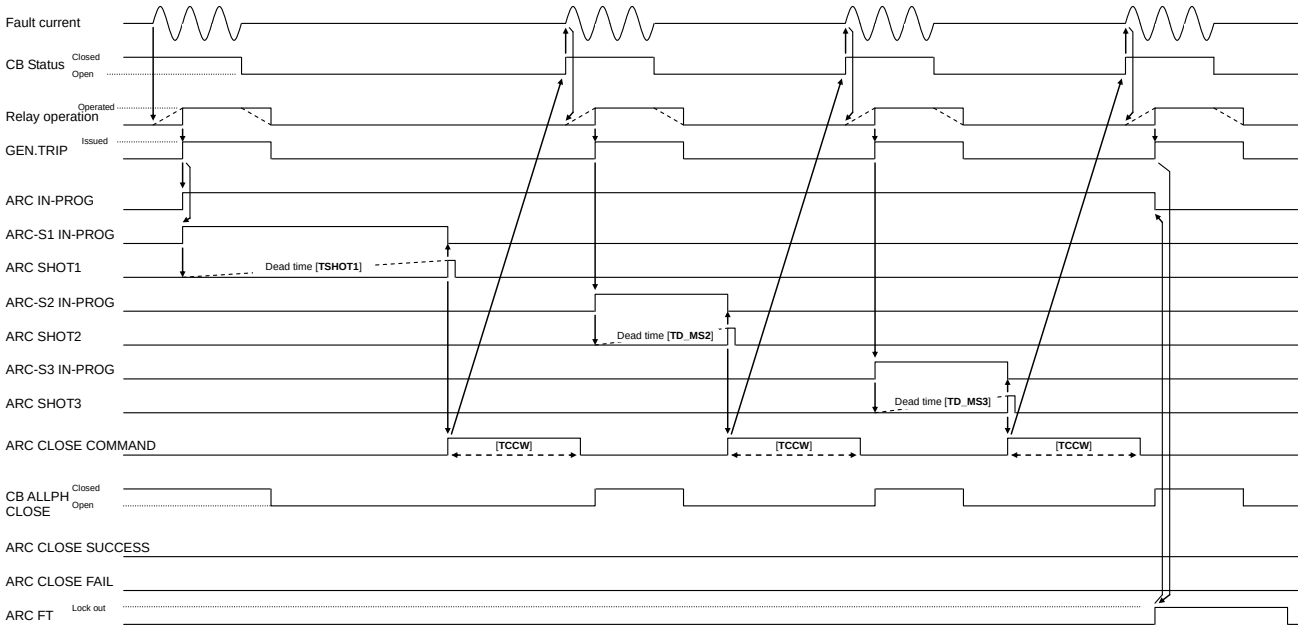


Figure 3.24-14 Multi shot scheme [ARCNUM]=S3 for a Permanent fault

Note:

1. As described in section 3.24.4(iii), the permissive signal 'ARC1-VCHK' is required for ARC SHOT1 operation, but has been omitted for clarity in this figure.
2. While 'ARC1-VCHK' permissive signal is introduced automatically for ARC-SHOT1, For ARC-SHOT2 and onwards, the user must introduce the permissive signal from the VCHK function by using PLC programming.

3.24.6 Shot number coordination

When a distribution feeder is protected by two or more relays, the coordination of the shot-counter in the relays needs to be considered. For example, as shown in Figure 3.24-15, relay G and relay R protect the same main feeder; relays G and R are programmed to issue two first trip commands and two delayed trip commands successively†: $DT^{(1)}$, $DT^{(2)}$, $IDMT^{(3)}$, and $IDMT^{(4)}$ trips.

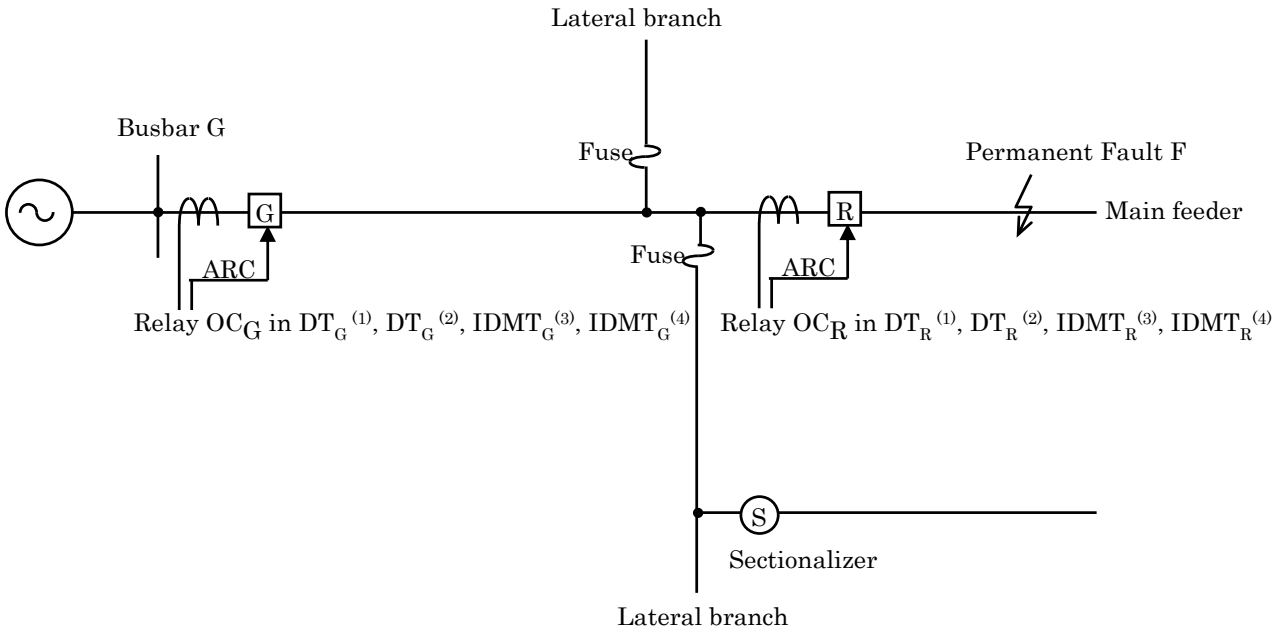


Figure 3.24-15 Occurrence of fault and OC operations with ARC

†Note:Delayed trip commands following the instantaneous trip commands may be used for realizing time coordination between the relays, sectionalizers and fuses.

Upon the occurrence of a permanent fault 'F', both relays G and R will issue a $DT^{(2)}$ trip following a $DT^{(1)}$ trip for their respective CBs; that is, in the first instance a reclose shot, (ARC SHOT1) will be issued by both relays. Then, a second reclose shot (ARC SHOT2) will also be issued by both the relays.

For the third reclose shot (ARC SHOT3), the difference between the settings of the $IDMT^{(3)}$ characteristic for relays G and R will alter the operating times of their respective ARC functions. Given that the pickup time in $IDMT_G^{(3)}$ is delayed in comparison to the pickup time in $IDMT_R^{(3)}$, the third reclosing (ARC SHOT3) will be performed only by relay R, whereas relay G neither issues a trip command nor an ARC shot. Consequently, relay G may now determine that the operation of its ARC sequence has been successful and hence relay G will reset to return to the beginning of its sequence 'ARC ready' (i.e. the ARC function at relay G will commence from the first reclose shot 'ARC SHOT1'). Conversely, relay R is unable to issue a fourth reclose shot (ARC SHOT4) because the delayed operation of $IDMT_R^{(4)}$ means that it will not have sufficient time to operate for the fault. This is because, following the tripping for the first $DT_G^{(1)}$, relay G issues the first reclose shot (ARC SHOT1), but its shot sequence is not correct. Figure 3.24-16 illustrates how tripping and reclosing are not performed correctly; thus erroneous coordination between the ARC operations at relay G and relay R is experienced.

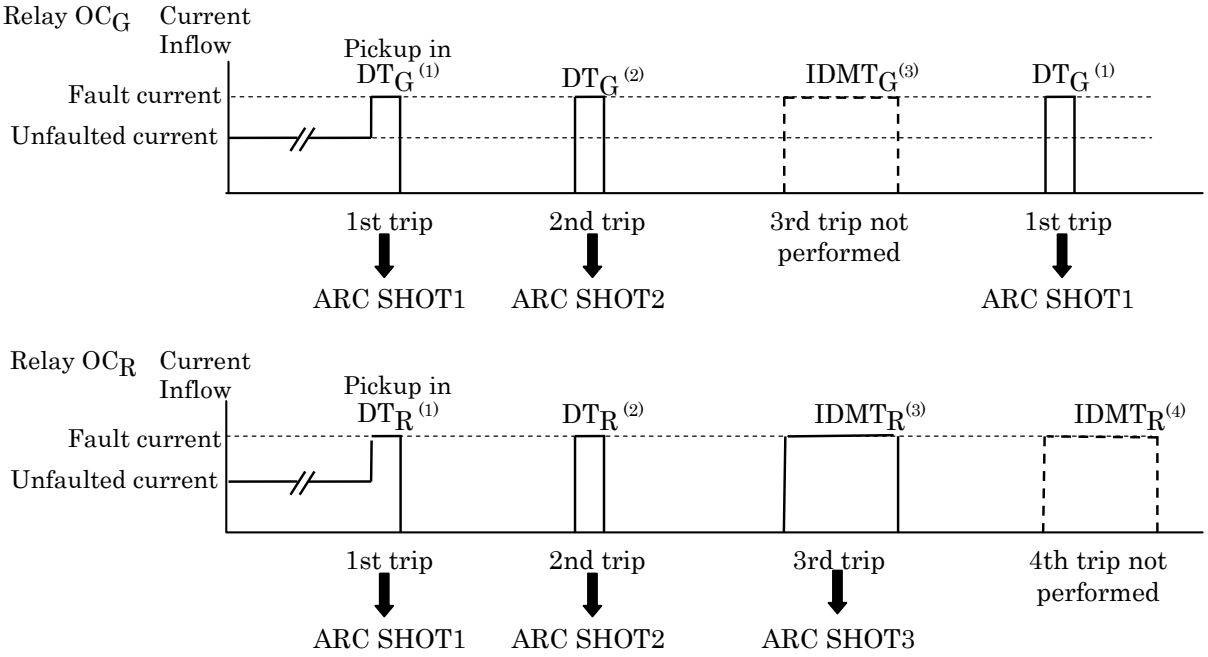


Figure 3.24-16 Coordination of shot number not performed

In order to avoid the mismatch in coordination between relays G and R described above, it is necessary to match the shot numbers between relay G and relay R; a coordination function provided to match the shot number in the ARC function, as illustrated in Figure 3.24-17.

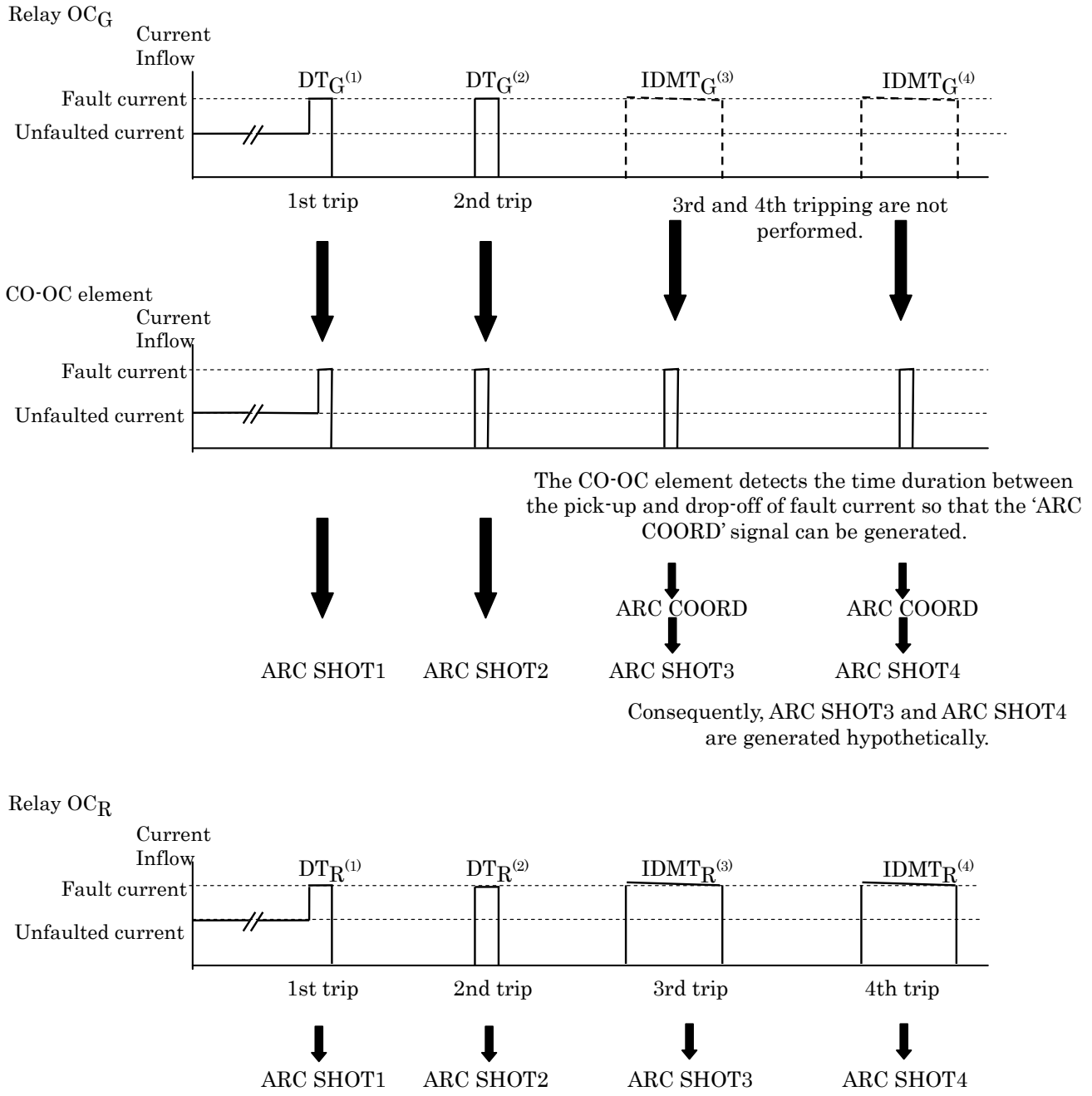


Figure 3.24-17 Coordination of shot number performed

The matching of shot numbers is achieved by distinguishing a different duration for the pick-up and drop-off of fault current using an over current element (CO-OC) or an earth fault element (OC-EF), which are arranged within the ARC function as shown in Figure 3.24-17. The user must set the thresholds of the CO-OC and CO-EF relays using settings [**CO-OC**] and [**CO-EF**], respectively. To engage the coordination feature, set the [**ARCCO-OCEN**] or [**ARCCO-EFEN**] to **On**, the switches of which are shown in Figure 3.24-18.

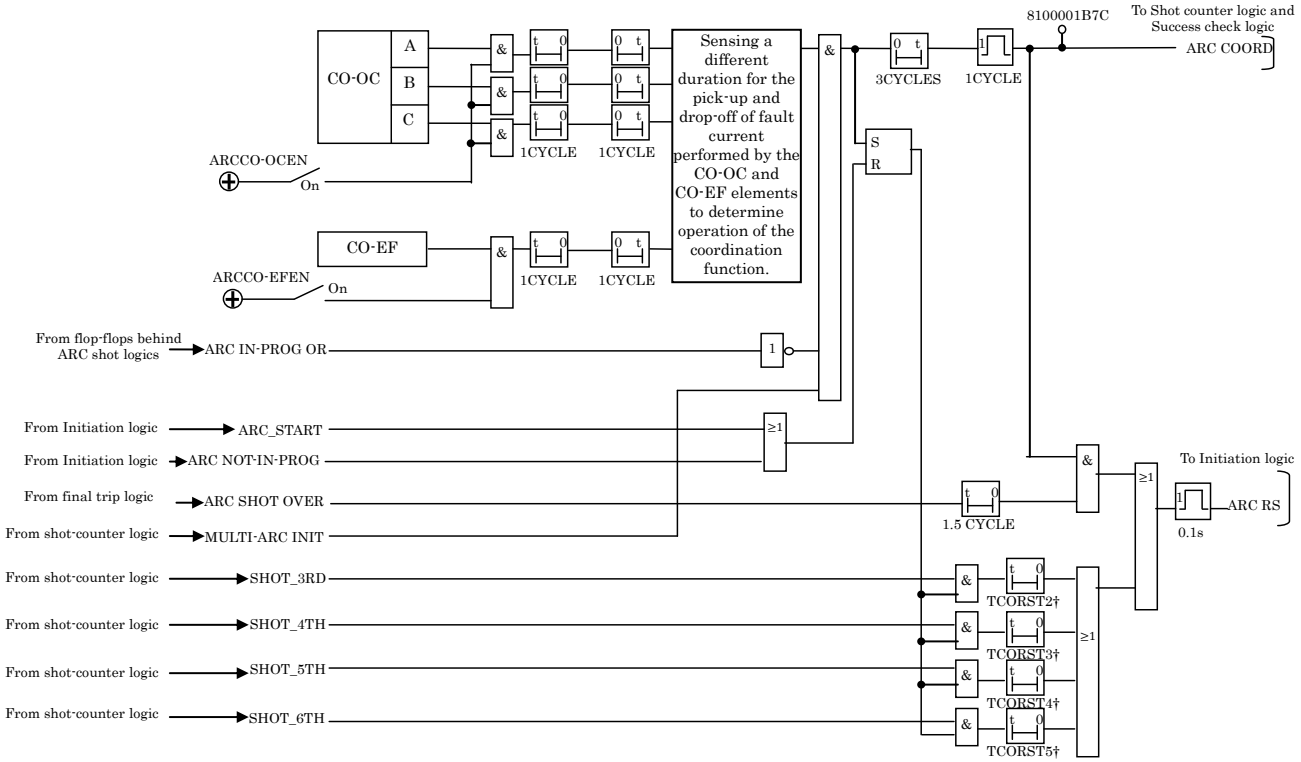


Figure 3.24-18 Shot number coordination logic

†Note:To reset the operation of the ARC function, delay timers 'TCORST*' are provided for 'ARC SHOT2' to 'ARC SHOT5', respectively. The values of the 'TCORST' are defined in the rules of Table 3.24-3.

Table 3.24-3 Delay timers in the shot number coordination logic

Delay timer	Retarding time for resetting
TCORST2	Setting [**TD_MS2**]+setting [**TARCDSUC**]
TCORST3	Setting [**TD_MS3**]+setting [**TARCDSUC**]
TCORST4	Setting [**TD_MS4**]+setting [**TARCDSUC**]
TCORST5	Setting [**TD_MS5**]+setting [**TARCDSUC**]

3.24.7 Miscellaneous feature

Scheme switch [**SHOTNUM-Test**] is provided for testing the ARC function. For example, if the user wishes to test autoreclosing to reach the 'ARC SHOT4' stage, regardless of the setting of [**ARC-NUM**], set **S4** for the [**SHOTNUM-Test**]. Note **Off** must be selected for this setting when the ARC function is in normal service.

3.24.8 Application guidelines

The application of settings in the ARC function requires careful consideration of the following factors:

(i)-1 Frequency and nature of faults

The frequency and nature of faults on the distribution line help to decide upon the number of ARC shots desired.

If the majority of the faults are transient, (e.g. due to lightning), then applying a single-shot scheme would be appropriate.

If a significant percentage of faults on the distribution line are semi-permanent (e.g. due to foreign objects like a small tree branch or small animal that may have fallen across the line), then adopting a multi-shot scheme becomes advantageous.

If transient or semi-permanent faults are rare (e.g. overhead distribution line in urban areas or a feeder which has a significant portion of cable), then non-use of the ARC function will be appropriate.

(i)-2 CB characteristics

The capability of a CB for ARC duty must be checked. The CB characteristics such as the number of successive open-close (OC) duty cycles and the dead time required between an open-close operation will determine the number of ARC shots employed and the minimum dead time before an ARC shot can be given.

(i)-3 De-ionization time

The time taken for de-ionization of the fault arc path is an important consideration for determining the dead time before an ARC shot can be given. The de-ionization period depends upon the system voltage, the fault current and the duration of the fault. Capacitive coupling between the unfaulted phase and the faulted phase will increase the de-ionizing time; however, this is not applicable for a relay for distribution systems, because tripping is always three-phase. A de-ionization time of at least 100ms may be considered for distribution voltages (66KV and below).

(i)-4 System stability

The intrinsic stability of an interconnected power system will determine the maximum dead time allowable before the ARC shot must be issued. This may not apply to conventional distribution systems where the generating source is remote from the load centers. However, with distributed generation located closer to load centers, stability becomes an important consideration. Transient stability studies can establish the maximum dead time allowed for

these systems.

(i)-5 Reclaim Time **[TREADY]**

The reclaim time of the ARC function and making it ready for the next cycle of operation requires certain considerations.

Where the incidence of recurrent lightning strikes is experienced, a shorter reclaim time will prevent the ARC function going into an unnecessary lock out. On the other hand, caution is required when considering the exposure of the CB to an excessive number of ARC cycles caused by recurrent faults thus increasing the frequency of maintenance that will be required.

The time necessary for the CB to be ready for the next cycle of ARC will determine the minimum time required in determining the setting of the reclaim time for the ARC function. The criteria for setting the reclaim time is described in (ii)-3 below.

(i)-6 Inhibiting or blocking the ARC function

The ARC function should be blocked for protection operations from thermal overload protection (THM), broken conductor protection (BCD), circuit breaker failure protection (CBF) and switch on to fault (SOTF-OC) functions.

(ii) Setting example

(ii)-1 Input data

- CB open-close cycle: OCO-0.3s-CO-30s
- CB opening time (trip coil energized to arc interruption): 3 cycles; 60ms (for 50Hz system)
- CB closing time (close command to CB contacts make): 80ms
- Protection operation time (pick up to operation): <45ms
- Protection resetting time: <30ms
- De-ionization time of fault arc path: 125ms
- Maximum dead time allowed from stability consideration: 500ms
- Trip mechanism reset time (if any):
  Not applicable in this case (e.g. spring charged mechanism, closing operation automatically charges the tripping spring)

Note:

1. Stability criterion may not be applicable for a highly interconnected power system where loss of one line does not endanger system stability.
2. Stability criterion will not apply to radial distribution feeders with no downstream generating source.

(ii)-2 ARC maximum shot number ([**ARC-NUM**]=S2)

Set to two (**S2**) shots, as CB is capable of only two successive reclosures.

(ii)-3 ARC reclaim time ([**TREADY**]): 35.0 seconds

The ARC ready logic requires the CB to be in the closed position with CB ARC ready (e.g. closing spring is charged, SF6 gas pressure OK).

When a CB is closed for the first time subsequent to the maintenance of a distribution line, the closure should be successful (that is, the CB is closed on to healthy line). Then the minimum time setting of the TREADY timer should be longer than the time required to judge that the CB has closed successfully; say a setting of 5 seconds will be appropriate.

Another consideration is, for the setting required after the CB has gone through a successful ARC cycle and the maximum allowable successive close-open operations have been used. In this case, the minimum time delay required before the CB is ready for the next ARC cycle becomes the setting criteria for the [**TREADY**] timer. In the example considered, this minimum time delay is 30 seconds so in order to provide some margin a setting of 35.0 seconds has been chosen.

(ii)-4 Dead time for first shot ([**TSHOT**] / [**TSHOT_SUB**]): 0.13s

Dead time for the first shot using the following equations:

$$A = \text{CB opening time} + \text{Deionizing time} - \text{CB closing time} \quad (3.24\text{-}1)$$

$$B = \text{CB opening time} + \text{Protection reset time} \quad (3.24\text{-}2)$$

$$C = \text{CB opening time} + \text{Trip mechanism reset time} \quad (3.24\text{-}3)$$

$$D = \text{CB opening time} + \text{Minimum dead time required by CB before Shot1} \quad (3.24\text{-}4)$$

If the A to D values were calculated using Equations (3.24-1) to (3.24-4)

A= (60ms + 125ms – 80ms) = 105ms

B= (60ms + 30ms) = 90ms

C= (60ms + 0) = 60ms

D= (60ms + 0) = 60ms

The maximum of A, B, C, D would be A; therefore the [**TSHOT**] setting = A + margin = 105ms + 20ms = 125ms.

Note: The user can choose [**TSHOT_SUB**] using PLC signals ARC_SUB_START and

ARC_SUB_COND. For example, when changing network conditions downstream of the line requires no voltage check (VCHK) for reclosure, then the user can configure the same through PLC by using the ARC_SUB_START and ARC_SUB_SOND signal inputs.

(ii)-5 Dead time for second shot ([**TD_MS2**]): 0.33s

The same criteria as for the first shot apply for determining the dead time for the second shot. However, as per the requirement of the CB, the minimum time before a second successive closure is 0.3s. The [**TD_MS2**] time has been set at 0.33s including a margin.

(ii)-6 ARC command pulse width ([**TCCW**]): 0.1s

The ARC command pulse width should be set higher than the closing time of the CB. As the CB closing time is 80ms, the [**TCCW**] timer is set to 100ms to include a margin.

Note: The difference between the setting [**TCCW**] and the CB closing time, (in this case 20ms) should be lower than 'the protection operation time + CB opening time'. This is to ensure that for CBs without an anti-pumping feature, the close pulse is not present if the CB were to re-trip on closure.

(ii)-7 Check time for successful reclosure ([**TARCDSUC**]): 0.25s

As explained under section 3.24.2(xi), the [**TARCDSUC**] timer signals the following:

[**ARC-SucChk**]=**Off**; the [**TARCDSUC**] timer signals a successful reclosure. However, it does not differentiate between a successful reclosure and a CB failure to close.

[**ARC-SucChk**]=**On**; the [**TARCDSUC**] timer signals a CB failure to close condition. Setting of TARCDSUC timer should be higher than the time required to determine a successful CB closure; that is, higher than protection operating time + CB opening + dead time + CB closing time. In this case it should be > (45ms + 60ms + 105ms + 80ms); that is, > 290ms. Setting chosen is 350ms.

(ii)-8 Time for resetting upon CB failure ([**TRESET**]): 0.15s

The setting for [**TRESET**] should be longer in duration than the CB opening time. In this case, it should be > 60ms. Setting chosen is 150ms.

(ii)-9 Abandon time for ARC SHOT1 ([**TRR**]): 0.15s

The setting of [**TRR**] should be longer in duration than the [**TSHOT/TSHOT_SUB**] timer settings. In this case, it should be set > 125ms. Setting chosen is 150ms.

(ii)-10 Abandoning time for ARC SHOT2 ([**TRR_MS2**]): 0.4s

The setting of [**TRR_MS2**] should be longer in duration than the [**TD_MS2**] timer setting. In this case, it should be set > 0.33s. Setting chosen is 0.4s.

Note: The ARC coordination function may be enabled if there is another downstream CB with which shot coordination is required. The function is enabled by setting '**On**' for scheme switches [**ARCCO-OCEN**] and [**ARCCO-EFEN**]. The default settings for overcurrent pickup (CO-OC=1.0/5.0 A) and earth fault pickup (CO-EF=0.30/1.5 A) should be adequate for most applications.

3.24.9 Setting

ARC Settings (Function ID: 4A7001)

Setting item	Range	Units	Contents	Default setting value	Notes
ARC-EN	Off/On	–	Enabling ARC operation	Off	
ARC-NUM	S1/S2/S3/S4/S5	–	Maximum shot number	S1	
ARC-SucChk	Off/On	–	Enable autoreclose success checking	On	
TARCDSUC	0.10-100.00	s	Check time for successful reclosing	0.30	
TRESET	0.01-300.00	s	Time for ARC resetting on CB failure	0.30	
SHOTNUM-Test	Off/S1/S2/S3/S4/S5/S6	–	Shot number for testing	Off	
TREADY	0.0 – 600.0	s	Reclaim time for autoreclosing	60.0	
TSHOT	0.01 – 300.00	s	Dead time for first shot (ARC SHOT1)	0.60	
TSHOT_SUB	0.01 – 300.00	s	Sub dead time for ARC SHOT1	300.00	
TRR	0.01 - 310.00	s	Abandon time for ARC SHOT1	2.00	
TCCW	0.01-10.00	s	ARC command pulse width	0.20	
TD_MS2	0.01 – 300.00	s	Dead time for ARC SHOT2	20.00	
TRR_MS2	0.01 - 310.00	s	Abandon time for ARC SHOT2	30.00	
TD_MS3	0.01 – 300.00	s	Dead time for ARC SHOT3	20.00	
TRR_MS3	0.01 - 310.00	s	Abandon time for ARC SHOT3	30.00	
TD_MS4	0.01 – 300.00	s	Dead time for the 4th shot (ARC SHOT4)	20.00	
TRR_MS4	0.01 - 310.00	s	Abandon time for ARC SHOT4	30.00	
TD_MS5	0.01 – 300.00	s	Dead time for the 5th shot (ARC SHOT5)	20.00	
TRR_MS5	0.01 - 310.00	s	Abandon time for ARC SHOT5	30.00	
ARC-EN	Off/On	–	Enabling ARC operation	Off	

ARC coordination Settings (Function ID: 4A7001)

Setting item	Range		Units	Contents	Default setting value		Notes
	1A Rating	5A rating			1A rating	5A rating	
ARCCO-OCEN	Off/On		–	Enable OC relay (CO-OC) for coordination	Off		
ARCCO-EFEN	Off/On		–	Enable EF relay (CO-EF) for coordination	Off		
CO-OC	0.02-50.00	0.10-250.00	A	Setting pick-up threshold of CO-OC relay	1.00	5.00	
CO-EF	0.02-50.00	0.10-250.00	A	Setting pick-up threshold of CO-EF relay	0.30	1.50	

3.24.10 Data ID

◆ Signal monitoring points

ARC(Function ID: 4A7001)

Element ID	Name	Description
8100001B60	EXT_START_SIGNAL	ARC operation is initiated by an external relay
8000001B61	ARC_START	ARC is started by GEN.TRIP command
8000001B63	ARC READY	CB is ready for reclosing
8200001B64	ARC IN-PROG	ARC is in progress for reclosing
8000001B65	ARC SHOT1	First reclosing shot for CB
8100001B66	ARC SHOT2	Second reclosing shot for CB
8200001B67	ARC SHOT3	Third reclosing shot for CB
8300001B68	ARC SHOT4	Forth reclosing shot for CB
8400001B69	ARC SHOT5	Fifth reclosing shot for CB
8000001B6A	ARC CLOSE COMMAND	Close command to the CB closing coil
8000001B6B	FT ARC UNREADY	ARC operation locked out because ARC is not ready.
8400001B6C	ARC FT	Final trip command issued after ARC operation is locked out.
8700001B6D	ARC RESET	ARC is reset when ARC no action or unsuccessful
8400001B6E	SHOT NUMBER OVER	Shot number for reclosing is over
8C00001B6F	ARC CLOSE FAIL	ARC operation failed
8000001B70	ARC CLOSE SUCCESS	ARC operation successful
8000001B71	SHOT_1ST	Counter in the shot counter logic does not run
8100001B72	SHOT_2ND	Shot counter logic is running for first cycle
8200001B73	SHOT_3RD	Shot counter logic is running for second cycle
8300001B74	SHOT_4TH	Shot counter logic is running for third cycle
8400001B75	SHOT_5TH	Clock hand in the shot counter logic is running for fourth round
8500001B76	SHOT_6TH	Shot counter logic is running for fifth cycle
8000001B77	SHOT_MULTI	Shot counter logic is started
8000001B78	CO-OC A Phase	Coordination OC element operated in phase-A
8100001B79	CO-OC B Phase	Coordination OC element operated in phase-B
8200001B7A	CO-OC C Phase	Coordination OC element operated in phase-C
8300001B7B	CO-EF	Coordination EF relay operated
8100001B7C	ARC COORD	Coordination for shot number is operated
8000001BB0	ARC-OFF	Off mode in ARC
8100001BB1	ARC-ON	On mode in ARC
8000001BB2	EXT.ARC_START	External relay starts the ARC operation
8000001BB3	ARC NO ACT	Request not to operate ARC from an external relay
8000001BB4	CB-ARC READY	Ready signal for reclosing in CB
8000001BB5	ARC_MAIN_START	First reclosing sequence is in progress
8000001BB6	ARC_MAIN_COND	Permission state for the first reclosing
8100001BB7	ARC_SUB_START	Sub first reclosing sequence is in progress
8100001BB8	ARC_SUB_COND	Permission state for the sub first reclosing
8100001BB9	ARC-S2 COND	Permission state for the second reclosing
8200001BBA	ARC-S3 COND	Permission state for the third reclosing
8300001BBB	ARC-S4 COND	Permission state for the fourth reclosing
8400001BBC	ARC-S5 COND	Permission state for the fifth reclosing
8000001BBD	CB_MANUAL_CLOSE	Manual close signal is applied
8000001BBE	ARC_BLOCK	Blocking the ARC operation is applied

◆ Connection points in PLC logic

ARC(Function ID: 4A70001)

Element ID	Name	Description
800000EBB0	ARC-OFF	Request to select Off mode in ARC
810000EBB1	ARC-ON	Request to select On mode in ARC
800000EBB2	EXT.ARC_START	Receipt point from an external relay for starting ARC
800000EBB3	ARC NO ACT	Request not to operate
800000EBB4	CB-ARC READY	Signal injection point indicating that the CB is ready to be reclosed
800000EBB5	ARC_MAIN_START	Start signal for the ARC operation
800000EBB6	ARC_MAIN_COND	Point for the permissive signal to issue the first ARC shot
810000EBB7	ARC_SUB_START	Sub-start signal for the ARC operation
810000EBB8	ARC_SUB_COND	Point for the sub permissive signal to issue the first ARC shot
810000EBB9	ARC-S2 COND	Point for the permissive signal to issue the second ARC shot
820000EBBA	ARC-S3 COND	Point for the permissive signal to issue the third ARC shot
830000EBBB	ARC-S4 COND	Point for the permissive signal to issue the fourth ARC shot
840000EBBC	ARC-S5 COND	Point for the permissive signal to issue the fifth ARC shot
800000EBBD	CB_MANUAL_CLOSE	Point for reclose signal generated manually
800000EBBE	ARC_BLOCK	Point for blocking the ARC operation

3.25 Voltage check for autoreclose (VCHK)

To start the autoreclose function (ARC), a synchronism check may be required between the incoming voltage and the running voltage. Hence, a voltage-check-for-autoreclose (VCHK) function is provided within the (ARC) to fulfil this requirement. The (VCHK) function checks the absence/presence of the incoming/running voltages and the difference in their respective voltages, phase angle and frequencies. After successful checking, a permissive signal (ARC1-VCHK) is output to the ARC function. Subsequently, the ARC function will issue an 'ARC CLOSE COMMAND' for the closing of the CB†.

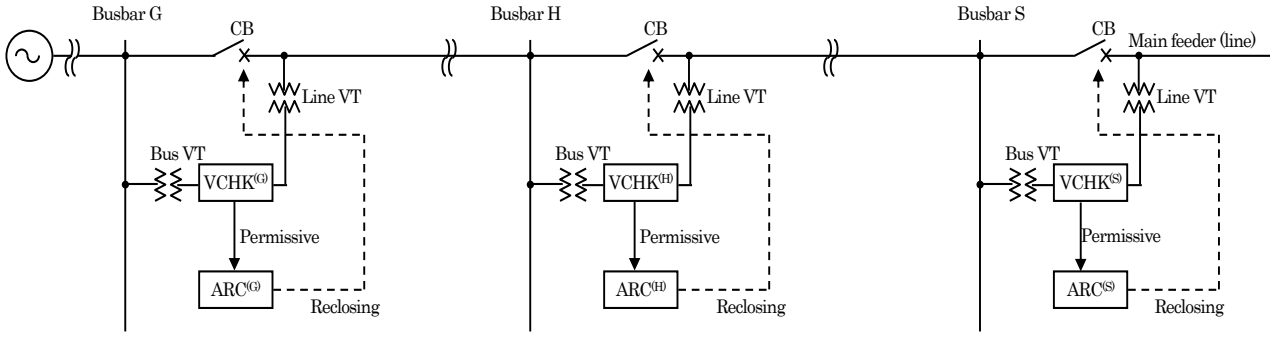


Figure 3.25-1 Three ARC relays applied to a distribution line with VCHK operations

†Note: If the ARC function does not require the permissive signal generated by the VCHK function, set the scheme switch [**ARC-NOVCHK**] to **On**. In this case, the permissive signal (ARC1-VCHK) is output to the ARC function unconditionally.

Note: The implementation of the feature depends on the selection of both the hardware and the software. Note that the feature is not supplied for the several models; hence, the user has to check the implementation for the model. Locate the ordering number and check it at the "G&T position" referring to the comparison table below. For more information, see *Appendix: Ordering*.

Table 3.25-1 Comparative table in respective ordering numbers

Sec.	Feature	Ordering No. at "G&T"					
		BCU			BCPU		IFU
		11	13	1F	2C	2N	19
–	Main features	NA	NA	NA	✓	✓	NA
–	PLC driver	NA	NA	NA	NA	NA	NA

✓: Applicable NA: Not applicable

3.25.1 Voltage condition and check zone

To provide the voltage and synchronism check schemes, the VCHK function has the following relay elements: OVB, OVL, UVB, and UVL. The OVB and OVL elements are used to verify the presence of voltage on the busbar and the line respectively, whereas the UVB and UVL elements are used to verify the absence of voltage on the busbar and the line respectively.

Figure 3.25-2 illustrates the four zones used (A1 to D1) to verify the presence or the absence of the above voltages. For example, as shown in Figure 3.25-2, when reclosing of CB(G) on the line is required, the voltage condition on the busbar G (i.e., running voltage) should be examined prior to reclosing. Thus, if the OVB element(G) operates and the UVL element(G) operates, the VCHK function is able to output the permissive signal. Incidentally, if the voltage condition coincides with the B1 zone, the synchronism check scheme is ready to start within the VCHK function. In addition, note that the synchronism check scheme is not required for zones A1, C1 or D1.

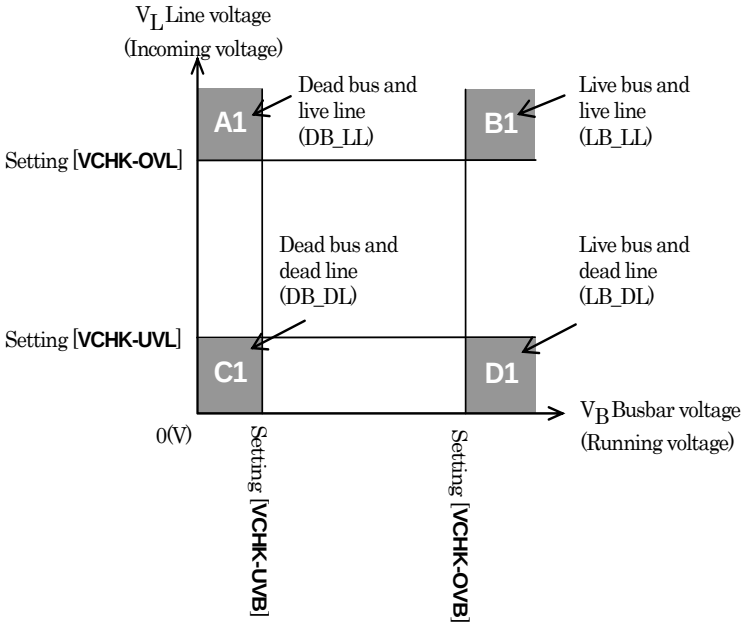


Figure 3.25-2 Four check zones examined in the VCHK function

Table 3.25-2 Four voltage conditions and zones

Voltage condition	**D**Ⓑ_**L**Ⓛ	**L**Ⓑ_**L**Ⓛ	**D**Ⓑ_**D**Ⓛ	**L**Ⓑ_**D**Ⓛ
Check zone	**A1**	**B1**	**C1**	**D1**
Ⓑusbar voltage (V_B=Running voltage)	**D**ead	**L**ive	**D**ead	**L**ive
Ⓛine voltage (V_L=Incoming voltage)	**L**ive	**L**ive	**D**ead	**D**ead
Synchronism check	N.A.	Applicable	N.A.	N.A.

3.25.2 Synchronism check scheme

The VCHK function has a measuring element to check the difference between a running voltage and an incoming voltage. The measuring element can check phase angles, voltages, and frequencies. Operation in the synchronism check mode is carried out in the 'B1' zone, as shown in Table 3.25-2.

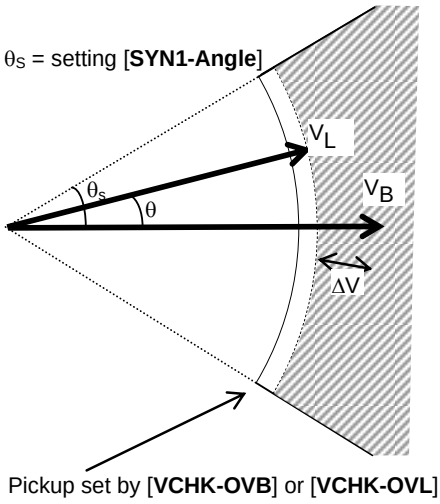


Figure 3.25-3 SYN1 measuring element

The scheme checks the following parameters: (i). voltage difference, (ii). frequency difference, and (iii). phase difference. The following variables represent the algebraic expression used to implement the scheme:

V_B = Busbar voltage
V_L = Line voltage
ΔV = Voltage difference between Busbar and Line
fV_B = Frequency of V_B
fV_L = Frequency of V_L
f = Slip cycle
Δf = Frequency difference between Busbar and Line
θ = Phase difference between V_B and V_L
SYN1-dV = Voltage difference set by [**SYN1-dV**]
VCHK-OVB = Pickup voltage set by [**VCHK-OVB**] for Busbar
VCHK-OVL = Pickup voltage set by [**VCHK-OVL**] for Line
SYN1-Angle = Phase difference between V_B and V_L, set by [**SYN1-Angle**]
SYN1-df = Value of frequency difference between Busbar and Line, set by [**SYN1-df**]
T_SYN1 = Delay timer for checking synchronism, set by [**T_SYN1**] (in seconds)

Table 3.25-3 VCHK synchronism setting

Setting	Range	Units	Comment
SYN1-df	0.01–2.00	Hz	Setting of difference in frequency between V_B and V_L
SYN1-dV	0–150	V	Setting of difference in voltage between V_B and V_L
SYN1-Angle	0–75	deg	Setting for difference angle between V_B and V_L

Setting	Range	Units	Comment
VCHK-OVL	10–150	V	Checking V_L for "Line being in live condition"
VCHK-OVB	10–150	V	Checking V_B for "Busbar being in live condition"
T_SYN1	0.01–100.00	s	Delay time for Synchro-check
ARC1-SYN	Off/On	–	Synchronism check enable

The VCHK can have the decision of synchronism between the running voltage and the incoming voltage when the following items (i) to (iv) are satisfied:

(i) Voltage magnitudes

The magnitude of the running voltage and the incoming voltage are greater than the SYN1 setting:

$V_B \geq$ [**VCHK-OVB**] and $V_L \geq$ [**VCHK-OVL**]

(ii) Voltage difference

The difference of the magnitude between the running voltage and the incoming voltage (ΔV1) is smaller than the SYN1 setting:

$\Delta V \geq | V_B - K \times V_L | \leq$ [**SYN1-dV**]

Note: The VCHK calculation should be achieved with respective rating voltages in V_B and V_L being identical. Thus, the VCHK function has a matching factor (K) designed to adjust the respective rating voltages when they are not identical. The matching factor (K) is calculated automatically using the setting values of VCT ratios; the K is generated based on the busbar voltage as shown below:

$$K = \frac{\text{VT ratio at Line}}{\text{VT ratio at busbar}}$$

whereas, 'VT ratio at Line' is obtained from the actual value in VCT ratio setting corresponding with scheme switch [**SYN-VLine**], and 'VT ratio at busbar' is obtained from the actual one corresponding with the scheme switch [**SYN-VBus**]. We shall see the scheme switches in the succeeding section.

(iii) Frequency difference

The frequency difference between the running voltage and the incoming voltage (Δf) is smaller than the SYN1 setting:

$\Delta f1 \geq | fV_B - fV_L | \leq$ [**SYN1-df**]

Note: When **Off** is set for the scheme switch [**SYN1-dfEN**], the VCHK abandons the frequency difference condition from synchronism requirements.

(iv) Phase angle difference

The phase difference between the running voltage and the incoming voltage (θ) is smaller than the SYN1 setting:

$V_B \times V_L \cos\theta \geq 0$

$V_B \times V_L \sin([\textbf{SYN1-Angle}]) \geq V_B \times V_L \sin\theta$

(v) Notice and tips

If the frequency difference between the V_L and the V_B is shown very large, the VCHK may fail to make the decision for the synchronism, although **Off** is set for the [**SYN1-dfEN**] to abandon checking the frequency difference. This is because; the vector passes the [**SYN1-Angle**] zone very quickly. As a result, the VCHK may fail to issue the permission command. To avoid the failure, the user has to set values for settings [**SYN1-Angle**] and [**T_SYN1**] depending on the assumed frequency difference (Δf):

$$\Delta f > \frac{\text{Setting } [\textbf{SYN1-Angle}]}{180° \times \text{Setting } [\textbf{T_SYN1}]} \qquad (3.25\text{-}1)$$

where,

Δf= Frequency-difference (or cycle-slip in Hertz)

Tips: **Cycles for the synchronism closure can be calculated:**

$$\text{Cycle for synchronism} = {}^{1}/_{\Delta f[\text{Hz}]} \qquad (3.25\text{-}2)$$

Time length for getting a synchronism:

$$\text{Time} = \frac{2 \times \text{Setting } [\textbf{SYN1-Angle}]}{360°} \times \frac{1}{\Delta f[\text{Hz}]} \qquad (3.25\text{-}3)$$

Check time for the synchronism:

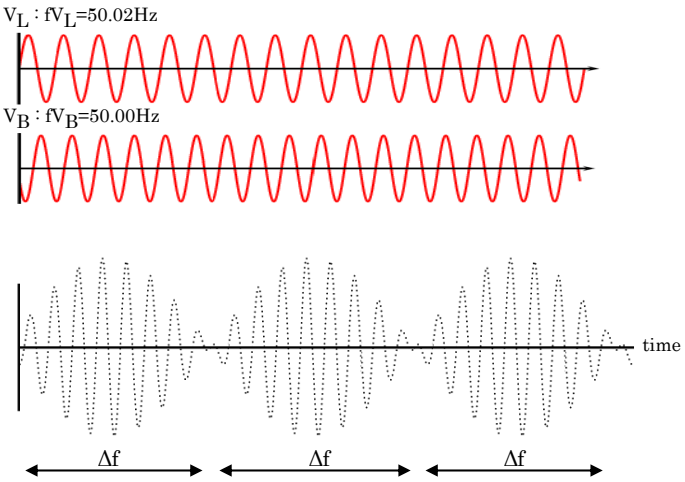
$$\text{Setting } [\textbf{T_SYN1}] < \frac{2 \times \text{Setting } [\textbf{SYN1-Angle}]}{360°} \times \frac{1}{\Delta f[\text{Hz}]} \qquad (3.25\text{-}4)$$

Equations rearrangements:

$$\text{Setting } [\textbf{T_SYN1}] < \frac{\text{Setting } [\textbf{SYN1-Angle}]}{180°} \times \frac{1}{\Delta f[\text{Hz}]} \qquad (3.25\text{-}5)$$

$$\frac{1}{\Delta f[Hz]} > \frac{Setting\ [\textbf{T_SYN1}]}{\text{Setting } [\textbf{SYN1-Angle}]} \div \frac{1}{180°} \qquad (3.25\text{-}6)$$

$$Setting\ \ [\textbf{T_SYN1}] < \frac{Setting\ \ [\textbf{SYN1-Angle}]}{180°} \times \frac{1}{\Delta f\,[Hz]} \qquad (3.25\text{-}7)$$



Example: $|fV_B - fV_L| = |50.00Hz - 50.02Hz| = 0.02Hz = 10s$

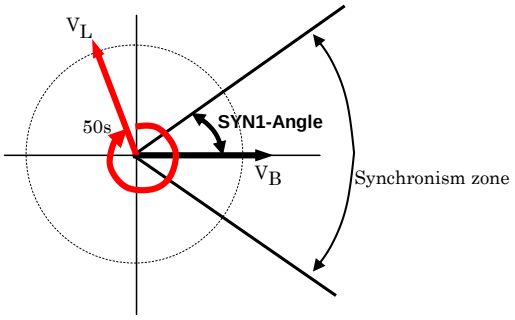


Figure 3.25-4 Synchronism between V_B and V_L when system frequency = 50Hz

3.25.3 Voltage selection for line arrangement

As shown in Figure 3.25-5, input-voltage signals are required to reflect the line and busbar arrangement. The input-voltage signals supplied by the VTs on the line and the busbar are applied to the IED via the transformer module (VCT[1]); hence, the input-voltage signal should correspond with the required element. On this account, settings are provided in the VCHK function: [**SYN-VBus**] and [**SYN-VLine**].

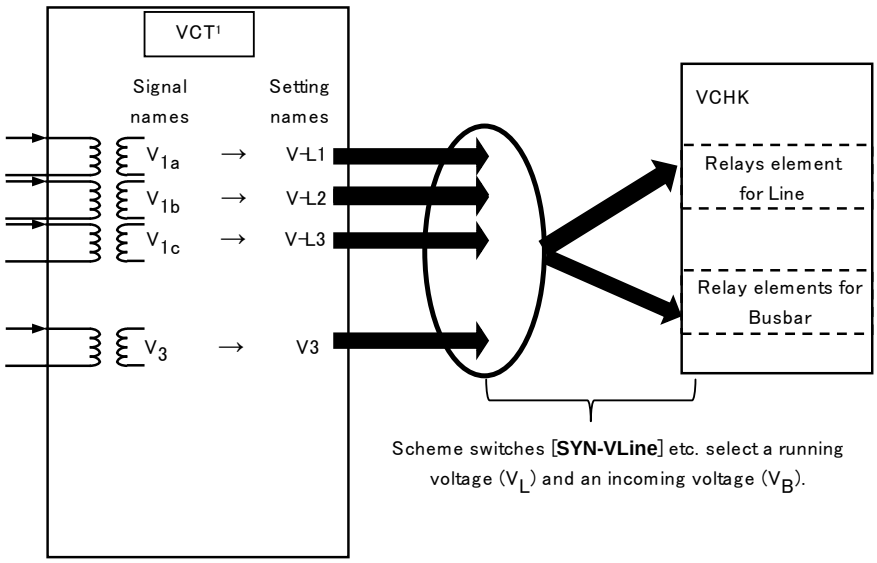


Figure 3.25-5 Voltage signals selected using scheme switches

Table 3.25-4 VCHK line selection setting

Scheme switchs	Setting names[2]	Comments
SYN-VBus	V-L1 / V-L2 / V-L3 / V-L12 / V-L23 / V-L31 / V3	Selection of Busbar voltage (V_B)
SYN-VLine	V-L1 / V-L2 / V-L3 / V-L12 / V-L23 / V-L31 / V3	Selection of Line voltage (V_L)

[1]Note: For the actual terminal arrangement and signals injected, see *Chapter Technical description: Transformer module for AC analog input*. For the information of external connections, see *Appendix: Typical external connection*.

[2]Note: Together, the individual voltages 'V-L1, V-L2, V-L3 etc. represent the three-phase voltage that is applied to the VCT, whereas 'V3' represents a single-phase voltage applied to the VCT. That is, selection of either V-L* is for a three-phase VT connection. Alternatively, selection of 'V3' is for a single-phase VT connection.

(i) Setting example 1 (Busbar VT=Three-phases, Line VT=Phase-A)

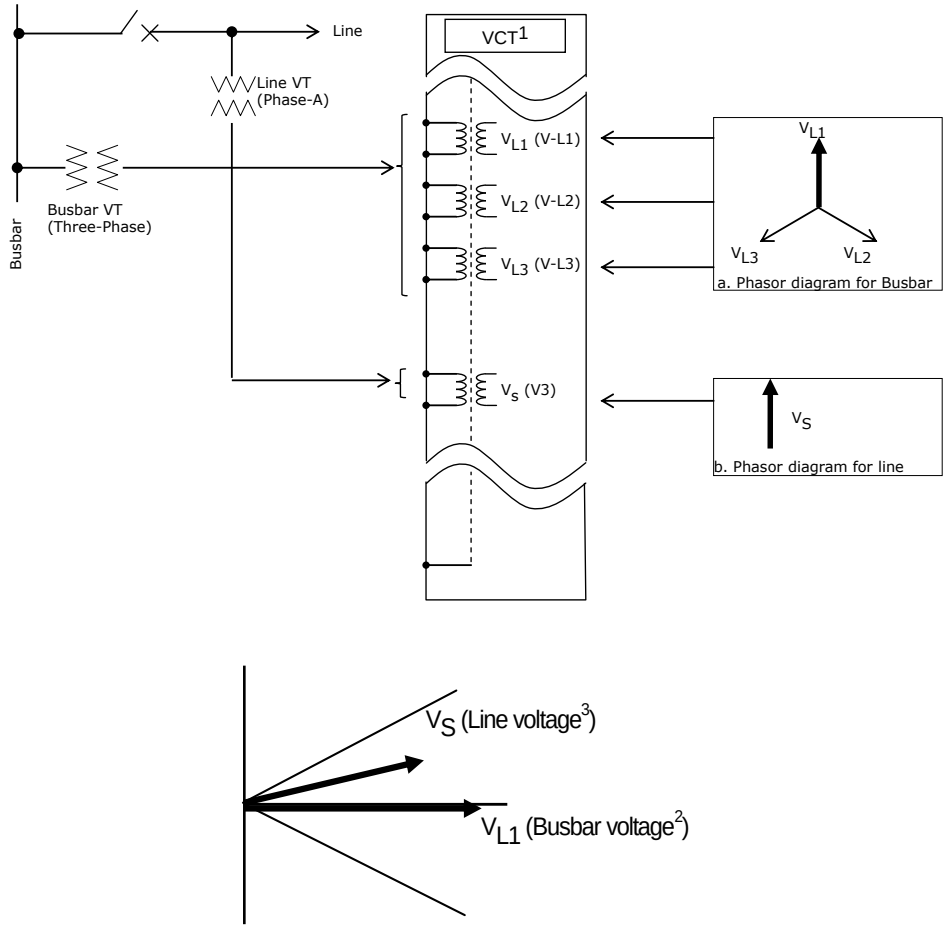


Figure 3.25-6 Example 1: Input voltages and respective phasor diagram for SYN

[1]Note: The hardware arrangement is dependent on the VCT type. (See chapter *Technical description: Transformer module for AC analog input*)

[2]Note: V_{Busbar} is the Running voltage. Set **V-L1** for [**SYN-VBus**], as shown in Figure 3.25-5.Note that V_S and V_{L1} have the same phase.

[3]Note: V_{Line} is the Incoming voltage. Set **V3** for [**SYN-VLine**].

Figure 3.25-6 shows the input voltages and phases available at the VCT from the line and the busbar; it illustrates the phase relationship between the running voltage and the incoming voltage. Table 3.25-5 shows the related settings in accordance with Figure 3.25-6.

Table 3.25-5 Settings for Example 1

Output voltage at VT	Busbar VT= Three-phase Line VT= Phase-A
Input voltage at VCHK	Running voltage = Phase-A (Busbar VT) Incoming voltage= Phase-A (Line VT)
VCHK Setting	[**SYN-VBus**] = **V-L1** [**SYN-Vline**]= **V3**

(ii) Setting example 2 (Busbar VT=Three-phases, Line1 VT=Phase-BC)

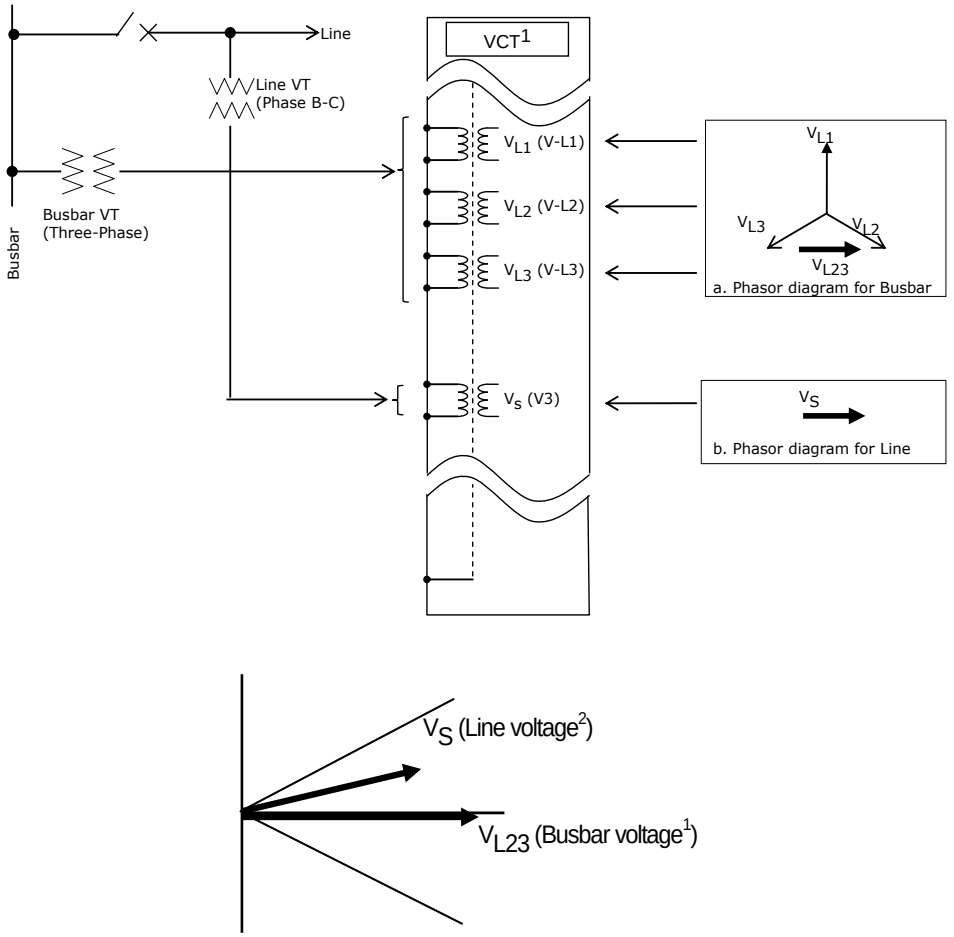


Figure 3.25-7 Example 2: Input voltages and respective phasor diagram for SYN

[1]Note: V_{Busbar} is the Running voltage. Set **V-L23** for [**SYN-VBus**]. Note that V_S (Line) and V_{L23} (Busbar) have the same phase.

[2]Note: V_{Line} is the Incoming voltage. Set **V3** for [**SYN-VLine**].

Similarly, Figure 3.25-7 shows the available input voltages and phases at the VCT from the line and the busbar. Table 3.25-6 shows how the settings are configured in accordance with Figure 3.25-7.

Table 3.25-6 Settings for Example 2

Output voltage at VT	Busbar VT= Line VT=	Three-phase Phase-BC
Input voltage at VCHK	Running voltage(V_{L2} V_{L3})= Incoming voltage (V3)=	Phase-B and C (Busbar VT) Phase-BC (Line VT)
VCHK Setting	[**SYN-VBus**] = [**SYN-VLine**]=	**V-L23** **V3**

(iii) Setting example 3 (Busbar VT=Phase-C, Line VT= Three-phase)

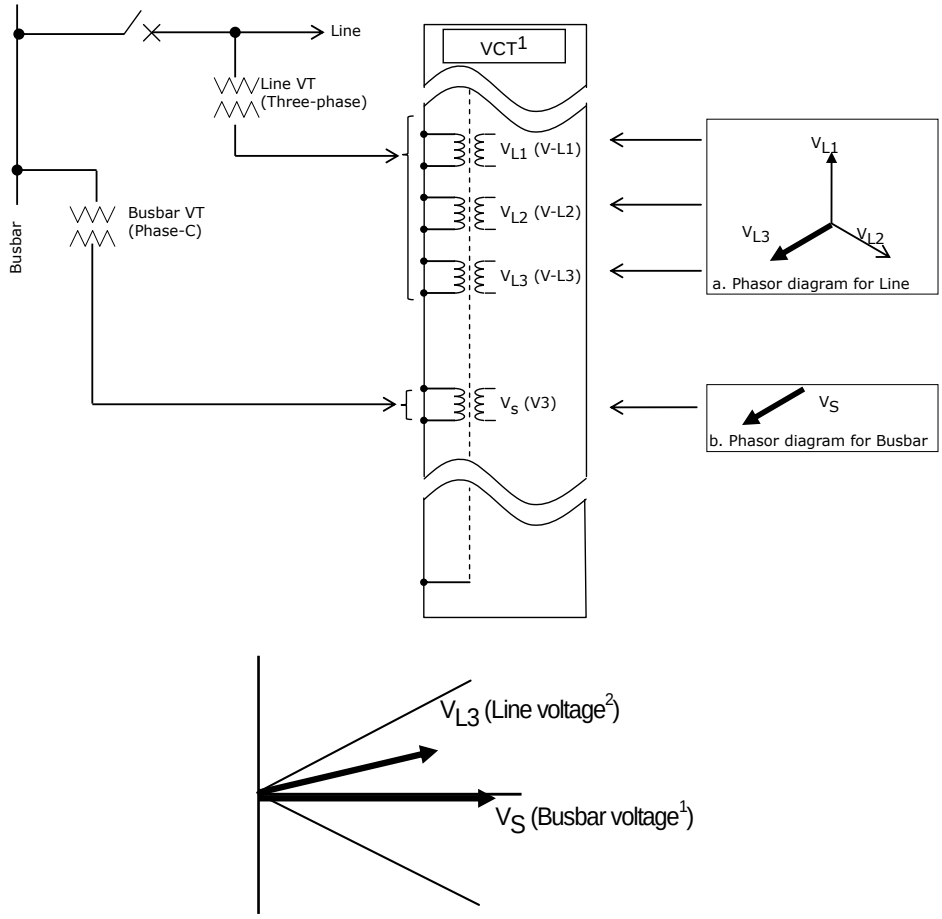


Figure 3.25-8 Example 3: Input voltages and respective phasor diagram for SYN

[1]Note: V_{Busbar} is the Running voltage. Set **V3** for the [**SYN-VBus**]. Note that V_S (Line) and V_{L3} (Busbar) have the same phase.

[2]Note: V_{Line} is the Incoming voltage. Set **V–L1** for the [**SYN-VLine**].

If three-phase voltages are provided for the incoming voltage, the configuration of the input voltages and phases is as shown in Figure 3.25-8. Table 3.25-7 shows how the settings are configured in accordance with Figure 3.25-8.

Table 3.25-7 Setting for example 3

Output voltage at VT	Bus-bar VT= Phase-C Line VT= Three phase
Input voltage at VCT	Running voltage (V3)= Phase-C (Busbar VT) Incoming voltage (V_{L3})= Phase-C (Line VT)
VCHK Setting	[**SYN-VBus**] = **V3** [**SYN-VLine**]= **V-L3**

3.25.4 Check logic for the voltage and the synchronism

The VCHK function can send the permissive signal when the results of the voltage check and synchronism check are successful, as described earlier. Figure 3.25-9 illustrates that the ARC1-VCHK signal is sent to the ARC function when one or more of the following conditions are established: (1) Synchronism check operates, (2) the OVB and UVL elements operate, (3) the UVB and OVL elements operate or (4) the UVB and UVL elements operate. To engage the check logic in the VCHK function, the user should set the [**ARC1-LB_DL**], [**ARC1-DB_LL**], [**ARC1-DB_DL**], and [**ARC1-SYN1**] switches. For example, if the DB_LL condition, (see Table 3.25-2) is the only criteria for ARC operation, **On** should be set for the scheme switch [**ARC1-DB_LL**] while **Off** is set for the others. As a result, the ARC can reclose the CB on receiving the permissive signal from the VCHK function. Note that the SYN1-df operation is nullified when **Off** is set for the [**SYN1-dfEN**].

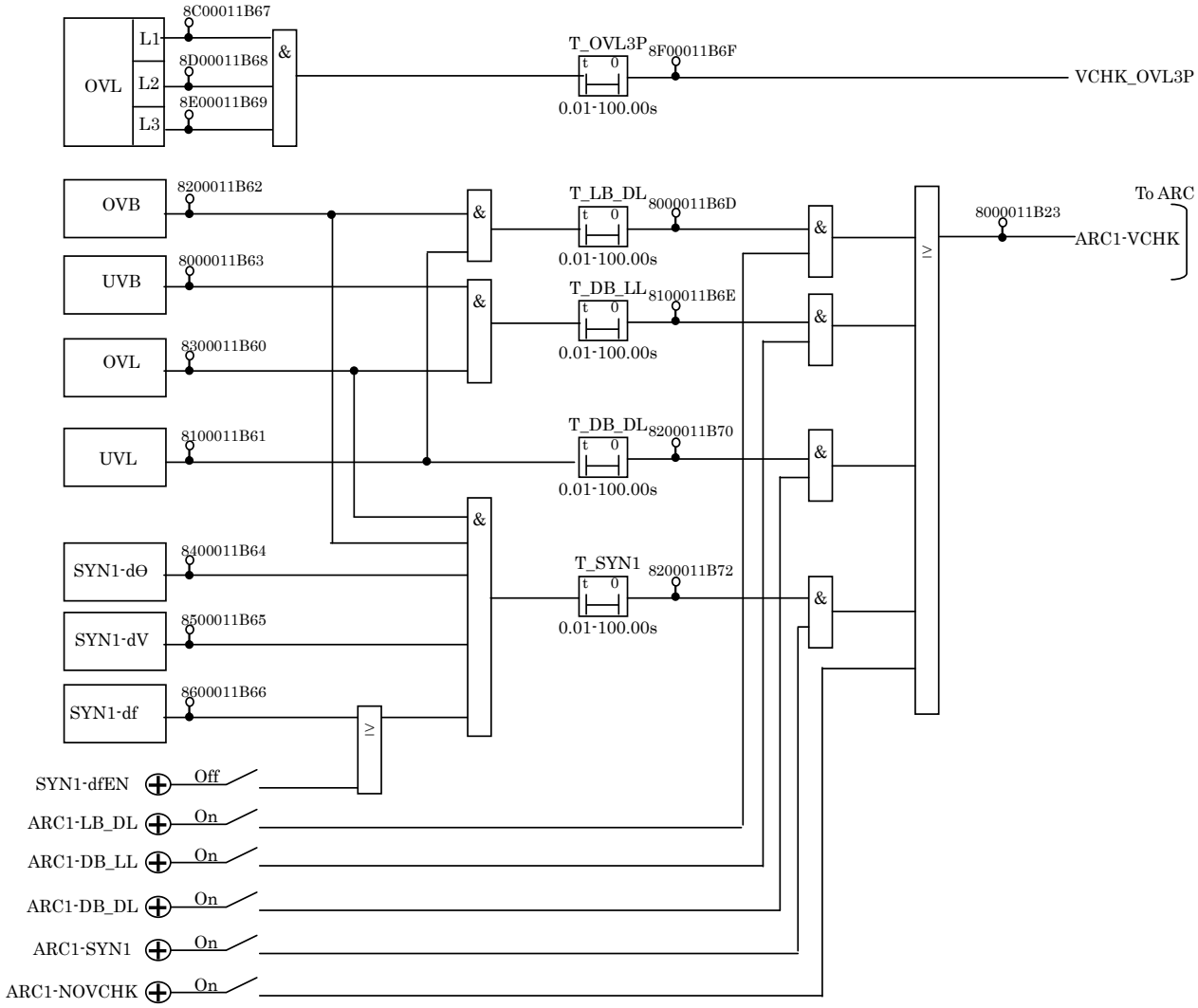


Figure 3.25-9 VCHK Logic

†Note: Signal "VCHK_OVL3P" may be used when the user wishes to check for the presence of respective phase-voltages on the line.

3.25.5 Setting

Setting of VCHK (Function ID: 4A8001)

Setting items		Range	Units	Contents	Default setting value	Notes
ARC1 Voltage check	SYN-VBus	V-L1 / V-L2 / V-L3 / V-L12 / V-L23 / V-L31 / V3	–	Selection of Bus voltage(Running Voltage) for SYN (Depending on relay model, setting items 'V2-L1, V2-L2, V2-L3, V2-L12, V2-L23, V2-L31, and V4' may not be applicable to the VCHK settings, please check when ordering.)	V-L1	
	SYN-VLine	V-L1 / V-L2 / V-L3 / V-L12 / V-L23 / V-L31 / V3	–	Selection of Line voltage (Incoming Voltage) for SYN (Depending on relay model, setting items 'V2-L1, V2-L2, V2-L3, V2-L12, V2-L23, V2-L31, and V4' may not be applicable to the VCHK settings, please check when ordering)	V3	
	VCHK-OVB	10 – 150	V	Voltage for checking Live-Bus	51	
	VCHK-UVB	10 – 150	V	Voltage for checking Dead-Bus	13	
	VCHK-OVL	10 – 150	V	Voltage for checking Live-Line	51	
	VCHK-UVL	10 – 150	V	Voltage for checking Dead-Line	13	
	SYN1-Angle	0 – 75	deg	Difference angle for SYN check	30	
	SYN1-dV	0 – 150	V	Difference voltage for SYN check	150	
	SYN1-df	0.01 – 2.00	Hz	Difference frequency for SYN check	1.00	
	SYN1-dfEN	Off / On	–	Enabling switch of df in SYN1	Off	
	ARC1-LB_DL	Off /On	–	"Live-Bus & Dead-Line" is checked	Off	
	ARC1-DB_LL	Off / On	–	"Dead-Bus & Live-Line" is checked	Off	
	ARC1-DB_DL	Off / On	–	"Dead-Bus & Dead-Line" is checked	Off	
	ARC1-SYN1	Off / On	–	"SYN(Live-Bus & Live-Line & Synchronism check)" is checked	Off	
	ARC1-NOVCHK	Off / On	–	Voltage check is not applied to ARC	On	
	T_LB_DL	0.01 – 100.00	s	Check delay timer "Live-Bus and Dead-Line"	0.05	
	T_DB_LL	0.01 – 100.00	s	Check delay timer "Dead-Bus and Live-Line"	0.05	
	T_DB_DL	0.01 – 100.00	s	Check delay timer "Dead-Bus and Dead-Line"	0.05	
	T_SYN1	0.01 – 100.00	s	Check delay timer "SYN1(LB_LL & Sync check)"	1.00	
	T_OVL3P	0.01 – 100.00	s	Check delay timer "Live-Line"	0.05	

3.25.6 Data ID

◆ Signal monitoring point

VCHK(Function ID: 4A8001)

Element ID	Name	Description
8300011B60	OVL	OVL relay element operated
8100011B61	UVL	UVL relay element operated
8200011B62	OVB	OVB relay element operated
8000011B63	UVB	UVB relay element operated
8400011B64	SYN-Angle	SYN-Angle relay element operated
8500011B65	SYN-dV	SYN-dV relay element operated
8600011B66	SYN-df	SYN-df relay element operated
8C00011B67	OVL-L1	OVL relay element operated (phase-L1)
8D00011B68	OVL-L2	OVL relay element operated (phase-L2)
8E00011B69	OVL-L3	OVL relay element operated (phase-L3)
8700011B6A	SYN-Angle zero	SYN Angle check (zero)
8800011B6B	SYN-Angle loss	SYN Angle check (loss)
8000011B6D	VCHK_LB-DL	Voltage check (Live Bus & Dead Line)
8100011B6E	VCHK_DB_LL	Voltage check (Dead Bus & Live Line)
8F00011B6F	VCHK_OVL3P	Voltage check (Live 3-phase Line)
8200011B70	VCHK_DB-DL	Voltage check (Dead Bus & Dead Line)
8300011B72	VCHK_SYN	Synchronous voltage (after timer)
8000011B23	ARC1-VCHK	Permissive signal for the ARC function

4 Technical Description

The IED hardware consists of a case, modules, and a front panel for human machine interface (HMI). For instance, figure below shows the constitution of the GR-series IED which is embedded in 1/1×19" rack. The user can find that the IED consists of two transformer modules (VCTs), a signal processing and communication module (CPU), binary input and output modules (BI, BI, and BIO), an analog input module (DCAI), and a power supply module (PWS), which are in a row from left to right. The IED case has two flanges attached on the IED sides. Another figure shows hardware block diagram. The module constitution depends on the GR-series models, IED cases, and the customer order. Therefore, the user should examine the actual assertion of modules from ordering numbers made by the user.

To understanding the IED structure and its functions, we start with the discussion of the IED case. At all events, the user should keep in mind that the information of this chapter are essential for wiring between the IED and external apparatus; and these are requisite for setting of the IED. Hence, we recommend the user be required to read this chapter thoroughly.

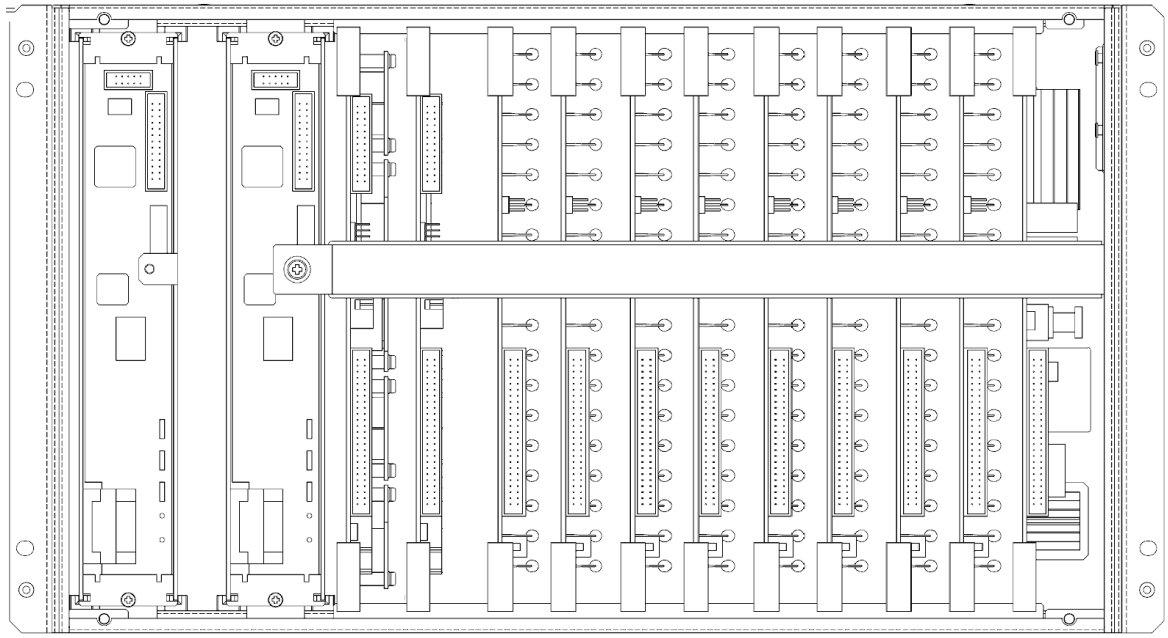


Figure 1/1 case for 1/1 19" rack (Front view, removed the front panel)

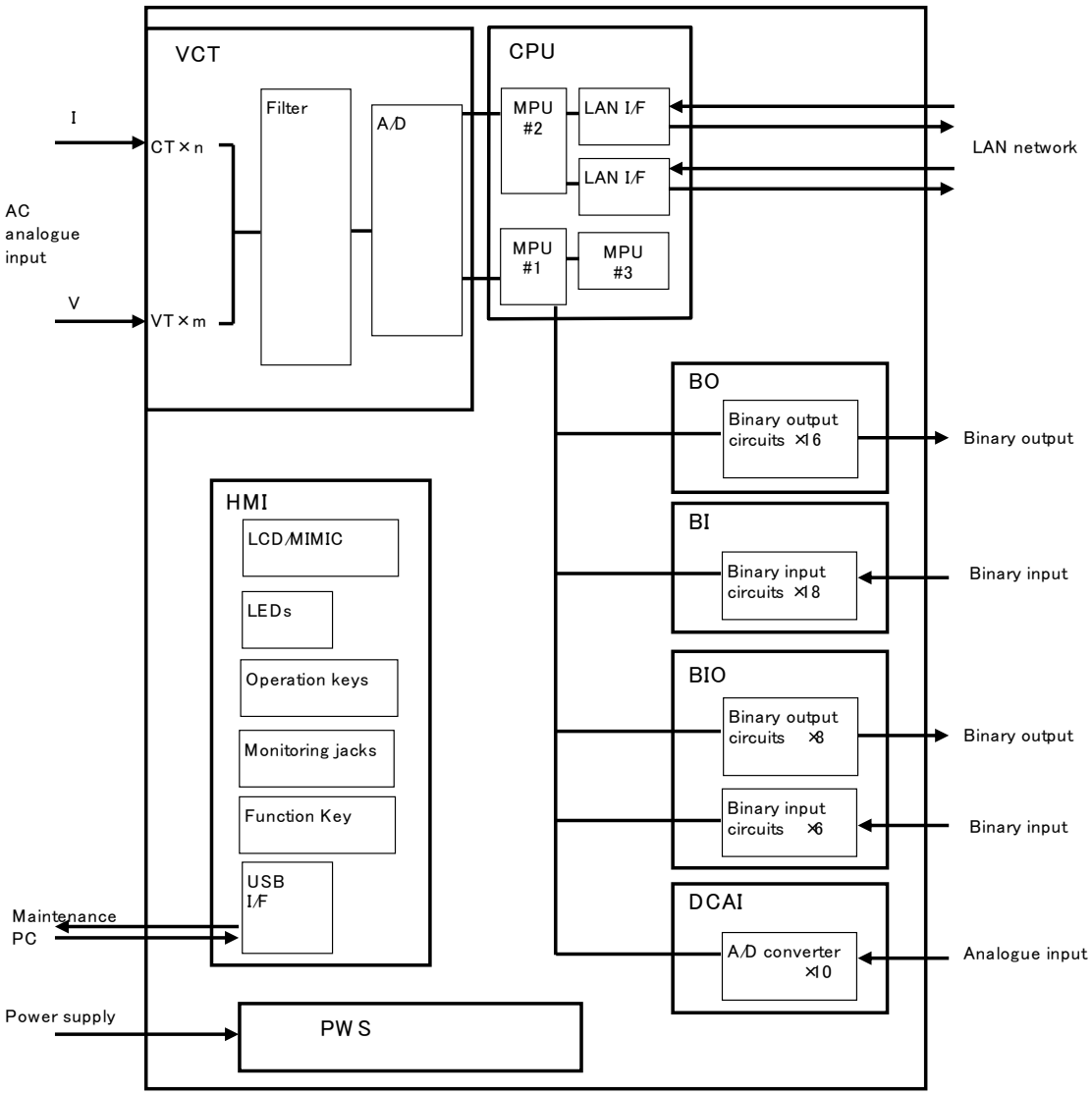


Figure Hardware Block Diagram (for example)

4.1 IED case and module slot

4.1.1 1/1 Case

Figure 4.1-1 shows diagrams of the IED case structure for 1/1 size: (a) IED internal structure seen from the front, (b) Terminal block arrangement seen from the rear, and (c) schematic diagram.

(i) Viewing from the front side (Figure 4.1-1.a)

Thirteen slots are provided for mounting modules. The transformer module (VCT), the signal processing and communication module (CPU), and the power supply module (PWS) are mounted at predefined locations in the case. The binary IO modules (BI, BO, and BIO) are placed in slots (IO#1 to IO#8), these slot locations are determined before factory shipment. For detailed information on slot locations, module types and their connections for all IEDs, see external connection figures. (See Appendix: Typical external connection).

(ii) Viewing from the rear side (Figure 4.1-1.b)

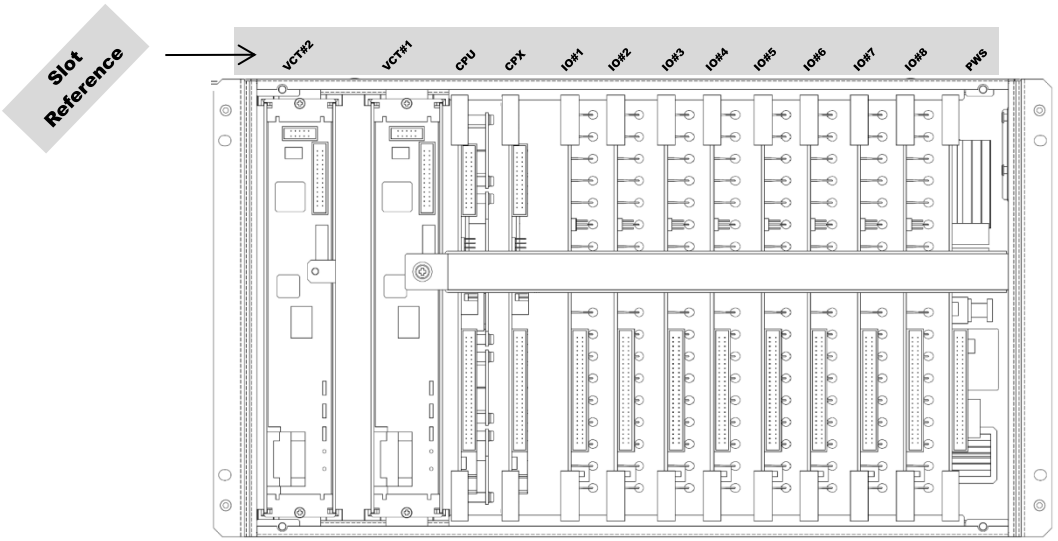
The group of terminal blocks for the 1/1 case viewed from the rear is shown. With respect to BI, BO, and BIO, the terminal blocks are designed with both upper and lower terminals and are labeled with alpha-numeric reference "T1", "T2" and so on. Note that both the upper and lower terminals are provided in the form of a single terminal block for respective BIs, BOs, or BIOs. The terminal screw numbers for each terminal block relate to the individual circuits and the user should check the configuration for each circuit. (For details, see section 4.4 or later). Each slot is identified by its alpha-numeric reference (or slot reference) on the IED case. For example, the user can identify that slot "IO#1" is linked with alpha-numeric reference "T1".

For PWS, note that the terminal blocks are placed on the left hand side. The user can also find alpha-numeric reference "T9" for PWS. The PWS circuits and relevant terminals are discussed later. (For details, see section 4.7 or later)

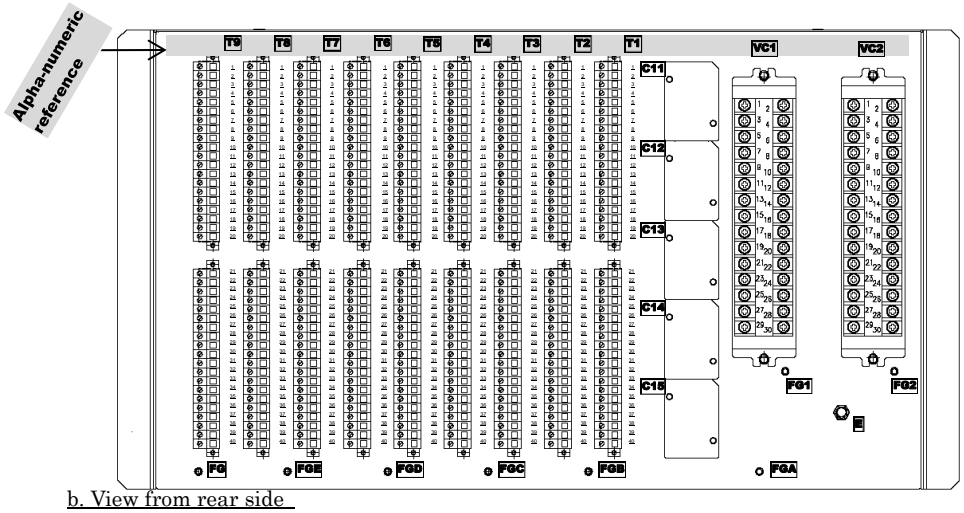
The communication modules, which are between the VCT slot and BIO slot, are labeled "C11" to "C15". These communication modules are used for LAN, IEC61850 communication, and external devices.

(iii) Schematic figure (Figure 4.1-1.c)

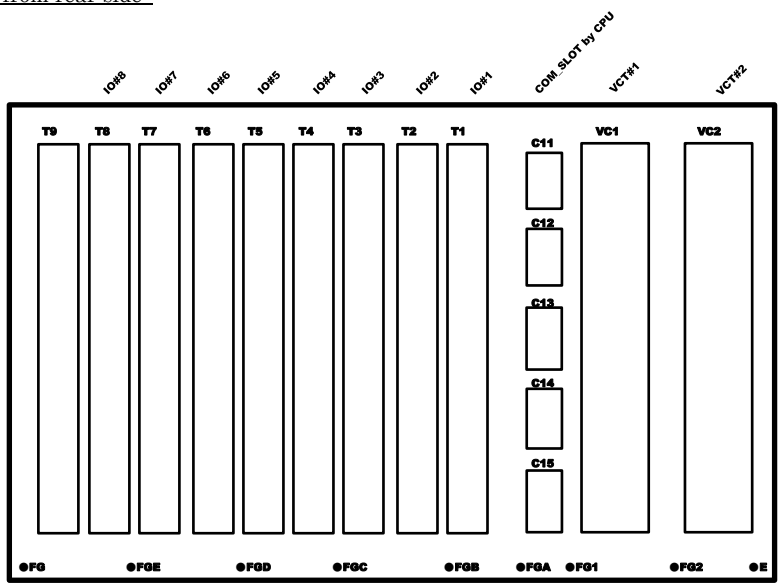
The slots and terminal blocks in the IED are shown. Using this figure, the user can find the location of VCT, BIO, and PWS. This figure is useful when the user sets binary IO modules using the setting tables. (For setting of binary IO modules, see section 4.4)



a. View from front side



b. View from rear side

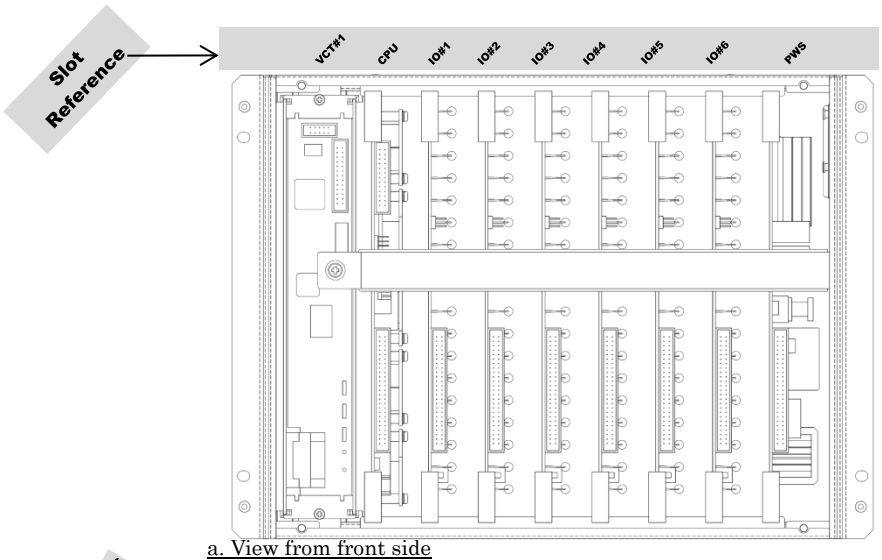


c. Schematic diagram

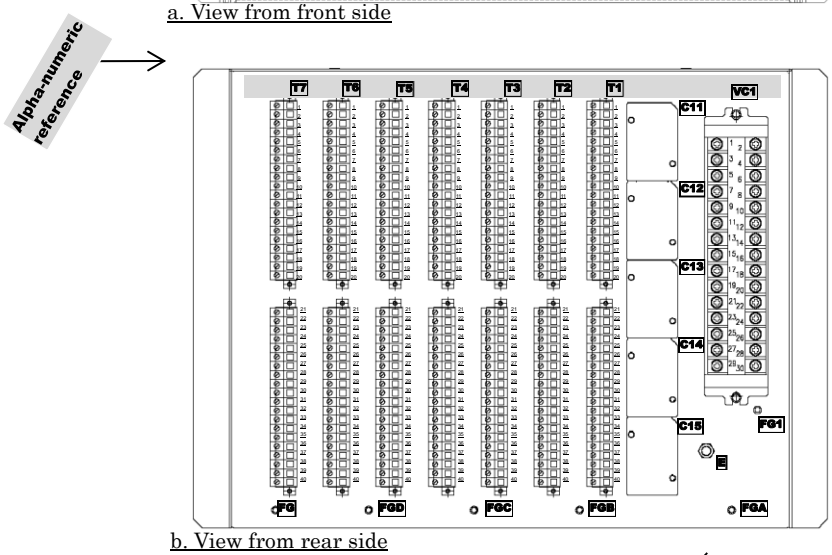
Figure 4.1-1 Slots and terminal blocks in 1/1 case for Compression-type terminal

4.1.2 3/4 case

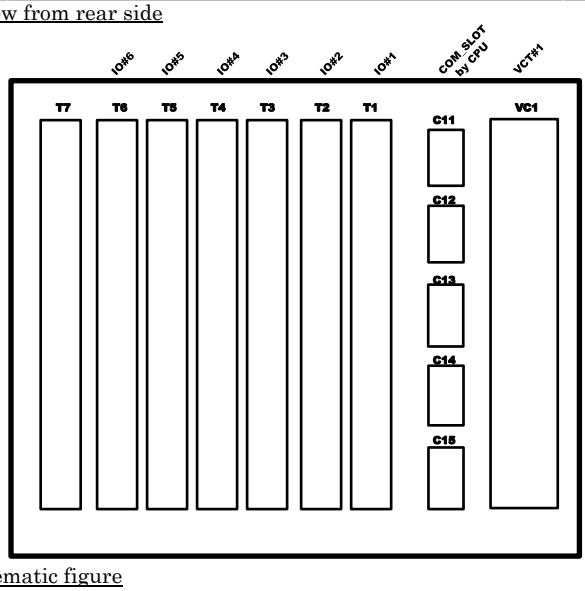
Figure 4.1-2 shows diagrams of the IED case structure for 3/4 size: (a) IED internal structure seen from the front, (b) Terminal block arrangement seen from the rear, and (c) schematic diagram. For PWS, note that the terminal blocks are placed on the left hand side. The user can also find alpha-numeric reference "T7" for PWS.



a. View from front side



b. View from rear side



c. Schematic figure

Figure 4.1-2 Slots and terminal blocks in 3/4 case for Compression-type terminal

4.1.3 1/2 case

Figure 4.1-3 shows diagrams of the IED case structure for 1/2 size: (a) IED internal structure seen from the front, (b) Terminal block arrangement seen from the rear, and (c) schematic diagram. For PWS, note that the terminal blocks are placed on the left hand side. The user can also find alpha-numeric reference “T4” for PWS.

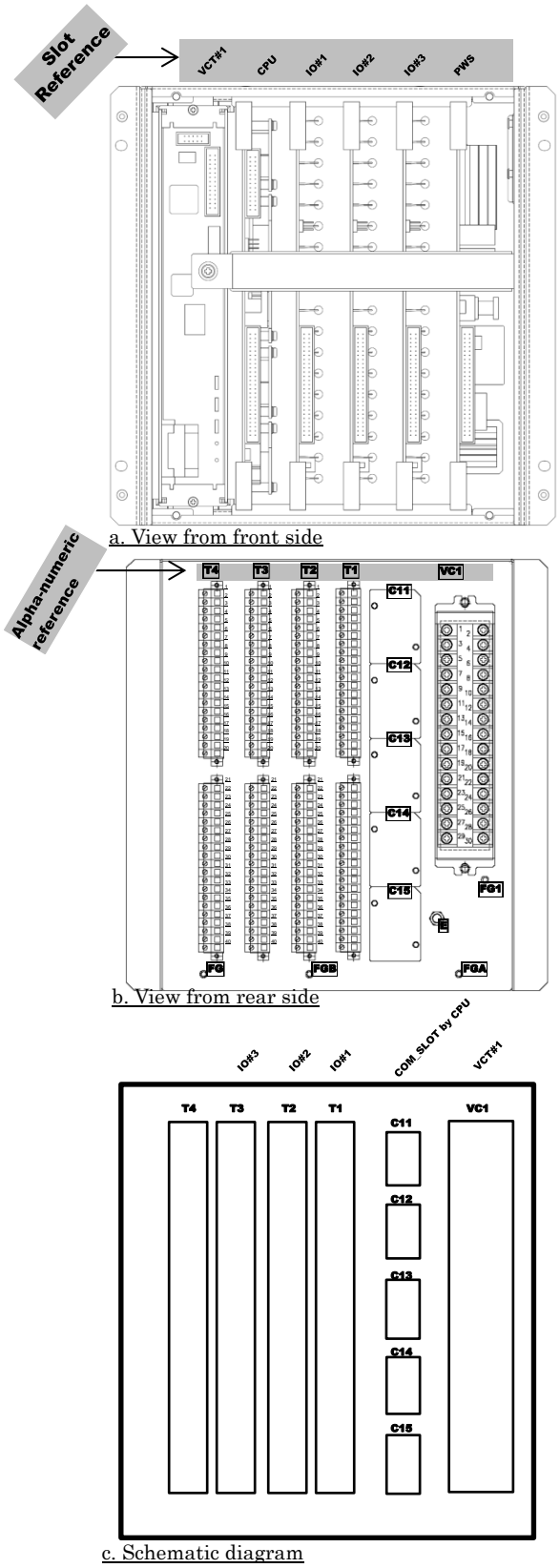
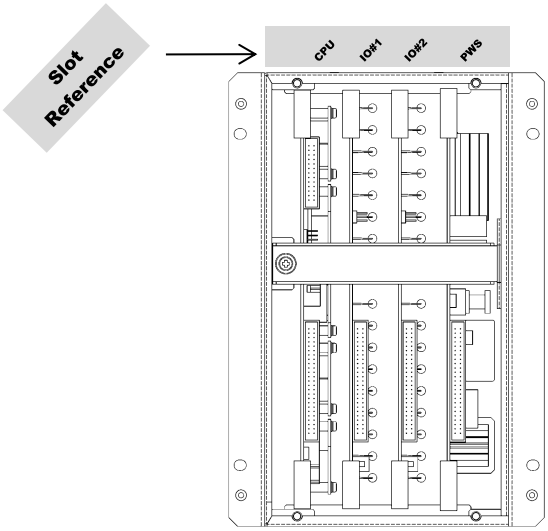


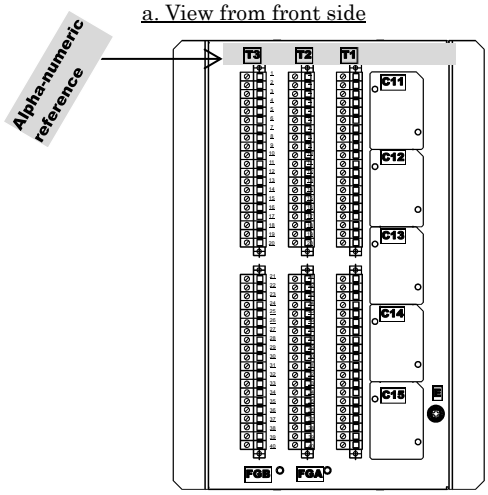
Figure 4.1-3 Slots and terminal blocks in 1/2 case for Compression-type terminal

4.1.4 IFU case (1/3 size case)

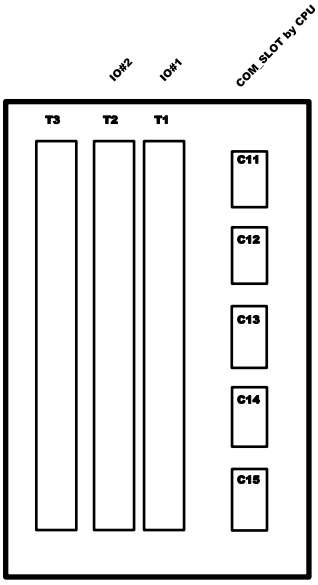
Figure 4.1-4 shows diagrams of the 1/3 size case structure for interface unit (IFU): (a) IFU internal structure seen from the front, (b) Terminal block arrangement seen from the rear, and (c) schematic diagram. For PWS, note that its terminal block is located on the left hand side. The user can also find alpha-numeric reference “T3” for the PWS.



a. View from front side



b. View from rear side



c. Schematic diagram

Figure 4.1-4 Slots and terminal blocks in IFU (1/3 case) for Compression-type terminal

4.2 Transformer module for AC analog input (VCT)

The transformer module (VCT) of the IED is used to acquire the power system quantities. A safety feature is available such that all of the VCT current inputs are shorted when a VCT module is removed from the IED case. Note also that all of the voltage inputs are disconnected. However, the user should make short circuit all AC current inputs and disconnect all AC voltage inputs.

Note; The user should understand that the rating current is fixed once the ordering is done.

Note: We represent respective input signals at the "AC analog input (VCT)" as "Channel numbers (Ch*)" when settings as to the ratio and others are required. The figure below shows the operation screen for the AC analog input, which we shall discuss later. The term "AI#1" in the below figure represents the VC alpha-numeric references discussed in the preceding section.

The blow figures exemplify the ratio settings for respective channels on the VCT. For more information about the operation of LCD screen, see chapter *User interface*. The user can also set them using GR-TIMES (see chapter *Engineering tool*).

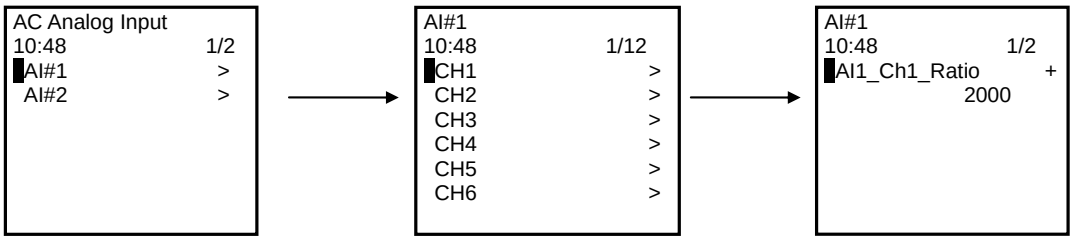


Figure 4.2-1 Ratio setting sample of AC analog input for VCT

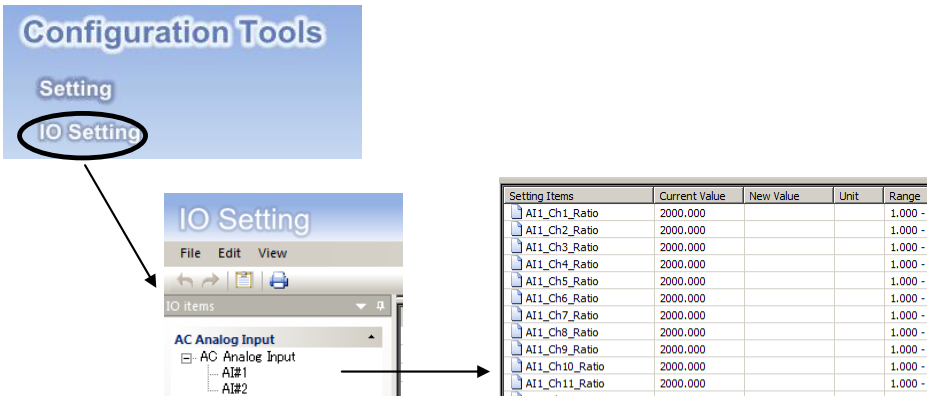
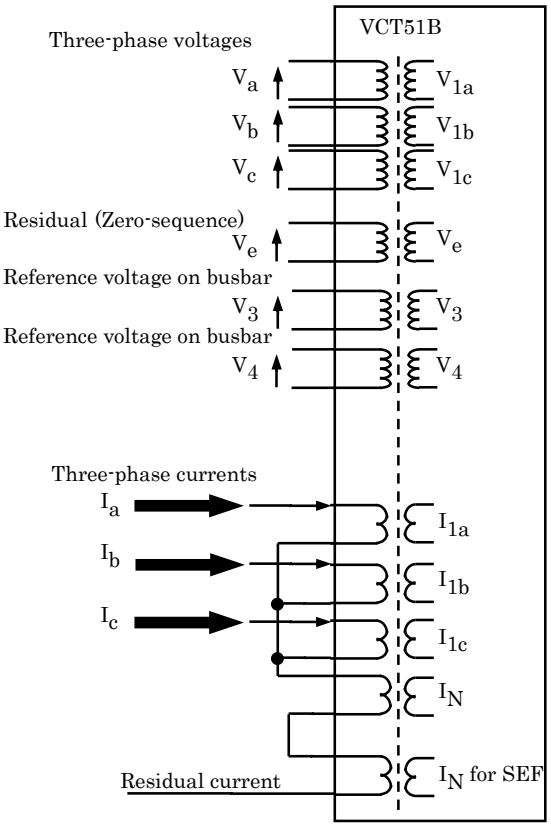


Figure 4.2-2 Setting sample of AC analog input (GR-TIEMS)

4.2.1 VCT51B for BCPU

VCT51B is designed with for a bay control unit plus protection functions (BCPU), as shown in Figure 4.2-3.



Terminal Screw Number		Input signal(6)	Type of input	Jumper position (4)	AC analog input channel(3)
1	2	V_{1a}	Voltage	NA	Ch1
3	4	V_{1b}	Voltage	NA	Ch2
5	6	V_{1c}	Voltage	NA	Ch3
7	8	V_e(5)	Voltage	NA	Ch4
9	10	V3(7)	Voltage	NA	Ch5
11	12	V4(7)	Voltage	NA	Ch5
13	14	–	–	–	–
15	16	–	–	–	–
17	18	–	–	–	–
19	20	I_{1a}	Current	W10(1)	Ch10
21	22	I_{1b}	Current	W11(1)	Ch11
23	24	I_{1c}	Current	W12(1)	Ch12
25	26	I_N	Current	W13(1)	Ch13
27	28	I_N for SEF	Current	NA(2)	Ch14

Figure 4.2-3 Transformer module (VCT51B)

(1)Note: The scale is defined with the rated current multiplied by 65.536 (amperes).

(2)Note: The scale is fixed to be 1.024 (amperes), which is used only for sensitive earth fault protection function (SEF).

(3)Note: The cannel number about the AC analog input is used to represent the terminal location when the user sets the ratio about the CT or the VT. We shall discuss later in section *Setting VCT ratio.*

(4)Note: Inserting a jumper on the board is carried out to operate for 5A rated current. We shall discuss the rated current in later section *Check of rated current*.

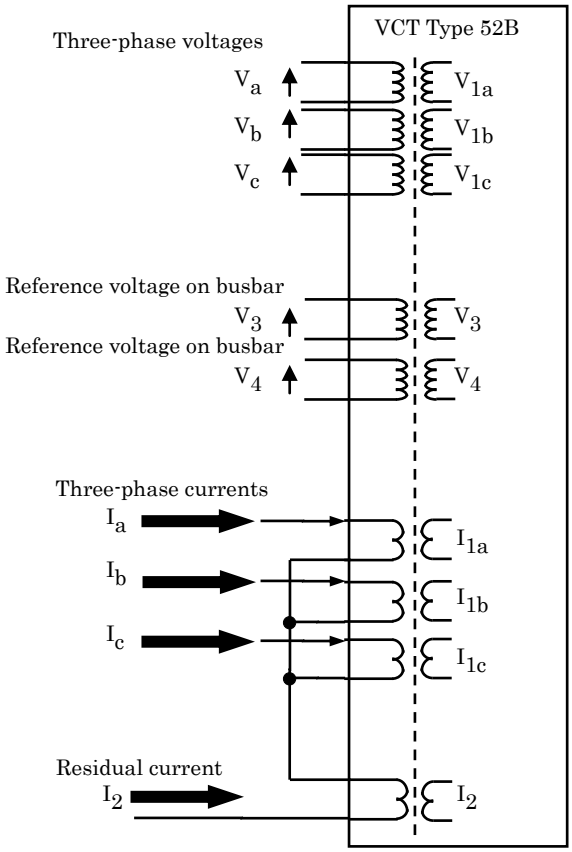
(5)Note: The zero-sequence quantity (V_0) can be derived by the means to the calculation. We shall discuss the deriving in the later section *Setting for obtaining zero-sequence voltage.*

(6)Note: For the destination of input signals, see Appendix: *Matrix between VCT terminals and relay applications*.

(7)Note: Reference voltage is used in the synchronizing check (SYNDIF) or Voltage check (VCHK) function; see Chapter *Control and monitoring, or Relay applications*.

4.2.2 VCT52B for BCU

VCT52B is designed for with for a bay control unit (BCU), as shown in Figure 4.2-4.



Terminal Screw Number		Input signal	Type of input	Jumper position(3)	AC analog input channel(2)
1	2	V_{1a}	Voltage	NA	Ch1
3	4	V_{1b}	Voltage	NA	Ch2
5	6	V_{1c}	Voltage	NA	Ch3
7	8	V3(4)	Voltage	NA	Ch4
9	10	V4(4)	Voltage	NA	Ch5
11	12	I_{1a}	Current	W6 (1)	Ch6
13	14	I_{1b}	Current	W7(1)	Ch7
15	16	I_{1c}	Current	W8(1)	Ch8
17	18	I_2	Current	W9(1)	Ch9
19	20	–	–	–	–
21	22	–	–	–	–
23	24	–	–	–	–
25	26	–	–	–	–
27	28	–	–	–	–

Figure 4.2-4 Transformer module (VCT52B)

(1)Note: The scale is defined with the rated current multiplied by 65.536 (amperes).

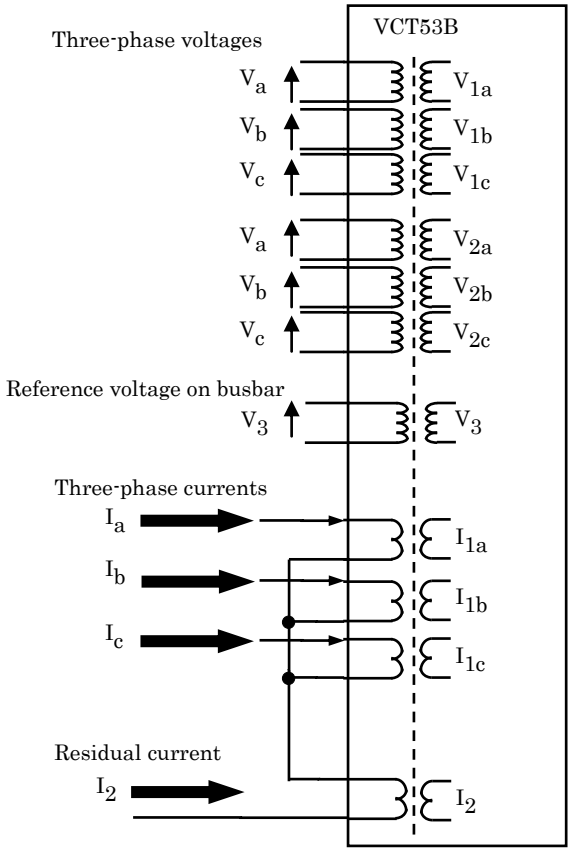
(2)Note: The cannel number about the AC analog input is used to represent the terminal location when the user sets the ratio about the CT or the VT. We shall discuss later in section *Setting VCT ratio.*

(3)Note: Inserting a jumper on the board is carried out to operate for 5A rated current. We shall discuss the rated current in later section *Check of rated current*.

(4)Note: Reference voltage is used in the synchronizing check (SYNDIF) or Voltage check (VCHK) function; see Chapter *Control and monitoring, or Relay applications*.

4.2.3 VCT53B for BCU

VCT53B is designed for with for a bay control unit (BCU), as shown in Figure 4.2-5.



Terminal Screw Number		Input signal	Type of input	Jumper position(3)	AC analog input channel(2)
1	2	V_{1a}	Voltage	NA	Ch1
3	4	V_{1b}	Voltage	NA	Ch2
5	6	V_{1c}	Voltage	NA	Ch3
7	8	V_{2a}	Voltage	NA	Ch4
9	10	V_{2b}	Voltage	NA	Ch5
11	12	V_{2c}	Voltage	NA	Ch6
13	14	V3(4)	Voltage	NA	Ch7
15	16	–	–	–	–
17	18	I1a	Current	W9 (1)	Ch9
19	20	I1b	Current	W10(1)	Ch10
21	22	I1c	Current	W11(1)	Ch11
23	24	I2	Current	W12(1)	Ch12
25	26	–	–	–	–
27	28	–	–	–	–

Figure 4.2-5 Transformer module (VCT type 53B)

(1)Note: The scale is defined with the rated current multiplied by 65.536 (amperes).

(2)Note: The cannel number about the AC analog input is used to represent the terminal location when the user sets the ratio about the CT or the VT. We shall discuss later in section *Setting VCT ratio.*

(3)Note: Inserting a jumper on the board is carried out to operate for 5A rated current. We shall discuss the rated current in later section *Check of rated current*.

(4)Note: Reference voltage is used in the synchronizing check (SYNDIF) or Voltage check (VCHK) function; see Chapter *Control and monitoring, or Relay applications*.

4.2.4 Constitution of VCT

Figure 4.2-6 shows a VCT terminal block together with its schematic diagram[1]; the same terminal screw numbers are shown on the terminal block and schematic diagram. The user should note that the last terminal screw[2] and FG terminal are connected with a short-wire by default.

[1]Note: When the size of the IED case is 1/1, two alpha-numeric references (VC1 and VC2) and two slot references (VCT#1 and VCT#2) are available.

[2]Note: In standard VCTs, the last terminal screw is designated as “No. 30”.

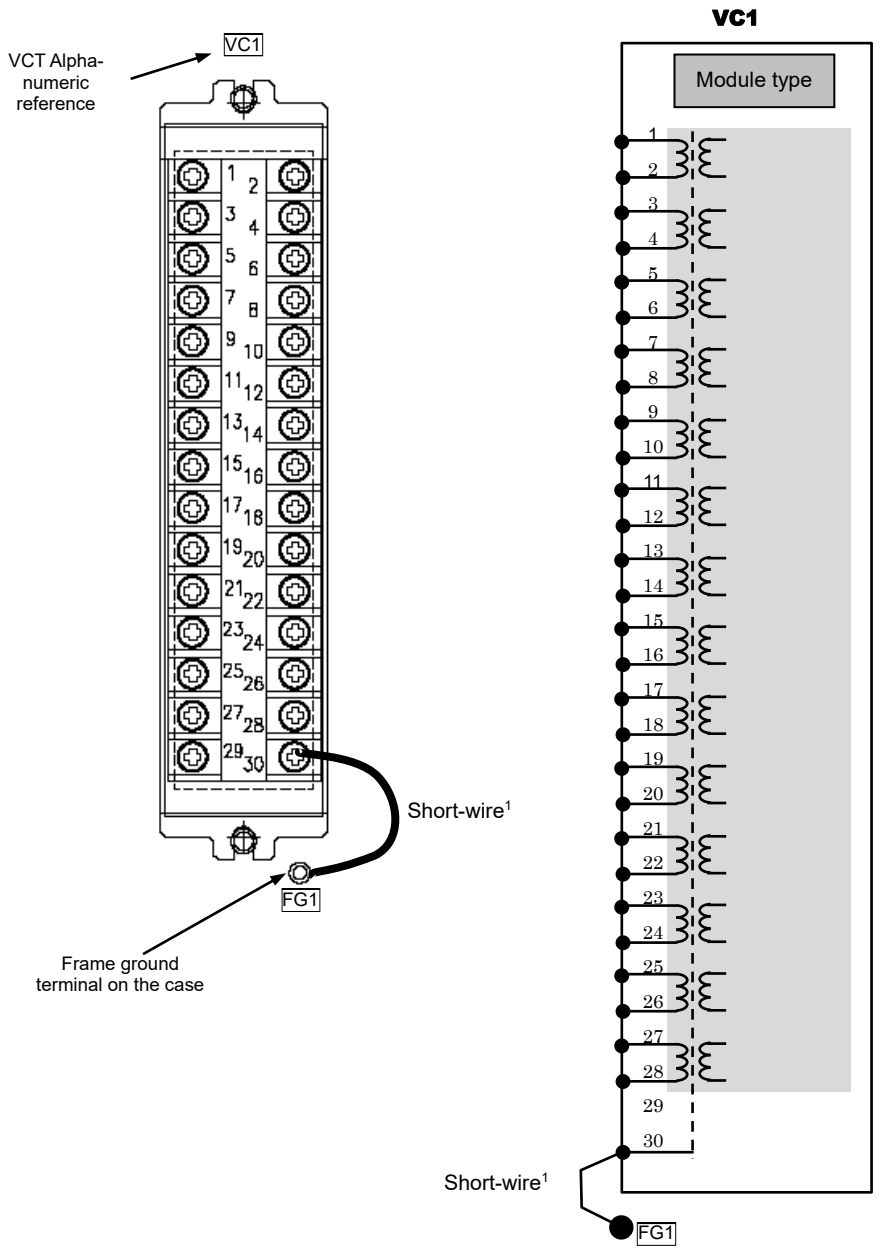


Figure 4.2-6 VC1 terminals[2] (Rear view)

[1]Note: The connection between terminal screw 30 and FG is made with a short-wire by the manufacturer.

[2]Note: This figure is used for general instruction with regard to the VCT. Thus, the alpha-numeric reference for the VCT will depend on the IED model.

[3]Note: "VC2" is available for VCT#2 slot.

4.2.5 Setting VCT ratio

As input sources are transformed with various VTs and CTs in the power system, the user shall set each VT or CT ratio at each VCT terminal.

(i) Setting a ratio for the VT

When the VT quantity applied at the VCT terminal, a ratio of the primary voltage to the secondary voltage should be set. A voltage is applied at the first terminal (Ch1) at VC1 alpha-numeric reference, the user should set the ratio for the setting [**AI1_Ch1_Ratio**]. For example, the user is required to set a value '3636' for the [**AI1_Ch1_Ratio**] when the primary is 400kV and the secondary is 110V (i.e., 400kV/110V=3636). The channel position on the VCT is discussed in the preceding section *VCT*.

(ii) Setting a ratio for the CT

When the CT quantity flows into the VCT terminal, a ratio of the primary current to the secondary current should be set. For example, the user is required to set a value '4000' for the [**AI1_Ch1_Ratio**] when the primary is 4000A and the secondary is 1A (i.e., 4000/1=4000).

(iii) Setting list

Setting of AC analog input(Function ID: 200201/200202)

Setting item			Range	Units	Contents	Default setting value	Notes
	VC1 alpha-numeric reference	AI1_Ch1_Ratio	1.000 to 20,000.000	–	For AC analog input ch#1 at VCT#1	1.000	
		AI1_Ch2_Ratio	1.000 to 20,000.000	–	For AC analog input ch#2 at VCT#1	1.000	
		AI1_Ch3_Ratio	1.000 to 20,000.000	–	For AC analog input ch#3 at VCT#1	1.000	
		AI1_Ch4_Ratio	1.000 to 20,000.000	–	For AC analog input ch#4 at VCT#1	1.000	
		AI1_Ch5_Ratio	1.000 to 20,000.000	–	For AC analog input ch#5 at VCT#1	1.000	
		AI1_Ch6_Ratio	1.000 to 20,000.000	–	For AC analog input ch#6 at VCT#1	1.000	
		AI1_Ch7_Ratio	1.000 to 20,000.000	–	For AC analog input ch#7 at VCT#1	1.000	
		AI1_Ch8_Ratio	1.000 to 20,000.000	–	For AC analog input ch#8 at VCT#1	1.000	
		AI1_Ch9_Ratio	1.000 to 20,000.000	–	For AC analog input ch#9 at VCT#1	1.000	
		AI1_Ch10_Ratio	1.000 to 20,000.000	–	For AC analog input ch#10 at VCT#1	1.000	
		AI1_Ch11_Ratio	1.000 to 20,000.000	–	For AC analog input ch#11 at VCT#1	1.000	
		AI1_Ch12_Ratio	1.000 to 20,000.000	–	For AC analog input ch#12 at VCT#1	1.000	
		AI1_Ch13_Ratio	1.000 to 20,000.000	–	For AC analog input ch#13 at VCT#1	1.000	
		AI1_Ch14_Ratio	1.000 to 20,000.000	–	For AC analog input ch#14 at VCT#1	1.000	
	VC2 alpha-numeric reference	AI2_Ch1_Ratio	1.000 to 20,000.000	–	For AC analog input ch#1 at VCT#2	1.000	
		AI2_Ch2_Ratio	1.000 to 20,000.000	–	For AC analog input ch#2 at VCT#2	1.000	
		AI2_Ch3_Ratio	1.000 to 20,000.000	–	For AC analog input ch#3 at VCT#2	1.000	
		AI2_Ch4_Ratio	1.000 to 20,000.000	–	For AC analog input ch#4 at VCT#2	1.000	
		AI2_Ch5_Ratio	1.000 to 20,000.000	–	For AC analog input ch#5 at VCT#2	1.000	
		AI2_Ch6_Ratio	1.000 to 20,000.000	–	For AC analog input ch#6 at VCT#2	1.000	
		AI2_Ch7_Ratio	1.000 to 20,000.000	–	For AC analog input ch#7 at VCT#2	1.000	
		AI2_Ch8_Ratio	1.000 to 20,000.000	–	For AC analog input ch#8 at VCT#2	1.000	
		AI2_Ch9_Ratio	1.000 to 20,000.000	–	For AC analog input ch#9 at VCT#2	1.000	
		AI2_Ch10_Ratio	1.000 to 20,000.000	–	For AC analog input ch#10 at VCT#2	1.000	
		AI2_Ch11_Ratio	1.000 to 20,000.000	–	For AC analog input ch#11 at VCT#2	1.000	
		AI2_Ch12_Ratio	1.000 to 20,000.000	–	For AC analog input ch#12 at VCT#2	1.000	
		AI2_Ch13_Ratio	1.000 to 20,000.000	–	For AC analog input ch#13 at VCT#2	1.000	
		AI2_Ch14_Ratio	1.000 to 20,000.000	–	For AC analog input ch#14 at VCT#2	1.000	

†Note: For more information on the IED operation, see Chapter *User interface: AC analog input.*

‡Note:The number of AC analog input channels depends on the configuration of the VCT type and the VCT slot. Thereby, the user has to set the value of the VCT ratio corresponding to a specific auxiliary VT/CT.

4.2.6 Check of rated current

On the VCT, the rated current is fixed by the manufacturer according to the hardware configuration. The set value is not allowed to change by the user; hence, the user should be in touch with the sales representative once changing the rated current is required. We just discuss here the means for checking the rated current set by the manufacture at each input channel.

(i) Hardware definition by jumper insertion

Each of the auxiliary CTs has a Jumper; either rated-1-ampere (1A) or rated-5-ampere (5A) is defined using the Jumpers. The user can examine the rated current by following the steps below with reference to Figure 4.2-7:

Step1: Open the IED front panel.

Step2: Check the receptacle at respective jumpers.

The Jumpers positons are represented with the marks "W1" to "W14", which are printed on the circuit board of the VCT. The user can find the "W*" marks correspond to the AC analog input channel numbers in the preceding section.

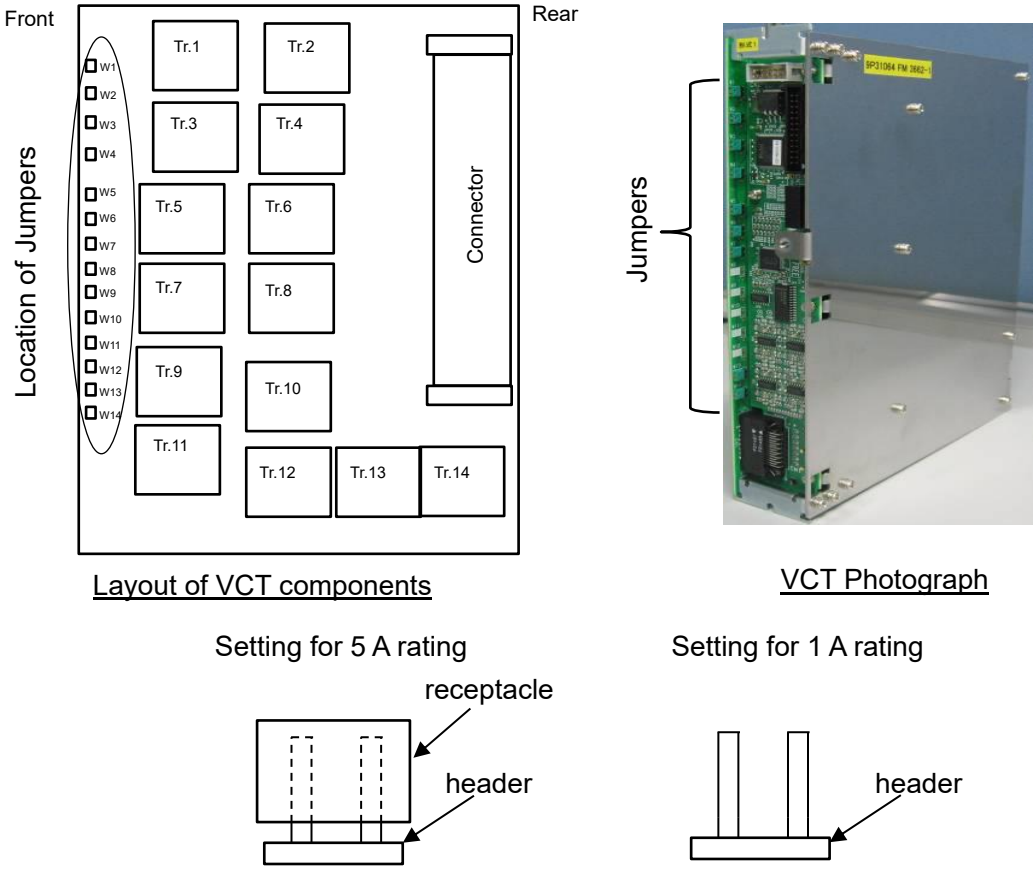


Figure 4.2-7 Jumpers and their locations

(ii) Software definition

The table below shows the software definitions for each AC analog input channel. As a rule, the rated current is defined once the customer has done the ordering: hence, term "**DEP**" is set for all settings [**AI1_Ch*_Rating**] (and [**AI2_Ch*_Rating**] when another VCT is available). The term "**DEP**" represents a pre-configured rated current set by the manufacturer; the pre-configured rated current is identical to the AC rating determined at the customer's ordering.

Setting of AC analog input(Function ID: 200201/200202)

Setting item			Range		Units	Contents	Default setting value		Notes
			1A rating	5A rating			1A rating	5A rating	
	VC1 alpha-numeric reference	AI1_Ch1_Rating	DEP / 1A / 5A		–	For AC analog input ch#1 at VCT#1	DEP		
		AI1_Ch2_Rating	DEP / 1A / 5A		–	For AC analog input ch#2 at VCT#1	DEP		
		AI1_Ch3_Rating	DEP / 1A / 5A		–	For AC analog input ch#3 at VCT#1	DEP		
		AI1_Ch4_Rating	DEP / 1A / 5A		–	For AC analog input ch#4 at VCT#1	DEP		
		AI1_Ch5_Rating	DEP / 1A / 5A		–	For AC analog input ch#5 at VCT#1	DEP		
		AI1_Ch6_Rating	DEP / 1A / 5A		–	For AC analog input ch#6 at VCT#1	DEP		
		AI1_Ch7_Rating	DEP / 1A / 5A		–	For AC analog input ch#7 at VCT#1	DEP		
		AI1_Ch8_Rating	DEP / 1A / 5A		–	For AC analog input ch#8 at VCT#1	DEP		
		AI1_Ch9_Rating	DEP / 1A / 5A		–	For AC analog input ch#9 at VCT#1	DEP		
		AI1_Ch10_Rating	DEP / 1A / 5A		–	For AC analog input ch#10 at VCT#1	DEP		
		AI1_Ch11_Rating	DEP / 1A / 5A		–	For AC analog input ch#11 at VCT#1	DEP		
		AI1_Ch12_Rating	DEP / 1A / 5A		–	For AC analog input ch#12 at VCT#1	DEP		
		AI1_Ch13_Rating	DEP / 1A / 5A		–	For AC analog input ch#13 at VCT#1	DEP		
		AI1_Ch14_Rating	DEP / 1A / 5A		–	For AC analog input ch#14 at VCT#1	DEP		
	VC2 alpha-numeric reference	AI2_Ch1_Rating	DEP / 1A / 5A		–	For AC analog input ch#1 at VCT#2	DEP		
		AI2_Ch2_Rating	DEP / 1A / 5A		–	For AC analog input ch#2 at VCT#2	DEP		
		AI2_Ch3_Rating	DEP / 1A / 5A		–	For AC analog input ch#3 at VCT#2	DEP		
		AI2_Ch4_Rating	DEP / 1A / 5A		–	For AC analog input ch#4 at VCT#2	DEP		
		AI2_Ch5_Rating	DEP / 1A / 5A		–	For AC analog input ch#5 at VCT#2	DEP		
		AI2_Ch6_Rating	DEP / 1A / 5A		–	For AC analog input ch#6 at VCT#2	DEP		
		AI2_Ch7_Rating	DEP / 1A / 5A		–	For AC analog input ch#7 at VCT#2	DEP		
		AI2_Ch8_Rating	DEP / 1A / 5A		–	For AC analog input ch#8 at VCT#2	DEP		
		AI2_Ch9_Rating	DEP / 1A / 5A		–	For AC analog input ch#9 at VCT#2	DEP		
		AI2_Ch10_Rating	DEP / 1A / 5A		–	For AC analog input ch#10 at VCT#2	DEP		
		AI2_Ch11_Rating	DEP / 1A / 5A		–	For AC analog input ch#11 at VCT#2	DEP		
		AI2_Ch12_Rating	DEP / 1A / 5A		–	For AC analog input ch#12 at VCT#2	DEP		
		AI2_Ch13_Rating	DEP / 1A / 5A		–	For AC analog input ch#13 at VCT#2	DEP		
		AI2_Ch14_Rating	DEP / 1A / 5A		–	For AC analog input ch#14 at VCT#2	DEP		

†Note: Number of auxiliary CTs depends on the configuration of the VCT type and the VCT slot. For more information, see Chapter *User interface: AC analog input.*

4.2.7 Setting for measuring zero-sequence (residual) voltage

The VCT module has a dedicated input for the residual voltage†, which is represented as "V_e", which is connected to the open delta winding of the voltage transformer. However, if an open delta winding is not available, the IED is also able to derive the residual voltage by calculation from the three-phase voltages (V_{1a}, V_{1b}, and V_{1c}). Thus, the user should select the measuring methods for the residual voltage using the setting [**APPL-VT**], as shown in Figure 4.2-9 and Figure 4.2-10. Figure 4.2-8 s shows that setting on the IED screen. For more information about the IED operation, see Chapter *User interface: IO setting sub-menu*.

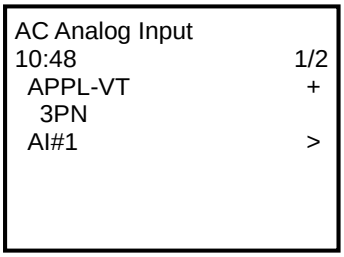


Figure 4.2-8 Setting screen

(i) Open delta VT measurement [APPL-VT] = 3PV

Set the setting [**APPL-VT**] **3PV** when the open delta voltage transformer is ready to be provided to the "Ve" on the VCT, as shown in Figure 4.2-9.

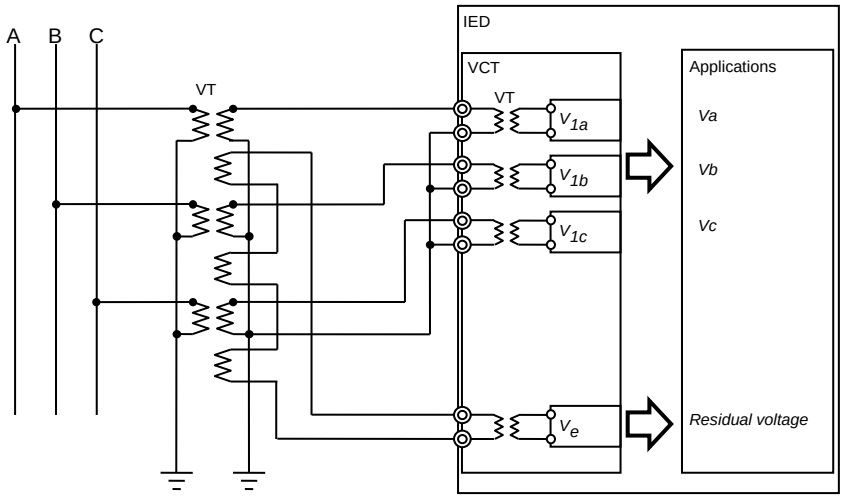


Figure 4.2-9 Connection with residual VT

(ii) Deriving operation [APPL-VT] = 3PN

Set **3PN** for the setting [**APPL-VT**], if the open delta voltage transformer is not directly provided to the VCT, as shown in Figure 4.2-10

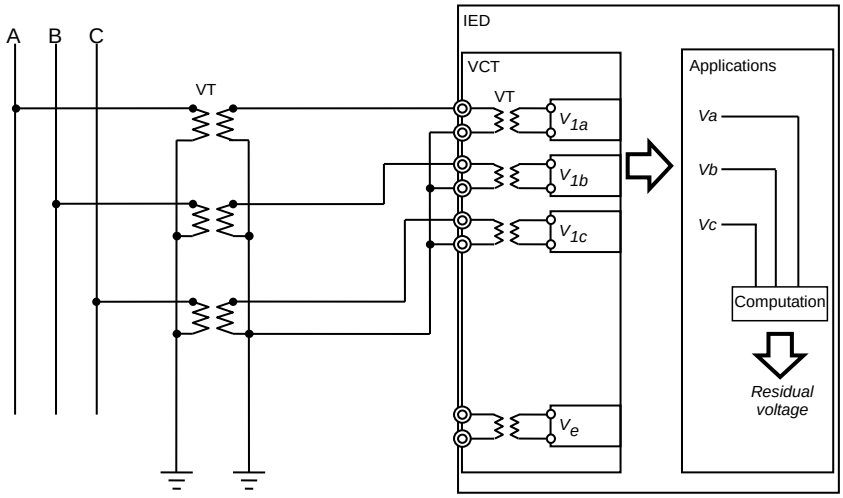


Figure 4.2-10 Connection without residual VT

Note: The implementation of particular features is dependent upon the selection of hardware and the configuration of functions. Several IED models do not support certain features. To determine whether a particular feature has been implemented within an IED, identify the IED ordering number; and check the order number for the "7, G, and T positions" whilst referring to the comparison table below. For more information, see Appendix: Ordering.

Table 4.2-1 Comparative table in respective ordering numbers

Feature	Ordering No. at "7" in Hardware									
	0	BCPU			BCU					
		1	4	A	2	3	5	6	B	C
V0 setting (VCT type)	NA (NA)	✓ (51B)	✓ (51B)	✓ (51B)	NA (52B)	NA (53B)	NA (52B)	NA (53B)	NA (52B)	NA (53B)

Feature	Ordering No. at "G&T" in Software						
	BCU			BCPU		IFU	
	11	13	1F	2N	2C	19	Notes
V0 setting	NA	NA	NA	✓	✓	NA	

✓: Applicable NA: Not applicable

4.3 Signal processing and communication module (CPU)

A signal-processing including communication module (CPU) consists of a main circuit board for processing (CPU1) and 'piggyback' circuit boards for communication modules (COM#1 to COM#5). The piggyback circuit boards are provided so that the IED can have the communication with the network, time synchronization servers and others. The piggyback circuit boards are mounted on the CPU1.

Other signal-processing modules (CPM1 and CPX1) are provided to augment the CPU performance. The CPUs configuration depends on respective models; the arrangement of the CPU1, CPM1, and CPX1 varies in the respective models. Figure 4.3-1 exemplifies the full implementation for the CPU.

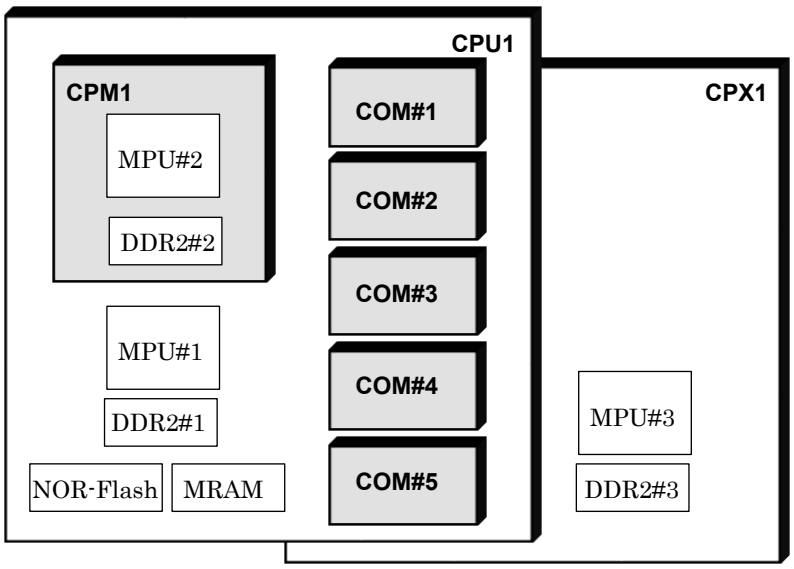


Figure 4.3-1 CPU and communication modules for the processing

Note: The implementation of the above may vary according to circumstances.

4.3.1 Processing module

Assuring the performance of protection and control functions can be obtained with some MPUs. The numbers of MPUs are chosen based on the performance. Memory on the CPU1 consists of MRAM, and NOR-Flash. The NOR-Flash is used to store setting data and recording data, whereas the MRAM is used to store several counter values. Both are of non-volatile memory so that the stored data will be not be erased if the power is cut off. Table 4.3-1 summarizes the memory type.

The relaying practices, which are validated by several IO modules, are operated through the signal processing. The diagram of their processing is illustrated in Figure 4.3-2.

Table 4.3-1 memory on CPU

Memory Type	Memory	Purpose of use
Volatile	DDR2	CPU working area
Non-volatile	NOR-Flash	Storage of setting data and recording data
Non-volatile	MRAM	Storage of counter values

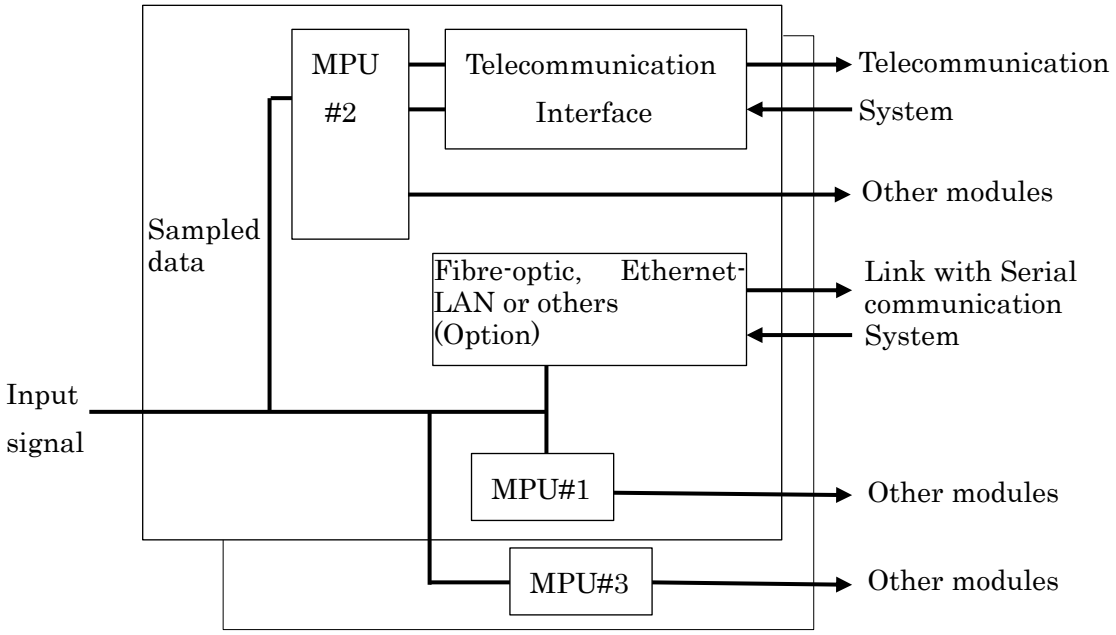
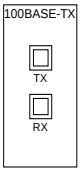
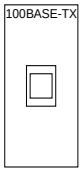


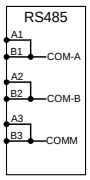
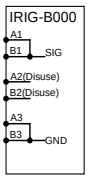
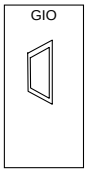
Figure 4.3-2 Diagram of processing

4.3.2 Communication modules

For communication, piggyback-circuit-modules are provided and these are mounted on CPU1, as shown in Table 4.3-2. These specifications are tabulated and their symbols are also shown in Table 4.3-2. The arrangement of these modules depends on the IED models. Thus, it is required to refer external connection figures in order to examine which modules are used and where they are located. The external connection figures are shown separately. (See *Appendix: Typical External connection*)

Table 4.3-2 Communication modules

I/F	100BASE-FX	100BASE-TX
Connector	SC type	RJ45 type
Medium	Fiber optic	Twist pair
Usage	Substation automation system and others	Substation automation system and others
Symbol		

I/F	RS485	IRIG-B000	GIO
Connector	PCB connector	PCB connector	D-sub 9 type
Medium	Twist pair	Twist pair	Twist pair
Usage	Setting and monitoring for the IED	Time synchronization	Connection for external I/O unit
Symbol			

1. 100BASE-TX module (RJ-45 plug)

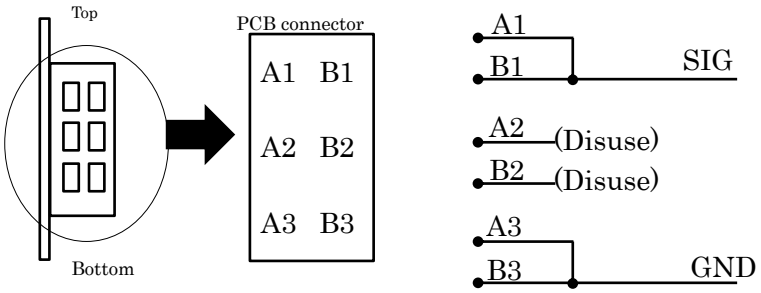
A twisted-pair cable is required for the LAN connection. The 100BASE-TX module is used for the GR-TIEMS operation or the communication for remote end. Use a shielded twisted pair cable so that electric magnetic compatibility is satisfied.

2. 100Base-FX module (SC plug)

A fiber optic cable is required for the connection. 100Base-FX module is used for the LAN communication.

3. IRIG-B000 module

IRIG-B000 module is used to receive the digital signal generated with an external clock; the signal is in conformity to serial IRIG-B000 format. Note that the IRIG-B000 module is able to receive digital signal (TTL) only (i.e., the reception of AM signal is not applicable). This module is isolated using a photo coupler; the user should note A2 and B2 connectors are not used. The peak value of IRIG-B000 signal should be greater than 3.5 volts; the IRIG-B000 module has the input register (about 3k ohm). Thus, the terminal register can be required when the IRIG-B000 signal is delivered for several devices; the value of the terminal register depends on the number of deliveries and the performance of the external clocks. For setting of time synchronization, see Chapter *Technical Description: Clock function*.



a. View from connector edge

b. Port circuit

4. GIO module

GIO module is used to link an IED with an external I/O unit. GIO module is made with a D-sub9 socket. It is connected using twisted pair cables. Figure 4.3-3 shows the cable specification of GIO.

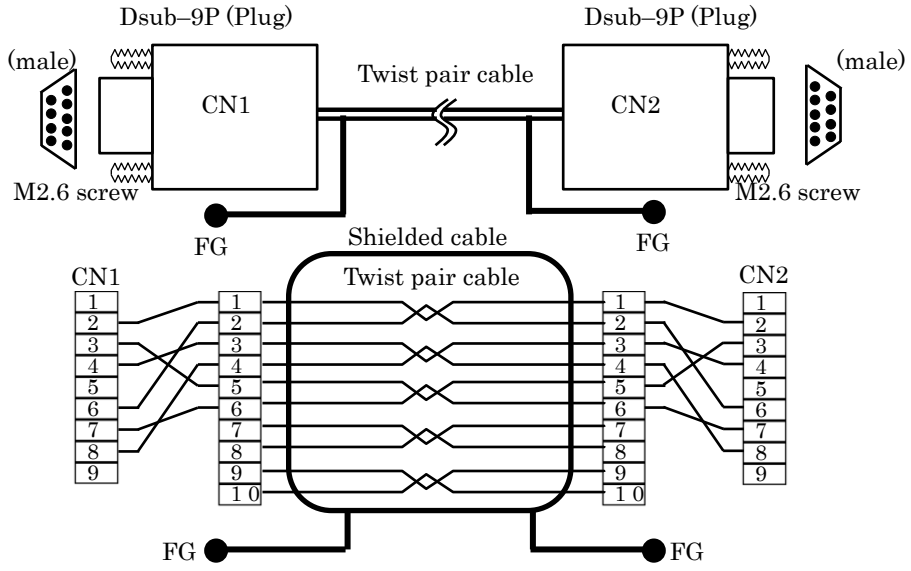


Figure 4.3-3 GIO cable and its structure

4.3.3 Location of communication modules

As described earlier, the user should examine the type of communication module and the location where the module is placed. Therefore, the user is required to understand the reference, when the user examines the connection figures. (See *Appendix: Typical external connection*)

For example, Figure 4.3-4 shows LAN modules (100BASE-FX) and a GIO (D-sub) module placed at locations C11, C12, and C15 in the IED. Blank panels are placed at the other locations. The user find the corresponding communication modules located in the IED on the right side.

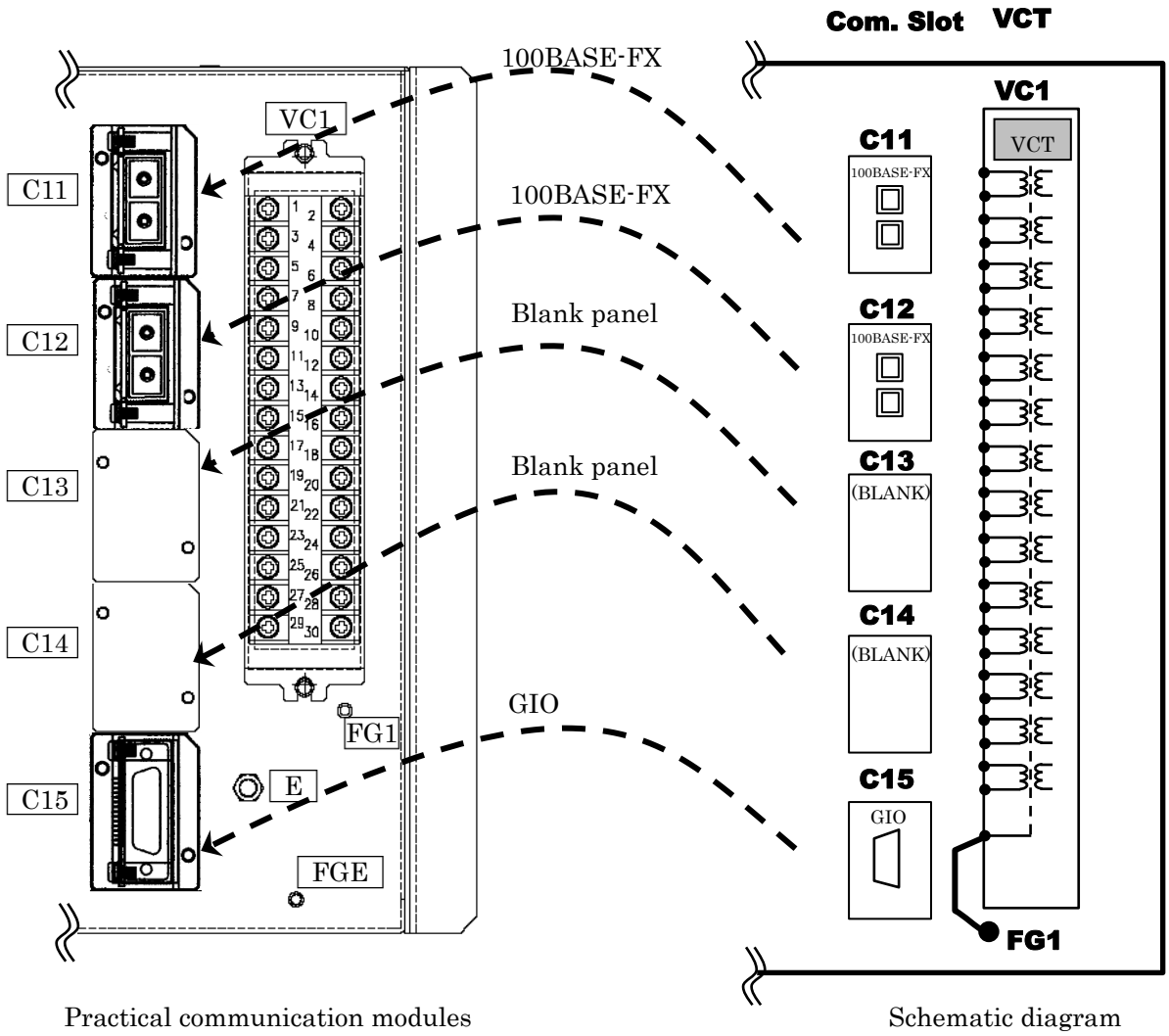


Figure 4.3-4 Communication module structure (an example)

4.4 Binary IO module (BI, BO, and BIO)

Binary IO modules are provided in the IED to signal a command for external devices. Binary IO modules are also used to receive status information. Binary IO modules are connected to external devices with signal wires using terminal blocks on the rear of the IED. There are standard type and variable type in Binary IO modules as shown in Table 4.4-1.

Table 4.4-1 Number of input and output circuits[1]

#	Module name[3]	Module Type[4]	Number of input circuits	Number of output circuits[2]				
				Fast operating	Semi-fast operating	Hybrid	Auxiliary (Normal)	Form C
1	BI1A	Standard	18	0	0	0	0	0
2	BI2A	Variable	12	0	0	0	0	0
3	BI3A	Standard	32	0	0	0	0	0
4	BO1A	Standard	0	0	6	0	12	0
5	BO2A	Standard	0	0	0	16	0	0
6	BIO1A	Standard	7	0	6	0	3	1
7	BIO2A	Standard	12	0	3	0	1	1
8	BIO3A	Standard	8	6	0	0	1	1
9	BIO4A	Variable	6	0	0	6	1	1

[1]Note: One of two voltages is applied for the binary IO modules: 48Vdc (24 to 60) and 220Vdc (110 to 250). The DC voltage supplied to the IED determines the voltage type selection; hence, a combination of different voltage types is not possible.

[2]Note: For the structure and the number of binary IO modules, see section 4.4.5.

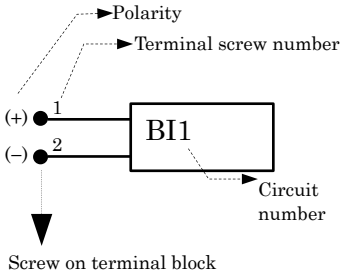
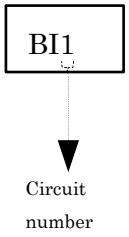
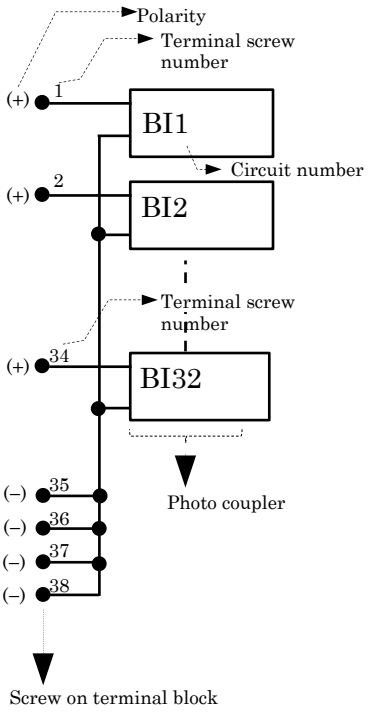
[3]Note: For details of the output circuits, see Table 4.4-6.

[4]Note: For the binary input circuits in the standard type, the user can choice either a high voltage or a low voltage with regard to the input threshold. For the ones of the variable type, the user itself can set a threshold value with regard to input voltage using settings.

4.4.1 Binary input feature

Binary input circuits have common programmable logic (CPL). Each circuit is independent, but the circuits in the BI3A module are not independent, as shown in Table 4.4-2.

Table 4.4-2 Input circuits and features associated with binary IO module

	Module type	Input features	Example sign	Symbols
1	BI1A	- Isolated using photo coupler -Polarity dependent -Independent circuit		
2	BI2A	-Isolated using photo coupler -Polarity dependent - Independent circuit -Variable threshold		
3	BI3A	-Isolated using photo coupler -Polarity dependent -Sharing common connections		
4	BIO1A	Same as BI1A		Same as BI1A and BI2A
5	BIO2A			
6	BIO3A			
7	BIO4A	Same as BI2A		

The user can find the connector of binary IO modules, the terminal number and arrangement of the binary input circuits in section 4.4.5.

4.4.2 Binary input circuit

The binary input circuit has a threshold for the input voltage and the user can regulate the threshold using scheme switches and settings. Additionally, the binary input circuit has a function in response to chattering signals produced by bouncing contacts, a programmable logic for retarding and inverting the signal, and the user can set the respective features with settings. Table 4.4-3 shows the respective settings and ranges in the standard type. Table 4.4-4 shows the ones in the variable types.

Table 4.4-3 Setting items for binary input circuits in the standard type

Setting item[1]		Range	Units	Contents	Default
Common	THRES_Lvl	Low/High	–	Threshold level for input voltage	Low
	CMP_NUM	4 to 9	–	Number of times in the filter	4
BI1	BI1_CPL	Off/On	–	Switch of programmable operation in BI1	Off
	On Delay Timer	0.000 to 300.000	s	Value in the on-delay timer	0.000
	Off Delay Timer	0.000 to 300.000	s	Value in the off-delay timer	0.000
	INVERSE-SW	Normal / Inverse	–	Inversion operation of BI1 signal	Normal
BI2	BI2_CPL	Off/On	–	Switch of programmable operation in BI2	Off
	On Delay Timer	0.000 to 300.000	s	Value in the on-delay timer	0.000
	Off Delay Timer	0.000 to 300.000	s	Value in the off-delay timer	0.000
	INVERSE-SW	Normal / Inverse	–	Inversion operation of BI2 signal	Normal
BI3	BI3_CPL	Off/On	–	Switch of programmable operation in BI3	Off
	On Delay Timer	0.000 to 300.000	s	Value in the on-delay timer	0.000
	Off Delay Timer	0.000 to 300.000	s	Value in the off-delay timer	0.000
	INVERSE-SW	Normal / Inverse	–	Inversion operation of BI3 signal	Normal
.....	.....	.....		.....	.....
BI*n*[2]	BI*n*_CPL	Off/On	–	Switch of programmable operation in BI*n*	Off
	On Delay Timer	0.000 to 300.000	s	Value in the on-delay timer	0.000
	Off Delay Timer	0.000 to 300.000	s	Value in the off-delay timer	0.000
	INVERSE-SW	Normal / Inverse	–	Inversion operation of BIn signal	Normal

[1]Note: Setting items are provided in each slot; see Figure 4.4-4. Also, see section 4.4.6 (i).

[2]Note: BI*n*_CPL and other settings are provided for all binary input circuits. For example, the user can configure 18 CPLs in BI1A.

[3]Note: Each setting item above is required to set at every IO_slots.

Table 4.4-4 Setting items for binary input circuits in the variable type (i.e., BI2A and BIO4A)

Setting devices		Range	Unit	Contents	Default
Common	BI1-3_PICKUP	18 to 222	V	Guaranteed-minimum-pick-ups at BI1, BI2, and BI3	77
	BI4-6_PICKUP	18 to 222	V	Guaranteed-minimum-pick-ups at BI4, BI5, and BI6	77
	BI7-9_PICKUP	18 to 222	V	Guaranteed-minimum-pick-ups at BI7 to BI9[4]	77
	BI10-12_PICKUP	18 to 222	V	Guaranteed-minimum-pick-ups at BI10 to BI*n*[4]	77
	CMP_NUM	4 to 9	–	Number of times in the filter	4
BI1	BI1_CPL	Off/On	–	Switch for programmable operation in BI1	Off
	On Delay Timer	0.000 to 300.000	s	Value in the on-delay timer	0.000
	Off Delay Timer	0.000 to 300.000	s	Value in the off-delay timer	0.000
	INVERSE-SW	Normal / Inverse	–	Inversion operation of BI1 signal	Normal
BI2	BI2_CPL	Off/On	–	Switch for programmable operation in BI 2	Off
	On Delay Timer	0.000 to 300.000	s	Value in the on-delay timer	0.000
	Off Delay Timer	0.000 to 300.000	s	Value in the off-delay timer	0.000
	INVERSE-SW	Normal / Inverse	–	Inversion operation of BI2 signal	Normal
BI3	BI3_CPL	Off/On	–	Switch for programmable operation in BI 3	Off
	On Delay Timer	0.000 to 300.000	s	Value in the on-delay timer	0.000
	Off Delay Timer	0.000 to 300.000	s	Value in the off-delay timer	0.000
	INVERSE-SW	Normal / Inverse	–	Inversion operation of BI3 signal	Normal
.....	.....	.....		.....	.....
BI*n*[4]	BI*n*_CPL	Off/On	–	Switch for programmable operation in BI *n*	Off
	On Delay Timer	0.000 to 300.000	s	Value in the on-delay timer	0.000
	Off Delay Timer	0.000 to 300.000	s	Value in the off-delay timer	0.000
	INVERSE-SW	Normal / Inverse	–	Inversion operation of BIn signal	Normal

[4]Note: BI*n*_CPL and other settings are provided for all binary input circuits. For example, the user can set for 12 CPLs in BI2A and for 6 CPLs in BIO4A.

As an example, Figure 4.4-1 shows the binary input circuit of BI1A in order to help understand the settings. BI1A consists of 18 binary input circuits and each circuit has three settings:

Setting threshold level

Comparison feature for contact chatter

CPL switches ("Delayed pick-up and delayed drop-off signal" and "Logic level inversion"), used as basis of input signal characteristics.

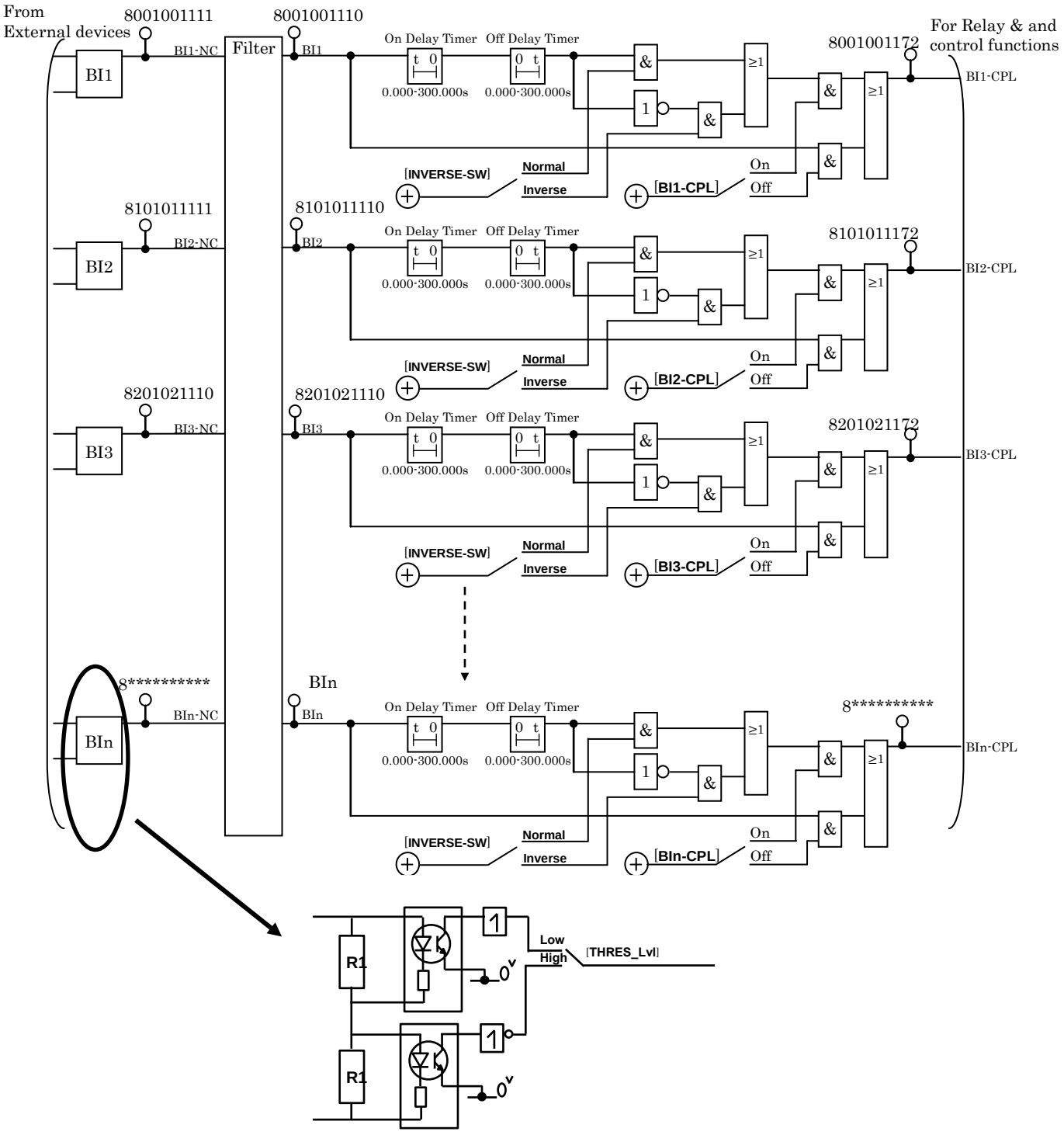


Figure 4.4-1 Common programmable logic for BI1A

Respective element IDs (i.e., 8001001172 and others) designate respective signal monitoring points of the binary input circuits (i.e., BI1-CPL and others). Thus, the user can handle the signals on the binary input circuit using element ID together with function ID. When we assume that BI1A module is at IO#1 slot in the IED case, and if the user wishes to see the first circuit signal of this BI1A module, the user can identify its signal† using the element ID (8001001172) and the function ID of IO#1 slot‡.

†Note: The user can see the signals of the binary input circuits on the IED screen. Chapter *User interface: Monitoring-sub menu* discusses how to see the state of the binary input circuits.

‡Note: Function IDs identify every IO slots. For example, IO#1 slot has been identified by the function ID "200B001". Therefore, when the user wishes to program the signal "BI1-CPL" on BI1A at IO#1, the user should designate its signal using the function ID "200B001" and Element ID "8001001172". On the other hand, when the signal "BI2-CPL" on BI1A at IO#2 is required to program, the user should designate that signal using the function ID "200B002" and Element ID "8001001172". For more information with regard to the function ID and the Data ID at IO#1, see sections 4.4.6(i), 4.4.7(i), and others.

(i) Setting threshold level

(i)-1 For Standard type (BI1A and others)

The selection switch is used to adjust the threshold of an input signal; it is designated as [**THRES_Lvl**]. If an external device signal is lower than DC 110V[1], the user should set **Low** for scheme switch [**THRES_Lvl**]. Conversely if an external device signal is higher than DC 220V[1], the user should set **High** for the scheme switch. Note that scheme switch [**THRES_Lvl**] is used to control all binary input circuits. The user must ensure that the input voltage is higher than DC 77V[1] when the setting '**Low'** is applied; the input voltage should be higher than DC 136V[1] when the setting '**High'** is applied.

(i)-2 For Variable type (exclusive for BI2A and BIO4A)

BI2A and BIO4A have a unique feature as a substitute for setting (i)-1 in order that the user can determine the guaranteed-minimum-pick-up voltages (thresholds) as required. This unique feature is performed with settings [**BI1-3_PICKUP**], [**BI4-6_PICKUP**], [**BI7-9_PICKUP**], and [**BI10-12_PICKUP**]; every setting is applied to a group of three binary input circuits.

Provided that the user uses BI2A, then binary input circuits #1 to #3 follow the setting [**BI1-3_PICKUP**] and the user should set the value between 18 to 222V DC[2] for this setting. For the setting [**BI4-6_PICKUP**], the above mentioned value holds true for #4 to #6 binary input circuits; similarly the setting [**BI7-9_PICKUP**] is used for #7 to #9 binary input circuits; and finally the setting [**BI10-12_PICKUP**] is used for #10 to #12 binary input circuits.

On the other hand, when BIO4A is used, the binary input circuits #1 to #3 follow the setting [**BI1-3_PICKUP**]; and the binary input circuits #4 to #6 follow the setting [**BI4-6_PICKUP**]. Since BIO4A has six binary input circuits, the other settings [**BI7-9_PICKUP**] and [**BI10-12_PICKUP**] are not required here.

[1]Note: The threshold value is fixed for all binary IO module types with the exception of BI2A and BIO4A. The user should notice that "binary IO module voltage type" influences these values (see the 1st note in Table 4.4-1). These particular values are found when 220V dc type is used.

[2]Note: In the variable type, the user can set the threshold arbitrarily between 18 to 222V in DC, and can regulate its threshold voltage in a voltage step. Table 4.4-5 shows the corresponding values with regard to guaranteed and typical thresholds in response to the setting values. Note that the operation in the variable type is segmented into 'Operate', 'Intermediate', 'and 'Non-operate' areas, which are decided by the guaranteed-pick-up, typical-pick-up, and guaranteed-drop-off levels, as illustrated in Figure 4.4-2.

Table 4.4-5 Guaranteed and typical thresholds in the variable type

Setting values [V]	Guaranteed levels		Typical levels
	Pick-up voltage [V]	Drop-off voltage [V]	Pick-up voltage [V]
18	17.9	10.5	14.2
19	18.5	11.1	14.8
20	19.9	12.3	16.1
21	20.5	12.9	16.7
22 to 29	21.8	14.0	17.9
30	29.3	20.8	25.0
31 to 32	30.8	22.2	26.5
33	32.5	23.7	28.1
34 to 35	34.0	25.0	29.5
36 to 37	36.0	26.8	31.4
38 to 39	37.5	28.3	32.9
40	39.2	29.8	34.5
41 to 49	40.8	31.2	36.0
50 to 52	49.8	39.4	44.6
53 to 56	53.0	42.2	47.6
57 to 59	56.3	45.3	50.8
60 to 61	59.5	48.1	53.8
62 to 63	61.8	50.2	56.0
64 to 65	63.6	51.8	57.7
66	65.9	53.9	59.9
67 to 70	66.7	54.7	60.7
71	70.1	57.7	63.9
71 to 73	70.3	57.9	64.1
74	73.2	60.6	66.9
75 to 79	74.4	61.6	68.0
80 to 83	79.7	66.4	73.0
84 to 88	83.7	70.1	76.9
89 to 92	88.2	74.0	81.1
93 to 99	92.3	77.8	85.0
100 to 106	99.4	84.2	91.8
107 to 111	106.4	90.6	98.5
112 to 113	111.4	95.0	103.2
114 to 119	114.0	97.4	105.7
120	119.3	102.3	110.8
121 to 127	121.0	103.8	112.4
128 to 130	128.0	110.1	119.0
131	130.1	112.0	121.0
132 to 135	131.9	113.7	122.8
136 to 137	135.9	117.3	126.6
138 to 141	137.1	118.3	127.7
142 to 143	141.5	122.3	131.9
144	143.9	124.5	134.2
145 to 146	144.6	125.2	134.9
147 to 151	146.1	126.5	136.3
152 to 154	151.8	131.6	141.7
155 to 161	154.4	134.0	144.2
162	161.3	140.3	150.8
163 to 165	162.6	141.4	152.0
166 to 170	165.8	144.3	155.0
171 to 173	170.6	148.6	159.6
174 to 176	173.6	151.4	162.5
177 to 183	176.3	153.8	165.0
184 to 189	183.3	160.1	171.7
190 to 193	189.7	165.9	177.8
194 to 200	193.6	169.4	181.5
201 to 203	200.3	175.5	187.9
204 to 211	203.1	178.1	190.6
212 to 221	211.5	185.7	198.6
222	222.0	195.2	208.6

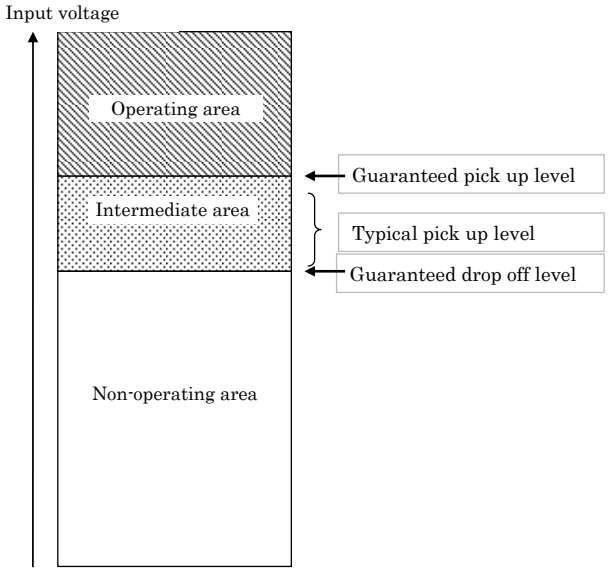


Figure 4.4-2 Operating area in the variable type

Note: In practice, the pick-up voltages depend on respective binary circuits physically This means the characteristics are not affected by the ambient conditions and the applied voltages.

(ii) Comparison feature for contact chatter

The input circuit incorporates a comparison feature that protects against contact chatter and this feature is configured using the setting [**CMP_NUM**]. Figure 4.4-3 illustrates this feature; the comparison feature removes contact chatter. The period '**t**' applied for the removal of contact chatter can be configured by setting a value for [**CMP_NUM**]. The formula for the calculation of 't' is,

$$[\textbf{CPM_NUM}] \times \frac{1}{\text{System Frequency} \times 12}$$

The setting [**CMP_NUM**] is provided for all binary input circuits.

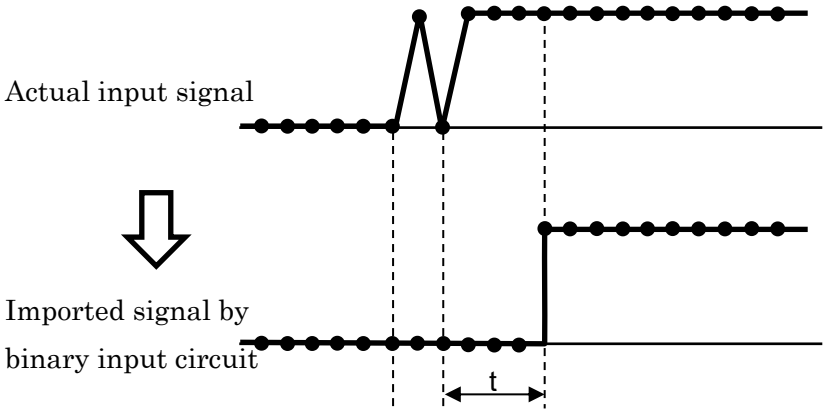


Figure 4.4-3 Chattering countermeasure (e.g. [CMP_NUM] = 4)

(iii) CPL switch

If the user needs to operate the CPL for binary input circuit #1, the user should set **On** for scheme switch [**BI1_CPL**]. Conversely, the user should set **Off** for scheme switch [**BI1_CPL**] if CPL is not required. Since the entire range of binary input circuits have CPLs, a setting of **On** or **Off** is a pre-requisite for every binary input circuit. The number of CPL is equal to number of binary input circuits: that is, if BI1A is selected, the number of CPLs is 18.

(iv) Delayed pick-up and delayed drop-off signal

Both an on-delay timer and an off-delay timer are provided in CPL; both are used to adjust the timing for input signals, the user should set their respective time values for settings [**On Delay Timer**] and [**Off Delay Timer**].

(v) Logic level inversion

The Logic inversion function can invert the input signal and is provided for each binary input circuit; the user can invert an input signal by setting **Inverse** for scheme switch [**INVERSE-SW**]. A setting of **Normal** is also provided when inversion is not required.

(vi) How to set the settings for binary input circuits

Figure 4.4-4 illustrates an example of the binary IO module arrangement for the binary input circuit printed circuit boards (PCBs); it illustrates the setting targets are on BI1A at IO#1 and BIO1A at IO#3. The user should key the settings with regard to BI1A and BIO1A using the setting tables for IO_SLOT1 and IO_SLOT3. As the setting points are for BI1A and BIO1A at IO#1 and IO#3, the user should take the setting table of the standard type (in sec. 4.4.6).

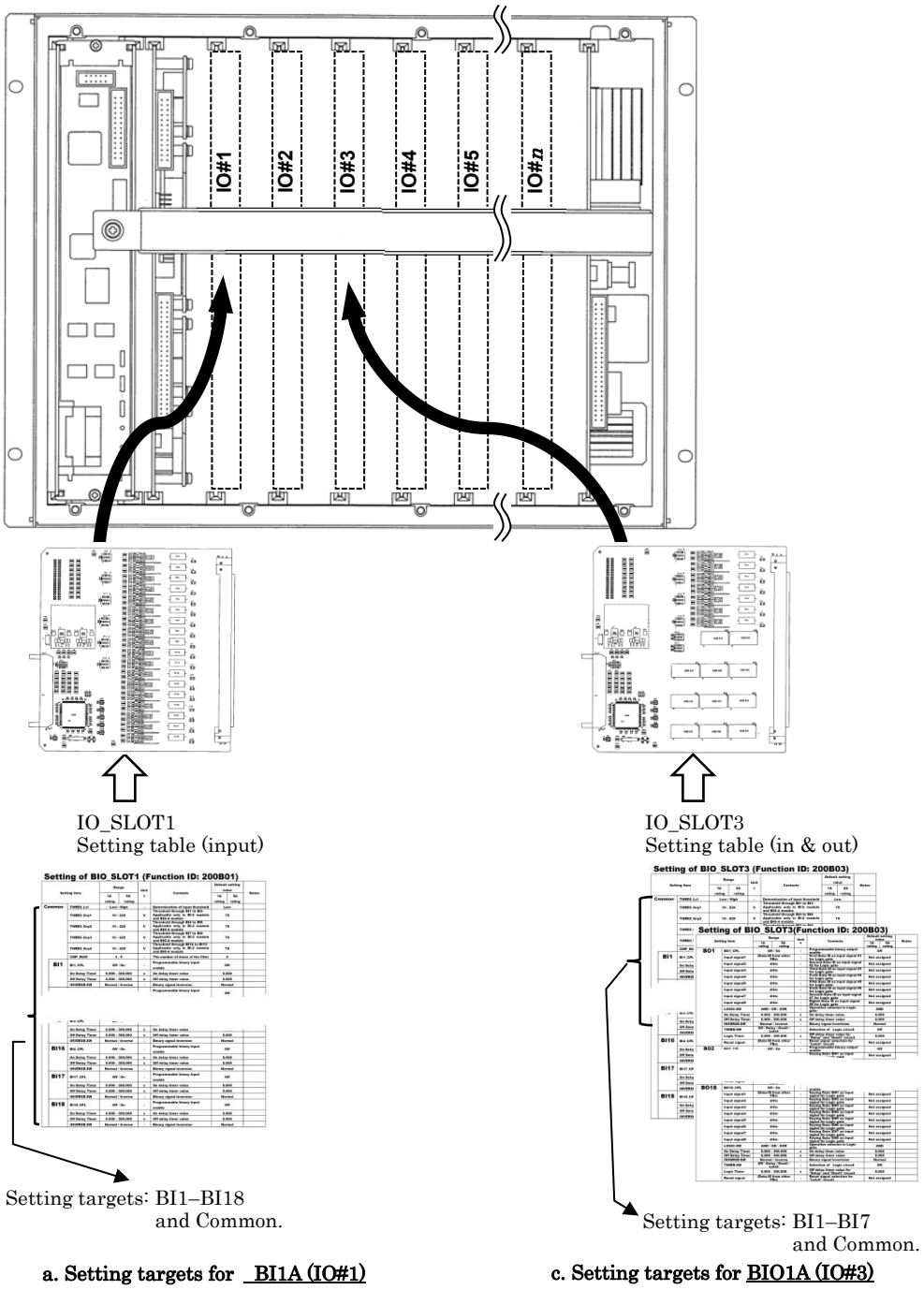


Figure 4.4-4 BO and BIO setting tables related to IO_slot1 and IO_slot3

The setting table of section 4.4.6 is available for all binary IO modules except for BI2A and BIO4A; thus, the user should understand and select the setting points that are relevant to BI1A. That is, for BI1A the user should choose the setting items of reference (i.e., binary input circuits #1 to #18) from IO_SLOT1 setting table. On the other hand, for BIO1A the user should choose the setting items of reference (i.e., binary input circuits #1 to #7) from IO_SLOT3 setting table. The IO_SLOT3 setting table for the binary input circuits are shown in sec. 4.4.6. The setting operation via the IED screen is discussed later. (See chapter *User interface: I/O setting sub-menu*)

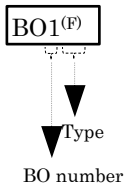
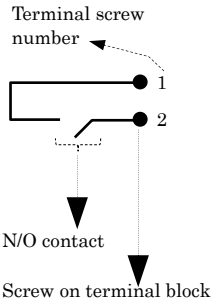
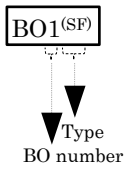
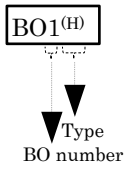
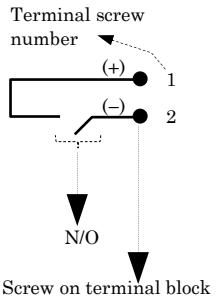
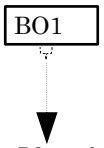
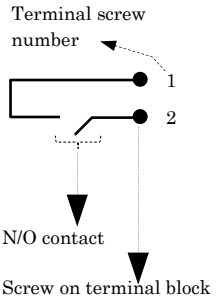
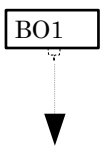
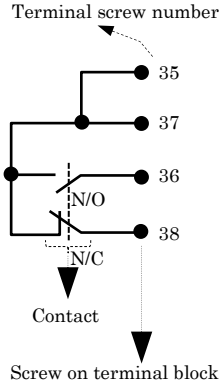
4.4.3 Binary output feature

A binary output circuit (BO) along with the CPL drives a single contact. There are five types of BOs; different types of BOs are provided which are suitable for controlling the speed and capacity of current in a variety of external devices, as listed below:

(1) Fast operating
(2) Semi-fast operating
(3) Hybrid
(4) Auxiliary
(5) BO with Form-C

The arrangement of the BO types is determined for every binary IO module, as shown in Table 4.4-1 and Table 4.4-6. The difference in the types and number of BOs are also found in section 4.4.5.

Table 4.4-6 Output circuits and features associated with binary IO module

No	Type	Binary output feature	Example sign	Symbol	Applied module
1	Fast operating (F)	-Normally open (N/O) -Dry contact -Closure is the fastest amongst all of the BO types. -Make & Carry: 5A cont. -Break: 0.15A at 290Vdc -OP Time: 3ms (typical)			BIO3A
2	Semi-fast operating (SF)	-Normally open (N/O) -Dry contact -Closure is faster than normal. -Make and carry: 8A cont. -Break: 0.1A at 250Vdc 0.2A at 125Vdc -OP Time: 6ms (typical)			BO1A BIO1A BIO2A
3	Hybrid (H)	-Normally open (N/O) -Polarity dependent -Interruption capability for high-current (up to 10A) -Consisting of an IGBT device and a contact -Make and carry: 8A cont. -Break: 10A at 220/110Vdc -OP Time: 1ms			BO2A BIO4A
4	Auxiliary	-Normally open (N/O) -Dry contact -Normal speed closure -Make and carry: 8A cont. -Break: 0.1A at 250Vdc 0.2A at 125Vdc -OP Time: 8ms (typical)			BO1A BIO1A BIO2A BIO3A
5	Form-C	-Uses a N/C and a N/O contact -Shares a common connections -Make and carry: 8A cont. -Break: 0.1A at 250Vdc 0.2A at 125Vdc -OP Time: 8ms (typical)			BIO2A BIO3A BIO4A

4.4.4 Binary output circuit

Either a CPL logic or a PLC signal can drive a binary output circuit. Table 4.4-7 shows the settings summary of CPL function.

Table 4.4-7 Setting items for binary output circuits

Setting items		Setting-range or Data_ID	Unit	Contents	Default
BO1	BO1_CPL	Off / On	–	Switch On for programmable operation	Off
	Input signal1	(Preferred Data ID)	–	Set a Data ID at the first input on BO1.	Not assigned[1]
	Input signal2	(Preferred Data ID)	–	Set a Data ID at the second input on BO1.	Not assigned[1]
	Input signal3	(Preferred Data ID)	–	Set a Data ID at the third input on BO1.	Not assigned[1]
	Input signal4	(Preferred Data ID)	–	Set a Data ID at the forth input on BO1.	Not assigned[1]
	Input signal5	(Preferred Data ID)	–	Set a Data ID at the fifth input on BO1.	Not assigned[1]
	Input signal6	(Preferred Data ID)	–	Set a Data ID at the sixth input on BO1.	Not assigned[1]
	Input signal7	(Preferred Data ID)	–	Set a Data ID at the seventh input on BO1.	Not assigned[1]
	Input signal8	(Preferred Data ID)	–	Set a Data ID at the eighth input on BO1.	Not assigned[1]
	LOGIC-SW	AND/OR/XOR	–	Switch for logic-gate operation on BO1	AND
	On Delay Timer	0.000 to 300.000	s	Set a value for an on-delay-timer on BO1	0.000
	Off Delay Timer	0.000 to 300.000	s	Set a value for an off-delay-timer on BO1	0.000
	INVERSE-SW	Normal / Inverse	s	Inversion operation of BO1 signal	Normal
	TIMER-SW	OFF/Delay/Dwell/Latch	–	Selection of a type in the delay timer on BO1	OFF
	Logic Timer	0.000 to 300.000	s	Setting Off Delay Timer for Delay and Dwell	0.000
	Reset signal	(Preferred Data ID)	–	Setting Data ID for Latch	Not assigned[1]
BO2	BO2_CPL	Off / On	–	Switch On for programmable operation	Off
	Input signal1	(Preferred Data ID)	–	Set a Data ID at the first input on BO2.	Not assigned[1]
	.....	.....		.....	.....
	Input signal8	(Preferred Data ID)	–	Set a Data ID at the eighth input on BO2	Not assigned[1]
	LOGIC-SW	AND/OR/XOR	–	Switch for logic-gate operation on BO2	AND
	On Delay Timer	0.000 to 300.000	s	Set a value for an on-delay-timer on BO2	0.000
	Off Delay Timer	0.000 to 300.000	s	Set a value for an off-delay-timer on BO2	0.000
	INVERSE-SW	Normal / Inverse	–	Inversion operation of BO2 signal	Normal
	TIMER-SW	OFF/Delay/Dwell/Latch	–	Selection of a type in the delay timer on BO2	OFF
	Logic Timer	0.000 to 300.000	s	Setting Off Delay Timer for Delay and Dwell	0.000
	Reset signal	(Preferred Data ID)	–	Setting Data ID for Latch	Not assigned[1]
.....					
BO*n*	BO*n*_CPL	Off / On	–	Switch On for programmable operation	Off
	Input signal1	(Preferred Data ID)	–	Set a Data ID at the first input on BO*n*	Not assigned[1]
	.....	.....		.....	.....
	Input signal8	(Preferred Data ID)	–	Set a Data ID at the eighth input on BO*n*	Not assigned[1]
	LOGIC-SW	AND/OR/XOR	–	Switch for logic-gate operation on BO*n*	AND
	On Delay Timer	0.000 to 300.000	s	Set a value for an on-delay-timer on BO*n*	0.000
	Off Delay Timer	0.000 to 300.000	s	Set a value for an off-delay-timer on BO*n*	0.000
	INVERSE-SW	Normal / Inverse	–	Inversion operation of BO*n* signal	Normal
	TIMER-SW	OFF/Delay/Dwell/Latch	–	Selection of a type in the delay timer on BO*n*	OFF
	Logic Timer	0.000 to 300.000	s	Setting Off Delay Timer for Delay and Dwell	0.000
	Reset signal	(Preferred Data ID)	–	Setting Data ID for Latch	Not assigned[1]

[1]Note: The user can set a reset signal and eight input signals with Data IDs. Data IDs are listed as a signal monitoring point for each function. Setting items are summarized in each slot. (See sections 4.4.8(i) and 4.4.8(ii))

Figure 4.4-5 shows the binary output circuits on BO1A in order to help understand the settings. BO1A consists of 18 binary output circuits and every circuit has timers and switches. The features of the CPLs are divided into the five components as listed below:

CPL switch

Selection of input signals

Logic gate switch

Delayed pick-up/delayed drop-off

Logic level inversion

Logic timer switch

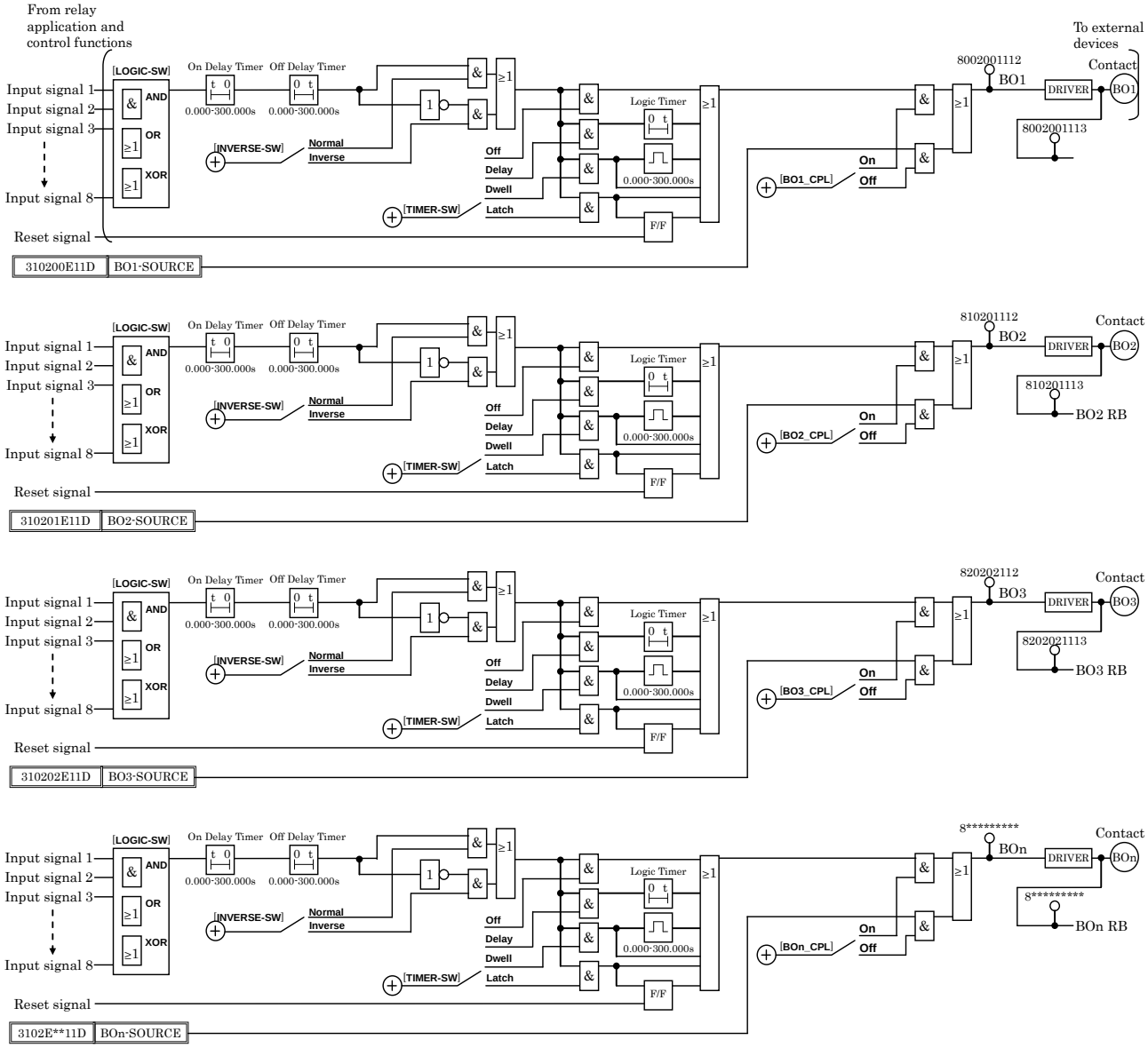


Figure 4.4-5 Binary Output Circuit for BO1A (#1 to #n=18)

In Figure 4.4-5 respective element IDs (i.e., 8002001112 and others) designate respective signal monitoring points of the binary output circuits. The user can monitor the operations of

the binary output circuit using element ID together with function ID. When we assume that BO1A module is at IO#2 slot in the IED case, and if the user wishes to monitor the first-circuit in the BO1A module, the user can see the operation using the element ID (8002001112) and the function ID† of IO#2 slot.

†Note: A function ID identifies every IO slots. For example, with regard to the function ID and the Data ID at IO#1 slot, see section 4.4.9(i). On the other hand, for IO#2 slot see section 4.4.9(ii).

(i) CPL switch

When the user needs to operate the CPL for binary output circuit #1, the user should set **On** for the scheme switch [**BO1_CPL**]. Conversely, the user should set **Off** for the scheme switch [**BO1_CPL**] if CPL is not required. Since all binary output circuits have CPLs setting between **On** and **Off** is required for every binary output circuit. The number of CPL is equal to the number of binary output circuits: that is, if the BO1A module is selected, the number of CPLs is 18. Note that the subsequent PLC settings described later require that **Off** be set for the scheme switch.

(ii) Selection of input signals

Since a binary input circuit is operated by commands introduced from other functions, eight ports for input signals are provided, designated as *input-signal1* to *input-signal8*. The user must ensure that *input-signal1* to *input-signal8* are configured with eight DataIDs. That is, the user can select input-signals that are available from other functions, these input-signals are designated using DataIDs. The user can key the DataIDs into settings [**Input signal1**] to [**Input signal8**]. The DataIDs are selected from the *Signal monitoring point* list, which is provided for every function.

(iii) Logic gate switch

A binary input circuit has a logic scheme for the eight input signals, and can combine the eight input signals as required using scheme switch [**LOGIC-SW**] for which the user should set either **AND**, **OR** or **XOR**.

(iv) Delayed pick-up/delayed drop-off signal

An on-delay timer and an off-delay timer are provided in the CPL; both are used to adjust the timing for binary output circuits, the user should set their respective time values for settings [**On Delay Timer**] and [**Off Delay Timer**].

(v) Logic level inversion

The logic inversion function can invert the input signal for each binary output circuit; the user

can invert an input output when the user sets **Inverse** for the scheme switch [**INVERSE-SW**]. **Normal** setting is also provided when logic inversion is not required for processing.

(vi) Logic timer switch

In order that the binary output circuit can have a programmable reset characteristic, a scheme switch and a setting are provided. The programmable reset characteristic consists of four types and the user can select the type required using a scheme switch: (1) dwell type, (2) delay type, (3) latch type, and (4) instantaneous type:

(vi)-1 Instant type

When the user uses a binary output signal without the following characteristics, the user should set **Off** for the scheme switch [**TIMER-SW**].

(vi)-2 Delay type

If the user requires a binary output signal with a delayed characteristic, the user should set **Delay** for scheme switch [**TIMER-SW**] and set the value of the pulse width using setting [**Logic timer**].

(vi)-3 Dwell type

For instance, if the user requires a binary output signal as a one shot pulse, the user should set **Dwell** for scheme switch [**TIMER-SW**] and set the value of the pulse width using setting [**Logic timer**]. If the input signals received have a shorter duration than the set value in the setting [**Logic timer**], the pulse width will be equal to the setting value. On the other hand, if the duration of the input signals are longer than that of the set value, the pulse width will be equal to the width of the input signals.

(vi)-4 Latch type

If the user requires a binary output signal to be removed by a reset signal, the user should set **Latch** for scheme switch [**TIMER-SW**] and key the Data ID of the reset signal for setting [**Reset signal**]. Since the binary output signal is removed with the Data ID, the user should determine the Data ID from other functions. The Data ID is designated by the signal monitoring point for each function and the user should set the [**Reset signal**] setting.

Note: When **Latch** is set, the state of BO circuit will be sustained during power turn-on/off.

(vii) How to set the settings for binary output circuits

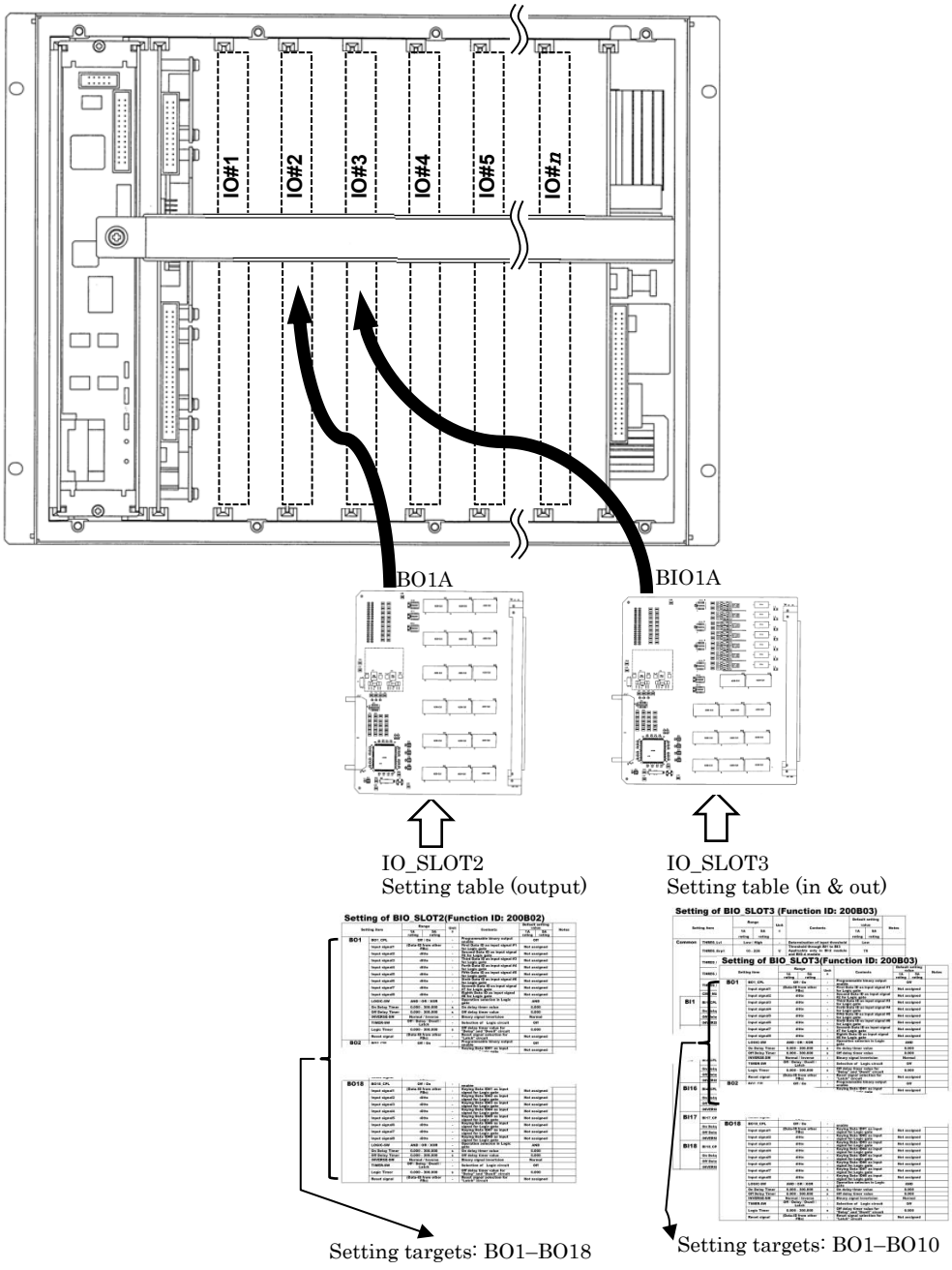


Figure 4.4-6 BO and BIO modules and setting tables related to IO_SLOT2 and IO_SLOT3

Figure 4.4-6 illustrates an example of a binary IO module arrangement and the binary output circuit printed circuit boards (PCBs). If the user wishes to set the binary output circuits, the setting targets are on BO1A and BIO1A at locations IO#2 and IO#3. The user should key the CPL settings from the setting tables for the IO2_SLOT and IO3_SLOT.

The setting table is available for all binary IO modules; thus, the user should understand and select setting points that are relevant to BO1A and BIO1A. That is, for BO1A the user should choose the setting terms of reference (i.e., binary output circuits #1 to #18) from

IO_SLOT2. On the other hand, for BIO1A, the setting terms of reference (i.e., binary output circuits #1 to #10) are from IO_SLOT3. These setting tables are shown in section 4.4.8(ii).

(viii) PLC and the binary output circuits

The Programmable logic controller (PLC) is also available for the control of binary output circuits as a substitute for the CPL, and is able to signal an output command directly. In the case that the binary output circuit is controlled by the PLC, the user is required to connect the PLC to the binary output circuit. In Figure 4.4-5, the PLC logic connection points are designated with BO1-SOURCE, BO2-SOURCE, and others. (The PLC is discussed separately. Note that Connection points on the PLC are shown with the DataIDs of BIO_SLOT. See section 4.4.9(i)-3 and 4.4.9(ii)-3. (For more information of PLC function, see Chapter *PLC function*)

4.4.5 Structure of binary IO Module

Binary IO modules consist of a number of module types and the arrangement of the respective inputs-and-outputs are particular to each binary IO module type, as shown in Figure 4.4-7 to Figure 4.4-11. Referring to the figures on the left, the user can for example, identify the actual terminal blocks of the binary IO module. Corresponding circuits are drawn on the right in the form of schematic diagrams. If the wiring of BI1A is considered, the wiring objects are designated with terminal screw numbers 1 to 40. The terminal screw numbers are shown next to the terminal blocks. Here the user can find a slot number labeled with alpha-numeric reference "T*****". The asterisk sign (*****) is substituted for any one of the slot numbers. For the actual implementation of a binary IO module, the user should examine the arrangement of binary IO modules from *External connection figures*, which are shown separately. (See *Appendix: Typical external connection*)

Note that some input and output circuits have polarity, which is designated with either a plus sign (+) or a minus sign (–) respectively.

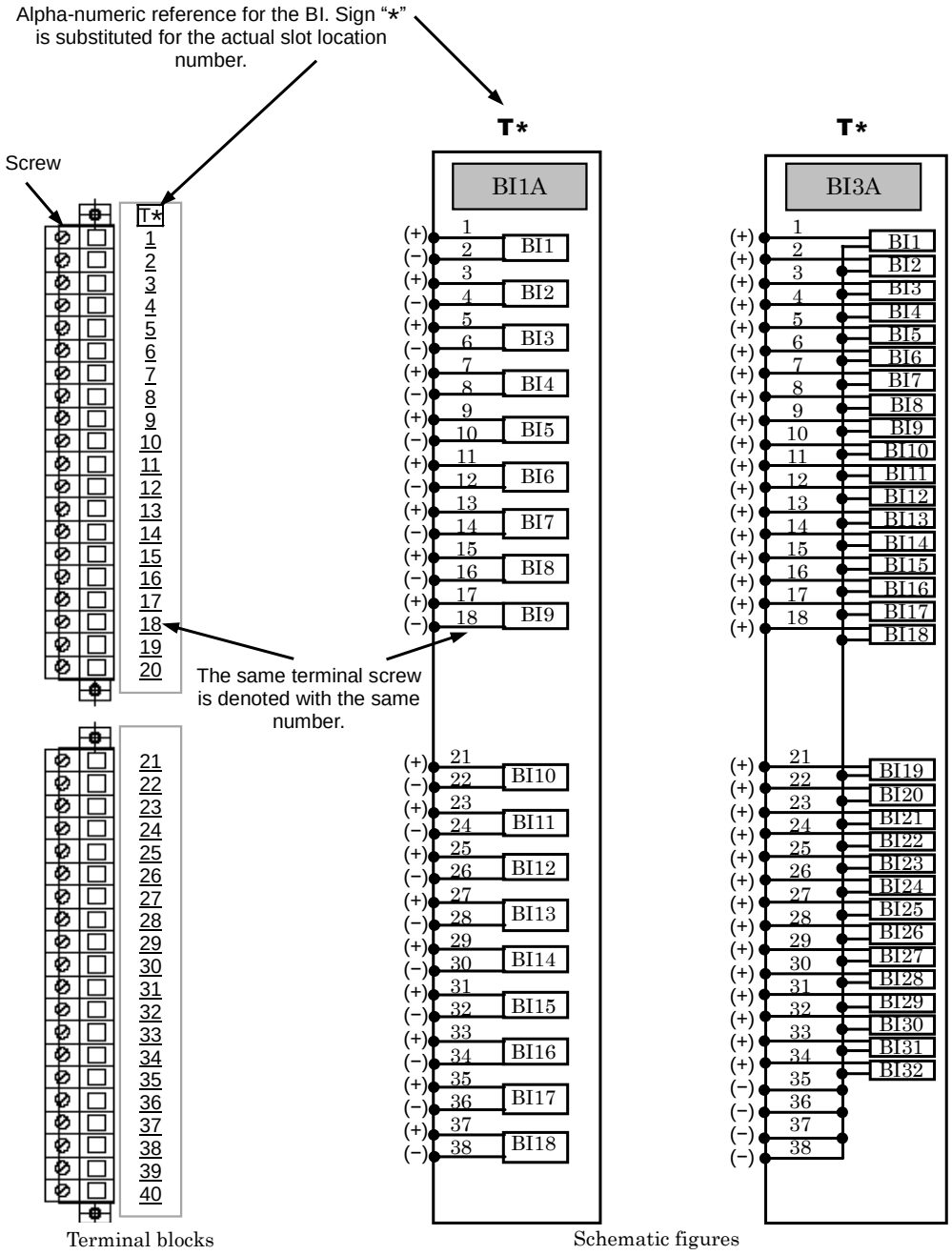


Figure 4.4-7 Input arrangements for BI1A and BI3A

Note: For more detailed circuit information, refer to Table 4.4-2 or Table 4.4-6.

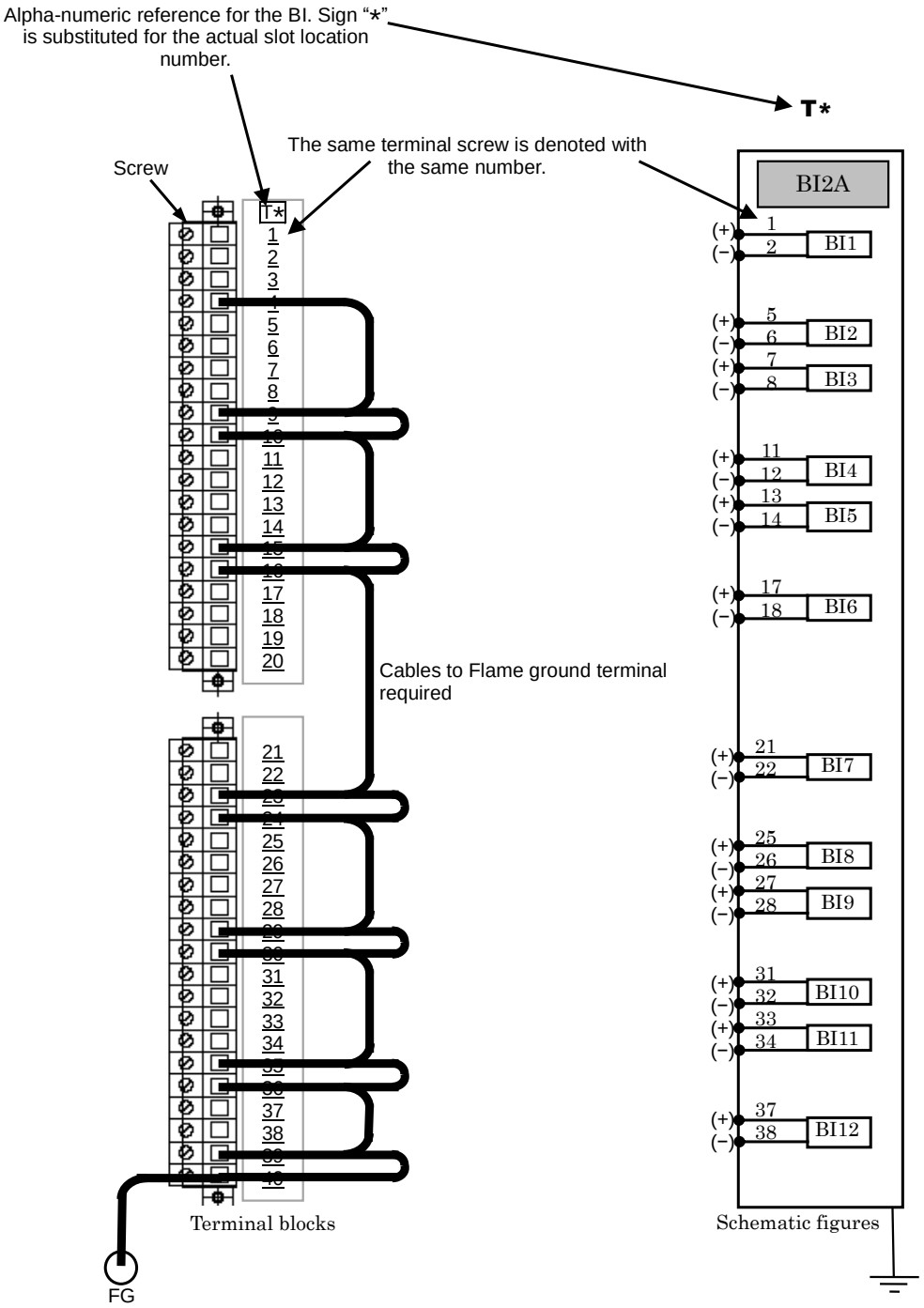


Figure 4.4-8 Input arrangements for BI2A

Note: For more detailed circuit information, refer to Table 4.4-2 or Table 4.4-6.

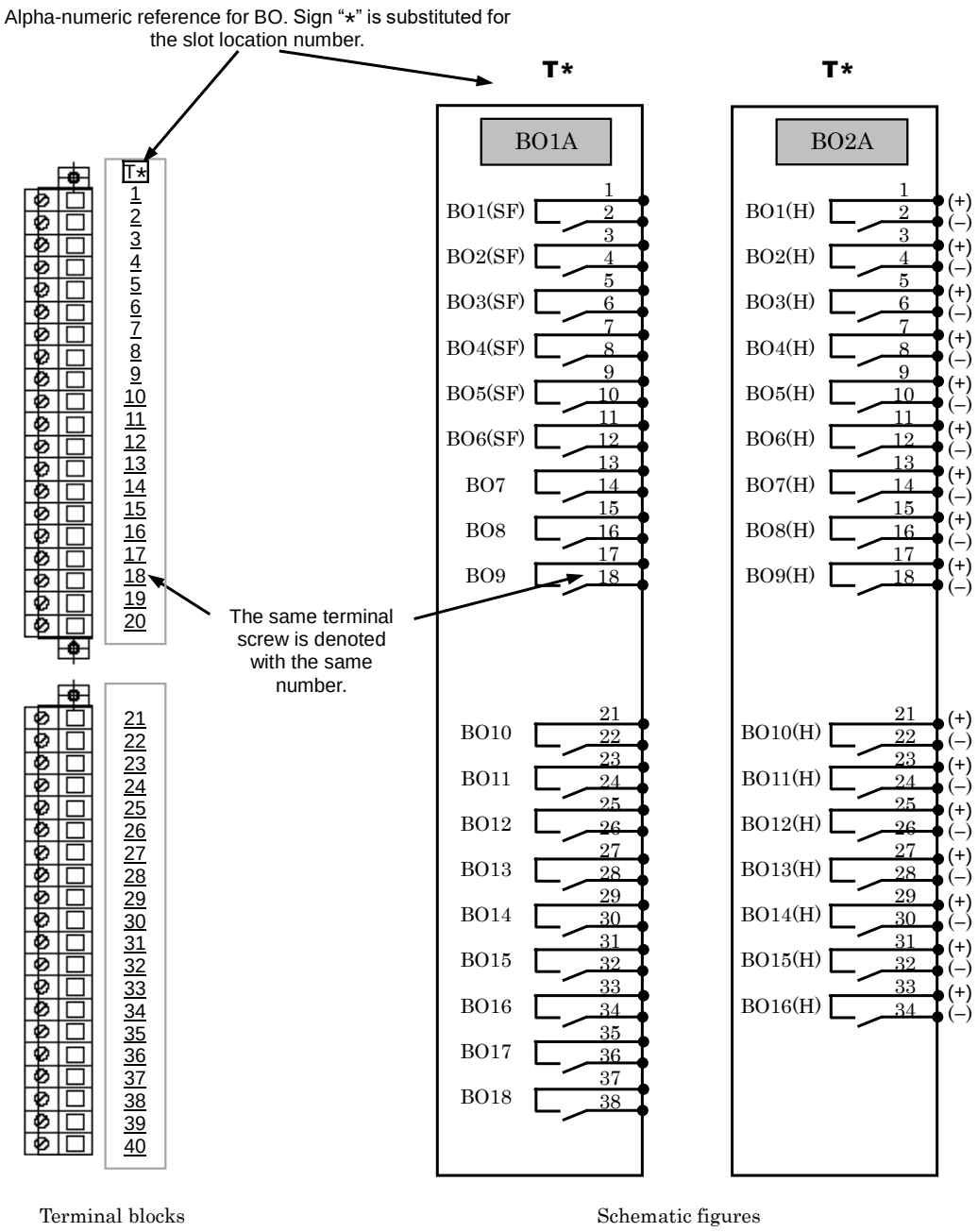


Figure 4.4-9 Output arrangements in BO1A and BO2A

Note: For more detailed circuit information, refer to Table 4.4-2 or Table 4.4-6.

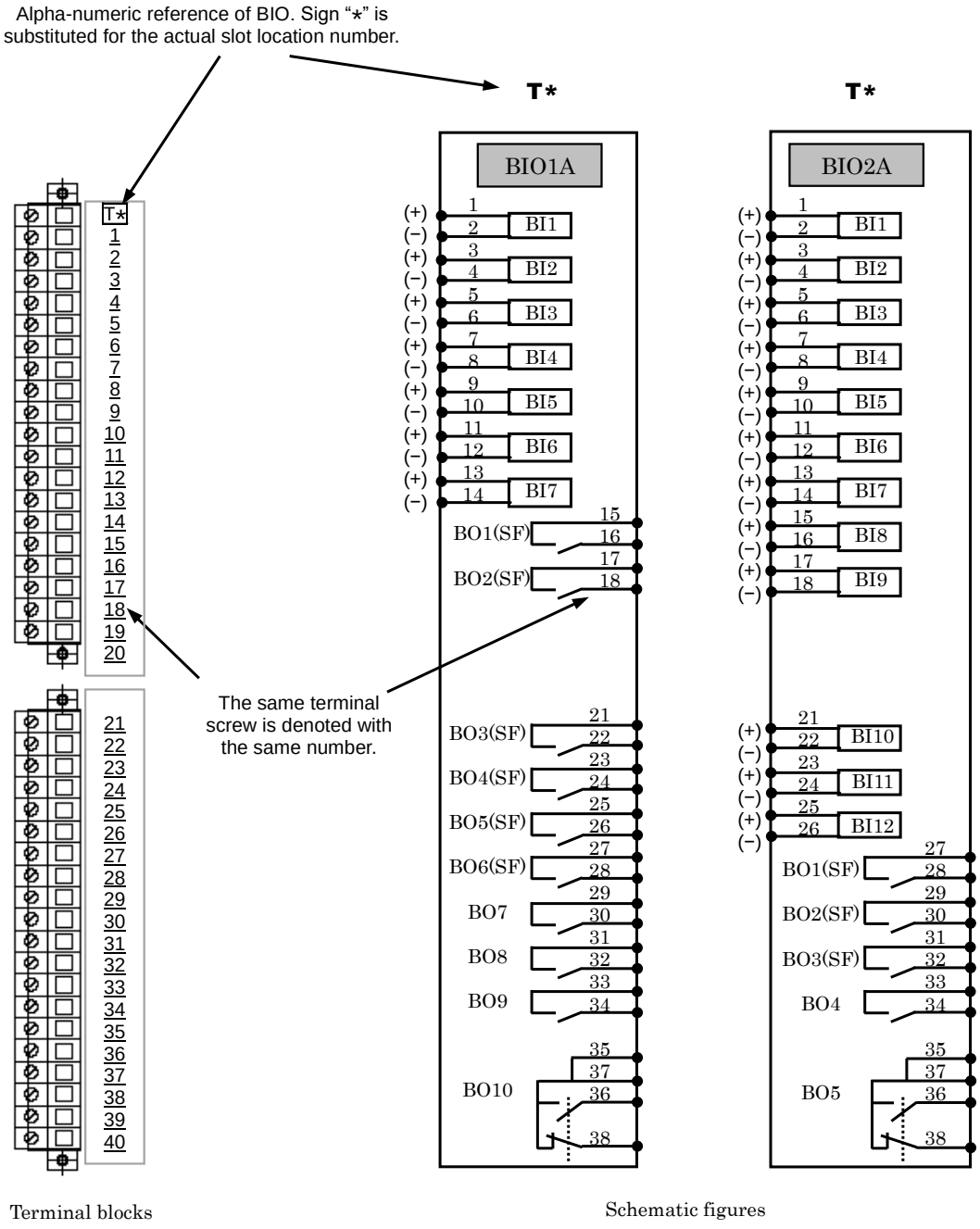


Figure 4.4-10 Input and output arrangements in BIO1A and BIO2A

Note: For more detailed circuit information, refer to Table 4.4-2 or Table 4.4-6.

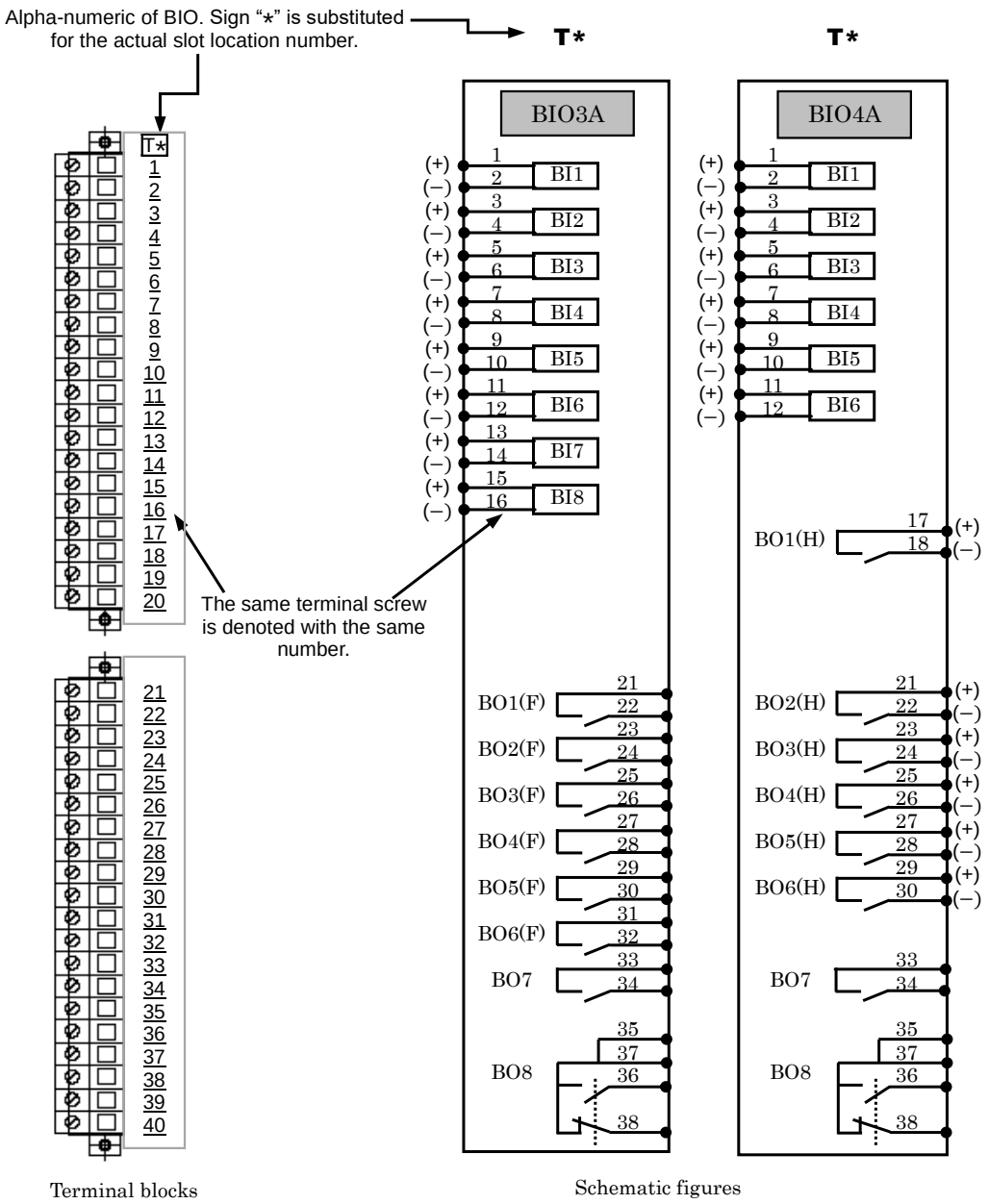


Figure 4.4-11 Input and output arrangements in BIO3A and BIO4A

Note: PHOENIX CONTACT ® is the manufacturer of the terminal block. The model of this terminal is described as "FRONT-MSTB 2.5/20-STF 5.08". The user can connect a cable to this terminal directly without a cable ferrule; hence, the recommended cables are AWG14 and their stripping lengths are 10mm. Use a cable ferrule made in PHOENIX CONTACT ® when required.

4.4.6 Settings of binary input circuits

(i) Setting table (IO_SLOT1) at IO#1 (Function ID: 200B01)

(i)-1 For the standard type being furnished

Setting item			Range	Unit s	Contents	Default setting value	Notes
Common		THRES_Lvl	Low / High	-	Determination of input threshold	Low	
		CMP_NUM	4 - 9	-	Number of times filtered	4	
	BI1	BI1_CPL	Off / On	-	Programmable binary input enable	Off	
		On Delay Timer	0.000 - 300.000	s	On delay timer value	0.000	
		Off Delay Timer	0.000 - 300.000	s	Off delay timer value	0.000	
		INVERSE-SW	Normal / Inverse	-	Binary signal inversion	Normal	
	BI2	BI2_CPL	Off / On	-	Programmable binary input enable	Off	
		On Delay Timer	0.000 - 300.000	s	On delay timer value	0.000	
		Off Delay Timer	0.000 - 300.000	s	Off delay timer value	0.000	
		INVERSE-SW	Normal / Inverse	-	Binary signal inversion	Normal	
	.....	.....	.....		.....	.....	
	BI32	BI32_CPL	Off / On	-	Programmable binary input enable	Off	
		On Delay Timer	0.000 - 300.000	s	On delay timer value	0.000	
		Off Delay Timer	0.000 - 300.000	s	Off delay timer value	0.000	
		INVERSE-SW	Normal / Inverse	-	Binary signal inversion	Normal	

(i)-2 For the variable type being furnished

Setting item			Range	Unit s	Contents	Default setting value	Notes
Common		THRES_Lvl	Low / High	-	Determination of input threshold	Low	
		THRES_Grp1	10 - 220	V	Threshold through BI1 to BI3 Applicable only in BI-2 module and BIO-4 module	75	
		THRES_Grp2	10 - 220	V	Threshold through BI4 to BI6 Applicable only in BI-2 module and BIO-4 module	75	
		THRES_Grp3	10 - 220	V	Threshold through BI7 to BI9 Applicable only in BI-2 module and BIO-4 module	75	
		THRES_Grp4	10 - 220	V	Threshold through BI10 to BI12 Applicable only in BI-2 module and BIO-4 module	75	
		CMP_NUM	4 - 9	-	Number of times filtered	4	
	BI1	BI1_CPL	Off / On	-	Programmable binary input enable	Off	
		On Delay Timer	0.000 - 300.000	s	On delay timer value	0.000	
		Off Delay Timer	0.000 - 300.000	s	Off delay timer value	0.000	
		INVERSE-SW	Normal / Inverse	-	Binary signal inversion	Normal	
	BI2	BI2_CPL	Off / On	-	Programmable binary input enable	Off	
		On Delay Timer	0.000 - 300.000	s	On delay timer value	0.000	
		Off Delay Timer	0.000 - 300.000	s	Off delay timer value	0.000	
		INVERSE-SW	Normal / Inverse	-	Binary signal inversion	Normal	
	.....	.....	.....		.....	.....	
	BI12	BI12_CPL	Off / On	-	Programmable binary input enable	Off	
		On Delay Timer	0.000 - 300.000	s	On delay timer value	0.000	
		Off Delay Timer	0.000 - 300.000	s	Off delay timer value	0.000	
		INVERSE-SW	Normal / Inverse	-	Binary signal inversion	Normal	

(ii) Setting tables (IO_SLOT2 to SLOT*n*) at IO#2 to IO#*n* (Function ID: 200B02 to 200B0n)

(ii)-1 For the standard type being furnished

Setting table is the same as the table for the IO#1 (in previous section (i)-1)

(ii)-2 For the variable type being furnished

Setting table is the same as the table for the IO#2 (in previous section (i)-2)

4.4.7 Signals (Data ID) of binary input circuits

(i) Table (IO_SLOT1) at IO#1 (Function ID: 200B01)

(i)-1 Before the filer

◆ Signal monitoring points (before the filter)

Element ID	Name	Description
8001001111	BI1-NC	BI1 signal without filter
8101011111	BI2-NC	BI2 signal without filter
8201021111	BI3-NC	BI3 signal without filter
8301031111	BI4-NC	BI4 signal without filter
8401041111	BI5-NC	BI5 signal without filter
8501051111	BI6-NC	BI6 signal without filter
8601061111	BI7-NC	BI7 signal without filter
8701071111	BI8-NC	BI8 signal without filter
8801081111	BI9-NC	BI9 signal without filter
8901091111	BI10-NC	BI10 signal without filter
8A010A1111	BI11-NC	BI5 signal without filter
8B010B1111	BI12-NC	BI7 signal without filter
8C010C1111	BI13-NC	BI9 signal without filter
8D010D1111	BI14-NC	BI11 signal without filter
8E010E1111	BI15-NC	BI13 signal without filter
8F010F1111	BI16-NC	BI15 signal without filter
8001101111	BI17-NC	BI17 signal without filter
8101111111	BI18-NC	BI18 signal without filter
8201121111	BI19-NC	BI19 signal without filter
8301131111	BI20-NC	BI20 signal without filter
8401141111	BI21-NC	BI21 signal without filter
8501151111	BI22-NC	BI22 signal without filter
8601161111	BI23-NC	BI23 signal without filter
8701171111	BI24-NC	BI24 signal without filter
8801181111	BI25-NC	BI25 signal without filter
8901191111	BI26-NC	BI26 signal without filter
8A011A1111	BI27-NC	BI27 signal without filter
8B011B1111	BI28-NC	BI28 signal without filter
8C011C1111	BI29-NC	BI29 signal without filter
8D011D1111	BI30-NC	BI30 signal without filter
8F011F1111	BI32-NC	BI31 signal without filter
8E011E1111	BI31-NC	BI32 signal without filter

(i)-2 After the filter

◆ Signal monitoring points (after the filer)

Element ID	Name	Description
8001001110	BI1	BI1 signal with filter
8101011110	BI2	BI2 signal with filter
8201021110	BI3	BI3 signal with filter
8301031110	BI4	BI4 signal with filter
8401041110	BI5	BI5 signal with filter

◆ Signal monitoring points (after the filer)

Element ID	Name	Description
8501051110	BI6	BI6 signal with filter
8601061110	BI7	BI7 signal with filter
8701071110	BI8	BI8 signal with filter
8801081110	BI9	BI9 signal with filter
8901091110	BI10	BI10 signal with filter
8A010A1110	BI11	BI11 signal with filter
8B010B1110	BI12	BI12 signal with filter
8C010C1110	BI13	BI13 signal with filter
8D010D1110	BI14	BI14 signal with filter
8E010E1110	BI15	BI15 signal with filter
8F010F1110	BI16	BI16 signal with filter
8001101110	BI17	BI17 signal with filter
8101111110	BI18	BI18 signal with filter
8201121110	BI19	BI19 signal with filter
8301131110	BI20	BI20 signal with filter
8401141110	BI21	BI21 signal with filter
8501151110	BI22	BI22 signal with filter
8601161110	BI23	BI23 signal with filter
8701171110	BI24	BI24 signal with filter
8801181110	BI25	BI25 signal with filter
8901191110	BI26	BI26 signal with filter
8A011A1110	BI27	BI27 signal with filter
8B011B1110	BI28	BI28 signal with filter
8C011C1110	BI29	BI29 signal with filter
8D011D1110	BI30	BI30 signal with filter
8E011E1110	BI31	BI31 signal with filter
8F011F1110	BI32	BI32 signal with filter

(i)-3 The ends of binary input circuits

◆ Signal monitoring points (at the end of binary input circuit)

Element ID	Name	Description
8001001172	BI1-CPL	BI1 signal with filter and programmable logic
8101011172	BI2-CPL	BI2 signal with filter and programmable logic
8201021172	BI3-CPL	BI3 signal with filter and programmable logic
8301031172	BI4-CPL	BI4 signal with filter and programmable logic
8401041172	BI5-CPL	BI5 signal with filter and programmable logic
8501051172	BI6-CPL	BI6 signal with filter and programmable logic
8601061172	BI7-CPL	BI7 signal with filter and programmable logic
8701071172	BI8-CPL	BI8 signal with filter and programmable logic
8801081172	BI9-CPL	BI9 signal with filter and programmable logic
8901091172	BI10-CPL	BI10 signal with filter and programmable logic
8A010A1172	BI11-CPL	BI11 signal with filter and programmable logic
8B010B1172	BI12-CPL	BI12 signal with filter and programmable logic
8C010C1172	BI13-CPL	BI13 signal with filter and programmable logic
8D010D1172	BI14-CPL	BI14 signal with filter and programmable logic

◆ Signal monitoring points (at the end of binary input circuit)

Element ID	Name	Description
8E010E1172	BI15-CPL	BI15 signal with filter and programmable logic
8F010F1172	BI16-CPL	BI16 signal with filter and programmable logic
8001101172	BI17-CPL	BI17 signal with filter and programmable logic
8101111172	BI18-CPL	BI18 signal with filter and programmable logic
8201121172	BI19-CPL	BI19signal with filter and programmable logic
8301131172	BI20-CPL	BI20ignal with filter and programmable logic
8401141172	BI21-CPL	BI21 signal with filter and programmable logic
8501151172	BI22-CPL	BI22 signal with filter and programmable logic
8601161172	BI23-CPL	BI23 signal with filter and programmable logic
8701171172	BI24-CPL	BI24 signal with filter and programmable logic
8801181172	BI25-CPL	BI25 signal with filter and programmable logic
8901191172	BI26-CPL	BI26 signal with filter and programmable logic
8A011A1172	BI27-CPL	BI27 signal with filter and programmable logic
8B011B1172	BI28-CPL	BI28 signal with filter and programmable logic
8C011C1172	BI29-CPL	BI29 signal with filter and programmable logic
8D011D1172	BI30-CPL	BI30 signal with filter and programmable logic
8E011E1172	BI31-CPL	BI31 signal with filter and programmable logic
8F011F1172	BI32-CPL	BI32 signal with filter and programmable logic

(ii) Tables (IO_SLOT2 to SLOT*n*) at IO#2 to IO#*n* (Function ID: 200B02 to 200B0*n*)

(ii)-1 Before the filter

Table is the same as the table in previous section (i)-1.

(ii)-2 After the filter

Table is the same as the table in previous section (i)-2.

(ii)-3 The ends of binary input circuits

Table is the same as the table in previous section (i)-3.

4.4.8 Settings of binary output circuits

(i) Setting table (IO_SLOT1) at IO#1 (Function ID 200B01)

Setting item		Range	Units	Contents	Default setting value	Notes
BO1	BO1_CPL	Off / On	-	Programmable binary output enable	Off	
	Input signal1	(Data-ID from other FBs)	-	First Data ID as input signal #1 for Logic gate	Not assigned	
	Input signal2	ditto	-	Second Data ID as input signal #2 for Logic gate	Not assigned	
	Input signal3	ditto	-	Third Data ID as input signal #3 for Logic gate	Not assigned	
	Input signal4	ditto	-	Forth Data ID as input signal #4 for Logic gate	Not assigned	
	Input signal5	ditto	-	Fifth Data ID as input signal #5 for Logic gate	Not assigned	
	Input signal6	ditto	-	Sixth Data ID as input signal #6 for Logic gate	Not assigned	
	Input signal7	ditto	-	Seventh Data ID as input signal #7 for Logic gate	Not assigned	
	Input signal8	ditto	-	Eighth Data ID as input signal #8 for Logic gate	Not assigned	
	LOGIC-SW	AND / OR / XOR	-	Operation selection in Logic gate	AND	
	On Delay Timer	0.000 - 300.000	s	On delay timer value	0.000	
	Off Delay Timer	0.000 - 300.000	s	Off delay timer value	0.000	
	INVERSE-SW	Normal / Inverse	-	Binary signal inversion	Normal	
	TIMER-SW	Off / Delay / Dwell / Latch	-	Selection of Logic circuit	Off	
	Logic Timer	0.000 - 300.000	s	Off delay timer value for "Delay" and "Dwell" circuit	0.000	
	Reset signal	(Data-ID from other FBs)	-	Reset signal selection for "Latch" circuit	Not assigned	
BO2	BO2_CPL	Off / On	-	Programmable binary output enable	Off	
	Input signal1	(Data-ID from other FBs)	-	Keying Data ID#1 as input signal for Logic gate	Not assigned	
	Input signal2	ditto	-	Keying Data ID#2 as input signal for Logic gate	Not assigned	
	Input signal3	ditto	-	Keying Data ID#3 as input signal for Logic gate	Not assigned	
	Input signal4	ditto	-	Keying Data ID#4 as input signal for Logic gate	Not assigned	
	Input signal5	ditto	-	Keying Data ID#5 as input signal for Logic gate	Not assigned	
	Input signal6	ditto	-	Keying Data ID#6 as input signal for Logic gate	Not assigned	
	Input signal7	ditto	-	Keying Data ID#7 as input signal for Logic gate	Not assigned	
	Input signal8	ditto	-	Keying Data ID#8 as input signal for Logic gate	Not assigned	
	LOGIC-SW	AND / OR / XOR	-	Operation selection in Logic gate	AND	
	On Delay Timer	0.000 - 300.000	s	On delay timer value	0.000	
	Off Delay Timer	0.000 - 300.000	s	Off delay timer value	0.000	
	INVERSE-SW	Normal / Inverse	-	Binary signal inversion	Normal	
	TIMER-SW	Off / Delay / Dwell / Latch	-	Selection of Logic circuit	Off	
	Logic Timer	0.000 - 300.000	s	Off delay timer value for "Delay" and "Dwell" circuit	0.000	
	Reset signal	(Data-ID from other FBs)	-	Reset signal selection for "Latch" circuit	Not assigned	
.....	.....	.....		.....	.....	
BO18	BO18_CPL	Off / On	-	Programmable binary output enable	Off	
	Input signal1	(Data-ID from other FBs)	-	Keying Data ID#1 as input signal for Logic gate	Not assigned	
	.....	.....		.....	.....	
	Input signal8	ditto	-	Keying Data ID#8 as input signal for Logic gate	Not assigned	
	LOGIC-SW	AND / OR / XOR	-	Operation selection in Logic gate	AND	
	On Delay Timer	0.000 - 300.000	s	On delay timer value	0.000	
	Off Delay Timer	0.000 - 300.000	s	Off delay timer value	0.000	
	INVERSE-SW	Normal / Inverse	-	Binary signal inversion	Normal	
	TIMER-SW	Off / Delay / Dwell / Latch	-	Selection of Logic circuit	Off	
	Logic Timer	0.000 - 300.000	s	Off delay timer value for "Delay" and "Dwell" circuit	0.000	
	Reset signal	(Data-ID from other FBs)	-	Reset signal selection for "Latch" circuit	Not assigned	

(ii) Setting tables (IO_SLOT2 to SLOT*n*) at IO#2 to IO#*n* (Function ID 200B02 to 200B0*n*)

Setting table is the same as the table for the IO#1 (in section (i))

4.4.9 Signals (Data ID) of binary output circuits

(i) Table (IO_SLOT1) at IO#1 (Function ID: 200B01)

(i)-1 Before the contact-driver

◆ Signal monitoring points (before the contact-driver)

Element ID	Name	Description
8002001112	BO1	BO1 signal
8102011112	BO2	BO2 signal
8202021112	BO3	BO3 signal
8302031112	BO4	BO4 signal
8402041112	BO5	BO5 signal
8502051112	BO6	BO6 signal
8602061112	BO7	BO7 signal
8702071112	BO8	BO8 signal
8802081112	BO9	BO9 signal
8902091112	BO10	BO10 signal
8A020A1112	BO11	BO11 signal
8B020B1112	BO12	BO12 signal
8C020C1112	BO13	BO13 signal
8D020D1112	BO14	BO14 signal
8E020E1112	BO15	BO15 signal
8F020F1112	BO16	BO16 signal
8002101112	BO17	BO17 signal
8102111112	BO18	BO18 signal

(i)-2 After the contact-driver

◆ Signal monitoring points (after the contact-driver)

Element ID	Name	Description
8002001113	BO1 RB	BO1 driver read signal
8102011113	BO2 RB	BO2 driver read signal
8202021113	BO3 RB	BO3 driver read signal
8302031113	BO4 RB	BO4 driver read signal
8402041113	BO5 RB	BO5 driver read signal
8502051113	BO6 RB	BO6 driver read signal
8602061113	BO7 RB	BO7 driver read signal
8702071113	BO8 RB	BO8 driver read signal
8802081113	BO9 RB	BO9 driver read signal
8902091113	BO10 RB	BO10 driver read signal
8A020A1113	BO11 RB	BO11 driver read signal
8B020B1113	BO12 RB	BO12 driver read signal
8C020C1113	BO13 RB	BO13 driver read signal
8D020D1113	BO14 RB	BO14 driver read signal
8E020E1113	BO15 RB	BO15 driver read signal
8F020F1113	BO16 RB	BO16 driver read signal
8002101113	BO17 RB	BO17 driver read signal
8102111113	BO18 RB	BO18 driver read signal

(i)-3 Connection points for the PLC

◆ Connection point in PLC logic

Element ID	Name	Description
310200E11D	BO1-SOURCE	BO1 output command by PLC-logic
310201E11D	BO2-SOURCE	BO2 output command by PLC-logic
310202E11D	BO3-SOURCE	BO3 output command by PLC-logic
310203E11D	BO4-SOURCE	BO4 output command by PLC-logic
310204E11D	BO5-SOURCE	BO5 output command by PLC-logic
310205E11D	BO6-SOURCE	BO6 output command by PLC-logic
310206E11D	BO7-SOURCE	BO7 output command by PLC-logic
310207E11D	BO8-SOURCE	BO8 output command by PLC-logic
310208E11D	BO9-SOURCE	BO9 output command by PLC-logic
310209E11D	BO10-SOURCE	BO10 output command by PLC-logic
31020AE11D	BO11-SOURCE	BO11 output command by PLC-logic
31020BE11D	BO12-SOURCE	BO12 output command by PLC-logic
31020CE11D	BO13-SOURCE	BO13 output command by PLC-logic
31020DE11D	BO14-SOURCE	BO14 output command by PLC-logic
31020EE11D	BO15-SOURCE	BO15 output command by PLC-logic
31020FE11D	BO16-SOURCE	BO16 output command by PLC-logic
310210E11D	BO17-SOURCE	BO17 output command by PLC-logic
310211E11D	BO18-SOURCE	BO18 output command by PLC-logic

(ii) Tables (IO_SLOT2 to SLOT*n*) at IO#2 to IO#*n* (Function ID: 200B02 to 200B0*n*)

(ii)-1 Before the contact-driver

Table is the same as the table in previous section (i)-1.

(ii)-2 After the contact-driver

Table is the same as the table in previous section (i)-2.

(ii)-3 Connection points for the PLC

Table is the same as the table in previous section (i)-3.

4.5 DC analog input module (DCAI2A)

Direct current analog input (DCAI2A) module can convert received analog signals into numerical value; this is accomplished by means of analog to digital conversion. A DCAI2A module can handle 10 signals (10 channels). In respective channels the user can configure their ranges by settings; thereby the DCAI2 module can handle several types of signals. The numerical data generated in the DCAI2 module is transferred the remote-end by the communication. Figure 4.5-1 shows the outline of the DCAI2A module; the receipt signal is represented with the channel number. Table 4.5-1 tabulates the specifications in the DCAI2 module.

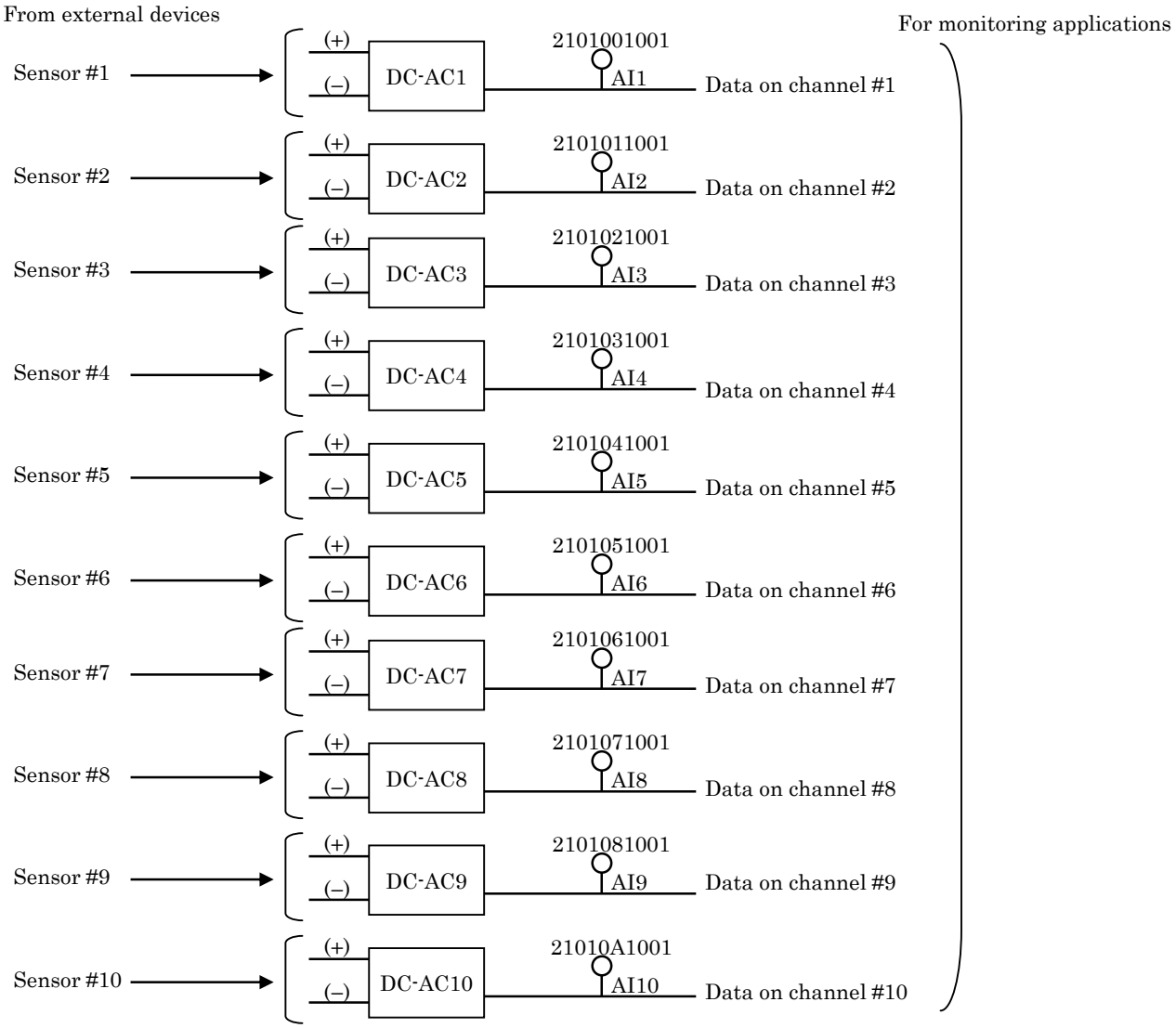


Figure 4.5-1 Logics in DCAI2A module

Table 4.5-1 DCAI2A specification

Items	Specification	Remarks
Number of channel	10 channel per a DCAI2A module	
Isolated breakdown	Channel to channel: 2000Vac／4500V impulse Earth to channel: 2000Vac／4500V impulse Internal circuit to channel: 2000Vac／4500V impulse	
Resolution	16 bits	
Current	20mA or 1mA	Range selection is made by EL bit connector
Voltage	10V or 1V	
Input impedance	Depend on current and voltage range: ±1mA: 4.7k ohm ±20mA: 235 ohm ±10V: 38k ohm ±1V: 580k ohm	Input impedance is set automatically
External wiring terminal	See Figure 4.5-4	

4.5.1 Setting input range for the hardware

With respect to either input current or input voltage, the user can set its input range in each channel by inserting Jumper connector. Figure 4.5-1 shows the DCAI2A circuit board and the locations of the EL-BIT connectors. The selection of input range is applicable in each channel. For instance, with regard to the channel 1, if the user selects the input range as 10V, the user should insert two Jumpers to the 1-2 of the JP1D and the JP1B both. On the other hand, if the user selects the input current as 20mA, the user should insert two Jumpers to the 1-2 of the JP1A and the 1-2 of the JP1D. Table 4.5-2 tabulates the range settings for channel 1 to channel 10 and the insertions pattern of each selection.

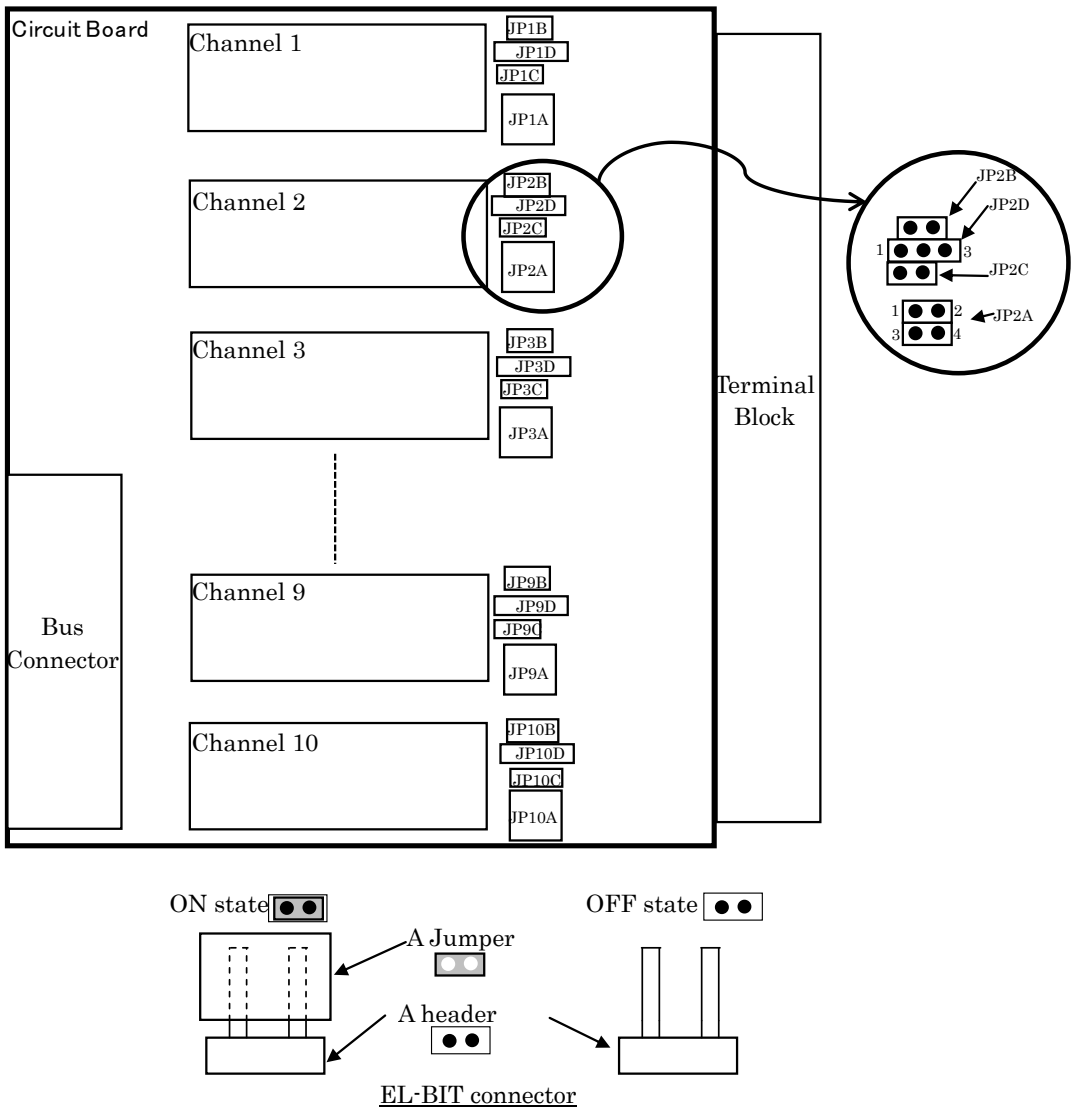
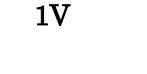
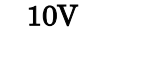
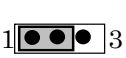
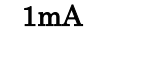
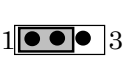
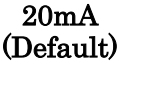
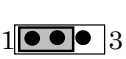


Figure 4.5-2 Arrangement of channels and Jumpers on DCAI2A module

Table 4.5-2 Input range selection with Jumper insertion

Range Selection	Insertion pattern of Jumper connector			
	JP_A	JP_B	JP_C	JP_D
1V	OFF 	OFF 	ON 	ON(2-3) 
10V	OFF 	ON 	OFF 	ON(1-2) 
1mA	ON(3-4) 	OFF 	OFF 	ON(1-2) 
20mA (Default)	ON(1-2) 	OFF 	OFF 	ON(1-2) 

⚠CAUTION

Note: The manufacture sets '20mA Jumpers patterns (for input ranges)' for respective channels on the production of the DCAI2 module. When you replace the old DCAI2 one with the new DCAI2 one, take the same Jumper patterns of the old one again for the new one, or the new DIAC2 module results in broken-down.

Note: Sign underscore "_" represents the number of each channel. Notations "ON" and "OFF" in above table follows in Figure 4.5-2. Default combination of the jumpers is set for "20mA".

4.5.2 Setting input range for application

With regard to the DCAI2A hardware, the input range selection is made with the Jumper insertion. However, the user should also set its input range for the DCAI2A software. Table 4.5-3 shows setting items. The setting means of the DCAI2A is similar to the setting means of the BIO module; the user should examine the location of the DCAI2A module and select the setting table being relative to its slot location number.

The DCAI2A module has ten input circuits (10 channels); hence, the user can choice the range in each channel. For example, if the user wishes to select 10V range at channel 1, set **10V** for scheme switch [**AI01_CH_TYPE]**. On the other hand, if the user wishes to selects 20mA range, set **20mA** for the scheme switch [**AI01_CH_TYPE**]. The same settings hold true for the other channels. The user should select a setting table as to the slot location of the DCAI2A module. Figure 4.5-3 exemplifies the user can set the ranges in respective channels using setting table "AIO_SLOT4" because the DCAI2A module is located at IO#4 slot. The user can

obtain the setting table at each slot in section 4.5.4.

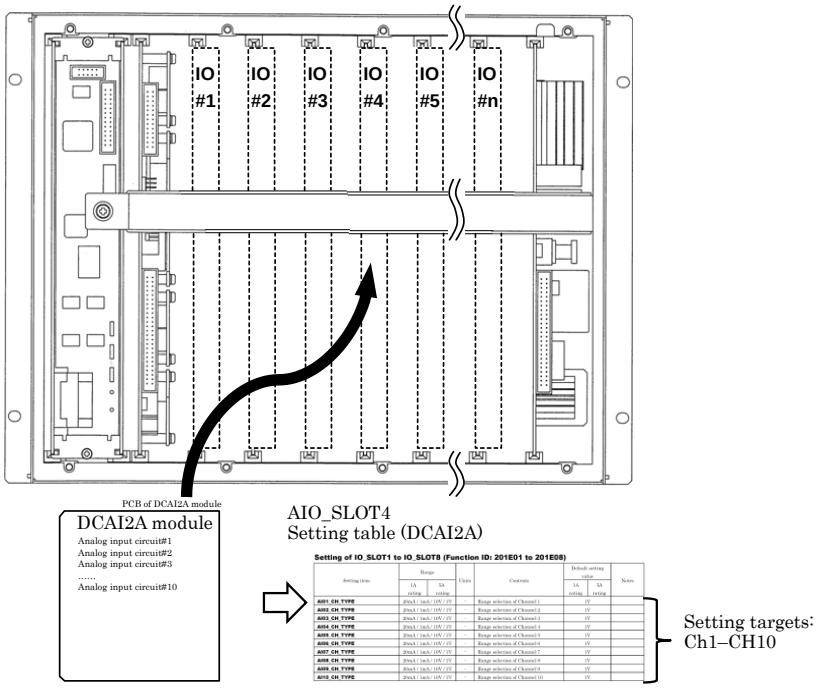


Figure 4.5-3 DCAI2A module and its setting table

Table 4.5-3 Range settings of respective DCAI2 modules

Setting items	Default	Selection range
AI01_CH_TYPE	20mA	1V, 10V, 1mA, 20mA
AI02_CH_TYPE	20mA	1V, 10V, 1mA, 20mA
AI03_CH_TYPE	20mA	1V, 10V, 1mA, 20mA
AI04_CH_TYPE	20mA	1V, 10V, 1mA, 20mA
AI05_CH_TYPE	20mA	1V, 10V, 1mA, 20mA
AI06_CH_TYPE	20mA	1V, 10V, 1mA, 20mA
AI07_CH_TYPE	20mA	1V, 10V, 1mA, 20mA
AI08_CH_TYPE	20mA	1V, 10V, 1mA, 20mA
AI09_CH_TYPE	20mA	1V, 10V, 1mA, 20mA
AI10_CH_TYPE	20mA	1V, 10V, 1mA, 20mA

4.5.3 Terminal structure

The terminal blocks of the DCAI2A are shown in Figure 4.5-4. When the user wishes to wire the DCAI2A module, the wiring targets are designated with terminal screw number 1 to 14 and 21 to 24. Terminal screws 18/38 is provided for signal ground. These terminal screw numbers are printed next to the terminal blocks. The user can find the location of terminal block (slot) labeled alpha-numerical reference "T*". The asterisk sign (*) is substituted for any

one of the slot location numbers. The schematic diagram is also found in *External connection figures*. (See *Appendix: Typical external connection*)

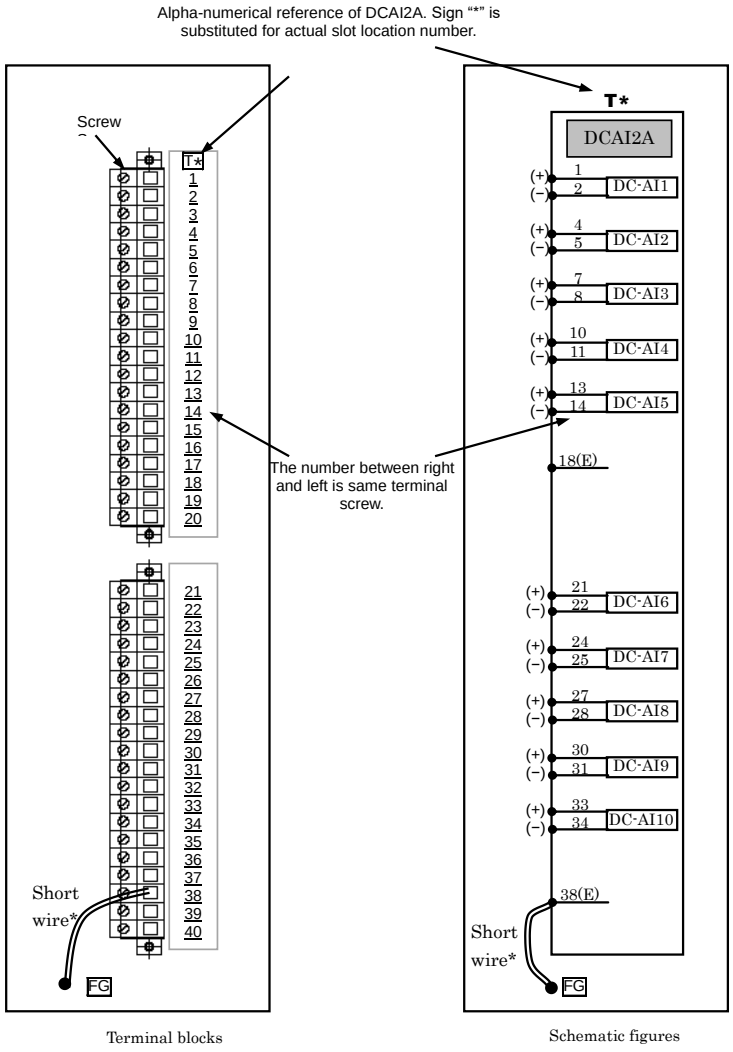


Figure 4.5-4 DCAI2A module terminals (Rear view)

*Note: PHOENIX CONTACT ® is the manufacturer of the terminal block. The model of this terminal is described as "FRONT-MSTB 2.5/20-STF 5.08". The user can connect a cable to this terminal directly without a cable ferrule; hence, the recommended cables are AWG14 and their stripping lengths are 10mm. Use "AI2.5-10BU" for AWG14 in the PHOENIX CONTACT ® when a cable ferrule is required.

4.5.4 Settings

(i) Setting table at IO#1

Setting of AIO_SLOT1 (Function ID: 201E01)

Setting item	Range	Units	Contents	Default setting value	Notes
AI01_CH_TYPE	20mA / 1mA / 10V / 1V	-	Range selection at Channel 1	20mA	
AI02_CH_TYPE	20mA / 1mA / 10V / 1V	-	Range selection at Channel 2	20mA	
AI03_CH_TYPE	20mA / 1mA / 10V / 1V	-	Range selection at Channel 3	20mA	
AI04_CH_TYPE	20mA / 1mA / 10V / 1V	-	Range selection at Channel 4	20mA	
AI05_CH_TYPE	20mA / 1mA / 10V / 1V	-	Range selection at Channel 5	20mA	
AI06_CH_TYPE	20mA / 1mA / 10V / 1V	-	Range selection at Channel 6	20mA	
AI07_CH_TYPE	20mA / 1mA / 10V / 1V	-	Range selection at Channel 7	20mA	
AI08_CH_TYPE	20mA / 1mA / 10V / 1V	-	Range selection at Channel 8	20mA	
AI09_CH_TYPE	20mA / 1mA / 10V / 1V	-	Range selection at Channel 9	20mA	
AI10_CH_TYPE	20mA / 1mA / 10V / 1V	-	Range selection at Channel 10	20mA	

(ii) Setting table at IO#2

Setting of AIO_SLOT2 (Function ID: 201E02)

Setting item	Range	Units	Contents	Default setting value	Notes
AI01_CH_TYPE	20mA / 1mA / 10V / 1V	-	Range selection at Channel 1	20mA	
AI02_CH_TYPE	20mA / 1mA / 10V / 1V	-	Range selection at Channel 2	20mA	
AI03_CH_TYPE	20mA / 1mA / 10V / 1V	-	Range selection at Channel 3	20mA	
AI04_CH_TYPE	20mA / 1mA / 10V / 1V	-	Range selection at Channel 4	20mA	
AI05_CH_TYPE	20mA / 1mA / 10V / 1V	-	Range selection at Channel 5	20mA	
AI06_CH_TYPE	20mA / 1mA / 10V / 1V	-	Range selection at Channel 6	20mA	
AI07_CH_TYPE	20mA / 1mA / 10V / 1V	-	Range selection at Channel 7	20mA	
AI08_CH_TYPE	20mA / 1mA / 10V / 1V	-	Range selection at Channel 8	20mA	
AI09_CH_TYPE	20mA / 1mA / 10V / 1V	-	Range selection at Channel 9	20mA	
AI10_CH_TYPE	20mA / 1mA / 10V / 1V	-	Range selection at Channel 10	20mA	

(iii) Setting tables at IO#3 to IO#8

Setting items are the same as the items above. Note that the function IDs are assigned 201E03 to 201E08.

4.5.5 Signals (Data IDs)

(i) Table (IO_SLOT1) at IO#1 (Function ID: 201E01)

◆ Signal monitoring points

Element ID	Name	Description
2101001001	AI1	AI01 data
2101011001	AI2	AI02 data
2101021001	AI3	AI03 data
2101031001	AI4	AI04 data
2101041001	AI5	AI05 data
2101051001	AI6	AI06 data
2101061001	AI7	AI07 data
2101071001	AI8	AI08 data
2101081001	AI9	AI09 data
2101091001	AI10	AI10 data
3100001210	AI_NUM	valid AI number
310000121A	CONER_CNT	SLOT01 connection error count
2101001212	UPDTCT1	update1 count data
2101011212	UPDTCT2	update2 count data
2101021212	UPDTCT3	update3 count data
2101031212	UPDTCT4	update4 count data
2101041212	UPDTCT5	update5 count data
2101051212	UPDTCT6	update6 count data
2101061212	UPDTCT7	update7 count data
2101071212	UPDTCT8	update8 count data
2101081212	UPDTCT9	update9 count data
2101091212	UPDTCT10	update10 count data

(ii) Tables (IO_SLOT2 to SLOT*n*) at IO#2 to IO#*n* (Function ID: 201E02 to 201E0*n*)

Element IDs are the same as the table above. Note that Function ID is unique.

4.6 DC analog output module (DCAO1A)

Direct current analog output (DCAO1A) module is designed converting four numerical data to four analog signals. Up to four modules can be accommodated within the IED; hence, generating 16 signals are available in maximum. The specification of the DCAO1A is listed in Table 4.5-1.

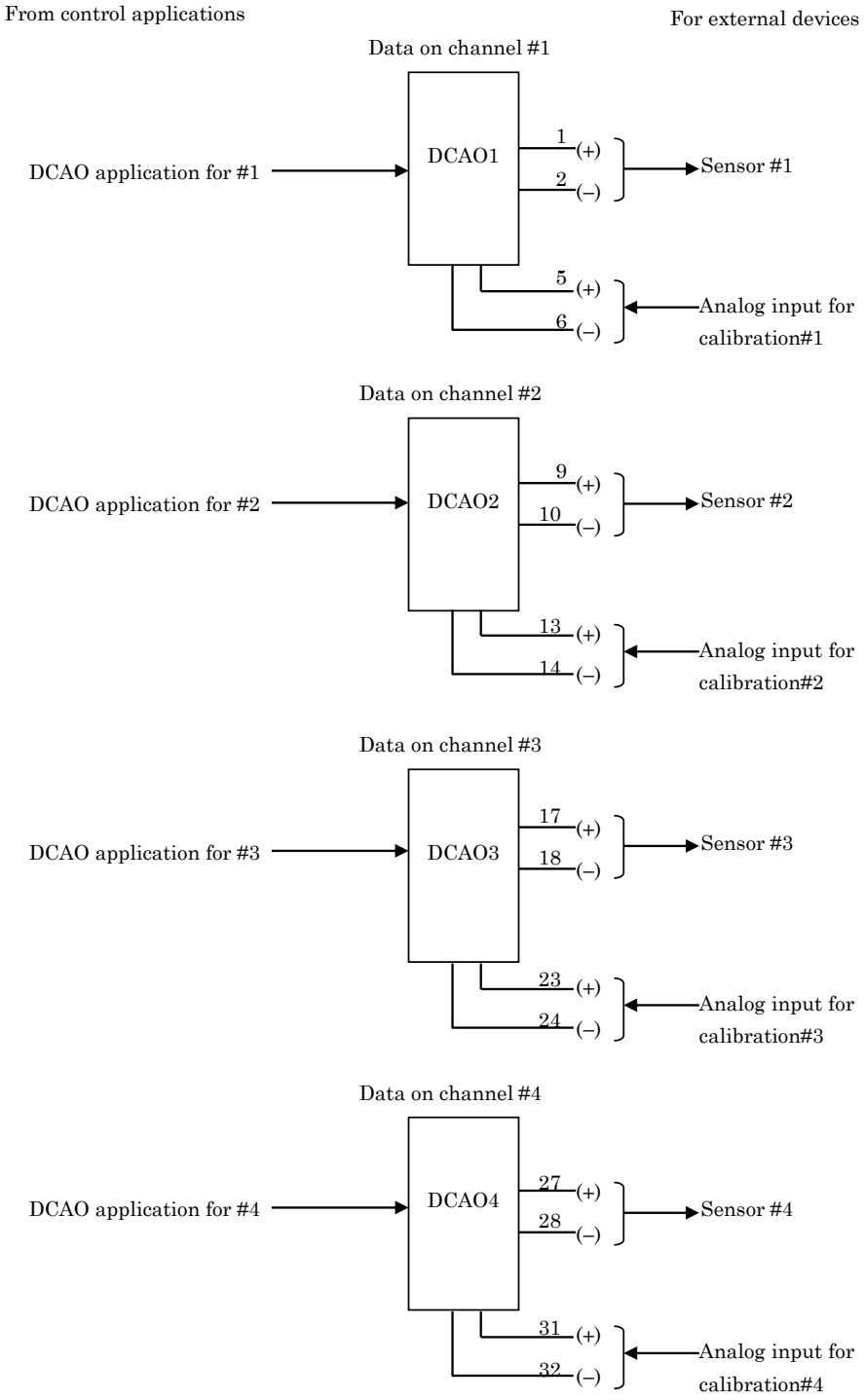


Figure 4.6-1 Logics in DCAO1A module

Table 4.6-1 DCAO1A specification

Items	Specification	Remarks
Number of channels	4 channels per module	
Rated channel output	Either ±20mA or ±10V	Selection available by jumpers and settings
Isolated breakdown	Channel to channel: 2000Vac／4500V impulse Earth to channel: 2000Vac／4500V impulse Internal circuit to channel: 2000Vac／4500V impulse	
Accuracy	Less than 1% within the full scale	
Rated output burden	Less than 500 ohm when leaving currents	
Maximum output burden	A rated-output multiplied by 1.3 should be endured when the output is set within double full scales (2×FS). Under the condition, the following operations are possible: Ten outputs with one-second pulse in every 10 seconds, or a single output with five-seconds pulse	
Resolution	13 bits	
Operation delay	Less than 10ms / full scale (FS)	
External wiring terminal	See Figure 4.5-4	

4.6.1 Setting input range for the hardware

To select either current or voltage, the user should set in each channel by inserting Jumper connector. Figure 4.5-2 shows the DCAO1A circuit board and the locations of the jumpers. For instance, the user should insert jumpers, as shown in Table 4.5-2.

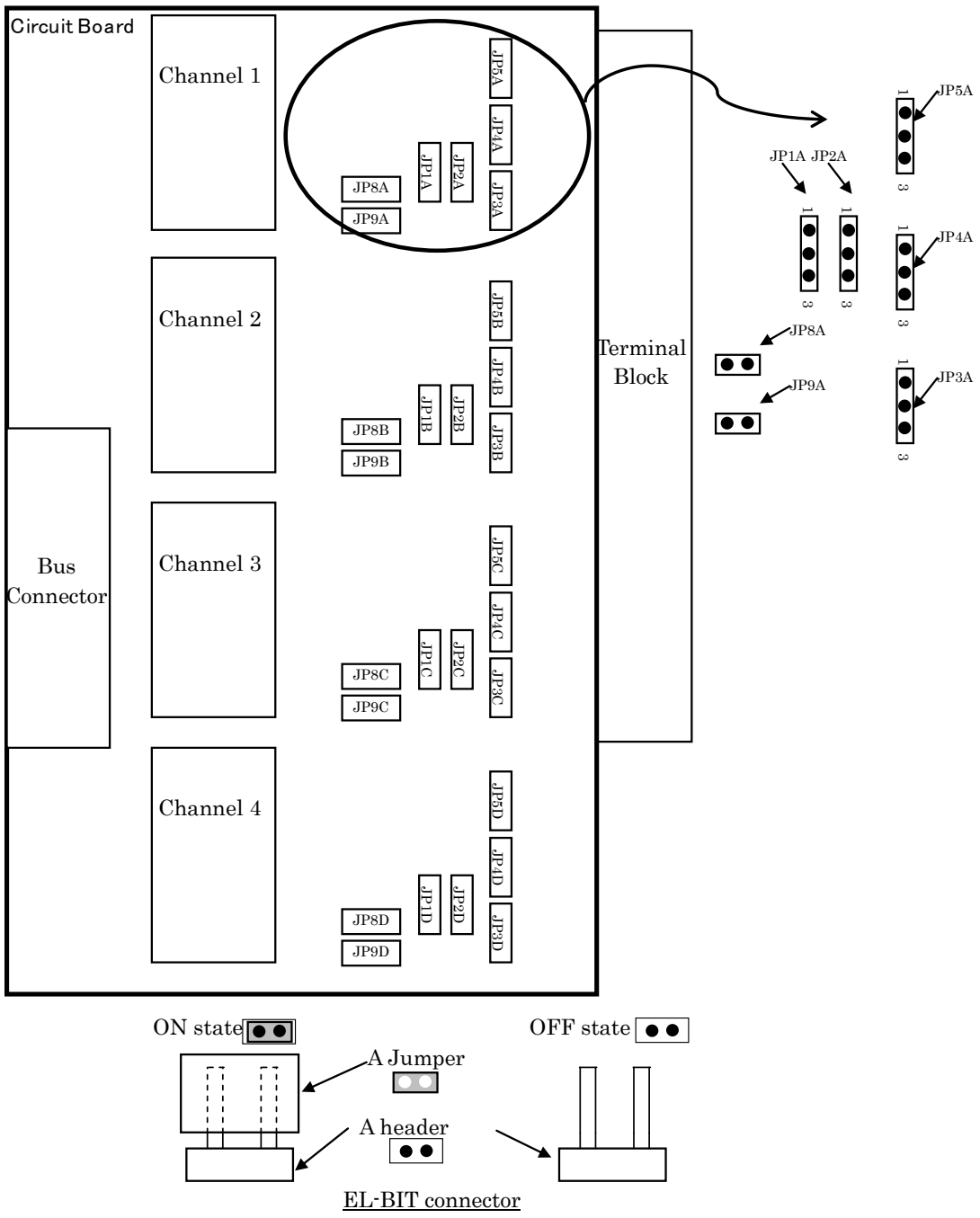


Figure 4.6-2 Arrangement of channels and Jumpers on DCAO1A module

Table 4.6-2 Range selection with Jumper insertion

Rage Selection	Insertion pattern of Jumper connector						
	JP1_	JP2_	JP3_	JP4_	JP5_	JP8_	JP9_
20mA	On(1-2) 	On(1-2) 	On(1-2) 	On(1-2) 	On(1-2) 	ON 	OFF 
10V	On(2-3) 	On(2-3) 	On(2-3) 	On(2-3) 	On(2-3) 	OFF 	ON 

Note: Sign underscore "_" represents respective channels. Notations "ON" and "OFF" in above table follows in Figure 4.5-2. Default combination of the jumpers is set for "20mA".

4.6.2 Setting output range for application

As to execute the operation in the DCAO1A hardware, the output range selection has been taken by inserting the jumpers. However, the user should also set its output range for the DCAO1A software. Table 4.5-3 shows setting items. The setting means of the DCA01A is similar to the setting means of the BIO module; the user should examine the location of the DCAO1A module and select the setting table being relative to its slot location number.

The DCAO1A module has four circuits (4 channels); hence, the user can choice the range in each channel. For example, if the user wishes to select 10V range at channel 1, set **10V** for scheme switch [**AO1_CH_TYPE]**. On the other hand, if the user wishes to selects 20mA range, set **20mA** for the scheme switch [**AO1_CH_TYPE**]. The same settings hold true for the other channels. The user should select a setting table as to the slot location of the DCAO1A module. Figure 4.5-3 exemplifies the user can set the ranges in respective channels using setting table "AIO_SLOT4" because the DCAO1A module is located at IO#4 slot. The user can obtain the setting table at each slot in section 4.5.4.

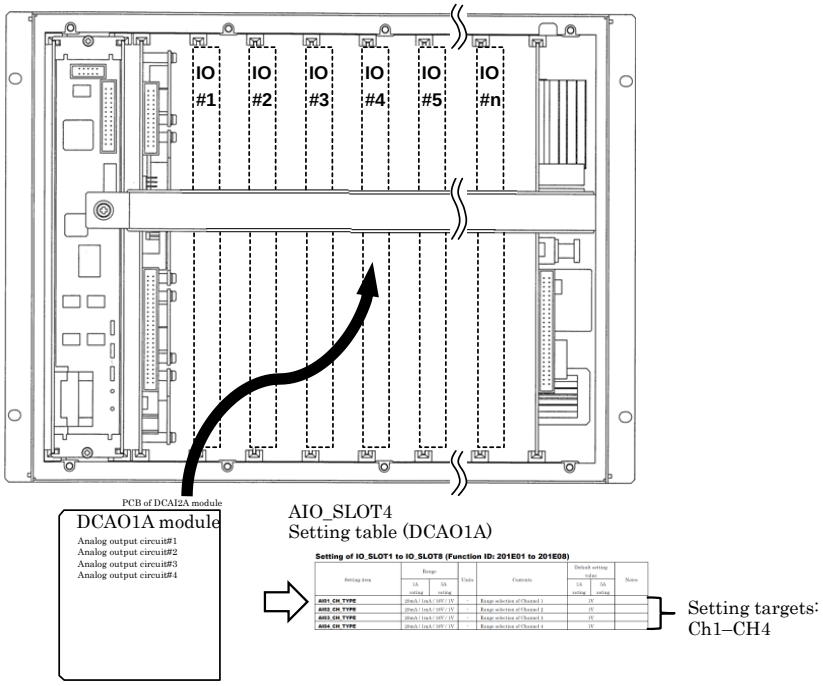


Figure 4.6-3 DCAO1A module and its setting table

Table 4.6-3 Range settings of respective DCAO1A modules

Setting items	Default	Selection range
AO1_CH_TYPE	±20mA	±20mA / ±1V
AO2_CH_TYPE	±20mA	±20mA / ±10V
AO3_CH_TYPE	±20mA	±20mA / ±10V
AO4_CH_TYPE	±20mA	±20mA / ±10V

4.6.3 Terminal structure

The terminal blocks of the DCAO1A are shown in Figure 4.5-4. When the user wishes to wire the DCAO1A module, the wiring targets are designated with terminal screw numbers 1–2, 9–10, 17–18, 27–28. Terminal screw 38 is provided for signal ground. The screw other number (i.e., 5, 6, etc.) are all reserved in the manufacture so that the user shall not use them. The screw numbers are printed next to the terminal blocks. The user can find the location of terminal block (slot) labeled alpha-numerical reference "T*". The asterisk sign (*) is substituted for any one of the slot location numbers. The schematic diagram is also found in *External connection figures*. (See *Appendix: Typical external connection*)

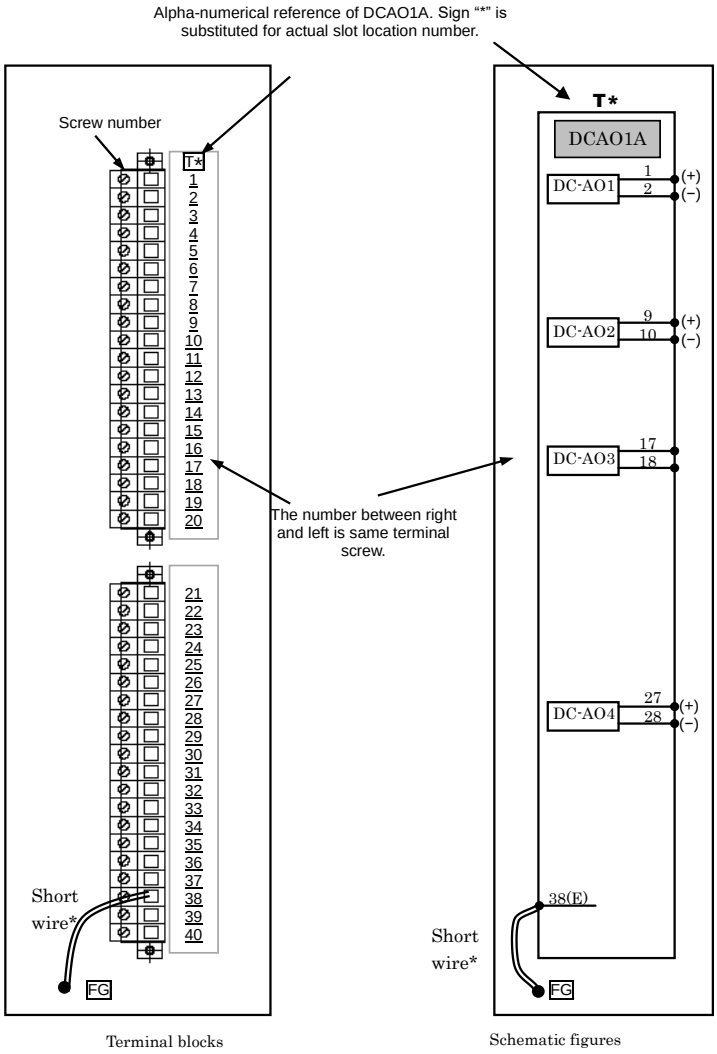


Figure 4.6-4 DCAO1A module terminals (Rear view)

*Note: PHOENIX CONTACT ® is the manufacturer of the terminal block. The model of this terminal is described as "FRONT-MSTB 2.5/20-STF 5.08". The user can connect a cable to this terminal directly without a cable ferrule; hence, the recommended cables are AWG12–AWG24 and their stripping lengths are 10mm. Use "AI2.5-10BU" for AWG14 (cross section 2mm^2) or "AI1.5-10BK" for AWG16 (cross section 1.25mm^2) in the PHOENIX CONTACT ® when a cable ferrule is required.

4.6.4 Settings

(i) Setting table at IO#1

Setting of AIO_SLOT1 (Function ID: 203E01)

Setting item	Range	Units	Contents	Default setting value	Notes
AO1_CH1_TYPE	20mA / 10V	-	Range selection at Channel 1	20mA	
AO1_CH2_TYPE	20mA / 10V	-	Range selection at Channel 2	20mA	
AO1_CH3_TYPE	20mA / 10V	-	Range selection at Channel 3	20mA	
AO1_CH4_TYPE	20mA / 10V	-	Range selection at Channel 4	20mA	

(ii) Setting table at IO#2

Setting of AIO_SLOT2 (Function ID: 203E01)

Setting item	Range	Units	Contents	Default setting value	Notes
AO2_CH1_TYPE	20mA / 10V	-	Range selection at Channel 1	20mA	
AO2_CH2_TYPE	20mA / 10V	-	Range selection at Channel 2	20mA	
AO2_CH3_TYPE	20mA / 10V	-	Range selection at Channel 3	20mA	
AO2_CH4_TYPE	20mA / 10V	-	Range selection at Channel 4	20mA	

(iii) Setting tables at IO#3 to IO#8

Setting items are the same as the items above. Note that the function IDs are assigned to 203E03 to 203E08.

4.6.5 Signals (Data IDs)

(i) Table (IO_SLOT1) at IO#1 (Function ID: 203E01)

◆ Signal monitoring points

Element ID	Name	Description
2101001001	AI1	AI01 data
2101011001	AI2	AI02 data
2101021001	AI3	AI03 data
2101031001	AI4	AI04 data
2101041001	AI5	AI05 data
2101051001	AI6	AI06 data
2101061001	AI7	AI07 data
2101071001	AI8	AI08 data
2101081001	AI9	AI09 data
2101091001	AI10	AI10 data
3100001210	AI_NUM	valid AI number
310000121A	CONER_CNT	SLOT01 connection error count
2101001212	UPDTCT1	update1 count data
2101011212	UPDTCT2	update2 count data
2101021212	UPDTCT3	update3 count data
2101031212	UPDTCT4	update4 count data
2101041212	UPDTCT5	update5 count data
2101051212	UPDTCT6	update6 count data
2101061212	UPDTCT7	update7 count data
2101071212	UPDTCT8	update8 count data
2101081212	UPDTCT9	update9 count data
2101091212	UPDTCT10	update10 count data

(ii) Tables (IO_SLOT2 to SLOT*n*) at IO#2 to IO#*n* (Function ID: 203E02 to 203E0*n*)

Element IDs are the same as the table above. Note that Function ID is unique.

4.7 Power supply module (PWS)

The power supply module (PWS) consists of a DC/DC converter and line noise filters. The input range rating of the PWS is 110 to 250 V DC.

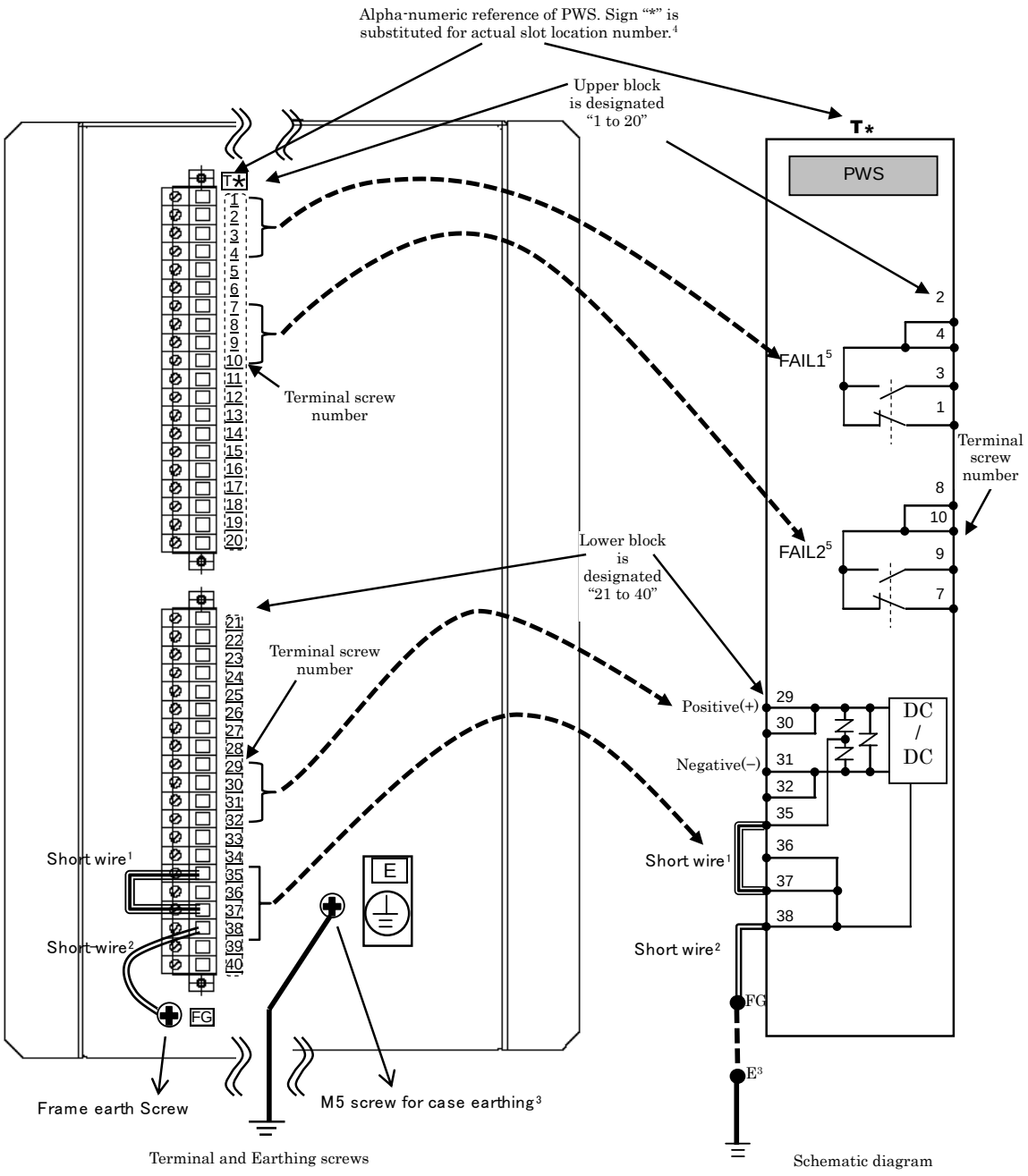


Figure 4.7-1 PWS terminal block (Rear view)

PWS consists of a pair of terminal blocks[4] (which are labeled with alpha-numeric reference "T*"; a number replaces the asterisk "*" to designate the slot numbers.) The left of Figure 4.7-1 shows the PWS terminal blocks, and the schematic figure for PWS is also shown on the right.

Terminal screws No. 1 to 4 (FAIL1) and No. 7 to 10 (FAIL2) are provided to output the

failure results of the automatic supervision function[5]. Terminal screws No. 29(+) and 31(–) are linked to the power supply. Other terminal screws No. 30(+) and 31(–) are also provided for the power terminal and are used when bus distribution is required or when the safety improvement of the cable capacity is required because the power cable is thin. Terminal screw No. 38 and FG, by default, are linked with a short-wire and also terminal screw No. 35 and terminal screw No. 37. The user should connect the IED case to the earth with the earth screw. The other terminal screws are not used.

The actual terminal slot location is also found in external connection figures. (See *Appendix: Typical External connection*)

Table 4.7-1 PWS specifications

Input voltage rating[6]	Voltage fluctuation permissible	Description
DC: 110 to 250V	DC: 88 to 300V	Input voltage (110/125Vdc, 220/250Vdc) is available where the voltage varies in ±20% of the rated voltage (110V× 80% to 250V×120%).

⚠CAUTION

[1]Note: The connection (triplet lines) between terminal screw No. 35 and terminal screw No. 37 is made with a short-wire, which is installed by the manufacturer. Read *Appendix: Notes for the dielectric voltage test* carefully and follow the instructions during testing.

[2]Note: The connection (double lines) between terminal screw 38 and screw labeled "FG" is made with a short-wire by the manufacturer.

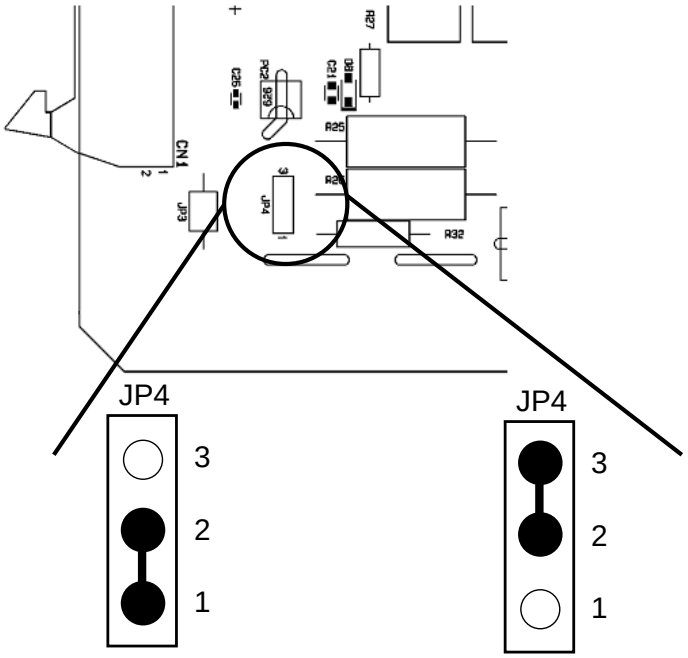
[3]Note: For installation, the user should connect the case earth screw labeled "E" to the protective earth of the panel or others using earthing wire, such that its cross-section is AWG9 or larger.

[4]Note:The user can connect a cable to this terminal directly without a cable ferrule; hence, the recommended cables are AWG14 and their stripping lengths are 10mm. Use "AI 2.5 -10 BU" ferrule for AWG14 when the user wishes to use a cable ferrule made by PHOENIX CONTACT®.

[5]Note: The PWS module monitors DC voltages. The supervision function can issue a power failure when the DC voltage is less than 85V (default threshold; for more information about the failure, see *Chapter Automatic supervision function*). The user can change the 85V threshold to 170V by inserting a shunt connecter (1-2) at JP4 on the PWS module (see Figure 4.7-2).

[6]Note: IED (PWS module) can run on AC power supply (100–220Vac), but the operation is not guaranteed. Power failure (error) is issued when the supervision function is not

disabled, if the IED runs on AC power supply for testing etc.



Setting to 170V (typical)
(Position '1-2')

Setting to 85V (typical)
(Default position '2-3')

Figure 4.7-2 Alarm threshold for DC voltage dropping on the PWS module

4.8 Human Machine Interface (HMI)

4.8.1 Outlook

Figure 4.8-1 shows the outlook of human machine interface module (HMI) on the front panel. The HMI has a screen (standard LCD or large LCD 'MIMIC'), LED indicators (#1– #26), operation keys, function keys (F1–F7), monitoring jacks (Term A/B/C) and a USB receptacle. The LCD can display information; e.g. IED operation menu, status, setting data, monitoring, fault records and others. We shall see the menus on the display in Chapter *User interface* later. A USB receptacle in B-type is provided for the connection to the PC. Thus, the user can connect the engineering tools (GR-TIEMS®) or the PLC editor (MULTIPLOG®) with the IED using the USB receptacle.

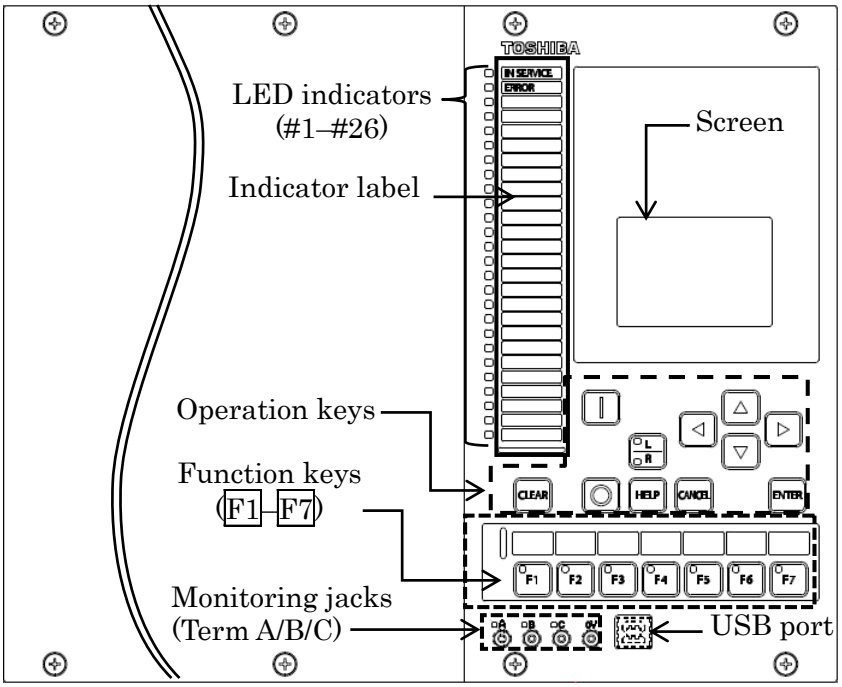


Figure 4.8-1 HMI on front panel

4.8.2 LED Indicators

The LED indicators #1 and #2 are used to indicate the IED statuses. The others (#3 to #26) are provided to indicate statuses, which the user wishes to check; the settings or by the PLC function can control to indicate the statuses. The user can make a new indicator label using the label maker of the GR-TIEMS®. (See *Chapter Engineering tool*)

The LED indicators‡ (#3 to #26) are also provided as user-programmable indicators. Figure 4.8-2 shows the schematic diagrams. Each LED indicator can be lit and controlled using a logic-gate-switch setting and others. For simplicity, we discuss setting the LED indicator #3 only, but the user can take account that setting the other LED indicators (#4 to #26) is the same as the #3. Table 4.8-1 shows the LED indicator settings; Table 4.8-2 shows the signal monitoring points on all LED indicator logics.

‡Note:Setting menus of the LED indicator are also discussed in Chapter *User interface: I/O setting sub-menu*.

(i) Selection of input signals

The LED indicator (#3) is lit by entering signals from other functions; eight ports are provided for the entering signals, designated as *input-signal1* to *input-signal8*. The user should ensure one or more DataIDs are set for the *input-signal1* to *input-signal8*. Entering signals are designated using DataIDs, respectively; the user should set respective DataIDs for the settings [**Input signal1**] to [**Input signal8**].

(ii) Logic gate switch

In the LED indicator logic #3 a logic scheme is provide for the eight entering signals; the entering signals are grouped by the selection using scheme switch [**LOGIC-SW**] for which the user should set either **AND**, **OR** or **XOR**.

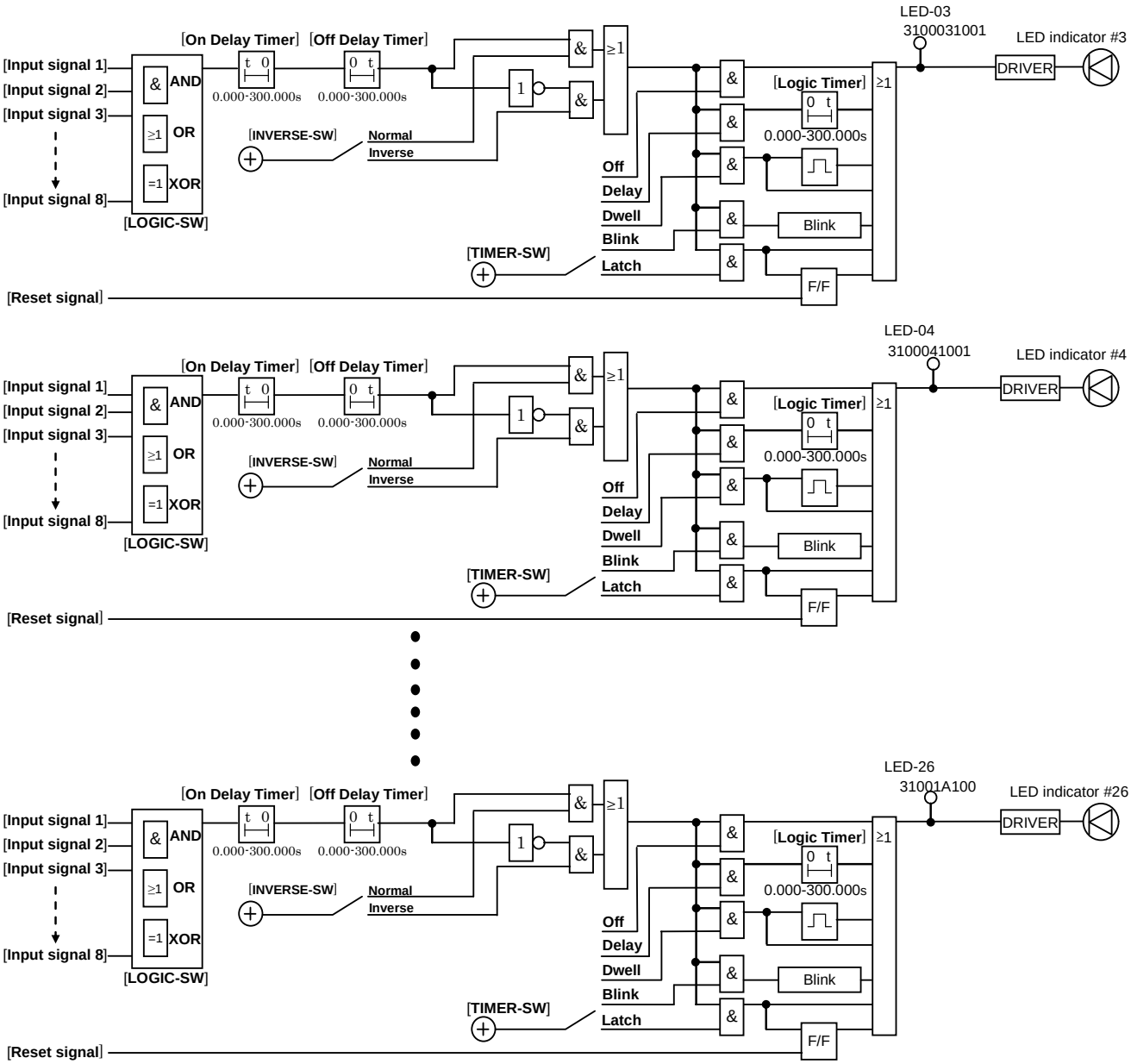


Figure 4.8-2 LED indicator logics (#3 to #26)

(iii) Delayed pick-up/delayed drop-off signal

For the LED indicator logic #3 the user can use an on-delay timer and an off-delay timer; both are used to adjust the timing for lighting the LED indicator #3. The user should set their respective time values for settings [**On Delay Timer**] and [**Off Delay Timer**].

(iv) Logic level inversion

On the LED indicator logic #3 the entering signal is inverted by the logic inversion function; inverting an entering signal is carried out when the user sets **Inverse** for the scheme switch [**INVERSE-SW**]. Set **Normal** for the scheme switch when logic inversion is not required.

(v) Logic timer switch

The LED indicator #3 can have programmable reset characteristics using scheme switch [**TIMER-SW**]. Four types are available: (1) dwell type, (2) delay type, (3) latch type, and (4) instantaneous type:

(v)-1 Instant type

When required not to have the below characteristics (v)-2, (v)-3, and (v)-4, the user should set **Off** for the scheme switch [**TIMER-SW**].

(v)-2 Delay type

If the user requires lighting the LED indicator with a delayed characteristic, the user should set **Delay** for scheme switch [**TIMER-SW**] and set the value of the pulse width using setting [**Logic timer**].

(v)-3 Dwell type

For instance, if the user requires lighting the LED indicator as a one shot pulse, the user should set **Dwell** for scheme switch [**TIMER-SW**] and set the value of the pulse width using setting [**Logic timer**]. If the input signals received have a shorter duration than the set value in the setting [**Logic timer**], the pulse width will be equal to the setting value. On the other hand, if the duration of the input signals are longer than that of the set value, the pulse width will be equal to the width of the input signals.

(v)-4 Latch type

If the user requires lighting the LED indicator to be removed by a reset signal, the user should set **Latch** for scheme switch [**TIMER-SW**]; the user should set the Data ID of the reset signal for setting [**Reset signal**]. Since lighting the LED indicator is cleared with the Data ID, the user should determine the Data ID from other functions. The Data ID is designated by the signal monitoring point for each function and the user should set the [**Reset signal**] setting.

(vi) Selection of the LED color

For the LED indicator #3, color selection of either RED/GREEN/YELLOW is possible using the setting [**Color**].

Table 4.8-1 Settings of LED indictors #3 to #26 (Function ID: 201B01))

Setting items		Range	Units	Contents	Default setting value
LED#3	Color	RED / GREEN / YELLOW	-	LED#3 color selection	RED
	Input signal1	(Preferred Data ID)	-	Set a Data ID at the first input on LED3	(No Assigned)
	Input signal2	(Preferred Data ID)	-	Set a Data ID at the second input on LED#3.	(No Assigned)
	Input signal3	(Preferred Data ID)	-	Set a Data ID at the third input on LED#3.	(No Assigned)
	Input signal4	(Preferred Data ID)	-	Set a Data ID at the forth input on LED#3.	(No Assigned)
	Input signal5	(Preferred Data ID)	-	Set a Data ID at the fifth input on LED#3.	(No Assigned)
	Input signal6	(Preferred Data ID)	-	Set a Data ID at the sixth input on LED#3.	(No Assigned)
	Input signal7	(Preferred Data ID)	-	Set a Data ID at the seventh input on LED#3.	(No Assigned)
	Input signal8	(Preferred Data ID)	-	Set a Data ID at the eighth input on LED#3.	(No Assigned)
	LOGIC-SW	AND / OR / XOR	-	Switch for logic-gate operation on LED#3	AND
	On Delay Timer	0.00 – 300.00	s	Set a value for an on-delay-timer on LED#3	0.00
	Off Delay Timer	0.00 – 300.00	s	Set a value for an off-delay-timer on LED#3	0.00
	INVERSE-SW	Normal / Inverse	-	Inversion operation of LED#3 signal	Normal
	TIMER-SW	Off/Delay/Dwell/Latch/Blink	-	Selection of a type in the delay timer on LED#3	Off
	Logic Timer	0.00 – 300.00	s	Off delay timer value for "Delay" and "Dwell" circuit	0.00
	Reset signal	(Preferred Data ID)	-	Setting Data ID for "Latch" circuit	(No Assigned)
LED#4	Color	RED / GREEN / YELLOW	-	LED#4 color selection	RED
	Input signal1	(Preferred Data ID)	-	Set a Data ID at the first input on LED#4	(No Assigned)
	Input signal2	(Preferred Data ID)	-	Set a Data ID at the second input on LED#4.	(No Assigned)
	Input signal3	(Preferred Data ID)	-	Set a Data ID at the third input on LED#4.	(No Assigned)
	Input signal4	(Preferred Data ID)	-	Set a Data ID at the forth input on LED#4.	(No Assigned)
	Input signal5	(Preferred Data ID)	-	Set a Data ID at the fifth input on LED#4.	(No Assigned)
	Input signal6	(Preferred Data ID)	-	Set a Data ID at the sixth input on LED#4.	(No Assigned)
	Input signal7	(Preferred Data ID)	-	Set a Data ID at the seventh input on LED#4.	(No Assigned)
	Input signal8	(Preferred Data ID)	-	Set a Data ID at the eighth input on LED#4.	(No Assigned)
	LOGIC-SW	AND / OR / XOR	-	Switch for logic-gate operation on LED#4	AND
	On Delay Timer	0.00 – 300.00	s	Set a value for an on-delay-timer on LED#4	0.00
	Off Delay Timer	0.00 – 300.00	s	Set a value for an off-delay-timer on LED#4	0.00
	INVERSE-SW	Normal / Inverse	-	Inversion operation of LED#4 signal	Normal
	TIMER-SW	Off/Delay/Dwell/Latch/Blink	-	Selection of a type in the delay timer on LED#4	Off
	Logic Timer	0.00 – 300.00	s	Off delay timer value for "Delay" and "Dwell" circuit	0.00
	Reset signal	(Preferred Data ID)	-	Setting Data ID for "Latch" circuit	(No Assigned)
•••••••••••					
LED#26	Color	RED / GREEN / YELLOW	-	LED#26 color selection	RED
	Input signal1	(Preferred Data ID)	-	Set a Data ID at the first input on LED#26	(No Assigned)
	Input signal2	(Preferred Data ID)	-	Set a Data ID at the second input on LED#26.	(No Assigned)
	Input signal3	(Preferred Data ID)	-	Set a Data ID at the third input on LED#26.	(No Assigned)
	Input signal4	(Preferred Data ID)	-	Set a Data ID at the forth input on LED#26.	(No Assigned)
	Input signal5	(Preferred Data ID)	-	Set a Data ID at the fifth input on LED#26.	(No Assigned)
	Input signal6	(Preferred Data ID)	-	Set a Data ID at the sixth input on LED#26.	(No Assigned)
	Input signal7	(Preferred Data ID)	-	Set a Data ID at the seventh input on LED#26.	(No Assigned)
	Input signal8	(Preferred Data ID)	-	Set a Data ID at the eighth input on LED#26.	(No Assigned)
	LOGIC-SW	AND / OR / XOR	-	Switch for logic-gate operation on LED#26	AND
	On Delay Timer	0.00 – 300.00	s	Set a value for an on-delay-timer on LED#26	0.00
	Off Delay Timer	0.00 – 300.00	s	Set a value for an off-delay-timer on LED#26	0.00
	INVERSE-SW	Normal / Inverse	-	Inversion operation of LED#26 signal	Normal
	TIMER-SW	Off/Delay/Dwell/Latch/Blink	-	Selection of a type in the delay timer on LED#26	Off
	Logic Timer	0.00 – 300.00	s	Off delay timer value for "Delay" and "Dwell" circuit	0.00
	Reset signal	(Preferred Data ID)	-	Setting Data ID for "Latch" circuit	(No Assigned)

Table 4.8-2 Signal monitoring points on all LED indicator (Function ID: 201B01)

Element ID	Name	Description
3100021001	ERROR	Error LED
3100011001	IN SERV	In service LED
3100031001	LED-03	Output signal of the LED indicator #3
3100041001	LED-04	Output signal of the LED indicator #4
3100051001	LED-05	Output signal of the LED indicator #5
3100061001	LED-06	Output signal of the LED indicator #6
3100071001	LED-07	Output signal of the LED indicator #7
3100081001	LED-08	Output signal of the LED indicator #8
3100091001	LED-09	Output signal of the LED indicator #9
31000A1001	LED-10	Output signal of the LED indicator #10
31000B1001	LED-11	Output signal of the LED indicator #11
31000C1001	LED-12	Output signal of the LED indicator #12
31000D1001	LED-13	Output signal of the LED indicator #13
31000E1001	LED-14	Output signal of the LED indicator #14
31000F1001	LED-15	Output signal of the LED indicator #15
3100101001	LED-16	Output signal of the LED indicator #16
3100111001	LED-17	Output signal of the LED indicator #17
3100121001	LED-18	Output signal of the LED indicator #18
3100131001	LED-19	Output signal of the LED indicator #19
3100141001	LED-20	Output signal of the LED indicator #20
3100151001	LED-21	Output signal of the LED indicator #21
3100161001	LED-22	Output signal of the LED indicator #22
3100171001	LED-23	Output signal of the LED indicator #23
3100181001	LED-24	Output signal of the LED indicator #24
3100191001	LED-25	Output signal of the LED indicator #25
31001A1001	LED-26	Output signal of the LED indicator #26

4.8.3 Function keys with LEDs

The function keys (F1 to F7) are provided to jump to other menus during the LCD operation; the jump destinations are already set as factory default (see Table 4.8-3). However, the user can program the F1 to F7 keys to jump to user-preferred menus using settings. Incidentally, the user can program the function key so that a binary signal is generated when the user presses the function key.

Table 4.8-3 Function keys and jump destinations (default)

Function Key#	Jump destination as default	LED lit when pressing
F1	Metering menu	Yellow
F2	Fault Record menu	Yellow
F3	Event Record1 menu	Yellow
F4	Event Record2 menu	Yellow
F5	Event Record3 menu	Yellow
F6	Diagnostics menu	Yellow
F7	(Not defined)	Yellow

For testing, the user can also program to generate binary signals when the user presses the F1 to F7 keys. The F1 to F7 circuits have LEDs; accordingly, the user can also program to light the LEDs using the settings.

(i) Screen jump pressing the function key

The user can program the F1 to F7 keys as the user-preferred jump keys. For example, when the user wishes to use the F1 key to jump to another screen, set **Screen jump** for scheme switch [**Function**] in the F1 key (see Table 4.8-6). We shall see the setting in Chapter *User interface: Setting sub-menu: Configuration of Function keys.*

(ii) Binary signal generated pressing the function key

When the user wishes to generate a binary signal upon occurrence of pressing the F1 key, set **Assign Signal** for scheme switch [**Function**] in the F1 key. For instance, if the user wishes to send a signal generated pressing F1 to the binary output circuit (BO1‡) at the IO#1 slot, set the Data ID of "FUNC-KEY1(**240001 310001730**)" for the setting [**Input signal 1**] of the BO1‡ circuit. Note that the user should set **On** for the scheme switch [**BO1_CPL**] when the connection is done using the setting [**Input signal 1**]. Figure 4.8-3 shows that a generate signal is outputted at the FUNC-KEY1 SIGNAL. Table 4.8-7 shows the other FUNC-KEY2 to 7 points. We shall see the setting procedure in Chapter *User interface: Setting sub-menu: Signal control function.*

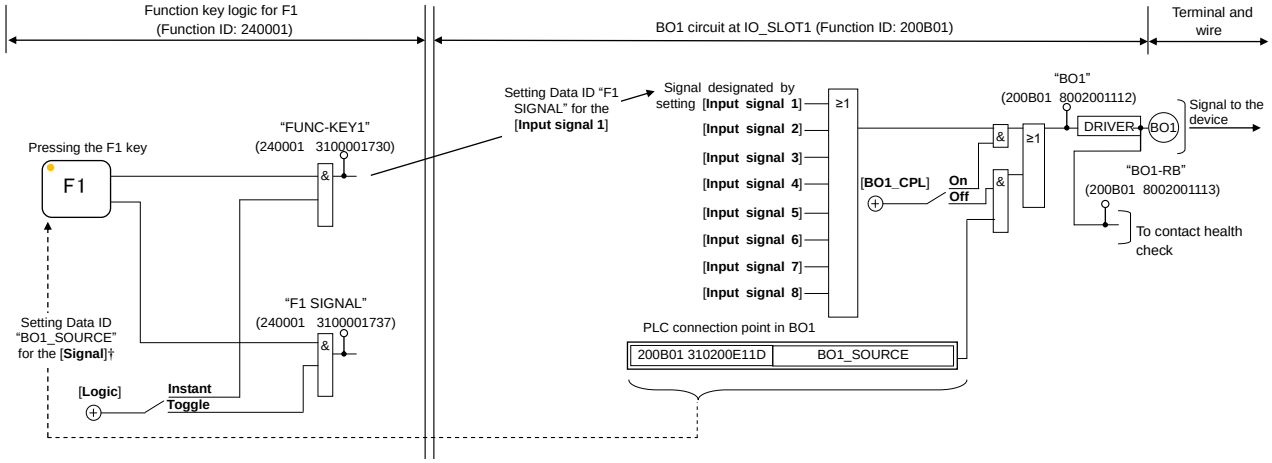


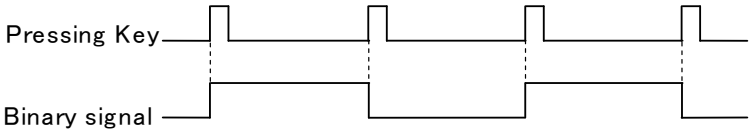
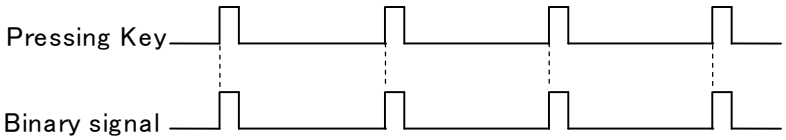
Figure 4.8-3 F1 key connected with the BO1‡

‡Note: The BO1 circuit is used just for an explanation; it is discussed in Chapter *Technical description: Binary IO module*.

†Note: When the user wishes to inject the signal at the PLC connection point of the "BO1-SOURCE (**200B01 31200E11D** at the IO#1 slot)", the user should set the BO1-SOURCE (**200B01 31200E11D**) for the setting [**Signal**] of the F1 key. Then, set **Off** for the scheme switch [**BO1_CPL**]

The user can select either **Toggle** or **Instant** modes for the signal generation using scheme switch [**LOGIC**], as shown in Table 4.8-4. Thus, the user can substitute "F1-SIGNAL (**240001 310001737**)" for the "FUNC-KEY1 SIGNAL (**240001 310001730**)", provided the **Toggle** mode is preferred. In the Table 4.8-7 the other FUNC-KEY2 to FUNC-KEY7 are shown.

Table 4.8-4 Signal mode selection using setting [LOGIC]

Setting	Generated signal corresponding to pressing the function key
Toggle	
Instant	

(iii) Lighting LEDs on F1 to F7

Figure 4.8-4 shows the F1 to F7 LED logics. Programing to light the LEDs (F1 to F7) is the same as the programing of the LED indicators (#3 to #26) (for the programming, see section 4.8.2). As a default, e.g., the "FUNC-KEY1 (**240001 310001730**)" is set for the setting [**Input signal 1**] of the F1 LED logic. The LED-F2 to F7 points are listed in Table 4.8-8.

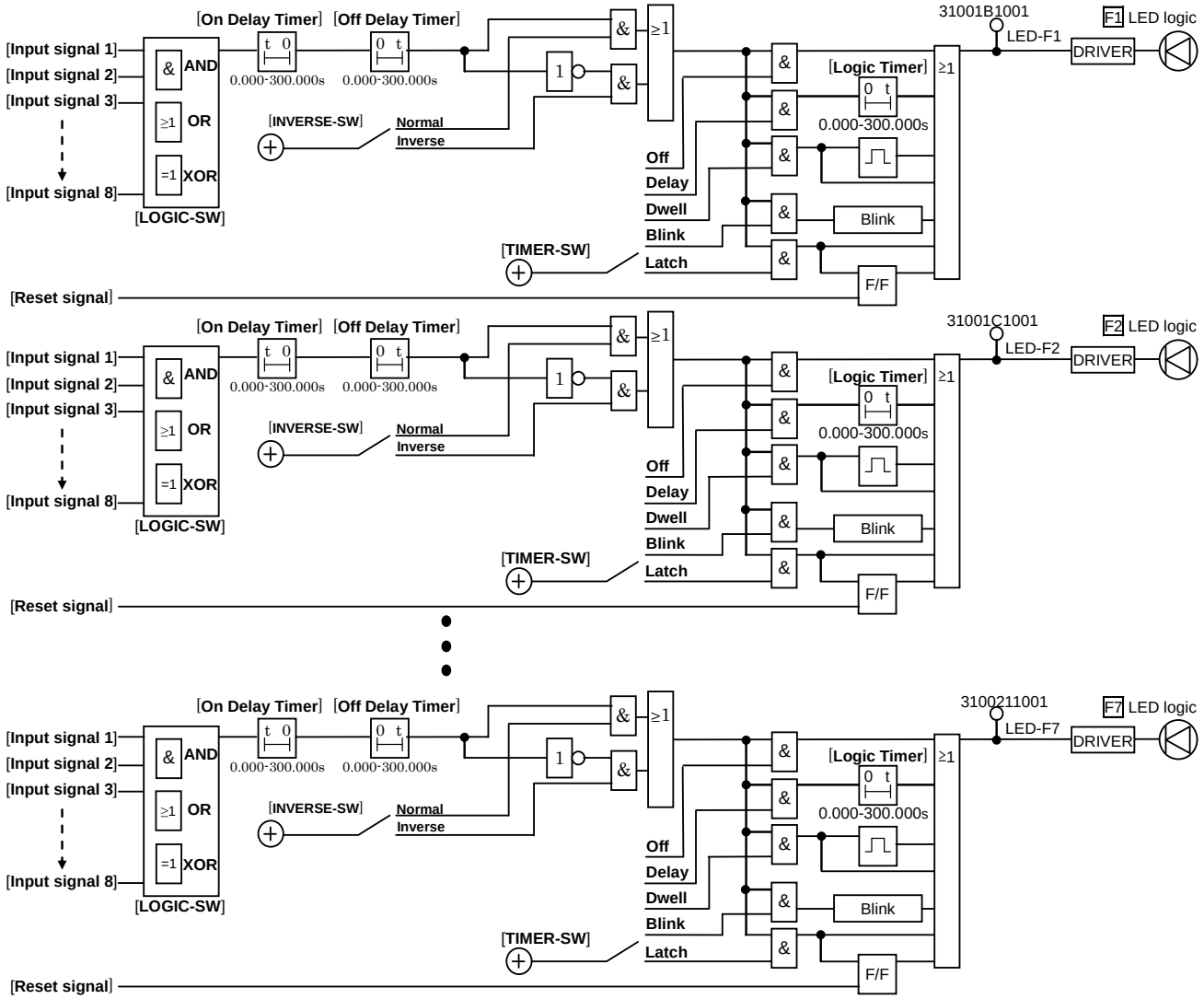


Figure 4.8-4 LED logics on the function keys F1 to F7

Table 4.8-5 Settings of Function keys (Function ID: 240001)

Setting items		Range	Units	Contents	Default setting value
F1	Function	Screen Jump / Assign Signal / No Assign	-	Operation mode for the F1 key	Screen Jump
	Signal	(Preferred Data ID)	-	Set a Data ID at the input on F1 key	(No Assigned)
	Logic	Instant / Toggle	-	Switch for logic-gate operation on F1	Instant
F2	Function	Screen Jump / Assign Signal / No Assign	-	Operation mode for the F2 key	Screen Jump
	Signal	(Preferred Data ID)	-	Set a Data ID at the input on F2 key	(No Assigned)
	Logic	Instant / Toggle	-	Switch for logic-gate operation on F2	Instant
•••••••••••					
F7	Function	Screen Jump / Assign Signal / No Assign	-	Operation mode for the F7 key	Screen Jump
	Signal	(Preferred Data ID)	-	Set a Data ID at the input on F7 key	(No Assigned)
	Logic	Instant / Toggle	-	Switch for logic-gate operation on F7	Instant

Table 4.8-6 Settings of LEDs on the Function keys (Function ID: 240001)

Setting items		Range	Units	Contents	Default setting value
F1	Input signal1	(Preferred Data ID)	-	Set a Data ID at the first input on F1	(No Assigned)
	Input signal2	(Preferred Data ID)	-	Set a Data ID at the second input on F1.	(No Assigned)
	Input signal3	(Preferred Data ID)	-	Set a Data ID at the third input on F1.	(No Assigned)
	Input signal4	(Preferred Data ID)	-	Set a Data ID at the forth input on F1.	(No Assigned)
	Input signal5	(Preferred Data ID)	-	Set a Data ID at the fifth input on F1.	(No Assigned)
	Input signal6	(Preferred Data ID)	-	Set a Data ID at the sixth input on F1.	(No Assigned)
	Input signal7	(Preferred Data ID)	-	Set a Data ID at the seventh input on F1.	(No Assigned)
	Input signal8	(Preferred Data ID)	-	Set a Data ID at the eighth input on F1.	(No Assigned)
	Reset signal	(Preferred Data ID)	-	Setting Data ID for "Latch" circuit	(No Assigned)
	LOGIC-SW	AND / OR / XOR	-	Switch for logic-gate operation on F1	AND
	INVERSE-SW	Normal / Inverse	-	Inversion operation of F1 signal	Normal
	TIMER-SW	Off/Delay/Dwell/Latch/Blink	-	Selection of a type in the delay timer on F1	Off
	On Delay Timer	0.00 – 300.00	s	Set a value for an on-delay-timer on F1	0.00
	Off Delay Timer	0.00 – 300.00	s	Set a value for an off-delay-timer on F1	0.00
	Logic Timer	0.00 – 300.00	s	Off delay timer value for "Delay" and "Dwell" circuit	0.00
F2	Input signal1	(Preferred Data ID)	-	Set a Data ID at the first input on F2	(No Assigned)
	Input signal2	(Preferred Data ID)	-	Set a Data ID at the second input on F2.	(No Assigned)
	Input signal3	(Preferred Data ID)	-	Set a Data ID at the third input on F2.	(No Assigned)
	Input signal4	(Preferred Data ID)	-	Set a Data ID at the forth input on F2.	(No Assigned)
	Input signal5	(Preferred Data ID)	-	Set a Data ID at the fifth input on F2.	(No Assigned)
	Input signal6	(Preferred Data ID)	-	Set a Data ID at the sixth input on F2.	(No Assigned)
	Input signal7	(Preferred Data ID)	-	Set a Data ID at the seventh input on F2.	(No Assigned)
	Input signal8	(Preferred Data ID)	-	Set a Data ID at the eighth input on F2.	(No Assigned)
	Reset signal	(Preferred Data ID)	-	Setting Data ID for "Latch" circuit	(No Assigned)
	LOGIC-SW	AND / OR / XOR	-	Switch for logic-gate operation on F2	AND
	INVERSE-SW	Normal / Inverse	-	Inversion operation of F2 signal	Normal
	TIMER-SW	Off/Delay/Dwell/Latch/Blink	-	Selection of a type in the delay timer on F2	Off
	On Delay Timer	0.00 – 300.00	s	Set a value for an on-delay-timer on F2	0.00
	Off Delay Timer	0.00 – 300.00	s	Set a value for an off-delay-timer on F2	0.00
	Logic Timer	0.00 – 300.00	s	Off delay timer value for "Delay" and "Dwell" circuit	0.00
• • • • • • • • • •					
F7	Input signal1	(Preferred Data ID)	-	Set a Data ID at the first input on F7	(No Assigned)
	Input signal2	(Preferred Data ID)	-	Set a Data ID at the second input on F7.	(No Assigned)
	Input signal3	(Preferred Data ID)	-	Set a Data ID at the third input on F7.	(No Assigned)
	Input signal4	(Preferred Data ID)	-	Set a Data ID at the forth input on F7.	(No Assigned)
	Input signal5	(Preferred Data ID)	-	Set a Data ID at the fifth input on F7.	(No Assigned)
	Input signal6	(Preferred Data ID)	-	Set a Data ID at the sixth input on F7.	(No Assigned)
	Input signal7	(Preferred Data ID)	-	Set a Data ID at the seventh input on F7.	(No Assigned)
	Input signal8	(Preferred Data ID)	-	Set a Data ID at the eighth input on F7.	(No Assigned)
	Reset signal	(Preferred Data ID)	-	Setting Data ID for "Latch" circuit	(No Assigned)
	LOGIC-SW	AND / OR / XOR	-	Switch for logic-gate operation on F7	AND
	INVERSE-SW	Normal / Inverse	-	Inversion operation of F7 signal	Normal
	TIMER-SW	Off/Delay/Dwell/Latch/Blink	-	Selection of a type in the delay timer on F7	Off
	On Delay Timer	0.00 – 300.00	s	Set a value for an on-delay-timer on F7	0.00
	Off Delay Timer	0.00 – 300.00	s	Set a value for an off-delay-timer on F7	0.00
	Logic Timer	0.00 – 300.00	s	Off delay timer value for "Delay" and "Dwell" circuit	0.00

Table 4.8-7 Signal monitoring points for KEYINPUT (Function ID: 240001)

Element ID	Name	Description
3100001737	F1 SIGNAL	Signal generated when pressing F1 referring the setting [**LOGIC**]
3100011737	F2 SIGNAL	Signal generated when pressing F2 referring the setting [**LOGIC**]
3100021737	F3 SIGNAL	Signal generated when pressing F3 referring the setting [**LOGIC**]
3100031737	F4 SIGNAL	Signal generated when pressing F4 referring the setting [**LOGIC**]
3100041737	F5 SIGNAL	Signal generated when pressing F5 referring the setting [**LOGIC**]
3100051737	F6 SIGNAL	Signal generated when pressing F6 referring the setting [**LOGIC**]
3100061737	F7 SIGNAL	Signal generated when pressing F7 referring the setting [**LOGIC**]
3100001730	FUNC-KEY1	Signal generated directly when pressing F1
3100011730	FUNC-KEY2	Signal generated directly when pressing F2
3100021730	FUNC-KEY3	Signal generated directly when pressing F3
3100031730	FUNC-KEY4	Signal generated directly when pressing F4
3100041730	FUNC-KEY5	Signal generated directly when pressing F5
3100051730	FUNC-KEY6	Signal generated directly when pressing F6
3100061730	FUNC-KEY7	Signal generated directly when pressing F7

Table 4.8-8 Signal monitoring points for function LEDs (Function ID: 201B01)

Element ID	Name	Description
31001B1001	LED-F1	Signal generated during pressing the F1 key
31001C1001	LED-F2	Signal generated during pressing the F2 key
31001D1001	LED-F3	Signal generated during pressing the F3 key
31001E1001	LED-F4	Signal generated during pressing the F4 key
31001F1001	LED-F5	Signal generated during pressing the F5 key
3100201001	LED-F6	Signal generated during pressing the F6 key
3100211001	LED-F7	Signal generated during pressing the F7 key

4.8.4 Monitoring jacks

A monitoring jack including a LED is provided so that the user can monitor a binary signal on the logic straightforwardly. For example, when the user wishes to monitor the operating state of a relay function, set the signal number (Data ID) that the user wishes to monitor; then the user can see lighting the LED when the relay is operated. Using with an oscilloscope, the user can also observe the binary signal that comes from the monitoring jack; three monitoring jacks (Term A, B, and C) are available on the front panel.

Table 4.8-9 Output terminals for signal monitoring (No default setting)

Jack	Jack name	LED Color	Remarks
A	Term A	Yellow	Set user's preferred signal number
B	Term B	Yellow	Set user's preferred signal number
C	Term C	Yellow	Set user's preferred signal number

When the user wishes to test the phase-A element the OC1 relay using an oscilloscope, for example, set the phase-A monitoring point (**44001 8000011C20**†) for the setting [**Term A**], as shown in Figure 4.8-5. Consequently, the OC1 operating signal is outputted to the jack at the Term A. The LED at the Term A is also lit in step with the output signal. The user can use to monitor the phase-B and phase-C signals using by settings respective Data IDs for the [**Term B**] and [**Term C**]. We shall see the menus for the Term A to Term C in Chapter *User interface: Test sub-menu: Signal monitoring screen.*

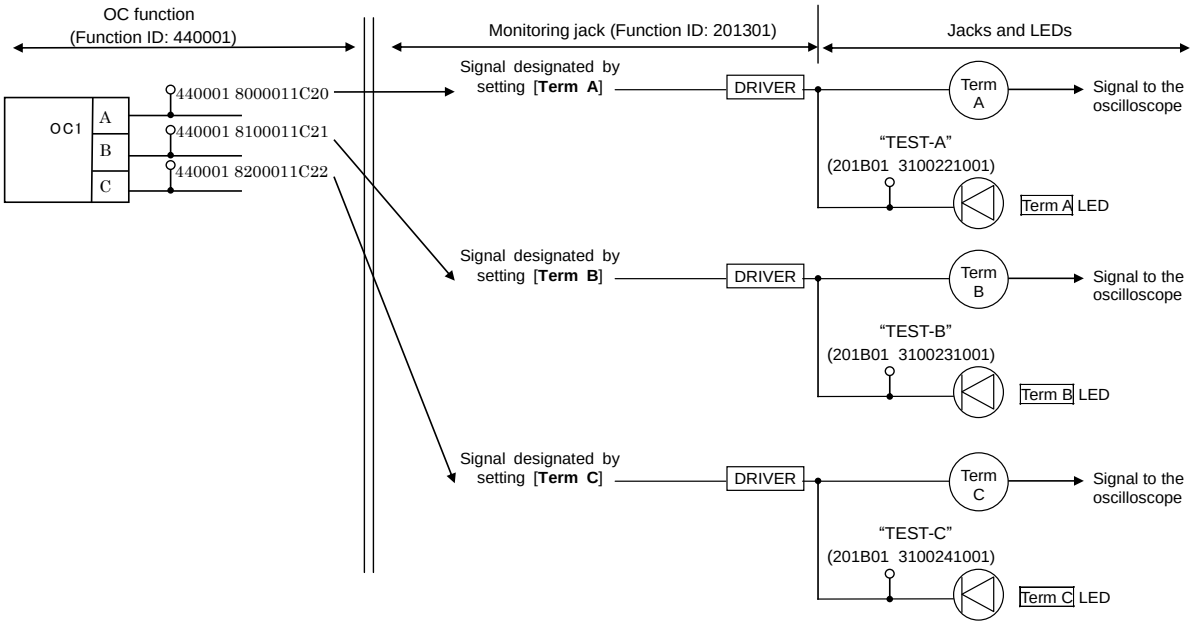


Figure 4.8-5 Monitoring logics A, B and C

†Note: The monitoring point is just selected for the explanation; the user can select a monitoring point from the relay applications and the control and monitoring applications. The monitoring points is listed as PLC monitoring points in each function.

Table 4.8-10 Settings of Monitoring jacks (Function ID: 201301)

Setting items		Range	Units	Contents	Default setting value
	Term A	(Preferred Data ID)	-	Select a signal for Term A	(No Assigned)
	Term B	(Preferred Data ID)	-	Select a signal for Term B	(No Assigned)
	Term C	(Preferred Data ID)	-	Select a signal for Term C	(No Assigned)

Table 4.8-11 Signal monitoring points for monitoring jack LEDs (Function ID: 201B01)

Element ID	Name	Description
3100221001	TEST-A	TEST-A
3100231001	TEST-B	TEST-B
3100241001	TEST-C	TEST-C

4.8.5 Operation keys

(i) L/R key

The IED has two LEDs on the L/R key; either LEDs is lit in response to a local mode or a remote mode. Lighting the LED is instructed by the LOCRMT function. Table 4.8-12 shows the signal monitoring points on the L/R LEDs.

Table 4.8-12 Signal monitoring points for L/R LEDs (Function ID: 201B01)

Element ID	Name	Description
3100251001	LOC LED	Local
3100261001	REM LED	Remote

(ii) Operation keys except L/R key

Like in the function keys (F1 to F7), the operation keys can provide signals when pressing the keys; the user can monitor the signals at the signal monitoring points in Table 4.8-13.

Table 4.8-13 Signal monitoring points for KEYINPUT (Function ID: 240001)

Element ID	Name	Description
3100081730	CANCEL	Key situation of CANCEL
31000E1730	CLEAR	Key situation of CLEAR
31000D1730	CLOSE	Key situation of CLOSE
31000F1730	DOWN	Key situation of DOWN
3100071730	ENTER	Key situation of ENTER
3100091730	HELP	Key situation of HELP
3100111730	LEFT	Key situation of LEFT
31000A1730	LOC/REM	Key situation of LOC/REM
31000C1730	OPEN	Key situation of OPEN
3100121730	RIGHT	Key situation of RIGHT
3100101730	UP	Key situation of UP

4.9 Clock function

Clock function (or time function) provides the time information for recording upon occurrence of the fault; it includes a synchronization function when the reference clock is available out of the IED. The clock is operated referring the Coordinated Universal Time (UTC‡) when the UTC is selected; the clock can run in accordance with the user's time zone and summer time(DST)† by referring the UTC when the time zone and the DST are set. The explanation is also found in Chapter *User interface: Time sub-menu*.

†Note: In other words, it is called "daylight saving time (DST)". For setting, see section 4.9.5.

‡Note: For example, the Internet and World Wide Web standards run in the UTC. For more information, see section 4.9.4.

4.9.1 Clock setting

The user can set the time using the time sub-menu as shown in Figure 4.9-1. The user also can set the time using the GR-TIEMS†.

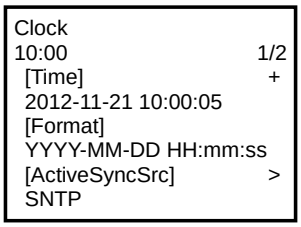


Figure 4.9-1 Time sub-menu in Clock menu

†Note: Make the calibration the when the clock is set using the GR-TIMES. This is because the transmission time is required from the PC to the IED.

4.9.2 Selection of date and time formats

The user can select user-preferred date/time format; setting [**Data_fmt**] is provided for the selection of the format. For example, 'March 24th 2014 10:48' can be displayed when the format "DDMMYYYY" is selected.

- "2014-03-24 10:48" is displayed upon the selection of "YYYYMMDD".
- "03-24-2014 10:48" is displayed upon the selection of "MMDDYYYY".
- "24-03-2014 10:48" is displayed upon the selection of "DDMMYYYY".

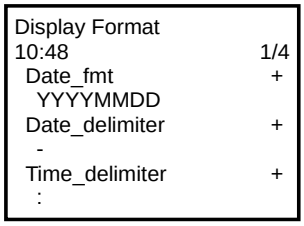


Figure 4.9-2 Setting screen of Display format

4.9.3 Time Synchronization

The synchronization function can run when a synchronized signal is provided for respective IEDs; the user should select one of the following synchronization methods using the setting [**Time Sync Src**]:

- **SNTP** method
- **IRIG-B** method
- Binary Input (**BI**) method

(i) Synchronization using SNTP

(i)-1 Example of SNTP synchronization

The SNTP method is possible when IEDs connect with time-servers. Figure 4.9-3 exemplifies two servers are connected with the IEDs using the LAN.

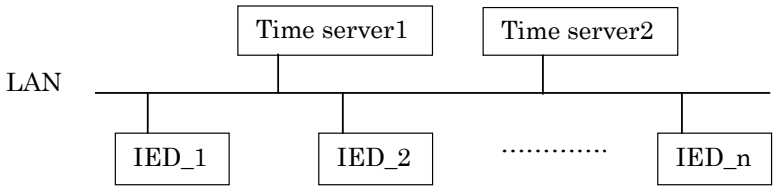


Figure 4.9-3 Two time servers connected on the LAN

(i)-2 Setting procedure

The user should make the following steps in respective IEDs.

1) Set **SNTP** for the setting [**Time Sync Src**]; then set **On** for the setting [**SNTP**].
2) Set the address of a time server using settings [**Server1**]. The settings [**Server2**], [**Server3**], and [**Server4**] are provided for other time-servers.
3) Check that the **SNTP** is shown under the ActivSyncSrc, as shown in Figure 4.9-4.
4) Check to see that the time zone and the DST are set correctly (see 4.9.4 and 4.9.5).

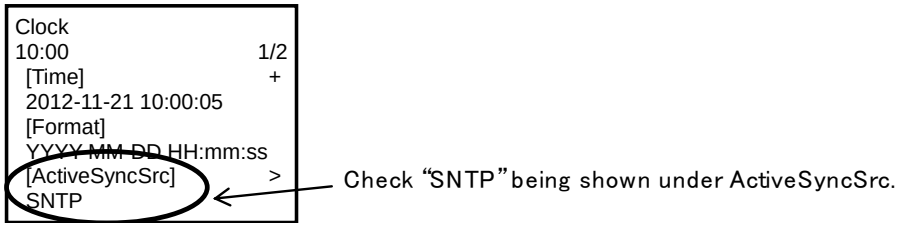


Figure 4.9-4 Time setting for SNTP

Table 4.9-1 Settings for the SNTP synchronization

Setting item	Range	Contents	Setting example	Notes
TimeSyncSrc	SNTP / BI / IRIG-B	Selection of sync method	SNTP	
SNTP	Off /On	Operation of SNTP	0On	
Server1	000.000.000.000–255.255.255.255	Setting for Time server 1	197.1.23.11	
Server2	000.000.000.000–255.255.255.255	Setting for Time server 2	000.000.000.000	
Server3	000.000.000.000–255.255.255.255	Setting for Time server 3	000.000.000.000	
Server4	000.000.000.000–255.255.255.255	Setting for Time server 4	000.000.000.000	

(ii) Synchronization using IRIG-B

(ii)-1 Example of IRIG-B synchronization

The IRIG-B method is possible when a synchronization signal in the IRIG-B format is provided. The synchronization signal is transferred using the IRIG-B000 module†.

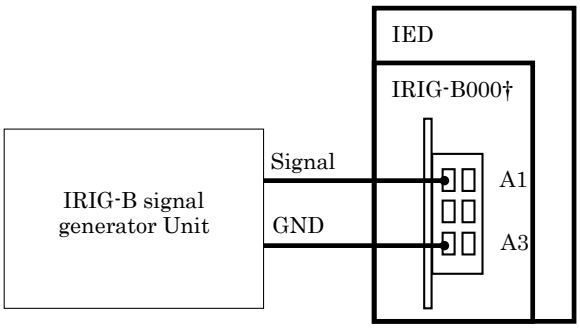


Figure 4.9-5 IED connected with the signal generator unit using IRIG-B000 module

†Note:See Chapter *Technical description: Signal processing and communication module*.

(ii)-2 Setting procedure

The user should make the following steps in respective IEDs.

1) Set **IRIG-B** for the setting [**Time Sync Src**]; then set **On** for the setting [**IRIG-SYNC**].

2) Check that the **IRIG-B** is shown under the ActivSyncSrc, as shown in Figure 4.9-6.

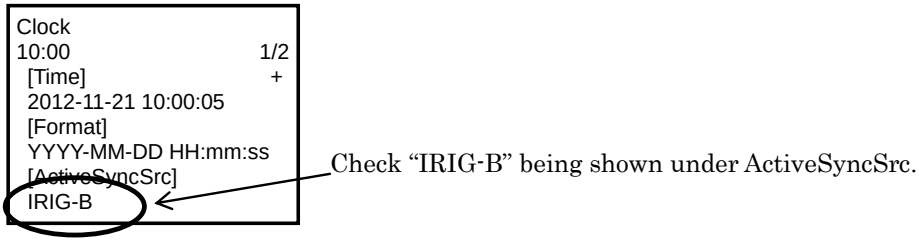


Figure 4.9-6 Time setting for IRIG-B

(ii)-3 Setting year in IRIG-B

When the IRIG-B data is generated in the IEEE C37.118 / IRIG-B000 format, the user should set **On** for setting [**USE_BCDYEAR**]. Conversely, when the IRIG-B data with absence the C37.118† is generated, **Off** should be set for the setting [**USE_BCDYEAR**].

†Note: "Year" is informed from the IED clock itself when the C37.118 is absent.

(ii)-4 Setting UTC/local time

When the IRIG-B data is generated in the UTC†, set **Off** for the setting [**USE_LOCALTIME**]. Conversely, when the IRIG-B data is generated in the local time‡, set **On** for setting [**USE_LOCALTIME**]; set **Off** for the setting [**IS_UTC_base**].

†Note:We shall see the settings of the UTS in section 4.9.4.

‡Note:In the IRIG-B signal generator unit, the DST settings should be corresponded to the DST settings of the IED. We shall see the DST settings in section 4.9.5.

Table 4.9-2 Settings for the IRIG-B Time synchronization

Setting item	Range	Contents	Setting example	Notes
TimeSyncSrc	SNTP / BI / IRIG-B	Selection of sync method	IRIG-B	
IRIG-SYNC	Off /On	Operation of IRIG-B	On	
USE_BCDYEAR	Off / On	Selection of IEEE C37.118/IRIG-B000	Off	
USE_LOCALTIME	Off / On	Operation in the local time	Off	

(iii) Synchronization using BI signal

When accurate1Hz square-wave can be supplied as a reference clock, the clock function can make the time synchronization. The 1Hz square-wave is transferred using a binary input circuit (BI).

(iii)-1 Example of time synchronization via BI circuit

Figure 4.9-7 exemplifies that the 1Hz square-wave is provided via the BI1 circuit†.

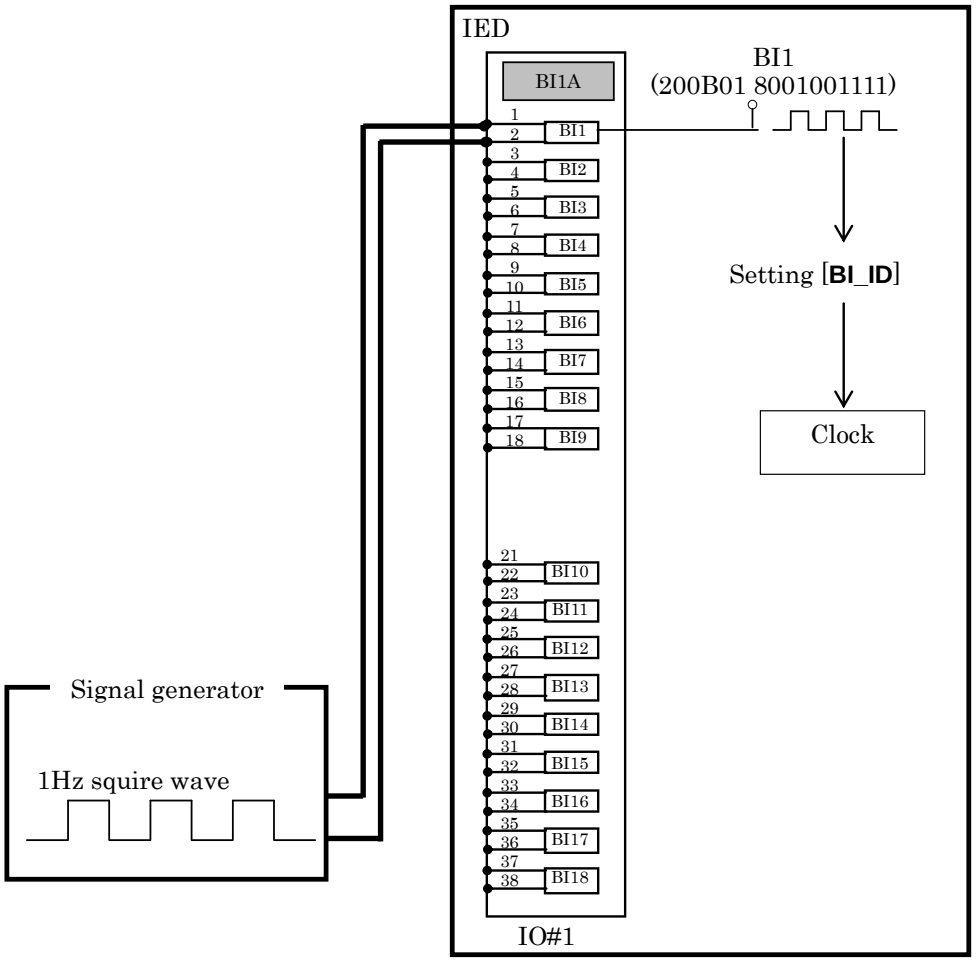


Figure 4.9-7 IED connected with the signal generator via BI module

†Note:The BI1 circuit is just used for the explanation; hence, an actual BI circuit should be selected in accordance with wiring cables. For more information of the BI circuit, see Chapter *Technical description: Binary IO module*.

(iii)-2 Setting procedure

The user should make the following steps in respective IEDs.

1) Set **BI** for the setting [**Time Sync Src**]; then set **On** for the setting [**BI-SYNC**].

2) Check **BI** is shown under the ActivSyncSrc, as shown in Figure 4.9-8.

3) Set a Data ID for setting [**BI_ID**]. For example, as shown in the Figure 4.9-7, when the user wishes to inject the signal at the BI1 on the IO#1 slot, the user should set BI1(200B01 8001001111) for the setting [**BI_ID**].

4) Set a time adjuster for the setting [**SYNC ADJ**]. For example, set a value (e.g., −0.050s) for setting [**SYNC ADJ**]. The setting is used when the clock function should be synchronized before reaching the 1Hz square-wave due to the propagation or the operating time on the BI circuit.

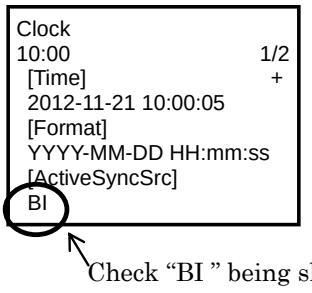


Figure 4.9-8 Time setting for BI

Table 4.9-3 Setting items for the BI Time synchronization

Setting item	Range	Contents	Setting example	Notes
TimeSyncSrc	SNTP / BI / IRIG-B	Selection of sync method	BI	
BI-SYNC	Off /On	Operation of BI	On	
BI_ID	[Preferred ID]	Signal monitoring point	200B01 8001001111	
SYNC ADJ	−0.050 to +0.050	Time adjust factor (in sec.)	0.000	− : Leading the clock + : Delaying the clock

4.9.4 Setting time zone

When the clock should run in the UTC, the user should set **On** for the setting [**IS_UTC_base**]. Additionally, the user should set the time zone† when the time should be displayed in the Local standard time. The time zone is divided in every 15 minutes; the user can set it using 0.25 units (i.e., 15 min = 0.25 unit). For example, if the IED is used in Venezuela (UTC-04:30), the user should set "−4.50" for the setting, as shown Figure 4.9-9.

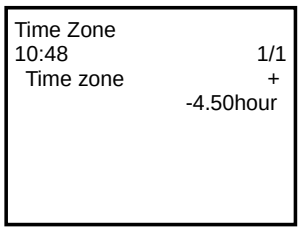


Figure 4.9-9 Setting screen of Time zone

Table 4.9-4 Example time offsets and locations

Time offset†	Example locations
UTC−10:00	United States (Hawaii)
UTC−09:00	United States (Anchorage)
UTC−08:00	United States (PST)
UTC−06:00	Canada , Costa Rica, El Salvador, Ecuador, Mexico, United States (CST)
UTC−05:00	Brazil (Acre), Colombia, Cuba, Jamaica, Panama, Peru, United States (EST)
UTC−04:30	Venezuela
UTC−04:00	Bolivia, Brazil, Dominican Republic, Puerto Rico, Barbados
UTC−03:00	Argentina, Brazil (Bahia, Pernambuco), Chile
UTC−02:00	Brazil (Fernando de Noronha)
UTC±00:00	United kingdom, Iceland, Ireland, Senegal, Saint Helena, Mali
UTC+01:00	Germany, Hungary, Italy, France, Montenegro
UTC+02:00	Egypt, Estonia, Finland, Slovenia, Greece
UTC+03:00	Ethiopia, Iraq, Kenya, Madagascar, Russia, Saudi Arabia, Turkey
UTC+04:00	Armenia, Azerbaijan, Oman, Seychelles, United Arab Emirates
UTC+05:00	Pakistan
UTC+05:30	India, Sri Lanka
UTC+06:00	Bangladesh, Bhutan, Kazakhstan
UTC+06:30	Myanmar
UTC+07:00	Western Indonesia, Thailand, Vietnam, Cambodia, Laos
UTC+08:00	China, Malaysia, Philippines, Australia (Western Australia), Mongolia
UTC+09:00	Japan, South Korea
UTC+10:00	Australia (Queensland)
UTC+12:00	New Zealand

†Note:Time zone is expressed in the difference between UTC and the local standard time (wintertime).

Table 4.9-5 Setting time zone

Setting item	Range	Contents	Setting example	Notes
IS_UTC_base	On / Off	Selection of either the UTC or the local time	On	

4.9.5 DST setting (Summer time setting)

When the summer time (DST) is applied, the user should set the beginning and the ending dates of the DST in the clock function. The user should set **On** for the setting [**Summer time**] for DST.

Note: The clock function is not designed for particular DSTs such as they are depending on the religious events and the astronomy.

(i) DST set by the day (Mon to Sun) of week

For example, when the DST starts at 01:00 a.m. on Sunday of the fifth week in March and it ends at 2:00 a.m. on Sunday of the fourth week in October, the user has the following settings. Note that transposing the calendar is required, as shown in Figure 4.9-10; accordingly the first of the month is located at the first row and the first column of the transposed calendar.

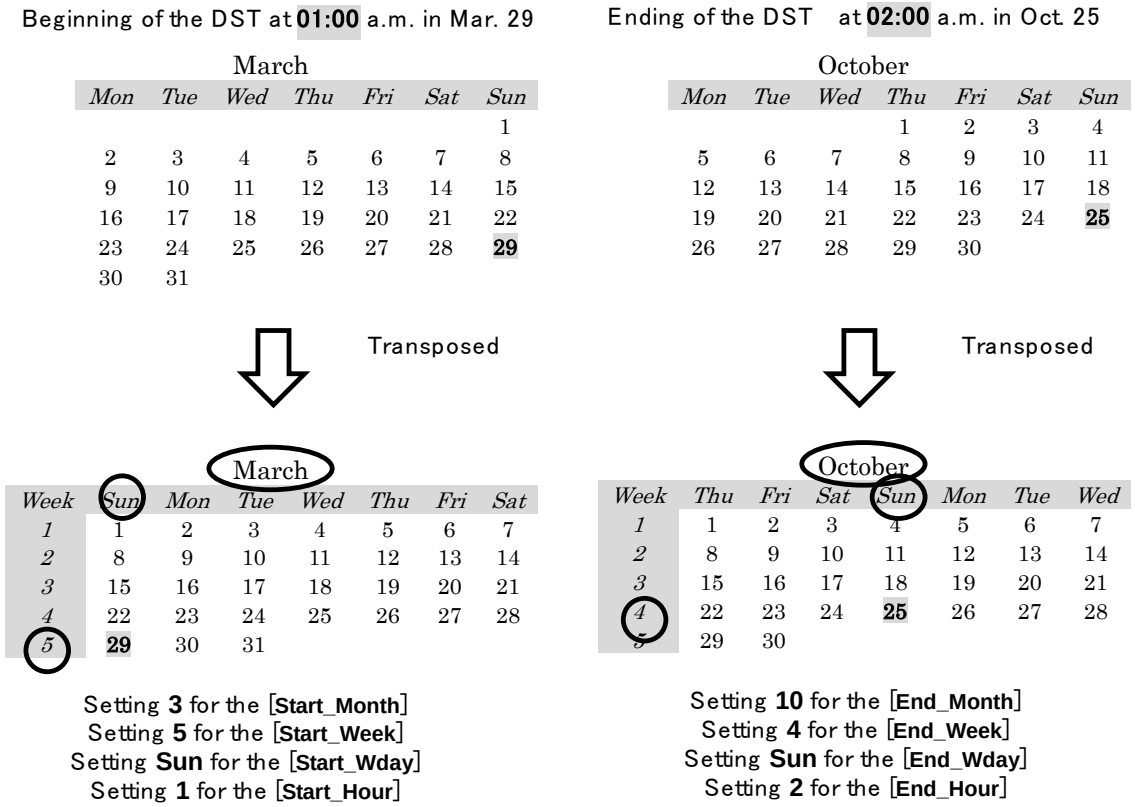


Figure 4.9-10 DST setting examples by the day of week

(ii) DST set by the day (1st or 15th) of month

For example, when the DST starts at 01:00 p.m. on the first day in March and it ends at 3:00 p.m. on the middle day in October; the user has the following settings.

March

Week	Sun	Mon	Tue	Wed	Thu	Fri	Sat
1	1	2	3	4	5	6	7
2	8	9	10	11	12	13	14
3	15	16	17	18	19	20	21
4	22	23	24	25	26	27	28
5	29	30	31				

Beginning of the DST
at **01:00** p.m. in Mar. 1

Setting **3** for the [**Start_Month**]
Setting **1** for the [**Start_Week**]
Setting **–** for the [**Start_Wday**]
Setting **13** for the [**Start_Hour**]

October

Week	Thu	Fri	Sat	Sun	Mon	Tue	Wed
1	1	2	3	4	5	6	7
2	8	9	10	11	12	13	14
3	15	16	17	18	19	20	21
4	22	23	24	25	26	27	28
5	29	30					

Ending of the DST
at **03:00** p.m. in Oct. 15

Setting **10** for the [**End_Month**]
Setting **3** for the [**End_Week**]
Setting **–** for the [**End_Wday**]
Setting **15** for the [**End_Hour**]

Figure 4.9-11 DST setting examples by the day (1st or 15th) of month

(iii) Time shift

After setting the DST, the clock is forwarded by 1 hour at the DST start; the clock is backed by 1 hour at the DST end.

Table 4.9-6 DST settings

Setting item	Range	Contents	Setting example	Notes
Summer time	On / Off	Enabling DST operation	On	
Start_Month	1 to 12	Set the beginning of DST in the month	3	
Start_Week	1 to 5	Set the beginning of DST in the week	5	
Start_Wday	–, Sun, Mon, Tue, Wed, Thu, Fri, Sat	Set the beginning of DST in the day	Sun	
Start_Hour	0 to 23	Set the beginning of DST in 24 hour-clock	1	
End_Month	1 to 12	Set the end of DST in the month	10	
End_Week	1 to 5	Set the end of DST in the week	5	
End_Wday	–, Sun, Mon, Tue, Wed, Thu, Fri, Sat	Set the end of DST in the day	Sun	
End_Hour	0 to 23	Set the beginning of DST in 24 hour-clock	2	

4.9.6 Setting

Setting of CLOCK (Function ID: 200301)

Setting item		Range	Units	Contents	Default setting value	Notes
	Timezone	-14.00 - 14.00	hour	Time zone	0.00	
	TimeSyncSrc	--- / SNTP / BI / MODBUS / IRIG-B	-	Time sync source	SNTP	
	Date_fmt	YYYYMMDD / MMDDYYYY / DDMMYYYY	-	YMD/MDY/DMY	YYYYMMDD	
	Date_delimiter	- / / / .	-	- or / or .	-	
	Time_delimiter	: / .	-	: or period	:	
	Sec_delimiter	. / ,	-	. or ,	.	
	SummerTime	Off / On	-	Summer time enable	Off	
	IS_UTC_base	Off / On	-	Is setting value base on UTC?	On	
	Start_Month	1 - 12	-	Start month	3	
	Start_Week	1 - 5	-	Start week	5	
	Start_Wday	--- / Sun. / Mon. / Tue. / Wed. / Thr. / Fri. / Sat.	-	Start day of week	Sun.	
	Start_Hour	0 - 23	-	Start hour	1	
	End_Month	1 - 12	-	End month	10	
	End_Week	1 - 5	-	End week	5	
	End_Wday	--- / Sun. / Mon. / Tue. / Wed. / Thr. / Fri. / Sat.	-	End day of week	Sun.	
	End_Hour	0 - 23	-	End hour	1	

Setting of SNTP_SYNC (Function ID: 200A01)

Setting item		Range	Units	Contents	Default setting value	Notes
	SNTP	Off / On	-	Enabling SNTP synchronization	On	
	Server1	0 - 255	-	IP address#1	0. 0. 0. 0	
	Server2	0 - 255	-	IP address#2	0. 0. 0. 0	
	Server3	0 - 255	-	IP address#3	0. 0. 0. 0	
	Server4	0 - 255	-	IP address#4	0. 0. 0. 0	

Setting of BI_SYNC (Function ID: 202001)

Setting item		Range	Units	Contents	Default setting value	Notes
	BI SYNC	Off / On	-	BI sync switch	Off	
	BI_ID	[Preferred ID]	-	Source BI Data ID		
	SYNC ADJ	-0.050 to 0.050	s	Time adjust factor	0.000	

Setting of IRIG_SYNC (Function ID: 202101)

Setting item		Range	Units	Contents	Default setting value	Notes
	IRIG SYNC	Off / On	-	IRIGB sync switch	Off	
	USE_BCDYEAR	Off / On	-	Use BCD year code	Off	
	USE_LOCALTIME	Off / On	-	Use local time	Off	

4.10 Group setting for protection functions

With regard to protection functions (i.e., OC, EF, and others), eight groups are available for settings, as shown in Figure 4.10-1; different values for the relays can be set as per circumstances such as operation conditions and others. Note that changing the group cannot be not carried out instantly.

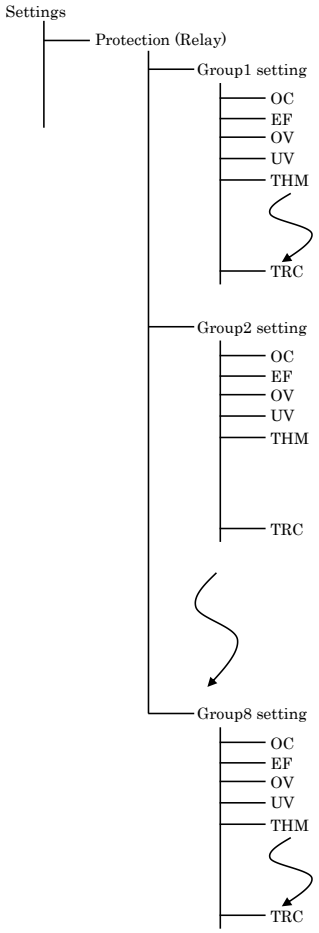


Figure 4.10-1 Eight groups for protection settings

(i) Changing group number by menu operation

The user can change the group number using the menu† on the IED screen. See the Chapter *User interface: Setting sub-menu.*

(ii) Changing group number by user-programming

Another changing method is provided by programing PLC logics (For more information about PLC programing, see the Chapter *PLC function.*) Figure 4.10-2 exemplifies a PLC logic: changing group2 from group1 is performed while BI1 circuit is energized. The group setting function "Setting (Function ID 201400)" has a signal reception point 'PLC_Group_ENUM' in UNIT type; thus changing the group is performed when either numbers (1 to 8) enters at the signal reception point. The example logic, designed for changing to group2 from group1,

consists of a binary input circuit (BI1), a number generation function ('Binary selection' provided in basic functions of the PLC editor), and the signal reception point. That is, when the B1 switch is closed, a signal enters the BI1 circuit and is carried to the Binary selection; accordingly the Binary selection, which is programmed to generate a group number '2' in UNIT when signal '1' is injected in BOOL(BIT), can generates and inject the group number '2' at the 'PLC_Group_ENUM'. Consequently, the Setting function (201400) starts change the group from number '1' to '2'. Note that changing is only performed during the BI1 is closed in the example logic; hence, the setting number goes back to '1' when the BI1 is open.

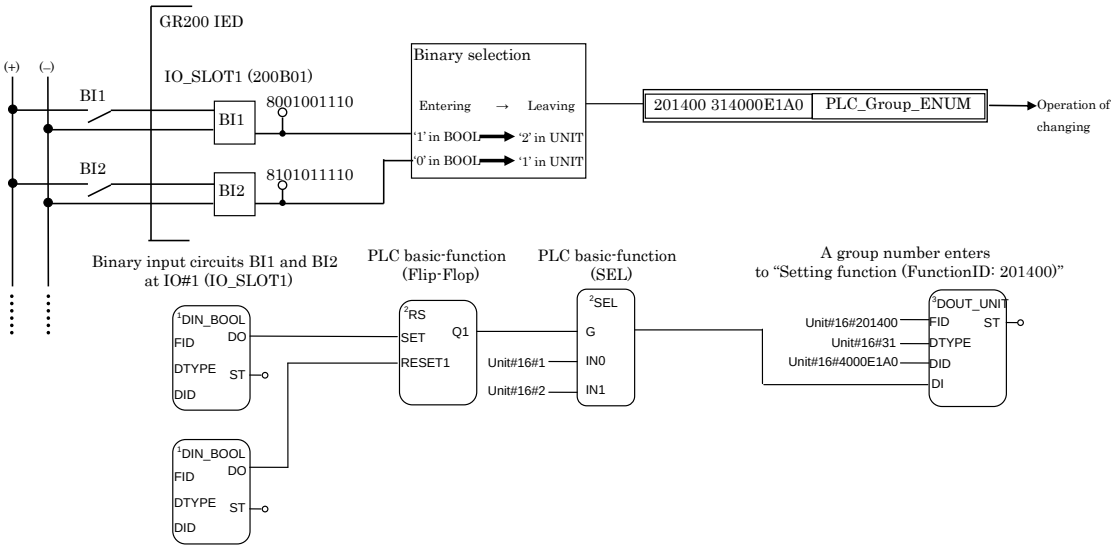


Figure 4.10-2 Example for changing a group setting[4]

[1]Note: Function block for the binary input circuit (Binary input FB) is provided in User library of PLC editor. See the Chapter *PLC editing* in *Basic manual "Programmable Logic Controller and PLC editor"* attached the PLC software.

[2]Note: The SEL and RS functions are the basic functions. In the logic, when signal '1' enters the SEL function, value '2' is generated. For more information, see the help menu on the PLC editor.

[3]Note: For your reference, changing to group3 is performed when value '3' enters. In other words, values '1' to '8' correspond to 'group1' to 'group8', respectively.

[4]Note: This example is designed to change 'group1' to 'group2' or 'group2' to 'group1'.

Figure 4.10-3 exemplifies that selecting a group among eight groups is required by the usage of three BI circuits (i.e., Group 1→Group2, Group3,… Group8).

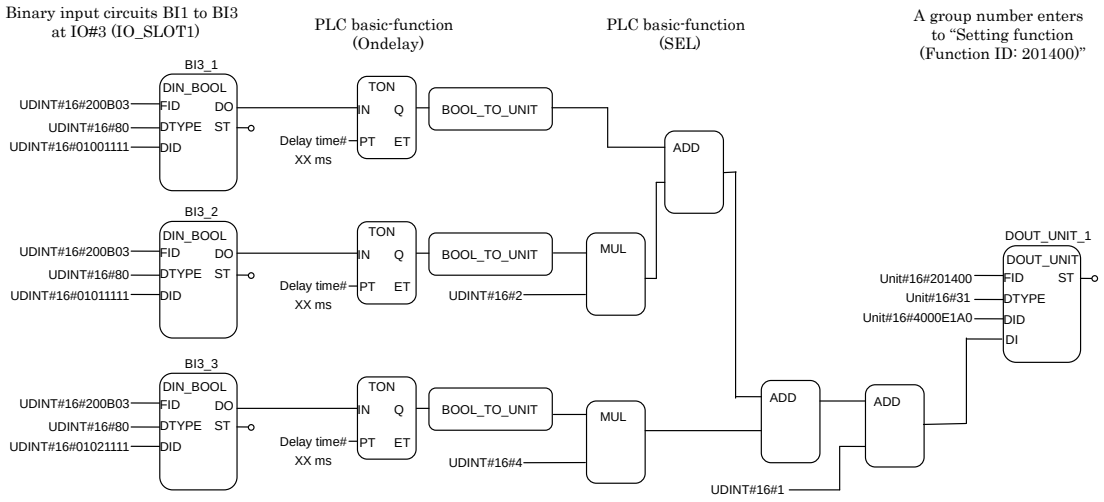


Figure 4.10-3 Logic for changing a group setting

(iii) Setting

Setting_PF (Function ID: 201400)

Setting item	Range	Units	Contents	Default setting value	Notes
Active Group	1 to 8	–	Selection of a setting group number	1	

(iv) Signal (Data ID)

◆ Connection point on PLC logic

Setting_PF (Function ID: 201400)

Element ID	Name	Description
314000E1A0	PLC_Group_ENUM	Reception for setting group number

◆ Signal monitoring points

Setting_PF (Function ID: 201400)

Element ID	Name	Description
3200001001	ACT_GRP	
3010011001	COM_CHG	
3010031001	CTRL_CHG	
3010021001	PRO_CHG	
3010001001	SYS_CHG	

5 Engineering tool

5.1 Overview of GR-TIEMS

When engineering, monitoring, record viewing, and test support functions are required in the IED, the user can handle these advanced and integrated functions using GR-Series Toshiba IED Engineering and Monitoring Software (GR-TIEMS). The GR-TIEMS should be installed into a PC prior to engineering. After that, the user can view the IED states (Table 5.1-1) on a PC screen connected with the IED. The user can also program the IED using the GR-TIEMS.

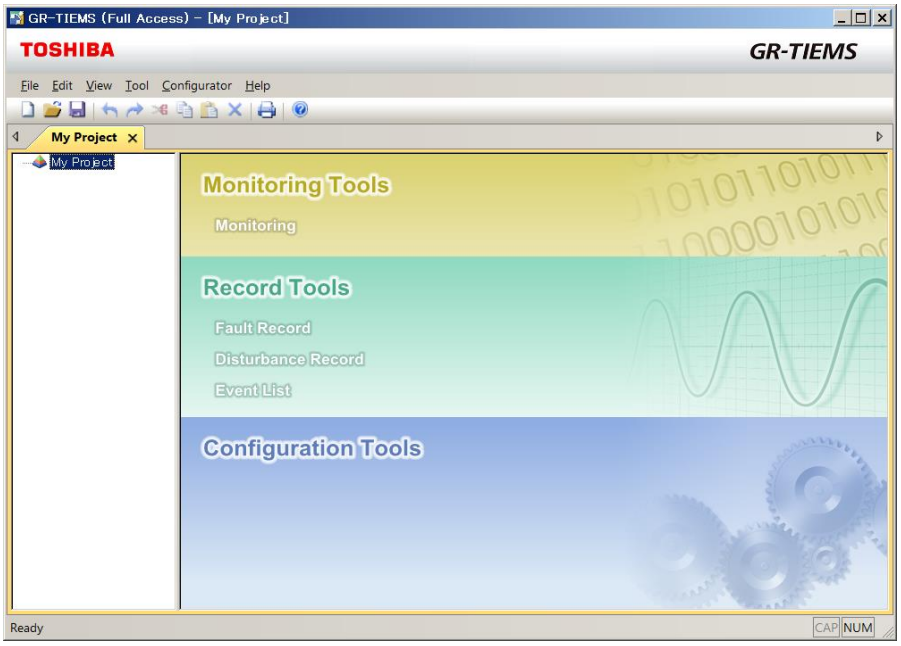


Figure 5.1-1 GR-TIEMS® screen on PC

Table 5.1-1 Information on the GR-TIEMS

Information	Displaying format
Display of voltage and current waveform	Oscillograph, vector display
Symmetrical component analysis	On arbitrary time span
Harmonic analysis	On arbitrary time span
Frequency analysis	On arbitrary time span

The GR-TIEMS is software to retrieve and analyze power system quantities, fault and event records. The user can change the settings in the respective IEDs when the PC is connected with the IED via a USB or a LAN. For more information in the GR-TIEMS operations, see separate manual "*Operation manual GR-TIEMS (6F2M1082)*".

5.2 Connection

The user can connect the GR-TIEMS with the IED using either the LAN or the USB, as shown in Figure 5.2-1.

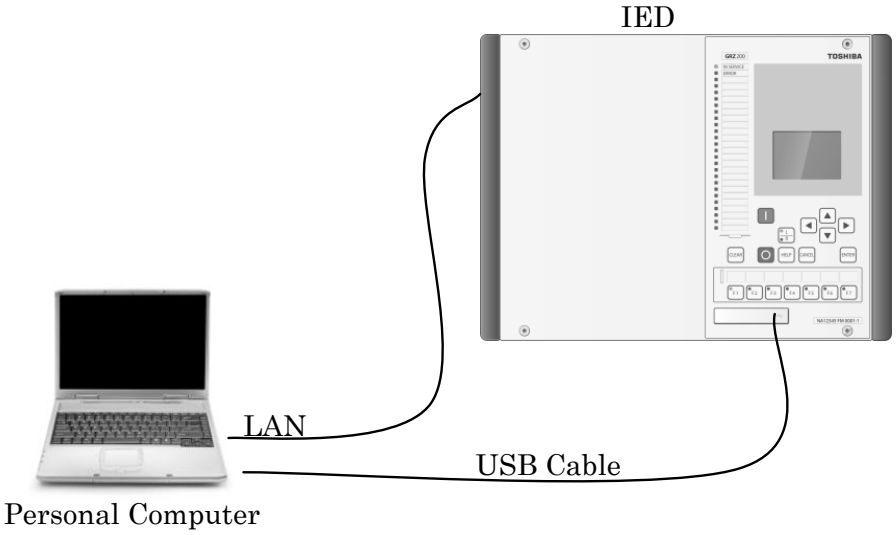


Figure 5.2-1 GR-TIEMS connected with IED

5.3 Common tools

(i) Project management

Project files are required to engage sub-engineering tools. The user can manage to read/write the project file of the IED using the project management function. The user can also see the contents of the project files.

(ii) Comparison

When the user wishes to get the comparison between respective IEDs, using the compare function the user can get the comparison data for Setting, Setting I/O, Setting Event List, Disturbance record binary signal, PLC, Interlock, Large LCD (MIMIC)†, Busbar Replica†, IEC61850, IEC60870-5-103†, Modbus† and DNP3†.

(iii) Pocket label creator

The user can create the name label of LEDs and Function keys for the IED front panel using a pocket label sheet, which is provided together with the IED. For more information with regard the LEDs and Function keys, see Chapter *Technical description: Human machine interface*.

(iv) Logging

The user can view the recorded data with regard to the logging date/time. As the user can also find operation recorded when an operator/engineer logs into the IED, analyzing a problem is possible when an error is detected during the IED operations.

(v) Double command block

For controlling, there is a principle that a first receiving-command shall be carried out primarily. In other words, succeeding receiving-commands cannot have the right to run until the first receiving-command is not completed to operate (that is, the principle of double command blocking (DCB) is established). The principle is significant for the device protections; hence, the user should DCB setting. For more information with regard to set the DCB, see Chapter *Control and monitoring application: Common controls*.

5.4 Monitoring tools

The user can monitor status and measurement value obtained in the IED using the monitoring tools. All signals monitored are tabulated in the monitoring list dialog. When the user wishes to monitor a signal, select a signal in the monitoring list dialog after the operation of the drag-drop on the monitoring window. The monitoring tools can generate an exporting layout file in the CSV; it also can obtain the layout file in the CSV.

5.5 Record tools

(i) Fault record

Fault records are including measuring information before and after the occurrence of the faults. Accordingly, the user can see information before the fault so that the user can analyze the fault more precisely. The user can select a fault from the recorded lists; the user can save it into the fault information file in the CSV. The user can also view the fault records when the exported data file in the CSV are retrieved into the IED.

(ii) Disturbance record

Disturbance record is a kind of module information measured so that the user can see them in several graphs: an oscilloscope chart, a harmonic graph, a 3D harmonic graph, a vector in relay operation analysis (ROA) chart. The user can see disturbance records when the disturbance records file in COMTRADE are provided. The user can also save disturbance records into the COMTRADE file.

(iii) Event list

The event list is recorded events information in the IED. The user can generate events information file in the CSV; the user can retrieve events data file into the IED to view when the file is in the CSV.

Note: In the IED the date and time is clocked in the coordinated universal time (UTC) when the clock is selected to operate in UTC. In the record tools within the PC the date and time is treated in the UTC. Notice that the time in the UTC is converted

for the local time when the recording time is displayed on the PC. For the clock operation if the user selects neither the UTC, the time zone or the daylight saving time (the summer time), displaying incorrect time may result in between the IED and the PC. For more information about the clock and time, see Chapter *Technical description: Clock function*.

5.6 Generic configuration tools

(i) Setting (general setting for the relay and controlling functions)

The user can make the IED settings on the GR-TIEMS; the IED settings are transferred into the IED by the connection between the IED and the GR-TIEMS.

(ii) Setting I/O

The user can see and make the setting with regard to binary input/output circuits (BIO†), DC analog input circuits (DCAI†), LEDs using the setting I/O function. For more information about the BIO, DCAI†, and the LED, see chapter *Technical description*.

(iii) Setting event list

The user can set information with regard to the event of an IED using the event list function.

(iv) Interlock configurator

The user can program conditions for executing to control the primary equipment using the interlock (ILK) configurator. For example, controlling a circuit breaker (open and closing) is significant; note not induce mal-operations caused by improper conditions; otherwise a severe fault/blackout results in. The ILK configurator can provide the user to program conditions concerning the status of the power system. For more information of the ILK, see chapter *Control and monitoring application*.

5.7 IEC 61850 configuration tool

The user can configure conversion data for the IEC61850 communication†, provided the IED exchanges the data with the SAS. The user also configures a logical device, a logical node, Goose publish information, and Goose subscribe information. For setting and configuration for the IEC61850 communication see Chapter *Communication protocol: IEC 61850 communication*".

†Note:The configuration is possible when the IED software has the IEC61850 protocol. To confirmed the implementation of IEC61850 protocol, the user needs to check the IED ordering code (for more information, see *Appendix: Ordering*).

5.8 MIMIC configuration tool

When the IED has a large LCD, the user can create user-preferred screens using the MIMIC configurator. The large LCD will be able to display measurement values, diagrams and others after the configuration. Note that the MIMIC is not available when the standard LCD is equipped for the IED.

6 PLC function

6.1 Overview of PLC function

PLC (Programmable Logic Controller) software is used for configuring the Inputs/outputs (I/Os), alarms, indications, recording and others. PLC logic consist of “timers”, “flip-flops”, and logic gates “AND, OR, XOR, NOT”. The user can configure PLC-logic using the PLC editor (MULTIPROG®), which should be installed in the user’s PC. Figure 6.1-1 shows the screen for the PLC editor.

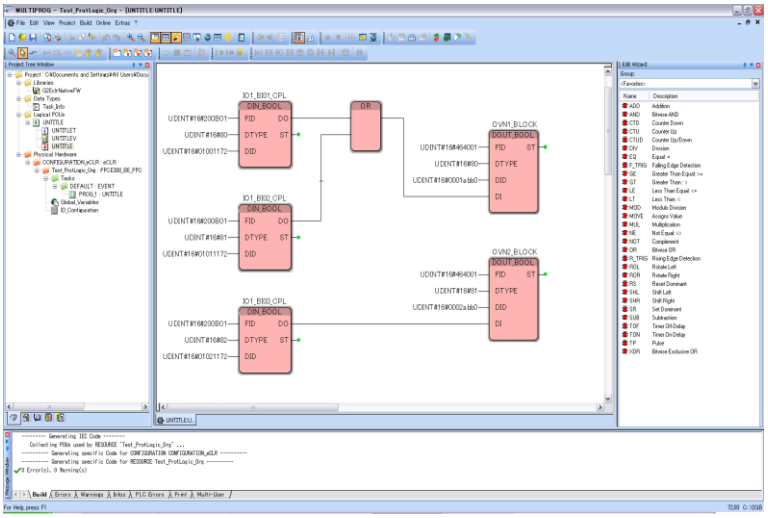


Figure 6.1-1 PC screen of MULTIPROG®

Note: To handle the PLC editor on the PC, the user shall purchase a software license (EP-261; see *Appendix: Ordering*) from Toshiba sales representative. For more information of PLC and MULTIPROG®, see separate manual *Basic manual: Programmable Logic Controller and PLC editor (6F2S1904))*.

6.2 PLC data error

The Automatic supervision reports the error information when an error occurs in PLC logic. The error information† is shown in the Monitoring sub-menu on the IED screen. See Chapter *Automatic supervision: Supervision tasks: Supervision of data in PLC function*.

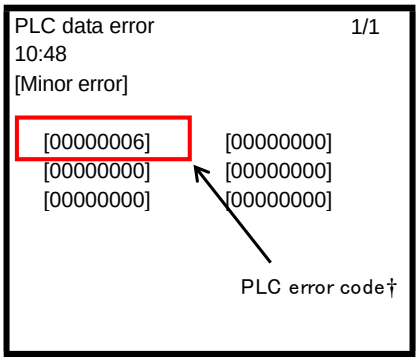


Figure 6.2-1 Error code at 1st row and 1st column on Monitoring sub-menu

6.3 PLC driver

Figure 6.3-1 illustrates that a function logic in the sub-CPU (CPM1 or CPX1) can be required to operate in step with the PLC logic in the main-CPU (CPU1); hence, a PLC driver is provided as one of coupling methods between CPUs. The PLC driver is not required to operate when both logics are placed at the same CPU (say, coupling means is required between the main and the sub-CPUs). One hundred and twenty-eight PLC drivers are provided in the function "PLC_DRV (Function ID: 230301)"; the PLC drivers are termed "PMX3s".

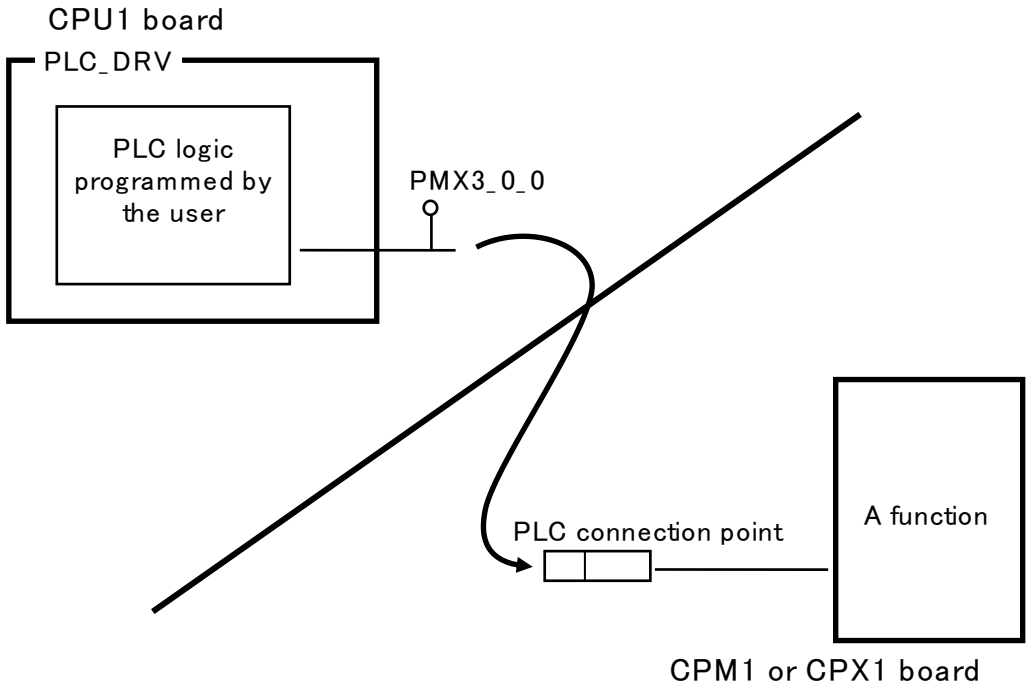


Figure 6.3-1 Communication between boards operated by the PMX3

Table 6.3-1 PLC drivers

◆ Monitoring point at PLC Driver

PLC_DRV (Function ID: 230301)

Name	Element ID	Description
PMX3_0_0	8810001BB0	Reserved for OC
PMX3_0_1	8910001BB1	Reserved for OC
PMX3_0_2	8A10001BB2	Reserved for OC
PMX3_0_3	8B10001BB3	Reserved for OC
PMX3_0_4	8C10001BB4	Reserved for OC
PMX3_0_5	8D10001BB5	Reserved for OC
PMX3_0_6	8E10001BB6	Reserved for OC
PMX3_0_7	8F10001BB7	Reserved for OC
PMX3_1_0	8010001BB8	Reserved for EF
PMX3_1_1	8110001BB9	Reserved for EF
PMX3_1_2	8210001BBA	Reserved for EF
PMX3_1_3	8310001BBB	Reserved for EF
PMX3_1_4	8410001BBC	Reserved for EF
PMX3_1_5	8510001BBD	Reserved for EF
PMX3_1_6	8610001BBE	Reserved for EF
PMX3_1_7	8710001BBF	Reserved for EF
PMX3_2_0	8810011BB0	Reserved for OCN
PMX3_2_1	8910011BB1	Reserved for OCN
PMX3_2_2	8A10011BB2	Reserved for OCN
PMX3_2_3	8B10011BB3	Reserved for OCN
PMX3_2_4	8C10011BB4	Reserved for OCN
PMX3_2_5	8D10011BB5	Reserved for OCN
PMX3_2_6	8E10011BB6	Reserved for OCN
PMX3_2_7	8F10011BB7	Reserved for OCN
PMX3_3_0	8010011BB8	Reserved for OCV
PMX3_3_1	8110011BB9	Reserved for OCV
PMX3_3_2	8210011BBA	Reserved for OCV
PMX3_3_3	8310011BBB	Reserved for OCV
PMX3_3_4	8410011BBC	Reserved for UC
PMX3_3_5	8510011BBD	Reserved for UC
PMX3_3_6	8610011BBE	Reserved for THM
PMX3_3_7	8710011BBF	Reserved for THM
PMX3_4_0	8810021BB0	Reserved for BCD
PMX3_4_1	8910021BB1	Reserved for CBF
PMX3_4_2	8A10021BB2	Reserved for CBF
PMX3_4_3	8B10021BB3	Reserved for CBF
PMX3_4_4	8C10021BB4	Reserved for CBF
PMX3_4_5	8D10021BB5	Reserved for CBF
PMX3_4_6	8E10021BB6	Reserved for CBF
PMX3_4_7	8F10021BB7	Reserved for CBF
PMX3_5_0	8010021BB8	Reserved for CBF

◆ Monitoring point at PLC Driver

PLC_DRV (Function ID: 230301)

Name	Element ID	Description
PMX3_5_1	8110021BB9	Reserved for CBF
PMX3_5_2	8210021BBA	Reserved for CBF
PMX3_5_3	8310021BBB	Reserved for CBF
PMX3_5_4	8410021BBC	Reserved for CBF
PMX3_5_5	8510021BBD	Reserved for CBF
PMX3_5_6	8610021BBE	Reserved for CBF
PMX3_5_7	8710021BBF	Reserved for SOTF-OC
PMX3_6_0	8810031BB0	Reserved for OV
PMX3_6_1	8910031BB1	Reserved for OV
PMX3_6_2	8A10031BB2	Reserved for OV
PMX3_6_3	8B10031BB3	Reserved for OV
PMX3_6_4	8C10031BB4	Reserved for OVS
PMX3_6_5	8D10031BB5	Reserved for OVS
PMX3_6_6	8E10031BB6	Reserved for OVS
PMX3_6_7	8F10031BB7	Reserved for OVS
PMX3_7_0	8010031BB8	Reserved for OVG
PMX3_7_1	8110031BB9	Reserved for OVG
PMX3_7_2	8210031BBA	Reserved for OVG
PMX3_7_3	8310031BBB	Reserved for OVG
PMX3_7_4	8410031BBC	Reserved for OVN
PMX3_7_5	8510031BBD	Reserved for OVN
PMX3_7_6	8610031BBE	Reserved for OVN
PMX3_7_7	8710031BBF	Reserved for OVN
PMX3_8_0	8810041BB0	Reserved for UV
PMX3_8_1	8910041BB1	Reserved for UV
PMX3_8_2	8A10041BB2	Reserved for UV
PMX3_8_3	8B10041BB3	Reserved for UV
PMX3_8_4	8C10041BB4	Reserved for UV
PMX3_8_5	8D10041BB5	Reserved for UV
PMX3_8_6	8E10041BB6	Reserved for UV
PMX3_8_7	8F10041BB7	Reserved for UVS
PMX3_9_0	8010041BB8	Reserved for UVS
PMX3_9_1	8110041BB9	Reserved for UVS
PMX3_9_2	8210041BBA	Reserved for UVS
PMX3_9_3	8310041BBB	Reserved for UVS
PMX3_9_4	8410041BBC	Reserved for UVS
PMX3_9_5	8510041BBD	Reserved for UVS
PMX3_9_6	8610041BBE	Reserved for FRQ
PMX3_9_7	8710041BBF	Reserved for FRQ
PMX3_10_0	8810051BB0	Reserved for FRQ
PMX3_10_1	8910051BB1	Reserved for FRQ
PMX3_10_2	8A10051BB2	Reserved for FRQ

◆ Monitoring point at PLC Driver

PLC_DRV (Function ID: 230301)

Name	Element ID	Description
PMX3_10_3	8B10051BB3	Reserved for FRQ
PMX3_10_4	8C10051BB4	Reserved for FRQ
PMX3_10_5	8D10051BB5	Reserved for FRQ
PMX3_10_6	8E10051BB6	Reserved for FRQ
PMX3_10_7	8F10051BB7	Reserved for FRQ
PMX3_11_0	8010051BB8	Reserved for FRQ
PMX3_11_1	8110051BB9	Reserved for FRQ
PMX3_11_2	8210051BBA	Reserved for FRQ
PMX3_11_3	8310051BBB	Reserved for FRQ
PMX3_11_4	8410051BBC	Reserved for FRQ
PMX3_11_5	8510051BBD	Reserved for FRQ
PMX3_11_6	8610051BBE	Reserved for FRQ
PMX3_11_7	8710051BBF	Reserved for FRQ
PMX3_12_0	8810061BB0	Reserved for FRQ
PMX3_12_1	8910061BB1	Reserved for FRQ
PMX3_12_2	8A10061BB2	Reserved for FRQ
PMX3_12_3	8B10061BB3	Reserved for FRQ
PMX3_12_4	8C10061BB4	Reserved for FRQ
PMX3_12_5	8D10061BB5	Reserved for FRQ
PMX3_12_6	8E10061BB6	Reserved for VTF
PMX3_12_7	8F10061BB7	Reserved for VTF
PMX3_13_0	8010061BB8	Reserved for CTF
PMX3_13_1	8110061BB9	Reserved for CTF
PMX3_13_2	8210061BBA	Reserved for SEF
PMX3_13_3	8310061BBB	Reserved for SEF
PMX3_13_4	8410061BBC	Reserved for SEF
PMX3_13_5	8510061BBD	Reserved for SEF
PMX3_13_6	8610061BBE	Reserved for SEF
PMX3_13_7	8710061BBF	Reserved for SEF
PMX3_14_0	8810071BB0	Reserved for SEF
PMX3_14_1	8910071BB1	Reserved for SEF
PMX3_14_2	8A10071BB2	Reserved for SOTF-OC
PMX3_14_3	8B10071BB3	Reserved for SOTF-OC
PMX3_14_4	8C10071BB4	(Not used)
PMX3_14_5	8D10071BB5	(Not used)
PMX3_14_6	8E10071BB6	(Not used)
PMX3_14_7	8F10071BB7	(Not used)
PMX3_15_0	8010071BB8	(Not used)
PMX3_15_1	8110071BB9	(Not used)
PMX3_15_2	8210071BBA	(Not used)
PMX3_15_3	8310071BBB	(Not used)
PMX3_15_4	8410071BBC	(Not used)

◆ Monitoring point at PLC Driver

PLC_DRV (Function ID: 230301)

Name	Element ID	Description
PMX3_15_5	8510071BBD	(Not used)
PMX3_15_6	8610071BBE	(Not used)
PMX3_15_7	8710071BBF	(Not used)

6.3.1 Usage of PLC drivers

PLC drivers have been provided for relay and control operations; the operation can be allowed when a signal is injected by the PLC driver.

Suppose that we wish to operate the SOTF-OC function using 'ADD.SOTF_EN†'. If a permission signal is generated in the binary input circuit 'S1_BI1_1' at the IO#1 slot‡, we may be required to inject the permission signal for the PLC driver 'PMX3_14_3†'. This is because the 'PMX3_14_3' driver is default connected with the 'ADD.SOTF_EN' in the IED.

†Note:The 'Switch on to fault (SOTF-OC)' logic has 'ADD.SOTF_EN' connection point (454001 8B10071BB3), which the user can use with the PLC driver 'PMX3_14_3 (230301 8B10071BB3)'. For more information about the SOTF-OC function, see *Chapter Relay application: Switch on to fault*. The other drivers are also lists in the SOTF-OC section.

‡Note: The signal generated in the BI1 circuit (200B01 800100111) is taken account here for the explanation, but we can choice another logic arbitrary. Incidentally, we have discussed the BI1 circuit in Chapter *Technical description: Binary IO module*. In the PLC editor, we present 'S1_BI1_1' as the BI1 signal.

6.3.2 How to edit PLC driver

We should open the screen in the PLC editor; select 'Variable (V)" as shown in Figure 6.3-2: we can find the property screen about the variable (Figure 6.3-3). Set arbitrary name; we should also set PLC_DRV signal (PMX3_14_3) as shown in the figure.

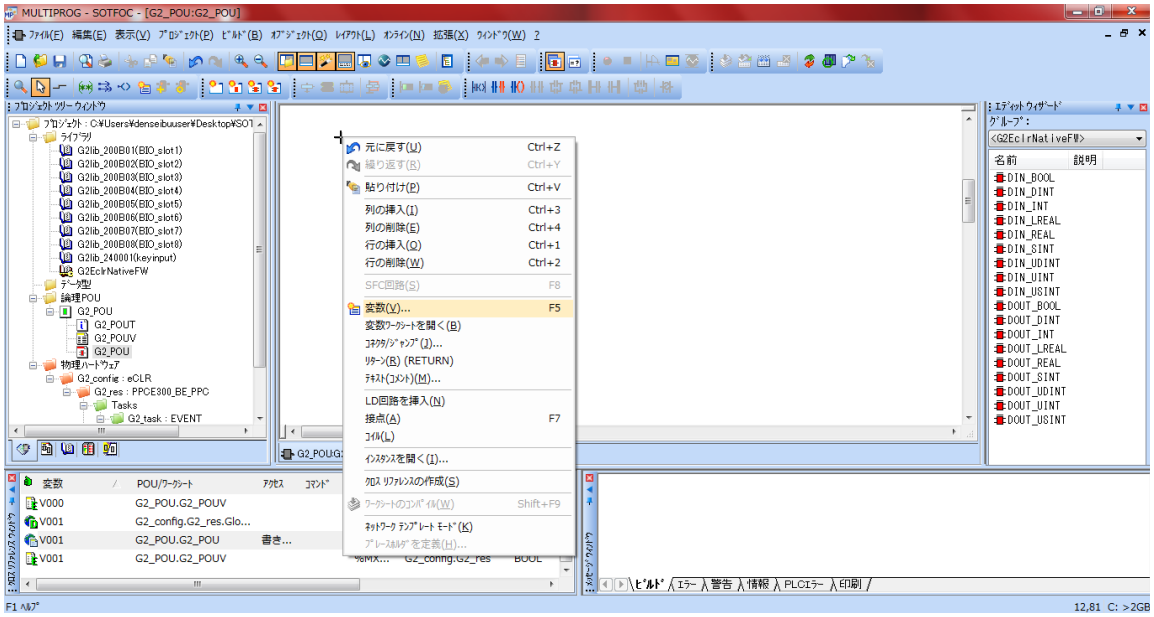


Figure 6.3-2 Selection 'Variable' in the PLC editor

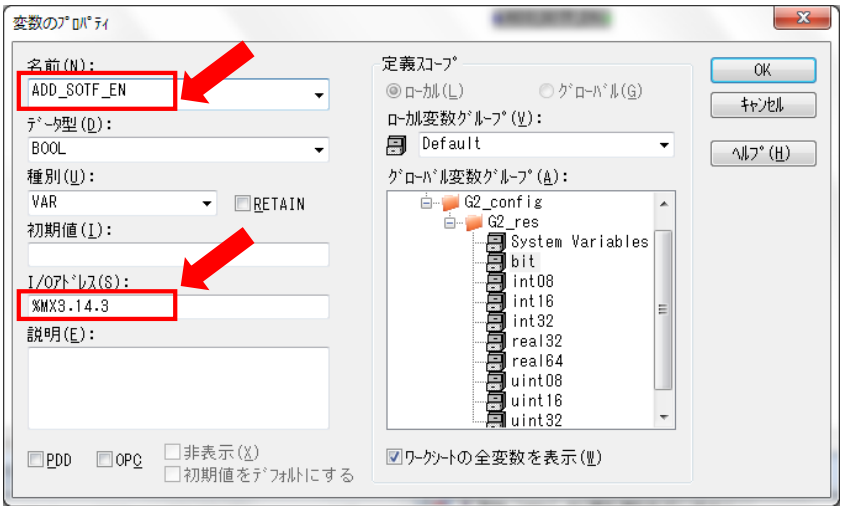


Figure 6.3-3 Settings ADD.SOTF_EN variable

The ADD.SOTF_EN is created in the work sheet, as shown in Figure 6.3-4. Then, we can connect the 'S1_BI1_1' with the 'ADD.SOFT_EN'. We are required to transfer the logic into the IED after the connection (for the transfer to the IED, see the PLC editor manual).

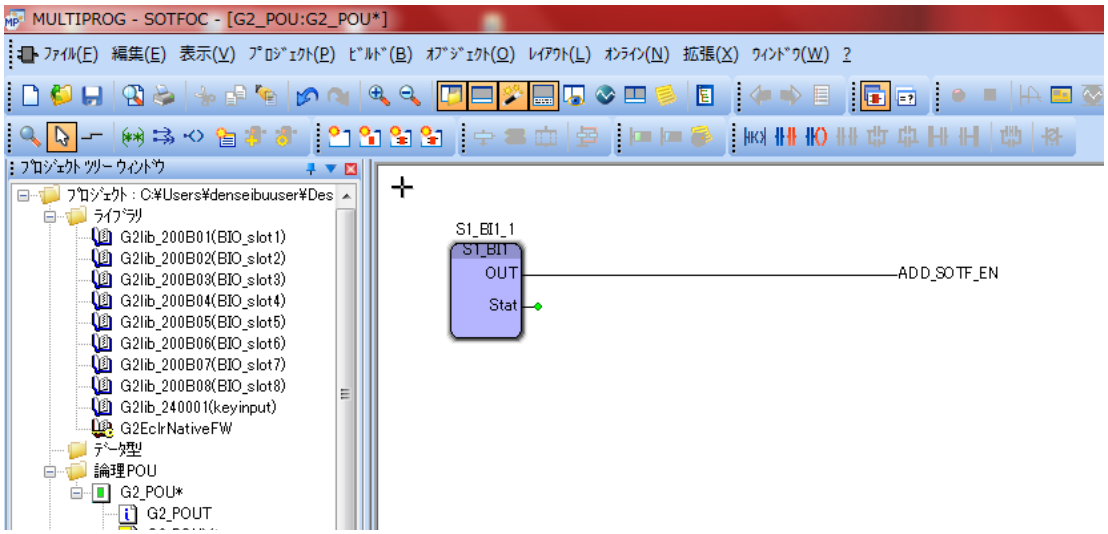


Figure 6.3-4 Connection between ADD.SOFT_EN and S1_BI1_1

7 Recording function

The recording function consists of three recording features: (1) Fault recorder†, (2) Event recorder, and (3) Disturbance recorder†. The fault recorder collects the information about the power system quantities when a fault occurs. The event recorder groups state information when the changes are detected. The disturbance recorder is designed to memory the various quantities—numerical analog data and logic data (binary data)—from the monitoring function and the BIO modules; it is possible to analyze the disturbance using the engineering tool (GR-TIMES), which can draw several chronological waves.

†Note: The fault recorder and the disturbance recorder are only provided for the BCPU models.

Note: The implementation of the feature depends on the selection of both the hardware and the software. Note that the feature is not supplied for the several models; hence, the user has to check the implementation for the model. Locate the ordering number and check it at the "G&T position" referring to the comparison table below. For more information, see *Appendix: Ordering*.

Table 6.3-1 Comparative table in respective ordering numbers

Sec.	Feature	Ordering No. at "G&T"					
		BCU			BCPU		IFU
		11	13	1F	2C	2N	19
7.1	Fault recorder	NA	NA	NA	✓	✓	NA
7.2	Event recorder	✓	✓	✓	✓	✓	✓
7.3	Disturbance recorder	NA	NA	NA	✓	✓	NA

✓: Applicable NA: Not applicable

7.1 Fault recorder

During the fault, the fault recorder can memorize reasons by equipment failures/operation states, system information etc. It commences by injecting a signal coming from the TRC alarm-signal generation logic, but is also started by a trigger provided by PLC function. The fault recorder captures the following items for each fault:

- Date and time at the fault
- Tripped phase information
- Operating mode information
- FL calculation result (if the FL function operates)
- Evolving faults (if the ARC function operates)
- Fault and pre-fault quantities

7.1.1 Types of recording information

The fault recorder can cyclically memory past eight faults; the oldest memory will be erased cyclically if another fault occurs. The memorized information has 1ms accuracy. If a fault occurs, the fault recorder is directed to operate to memory operating modes etc. about the fault.

(i) Date and time at fault

The date and time at the fault is recorded. The date and time information is provided by the clock function (see Chapter *Technical description: Clock function*).

(ii) Tripped phase information

Information about tripped phases (i.e., faulted phases) are recorded using the recording identifiers ('OPT-PHASE-A,B,C, and -N' signals), which the TRC function provides.

(iii) Mode information

At the occurrence of a fault, the protection functions gives the fault recorder the reasons of tripping; the reasons are brought using operation identifiers† and logical signals‡. The fault recorder can have up to 192 of all identifiers and signals in the IED. The operation identifiers are chosen using the settings [**OP Mode ID1**] to [**OP Mode ID128**]. The settings [**OP Mode ID201**] to [**OP Mode ID264**] are used for general purposes to record the logical signals.

†Note: A number of the operation identifiers are provided by the protection functions. For example, the 'OC1-OPT-A' operation identifier is used to identify the pickup in the first element of the overcurrent function (OC1) in phase-A. See respective protection functions in Chapter *Relay application*.

‡Note: 64 logical signals are selectable for recording. For example in this purpose, the user may choose an operation signal on the circuits of the BIO modules (BIOs).

(iv) FL calculation result

The location of the fault occurrence is recoded if the fault locator function (FL) operates.

(v) Evolving faults

The fault recorder is able to record evolving faults† during the operation of the ARC function. Strikes number for reclosing CB is also recorded.

†Note:The evolving faults are found during the 'ARC_IN_PROG' signal being generating.

For more information, see Chapter *Relay application: Autoreclose*.

(vi) Fault quantities and pre-fault-quantities

Several quantity items (amplitude and phase angle of current, etc.) are memorized in the fault recorder, as shown in Table 7.1-1. Quantities just before the fault are also memorized. The pre-fault quantities are captured 10 seconds before tripping, but it is possible to take back longer using the setting [**Pre-Fault time**].

Table 7.1-1 Recording quantities before the fault and at the fault

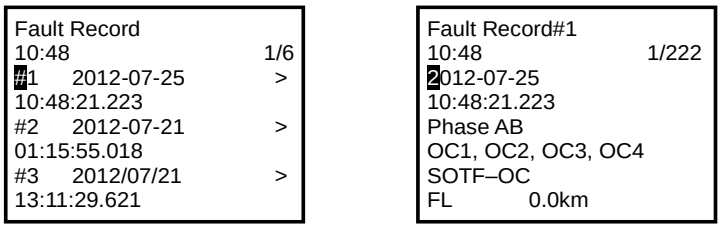
Signals on the screen	Meanings of signals
I_a, I_b, I_c,	Currents in phase
I_e	Zero-sequence (residual) current
I_{se}	Residual current
I_1, I_2, I_0	Symmetrical components by derived with I_{1a}, I_{1b}, I_{1c}
V_a, V_b, V_c,	Voltages in phase
V_{ab}, V_{bc}, V_{ca}	Voltages in phase-to-phase by calculated with V_{1a}, V_{1b}, V_{1c}
V_1, V_2, V_0	Symmetrical components by derived with V_{1a}, V_{1b}, V_{1c}
V3, V4	Reference voltages on busbars
V_e	Residual (zero-sequence) voltage
V_B	Busbar voltage provided by the VCHK function
V_L	Line voltage provided by the VCHK function
dV-SYN1	Voltage difference between V_B and V_L by the VCHK function
dAng.-SYN1	Phase difference between V_B and V_L by the VCHK function
df-SYN1	Frequency difference between V_B and V_L by the VCHK
df/dt	Frequency slip ratio
I2/I1	Ratio of negative-sequence (I2) to positive-sequence (I1)
THM-Capacity	Thermal capacity

[1]Note: Terms 'I_0 (i.e., $3I_0$)' and 'V_0 (i.e., $3V_0$)' are calculated using three-phase quantities.

[2]Note: The 'I_e' is obtained with corresponding 'I_N' circuit in the VCT.

7.1.2 Screen information

Figure 7.1-1 illustrates the information displayed on the IED screen†, which can display up to eight fault records (#1 to #8). Figure 7.1-2 illustrates the structure of the first fault record#1. The line ⓒ indicates the tripped phase. The lines ⓓ show how tripping occurred. The lines ⓕ have the information about evolving faults, which is able to memory up to 32 developing faults. Quantitates when the fault occurred are shown below messages ⓖ ⓗ.



List of fault records (#1 to #8) Details of #1 information

Figure 7.1-1 Information of the fault recorder displayed on the IED screen

†Note: For more screen information, see Chapter *User interface: Record sub-menu*. For more information about the FL calculation, see Chapter *Relay application: Single-end fault locator*.

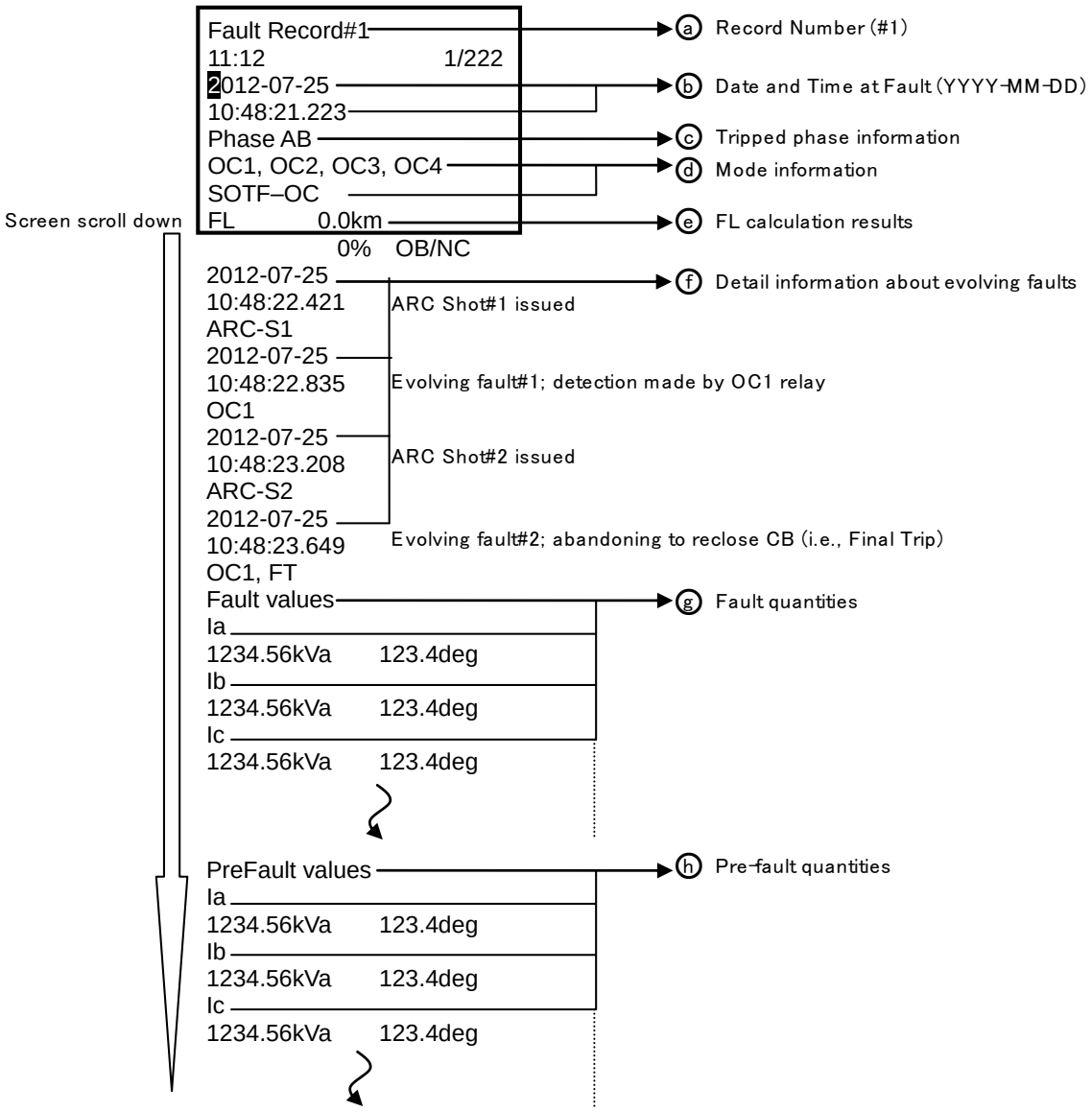


Figure 7.1-2 Screen structure about the information #1.

7.1.3 Setup for the fault recorder

(i) Operation identifiers (ID1–ID128)

The user can select the operation identifies arbitrarily using the settings [**OP Mode ID1**] etc. For example, when the operation result with regard to the overcurrent relay element (i.e., OC1 in phase-A) shall be recorded, choose the operated signal 'OC1-OPT-A (440001 800011B68)" and set it for the [**OP Mode ID1**]. Remember to program the displaying name about the OC1-OPT-A using the setting [**OP Mode Name1**] (e.g., "OC1-A relay OP-ed"). Note that the length of the displaying name should be less than 18 letters. The user should find blanks in the setting list, because several IDs have been already set.

(ii) Logical signals (ID201–ID264)

Wishing to record a logical level '1 (TRUE)' or '0 (FALSE)' on the circuits, the user can pick the

logical signal using settings the [**OP Mode ID265**] etc. For example, the user wishes to record the output level of the binary output circuit#1 (BO1) at the IO#1 slot, set its PLC monitoring point '200B01 8002001112' for the setting [**OP Mode ID265**]; set the displaying name using the [**OP Mode Name265**].

(iii) Additional triggers for the recording

Wishing to start the fault recorder except for the trip instruction, the user can use the PLC connection points 'ADD_F.RECORD_TRIG1' to 'ADD_F.RECORD_TRIG4', respectively.

(iv) Time setting for Pre-fault

The instant before the trip is programmable using the setting [**Pre-Fault Time**] among 10s, 50s, 100s, 200s, 300s.

(v) Unit setting for the quantities

To change the units of power quantities, go to the metering function discussed in *Chapter Metering function*.

Table 7.1-2 Default settings (ID1–ID128 and ID201–ID264)

Settings in Fault recorder				Actual PLC connection points
Data IDs		Screen names		
[OP Mode ID1]	*Not assigned*	[OP Mode Name1]	-	*Not assigned*
[OP Mode ID2]	*Not assigned*	[OP Mode Name2]	-	*Not assigned*
[OP Mode ID3]	*Not assigned*	[OP Mode Name3]	-	*Not assigned*
[OP Mode ID4]	*Not assigned*	[OP Mode Name4]	-	*Not assigned*
[OP Mode ID5]	*Not assigned*	[OP Mode Name5]	-	*Not assigned*
[OP Mode ID6]	*Not assigned*	[OP Mode Name6]	-	*Not assigned*
[OP Mode ID7]	*Not assigned*	[OP Mode Name7]	-	*Not assigned*
[OP Mode ID8]	*Not assigned*	[OP Mode Name8]	-	*Not assigned*
[OP Mode ID9]	*Not assigned*	[OP Mode Name9]	-	*Not assigned*
[OP Mode ID10]	*Not assigned*	[OP Mode Name10]	-	*Not assigned*
[OP Mode ID11]	*Not assigned*	[OP Mode Name11]	-	*Not assigned*
[OP Mode ID12]	*Not assigned*	[OP Mode Name12]	-	*Not assigned*
[OP Mode ID13]	*Not assigned*	[OP Mode Name13]	-	*Not assigned*
[OP Mode ID14]	*Not assigned*	[OP Mode Name14]	-	*Not assigned*
[OP Mode ID15]	*Not assigned*	[OP Mode Name15]	-	*Not assigned*
[OP Mode ID16]	*Not assigned*	[OP Mode Name16]	-	*Not assigned*
[OP Mode ID17]	*Not assigned*	[OP Mode Name17]	-	*Not assigned*
[OP Mode ID18]	*Not assigned*	[OP Mode Name18]	-	*Not assigned*
[OP Mode ID19]	*Not assigned*	[OP Mode Name19]	-	*Not assigned*
[OP Mode ID20]	*Not assigned*	[OP Mode Name20]	-	*Not assigned*
[OP Mode ID21]	*Not assigned*	[OP Mode Name21]	-	*Not assigned*
[OP Mode ID22]	*Not assigned*	[OP Mode Name22]	-	*Not assigned*
[OP Mode ID23]	*Not assigned*	[OP Mode Name23]	-	*Not assigned*
[OP Mode ID24]	*Not assigned*	[OP Mode Name24]	-	*Not assigned*
[OP Mode ID25]	*Not assigned*	[OP Mode Name25]	-	*Not assigned*
[OP Mode ID26]	440001 8000011B68	[OP Mode Name26]	OC1	OC1-OPT
[OP Mode ID27]	440001 8100021B68	[OP Mode Name27]	OC2	OC2-OPT
[OP Mode ID28]	440001 8200031B68	[OP Mode Name28]	OC3	OC3-OPT
[OP Mode ID29]	440001 8300041B68	[OP Mode Name29]	OC4	OC4-OPT
[OP Mode ID30]	441001 8000011B60	[OP Mode Name30]	EF1	EF1-OPT
[OP Mode ID31]	441001 8100021B60	[OP Mode Name31]	EF2	EF2-OPT
[OP Mode ID32]	441001 8200031B60	[OP Mode Name32]	EF3	EF3-OPT
[OP Mode ID33]	441001 8300041B60	[OP Mode Name33]	EF4	EF4-OPT
[OP Mode ID34]	443001 8000011B60	[OP Mode Name34]	OCN1	OCN1-OPT
[OP Mode ID35]	443001 8100021B60	[OP Mode Name35]	OCN2	OCN2-OPT
[OP Mode ID36]	443001 8200031B60	[OP Mode Name36]	OCN3	OCN3-OPT
[OP Mode ID37]	443001 8300041B60	[OP Mode Name37]	OCN4	OCN4-OPT
[OP Mode ID38]	444001 8000011B68	[OP Mode Name38]	OCV1	OCV1-OPT
[OP Mode ID39]	444001 8100021B68	[OP Mode Name39]	OCV2	OCV2-OPT
[OP Mode ID40]	444001 8200031B68	[OP Mode Name40]	OCV3	OCV3-OPT
[OP Mode ID41]	444001 8300041B68	[OP Mode Name41]	OCV4	OCV4-OPT
[OP Mode ID42]	*Not assigned*	[OP Mode Name42]	-	*Not assigned*
[OP Mode ID43]	*Not assigned*	[OP Mode Name43]	-	*Not assigned*
[OP Mode ID44]	451001 8100021B60	[OP Mode Name44]	THM	THM-ALARM
[OP Mode ID45]	451001 8000011B60	[OP Mode Name45]	THM-A	THM-TRIP
[OP Mode ID46]	452001 8000001B60	[OP Mode Name46]	BCD	BCD-OPT
[OP Mode ID47]	Not assigned	[OP Mode Name47]	-	*Not assigned*
[OP Mode ID48]	460001 8000011B65	[OP Mode Name48]	OV1	Not assigned
[OP Mode ID49]	460001 8100021B65	[OP Mode Name49]	OV2	Not assigned
[OP Mode ID50]	461001 8000011B65	[OP Mode Name50]	OVS1	Not assigned
[OP Mode ID51]	461001 8100021B65	[OP Mode Name51]	OVS2	Not assigned
[OP Mode ID52]	462001 8000011B60	[OP Mode Name52]	OVG1	Not assigned
[OP Mode ID53]	462001 8100021B60	[OP Mode Name53]	OVG2	Not assigned
[OP Mode ID54]	*Not assigned*	[OP Mode Name54]	-	*Not assigned*
[OP Mode ID55]	*Not assigned*	[OP Mode Name55]	-	*Not assigned*
[OP Mode ID56]	470001 8000011B65	[OP Mode Name56]	UV1	OV1-OPT
[OP Mode ID57]	470001 8100021B65	[OP Mode Name57]	UV2	OV2-OPT
[OP Mode ID58]	471001 8000011B65	[OP Mode Name58]	UVS1	OVS1-OPT
[OP Mode ID59]	471001 8100021B65	[OP Mode Name59]	UVS2	OVS2-OPT
[OP Mode ID60]	475001 8000011BB1	[OP Mode Name60]	FRQ-S1	FRQ-S1-OPT
[OP Mode ID61]	475001 8100021BB1	[OP Mode Name61]	FRQ-S2	FRQ-S2-OPT
[OP Mode ID62]	475001 8200031BB1	[OP Mode Name62]	FRQ-S3	FRQ-S3-OPT
[OP Mode ID63]	475001 8300041BB1	[OP Mode Name63]	FRQ-S4	FRQ-S4-OPT
[OP Mode ID64]	475001 8400051BB1	[OP Mode Name64]	FRQ-S5	FRQ-S5-OPT
[OP Mode ID65]	475001 8500061BB1	[OP Mode Name65]	FRQ-S6	FRQ-S6-OPT
[OP Mode ID66]	475001 8000111BB1	[OP Mode Name66]	DFRQ-S1	DFRQ-S1-OPT
[OP Mode ID67]	475001 8100121BB1	[OP Mode Name67]	DFRQ-S2	DFRQ-S2-OPT
[OP Mode ID68]	475001 8200131BB1	[OP Mode Name68]	DFRQ-S3	DFRQ-S3-OPT
[OP Mode ID69]	475001 8300141BB1	[OP Mode Name69]	DFRQ-S4	DFRQ-S4-OPT
[OP Mode ID70]	475001 8400151BB1	[OP Mode Name70]	DFRQ-S5	DFRQ-S5-OPT
[OP Mode ID71]	475001 8500161BB1	[OP Mode Name71]	DFRQ-S6	DFRQ-S6-OPT
[OP Mode ID72]	*Not assigned*	[OP Mode Name72]	-	*Not assigned*
[OP Mode ID73]	*Not assigned*	[OP Mode Name73]	-	*Not assigned*
[OP Mode ID74]	*Not assigned*	[OP Mode Name74]	-	*Not assigned*
[OP Mode ID75]	*Not assigned*	[OP Mode Name75]	-	*Not assigned*
[OP Mode ID76]	*Not assigned*	[OP Mode Name76]	-	*Not assigned*
[OP Mode ID77]	*Not assigned*	[OP Mode Name77]	-	*Not assigned*
[OP Mode ID78]	*Not assigned*	[OP Mode Name78]	-	*Not assigned*
[OP Mode ID79]	*Not assigned*	[OP Mode Name79]	-	*Not assigned*
[OP Mode ID80]	*Not assigned*	[OP Mode Name80]	-	*Not assigned*
[OP Mode ID81]	*Not assigned*	[OP Mode Name81]	-	*Not assigned*
[OP Mode ID82]	*Not assigned*	[OP Mode Name82]	-	*Not assigned*
[OP Mode ID83]	*Not assigned*	[OP Mode Name83]	-	*Not assigned*
[OP Mode ID84]	*Not assigned*	[OP Mode Name84]	-	*Not assigned*
[OP Mode ID85]	*Not assigned*	[OP Mode Name85]	-	*Not assigned*
[OP Mode ID86]	*Not assigned*	[OP Mode Name86]	-	*Not assigned*
[OP Mode ID87]	*Not assigned*	[OP Mode Name87]	-	*Not assigned*
[OP Mode ID88]	*Not assigned*	[OP Mode Name88]	-	*Not assigned*
[OP Mode ID89]	*Not assigned*	[OP Mode Name89]	-	*Not assigned*
[OP Mode ID90]	*Not assigned*	[OP Mode Name90]	-	*Not assigned*
[OP Mode ID91]	*Not assigned*	[OP Mode Name91]	-	*Not assigned*
[OP Mode ID92]	*Not assigned*	[OP Mode Name92]	-	*Not assigned*
[OP Mode ID93]	*Not assigned*	[OP Mode Name93]	-	*Not assigned*
[OP Mode ID94]	*Not assigned*	[OP Mode Name94]	-	*Not assigned*
[OP Mode ID95]	*Not assigned*	[OP Mode Name95]	-	*Not assigned*
[OP Mode ID96]	*Not assigned*	[OP Mode Name96]	-	*Not assigned*

Settings in Fault recorder				Actual PLC connection points
Data IDs		Screen names		
[OP Mode ID97]	*Not assigned*	[OP Mode Name97]	-	*Not assigned*
[OP Mode ID98]	*Not assigned*	[OP Mode Name98]	-	*Not assigned*
[OP Mode ID99]	*Not assigned*	[OP Mode Name99]	-	*Not assigned*
[OP Mode ID100]	*Not assigned*	[OP Mode Name100]	-	*Not assigned*
[OP Mode ID101]	*Not assigned*	[OP Mode Name101]	-	*Not assigned*
[OP Mode ID102]	*Not assigned*	[OP Mode Name102]	-	*Not assigned*
[OP Mode ID103]	*Not assigned*	[OP Mode Name103]	-	*Not assigned*
[OP Mode ID104]	*Not assigned*	[OP Mode Name104]	-	*Not assigned*
[OP Mode ID105]	*Not assigned*	[OP Mode Name105]	-	*Not assigned*
[OP Mode ID106]	*Not assigned*	[OP Mode Name106]	-	*Not assigned*
[OP Mode ID107]	*Not assigned*	[OP Mode Name107]	-	*Not assigned*
[OP Mode ID108]	*Not assigned*	[OP Mode Name108]	-	*Not assigned*
[OP Mode ID109]	*Not assigned*	[OP Mode Name109]	-	*Not assigned*
[OP Mode ID110]	*Not assigned*	[OP Mode Name110]	-	*Not assigned*
[OP Mode ID111]	*Not assigned*	[OP Mode Name111]	-	*Not assigned*
[OP Mode ID112]	*Not assigned*	[OP Mode Name112]	-	*Not assigned*
[OP Mode ID113]	*Not assigned*	[OP Mode Name113]	-	*Not assigned*
[OP Mode ID114]	*Not assigned*	[OP Mode Name114]	-	*Not assigned*
[OP Mode ID115]	*Not assigned*	[OP Mode Name115]	-	*Not assigned*
[OP Mode ID116]	*Not assigned*	[OP Mode Name116]	-	*Not assigned*
[OP Mode ID117]	*Not assigned*	[OP Mode Name117]	-	*Not assigned*
[OP Mode ID118]	*Not assigned*	[OP Mode Name118]	-	*Not assigned*
[OP Mode ID119]	*Not assigned*	[OP Mode Name119]	-	*Not assigned*
[OP Mode ID120]	*Not assigned*	[OP Mode Name120]	-	*Not assigned*
[OP Mode ID121]	*Not assigned*	[OP Mode Name121]	-	*Not assigned*
[OP Mode ID122]	*Not assigned*	[OP Mode Name122]	-	*Not assigned*
[OP Mode ID123]	*Not assigned*	[OP Mode Name123]	-	*Not assigned*
[OP Mode ID124]	*Not assigned*	[OP Mode Name124]	-	*Not assigned*
[OP Mode ID125]	*Not assigned*	[OP Mode Name125]	-	*Not assigned*
[OP Mode ID126]	*Not assigned*	[OP Mode Name126]	-	*Not assigned*
[OP Mode ID127]	*Not assigned*	[OP Mode Name127]	-	*Not assigned*
[OP Mode ID128]	*Not assigned*	[OP Mode Name128]	-	*Not assigned*
[OP Mode ID201]	*Not assigned*	[OP Mode Name201]	-	*Not assigned*
[OP Mode ID202]	*Not assigned*	[OP Mode Name202]	-	*Not assigned*
[OP Mode ID203]	*Not assigned*	[OP Mode Name203]	-	*Not assigned*
[OP Mode ID204]	4530018 B00011B27	[OP Mode Name204]	CBF	CBF1_TRIP
[OP Mode ID205]	4530018 300011B23	[OP Mode Name205]	CBF-RE	CBF1_RETRIP
[OP Mode ID206]	*Not assigned*	[OP Mode Name206]	-	*Not assigned*
[OP Mode ID207]	*Not assigned*	[OP Mode Name207]	-	*Not assigned*
[OP Mode ID208]	*Not assigned*	[OP Mode Name208]	-	*Not assigned*
[OP Mode ID209]	*Not assigned*	[OP Mode Name209]	-	*Not assigned*
[OP Mode ID210]	*Not assigned*	[OP Mode Name210]	-	*Not assigned*
[OP Mode ID211]	*Not assigned*	[OP Mode Name211]	-	*Not assigned*
[OP Mode ID212]	*Not assigned*	[OP Mode Name212]	-	*Not assigned*
[OP Mode ID213]	*Not assigned*	[OP Mode Name213]	-	*Not assigned*
[OP Mode ID214]	*Not assigned*	[OP Mode Name214]	-	*Not assigned*
[OP Mode ID215]	*Not assigned*	[OP Mode Name215]	-	*Not assigned*
[OP Mode ID216]	*Not assigned*	[OP Mode Name216]	-	*Not assigned*
[OP Mode ID217]	*Not assigned*	[OP Mode Name217]	-	*Not assigned*
[OP Mode ID218]	*Not assigned*	[OP Mode Name218]	-	*Not assigned*
[OP Mode ID219]	*Not assigned*	[OP Mode Name219]	-	*Not assigned*
[OP Mode ID220]	*Not assigned*	[OP Mode Name220]	-	*Not assigned*
[OP Mode ID221]	*Not assigned*	[OP Mode Name221]	-	*Not assigned*
[OP Mode ID222]	*Not assigned*	[OP Mode Name222]	-	*Not assigned*
[OP Mode ID223]	*Not assigned*	[OP Mode Name223]	-	*Not assigned*
[OP Mode ID224]	*Not assigned*	[OP Mode Name224]	-	*Not assigned*
[OP Mode ID225]	*Not assigned*	[OP Mode Name225]	-	*Not assigned*
[OP Mode ID226]	*Not assigned*	[OP Mode Name226]	-	*Not assigned*
[OP Mode ID227]	*Not assigned*	[OP Mode Name227]	-	*Not assigned*
[OP Mode ID228]	*Not assigned*	[OP Mode Name228]	-	*Not assigned*
[OP Mode ID229]	*Not assigned*	[OP Mode Name229]	-	*Not assigned*
[OP Mode ID230]	*Not assigned*	[OP Mode Name230]	-	*Not assigned*
[OP Mode ID231]	*Not assigned*	[OP Mode Name231]	-	*Not assigned*
[OP Mode ID232]	*Not assigned*	[OP Mode Name232]	*Not assigned*	*Not assigned*
[OP Mode ID233]	4A7001 8000001B65	[OP Mode Name233]	ARC-S1	ARC SHOT1
[OP Mode ID234]	4A7001 8100001B66	[OP Mode Name234]	ARC-S2	ARC SHOT2
[OP Mode ID235]	4A7001 8200001B67	[OP Mode Name235]	ARC-S3	ARC SHOT3
[OP Mode ID236]	4A7001 8300001B68	[OP Mode Name236]	ARC-S4	ARC SHOT4
[OP Mode ID237]	4A7001 8400001B69	[OP Mode Name237]	ARC-S5	ARC SHOT5
[OP Mode ID238]	*Not assigned*	[OP Mode Name238]	*Not assigned*	*Not assigned*
[OP Mode ID239]	4A7001 8400001B6C	[OP Mode Name239]	FT	ARC FT
[OP Mode ID240]	*Not assigned*	[OP Mode Name240]	*Not assigned*	*Not assigned*
[OP Mode ID241]	4A7001 8700001B6D	[OP Mode Name241]	AR	ARC RESET
[OP Mode ID242]	4A7001 8C00001B6F	[OP Mode Name242]	AF	ARC CLOSE FAIL
[OP Mode ID243]	4A7001 8000001B70	[OP Mode Name243]	AS	ARC CLOSE SUCCESS
[OP Mode ID244]	*Not assigned*	[OP Mode Name244]	*Not assigned*	*Not assigned*
[OP Mode ID245]	*Not assigned*	[OP Mode Name245]	-	*Not assigned*
[OP Mode ID246]	*Not assigned*	[OP Mode Name246]	-	*Not assigned*
[OP Mode ID247]	*Not assigned*	[OP Mode Name247]	-	*Not assigned*
[OP Mode ID248]	*Not assigned*	[OP Mode Name248]	-	*Not assigned*
[OP Mode ID249]	*Not assigned*	[OP Mode Name249]	-	*Not assigned*
[OP Mode ID250]	*Not assigned*	[OP Mode Name250]	-	*Not assigned*
[OP Mode ID251]	*Not assigned*	[OP Mode Name251]	-	*Not assigned*
[OP Mode ID252]	*Not assigned*	[OP Mode Name252]	-	*Not assigned*
[OP Mode ID253]	*Not assigned*	[OP Mode Name253]	-	*Not assigned*
[OP Mode ID254]	*Not assigned*	[OP Mode Name254]	-	*Not assigned*
[OP Mode ID255]	*Not assigned*	[OP Mode Name255]	-	*Not assigned*
[OP Mode ID256]	*Not assigned*	[OP Mode Name256]	-	*Not assigned*
[OP Mode ID257]	*Not assigned*	[OP Mode Name257]	-	*Not assigned*
[OP Mode ID258]	*Not assigned*	[OP Mode Name258]	-	*Not assigned*
[OP Mode ID259]	*Not assigned*	[OP Mode Name259]	-	*Not assigned*
[OP Mode ID260]	*Not assigned*	[OP Mode Name260]	-	*Not assigned*
[OP Mode ID261]	*Not assigned*	[OP Mode Name261]	-	*Not assigned*
[OP Mode ID262]	*Not assigned*	[OP Mode Name262]	-	*Not assigned*
[OP Mode ID263]	*Not assigned*	[OP Mode Name263]	-	*Not assigned*
[OP Mode ID264]	*Not assigned*	[OP Mode Name264]	-	*Not assigned*

7.1.4 Scheme logic

The operation of the fault recorder can be directed by the TRC function, protection functions (FC1 to FC40†), and the PLC function, as shown in Figure 7.1-3.

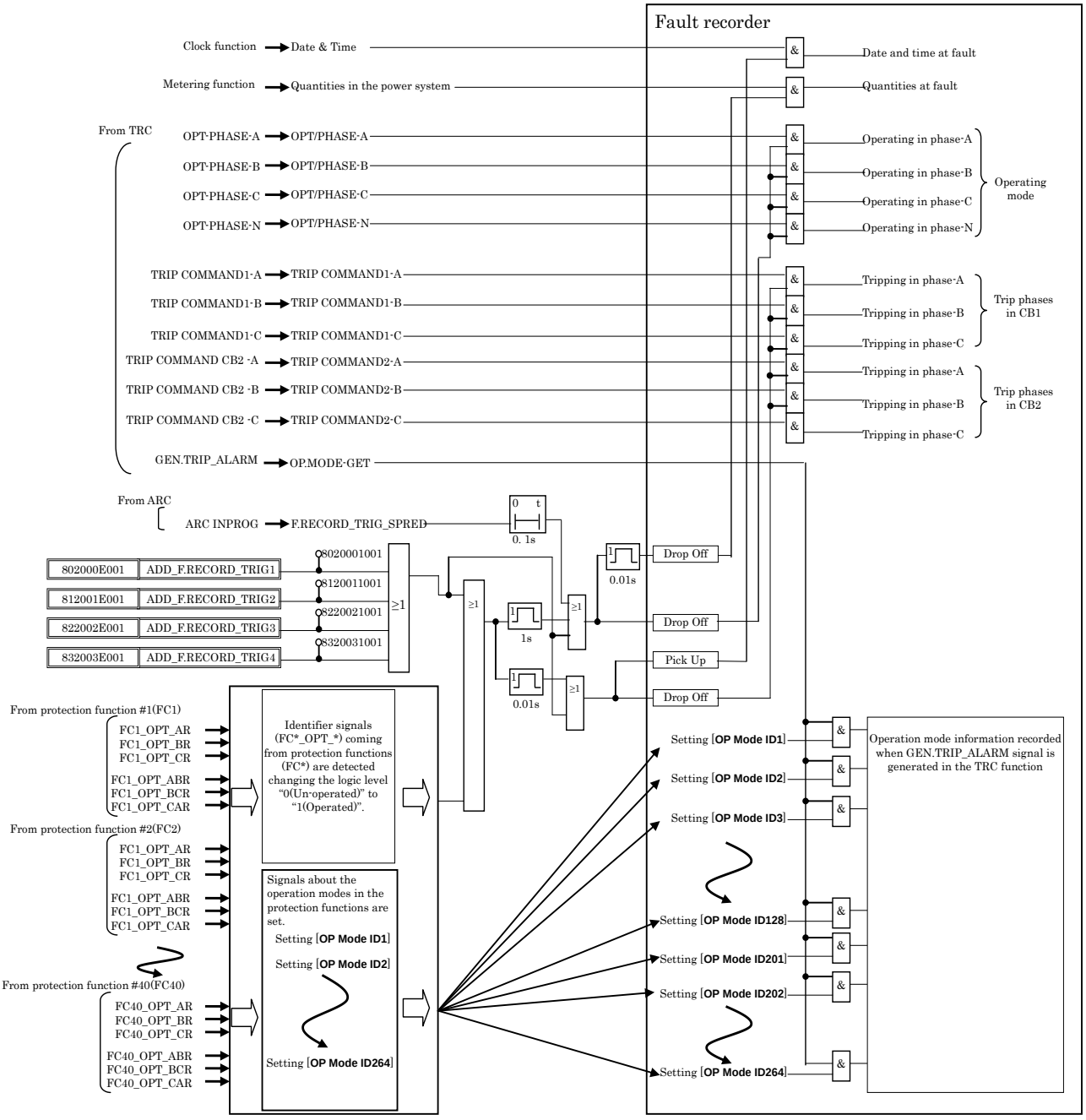


Figure 7.1-3 Fault record circuit

†Note:The correspondences table for the FC numbers are discussed in Chapter *Relay application: Trip circuit*.

7.1.5 Setting

Setting of FAULT_RECORD(Function ID: 200602)

Setting item		Range	Units	Contents	Default setting value	Notes
	Pre-Fault Time	10s/ 50 / 100 / 200 / 300	Sec.	Recording time before the fault	10	
	Op Mode Name1	(Preferred name)	–	Name of the operation mode for ID1	–	
	Op Mode ID1	(Preferred DataID)	–	Signal of the operation identifier	–	
	Op Mode Name2	(Preferred name)	–	Name of the operation mode for ID2	–	
	Op Mode ID2	(Preferred DataID)	–	Signal of the operation identifier2	–	
	Op Mode Name3	(Preferred name)	–	Name of the operation mode for ID3	–	
	Op Mode ID3	(Preferred DataID)	–	Signal of the operation identifier3	–	
	.....	.....	–	.....	–	
	.....	.....	–	.....	–	
	.....	.....	–	.....	–	
	.....	.....	–	.....	–	
	Op Mode Name264	(Preferred name)	–	Name of the operation mode for ID264	–	
	Op Mode ID264	(Preferred DataID)	–	Signal of the operation identifier264	–	

7.1.6 Signal (Data ID)

◆ Signal monitoring point

FAULT_RECORD (Function ID: 200602)

Name	Element ID	Description
ADD_F.RECORD_TRIG1	8020001001	Receiving Trigger1
ADD_F.RECORD_TRIG2	8120011001	Receiving Trigger2
ADD_F.RECORD_TRIG3	8220021001	Receiving Trigger3
ADD_F.RECORD_TRIG4	8320031001	Receiving Trigger4
FAULT RECORD TRIG1	8000011001	TRIG1 signal generated
FAULT RECORD TRIG3	8200031001	TRIG3 signal generated
FLTRCDING	8020101001	Data writing in the fault recorder
FR_CLR	3000001001	Data erasing in the fault recorder

◆ Connection point on PLC logic

FAULT_RECORD (Function ID: 200602)

Name	Element ID	Description
ADD_F.RECORD_TRIG1	802000E001	Input1 for the external trigger
ADD_F.RECORD_TRIG2	812001E001	Input2 for the external trigger
ADD_F.RECORD_TRIG3	822002E001	Input3 for the external trigger
ADD_F.RECORD_TRIG4	832003E001	Input4 for the external trigger

7.2 Event recorder

Signals are generated in the logics of BIO modules etc. in the IED. The event recorder can memory the generated signals as events. To operate the event recorder, the user should pick a preferred signal as a trigger of the event recorder; the event recorder can have 768 triggers, some of which have been set as a default. The user can group the triggers into three categories; consequently, it is possible that a number of the events are divided depending on the degree of the errors, the meaning of the operations, and the signals of relay elements, etc. The user can also program how an event is to be detected. An event is recorded with millisecond accuracy. The information are memorized until the number of the events reaching 1024; the oldest event will be deleted when a new event appears.

7.2.1 Trigger signals

The event is memorized when the event recorder detects changing the trigger signal that is connected with the logic signal; they are defined using settings [**Trigger ID1**] to [**Trigger ID768**]. Settings [**End of E.Record-1**] and [**End of E.Record-2**] are provided for grouping†; the user can adjust the size of the 'Event Record1' group using the [**End of E.Record-1**]. The next 'Event Record2' group is set with the [**End of E.Record-2**]. The remains are set for the 'Event Record3' group. Remember that the [**Trigger ID1**] etc. are required to set together with the [**Event Name1**] etc.; user's preferred names should be less than 18 letters.

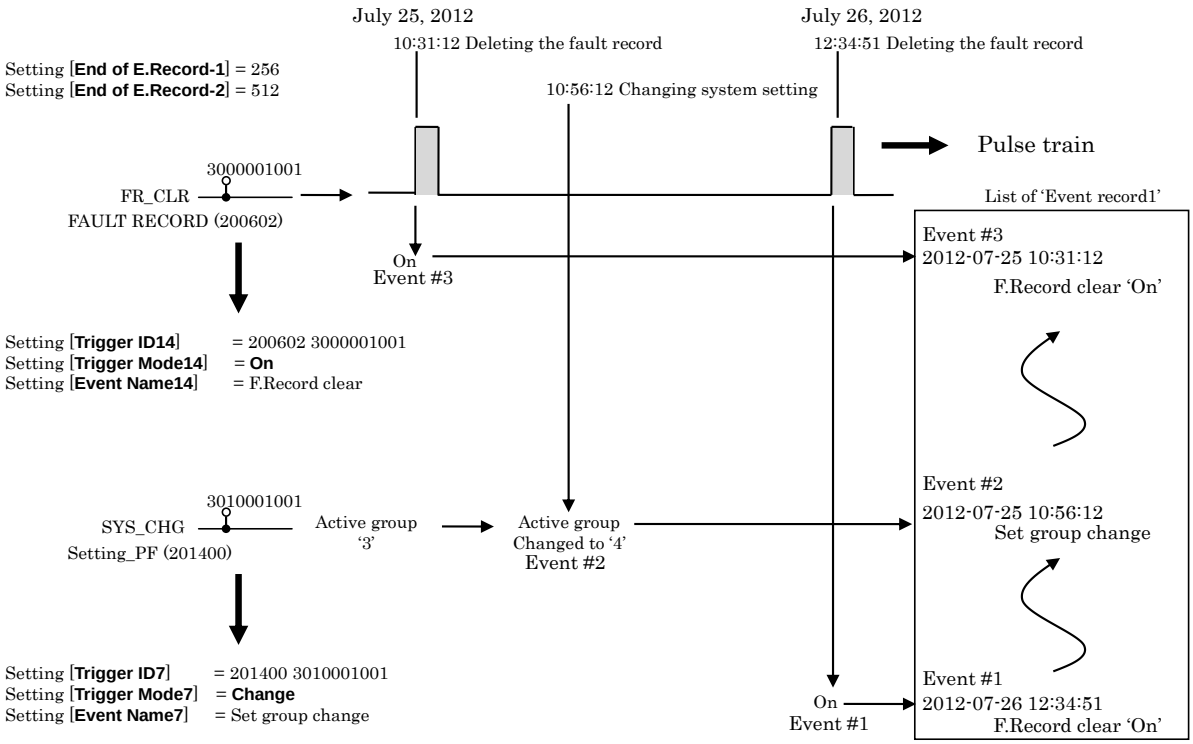


Figure 7.2-1 Relation between function signals and triggers for Event record1

Figure 7.2-1 illustrates signals connected with triggers in the event recorder When the IED has the protection functions (BCPU), for example, 'SYS_CHG' is connected with trigger#7

using the [**Trigger ID7**] and 'FR_CLR' is connected with trigger#14 using the [**Trigger ID14**], as shown in Table 7.2-1. Note that the both triggers (#7 and #14) are smaller than the setting [**End of E.Record-1**]=256; hence, the both are listed in the 'Event recored1' list. Keep in mind that the event names are set by the [**Event Name7**] and [**Event Name14**]. Table 7.2-2 shows the list (ID1 to 256) when the IED has no protection function (i.e., for BCU). Table 7.2-3 and Table 7.2-4 shows the list (ID257 to 768) for the BCU and the BCPU both.

†Note:The GR-TIEMS uses terms 'Level1', 'Level2', and 'Level3' to represent the 'Event Record1', 'Event Record2', and 'Event Record3'. The scope of each level is the same as the scope of each group. The GR-TIEMS does not show unused triggers and Trigger ID numbers automatically when the triggers are displayed on the screen.

Table 7.2-1 Event1 group set with [End of E.Record-1]=256 for the BCPU

Triggers	Data IDs	Modes	Names
[Trigger ID1]	220001 3110201001	On-Off	Serious error
[Trigger ID2]	220001 3110211001	On-Off	ErrorLevel2
[Trigger ID3]	220001 3110221001	On-Off	Minor error
[Trigger ID4]	220001 3110231001	On-Off	ErrorLevel4
[Trigger ID5]	220001 3110241001	On-Off	ErrorLevel5
[Trigger ID6]	(Not Assigned)	Off	-
[Trigger ID7]	201400 3200001001	Change	Set. group change
[Trigger ID8]	201400 3010001001	On	System set. change
[Trigger ID9]	201400 3010011001	On	Comm. set. change
[Trigger ID10]	201400 3010021001	On	Prot. set. change
[Trigger ID11]	201400 3010031001	On	Ctrl. set. change
[Trigger ID12]	(Not Assigned)	Off	-
[Trigger ID13]	(Not Assigned)	Off	-
[Trigger ID14]	200602 3000001001	On	F.Record clear
[Trigger ID15]	200710 3001001001	On	E.Record1 clear
[Trigger ID16]	200710 3002001001	On	E.Record2 clear
[Trigger ID17]	200710 3003001001	On	E.Record3 clear
[Trigger ID18]	20040130A0001001	On	D.Record clear
[Trigger ID19]	(Not Assigned)	Off	-
[Trigger ID20]	(Not Assigned)	Off	-
[Trigger ID21]	(Not Assigned)	Off	-
[Trigger ID22]	(Not Assigned)	Off	-
[Trigger ID23]	(Not Assigned)	Off	-
[Trigger ID24]	(Not Assigned)	Off	-
[Trigger ID25]	(Not Assigned)	Off	-
[Trigger ID26]	(Not Assigned)	Off	-
[Trigger ID27]	(Not Assigned)	Off	-
[Trigger ID28]	(Not Assigned)	Off	-
[Trigger ID29]	(Not Assigned)	Off	-
[Trigger ID30]	(Not Assigned)	Off	-
[Trigger ID31]	(Not Assigned)	Off	-
[Trigger ID32]	(Not Assigned)	Off	-
[Trigger ID33]	(Not Assigned)	Off	-
[Trigger ID34]	(Not Assigned)	Off	-
[Trigger ID35]	(Not Assigned)	Off	-
[Trigger ID36]	(Not Assigned)	Off	-
[Trigger ID37]	(Not Assigned)	Off	-
[Trigger ID38]	(Not Assigned)	Off	-
[Trigger ID39]	(Not Assigned)	Off	-
[Trigger ID40]	(Not Assigned)	Off	-
[Trigger ID41]	(Not Assigned)	Off	-
[Trigger ID42]	(Not Assigned)	Off	-
[Trigger ID43]	(Not Assigned)	Off	-
[Trigger ID44]	(Not Assigned)	Off	-
[Trigger ID45]	(Not Assigned)	Off	-
[Trigger ID46]	(Not Assigned)	Off	-
[Trigger ID47]	(Not Assigned)	Off	-
[Trigger ID48]	(Not Assigned)	Off	-
[Trigger ID49]	(Not Assigned)	Off	-
[Trigger ID50]	(Not Assigned)	Off	-
[Trigger ID51]	(Not Assigned)	Off	-
[Trigger ID52]	(Not Assigned)	Off	-
[Trigger ID53]	(Not Assigned)	Off	-
[Trigger ID54]	(Not Assigned)	Off	-
[Trigger ID55]	(Not Assigned)	Off	-
[Trigger ID56]	(Not Assigned)	Off	-
[Trigger ID57]	(Not Assigned)	Off	-
[Trigger ID58]	(Not Assigned)	Off	-
[Trigger ID59]	(Not Assigned)	Off	-
[Trigger ID60]	(Not Assigned)	Off	-
[Trigger ID61]	(Not Assigned)	Off	-
[Trigger ID62]	(Not Assigned)	Off	-
[Trigger ID63]	(Not Assigned)	Off	-
[Trigger ID64]	(Not Assigned)	Off	-
[Trigger ID65]	(Not Assigned)	Off	-
[Trigger ID66]	(Not Assigned)	Off	-
[Trigger ID67]	(Not Assigned)	Off	-
[Trigger ID68]	(Not Assigned)	Off	-
[Trigger ID69]	(Not Assigned)	Off	-
[Trigger ID70]	(Not Assigned)	Off	-
[Trigger ID71]	(Not Assigned)	Off	-
[Trigger ID72]	(Not Assigned)	Off	-
[Trigger ID73]	(Not Assigned)	Off	-
[Trigger ID74]	(Not Assigned)	Off	-
[Trigger ID75]	(Not Assigned)	Off	-
[Trigger ID76]	(Not Assigned)	Off	-
[Trigger ID77]	(Not Assigned)	Off	-
[Trigger ID78]	(Not Assigned)	Off	-
[Trigger ID79]	(Not Assigned)	Off	-
[Trigger ID80]	(Not Assigned)	Off	-
[Trigger ID81]	(Not Assigned)	Off	-
[Trigger ID82]	(Not Assigned)	Off	-
[Trigger ID83]	(Not Assigned)	Off	-
[Trigger ID84]	(Not Assigned)	Off	-
[Trigger ID85]	(Not Assigned)	Off	-
[Trigger ID86]	(Not Assigned)	Off	-
[Trigger ID87]	(Not Assigned)	Off	-
[Trigger ID88]	(Not Assigned)	Off	-
[Trigger ID89]	(Not Assigned)	Off	-
[Trigger ID90]	(Not Assigned)	Off	-
[Trigger ID91]	(Not Assigned)	Off	-
[Trigger ID92]	(Not Assigned)	Off	-
[Trigger ID93]	(Not Assigned)	Off	-
[Trigger ID94]	(Not Assigned)	Off	-
[Trigger ID95]	(Not Assigned)	Off	-
[Trigger ID96]	(Not Assigned)	Off	-
[Trigger ID97]	(Not Assigned)	Off	-
[Trigger ID98]	(Not Assigned)	Off	-
[Trigger ID99]	(Not Assigned)	Off	-
[Trigger ID100]	(Not Assigned)	Off	-
[Trigger ID101]	(Not Assigned)	Off	-
[Trigger ID102]	(Not Assigned)	Off	-
[Trigger ID103]	(Not Assigned)	Off	-
[Trigger ID104]	(Not Assigned)	Off	-
[Trigger ID105]	(Not Assigned)	Off	-
[Trigger ID106]	(Not Assigned)	Off	-
[Trigger ID107]	(Not Assigned)	Off	-
[Trigger ID108]	(Not Assigned)	Off	-
[Trigger ID109]	(Not Assigned)	Off	-
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[Trigger ID111]	(Not Assigned)	Off	-
[Trigger ID112]	(Not Assigned)	Off	-
[Trigger ID113]	(Not Assigned)	Off	-
[Trigger ID114]	(Not Assigned)	Off	-
[Trigger ID115]	(Not Assigned)	Off	-
[Trigger ID116]	(Not Assigned)	Off	-
[Trigger ID117]	(Not Assigned)	Off	-
[Trigger ID118]	(Not Assigned)	Off	-
[Trigger ID119]	(Not Assigned)	Off	-
[Trigger ID120]	(Not Assigned)	Off	-
[Trigger ID121]	(Not Assigned)	Off	-
[Trigger ID122]	(Not Assigned)	Off	-
[Trigger ID123]	(Not Assigned)	Off	-
[Trigger ID124]	(Not Assigned)	Off	-
[Trigger ID125]	48A0018300001B76	On-Off	CB_CLOSE
[Trigger ID126]	(Not Assigned)	Off	-
[Trigger ID127]	(Not Assigned)	Off	-
[Trigger ID128]	(Not Assigned)	Off	-
[Trigger ID129]	(Not Assigned)	Off	-
[Trigger ID130]	(Not Assigned)	Off	-
[Trigger ID131]	48A0018E00001B85	On-Off	DS_CLOSE
[Trigger ID132]	48A0018000001B9C	On-Off	DEAD_LINE_DETECT
[Trigger ID133]	(Not Assigned)	Off	-
[Trigger ID134]	4A70018000001B63	On-Off	ARC READY
[Trigger ID135]	4A70018000001BBE	On-Off	ARC_BLOCK
[Trigger ID135]	4A70018000001BB3	On-Off	ARC NO ACT
[Trigger ID136]	4A70018000001BB2	On-Off	EXT.ARC_START
[Trigger ID137]	4A70018000001B6A	On-Off	ARC CLOSE COMMAND
[Trigger ID138]	48A0018300001B76	On-Off	CB_CLOSE
[Trigger ID140]	(Not Assigned)	Off	-
[Trigger ID141]	(Not Assigned)	Off	-
[Trigger ID142]	(Not Assigned)	Off	-
[Trigger ID143]	(Not Assigned)	Off	-
[Trigger ID144]	(Not Assigned)	Off	-
[Trigger ID145]	(Not Assigned)	Off	-
[Trigger ID146]	(Not Assigned)	Off	-
[Trigger ID147]	(Not Assigned)	Off	-
[Trigger ID148]	(Not Assigned)	Off	-
[Trigger ID149]	(Not Assigned)	Off	-
[Trigger ID150]	(Not Assigned)	Off	-
[Trigger ID151]	(Not Assigned)	Off	-
[Trigger ID152]	(Not Assigned)	Off	-
[Trigger ID153]	(Not Assigned)	Off	-
[Trigger ID154]	4900018000001B61	On-Off	VTF DETECT
[Trigger ID155]	4900018100001BB1	On-Off	EXTERNAL VTF
[Trigger ID156]	(Not Assigned)	Off	-
[Trigger ID157]	4A0001 8300001B6F	On-Off	GEN.TRIP
[Trigger ID158]	4A0001 8400001B64	On-Off	GEN.ALARM
[Trigger ID159]	4A0001 8000001B71	On-Off	OPT.PHASE-A
[Trigger ID160]	4A0001 8100001B72	On-Off	OPT.PHASE-B
[Trigger ID161]	4A0001 8200001B73	On-Off	OPT.PHASE-C
[Trigger ID162]	4A0001 8300001B74	On-Off	OPT.PHASE-N
[Trigger ID163]	(Not Assigned)	Off	-
[Trigger ID164]	(Not Assigned)	Off	-
[Trigger ID165]	(Not Assigned)	Off	-
[Trigger ID166]	(Not Assigned)	Off	-
[Trigger ID167]	(Not Assigned)	Off	-
[Trigger ID168]	(Not Assigned)	Off	-
[Trigger ID169]	453001 8000011BB0	On-Off	EXT.CBF_START-A
[Trigger ID170]	453001 8100011BB1	On-Off	EXT.CBF_START-B
[Trigger ID171]	453001 8200011BB2	On-Off	EXT.CBF_START-C
[Trigger ID172]	(Not Assigned)	Off	-
[Trigger ID173]	(Not Assigned)	Off	-
[Trigger ID174]	(Not Assigned)	Off	-
[Trigger ID175]	(Not Assigned)	Off	-
[Trigger ID176]	(Not Assigned)	Off	-
[Trigger ID177]	(Not Assigned)	Off	-
[Trigger ID178]	(Not Assigned)	Off	-
[Trigger ID179]	(Not Assigned)	Off	-
[Trigger ID180]	(Not Assigned)	Off	-
[Trigger ID181]	(Not Assigned)	Off	-
[Trigger ID182]	(Not Assigned)	Off	-
[Trigger ID183]	(Not Assigned)	Off	-
[Trigger ID184]	(Not Assigned)	Off	-
[Trigger ID185]	(Not Assigned)	Off	-
[Trigger ID186]	(Not Assigned)	Off	-
[Trigger ID187]	(Not Assigned)	Off	-
[Trigger ID188]	(Not Assigned)	Off	-
[Trigger ID189]	(Not Assigned)	Off	-
[Trigger ID190]	(Not Assigned)	Off	-
[Trigger ID191]	(Not Assigned)	Off	-
[Trigger ID192]	(Not Assigned)	Off	-
[Trigger ID193]	(Not Assigned)	Off	-
[Trigger ID194]	(Not Assigned)	Off	-
[Trigger ID195]	(Not Assigned)	Off	-
[Trigger ID196]	(Not Assigned)	Off	-
[Trigger ID197]	(Not Assigned)	Off	-
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[Trigger ID203]	(Not Assigned)	Off	-
[Trigger ID204]	(Not Assigned)	Off	-
[Trigger ID205]	(Not Assigned)	Off	-
[Trigger ID206]	(Not Assigned)	Off	-
[Trigger ID207]	(Not Assigned)	Off	-
[Trigger ID208]	(Not Assigned)	Off	-
[Trigger ID209]	(Not Assigned)	Off	-
[Trigger ID210]	(Not Assigned)	Off	-
[Trigger ID211]	(Not Assigned)	Off	-
[Trigger ID212]	(Not Assigned)	Off	-
[Trigger ID213]	(Not Assigned)	Off	-
[Trigger ID214]	(Not Assigned)	Off	-
[Trigger ID215]	(Not Assigned)	Off	-
[Trigger ID216]	(Not Assigned)	Off	-
[Trigger ID217]	(Not Assigned)	Off	-
[Trigger ID218]	(Not Assigned)	Off	-
[Trigger ID219]	(Not Assigned)	Off	-
[Trigger ID220]	(Not Assigned)	Off	-
[Trigger ID221]	(Not Assigned)	Off	-
[Trigger ID222]	(Not Assigned)	Off	-
[Trigger ID223]	(Not Assigned)	Off	-
[Trigger ID224]	(Not Assigned)	Off	-
[Trigger ID225]	(Not Assigned)	Off	-
[Trigger ID226]	(Not Assigned)	Off	-
[Trigger ID227]	(Not Assigned)	Off	-
[Trigger ID228]	(Not Assigned)	Off	-
[Trigger ID229]	(Not Assigned)	Off	-
[Trigger ID230]	(Not Assigned)	Off	-
[Trigger ID231]	(Not Assigned)	Off	-
[Trigger ID232]	(Not Assigned)	Off	-
[Trigger ID233]	(Not Assigned)	Off	-
[Trigger ID234]	(Not Assigned)	Off	-
[Trigger ID235]	(Not Assigned)	Off	-
[Trigger ID236]	(Not Assigned)	Off	-
[Trigger ID237]	(Not Assigned)	Off	-
[Trigger ID238]	(Not Assigned)	Off	-
[Trigger ID239]	(Not Assigned)	Off	-
[Trigger ID240]	(Not Assigned)	Off	-
[Trigger ID241]	(Not Assigned)	Off	-
[Trigger ID242]	(Not Assigned)	Off	-
[Trigger ID243]	(Not Assigned)	Off	-
[Trigger ID244]	(Not Assigned)	Off	-
[Trigger ID245]	(Not Assigned)	Off	-
[Trigger ID246]	(Not Assigned)	Off	-
[Trigger ID247]	(Not Assigned)	Off	-
[Trigger ID248]	(Not Assigned)	Off	-
[Trigger ID249]	(Not Assigned)	Off	-
[Trigger ID250]	(Not Assigned)	Off	-
[Trigger ID254]	(Not Assigned)	Off	-
[Trigger ID252]	(Not Assigned)	Off	-
[Trigger ID253]	(Not Assigned)	Off	-
[Trigger ID254]	(Not Assigned)	Off	-
[Trigger ID255]	(Not Assigned)	Off	-
[Trigger ID256]	(Not Assigned)	Off	-

Table 7.2-2 Event1 group set with [End of E.Record-1]=256 for the BCU

Triggers	Data IDs	Modes	Names
[Trigger ID1]	220001 3110201001	On-Off	Serious error
[Trigger ID2]	220001 3110211001	On-Off	ErrorLevel2
[Trigger ID3]	220001 3110221001	On-Off	Minor error
[Trigger ID4]	220001 3110231001	On-Off	ErrorLevel4
[Trigger ID5]	220001 3110241001	On-Off	ErrorLevel5
[Trigger ID6]	(Not Assigned)	Off	-
[Trigger ID7]	201400 3200001001	Change	Set. group change
[Trigger ID8]	201400 3010001001	On	System set. change
[Trigger ID9]	201400 3010011001	On	Comm. set. change
[Trigger ID10]	201400 3010021001	On	Prot. set. change
[Trigger ID11]	201400 3010031001	On	Ctrl. set. change
[Trigger ID12]	(Not Assigned)	Off	-
[Trigger ID13]	(Not Assigned)	Off	-
[Trigger ID14]	200602 3000001001	On	F.Record clear
[Trigger ID15]	200710 3001001001	On	E.Record1 clear
[Trigger ID16]	200710 3002001001	On	E.Record2 clear
[Trigger ID17]	200710 3003001001	On	E.Record3 clear
[Trigger ID18]	20040130A0001001	On	D.Record clear
[Trigger ID19]	(Not Assigned)	Off	-
[Trigger ID20]	(Not Assigned)	Off	-
[Trigger ID21]	(Not Assigned)	Off	-
[Trigger ID22]	(Not Assigned)	Off	-
[Trigger ID23]	(Not Assigned)	Off	-
[Trigger ID24]	(Not Assigned)	Off	-
[Trigger ID25]	(Not Assigned)	Off	-
[Trigger ID26]	(Not Assigned)	Off	-
[Trigger ID27]	(Not Assigned)	Off	-
[Trigger ID28]	(Not Assigned)	Off	-
[Trigger ID29]	(Not Assigned)	Off	-
[Trigger ID30]	(Not Assigned)	Off	-
[Trigger ID31]	(Not Assigned)	Off	-
[Trigger ID32]	(Not Assigned)	Off	-
[Trigger ID33]	(Not Assigned)	Off	-
[Trigger ID34]	(Not Assigned)	Off	-
[Trigger ID35]	(Not Assigned)	Off	-
[Trigger ID36]	(Not Assigned)	Off	-
[Trigger ID37]	(Not Assigned)	Off	-
[Trigger ID38]	(Not Assigned)	Off	-
[Trigger ID39]	(Not Assigned)	Off	-
[Trigger ID40]	(Not Assigned)	Off	-
[Trigger ID41]	(Not Assigned)	Off	-
[Trigger ID42]	(Not Assigned)	Off	-
[Trigger ID43]	(Not Assigned)	Off	-
[Trigger ID44]	(Not Assigned)	Off	-
[Trigger ID45]	(Not Assigned)	Off	-
[Trigger ID46]	(Not Assigned)	Off	-
[Trigger ID47]	(Not Assigned)	Off	-
[Trigger ID48]	(Not Assigned)	Off	-
[Trigger ID49]	(Not Assigned)	Off	-
[Trigger ID50]	(Not Assigned)	Off	-
[Trigger ID51]	(Not Assigned)	Off	-
[Trigger ID52]	(Not Assigned)	Off	-
[Trigger ID53]	(Not Assigned)	Off	-
[Trigger ID54]	(Not Assigned)	Off	-
[Trigger ID55]	(Not Assigned)	Off	-
[Trigger ID56]	(Not Assigned)	Off	-
[Trigger ID57]	(Not Assigned)	Off	-
[Trigger ID58]	(Not Assigned)	Off	-
[Trigger ID59]	(Not Assigned)	Off	-
[Trigger ID60]	(Not Assigned)	Off	-
[Trigger ID61]	(Not Assigned)	Off	-
[Trigger ID62]	(Not Assigned)	Off	-
[Trigger ID63]	(Not Assigned)	Off	-
[Trigger ID64]	(Not Assigned)	Off	-
[Trigger ID65]	(Not Assigned)	Off	-
[Trigger ID66]	(Not Assigned)	Off	-
[Trigger ID67]	(Not Assigned)	Off	-
[Trigger ID68]	(Not Assigned)	Off	-
[Trigger ID69]	(Not Assigned)	Off	-
[Trigger ID70]	(Not Assigned)	Off	-
[Trigger ID71]	(Not Assigned)	Off	-
[Trigger ID72]	(Not Assigned)	Off	-
[Trigger ID73]	(Not Assigned)	Off	-
[Trigger ID74]	(Not Assigned)	Off	-
[Trigger ID75]	(Not Assigned)	Off	-
[Trigger ID76]	(Not Assigned)	Off	-
[Trigger ID77]	(Not Assigned)	Off	-
[Trigger ID78]	(Not Assigned)	Off	-
[Trigger ID79]	(Not Assigned)	Off	-
[Trigger ID80]	(Not Assigned)	Off	-
[Trigger ID81]	(Not Assigned)	Off	-
[Trigger ID82]	(Not Assigned)	Off	-
[Trigger ID83]	(Not Assigned)	Off	-
[Trigger ID84]	(Not Assigned)	Off	-
[Trigger ID85]	(Not Assigned)	Off	-
[Trigger ID86]	(Not Assigned)	Off	-
[Trigger ID87]	(Not Assigned)	Off	-
[Trigger ID88]	(Not Assigned)	Off	-
[Trigger ID89]	(Not Assigned)	Off	-
[Trigger ID90]	(Not Assigned)	Off	-
[Trigger ID91]	(Not Assigned)	Off	-
[Trigger ID92]	(Not Assigned)	Off	-
[Trigger ID93]	(Not Assigned)	Off	-
[Trigger ID94]	(Not Assigned)	Off	-
[Trigger ID95]	(Not Assigned)	Off	-
[Trigger ID96]	(Not Assigned)	Off	-
[Trigger ID97]	(Not Assigned)	Off	-
[Trigger ID98]	(Not Assigned)	Off	-
[Trigger ID99]	(Not Assigned)	Off	-
[Trigger ID100]	(Not Assigned)	Off	-
[Trigger ID101]	(Not Assigned)	Off	-
[Trigger ID102]	(Not Assigned)	Off	-
[Trigger ID103]	(Not Assigned)	Off	-
[Trigger ID104]	(Not Assigned)	Off	-
[Trigger ID105]	(Not Assigned)	Off	-
[Trigger ID106]	(Not Assigned)	Off	-
[Trigger ID107]	(Not Assigned)	Off	-
[Trigger ID108]	(Not Assigned)	Off	-
[Trigger ID109]	(Not Assigned)	Off	-
[Trigger ID110]	(Not Assigned)	Off	-
[Trigger ID111]	(Not Assigned)	Off	-
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[Trigger ID113]	(Not Assigned)	Off	-
[Trigger ID114]	(Not Assigned)	Off	-
[Trigger ID115]	(Not Assigned)	Off	-
[Trigger ID116]	(Not Assigned)	Off	-
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[Trigger ID124]	(Not Assigned)	Off	-
[Trigger ID125]	(Not Assigned)	Off	-
[Trigger ID126]	(Not Assigned)	Off	-
[Trigger ID127]	(Not Assigned)	Off	-
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[Trigger ID129]	(Not Assigned)	Off	-
[Trigger ID130]	(Not Assigned)	Off	-
[Trigger ID131]	(Not Assigned)	Off	-
[Trigger ID132]	(Not Assigned)	Off	-
[Trigger ID133]	(Not Assigned)	Off	-
[Trigger ID134]	(Not Assigned)	Off	-
[Trigger ID135]	(Not Assigned)	Off	-
[Trigger ID135]	(Not Assigned)	Off	-
[Trigger ID136]	(Not Assigned)	Off	-
[Trigger ID137]	(Not Assigned)	Off	-
[Trigger ID138]	(Not Assigned)	Off	-
[Trigger ID140]	(Not Assigned)	Off	-
[Trigger ID141]	(Not Assigned)	Off	-
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[Trigger ID143]	(Not Assigned)	Off	-
[Trigger ID144]	(Not Assigned)	Off	-
[Trigger ID145]	(Not Assigned)	Off	-
[Trigger ID146]	(Not Assigned)	Off	-
[Trigger ID147]	(Not Assigned)	Off	-
[Trigger ID148]	(Not Assigned)	Off	-
[Trigger ID149]	(Not Assigned)	Off	-
[Trigger ID150]	(Not Assigned)	Off	-
[Trigger ID151]	(Not Assigned)	Off	-
[Trigger ID152]	(Not Assigned)	Off	-
[Trigger ID153]	(Not Assigned)	Off	-
[Trigger ID154]	(Not Assigned)	Off	-
[Trigger ID155]	(Not Assigned)	Off	-
[Trigger ID156]	(Not Assigned)	Off	-
[Trigger ID157]	(Not Assigned)	Off	-
[Trigger ID158]	(Not Assigned)	Off	-
[Trigger ID159]	(Not Assigned)	Off	-
[Trigger ID160]	(Not Assigned)	Off	-
[Trigger ID161]	(Not Assigned)	Off	-
[Trigger ID162]	(Not Assigned)	Off	-
[Trigger ID163]	(Not Assigned)	Off	-
[Trigger ID164]	(Not Assigned)	Off	-
[Trigger ID165]	(Not Assigned)	Off	-
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[Trigger ID167]	(Not Assigned)	Off	-
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[Trigger ID170]	(Not Assigned)	Off	-
[Trigger ID171]	(Not Assigned)	Off	-
[Trigger ID172]	(Not Assigned)	Off	-
[Trigger ID173]	(Not Assigned)	Off	-
[Trigger ID174]	(Not Assigned)	Off	-
[Trigger ID175]	(Not Assigned)	Off	-
[Trigger ID176]	(Not Assigned)	Off	-
[Trigger ID177]	(Not Assigned)	Off	-
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[Trigger ID219]	(Not Assigned)	Off	-
[Trigger ID220]	(Not Assigned)	Off	-
[Trigger ID221]	(Not Assigned)	Off	-
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[Trigger ID224]	(Not Assigned)	Off	-
[Trigger ID225]	(Not Assigned)	Off	-
[Trigger ID226]	(Not Assigned)	Off	-
[Trigger ID227]	(Not Assigned)	Off	-
[Trigger ID228]	(Not Assigned)	Off	-
[Trigger ID229]	(Not Assigned)	Off	-
[Trigger ID230]	(Not Assigned)	Off	-
[Trigger ID231]	(Not Assigned)	Off	-
[Trigger ID232]	(Not Assigned)	Off	-
[Trigger ID233]	(Not Assigned)	Off	-
[Trigger ID234]	(Not Assigned)	Off	-
[Trigger ID235]	(Not Assigned)	Off	-
[Trigger ID236]	(Not Assigned)	Off	-
[Trigger ID237]	(Not Assigned)	Off	-
[Trigger ID238]	(Not Assigned)	Off	-
[Trigger ID239]	(Not Assigned)	Off	-
[Trigger ID240]	(Not Assigned)	Off	-
[Trigger ID241]	(Not Assigned)	Off	-
[Trigger ID242]	(Not Assigned)	Off	-
[Trigger ID243]	(Not Assigned)	Off	-
[Trigger ID244]	(Not Assigned)	Off	-
[Trigger ID245]	(Not Assigned)	Off	-
[Trigger ID246]	(Not Assigned)	Off	-
[Trigger ID247]	(Not Assigned)	Off	-
[Trigger ID248]	(Not Assigned)	Off	-
[Trigger ID249]	(Not Assigned)	Off	-
[Trigger ID250]	(Not Assigned)	Off	-
[Trigger ID254]	(Not Assigned)	Off	-
[Trigger ID252]	(Not Assigned)	Off	-
[Trigger ID253]	(Not Assigned)	Off	-
[Trigger ID254]	(Not Assigned)	Off	-
[Trigger ID255]	(Not Assigned)	Off	-
[Trigger ID256]	(Not Assigned)	Off	-

Table 7.2-3 Event2 group set with [End of E.Record-1]=256 and [End of E.Record-2]=512

Triggers	Data IDs	Modes	Names
[Trigger ID257]	510001 3101011D81	On	SPOS01 SLF
[Trigger ID258]	510001 3101011D82	On	SPOS01 CCF
[Trigger ID259]	510001 3101011D84	On	SPOS01 OPF
[Trigger ID260]	510001 3101011D86	On	SPOS01 EXF
[Trigger ID261]	510001 3101021D81	On	SPOS02 SLF
[Trigger ID262]	510001 3101021D82	On	SPOS02 CCF
[Trigger ID263]	510001 3101021D84	On	SPOS02 OPF
[Trigger ID264]	510001 3101021D86	On	SPOS02 EXF
[Trigger ID265]	510001 3101031D81	On	SPOS03 SLF
[Trigger ID266]	510001 3101031D82	On	SPOS03 CCF
[Trigger ID267]	510001 3101031D84	On	SPOS03 OPF
[Trigger ID268]	510001 3101031D86	On	SPOS03 EXF
[Trigger ID269]	510001 3101041D81	On	SPOS04 SLF
[Trigger ID270]	510001 3101041D82	On	SPOS04 CCF
[Trigger ID271]	510001 3101041D84	On	SPOS04 OPF
[Trigger ID272]	510001 3101041D86	On	SPOS04 EXF
[Trigger ID273]	510001 3101051D81	On	SPOS05 SLF
[Trigger ID274]	510001 3101051D82	On	SPOS05 CCF
[Trigger ID275]	510001 3101051D84	On	SPOS05 OPF
[Trigger ID276]	510001 3101051D86	On	SPOS05 EXF
[Trigger ID277]	510001 3101061D81	On	SPOS06 SLF
[Trigger ID278]	510001 3101061D82	On	SPOS06 CCF
[Trigger ID279]	510001 3101061D84	On	SPOS06 OPF
[Trigger ID280]	510001 3101061D86	On	SPOS06 EXF
[Trigger ID281]	510001 3101071D81	On	SPOS07 SLF
[Trigger ID282]	510001 3101071D82	On	SPOS07 CCF
[Trigger ID283]	510001 3101071D84	On	SPOS07 OPF
[Trigger ID284]	510001 3101071D86	On	SPOS07 EXF
[Trigger ID285]	510001 3101081D81	On	SPOS08 SLF
[Trigger ID286]	510001 3101081D82	On	SPOS08 CCF
[Trigger ID287]	510001 3101081D84	On	SPOS08 OPF
[Trigger ID288]	510001 3101081D86	On	SPOS08 EXF
[Trigger ID289]	510001 3101091D81	On	SPOS09 SLF
[Trigger ID290]	510001 3101091D82	On	SPOS09 CCF
[Trigger ID291]	510001 3101091D84	On	SPOS09 OPF
[Trigger ID292]	510001 3101091D86	On	SPOS09 EXF
[Trigger ID293]	510001 31010A1D81	On	SPOS10 SLF
[Trigger ID294]	510001 31010A1D82	On	SPOS10 CCF
[Trigger ID295]	510001 31010A1D84	On	SPOS10 OPF
[Trigger ID296]	510001 31010A1D86	On	SPOS10 EXF
[Trigger ID297]	510001 0001011001	On-Off	SPOS01 STATUS
[Trigger ID298]	510001 0001021001	On-Off	SPOS02 STATUS
[Trigger ID299]	510001 0001031001	On-Off	SPOS03 STATUS
[Trigger ID300]	510001 0001041001	On-Off	SPOS04 STATUS
[Trigger ID301]	510001 0001051001	On-Off	SPOS05 STATUS
[Trigger ID302]	510001 0001061001	On-Off	SPOS06 STATUS
[Trigger ID303]	510001 0001071001	On-Off	SPOS07 STATUS
[Trigger ID304]	510001 0001081001	On-Off	SPOS08 STATUS
[Trigger ID305]	510001 0001091001	On-Off	SPOS09 STATUS
[Trigger ID306]	510001 00010A1001	On-Off	SPOS10 STATUS
[Trigger ID307]	510001 8001011E93	On	SPOS01 CONTROL END
[Trigger ID308]	510001 8001021E93	On	SPOS02 CONTROL END
[Trigger ID309]	510001 8001031E93	On	SPOS03 CONTROL END
[Trigger ID310]	510001 8001041E93	On	SPOS04 CONTROL END
[Trigger ID311]	510001 8001051E93	On	SPOS05 CONTROL END
[Trigger ID312]	510001 8001061E93	On	SPOS06 CONTROL END
[Trigger ID313]	510001 8001071E93	On	SPOS07 CONTROL END
[Trigger ID314]	510001 8001081E93	On	SPOS08 CONTROL END
[Trigger ID315]	510001 8001091E93	On	SPOS09 CONTROL END
[Trigger ID316]	510001 80010A1E93	On	SPOS10 CONTROL END
[Trigger ID317]	520001 3105011D81	On	TAP SLF
[Trigger ID318]	520001 3105011D82	On	TAP CCF
[Trigger ID319]	520001 3105011D84	On	TAP OPF
[Trigger ID320]	520001 3105011D86	On	TAP EXF
[Trigger ID321]	520001 8105011DD0	On	TAP RAISE
[Trigger ID322]	520001 8205011DD3	On	TAP LOWER
[Trigger ID323]	520001 8005011E93	On	TAP CONTROL END
[Trigger ID324]	520001 0005011F7C	On-Off	TAP HI
[Trigger ID325]	520001 0005011F7D	On-Off	TAP LOW
[Trigger ID326]	520001 0005011F7E	On-Off	TAP MAX LOW
[Trigger ID327]	520001 0005011F7F	On-Off	TAP MAX HIGH
[Trigger ID328]	522001 000A011001	On-Off	S43 CMDBLK
[Trigger ID329]	522001 000A021001	On-Off	S43 ILKBYP
[Trigger ID330]	522001 000A031001	On-Off	S43 SYNCBYP
[Trigger ID331]	522001 000A041001	On-Off	S4304 STATUS
[Trigger ID332]	522001 000A051001	On-Off	S4305 STATUS
[Trigger ID333]	522001 000A061001	On-Off	S4306 STATUS
[Trigger ID334]	522001 000A071001	On-Off	S4307 STATUS
[Trigger ID335]	522001 000A081001	On-Off	S4308 STATUS
[Trigger ID336]	522001 000A011D90	On	S43 CMDBLK SEL
[Trigger ID337]	522001 000A021D90	On	S43 ILKBYP SEL
[Trigger ID338]	522001 000A031D90	On	S43 SYNCBYP SEL
[Trigger ID339]	522001 000A041D90	On	S4304 SEL
[Trigger ID340]	522001 000A051D90	On	S4305 SEL
[Trigger ID341]	522001 000A061D90	On	S4306 SEL
[Trigger ID342]	522001 000A071D90	On	S4307 SEL
[Trigger ID343]	522001 000A081D90	On	S4308 SEL
[Trigger ID344]	523001 820D011F50	On	ASC01 START
[Trigger ID345]	523001 820D021F50	On	ASC02 START
[Trigger ID346]	523001 820D031F50	On	ASC03 START
[Trigger ID347]	523001 820D041F50	On	ASC04 START
[Trigger ID348]	523001 820D051F50	On	ASC05 START
[Trigger ID349]	523001 820D061F50	On	ASC06 START
[Trigger ID350]	523001 820D071F50	On	ASC07 START
[Trigger ID351]	523001 820D081F50	On	ASC08 START
[Trigger ID352]	523001 820D091F50	On	ASC09 START
[Trigger ID353]	523001 820D0A1F50	On	ASC10 START
[Trigger ID354]	523001 820D0B1F50	On	ASC11 START
[Trigger ID355]	523001 820D0C1F50	On	ASC12 START
[Trigger ID356]	523001 810D011F51	On	ASC01 STOP
[Trigger ID357]	523001 810D021F51	On	ASC02 STOP
[Trigger ID358]	523001 810D031F51	On	ASC03 STOP
[Trigger ID359]	523001 810D041F51	On	ASC04 STOP
[Trigger ID360]	523001 810D051F51	On	ASC05 STOP
[Trigger ID361]	523001 810D061F51	On	ASC06 STOP
[Trigger ID362]	523001 810D071F51	On	ASC07 STOP
[Trigger ID363]	523001 810D081F51	On	ASC08 STOP
[Trigger ID364]	523001 810D091F51	On	ASC09 STOP
[Trigger ID365]	523001 810D0A1F51	On	ASC10 STOP
[Trigger ID366]	523001 810D0B1F51	On	ASC11 STOP
[Trigger ID367]	523001 810D0C1F51	On	ASC12 STOP
[Trigger ID368]	523001 810D0D1F50	On	EMEGENCY STOP
[Trigger ID369]	528001 3107011EA1	On	LED RST
[Trigger ID370]	529001 310C011EA1	On	OPERATION TIME RST
[Trigger ID371]	560001 8D0B011F51	On	SYN1 SPLIT SYN
[Trigger ID372]	560001 860B011F52	On	SYN1 SEL FAI
[Trigger ID373]	560001 890B011F53	On	SYN1 LOOP SYN
[Trigger ID374]	560001 800B011F54	On-Off	SYN1 SYNBYP
[Trigger ID375]	560001 810B011F55	On	SYN1 S-CHK START
[Trigger ID376]	560001 820B011F56	On	SYN1 S-CHK FAI
[Trigger ID377]	560001 830B011F57	On	SYN1 S-CHK OK
[Trigger ID378]	560001 840B011F58	On	SYN1 V-CHK OK
[Trigger ID379]	560001 850B011F59	On	SYN1 EXE
[Trigger ID380]	560001 860B011F5A	On-Off	SYN1 VR-On.VI-On
[Trigger ID381]	560001 870B011F5B	On-Off	SYN1 VR-Off.VI-On
[Trigger ID382]	560001 880B011F5C	On-Off	SYN1 VR-Off.VI-Off
[Trigger ID383]	560001 890B011F5D	On-Off	SYN1 VR-On.VI-Off
[Trigger ID384]	560001 870B011F77	On-Off	SYN1 OPT .ZERO
[Trigger ID385]	560001 880B011F78	On-Off	SYN1 OPT .RED
[Trigger ID386]	560001 800B011F80	On-Off	SYN1 PLC-CHK OK
[Trigger ID387]	560001 800B011F81	On-Off	SYN1 RY1
[Trigger ID388]	560001 800B011F82	On-Off	SYN1 RY2
[Trigger ID389]	530001 3109001001	On	R/L Key
[Trigger ID390]	513001 3104011D81	On	TPOS1 SLF
[Trigger ID391]	513001 3104011D82	On	TPOS1 CCF
[Trigger ID392]	513001 3104011D84	On	TPOS1 OPF
[Trigger ID393]	513001 3104011D86	On	TPOS1 EXF
[Trigger ID394]	513001 3104021D81	On	TPOS2 SLF
[Trigger ID395]	513001 3104021D82	On	TPOS2 CCF
[Trigger ID396]	513001 3104021D84	On	TPOS2 OPF
[Trigger ID397]	513001 3104021D86	On	TPOS2 EXF
[Trigger ID398]	513001 3104031D81	On	TPOS3 SLF
[Trigger ID399]	513001 3104031D82	On	TPOS3 CCF
[Trigger ID400]	513001 3104031D84	On	TPOS3 OPF
[Trigger ID401]	513001 3104031D86	On	TPOS3 EXF
[Trigger ID402]	513001 8304011D02	On	TPOS1 P1
[Trigger ID403]	513001 8104011D03	On	TPOS1 P2
[Trigger ID404]	513001 8504011D04	On	TPOS1 P3
[Trigger ID405]	513001 8304021D02	On	TPOS2 P1
[Trigger ID406]	513001 8104021D03	On	TPOS2 P2
[Trigger ID407]	513001 8504021D04	On	TPOS2 P3
[Trigger ID408]	513001 8304031D02	On	TPOS3 P1
[Trigger ID409]	513001 8104031D03	On	TPOS3 P2
[Trigger ID410]	513001 8504031D04	On	TPOS3 P3
[Trigger ID411]	513001 8004011E93	On	TPOS1 CONTROL END
[Trigger ID412]	513001 8004021E93	On	TPOS2 CONTROL END
[Trigger ID413]	513001 8004031E93	On	TPOS3 CONTROL END
[Trigger ID414]	540001 8B0E011E7B	On	ARC CLOSE SEL FAI
[Trigger ID415]	540001 8B0E021E7B	On	GCNT2 SEL FAI
[Trigger ID416]	540001 8B0E031E7B	On	GCNT3 SEL FAI
[Trigger ID417]	540001 8B0E041E7B	On	GCNT4 SEL FAI
[Trigger ID418]	540001 8B0E051E7B	On	GCNT5 SEL FAI
[Trigger ID419]	540001 8B0E061E7B	On	GCNT6 SEL FAI
[Trigger ID420]	540001 8B0E071E7B	On	GCNT7 SEL FAI
[Trigger ID421]	540001 8B0E081E7B	On	GCNT8 SEL FAI
[Trigger ID422]	540001 8B0E091E7B	On	GCNT9 SEL FAI
[Trigger ID423]	540001 8B0E0A1E7B	On	GCNT10 SEL FAI
[Trigger ID424]	540001 8B0E0B1E7B	On	GCNT11 SEL FAI
[Trigger ID425]	540001 8B0E0C1E7B	On	GCNT12 SEL FAI
[Trigger ID426]	540001 8B0E0D1E7B	On	GCNT13 SEL FAI
[Trigger ID427]	540001 8B0E0E1E7B	On	GCNT14 SEL FAI
[Trigger ID428]	540001 8B0E0F1E7B	On	GCNT15 SEL FAI
[Trigger ID429]	540001 8B0E101E7B	On	GCNT16 SEL FAI
[Trigger ID430]	540001 8B0E111E7B	On	GCNT17 SEL FAI
[Trigger ID431]	540001 8B0E121E7B	On	GCNT18 SEL FAI
[Trigger ID432]	540001 8B0E131E7B	On	GCNT19 SEL FAI
[Trigger ID433]	540001 8B0E141E7B	On	GCNT20 SEL FAI
[Trigger ID434]	540001 8B0E151E7B	On	GCNT21 SEL FAI
[Trigger ID435]	540001 8B0E161E7B	On	GCNT22 SEL FAI
[Trigger ID436]	540001 8B0E171E7B	On	GCNT23 SEL FAI
[Trigger ID437]	540001 8B0E181E7B	On	GCNT24 SEL FAI
[Trigger ID438]	540001 8B0E191E7B	On	GCNT25 SEL FAI
[Trigger ID439]	540001 8B0E1A1E7B	On	GCNT26 SEL FAI
[Trigger ID440]	540001 8B0E1B1E7B	On	GCNT27 SEL FAI
[Trigger ID441]	540001 8B0E1C1E7B	On	GCNT28 SEL FAI
[Trigger ID442]	540001 8B0E1D1E7B	On	GCNT29 SEL FAI
[Trigger ID443]	540001 8B0E1E1E7B	On	GCNT30 SEL FAI
[Trigger ID444]	540001 8B0E1F1E7B	On	GCNT31 SEL FAI
[Trigger ID445]	540001 8B0E201E7B	On	GCNT32 SEL FAI
[Trigger ID446]	540001 830E011E8B	On	ARC CLOSE EXE FAI
[Trigger ID447]	540001 830E021E8B	On	GCNT2 EXE FAI
[Trigger ID448]	540001 830E031E8B	On	GCNT3 EXE FAI
[Trigger ID449]	540001 830E041E8B	On	GCNT4 EXE FAI
[Trigger ID450]	540001 830E051E8B	On	GCNT5 EXE FAI
[Trigger ID451]	540001 830E061E8B	On	GCNT6 EXE FAI
[Trigger ID452]	540001 830E071E8B	On	GCNT7 EXE FAI
[Trigger ID453]	540001 830E081E8B	On	GCNT8 EXE FAI
[Trigger ID454]	540001 830E091E8B	On	GCNT9 EXE FAI
[Trigger ID455]	540001 830E0A1E8B	On	GCNT10 EXE FAI
[Trigger ID456]	540001 830E0B1E8B	On	GCNT11 EXE FAI
[Trigger ID457]	540001 830E0C1E8B	On	GCNT12 EXE FAI
[Trigger ID458]	540001 830E0D1E8B	On	GCNT13 EXE FAI
[Trigger ID459]	540001 830E0E1E8B	On	GCNT14 EXE FAI
[Trigger ID460]	540001 830E0F1E8B	On	GCNT15 EXE FAI
[Trigger ID461]	540001 830E101E8B	On	GCNT16 EXE FAI
[Trigger ID462]	540001 830E111E8B	On	GCNT17 EXE FAI
[Trigger ID463]	540001 830E121E8B	On	GCNT18 EXE FAI
[Trigger ID464]	540001 830E131E8B	On	GCNT19 EXE FAI
[Trigger ID465]	540001 830E141E8B	On	GCNT20 EXE FAI
[Trigger ID466]	540001 830E151E8B	On	GCNT21 EXE FAI
[Trigger ID467]	540001 830E161E8B	On	GCNT22 EXE FAI
[Trigger ID468]	540001 830E171E8B	On	GCNT23 EXE FAI
[Trigger ID469]	540001 830E181E8B	On	GCNT24 EXE FAI
[Trigger ID470]	540001 830E191E8B	On	GCNT25 EXE FAI
[Trigger ID471]	540001 830E1A1E8B	On	GCNT26 EXE FAI
[Trigger ID472]	540001 830E1B1E8B	On	GCNT27 EXE FAI
[Trigger ID473]	540001 830E1C1E8B	On	GCNT28 EXE FAI
[Trigger ID474]	540001 830E1D1E8B	On	GCNT29 EXE FAI
[Trigger ID475]	540001 830E1E1E8B	On	GCNT30 EXE FAI
[Trigger ID476]	540001 830E1F1E8B	On	GCNT31 EXE FAI
[Trigger ID477]	540001 830E201E8B	On	GCNT32 EXE FAI
[Trigger ID478]	540001 820E011E84	On	ARC CLOSE EXE OK
[Trigger ID479]	540001 820E021E84	On	GCNT2 EXE OK
[Trigger ID480]	540001 820E031E84	On	GCNT3 EXE OK
[Trigger ID481]	540001 820E041E84	On	GCNT4 EXE OK
[Trigger ID482]	540001 820E051E84	On	GCNT5 EXE OK
[Trigger ID483]	540001 820E061E84	On	GCNT6 EXE OK
[Trigger ID484]	540001 820E071E84	On	GCNT7 EXE OK
[Trigger ID485]	540001 820E081E84	On	GCNT8 EXE OK
[Trigger ID486]	540001 820E091E84	On	GCNT9 EXE OK
[Trigger ID487]	540001 820E0A1E84	On	GCNT10 EXE OK
[Trigger ID488]	540001 820E0B1E84	On	GCNT11 EXE OK
[Trigger ID489]	540001 820E0C1E84	On	GCNT12 EXE OK
[Trigger ID490]	540001 820E0D1E84	On	GCNT13 EXE OK
[Trigger ID491]	540001 820E0E1E84	On	GCNT14 EXE OK
[Trigger ID492]	540001 820E0F1E84	On	GCNT15 EXE OK
[Trigger ID493]	540001 820E101E84	On	GCNT16 EXE OK
[Trigger ID494]	540001 820E111E84	On	GCNT17 EXE OK
[Trigger ID495]	540001 820E121E84	On	GCNT18 EXE OK
[Trigger ID496]	540001 820E131E84	On	GCNT19 EXE OK
[Trigger ID497]	540001 820E141E84	On	GCNT20 EXE OK
[Trigger ID498]	540001 820E151E84	On	GCNT21 EXE OK
[Trigger ID499]	540001 820E161E84	On	GCNT22 EXE OK
[Trigger ID500]	540001 820E171E84	On	GCNT23 EXE OK
[Trigger ID501]	540001 820E181E84	On	GCNT24 EXE OK
[Trigger ID502]	540001 820E191E84	On	GCNT25 EXE OK
[Trigger ID503]	540001 820E1A1E84	On	GCNT26 EXE OK
[Trigger ID504]	540001 820E1B1E84	On	GCNT27 EXE OK
[Trigger ID505]	540001 820E1C1E84	On	GCNT28 EXE OK
[Trigger ID506]	540001 820E1D1E84	On	GCNT29 EXE OK
[Trigger ID507]	540001 820E1E1E84	On	GCNT30 EXE OK
[Trigger ID508]	540001 820E1F1E84	On	GCNT31 EXE OK
[Trigger ID509]	540001 820E201E84	On	GCNT32 EXE OK
[Trigger ID510]	(Not Assigned)	Off	-
[Trigger ID511]	(Not Assigned)	Off	-
[Trigger ID512]	(Not Assigned)	Off	-

Table 7.2-4 Event3 group set with [End of E.Record-2]=512

Triggers	Data IDs	Modes	Names
[Trigger ID513]	5A0001 0008001FB3	On-Off	STOP: CHK
[Trigger ID514]	511001 8302011D02	On	DPSY1 OPEN
[Trigger ID515]	511001 8302021D02	On	DPSY2 OPEN
[Trigger ID516]	511001 8102011D03	On	DPSY1 CLOSE
[Trigger ID517]	511001 8102021D03	On	DPSY2 CLOSE
[Trigger ID518]	511001 3102011D81	On	DPSY1 SLF
[Trigger ID519]	511001 3102011D82	On	DPSY1 CCF
[Trigger ID520]	511001 3102011D84	On	DPSY1 OPF
[Trigger ID521]	511001 3102011D86	On	DPSY1 EXF
[Trigger ID522]	511001 3102021D81	On	DPSY2 SLF
[Trigger ID523]	511001 3102021D82	On	DPSY2 CCF
[Trigger ID524]	511001 3102021D84	On	DPSY2 OPF
[Trigger ID525]	511001 3102021D86	On	DPSY2 EXF
[Trigger ID526]	511001 8002011E93	On	DPSY1 CONTROL END
[Trigger ID527]	511001 8002021E93	On	DPSY2 CONTROL END
[Trigger ID528]	512001 3103011D81	On	DPOS01 SLF
[Trigger ID529]	512001 3103011D82	On	DPOS01 CCF
[Trigger ID530]	512001 3103011D84	On	DPOS01 OPF
[Trigger ID531]	512001 3103011D86	On	DPOS01 EXF
[Trigger ID532]	512001 3103021D81	On	DPOS02 SLF
[Trigger ID533]	512001 3103021D82	On	DPOS02 CCF
[Trigger ID534]	512001 3103021D84	On	DPOS02 OPF
[Trigger ID535]	512001 3103021D86	On	DPOS02 EXF
[Trigger ID536]	512001 3103031D81	On	DPOS03 SLF
[Trigger ID537]	512001 3103031D82	On	DPOS03 CCF
[Trigger ID538]	512001 3103031D84	On	DPOS03 OPF
[Trigger ID539]	512001 3103031D86	On	DPOS03 EXF
[Trigger ID540]	512001 3103041D81	On	DPOS04 SLF
[Trigger ID541]	512001 3103041D82	On	DPOS04 CCF
[Trigger ID542]	512001 3103041D84	On	DPOS04 OPF
[Trigger ID543]	512001 3103041D86	On	DPOS04 EXF
[Trigger ID544]	512001 3103051D81	On	DPOS05 SLF
[Trigger ID545]	512001 3103051D82	On	DPOS05 CCF
[Trigger ID546]	512001 3103051D84	On	DPOS05 OPF
[Trigger ID547]	512001 3103051D86	On	DPOS05 EXF
[Trigger ID548]	512001 3103061D81	On	DPOS06 SLF
[Trigger ID549]	512001 3103061D82	On	DPOS06 CCF
[Trigger ID550]	512001 3103061D84	On	DPOS06 OPF
[Trigger ID551]	512001 3103061D86	On	DPOS06 EXF
[Trigger ID552]	512001 3103071D81	On	DPOS07 SLF
[Trigger ID553]	512001 3103071D82	On	DPOS07 CCF
[Trigger ID554]	512001 3103071D84	On	DPOS07 OPF
[Trigger ID555]	512001 3103071D86	On	DPOS07 EXF
[Trigger ID556]	512001 3103081D81	On	DPOS08 SLF
[Trigger ID557]	512001 3103081D82	On	DPOS08 CCF
[Trigger ID558]	512001 3103081D84	On	DPOS08 OPF
[Trigger ID559]	512001 3103081D86	On	DPOS08 EXF
[Trigger ID560]	512001 3103091D81	On	DPOS09 SLF
[Trigger ID561]	512001 3103091D82	On	DPOS09 CCF
[Trigger ID562]	512001 3103091D84	On	DPOS09 OPF
[Trigger ID563]	512001 3103091D86	On	DPOS09 EXF
[Trigger ID564]	512001 31030A1D81	On	DPOS10 SLF
[Trigger ID565]	512001 31030A1D82	On	DPOS10 CCF
[Trigger ID566]	512001 31030A1D84	On	DPOS10 OPF
[Trigger ID567]	512001 31030A1D86	On	DPOS10 EXF
[Trigger ID568]	512001 31030B1D81	On	DPOS11 SLF
[Trigger ID569]	512001 31030B1D82	On	DPOS11 CCF
[Trigger ID570]	512001 31030B1D84	On	DPOS11 OPF
[Trigger ID571]	512001 31030B1D86	On	DPOS11 EXF
[Trigger ID572]	512001 31030C1D81	On	DPOS12 SLF
[Trigger ID573]	512001 31030C1D82	On	DPOS12 CCF
[Trigger ID574]	512001 31030C1D84	On	DPOS12 OPF
[Trigger ID575]	512001 31030C1D86	On	DPOS12 EXF
[Trigger ID576]	512001 31030D1D81	On	DPOS13 SLF
[Trigger ID577]	512001 31030D1D82	On	DPOS13 CCF
[Trigger ID578]	512001 31030D1D84	On	DPOS13 OPF
[Trigger ID579]	512001 31030D1D86	On	DPOS13 EXF
[Trigger ID580]	512001 31030E1D81	On	DPOS14 SLF
[Trigger ID581]	512001 31030E1D82	On	DPOS14 CCF
[Trigger ID582]	512001 31030E1D84	On	DPOS14 OPF
[Trigger ID583]	512001 31030E1D86	On	DPOS14 EXF
[Trigger ID584]	512001 31030F1D81	On	DPOS15 SLF
[Trigger ID585]	512001 31030F1D82	On	DPOS15 CCF
[Trigger ID586]	512001 31030F1D84	On	DPOS15 OPF
[Trigger ID587]	512001 31030F1D86	On	DPOS15 EXF
[Trigger ID588]	512001 3103101D81	On	DPOS16 SLF
[Trigger ID589]	512001 3103101D82	On	DPOS16 CCF
[Trigger ID590]	512001 3103101D84	On	DPOS16 OPF
[Trigger ID591]	512001 3103101D86	On	DPOS16 EXF
[Trigger ID592]	512001 3103111D81	On	DPOS17 SLF
[Trigger ID593]	512001 3103111D82	On	DPOS17 CCF
[Trigger ID594]	512001 3103111D84	On	DPOS17 OPF
[Trigger ID595]	512001 3103111D86	On	DPOS17 EXF
[Trigger ID596]	512001 3103121D81	On	DPOS18 SLF
[Trigger ID597]	512001 3103121D82	On	DPOS18 CCF
[Trigger ID598]	512001 3103121D84	On	DPOS18 OPF
[Trigger ID599]	512001 3103121D86	On	DPOS18 EXF
[Trigger ID600]	512001 3103131D81	On	DPOS19 SLF
[Trigger ID601]	512001 3103131D82	On	DPOS19 CCF
[Trigger ID602]	512001 3103131D84	On	DPOS19 OPF
[Trigger ID603]	512001 3103131D86	On	DPOS19 EXF
[Trigger ID604]	512001 3103141D81	On	DPOS20 SLF
[Trigger ID605]	512001 3103141D82	On	DPOS20 CCF
[Trigger ID606]	512001 3103141D84	On	DPOS20 OPF
[Trigger ID607]	512001 3103141D86	On	DPOS20 EXF
[Trigger ID608]	512001 8003011F40	On-Off	DPOS01 UNDEFINE
[Trigger ID609]	512001 8003021F40	On-Off	DPOS02 UNDEFINE
[Trigger ID610]	512001 8003031F40	On-Off	DPOS03 UNDEFINE
[Trigger ID611]	512001 8003041F40	On-Off	DPOS04 UNDEFINE
[Trigger ID612]	512001 8003051F40	On-Off	DPOS05 UNDEFINE
[Trigger ID613]	512001 8003061F40	On-Off	DPOS06 UNDEFINE
[Trigger ID614]	512001 8003071F40	On-Off	DPOS07 UNDEFINE
[Trigger ID615]	512001 8003081F40	On-Off	DPOS08 UNDEFINE
[Trigger ID616]	512001 8003091F40	On-Off	DPOS09 UNDEFINE
[Trigger ID617]	512001 80030A1F40	On-Off	DPOS10 UNDEFINE
[Trigger ID618]	512001 80030B1F40	On-Off	DPOS11 UNDEFINE
[Trigger ID619]	512001 80030C1F40	On-Off	DPOS12 UNDEFINE
[Trigger ID620]	512001 80030D1F40	On-Off	DPOS13 UNDEFINE
[Trigger ID621]	512001 80030E1F40	On-Off	DPOS14 UNDEFINE
[Trigger ID622]	512001 80030F1F40	On-Off	DPOS15 UNDEFINE
[Trigger ID623]	512001 8003101F40	On-Off	DPOS16 UNDEFINE
[Trigger ID624]	512001 8003111F40	On-Off	DPOS17 UNDEFINE
[Trigger ID625]	512001 8003121F40	On-Off	DPOS18 UNDEFINE
[Trigger ID626]	512001 8003131F40	On-Off	DPOS19 UNDEFINE
[Trigger ID627]	512001 8003141F40	On-Off	DPOS20 UNDEFINE
[Trigger ID628]	512001 8003151F40	On-Off	DPOS21 UNDEFINE
[Trigger ID629]	512001 8003161F40	On-Off	DPOS22 UNDEFINE
[Trigger ID630]	512001 8003171F40	On-Off	DPOS23 UNDEFINE
[Trigger ID631]	512001 8003181F40	On-Off	DPOS24 UNDEFINE
[Trigger ID632]	512001 8003191F40	On-Off	DPOS25 UNDEFINE
[Trigger ID633]	512001 80031A1F40	On-Off	DPOS26 UNDEFINE
[Trigger ID634]	512001 80031B1F40	On-Off	DPOS27 UNDEFINE
[Trigger ID635]	512001 80031C1F40	On-Off	DPOS28 UNDEFINE
[Trigger ID636]	512001 80031D1F40	On-Off	DPOS29 UNDEFINE
[Trigger ID637]	512001 80031E1F40	On-Off	DPOS30 UNDEFINE
[Trigger ID638]	512001 8103011F41	On-Off	DPOS01 FAULTY
[Trigger ID639]	512001 8103021F41	On-Off	DPOS02 FAULTY
[Trigger ID640]	512001 8103031F41	On-Off	DPOS03 FAULTY
[Trigger ID641]	512001 8103041F41	On-Off	DPOS04 FAULTY
[Trigger ID642]	512001 8103051F41	On-Off	DPOS05 FAULTY
[Trigger ID643]	512001 8103061F41	On-Off	DPOS06 FAULTY
[Trigger ID644]	512001 8103071F41	On-Off	DPOS07 FAULTY
[Trigger ID645]	512001 8103081F41	On-Off	DPOS08 FAULTY
[Trigger ID646]	512001 8103091F41	On-Off	DPOS09 FAULTY
[Trigger ID647]	512001 81030A1F41	On-Off	DPOS10 FAULTY
[Trigger ID648]	512001 81030B1F41	On-Off	DPOS11 FAULTY
[Trigger ID649]	512001 81030C1F41	On-Off	DPOS12 FAULTY
[Trigger ID650]	512001 81030D1F41	On-Off	DPOS13 FAULTY
[Trigger ID651]	512001 81030E1F41	On-Off	DPOS14 FAULTY
[Trigger ID652]	512001 81030F1F41	On-Off	DPOS15 FAULTY
[Trigger ID653]	512001 8103101F41	On-Off	DPOS16 FAULTY
[Trigger ID654]	512001 8103111F41	On-Off	DPOS17 FAULTY
[Trigger ID655]	512001 8103121F41	On-Off	DPOS18 FAULTY
[Trigger ID656]	512001 8103131F41	On-Off	DPOS19 FAULTY
[Trigger ID657]	512001 8103141F41	On-Off	DPOS20 FAULTY
[Trigger ID658]	512001 8103151F41	On-Off	DPOS21 FAULTY
[Trigger ID659]	512001 8103161F41	On-Off	DPOS22 FAULTY
[Trigger ID660]	512001 8103171F41	On-Off	DPOS23 FAULTY
[Trigger ID661]	512001 8103181F41	On-Off	DPOS24 FAULTY
[Trigger ID662]	512001 8103191F41	On-Off	DPOS25 FAULTY
[Trigger ID663]	512001 81031A1F41	On-Off	DPOS26 FAULTY
[Trigger ID664]	512001 81031B1F41	On-Off	DPOS27 FAULTY
[Trigger ID665]	512001 81031C1F41	On-Off	DPOS28 FAULTY
[Trigger ID666]	512001 81031D1F41	On-Off	DPOS29 FAULTY
[Trigger ID667]	512001 81031E1F41	On-Off	DPOS30 FAULTY
[Trigger ID668]	512001 8003011E93	On	DPOS01 CONTROL END
[Trigger ID669]	512001 8003021E93	On	DPOS02 CONTROL END
[Trigger ID670]	512001 8003031E93	On	DPOS03 CONTROL END
[Trigger ID671]	512001 8003041E93	On	DPOS04 CONTROL END
[Trigger ID672]	512001 8003051E93	On	DPOS05 CONTROL END
[Trigger ID673]	512001 8003061E93	On	DPOS06 CONTROL END
[Trigger ID674]	512001 8003071E93	On	DPOS07 CONTROL END
[Trigger ID675]	512001 8003081E93	On	DPOS08 CONTROL END
[Trigger ID676]	512001 8003091E93	On	DPOS09 CONTROL END
[Trigger ID677]	512001 80030A1E93	On	DPOS10 CONTROL END
[Trigger ID678]	512001 80030B1E93	On	DPOS11 CONTROL END
[Trigger ID679]	512001 80030C1E93	On	DPOS12 CONTROL END
[Trigger ID680]	512001 80030D1E93	On	DPOS13 CONTROL END
[Trigger ID681]	512001 80030E1E93	On	DPOS14 CONTROL END
[Trigger ID682]	512001 80030F1E93	On	DPOS15 CONTROL END
[Trigger ID683]	512001 8003101E93	On	DPOS16 CONTROL END
[Trigger ID684]	512001 8003111E93	On	DPOS17 CONTROL END
[Trigger ID685]	512001 8003121E93	On	DPOS18 CONTROL END
[Trigger ID686]	512001 8003131E93	On	DPOS19 CONTROL END
[Trigger ID687]	512001 8003141E93	On	DPOS20 CONTROL END
[Trigger ID688]	512001 8303011D02	On	DPOS01 OPEN
[Trigger ID689]	512001 8303021D02	On	DPOS02 OPEN
[Trigger ID690]	512001 8303031D02	On	DPOS03 OPEN
[Trigger ID691]	512001 8303041D02	On	DPOS04 OPEN
[Trigger ID692]	512001 8303051D02	On	DPOS05 OPEN
[Trigger ID693]	512001 8303061D02	On	DPOS06 OPEN
[Trigger ID694]	512001 8303071D02	On	DPOS07 OPEN
[Trigger ID695]	512001 8303081D02	On	DPOS08 OPEN
[Trigger ID696]	512001 8303091D02	On	DPOS09 OPEN
[Trigger ID697]	512001 83030A1D02	On	DPOS10 OPEN
[Trigger ID698]	512001 83030B1D02	On	DPOS11 OPEN
[Trigger ID699]	512001 83030C1D02	On	DPOS12 OPEN
[Trigger ID700]	512001 83030D1D02	On	DPOS13 OPEN
[Trigger ID701]	512001 83030E1D02	On	DPOS14 OPEN
[Trigger ID702]	512001 83030F1D02	On	DPOS15 OPEN
[Trigger ID703]	512001 8303101D02	On	DPOS16 OPEN
[Trigger ID704]	512001 8303111D02	On	DPOS17 OPEN
[Trigger ID705]	512001 8303121D02	On	DPOS18 OPEN
[Trigger ID706]	512001 8303131D02	On	DPOS19 OPEN
[Trigger ID707]	512001 8303141D02	On	DPOS20 OPEN
[Trigger ID708]	512001 8303151D02	On	DPOS21 OPEN
[Trigger ID709]	512001 8303161D02	On	DPOS22 OPEN
[Trigger ID710]	512001 8303171D02	On	DPOS23 OPEN
[Trigger ID711]	512001 8303181D02	On	DPOS24 OPEN
[Trigger ID712]	512001 8303191D02	On	DPOS25 OPEN
[Trigger ID713]	512001 83031A1D02	On	DPOS26 OPEN
[Trigger ID714]	512001 83031B1D02	On	DPOS27 OPEN
[Trigger ID715]	512001 83031C1D02	On	DPOS28 OPEN
[Trigger ID716]	512001 83031D1D02	On	DPOS29 OPEN
[Trigger ID717]	512001 83031E1D02	On	DPOS30 OPEN
[Trigger ID718]	512001 8103011D03	On	DPOS01 CLOSE
[Trigger ID719]	512001 8103021D03	On	DPOS02 CLOSE
[Trigger ID720]	512001 8103031D03	On	DPOS03 CLOSE
[Trigger ID721]	512001 8103041D03	On	DPOS04 CLOSE
[Trigger ID722]	512001 8103051D03	On	DPOS05 CLOSE
[Trigger ID723]	512001 8103061D03	On	DPOS06 CLOSE
[Trigger ID724]	512001 8103071D03	On	DPOS07 CLOSE
[Trigger ID725]	512001 8103081D03	On	DPOS08 CLOSE
[Trigger ID726]	512001 8103091D03	On	DPOS09 CLOSE
[Trigger ID727]	512001 81030A1D03	On	DPOS10 CLOSE
[Trigger ID728]	512001 81030B1D03	On	DPOS11 CLOSE
[Trigger ID729]	512001 81030C1D03	On	DPOS12 CLOSE
[Trigger ID730]	512001 81030D1D03	On	DPOS13 CLOSE
[Trigger ID731]	512001 81030E1D03	On	DPOS14 CLOSE
[Trigger ID732]	512001 81030F1D03	On	DPOS15 CLOSE
[Trigger ID733]	512001 8103101D03	On	DPOS16 CLOSE
[Trigger ID734]	512001 8103111D03	On	DPOS17 CLOSE
[Trigger ID735]	512001 8103121D03	On	DPOS18 CLOSE
[Trigger ID736]	512001 8103131D03	On	DPOS19 CLOSE
[Trigger ID737]	512001 8103141D03	On	DPOS20 CLOSE
[Trigger ID738]	512001 8103151D03	On	DPOS21 CLOSE
[Trigger ID739]	512001 8103161D03	On	DPOS22 CLOSE
[Trigger ID740]	512001 8103171D03	On	DPOS23 CLOSE
[Trigger ID741]	512001 8103181D03	On	DPOS24 CLOSE
[Trigger ID742]	512001 8103191D03	On	DPOS25 CLOSE
[Trigger ID743]	512001 81031A1D03	On	DPOS26 CLOSE
[Trigger ID744]	512001 81031B1D03	On	DPOS27 CLOSE
[Trigger ID745]	512001 81031C1D03	On	DPOS28 CLOSE
[Trigger ID746]	512001 81031D1D03	On	DPOS29 CLOSE
[Trigger ID747]	512001 81031E1D03	On	DPOS30 CLOSE
[Trigger ID748]	(Not Assigned)	Off	-
[Trigger ID749]	(Not Assigned)	Off	-
[Trigger ID760]	550001 3113011D84	On	MDCTRL OPF
[Trigger ID761]	550001 3113011D86	On	MDCTRL EXF
[Trigger ID762]	550001 2013011001	Change	MDCTRL STATUS
[Trigger ID763]	550001 8013011E93	On	MDCTRL CONTROL END
[Trigger ID764]	(Not Assigned)	Off	-
[Trigger ID765]	(Not Assigned)	Off	-
[Trigger ID766]	(Not Assigned)	Off	-
[Trigger ID767]	(Not Assigned)	Off	-
[Trigger ID768]	(Not Assigned)	Off	-

7.2.2 Trigger modes

We can simplify the trigger signals into four: 'On', 'Off', 'On and Off', and 'Change' modes. Thus, the user can should set a mode for respective triggers using [**Trigger Mode1**] and others.

(i) 'On' mode

In the 'On' mode, the event recorder can take an action when the trigger signal is switched to 'On', as shown in Figure 7.2-2. For the operation, set **On** for the [**Trigger Mode***].

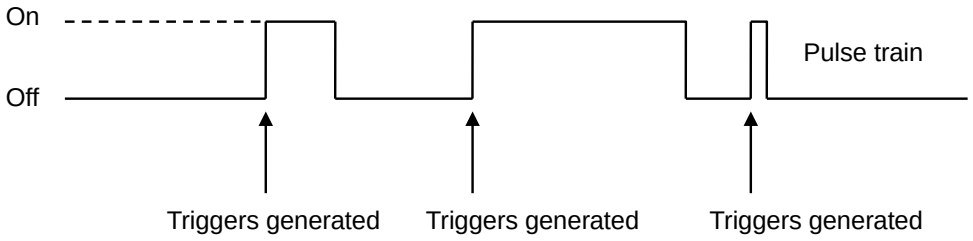


Figure 7.2-2 Trigger generated at 'On' mode

(ii) 'Off' mode

The 'Off' mode is the other way of the 'On' mode; set **Off** for the operation.

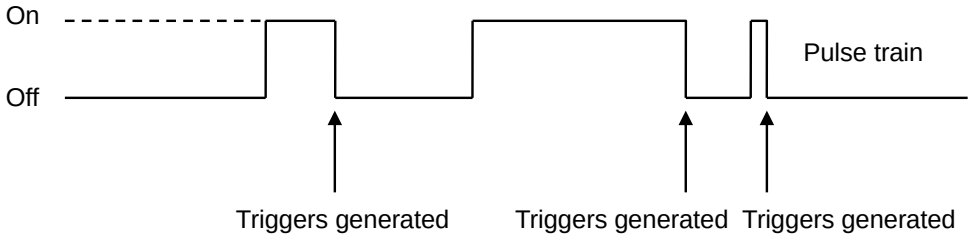


Figure 7.2-3 Trigger generated at 'Off' mode

(iii) 'On-Off' mode

In the 'On-Off' mode, the trigger signal is generated when the pulse train is changed from 'On to Off' and 'Off to On' both, as shown in Figure 7.2-4. Set **On-Off** for the operation

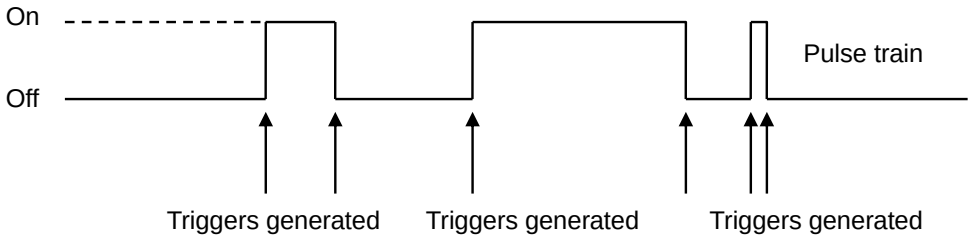


Figure 7.2-4 Trigger generated at 'On-Off' mode

(iv) 'Change' mode

The 'Change mode' is provided to detect the increment or the decrement of a number, when new number is generated in the PLC logic. For example, this mode allows to detect the change

of group settings (e.g., the 'SYS_CHG' signal; which has been connected with the trigger#9 using the setting [**Trigger ID9**], as default; we have been discussed in Chapter *Technical description: Group setting for protection functions*.)

7.2.3 Screen information

Figure 7.2-5 illustrates the structure about the 'Event Recored1' group, which can be shown the latest event#1 at the top structure (line ⓑ). The lines ⓒ and ⓓ describes how an event occurred for the event#1. Preceding event#2, event#3, etc. are shown below the event#1. Similarly, the information about the 'Event Record2' and 'Event Record3' groups are displayed on the IED screen.

†Note:For more information about the screen operation, see Chapter *User interface: Record sub-menu*.

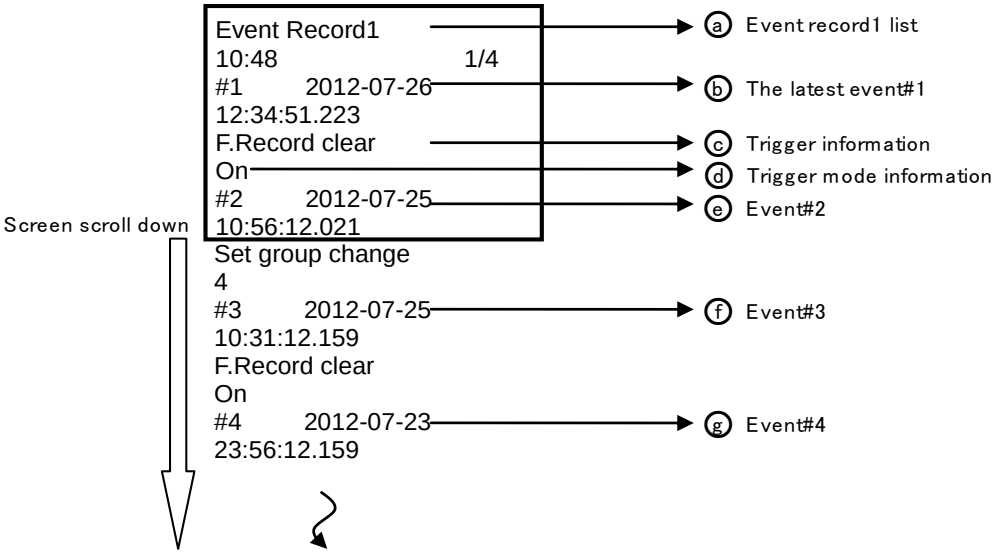


Figure 7.2-5 Event information grouped in the Event record1

7.2.4 Setup for the event recorder

Consider that a trip-command, which is denoted with Data ID '4A1001 8300001B6F', should be sorted into the 'Event record1' group. The settings [**End of E.Record-1**]=256 and [**End of E.Record-2**]=512 have been made as default; hence, we may select it with the trigger#157 by setting the [**Trigger ID157**]= '4A1001 8300001B6F'. Set **On-OFF** for the [**Trigger Mode157**], because the pulse-train of the trip command should be recorded along the pick-up and drop-off times. Remember that the preferred name for the Trigger ID157 should be set using the [**Event Name157**].

7.2.5 Setting

Setting of EVENTRECORD(Function ID: 200710)

Setting item		Range	Units	Contents	Default setting value	Notes
	End of E.Record-1	0 to 768	–	The last position of the event group1	256	
	End of E.Record-2	0 to 768	–	The last position of the event group2	512	
	Trigger ID1	(Preferred DataID)	–	Trigger signal1 for the operation	–	
	Tigger Mode1	On / Off / On-Off / Change	–	Mode setting for the detection	–	
	Event name1	(Preferred name)	–	Name of the trigger signal1	–	
	Trigger ID2	(Preferred DataID)	–	Trigger signal2 for the operation	–	
	Tigger Mode2	On / Off / On-Off / Change	–	Mode setting for the detection	–	
	Event name2	(Preferred name)	–	Name of the trigger signal2	–	
	.....	.....	–	.....	–	
	.....	.....	–	.....	–	
	.....	.....	–	.....	–	
	Trigger ID768	(Preferred DataID)	–	Trigger signal768 for the operation	–	
	Tigger Mode768	On / Off / On-Off / Change	–	Mode setting for the detection	–	
	Event name768	(Preferred name)	–	Name of the trigger signal768	–	

7.2.6 Signal (Data ID)

◆ Signal monitoring point

EVENTRECORD (Function ID: 200710)

Name	Element ID	Description
ER1_CLR	3001001001	Clearing the data in Event group1
ER2_CLR	3002001001	Clearing the data in Event group2
ER3_CLR	3003001001	Clearing the data in Event group3
POWER ON	3100001001	Detection of switch On

7.3 Disturbance recorder

Disturbance recorder is to record the phenomenon about the occurrences of the fault with 1ms accuracy; the disturbance recorder is operated with the reception of the TRC trip command. The disturbance recorder has exclusive overcurrent and other relays; thus, they can also start the disturbance recorder when the exclusive relays detects abnormal phenomenon. Additionally, the disturbance recorder can accept the instruction of the PLC function using settings. The recording time and the sampling time are programmable; thus, the measuring values about currents, voltage, frequency, and logic signals are collected in accordance with the recording and the sampling times. The logic signals are also memorized during the disturbance phenomenon; the disturbance recorder can hold up to 256 signals. The recording number of the disturbance phenomena is limited by the recording and sampling times.

7.3.1 Recording time and amount

(i) Time settings

Period of the recording is set using the [**Record Time**]. The disturbance recorder can operate before the occurrence of the fault; the time before the fault occurrence can be set using the [**Pre-fault Time**]. The user can choose a time among 0.1 sec. to 10.0 sec.

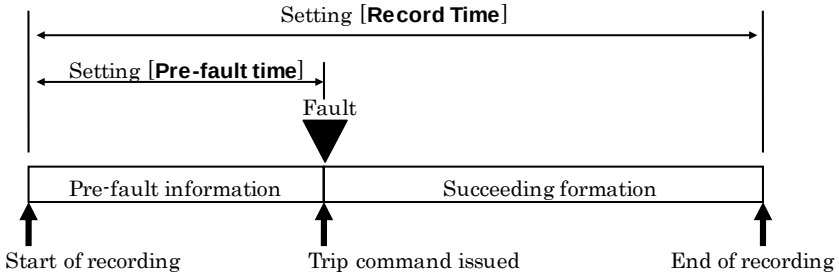


Figure 7.3-1 Period of recording time

(ii) Sampling rate setting

Sampling time is defined with setting [**Sampling rate**]; it can be selected either 7.5 electrical degrees or 15 electrical degrees. For example, if the user set **7.5** for the [**Sampling rate**], the disturbance recorder starts to collect the date in the sampling rate (2400Hz) in 50Hz system.

(iii) Trip command setting

As shown in Figure 7.3-1, the disturbance recorder starts when the trip command is issued, provided **On** is set for the [**Trip Trig.Sw**]. The user has to set **Off** for the setting, if the disturbance recorder shall not start with the trip command.

7.3.2 Relays within disturbance recorder

Four relays are provided in the disturbance recorder exclusively: OC-DRT, EF-DRT, UV-DRT, and UVS-DRT relays.

(i) OC-DRT relay setting

An overcurrent relay within the disturbance recorder (OC-DRT) is provided. The user should set a pick-up value for the relay to commence the disturbance recorder. Use the setting [**OC-DRT**]; then set **On** for the [**OC-DRT-EN**] if this relay operation is required to commence the recording.

(ii) EF-DRT relay setting

An earth fault relay (EF-DRT) is provided; set the pick-up value for the [**EF-DRT**]; then set **On** for the [**EF-DRT-EN**].

(iii) UV-DRT relay setting

An under-voltage relay (Line-ground) (UV-DRT) is provided. Set the value for the [**UV-DRT**]; then set **On** for the [**UV-DRT-EN**].

(iv) UVS-DRT relay setting

An under-voltage relay (Line-Line) (UVS-DRT) is provided. Set the value for the [**UVS-DRT**]; then set **On** for the [**UVS-DRT-EN**].

7.3.3 Maximum number for recording disturbance phenomena

Note that the maximum number for recording the disturbance phenomena depends on the recording time and the sampling rate. Table 7.3-1 illustrates the maximum number. For example, the 213 phenomena can be memorized in the disturbance recorder, when the [**Record Time**] =1 and the [**Sampling Rate**] =7.5° elec., if the IED operates in 50Hz system. The user can also check the maximum number on the IED screen (See Figure 7.3-2).

Table 7.3-1 Max number depending on time settings

Recording period set with [**Record Time**]	Max. recording number for Disturbance phenomena			
	Setting [**Sampling Rate**] in 50Hz sys.		Setting [**Sampling Rate**] in 60Hz sys.	
	7.5°	**15°**	**7.5°**	**15°**
1 sec	213	405	179	343
3 sec	73	144	61	121
5 sec	44	88	37	73

7.3.4 Number of analog quantities and logical signals for disturbance recorder

Ten analog quantities and 256 logical signals are record in a disturbance phenomenon.

(i) Number of analog quantities

For example, when VCT51B is used in the IED (BCPU), the currents (I1a, I1b, I1c, I0, I3, I4) and the voltages (V1a, V1b, V1c, VN) are recorded. For more information about the construction, see Chapter *Technical description: Transformer module for AC analog input*.

Table 7.3-2 Recording number of logic signals depending on time settings

VCT type	BCPU
	51B
Voltages	V_{1a}
	V_{1b}
	V_{1c}
	–
	–
	–
	V_0
	V_3
	V_4
Currents	I_{1a}
	I_{1b}
	I_{1c}
	I_N
	I_N for SEF
Number of inputs	11

(ii) Number of logical signals

As mentioned earlier, the disturbance recorder can hold the traces of logic signals during the recording time. Using settings [**Binary Signal***], the user can select 256 logic signal arbitrary. The logic signals that the user has selected should be termed with user's preferred names using settings [**Binary Sig.Name***]. Table 7.3-3 tabulates the settings. For example, 'CB1_ALLPH_CLOSE' signal of the PROT_COMM function may be chosen to record using the setting [**Binary Signal1**]; we should term it 'CB_CLOSE' using the [**Binary Sig.Name1**].

Table 7.3-3 Setting list for logic signals for BCPU

Settings	Data IDs	[Binary Sig. Name]	Origins	Settings	Data IDs	[Binary Sig. Name]	Origins	Settings	Data IDs	[Binary Sig. Name]	Origins
[Binary Signal1]	48A001 8300001B76	CB_CLOSE	PROT_COMM	[Binary Signal91]	(Not Assigned)	-	....	[Binary Signal191]	(Not Assigned)	-	....
[Binary Signal2]	48A001 8E00001B85	DS_CLOSE	PROT_COMM	[Binary Signal92]	(Not Assigned)	-	....	[Binary Signal192]	(Not Assigned)	-	....
[Binary Signal3]	4A1001 8300001B6F	GEN.TRIP	TRC	[Binary Signal93]	(Not Assigned)	-	....	[Binary Signal193]	(Not Assigned)	-	....
[Binary Signal4]	4A1001 8400001B64	GEN.ALARM	TRC	[Binary Signal94]	(Not Assigned)	-	....	[Binary Signal194]	(Not Assigned)	-	....
[Binary Signal5]	490001 8000001B61	VTF_DETECT	VTF	[Binary Signal95]	(Not Assigned)	-	....	[Binary Signal195]	(Not Assigned)	-	....
[Binary Signal6]	491001 8000001B62	CTF_DETECT	VTF	[Binary Signal96]	(Not Assigned)	-	....	[Binary Signal196]	(Not Assigned)	-	....
[Binary Signal7]	440001 8000011B68	OC1-OPT	OC	[Binary Signal97]	(Not Assigned)	-	....	[Binary Signal197]	(Not Assigned)	-	....
[Binary Signal8]	440001 8100021B68	OC2-OPT	OC	[Binary Signal98]	(Not Assigned)	-	....	[Binary Signal198]	(Not Assigned)	-	....
[Binary Signal9]	440001 8200031B68	OC3-OPT	OC	[Binary Signal99]	(Not Assigned)	-	....	[Binary Signal199]	(Not Assigned)	-	....
[Binary Signal10]	440001 8300041B68	OC4-OPT	OC	[Binary Signal100]	(Not Assigned)	-	....	[Binary Signal200]	(Not Assigned)	-	....
[Binary Signal11]	441001 8000011B60	EF1-OPT	EF	[Binary Signal101]	(Not Assigned)	-	....	[Binary Signal201]	(Not Assigned)	-	....
[Binary Signal12]	441001 8100021B60	EF2-OPT	EF	[Binary Signal102]	(Not Assigned)	-	....	[Binary Signal202]	(Not Assigned)	-	....
[Binary Signal13]	441001 8200031B60	EF3-OPT	EF	[Binary Signal103]	(Not Assigned)	-	....	[Binary Signal203]	(Not Assigned)	-	....
[Binary Signal14]	441001 8300041B60	EF4-OPT	EF	[Binary Signal104]	(Not Assigned)	-	....	[Binary Signal204]	(Not Assigned)	-	....
[Binary Signal15]	444001 8000011B68	OCV1-OPT	OCV	[Binary Signal105]	(Not Assigned)	-	....	[Binary Signal205]	(Not Assigned)	-	....
[Binary Signal16]	444001 8100021B68	OCV2-OPT	OCV	[Binary Signal106]	(Not Assigned)	-	....	[Binary Signal206]	(Not Assigned)	-	....
[Binary Signal17]	444001 8200031B68	OCV3-OPT	OCV	[Binary Signal107]	(Not Assigned)	-	....	[Binary Signal207]	(Not Assigned)	-	....
[Binary Signal18]	444001 8300041B68	OCV4-OPT	OCV	[Binary Signal108]	(Not Assigned)	-	....	[Binary Signal208]	(Not Assigned)	-	....
[Binary Signal19]	460001 8000011B65	OV1-OPT	OV	[Binary Signal109]	(Not Assigned)	-	....	[Binary Signal209]	(Not Assigned)	-	....
[Binary Signal20]	460001 8100021B65	OV2-OPT	OV	[Binary Signal110]	(Not Assigned)	-	....	[Binary Signal210]	(Not Assigned)	-	....
[Binary Signal21]	470001 8000011B65	UV1-OPT	UV	[Binary Signal111]	(Not Assigned)	-	....	[Binary Signal211]	(Not Assigned)	-	....
[Binary Signal22]	470001 8100021B65	UV2-OPT	UV	[Binary Signal112]	(Not Assigned)	-	....	[Binary Signal212]	(Not Assigned)	-	....
[Binary Signal23]	4A7001 8000001B63	ARC READY	ARC	[Binary Signal113]	(Not Assigned)	-	....	[Binary Signal213]	(Not Assigned)	-	....
[Binary Signal24]	4A7001 8000001B6A	ARC CLOSE COMMAND	ARC	[Binary Signal114]	(Not Assigned)	-	....	[Binary Signal214]	(Not Assigned)	-	....
[Binary Signal25]	4A7001 8400001B6C	ARC_FT	ARC	[Binary Signal115]	(Not Assigned)	-	....	[Binary Signal215]	(Not Assigned)	-	....
[Binary Signal26]	(Not Assigned)	-	....	[Binary Signal116]	(Not Assigned)	-	....	[Binary Signal216]	(Not Assigned)	-	....
[Binary Signal27]	(Not Assigned)	-	....	[Binary Signal117]	(Not Assigned)	-	....	[Binary Signal217]	(Not Assigned)	-	....
[Binary Signal28]	(Not Assigned)	-	....	[Binary Signal118]	(Not Assigned)	-	....	[Binary Signal218]	(Not Assigned)	-	....
[Binary Signal29]	(Not Assigned)	-	....	[Binary Signal119]	(Not Assigned)	-	....	[Binary Signal219]	(Not Assigned)	-	....
[Binary Signal30]	(Not Assigned)	-	....	[Binary Signal120]	(Not Assigned)	-	....	[Binary Signal220]	(Not Assigned)	-	....
[Binary Signal31]	(Not Assigned)	-	....	[Binary Signal121]	(Not Assigned)	-	....	[Binary Signal221]	(Not Assigned)	-	....
[Binary Signal32]	(Not Assigned)	-	....	[Binary Signal122]	(Not Assigned)	-	....	[Binary Signal222]	(Not Assigned)	-	....
[Binary Signal33]	(Not Assigned)	-	....	[Binary Signal123]	(Not Assigned)	-	....	[Binary Signal223]	(Not Assigned)	-	....
[Binary Signal34]	(Not Assigned)	-	....	[Binary Signal124]	(Not Assigned)	-	....	[Binary Signal224]	(Not Assigned)	-	....
[Binary Signal35]	(Not Assigned)	-	....	[Binary Signal125]	(Not Assigned)	-	....	[Binary Signal225]	(Not Assigned)	-	....
[Binary Signal36]	(Not Assigned)	-	....	[Binary Signal126]	(Not Assigned)	-	....	[Binary Signal226]	(Not Assigned)	-	....
[Binary Signal37]	(Not Assigned)	-	....	[Binary Signal127]	(Not Assigned)	-	....	[Binary Signal227]	(Not Assigned)	-	....
[Binary Signal38]	(Not Assigned)	-	....	[Binary Signal128]	(Not Assigned)	-	....	[Binary Signal228]	(Not Assigned)	-	....
[Binary Signal39]	(Not Assigned)	-	....	[Binary Signal129]	(Not Assigned)	-	....	[Binary Signal229]	(Not Assigned)	-	....
[Binary Signal40]	(Not Assigned)	-	....	[Binary Signal130]	(Not Assigned)	-	....	[Binary Signal230]	(Not Assigned)	-	....
[Binary Signal41]	(Not Assigned)	-	....	[Binary Signal131]	(Not Assigned)	-	....	[Binary Signal231]	(Not Assigned)	-	....
[Binary Signal42]	(Not Assigned)	-	....	[Binary Signal132]	(Not Assigned)	-	....	[Binary Signal232]	(Not Assigned)	-	....
[Binary Signal43]	(Not Assigned)	-	....	[Binary Signal133]	(Not Assigned)	-	....	[Binary Signal233]	(Not Assigned)	-	....
[Binary Signal44]	(Not Assigned)	-	....	[Binary Signal134]	(Not Assigned)	-	....	[Binary Signal234]	(Not Assigned)	-	....
[Binary Signal45]	(Not Assigned)	-	....	[Binary Signal135]	(Not Assigned)	-	....	[Binary Signal235]	(Not Assigned)	-	....
[Binary Signal46]	(Not Assigned)	-	....	[Binary Signal136]	(Not Assigned)	-	....	[Binary Signal236]	(Not Assigned)	-	....
[Binary Signal47]	(Not Assigned)	-	....	[Binary Signal137]	(Not Assigned)	-	....	[Binary Signal237]	(Not Assigned)	-	....
[Binary Signal48]	(Not Assigned)	-	....	[Binary Signal138]	(Not Assigned)	-	....	[Binary Signal238]	(Not Assigned)	-	....
[Binary Signal49]	(Not Assigned)	-	....	[Binary Signal139]	(Not Assigned)	-	....	[Binary Signal239]	(Not Assigned)	-	....
[Binary Signal50]	(Not Assigned)	-	....	[Binary Signal150]	(Not Assigned)	-	....	[Binary Signal250]	(Not Assigned)	-	....
[Binary Signal51]	(Not Assigned)	-	....	[Binary Signal151]	(Not Assigned)	-	....	[Binary Signal251]	(Not Assigned)	-	....
[Binary Signal52]	(Not Assigned)	-	....	[Binary Signal152]	(Not Assigned)	-	....	[Binary Signal252]	(Not Assigned)	-	....
[Binary Signal53]	(Not Assigned)	-	....	[Binary Signal153]	(Not Assigned)	-	....	[Binary Signal253]	(Not Assigned)	-	....
[Binary Signal54]	(Not Assigned)	-	....	[Binary Signal154]	(Not Assigned)	-	....	[Binary Signal254]	(Not Assigned)	-	....
[Binary Signal55]	(Not Assigned)	-	....	[Binary Signal155]	(Not Assigned)	-	....	[Binary Signal255]	(Not Assigned)	-	....
[Binary Signal56]	(Not Assigned)	-	....	[Binary Signal156]	(Not Assigned)	-	....	[Binary Signal256]	(Not Assigned)	-	....
[Binary Signal57]	(Not Assigned)	-	....	[Binary Signal157]	(Not Assigned)	-	....				
[Binary Signal58]	(Not Assigned)	-	....	[Binary Signal158]	(Not Assigned)	-	....				
[Binary Signal59]	(Not Assigned)	-	....	[Binary Signal159]	(Not Assigned)	-	....				
[Binary Signal60]	(Not Assigned)	-	....	[Binary Signal160]	(Not Assigned)	-	....				
[Binary Signal61]	(Not Assigned)	-	....	[Binary Signal161]	(Not Assigned)	-	....				
[Binary Signal62]	(Not Assigned)	-	....	[Binary Signal162]	(Not Assigned)	-	....				
[Binary Signal63]	(Not Assigned)	-	....	[Binary Signal163]	(Not Assigned)	-	....				
[Binary Signal64]	(Not Assigned)	-	....	[Binary Signal164]	(Not Assigned)	-	....				
[Binary Signal65]	(Not Assigned)	-	....	[Binary Signal165]	(Not Assigned)	-	....				
[Binary Signal66]	(Not Assigned)	-	....	[Binary Signal166]	(Not Assigned)	-	....				
[Binary Signal67]	(Not Assigned)	-	....	[Binary Signal167]	(Not Assigned)	-	....				
[Binary Signal68]	(Not Assigned)	-	....	[Binary Signal168]	(Not Assigned)	-	....				
[Binary Signal69]	(Not Assigned)	-	....	[Binary Signal169]	(Not Assigned)	-	....				
[Binary Signal70]	(Not Assigned)	-	....	[Binary Signal170]	(Not Assigned)	-	....				
[Binary Signal71]	(Not Assigned)	-	....	[Binary Signal171]	(Not Assigned)	-	....				
[Binary Signal72]	(Not Assigned)	-	....	[Binary Signal172]	(Not Assigned)	-	....				
[Binary Signal73]	(Not Assigned)	-	....	[Binary Signal173]	(Not Assigned)	-	....				
[Binary Signal74]	(Not Assigned)	-	....	[Binary Signal174]	(Not Assigned)	-	....				
[Binary Signal75]	(Not Assigned)	-	....	[Binary Signal175]	(Not Assigned)	-	....				
[Binary Signal76]	(Not Assigned)	-	....	[Binary Signal176]	(Not Assigned)	-	....				
[Binary Signal77]	(Not Assigned)	-	....	[Binary Signal177]	(Not Assigned)	-	....				
[Binary Signal78]	(Not Assigned)	-	....	[Binary Signal178]	(Not Assigned)	-	....				
[Binary Signal79]	(Not Assigned)	-	....	[Binary Signal179]	(Not Assigned)	-	....				
[Binary Signal80]	(Not Assigned)	-	....	[Binary Signal180]	(Not Assigned)	-	....				
[Binary Signal81]	(Not Assigned)	-	....	[Binary Signal181]	(Not Assigned)	-	....				
[Binary Signal82]	(Not Assigned)	-	....	[Binary Signal182]	(Not Assigned)	-	....				
[Binary Signal83]	(Not Assigned)	-	....	[Binary Signal183]	(Not Assigned)	-	....				
[Binary Signal84]	(Not Assigned)	-	....	[Binary Signal184]	(Not Assigned)	-	....				
[Binary Signal85]	(Not Assigned)	-	....	[Binary Signal185]	(Not Assigned)	-	....				
[Binary Signal86]	(Not Assigned)	-	....	[Binary Signal186]	(Not Assigned)	-	....				
[Binary Signal87]	(Not Assigned)	-	....	[Binary Signal187]	(Not Assigned)	-	....				
[Binary Signal88]	(Not Assigned)	-	....	[Binary Signal188]	(Not Assigned)	-	....				
[Binary Signal89]	(Not Assigned)	-	....	[Binary Signal189]	(Not Assigned)	-	....				
[Binary Signal90]	(Not Assigned)	-	....	[Binary Signal190]	(Not Assigned)	-	....				

7.3.5 Trigger settings for PLC programming

If the PLC program instructs the operation of the disturbance recorder, the user should set the [**Trigger ID1**] to [**Trigger ID4**]. That is, the program-output points should be set for the settings [**Trigger ID1**] to [**Trigger ID4**]; then, set **On** for the [**Trigger SW1**] to [**Trigger SW4**], respectively.

7.3.6 Screen information

Figure 7.3-2 indicates the maximum number of the recording operations as the number is changed depending on the time settings, which are shown in Table 7.3-1. Figure 7.3-3 shows the operation time and the date for the disturbance recorder and the figure illustrates five disturbance phenomena have been memorized in the IED.

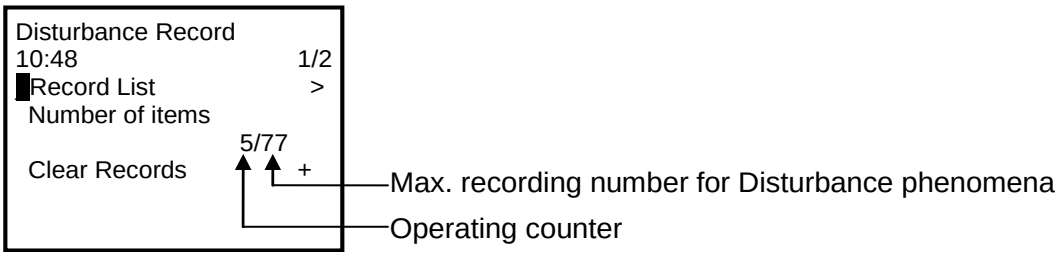


Figure 7.3-2 Running counter and Max number in the disturbance recorder

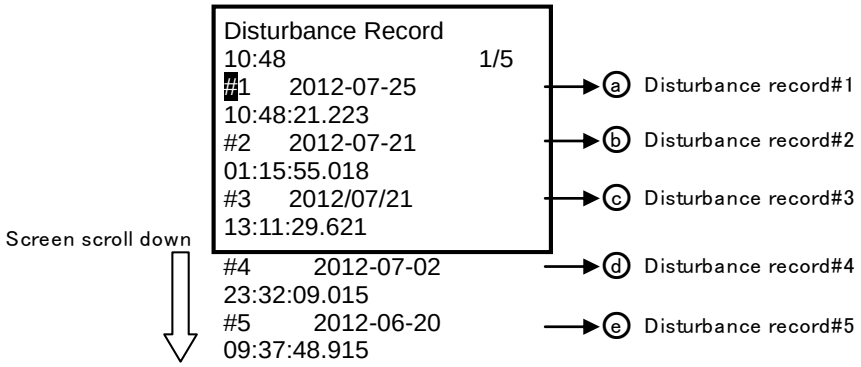


Figure 7.3-3 Detail information in the disturbance recorder

The information in the disturbance recorder is managed in the COMTRADE format, hence, the user can transfer the disturbance recording file to the PC using the engineering tool 'GR-TIEMS'. Figure 7.3-4 shows the example of the GR-TIMES screen. For more information, see *Chapter Engineering tool*.

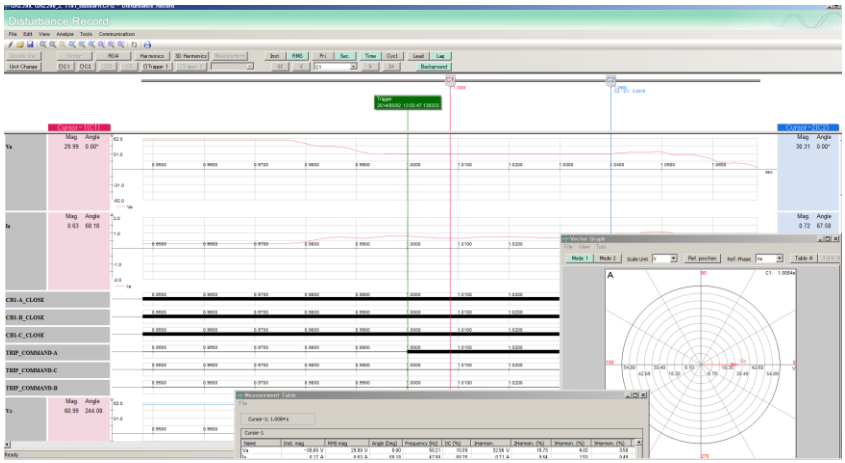


Figure 7.3-4 Screen shot from GR-TIEMS

7.3.7 Setting

Setting of DRT_LP(Function ID: 4B0001)

Setting item		Range		Units	Contents	Default setting value		Notes
		1A rating	5A rating			1A	5A	
	OC-DRT-EN	Off / On		–	Disturbance Record Trigger OC-DRT enable	Off		
	OC-DRT	0.10 - 50.00	0.50 - 250.00	A	OC-DRT relay operating value	1.00	5.00	
	EF-DRT-EN	Off / On		–	Disturbance Record Trigger EF-DRT enable	Off		
	EF-DRT	0.10 - 50.00	0.50 - 250.00	A	EF-DRT relay operating value	0.20	1.00	
	UV-DRT-EN	Off / On		–	Disturbance Record Trigger UV-DRT enable	–		
	UV-DRT	5.0 - 130.0		–	UV-DRT relay operating value	–		
	UVS-DRT-EN	Off / On		–	Disturbance Record Trigger UVS-DRT enable	–		
	UVS-DRT	5.0 - 130.0		V	UVS-DRT relay operating value	–		

Setting of DISTURB_REC(Function ID: 200401)

Setting item		Range	Units	Contents	Default setting value	Notes
	Record Time	0.1 - 10.0	s	Time for disturbance recording	3.0	
	Sampling Rate	7.5 - 15.0	deg	Sampling rate in electrical degree	7.5	
	Pre-fault Time	0.1 - 10.0	s	Pre-fault time	0.3	
	Trigger ID1	(Preferred DataID)	–	Signal1 generated in User's program	No Assign	
	Trigger SW1	Off / On	–	Enabling the signal1 of user's program	Off	
	Trigger ID2	-	–	Signal2 generated in User's program	No Assign	
	Trigger SW2	Off / On	–	Enabling the signal2 of user's program	Off	
	Trigger ID3	-	–	Signal3 generated in User's program	No Assign	
	Trigger SW3	Off / On	–	Enabling the signal3 of user's program	Off	
	Trigger ID4	-	–	Signal4 generated in User's program	No Assign	
	Trigger SW4	Off / On	–	Enabling the signal4 of user's program	Off	
	Trip Trig.SW	Off / On	–	Operation with the TRC trip command	On	
	Binary Signal1	(Preferred DataID)	–	Logic signal1 for the operation	–	
	Binary Sig.Name1	(Preferred name)	–	Name of the logic signal1	–	
	Binary Signal2	(Preferred DataID)	–	Logic signal2 for the operation	–	
	Binary Sig.Name2	(Preferred name)	–	Name of the logic signal2	–	
	Binary Signal3	(Preferred DataID)	–	Logic signal3 for the operation	–	
	Binary Sig.Name3	(Preferred name)	–	Name of the logic signal3	–	
	……	……	–	……	–	
	……	……	–	……	–	
	Binary Signal256	(Preferred DataID)	–	Mode setting for the detection	–	
	Binary Sig.Name256	(Preferred name)	–	Name of the trigger signal768	–	

7.3.8 Data ID

◆ Signal monitoring point

DRT_LP (Function ID: 4B0001)

Element ID	Name	Description
8000001C20	DRT-LP	DRT-LP protection operated
8400021C23	EF-DRT	EF-DRT relay element operated
8000011C20	OC-DRT-A	OC-DRT relay element operated (phase-A)
8100011C21	OC-DRT-B	OC-DRT relay element operated (phase-B)
8200011C22	OC-DRT-C	OC-DRT relay element operated (phase-C)
8800031C20	UV-DRT-A	UV-DRT relay element operated (phase-A)
8900031C21	UV-DRT-B	UV-DRT relay element operated (phase-B)
8A00031C22	UV-DRT-C	UV-DRT relay element operated (phase-C)
8C00041C20	UVS-DRT-AB	UVS-DRT relay element operated (phase-AB)
8D00041C21	UVS-DRT-BC	UVS-DRT relay element operated (phase-BC)
8E00041C22	UVS-DRT-CA	UVS-DRT relay element operated (phase-CA)

◆ Signal monitoring point

DISTURB_REC (Function ID: 200401)

Element ID	Name	Description
80A0041001	DSTRING	Writing the disturbance data
30A0001001	DSTR_CLR	Data erased
80A0031001	DSTR_MADE	Completion for writing the disturbance data
32A0011001	DSTR_MAX	Maximum possible number of the operations
32A0021001	DSTR_NUM	Operation counter

8 Monitoring function

8.1 Outline

The monitoring function is provided to measure the number of power quantities and statistics data obtained within the VCT, the DCAI, and BI circuits†. When the measuring instruments start measures power quantities, mathematical means is applied to the data from the VCT so that the data are shown accurately on the IED screen. The monitoring function has several screens together.

†Note: The VCT/DCAI/BIO structures and their features are discussed in Chapter *Technical description*.

8.2 Metering data (Metering group)

When the VCT module operates, metering data are screened along with several abbreviations, which represents their natures, as tabulated in the below Tables[1–4].

[1]Note: Terms 'I_0 (i.e., $3I_0$)' and 'V_0 (i.e., $3V_0$)' are calculated using three-phase quantities.

[2]Note: The 'I_e' is obtained usually with corresponding 'I_e' circuit in the VCT.

[3]Note: Positive sequence V1, which is used to represents the frequency of power system of, is measured.

[4]Note: Check Function block table and see the G&T position of the ordering (See *Appendix: Ordering*).

Table 8.2-1 Metering data for BCU and BCPU

Signals on the screen	Meanings of signals	Corresponding terminal screws VCT slot locations		BCU[1] software[3] with VCT52B				BCPU[2] software[3] with VCT51B	
		VC1 slot	VC2 slot	11[3]	13[3]	19[3]	1F[3]	2C[3]	2N[3]
I_a, I_b, I_c,	Currents in phase	I_{1a}, I_{1b}, I_{1c}		X	X	X	X	X	X
I_{ab}, I_{bc}, I_{ca}	Currents in phase-to-phase by calculated with I_{1a}, I_{1b}, I_{1c}	(N.A)[4]		X	X	X	X	X	X
I_e	Zero-sequence (residual) current	I_2		X	X	X	X	–	–
I_e	Zero-sequence (residual) current	I_N		–	–	–	–	X	X
I_{se}	Residual current	$I_{N\ for\ SEF}$		–	–	–	–	X	X
I_1, I_2, I_0	Symmetrical components by derived with I_{1a}, I_{1b}, I_{1c}	(N.A)		X	X	X	X	X	X
V_a, V_b, V_c,	Voltages in phase	V_{1a}, V_{1b}, V_{1c}		X	X	X	X	X	X
V_{ab}, V_{bc}, V_{ca}	Voltages in phase-to-phase by calculated with V_{1a}, V_{1b}, V_{1c}	(N.A)		X	X	X	X	X	X
V_1, V_2, V_0	Symmetrical components by derived with V_{1a}, V_{1b}, V_{1c}	(N.A)		X	X	X	X	X	X
V3, V4	Reference voltages on busbars	V3, V4		X	X	X	X	X	X
V_e	Zero-sequence (residual) voltage	V_0		–	–	–	–	X	X
f	Frequency (measured with V_1)	(N.A)		X	X	X	X	X	X
PFa, PFb, PFc / PF	Power factors in phase-a,-b,-c / three-phase	(N.A)		X	X	X	X	X	X
Pa, Pb, Pc / P	Active(real) power in phase-a,-b,-c / three-phase	(N.A)		X	X	X	X	X	X
Qa, Qb, Qc / Q	Reactive power in phase-a,-b,-c / three-phase	(N.A)		X	X	X	X	X	X
Sa, Sb, Sc / S	Complex (apparent) power in phase-a,-b,-c / three-phase	(N.A)		X	X	X	X	X	X
V_{R1}	Running voltage provided by the SYNDIF function	(N.A)		X	X	X	X	X	X
V_{I1}	Incoming voltage provided by the SYNDIF function	(N.A)		X	X	X	X	X	X
dV-SYN1	Voltage difference between V_{R1} and V_{I1} by the SYNDIF function	(N.A)		X	X	X	X	X	X
dAng.-SYN1	Phase difference between V_{R1} and V_{I1} by the SYNDIF function	(N.A)		X	X	X	X	X	X
df-SYN1	Frequency difference between V_{R1} and V_{I1} by the SYNDIF	(N.A)		X	X	X	X	X	X

Signals on the screen	Meanings of signals	Corresponding terminal screws VCT slot locations		BCU[1] software[3] with VCT52B				BCPU[2] software[3] with VCT51B	
		VC1 slot	VC2 slot	11[3]	13[3]	19[3]	1F[3]	2C[3]	2N[3]
V_{R2}	Running voltage provided by the SYNDIF function	(N.A)		X	X	X	X	X	X
V_{I2}	Incoming voltage provided by the SYNDIF function	(N.A)		X	X	X	X	X	X
dV-SYN2	Voltage difference between V_{R2} and V_{12} by the SYNDIF function	(N.A)		X	X	X	X	X	X
dAng.-SYN2	Phase difference between V_{R2} and V_{I2} by the SYNDIF function	(N.A)		X	X	X	X	X	X
df-SYN2	Frequency difference between V_{R2} and V_{I2} by the SYNDIF	(N.A)		X	X	X	X	X	X
V_B	Busbar voltage provided by the VCHK function	(N.A)		–	–	–	–	X	X
V_L	Line voltage provided by the VCHK function	(N.A)		–	–	–	–	X	X
dV-SYN1	Voltage difference between V_B and V_L by the VCHK function	(N.A)		–	–	–	–	X	X
dAng.-SYN1	Phase difference between V_B and V_L by the VCHK function	(N.A)		–	–	–	–	X	X
df-SYN1	Frequency difference between V_B and V_L by the VCHK	(N.A)		–	–	–	–	X	X
df/dt	Frequency slip ratio	(N.A)		–	–	–	–	X	X
I2/I1	Ratio of negative-sequence (I2) to positive-sequence (I1)	(N.A)		X	X	X	X	X	X
THM-Capacity	Thermal capacity	(N.A)		–	–	–	–	X	X

[1]Note: BCU with VCT in type 52B (code '2' is selected at Position '7' of *Ordering*)

[2]Note: BCPU with VCT in type 51B (code '1' is selected at Position '7' of *Ordering*)

[3]Note: See Function table in *Appendix: Ordering*

[4]Note: 'N.A'=Corresponding terminals do not exist on the VCT.

[5]Note: '–' represents that signals do not read.

Table 8.2-2 Metering data for BCU[1]

Signals on the screen	Meanings of signals	Corresponding terminal screws VCT slot locations		BCU software[2] with VCT53B				Note
		VC1 slot	VC2 slot	11[2]	13[2]	19[2]	1F[2]	
I_a, I_b, I_c,	Currents in phase at VC1 slot	I_{1a}, I_{1b}, I_{1c}		X	X	X	X	
I_{ab}, I_{bc}, I_{ca}	Currents in phase-to-phase at VC1 slot	(N.A)		X	X	X	X	
I_e	Zero-sequence (residual) current at VC1 slot	I2		X	X	X	X	
I_1, I_2, I_0	Symmetrical components derived at VC1 slot	(N.A)		X	X	X	X	
V_{a1}, V_{b1}, V_{c1}	Voltages in phase at VC1 slot	V_{1a}, V_{1b}, V_{1c}		X	X	X	X	
V_{ab1}, V_{bc1}, V_{ca1}	Voltages in phase-to-phase at VC1 slot	(N.A)		X	X	X	X	
V_{11}, V_{21}, V_{01}	Symmetrical components derived at VC1 slot	(N.A)		X	X	X	X	
V3	Reference voltage on busbar at VC1 slot	V3		X	X	X	X	
f1	Frequency (measured with V_{11})	(N.A)		X	X	X	X	
PFa1, PFb1, PFc1 / PF1	Power factors in phase-1a,-1b,-1c / three-phase	(N.A)		X	X	X	X	
Pa1, Pb1, Pc1 / P1	Active(real) power in phase-1a,-1b,-1c / three-phase	(N.A)		X	X	X	X	
Qa1, Qb1, Qc1 / Q1	Reactive power in phase-1a,-1b,-1c / three-phase	(N.A)		X	X	X	X	
Sa1, Sb1, Sc1 / S1	Complex (apparent) power in phase-1a,-1b,-1c / three-phase	(N.A)		X	X	X	X	
V_{a2}, V_{b2}, V_{c2}	Voltages in phase at VC1 slot	V_{2a}, V_{2b}, V_{2c}		X	X	X	X	
V_{ab2}, V_{bc2}, V_{ca2}	Voltages in phase-to-phase at the VC1 slot	(N.A)		X	X	X	X	
V_{12}, V_{22}, V_{02}	Symmetrical components derived with V_{2a}, V_{2b}, V_{2c} at VC1 slot	(N.A)		X	X	X	X	
f2	Frequency (measured with V_{12}) at VC1 slot	(N.A)		X	X	X	X	
PFa2, PFb2, PFc2 / PF2	Power factors in phase-2a,-2b,-2c / three-phase at VC1 slot	(N.A)		X	X	X	X	
Pa2, Pb2, Pc2 / P2	Active(real) power in phase-2a,-2b,-2c / three-phase at VC1 slot	(N.A)		X	X	X	X	
Qa2, Qb2, Qc2 / Q2	Reactive power in phase-2a,-2b,-2c / three-phase at VC1 slot	(N.A)		X	X	X	X	

Signals on the screen	Meanings of signals	Corresponding terminal screws VCT slot locations		BCU software[2] with VCT53B				Note
		VC1 slot	VC2 slot	11[2]	13[2]	19[2]	1F[2]	
Sa2, Sb2, Sc2 / S2	Complex (apparent) power in phase-2a,-2b,-2c / three-phase at VC1 slot	(N.A)		X	X	X	X	
V_{R1}	Running voltage provided by the SYNDIF function	(N.A)		X	X	X	X	
V_{I1}	Incoming voltage provided by the SYNDIF function	(N.A)		X	X	X	X	
dV-SYN1	Voltage difference between V_{R1} and V_{I1} by the SYNDIF function	(N.A)		X	X	X	X	
dAng.-SYN1	Phase difference between V_{R1} and V_{I1} by the SYNDIF function	(N.A)		X	X	X	X	
df-SYN1	Frequency difference between V_{R1} and V_{I1} by the SYNDIF function	(N.A)		X	X	X	X	
V_{R2}	Running voltage provided by the SYNDIF function	(N.A)		X	X	X	X	
V_{I2}	Incoming voltage provided by the SYNDIF function	(N.A)		X	X	X	X	
dV-SYN2	Voltage difference between V_{R2} and V_{12} by the SYNDIF function	(N.A)		X	X	X	X	
dAng.-SYN2	Phase difference between V_{R2} and V_{I2} by the SYNDIF function	(N.A)		X	X	X	X	
df-SYN2	Frequency difference between V_{R2} and V_{I2} by the SYNDIF function	(N.A)		X	X	X	X	

[1]Note: BCU with VCT in type 53B (code '3' is selected at Position '7' of the ordering)

[2]Note: See Function table in *Appendix: Ordering*

Table 8.2-3 Metering data for BCPU[1]

Signals on the screen	Meanings of signals	Corresponding terminal screws VCT slot locations		BCPU software[2] with VCT52B		Note
		VC1 slot	VC2 slot	2N[2]	2C[2]	
I_{a1}, I_{b1}, I_{c1},	Currents in phase at VC1 slot	I_{1a}, I_{1b}, I_{1c}	(N.A)	X	X	
I_{ab1}, I_{bc1}, I_{ca1}	Currents in phase-to-phase at VC1 slot	(N.A)	(N.A)	X	X	
I_{e1}	Zero-sequence (residual) current derived at VC1 slot	I2	(N.A)	X	X	
I_{11}, I_{21}, I_{01}	Symmetrical components derived at VC1 slot	(N.A)	(N.A)	X	X	
V_{a1}, V_{b1}, V_{c1}	Voltages in phase at VC1 slot	V_{1a}, V_{1b}, V_{1c}	(N.A)	X	X	
V_{ab1}, V_{bc1}, V_{ca1}	Voltages in phase-to-phase at VC1 slot	(N.A)	(N.A)	X	X	
V_{11}, V_{21}, V_{01}	Symmetrical components at the VC1 slot	(N.A)	(N.A)	X	X	
V31, V41	Reference voltages on busbar (=V3, V4 at the VC1 slot)	V3,V4	(N.A)	X	X	
f1	Frequency (measured with V_{11} the VC1 slot)	(N.A)	(N.A)	X	X	
PFa1, PFb1, PFc1 / PF1	Power factors in phase-1a,-1b,-1c / three-phase at the VC1 slot	(N.A)	(N.A)	X	X	
Pa1, Pb1, Pc1 / P1	Active(real) power in phase-1a,-1b,-1c / three-phase at the VC1 slot	(N.A)	(N.A)	X	X	
Qa1, Qb1, Qc1 / Q1	Reactive power in phase-1a,-1b,-1c / three-phase at the VC1 slot	(N.A)	(N.A)	X	X	
Sa1, Sb1, Sc1 / S1	Complex(apparent)power in phase-1a,1b,1c/three-phase at VC1 slot	(N.A)	(N.A)	X	X	
I_{a2}, I_{b2}, I_{c2},	Currents in phase at the VC2 slot	(N.A)	I_{1a}, I_{1b}, I_{1c}	X	X	
I_{ab2}, I_{bc2}, I_{ca2}	Currents in phase-to-phase(=I_{1ab}, I_{1bc}, I_{1ca} at the VC2 slot)	(N.A)	(N.A)	X	X	
I_{e2}	Zero-sequence (residual) current derived with three-phase currents	(N.A)	I2	X	X	
I_{12}, I_{22}, I_{02}	Currents in the symmetrical components at the VC2 slot	(N.A)	(N.A)	X	X	
V_{a2}, V_{b2}, V_{c2}	Voltages in phase at the VC2 slot	(N.A)	V_{1a}, V_{1b}, V_{1c}	X	X	
V_{ab2}, V_{bc2}, V_{ca2}	Voltages in phase-to-phase at the VC2 slot	(N.A)	(N.A)	X	X	
V_{12}, V_{22}, V_{02}	Voltages in the symmetrical components at the VC2 slot	(N.A)	(N.A)	X	X	
V32, V42	Reference voltages on busbar at the VC2 slot	(N.A)	V3,V4	X	X	

Signals on the screen	Meanings of signals	Corresponding terminal screws VCT slot locations		BCPU software[2] with VCT52B		Note
		VC1 slot	VC2 slot	2N[2]	2C[2]	
f2	Frequency (measured with V_{11} at the VC2 slot	(N.A)	(N.A)	X	X	
PFa2, PFb2, PFc2 / PF2	Power factors in phase-1a,-1b,-1c / three-phase at the VC2 slot	(N.A)	(N.A)	X	X	
Pa2, Pb2, Pc2 / P2	Active(real) power in phase-1a,-1b,-1c / three-phase at the VC2 slot	(N.A)	(N.A)	X	X	
Qa2, Qb2, Qc2 / Q2	Reactive power in phase-1a,-1b,-1c / three-phase at the VC2 slot	(N.A)	(N.A)	X	X	
Sa2, Sb2, Sc2 / S2	Complex(apparent)power in phase-1a,1b,1c/three-phase at VC2 slot	(N.A)	(N.A)	X	X	
V_{R1}	Running voltage provided by the SYNDIF function	(N.A)	(N.A)	X	X	
V_{I1}	Incoming voltage provided by the SYNDIF function	(N.A)	(N.A)	X	X	
dV-SYN1	Voltage difference between V_{R1} and V_{I1} by the SYNDIF function	(N.A)	(N.A)	X	X	
dAng.-SYN1	Phase difference between V_{R1} and V_{I1} by the SYNDIF function	(N.A)	(N.A)	X	X	
df-SYN1	Frequency difference between V_{R1} and V_{I1} by the SYNDIF function	(N.A)	(N.A)	X	X	
V_{R2}	Running voltage provided by the SYNDIF function	(N.A)	(N.A)	X	X	
V_{I2}	Incoming voltage provided by the SYNDIF function	(N.A)	(N.A)	X	X	
dV-SYN2	Voltage difference between V_{R2} and V_{12} by the SYNDIF function	(N.A)	(N.A)	X	X	
dAng.-SYN2	Phase difference between V_{R2} and V_{I2} by the SYNDIF function	(N.A)	(N.A)	X	X	
df-SYN2	Frequency difference between V_{R2} and V_{I2} by the SYNDIF function	(N.A)	(N.A)	X	X	

[1]Note: BCPU with VCT in type 52B (code 'B' is selected at Position '7' of the ordering)

[2]Note: See Function table in *Appendix: Ordering*

8.2.1 Metering information on the screen

The user can examine the values provided by the metering function on the IED screen; Figure 8.2-1 illustrates the information about currents. A reference phasor is defined to examine a complex data in the metering and a positive-sequence voltage (V1) is defined as the reference. The metering function has minimum sensing threshold; thus, the user shall notice that zero (0) is displayed, if the provided data is lesser than the threshold.

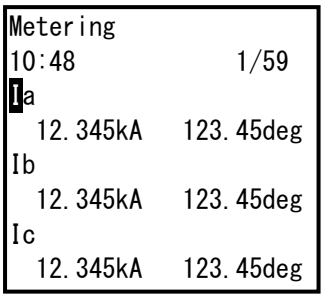


Figure 8.2-1 Current meter on the IED screen

Note: If any quantity does not enter to the VCT, the value on the screen is displayed such as "***.**" and "———".

8.2.2 Setting for measurements

(i) Selecting either primary/secondary values

The value at the primary side is screened when the default setting is applied; the unit of a value can be set in kV when the value is larger than 1000 volts. When wishing to display the value at the secondary side, the user should set **Secondary** for the setting [**Display Value**].Table 8.2-4 shows the effective digit when **Secondary** is set.

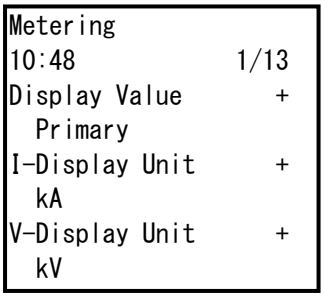


Figure 8.2-2 Metering setting in the setting screen

Note: For the operation of the menu, see Chapter *User interface: Setting sub-menu*.

Table 8.2-4 Effective digits for metering in the secondary side

Metering items	Rated values rulued at the secondary	Number of significatnt figures	
		Current or voltage	Phase angle
Voltage	100/110/115/120 volt	3 digit number with 2 decimal places (***.**V)	(±***.*°)

Metering items	Rated values rulued at the secondary	Number of significatnt figures	
		Current or voltage	Phase angle
Current	1 amper / 5 amper	3 digit number with 2 decimal places (***.**A)	

(ii) Unit setting

For example, if preferred to be displayed in kA unit, set **kA** for the [**I-Display Unit**]. Table 8.2-5 shows the unit lists in the metering funciton.

Table 8.2-5 Selection of units to display

Metering items	Settings	Selection of a unit to display
Voltage (V)	[**V-Display Unit**]	Volt (**V**) or kilo-volt (**kV**)
Current (I)	[**I-Display Unit**]	Ampare (**A**) or kilo-ampare (**kA**)
Active power (P)	[**P-Display Unit**]	Kilo-watt (**kW**) or Mega-watt (**MW**)
Reactive power (Q)	[**Q-Display Unit**]	Kilo-var (**kvar**) or Mega-var (**Mvar**)
Apprent power (S)	[**S-Display Unit**]	Kilo-VA (**kVA**) or Mega-VA (**MVA**)

8.2.3 Diminishing a very small value to display zero

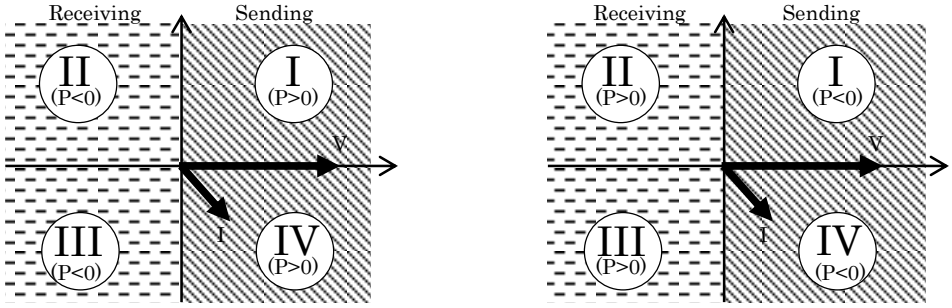
In the metering function, negligible metering values will be considered as zero. The user can set the level to diminish in % using settings [**I-Valid Level**] and [**V-Valid Level**], at which values '4.00' and '0.30' are set, as default, respectively. Thus, zero (0) will be displayed when the applied quantities at the VCT, which are lesser than the setting levels.

8.2.4 Flow settings for active/reactive/apparent powers

The user should set the rules for the metering P, Q, and S

(i) Metering in active power (P)

When the metering function measures the value for supplying power, the user should set **Send** for the [**Power**]. Conversely, if the metering function should operate for absorbing power, set **Receive** for the setting. Figure 8.2-3 illustrates the sign of the active power (P), which is polarized with the voltage (V). In Figure 8.2-3.a exemplifies the metering function operating for the supplying power so that the value P will have plus (+) sign (i.e., the I lags the V, which shown in Quadrant IV). In Figure 8.2-3.b, the value P will have minus (–) sign when the I lags the V, provided **Receive** is set for the setting.



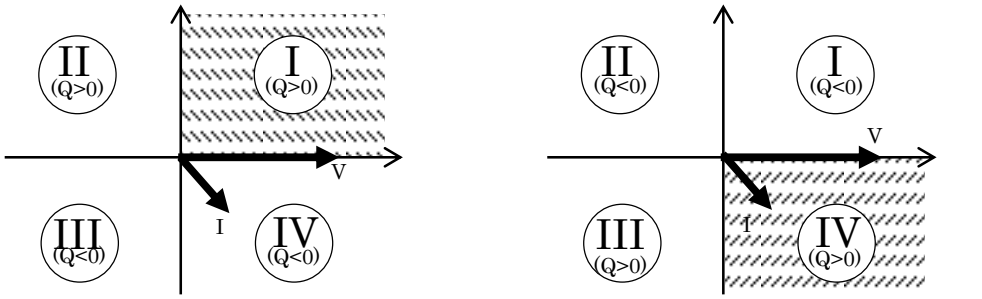
a. Metering (P) for supplying power
[**Power**]=**Send**

b. Metering (P) for absorbing power
[**Power**]=**Receive**

Figure 8.2-3 Sign of the active power (P) ruled by setting [Power]

(ii) Metering in reactive power (Q)

Similar to the active power (P), the user should set the metering sign for the reactive power (Q). The Q value will have the minus sign (–) based on the P value, when **Lag** is set for setting [**Current**] (Figure 8.2-4.a). On the other hand, the Q value will have the plus sign (+) based on the P value, when **Lead** set for the setting (Figure 8.2-4.b).



a. Q (shown in quadrant IV) has a minus sign because the Q is supplied by the outside source. The decision is made with the P (shown in the quadrant IV, defined with [**Power**]=**Send**) having "a plus sign" when the current lags the voltage.

[**Current**]=**Lag**

b. Q (shown in quadrant IV) has a plus sign because the Q is absorbed by the outside source. The decision is based on the P (shown in the quadrant I, defined with [**Power**]=**Receive**) having "a minus sign" when the current leads the voltage.

[**Current**]=**Lead**

Figure 8.2-4 Sign of the reactive power (Q) ruled by setting [Current]

8.2.5 Polarity setting for power factor values

The power factor (PF) value is shown by the rule to align the plus/minus sign (±) of the P value (i.e., setting [**PF sign**]=**AP**, default setting). However, the user can change the rule (i.e., setting [**PF sign**]=**AP+RP**); as a result, the PF value will have the plus sign (+), provided both the P value and the Q value have the same plus (+) sign or minus (–) sign.

(i) AP setting

When the sign of the PF value is required to match with the sign of the P value, set **AP** for the setting [**PF sign**].

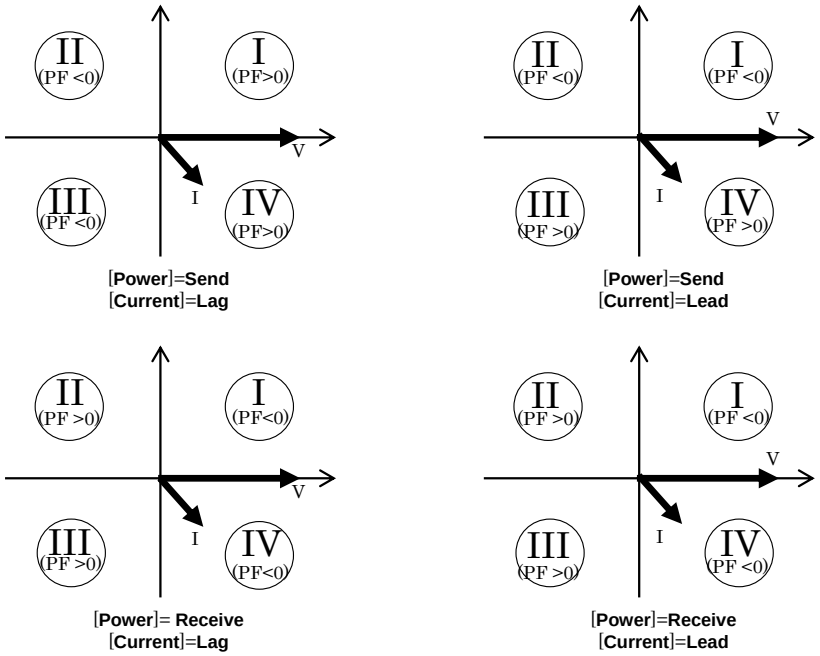


Figure 8.2-5 PF sign matched with the sign of the P value (i.e., [PF sign]=AP)

(ii) AP+PR setting

When the plus or minus sign of the PF value is required to be in conjunction with the states of the leading current (i.e., supplying power) and the ragging current (i.e., absorbing power), the user should set **AP+RP** for the set [**PF sign**]. Note that the plus or minus signs of the P and Q values cause the difference from the sign of the PF value; thus, the user should figure out the correspondences between the settings [**Power**] and [**Current**] of Figure 8.2-6.

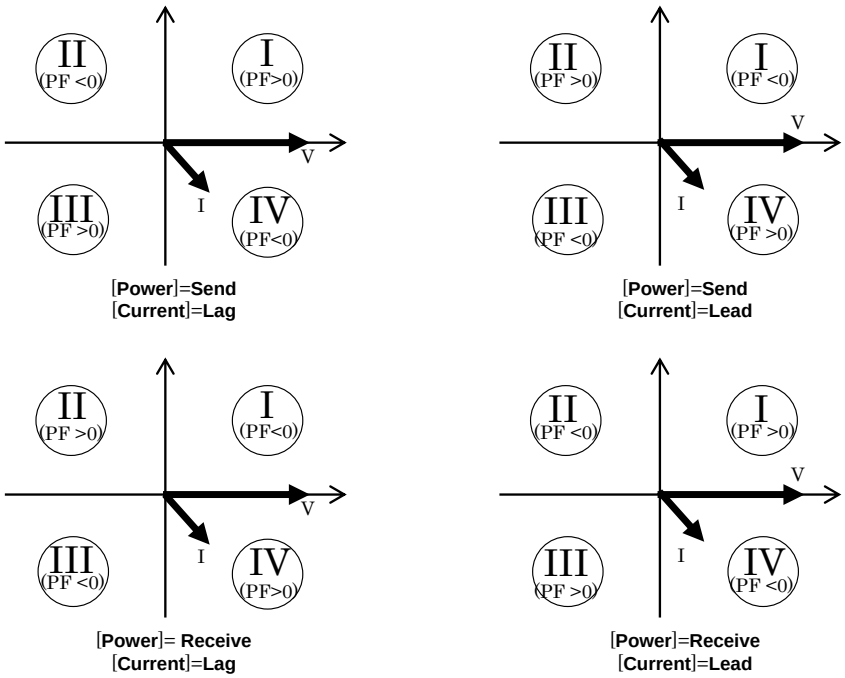


Figure 8.2-6 PF corresponding with P and Q (i.e., [PF sign]=AP+RP)

8.2.6 Setting for the report (Dead band feature)

The data collected in the metering function will be sent to the network upward, but the data sent may give the network a heavy burden because the amount of the data sent could be larger. Thus, the dead band (SD) feature is designed not to send unnecessary data will not be sent (say, the dead band feature regulates not to send the same data repeatedly). In practice the analog values in the metering are not always the same; hence, the regulation for not sending is defined by the user can change it using a setting in each power quantity.

(i) Counting operation in SD feature

Figure 8.2-7 illustrates the operation for the SD feature about entering a current. At Time=0, the current enters into the VCT and it is observed (Time=0). When the entering current is being beyond the upper limit (Time=a), a repeated number is set for '1'. If the entering current is out of the upper and lower limits (Time=b), the repeat number gets to have '2'. Note that the repeated number is kept to have '2' even if the entering current goes back within the upper and lower limits (Time=c). The repeated number will be larger than the setting [**Period SD**]=3, when the entering current is out of the upper and lower limits again (i.e., Time=d). Then, at Time=e, the value of the entering current will be sent to the network, because the repeated number is incremented. After that, the repeated number will be set zero (0); the new positon for the SD feature is set (i.e., from Time=e).

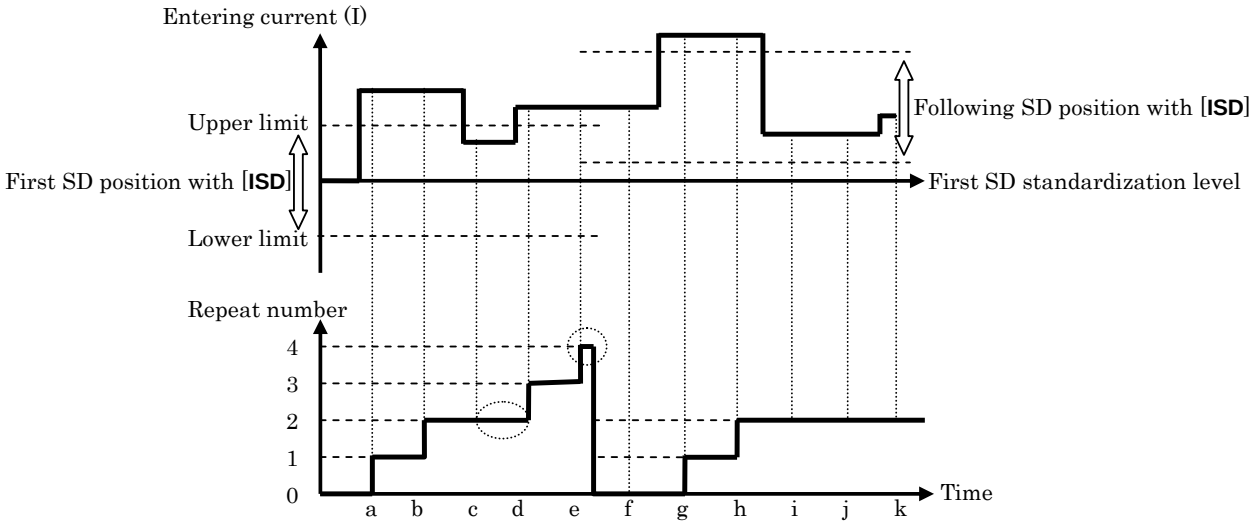


Figure 8.2-7 Dead band operation with [PeriodSD]=3

(ii) Check cycle in SD feature

The check cycle is defined for 500 milliseconds in the SD feature. (i.e., interval ab in Figure 8.2-7 is equal to 500ms). If the entering current, in Figure 8.2-7, is required to send promptly when the entering current is beyond the limits, set **0** for the setting [**Period SD**].

(iii) Setting bands for the operation

As illustrated in Figure 8.2-7, with regard to the entering current the user can define the upper limit and lower limit using the setting [**ISD**] in %. The limit-size of the SD feature is calculated based on the amount of the entering current. Table 8.2-6 shows respective settings for the power quantities.

Table 8.2-6 SD settings for respective quantities

Quantities	SD settings	Units for settings	Setting ranges
Voltage	**VSD**	%	0.00% to 50.00%
Current	**ISD**	%	0.00% to 50.00%
Active/Reactive/Apparent power	**P/Q/SSD**	–	0.00% to 50.00%
Power factor	**PFSD**	–	0.00 to 1.00
Frequencty	**FSD**	%	0.00% to 50.00%
Watt-hour/var-hour	**Wh/varhSD**	–	0.0 to 999.9
Phase	**PhaseSD**	Degree	0.0 deg. to 90 deg.
Difference of voltages†	**dVSD**	%	0.00% to 50.00%

†Note:The values are derived in the VCHK function. For more information, see Chapter *Relay application: Voltage check for autoreclose function*.

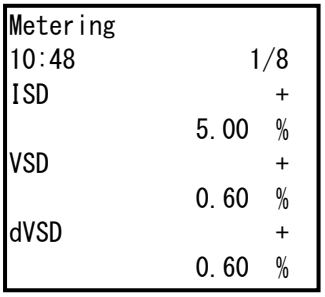


Figure 8.2-8 Metering setting in the setting screen

Note: For the operation of the menu, see Chapter *User interface: Setting sub-menu*.

8.3 DC metering data (DC metering group)

The user can examine the DC metering data on the IED screen; Figure 8.2-1 exemplifies the DC information about DCAI2A module at IO#5 slot (i.e., the data is names as 'DCAI1' plus devise name). The user can set the name of each device and its metering unit by the DCAITM function, which is discussed in Chapter *Control and monitoring application*.

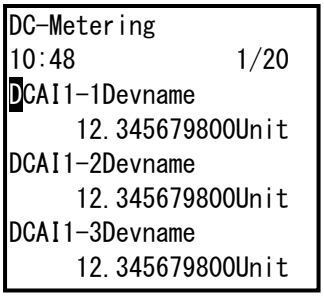


Figure 8.3-1 DC meter on the IED screen

8.4 Statistics data (Power value group)

Table 8.4-1 shows the statistics information and its abbreviation in power value data.

Table 8.4-1 Power value data

Groups	Displayed quantities	Abbreviations
Power values	Watt-hour (plus/minus), var-hour (plus/minus)	Wh, varh

8.4.1 Power information on the screen

Figure 8.4-1 shows the information about the watt-hour and var-hour (Wh and varh).

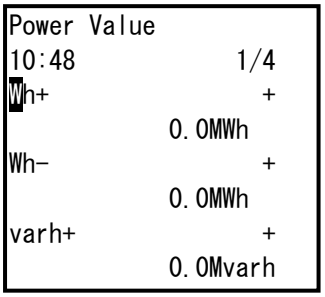


Figure 8.4-1 Example of Power Value screen

Note: See Chapter *User interface: Monitoring sub-menu: Statistics sub-menu*.

8.4.2 Setting for power values

The user can select the unit for each power value. For example, set the [**Wh-Display Unit**]=**kWh**, when kWh is perferred to display.

Table 8.4-2 Selection of units for displaying

Statisics items	Settings	Selection of a unit fot the displaying
Watt-hour	**Wh-Display Unit**	Kilo-watt-hour (**kWh**) or Mega-watt-hour (**MWh**)
Var-hour	**Varh-Display Unit**	Kilo-var-hour (**kvarh**) or Mega-var-hour (**Mvarh**)

8.4.3 Regulation of power values

The number of digits for the power value can be reduced based on the units kWh, MWh and kvarh+. For instance when the power is measured as "123,456kWh" then it is displayed as "123MWh". If this value has to be changed then the user can key in a new compensated value. For example, if "78MWh" should be displayed on the IED screen even though the measured value is "123,456kWh" then the user can set the new value of "78MWh". Note that the compensated value "78MWh" is "78,000kWh", and it is not "78,456kWh" or "123,456kWh"; the compensated value will be affected when a change in the setting of VCT ratio. That is, the user can set a value of "78MW" during the CT ratio of "2000:1", but the CT ratio would be changed from "2000:1" to "4000:1"; hence, the value will be displayed as "156MW" on the IED screen later. Therefore, when the CT ratio setting is required to be changed, remember to set the value of "78MW" again to display the compensated value.

8.5 Statistics data (Demand value group)

The user can keep track of the variable power quantities using the demand feature; the statistical information (such as maximum load, minimum load, and averaged load) are collected in every defined period.

Table 8.5-1 Demand data

			Software Model[3]					
Gr.	Displayed quantities	Abbreviations	11	13	1F	2C	2N	19
Demand value	Current in phase-a (Max., Min., and Averaged data)	I_a Max, I_a Min, I_a Ave	X	X	X	X	X	X
	Current in phase-b (Max., Min., and Averaged data)	I_b Max, I_b Min, I_b Ave	X	X	X	X	X	X
	Current in phase-c (Max., Min., and Averaged data)	I_c Max, I_c Min, I_c Ave	X	X	X	X	X	X
	Residual current (Max., Min., and Averaged data)	I_e Max, I_e Min, I_e Ave(1)	X	X	X	X	X	X
	Voltage applied at phase-a (Max., Min., and Averaged data)	V_a Max, V_a Min, V_a Ave	X	X	X	X	X	X
	Voltage applied at phase-b (Max., Min., and Averaged data)	V_b Max, V_b Min, V_b Ave	X	X	X	X	X	X
	Voltage applied at phase-c (Max., Min., and Averaged data)	V_c Max, V_c Min, V_c Ave	X	X	X	X	X	X
	Voltage applied between phases-a-to-b (Max., Min., and Averaged data)	V_{ab} Max, V_{ab} Min, V_{ab} Ave	X	X	X	X	X	X
	Voltage applied between phases-b-to-b (Max., Min., and Averaged data)	V_{bc} Max, V_{bc} Min, V_{bc} Ave	X	X	X	X	X	X
	Voltage applied between phases-c-to-a (Max., Min., and Averaged data)	V_{ca} Max, V_{ca} Min, V_{ca} Ave	X	X	X	X	X	X
	Zero-sequence voltage (Max., Min., and Averaged data)	V_0 Max, V_0 Min, V_0 Ave(2)	X	X	X	X	X	X
	Reference voltages (Max., Min., and Averaged data)	V3 Max, V3 Min, V3 Ave	X	X	X	X	X	X
	Second reference voltages (Max., Min., and Averaged data)	V4Max, V4 Min, V4 Ave	X	X	X	X	X	X
	Sensitive residual current (Max., Min., and Averaged data)	I_{se} Max, I_{se} Min, I_{se} Ave(1)				X		
	Residual voltage (Max., Min., and Averaged data)	V_e Max, V_e Min, V_e Ave(2)				X	X	

[1]Note: The 'I_e' is taken usually with corresponding VCT circuit.

[2]Note: Terms 'I_0 (i.e., $3I_0$)' and 'V_0 (i.e., $3V_0$)' are gotten in the software calculation using three-phase quantities.

[3]Note: Check the ordering number at the G&T position referring to the ordering (See *AppendiX: Ordering*)

8.5.1 Demand information on the screen

The statistics feature can provides the information about maximum, minimum, and averaged values. Figure 8.5-1 shows the example about the current information

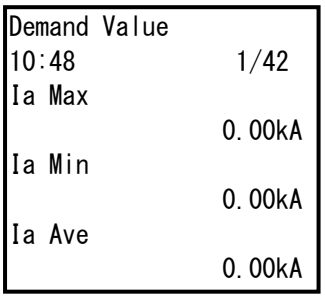


Figure 8.5-1 Example of Demand Value screen

8.5.2 Max/Min/Averaged information about the demand feature

The demand feature is used to calculate the active power (P), the reactive power (P), and the complex power (S) that are weighted with the plus (+) or minus (–) sign; the calculation will be made by the following rules:

(i) Maximum and minimum value

For example, the demand feature gets to have both a minus (e.g., –100 watt) and a plus (e.g., +50 watt) values, '–100 watt' is taken to the minimum data and '+50 watt' is taken to the maximum data. Note that given values do not come out as absolute values.

(ii) Averaged value

If the demand feature gets a data (e.g. +100 watt) in the first period and the other data (that is, –100 watt) in the later period, the data is taken into the absolute value calculation (that is, |–100W|+|100W|=200W; 200W/2=100W).

8.5.3 Demand cycle

The data is taken into the memory every second; the demand feature will calculate the Max/Min/Ave values by the function by collecting the latest data in the memory. When setting 15 minutes for the [**Demand_period**], for example, the calculation is done using the data during the latest 15 minutes. The user can have the cycle of the demand feature be selected among 1min, 5min, 10min, 15min, 30min, and 60min.

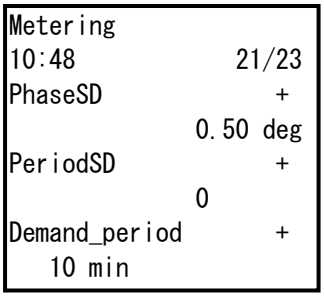


Figure 8.5-2 Demand cycle setting in the setting screen

8.5.4 Resetting data in demand features

The data will be cleared by the following cases:

(a) To energize the IED or to make the initialization about the IED functions

(b) To set a value for the setting [**Demand_period**]

(c) To operate "Reset All Values" on the IED menu

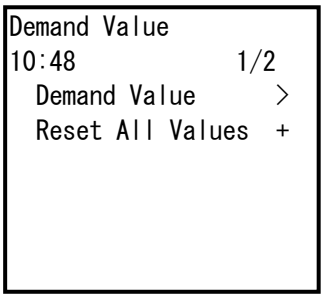


Figure 8.5-3 Reset menu for Demand values

8.6 Statistics data (Peak-demand value group)

Similar to the demand feature (Demand value group), the user can have another peak-demand feature that provides the Max/Min/Ave data that can be obtained from the initialized time to the current time; note these data have been calculated from the first energizing moment of the IED. That is, the data of the peak-demand feature gets to have the latest values in every cycle; the data will be replaced if the past data is not needed. The user can find that the nature of the collected values in the peak-demand values being identical to the one of the Demand value group.

8.6.1 Max/Min/Averaged information about the peak-demand feature

(i) Maximum value

The peak-demand feature starts to collect the data in every cycle after the IED energized; the peak-demand feature will have the largest data. If the present data is larger than the past one with the peak-demand feature will replace the past one for the present one. The maximum value will be cleared when the data is reset.

(ii) Minimum value

Similarly, for the minimum value, the IED displays the smallest data after energizing; the data will be replaced when the present data is smaller than the past one.

(iii) Averaged value

The averaged value is computed using the data in the IED memory, the data which was collected after energizing. Collecting data stays on for a long time; hence, when the counter with regard to the data collection gets to be 2,147,483,647(=0x7FFFFFFF; almost 68 years), resetting data is performed.

8.6.2 Resetting data of peak-demand features

The data will be cleared by the following operations:

(a) To energize the IED or to make the initialization about the IED functions

(b) To operate “Reset All Values” on the IED menu

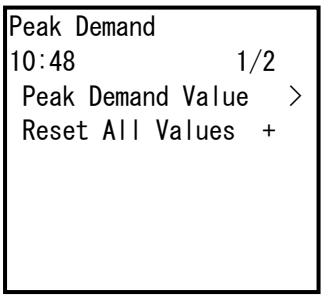


Figure 8.6-1 Reset menu for Peak demand values

8.7 Statistics data (Counter group)

The user can check on the counting numbers provided by the general counter function†. Table 8.7-1 shows the user to find the count numbers in the counter group.

Table 8.7-1 Counter data for software models 2C and 2N

Group	Counter number displayed	Origin of info (default)	Correspondences to GCNTs†
Counter	ARC CLOSE COMMAND	ARC function‡	GCNT01
	COUNT2	(Not assigned)	GCNT02
	COUNT3	(Not assigned)	GCNT03
	….	….	….
	COUNT32	(Not assigned)	GCNT32

Table 8.7-2 Counter data for software models 11, 13, 19, and 1F

Group	Counter number displayed	Origin of info (default)	Correspondences to GCNTs†
Counter	COUNT1	(Not assigned)	GCNT01
	COUNT2	(Not assigned)	GCNT02
	….	….	….
	COUNT32	(Not assigned)	GCNT32

†Note:See Chapter *General control function: Counter function for the general (GCNT)*.

‡Note:See Chapter *Relay application: Autoreclose* for more information.

8.7.1 Count information on the screen

The user can see the count number in the counter group. Figure 8.7-1 illustrates the count numbers provided by the ARC function.

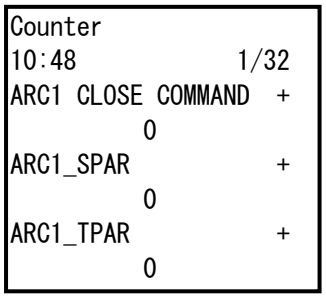


Figure 8.7-1 Example of Counter screen

Note: See Chapter *User interface: Monitoring sub-menu: Statistics sub-menu*.

8.7.2 Report setting for GCNT (Dead band feature)

The data collected with the GCNT functions will be sent to the network; thus, the user should set a regulation value using the SD feature in the GCNT function. See section Setting for the report (Dead band) in the GCNT function.

8.8 Statistics data (Accumulated time)

Over all running time for which the IED has operated is provided in “Accumulated Time”. The user can see the overall time on the Accumulated Time screen. The time will be cleared when the IED is switched off.

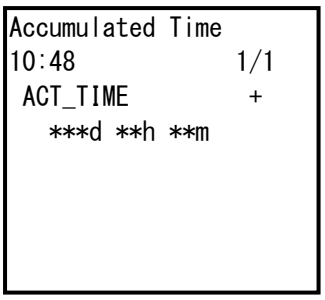


Figure 8.8-1 Example of Accumulated Time screen

Note: The user can also clear the Accumulated time in the screen menu. For key operation, see Chapter *User interface: Monitoring sub-menu: Statistics sub-menu*.

8.9 Statistics data (Total time group)

Total times are provided by the total time measurement function†, as shown in Table 8.7-1.

Table 8.9-1 Total time data

Group	Displayed quantities	Origin of time data	Correspondences to TOTALTIM†
Total time	TOTAL TIME 1	TOTALTIM01 function	TT1
	TOTAL TIME 2	TOTALTIM02 function	TT2
	TOTAL TIME 3	TOTALTIM03 function	TT3
	….	….	….
	TOTAL TIME 12	TOTALTIM03 function	TT12

†Note:See Chapter *Control and monitoring application: Total time measurement function*

8.9.1 Time information on the screen

The user can see the total times on the IED screen.

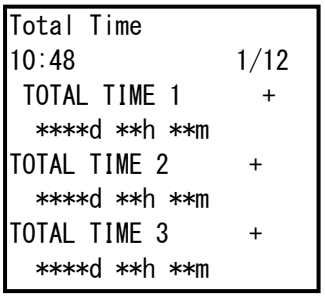


Figure 8.9-1 Example of Total Time screen

Note: See Chapter *User interface: Monitoring sub-menu: Statistics sub-menu*.

8.9.2 Report setting for TOTALTIM (Dead band feature)

The data collected with the TOTALTIM function will be sent to the network; thus, the user should set a regulation value using the SD feature in the TOTALTIME function. See section *Setting for the report (Dead band)* in the TOTALTIME function.

8.10 Monitoring for miscellaneous functions

Operating status of relay elements, binary IO modules, communication modules, GOOSE, and diagnostics are displayed in the monitoring function.

(i) Relay element

(For more information about the menu operation, see Chapter *User interface: Monitoring sub-menu: Relay Elements*. The relay functions and their characteristics are discussed in Chapter *Relay application*).

(ii) Communication

(For more information about the menu operation, see Chapter *User interface: Monitoring sub-menu: Communication*. The communication features about the LAN port is discussed in Chapter *Communication protocol: LAN communication*. The hardware information is discussed in Chapter *Technical description: Signal processing and communication module*).

(iii) Binary IO

(For more information about the menu operation, see Chapter *User interface: Monitoring sub-menu: Binary I/O*. The structure and its operation is discussed in Chapter *Technical description: Binary IO module*).

(iv) Goose monitoring

(For more information about the menu operation, see Chapter *User interface: Monitoring sub-menu: Goose monitoring*. The information about the GOOSE is discussed in Chapter *Communication protocol: IEC 61850 communication*).

(v) Diagnostics

(For more information about the menu operation, see Chapter *User interface: Monitoring sub-menu: Diagnostics sub-menu*. The information about the diagnostics is discussed in Chapter *Automatic supervision*).

8.11 Setting

Metering settings in MES (Function ID: 710001)

Setting item		Range	Units	Contents	Default setting value	Notes
	Display Value	Primary/Secondary	–	Display selection of primary or secondary	Primary	
	Power	Send/Receive	–	Power flow definition (Supply or absorb)	Send	
	Current	Lead/Lag	–	The angle compared with the voltage	Lead	
	PF Sign	AP/AP+RP	–	Denison of the sign of the power factor	AP+RP	
	I-Valid Level	0.10 to 5.00	%	Cutting off small entering current	4.00	
	V-Valid Level	0.10 to 5.00	%	Cutting off small applied voltage	0.30	
	I-Display Unit	A/kA	–	Current shown in Ampere or Kilo-Ampere	kA	
	V-Display Unit	V/kV	–	Voltage shown in Volt or Kilo-Volt	kV	
	P-Display Unit	kW/MW	–	Active power shown in Kilo- or Mega-watt	MW	
	Q-Display Unit	kvar/Mvar	–	Reactive power shown in Kilo- or Mega-var	Mvar	
	S-Display Unit	kVA/MVA	–	Apparent power shown in Kilo- or Mega-VA	MVA	

Statistics settings in MES (Function ID: 710001)

Setting item		Range	Units	Contents	Default setting value	Notes
	Wh-Display Unit	kWh/MWh	–	Watt-hour shown in Kilo- or Mega-Wh	MWh	
	varh-Display Unit	kvarh/Mvarh	–	Var-hour shown in Kilo- or Mega-varh	Mvarh	

Demand settings in MES (Function ID: 712001)

Setting item		Range	Units	Contents	Default setting value	Notes
	Demand_period	1min / 5min / 10min / 15min / 30min / 60min	–	Period of demand calculation	10min	

Dead-band setting in MES (Function ID: 710001)

Setting item		Range	Units	Contents	Default setting value	Notes
	ISD	0.00 to 50.00	%	Sending Dead Band in current	5.00	
	VSD	0.00 to 50.00	%	Sending Dead Band in voltage	0.60	
	P/Q/SSD	0.00 to 50.00	%	P/Q/S Sending Dead Band	5.00	
	PFSD	0.00 to 1.00	–	PF Sending Dead Band	0.02	
	FSD	0.00 to 50.00	%	F Sending Dead Band	0.50	
	Wh/varhSD	0.0 to 999.9	–	Wh/varh Sending Dead Band	1.0	
	PhaseSD	0.0 to 90.0	deg	Phase Sending Dead Band	0.5	
	PeriodSD	0 to 4	–	Period of Sending Dead band	0	
	dVSD	0.00 to 50.00	%	dV Sending Dead Band	0.60	

Setting of Test in MES (Function ID: 710001)

Setting item		Range	Units	Contents	Default setting value	Notes
	Commercial Test	OFF / ON	–	Commercial Test Switch	OFF / ON	

8.12 Signal

Signal monitoring points in BCPU with single VCT51B Software 2N [MES_MANAGEMENT(FunctionID: 711001)]

Element IDs	Names	Contents Note	Element IDs	Names	Contents Note
3100901060	CT-ERR	CT Monitoring Result	4302B61056	VL2	Line2 Voltage (VT secondary value)
3100921060	V0-ERR	V0 Monitoring Result	4302B6107C	VL2	Line2 Voltage (VT primary value)
3100931060	V2-ERR	V2 Monitoring Result	4302B71056	dV-SYN2	Differential voltage of SYN2's VL2 and VL (VT secondary value)
43000E1091	PFa	PFa measurement	4302B7107C	dV-SYN2	Differential voltage of SYN2's VL2 and VL (VT primary value)
43000E1092	PFb	PFb measurement	4302C31056	Ve	V4 measurement secondary
43000E1093	PFc	PFc measurement	4302C31057	Ve-Angle	V4 measurement angle
43000E1094	PF	PF measurement	4302C3107C	Ve	V4 measurement primary
4300A01090	THM-Capacity	Percentage of thermal capacity for fault record / metering	43030B1095	Pa	Pa measurement primary
4300A11090	VR1-f	Frequency of SyncRy1's VR	43030B1096	Pb	Pb measurement primary
4300A21090	VI1-f	Frequency of SyncRy1's VI	43030B1097	Pc	Pc measurement primary
4300AE1099	dAng.-SyncRy1	Differential angle of SyncRy1's VR and VI	43030B1098	P	P measurement primary
4300AF1090	df-SyncRy1	Differential frequency of SyncRy1's VR and VI	43040C1095	Qa	Qa measurement primary
4300B31099	dAng.-SyncRy2	Differential angle of SyncRy2's VR and VI	43040C1096	Qb	Qb measurement primary
4300B41090	df-SyncRy2	Differential frequency of SyncRy2's VR and VI	43040C1097	Qc	Qc measurement primary
4300B51090	I2/I1	I2/I1 measurement for fault record / metering	43040C1098	Q	Q measurement primary
4300B61090	df/dt	df/dt measurement	43050D1095	Sa	Sa measurement primary
4300B71099	dAng.-SYN1	Differential angle of SYN1's VB and VL	43050D1096	Sb	Sb measurement primary
4300B81090	df-SYN1	Differential frequency of SYN1's VB and VL	43050D1097	Sc	Sc measurement primary
4300B91099	dAng.-SYN2	Differential angle of SYN2's VL2 and VL	43050D1098	S	S measurement primary
4300BA1090	df-SYN2	Differential frequency of SYN2's VL2 and VL	43060F105C	f	Frequency measurement
4300BB1090	VR2-f	Frequency of SyncRy2's VR	43092E1056	Ise	Ise measurement secondary
4300BC1090	VI2-f	Frequency of SyncRy2's VI	43092E1057	Ise-Angle	Ise measurement angle
4301001050	Ia	Ia measurement secondary	43092E107C	Ise	Ise measurement primary
4301001050	Ia-Angle	Ia measurement angle	(N.A)	(N.A)	
4301001050	Ib	Ib measurement secondary	(N.A)	(N.A)	
4301001050	Ib-Angle	Ib measurement angle	(N.A)	(N.A)	
4301001050	Ic	Ic measurement secondary	(N.A)	(N.A)	
4301001050	Ic-Angle	Ic measurement angle	(N.A)	(N.A)	
4301001070	Ia	Ia measurement primary	(N.A)	(N.A)	
4301001070	Ib	Ib measurement primary	(N.A)	(N.A)	
430100107A	Ic	Ic measurement primary	(N.A)	(N.A)	
4301021050	I1	I1 measurement secondary	(N.A)	(N.A)	
4301021050	I1-Angle	I1 measurement angle	(N.A)	(N.A)	
4301021050	I2	I2 measurement secondary	(N.A)	(N.A)	
4301021050	I2-Angle	I2 measurement angle	(N.A)	(N.A)	
4301021050	I0	I0 measurement secondary	(N.A)	(N.A)	
4301021050	I0-Angle	I0 measurement angle	(N.A)	(N.A)	
4301021070	I1	I1 measurement primary	(N.A)	(N.A)	
4301021070	I2	I2 measurement primary	(N.A)	(N.A)	
430102107C	I0	I0 measurement primary	(N.A)	(N.A)	
43010A1056	Ie	Ie measurement secondary	(N.A)	(N.A)	
43010A1057	Ie-Angle	Ie measurement angle	(N.A)	(N.A)	
43010A107C	Ie	Ie measurement primary	(N.A)	(N.A)	
4302041050	Va	Va measurement secondary	(N.A)	(N.A)	
4302041050	Va-Angle	Va measurement angle	(N.A)	(N.A)	
4302041050	Vb	Vb measurement secondary	(N.A)	(N.A)	
4302041050	Vb-Angle	Vb measurement angle	(N.A)	(N.A)	
4302041050	Vc	Vc measurement secondary	(N.A)	(N.A)	
4302041050	Vc-Angle	Vc measurement angle	(N.A)	(N.A)	
4302041070	Va	Va measurement primary	(N.A)	(N.A)	
4302041070	Vb	Vb measurement primary	(N.A)	(N.A)	
430204107A	Vc	Vc measurement primary	(N.A)	(N.A)	
4302051050	Vab	Vab measurement secondary	(N.A)	(N.A)	
4302051050	Vab-Angle	Vab measurement angle	(N.A)	(N.A)	
4302051050	Vbc	Vbc measurement secondary	(N.A)	(N.A)	
4302051050	Vbc-Angle	Vbc measurement angle	(N.A)	(N.A)	
4302051050	Vca	Vca measurement secondary	(N.A)	(N.A)	
4302051050	Vca-Angle	Vca measurement angle	(N.A)	(N.A)	
4302051070	Vab	Vab measurement primary	(N.A)	(N.A)	
4302051070	Vbc	Vbc measurement primary	(N.A)	(N.A)	
430205107A	Vca	Vca measurement primary	(N.A)	(N.A)	
4302061050	V1	V1 measurement secondary	(N.A)	(N.A)	
4302061050	V1-Angle	V1 measurement angle	(N.A)	(N.A)	
4302061050	V2	V2 measurement secondary	(N.A)	(N.A)	
4302061050	V2-Angle	V2 measurement angle	(N.A)	(N.A)	
4302061050	V0	V0 measurement secondary	(N.A)	(N.A)	
4302061050	V0-Angle	V0 measurement angle	(N.A)	(N.A)	
4302061070	V1	V1 measurement primary	(N.A)	(N.A)	
4302061070	V2	V2 measurement primary	(N.A)	(N.A)	
430206107C	V0	V0 measurement primary	(N.A)	(N.A)	
4302081050	V3	Vs measurement secondary	(N.A)	(N.A)	
4302081050	V3-Angle	Vs measurement angle	(N.A)	(N.A)	
430208107C	V3	Vs measurement primary	(N.A)	(N.A)	
4302091050	V4	Vs2 measurement secondary	(N.A)	(N.A)	
4302091050	V4-Angle	Vs2 measurement angle	(N.A)	(N.A)	
430209107C	V4	Vs2 measurement primary	(N.A)	(N.A)	
4302AB1056	VR1	Running voltage of SyncRy1 (VT secondary value)	(N.A)	(N.A)	
4302AB107C	VR1	Running voltage of SyncRy1 (VT primary value)	(N.A)	(N.A)	
4302AC1056	VI1	Incoming voltage of SyncRy1 (VT secondary value)	(N.A)	(N.A)	
4302AC107C	VI1	Incoming voltage of SyncRy1 (VT primary value)	(N.A)	(N.A)	
4302AD1056	dV-SyncRy1	Differential voltage of SyncRy1's VR and VI (VT secondary value)	(N.A)	(N.A)	
4302AD107C	dV-SyncRy1	Differential voltage of SyncRy1's VR and VI (VT primary value)	(N.A)	(N.A)	
4302B01056	VR2	Running voltage of SyncRy2 (VT secondary value)	(N.A)	(N.A)	
4302B0107C	VR2	Running voltage of SyncRy2 (VT primary value)	(N.A)	(N.A)	
4302B11056	VI2	Incoming voltage of SyncRy2 (VT secondary value)	(N.A)	(N.A)	
4302B1107C	VI2	Incoming voltage of SyncRy2 (VT primary value)	(N.A)	(N.A)	
4302B21056	dV-SyncRy2	Differential voltage of SyncRy2's VR and VI (VT secondary value)	(N.A)	(N.A)	
4302B2107C	dV-SyncRy2	Differential voltage of SyncRy2's VR and VI (VT primary value)	(N.A)	(N.A)	
4302B31056	VB	Busbar Voltage (VT secondary value)	(N.A)	(N.A)	
4302B3107C	VB	Busbar Voltage (VT primary value)	(N.A)	(N.A)	
4302B41056	VL	Line Voltage (VT secondary value)	(N.A)	(N.A)	
4302B4107C	VL	Line Voltage (VT primary value)	(N.A)	(N.A)	
4302B51056	dV-SYN1	Differential voltage of SYN1's VB and VL (VT secondary value)	(N.A)	(N.A)	
4302B5107C	dV-SYN1	Differential voltage of SYN1's VB and VL (VT primary value)	(N.A)	(N.A)	

Signal monitoring points in BCPU with single VCT51B
Software 2C[MES_MANAGEMENT (FunctionID: 711001)]

Element IDs	Names	Contents Note	Element IDs	Names	Contents Note
3100901060	CT-ERR	CT Monitoring Result	4302B61056	VL2	Line2 Voltage (VT secondary value)
3100921060	V0-ERR	V0 Monitoring Result	4302B6107C	VL2	Line2 Voltage (VT primary value)
3100931060	V2-ERR	V2 Monitoring Result	4302B71056	dV-SYN2	Differential voltage of SYN2's VL2 and VL (VT secondary value)
43000E1091	PFa	PFa measurement	4302B7107C	dV-SYN2	Differential voltage of SYN2's VL2 and VL (VT primary value)
43000E1092	PFb	PFb measurement	4302C31056	Ve	V4 measurement secondary
43000E1093	PFc	PFc measurement	4302C31057	Ve-Angle	V4 measurement angle
43000E1094	PF	PF measurement	4302C3107C	Ve	V4 measurement primary
4300A01090	THM-Capacity	Percentage of thermal capacity for fault record / metering	43030B1095	Pa	Pa measurement primary
4300A11090	VR1-f	Frequency of SyncRy1's VR	43030B1096	Pb	Pb measurement primary
4300A21090	VI1-f	Frequency of SyncRy1's VI	43030B1097	Pc	Pc measurement primary
4300AE1099	dAng.-SyncRy1	Differential angle of SyncRy1's VR and VI	43030B1098	P	P measurement primary
4300AF1090	df-SyncRy1	Differential frequency of SyncRy1's VR and VI	43040C1095	Qa	Qa measurement primary
4300B31099	dAng.-SyncRy2	Differential angle of SyncRy2's VR and VI	43040C1096	Qb	Qb measurement primary
4300B41090	df-SyncRy2	Differential frequency of SyncRy2's VR and VI	43040C1097	Qc	Qc measurement primary
4300B51090	I2/I1	I2/I1 measurement for fault record / metering	43040C1098	Q	Q measurement primary
4300B61090	df/dt	df/dt measurement	43050D1095	Sa	Sa measurement primary
4300B71099	dAng.-SYN1	Differential angle of SYN1's VB and VL	43050D1096	Sb	Sb measurement primary
4300B81090	df-SYN1	Differential frequency of SYN1's VB and VL	43050D1097	Sc	Sc measurement primary
4300B91099	dAng.-SYN2	Differential angle of SYN2's VL2 and VL	43050D1098	S	S measurement primary
4300BA1090	df-SYN2	Differential frequency of SYN2's VL2 and VL	43060F105C	f	Frequency measurement
4300BB1090	VR2-f	Frequency of SyncRy2's VR	43092E1056	Ise	Ise measurement secondary
4300BC1090	VI2-f	Frequency of SyncRy2's VI	43092E1057	Ise-Angle	Ise measurement angle
4301001050	Ia	Ia measurement secondary	43092E107C	Ise	Ise measurement primary
4301001050	Ia-Angle	Ia measurement angle	(N.A)	(N.A)	
4301001050	Ib	Ib measurement secondary	(N.A)	(N.A)	
4301001050	Ib-Angle	Ib measurement angle	(N.A)	(N.A)	
4301001050	Ic	Ic measurement secondary	(N.A)	(N.A)	
4301001050	Ic-Angle	Ic measurement angle	(N.A)	(N.A)	
4301001070	Ia	Ia measurement primary	(N.A)	(N.A)	
4301001070	Ib	Ib measurement primary	(N.A)	(N.A)	
430100107A	Ic	Ic measurement primary	(N.A)	(N.A)	
4301021050	I1	I1 measurement secondary	(N.A)	(N.A)	
4301021050	I1-Angle	I1 measurement angle	(N.A)	(N.A)	
4301021050	I2	I2 measurement secondary	(N.A)	(N.A)	
4301021050	I2-Angle	I2 measurement angle	(N.A)	(N.A)	
4301021050	I0	I0 measurement secondary	(N.A)	(N.A)	
4301021050	I0-Angle	I0 measurement angle	(N.A)	(N.A)	
4301021070	I1	I1 measurement primary	(N.A)	(N.A)	
4301021070	I2	I2 measurement primary	(N.A)	(N.A)	
430102107C	I0	I0 measurement primary	(N.A)	(N.A)	
43010A1056	Ie	Ie measurement secondary	(N.A)	(N.A)	
43010A1057	Ie-Angle	Ie measurement angle	(N.A)	(N.A)	
43010A107C	Ie	Ie measurement primary	(N.A)	(N.A)	
4302041050	Va	Va measurement secondary	(N.A)	(N.A)	
4302041050	Va-Angle	Va measurement angle	(N.A)	(N.A)	
4302041050	Vb	Vb measurement secondary	(N.A)	(N.A)	
4302041050	Vb-Angle	Vb measurement angle	(N.A)	(N.A)	
4302041050	Vc	Vc measurement secondary	(N.A)	(N.A)	
4302041050	Vc-Angle	Vc measurement angle	(N.A)	(N.A)	
4302041070	Va	Va measurement primary	(N.A)	(N.A)	
4302041070	Vb	Vb measurement primary	(N.A)	(N.A)	
430204107A	Vc	Vc measurement primary	(N.A)	(N.A)	
4302051050	Vab	Vab measurement secondary	(N.A)	(N.A)	
4302051050	Vab-Angle	Vab measurement angle	(N.A)	(N.A)	
4302051050	Vbc	Vbc measurement secondary	(N.A)	(N.A)	
4302051050	Vbc-Angle	Vbc measurement angle	(N.A)	(N.A)	
4302051050	Vca	Vca measurement secondary	(N.A)	(N.A)	
4302051050	Vca-Angle	Vca measurement angle	(N.A)	(N.A)	
4302051070	Vab	Vab measurement primary	(N.A)	(N.A)	
4302051070	Vbc	Vbc measurement primary	(N.A)	(N.A)	
430205107A	Vca	Vca measurement primary	(N.A)	(N.A)	
4302061050	V1	V1 measurement secondary	(N.A)	(N.A)	
4302061050	V1-Angle	V1 measurement angle	(N.A)	(N.A)	
4302061050	V2	V2 measurement secondary	(N.A)	(N.A)	
4302061050	V2-Angle	V2 measurement angle	(N.A)	(N.A)	
4302061050	V0	V0 measurement secondary	(N.A)	(N.A)	
4302061050	V0-Angle	V0 measurement angle	(N.A)	(N.A)	
4302061070	V1	V1 measurement primary	(N.A)	(N.A)	
4302061070	V2	V2 measurement primary	(N.A)	(N.A)	
430206107C	V0	V0 measurement primary	(N.A)	(N.A)	
4302081050	V3	Vs measurement secondary	(N.A)	(N.A)	
4302081050	V3-Angle	Vs measurement angle	(N.A)	(N.A)	
430208107C	V3	Vs measurement primary	(N.A)	(N.A)	
4302091050	V4	Vs2 measurement secondary	(N.A)	(N.A)	
4302091050	V4-Angle	Vs2 measurement angle	(N.A)	(N.A)	
430209107C	V4	Vs2 measurement primary	(N.A)	(N.A)	
4302AB1056	VR1	Running voltage of SyncRy1 (VT secondary value)	(N.A)	(N.A)	
4302AB107C	VR1	Running voltage of SyncRy1 (VT primary value)	(N.A)	(N.A)	
4302AC1056	VI1	Incoming voltage of SyncRy1 (VT secondary value)	(N.A)	(N.A)	
4302AC107C	VI1	Incoming voltage of SyncRy1 (VT primary value)	(N.A)	(N.A)	
4302AD1056	dV-SyncRy1	Differential voltage of SyncRy1's VR and VI (VT secondary value)	(N.A)	(N.A)	
4302AD107C	dV-SyncRy1	Differential voltage of SyncRy1's VR and VI (VT primary value)	(N.A)	(N.A)	
4302B01056	VR2	Running voltage of SyncRy2 (VT secondary value)	(N.A)	(N.A)	
4302B0107C	VR2	Running voltage of SyncRy2 (VT primary value)	(N.A)	(N.A)	
4302B11056	VI2	Incoming voltage of SyncRy2 (VT secondary value)	(N.A)	(N.A)	
4302B1107C	VI2	Incoming voltage of SyncRy2 (VT primary value)	(N.A)	(N.A)	
4302B21056	dV-SyncRy2	Differential voltage of SyncRy2's VR and VI (VT secondary value)	(N.A)	(N.A)	
4302B2107C	dV-SyncRy2	Differential voltage of SyncRy2's VR and VI (VT primary value)	(N.A)	(N.A)	
4302B31056	VB	Busbar Voltage (VT secondary value)	(N.A)	(N.A)	
4302B3107C	VB	Busbar Voltage (VT primary value)	(N.A)	(N.A)	
4302B41056	VL	Line Voltage (VT secondary value)	(N.A)	(N.A)	
4302B4107C	VL	Line Voltage (VT primary value)	(N.A)	(N.A)	
4302B51056	dV-SYN1	Differential voltage of SYN1's VB and VL (VT secondary value)	(N.A)	(N.A)	
4302B5107C	dV-SYN1	Differential voltage of SYN1's VB and VL (VT primary value)	(N.A)	(N.A)	

Signal monitoring points in BCU with single VCT52B
Software 11[MES_MANAGEMENT (FunctionID: 711001)]

Element IDs	Names	Contents Note	Element IDs	Names	Contents Note
3100901060	CT-ERR	CT Monitoring Result	43050D1095	Sa	Sa measurement primary
3100911060	I0-ERR	I0 Monitoring Result	43050D1096	Sb	Sb measurement primary
3100921060	V0-ERR	V0 Monitoring Result	43050D1097	Sc	Sc measurement primary
3100931060	V2-ERR	V2 Monitoring Result	43050D1098	S	S measurement primary
3100941060	CT2-ERR	CT2 Monitoring Result	43060F105C	f	Frequency measurement
3100951060	I02-ERR	I02 Monitoring Result	(N.A)	(N.A)	
3100961060	V02-ERR	V02 Monitoring Result	(N.A)	(N.A)	
3100971060	V22-ERR	V22 Monitoring Result	(N.A)	(N.A)	
43000E1091	PFa	PFa measurement	(N.A)	(N.A)	
43000E1092	PFb	PFb measurement	(N.A)	(N.A)	
43000E1093	PFc	PFc measurement	(N.A)	(N.A)	
43000E1094	PF	PF measurement	(N.A)	(N.A)	
4300A11090	VR1-f	Frequency of SyncRy1's VR	(N.A)	(N.A)	
4300A21090	VI1-f	Frequency of SyncRy1's VI	(N.A)	(N.A)	
4300AE1099	dAng.-SyncRy1	Differential angle of SyncRy1's VR and VI	(N.A)	(N.A)	
4300AF1090	df-SyncRy1	Differential frequency of SyncRy1's VR and VI	(N.A)	(N.A)	
4300B31099	dAng.-SyncRy2	Differential angle of SyncRy2's VR and VI	(N.A)	(N.A)	
4300B41090	df-SyncRy2	Differential frequency of SyncRy2's VR and VI	(N.A)	(N.A)	
4300BB1090	VR2-f	Frequency of SyncRy2's VR	(N.A)	(N.A)	
4300BC1090	VI2-f	Frequency of SyncRy2's VI	(N.A)	(N.A)	
4301001050	Ia	Ia measurement secondary	(N.A)	(N.A)	
4301001050	Ia-Angle	Ia measurement angle	(N.A)	(N.A)	
4301001050	Ib	Ib measurement secondary	(N.A)	(N.A)	
4301001050	Ib-Angle	Ib measurement angle	(N.A)	(N.A)	
4301001050	Ic	Ic measurement secondary	(N.A)	(N.A)	
4301001050	Ic-Angle	Ic measurement angle	(N.A)	(N.A)	
4301001070	Ia	Ia measurement primary	(N.A)	(N.A)	
4301001070	Ib	Ib measurement primary	(N.A)	(N.A)	
430100107A	Ic	Ic measurement primary	(N.A)	(N.A)	
4301021050	I1	I1 measurement secondary	(N.A)	(N.A)	
4301021050	I1-Angle	I1 measurement angle	(N.A)	(N.A)	
4301021050	I2	I2 measurement secondary	(N.A)	(N.A)	
4301021050	I2-Angle	I2 measurement angle	(N.A)	(N.A)	
4301021050	I0	I0 measurement secondary	(N.A)	(N.A)	
4301021050	I0-Angle	I0 measurement angle	(N.A)	(N.A)	
4301021070	I1	I1 measurement primary	(N.A)	(N.A)	
4301021070	I2	I2 measurement primary	(N.A)	(N.A)	
430102107C	I0	I0 measurement primary	(N.A)	(N.A)	
43010A1056	Ie	Ie measurement secondary	(N.A)	(N.A)	
43010A1057	Ie-Angle	Ie measurement angle	(N.A)	(N.A)	
43010A107C	Ie	Ie measurement primary	(N.A)	(N.A)	
4302041050	Va	Va measurement secondary	(N.A)	(N.A)	
4302041050	Va-Angle	Va measurement angle	(N.A)	(N.A)	
4302041050	Vb	Vb measurement secondary	(N.A)	(N.A)	
4302041050	Vb-Angle	Vb measurement angle	(N.A)	(N.A)	
4302041050	Vc	Vc measurement secondary	(N.A)	(N.A)	
4302041050	Vc-Angle	Vc measurement angle	(N.A)	(N.A)	
4302041070	Va	Va measurement primary	(N.A)	(N.A)	
4302041070	Vb	Vb measurement primary	(N.A)	(N.A)	
430204107A	Vc	Vc measurement primary	(N.A)	(N.A)	
4302051050	Vab	Vab measurement secondary	(N.A)	(N.A)	
4302051050	Vab-Angle	Vab measurement angle	(N.A)	(N.A)	
4302051050	Vbc	Vbc measurement secondary	(N.A)	(N.A)	
4302051050	Vbc-Angle	Vbc measurement angle	(N.A)	(N.A)	
4302051050	Vca	Vca measurement secondary	(N.A)	(N.A)	
4302051050	Vca-Angle	Vca measurement angle	(N.A)	(N.A)	
4302051070	Vab	Vab measurement primary	(N.A)	(N.A)	
4302051070	Vbc	Vbc measurement primary	(N.A)	(N.A)	
430205107A	Vca	Vca measurement primary	(N.A)	(N.A)	
4302061050	V1	V1 measurement secondary	(N.A)	(N.A)	
4302061050	V1-Angle	V1 measurement angle	(N.A)	(N.A)	
4302061050	V2	V2 measurement secondary	(N.A)	(N.A)	
4302061050	V2-Angle	V2 measurement angle	(N.A)	(N.A)	
4302061050	V0	V0 measurement secondary	(N.A)	(N.A)	
4302061050	V0-Angle	V0 measurement angle	(N.A)	(N.A)	
4302061070	V1	V1 measurement primary	(N.A)	(N.A)	
4302061070	V2	V2 measurement primary	(N.A)	(N.A)	
430206107C	V0	V0 measurement primary	(N.A)	(N.A)	
4302081050	V3	Vs measurement secondary	(N.A)	(N.A)	
4302081050	V3-Angle	Vs measurement angle	(N.A)	(N.A)	
430208107C	V3	Vs measurement primary	(N.A)	(N.A)	
4302091050	V4	Vs2 measurement secondary	(N.A)	(N.A)	
4302091050	V4-Angle	Vs2 measurement angle	(N.A)	(N.A)	
430209107C	V4	Vs2 measurement primary	(N.A)	(N.A)	
4302AB1056	VR1	Running voltage of SyncRy1 (VT secondary value)	(N.A)	(N.A)	
4302AB107C	VR1	Running voltage of SyncRy1 (VT primary value)	(N.A)	(N.A)	
4302AC1056	VI1	Incoming voltage of SyncRy1 (VT secondary value)	(N.A)	(N.A)	
4302AC107C	VI1	Incoming voltage of SyncRy1 (VT primary value)	(N.A)	(N.A)	
4302AD1056	dV-SyncRy1	Differential voltage of SyncRy1's VR and VI (VT secondary value)	(N.A)	(N.A)	
4302AD107C	dV-SyncRy1	Differential voltage of SyncRy1's VR and VI (VT primary value)	(N.A)	(N.A)	
4302B01056	VR2	Running voltage of SyncRy2 (VT secondary value)	(N.A)	(N.A)	
4302B0107C	VR2	Running voltage of SyncRy2 (VT primary value)	(N.A)	(N.A)	
4302B11056	VI2	Incoming voltage of SyncRy2 (VT secondary value)	(N.A)	(N.A)	
4302B1107C	VI2	Incoming voltage of SyncRy2 (VT primary value)	(N.A)	(N.A)	
4302B21056	dV-SyncRy2	Differential voltage of SyncRy2's VR and VI (VT secondary value)	(N.A)	(N.A)	
4302B2107C	dV-SyncRy2	Differential voltage of SyncRy2's VR and VI (VT primary value)	(N.A)	(N.A)	
43030B1095	Pa	Pa measurement primary	(N.A)	(N.A)	
43030B1096	Pb	Pb measurement primary	(N.A)	(N.A)	
43030B1097	Pc	Pc measurement primary	(N.A)	(N.A)	
43030B1098	P	P measurement primary	(N.A)	(N.A)	
43040C1095	Qa	Qa measurement primary	(N.A)	(N.A)	
43040C1096	Qb	Qb measurement primary	(N.A)	(N.A)	
43040C1097	Qc	Qc measurement primary	(N.A)	(N.A)	
43040C1098	Q	Q measurement primary	(N.A)	(N.A)	

Signal monitoring points in BCU with single VCT52B
Software 1F[MES_MANAGEMENT (FunctionID: 711001)]

Element IDs	Names	Contents Note	Element IDs	Names	Contents Note
3100901060	CT-ERR	CT Monitoring Result	43050D1095	Sa	Sa measurement primary
3100911060	I0-ERR	I0 Monitoring Result	43050D1096	Sb	Sb measurement primary
3100921060	V0-ERR	V0 Monitoring Result	43050D1097	Sc	Sc measurement primary
3100931060	V2-ERR	V2 Monitoring Result	43050D1098	S	S measurement primary
3100941060	CT2-ERR	CT2 Monitoring Result	43060F105C	f	Frequency measurement
3100951060	I02-ERR	I02 Monitoring Result	(N.A)	(N.A)	
3100961060	V02-ERR	V02 Monitoring Result	(N.A)	(N.A)	
3100971060	V22-ERR	V22 Monitoring Result	(N.A)	(N.A)	
43000E1091	PFa	PFa measurement	(N.A)	(N.A)	
43000E1092	PFb	PFb measurement	(N.A)	(N.A)	
43000E1093	PFc	PFc measurement	(N.A)	(N.A)	
43000E1094	PF	PF measurement	(N.A)	(N.A)	
4300A11090	VR1-f	Frequency of SyncRy1's VR	(N.A)	(N.A)	
4300A21090	VI1-f	Frequency of SyncRy1's VI	(N.A)	(N.A)	
4300AE1099	dAng.-SyncRy1	Differential angle of SyncRy1's VR and VI	(N.A)	(N.A)	
4300AF1090	df-SyncRy1	Differential frequency of SyncRy1's VR and VI	(N.A)	(N.A)	
4300B31099	dAng.-SyncRy2	Differential angle of SyncRy2's VR and VI	(N.A)	(N.A)	
4300B41090	df-SyncRy2	Differential frequency of SyncRy2's VR and VI	(N.A)	(N.A)	
4300BB1090	VR2-f	Frequency of SyncRy2's VR	(N.A)	(N.A)	
4300BC1090	VI2-f	Frequency of SyncRy2's VI	(N.A)	(N.A)	
4301001050	Ia	Ia measurement secondary	(N.A)	(N.A)	
4301001050	Ia-Angle	Ia measurement angle	(N.A)	(N.A)	
4301001050	Ib	Ib measurement secondary	(N.A)	(N.A)	
4301001050	Ib-Angle	Ib measurement angle	(N.A)	(N.A)	
4301001050	Ic	Ic measurement secondary	(N.A)	(N.A)	
4301001050	Ic-Angle	Ic measurement angle	(N.A)	(N.A)	
4301001070	Ia	Ia measurement primary	(N.A)	(N.A)	
4301001070	Ib	Ib measurement primary	(N.A)	(N.A)	
430100107A	Ic	Ic measurement primary	(N.A)	(N.A)	
4301021050	I1	I1 measurement secondary	(N.A)	(N.A)	
4301021050	I1-Angle	I1 measurement angle	(N.A)	(N.A)	
4301021050	I2	I2 measurement secondary	(N.A)	(N.A)	
4301021050	I2-Angle	I2 measurement angle	(N.A)	(N.A)	
4301021050	I0	I0 measurement secondary	(N.A)	(N.A)	
4301021050	I0-Angle	I0 measurement angle	(N.A)	(N.A)	
4301021070	I1	I1 measurement primary	(N.A)	(N.A)	
4301021070	I2	I2 measurement primary	(N.A)	(N.A)	
430102107C	I0	I0 measurement primary	(N.A)	(N.A)	
43010A1056	Ie	Ie measurement secondary	(N.A)	(N.A)	
43010A1057	Ie-Angle	Ie measurement angle	(N.A)	(N.A)	
43010A107C	Ie	Ie measurement primary	(N.A)	(N.A)	
4302041050	Va	Va measurement secondary	(N.A)	(N.A)	
4302041050	Va-Angle	Va measurement angle	(N.A)	(N.A)	
4302041050	Vb	Vb measurement secondary	(N.A)	(N.A)	
4302041050	Vb-Angle	Vb measurement angle	(N.A)	(N.A)	
4302041050	Vc	Vc measurement secondary	(N.A)	(N.A)	
4302041050	Vc-Angle	Vc measurement angle	(N.A)	(N.A)	
4302041070	Va	Va measurement primary	(N.A)	(N.A)	
4302041070	Vb	Vb measurement primary	(N.A)	(N.A)	
430204107A	Vc	Vc measurement primary	(N.A)	(N.A)	
4302051050	Vab	Vab measurement secondary	(N.A)	(N.A)	
4302051050	Vab-Angle	Vab measurement angle	(N.A)	(N.A)	
4302051050	Vbc	Vbc measurement secondary	(N.A)	(N.A)	
4302051050	Vbc-Angle	Vbc measurement angle	(N.A)	(N.A)	
4302051050	Vca	Vca measurement secondary	(N.A)	(N.A)	
4302051050	Vca-Angle	Vca measurement angle	(N.A)	(N.A)	
4302051070	Vab	Vab measurement primary	(N.A)	(N.A)	
4302051070	Vbc	Vbc measurement primary	(N.A)	(N.A)	
430205107A	Vca	Vca measurement primary	(N.A)	(N.A)	
4302061050	V1	V1 measurement secondary	(N.A)	(N.A)	
4302061050	V1-Angle	V1 measurement angle	(N.A)	(N.A)	
4302061050	V2	V2 measurement secondary	(N.A)	(N.A)	
4302061050	V2-Angle	V2 measurement angle	(N.A)	(N.A)	
4302061050	V0	V0 measurement secondary	(N.A)	(N.A)	
4302061050	V0-Angle	V0 measurement angle	(N.A)	(N.A)	
4302061070	V1	V1 measurement primary	(N.A)	(N.A)	
4302061070	V2	V2 measurement primary	(N.A)	(N.A)	
430206107C	V0	V0 measurement primary	(N.A)	(N.A)	
4302081050	V3	Vs measurement secondary	(N.A)	(N.A)	
4302081050	V3-Angle	Vs measurement angle	(N.A)	(N.A)	
430208107C	V3	Vs measurement primary	(N.A)	(N.A)	
4302091050	V4	Vs2 measurement secondary	(N.A)	(N.A)	
4302091050	V4-Angle	Vs2 measurement angle	(N.A)	(N.A)	
430209107C	V4	Vs2 measurement primary	(N.A)	(N.A)	
4302AB1056	VR1	Running voltage of SyncRy1 (VT secondary value)	(N.A)	(N.A)	
4302AB107C	VR1	Running voltage of SyncRy1 (VT primary value)	(N.A)	(N.A)	
4302AC1056	VI1	Incoming voltage of SyncRy1 (VT secondary value)	(N.A)	(N.A)	
4302AC107C	VI1	Incoming voltage of SyncRy1 (VT primary value)	(N.A)	(N.A)	
4302AD1056	dV-SyncRy1	Differential voltage of SyncRy1's VR and VI (VT secondary value)	(N.A)	(N.A)	
4302AD107C	dV-SyncRy1	Differential voltage of SyncRy1's VR and VI (VT primary value)	(N.A)	(N.A)	
4302B01056	VR2	Running voltage of SyncRy2 (VT secondary value)	(N.A)	(N.A)	
4302B0107C	VR2	Running voltage of SyncRy2 (VT primary value)	(N.A)	(N.A)	
4302B11056	VI2	Incoming voltage of SyncRy2 (VT secondary value)	(N.A)	(N.A)	
4302B1107C	VI2	Incoming voltage of SyncRy2 (VT primary value)	(N.A)	(N.A)	
4302B21056	dV-SyncRy2	Differential voltage of SyncRy2's VR and VI (VT secondary value)	(N.A)	(N.A)	
4302B2107C	dV-SyncRy2	Differential voltage of SyncRy2's VR and VI (VT primary value)	(N.A)	(N.A)	
43030B1095	Pa	Pa measurement primary	(N.A)	(N.A)	
43030B1096	Pb	Pb measurement primary	(N.A)	(N.A)	
43030B1097	Pc	Pc measurement primary	(N.A)	(N.A)	
43030B1098	P	P measurement primary	(N.A)	(N.A)	
43040C1095	Qa	Qa measurement primary	(N.A)	(N.A)	
43040C1096	Qb	Qb measurement primary	(N.A)	(N.A)	
43040C1097	Qc	Qc measurement primary	(N.A)	(N.A)	
43040C1098	Q	Q measurement primary	(N.A)	(N.A)	

Signal monitoring points in BCU with double VCT52Bs
Software 1F[MES_MANAGEMENT (FunctionID: 711001)]

Element IDs	Names	Contents Note	Element IDs	Names	Contents Note
3100901060	CT-ERR	CT Monitoring Result	43050D1095	Sa	Sa measurement primary
3100911060	I0-ERR	I0 Monitoring Result	43050D1096	Sb	Sb measurement primary
3100921060	V0-ERR	V0 Monitoring Result	43050D1097	Sc	Sc measurement primary
3100931060	V2-ERR	V2 Monitoring Result	43050D1098	S	S measurement primary
3100941060	CT2-ERR	CT2 Monitoring Result	43060F105C	f	Frequency measurement
3100951060	I02-ERR	I02 Monitoring Result	(N.A)	(N.A)	
3100961060	V02-ERR	V02 Monitoring Result	(N.A)	(N.A)	
3100971060	V22-ERR	V22 Monitoring Result	(N.A)	(N.A)	
43000E1091	PFa	PFa measurement	(N.A)	(N.A)	
43000E1092	PFb	PFb measurement	(N.A)	(N.A)	
43000E1093	PFc	PFc measurement	(N.A)	(N.A)	
43000E1094	PF	PF measurement	(N.A)	(N.A)	
4300A11090	VR1-f	Frequency of SyncRy1's VR	(N.A)	(N.A)	
4300A21090	VI1-f	Frequency of SyncRy1's VI	(N.A)	(N.A)	
4300AE1099	dAng.-SyncRy1	Differential angle of SyncRy1's VR and VI	(N.A)	(N.A)	
4300AF1090	df-SyncRy1	Differential frequency of SyncRy1's VR and VI	(N.A)	(N.A)	
4300B31099	dAng.-SyncRy2	Differential angle of SyncRy2's VR and VI	(N.A)	(N.A)	
4300B41090	df-SyncRy2	Differential frequency of SyncRy2's VR and VI	(N.A)	(N.A)	
4300BB1090	VR2-f	Frequency of SyncRy2's VR	(N.A)	(N.A)	
4300BC1090	VI2-f	Frequency of SyncRy2's VI	(N.A)	(N.A)	
4301001050	Ia	Ia measurement secondary	(N.A)	(N.A)	
4301001050	Ia-Angle	Ia measurement angle	(N.A)	(N.A)	
4301001050	Ib	Ib measurement secondary	(N.A)	(N.A)	
4301001050	Ib-Angle	Ib measurement angle	(N.A)	(N.A)	
4301001050	Ic	Ic measurement secondary	(N.A)	(N.A)	
4301001050	Ic-Angle	Ic measurement angle	(N.A)	(N.A)	
4301001070	Ia	Ia measurement primary	(N.A)	(N.A)	
4301001070	Ib	Ib measurement primary	(N.A)	(N.A)	
430100107A	Ic	Ic measurement primary	(N.A)	(N.A)	
4301021050	I1	I1 measurement secondary	(N.A)	(N.A)	
4301021050	I1-Angle	I1 measurement angle	(N.A)	(N.A)	
4301021050	I2	I2 measurement secondary	(N.A)	(N.A)	
4301021050	I2-Angle	I2 measurement angle	(N.A)	(N.A)	
4301021050	I0	I0 measurement secondary	(N.A)	(N.A)	
4301021050	I0-Angle	I0 measurement angle	(N.A)	(N.A)	
4301021070	I1	I1 measurement primary	(N.A)	(N.A)	
4301021070	I2	I2 measurement primary	(N.A)	(N.A)	
430102107C	I0	I0 measurement primary	(N.A)	(N.A)	
43010A1056	Ie	Ie measurement secondary	(N.A)	(N.A)	
43010A1057	Ie-Angle	Ie measurement angle	(N.A)	(N.A)	
43010A107C	Ie	Ie measurement primary	(N.A)	(N.A)	
4302041050	Va	Va measurement secondary	(N.A)	(N.A)	
4302041050	Va-Angle	Va measurement angle	(N.A)	(N.A)	
4302041050	Vb	Vb measurement secondary	(N.A)	(N.A)	
4302041050	Vb-Angle	Vb measurement angle	(N.A)	(N.A)	
4302041050	Vc	Vc measurement secondary	(N.A)	(N.A)	
4302041050	Vc-Angle	Vc measurement angle	(N.A)	(N.A)	
4302041070	Va	Va measurement primary	(N.A)	(N.A)	
4302041070	Vb	Vb measurement primary	(N.A)	(N.A)	
430204107A	Vc	Vc measurement primary	(N.A)	(N.A)	
4302051050	Vab	Vab measurement secondary	(N.A)	(N.A)	
4302051050	Vab-Angle	Vab measurement angle	(N.A)	(N.A)	
4302051050	Vbc	Vbc measurement secondary	(N.A)	(N.A)	
4302051050	Vbc-Angle	Vbc measurement angle	(N.A)	(N.A)	
4302051050	Vca	Vca measurement secondary	(N.A)	(N.A)	
4302051050	Vca-Angle	Vca measurement angle	(N.A)	(N.A)	
4302051070	Vab	Vab measurement primary	(N.A)	(N.A)	
4302051070	Vbc	Vbc measurement primary	(N.A)	(N.A)	
430205107A	Vca	Vca measurement primary	(N.A)	(N.A)	
4302061050	V1	V1 measurement secondary	(N.A)	(N.A)	
4302061050	V1-Angle	V1 measurement angle	(N.A)	(N.A)	
4302061050	V2	V2 measurement secondary	(N.A)	(N.A)	
4302061050	V2-Angle	V2 measurement angle	(N.A)	(N.A)	
4302061050	V0	V0 measurement secondary	(N.A)	(N.A)	
4302061050	V0-Angle	V0 measurement angle	(N.A)	(N.A)	
4302061070	V1	V1 measurement primary	(N.A)	(N.A)	
4302061070	V2	V2 measurement primary	(N.A)	(N.A)	
430206107C	V0	V0 measurement primary	(N.A)	(N.A)	
4302081050	V3	Vs measurement secondary	(N.A)	(N.A)	
4302081050	V3-Angle	Vs measurement angle	(N.A)	(N.A)	
430208107C	V3	Vs measurement primary	(N.A)	(N.A)	
4302091050	V4	Vs2 measurement secondary	(N.A)	(N.A)	
4302091050	V4-Angle	Vs2 measurement angle	(N.A)	(N.A)	
430209107C	V4	Vs2 measurement primary	(N.A)	(N.A)	
4302AB1056	VR1	Running voltage of SyncRy1 (VT secondary value)	(N.A)	(N.A)	
4302AB107C	VR1	Running voltage of SyncRy1 (VT primary value)	(N.A)	(N.A)	
4302AC1056	VI1	Incoming voltage of SyncRy1 (VT secondary value)	(N.A)	(N.A)	
4302AC107C	VI1	Incoming voltage of SyncRy1 (VT primary value)	(N.A)	(N.A)	
4302AD1056	dV-SyncRy1	Differential voltage of SyncRy1's VR and VI (VT secondary value)	(N.A)	(N.A)	
4302AD107C	dV-SyncRy1	Differential voltage of SyncRy1's VR and VI (VT primary value)	(N.A)	(N.A)	
4302B01056	VR2	Running voltage of SyncRy2 (VT secondary value)	(N.A)	(N.A)	
4302B0107C	VR2	Running voltage of SyncRy2 (VT primary value)	(N.A)	(N.A)	
4302B11056	VI2	Incoming voltage of SyncRy2 (VT secondary value)	(N.A)	(N.A)	
4302B1107C	VI2	Incoming voltage of SyncRy2 (VT primary value)	(N.A)	(N.A)	
4302B21056	dV-SyncRy2	Differential voltage of SyncRy2's VR and VI (VT secondary value)	(N.A)	(N.A)	
4302B2107C	dV-SyncRy2	Differential voltage of SyncRy2's VR and VI (VT primary value)	(N.A)	(N.A)	
43030B1095	Pa	Pa measurement primary	(N.A)	(N.A)	
43030B1096	Pb	Pb measurement primary	(N.A)	(N.A)	
43030B1097	Pc	Pc measurement primary	(N.A)	(N.A)	
43030B1098	P	P measurement primary	(N.A)	(N.A)	
43040C1095	Qa	Qa measurement primary	(N.A)	(N.A)	
43040C1096	Qb	Qb measurement primary	(N.A)	(N.A)	
43040C1097	Qc	Qc measurement primary	(N.A)	(N.A)	
43040C1098	Q	Q measurement primary	(N.A)	(N.A)	

Signal monitoring points in BCU with single VCT53B
Software 11[MES_MANAGEMENT (FunctionID: 711001)]

Element IDs	Names	Contents Note	Element IDs	Names	Contents Note
3100901060	CT-ERR	CT Monitoring Result	4302C01078	Vb2	Vb2 measurement primary
3100911060	I0-ERR	I0 Monitoring Result	4302C0107A	Vc2	Vc2 measurement primary
3100921060	V0-ERR	V0 Monitoring Result	4302C11050	Vab2	Vab2 measurement secondary
3100931060	V2-ERR	V2 Monitoring Result	4302C11051	Vab2-Angle	Vab2 measurement angle
3100941060	CT2-ERR	CT2 Monitoring Result	4302C11052	Vbc2	Vbc2 measurement secondary
3100951060	I02-ERR	I02 Monitoring Result	4302C11053	Vbc2-Angle	Vbc2 measurement angle
3100961060	V02-ERR	V02 Monitoring Result	4302C11054	Vca2	Vca2 measurement secondary
3100971060	V22-ERR	V22 Monitoring Result	4302C11055	Vca2-Angle	Vca2 measurement angle
43000E1091	PFa	PFa measurement	4302C11076	Vab2	Vab2 measurement primary
43000E1092	PFb	PFb measurement	4302C11078	Vbc2	Vbc2 measurement primary
43000E1093	PFc	PFc measurement	4302C1107A	Vca2	Vca2 measurement primary
43000E1094	PF	PF measurement	4302C21050	V12	V12 measurement secondary
4300A11090	VR1-f	Frequency of SyncRy1's VR	4302C21051	V12-Angle	V12 measurement angle
4300A21090	VI1-f	Frequency of SyncRy1's VI	4302C21052	V22	V22 measurement secondary
4300AE1099	dAng.-SyncRy1	Differential angle of SyncRy1's VR and VI	4302C21053	V22-Angle	V22 measurement angle
4300AF1090	df-SyncRy1	Differential frequency of SyncRy1's VR and VI	4302C21056	V02	V02 measurement secondary
4300B31099	dAng.-SyncRy2	Differential angle of SyncRy2's VR and VI	4302C21057	V02-Angle	V02 measurement angle
4300B41090	df-SyncRy2	Differential frequency of SyncRy2's VR and VI	4302C21076	V12	V12 measurement primary
4300BB1090	VR2-f	Frequency of SyncRy2's VR	4302C21078	V22	V22 measurement primary
4300BC1090	VI2-f	Frequency of SyncRy2's VI	4302C2107C	V02	V02 measurement primary
4300C71091	PFa2	PFa2 measurement	43030B1095	Pa	Pa measurement primary
4300C71092	PFb2	PFb2 measurement	43030B1096	Pb	Pb measurement primary
4300C71093	PFc2	PFc2 measurement	43030B1097	Pc	Pc measurement primary
4300C71094	PF2	PF2 measurement	43030B1098	P	P measurement primary
4301001050	Ia	Ia measurement secondary	4303C41095	Pa2	Pa2 measurement primary
4301001050	Ia-Angle	Ia measurement angle	4303C41096	Pb2	Pb2 measurement primary
4301001050	Ib	Ib measurement secondary	4303C41097	Pc2	Pc2 measurement primary
4301001050	Ib-Angle	Ib measurement angle	4303C41098	P2	P2 measurement primary
4301001050	Ic	Ic measurement secondary	43040C1095	Qa	Qa measurement primary
4301001050	Ic-Angle	Ic measurement angle	43040C1096	Qb	Qb measurement primary
4301001070	Ia	Ia measurement primary	43040C1097	Qc	Qc measurement primary
4301001070	Ib	Ib measurement primary	43040C1098	Q	Q measurement primary
430100107A	Ic	Ic measurement primary	4304C51095	Qa2	Qa2 measurement primary
4301021050	I1	I1 measurement secondary	4304C51096	Qb2	Qb2 measurement primary
4301021050	I1-Angle	I1 measurement angle	4304C51097	Qc2	Qc2 measurement primary
4301021050	I2	I2 measurement secondary	4304C51098	Q2	Q2 measurement primary
4301021050	I2-Angle	I2 measurement angle	43050D1095	Sa	Sa measurement primary
4301021050	I0	I0 measurement secondary	43050D1096	Sb	Sb measurement primary
4301021050	I0-Angle	I0 measurement angle	43050D1097	Sc	Sc measurement primary
4301021070	I1	I1 measurement primary	43050D1098	S	S measurement primary
4301021070	I2	I2 measurement primary	4305C61095	Sa2	Sa2 measurement primary
430102107C	I0	I0 measurement primary	4305C61096	Sb2	Sb2 measurement primary
43010A1056	Ie	Ie measurement secondary	4305C61097	Sc2	Sc2 measurement primary
43010A1057	Ie-Angle	Ie measurement angle	4305C61098	S2	S2 measurement primary
43010A107C	Ie	Ie measurement primary	43060F105C	f	Frequency measurement
4302041050	Va	Va measurement secondary	4306C8105C	f2	Frequency2 measurement
4302041050	Va-Angle	Va measurement angle	(N.A)	(N.A)	
4302041050	Vb	Vb measurement secondary	(N.A)	(N.A)	
4302041050	Vb-Angle	Vb measurement angle	(N.A)	(N.A)	
4302041050	Vc	Vc measurement secondary	(N.A)	(N.A)	
4302041050	Vc-Angle	Vc measurement angle	(N.A)	(N.A)	
4302041070	Va	Va measurement primary	(N.A)	(N.A)	
4302041070	Vb	Vb measurement primary	(N.A)	(N.A)	
430204107A	Vc	Vc measurement primary	(N.A)	(N.A)	
4302051050	Vab	Vab measurement secondary	(N.A)	(N.A)	
4302051050	Vab-Angle	Vab measurement angle	(N.A)	(N.A)	
4302051050	Vbc	Vbc measurement secondary	(N.A)	(N.A)	
4302051050	Vbc-Angle	Vbc measurement angle	(N.A)	(N.A)	
4302051050	Vca	Vca measurement secondary	(N.A)	(N.A)	
4302051050	Vca-Angle	Vca measurement angle	(N.A)	(N.A)	
4302051070	Vab	Vab measurement primary	(N.A)	(N.A)	
4302051070	Vbc	Vbc measurement primary	(N.A)	(N.A)	
430205107A	Vca	Vca measurement primary	(N.A)	(N.A)	
4302061050	V1	V1 measurement secondary	(N.A)	(N.A)	
4302061050	V1-Angle	V1 measurement angle	(N.A)	(N.A)	
4302061050	V2	V2 measurement secondary	(N.A)	(N.A)	
4302061050	V2-Angle	V2 measurement angle	(N.A)	(N.A)	
4302061050	V0	V0 measurement secondary	(N.A)	(N.A)	
4302061050	V0-Angle	V0 measurement angle	(N.A)	(N.A)	
4302061070	V1	V1 measurement primary	(N.A)	(N.A)	
4302061070	V2	V2 measurement primary	(N.A)	(N.A)	
430206107C	V0	V0 measurement primary	(N.A)	(N.A)	
4302081050	V3	Vs measurement secondary	(N.A)	(N.A)	
4302081050	V3-Angle	Vs measurement angle	(N.A)	(N.A)	
430208107C	V3	Vs measurement primary	(N.A)	(N.A)	
4302AB1056	VR1	Running voltage of SyncRy1 (VT secondary value)	(N.A)	(N.A)	
4302AB107C	VR1	Running voltage of SyncRy1 (VT primary value)	(N.A)	(N.A)	
4302AC1056	VI1	Incoming voltage of SyncRy1 (VT secondary value)	(N.A)	(N.A)	
4302AC107C	VI1	Incoming voltage of SyncRy1 (VT primary value)	(N.A)	(N.A)	
4302AD1056	dV-SyncRy1	Differential voltage of SyncRy1's VR and VI (VT secondary value)	(N.A)	(N.A)	
4302AD107C	dV-SyncRy1	Differential voltage of SyncRy1's VR and VI (VT primary value)	(N.A)	(N.A)	
4302B01056	VR2	Running voltage of SyncRy2 (VT secondary value)	(N.A)	(N.A)	
4302B0107C	VR2	Running voltage of SyncRy2 (VT primary value)	(N.A)	(N.A)	
4302B11056	VI2	Incoming voltage of SyncRy2 (VT secondary value)	(N.A)	(N.A)	
4302B1107C	VI2	Incoming voltage of SyncRy2 (VT primary value)	(N.A)	(N.A)	
4302B21056	dV-SyncRy2	Differential voltage of SyncRy2's VR and VI (VT secondary value)	(N.A)	(N.A)	
4302B2107C	dV-SyncRy2	Differential voltage of SyncRy2's VR and VI (VT primary value)	(N.A)	(N.A)	
4302C01050	Va2	Va2 measurement secondary	(N.A)	(N.A)	
4302C01051	Va2-Angle	Va2 measurement angle	(N.A)	(N.A)	
4302C01052	Vb2	Vb2 measurement secondary	(N.A)	(N.A)	
4302C01053	Vb2-Angle	Vb2 measurement angle	(N.A)	(N.A)	
4302C01054	Vc2	Vc2 measurement secondary	(N.A)	(N.A)	
4302C01055	Vc2-Angle	Vc2 measurement angle	(N.A)	(N.A)	
4302C01076	Va2	Va2 measurement primary	(N.A)	(N.A)	

Signal monitoring points in BCU with single VCT53B
Software 1F[MES_MANAGEMENT (FunctionID: 711001)]

Element IDs	Names	Contents Note	Element IDs	Names	Contents Note
3100901060	CT-ERR	CT Monitoring Result	4302C01078	Vb2	Vb2 measurement primary
3100911060	I0-ERR	I0 Monitoring Result	4302C0107A	Vc2	Vc2 measurement primary
3100921060	V0-ERR	V0 Monitoring Result	4302C11050	Vab2	Vab2 measurement secondary
3100931060	V2-ERR	V2 Monitoring Result	4302C11051	Vab2-Angle	Vab2 measurement angle
3100941060	CT2-ERR	CT2 Monitoring Result	4302C11052	Vbc2	Vbc2 measurement secondary
3100951060	I02-ERR	I02 Monitoring Result	4302C11053	Vbc2-Angle	Vbc2 measurement angle
3100961060	V02-ERR	V02 Monitoring Result	4302C11054	Vca2	Vca2 measurement secondary
3100971060	V22-ERR	V22 Monitoring Result	4302C11055	Vca2-Angle	Vca2 measurement angle
43000E1091	PFa	PFa measurement	4302C11076	Vab2	Vab2 measurement primary
43000E1092	PFb	PFb measurement	4302C11078	Vbc2	Vbc2 measurement primary
43000E1093	PFc	PFc measurement	4302C1107A	Vca2	Vca2 measurement primary
43000E1094	PF	PF measurement	4302C21050	V12	V12 measurement secondary
4300A11090	VR1-f	Frequency of SyncRy1's VR	4302C21051	V12-Angle	V12 measurement angle
4300A21090	VI1-f	Frequency of SyncRy1's VI	4302C21052	V22	V22 measurement secondary
4300AE1099	dAng.-SyncRy1	Differential angle of SyncRy1's VR and VI	4302C21053	V22-Angle	V22 measurement angle
4300AF1090	df-SyncRy1	Differential frequency of SyncRy1's VR and VI	4302C21056	V02	V02 measurement secondary
4300B31099	dAng.-SyncRy2	Differential angle of SyncRy2's VR and VI	4302C21057	V02-Angle	V02 measurement angle
4300B41090	df-SyncRy2	Differential frequency of SyncRy2's VR and VI	4302C21076	V12	V12 measurement primary
4300BB1090	VR2-f	Frequency of SyncRy2's VR	4302C21078	V22	V22 measurement primary
4300BC1090	VI2-f	Frequency of SyncRy2's VI	4302C2107C	V02	V02 measurement primary
4300C71091	PFa2	PFa2 measurement	43030B1095	Pa	Pa measurement primary
4300C71092	PFb2	PFb2 measurement	43030B1096	Pb	Pb measurement primary
4300C71093	PFc2	PFc2 measurement	43030B1097	Pc	Pc measurement primary
4300C71094	PF2	PF2 measurement	43030B1098	P	P measurement primary
4301001050	Ia	Ia measurement secondary	4303C41095	Pa2	Pa2 measurement primary
4301001050	Ia-Angle	Ia measurement angle	4303C41096	Pb2	Pb2 measurement primary
4301001050	Ib	Ib measurement secondary	4303C41097	Pc2	Pc2 measurement primary
4301001050	Ib-Angle	Ib measurement angle	4303C41098	P2	P2 measurement primary
4301001050	Ic	Ic measurement secondary	43040C1095	Qa	Qa measurement primary
4301001050	Ic-Angle	Ic measurement angle	43040C1096	Qb	Qb measurement primary
4301001070	Ia	Ia measurement primary	43040C1097	Qc	Qc measurement primary
4301001070	Ib	Ib measurement primary	43040C1098	Q	Q measurement primary
430100107A	Ic	Ic measurement primary	4304C51095	Qa2	Qa2 measurement primary
4301021050	I1	I1 measurement secondary	4304C51096	Qb2	Qb2 measurement primary
4301021050	I1-Angle	I1 measurement angle	4304C51097	Qc2	Qc2 measurement primary
4301021050	I2	I2 measurement secondary	4304C51098	Q2	Q2 measurement primary
4301021050	I2-Angle	I2 measurement angle	43050D1095	Sa	Sa measurement primary
4301021050	I0	I0 measurement secondary	43050D1096	Sb	Sb measurement primary
4301021050	I0-Angle	I0 measurement angle	43050D1097	Sc	Sc measurement primary
4301021070	I1	I1 measurement primary	43050D1098	S	S measurement primary
4301021070	I2	I2 measurement primary	4305C61095	Sa2	Sa2 measurement primary
430102107C	I0	I0 measurement primary	4305C61096	Sb2	Sb2 measurement primary
43010A1056	Ie	Ie measurement secondary	4305C61097	Sc2	Sc2 measurement primary
43010A1057	Ie-Angle	Ie measurement angle	4305C61098	S2	S2 measurement primary
43010A107C	Ie	Ie measurement primary	43060F105C	f	Frequency measurement
4302041050	Va	Va measurement secondary	4306C8105C	f2	Frequency2 measurement
4302041050	Va-Angle	Va measurement angle	(N.A)	(N.A)	
4302041050	Vb	Vb measurement secondary	(N.A)	(N.A)	
4302041050	Vb-Angle	Vb measurement angle	(N.A)	(N.A)	
4302041050	Vc	Vc measurement secondary	(N.A)	(N.A)	
4302041050	Vc-Angle	Vc measurement angle	(N.A)	(N.A)	
4302041070	Va	Va measurement primary	(N.A)	(N.A)	
4302041070	Vb	Vb measurement primary	(N.A)	(N.A)	
430204107A	Vc	Vc measurement primary	(N.A)	(N.A)	
4302051050	Vab	Vab measurement secondary	(N.A)	(N.A)	
4302051050	Vab-Angle	Vab measurement angle	(N.A)	(N.A)	
4302051050	Vbc	Vbc measurement secondary	(N.A)	(N.A)	
4302051050	Vbc-Angle	Vbc measurement angle	(N.A)	(N.A)	
4302051050	Vca	Vca measurement secondary	(N.A)	(N.A)	
4302051050	Vca-Angle	Vca measurement angle	(N.A)	(N.A)	
4302051070	Vab	Vab measurement primary	(N.A)	(N.A)	
4302051070	Vbc	Vbc measurement primary	(N.A)	(N.A)	
430205107A	Vca	Vca measurement primary	(N.A)	(N.A)	
4302061050	V1	V1 measurement secondary	(N.A)	(N.A)	
4302061050	V1-Angle	V1 measurement angle	(N.A)	(N.A)	
4302061050	V2	V2 measurement secondary	(N.A)	(N.A)	
4302061050	V2-Angle	V2 measurement angle	(N.A)	(N.A)	
4302061050	V0	V0 measurement secondary	(N.A)	(N.A)	
4302061050	V0-Angle	V0 measurement angle	(N.A)	(N.A)	
4302061070	V1	V1 measurement primary	(N.A)	(N.A)	
4302061070	V2	V2 measurement primary	(N.A)	(N.A)	
430206107C	V0	V0 measurement primary	(N.A)	(N.A)	
4302081050	V3	Vs measurement secondary	(N.A)	(N.A)	
4302081050	V3-Angle	Vs measurement angle	(N.A)	(N.A)	
430208107C	V3	Vs measurement primary	(N.A)	(N.A)	
4302AB1056	VR1	Running voltage of SyncRy1 (VT secondary value)	(N.A)	(N.A)	
4302AB107C	VR1	Running voltage of SyncRy1 (VT primary value)	(N.A)	(N.A)	
4302AC1056	VI1	Incoming voltage of SyncRy1 (VT secondary value)	(N.A)	(N.A)	
4302AC107C	VI1	Incoming voltage of SyncRy1 (VT primary value)	(N.A)	(N.A)	
4302AD1056	dV-SyncRy1	Differential voltage of SyncRy1's VR and VI (VT secondary value)	(N.A)	(N.A)	
4302AD107C	dV-SyncRy1	Differential voltage of SyncRy1's VR and VI (VT primary value)	(N.A)	(N.A)	
4302B01056	VR2	Running voltage of SyncRy2 (VT secondary value)	(N.A)	(N.A)	
4302B0107C	VR2	Running voltage of SyncRy2 (VT primary value)	(N.A)	(N.A)	
4302B11056	VI2	Incoming voltage of SyncRy2 (VT secondary value)	(N.A)	(N.A)	
4302B1107C	VI2	Incoming voltage of SyncRy2 (VT primary value)	(N.A)	(N.A)	
4302B21056	dV-SyncRy2	Differential voltage of SyncRy2's VR and VI (VT secondary value)	(N.A)	(N.A)	
4302B2107C	dV-SyncRy2	Differential voltage of SyncRy2's VR and VI (VT primary value)	(N.A)	(N.A)	
4302C01050	Va2	Va2 measurement secondary	(N.A)	(N.A)	
4302C01051	Va2-Angle	Va2 measurement angle	(N.A)	(N.A)	
4302C01052	Vb2	Vb2 measurement secondary	(N.A)	(N.A)	
4302C01053	Vb2-Angle	Vb2 measurement angle	(N.A)	(N.A)	
4302C01054	Vc2	Vc2 measurement secondary	(N.A)	(N.A)	
4302C01055	Vc2-Angle	Vc2 measurement angle	(N.A)	(N.A)	
4302C01076	Va2	Va2 measurement primary	(N.A)	(N.A)	

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Element IDs	Names	Contents Note	Element IDs	Names	Contents Note
3100901060	CT-ERR	CT Monitoring Result	43011A1057	Ie-L-Angle	Ie local measurement angle
3100911060	I0-ERR	I0 Monitoring Result	43011A107C	Ie-L	Ie local measurement primary
3100921060	V0-ERR	V0 Monitoring Result	43011B1050	Ia2-L	Ia2 local measurement secondary
3100931060	V2-ERR	V2 Monitoring Result	43011B1051	Ia2-L-Angle	Ia2 local measurement angle
3100941060	CT2-ERR	CT2 Monitoring Result	43011B1052	Ib2-L	Ib2 local measurement secondary
3100951060	I02-ERR	I02 Monitoring Result	43011B1053	Ib2-L-Angle	Ib2 local measurement angle
3100961060	V02-ERR	V02 Monitoring Result	43011B1054	Ic2-L	Ic2 local measurement secondary
3100971060	V22-ERR	V22 Monitoring Result	43011B1055	Ic2-L-Angle	Ic2 local measurement angle
43000E1091	PFa1	PFa measurement	43011B1076	Ia2-L	Ia2 local measurement primary
43000E1092	PFb1	PFb measurement	43011B1078	Ib2-L	Ib2 local measurement primary
43000E1093	PFc1	PFc measurement	43011B107A	Ic2-L	Ic2 local measurement primary
43000E1094	PF1	PF measurement	43011C1056	Ie2-L	Ie2 local measurement secondary
4300A11090	VR1-f	Frequency of SyncRy1's VR	43011C1057	Ie2-L-Angle	Ie2 local measurement angle
4300A21090	VI1-f	Frequency of SyncRy1's VI	43011C107C	Ie2-L	Ie2 local measurement primary
4300AE1099	dAng.-SyncRy1	Differential angle of SyncRy1's VR and VI	43011D1050	Ia-R1	Ia remote CH1 measurement secondary
4300AF1090	df-SyncRy1	Differential frequency of SyncRy1's VR and VI	43011D1051	Ia-R1-Angle	Ia remote CH1 measurement angle
4300B31099	dAng.-SyncRy2	Differential angle of SyncRy2's VR and VI	43011D1052	Ib-R1	Ib remote CH1 measurement secondary
4300B41090	df-SyncRy2	Differential frequency of SyncRy2's VR and VI	43011D1053	Ib-R1-Angle	Ib remote CH1 measurement angle
4300BB1090	VR2-f	Frequency of SyncRy2's VR	43011D1054	Ic-R1	Ic remote CH1 measurement secondary
4300BC1090	VI2-f	Frequency of SyncRy2's VI	43011D1055	Ic-R1-Angle	Ic remote CH1 measurement angle
4300C71091	PFa2	PFa2 measurement	43011D1076	Ia-R1	Ia remote CH1 measurement primary
4300C71092	PFb2	PFb2 measurement	43011D1078	Ib-R1	Ib remote CH1 measurement primary
4300C71093	PFc2	PFc2 measurement	43011D107A	Ic-R1	Ic remote CH1 measurement primary
4300C71094	PF2	PF2 measurement	43011E1056	Ie-R1	Ie remote CH1 measurement secondary
4301001050	Ia	Ia measurement secondary	43011E1057	Ie-R1-Angle	Ie remote CH1 measurement angle
4301001050	Ia-Angle	Ia measurement angle	43011E107C	Ie-R1	Ie remote CH1 measurement primary
4301001050	Ib	Ib measurement secondary	43011F1050	Ia2-R1	Ia2 remote CH1 measurement secondary
4301001050	Ib-Angle	Ib measurement angle	43011F1051	Ia2-R1-Angle	Ia2 remote CH1 measurement angle
4301001050	Ic	Ic measurement secondary	43011F1052	Ib2-R1	Ib2 remote CH1 measurement secondary
4301001050	Ic-Angle	Ic measurement angle	43011F1053	Ib2-R1-Angle	Ib2 remote CH1 measurement angle
4301001070	Ia	Ia measurement primary	43011F1054	Ic2-R1	Ic2 remote CH1 measurement secondary
4301001070	Ib	Ib measurement primary	43011F1055	Ic2-R1-Angle	Ic2 remote CH1 measurement angle
430100107A	Ic	Ic measurement primary	43011F1076	Ia2-R1	Ia2 remote CH1 measurement primary
4301011050	Iab-Angle	Iab measurement angle	43011F1078	Ib2-R1	Ib2 remote CH1 measurement primary
4301011050	Ibc-Angle	Ibc measurement angle	43011F107A	Ic2-R1	Ic2 remote CH1 measurement primary
4301011050	Ica-Angle	Ica measurement angle	4301201050	Ie2-R1	Ie2 remote CH1 measurement secondary
4301021050	I1	I1 measurement secondary	4301201050	Ie2-R1-Angle	Ie2 remote CH1 measurement angle
4301021050	I1-Angle	I1 measurement angle	430120107C	Ie2-R1	Ie2 remote CH1 measurement primary
4301021050	I2	I2 measurement secondary	4301211050	Ia-R2	Ia remote CH2 measurement secondary
4301021050	I2-Angle	I2 measurement angle	4301211050	Ia-R2-Angle	Ia remote CH2 measurement angle
4301021050	I0	I0 measurement secondary	4301211050	Ib-R2	Ib remote CH2 measurement secondary
4301021050	I0-Angle	I0 measurement angle	4301211050	Ib-R2-Angle	Ib remote CH2 measurement angle
4301021070	I1	I1 measurement primary	4301211050	Ic-R2	Ic remote CH2 measurement secondary
4301021070	I2	I2 measurement primary	4301211050	Ic-R2-Angle	Ic remote CH2 measurement angle
430102107C	I0	I0 measurement primary	4301211070	Ia-R2	Ia remote CH2 measurement primary
4301031050	Iem	Iem measurement secondary	4301211070	Ib-R2	Ib remote CH2 measurement primary
4301031050	Iem-Angle	Iem measurement angle	430121107A	Ic-R2	Ic remote CH2 measurement primary
430103107C	Iem	Iem measurement primary	4301221050	Ie-R2	Ie remote CH2 measurement secondary
43010A1056	Ie	Ie measurement secondary	4301221050	Ie-R2-Angle	Ie remote CH2 measurement angle
43010A1057	Ie-Angle	Ie measurement angle	430122107C	Ie-R2	Ie remote CH2 measurement primary
43010A107C	Ie	Ie measurement primary	4301231050	Ia2-R2	Ia2 remote CH2 measurement secondary
4301141050	Ia2	Ia2 measurement secondary	4301231050	Ia2-R2-Angle	Ia2 remote CH2 measurement angle
4301141050	Ia2-Angle	Ia2 measurement angle	4301231050	Ib2-R2	Ib2 remote CH2 measurement secondary
4301141050	Ib2	Ib2 measurement secondary	4301231050	Ib2-R2-Angle	Ib2 remote CH2 measurement angle
4301141050	Ib2-Angle	Ib2 measurement angle	4301231050	Ic2-R2	Ic2 remote CH2 measurement secondary
4301141050	Ic2	Ic2 measurement secondary	4301231050	Ic2-R2-Angle	Ic2 remote CH2 measurement angle
4301141050	Ic2-Angle	Ic2 measurement angle	4301231070	Ia2-R2	Ia2 remote CH2 measurement primary
4301141070	Ia2	Ia2 measurement primary	4301231070	Ib2-R2	Ib2 remote CH2 measurement primary
4301141070	Ib2	Ib2 measurement primary	430123107A	Ic2-R2	Ic2 remote CH2 measurement primary
430114107A	Ic2	Ic2 measurement primary	4301241050	Ie2-R2	Ie2 remote CH2 measurement secondary
4301151050	Iab2	Iab2 measurement secondary	4301241050	Ie2-R2-Angle	Ie2 remote CH2 measurement angle
4301151050	Iab2-Angle	Iab2 measurement angle	430124107C	Ie2-R2	Ie2 remote CH2 measurement primary
4301151050	Ibc2	Ibc2 measurement secondary	4301251050	Ia-R3	Ia remote CH3 measurement secondary
4301151050	Ibc2-Angle	Ibc2 measurement angle	4301251050	Ia-R3-Angle	Ia remote CH3 measurement angle
4301151050	Ica2	Ica2 measurement secondary	4301251050	Ib-R3	Ib remote CH3 measurement secondary
4301151050	Ica2-Angle	Ica2 measurement angle	4301251050	Ib-R3-Angle	Ib remote CH3 measurement angle
4301151070	Iab2	Iab2 measurement primary	4301251050	Ic-R3	Ic remote CH3 measurement secondary
4301151070	Ibc2	Ibc2 measurement primary	4301251050	Ic-R3-Angle	Ic remote CH3 measurement angle
430115107A	Ica2	Ica2 measurement primary	4301251070	Ia-R3	Ia remote CH3 measurement primary
4301161050	I12	I12 measurement secondary	4301251070	Ib-R3	Ib remote CH3 measurement primary
4301161050	I12-Angle	I12 measurement angle	430125107A	Ic-R3	Ic remote CH3 measurement primary
4301161050	I22	I22 measurement secondary	4301261050	Ie-R3	Ie remote CH3 measurement secondary
4301161050	I22-Angle	I22 measurement angle	4301261050	Ie-R3-Angle	Ie remote CH3 measurement angle
4301161050	I02	I02 measurement secondary	430126107C	Ie-R3	Ie remote CH3 measurement primary
4301161050	I02-Angle	I02 measurement angle	4301271050	Ia-R4	Ia remote CH4 measurement secondary
4301161070	I12	I12 measurement primary	4301271050	Ia-R4-Angle	Ia remote CH4 measurement angle
4301161070	I22	I22 measurement primary	4301271050	Ib-R4	Ib remote CH4 measurement secondary
430116107C	I02	I02 measurement primary	4301271050	Ib-R4-Angle	Ib remote CH4 measurement angle
4301171050	Ie2	Ie2 measurement secondary	4301271050	Ic-R4	Ic remote CH4 measurement secondary
4301171050	Ie2-Angle	Ie2 measurement angle	4301271050	Ic-R4-Angle	Ic remote CH4 measurement angle
430117107C	Ie2	Ie2 measurement primary	4301271070	Ia-R4	Ia remote CH4 measurement primary
4301181050	Ie2	Ie2 measurement secondary	4301271070	Ib-R4	Ib remote CH4 measurement primary
4301181050	Ie2-Angle	Ie2 measurement angle	430127107A	Ic-R4	Ic remote CH4 measurement primary
430118107C	Ie2	Ie2 measurement primary	4301281050	Ie-R4	Ie remote CH4 measurement secondary
4301191050	Ia-L	Ia local measurement secondary	4301281050	Ie-R4-Angle	Ie remote CH4 measurement angle
4301191050	Ia-L-Angle	Ia local measurement angle	430128107C	Ie-R4	Ie remote CH4 measurement primary
4301191050	Ib-L	Ib local measurement secondary	4301A71050	Ida	DIF-L Phase-A Id secondary for fault record / metering
4301191050	Ib-L-Angle	Ib local measurement angle	4301A71052	Idb	DIF-L Phase-B Id secondary for fault record / metering
4301191050	Ic-L	Ic local measurement secondary	4301A71054	Idc	DIF-L Phase-C Id secondary for fault record / metering
4301191050	Ic-L-Angle	Ic local measurement angle	4301A71076	Ida	DIF-L Phase-A Id secondary for fault record / metering
4301191070	Ia-L	Ia local measurement primary	4301A71078	Idb	DIF-L Phase-B Id secondary for fault record / metering
4301191070	Ib-L	Ib local measurement primary	4301A7107A	Idc	DIF-L Phase-C Id secondary for fault record / metering
4301191070	Ic-L	Ic local measurement primary	4301A81050	Ira	DIF-L Phase-A Ir secondary for fault record / metering
43011A1056	Ie-L	Ie local measurement secondary	4301A81052	Irb	DIF-L Phase-B Ir secondary for fault record / metering

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Element IDs	Names	Contents Note	Element IDs	Names	Contents Note
4301A81054	Irc	DIF-L Phase-C Ir secondary for fault record / metering	43030B1096	Pb1	Pb measurement primary
4301A81076	Ira	DIF-L Phase-A Ir primary for fault record / metering	43030B1097	Pc1	Pc measurement primary
4301A81078	Irb	DIF-L Phase-B Ir primary for fault record / metering	43030B1098	P1	P measurement primary
4301A8107A	Irc	DIF-L Phase-C Ir primary for fault record / metering	4303C41095	Pa2	Pa2 measurement primary
4301A91056	Id0	DIFG-L Id0 measurement secondary for fault record / metering	4303C41096	Pb2	Pb2 measurement primary
4301A9107C	Id0	DIFG-L Id0 measurement primary for fault record / metering	4303C41097	Pc2	Pc2 measurement primary
4301AA1056	Ir0	DIFG-L Ir0 measurement secondary for fault record / metering	4303C41098	P2	P2 measurement primary
4301AA107C	Ir0	DIFG-L Ir0 measurement primary for fault record / metering	43040C1095	Qa1	Qa measurement primary
4302041050	Va1	Va measurement secondary	43040C1096	Qb1	Qb measurement primary
4302041050	Va-Angle	Va measurement angle	43040C1097	Qc1	Qc measurement primary
4302041050	Vb1	Vb measurement secondary	43040C1098	Q1	Q measurement primary
4302041050	Vb-Angle	Vb measurement angle	4304C51095	Qa2	Qa2 measurement primary
4302041050	Vc1	Vc measurement secondary	4304C51096	Qb2	Qb2 measurement primary
4302041050	Vc-Angle	Vc measurement angle	4304C51097	Qc2	Qc2 measurement primary
4302041070	Va1	Va measurement primary	4304C51098	Q2	Q2 measurement primary
4302041070	Vb1	Vb measurement primary	43050D1095	Sa1	Sa measurement primary
430204107A	Vc1	Vc measurement primary	43050D1096	Sb1	Sb measurement primary
4302051050	Vab1	Vab measurement secondary	43050D1097	Sc1	Sc measurement primary
4302051050	Vab-Angle	Vab measurement angle	43050D1098	S1	S measurement primary
4302051050	Vbc1	Vbc measurement secondary	4305C61095	Sa2	Sa2 measurement primary
4302051050	Vbc-Angle	Vbc measurement angle	4305C61096	Sb2	Sb2 measurement primary
4302051050	Vca1	Vca measurement secondary	4305C61097	Sc2	Sc2 measurement primary
4302051050	Vca-Angle	Vca measurement angle	4305C61098	S2	S2 measurement primary
4302051070	Vab1	Vab measurement primary	43060F105C	f1	Frequency measurement
4302051070	Vbc1	Vbc measurement primary	4306C8105C	f2	Frequency2 measurement
430205107A	Vca1	Vca measurement primary	(N.A)	(N.A)	
4302061050	V11	V1 measurement secondary	(N.A)	(N.A)	
4302061050	V1-Angle	V1 measurement angle	(N.A)	(N.A)	
4302061050	V21	V2 measurement secondary	(N.A)	(N.A)	
4302061050	V2-Angle	V2 measurement angle	(N.A)	(N.A)	
4302061050	V01	V0 measurement secondary	(N.A)	(N.A)	
4302061050	V0-Angle	V0 measurement angle	(N.A)	(N.A)	
4302061070	V11	V1 measurement primary	(N.A)	(N.A)	
4302061070	V21	V2 measurement primary	(N.A)	(N.A)	
430206107C	V01	V0 measurement primary	(N.A)	(N.A)	
4302081050	V3	Vs measurement secondary	(N.A)	(N.A)	
4302081050	V3-Angle	Vs measurement angle	(N.A)	(N.A)	
430208107C	V3	Vs measurement primary	(N.A)	(N.A)	
4302091050	V4-Angle	Vs2 measurement angle	(N.A)	(N.A)	
4302291050	V1-L	V1 local measurement secondary	(N.A)	(N.A)	
4302291050	V1-L-Angle	V1 local measurement angle	(N.A)	(N.A)	
430229107C	V1-L	V1 local measurement primary	(N.A)	(N.A)	
43022A1056	V1-R1	V1 remote CH1 measurement secondary	(N.A)	(N.A)	
43022A1057	V1-R1-Angle	V1 remote CH1 measurement angle	(N.A)	(N.A)	
43022A107C	V1-R1	V1 remote CH1 measurement primary	(N.A)	(N.A)	
43022B1056	V1-R2	V1 remote CH2 measurement secondary	(N.A)	(N.A)	
43022B1057	V1-R2-Angle	V1 remote CH2 measurement angle	(N.A)	(N.A)	
43022B107C	V1-R2	V1 remote CH2 measurement primary	(N.A)	(N.A)	
43022C1056	V1-R3	V1 remote CH3 measurement secondary	(N.A)	(N.A)	
43022C1057	V1-R3-Angle	V1 remote CH3 measurement angle	(N.A)	(N.A)	
43022C107C	V1-R3	V1 remote CH3 measurement primary	(N.A)	(N.A)	
43022D1056	V1-R4	V1 remote CH4 measurement secondary	(N.A)	(N.A)	
43022D1057	V1-R4-Angle	V1 remote CH4 measurement angle	(N.A)	(N.A)	
43022D107C	V1-R4	V1 remote CH4 measurement primary	(N.A)	(N.A)	
4302AB1056	VR1	Running voltage of SyncRy1 (VT secondary value)	(N.A)	(N.A)	
4302AB107C	VR1	Running voltage of SyncRy1 (VT primary value)	(N.A)	(N.A)	
4302AC1056	VI1	Incoming voltage of SyncRy1 (VT secondary value)	(N.A)	(N.A)	
4302AC107C	VI1	Incoming voltage of SyncRy1 (VT primary value)	(N.A)	(N.A)	
4302AD1056	dV-SyncRy1	Differential voltage of SyncRy1's VR and VI (VT secondary value)	(N.A)	(N.A)	
4302AD107C	dV-SyncRy1	Differential voltage of SyncRy1's VR and VI (VT primary value)	(N.A)	(N.A)	
4302B01056	VR2	Running voltage of SyncRy2 (VT secondary value)	(N.A)	(N.A)	
4302B0107C	VR2	Running voltage of SyncRy2 (VT primary value)	(N.A)	(N.A)	
4302B11056	VI2	Incoming voltage of SyncRy2 (VT secondary value)	(N.A)	(N.A)	
4302B1107C	VI2	Incoming voltage of SyncRy2 (VT primary value)	(N.A)	(N.A)	
4302B21056	dV-SyncRy2	Differential voltage of SyncRy2's VR and VI (VT secondary value)	(N.A)	(N.A)	
4302B2107C	dV-SyncRy2	Differential voltage of SyncRy2's VR and VI (VT primary value)	(N.A)	(N.A)	
4302C01050	Va2	Va2 measurement secondary	(N.A)	(N.A)	
4302C01051	Va2-Angle	Va2 measurement angle	(N.A)	(N.A)	
4302C01052	Vb2	Vb2 measurement secondary	(N.A)	(N.A)	
4302C01053	Vb2-Angle	Vb2 measurement angle	(N.A)	(N.A)	
4302C01054	Vc2	Vc2 measurement secondary	(N.A)	(N.A)	
4302C01055	Vc2-Angle	Vc2 measurement angle	(N.A)	(N.A)	
4302C01076	Va2	Va2 measurement primary	(N.A)	(N.A)	
4302C01078	Vb2	Vb2 measurement primary	(N.A)	(N.A)	
4302C0107A	Vc2	Vc2 measurement primary	(N.A)	(N.A)	
4302C11050	Vab2	Vab2 measurement secondary	(N.A)	(N.A)	
4302C11051	Vab2-Angle	Vab2 measurement angle	(N.A)	(N.A)	
4302C11052	Vbc2	Vbc2 measurement secondary	(N.A)	(N.A)	
4302C11053	Vbc2-Angle	Vbc2 measurement angle	(N.A)	(N.A)	
4302C11054	Vca2	Vca2 measurement secondary	(N.A)	(N.A)	
4302C11055	Vca2-Angle	Vca2 measurement angle	(N.A)	(N.A)	
4302C11076	Vab2	Vab2 measurement primary	(N.A)	(N.A)	
4302C11078	Vbc2	Vbc2 measurement primary	(N.A)	(N.A)	
4302C1107A	Vca2	Vca2 measurement primary	(N.A)	(N.A)	
4302C21050	V12	V12 measurement secondary	(N.A)	(N.A)	
4302C21051	V12-Angle	V12 measurement angle	(N.A)	(N.A)	
4302C21052	V22	V22 measurement secondary	(N.A)	(N.A)	
4302C21053	V22-Angle	V22 measurement angle	(N.A)	(N.A)	
4302C21056	V02	V02 measurement secondary	(N.A)	(N.A)	
4302C21057	V02-Angle	V02 measurement angle	(N.A)	(N.A)	
4302C21076	V12	V12 measurement primary	(N.A)	(N.A)	
4302C21078	V22	V22 measurement primary	(N.A)	(N.A)	
4302C2107C	V02	V02 measurement primary	(N.A)	(N.A)	
43030B1095	Pa1	Pa measurement primary	(N.A)	(N.A)	

8.12.1 61850 signals

61850 signals generated in BCPU with single VCT51B
Software 2N [MES_MANAGEMENT (Function ID: 711001)]

Element IDs	Names	Contents Note	Element IDs	Names	Contents Note
4200851090	PFa	PFa measurement	(N.A)	(N.A)	
4200851090	PFb	PFb measurement	(N.A)	(N.A)	
4200851090	PFc	PFc measurement	(N.A)	(N.A)	
4200851090	PF	PF measurement	(N.A)	(N.A)	
4200881090	dAng.-SyncRy1	Differential angle of SyncRy1's VR and VI	(N.A)	(N.A)	
42008B1099	dAng.-SyncRy2	Differential angle of SyncRy2's VR and VI	(N.A)	(N.A)	
4201601050	Ia-Angle	Ia measurement angle	(N.A)	(N.A)	
4201601050	Ib-Angle	Ib measurement angle	(N.A)	(N.A)	
4201601050	Ic-Angle	Ic measurement angle	(N.A)	(N.A)	
4201601070	Ia	Ia measurement primary	(N.A)	(N.A)	
4201601070	Ib	Ib measurement primary	(N.A)	(N.A)	
420160107A	Ic	Ic measurement primary	(N.A)	(N.A)	
4201611050	Iab-Angle	Iab measurement angle	(N.A)	(N.A)	
4201611050	Ibc-Angle	Ibc measurement angle	(N.A)	(N.A)	
4201611050	Ica-Angle	Ica measurement angle	(N.A)	(N.A)	
4201611070	Iab	Iab measurement primary	(N.A)	(N.A)	
4201611070	Ibc	Ibc measurement primary	(N.A)	(N.A)	
420161107A	Ica	Ica measurement primary	(N.A)	(N.A)	
4201621050	I1-Angle	I1 measurement angle	(N.A)	(N.A)	
4201621050	I2-Angle	I2 measurement angle	(N.A)	(N.A)	
4201621050	I0-Angle	I0 measurement angle	(N.A)	(N.A)	
4201621070	I1	I1 measurement primary	(N.A)	(N.A)	
4201621070	I2	I2 measurement primary	(N.A)	(N.A)	
420162107C	I0	I0 measurement primary	(N.A)	(N.A)	
4202641050	Va-Angle	Va measurement angle	(N.A)	(N.A)	
4202641050	Vb-Angle	Vb measurement angle	(N.A)	(N.A)	
4202641050	Vc-Angle	Vc measurement angle	(N.A)	(N.A)	
4202641070	Va	Va measurement primary	(N.A)	(N.A)	
4202641070	Vb	Vb measurement primary	(N.A)	(N.A)	
420264107A	Vc	Vc measurement primary	(N.A)	(N.A)	
4202651050	Vab-Angle	Vab measurement angle	(N.A)	(N.A)	
4202651050	Vbc-Angle	Vbc measurement angle	(N.A)	(N.A)	
4202651050	Vca-Angle	Vca measurement angle	(N.A)	(N.A)	
4202651070	Vab	Vab measurement primary	(N.A)	(N.A)	
4202651070	Vbc	Vbc measurement primary	(N.A)	(N.A)	
420265107A	Vca	Vca measurement primary	(N.A)	(N.A)	
4202661050	V1-Angle	V1 measurement angle	(N.A)	(N.A)	
4202661050	V2-Angle	V2 measurement angle	(N.A)	(N.A)	
4202661050	V0-Angle	V0 measurement angle	(N.A)	(N.A)	
4202661070	V1	V1 measurement primary	(N.A)	(N.A)	
4202661070	V2	V2 measurement primary	(N.A)	(N.A)	
420266107C	V0	V0 measurement primary	(N.A)	(N.A)	
4202671050	V3-Angle	Vs measurement angle	(N.A)	(N.A)	
420267107C	V3	Vs measurement primary	(N.A)	(N.A)	
4202681050	V4-Angle	Vs2 measurement angle	(N.A)	(N.A)	
420268107C	V4	Vs2 measurement primary	(N.A)	(N.A)	
4202791050	Ve-Angle	V4 measurement angle	(N.A)	(N.A)	
420279107C	Ve	V4 measurement primary	(N.A)	(N.A)	
4202871090	VR1	Running voltage of SyncRy1	(N.A)	(N.A)	
4202871090	VI1	Incoming voltage of SyncRy1	(N.A)	(N.A)	
4202871090	dV-SyncRy1	Differential voltage of SyncRy1's VR and VI	(N.A)	(N.A)	
42028A1095	VR2	Running voltage of SyncRy2	(N.A)	(N.A)	
42028A1096	VI2	Incoming voltage of SyncRy2	(N.A)	(N.A)	
42028A1097	dV-SyncRy2	Differential voltage of SyncRy2's VR and VI	(N.A)	(N.A)	
42037E1095	Pa	Pa measurement primary	(N.A)	(N.A)	
42037E1096	Pb	Pb measurement primary	(N.A)	(N.A)	
42037E1097	Pc	Pc measurement primary	(N.A)	(N.A)	
42037E1098	P	P measurement primary	(N.A)	(N.A)	
42047F1095	Qa	Qa measurement primary	(N.A)	(N.A)	
42047F1096	Qb	Qb measurement primary	(N.A)	(N.A)	
42047F1097	Qc	Qc measurement primary	(N.A)	(N.A)	
42047F1098	Q	Q measurement primary	(N.A)	(N.A)	
4205801090	Sa	Sa measurement primary	(N.A)	(N.A)	
4205801090	Sb	Sb measurement primary	(N.A)	(N.A)	
4205801090	Sc	Sc measurement primary	(N.A)	(N.A)	
4205801090	S	S measurement primary	(N.A)	(N.A)	
42066C105C	f	Frequency measurement	(N.A)	(N.A)	
420689109E	df-SyncRy1	Differential frequency of SyncRy1's VR and VI	(N.A)	(N.A)	
42068A109E	VR1-f	Frequency of SyncRy1's VR	(N.A)	(N.A)	
42068B109E	VI1-f	Frequency of SyncRy1's VI	(N.A)	(N.A)	
42068C109E	df-SyncRy2	Differential frequency of SyncRy2's VR and VI	(N.A)	(N.A)	
42068D109E	VR2-f	Frequency of SyncRy2's VR	(N.A)	(N.A)	
42068E109E	VI2-f	Frequency of SyncRy2's VI	(N.A)	(N.A)	
4209751050	Ise-Angle	Ise measurement angle	(N.A)	(N.A)	
420975107C	Ise	Ise measurement primary	(N.A)	(N.A)	
4210691090	dAng.-SYN1	Differential angle of SYN1's VB and VL	(N.A)	(N.A)	
42106C1099	dAng.-SYN2	Differential angle of SYN2's VL2 and VL	(N.A)	(N.A)	
4212681090	VB	Busbar Voltage	(N.A)	(N.A)	
4212681090	VL	Line Voltage	(N.A)	(N.A)	
4212681090	dV-SYN1	Differential voltage of SYN1's VB and VL	(N.A)	(N.A)	
42126B1095	VL2	Line2 voltage	(N.A)	(N.A)	
42126B1097	dV-SYN2	Differential voltage of SYN2's VL2 and VL	(N.A)	(N.A)	
42166A109E	df-SYN1	Differential frequency of SYN1's VB and VL	(N.A)	(N.A)	
42166D109E	df-SYN2	Differential frequency of SYN2's VL2 and VL	(N.A)	(N.A)	
4317601090	Wh+	Wh+ measurement primary	(N.A)	(N.A)	
4317611090	Wh-	Wh- measurement primary	(N.A)	(N.A)	
4318621090	varh+	varh+ measurement primary	(N.A)	(N.A)	
4318631090	varh-	varh- measurement primary	(N.A)	(N.A)	
(N.A)	(N.A)		(N.A)	(N.A)	
(N.A)	(N.A)		(N.A)	(N.A)	
(N.A)	(N.A)		(N.A)	(N.A)	
(N.A)	(N.A)		(N.A)	(N.A)	
(N.A)	(N.A)		(N.A)	(N.A)	
(N.A)	(N.A)		(N.A)	(N.A)	

61850 signals generated in BCU in single VCT51B
Software 2C [MES_MANAGEMENT (Function ID: 711001)]

Element IDs	Names	Contents Note	Element IDs	Names	Contents Note
4200851090	PFa	PFa measurement	(N.A)	(N.A)	
4200851090	PFb	PFb measurement	(N.A)	(N.A)	
4200851090	PFc	PFc measurement	(N.A)	(N.A)	
4200851090	PF	PF measurement	(N.A)	(N.A)	
4200881090	dAng.-SyncRy1	Differential angle of SyncRy1's VR and VI	(N.A)	(N.A)	
42008B1099	dAng.-SyncRy2	Differential angle of SyncRy2's VR and VI	(N.A)	(N.A)	
4201601050	Ia-Angle	Ia measurement angle	(N.A)	(N.A)	
4201601050	Ib-Angle	Ib measurement angle	(N.A)	(N.A)	
4201601050	Ic-Angle	Ic measurement angle	(N.A)	(N.A)	
4201601070	Ia	Ia measurement primary	(N.A)	(N.A)	
4201601070	Ib	Ib measurement primary	(N.A)	(N.A)	
420160107A	Ic	Ic measurement primary	(N.A)	(N.A)	
4201611050	Iab-Angle	Iab measurement angle	(N.A)	(N.A)	
4201611050	Ibc-Angle	Ibc measurement angle	(N.A)	(N.A)	
4201611050	Ica-Angle	Ica measurement angle	(N.A)	(N.A)	
4201611070	Iab	Iab measurement primary	(N.A)	(N.A)	
4201611070	Ibc	Ibc measurement primary	(N.A)	(N.A)	
420161107A	Ica	Ica measurement primary	(N.A)	(N.A)	
4201621050	I1-Angle	I1 measurement angle	(N.A)	(N.A)	
4201621050	I2-Angle	I2 measurement angle	(N.A)	(N.A)	
4201621050	I0-Angle	I0 measurement angle	(N.A)	(N.A)	
4201621070	I1	I1 measurement primary	(N.A)	(N.A)	
4201621070	I2	I2 measurement primary	(N.A)	(N.A)	
420162107C	I0	I0 measurement primary	(N.A)	(N.A)	
4202641050	Va-Angle	Va measurement angle	(N.A)	(N.A)	
4202641050	Vb-Angle	Vb measurement angle	(N.A)	(N.A)	
4202641050	Vc-Angle	Vc measurement angle	(N.A)	(N.A)	
4202641070	Va	Va measurement primary	(N.A)	(N.A)	
4202641070	Vb	Vb measurement primary	(N.A)	(N.A)	
420264107A	Vc	Vc measurement primary	(N.A)	(N.A)	
4202651050	Vab-Angle	Vab measurement angle	(N.A)	(N.A)	
4202651050	Vbc-Angle	Vbc measurement angle	(N.A)	(N.A)	
4202651050	Vca-Angle	Vca measurement angle	(N.A)	(N.A)	
4202651070	Vab	Vab measurement primary	(N.A)	(N.A)	
4202651070	Vbc	Vbc measurement primary	(N.A)	(N.A)	
420265107A	Vca	Vca measurement primary	(N.A)	(N.A)	
4202661050	V1-Angle	V1 measurement angle	(N.A)	(N.A)	
4202661050	V2-Angle	V2 measurement angle	(N.A)	(N.A)	
4202661050	V0-Angle	V0 measurement angle	(N.A)	(N.A)	
4202661070	V1	V1 measurement primary	(N.A)	(N.A)	
4202661070	V2	V2 measurement primary	(N.A)	(N.A)	
420266107C	V0	V0 measurement primary	(N.A)	(N.A)	
4202671050	V3-Angle	Vs measurement angle	(N.A)	(N.A)	
420267107C	V3	Vs measurement primary	(N.A)	(N.A)	
4202681050	V4-Angle	Vs2 measurement angle	(N.A)	(N.A)	
420268107C	V4	Vs2 measurement primary	(N.A)	(N.A)	
4202791050	Ve-Angle	V4 measurement angle	(N.A)	(N.A)	
420279107C	Ve	V4 measurement primary	(N.A)	(N.A)	
4202871090	VR1	Running voltage of SyncRy1	(N.A)	(N.A)	
4202871090	VI1	Incoming voltage of SyncRy1	(N.A)	(N.A)	
4202871090	dV-SyncRy1	Differential voltage of SyncRy1's VR and VI	(N.A)	(N.A)	
42028A1095	VR2	Running voltage of SyncRy2	(N.A)	(N.A)	
42028A1096	VI2	Incoming voltage of SyncRy2	(N.A)	(N.A)	
42028A1097	dV-SyncRy2	Differential voltage of SyncRy2's VR and VI	(N.A)	(N.A)	
42037E1095	Pa	Pa measurement primary	(N.A)	(N.A)	
42037E1096	Pb	Pb measurement primary	(N.A)	(N.A)	
42037E1097	Pc	Pc measurement primary	(N.A)	(N.A)	
42037E1098	P	P measurement primary	(N.A)	(N.A)	
42047F1095	Qa	Qa measurement primary	(N.A)	(N.A)	
42047F1096	Qb	Qb measurement primary	(N.A)	(N.A)	
42047F1097	Qc	Qc measurement primary	(N.A)	(N.A)	
42047F1098	Q	Q measurement primary	(N.A)	(N.A)	
4205801090	Sa	Sa measurement primary	(N.A)	(N.A)	
4205801090	Sb	Sb measurement primary	(N.A)	(N.A)	
4205801090	Sc	Sc measurement primary	(N.A)	(N.A)	
4205801090	S	S measurement primary	(N.A)	(N.A)	
42066C105C	f	Frequency measurement	(N.A)	(N.A)	
420689109E	df-SyncRy1	Differential frequency of SyncRy1's VR and VI	(N.A)	(N.A)	
42068A109E	VR1-f	Frequency of SyncRy1's VR	(N.A)	(N.A)	
42068B109E	VI1-f	Frequency of SyncRy1's VI	(N.A)	(N.A)	
42068C109E	df-SyncRy2	Differential frequency of SyncRy2's VR and VI	(N.A)	(N.A)	
42068D109E	VR2-f	Frequency of SyncRy2's VR	(N.A)	(N.A)	
42068E109E	VI2-f	Frequency of SyncRy2's VI	(N.A)	(N.A)	
4209751050	Ise-Angle	Ise measurement angle	(N.A)	(N.A)	
420975107C	Ise	Ise measurement primary	(N.A)	(N.A)	
4210691090	dAng.-SYN1	Differential angle of SYN1's VB and VL	(N.A)	(N.A)	
42106C1099	dAng.-SYN2	Differential angle of SYN2's VL2 and VL	(N.A)	(N.A)	
4212681090	VB	Busbar Voltage	(N.A)	(N.A)	
4212681090	VL	Line Voltage	(N.A)	(N.A)	
4212681090	dV-SYN1	Differential voltage of SYN1's VB and VL	(N.A)	(N.A)	
42126B1095	VL2	Line2 voltage	(N.A)	(N.A)	
42126B1097	dV-SYN2	Differential voltage of SYN2's VL2 and VL	(N.A)	(N.A)	
42166A109E	df-SYN1	Differential frequency of SYN1's VB and VL	(N.A)	(N.A)	
42166D109E	df-SYN2	Differential frequency of SYN2's VL2 and VL	(N.A)	(N.A)	
4317601090	Wh+	Wh+ measurement primary	(N.A)	(N.A)	
4317611090	Wh-	Wh- measurement primary	(N.A)	(N.A)	
4318621090	varh+	varh+ measurement primary	(N.A)	(N.A)	
4318631090	varh-	varh- measurement primary	(N.A)	(N.A)	
(N.A)	(N.A)		(N.A)	(N.A)	
(N.A)	(N.A)		(N.A)	(N.A)	
(N.A)	(N.A)		(N.A)	(N.A)	
(N.A)	(N.A)		(N.A)	(N.A)	
(N.A)	(N.A)		(N.A)	(N.A)	
(N.A)	(N.A)		(N.A)	(N.A)	

61850 signals generated in BCU with single VCT52B Software 11 [MES_MANAGEMENT (Function ID: 711001)]

Element IDs	Names	Contents Note	Element IDs	Names	Contents Note
4200851090	PFa	PFa measurement	(N.A)	(N.A)	
4200851090	PFb	PFb measurement	(N.A)	(N.A)	
4200851090	PFc	PFc measurement	(N.A)	(N.A)	
4200851090	PF	PF measurement	(N.A)	(N.A)	
4200881090	dAng.-SyncRy1	Differential angle of SyncRy1's VR and VI	(N.A)	(N.A)	
42008B1099	dAng.-SyncRy2	Differential angle of SyncRy2's VR and VI	(N.A)	(N.A)	
4201601050	Ia-Angle	Ia measurement angle	(N.A)	(N.A)	
4201601050	Ib-Angle	Ib measurement angle	(N.A)	(N.A)	
4201601050	Ic-Angle	Ic measurement angle	(N.A)	(N.A)	
4201601070	Ia	Ia measurement primary	(N.A)	(N.A)	
4201601070	Ib	Ib measurement primary	(N.A)	(N.A)	
420160107A	Ic	Ic measurement primary	(N.A)	(N.A)	
4201611050	Iab-Angle	Iab measurement angle	(N.A)	(N.A)	
4201611050	Ibc-Angle	Ibc measurement angle	(N.A)	(N.A)	
4201611050	Ica-Angle	Ica measurement angle	(N.A)	(N.A)	
4201611070	Iab	Iab measurement primary	(N.A)	(N.A)	
4201611070	Ibc	Ibc measurement primary	(N.A)	(N.A)	
420161107A	Ica	Ica measurement primary	(N.A)	(N.A)	
4201621050	I1-Angle	I1 measurement angle	(N.A)	(N.A)	
4201621050	I2-Angle	I2 measurement angle	(N.A)	(N.A)	
4201621050	I0-Angle	I0 measurement angle	(N.A)	(N.A)	
4201621070	I1	I1 measurement primary	(N.A)	(N.A)	
4201621070	I2	I2 measurement primary	(N.A)	(N.A)	
420162107C	I0	I0 measurement primary	(N.A)	(N.A)	
4202641050	Va-Angle	Va measurement angle	(N.A)	(N.A)	
4202641050	Vb-Angle	Vb measurement angle	(N.A)	(N.A)	
4202641050	Vc-Angle	Vc measurement angle	(N.A)	(N.A)	
4202641070	Va	Va measurement primary	(N.A)	(N.A)	
4202641070	Vb	Vb measurement primary	(N.A)	(N.A)	
420264107A	Vc	Vc measurement primary	(N.A)	(N.A)	
4202651050	Vab-Angle	Vab measurement angle	(N.A)	(N.A)	
4202651050	Vbc-Angle	Vbc measurement angle	(N.A)	(N.A)	
4202651050	Vca-Angle	Vca measurement angle	(N.A)	(N.A)	
4202651070	Vab	Vab measurement primary	(N.A)	(N.A)	
4202651070	Vbc	Vbc measurement primary	(N.A)	(N.A)	
420265107A	Vca	Vca measurement primary	(N.A)	(N.A)	
4202661050	V1-Angle	V1 measurement angle	(N.A)	(N.A)	
4202661050	V2-Angle	V2 measurement angle	(N.A)	(N.A)	
4202661050	V0-Angle	V0 measurement angle	(N.A)	(N.A)	
4202661070	V1	V1 measurement primary	(N.A)	(N.A)	
4202661070	V2	V2 measurement primary	(N.A)	(N.A)	
420266107C	V0	V0 measurement primary	(N.A)	(N.A)	
4202671050	V3-Angle	Vs measurement angle	(N.A)	(N.A)	
420267107C	V3	Vs measurement primary	(N.A)	(N.A)	
4202681050	V4-Angle	Vs2 measurement angle	(N.A)	(N.A)	
420268107C	V4	Vs2 measurement primary	(N.A)	(N.A)	
4202871090	VR1	Running voltage of SyncRy1	(N.A)	(N.A)	
4202871090	VI1	Incoming voltage of SyncRy1	(N.A)	(N.A)	
4202871090	dV-SyncRy1	Differential voltage of SyncRy1's VR and VI	(N.A)	(N.A)	
42028A1095	VR2	Running voltage of SyncRy2	(N.A)	(N.A)	
42028A1096	VI2	Incoming voltage of SyncRy2	(N.A)	(N.A)	
42028A1097	dV-SyncRy2	Differential voltage of SyncRy2's VR and VI	(N.A)	(N.A)	
42037E1095	Pa	Pa measurement primary	(N.A)	(N.A)	
42037E1096	Pb	Pb measurement primary	(N.A)	(N.A)	
42037E1097	Pc	Pc measurement primary	(N.A)	(N.A)	
42037E1098	P	P measurement primary	(N.A)	(N.A)	
42047F1095	Qa	Qa measurement primary	(N.A)	(N.A)	
42047F1096	Qb	Qb measurement primary	(N.A)	(N.A)	
42047F1097	Qc	Qc measurement primary	(N.A)	(N.A)	
42047F1098	Q	Q measurement primary	(N.A)	(N.A)	
4205801090	Sa	Sa measurement primary	(N.A)	(N.A)	
4205801090	Sb	Sb measurement primary	(N.A)	(N.A)	
4205801090	Sc	Sc measurement primary	(N.A)	(N.A)	
4205801090	S	S measurement primary	(N.A)	(N.A)	
42066C105C	f	Frequency measurement	(N.A)	(N.A)	
420689109E	df-SyncRy1	Differential frequency of SyncRy1's VR and VI	(N.A)	(N.A)	
42068A109E	VR1-f	Frequency of SyncRy1's VR	(N.A)	(N.A)	
42068B109E	VI1-f	Frequency of SyncRy1's VI	(N.A)	(N.A)	
42068C109E	df-SyncRy2	Differential frequency of SyncRy2's VR and VI	(N.A)	(N.A)	
42068D109E	VR2-f	Frequency of SyncRy2's VR	(N.A)	(N.A)	
42068E109E	VI2-f	Frequency of SyncRy2's VI	(N.A)	(N.A)	
4317601090	Wh+	Wh+ measurement primary	(N.A)	(N.A)	
4317611090	Wh-	Wh- measurement primary	(N.A)	(N.A)	
4318621090	varh+	varh+ measurement primary	(N.A)	(N.A)	
4318631090	varh-	varh- measurement primary	(N.A)	(N.A)	
(N.A)	(N.A)		(N.A)	(N.A)	
(N.A)	(N.A)		(N.A)	(N.A)	
(N.A)	(N.A)		(N.A)	(N.A)	
(N.A)	(N.A)		(N.A)	(N.A)	
(N.A)	(N.A)		(N.A)	(N.A)	
(N.A)	(N.A)		(N.A)	(N.A)	
(N.A)	(N.A)		(N.A)	(N.A)	
(N.A)	(N.A)		(N.A)	(N.A)	
(N.A)	(N.A)		(N.A)	(N.A)	
(N.A)	(N.A)		(N.A)	(N.A)	
(N.A)	(N.A)		(N.A)	(N.A)	
(N.A)	(N.A)		(N.A)	(N.A)	
(N.A)	(N.A)		(N.A)	(N.A)	
(N.A)	(N.A)		(N.A)	(N.A)	
(N.A)	(N.A)		(N.A)	(N.A)	
(N.A)	(N.A)		(N.A)	(N.A)	
(N.A)	(N.A)		(N.A)	(N.A)	
(N.A)	(N.A)		(N.A)	(N.A)	
(N.A)	(N.A)		(N.A)	(N.A)	
(N.A)	(N.A)		(N.A)	(N.A)	
(N.A)	(N.A)		(N.A)	(N.A)	
(N.A)	(N.A)		(N.A)	(N.A)	

61850 signals generated in BCU with single VCT52B Software 1F [MES_MANAGEMENT (Function ID: 711001)]

Element IDs	Names	Contents Note	Element IDs	Names	Contents Note
4200851090	PFa	PFa measurement	(N.A)	(N.A)	
4200851090	PFb	PFb measurement	(N.A)	(N.A)	
4200851090	PFc	PFc measurement	(N.A)	(N.A)	
4200851090	PF	PF measurement	(N.A)	(N.A)	
4200881090	dAng.-SyncRy1	Differential angle of SyncRy1's VR and VI	(N.A)	(N.A)	
42008B1099	dAng.-SyncRy2	Differential angle of SyncRy2's VR and VI	(N.A)	(N.A)	
4201601050	Ia-Angle	Ia measurement angle	(N.A)	(N.A)	
4201601050	Ib-Angle	Ib measurement angle	(N.A)	(N.A)	
4201601050	Ic-Angle	Ic measurement angle	(N.A)	(N.A)	
4201601070	Ia	Ia measurement primary	(N.A)	(N.A)	
4201601070	Ib	Ib measurement primary	(N.A)	(N.A)	
420160107A	Ic	Ic measurement primary	(N.A)	(N.A)	
4201611050	Iab-Angle	Iab measurement angle	(N.A)	(N.A)	
4201611050	Ibc-Angle	Ibc measurement angle	(N.A)	(N.A)	
4201611050	Ica-Angle	Ica measurement angle	(N.A)	(N.A)	
4201611070	Iab	Iab measurement primary	(N.A)	(N.A)	
4201611070	Ibc	Ibc measurement primary	(N.A)	(N.A)	
420161107A	Ica	Ica measurement primary	(N.A)	(N.A)	
4201621050	I1-Angle	I1 measurement angle	(N.A)	(N.A)	
4201621050	I2-Angle	I2 measurement angle	(N.A)	(N.A)	
4201621050	I0-Angle	I0 measurement angle	(N.A)	(N.A)	
4201621070	I1	I1 measurement primary	(N.A)	(N.A)	
4201621070	I2	I2 measurement primary	(N.A)	(N.A)	
420162107C	I0	I0 measurement primary	(N.A)	(N.A)	
4202641050	Va-Angle	Va measurement angle	(N.A)	(N.A)	
4202641050	Vb-Angle	Vb measurement angle	(N.A)	(N.A)	
4202641050	Vc-Angle	Vc measurement angle	(N.A)	(N.A)	
4202641070	Va	Va measurement primary	(N.A)	(N.A)	
4202641070	Vb	Vb measurement primary	(N.A)	(N.A)	
420264107A	Vc	Vc measurement primary	(N.A)	(N.A)	
4202651050	Vab-Angle	Vab measurement angle	(N.A)	(N.A)	
4202651050	Vbc-Angle	Vbc measurement angle	(N.A)	(N.A)	
4202651050	Vca-Angle	Vca measurement angle	(N.A)	(N.A)	
4202651070	Vab	Vab measurement primary	(N.A)	(N.A)	
4202651070	Vbc	Vbc measurement primary	(N.A)	(N.A)	
420265107A	Vca	Vca measurement primary	(N.A)	(N.A)	
4202661050	V1-Angle	V1 measurement angle	(N.A)	(N.A)	
4202661050	V2-Angle	V2 measurement angle	(N.A)	(N.A)	
4202661050	V0-Angle	V0 measurement angle	(N.A)	(N.A)	
4202661070	V1	V1 measurement primary	(N.A)	(N.A)	
4202661070	V2	V2 measurement primary	(N.A)	(N.A)	
420266107C	V0	V0 measurement primary	(N.A)	(N.A)	
4202671050	V3-Angle	Vs measurement angle	(N.A)	(N.A)	
420267107C	V3	Vs measurement primary	(N.A)	(N.A)	
4202681050	V4-Angle	Vs2 measurement angle	(N.A)	(N.A)	
420268107C	V4	Vs2 measurement primary	(N.A)	(N.A)	
4202871090	VR1	Running voltage of SyncRy1	(N.A)	(N.A)	
4202871090	VI1	Incoming voltage of SyncRy1	(N.A)	(N.A)	
4202871090	dV-SyncRy1	Differential voltage of SyncRy1's VR and VI	(N.A)	(N.A)	
42028A1095	VR2	Running voltage of SyncRy2	(N.A)	(N.A)	
42028A1096	VI2	Incoming voltage of SyncRy2	(N.A)	(N.A)	
42028A1097	dV-SyncRy2	Differential voltage of SyncRy2's VR and VI	(N.A)	(N.A)	
42037E1095	Pa	Pa measurement primary	(N.A)	(N.A)	
42037E1096	Pb	Pb measurement primary	(N.A)	(N.A)	
42037E1097	Pc	Pc measurement primary	(N.A)	(N.A)	
42037E1098	P	P measurement primary	(N.A)	(N.A)	
42047F1095	Qa	Qa measurement primary	(N.A)	(N.A)	
42047F1096	Qb	Qb measurement primary	(N.A)	(N.A)	
42047F1097	Qc	Qc measurement primary	(N.A)	(N.A)	
42047F1098	Q	Q measurement primary	(N.A)	(N.A)	
4205801090	Sa	Sa measurement primary	(N.A)	(N.A)	
4205801090	Sb	Sb measurement primary	(N.A)	(N.A)	
4205801090	Sc	Sc measurement primary	(N.A)	(N.A)	
4205801090	S	S measurement primary	(N.A)	(N.A)	
42066C105C	f	Frequency measurement	(N.A)	(N.A)	
420689109E	df-SyncRy1	Differential frequency of SyncRy1's VR and VI	(N.A)	(N.A)	
42068A109E	VR1-f	Frequency of SyncRy1's VR	(N.A)	(N.A)	
42068B109E	VI1-f	Frequency of SyncRy1's VI	(N.A)	(N.A)	
42068C109E	df-SyncRy2	Differential frequency of SyncRy2's VR and VI	(N.A)	(N.A)	
42068D109E	VR2-f	Frequency of SyncRy2's VR	(N.A)	(N.A)	
42068E109E	VI2-f	Frequency of SyncRy2's VI	(N.A)	(N.A)	
4317601090	Wh+	Wh+ measurement primary	(N.A)	(N.A)	
4317611090	Wh-	Wh- measurement primary	(N.A)	(N.A)	
4318621090	varh+	varh+ measurement primary	(N.A)	(N.A)	
4318631090	varh-	varh- measurement primary	(N.A)	(N.A)	
(N.A)	(N.A)		(N.A)	(N.A)	
(N.A)	(N.A)		(N.A)	(N.A)	
(N.A)	(N.A)		(N.A)	(N.A)	
(N.A)	(N.A)		(N.A)	(N.A)	
(N.A)	(N.A)		(N.A)	(N.A)	
(N.A)	(N.A)		(N.A)	(N.A)	
(N.A)	(N.A)		(N.A)	(N.A)	
(N.A)	(N.A)		(N.A)	(N.A)	
(N.A)	(N.A)		(N.A)	(N.A)	
(N.A)	(N.A)		(N.A)	(N.A)	
(N.A)	(N.A)		(N.A)	(N.A)	
(N.A)	(N.A)		(N.A)	(N.A)	
(N.A)	(N.A)		(N.A)	(N.A)	
(N.A)	(N.A)		(N.A)	(N.A)	
(N.A)	(N.A)		(N.A)	(N.A)	
(N.A)	(N.A)		(N.A)	(N.A)	
(N.A)	(N.A)		(N.A)	(N.A)	
(N.A)	(N.A)		(N.A)	(N.A)	
(N.A)	(N.A)		(N.A)	(N.A)	
(N.A)	(N.A)		(N.A)	(N.A)	
(N.A)	(N.A)		(N.A)	(N.A)	
(N.A)	(N.A)		(N.A)	(N.A)	
(N.A)	(N.A)		(N.A)	(N.A)	

61850 signals generated in BCU with Double VCT52Bs
Software 1F [MES_MANAGEMENT (Function ID: 711001)]

Element IDs	Names	Contents Note	Element IDs	Names	Contents Note
4200851090	PFa	PFa measurement	(N.A)	(N.A)	
4200851090	PFb	PFb measurement	(N.A)	(N.A)	
4200851090	PFc	PFc measurement	(N.A)	(N.A)	
4200851090	PF	PF measurement	(N.A)	(N.A)	
4200881090	dAng.-SyncRy1	Differential angle of SyncRy1's VR and VI	(N.A)	(N.A)	
42008B1099	dAng.-SyncRy2	Differential angle of SyncRy2's VR and VI	(N.A)	(N.A)	
4201601050	Ia-Angle	Ia measurement angle	(N.A)	(N.A)	
4201601050	Ib-Angle	Ib measurement angle	(N.A)	(N.A)	
4201601050	Ic-Angle	Ic measurement angle	(N.A)	(N.A)	
4201601070	Ia	Ia measurement primary	(N.A)	(N.A)	
4201601070	Ib	Ib measurement primary	(N.A)	(N.A)	
420160107A	Ic	Ic measurement primary	(N.A)	(N.A)	
4201611050	Iab-Angle	Iab measurement angle	(N.A)	(N.A)	
4201611050	Ibc-Angle	Ibc measurement angle	(N.A)	(N.A)	
4201611050	Ica-Angle	Ica measurement angle	(N.A)	(N.A)	
4201611070	Iab	Iab measurement primary	(N.A)	(N.A)	
4201611070	Ibc	Ibc measurement primary	(N.A)	(N.A)	
420161107A	Ica	Ica measurement primary	(N.A)	(N.A)	
4201621050	I1-Angle	I1 measurement angle	(N.A)	(N.A)	
4201621050	I2-Angle	I2 measurement angle	(N.A)	(N.A)	
4201621050	I0-Angle	I0 measurement angle	(N.A)	(N.A)	
4201621070	I1	I1 measurement primary	(N.A)	(N.A)	
4201621070	I2	I2 measurement primary	(N.A)	(N.A)	
420162107C	I0	I0 measurement primary	(N.A)	(N.A)	
4202641050	Va-Angle	Va measurement angle	(N.A)	(N.A)	
4202641050	Vb-Angle	Vb measurement angle	(N.A)	(N.A)	
4202641050	Vc-Angle	Vc measurement angle	(N.A)	(N.A)	
4202641070	Va	Va measurement primary	(N.A)	(N.A)	
4202641070	Vb	Vb measurement primary	(N.A)	(N.A)	
420264107A	Vc	Vc measurement primary	(N.A)	(N.A)	
4202651050	Vab-Angle	Vab measurement angle	(N.A)	(N.A)	
4202651050	Vbc-Angle	Vbc measurement angle	(N.A)	(N.A)	
4202651050	Vca-Angle	Vca measurement angle	(N.A)	(N.A)	
4202651070	Vab	Vab measurement primary	(N.A)	(N.A)	
4202651070	Vbc	Vbc measurement primary	(N.A)	(N.A)	
420265107A	Vca	Vca measurement primary	(N.A)	(N.A)	
4202661050	V1-Angle	V1 measurement angle	(N.A)	(N.A)	
4202661050	V2-Angle	V2 measurement angle	(N.A)	(N.A)	
4202661050	V0-Angle	V0 measurement angle	(N.A)	(N.A)	
4202661070	V1	V1 measurement primary	(N.A)	(N.A)	
4202661070	V2	V2 measurement primary	(N.A)	(N.A)	
420266107C	V0	V0 measurement primary	(N.A)	(N.A)	
4202671050	V3-Angle	Vs measurement angle	(N.A)	(N.A)	
420267107C	V3	Vs measurement primary	(N.A)	(N.A)	
4202681050	V4-Angle	Vs2 measurement angle	(N.A)	(N.A)	
420268107C	V4	Vs2 measurement primary	(N.A)	(N.A)	
4202871090	VR1	Running voltage of SyncRy1	(N.A)	(N.A)	
4202871090	VI1	Incoming voltage of SyncRy1	(N.A)	(N.A)	
4202871090	dV-SyncRy1	Differential voltage of SyncRy1's VR and VI	(N.A)	(N.A)	
42028A1095	VR2	Running voltage of SyncRy2	(N.A)	(N.A)	
42028A1096	VI2	Incoming voltage of SyncRy2	(N.A)	(N.A)	
42028A1097	dV-SyncRy2	Differential voltage of SyncRy2's VR and VI	(N.A)	(N.A)	
42037E1095	Pa	Pa measurement primary	(N.A)	(N.A)	
42037E1096	Pb	Pb measurement primary	(N.A)	(N.A)	
42037E1097	Pc	Pc measurement primary	(N.A)	(N.A)	
42037E1098	P	P measurement primary	(N.A)	(N.A)	
42047F1095	Qa	Qa measurement primary	(N.A)	(N.A)	
42047F1096	Qb	Qb measurement primary	(N.A)	(N.A)	
42047F1097	Qc	Qc measurement primary	(N.A)	(N.A)	
42047F1098	Q	Q measurement primary	(N.A)	(N.A)	
4205801090	Sa	Sa measurement primary	(N.A)	(N.A)	
4205801090	Sb	Sb measurement primary	(N.A)	(N.A)	
4205801090	Sc	Sc measurement primary	(N.A)	(N.A)	
4205801090	S	S measurement primary	(N.A)	(N.A)	
42066C105C	f	Frequency measurement	(N.A)	(N.A)	
420689109E	df-SyncRy1	Differential frequency of SyncRy1's VR and VI	(N.A)	(N.A)	
42068A109E	VR1-f	Frequency of SyncRy1's VR	(N.A)	(N.A)	
42068B109E	VI1-f	Frequency of SyncRy1's VI	(N.A)	(N.A)	
42068C109E	df-SyncRy2	Differential frequency of SyncRy2's VR and VI	(N.A)	(N.A)	
42068D109E	VR2-f	Frequency of SyncRy2's VR	(N.A)	(N.A)	
42068E109E	VI2-f	Frequency of SyncRy2's VI	(N.A)	(N.A)	
4317601090	Wh+	Wh+ measurement primary	(N.A)	(N.A)	
4317611090	Wh-	Wh- measurement primary	(N.A)	(N.A)	
4318621090	varh+	varh+ measurement primary	(N.A)	(N.A)	
4318631090	varh-	varh- measurement primary	(N.A)	(N.A)	
(N.A)	(N.A)		(N.A)	(N.A)	
(N.A)	(N.A)		(N.A)	(N.A)	
(N.A)	(N.A)		(N.A)	(N.A)	
(N.A)	(N.A)		(N.A)	(N.A)	
(N.A)	(N.A)		(N.A)	(N.A)	
(N.A)	(N.A)		(N.A)	(N.A)	
(N.A)	(N.A)		(N.A)	(N.A)	
(N.A)	(N.A)		(N.A)	(N.A)	
(N.A)	(N.A)		(N.A)	(N.A)	
(N.A)	(N.A)		(N.A)	(N.A)	
(N.A)	(N.A)		(N.A)	(N.A)	
(N.A)	(N.A)		(N.A)	(N.A)	
(N.A)	(N.A)		(N.A)	(N.A)	
(N.A)	(N.A)		(N.A)	(N.A)	
(N.A)	(N.A)		(N.A)	(N.A)	
(N.A)	(N.A)		(N.A)	(N.A)	
(N.A)	(N.A)		(N.A)	(N.A)	
(N.A)	(N.A)		(N.A)	(N.A)	
(N.A)	(N.A)		(N.A)	(N.A)	
(N.A)	(N.A)		(N.A)	(N.A)	
(N.A)	(N.A)		(N.A)	(N.A)	
(N.A)	(N.A)		(N.A)	(N.A)	
(N.A)	(N.A)		(N.A)	(N.A)	

61850 signals generated in BCU with Single VCT53B Software 11 [MES_MANAGEMENT (Function ID: 711001)]

Element IDs	Names	Contents Note	Element IDs	Names	Contents Note
4200851090	PFa	PFa measurement	4205831090	Sc2	Sc2 measurement primary
4200851090	PFb	PFb measurement	4205831090	S2	S2 measurement primary
4200851090	PFc	PFc measurement	42066C105C	f	Frequency measurement
4200851090	PF	PF measurement	420684105C	f2	Frequency measurement
4200861090	PFa2	PFa measurement	420689109E	df-SyncRy1	Differential frequency of SyncRy1's VR and VI
4200861090	PFb2	PFb measurement	42068A109E	VR1-f	Frequency of SyncRy1's VR
4200861090	PFc2	PFc measurement	42068B109E	VI1-f	Frequency of SyncRy1's VI
4200861090	PF2	PF measurement	42068C109E	df-SyncRy2	Differential frequency of SyncRy2's VR and VI
4200881090	dAng.-SyncRy1	Differential angle of SyncRy1's VR and VI	42068D109E	VR2-f	Frequency of SyncRy2's VR
42008B1099	dAng.-SyncRy2	Differential angle of SyncRy2's VR and VI	42068E109E	VI2-f	Frequency of SyncRy2's VI
4201601050	Ia-Angle	Ia measurement angle	4317601090	Wh+	Wh+ measurement primary
4201601050	Ib-Angle	Ib measurement angle	4317611090	Wh-	Wh- measurement primary
4201601050	Ic-Angle	Ic measurement angle	4317641090	Wh2+	Wh2+ measurement primary
4201601070	Ia	Ia measurement primary	4317651090	Wh2-	Wh2- measurement primary
4201601070	Ib	Ib measurement primary	4318621090	varh+	varh+ measurement primary
420160107A	Ic	Ic measurement primary	4318631090	varh-	varh- measurement primary
4201611050	Iab-Angle	Iab measurement angle	4318661090	varh2+	varh2+ measurement primary
4201611050	Ibc-Angle	Ibc measurement angle	4318671090	varh2-	varh2- measurement primary
4201611050	Ica-Angle	Ica measurement angle	(N.A)	(N.A)	
4201611070	Iab	Iab measurement primary	(N.A)	(N.A)	
4201611070	Ibc	Ibc measurement primary	(N.A)	(N.A)	
420161107A	Ica	Ica measurement primary	(N.A)	(N.A)	
4201621050	I1-Angle	I1 measurement angle	(N.A)	(N.A)	
4201621050	I2-Angle	I2 measurement angle	(N.A)	(N.A)	
4201621050	I0-Angle	I0 measurement angle	(N.A)	(N.A)	
4201621070	I1	I1 measurement primary	(N.A)	(N.A)	
4201621070	I2	I2 measurement primary	(N.A)	(N.A)	
420162107C	I0	I0 measurement primary	(N.A)	(N.A)	
4202641050	Va-Angle	Va measurement angle	(N.A)	(N.A)	
4202641050	Vb-Angle	Vb measurement angle	(N.A)	(N.A)	
4202641050	Vc-Angle	Vc measurement angle	(N.A)	(N.A)	
4202641070	Va	Va measurement primary	(N.A)	(N.A)	
4202641070	Vb	Vb measurement primary	(N.A)	(N.A)	
420264107A	Vc	Vc measurement primary	(N.A)	(N.A)	
4202651050	Vab-Angle	Vab measurement angle	(N.A)	(N.A)	
4202651050	Vbc-Angle	Vbc measurement angle	(N.A)	(N.A)	
4202651050	Vca-Angle	Vca measurement angle	(N.A)	(N.A)	
4202651070	Vab	Vab measurement primary	(N.A)	(N.A)	
4202651070	Vbc	Vbc measurement primary	(N.A)	(N.A)	
420265107A	Vca	Vca measurement primary	(N.A)	(N.A)	
4202661050	V1-Angle	V1 measurement angle	(N.A)	(N.A)	
4202661050	V2-Angle	V2 measurement angle	(N.A)	(N.A)	
4202661050	V0-Angle	V0 measurement angle	(N.A)	(N.A)	
4202661070	V1	V1 measurement primary	(N.A)	(N.A)	
4202661070	V2	V2 measurement primary	(N.A)	(N.A)	
420266107C	V0	V0 measurement primary	(N.A)	(N.A)	
4202671050	V3-Angle	Vs measurement angle	(N.A)	(N.A)	
420267107C	V3	Vs measurement primary	(N.A)	(N.A)	
4202761050	Va2-Angle	Va2 measurement angle	(N.A)	(N.A)	
4202761050	Vb2-Angle	Vb2 measurement angle	(N.A)	(N.A)	
4202761050	Vc2-Angle	Vc2 measurement angle	(N.A)	(N.A)	
4202761070	Va2	Va2 measurement primary	(N.A)	(N.A)	
4202761070	Vb2	Vb2 measurement primary	(N.A)	(N.A)	
420276107A	Vc2	Vc2 measurement primary	(N.A)	(N.A)	
4202771050	Vab2-Angle	Vab2 measurement angle	(N.A)	(N.A)	
4202771050	Vbc2-Angle	Vbc2 measurement angle	(N.A)	(N.A)	
4202771050	Vca2-Angle	Vca2 measurement angle	(N.A)	(N.A)	
4202771070	Vab2	Vab2 measurement primary	(N.A)	(N.A)	
4202771070	Vbc2	Vbc2 measurement primary	(N.A)	(N.A)	
420277107A	Vca2	Vca2 measurement primary	(N.A)	(N.A)	
4202781050	V12-Angle	V12 measurement angle	(N.A)	(N.A)	
4202781050	V22-Angle	V22 measurement angle	(N.A)	(N.A)	
4202781050	V02-Angle	V02 measurement angle	(N.A)	(N.A)	
4202781070	V12	V12 measurement primary	(N.A)	(N.A)	
4202781070	V22	V22 measurement primary	(N.A)	(N.A)	
420278107C	V02	V02 measurement primary	(N.A)	(N.A)	
4202871090	VR1	Running voltage of SyncRy1	(N.A)	(N.A)	
4202871090	VI1	Incoming voltage of SyncRy1	(N.A)	(N.A)	
4202871090	dV-SyncRy1	Differential voltage of SyncRy1's VR and VI	(N.A)	(N.A)	
42028A1095	VR2	Running voltage of SyncRy2	(N.A)	(N.A)	
42028A1096	VI2	Incoming voltage of SyncRy2	(N.A)	(N.A)	
42028A1097	dV-SyncRy2	Differential voltage of SyncRy2's VR and VI	(N.A)	(N.A)	
42037E1095	Pa	Pa measurement primary	(N.A)	(N.A)	
42037E1096	Pb	Pb measurement primary	(N.A)	(N.A)	
42037E1097	Pc	Pc measurement primary	(N.A)	(N.A)	
42037E1098	P	P measurement primary	(N.A)	(N.A)	
4203811090	Pa2	Pa2 measurement primary	(N.A)	(N.A)	
4203811090	Pb2	Pb2 measurement primary	(N.A)	(N.A)	
4203811090	Pc2	Pc2 measurement primary	(N.A)	(N.A)	
4203811090	P2	P2 measurement primary	(N.A)	(N.A)	
42047F1095	Qa	Qa measurement primary	(N.A)	(N.A)	
42047F1096	Qb	Qb measurement primary	(N.A)	(N.A)	
42047F1097	Qc	Qc measurement primary	(N.A)	(N.A)	
42047F1098	Q	Q measurement primary	(N.A)	(N.A)	
4204821090	Qa2	Qa2 measurement primary	(N.A)	(N.A)	
4204821090	Qb2	Qb2 measurement primary	(N.A)	(N.A)	
4204821090	Qc2	Qc2 measurement primary	(N.A)	(N.A)	
4204821090	Q2	Q2 measurement primary	(N.A)	(N.A)	
4205801090	Sa	Sa measurement primary	(N.A)	(N.A)	
4205801090	Sb	Sb measurement primary	(N.A)	(N.A)	
4205801090	Sc	Sc measurement primary	(N.A)	(N.A)	
4205801090	S	S measurement primary	(N.A)	(N.A)	
4205831090	Sa2	Sa2 measurement primary	(N.A)	(N.A)	
4205831090	Sb2	Sb2 measurement primary	(N.A)	(N.A)	

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Element IDs	Names	Contents Note	Element IDs	Names	Contents Note
4200851090	PFa	PFa measurement	4205831090	Sc2	Sc2 measurement primary
4200851090	PFb	PFb measurement	4205831090	S2	S2 measurement primary
4200851090	PFc	PFc measurement	42066C105C	f	Frequency measurement
4200851090	PF	PF measurement	420684105C	f2	Frequency measurement
4200861090	PFa2	PFa measurement	420689109E	df-SyncRy1	Differential frequency of SyncRy1's VR and VI
4200861090	PFb2	PFb measurement	42068A109E	VR1-f	Frequency of SyncRy1's VR
4200861090	PFc2	PFc measurement	42068B109E	VI1-f	Frequency of SyncRy1's VI
4200861090	PF2	PF measurement	42068C109E	df-SyncRy2	Differential frequency of SyncRy2's VR and VI
4200881090	dAng.-SyncRy1	Differential angle of SyncRy1's VR and VI	42068D109E	VR2-f	Frequency of SyncRy2's VR
42008B1099	dAng.-SyncRy2	Differential angle of SyncRy2's VR and VI	42068E109E	VI2-f	Frequency of SyncRy2's VI
4201601050	Ia-Angle	Ia measurement angle	4317601090	Wh+	Wh+ measurement primary
4201601050	Ib-Angle	Ib measurement angle	4317611090	Wh-	Wh- measurement primary
4201601050	Ic-Angle	Ic measurement angle	4317641090	Wh2+	Wh2+ measurement primary
4201601070	Ia	Ia measurement primary	4317651090	Wh2-	Wh2- measurement primary
4201601070	Ib	Ib measurement primary	4318621090	varh+	varh+ measurement primary
420160107A	Ic	Ic measurement primary	4318631090	varh-	varh- measurement primary
4201611050	Iab-Angle	Iab measurement angle	4318661090	varh2+	varh2+ measurement primary
4201611050	Ibc-Angle	Ibc measurement angle	4318671090	varh2-	varh2- measurement primary
4201611050	Ica-Angle	Ica measurement angle	(N.A)	(N.A)	
4201611070	Iab	Iab measurement primary	(N.A)	(N.A)	
4201611070	Ibc	Ibc measurement primary	(N.A)	(N.A)	
420161107A	Ica	Ica measurement primary	(N.A)	(N.A)	
4201621050	I1-Angle	I1 measurement angle	(N.A)	(N.A)	
4201621050	I2-Angle	I2 measurement angle	(N.A)	(N.A)	
4201621050	I0-Angle	I0 measurement angle	(N.A)	(N.A)	
4201621070	I1	I1 measurement primary	(N.A)	(N.A)	
4201621070	I2	I2 measurement primary	(N.A)	(N.A)	
420162107C	I0	I0 measurement primary	(N.A)	(N.A)	
4202641050	Va-Angle	Va measurement angle	(N.A)	(N.A)	
4202641050	Vb-Angle	Vb measurement angle	(N.A)	(N.A)	
4202641050	Vc-Angle	Vc measurement angle	(N.A)	(N.A)	
4202641070	Va	Va measurement primary	(N.A)	(N.A)	
4202641070	Vb	Vb measurement primary	(N.A)	(N.A)	
420264107A	Vc	Vc measurement primary	(N.A)	(N.A)	
4202651050	Vab-Angle	Vab measurement angle	(N.A)	(N.A)	
4202651050	Vbc-Angle	Vbc measurement angle	(N.A)	(N.A)	
4202651050	Vca-Angle	Vca measurement angle	(N.A)	(N.A)	
4202651070	Vab	Vab measurement primary	(N.A)	(N.A)	
4202651070	Vbc	Vbc measurement primary	(N.A)	(N.A)	
420265107A	Vca	Vca measurement primary	(N.A)	(N.A)	
4202661050	V1-Angle	V1 measurement angle	(N.A)	(N.A)	
4202661050	V2-Angle	V2 measurement angle	(N.A)	(N.A)	
4202661050	V0-Angle	V0 measurement angle	(N.A)	(N.A)	
4202661070	V1	V1 measurement primary	(N.A)	(N.A)	
4202661070	V2	V2 measurement primary	(N.A)	(N.A)	
420266107C	V0	V0 measurement primary	(N.A)	(N.A)	
4202671050	V3-Angle	Vs measurement angle	(N.A)	(N.A)	
420267107C	V3	Vs measurement primary	(N.A)	(N.A)	
4202761050	Va2-Angle	Va2 measurement angle	(N.A)	(N.A)	
4202761050	Vb2-Angle	Vb2 measurement angle	(N.A)	(N.A)	
4202761050	Vc2-Angle	Vc2 measurement angle	(N.A)	(N.A)	
4202761070	Va2	Va2 measurement primary	(N.A)	(N.A)	
4202761070	Vb2	Vb2 measurement primary	(N.A)	(N.A)	
420276107A	Vc2	Vc2 measurement primary	(N.A)	(N.A)	
4202771050	Vab2-Angle	Vab2 measurement angle	(N.A)	(N.A)	
4202771050	Vbc2-Angle	Vbc2 measurement angle	(N.A)	(N.A)	
4202771050	Vca2-Angle	Vca2 measurement angle	(N.A)	(N.A)	
4202771070	Vab2	Vab2 measurement primary	(N.A)	(N.A)	
4202771070	Vbc2	Vbc2 measurement primary	(N.A)	(N.A)	
420277107A	Vca2	Vca2 measurement primary	(N.A)	(N.A)	
4202781050	V12-Angle	V12 measurement angle	(N.A)	(N.A)	
4202781050	V22-Angle	V22 measurement angle	(N.A)	(N.A)	
4202781050	V02-Angle	V02 measurement angle	(N.A)	(N.A)	
4202781070	V12	V12 measurement primary	(N.A)	(N.A)	
4202781070	V22	V22 measurement primary	(N.A)	(N.A)	
420278107C	V02	V02 measurement primary	(N.A)	(N.A)	
4202871090	VR1	Running voltage of SyncRy1	(N.A)	(N.A)	
4202871090	VI1	Incoming voltage of SyncRy1	(N.A)	(N.A)	
4202871090	dV-SyncRy1	Differential voltage of SyncRy1's VR and VI	(N.A)	(N.A)	
42028A1095	VR2	Running voltage of SyncRy2	(N.A)	(N.A)	
42028A1096	VI2	Incoming voltage of SyncRy2	(N.A)	(N.A)	
42028A1097	dV-SyncRy2	Differential voltage of SyncRy2's VR and VI	(N.A)	(N.A)	
42037E1095	Pa	Pa measurement primary	(N.A)	(N.A)	
42037E1096	Pb	Pb measurement primary	(N.A)	(N.A)	
42037E1097	Pc	Pc measurement primary	(N.A)	(N.A)	
42037E1098	P	P measurement primary	(N.A)	(N.A)	
4203811090	Pa2	Pa2 measurement primary	(N.A)	(N.A)	
4203811090	Pb2	Pb2 measurement primary	(N.A)	(N.A)	
4203811090	Pc2	Pc2 measurement primary	(N.A)	(N.A)	
4203811090	P2	P2 measurement primary	(N.A)	(N.A)	
42047F1095	Qa	Qa measurement primary	(N.A)	(N.A)	
42047F1096	Qb	Qb measurement primary	(N.A)	(N.A)	
42047F1097	Qc	Qc measurement primary	(N.A)	(N.A)	
42047F1098	Q	Q measurement primary	(N.A)	(N.A)	
4204821090	Qa2	Qa2 measurement primary	(N.A)	(N.A)	
4204821090	Qb2	Qb2 measurement primary	(N.A)	(N.A)	
4204821090	Qc2	Qc2 measurement primary	(N.A)	(N.A)	
4204821090	Q2	Q2 measurement primary	(N.A)	(N.A)	
4205801090	Sa	Sa measurement primary	(N.A)	(N.A)	
4205801090	Sb	Sb measurement primary	(N.A)	(N.A)	
4205801090	Sc	Sc measurement primary	(N.A)	(N.A)	
4205801090	S	S measurement primary	(N.A)	(N.A)	
4205831090	Sa2	Sa2 measurement primary	(N.A)	(N.A)	
4205831090	Sb2	Sb2 measurement primary	(N.A)	(N.A)	

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Element IDs	Names	Contents Note	Element IDs	Names	Contents Note
4200851090	PFa	PFa measurement	4202651050	Vab-Angle	Vab measurement angle
4200851090	PFb	PFb measurement	4202651050	Vbc-Angle	Vbc measurement angle
4200851090	PFc	PFc measurement	4202651050	Vca-Angle	Vca measurement angle
4200851090	PF	PF measurement	4202651070	Vab	Vab measurement primary
4200861090	PFa2	PFa measurement	4202651070	Vbc	Vbc measurement primary
4200861090	PFb2	PFb measurement	420265107A	Vca	Vca measurement primary
4200861090	PFc2	PFc measurement	4202661050	V1-Angle	V1 measurement angle
4200861090	PF2	PF measurement	4202661050	V2-Angle	V2 measurement angle
4200881090	dAng.-SyncRy1	Differential angle of SyncRy1's VR and VI	4202661050	V0-Angle	V0 measurement angle
42008B1099	dAng.-SyncRy2	Differential angle of SyncRy2's VR and VI	4202661070	V1	V1 measurement primary
4201601050	Ia-Angle	Ia measurement angle	4202661070	V2	V2 measurement primary
4201601050	Ib-Angle	Ib measurement angle	420266107C	V0	V0 measurement primary
4201601050	Ic-Angle	Ic measurement angle	4202671050	V3-Angle	Vs measurement angle
4201601070	Ia	Ia measurement primary	420267107C	V3	Vs measurement primary
4201601070	Ib	Ib measurement primary	4202681050	V4-Angle	Vs2 measurement angle
420160107A	Ic	Ic measurement primary	420268107C	V4	Vs2 measurement primary
4201611050	Iab-Angle	Iab measurement angle	4202761050	Va2-Angle	Va2 measurement angle
4201611050	Ibc-Angle	Ibc measurement angle	4202761050	Vb2-Angle	Vb2 measurement angle
4201611050	Ica-Angle	Ica measurement angle	4202761050	Vc2-Angle	Vc2 measurement angle
4201611070	Iab	Iab measurement primary	4202761070	Va2	Va2 measurement primary
4201611070	Ibc	Ibc measurement primary	4202761070	Vb2	Vb2 measurement primary
420161107A	Ica	Ica measurement primary	420276107A	Vc2	Vc2 measurement primary
4201621050	I1-Angle	I1 measurement angle	4202771050	Vab2-Angle	Vab2 measurement angle
4201621050	I2-Angle	I2 measurement angle	4202771050	Vbc2-Angle	Vbc2 measurement angle
4201621050	I0-Angle	I0 measurement angle	4202771050	Vca2-Angle	Vca2 measurement angle
4201621070	I1	I1 measurement primary	4202771070	Vab2	Vab2 measurement primary
4201621070	I2	I2 measurement primary	4202771070	Vbc2	Vbc2 measurement primary
420162107C	I0	I0 measurement primary	420277107A	Vca2	Vca2 measurement primary
4201631050	Iem-Angle	Iem measurement angle	4202781050	V12-Angle	V12 measurement angle
420163107C	Iem	Iem measurement primary	4202781050	V22-Angle	V22 measurement angle
4201691050	Ia2-Angle	Ia2 measurement angle	4202781050	V02-Angle	V02 measurement angle
4201691050	Ib2-Angle	Ib2 measurement angle	4202781070	V12	V12 measurement primary
4201691050	Ic2-Angle	Ic2 measurement angle	4202781070	V22	V22 measurement primary
4201691070	Ia2	Ia2 measurement primary	420278107C	V02	V02 measurement primary
4201691070	Ib2	Ib2 measurement primary	4202871090	VR1	Running voltage of SyncRy1
420169107A	Ic2	Ic2 measurement primary	4202871090	VI1	Incoming voltage of SyncRy1
42016A1051	Iab2-Angle	Iab2 measurement angle	4202871090	dV-SyncRy1	Differential voltage of SyncRy1's VR and VI
42016A1053	Ibc2-Angle	Ibc2 measurement angle	42028A1095	VR2	Running voltage of SyncRy2
42016A1055	Ica2-Angle	Ica2 measurement angle	42028A1096	VI2	Incoming voltage of SyncRy2
42016A1076	Iab2	Iab2 measurement primary	42028A1097	dV-SyncRy2	Differential voltage of SyncRy2's VR and VI
42016A1078	Ibc2	Ibc2 measurement primary	42037E1095	Pa	Pa measurement primary
42016A107A	Ica2	Ica2 measurement primary	42037E1096	Pb	Pb measurement primary
42016B1051	I12-Angle	I12 measurement angle	42037E1097	Pc	Pc measurement primary
42016B1053	I22-Angle	I22 measurement angle	42037E1098	P	P measurement primary
42016B1057	I02-Angle	I02 measurement angle	4203811090	Pa2	Pa2 measurement primary
42016B1076	I12	I12 measurement primary	4203811090	Pb2	Pb2 measurement primary
42016B1078	I22	I22 measurement primary	4203811090	Pc2	Pc2 measurement primary
42016B107C	I02	I02 measurement primary	4203811090	P2	P2 measurement primary
42016D1051	Ia-R1-Angle	Ia Remote CH1 measurement angle	42047F1095	Qa	Qa measurement primary
42016D1053	Ib-R1-Angle	Ib Remote CH1 measurement angle	42047F1096	Qb	Qb measurement primary
42016D1055	Ic-R1-Angle	Ic Remote CH1 measurement angle	42047F1097	Qc	Qc measurement primary
42016D1076	Ia-R1	Ia Remote CH1 measurement primary	42047F1098	Q	Q measurement primary
42016D1078	Ib-R1	Ib Remote CH1 measurement primary	4204821090	Qa2	Qa2 measurement primary
42016D107A	Ic-R1	Ic Remote CH1 measurement primary	4204821090	Qb2	Qb2 measurement primary
42016E1057	Ie-R1-Angle	Ie Remote CH1 measurement angle	4204821090	Qc2	Qc2 measurement primary
42016E107C	Ie-R1	Ie Remote CH1 measurement primary	4204821090	Q2	Q2 measurement primary
42016F1051	Ia2-R1-Angle	Ia2 Remote CH1 measurement angle	4205801090	Sa	Sa measurement primary
42016F1053	Ib2-R1-Angle	Ib2 Remote CH1 measurement angle	4205801090	Sb	Sb measurement primary
42016F1055	Ic2-R1-Angle	Ic2 Remote CH1 measurement angle	4205801090	Sc	Sc measurement primary
42016F1076	Ia2-R1	Ia2 Remote CH1 measurement primary	4205801090	S	S measurement primary
42016F1078	Ib2-R1	Ib2 Remote CH1 measurement primary	4205831090	Sa2	Sa2 measurement primary
42016F107A	Ic2-R1	Ic2 Remote CH1 measurement primary	4205831090	Sb2	Sb2 measurement primary
4201701050	Ie2-R1-Angle	Ie2 Remote CH1 measurement angle	4205831090	Sc2	Sc2 measurement primary
420170107C	Ie2-R1	Ie2 Remote CH1 measurement primary	4205831090	S2	S2 measurement primary
4201711050	Ia-R2-Angle	Ia Remote CH2 measurement angle	42066C105C	f	Frequency measurement
4201711050	Ib-R2-Angle	Ib Remote CH2 measurement angle	420684105C	f2	Frequency measurement
4201711050	Ic-R2-Angle	Ic Remote CH2 measurement angle	420689109E	df-SyncRy1	Differential frequency of SyncRy1's VR and VI
4201711070	Ia-R2	Ia Remote CH2 measurement primary	42068A109E	VR1-f	Frequency of SyncRy1's VR
4201711070	Ib-R2	Ib Remote CH2 measurement primary	42068B109E	VI1-f	Frequency of SyncRy1's VI
420171107A	Ic-R2	Ic Remote CH2 measurement primary	42068C109E	df-SyncRy2	Differential frequency of SyncRy2's VR and VI
4201721050	Ie-R2-Angle	Ie Remote CH2 measurement angle	42068D109E	VR2-f	Frequency of SyncRy2's VR
420172107C	Ie-R2	Ie Remote CH2 measurement primary	42068E109E	VI2-f	Frequency of SyncRy2's VI
4201731050	Ia2-R2-Angle	Ia2 Remote CH2 measurement angle	4317601090	Wh+	Wh+ measurement primary
4201731050	Ib2-R2-Angle	Ib2 Remote CH2 measurement angle	4317611090	Wh-	Wh- measurement primary
4201731050	Ic2-R2-Angle	Ic2 Remote CH2 measurement angle	4317641090	Wh2+	Wh2+ measurement primary
4201731070	Ia2-R2	Ia2 Remote CH2 measurement primary	4317651090	Wh2-	Wh2- measurement primary
4201731070	Ib2-R2	Ib2 Remote CH2 measurement primary	4318621090	varh+	varh+ measurement primary
420173107A	Ic2-R2	Ic2 Remote CH2 measurement primary	4318631090	varh-	varh- measurement primary
4201741050	Ie2-R2-Angle	Ie2 Remote CH2 measurement angle	4318661090	varh2+	varh2+ measurement primary
420174107C	Ie2-R2	Ie2 Remote CH2 measurement primary	4318671090	varh2-	varh2- measurement primary
42017A1076	DIFL-Ida	Ida measurement primary	(N.A)	(N.A)	
42017A1078	DIFL-Idb	Idb measurement primary	(N.A)	(N.A)	
42017A107A	DIFL-Idc	Idc measurement primary	(N.A)	(N.A)	
42017B1076	DIFL-Ira	Ira measurement primary	(N.A)	(N.A)	
42017B1078	DIFL-Irb	Irb measurement primary	(N.A)	(N.A)	
42017B107A	DIFL-Irc	Irc measurement primary	(N.A)	(N.A)	
42017C107C	DIFGL-Id0	Id0 measurement primary	(N.A)	(N.A)	
42017D107C	DIFGL-Ir0	Ir0 measurement primary	(N.A)	(N.A)	
4202641050	Va-Angle	Va measurement angle	(N.A)	(N.A)	
4202641050	Vb-Angle	Vb measurement angle	(N.A)	(N.A)	
4202641050	Vc-Angle	Vc measurement angle	(N.A)	(N.A)	
4202641070	Va	Va measurement primary	(N.A)	(N.A)	
4202641070	Vb	Vb measurement primary	(N.A)	(N.A)	
420264107A	Vc	Vc measurement primary	(N.A)	(N.A)	

9 Automatic supervision

9.1 Outline of automatic supervision

In power system, the protection function is not required to operate during normal conditions. That is, the protection function should stay silent for the unfaulty conditions, but it has to start respond immediately upon the occurrence of the fault. Therefore, as for the operation of the protection system, the detection of an unhealthy condition, such as malfunction or errors in the hardware or in the software, is requisite within the IED. The automatic supervision function is designed to detect the unhealthy condition within the IED; the following concepts are taken into account:

- The operating performance of the protection system should not be distorted.
- Supervision should be carried out by itself without any failure whenever possible.
- The protection system should identify the fault instantly upon its occurrence.

Tips: The alarms can be blocked when **Off** is set for the switch [**A.M.F**]. The switch can be used to remove alarms during testing. See *Chapter User interface: Test sub-menu* for more information.

(i) Error levels

In the applications and the hardware, the number of items are supervised for detecting the operation failure; hence, the results of the supervision functions are grouped and they are classified into five error-levels to identify the error degree directly: warning (level 5=the minor error) to the serious error (level 1=the critical error). Incidentally, zero (level 0) can be identified as no error. Table 9.1-1 shows the errors grouped by the error degree. The grouping is provided, for setting the degree of error, the user can select an user-defined degree for each error occurs randomly. If a number of failures occur on several levels at same time, the automatic supervision function selects the critical error among them to represent the error inside the IED.

Table 9.1-1 Meanings and error degree in the supervision function

Levels	Degree of error	Example failures and errors
0	No error	No error exists
1‡	Serious	Fatal failures such as the memory errors within the IED
2†‡	Serious (Comm.)	Failures on tele-communication
3†‡	Minor	Failure on LAN (Ethernet) communication
4	Alarm	Minor errors such as invalid errors by the user using settings
5	Warning	Detection of warnings classified by the user using settings

†Note:Level 2 and level 3 are shown, but the difference between the level 2 and the level 3 not given; thus, we can take the both having the same degree.

‡Note: The IEC 61850quality value is also changed depending on the error level. For more information, see Chapter *Communication protocol: IEC 61850 communication: Quality signal*.

(ii) Error LED and LCD error message

The IED has LEDs and LCD screen† so that the automatic supervision function issues a result for the LEDs and the LCD screen. When the IED is linked with the SAS, it is possible to transfer the result for the LED and LCD screen using the communication system. Table 9.1-2 shows that which indicators are used for result generation in the function.

Table 9.1-2 Displays on LEDs, LCD, and SAS

Levels	"In service" LED	"Error" LED	Error message on LCD
0: No error	On	Off	(Not displayed)
1: Serious	Off	On	Displayed
2: Serious (Comm.)‡	On	On	Displayed
3: Minor	On (Off§)	On	Displayed
4: Alarm	On	Off	Displayed
5: Warning	On	Off	Displayed

†Note:For more information, see *Chapter User interface: Outline* and *Diagnostics*.

‡Note:It depends on the degree of the communication failure.

§Note:If the "In service" has to be turned off while a minor error (level:3) is occurring, set **On** for the setting [**ErrorLED_cond**].

The user can see a current error information in Monitoring sub-menu† on the LCD screen† (see Figure 9.1-1); Table 9.1-3 shows the six detail information, which the user can examine carefully using the hexadecimal number. When two or more errors occur at the same time, an error code is given by the summation of the error codes. That is, when X and Y errors (e.g., X-error-code '00000002' and Y-error-code '00000004') occur, the sum value '00000006' is screened.

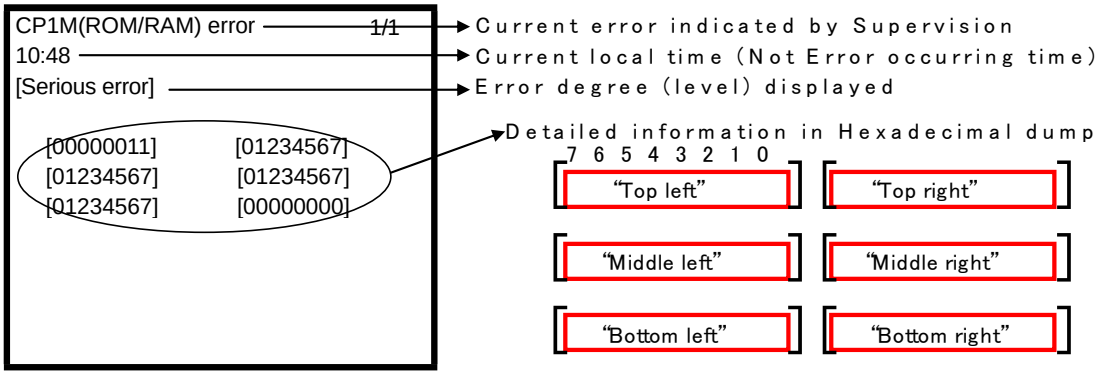


Figure 9.1-1 Example error codes and detailed information on Diagnostics sub-menu

†Note:See Chapter *User interface: Monitoring sub-menu: Diagnostics*. It will not be updated automatically. If new information is required, refresh LED screen again.

Table 9.1-3 Detailed information in Hexadecimal in the ROM and the RAM error (example)

Display area	Meaning of the detailed information	
	Left column	Right column
Top row	00000001: ROM read error 00000002: ROM RAM mismatch	ROM address
Middle row	RAM address	ROM value
Bottom row	RAM value	(No information displayed)

(iii) Error outputs with contacts and binary output circuits

Automatic supervision function drives a contact of the power supply module (PWS)† when an error occurs without warning; additionally, binary output circuits (BOs‡) will be locked out to drive when serious error (Level 1=Critical error) is detected.

Table 9.1-4 FAIL contact, BO, LED outputs depending on levels

Error Levels	PWS† contact outputs				BO‡ locked out	Error LED
	FAIL1 terminal		FAIL2 terminal			
	Screw No. 1 (N/C)	Screw No. 3 (N/O)	Screw No. 7 (N/C)	Screw No. 9 (N/O)		
0: No error	Open	Closed	Open	Closed	Not locked out	Off
1:Serious	Closed	Open	Closed	Open	Locked out	On
2:Serious(Comm.)	Open	Closed	Open	Closed	Not locked out	On
3:Minor	Open	Closed	Open	Closed	Not locked out	On
4:Alarm	Open	Closed	Open	Closed	Not locked out	Off
5:Warning	Open	Closed	Open	Closed	Not locked out	Off

(iii)-1 Error output by PWS contact†

If serious error (Level1) is detected by Automatic supervision function, normally-closed-contact (N/C) on FAIL1 and FAIL2 terminals is closed. On the other hand, the N/O contact is open on the serious error, as shown in Table 9.1-4.

(iii)-2 Locking out of BO circuit operation‡

BO is locked out to operate, when serious error (Level1) occurs. Serious error stops trip signal generations to the BO circuit. When serious error is removed, the operation will be recovered.

†Note:See Chapter *Technical description: Power supply module*. FAIL1 (FAIL2) contact is in Form-C; terminal-screw No. 2 & 4 (8 &10) are provided with the common.

‡Note:BO is discussed in Chapter *Technical description: Binary output circuit*.

(iv) Affection of application operation by error levels

The error levels influence the operation of relay and control and monitoring application.

Table 9.1-5 Operation states in the IED applications affected by the error levels

Levels	Relay applications	Control and monitoring applications	Notes
0: No error	–	–	
1: Serious	Stopped	Stopped	
2: Serious (Comm.)	Not affected†	Not affected	
3: Minor	Not affected	Stopped	
4: Alarm	Not affected	Not affected	
5: Warning	Not affected	Not affected	

†Note: Serious (Comm.) can be related to communication of tele-protection applications.

9.2 Generic supervision tasks

Displaying errors regarding to common problems are summarized in Table 9.2-1; the error is cleared when recovered

Table 9.2-1 Supervision items and error levels for generic

Sec. No.	Supervision items(Screen message)	Detailed Info.	Error Lvl	Error LED
9.2.1	Mismatch between ROM and RAM (ROM/RAM error)	Provided	1	On
9.2.2	Check-sum error (SUM error)	Provided	1	On
9.2.3	Supervision of RAM (RAM error)	Provided	1	On
9.2.4	Supervision of ECC on memory (ECC error)	Provided	1	On
9.2.5	Supervision of MRAM (MRAM)	Provided	1	On
9.2.6	Supervision of program codes (CPU error)	Provided	1	On
9.2.7	Detecting non-maskable interrupt (NMI error)	Provided	1	On
9.2.8	Supervision of DPRAM on sub-CPU (DPRAM error)	Provided	1	On
9.2.9	Supervision of DPRAM on external-CPU (DPRAM error)	Provided	3	On
9.2.10	Supervision of sampling period (SMP error)	Provided	1	On
9.2.11	Detection of sub-CPU not operated (Stopped error)	Provided	1	On
9.2.12	Detection of external-CPU not operated (Stopped error)	Provided	1	On
9.2.13	Supervision of setting data (Setting error)	Provided	1	On
9.2.14	Supervision of real-time clock (RTC error)	Provided	3	On
9.2.15	Supervision of analog input data on VCTs (AI ACC error)	Provided	1	On
9.2.16	Supervision of the A/D accuracy on VCT#2 (AI#2 ACC error)	Provided	1	On
9.2.17	Abnormal currents flowing in CTs (CT error)	N/A	3	On
9.2.18	Supervision of current in zero-sequence (I0 error)	N/A	3	On
9.2.19	Supervision of voltage in negative-sequence (V21/V22 error)	N/A	3	On
9.2.20	Supervision of voltages in zero-sequence (VZ1, VZ2 error)	N/A	3	On
9.2.21	Supervision of binary IO module#1 (BIO#1 error)	Provided	1	On
9.2.22	Supervision of binary IO module#2 (BIO#2 error)	Provided	1	On
9.2.23	Supervision of binary IO module#3 (BIO#3 error)	Provided	1	On
9.2.24	Supervision of binary IO module#4 (BIO#4 error)	Provided	1	On
9.2.25	Supervision of binary IO module#5 (BIO#5 error)	Provided	1	On
9.2.26	Supervision of binary IO module#6 (BIO#6 error)	Provided	1	On
9.2.27	Supervision of binary IO module#7 (BIO#7 error)	Provided	1	On
9.2.28	Supervision of binary IO module#8 (BIO#8 error)	Provided	1	On
9.2.29	Supervision of human machine interface (HMI error)	Provided	1	On
9.2.30	Supervision of power supply module (Power error)	N/A	3	On

Sec. No.	Supervision items(Screen message)	Detailed Info.	Error Lvl	Error LED
9.2.31	Supervision of data in PLC function (PLC data error)	Provided	3	On
9.2.32	Current transformer failure (CT fail)	N/A	3	On
9.2.33	Voltage transformer failure (VT fail)	N/A	3	On
9.2.34	Supervision of circuit breaker contacts (CB1 fail)	N/A	3	On
9.2.35	Supervision of second circuit breaker contacts (CB2 fail)	N/A	3	On
9.2.36	Supervision of disconnector contacts (DS fail)	N/A	3	On
9.2.37	Supervision of response for pinging (Ping error)	Provided	3	On
9.2.38	Supervision of data in 61850 settings (Commslv error)	Provided	3	On
9.2.39	Supervision of GOOSE publishing (LAN(GOOSE)error)	Provided	3	On
9.2.40	Aux. contacts monitoring (DPSY/DOPS/TOPS faulty or undefined)	Provided	3	On
9.2.41	Supervision of DCAI/DCAO modules (DCAIO error)	Provided	1	On

9.2.1 Mismatch between ROM and RAM (ROM/RAM error)

The ROM and RAM on the CPU module are verified every two minutes; when the error is found, an error message is displayed by the supervision function.

(i) Error level

The error level has been set at level 1 (**Serious error**[1]) for the supervision, checking error on the RAM and the ROM is carried out periodically. If the error is detected, the IED restarts its operation automatically. The supervision function runs in respective CPU modules[1]; hence, the error detection is carried out in each CPU module.

[1]Note: The kinds of the CPU modules are discussed in Chapter *Technical description: Signal processing and communication module: Processing module.*

(ii) Error message

When the function operates and detects error, an error message can be shown at the LED and the LCD screen.

Table 9.2-2 Error messages provided by the supervisor in CHK_ROMRAM

Message and level	Meaning of the information
CP*_ (ROM/RAM) error	Mismatch between the RAM and ROM detected on the following module instructed with "CP*_" as follows: CP1M: CPU1 module CP1S: CPM1 module CP2M: CPX1 module
Error level	Serious error (Level 1)

Table 9.2-3 Detailed information in CHK_ROMRAM

Display area	Meaning of the detailed information	
	Left column	Right column
Top row	00000001: ROM read error 00000002: ROM RAM mismatch	ROM address
Middle row	RAM address	ROM value
Bottom row	RAM value	(No information displayed)

9.2.2 Check-sum error (SUM error)

The check sum in the memory on the CPU module is verified every four minutes; when the error is found the error message is displayed by the supervision function.

(i) Error level

The error level has been set at level 1 (**Serious error**[1]) for the supervision, the check-sum error on the memory is carried out periodically. If the error is detected, the IED restarts its operation automatically. The supervision function runs in the respective CPU modules[1]; hence, the error detection is carried out in each CPU module. Clearing the error message is made promptly when the error is cleared.

[1]Note: The kinds of the CPU modules are discussed in Chapter *Technical description: Signal processing and communication module: Processing module.*

(ii) Error message

When the function operates and detects error, an error message can be shown at the LED and the LCD screen.

Table 9.2-4 Error messages provided by the supervisor in CHK_SUM

Message and level	Meaning of the information
CP*_ (SUM) error	Sum error in the memory detected on the following CPU module: CP1M: CPU1 module CP1S: CPM1 module CP2M: CPX1 module
Error level	Serious error (Level 1)

Table 9.2-5 Detailed information in Hexadecimal in CHK_SUM

Display area	Meaning of the detailed information	
	Left column	Right column
Top row	Bit 0: ROM read error Bit 1: ROM RAM mismatch	Sum value calculated
Middle row	Sum value pre-programmed	Address information that read error occurs in the ROM
Bottom row	(No information displayed)	(No information displayed)

9.2.3 Supervision of RAM (RAM error)

The read-write operation on RAM circuit of the CPU module is verified at any time; when the error is found an error message is displayed by the supervision function.

(i) Error level

The error level has been set at level 1 (**Serious error**[1]) for the supervision; checking errors on the RAM is carried out at any time. If the error is detected, the IED restarts its operation automatically. The supervision function runs in respective CPU modules[1]; hence, the error detection is carried out in each CPU module. Clearing the error message is made promptly when the error is cleared.

[1]Note: The kinds of the CPU modules are discussed in Chapter *Technical description: Signal processing and communication module: Processing module.*

(ii) Error message

When the function operates and detects error, an error message can be shown at the LED and the LCD screen.

Table 9.2-6 Error messages provided by the supervisor in CHK_RAM

Message and level	Meaning of the information
CPxx(RAM) error	Error detection in the RAM located on the following module instructed with "CP*_" as follows: 1M: CPU1 module (main CPU) 1S: CPM1 module (sub CPU) 2M: CPX1 module (another main CPU)
Error level	Serious error (Level 1)

Table 9.2-7 Detailed information in Hexadecimal in CHK_RAM

Display area	Meaning of the detailed information	
	Left column	Right column
Top row	Read value	Write value
Middle row	Error address	(No information displayed)
Bottom row	(No information displayed)	(No information displayed)

9.2.4 Supervision of ECC on memory (ECC error)

The error detection on the error-correcting code memory (ECC memory) of the CPU module is verified at any time; when the error is found an error message is displayed by the supervision function.

(i) Error level

The error level has been set at level 1 (**Serious error**[1]) for the supervision; checking error on the ECC is carried out at any time. If the error is detected, the IED restarts its operation automatically. The supervision function runs in respective CPU modules[1]; hence, the error detection is carried out in each CPU module. Clearing the error message is made promptly when the error is cleared.

[1]Note: The kinds of the CPU modules are discussed in Chapter *Technical description: Signal processing and communication module: Processing module.*

(ii) Error message

When the function operates and detects error, an error message can be shown at the LED and the LCD screen.

Table 9.2-8 Error messages provided by the supervisor in CHK_ECC

Message and level	Meaning of the information
CP*_ (ECC) error	Error in the ECC is detected on the following module instructed with "CP*_" as follows: CP1M: CPU1 module CP1S: CPM1 module CP2M: CPX1 module
Error level	Serious error (Level 1)

Table 9.2-9 Detailed information in Hexadecimal in CHK_ECC

Display area	Meaning of the detailed information	
	Left column	Right column
Top row	00000080: err_cnt	LR register
Middle row	SRR0 register	ADDR
Bottom row	DATA (H)	DATA (L)

9.2.5 Supervision of MRAM (MRAM)

The error detection on the Magnetoresistive Random Access Memory (MRAM memory) of the CPU module is verified every 1 second; when the error is found, an error message is displayed by the supervision function.

(i) Error level

The error level has been set at level 1 (**Serious error**[1]) for the supervision; checking errors on the ECC is carried out at any time. If the error is detected, the IED restarts its operation automatically. The function supervise for the MRAM on the main CPU module[1]. Clearing the error message is made in 1 second when the error is cleared.

[1]Note: The kinds of the CPU modules are discussed in Chapter *Technical description: Signal processing and communication module: Processing module.*

(ii) Error message

When the function operates and detects error, an error message can be shown at the LED and the LCD screen.

Table 9.2-10 Error messages provided by the supervisor in CHK_MRAM

Message and level	Meaning of the information
CP*_(MRAM) error	Error detection in the MRAM located on the following CPU module: 1M: CPU1 module (main CPU)
Error level	Serious error (Level 1)

Table 9.2-11 Detailed information in Hexadecimal in CHK_MRAM

Display area	Meaning of the detailed information	
	Left column	Right column
Top row	Address at error occurs	00000000: Error detected with 0xaaaaaaaa 00000001: Error detected with 0x555555555
Middle row	(No information is displayed)	(No information is displayed)
Bottom row	(No information is displayed)	(No information is displayed)

9.2.6 Supervision of program codes (CPU error)

The program code in the ROM and RAM on the CPU module is verified every times; when the error is found an error message is displayed by the supervision function.

(i) Error level

The error level has been set at level 1 (**Serious error**[1]) for the supervision, detecting Program errors on the RAM and the ROM are carried out any time. If the error is detected, the IED restarts its operation automatically. The supervision function runs in respective CPU modules[1]; hence, the error detection is carried out in each CPU module. Clearing the error message is made promptly when the error is cleared.

[1]Note: The kinds of the CPU modules are discussed in Chapter *Technical description: Signal processing and communication module: Processing module.*

(ii) Error message

When the function operates and detects error, an error message can be shown at the LED and the LCD screen.

Table 9.2-12 Error messages provided by the supervisor in CHK_PROGRAM

Message and level	Meaning of the information
CPxx(CPU) error	Error detection in the RAM and ROM located on the following CPU module: CP1M: CPU1 module CP1S: CPM1 module CP2M: CPX1 module
Error level	Serious error (Level 1)

Table 9.2-13 Detailed information in Hexadecimal in CHK_PROGRAM

Display area	Meaning of the detailed information	
	Left column	Right column
Top row	00000001: Address 00000002: Sub 00000004: Mul 00000008: Div	(No information displayed)
Middle row	(No information displayed)	(No information displayed)
Bottom row	(No information displayed)	(No information displayed)

9.2.7 Detecting non-maskable interrupt (NMI error)

The occurrences of non-maskable-interruptions (NMIs) on the CPU module are examined every time; when the interruption is triggered, an interruption message is detected and displayed.

(i) Error level

The error level has been set at level 1 (**Serious error**[1]) for the supervision; detecting the interruption carried out at any time. If the interruption is detected, the IED restarts its operation automatically. The supervision function runs in the respective CPU modules[1]; hence, the detection is carried out in each CPU module. Clearing the error message is made promptly when the error is cleared.

[1]Note: The kinds of the CPU modules are discussed in Chapter *Technical description: Signal processing and communication module: Processing module.*

(ii) Error message

When the function operates and detects error, an error message can be shown at the LED and the LCD screen.

Table 9.2-14 Error messages provided by the supervisor in CHK_NMI

Message and level	Meaning of the information
CPxx(NMI) error	Interruptions occurs on the following module instructed with "CP*_" as follows: CP1M: CPU1 module CP1S: CPM1 module CP2M: CPX1 module
Error level	Serious error (Level 1)

Table 9.2-15 Detailed information in Hexadecimal in NMI

Display area	Meaning of the detailed information	
	Left column	Right column
Top row	NMI code	LR register
Middle row	SRR0 resister	SPP1 resister
Bottom row	Stack pointer	FRSCR register

9.2.8 Supervision of DPRAM on sub-CPU (DPRAM error)

The state of the dual-ported RAM (DPRAM) is checked every 20 seconds when the erroneous state is found.

(i) Error level

The error level has been set at level 1 (**Serious error**[1]) for the supervision; the detection is carried out cyclically. If the error is detected, the IED does not restart its operation automatically. The function runs for the DPRAM on the main CPU of CPU1 module[1]. Clearing the error message is made in a second when the erroneous state is removed.

[1]Note: The kinds of the CPU modules are discussed in Chapter *Technical description: Signal processing and communication module: Processing module.*

(ii) Error message

When the function operates and detects error, an error message can be shown at the LED and the LCD screen.

Table 9.2-16 Error messages provided by the supervisor in CHK_DPRAM

Message and level	Meaning of the information
CP*_ (DPRAM) error	Detection is performed o detected on the following module instructed with "CP*_" as follows: CP1M: CPU1 module
Error level	Serious error (Level 1)

Table 9.2-17 Detailed information expressed in Hexadecimal in CHK_DPRAM

Display area	Meaning of the detailed information	
	Left column	Right column
Top row	Value of the counter to check the renewal not being occurred (=64H)	Checked data
Middle row	Inverted data retrieved from the opposite circuit module	(No information displayed)
Bottom row	(No information displayed)	(No information displayed)

9.2.9 Supervision of DPRAM on external-CPU (DPRAM error)

The state of the dual-ported RAM (DPRAM) is checked every 20 seconds when the erroneous state is found.

(i) Error level

The error level has been set at level 1 (**Serious error**[1]) for the supervision; the detection is carried out cyclically. If the error is detected, the IED does not restart its operation automatically. The function runs for the DPRAM on the CPU of CPX1 module[1]. Clearing the error message is made in a second when the erroneous state is removed.

[1]Note: The kinds of the CPU modules are discussed in Chapter *Technical description: Signal processing and communication module: Processing module.*

(ii) Error message

When the function operates and detects error, an error message can be shown at the LED and the LCD screen.

Table 9.2-18 Error messages provided by the supervisor in CHK_EXDPRAM

Message and level	Meaning of the information
CP*_ (DPRAM) error	Detection is performed o detected on the following module instructed with "CP*_" as follows: CP2M: CPX1 module
Error level	Serious error (Level 1)

Table 9.2-19 Detailed information expressed in Hexadecimal in CHK_EXDPRAM

Display area	Meaning of the detailed information	
	Left column	Right column
Top row	Value of the counter to check the renewal not being occurred (=64H)	Checked data
Middle row	Inverted data retrieved from the opposite circuit module	(No information displayed)
Bottom row	(No information displayed)	(No information displayed)

9.2.10 Supervision of sampling period (SMP error)

The sampling error is verified at any time; when the error is found an error message is displayed by the supervision function.

(i) Error level

The error level has been set at level 1 (**Serious error**[1]) for the supervision; sampling errors are checked every seconds. If the error is detected, the IED restarts its operation automatically. The supervision function runs in respective CPU modules[1]; hence, the error detection is carried out in each CPU module. Clearing the error message is made in a second when the error is cleared.

[1]Note: The kinds of the CPU modules are discussed in Chapter *Technical description: Signal processing and communication module: Processing module.*

(ii) Error message

When the function operates and detects error, an error message can be shown at the LED and the LCD screen.

Table 9.2-20 Error messages provided by the supervisor in CHK_SMP

Message and level	Meaning of the information
CP*_ (SMP) error	Sampling error detected on the following module instructed with "CP*_" as follows: CP1M: CPU1 module CP1S: CPM1 module CP2M: CPX1 module
Error level	Serious error (Level 1)

Table 9.2-21 Detailed information in Hexadecimal in CHK_SMP

Display area	Meaning of the detailed information	
	Left column	Right column
Top row	1	Diff time
Middle row	Current timing	Pervious timing
Bottom row	(No information is displayed)	(No information is displayed)

9.2.11 Detection of sub-CPU not operated (Stopped error)

The operation on the sub CPU is monitored every five minutes; the error message is displayed when the sub CUP is stopped.

(i) Error level

The error level has been set at level 1 (**Serious error**[1]) for the supervision; the detection is carried out periodically. If the error is detected, the IED does not restart its operation automatically. The supervision function runs for respective sub CPU modules[1]; hence, the error detection is carried out in each sub CPU module. Clearing the error message is made in a second when the sub CPU runs again.

[1]Note: The kinds of the CPU modules are discussed in Chapter *Technical description: Signal processing and communication module: Processing module.*

(ii) Error message

When the function operates and detects errors, an error message can be shown at the LED and the LCD screen.

Table 9.2-22 Error messages provided by the supervisor in CHK_SUBCPU

Message and level	Meaning of the information
CP*_ stopped error	Stopping detected on the following module instructed with "CP*_" as follows: CP1M: CPM1 module
Error level	Serious error (Level 1)

Table 9.2-23 Detailed information expressed in Hexadecimal in CHK_SUBCPU

Display area	Meaning of the detailed information	
	Left column	Right column
Top row	00000001: Failure existing	Value of the counter to check the renewal not being occurred
Middle row	Value of the counter when stopped	(No information displayed)
Bottom row	(No information displayed)	(No information displayed)

9.2.12 Detection of external-CPU not operated (Stopped error)

The operation on the external CPU is monitored every five minutes; the error message is displayed when the external CPU is stopped.

(i) Error level

The error level has been set at level 1 (**Serious error**[1]) for the supervision; the detection is carried out periodically. If the error is detected, the IED does not restart its operation automatically. The supervision function runs for respective CPU modules[1]; hence, the error detection is carried out in each CPU module. Clearing the error message is made in a second when the CPU runs again.

[1]Note: The kinds of the CPU modules are discussed in Chapter *Technical description: Signal processing and communication module: Processing module.*

(ii) Error message

When the function operates and detects errors, an error message can be shown at the LED and the LCD screen.

Table 9.2-24 Error messages provided by the supervisor in CHK_SUBCPU

Message and level	Meaning of the information
CP*_ stopped error	Stopping detected on the following module instructed with "CP*_" as follows: CP2M: CPX1 module
Error level	Serious error (Level 1)

Table 9.2-25 Detailed information expressed in Hexadecimal in CHK_SUBCPU

Display area	Meaning of the detailed information	
	Left column	Right column
Top row	00000001: Failure existing	Value of the counter to check the renewal not being occurred
Middle row	Value of the counter when stopped	(No information displayed)
Bottom row	(No information displayed)	(No information displayed)

9.2.13 Supervision of setting data (Setting error)

The values of the Settings are checked every second; the error message is displayed when the erroneous value is found.

(i) Error level

The error level has been set at level 1 (**Serious error**[1]) for the supervision; the detection is carried out periodically. If the error is detected, the IED does not try to restart its operation automatically. The function runs for the saved settings in the main CPU module[1]. When the erroneous setting is removed, the error messages will be cleared in a second.

[1]Note: The kinds of the CPU modules are discussed in Chapter *Technical description: Signal processing and communication module: Processing module.*

(ii) Error message

When the function operates and detects error, an error message can be shown at the LED and the LCD screen.

Table 9.2-26 Error messages provided by the supervisor in CHK_SETTING

Message and level	Meaning of the information
CP*_ (Setting) error	Setting error detected on the following module instructed with "CP*_" as follows: CP1M: CPU1 module
Error level	Serious error (Level 1)

Table 9.2-27 Detailed information expressed in Hexadecimal in CHK_SETTING

Display area	Meaning of the detailed information	
	Left column	Right column
Top row	00000001: Failure exists in the common settings 00000002: Failure exists in the group setting 00000004: Error data found in the initial setting	Offset address corresponding to the failure in the common settings
Middle row	Offset address corresponding to the failure in the group setting	(No information is displayed)
Bottom row	00000001: Exec_tbl.cnf 00000002: Lcd_conf.cnf 00000004: g2minic.dat 00000008: guidance.dat	(No information is displayed)

9.2.14 Supervision of real-time clock (RTC error)

The state of the real time clock (RTC) is checked every five minutes; the error message is displayed when the clock stops.

(i) Error level

Generally, the default error level has been set at level 3 (**Minor error**), but the user can program the level using setting [**CHK_RTC:LVI**]; then, set **On** for the setting [**CHK_RTC:Sw**]. The manufacturer sets five (5) minutes is set to detect the failure; it is reset within five minutes when the clock starts to operate again.

(ii) Error message

When the function operates and detects error, an error message can be shown at the LED and the LCD screen.

Table 9.2-28 Error messages provided by the supervisor in CHK_RTC

Message and level	Meaning of the information
CP*_ (RTC) error	Error detection is performed on the RTC on the following CPU module: CP1M: CPU1 module (main CPU)
Error level	Minor error (Level 3)

Table 9.2-29 Detailed information expressed in Hexadecimal in CHK_RTC

Display area	Meaning of the detailed information	
	Left column	Right column
Top row	"1" shows that the error exists in the RTC	Time in the second when the RTC stopped
Middle row	Time in the minute when the RTC stopped	(No information displayed)
Bottom row	(No information displayed)	(No information displayed)

9.2.15 Supervision of analog input data on VCTs (AI ACC error)

It is possible to detect the failure of the analog to digital conversion in the VCT module†.

†Note: For more information about the VCT, see Chapter *Technical description: Transformer module for AC analog input*. The function can operate for respective VCTs.

(i) Error level

Generally, the default error level has been set at level 1 (**Serious error**[1]). For example, the user can program the level using setting [**CHK_ACC1:LVl**] when the VCT module at the VCT#1[2] slot should be supervised. Set **On** for the settings [**CHK_ACC1:Sw**]. The manufacturer sets one (1) second to detect the failure; it is reset within a second when the failure is cleared.

[1]Note: When the error is detected, the entire operation of the IED is stopped forcibly.

[2]Note: The location of the VCT is discussed in Alpha-numerical references. See chapter *Technical description: IED case and module slot*.

(ii) Error message

When detecting an error, an error message can be shown on the LCD screen and an LED is lit.

Table 9.2-30 Error messages provided by the supervisor in CHK_ACC

Message and level	Meaning of the information
AI#x(ACC) error	Detection of the conversion deterioration at VCx slot
Error level	Serious error (Level 1)

Table 9.2-31 Detailed information in Hexadecimal in CHK_ACC

Display area	Meaning of the detailed information	
	Left column	Right column
Top row	00000001: P error 00000002: N error 00000004: Neg error 00000010: P(H) error 00000020: N(H) error 00000040: Neg(H) error	Plus value / Minus value
Middle row	Plus rev value / (none)	Plus value / Minus value
Bottom row	Plus rev value	(No message displayed)

9.2.16 Supervision of the A/D accuracy on VCT#2 (AI#2 ACC error)

It is possible to detect the failure of the analog to digital conversion in the second VCT module†.

†Note: For more information about the VCT, see Chapter *Technical description: Transformer module for AC analog input module*.

(i) Error level

Generally, the error level has been set at level 1 (**Serious error**[1]), as default. For example, the user can program the level using setting [**CHK_ACC2:LVl**] when the second VCT module at the VCT#2[2] slot should be supervised; then, set **On** for the setting [**CHK_ACC2:Sw**]. The manufacture sets one (1) second to detect the failure; it is reset in a second when the failure is cleared.

[1]Note: The entire operation of the IED is stopped forcibly when the error is detected.

[2]Note: The location of the VCT is discussed in Alpha-numerical references. See chapter *Technical description: IED case and module slot*.

(ii) Error message

When the function operates and detects error, an error message can be shown at the LED and the LCD screen

Table 9.2-32 Error messages provided by the supervisor in CHK_ACC

Message and level	Meaning of the information
AI2x(ACC) error	Detection of the VCT deterioration at VC2 alpha-numerical
Error level	Serious error (Level 1)

Table 9.2-33 Detailed information in Hexadecimal in CHK_ACC

Display area	Meaning of the detailed information	
	Left column	Right column
Top row	00000001: P error 00000002: N error 00000004: Neg error 00000010: P(H) error 00000020: N(H) error 00000040: Neg(H) error	Plus value / Minus value
Middle row	Plus rev value / (none)	Plus value / Minus value
Bottom row	Plus rev value	(No message displayed)

9.2.17 Abnormal currents flowing in CTs (CT error)

The CT supervision is to examine whether the three-phase currents are balanced and the current in zero-sequence is minimum. It secures the operation of the CT circuits†. By monitoring the currents flowing in the AC analog input circuits, it is also applicable to detect the failure in the CT circuit. The failure is determined as Equation (9.2-1) is satisfied.

$$\mathrm{Max}(|I_a|, |I_b|, |I_c|) - 4 \times \mathrm{Min}(|I_a|, |I_b|, |I_c|) \geq k_0 \qquad (9.2\text{-}1)$$

where,

Max (|Ia|, |Ib|, |Ic|): The largest amplitude among Ia, Ib, and Ic

Min (|Ia|, |Ib|, |Ic|): The smallest amplitude among Ia, Ib, and Ic

k_0: 20% of the rated current†

†Note: When the VCT has two or more three-phase-CT circuits, the CT supervision may be required to operate for respective CT circuits. The rated current above the equation is defined with VCT setting. For more information regarding the VCT, see Chapter *Technical description: Transformer module for AC analog input*. Settings are required to respective groups of the three-phase currents.

(i) Error level

Generally, the default error level has been set at level 3 (**Minor error**), but the user can program the level using settings [**CHK_CT1:LVI**] and the others; then, set **On** for the setting [**CHK_CT1:Sw**] or whatever required. The time to detect can be programmed using [**CHK_CT1:Timer**], etc., which can be set for 15 seconds as default. After the error is cleared, resetting will be performed after the elapse of setting time.

(ii) Error message

When detecting an error, an error message can be shown on the LCD screen and an LED is lit.

Table 9.2-34 Error messages provided by the supervisor in CHK_CT

Message and level	Meaning of the information
CTx error	the extraordinary current flowing located at CTx
Error level	Minor error (Level 3)

Table 9.2-35 Detailed information in Hexadecimal in CHK_CT

Display area	Meaning of the detailed information
N/A	(No information is displayed)

9.2.18 Supervision of current in zero-sequence (I0 error)

The zero-phase-sequence current entering to the input circuit is monitored; it is possible to provide a high sensitivity to detect the failure using the residual circuit current. Equation (9.2-2) is represented for the supervision:

$$\frac{|I_a + I_b + I_c - I_e|}{3} \geq 0.1 \times \mathrm{Max}(|I_a|, |I_b|, |I_c|) + k_0 \qquad (9.2\text{-}2)$$

where,

I_e	Residual current
$\mathrm{Max}(\|I_a\|, \|I_b\|, \|I_c\|)$	The largest amplitude among I_a, I_b and I_c
k_0:	5% of the rated current†

†Note: The rated current above the equation is defined with the setting of the VCT. For more information regarding the VCT, see Chapter *Technical description: Transformer module for AC analog input*.

(i) Error level

Generally, the default error level has been set at level 3 (**Minor error**), but the user can program the level using setting [**CHK_IZ:LVl**].; then, set **On** for the settings [**CHK_IZ:Sw**]. The time to detect can be set using [**CHK_IZ:Timer**], which is set for 15 seconds as default. If the error is cleared, resetting will be performed after the elapse of setting time.

(ii) Error message

When detecting an error, an error message can be shown on the LCD screen and an LED is lit.

Table 9.2-36 Error messages provided by the supervisor in CHK_IZ

Message and level	Meaning of the information
I0 error	Detection of flowing the zero-sequence current
Error level	Minor error (Level 3)

Table 9.2-37 Detailed information in Hexadecimal in CHK_IZ

Display area	Meaning of the detailed information
N/A	(No information is displayed)

9.2.19 Supervision of voltage in negative-sequence (V21/V22 error)

The voltage in negative-sequence is calculated regularly using three-phase voltages within the IED. If the equation below is satisfied over 10 seconds, the supervision function determines that a failure occurs in the input circuit.

The voltage in negative sequence can be used to detect a failure within the voltage input circuit in high sensitivity. It facilitates the detection of the incorrect phase sequence if cables are irregularly.

$$\frac{|V_a + a^2 V_b + aV_c|}{3} \geq 6.35 \ \text{(V)} \qquad (9.2\text{-}3)$$

where,

a = Phase shift operator of 120°

(i) Error level

Generally, the default error level has been set at level 3 (**Minor error**), but the user can program the level using settings [**CHK_V21:LVl**] for the first circuit and [**CHK_V22:LVl**] for the second circuit; then, set **On** for the setting [**CHK_V21:Sw**] or whatever required. The time to detect can be set using [**CHK_V21:Timer**], etc., which are set for 15 seconds as default. After the error is cleared, resetting will be performed after the elapse of setting time.

(ii) Error message

When the function operates and detects error, an error message can be shown at the LED and the LCD screen.

Table 9.2-38 Error messages provided by the supervisor in CHK_V2

Message and level	Meaning of the information
V21 error	Detection of the negative-sequence voltage at the first circuit
V22 error	Detection of the negative-sequence voltage at the second
Error level	Minor error (Level 3)

Table 9.2-39 Detailed information in Hexadecimal in CHK_V2

Display area	Meaning of the detailed information
N/A	(No information is displayed)

9.2.20 Supervision of voltages in zero-sequence (VZ1, VZ2 error)

Voltage in zero-phase sequence is automatically calculated using the three-phase voltages within the relay. If Equation (9.2-4) is satisfied, the supervision function can determine that a voltage in zero-sequence is being applied erroneously.

$$\frac{|V_a + V_b + V_c|}{3} \geq 6.35 \ \text{(V)} \qquad (9.2\text{-}4)$$

(i) Error level

Generally, the default error level has been set at level 3 (**Minor error**), but the user can program the level using setting [**CHK_VZ1:LVl**], etc.; then, set **On** for the setting [**CHK_VZ1:Sw**] or whatever required. The time to detect can be set using [**CHK_VZ1:Timer**], etc., which are set for 15 seconds as default. If the error is cleared, it is reset in the time that is the same as the setting time to the detection.

(ii) Error message

When the function operates and detects error, an error message can be shown at the LED and the LCD screen.

Table 9.2-40 Error messages provided by the supervisor in CHK_VZ

Message and level	Meaning of the information
VZ1 error	Detection of the zero-sequence voltage at the first circuit
VZ2 error	Detection of the zero-sequence voltage at the second circuit
Error level	Minor error (Level 3)

Table 9.2-41 Detailed information in Hexadecimal in CHK_VZ

Display area	Meaning of the detailed information
N/A	(No information is displayed)

9.2.21 Supervision of binary IO module#1 (BIO#1 error)

A supervision function is provided to detect the operation failure in the first binary IO modules (BIO)†.

†Note:The function can operate for respective BIO modules mounted in the IED; the user should have settings in them, which are located at the IO slot identified with the number.

(i) Error level

Generally, the default error level has been set at level 1 (**Serious error**[1]). For example, the user can program the level using setting [**CHK_BIO1:LVl**] when the BIO module at the IO#1[2] slot should be supervised; then, set **On** for the setting [**CHK_BIO1:Sw**]. The manufacturer sets one (1) second to detect the failure; it is reset with in a second when the failure is cleared.

[1]Note: When the error is detected, the entire operation of the IED is stopped forcibly.

[2]Note: The location of the IO slot is discussed in Chapter *Technical description: IED case and module slot*.

(ii) Error message

When detecting an error, an error message can be shown on the LCD screen and an LED is lit.

Table 9.2-42 Error messages provided by the supervisor in CHK_BIO1

Message and level	Meaning of the information
BIO#1 error	Detection of the BIO failure at IO slot#1
Error level	Serious error (Level 1)

Table 9.2-43 Detailed information in Hexadecimal in CHK_BIO1

Display area	Meaning of the detailed information	
	Left column	Right column
Top row	00000001: CRC error 00000002: Connection error 00000004: Read back error	Count number by the CRC error
Middle row	Count number by the connection error	Count number by the read-back error
Bottom row	(No message displayed)	(No message displayed)

9.2.22 Supervision of binary IO module#2 (BIO#2 error)

A supervision function is provided to detect the operation failure in the second binary IO modules (BIO)†.

†Note:The function can operate for respective BIO modules mounted in the IED; the user should have settings in them, which are located at the IO slot identified with the number.

(i) Error level

Generally, the default error level has been set at level 1 (**Serious error**[1]). For example, the user can program the level using setting [**CHK_BIO2:LVl**] when the BIO module at the IO#2[2] slot should be supervised; then, set **On** for the setting [**CHK_BIO2:Sw**]. The manufacturer sets one (1) second to detect the failure; it is reset within a second when the failure is cleared.

[1]Note: When the error is detected, the entire operation of the IED is stopped forcibly.

[2]Note: The location of the IO slot is discussed in Chapter *Technical description: IED case and module slot*.

(ii) Error message

When detecting an error, an error message can be shown on the LCD screen and an LED is lit.

Table 9.2-44 Error messages provided by the supervisor in CHK_BIO2

Message and level	Meaning of the information
BIO#2 error	Detection of the BIO failure at IO slot#2
Error level	Serious error (Level 1)

Table 9.2-45 Detailed information in Hexadecimal in CHK_BIO2

Display area	Meaning of the detailed information	
	Left column	Right column
Top row	00000001: CRC error 00000002: Connection error 00000004: Read back error	Count number by the CRC error
Middle row	Count number by the connection error	Count number by the read-back error
Bottom row	(No message displayed)	(No message displayed)

9.2.23 Supervision of binary IO module#3 (BIO#3 error)

A supervision function is provided to detect the operation failure in the third binary IO modules (BIO)†.

†Note:The function can operate for respective BIO modules mounted in the IED; the user should have settings in them, which are located at the IO slot identified with the number.

(i) Error level

Generally, the default error level has been set at level 1 (**Serious error**[1]). For example, the user can program the level using setting [**CHK_BIO3:LVl**] when the BIO module at the IO#3[2] slot should be supervised; then, set **On** for the setting [**CHK_BIO3:Sw**]. The manufacturer sets one (1) second to detect the failure; it is reset with in a second when the failure is cleared.

[1]Note: when the error is detected the entire operation of the IED is stopped forcibly.

[2]Note: The location of the IO slot is discussed in Chapter *Technical description: IED case and module slot*.

(ii) Error message

When detecting an error, an error message can be shown on the LCD screen and an LED is lit.

Table 9.2-46 Error messages provided by the supervisor in CHK_BIO3

Message and level	Meaning of the information
BIO#3 error	Detection of the BIO failure at IO slot#3
Error level	Serious error (Level 1)

Table 9.2-47 Detailed information in Hexadecimal in CHK_BIO3

Display area	Meaning of the detailed information	
	Left column	Right column
Top row	00000001: CRC error 00000002: Connection error 00000004: Read back error	Count number by the CRC error
Middle row	Count number by the connection error	Count number by the read-back error
Bottom row	(No message displayed)	(No message displayed)

9.2.24 Supervision of binary IO module#4 (BIO#4 error)

A supervision function is provided to detect the operation failure in the forth binary IO modules (BIO)†.

†Note:The function can operate for respective BIO modules mounted in the IED; the user should have settings in them, which are located at the IO slot identified with the number.

(i) Error level

Generally, the error level has been set at level 1 (**Serious error**[1]), as default. For example, the user can program the level using setting [**CHK_BIO4:LVl**] when the BIO module at the IO#4[2] slot should be supervised; then, set **On** for the setting [**CHK_BIO4:Sw**]. The manufacture sets one (1) second to detect the failure; it is reset in a second when the failure is cleared.

[1]Note: The entire operation of the IED is stopped forcibly when the error is detected.

[2]Note: The location of the IO slot is discussed in Chapter *Technical description: IED case and module slot*.

(ii) Error message

When detecting an error, an error message can be shown on the LCD screen and an LED is lit.

Table 9.2-48 Error messages provided by the supervisor in CHK_BIO4

Message and level	Meaning of the information
BIO#4 error	Detection of the BIO failure at IO slot#4
Error level	Serious error (Level 1)

Table 9.2-49 Detailed information in Hexadecimal in CHK_BIO4

Display area	Meaning of the detailed information	
	Left column	Right column
Top row	00000001: CRC error 00000002: Connection error 00000004: Read back error	Count number by the CRC error
Middle row	Count number by the connection error	Count number by the read-back error
Bottom row	(No message displayed)	(No message displayed)

9.2.25 Supervision of binary IO module#5 (BIO#5 error)

A supervision function is provided to detect the operation failure in the fifth binary IO modules (BIO)†.

†Note:The function can operate for respective BIO modules mounted in the IED; the user should have settings in them, which are located at the IO slot identified with the number.

(i) Error level

Generally, the default error level has been set at level 1 (**Serious error**[1]). For example, the user can program the level using setting [**CHK_BIO5:LVl**] when the BIO module at the IO#5[2] slot should be supervised; then, set **On** for the setting [**CHK_BIO5:Sw**]. The manufacturer sets one (1) second to detect the failure; it is reset with in a second when the failure is cleared.

[1]Note: When the error is detected, the entire operation of the IED is stopped forcibly.

[2]Note: The location of the IO slot is discussed in Chapter *Technical description: IED case and module slot*.

(ii) Error message

When detecting an error, an error message can be shown on the LCD screen and an LED is lit.

Table 9.2-50 Error messages provided by the supervisor in CHK_BIO5

Message and level	Meaning of the information
BIO#5 error	Detection of the BIO failure at IO slot#5
Error level	Serious error (Level 1)

Table 9.2-51 Detailed information in Hexadecimal in CHK_BIO5

Display area	Meaning of the detailed information	
	Left column	Right column
Top row	00000001: CRC error 00000002: Connection error 00000004: Read back error	Count number by the CRC error
Middle row	Count number by the connection error	Count number by the read-back error
Bottom row	(No message displayed)	(No message displayed)

9.2.26 Supervision of binary IO module#6 (BIO#6 error)

A supervision function is provided to detect the operation failure in the sixth binary IO modules (BIO)†.

†Note:The function can operate for respective BIO modules mounted in the IED; the user should have settings in them, which are located at the IO slot identified with the number.

(i) Error level

Generally, the default error level has been set at level 1 (**Serious error**[1]). For example, the user can program the level using setting [**CHK_BIO6:LVl**] when the BIO module at the IO#6[2] slot should be supervised; then, set **On** for the setting [**CHK_BIO6:Sw**]. The manufacturer sets one (1) second to detect the failure; it is reset with in a second when the failure is cleared.

[1]Note: when the error is detected the entire operation of the IED is stopped forcibly.

[2]Note: The location of the IO slot is discussed in Chapter *Technical description: IED case and module slot*.

(ii) Error message

When detecting an error, an error message can be shown on the LCD screen and an LED is lit.

Table 9.2-52 Error messages provided by the supervisor in CHK_BIO6

Message and level	Meaning of the information
BIO#6 error	Detection of the BIO failure at IO slot#6
Error level	Serious error (Level 1)

Table 9.2-53 Detailed information in Hexadecimal in CHK_BIO6

Display area	Meaning of the detailed information	
	Left column	Right column
Top row	00000001: CRC error 00000002: Connection error 00000004: Read back error	Count number by the CRC error
Middle row	Count number by the connection error	Count number by the read-back error
Bottom row	(No message displayed)	(No message displayed)

9.2.27 Supervision of binary IO module#7 (BIO#7 error)

A supervision function is provided to detect the operation failure in the seventh binary IO modules (BIO)†.

†Note:The function can operate for respective BIO modules mounted in the IED; the user should have settings in them, which are located at the IO slot identified with the number.

(i) Error level

Generally, the default error level has been set at level 1 (**Serious error**[1]). For example, the user can program the level using setting [**CHK_BIO7:LVl**] when the BIO module at the IO#7[2] slot should be supervised; then, set **On** for the setting [**CHK_BIO7:Sw**]. The manufacturer sets one (1) second to detect the failure; it is reset with in a second when the failure is cleared.

[1]Note: When the error is detected, the entire operation of the IED is stopped forcibly.

[2]Note: The location of the IO slot is discussed in Chapter *Technical description: IED case and module slot*.

(ii) Error message

When detecting an error, an error message can be shown on the LCD screen and an LED is lit.

Table 9.2-54 Error messages provided by the supervisor in CHK_BIO7

Message and level	Meaning of the information
BIO#7 error	Detection of the BIO failure at IO slot#7
Error level	Serious error (Level 1)

Table 9.2-55 Detailed information in Hexadecimal in CHK_BIO7

Display area	Meaning of the detailed information	
	Left column	Right column
Top row	00000001: CRC error 00000002: Connection error 00000004: Read back error	Count number by the CRC error
Middle row	Count number by the connection error	Count number by the read-back error
Bottom row	(No message displayed)	(No message displayed)

9.2.28 Supervision of binary IO module#8 (BIO#8 error)

A supervision function is provided, to detect the operation failure in the eighth binary IO modules (BIO)†.

†Note:The function can operate for respective BIO modules mounted in the IED; the user should have settings in them, which are located at the IO slot identified with the number.

(i) Error level

Generally, the default error level has been set at level 1 (**Serious error**[1]). For example, the user can program the level using setting [**CHK_BIO8:LVl**] when the BIO module at the IO#8[2] slot should be supervised; then, set **On** for the setting [**CHK_BIO8:Sw**]. The manufacturer sets one (1) second to detect the failure; it is reset with in a second when the failure is cleared.

[1]Note: When the error is detected, the entire operation of the IED is stopped forcibly.

[2]Note: The location of the IO slot is discussed in Chapter *Technical description: IED case and module slot*.

(ii) Error message

When detecting an error, an error message can be shown on the LCD screen and an LED is lit.

Table 9.2-56 Error messages provided by the supervisor in CHK_BIO8

Message and level	Meaning of the information
BIO#8 error	Detection of the BIO failure at IO slot#8
Error level	Serious error (Level 1)

Table 9.2-57 Detailed information in Hexadecimal in CHK_BIO8

Display area	Meaning of the detailed information	
	Left column	Right column
Top row	00000001: CRC error 00000002: Connection error 00000004: Read back error	Count number by the CRC error
Middle row	Count number by the connection error	Count number by the read-back error
Bottom row	(No message displayed)	(No message displayed)

9.2.29 Supervision of human machine interface (HMI error)

Supervising the failure in the human machine interface (HMI) is provided.

(i) Error level

Generally, the default error level has been set at level 3 (**Minor error**[1]). However, the user can program the level using setting [**CHK_HMI:LVI**]; then, set **On** for the setting [**CHK_HMI:Sw**]. The manufacturer sets ten (10) seconds to detect the failure; it is reset within 10 seconds when the failure is cleared.

[2]Note: The functions of the HMI is discussed in Chapter *Technical description: Human machine interface*.

(ii) Error message

When detecting an error, an error message can be shown on the LCD screen and an LED is lit.

Table 9.2-58 Error messages provided by the supervisor in CHK_HMI

Message and level	Meaning of the information
HMI error	Detection of the HMI failure
Error level	Minor error (Level 3)

Table 9.2-59 Detailed information in Hexadecimal in CHK_HMI

Display area	Meaning of the detailed information	
	Left column	Right column
Top row	00000001: Timeout of LCD communication 00000002: Format error in LCD communication 00000004: Communication error in MIMIC LCD	Culminated value for the timeout
Middle row	Counted value for the format error	Counter of the MIMIC communication
Bottom row	(No information is displayed)	(No information is displayed)

9.2.30 Supervision of power supply module (Power error)

A power error is issued when the DC voltage generated in the power supply module (PWS†) is less than a threshold. The user can select either 85V or 170V thresholds for issuing the power error; it is determined by inserting a shut connector (JP4) on the PWS.

†Note: For more information about the PWS, see Chapter *Technical description, Power supply module*. When the AC supply—however, the manufacture does not guarantee the operation in the AC power—is connected with the PWS module, the user shall set **Off** for the setting [**CHK_POWER:Sw**] (that is, the supervision function concerning to the PWS module are stopped). Remember that the state of the binary input circuit (BI) will be latched when the Power error occurs anytime.

(i) Error level

Generally, the default error level has been set at level 3 (**Minor error**), as default, but the user can program the level using setting [**CHK_POWER:LVl**]; then, set **On** for the setting [**CHK_POWER:Sw**]. The manufacturer sets one (1) second to detect the failure; it is reset with in a second when the failure is cleared.

(ii) Error message

When the function operates and detects error, an error message can be shown at the LED and the LCD screen.

Table 9.2-60 Error messages provided by the supervisor in CHK_POWER

Message and level	Meaning of the information
Power error	Detection of the failure in the PWS
Error level	Minor error (Level 3)

Table 9.2-61 Detailed information in Hexadecimal in CHK_POWER

Display area	Meaning of the detailed information	
	Left column	Right column
Top row	00000001: PWS failure	(No information displayed)
Middle row	(No information displayed)	(No information displayed)
Bottom row	(No information displayed)	(No information displayed)

9.2.31 Supervision of data in PLC function (PLC data error)

The error of the PLC function is detected when the data coded by the PLC editor[1] has an error.

(i) Error level

Generally, the default error level has been set at level 3 (**Minor error**), but the user can program the level using setting [**CHK_PLC_DAT:LVI**]; then, set **On** for the setting [**CHK_PLC_DAT:Sw**]. The manufacturer sets one-hundred-twenty (120) second to detect the failure; it is reset within 60 seconds when the failure is cleared.

(ii) Error message

When detecting an error, an error message can be shown on the LCD screen and an LED is lit.

Table 9.2-62 Error messages provided by the supervisor in CHK_PLC_DAT

Message and level	Meaning of the information
PLC data error	Detection of the failure in the PLC function
Error level	Minor error (Level 3)

Table 9.2-63 Detailed information in Hexadecimal in CHK_ PLC_DAT

Display area	Meaning of the detailed information	
	Left column	Right column
Top row	00000001: No PLC data exists in the IED. 00000002: Errors caused when Data is inputted in the IED[2] 00000004: Errors caused when Data is outputted in the IED[3] 00000008: Time over in the computation[4] 00000010: PLC stopped by the operation of the PLC editor[5]	(No information)
Middle row	(No information)	(No information)
Bottom row	(No information)	(No information)

[1]See Chapter *PLC editing in* PLC editor (6F2S1904) separately.

[2]It can be displayed when Data IDs are selected erroneously in DIN function.

[3]It can be displayed when Data IDs are selected erroneously in DOUT function.

[4]The kind of tasks (Main_1, Main_2, or Main_3) may be too large.

[5]The PLC stops manually by the PLC editor.

9.2.32 Current transformer failure (CT fail)

Detecting the failure in the CT is achieved by the operation of the CT failure detection function (CTF†). Thus, the failure signal in the CTF is transferred to the automatic supervision function and it is grouped into the error level together with other error signals.

†Note:For more information about the CTF function, see Chapter *Relay application: CT failure detection*.

(i) Error level

Generally, the default error level has been set at level 3 (**Minor error**), but the user can program the level using setting [**CHK_CTF:LVl**]; then, set **On** for the setting [**CHK_CTF:Sw**]. The manufacturer sets ten (10) seconds to detect the failure; it is reset instantly when the failure is cleared

(ii) Error message

When the function operates and detects error, an error message can be shown at the LED and the LCD screen.

Table 9.2-64 Error messages provided by the supervisor in CHK_CTF

Message and level	Meaning of the information
CT fail	Detection of the failure in the CT
Error level	Minor error (Level 3)

Table 9.2-65 Detailed information in Hexadecimal in CHK_CTF

Display area	Meaning of the detailed information
N/A	(No information is displayed)

9.2.33 Voltage transformer failure (VT fail)

Detecting the failure in the VT is achieved by the operation of the VT failure detection function (VTF†). Thus, the failure signal in the VTF is transferred to the automatic supervision function and it is grouped into the error level together with other error signals.

†Note:For more information about the VTF function, see Chapter *Relay application: VT failure detection*.

(i) Error level

Generally, the default error level has been set at level 3 (**Minor error**), but the user can program the level using setting [**CHK_VTF:LVl**]; then, set **On** for the setting [**CHK_VTF:Sw**]. The manufacturer sets ten (10) seconds to detect the failure; it is reset instantly when the failure is cleared.

(ii) Error message

When the function operates and detects error, an error message can be shown at the LED and the LCD screen.

Table 9.2-66 Error messages provided by the supervisor in CHK_VTF

Message and level	Meaning of the information
VT fail	Detection of the failure in the VT
Error level	Minor error (Level 3)

Table 9.2-67 Detailed information in Hexadecimal in CHK_VTF

Display area	Meaning of the detailed information
N/A	(No information is displayed)

9.2.34 Supervision of circuit breaker contacts (CB1 fail)

Detecting the operation failure in the CB is achieved by the operation of the protection common function (PROT_COMM†). Thus, the failure signal in the PROT_COMM is transferred to the automatic supervision function and it is grouped into the error level together with other error signals.

(i) Error level

Generally, the default error level has been set at level 3 (**Minor error**), as default, but the user can program the level using setting [**CHK_CB1:LVl**]; then, set **On** for the setting [**CHK_CB1:Sw**]. The time to detect can be set using [**TCBSV**], which is provided in the PROT_COMM function. It is resets instantly, if the error is cleared.

(ii) Error message

When detecting an error, an error message can be shown on the LCD screen and an LED is lit.

Table 9.2-68 Error messages provided by the supervisor in CHK_CB

Message and level	Meaning of the information
CB1 fail	Detection of the failure in the first CB
Error level	Minor error (Level 3)

Table 9.2-69 Detailed information in Hexadecimal in CHK_CB

Display area	Meaning of the detailed information
N/A	(No information is displayed)

9.2.35 Supervision of second circuit breaker contacts (CB2 fail)

Detecting the operation failure in the second CB is achieved by the operation of the protection common function (PROT_COMM†). Thus, the failure signal in the PROT_COMM is transferred to the automatic supervision function and it is grouped into the error level together with other error signals.

(i) Error level

Generally, the default error level has been set at level 3 (**Minor error**), but the user can program the level using setting [**CHK_CB2:LVl**]; then, set **On** for the setting [**CHK_CB2:Sw**]. The time to detect can be set using [**TCBSV**], which is provided in the PROT_COMM function. It is reset instantly if the error is cleared.

(ii) Error message

When the function operates and detects errors, an error message can be shown at the LED and the LCD screen.

Table 9.2-70 Error messages provided by the supervisor in CHK_CB

Message and level	Meaning of the information
CB2 fail	Detection of the failure in the second CB
Error level	Minor error (Level 3)

Table 9.2-71 Detailed information in Hexadecimal in CHK_CB

Display area	Meaning of the detailed information
N/A	(No information is displayed)

9.2.36 Supervision of disconnector contacts (DS fail)

Detecting the operation failure in the disconnector (DS) is achieved by the operation of the protection common function (PROT_COMM†). Thus, the failure signal in the PROT_COMM is transferred to the automatic supervision function and it is grouped into the error level together with other error signals.

†Note:For more information about the PROT_COMM function, see Chapter *Relay application: Protection common*.

(i) Error level

Generally, the default error level has been set at level 3 (**Minor error**), but the user can program the level using settings [**CHK_DS:LVl**]; then, set **On** for the setting [**CHK_DS:Sw**]. The time for the detection can be set using [**TDSSV**], which is provided in the PROT_COMM function. It is reset instantly when the error is cleared.

(ii) Error message

When the function operates and detects error, an error message can be shown at the LED and the LCD screen.

Table 9.2-72 Error messages provided by the supervisor in CHK_DS

Message and level	Meaning of the information
DS fail	Detection of the failure in the DS
Error level	Minor error (Level 3)

Table 9.2-73 Detailed information in Hexadecimal in CHK_DS

Display area	Meaning of the detailed information
N/A	(No information is displayed)

9.2.37 Supervision of response for pinging (Ping error)

Communication error on the LAN† is detected by pinging for the addresses instructed.

†Note: For more information about the LAN, see Chapter *Communication Protocol: LAN communication*. For the information about the LAN hardware, see Chapter *Technical description: Signal processing and communication module*. When two network modules operates, the message is provided for the both.

(i) Error level

Generally, the default error level has been set at level 3 (**Minor error**), but the user can program the level using settings [**CHK_PING*:LVl**]; then, set **On** for the settings [**CHK_PING*:Sw**]. The manufacturer sets one-hundred (100) second to detect the failure; it is reset in 20 seconds when the failure is cleared.

(ii) Error message

When detecting errors, an error message can be shown on the LCD screen and an LED is lit.

Table 9.2-74 Error messages provided by the supervisor in CHK_PING

Message and level	Meaning of the information
LAN* (ping) error	Detection of the pinging failure instructed with "LAN*" as follows: LAN1 (ping): Communication module (COM#1 at C11) LAN2 (ping): Communication module (COM#2 at C12)
Error level	Minor error (Level 3)

Table 9.2-75 Detailed information in Hexadecimal in CHK_PING

Display area	Meaning of the detailed information	
	Left column	Right column
Top row	Destination address for pinging	(No information is displayed)
Middle row	(No information is displayed)	(No information is displayed)
Bottom row	(No information is displayed)	(No information is displayed)

9.2.38 Supervision of data in 61850 settings (Commslv error)

The error† is detected when an inconsistency is found in the 61850 settings. Note that the information for the error may vary on the communication protocol.

(i) Error level

Generally, the default error level has been set at level 3 (**Minor error**), but the user can program the level using setting [**CHK_CMLV:LVl**]; then, set **On** for the setting [**CHK_CMLV:Sw**]. The error can be detected in two minutes after the IED is turned on.

(ii) Error message

When detecting errors, an error message can be shown on the LCD screen and an LED is lit.

Table 9.2-76 Error messages provided by the supervisor in CHK_CMLV

Message and level	Meaning of the information
Data(cmmslv) error	Detection of the failure in the settings
Error level	Minor error (Level 3)

Table 9.2-77 Detailed information in Hexadecimal in CHK_CMLV

Display area	Meaning of the detailed information	
	Left column	Right column
Top row	Error reasons code	Displaying the Data ID relating to erroneous mapping
Middle row	Displaying the Data ID relating to erroneous mapping	Additional information
Bottom row	Additional information	Additional information

†Note:In the IEC 61850 communication protocol, LN, DO and DA names are displayed in ASCII characteristic codes, which instruct wrong mappings performed. In the below sample, for example, the user can get the error mapping of "GGIO2$STtVal" when ASCII codes are solved in eight-characters and four-characters.

Top row and left colum: [4747494F] Top row and right column: [32245354]

Middle row: [7456616C]

47 47 49 4F 32 24 53 54 74 56 61 6C = "GGIO2$STtVal"

Table 9.2-78 Error reasons detected by the supervisor in CHK_CMLV

Reasons of errors	
Function error found	Erroneous index being used in the data for the protocol stack designated
Failure occurred on going through the selection process with regard to the protocol	Time out
Failure occurred on the initialization in the protocol process	Going through the process
Failure for opening file	Found invalid arguments
Failure of access	Found the data type not being supported
No space left in the buffer	Failure of the acquisition of the authority right
No space left in the buffer provided for the SSP mapping	Failure occurred on the setting process
Failure of memory allocation in the memory dynamically	Failure of the event registration
Check sum errors	No event occurred
Not unfound about the searching object	Restarting
Failure of the defining of data type	Communication error

9.2.39 Supervision of GOOSE publishing (LAN(GOOSE)error)

Publishing error in the IEC 61850 communication† is detected when a GOOSE message is not received.

†Note:For more information about GOOSE, see Chapter *Communication protocol: IEC 61850 communication*.

(i) Error level

Generally, the default error level has been set at level 3 (**Minor error**), but the user can program the level using setting [**CHK_GOOSERCV:LVl**]; then, set **On** for the setting [**CHK_GOOSERCV:Sw**]. Detecting the error is expressed in five-minutes when the IED detects no reception of the GOOSE. When the GOOSE is started to receive, it is reset in one-minute.

(ii) Error message

When detecting errors, an error message can be shown on the LCD screen and an LED is lit.

Table 9.2-79 Error messages provided by the supervisor in CHK_GOOSERCV

Message and level	Meaning of the information
LAN(GOOSE) error	Detection of the failure in GOOSE
Error level	Minor error (Level 3)

Table 9.2-80 Detailed information in Hexadecimal in CHK_GOOSERCV

Display area	Meaning of the detailed information	
	Left column	Right column
Top row	Receipt state regarding to the GOOSE subscribe information#1†	Receipt state regarding to the GOOSE subscribe information#2†
Middle row	Receipt state regarding to the GOOSE subscribe information#3†	Receipt state regarding to the GOOSE subscribe information#4†
Bottom row	Receipt state regarding to the GOOSE subscribe information#5†	Receipt state regarding to the GOOSE subscribe information#6†

†Note:"c000" is shown when no reception.

9.2.40 Aux. contacts monitoring (DPSY/DOPS/TOPS faulty or undefined)

When signals of an external device (i.e., a circuit breaker) are provided in a pair of auxiliary contacts[1], the signals may be grouped into four states: Open, Fault, Undefined, and Closed. This is because, two different kinds of N/C and N/O contacts operates in the other way around; hence, there is a possibility that the generated signal may have an incorrect condition (Faulty) or an intermediate condition (Undefined). When receiving the signal by the BI circuit[2] of the IED, a preliminary logic[3] starts to group the receiving signals into Open and the other states. Consequently, the control function is able to operate securely not being affected by improper signals (i.e., Fault, Undefined). In the supervision function, the received signals are sorted with the definition of the error levels programmed by the manufacture, but the user can program the sorting procedure arbitrarily using the settings in the check function (CHK_PALLET).

[1]Note: A pair of N/C and N/O contacts is called as "Pallet" in the manual.

[2]Note: The BI circuit is discussed in the Binary IO module. For more information, see Chapter *Technical description*.

[3]Note: The preliminary logic is designed to acquire a signal coming from the BI circuit and to sort the signal into the 'Open', 'Fault', 'Undefined', and 'Closed' states. The preliminary logic is furnished in every control functions. For example, we can find the logic in section "*Setup for BIO module*" in Chapter *Control and monitoring application: Double position controller with synchronizing-checking*.

(i) Correspondence between CHK_PALLETs and applications

There are a number of CHK_PALLETs operates in the automatic supervision function; hence, the user is required so that the control application corresponds with the CHK_PALLET, as shown in Table 9.2-81.

Table 9.2-81 Correspondence table for the control applications

Supervision functions		Controlling functions	
Function ID	Names	Function ID	Names
222201	CHK_PALLET1	511001	DPSY1 function†
222202	CHK_PALLET2	511001	DPSY2 function†
222203	CHK_PALLET3	512001	DPOS1 function
222204	CHK_PALLET4	512001	DPOS2 function
222205	CHK_PALLET5	512001	DPOS3 function
222206	CHK_PALLET6	512001	DPOS4 function
222207	CHK_PALLET7	512001	DPOS5 function
222208	CHK_PALLET8	512001	DPOS6 function
222209	CHK_PALLET9	512001	DPOS7 function
22220A	CHK_PALLET10	512001	DPOS8 function
22220B	CHK_PALLET11	512001	DPOS9 function
22220C	CHK_PALLET12	512001	DPOS10 function
22220D	CHK_PALLET13	512001	DPOS11 function
22220E	CHK_PALLET14	512001	DPOS12 function
22220F	CHK_PALLET15	512001	DPOS13 function
222210	CHK_PALLET16	512001	DPOS14 function
222211	CHK_PALLET17	512001	DPOS15 function
222212	CHK_PALLET18	512001	DPOS16 function
222213	CHK_PALLET19	512001	DPOS17 function

Supervision functions		Controlling functions	
Function ID	Names	Function ID	Names
222214	CHK_PALLET20	512001	DPOS18 function
222215	CHK_PALLET21	512001	DPOS19 function
222216	CHK_PALLET22	512001	DPOS20 function
222217	CHK_PALLET23	512001	DPOS21 function
222218	CHK_PALLET24	512001	DPOS22 function
222219	CHK_PALLET25	512001	DPOS23 function
22221A	CHK_PALLET26	512001	DPOS24 function
22221B	CHK_PALLET27	512001	DPOS25 function
22221C	CHK_PALLET28	512001	DPOS26 function
22221D	CHK_PALLET29	512001	DPOS27 function
22221E	CHK_PALLET30	512001	DPOS28 function
22221F	CHK_PALLET31	512001	DPOS29 function
222220	CHK_PALLET32	512001	DPOS30 function
222221	CHK_PALLET33	513001	TPOS1 function
222222	CHK_PALLET34	513001	TPOS2 function
222223	CHK_PALLET35	513001	TPOS3 function

†Note: To detect the "Faulty" and "Undefined" states in the DPSY1 function, the user can adjust the time for supervision using settings [**DPSY01-FLTTIM**] and [**DPSY01-UDFTIM**], each of which is accommodated in the DPSY1 function. Then, set [**DPSY01-FLTEN**] **On** for the operation. Likewise, settings are available in the DPSY2 function.

(ii) Error level

Generally, the default error level has been set at level 3 (**Minor error**) and level 4 (**Alarm**) for the faulty state and the undefined state, respectively . However the user can program them using settings. For example, when the user wish to program the fault and undefined states in the DPSY1 function, use the settings [**CHK_PALLET1:FTxt**] and [**CHK_PALLET1:UTxt**], respectively; then, set **On** for the setting [**CHK_PALLET1:Sw**].

(iii) Error message

When the function operates and detects error, an error message can be shown at the LED and the LCD screen.

Table 9.2-82 Error messages provided by the supervisor in CHK_PALLET

Message and level	Meaning of the information
XXXX* undefine	'Undefine" detected at * of the XXXX function
Error level	Minor error (Level 3) for 'Faulty'; Alarm (Level 4) for 'Undefine'

Table 9.2-83 Detailed information in Hexadecimal in CHK_PALLET

Display area	Meaning of the detailed information	
	Left column	Right column
Top row	Detecting 'undefined' is represented with "1". Detecting 'faulty' is represented with "2".	(No information is displayed)
Middle row	(No information is displayed)	(No information is displayed)
Bottom row	(No information is displayed)	(No information is displayed)

9.2.41 Supervision of DCAI/DCAO modules (DCAIO error)

An error in the DCAI and DCAO module† is detected when the modules detect fatal failures by themselves.

†Note:For more information about the DCAI and DCAO module, see Chapter *Technical description: DC analog input module* or *DC analog output module*.

(i) Error level

Generally, the default error level has been set at level 1 (**Serious error**[1]). For example, the user can program the level using setting [**CHK_DCAIO1:LVl**] when the module at the IO#1[2] slot should be supervised; then, set **On** for the setting [**CHK_DCAIO1:Sw**]. The manufacture set one (1) second to detect the failure; it is reset in a second when the failure is cleared.

[1]Note: The entire operation of the IED is stopped forcibly when the error is detected.

[2]Note: The location of the slot is discussed in Chapter *Technical description: IED case and module slot*.

(ii) Error message

When the function operates and detects errors, an error message can be shown at the LED and the LCD screen.

Table 9.2-84 Error messages provided by the supervisor in CHK_DCAIO

Message and level	Meaning of the information
DCAIO#x error	Detection of the failure at #x slot
Error level	Serious error (Level 1)

Table 9.2-85 Detailed information in Hexadecimal in CHK_DCAIO

Display area	Meaning of the detailed information	
	Left column	Right column
Top row	00000001: CRC error 00000002: Connection error 00000004: Carburation error 00000008: Error in A/D(+) 00000010: Error in AD(–)	Number of the CRC error detected
Middle row	Number of the connection error detected	Number of the carburation error detected
Bottom row	Detailed error in A/D(+) XXXX YYYY XXXX: Standardized value YYYY: Inputted value	Detailed error in A/D(–) XXXX YYYY XXXX: Standardized value YYYY: Inputted value

9.2.42 Setting

Setting of CHK_SAMPLING (Function ID: 220701)

Setting item	Range	Contents	Default setting value	Notes
CHK_SPSYNC1:Sw	Off / On	Enable switch	On	
CHK_ SPSYNC1:Lvl	--- / Serious error / Serious error(Comm) / Minor error / Alarm/ Warning	Error level	Serious error(Comm)	
CHK_SPSYNC2:Sw	Off / On	Enable switch	On	
CHK_ SPSYNC2:Lvl	--- / Serious error / Serious error(Comm) / Minor error / Alarm/ Warning	Error level	Serious error(Comm)	

Setting of CHK_ACC (Function ID: 220E01 and 220E02)

Setting item	Range	Contents	Default setting value	Notes
CHK_ACC1:Sw	Off / On	Enable switch	On	
CHK_ ACC1:Lvl	--- / Serious error / Serious error(Comm) / Minor error / Alarm/ Warning	Error level	Serious error	
CHK_ACC2:Sw	Off / On	Enable switch	On	
CHK_ ACC2:Lvl	--- / Serious error / Serious error(Comm) / Minor error / Alarm/ Warning	Error level	Serious error	

Setting of CHK_BIO (Function ID: 221101 to 221108)

Setting item	Range	Contents	Default setting value	Notes
CHK_BIO1:Sw	Off / On	Enable switch for BIO#1	On	
CHK_ BIO 1:Lvl	--- / Serious error / Serious error(Comm) / Minor error / Alarm/ Warning	Error level at BIO#1	Serious error	
…	…	…	…	
CHK_ BIO8:Sw	Off / On	Enable switch for BIO#8	On	
CHK_ BIO8:Lvl	--- / Serious error / Serious error(Comm) / Minor error / Alarm/ Warning	Error level at BIO#1	Serious error	

Setting of CHK_HMI (Function ID: 221301)

Setting item	Range	Contents	Default setting value	Notes
CHK_HMI:Sw	Off / On	Enable switch	On	
CHK_ HMI:Lvl	--- / Serious error / Serious error(Comm) / Minor error / Alarm/ Warning	Error level	Minor error	

Setting of CHK_RTC (Function ID: 221701)

Setting item	Range	Contents	Default setting value	Notes
CHK_RTC:Sw	Off / On	Enable switch	On	
CHK_RTC:Lvl	--- / Serious error / Serious error(Comm) / Minor error / Alarm / Warning	Error level	Minor error	

Setting of CHK_CT (Function ID: 221801)

Setting item	Range	Contents	Default setting value	Notes
CHK_CT:Sw	Off / On	Enable switch	On	
CHK_CT:Lvl	--- / Serious error / Serious error(Comm) / Minor error / Alarm/ Warning	Error level	Serious error	
CHK_CT:Timer	10 – 60 seconds	Checking timer	15 seconds	

Setting of CHK_IZ (Function ID: 221901)

Setting item	Range	Contents	Default setting value	Notes
CHK_IZ:Sw	Off / On	Enable switch	On	
CHK_IZ:Lvl	--- / Serious error / Serious error(Comm) / Minor error / Alarm / Warning	Error level	Minor error	
CHK_IZ:Timer	10s – 60s	Checking timer	15s	

Setting of CHK_V21 (Function ID: 221A01)

Setting item	Range	Contents	Default setting value	Notes
CHK_V21:Sw	Off / On	Enable switch	On	
CHK_V21:Lvl	--- / Serious error / Serious error(Comm) / Minor error / Alarm / Warning	Error level	Minor error	
CHK_V21:Timer	10s – 60s	Checking timer	15s	

Setting of CHK_V22 (Function ID: 221A02)

Setting item	Range	Contents	Default setting value	Notes
CHK_V22:Sw	Off / On	Enable switch	On	
CHK_V22:Lvl	--- / Serious error / Serious error(Comm) / Minor error / Alarm / Warning	Error level	Minor error	
CHK_V22:Timer	10s – 60s	Checking timer	15s	

Setting of CHK_VZ1 (Function ID: 221B01)

Setting item	Range	Contents	Default setting value	Notes
CHK_VZ1:Sw	Off / On	Enable switch	On	
CHK_VZ1:Lvl	--- / Serious error / Serious error(Comm) / Minor error / Alarm / Warning	Error level	Minor error	
CHK_VZ1:Timer	10s – 60s	Checking timer	15s	

Setting of CHK_VZ2 (Function ID: 221B02)

Setting item	Range	Contents	Default setting value	Notes
CHK_VZ2:Sw	Off / On	Enable switch	On	
CHK_VZ2:Lvl	--- / Serious error / Serious error(Comm) / Minor error / Alarm / Warning	Error level	Minor error	

Setting of CHK_VZ2 (Function ID: 221B02)

Setting item	Range	Contents	Default setting value	Notes
CHK_VZ2:Timer	10s – 60s	Checking timer	15s	

Setting of CHK_VTF (Function ID: 221C01)

Setting item	Range	Contents	Default setting value	Notes
CHK_VTF:Sw	Off / On	Enable switch	On	
CHK_ VTF:Lvl	--- / Serious error / Serious error(Comm) / Minor error / Alarm/ Warning	Error level	Minor error	

Setting of CHK_POWER (Function ID: 222D01)

Setting item	Range	Contents	Default setting value	Notes
CHK_POWER:Sw	Off / On	Enable switch	On	
CHK_POWER:Lvl	--- / Serious error / Serious error(Comm) / Minor error / Alarm / Warning	Error level	Minor error	

Setting of CHK_CTF (Function ID: 221E01)

Setting item	Range	Contents	Default setting value	Notes
CHK_CTF:Sw	Off / On	Enable switch	On	
CHK_ CTF:Lvl	--- / Serious error / Serious error(Comm) / Minor error / Alarm/ Warning	Error level	Minor error	

Setting of CHK_CB (Function ID: 222001 and 222002)

Setting item	Range	Contents	Default setting value	Notes
CHK_CB1:Sw	Off / On	Enable switch	On	
CHK_ CB1 1:Lvl	--- / Serious error / Serious error(Comm) / Minor error / Alarm/ Warning	Error level	Minor error	
CHK_ CB2:Sw	Off / On	Enable switch	On	
CHK_ CB2:Lvl	--- / Serious error / Serious error(Comm) / Minor error / Alarm/ Warning	Error level	Minor error	

Setting of CHK_PLC_DAT (Function PLC_DAT: 223201)

Setting item	Range	Contents	Default setting value	Notes
CHK_PLC_DAT:Sw	Off / On	Enable switch	On	
CHK_PLC_DAT:Lvl	--- / Serious error / Serious error(Comm) / Minor error / Alarm / Warning	Error level	Minor error	

Setting of CHK_PING (Function ID: 223601 and 223602)

Setting item	Range	Contents	Default setting value	Notes
CHK_PING1:Sw	Off / On	Enable switch	Off	
CHK_PING1:Lvl	--- / Serious error / Serious error(Comm) / Minor error / Alarm / Warning	Error level	Minor error	
PING_IP_ADRS	0 - 255	Ping target IP address	192	
PING_IP_ADRS2	0 - 255		168	
PING_IP_ADRS3	0 - 255		1	
PING_IP_ADRS4	0 - 255		1	
CHK_PING2:Sw	Off / On	Enable switch	Off	
CHK_PING2:Lvl	--- / Serious error / Serious error(Comm) / Minor error / Alarm / Warning	Error level	Minor error	
PING_IP_ADRS	0 - 255	Ping target IP address	192	
PING_IP_ADRS2	0 - 255		168	
PING_IP_ADRS3	0 - 255		1	
PING_IP_ADRS4	0 - 255		1	

Setting of CHK_CMLV (Function ID: 224001)

Setting item	Range	Contents	Default setting value	Notes
CHK_CMLV_DAT:Sw	Off / On	Enable switch	On	
CHK_CMLV_DAT:Lvl	--- / Serious error / Serious error(Comm) / Minor error / Alarm/ Warning	Error level	Minor error	

Setting of CHK_GOOSERCV (Function ID: 223501)

Setting item	Range	Contents	Default setting value	Notes
CHK_GOOSERCV:Sw	Off / On	Enable switch	On	
CHK_GOOSERCV:Lvl	--- / Serious error / Serious error(Comm) / Minor error / Alarm / Warning	Error level	Minor error	

Setting of CHK_PALLET (Function ID: 222201 to 222223)

Setting item	Range	Contents	Default setting value	Notes
CHK_PALLET1:Sw	Off / On	Enable switch to supervising the DPSY1	On	
CHK_PALLET1:ULvl	--- / Serious error / Serious error(Comm) / Minor error / Alarm / Warning	Error level for undefined error at DPSY1	Alarm	
CHK_PALLET1:FLvl	--- / Serious error / Serious error(Comm) / Minor error / Alarm / Warning	Error level for faulty error at DPSY1	Minor error	
CHK_PALLET2:Sw	Off / On	Enable switch to supervising the DPSY2	On	

Setting of CHK_PALLET (Function ID: 222201 to 222223)

Setting item	Range	Contents	Default setting value	Notes
CHK_PALLET2:ULvl	--- / Serious error / Serious error(Comm) / Minor error / Alarm / Warning	Error level for undefined error at DPSY2	Alarm	
CHK_PALLET2:FLvl	--- / Serious error / Serious error(Comm) / Minor error / Alarm / Warning	Error level for faulty error at DPSY2	Minor error	
CHK_PALLET3:Sw	Off / On	Enable switch to supervising the DPOS1	On	
CHK_PALLET3:ULvl	--- / Serious error / Serious error(Comm) / Minor error / Alarm / Warning	Error level for undefined error at DPOS1	Alarm	
CHK_PALLET3:FLvl	--- / Serious error / Serious error(Comm) / Minor error / Alarm / Warning	Error level for faulty error at DPOS1	Minor error	
CHK_PALLET4:Sw	Off / On	Enable switch to supervising the DPOS2	On	
CHK_PALLET4:ULvl	--- / Serious error / Serious error(Comm) / Minor error / Alarm / Warning	Error level for undefined error at DPOS2	Alarm	
CHK_PALLET4:FLvl	--- / Serious error / Serious error(Comm) / Minor error / Alarm / Warning	Error level for faulty error at DPOS2	Minor error	
CHK_PALLET5:Sw	Off / On	Enable switch to supervising the DPOS3	On	
CHK_PALLET5:ULvl	--- / Serious error / Serious error(Comm) / Minor error / Alarm / Warning	Error level for undefined error at DPOS3	Alarm	
CHK_PALLET5:FLvl	--- / Serious error / Serious error(Comm) / Minor error / Alarm / Warning	Error level for faulty error at DPOS3	Minor error	
…	…	…	…	
CHK_PALLET32:Sw	Off / On	Enable switch to supervising the DPOS30	On	
CHK_PALLET32:ULvl	--- / Serious error / Serious error(Comm) / Minor error / Alarm / Warning	Error level for undefined error at DPOS30	Alarm	
CHK_PALLET32:FLvl	--- / Serious error / Serious error(Comm) / Minor error / Alarm / Warning	Error level for faulty error at DPOS30	Minor error	
CHK_PALLET33:Sw	Off / On	Enable switch to supervising the TPOS1	On	
CHK_PALLET33:ULvl	--- / Serious error / Serious error(Comm) / Minor error / Alarm / Warning	Error level for undefined error at TPOS1	Alarm	
CHK_PALLET33:FLvl	--- / Serious error / Serious error(Comm) / Minor error / Alarm / Warning	Error level for faulty error at TPOS1	Minor error	
CHK_PALLET34:Sw	Off / On	Enable switch to supervising the TPOS2	On	
CHK_PALLET34:ULvl	--- / Serious error / Serious error(Comm) / Minor error / Alarm / Warning	Error level for undefined error at TPOS2	Alarm	
CHK_PALLET34:FLvl	--- / Serious error / Serious error(Comm) / Minor error / Alarm / Warning	Error level for faulty error at TPOS2	Minor error	
CHK_PALLET35:Sw	Off / On	Enable switch to supervising the TPOS3	On	
CHK_PALLET35:ULvl	--- / Serious error / Serious error(Comm) / Minor error / Alarm / Warning	Error level for undefined error at TPOS3	Alarm	

Setting of CHK_PALLET (Function ID: 222201 to 222223)

Setting item	Range	Contents	Default setting value	Notes
CHK_PALLET35:FLvl	--- / Serious error / Serious error(Comm) / Minor error / Alarm / Warning	Error level for faulty error at TPOS3	Minor error	

Setting of CHK_DCAIO (Function ID: 222E01 and 222E08)

Setting item	Range	Contents	Default setting value	Notes
CHK_DCAIO1:Sw	Off / On	Enable switch	On	
CHK_ DCAIO 1:Lvl	--- / Serious error / Serious error(Comm) / Minor error / Alarm/ Warning	Error level	Serious error	
…	….	….	…	
CHK_ DCAIO8:Sw	Off / On	Enable switch	On	
CHK_ DCAIO8:Lvl	--- / Serious error / Serious error(Comm) / Minor error / Alarm/ Warning	Error level	Serious error	

9.2.43 Signal (Data ID)

◆ **Signal monitoring point**

CHK_ROMRAM (Function ID: 220101)

Element ID	Name	Description
32FFFF1001	EXEC_CNT	Executing counter
3210001001	RESULT	Check result
3210011001	RES_INST	Check result (instant)

◆ **Signal monitoring point**

CHK_SUM (Function ID: 220201)

Element ID	Name	Description
3210101001	CHECKSUM	
3210111001	CHECKSUMC	
32E0001001	CHK_POINT	
32FFFF1001	EXEC_CNT	Executing counter
3210201001	LOADERSUM	
3210121001	PROG_SIZE	
3210001001	RESULT	Check result
3210011001	RES_INST	Check result (instant)

◆ **Signal monitoring point**

CHK_PROGRAM (Function ID: 220301)

Element ID	Name	Description
30E0001001	CHKPOINT	test point1
30E0011001	CHKPOINT2	test point2
32FFFF1001	EXEC_CNT	executing counter
3210001001	RESULT	check result
3210011001	RES_INST	check result(instant)

◆ **Signal monitoring point**

CHK_NMI (Function ID: 220401)

Element ID	Name	Description
32FFFF1001	EXEC_CNT	executing counter
3210001001	RESULT	check result
3210011001	RES_INST	check result(instant)

◆ **Signal monitoring point**

CHK_RAM (Function ID: 220601)

Element ID	Name	Description
32E0001001	CHKPOINT	test point
3210021001	ECC_SECNT	ECC single error cnt
32FFFF1001	EXEC_CNT	executing counter
3210001001	RESULT	check result

◆ **Signal monitoring point**

CHK_RAM (Function ID: 220601)

Element ID	Name	Description
3210011001	RES_INST	check result(instant)

◆ **Signal monitoring point**

CHK_ECC (Function ID: 220602)

Element ID	Name	Description
32FFFF1001	EXEC_CNT	executing counter
3210001001	RESULT	check result
3210011001	RES_INST	check result(instant)

◆ **Signal monitoring point**

CHK_ SAMPLING (Function ID: 220701)

Element ID	Name	Description
32FFFF1001	EXEC_CNT	executing counter
3210001001	RESULT	check result
3210011001	RES_INST	check result(instant)

◆ **Signal monitoring point**

CHK_SUBCPU (Function ID: 220901 and 220902)

Element ID	Name	Description
32FFFF1001	EXEC_CNT	Executing counter
3210001001	RESULT	Check result
3210011001	RES_INST	Check result (instant)

◆ **Signal monitoring point**

CHK_ ACC (Function ID: 220E01 and 220E2)

Element ID	Name	Description
32FFFF1001	EXEC_CNT	executing counter
3210001001	RESULT	check result
3210021001	RES_FAST	check result(fast)
3210011001	RES_INST	check result(instant)

◆ **Signal monitoring point**

CHK_MRAM (Function ID: 220F01)

Element ID	Name	Description
32E0001001	CHKPOINT	test point
32FFFF1001	EXEC_CNT	executing counter
3210001001	RESULT	check result
3210011001	RES_INST	check result(instant)

◆ **Signal monitoring point**

CHK_ BIO (Function ID: 221101 to 221108)

Element ID	Name	Description
32FFFF1001	EXEC_CNT	executing counter
3210001001	RESULT	check result
3210011001	RES_INST	check result(instant)

◆ **Signal monitoring point**

CHK_ HMI (Function ID: 2201301)

Element ID	Name	Description
32FFFF1001	EXEC_CNT	executing counter
3210001001	RESULT	check result
3210011001	RES_INST	check result(instant)

◆ **Signal monitoring point**

CHK_SETTING (Function ID: 221501)

Element ID	Name	Description
32FFFF1001	EXEC_CNT	executing counter
3210001001	RESULT	check result
3210011001	RES_INST	check result(instant)

◆ **Signal monitoring point**

CHK_DPRAM and CHK_EXDPRAM (Function ID: 221601 and 221602)

Element ID	Name	Description
32FFFF1001	EXEC_CNT	Executing counter
3210001001	RESULT	Check result
3210011001	RES_INST	Check result (instant)

◆ **Signal monitoring point**

CHK_RTC (Function ID: 221701)

Element ID	Name	Description
32E0001001	CHKPOINT	Test point
32FFFF1001	EXEC_CNT	executing counter
3210001001	RESULT	check result
3210011001	RES_INST	check result(instant)

◆ **Signal monitoring point**

CHK_CT (Function ID: 221801)

Element ID	Name	Description
32FFFF1001	EXEC_CNT	executing counter
3210001001	RESULT	check result

◆ **Signal monitoring point**

CHK_CT (Function ID: 221801)

Element ID	Name	Description
3210011001	RES_INST	check result(instant)

◆ **Signal monitoring point**

CHK_IZ (Function ID: 221901)

Element ID	Name	Description
32FFFF1001	EXEC_CNT	executing counter
3210001001	RESULT	check result
3210011001	RES_INST	check result(instant)

◆ **Signal monitoring point**

CHK_V2 (Function ID: 221A01 and 221A02)

Element ID	Name	Description
32FFFF1001	EXEC_CNT	executing counter
3210001001	RESULT	check result
3210011001	RES_INST	check result(instant)

◆ **Signal monitoring point**

CHK_VZ (Function ID: 221B01 and 221B02)

Element ID	Name	Description
32FFFF1001	EXEC_CNT	executing counter
3210001001	RESULT	check result
3210011001	RES_INST	check result(instant)

◆ **Signal monitoring point**

CHK_ VTF (Function ID: 221C01)

Element ID	Name	Description
32FFFF1001	EXEC_CNT	executing counter
3210001001	RESULT	check result
3210011001	RES_INST	check result(instant)

◆ **Signal monitoring point**

CHK_POWER (Function ID: 222D01)

Element ID	Name	Description
32FFFF1001	EXEC_CNT	executing counter
3210001001	RESULT	check result
3210011001	RES_INST	check result(instant)

◆ **Signal monitoring point**

CHK_CTF (Function ID: 221E01)

Element ID	Name	Description
32FFFF1001	EXEC_CNT	executing counter
3210001001	RESULT	check result
3210011001	RES_INST	check result(instant)

◆ **Signal monitoring point**

CHK_CB (Function ID: 222001)

Element ID	Name	Description
32FFFF1001	EXEC_CNT	executing counter
3210001001	RESULT	check result
3210011001	RES_INST	check result(instant)

◆ **Signal monitoring point**

CHK_DS (Function ID: 221101)

Element ID	Name	Description
32FFFF1001	EXEC_CNT	executing counter
3210001001	RESULT	check result
3210011001	RES_INST	check result(instant)

◆ **Signal monitoring point**

CHK_PLC_DAT (Function ID: 223201)

Element ID	Name	Description
32FFFF1001	EXEC_CNT	executing counter
3210001001	RESULT	check result
3210011001	RES_INST	check result(instant)

◆ **Signal monitoring point**

CHK_PING (Function ID: 223601 and 223602)

Element ID	Name	Description
EXEC_CNT	32FFFF1001	execute counter
RESULT	3210001001	check result
RES_INST	3210011001	check result(instant)

◆ **Signal monitoring point**

CHK_ CMLV (Function ID: 224001)

Element ID	Name	Description
32FFFF1001	EXEC_CNT	executing counter
3210001001	RESULT	check result
3210011001	RES_INST	check result(instant)

◆ **Signal monitoring point**

CHK_PALLET (Function ID: 222201 to 222223)

Element ID	Name	Description
32FFFF1001	EXEC_CNT	Executing counter
3210001001	RESULT	Check result
3210011001	RES_INST	Check result (instant)

◆ **Signal monitoring point**

CHK_DCAIO (Function ID: 222E01 and 222E08)

Element ID	Name	Description
311000131F	ACC_ERR	Executing counter
311000111A	CONN_ERR	
3110001215	CORDATERR	
32FFFF1001	EXEC_CNT	
3210001001	RESULT	check result
3210011001	RES_INST	check result(instant)

9.3 Trip circuit supervision task

The TCS function provides an alarm when it detects a failure in the circuit breaker tripping control circuit. The failure could be caused by loss of power supply in the trip circuit or an open circuit in the control circuit connection.

Displaying error message founded by the TCS function is shown in Table 9.3-1; the error is cleared when recovered

Table 9.3-1 Supervision items and error levels for Trip supervision

		Detailed	Error	
Sec.No.	Supervision items(Screen message)	Info.	Lvl	LED
9.3.1	Trip circuit error (TC error)	N/A	3	On

Note: The implementation of particular features is dependent upon the selection of hardware and the configuration of functions. Several IED models do not support certain features. To determine whether a particular feature has been implemented within an IED, identify the IED ordering number; and check the order number for the "G&T position" whilst referring to the comparison table below. For more information, see *Appendix: Ordering*.

Table 9.3-2 Comparative table in respective ordering numbers

Sec.	Feature	Ordering No. at "G&T"					
		BCU			BCPU		IFU
		11	13	1F	2C	2N	19
–	Main features	NA	NA	NA	✓	✓	NA

✓: Applicable NA: Not applicable

9.3.1 Detecting erroneous operation

(i) Operation logics

The TCS has six sets of monitoring logic (TCS1 to TCS6), as shown in Figure 9.3-1. For example, the TCS1 logic issues a signal "TC1_Fail" when the following conditions are determined in the TCS1 logic:

- Both signals at PLC connection points "TC1_FAIL_SIGNAL1" and "TC1_FAIL_SIGNAL2" being absent for more than 0.4 sec.
- Either **On** or **OPT-On†** being set for scheme switch [**TCS1-EN**].

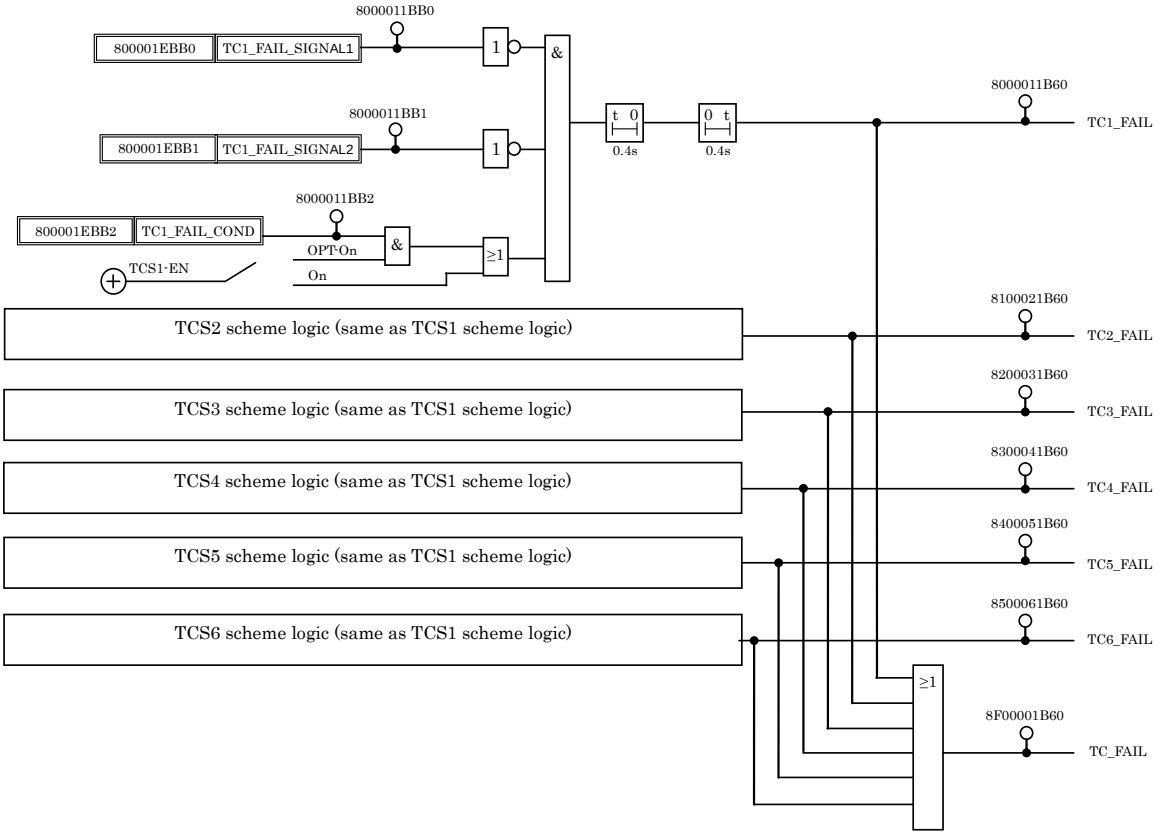


Figure 9.3-1 Six sets of TCS scheme logic

†Note: If the user wishes to add a user-programmed condition for the TCS1 decision, set **OPT-On** and connect the user-programmed signal at PLC connection point "TC1_FAIL_COND". The TCS1 monitor will then only be available when a user-programmed signal is present at PLC connection point "TC1_FAIL_COND".

(ii) Applications

(ii)-1 Example1

Figure 9.3-2 provides an application example of the TCS function. Two binary-input signals are assigned to PLC connection points "TC1_FAIL_SIGNAL1" and "TC1_FAIL_SIGNAL2". When the trip circuit is healthy, a small current will flow in the BI circuits, the CB auxiliary contacts, and the trip coil. This small current can be observed to flow in both the CB-open condition and the CB-closed condition. If the small current supplied to the trip circuit is lost,

or if the connections between the trip circuit and the BI circuits become open circuit, a signal "TC1_FAIL" is generated; then, the TCS1 logic will issue a Trip Circuit Fail alarm.

Note: A threshold setting voltage is required for the BI circuits. The user should set the threshold to one-half of the value of the trip supply voltage. This is because in this scheme there are two BI circuits connected in series. The supply voltage across the BI circuit will be divided by two when the 52 contact is closed and the 52b contact is open. Thus, the BI circuit may fail to operate if the BI sensitivity is only set in response to the supply voltage. For example, the BI threshold voltage should be set below 55V when a trip supply voltage of 110V is applied. For the TCS function, the user should select two BI circuits from the BI2A module, because the BI circuits of both of these modules can have lower threshold voltages than the BI circuits that are available in other modules.

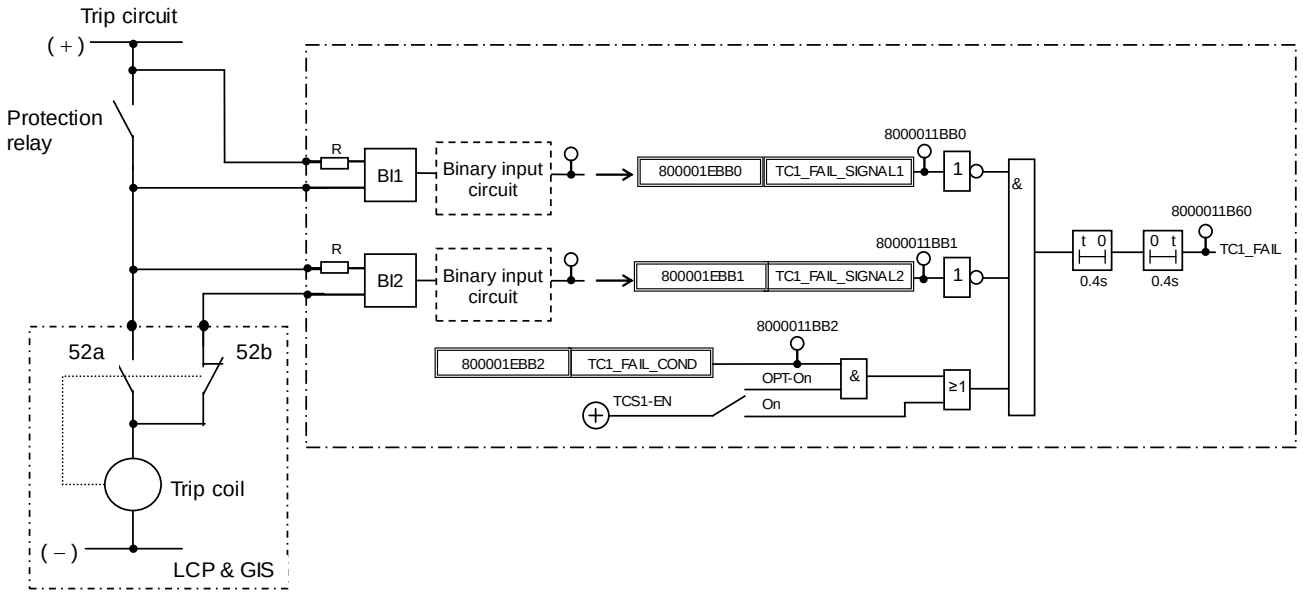


Figure 9.3-2 Connection Example1 for TCS1 logic

(ii)-2 Example2

In Example2 a binary input signal is assigned to PLC connection point "TC1_FAIL_SIGNAL1". With this arrangement if the CB is open, the small monitoring current will not be able to flow in the BI circuit. Therefore, it is recommended that setting **OPT-On** is selected for the scheme switch **[TCS1-EN]** and that a CB-closed-status signal is applied to PLC connection point "TC1_FAIL_COND". Monitoring is only enabled while the CB is in the closed position when using this setting. This setting avoids unnecessary monitoring when the circuit breaker is open when using this scheme.

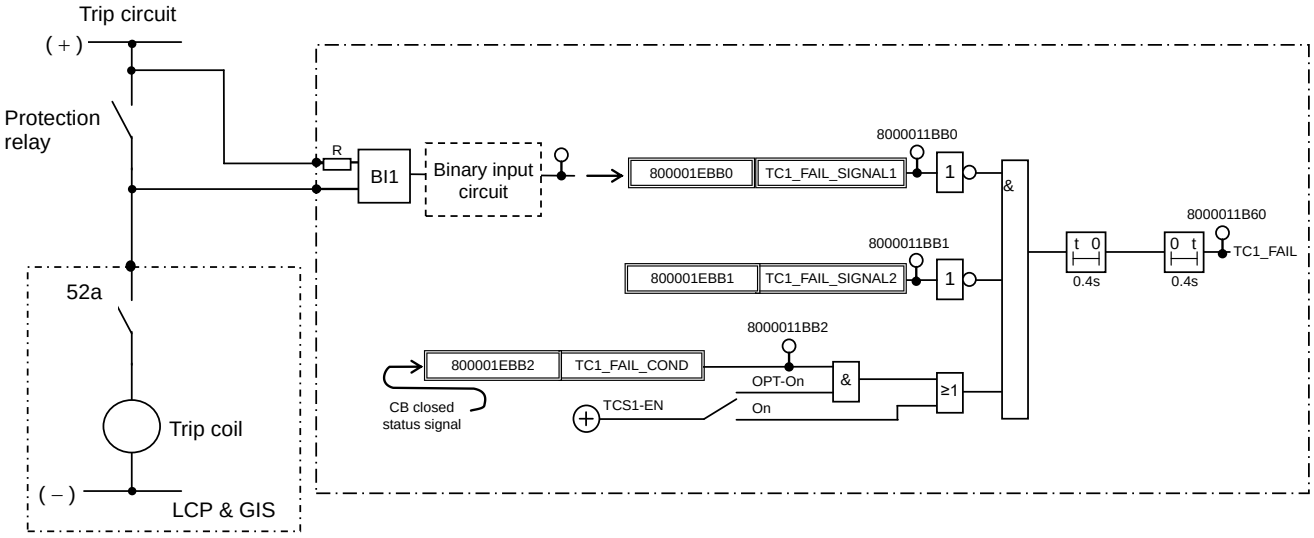


Figure 9.3-3 Connection Example2 for TCS1 logic

9.3.2 Trip circuit error (TC error)

(i) Error level

For the operation, the user can set the error level when the function detects the error concerning the operation. Generally, the default error level is set at level 3 (**Minor error**), but the user can program the level for the TCS1—6 using settings [**CHK_TCS1:LVL**] to [**CHK_TCS6:LVL**]; then, set **On** for the setting [**CHK_TCS1:Sw**] to [**CHK_TCS6:Sw**].

(ii) Error message

When the function operates and detects error, an error message can be shown at the LED and the LCD screen.

Table 9.3-3 Error messages provided by the supervisor in TCS

Item	Meaning of the information
TCx error	Detection of an error located at x
Error level	Minor error (Level 3)

Table 9.3-4 Detailed information in TCS

Display area	Meaning of the detailed information
N/A	(No message is displayed)

9.3.3 Setting

Setting of TCS(Function ID: 482001)

Setting item	Range	Units	Contents	Default setting value	Notes
TCS1-EN	Off / On / OPT-On	—	TCS1(Trip Circuit Supervision 1) enable	Off	
TCS2-EN	Off / On / OPT-On	—	TCS2(Trip Circuit Supervision 2) enable	Off	
TCS3-EN	Off / On / OPT-On	—	TCS3(Trip Circuit Supervision 3) enable	Off	
TCS4-EN	Off / On / OPT-On	—	TCS4(Trip Circuit Supervision 4) enable	Off	
TCS5-EN	Off / On / OPT-On	—	TCS5(Trip Circuit Supervision 5) enable	Off	
TCS6-EN	Off / On / OPT-On	—	TCS6(Trip Circuit Supervision 6) enable	Off	

Setting of CHK_TCS (Function ID: 223B01 to 223B06)

Setting item	Range	Contents	Default setting value	Notes
CHK_TCS1:Sw	Off / On	Enable switch	On	
CHK_ TCS1:Lvl	--- / Serious error / Serious error(Comm) / Minor error / Alarm/ Warning	Error level	Minor error	
….	….	….	….	
CHK_TCS6:Sw	Off / On	Enable switch	On	
CHK_ TCS6:Lvl	--- / Serious error / Serious error(Comm) / Minor error / Alarm/ Warning	Error level	Minor error	

9.3.4 Signal (Data ID)

◆ Signal monitoring point

TCS(Function ID: 482001)

Element ID	Name	Description
8000011B60	TC1_FAIL	Trip circuit1 fail
8000011BB0	TC1_FAIL_SIGNAL1	Trip circuit1 fail signal1
8000011BB1	TC1_FAIL_SIGNAL2	Trip circuit1 fail signal2
8000011BB2	TC1_FAIL_COND	TC1 fail condition
8100021B60	TC2_FAIL	Trip circuit2 fail
8100021BB0	TC2_FAIL_SIGNAL1	Trip circuit2 fail signal1
8100021BB1	TC2_FAIL_SIGNAL2	Trip circuit2 fail signal2
8100021BB2	TC2_FAIL_COND	TC2 fail condition
8200031B60	TC3_FAIL	Trip circuit3 fail
8200031BB0	TC3_FAIL_SIGNAL1	Trip circuit3 fail signal1
8200031BB1	TC3_FAIL_SIGNAL2	Trip circuit3 fail signal2
8200031BB2	TC3_FAIL_COND	TC3 fail condition
8300041B60	TC4_FAIL	Trip circuit4 fail
8300041BB0	TC4_FAIL_SIGNAL1	Trip circuit4 fail signal1
8300041BB1	TC4_FAIL_SIGNAL2	Trip circuit4 fail signal2
8300041BB2	TC4_FAIL_COND	TC4 fail condition
8400051B60	TC5_FAIL	Trip circuit5 fail
8400051BB0	TC5_FAIL_SIGNAL1	Trip circuit5 fail signal1
8400051BB1	TC5_FAIL_SIGNAL2	Trip circuit5 fail signal2
8400051BB2	TC5_FAIL_COND	TC5 fail condition
8500061B60	TC6_FAIL	Trip circuit6 fail
8500061BB0	TC6_FAIL_SIGNAL1	Trip circuit6 fail signal1
8500061BB1	TC6_FAIL_SIGNAL2	Trip circuit6 fail signal2
8500061BB2	TC6_FAIL_COND	TC6 fail condition
8F00001B60	TC_FAIL	Trip circuit fail

◆ Signal Connection point

TCS(Function ID: 482001)

Element ID	Name	Description
800001EBB2	TC1_FAIL_COND	TC1 fail condition
800001EBB0	TC1_FAIL_SIGNAL1	Trip circuit1 fail signal1
800001EBB1	TC1_FAIL_SIGNAL2	Trip circuit1 fail signal2
810002EBB2	TC2_FAIL_COND	TC2 fail condition
810002EBB0	TC2_FAIL_SIGNAL1	Trip circuit2 fail signal1
810002EBB1	TC2_FAIL_SIGNAL2	Trip circuit2 fail signal2
820003EBB2	TC3_FAIL_COND	TC3 fail condition
820003EBB0	TC3_FAIL_SIGNAL1	Trip circuit3 fail signal1
820003EBB1	TC3_FAIL_SIGNAL2	Trip circuit3 fail signal2
830004EBB2	TC4_FAIL_COND	TC4 fail condition
830004EBB0	TC4_FAIL_SIGNAL1	Trip circuit4 fail signal1
830004EBB1	TC4_FAIL_SIGNAL2	Trip circuit4 fail signal2
840005EBB2	TC5_FAIL_COND	TC5 fail condition
840005EBB0	TC5_FAIL_SIGNAL1	Trip circuit5 fail signal1

◆ Signal Connection point

TCS(Function ID: 482001)

Element ID	Name	Description
840005EBB1	TC5_FAIL_SIGNAL2	Trip circuit5 fail signal2
850006EBB2	TC6_FAIL_COND	TC6 fail condition
850006EBB0	TC6_FAIL_SIGNAL1	Trip circuit6 fail signal1
850006EBB1	TC6_FAIL_SIGNAL2	Trip circuit6 fail signal2

◆ Signal monitoring point

CHK_TCS (Function ID: 223B01 to 223B06)

Element ID	Name	Description
32FFFF1001	EXEC_CNT	executing counter
3210001001	RESULT	check result
3210011001	RES_INST	check result(instant)

9.4 Supervision task for interruption capability on CB

For the supervision of the circuit breaker, the sigma_Iy function is provided so that the broken current quantities at respective tripping are accumulated. Thereby, the user can monitor the interrupting capability using the sigma_Iy function. When trip commands are issued, the sigma_Iy function monitors the maximum current (I at CT primary) in every occurrence of the fault, the sigma_Iy function accumulates each maximum fault current powered by a parameter 'y'. Thus, the user can find a synthesized broken current value using the sigma_Iy function.

Displaying error message founded by the sigma_Iy function is shown in Table 9.4-1.

Table 9.4-1 Supervision items and error levels for Sigma_Iy

		Detailed	Error	
Sec.No.	Supervision items(Screen message)	Info.	Lvl	LED
9.4.1	Sigma Iy error (CHK_SGMIY error)	N/A	3	On

Note: The implementation of particular features is dependent upon the selection of hardware and the configuration of functions. Several IED models do not support certain features. To determine whether a particular feature has been implemented within an IED, identify the IED ordering number; and check the order number for the "G&T position" whilst referring to the comparison table below. For more information, see *Appendix: Ordering*.

Table 9.4-2 Comparative table in respective ordering numbers

Sec.	Feature	Ordering No. at "G&T"					
		BCU			BCPU		IFU
		11	13	1F	2C	2N	19
–	Main features	NA	NA	NA	✓	✓	NA

✓: Applicable NA: Not applicable

9.4.1 Operation of sigma Iy

When the value 'n' is provided as the number of the fault currents, equation (9.4-1) is satisfied:

$$\sum I_Y = I_1^y + I_2^y + I_3^y + \cdots + I_n^y \qquad (9.4\text{-}1)$$

As setting for a conventional CB with regard to the parameter 'y', the user can set a value '**2.0**' for the [**SIGMA_IY-Y**]; that is, the accumulation is performed with the fault currents squared (I^2). On the other hand, the user can be required to set a less value (say '**1.0**') for the [**SIGMA_IY-Y**] when a special CB is required (that is, for the high voltage system).

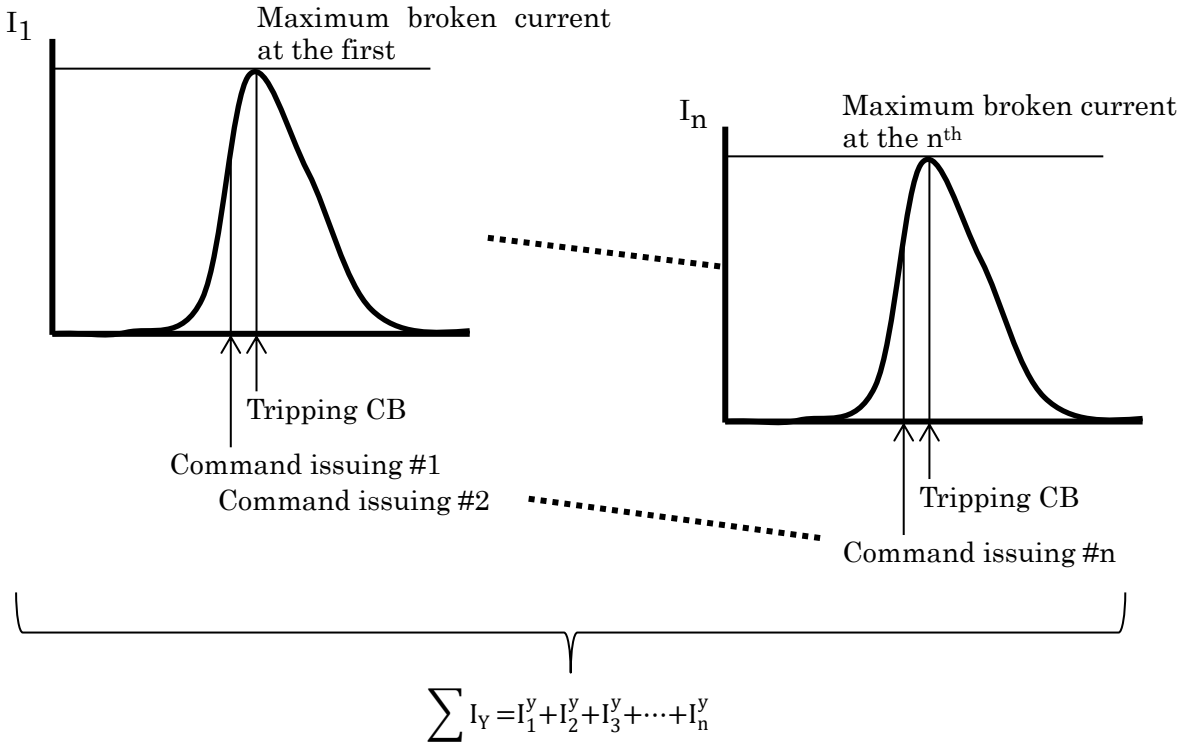


Figure 9.4-1 Concept of Sigma_Iy function

The sigma_Iy function can designed to issue an alarm when the synthesized broken current value reaches an alarm level set by [**SIGMA_IY-Alarm**]; issuing an alarm is ready when the user sets **On** for scheme switch [**SIGMA_IY-AEN**].

9.4.2 Sigma ly error (CHK_SGMIY error)

(i) Error level

For the operation, the user can set the error level when the function detects the error concerning the operation. Generally, the default error level is set at level 3 (**Minor error**), but the user can program the level using settings [**CHK_SGMIY-A:LVL**] to [**CHK_SGMIY-C:LVL**] in respective phase A, B, and C; then, set On for the setting [**CHK_SGMIY-A:Sw**] to [**CHK_SGMIY-C:Sw**].

(ii) Error message

When the function operates and detects error, an error message can be shown at the LED and the LCD screen.

Table 9.4-3 Error messages provided by the supervisor in SIGMIY

Item	Meaning of the information
CHK_SGMIY-x error	Detection of an error located at x-phase
Error level	Minor error (Level 3)

Table 9.4-4 Detailed information in SIGMIY

Display area	Meaning of the detailed information
N/A	(No message is displayed)

9.4.3 Setting

Setting of SIGMA_IY (Function ID: 713001)

Setting item	Range	Units	Contents	Default setting value	Notes
SIGMA_IY-EN	Off / On	—	Enabling Sigma Iy function operation	Off	
SIGMA_IY-AEN	Off / On	—	Enabling Sigma Iy alarming	Off	
SIGMA_IY-Alarm	1.0 to 100000000.0	—	Alarm level in Sigma Iy function	10000.0	
SIGMA_IY-Y	1.0 to 2.0	—	Y parameter for in Sigma Iy	1.0	

Setting of CHK_SGMIY (Function ID: 223A01 to 223A03)

Setting item	Range	Contents	Default setting value	Notes
CHK_SGMIY-A:Sw	Off / On	Enable switch	On	
CHK_SGMIY-A:Lvl	--- / Serious error / Serious error(Comm) / Minor error / Alarm/ Warning	Error level	Minor error	
CHK_SGMIY-B:Sw	Off / On	Enable switch	On	
CHK_SGMIY-B:Lvl	--- / Serious error / Serious error(Comm) / Minor error / Alarm/ Warning	Error level	Minor error	
CHK_SGMIY-C:Sw	Off / On	Enable switch	On	
CHK_SGMIY-C:Lvl	--- / Serious error / Serious error(Comm) / Minor error / Alarm/ Warning	Error level	Minor error	

9.4.4 Signal (Data ID)

◆ Signal monitoring point

SIGMA_IY (Function ID: 713001)

Element ID	Name	Description
8000001C20	SGMIY-A	Monitoring SIGMA_IY relay element output (phase-A)
8100001C21	SGMIY-B	Monitoring SIGMA_IY relay element output (phase-B)
8200001C22	SGMIY-C	Monitoring SIGMA_IY relay element output (phase-C)

◆ Signal monitoring point

CHK_SGMIY-A to C (Function ID: 223A01 to 223A03)

Element ID	Name	Description
32FFFF1001	EXEC_CNT	executing counter
3210001001	RESULT	check result
3210011001	RES_INST	check result(instant)

10 Communication protocol

10.1 LAN communication

When LAN module(s) are provided in the IED, the IED can operate with LAN communications using the "Transmission Control Protocol/Internet Protocol (TCP/IP)". Thus, the user should set IP addresses and other information in accordance with the requirements of TCP/IP. Two communication features are provided within TCP/IP: Hot-standby communication and LAN monitoring. The two features are discussed later.

10.1.1 Setup

(i) How to set the local IP address

Table 10.1-1 shows a summary of the setting items provided in the communication module for Network. The user can set an IP address, subnet mask and gateway addresses in the IED†.

Table 10.1-1 TCP/IP setting of LAN module

Setting items	Range	Setting meaning	Default value
IPADDRESS1‡	0.0.0.0–255.255.255.255	IP address	192.l68.1.11
SUBNETMASK1‡	0.0.0.0–255.255.255.255	Subnet mask	255.255.255.0
GATEWAY1‡	0.0.0.0–255.255.255.255	Default gateway	192.168.1.1

When the wishing to change addresses, the user can use this setting menu. Figure 10.1-1 shows the setting menu provided to change the addresses‡.

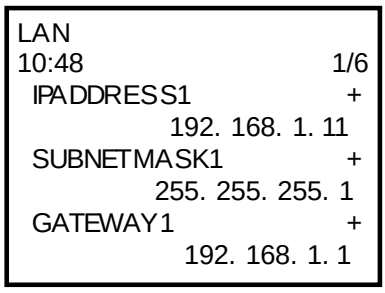


Figure 10.1-1 Local LAN setting menu (on IED screen)

†Note: For more information with regard to the communication modules, see Chapter *Technical description: Signal processing and communication module*.

‡Note: Although the IED can support either one or two LAN modules, the user should assign a single IP address for the IED. (Just for the record, subscript '1' of "IPADDRESS1, SUBNETMASK1, and GATEWAY1" is not relevant in this case.)

‡Note: Chapter *User interface: Setting sub-menu* describes how to set the address on the IED screen.

(ii) How to set Hot-standby communication

Redundant communication (i.e. "Hot-standby") is designed to provide additional security if a communications failure should occur on the LAN network. The "Hot-standby (HOTST)" function is implemented using two LAN modules in the IED.

For the Hot-standby communication, the first communication module for Network is used as the primary port, (i.e. LAN#1) while a second communication module for Network, (i.e. LAN#2) is used as the secondary port; the IED will communicate using the LAN#1 for normal operation. If a communications failure occurs at the LAN#1, the IED can automatically switch communication from the LAN#1 to the LAN#2.

When the IED detects the occurrence of a communications failure, for which the LAN module is unable to respond to the IED (i.e. a communications link is down), the IED starts a timer. When the timer exceeds a setting [**DownTime**], the IED will switch ports. Thus, LAN#2 is then used for communications. (Note that LAN#1 can be determined to be the secondary port on the occurrence of the failure. If LAN#2 is unable to continue to operate, then LAN#1 will be re-switched to run after a predetermined setting [**UpTime**]. Then, LAN#2 will be discriminated as the secondary port.)

(ii)-1 Setting for redundant mode

The Hot-standby function runs when the user sets **Hot_Standby** for scheme switch [**RedundantMode**]. If the user does not wish to run the Hot-standby function, set **Fixed** for the scheme switch [**RedundantMode**]. In this case, LAN#2 will not function even though dual LAN ports are provided by the IED.

(ii)-2 Selection of any one of ports as the primary port

The user can select any one of the ports to be the primary port although the LAN#1 is normally used as the primary port. For example, provided that both the LAN#1 and the LAN#2 are physically connected to the LAN, when the user wishes to use LAN#2 as the primary port, the user should set **Port2** for scheme switch [**PrimaryPort**]. If the user wishes not to select the primary port, set **None** for scheme switch [**PrimaryPort**].

(ii)-3 Setting of link-down timer

As mentioned earlier, the occurrence of a communication failure is determined when the timer exceeds the setting [**DownTime**]. Thus, the user should set a time setting for this decision.

(ii)-4 Setting of link-up timer

Another timer is provided in the Hot-standby function. Let us assume that the communication on LAN#1 is changed to LAN#2. If the failure of LAN#1 is removed after changing to LAN#2,

the IED will try to re-start using LAN#1 as the primary port. In this case, the user can define a time to revert to the original port and re-start communication on the original port by applying a re-start time for setting [**UpTime**].

Table 10.1-2 Summary of Hot-standby communication setting

Setting Items	Range	Meaning	Default
RedundantMode	Fixed / Hot_Standby	Fixed: LAN#2 not used. Hot_Standby: Hot-standby activated.	Fixed
DownTime	0–10000ms	A timer starts upon the occurrence of the communication failure (link down). The standby port commences communication in the DownTime.	5ms
PrimaryPort	None / Port1 / Port2	Selection of priority port None: No selection for the priority port. Port1: LAN#1 selected as the priority port. Port2: LAN#2 selected as the priority port.	None
UpTime	0–10000ms	A timer starts when the primary port is ready to commence communication after switching port.	5ms

The user should be aware of the following three facts prior to the Hot-standby operation:

1 The IED uses the IP/MAC address of LAN#1 for the Hot-standby operation. The IP/MAC address of LAN#2 is not used even if communication is carried out on LAN#2.

2 The user should ensure that an optical fiber is correctly connected when a 100Base-FX module is used in the IED, otherwise a repeat communication failure (link-down) will be experienced continuously. If the period for which the link-down is shorter than the setting [**DownTime**], another LAN port cannot be switched as the primary port. Thus, the user should determine the setting to be applied for [**DownTime**] on the basis of the system requirement. It is allowable for the user to apply a setting of zero for [**DownTime**] so that the switching of the ports will be performed immediately; conversely, the user can set any value less than 3000ms in order that the system would negate chattering failures if the optic fiber were not connected securely. Switching between the primary and the secondary ports is not performed when the user is keying a value for the setting [**DownTime**]. The user should consider the setting approach for [**UpTime**] in the same manner as when setting [**DownTime**].

3 The auto-negotiation function is executed when the 100Base-TX modules establish communication over the communications network. The auto-negotiation function selects a mode for communication; the auto-negotiation function adjusts the communication speed. In the case of a link-down condition, the auto-negotiation function will run again immediately. The link-down condition continues until auto-negotiation has been completed (it may continue for 1 or 2 seconds). The user can apply a setting for [**DownTime**] for any value of time less than that required by the

auto-negotiation function in response to the system requirement (i.e. the user can set [**DownTime**] to be zero milliseconds). In this case, switching between the primary and secondary ports is performed immediately i.e. prior to the auto-negotiation function running. If switching between ports is not required before the completion of the auto-negotiation function, the user can set the setting [**DownTime**] longer than the time required by the auto-negotiation function. The user can consider the setting for [**UpTime**] in the same manner as when setting [**DownTime**].

(ii)-5 Switching using PLC signals

Compulsory signals may be used to switch the ports. For example, if a compulsory signal is issued via PLC connection point “CH1_CH_CHG”, communication is switched from the LAN#1 to the LAN#2. On the other hand, changing from the LAN#2 to the LAN#1 can be executed upon the reception of a signal via PLC signal “CH2_CH_CHG”.

(iii) Network monitoring during Hot-standby operation

The Hot-standby (HOTST) function can send PING packets to remote devices thus enabling the Hot-standby function to monitor the state of the network. The Hot-standby function checks for a response signal from the remote device. If the Hot-standby function does not receive a response signal, the Hot-standby function will switch to the other port. The operation is performed when the user sets the scheme switches [**RedundantMode**] **Hot_Standby** and [**NetMonitor_EN**] **On**.

Settings [**Ping_IP1**] to [**Ping_IP12**] are provided in the Hot-standby function for the monitoring of remote devices on the network. When the user sets plural remote IP addresses for the settings [**Ping_IP***], and if the Hot-standby function does not receive a response from any one of these remote devices, the Hot-standby function determines that a communication failure has occurred. Table 10.1-3 shows the network monitoring settings for Hot-standby operation.

Table 10.1-3 Settings network monitoring on Hot-standby

Setting items	Range	Meaning	Default
NetMonitor_EN	Off/On	Enabling switch for monitoring	Off
Ping_IP1 to Ping_IP12	0.0.0.0 to 255.255.255.255	The user can set twelve IP addresses at 12 remote terminals. Value "0.0.0.0" should be set respectively when the remote IP addresses are not provided.	0.0.0.0
Ping_Wait	1–10 (sec)	Waiting time to PING response; if any one of the responses is not received, after the setting time has elapsed, the function will determine that there has been no-response.	1
Ping_Interval	1–120 (sec)	Interval of PING send; a PING packet is sent sequentially in accordance with this setting.	5
Chk_Count	1–10	Number of PING packets for checking; the "no-response "condition is determined when the IED is unable to obtain a number of responses from the same IP address. The user can set the number of responses required to determine the "no-response" condition using the setting [**Chk_Count**].	3

The user should note that the use of network monitoring could increase the burden on the network. This is because a number of PING packets are repeatedly transmitted over the network. Thus, the user should choose the setting values carefully in accordance with the network capacity, the burden, and the required time. Examples 1 and 2 below show the respective results using the network monitoring function with for different settings.

(iii)-1 Example operation 1

There is a remote device on the network with the address Ping_IP1. The Hot-standby function sends ping packets to the remote device every five seconds; then the Hot-standby function waits for one second until the Hot-standby function receives a response signal from the remote device. The Hot-standby function will determine that a communication failure has occurred if two sequential response signals are not received from the remote device. Subsequently, the Hot-Standby function will switch from one port to the other port (See Figure 10.1-2). The following settings are required in this example 1:

- The IP address of the remote device1 is set for setting [**Ping_IP1**]. (the setting of IP addresses in the other remote devices is not required.)
- One second is set for setting [**Ping_Wait**].
- Number "5" is set for [**Ping_Interval**].
- Number "2" is set for [**Check_Count**].

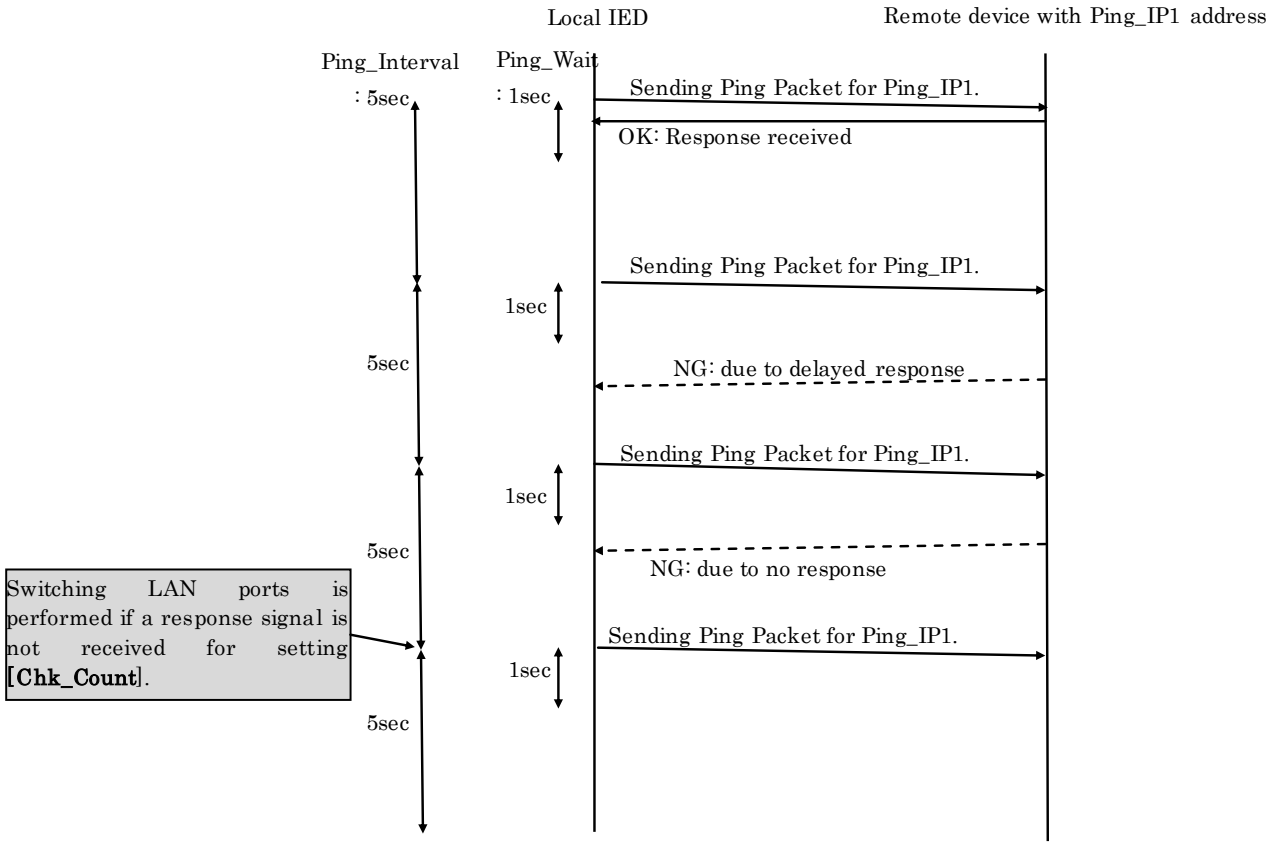


Figure 10.1-2 Time chart for Example 1

(iii)-2 Example operation 2

In Example 2 it is assumed that there are three remote devices on the network: Ping_IP1, Ping_IP2, and Ping_IP3. The Hot-standby function sends a Ping packet to each of the respective remote devices alternately every 10 seconds (i.e., the IED sends ping packets to the same remote device every 30 seconds). Since "1" is set for [**Check_Count**], the Hot-standby function will determine that a communication failure has occurred after 30 seconds if any one of the remote devices is unable to send a response. Figure 10.1-3 shows the operation of the Hot-standby function for Example 2; first switching of the ports is not executed as shown in the figure. This is because a response has not been confirmed from one of the remote addresses. In other words, switching of the ports is only applicable when all responses from all remote devices are not confirmed.

- The IP addresses of the remote devices are set for [**Ping_IP1**] to [**Ping_IP3**]. (Setting IP addresses for other remote devices is not required.)
- 10seconds is set for [**Ping_Wait**].
- Number "5" is set for [**Ping_Interval**].
- Number "1" is set for [**Check_Count**].

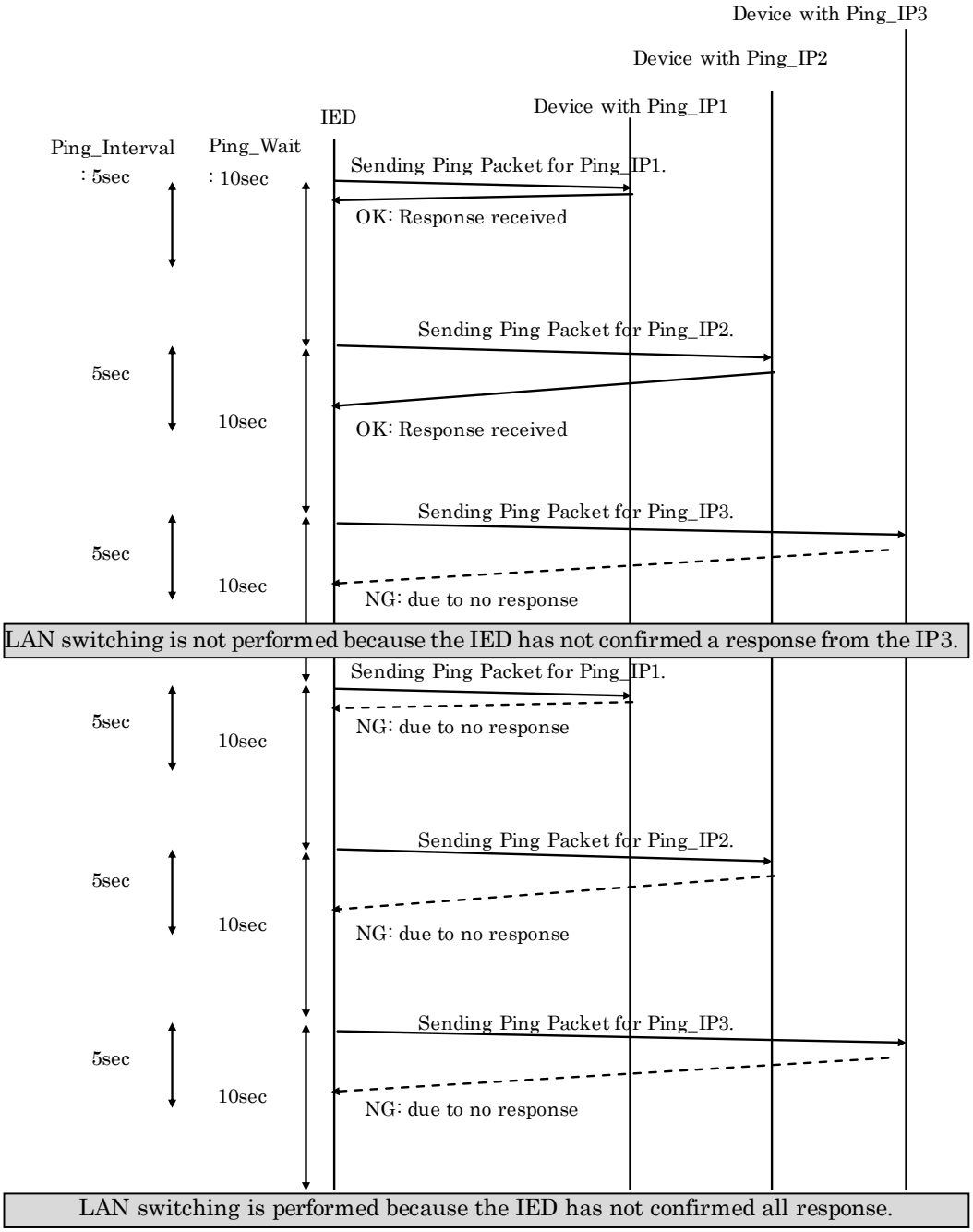


Figure 10.1-3 Time chart for Example 2

10.1.2 Auto reset function

To set the communication protocols† in the IED, the user can write the settings in the IED by transferring the setting-file generated in GR-TIEMS. After the transfer, the IED is required to start up again, but the user can allow the IED restart automatically with Auto reset function, shown in Table 10.1-4. Figure 10.1-4 shows the setting 'Common' under 'Main Menu-Setting-Communication' screens.

Table 10.1-4 Autoreset setting

Setting item	Switch	Feature	Default setting
AUTORESET	None / Cold	Restart function	None

†Note:GOOSE Subscribe, IEC 61850-CID File, IEC61850-Mapping Data, IEC 61870-103, DNP3, Modbus are applied.

None: is used when the user wishes to reset the IED by the hand. For example, the communication settings are written in the IED using the GR-TIEMS, the user should make restart the IED by oneself.

Cold: can allow the IED restart automatically when settings have been written in the IED with the GR-TIEMS. After that, the settings can be applied in the IED. Note that the protection operations are disqualified during the restart.

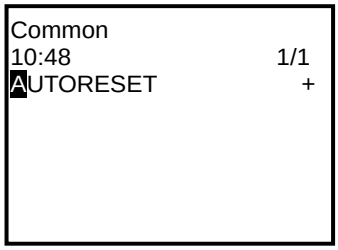


Figure 10.1-4 Setting screen for AUTORESET

Note: The implementation of the feature depends on the selection of both the hardware and the software. Note that the feature is not supplied for the several models; hence, the user has to check the implementation for the model. Locate the ordering number and check it at the "G&T position" referring to the comparison table below. For more information, see *Appendix: Ordering*.

Table 10.1-5 Comparative table in respective ordering numbers

Sec.	Feature	Ordering No. at "G&T"					
		BCU			BCPU		IFU
		11	13	1F	2C	2N	19
–	Main features	✓	✓	NA	NA	✓	✓

✓: Applicable NA: Not applicable

10.1.3 Monitoring LAN communication

(i) LCD screen

The user can examine the statuses about the communion modules by the monitoring function.

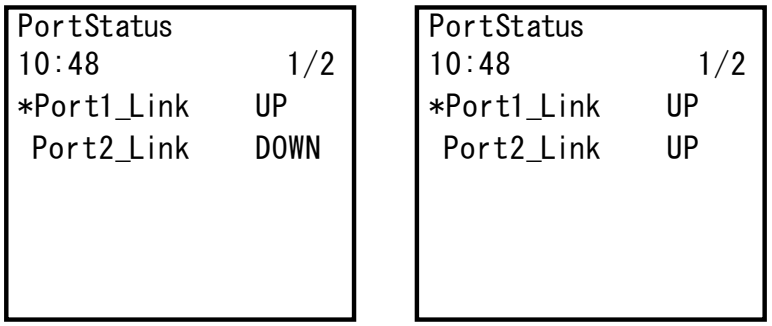


Figure 10.1-5 shows the port status about the modules; terms 'Up' and 'Down' mean running and stopping, respectively. For menus operations, see Chapter *User interface: Monitoring sub-menu*.

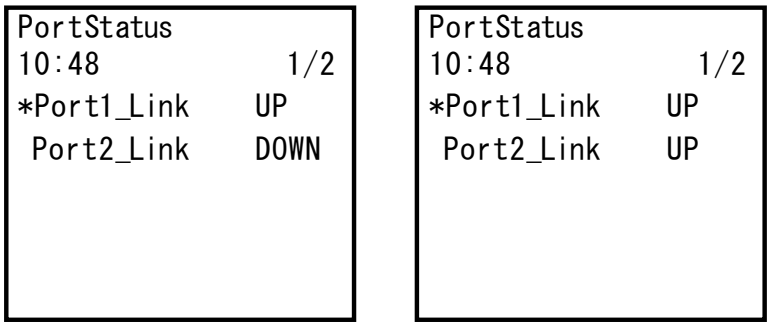


Figure 10.1-5 Communication status

(ii) Status signals for Port1 and Port2

The user can also examine the LAN status using PLC signal monitoring points 'Port1_Link (3100061001)' and 'Port2_Link (3100061001)' of the HOTST function. For example, when the user wishes to monitor the status of the Prot1_Link, use the 'Port1_Link'. Consequently, the user can get the physical information about the port1: the value '1' is issued when the communication is made (Linkup), whereas value '0' is issued when the communication is not made (Linkdown).

When the **Hot_Standby** is set for the setting [**RedundantMode**], the user can find a running port using the PLC signal monitoring point 'Using_CH (3100081001)' of the HOTST function. Value '1' is provided when the Port1 is running, whereas value '2' is provided when the Port2 is running.

10.1.4 Settings

Setting of TCP/IP (Function ID: 230201)

Setting item			Range	Unit s	Contents	Default setting value	Notes
	IP	IPADDRESS1	0 – 255	–	First decimal in IP at local IED	192	
		IP1_2	0 – 255	–	Second decimal in IP at local IED	168	
		IP1_3	0 – 255	–	Third decimal in IP at local IED	1	
		IP1_4	0 – 255	–	Forth decimal in IP at local IED	11	
	SUB NET	SUBNETMASK1	0 – 255	–	First decimal in subnet mask	255	
		SM1_2	0 – 255	–	Second decimal in subnet mask	255	
		SM1_3	0 – 255	–	Third decimal in subnet mask	255	
		SM1_4	0 – 255	–	Fourth decimal in subnet mask	1	
	GATE WAY	GATEWAY1	0 – 255	–	First decimal in gateway	192	
		GW1_2	0 – 255	–	Second decimal in gateway	168	
		GW1_3	0 – 255	–	Third decimal in gateway	1	
		GW1_4	0 – 255	–	Fourth decimal in gateway	1	

Setting of Net_MONITOR(Function ID: 351001)

Setting item			Range	Unit s	Contents	Default setting value	Notes
		NetMonitor_EN	Off / On	–	Enable switch for net monitoring	Off	
	IP1	Ping_IP1	0 – 255	–	First decimal address in IP1	0	
		Ping_IP1_2	0 – 255	–	Second decimal address in IP1	0	
		Ping_IP1_3	0 – 255	–	Third decimal address in IP1	0	
		Ping_IP1_4	0 – 255	–	Fourth decimal address in IP1	0	
	IP2	Ping_IP2	0 – 255	–	First decimal address in IP2	0	
		Ping_IP2_2	0 – 255	–	Second decimal address in IP2	0	
		Ping_IP2_3	0 – 255	–	Third decimal address in IP2	0	
		Ping_IP2_4	0 – 255	–	Fourth decimal address in IP2	0	
	IP3	Ping_IP3	0 – 255	–	First decimal address in IP3	0	
		Ping_IP3_2	0 – 255	–	Second decimal address in IP3	0	
		Ping_IP3_3	0 – 255	–	Third decimal address in IP3	0	
		Ping_IP3_4	0 – 255	–	Fourth decimal address in IP3	0	
	IP4	Ping_IP4	0 – 255	–	First decimal address in IP4	0	
		Ping_IP4_2	0 – 255	–	Second decimal address in IP4	0	
		Ping_IP4_3	0 – 255	–	Third decimal address in IP4	0	
		Ping_IP4_4	0 – 255	–	Fourth decimal address in IP4	0	
	IP5	Ping_IP5	0 – 255	–	First decimal address in IP5	0	
		Ping_IP5_2	0 – 255	–	Second decimal address in IP5	0	
		Ping_IP5_3	0 – 255	–	Third decimal address in IP5	0	
		Ping_IP5_4	0 – 255	–	Fourth decimal address in IP5	0	
	IP6	Ping_IP6	0 – 255	–	First decimal address in IP6	0	
		Ping_IP6_2	0 – 255	–	Second decimal address in IP6	0	
		Ping_IP6_3	0 – 255	–	Third decimal address in IP6	0	
		Ping_IP6_4	0 – 255	–	Fourth decimal address in IP6	0	
	IP7	Ping_IP7	0 – 255	–	First decimal address in IP7	0	
		Ping_IP7_2	0 – 255	–	Second decimal address in IP7	0	
		Ping_IP7_3	0 – 255	–	Third decimal address in IP7	0	
		Ping_IP7_4	0 – 255	–	Fourth decimal address in IP7	0	
		Ping_IP8	0 – 255	–	First decimal address in IP8	0	

Setting of Net_MONITOR(Function ID: 351001)

Setting item			Range	Units	Contents	Default setting value	Notes
	IP8	Ping_IP8_2	0 – 255	–	Second decimal address in IP8	0	
		Ping_IP8_3	0 – 255	–	Third decimal address in IP8	0	
		Ping_IP8_4	0 – 255	–	Fourth decimal address in IP8	0	
	IP9	Ping_IP9	0 – 255	–	First decimal address in IP9	0	
		Ping_IP9_2	0 – 255	–	Second decimal address in IP9	0	
		Ping_IP9_3	0 – 255	–	Third decimal address in IP9	0	
		Ping_IP9_4	0 – 255	–	Fourth decimal address in IP9	0	
	IP10	Ping_IP10	0 – 255	–	First decimal address in IP10	0	
		Ping_IP10_2	0 – 255	–	Second decimal address in IP10	0	
		Ping_IP10_3	0 – 255	–	Third decimal address in IP10	0	
		Ping_IP10_4	0 – 255	–	Fourth decimal address in IP10	0	
	IP11	Ping_IP11	0 – 255	–	First decimal address in IP11	0	
		Ping_IP11_2	0 – 255	–	Second decimal address in IP11	0	
		Ping_IP11_3	0 – 255	–	Third decimal address in IP11	0	
		Ping_IP11_4	0 – 255	–	Fourth decimal address in IP11	0	
	IP12	Ping_IP12	0 – 255	–	First decimal address in IP12	0	
		Ping_IP12_2	0 – 255	–	Second decimal address in IP12	0	
		Ping_IP12_3	0 – 255	–	Third decimal address in IP12	0	
		Ping_IP12_4	0 – 255	–	Fourth decimal address in IP12	0	
	Ping	Ping_Wait	1 – 10	sec	Ping packet waiting time	1	
		Ping_Interval	1 – 120	sec	Ping packet interval time	5	
		Chk_Count	1 – 10	sec	Number of ping check count	3	

Setting of REDLAN(Function ID: 340001)

Setting item		Range	Units	Contents	Default setting value	Notes
	RedundantMode	Fixed / Hot_Standby	–	Selection of Hot-standby	Fixed	

Setting of HOTST(Function ID: 341001)

Setting item		Range	Units	Contents	Default setting value	Notes
	PrimaryPort	None / Port1 /Port2	–	Selection of any one of the actual ports as the primary port	None	
	DownTime	0 – 10000	ms	Determination time for link-down	5	
	UpTime	0 – 10000	ms	Determination time for link-up	5	

Setting of TOOL_COM (Function ID: 201501)

Setting item	Range	Units	Contents	Default setting value	Notes
AUTORESET	None / Cold	–	Auto Restart function	None	

10.1.5 Data ID

◆ Signal monitoring points

TCPIP_DRV (Function ID: 230201)

Element ID	Name	Description
3030021150	GATEWAY1_1	Default gateway octet1
3030021151	GATEWAY1_2	Default gateway octet2
3030021152	GATEWAY1_3	Default gateway octet3
3030021153	GATEWAY1_4	Default gateway octet4
3030001150	IP ADDR1_1	IP address octet1
3030001151	IP ADDR1_2	IP address octet2
3030001152	IP ADDR1_3	IP address octet3
3030001153	IP ADDR1_4	IP address octet4
3010001150	MAC1_OCT1	MAC1 address octet 1
3010001151	MAC1_OCT2	MAC1 address octet 2
3010001152	MAC1_OCT3	MAC1 address octet 3
3010001153	MAC1_OCT4	MAC1 address octet 4
3010001154	MAC1_OCT5	MAC1 address octet 5
3010001155	MAC1_OCT6	MAC1 address octet 6
3011001150	MAC2_OCT1	MAC2 address octet 1
3011001151	MAC2_OCT2	MAC2 address octet 2
3011001152	MAC2_OCT3	MAC2 address octet 3
3011001153	MAC2_OCT4	MAC2 address octet 4
3011001154	MAC2_OCT5	MAC2 address octet 5
3011001155	MAC2_OCT6	MAC2 address octet 6
0012001001	NIC_R_SIG	NIC refreshed signal
0012011001	NIC_R_SIG1H	NIC refreshed signal (1 hour timer)
3110111001	RX1ER_CNT	receive error counter
3110101001	RX1_CNT	receive packet counter
3111111001	RX2ER_CNT	
3111101001	RX2_CNT	
3030011150	SUBNET1_1	Subnetmask octet1
3030011151	SUBNET1_2	Subnetmask octet2
3030011152	SUBNET1_3	Subnetmask octet3
3030011153	SUBNET1_4	Subnetmask octet4
3110211001	TX1ER_CNT	send error counter
3110201001	TX1_CNT	send packet counter
3111211001	TX2ER_CNT	
3111201001	TX2_CNT	

◆ Signal monitoring points

NET_MONITOR (Function ID: 351001)

Element ID	Name	Description
3121001001	NETMONITOR	Change to Network monitoring function
3120001460	Ping_IP1	Decision output of PING1 response w.r.t IP1 address
3120011460	Ping_IP2	Decision output of PING2 response w.r.t IP2 address
3120021460	Ping_IP3	Decision output of PING3 response w.r.t IP3 address
3120031460	Ping_IP4	Decision output of PING4 response w.r.t IP4 address
3120041460	Ping_IP5	Decision output of PING5 response w.r.t IP5 address
3120051460	Ping_IP6	Decision output of PING6 response w.r.t IP6 address
3120061460	Ping_IP7	Decision output of PING7 response w.r.t IP7 address
3120071460	Ping_IP8	Decision output of PING8 response w.r.t IP8 address
3120081460	Ping_IP9	Decision output of PING9 response w.r.t IP9 address
3120091460	Ping_IP10	Decision output of PING10 response w.r.t IP10 address
31200A1460	Ping_IP11	Decision output of PING11 response w.r.t IP11 address
31200B1460	Ping_IP12	Decision output of PING12 response w.r.t IP12 address

◆ Signal monitoring points

HOTST (Function ID: 341001)

Element ID	Name	Description
3100061001	Port1_Link	Port1 Link Status
3100071001	Port2_Link	Port2 Link Status
3100081001	Using_CH	Using channel information

◆ Connection point on PLC logic

HOTST (Function ID: 341001)

Element ID	Name	Description
310000E001	CH1_CH_CHG	Change to CH1 from CH2
310001E001	CH2_CH_CHG	Change to CH2 from CH1

10.2 IEC 61850 communication

Figure 10.2-1 shows a substation automation system (SAS) and a number of IEDs connected via a Ring LAN (100BASE-FX). The IEDs can have communication with other devices using the international standard protocol (IEC 61850 standard‡); additionally, the ring network topology is used to achieve network redundancy in the system. The user should use the GR-TIEMS to configure the protocol in the IEC 61850 standard. That is, the functions for the protection, the measurement, monitoring at local and remote, controlling and logging the data are required to program in the IEC 61850 standard.

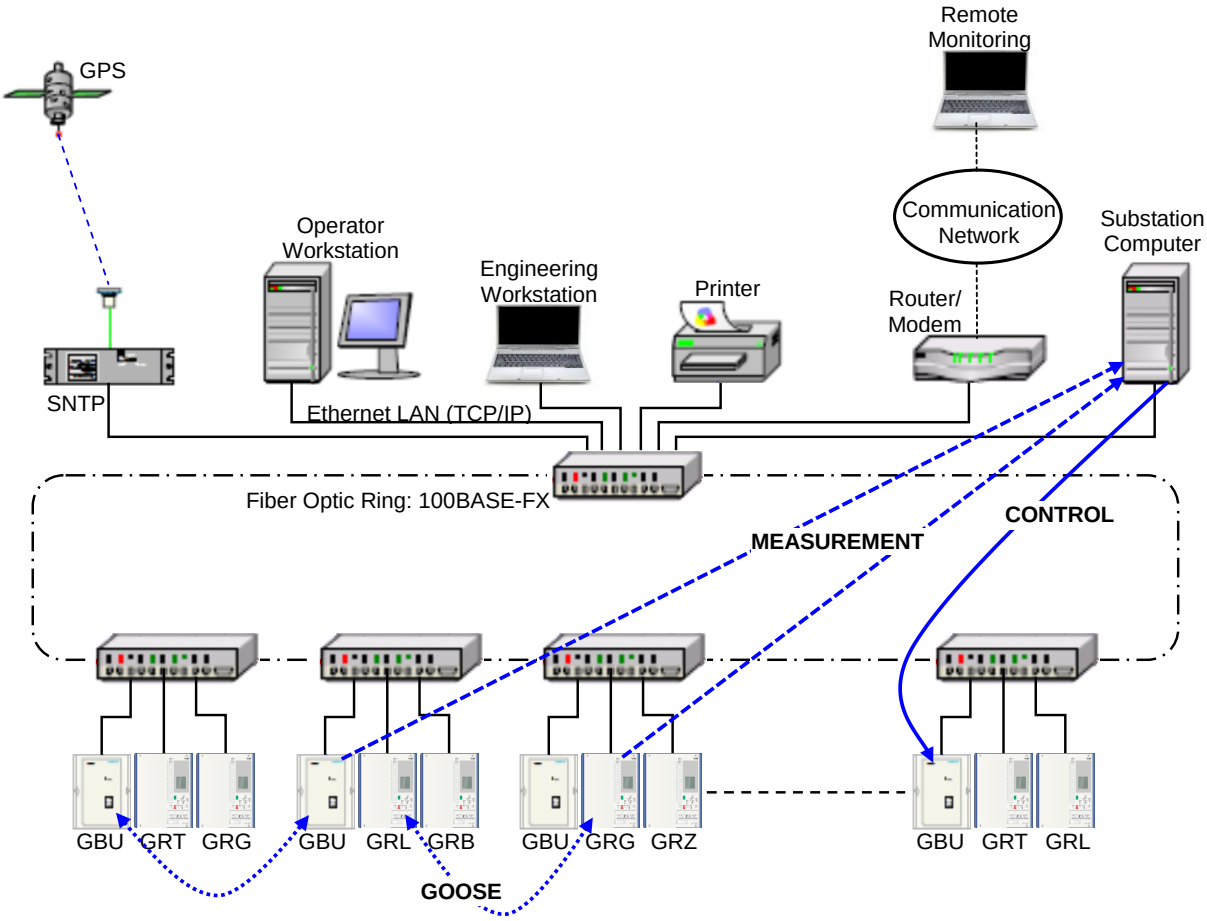


Figure 10.2-1 SAS network using IEC 61850 protocol

†Note: When applying IEC 61850 communications, the user should map application signals with the required logical-nodes (LNs) within the IED. In this manual, we show the application signals as Data IDs; hence, the user is able to connect the Data IDs with the required LNs using the engineering tool (GR-TIEMS) provided by Toshiba. For the GR-TIEMS, see Chapter *Engineering tool*.

‡Note: Before using the IEC 61850 communications feature provided within the IED, the user should verify its IEC 61850 capability by reviewing both the protocol-implementation-conformance-statement (PICS) and the model-implementation-

conformance-statement (MICS). The MICS provides the user with information for the LNs provided within the IED; the PICS provides the user with information to enable the IED to communicate with both SAS and other devices. See *Appendix:IEC61850 MICS, PICS, PIXIT and TICS*. It explains how the user can obtain this information.

When TCP/IP operates, the IEDs can communicate with SAS computer, operator workstation (OWS), engineering workstation (EWS), remote monitoring system, SNTP server. In the SAS, the communication is served with the method of data transfer:

- Report method of sending event messages like measurement, status, alarm and so on
- GOOSE (Generic Object Oriented Substation Event) method of communication between IEDs like interlock
- Control method like controlling the circuit breaker (CB), the disconnector (DS), the selector device (43), the transformer tap (TAP) and so on

10.2.1 About protocol

The IED dynamically generates Logical Nodes, Data sets and control blocks defined in CID file upon boot-up. We shall discuss the configuration procedure to set the data in CID files later.

For the IEC 61850 communication, the IED consists of multiple logical devices and logical nodes. The user should configure the 61850 Data Model to perform a required function for the protection and control.

Modular approach achieves data transfer between devices in the IEC 61850 standard. All function in the IEC 61850 network are grouped into smaller objects called Logical Nodes (LNs), which contains process objects related data and attributes of a logical device protection and control function. Logical Node Zero (LLN0) represents specific information of the logical device. Logical Node Physical Device (LPHD) represents specific information of a physical device. A generic device is called Physical device (PD). The LPHD contains the properties of the PD. A specific function in the IED is represented as domain specific LN. The domain specific LN contains the essential function for target devices in the IEC 61850 network.

LN data model defines the abstract syntax and semantics of the information exchanged between PDs. The relation between data object classes, data types, data attributes and abstract data objects are provided in the LN data model. The LN data model is mapped to Manufacturing Message Specification (MMS) and Generic Object Oriented Substation Event (GOOSE) functions. Table 10.2-1shows the description of LNs.

Table 10.2-1 LN descripion

LN	Description	Actual device corresponding to LN
LLNO	Logical node zero represents logical device specific information	Operation state of BCU State of 43 switch
LPHD	Logical node physical device represents physical device specific information	BCU,BCPU
Domain specific LN	Domain specific LN represents protection relay specific function	XCBR,CSWI
GGIO	Generic input output logical node is used if essential signals are not defined in the extended logical nodes.	Based on client requirements

All LN classes (LLN0 and domain specific LN) receive the mandatory data of the common LN except LPHD. Table 10.2-2 exemplifies Function, Logical node and Communication service used in the IEC 61850 communication.

Table 10.2-2 Function groups in 61850

Functions grouped in 61850	Examples of IED applications to provide protection/control functions for the power system	Logical node defined in 61850	Communication methods serviced in 61850
Monitor	Overvoltage relay (OV)	PTOV	Buffered Report
	Overcurrent relay (OC)	PTOC	Buffered Report
	Trip circuit (TRC)	XCBR	GOOSE
	Generic functions	SIMG	GOOSE
Control	SPOS etc.	CSWI	Enhanced-security Control
Measurement	Measurement	MMXU	Unbuffered Report
	Harmonics	MHAI	Unbuffered Report
Time Synchronization	Simple Network Time Protocol	NA	SNTP

Figure 10.2-2 shows Physical Model, which is equivalent to the IEC 61850 Model. The Physical Model illustrates that both the IED and its functions are communicating with the SAS using the Ethernet. The equivalent IEC 61850 Model represents communication at LNs in both the PD using different Communication services, which we shall discuss in section 10.2.2.

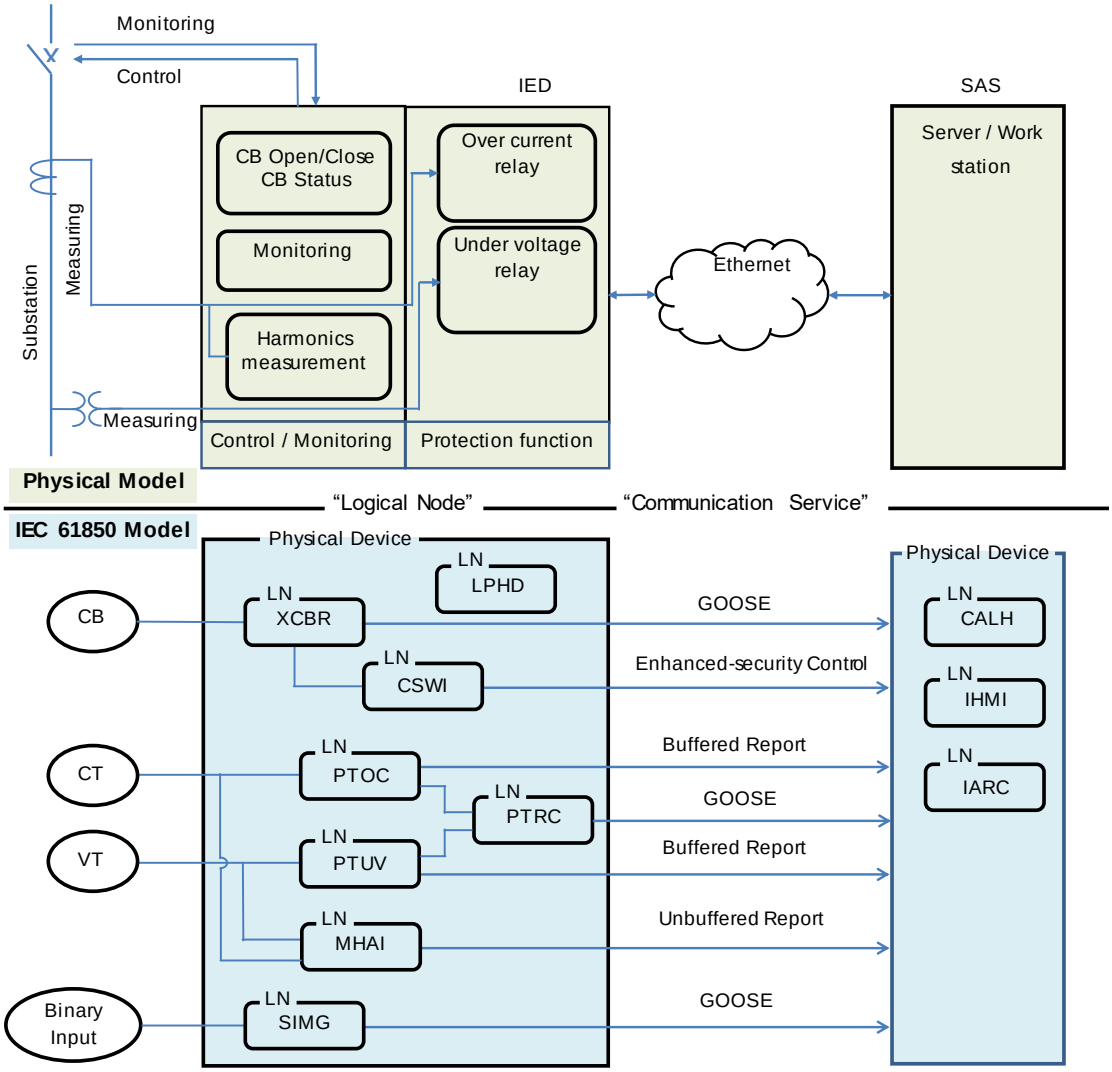


Figure 10.2-2 Example of Physical model and its equivalent IEC 61850 model

10.2.2 Communication service

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All essential data transmission methods are summarized in Abstract communication service interface (ACSI); the IED application from communication stack is separated by the ACSI. The user can map an interface to a communication stack using Specific communication service mapping (SCSM).

The LN contains data list with their attributes based on their functionality in SAS. A data has a well-defined structure and information of SAS. The data and attributes of the LN in a logical device are exchanged by the communication services according to IEC 61850 protocol. The communication services are implemented by SCSM using Ethernet TCP/IP protocol.

(i) Report for SAS

In the IED, 'report' is a method of sending status data, alarm data, measurement data and so on. Using server-client communication, 'Report' is a 'data set' transferred from the IED to the SAS. The 'reports' generated by the predefined 'triggers' are issued regularly in interval; the 'reports' are also generated upon a change in the event. The 'reports' are grouped into two types: (1) Buffered-report-control-block and (2) Unbuffered-report-control-block. Note that the system achieved by the unbuffered-report-service cannot start an event recover function during the communication failure.

(ii) GOOSE for peer-to-peer communication

'Generic Object Oriented Substation Event (GOOSE) ' is a faster method to transfer the data in 'Generic substation event (GSE)' between IEDs. In all IEDs, multicast GOOSE message is published from the 'GOOSE_control_block (GCB)'. The GOOSE communication methods are grouped into two: (1) GOOSE publish and (2) GOOSE subscribe.

The data structures of the GOOSE are illustrated in Table 10.2-3; they are grouped for the system (say, SAS) and other logical devices (say, a relay); they are used in the applications in the SAS and the IED.

Table 10.2-3 Data structures in the GOOSE

Logical Device		
Category	"System"	Other Logical device (e.g., "Relay")
Data Model	System DataSet "GOOSEDS" GGIO1 Ind1..16 LLN0 GoCB The DataSet "GOOSEDS" is fixed LPHD1 GGIO	Relay LLN0 GoCB LPHD1 PTRC ….
Data set	Fixed (Not configurable)	Configurable
Performance	GOOSE data sent communication time is < 3msec	GOOSE data sent, communication time is around 10msec

(iii) System

The data model in the LN named "System" is not allowed to modify (that is, a data model is fixed; other LN data models are configurable to meet the system requirement). Mapping signals to the GGIO1 is required when the GOOSE should send data faster.

(iv) Control mode using GOOSE

In the IED, signals generated on the binary output circuit (BO) can be controlled by the SAS, if the user makes the link between a reviving control message and a control function block that changes the state of the output element. Four control modes are provided:

DOes: Direct control with normal security (direct-operate)
SBOns: SBO control with normal security (operate-once or operate-many)
DOes: Direct control with enhanced security (direct-operate)
SBOes: SBO control with enhanced security (operate-once or operate-many)

(v) Time synchronization using IEC 61850 protocol / SNTP

SNTP (Simple network time protocol) is used to synchronize clocks of all IEDs in SAS. Time synchronization is required to maintain common time across all IEDs in the network. This makes it easier to analyze the Time stamped event data generated by the IEDs in chronological order. In the system, IEDs are synchronized with the device having precision time source (for example, GPS).

(vi) File transfer (COMTRADE)

To send data of the disturbance records, file transfer service is used, which is the operated in COMTRADE format.

(vii) Manufacturing Message Specification (MMS)

MMS is an application layer protocol that provides data transmission between IEDs, which performs monitoring and controlling; it can provide reliability for the data transmission. The MMS operates in the international standardized messaging system that are made of TCP/IP and Ethernet.

(viii) Generic Substation Events (GSE)

GSE is a control model defined in the IEC 61850 standard; it provides a fast and reliable method for transferring the event data over the SAS. The GSE provides facility to transfer the same event message to multiple physical devices using multicast or broadcast service.

10.2.3 How to manage engineering work

An IED can have multiple logical devices, which represents protection and control functions. Each logical device has Logical Nodes (LN), Datasets, Report Control Block (RCB), GOOSE Control Block (GCB), GOOSE Publish and GOOSE Subscribe function. Figure 10.2-3 illustrates the data structure in the IED.

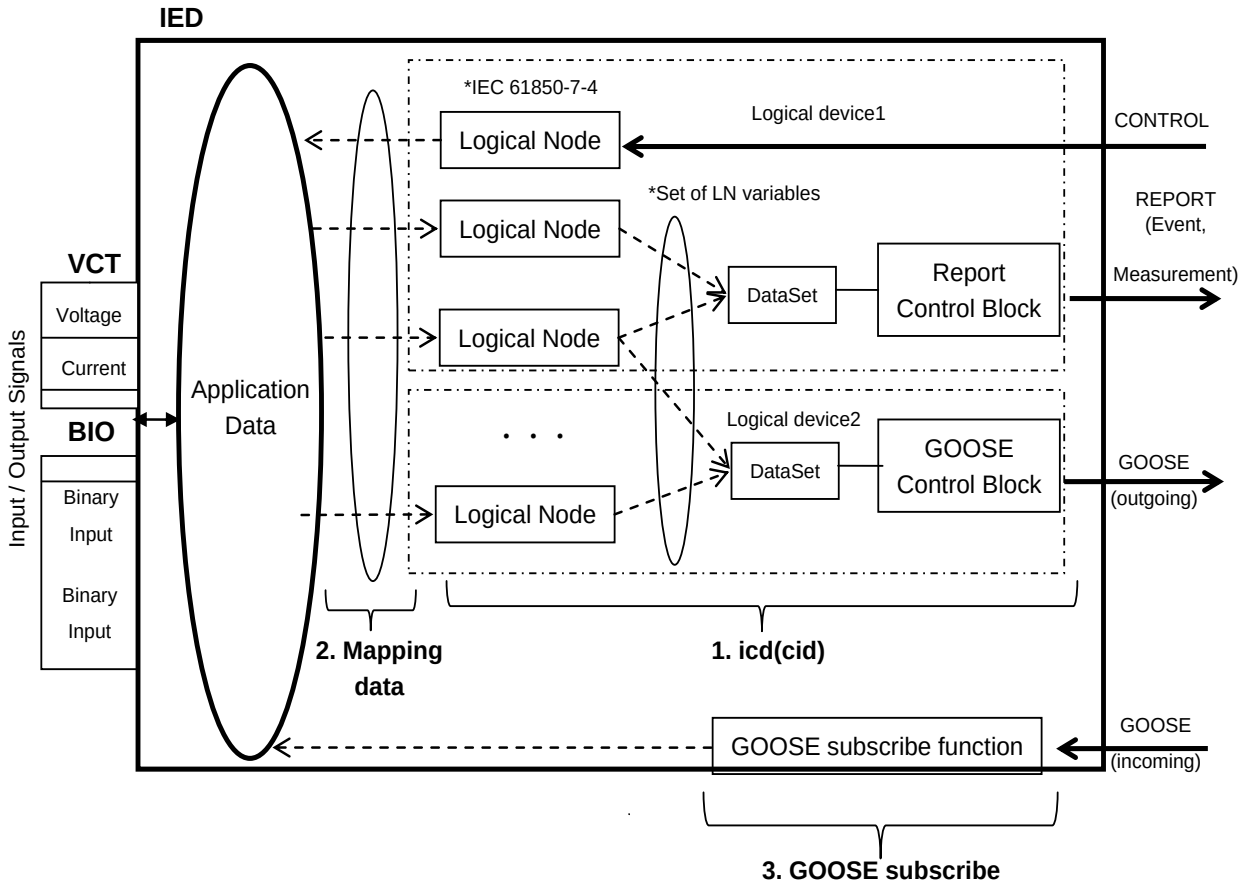


Figure 10.2-3 IED Data Structure

To configure the data structure of an IED, the user needs to edit the following items using the GR-TIEMS. Figure 10.2-4 shows the flow diagram for IEC 61850 configuration using GR-TIEMS.

- Edit Signal mapping
- Edit Logical Node
- Edit DataSet
- Edit Report Control Block
- Edit GOOSE Control Block
- Edit GOOSE Publish
- Edit GOOSE Subscribe
- Edit Control function

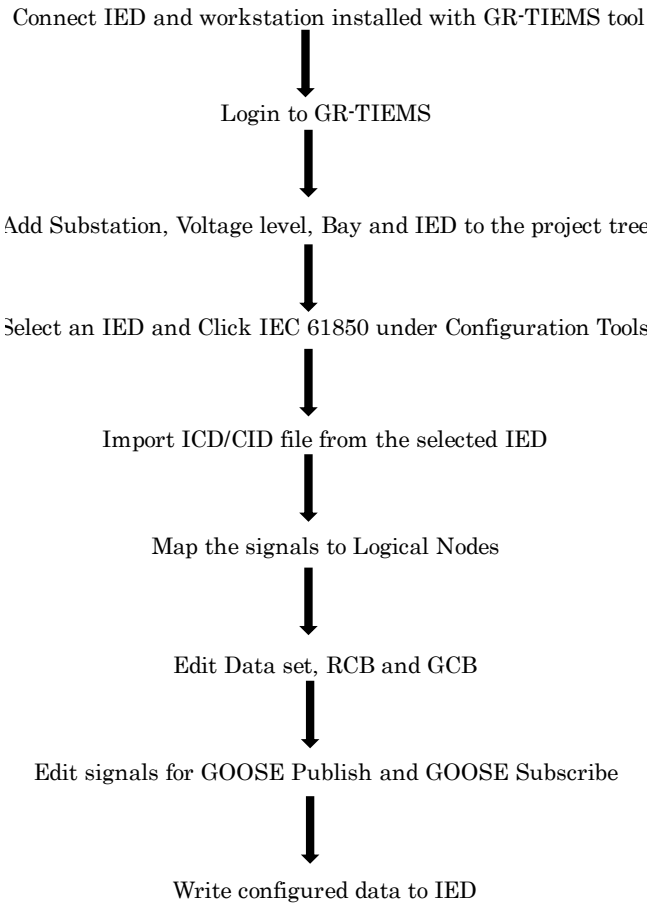


Figure 10.2-4 Flow diagram

(i) Creating and opening project

In the operation of the GR-TIEMS, the user can find an existing project or create a new project. Figure 10.2-5 shows the 'File Menu', where the user can open an existing project or create a new project.

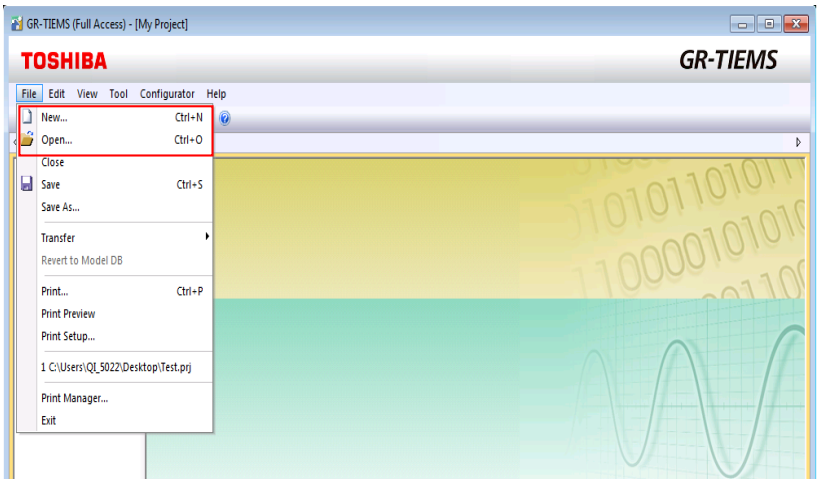


Figure 10.2-5 File menu

Once the project is created, the user can add IEDs in the project tree structure as shown in Figure 10.2-6.

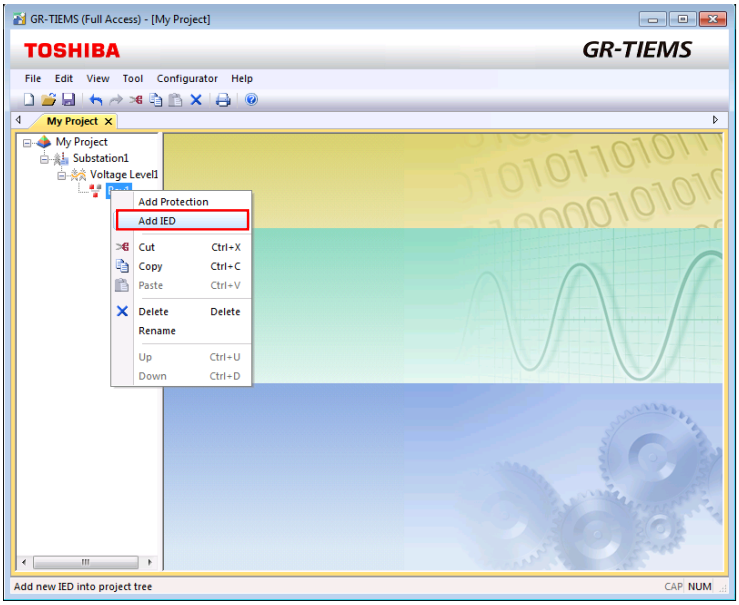


Figure 10.2-6 Adding IED

Select the IED in the project tree structure and **Click** IEC 61850 under Configuration Tools as shown in Figure 10.2-7.

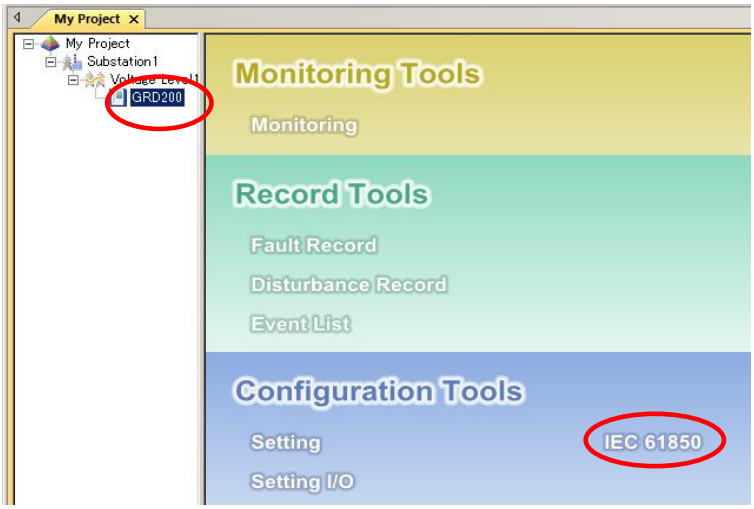


Figure 10.2-7 GR-TIEMS main screen

Click 'IEC 61850', then check to see that four engineering screens are appeared:

- Logical Node Screen
- Signal List Screen
- GOOSE Publish Screen
- GOOSE Subscribe Screen

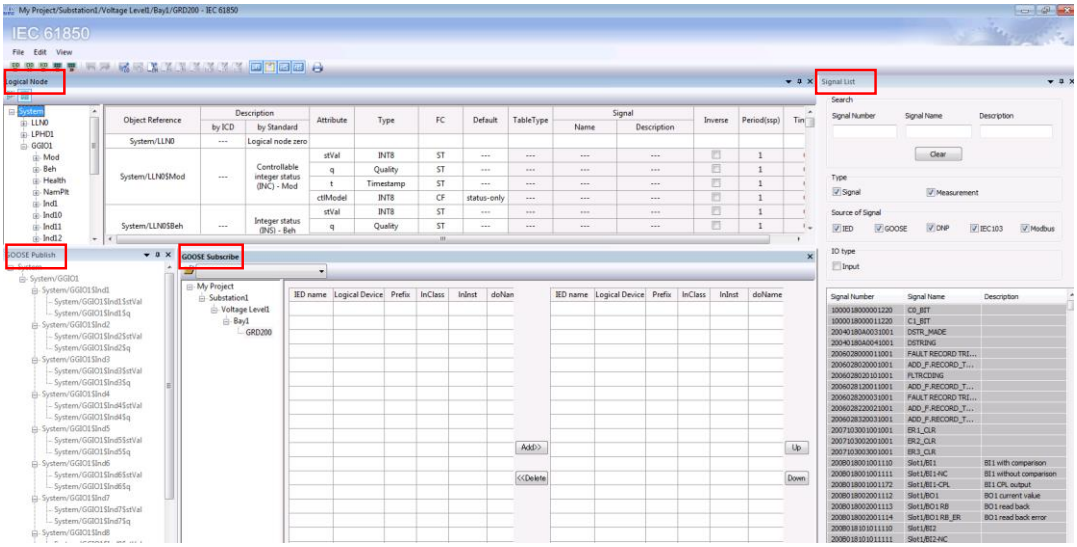


Figure 10.2-8 IEC 61850 Main screen

(ii) IEC 61850 configuration files

Substation configuration language (SCL) files are generated by the configuration in the IEC 61850 protocol. The SCL files are used to exchange the configuration data in different manufacture tools. Two types of files are used for exchanging data in Table 10.2-4.

Table 10.2-4 Types of SCL files

SCL file	Description
.ICD IED Capability Description	This file describes the capabilities of an IED. It contains the communication data and function of LN in an IED.
.CID Configured IED Description	Every device configured for IEC 61850 in the GR-TIEMS tool generates a CID file. This file is then written to the IED. This file contains configuration information of the IED to which it is connected.

(ii)-1 Exporting and Importing CID/ICD file

The user can export or / import a CID/ICD file as a CSV file. The user can edit the exported CSV file using the MS-EXCEL®; the user can import the edited CSV file back to the GR-TIEMS. Figure 10.2-9 shows the options available to import/export CID/ICD file. The user can either click the icons on the menu bar or select the required option form the File menu drop down list.

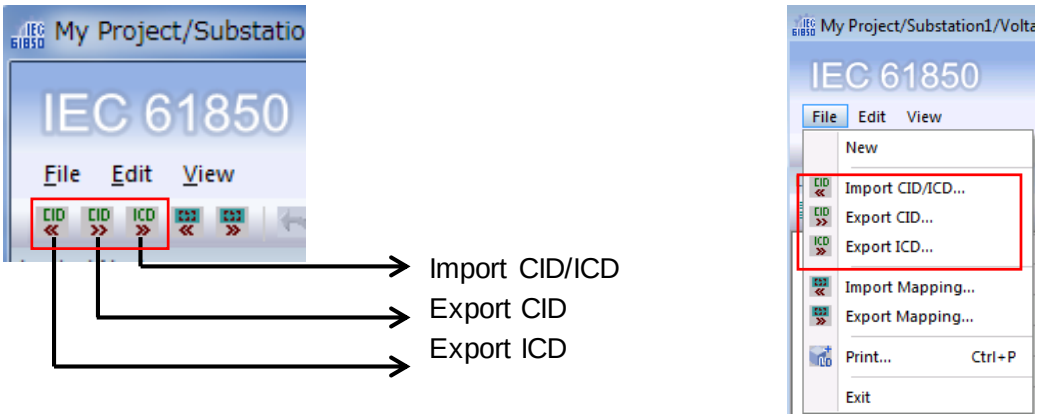


Figure 10.2-9 Export / Import of CID / ICD file

(ii)-2 Manage third party CID file

The GR-TIEMS can have third party CID file. In the project tree of the GR-TIEMS, the user can use the device information for creating a third Party IED. To configure dataset, RCB, GCB, GOOSE publish and GOOSE subscribe settings and so on, the data attributes are used after the creation of the data.

(ii)-3 Mapping application data in IEC 61850

For any IED, the IEC61850 configuration* is available by default. The user

should check whether the required signals are mapped in the default configuration.

*Note: There is no default configuration for GOOSE subscription. If GOOSE subscribe function is required, then a new configuration has to be done.

To verify the signals configured for the IEC 61850 protocol, the user should check the mapped data, Dataset or Report Control list. If they have existed, the signals in the signal list should be matched with the attributes of LNs.

Figure 10.2-10 shows an example to check if the signals are mapped in default configuration. For example, to check for mapping of the primary element signal in earth fault protection (EF1), follow the steps below:

1. To check if the EF1 signal is already mapped in the LN, key 'EF1' under Signal Name in the Signal List screen.

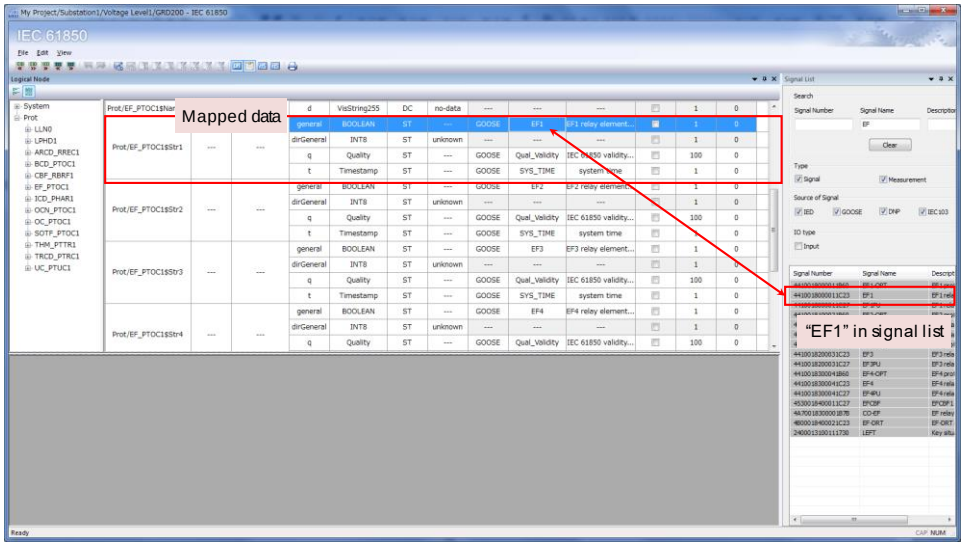


Figure 10.2-10 Signal mapping

As shown in the above figure, the "EF1" signal is already mapped to LN attribute Prot/EF_PTOC1$Str1, general.

2. To check if "Prot/EF_PTOC1$Str1, general" is already added in Dataset. **Right click** on "LLN0" and select Edit DataSet, then DataSet List screen appears as shown in Figure 10.2-11.

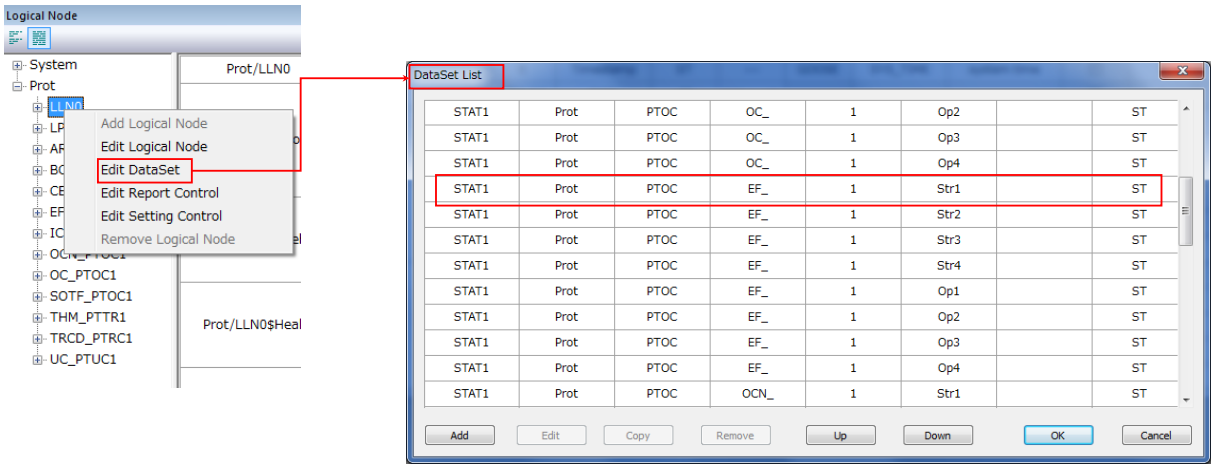


Figure 10.2-11 DataSet list

As shown in the above figure, "Prot/EF_PTOC1$Str1, general" is already mapped in the Dataset "STAT1".

3. To check, if the DataSet is already assigned to RCB, **Right click** on "LLN0" and select Edit Report Control, then Report Control List screen appears as shown in Figure 10.2-12.

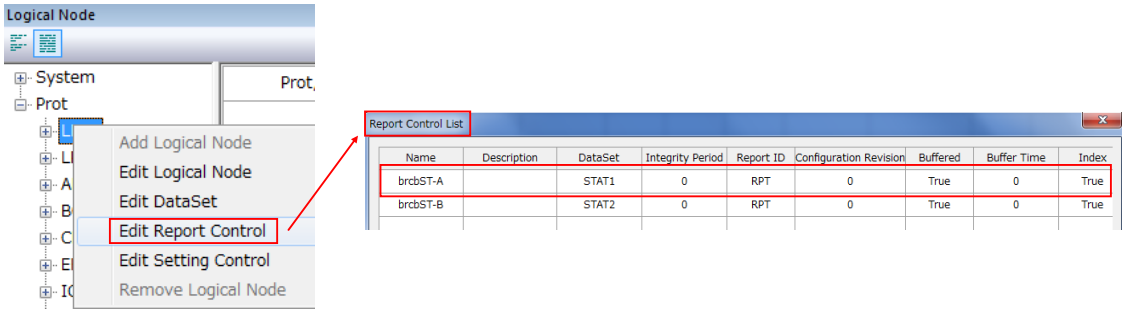


Figure 10.2-12 Report Control List

As shown in the above figure, the DataSet "STAT1" is already assigned to RCB "brcbST-A".

(iii) Mapping signals in signal list to Logical Nodes

The user can add or modify signal mapping to the LN variable. The following section describes how to modify the mapped data if the user wants to add signals, which are sent using Report or GOOSE.

(iii)-1 Edit Mapping Data

1. Search the signal to be sent from the Signal List window as shown in Figure 10.2-13.
2. Drag and Drop the selected signal to the logical node variable.

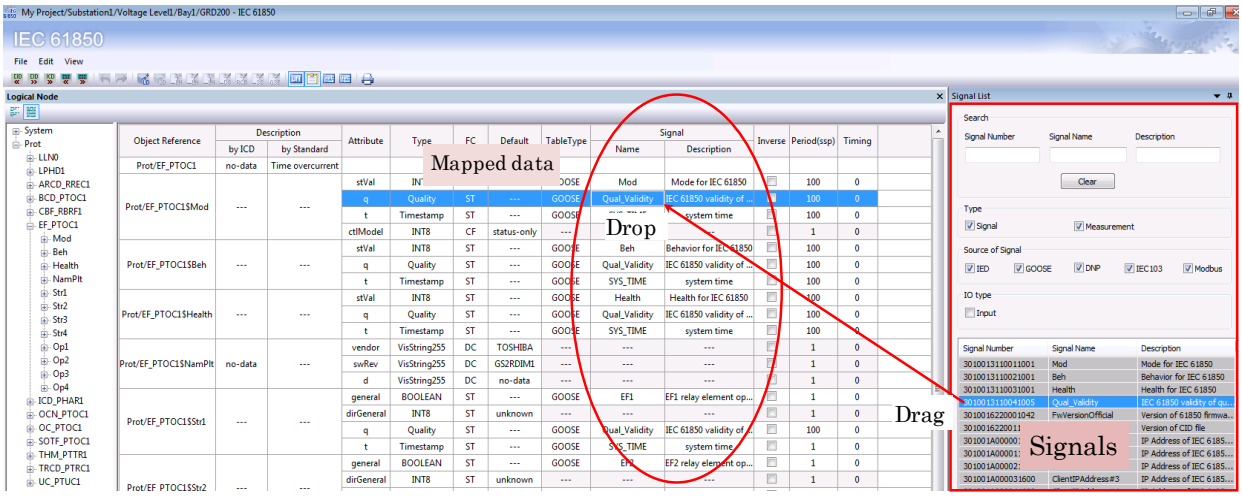


Figure 10.2-13 Signal mapping

Note: To optimize the performance of the IED, “Period” should be 100 if the signal is not required to be sent immediately.

“301001 3110041005 (Qual_Validity)” should be mapped to “q” with Period=100.

“200301 9010001006 (SYS_TIME)” should be mapped to “t”.

(iii)-2 Export / Import Mapping Data

The user can export mapped data in the CSV file; the user can edit the exported CSV file by the MS-Excel® and import back into the GR-TIEMS. Figure 10.2-14 shows the export / import options.

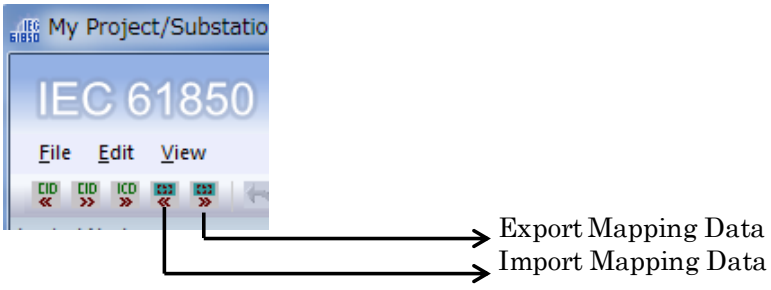


Figure 10.2-14 Export / Import mapping data

(iii)-3 Edit Logical Node

If the required LN or variable is not available in the IED, the user should follow the steps below to add or modify the Logical Node:

1. To add new LN or to edit the variable of an existing LN, **Right click** Prot and select Add Logical Node or select Edit Logical Node.
2. In the Edit Logical Node screen, select LN Class, Prefix and LN Instance and check the required variable check boxes as shown in Figure 10.2-15 below.

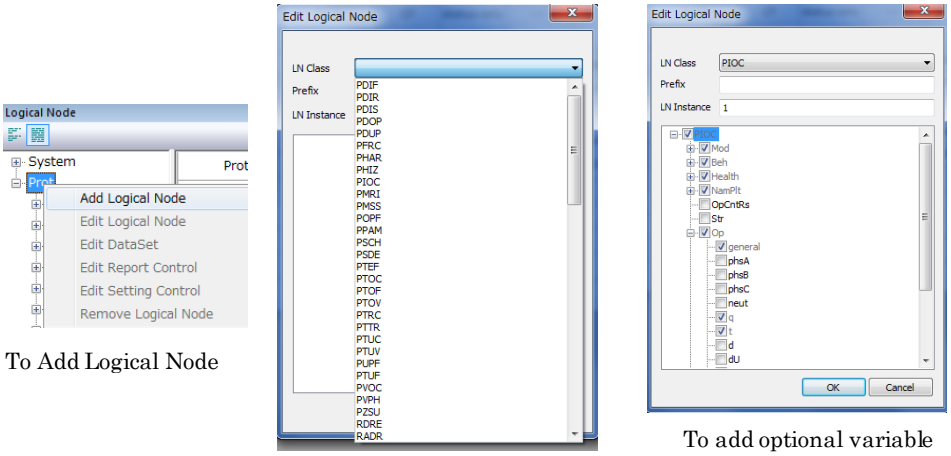


Figure 10.2-15 Add or Edit Logical Node

*Note: Refer to IEC 61850-7-4 to choose a proper Logical Node.

(iii)-4 Edit DataSet

Dataset can be edited or a new dataset can be added for the LNs as shown in Figure 10.2-16. For editing the DataSet, follow the steps below:

1. Right **click** LLNO and select Edit DataSet, DataSet List window appears as shown in Figure 10.2-16.
2. Choose the variables to be added to the DataSet and **click** OK.

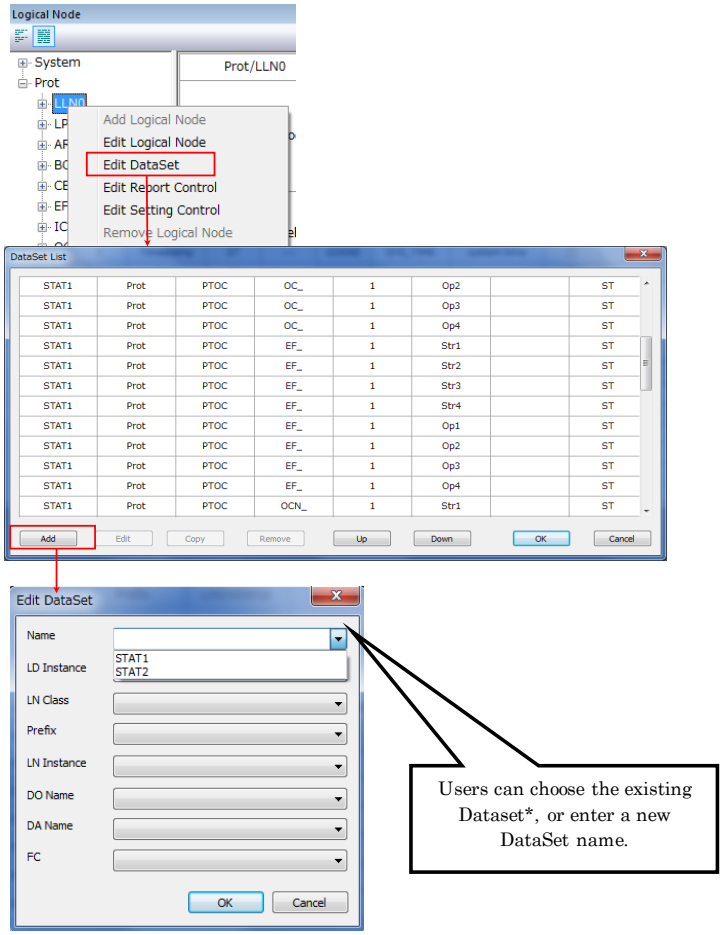


Figure 10.2-16 Edit DataSet screen

*Note: 100 DataSets can be added in the DataSet List and each DataSet can have maximum of 32 elements.

(iii)-5 Edit Report Control Block (RCB)

Report Control Block (RCB) is used to send report from IEDs to client. If the user wishes to assign the DataSet to Report Control Block, follow the steps below:

1. Under the LN tree structure, select Prot, **Right click** LLN0 and select Edit Report Control. Report Control List screen appears as shown in Figure 10.2-17.
2. **Click** Add or Edit to add a new dataset or to edit the existing dataset in the Report Control List window as shown in Figure 10.2-17.

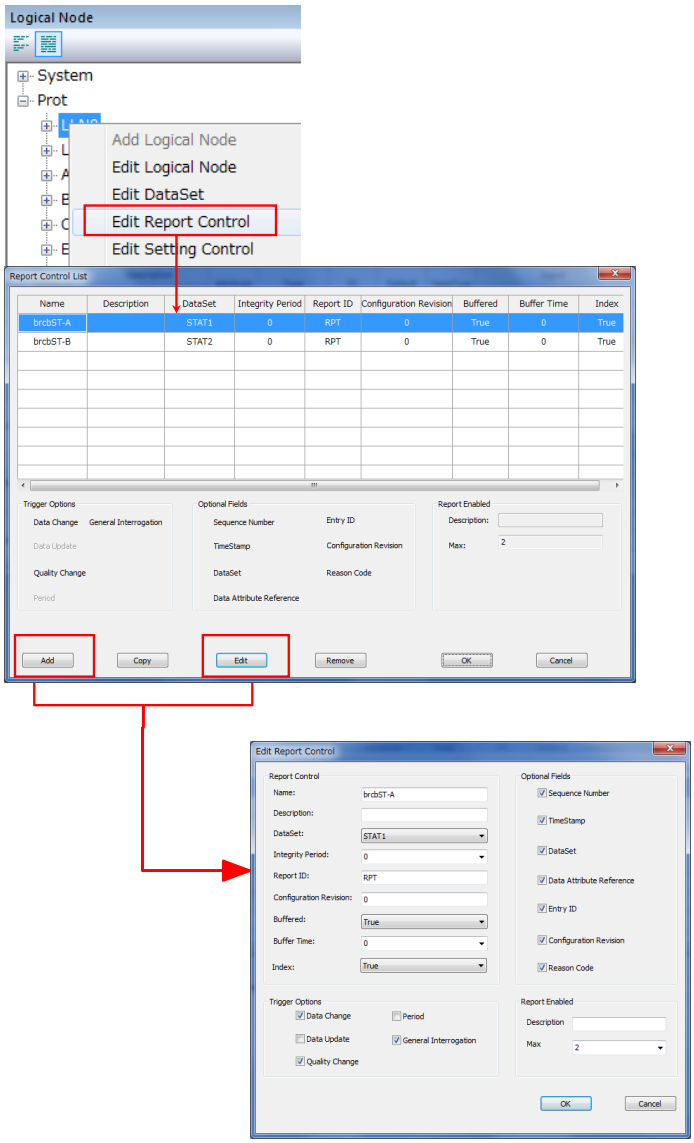


Figure 10.2-17 Edit Report Control screen

(iii)-6 Edit GOOSE Control Block

GOOSE control block is used to exchange information between IEDs. GOOSE messages are used for interlock operation between IEDs in order to protect the electrical system. GGIO1 is used for sending high-speed GOOSE messages. The DataID assigned to GGIO1 is sent within 3ms.

If the user wishes to assign the DataID for GOOSE operation, follow the steps below:

1. **Click** GGIO1 and select Ind1 as shown in Figure 10.2-18.
2. **Drag** and **Drop** the required signals to be sent by GOOSE.

Note: The user can assign any signal to GGIO1->Ind1~16 for high-speed GOOSE, as required.

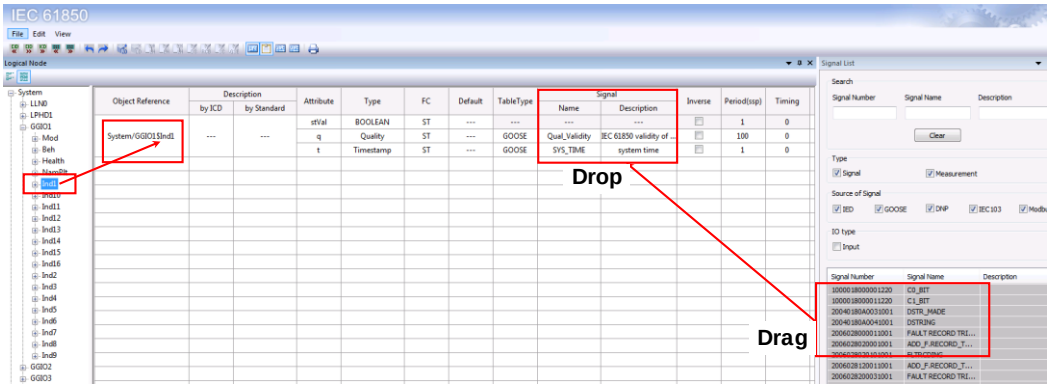


Figure 10.2-18 Signal mapping for high speed GOOSE

As shown in the above figure, signals are assigned to “System/GGIO1$Ind1”. The user can assign signals to other GGIOs (for example, GGIO2, GGIO3 and so on) which are not meant for high-speed GOOSE operation.

(iii)-7 Edit GOOSE Publish

The signals assigned to GGIO1 variables are published automatically by default. The GGIO1 data set is fixed and is pre-configured in GOOSE Publish screen. If the user assign signals to other GGIO variables (for example, GGIO2, GGIO3) for GOOSE publish operation, then the user needs to add those variables in the GOOSE Publish screen.

Figure 10.2-19 shows the GOOSE Publish screen, where "System" is fixed and is not configurable for GGIO1, whereas "Ctrl" (Control) and "Prot" (Protection) are configurable. The user can add new variables from the "Logical Node" screen to the GOOSE Publish screen using drag & drop* method. Figure 10.2-19 shows an example for GOOSE Publish, where "System/GGIO2$Ind1$stVal" is added to the GOOSE Publish screen.

*Note: Only "stVal" and "q" variables can be added to GOOSE Publish screen.

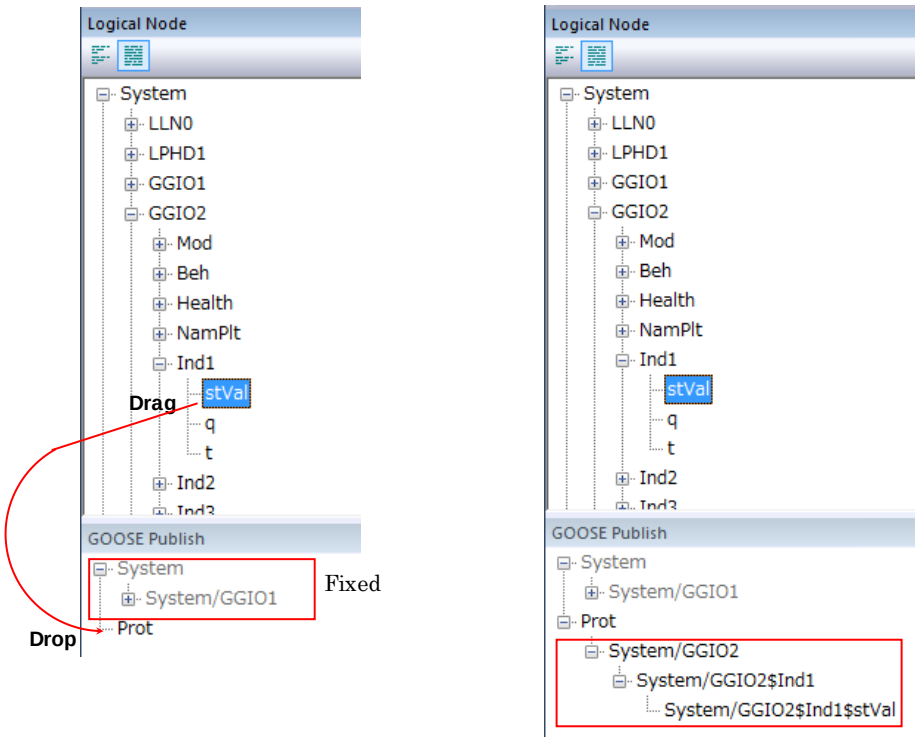


Figure 10.2-19 GOOSE Publish

(iii)-8 Edit GOOSE subscribe

GOOSE subscribe function is configured to receive GOOSE messages published by other IEDs. Figure 10.2-20 exemplifies the GOOSE Subscribe screen; the user can select the necessary signals to be added. For example, "Bay1 GBU200" is the current IED; "Bay2 GRZ200" is the other IED. "List 1" is GOOSE publisher of GRZ200; "List 2" is GOOSE subscriber for GBU200. The user can select the GOOSE publisher from GRZ200 and add to the GOOSE subscriber of GBU200.

In the example shown below, select the required variable and **click** Add. Similarly, the user can delete the variables.

When the user adds a signal to the GOOSE subscribe list from the other IED, then the same signal is automatically added in the Signal List of the current IED.

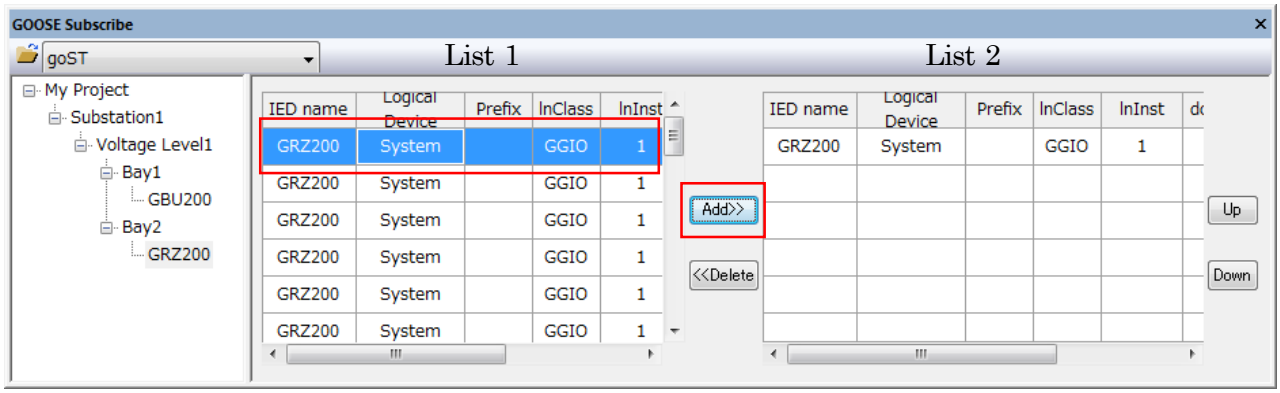


Figure 10.2-20 GOOSE Subscribe

Note: The user can monitor about the GOOSE message on the LCD screen. See sec. 10.2.7.

(iii)-9 Edit Control function

The Data IDs (i.e., Signal Number) starting with "5" is used for control function when the IED has the control function by default. The user should check whether the required signals are mapped in the default configuration. The user can edit and add the control signals to the LN as described in section 10.2.3(iii).

In an IED, usually an output Data ID of a protection function is assigned to LN variable. However, for the control application, the IED is capable of receiving command from the SAS server. To control a device (such as a circuit breaker), the input point* (Data ID) in the control application should be configured to receive commands from the SAS sever (that is, selecting, operating or cancel command).

For example, to let a device execute “Select”, “Operate” and “Cancel” commands from the sever through “CSWI4” and transmit the information to an IED, the user should map an input point (Data ID) to several variables of “CSWI4” (See Figure 10.2-21). Mapping period for Control shall be 100.

*Note: For more information of the input points, see chapter *General control function or Control and monitoring application*, if available.

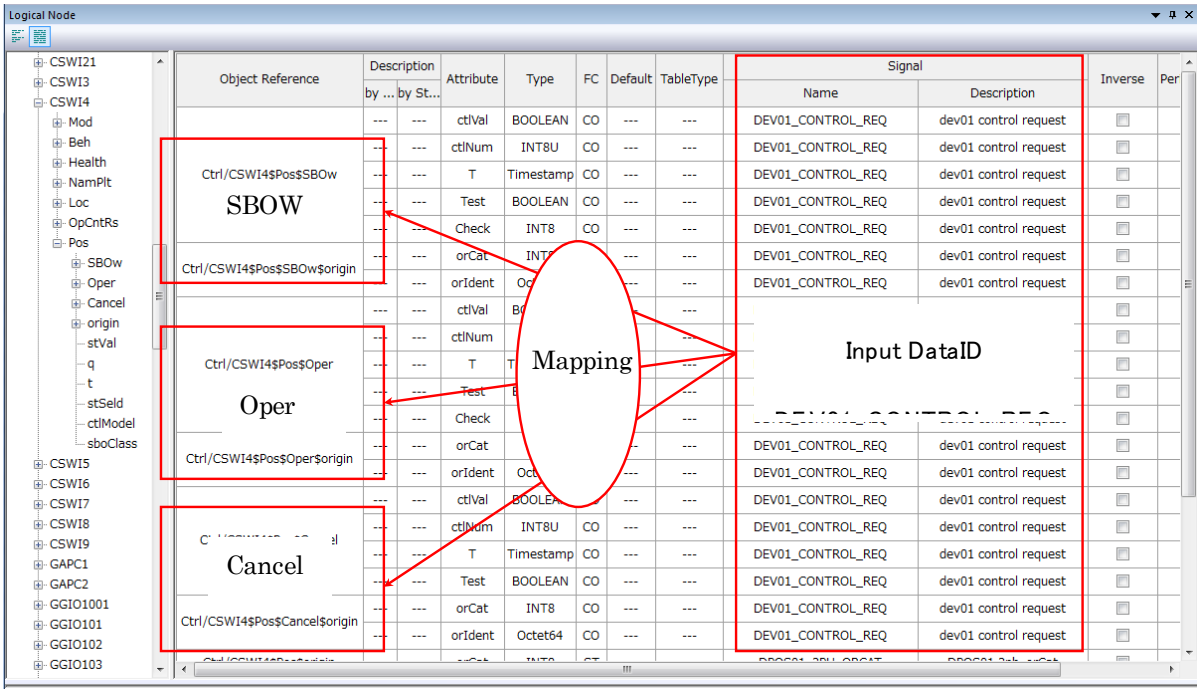


Figure 10.2-21 Control function mapping

To complete the setting for control function, after mapping data, the user needs to set BI, BO† in the GR-TIEMS ->Setting.

†Note:For more information for the BI, BO, see Chapter *Technical description: Binary IO module*.

(iv) Writing the configuration file to IED

After completing the IEC 61850 configuration, follow the steps below to download the CID file for the IED.

1. Save the project.
2. Right click on the required IED and select Write to IED.
3. Configure the parameters in the Connection Method window to connect the IED (If needed).
4. Select the writing items (IEC 61850-CID File and IEC 61850-Mapping Data) to be written into the IED and click Write to download the IEC 61850 configuration. If GOOSE subscribe operation is required, then select writing items Signal List and GOOSE Subscribe before clicking Write.

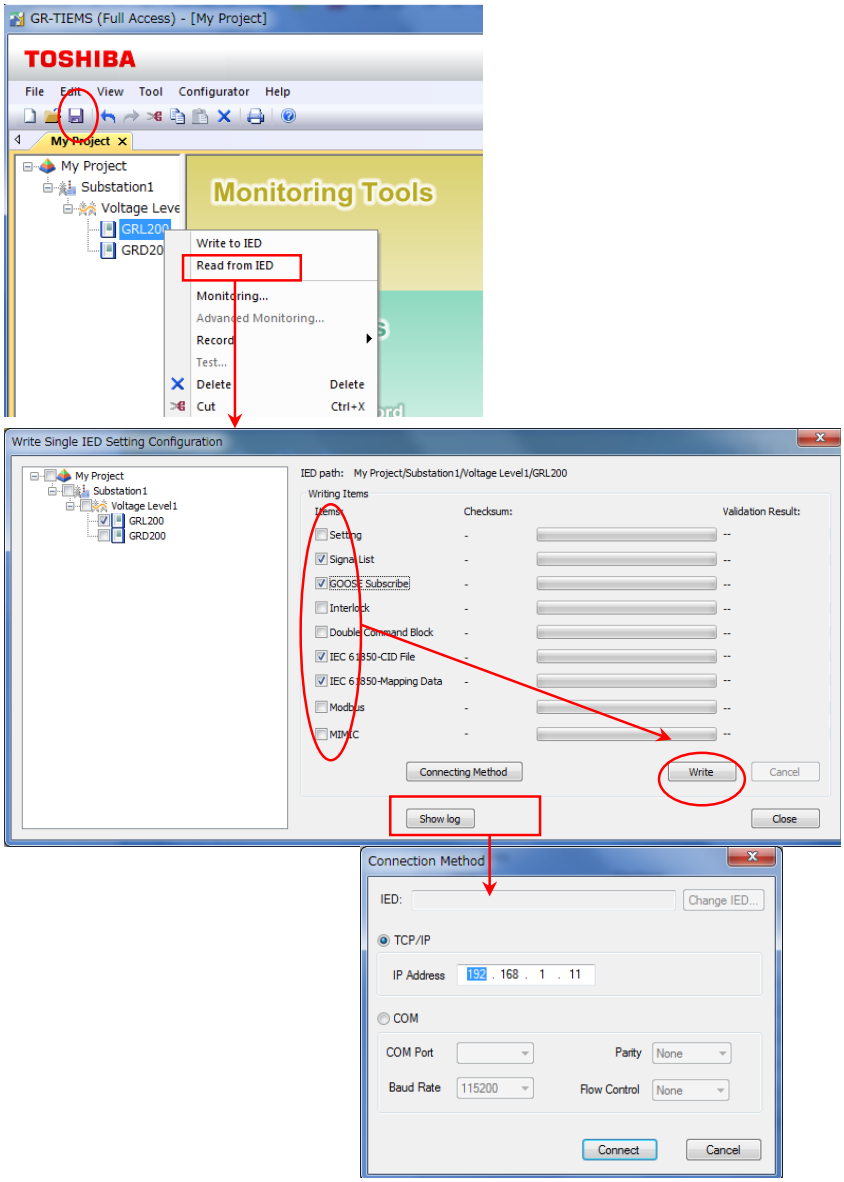


Figure 10.2-22 Write to IED

10.2.4 Setting for IED

(i) Setting time for re-sending GOOSE subscribe information

The user can configure the maximum duration time for the case when the IED fails to re-send GOOSE subscribe information. Set the time in seconds using setting [**GOINT**].

(ii) Setting for 61850 authentication

When the IED is to be authenticated for starting the IEC 61850 communications, the user should set scheme switch [**850AUT**] **On**.

(iii) Blocking 61850 communication

If the user does not want the IED to start the IEC 61850 communications, the user should set scheme switch [**850BLK**] **On**.

(iv) Setting 'keep-alive' time for TCP

When applying IEC 61850 communications with TCP/IP, the user should set a time for the 'keep-alive' signal. The user should set the time in seconds using the setting [**850KEEPALIVE**].

(v) Setting 'CommTerm'

If the user wishes to receive a 'CommTerm' signal carrying an actual operation time from a device outside the IED, the user should set scheme switch [**TCMD**] **On**. Note that the 'CommTerm' signal† will not conform to the IEC 61850 standard when the user turns on this function. That is, this function can be availed on the server communication provided by TOSHIBA.

†Note: For example, Figure 10.2-23 shows the signal flow between a substation computer (SC), an IED and a target device (e.g. CB). If the requirement is to close the CB on request of the SC, the SC will send the operation command "Operate" to the IED; the time information (T) is also sent along with the operation command. When receiving the operation command and observing that the CB has closed, the IED will send a response signal "CommTerm" to the SC along with the time information. However, this time information is not the actual operation time of the CB, but the same time information originally sent with the operation command. The IEC 61850 standard defines this rule; hence, general operations in the IEC 61850 standard are subject to this rule. However, the server communication provided by Toshiba is able to accept the actual operation time; hence, the setting 'CommTerm' is required in the Toshiba communication. The user should also note that **Off** is set for the scheme switch [**TCMD**] as the default setting.

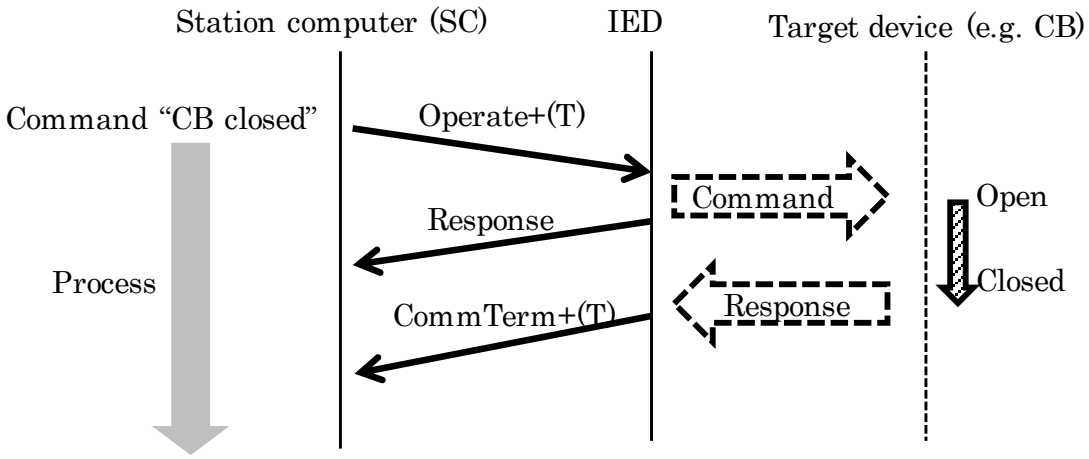


Figure 10.2-23 Example of CB operation flow

(vi) Setting test mode

With regard to the reception test for GOOSE subscribe information, the user can simulate a bad condition passively by using both GOSNDBLK and GOSUBBLK functions†.

(vi)-1 GOOSE sending block (GOSNDBLK)

For the test using the GOOSE sending block function (GOSNDBLK), the user can disable the IED so that it does not send the GOOSE message. The GOSNDBLK function is useful when there is a conflict in the communication with another active IED on sending a GOOSE signal. To block the sending of the GOOSE message, the user should set **On** for scheme switch [**GOSNDBLK**].

(vi)-2 GOOSE receive block (GOSUBBLK)

Suppose the user wishes to simulate a bad reception condition with regard to the GOOSE signal, the user can apply a setting that will prevent an IED from receiving the GOOSE message from another IED using this test. The user can perform this test using the test setting **On** for scheme switch [**GOSUBBLK**]. Consequently, the IED rejects the GOOSE messages from other IEDs. The GOOSE receive block function (GOSUBBLK) is also useful for the validation of switchgear interlocking determination.

†Note: The user may wish to perform bad reception tests from a remote terminal using the GOSNDBLK function. However, carrying out the GOSNDBLK function at a remote terminal may influence the overall operation of other IEDs, because communication packets will not be received from the remote terminal. In order to avoid the influence, we recommend the user to test bad receptions for a particular IED using the GOSUBBLK function. As a result, testing will only affect the particular IED under test i.e. all other terminals will not be influenced by the

tests.

10.2.5 How to supervise in 61850 communications

The IED can monitor the status of the IEC 61850 communications. Discussions on IEC 61850 communications status monitoring are provided separately. (See Chapter *Automatic supervision*)

10.2.6 Quality signal in 61850 communication

The IED can send the quality signal of the IEC 61850 communications. Table 10.2-5 shows the structure of the quality signal; a value is set for the 'Validity' bits in accordance with 'Error level' in the IED†. 'Test mode' bit is set when the IED is set for the test operation‡.

Table 10.2-5 Quality signal in the IEC 61850-7-3

Bit(s)	Definitions in the IEC 61850 7-3		Value	Definitions in the IED
	Attribute Name	Attribute Value		
0-1	Validity	Good	00	No error(Level0)†
		Invalid	01	Serious Error, Serious Error(Comm.) (Level1 and Level2)†
		Reserved	10	Not applicable
		questionable	11	Minor Error, Alarm, Warning (Level3, Level4, Level5)†
2	Overflow	–	–	*Not applicable (Default '0' setting)*
3	OutofRange	–	–	*Not applicable (Default '0' setting)*
4	BadReference	–	–	*Not applicable (Default '0' setting)*
5	Oscillatory	–	–	*Not applicable (Default '0' setting)*
6	Failure	–	–	*Not applicable (Default '0' setting)*
7	Olddata	–	–	*Not applicable (Default '0' setting)*
8	Inconsistent	–	–	*Not applicable (Default '0' setting)*
9	Inaccurate	–	–	*Not applicable (Default '0' setting)*
10	Source	Process	0	*'0' setting, unconditionally*
		Substituted	1	*Not used*
11	Test	–	0	Operation in 'Test mode'
			1	Normal operation
12	OperatorBlocked	–	0	*'0' setting, unconditionally*

†Note: For more information about the meanings about the error levels, see Chapter *Automatic supervision: Outline of automatic supervision*.

‡Note: The user can change the IED the test mode by the screen operation. See Chapter *User interface: Test sub-menu* and Chapter *Commissioning and Maintenance*.

10.2.7 Goose monitoring status in 61850 communication

IEDs are able to monitor the communication using GOOSE packets, which other IEDs have sent their information via the network. If the IED can receive the GOOSE packets, the IED can display them on the information list. Figure 10.2-24 illustrates an example of the GOOSE monitoring list; it shows all IEDs have reported good status (OK) message, except one IED.

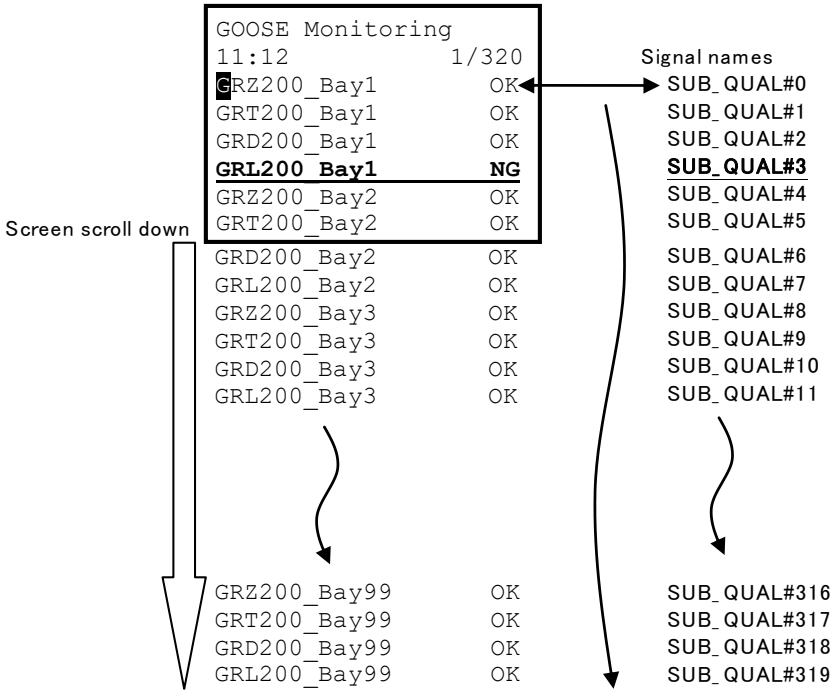


Figure 10.2-24 Screen example of GOOSE Monitoring

Note: The IED shall be managed with own subscription information to receive the GOOSE packets regarding the other IEDs. Thus, the user should edit the subscription contents (see Figure 10.2-20). The LCD displays the statuses based on that the user has edited the list of the subscription contents.

Note: Jump to *Monitoring sub-menu* (see Chapter *User interface*) to display the GOOSE mentoring screen. The user can also find the GOOSE information on the test screen on GR-TIEMS.

On the LCD screen, the user can find either OK or NG message regarding other IEDs. The OK/NG message is generated with the information of the GOOSE packet received. Table 10.2-6 illustrates the messages displayed on LCD screen and GR-TIEMS screen.

Table 10.2-6 GOOSE statutes and signal outputs

Signal values	LCD screen messages	GR-TIEMS screen messages
0x0000	OK	GOOD
0xC000	NG	QUESTIONABLE
0xC010	NG	QUESTIONABLE | TEST
0xC040	NG	QUESTIONABLE | INACCURATE
0xC080	NG	QUESTIONABLE | INCONSISTENT

When the user wishes to see GOOSE outputs†, the user can see them by user's PLC logic, but the user should build its logic using the PLC function. Table 10.2-7 shows the GOOSE signals, which the user can select. For example, in order to get the GRL200_Bay1_4 information, the user should take the GOOSE content using SUB_QUAL#3 output.

Table 10.2-7 GOOSE output signals

Data ID	Signal names	Descriptions
301101 3100001001	SUB_QUAL#0	GOOSE subscription quality status
301101 3100011001	SUB_QUAL#1	GOOSE subscription quality status
301101 3100021001	SUB_QUAL#2	GOOSE subscription quality status
301101 3100031001	SUB_QUAL#3	GOOSE subscription quality status
301101 3100041001	SUB_QUAL#4	GOOSE subscription quality status
~~	~~~	~~~
301101 31013E1001	SUB_QUAL#318	GOOSE subscription quality status
301101 31013F1001	SUB_QUAL#319	GOOSE subscription quality status

†Note: The user cannot view GOOSEs signal lists on the GR-TIMES engineering.

10.2.8 Setting

Setting of 61850(Function ID: 301001)

Setting item			Range	Unit s	Contents	Default setting value	Notes
		GOINT	1 to 120	sec.	Maximum GOOSE resend interval	2	
		850BLK	Off/On		IEC 61850 enable/disable	Off	
		850AUT	Off/On		Authentication of IEC 61850 association	Off	
		850KEEPALIVE	1 to 120	sec.	TCP 'KeepAlive' time for IEC 61850	20	
		GOSNDBLK	Off/On		GOOSE publishing block	Off	
		GOSUBBLK	Off/On		GOOSE subscription block	Off	
		TCMD	Off/On		Set 'T' in 'CommTerm' as actual Time	Off	

10.2.9 Data ID

◆ Monitoring point

61850 (Function ID: 301001)

Element ID	Name	Description
0010001001	61850STAT	Status of IEC 61850(T:Running, F:Stop)
3100001440	INCOMINGPKT#0	Incoming packet number from IEC 61850 client#0
3100011440	INCOMINGPKT#1	Incoming packet number from IEC 61850 client#1
3100021440	INCOMINGPKT#2	Incoming packet number from IEC 61850 client#2
3100031440	INCOMINGPKT#3	Incoming packet number from IEC 61850 client#3
3100041440	INCOMINGPKT#4	Incoming packet number from IEC 61850 client#4
3100051440	INCOMINGPKT#5	Incoming packet number from IEC 61850 client#5
3100001441	OUTGOINGPKT#0	Outgoing packet number to IEC 61850 client#0
3100011441	OUTGOINGPKT#1	Outgoing packet number to IEC 61850 client#1
3100021441	OUTGOINGPKT#2	Outgoing packet number to IEC 61850 client#2
3100031441	OUTGOINGPKT#3	Outgoing packet number to IEC 61850 client#3
3100041441	OUTGOINGPKT#4	Outgoing packet number to IEC 61850 client#4
3100051441	OUTGOINGPKT#5	Outgoing packet number to IEC 61850 client#5
3100001001	REMOTEPORTNUM#0	Port number of IEC 61850 client #0
3100011001	REMOTEPORTNUM#1	Port number of IEC 61850 client #1
3100021001	REMOTEPORTNUM#2	Port number of IEC 61850 client #2
3100031001	REMOTEPORTNUM#3	Port number of IEC 61850 client #3
3100041001	REMOTEPORTNUM#4	Port number of IEC 61850 client #4
3100051001	REMOTEPORTNUM#5	Port number of IEC 61850 client #5
3110041005	Qual_Validity	IEC 61850 validity of quality

◆ Monitoring point

GOOSE (Function ID: 301101)

Element ID	Name	Description
3110001001	GOOSESUB_STATUS	0 if all GOOSE being subscribed are not subscribed.
3100001001	SUB_QUAL#0	GOOSE subscription quality for record #0
3100011001	SUB_QUAL#1	GOOSE subscription quality for record #1
3100021001	SUB_QUAL#2	GOOSE subscription quality for record #2
3100031001	SUB_QUAL#3	GOOSE subscription quality for record #3

◆ Monitoring point

GOOSE (Function ID: 301101)

Element ID	Name	Description
3100041001	SUB_QUAL#4	GOOSE subscription quality for record #4
3100051001	SUB_QUAL#5	GOOSE subscription quality for record #5
3100061001	SUB_QUAL#6	GOOSE subscription quality for record #6
3100071001	SUB_QUAL#7	GOOSE subscription quality for record #7
3100081001	SUB_QUAL#8	GOOSE subscription quality for record #8
3100091001	SUB_QUAL#9	GOOSE subscription quality for record #9
31000A1001	SUB_QUAL#10	GOOSE subscription quality for record #10
31000B1001	SUB_QUAL#11	GOOSE subscription quality for record #11
31000C1001	SUB_QUAL#12	GOOSE subscription quality for record #12
31000D1001	SUB_QUAL#13	GOOSE subscription quality for record #13
31000E1001	SUB_QUAL#14	GOOSE subscription quality for record #14
31000F1001	SUB_QUAL#15	GOOSE subscription quality for record #15
3100101001	SUB_QUAL#16	GOOSE subscription quality for record #16
3100111001	SUB_QUAL#17	GOOSE subscription quality for record #17
3100121001	SUB_QUAL#18	GOOSE subscription quality for record #18
3100131001	SUB_QUAL#19	GOOSE subscription quality for record #19
3100141001	SUB_QUAL#20	GOOSE subscription quality for record #20
3100151001	SUB_QUAL#21	GOOSE subscription quality for record #21
3100161001	SUB_QUAL#22	GOOSE subscription quality for record #22
3100171001	SUB_QUAL#23	GOOSE subscription quality for record #23
3100181001	SUB_QUAL#24	GOOSE subscription quality for record #24
3100191001	SUB_QUAL#25	GOOSE subscription quality for record #25
31001A1001	SUB_QUAL#26	GOOSE subscription quality for record #26
31001B1001	SUB_QUAL#27	GOOSE subscription quality for record #27
31001C1001	SUB_QUAL#28	GOOSE subscription quality for record #28
31001D1001	SUB_QUAL#29	GOOSE subscription quality for record #29
31001E1001	SUB_QUAL#30	GOOSE subscription quality for record #30
31001F1001	SUB_QUAL#31	GOOSE subscription quality for record #31
3100201001	SUB_QUAL#32	GOOSE subscription quality for record #32
3100211001	SUB_QUAL#33	GOOSE subscription quality for record #33
3100221001	SUB_QUAL#34	GOOSE subscription quality for record #34
3100231001	SUB_QUAL#35	GOOSE subscription quality for record #35
3100241001	SUB_QUAL#36	GOOSE subscription quality for record #36
3100251001	SUB_QUAL#37	GOOSE subscription quality for record #37
3100261001	SUB_QUAL#38	GOOSE subscription quality for record #38
3100271001	SUB_QUAL#39	GOOSE subscription quality for record #39
3100281001	SUB_QUAL#40	GOOSE subscription quality for record #40
3100291001	SUB_QUAL#41	GOOSE subscription quality for record #41
31002A1001	SUB_QUAL#42	GOOSE subscription quality for record #42
31002B1001	SUB_QUAL#43	GOOSE subscription quality for record #43
31002C1001	SUB_QUAL#44	GOOSE subscription quality for record #44
31002D1001	SUB_QUAL#45	GOOSE subscription quality for record #45

◆ Monitoring point

GOOSE (Function ID: 301101)

Element ID	Name	Description
31002E1001	SUB_QUAL#46	GOOSE subscription quality for record #46
31002F1001	SUB_QUAL#47	GOOSE subscription quality for record #47
3100301001	SUB_QUAL#48	GOOSE subscription quality for record #48
3100311001	SUB_QUAL#49	GOOSE subscription quality for record #49
3100321001	SUB_QUAL#50	GOOSE subscription quality for record #50
3100331001	SUB_QUAL#51	GOOSE subscription quality for record #51
3100341001	SUB_QUAL#52	GOOSE subscription quality for record #52
3100351001	SUB_QUAL#53	GOOSE subscription quality for record #53
3100361001	SUB_QUAL#54	GOOSE subscription quality for record #54
3100371001	SUB_QUAL#55	GOOSE subscription quality for record #55
3100381001	SUB_QUAL#56	GOOSE subscription quality for record #56
3100391001	SUB_QUAL#57	GOOSE subscription quality for record #57
31003A1001	SUB_QUAL#58	GOOSE subscription quality for record #58
31003B1001	SUB_QUAL#59	GOOSE subscription quality for record #59
31003C1001	SUB_QUAL#60	GOOSE subscription quality for record #60
31003D1001	SUB_QUAL#61	GOOSE subscription quality for record #61
31003E1001	SUB_QUAL#62	GOOSE subscription quality for record #62
31003F1001	SUB_QUAL#63	GOOSE subscription quality for record #63
3100401001	SUB_QUAL#64	GOOSE subscription quality for record #64
3100411001	SUB_QUAL#65	GOOSE subscription quality for record #65
3100421001	SUB_QUAL#66	GOOSE subscription quality for record #66
3100431001	SUB_QUAL#67	GOOSE subscription quality for record #67
3100441001	SUB_QUAL#68	GOOSE subscription quality for record #68
3100451001	SUB_QUAL#69	GOOSE subscription quality for record #69
3100461001	SUB_QUAL#70	GOOSE subscription quality for record #70
3100471001	SUB_QUAL#71	GOOSE subscription quality for record #71
3100481001	SUB_QUAL#72	GOOSE subscription quality for record #72
3100491001	SUB_QUAL#73	GOOSE subscription quality for record #73
31004A1001	SUB_QUAL#74	GOOSE subscription quality for record #74
31004B1001	SUB_QUAL#75	GOOSE subscription quality for record #75
31004C1001	SUB_QUAL#76	GOOSE subscription quality for record #76
31004D1001	SUB_QUAL#77	GOOSE subscription quality for record #77
31004E1001	SUB_QUAL#78	GOOSE subscription quality for record #78
31004F1001	SUB_QUAL#79	GOOSE subscription quality for record #79
3100501001	SUB_QUAL#80	GOOSE subscription quality for record #80
3100511001	SUB_QUAL#81	GOOSE subscription quality for record #81
3100521001	SUB_QUAL#82	GOOSE subscription quality for record #82
3100531001	SUB_QUAL#83	GOOSE subscription quality for record #83
3100541001	SUB_QUAL#84	GOOSE subscription quality for record #84
3100551001	SUB_QUAL#85	GOOSE subscription quality for record #85
3100561001	SUB_QUAL#86	GOOSE subscription quality for record #86
3100571001	SUB_QUAL#87	GOOSE subscription quality for record #87

◆ Monitoring point

GOOSE (Function ID: 301101)

Element ID	Name	Description
3100581001	SUB_QUAL#88	GOOSE subscription quality for record #88
3100591001	SUB_QUAL#89	GOOSE subscription quality for record #89
31005A1001	SUB_QUAL#90	GOOSE subscription quality for record #90
31005B1001	SUB_QUAL#91	GOOSE subscription quality for record #91
31005C1001	SUB_QUAL#92	GOOSE subscription quality for record #92
31005D1001	SUB_QUAL#93	GOOSE subscription quality for record #93
31005E1001	SUB_QUAL#94	GOOSE subscription quality for record #94
31005F1001	SUB_QUAL#95	GOOSE subscription quality for record #95
3100601001	SUB_QUAL#96	GOOSE subscription quality for record #96
3100611001	SUB_QUAL#97	GOOSE subscription quality for record #97
3100621001	SUB_QUAL#98	GOOSE subscription quality for record #98
3100631001	SUB_QUAL#99	GOOSE subscription quality for record #99
3100641001	SUB_QUAL#100	GOOSE subscription quality for record #100
3100651001	SUB_QUAL#101	GOOSE subscription quality for record #101
3100661001	SUB_QUAL#102	GOOSE subscription quality for record #102
3100671001	SUB_QUAL#103	GOOSE subscription quality for record #103
3100681001	SUB_QUAL#104	GOOSE subscription quality for record #104
3100691001	SUB_QUAL#105	GOOSE subscription quality for record #105
31006A1001	SUB_QUAL#106	GOOSE subscription quality for record #106
31006B1001	SUB_QUAL#107	GOOSE subscription quality for record #107
31006C1001	SUB_QUAL#108	GOOSE subscription quality for record #108
31006D1001	SUB_QUAL#109	GOOSE subscription quality for record #109
31006E1001	SUB_QUAL#110	GOOSE subscription quality for record #110
31006F1001	SUB_QUAL#111	GOOSE subscription quality for record #111
3100701001	SUB_QUAL#112	GOOSE subscription quality for record #112
3100711001	SUB_QUAL#113	GOOSE subscription quality for record #113
3100721001	SUB_QUAL#114	GOOSE subscription quality for record #114
3100731001	SUB_QUAL#115	GOOSE subscription quality for record #115
3100741001	SUB_QUAL#116	GOOSE subscription quality for record #116
3100751001	SUB_QUAL#117	GOOSE subscription quality for record #117
3100761001	SUB_QUAL#118	GOOSE subscription quality for record #118
3100771001	SUB_QUAL#119	GOOSE subscription quality for record #119
3100781001	SUB_QUAL#120	GOOSE subscription quality for record #120
3100791001	SUB_QUAL#121	GOOSE subscription quality for record #121
31007A1001	SUB_QUAL#122	GOOSE subscription quality for record #122
31007B1001	SUB_QUAL#123	GOOSE subscription quality for record #123
31007C1001	SUB_QUAL#124	GOOSE subscription quality for record #124
31007D1001	SUB_QUAL#125	GOOSE subscription quality for record #125
31007E1001	SUB_QUAL#126	GOOSE subscription quality for record #126
31007F1001	SUB_QUAL#127	GOOSE subscription quality for record #127
3100801001	SUB_QUAL#128	GOOSE subscription quality for record #128
3100811001	SUB_QUAL#129	GOOSE subscription quality for record #129

◆ Monitoring point

GOOSE (Function ID: 301101)

Element ID	Name	Description
3100821001	SUB_QUAL#130	GOOSE subscription quality for record #130
3100831001	SUB_QUAL#131	GOOSE subscription quality for record #131
3100841001	SUB_QUAL#132	GOOSE subscription quality for record #132
3100851001	SUB_QUAL#133	GOOSE subscription quality for record #133
3100861001	SUB_QUAL#134	GOOSE subscription quality for record #134
3100871001	SUB_QUAL#135	GOOSE subscription quality for record #135
3100881001	SUB_QUAL#136	GOOSE subscription quality for record #136
3100891001	SUB_QUAL#137	GOOSE subscription quality for record #137
31008A1001	SUB_QUAL#138	GOOSE subscription quality for record #138
31008B1001	SUB_QUAL#139	GOOSE subscription quality for record #139
31008C1001	SUB_QUAL#140	GOOSE subscription quality for record #140
31008D1001	SUB_QUAL#141	GOOSE subscription quality for record #141
31008E1001	SUB_QUAL#142	GOOSE subscription quality for record #142
31008F1001	SUB_QUAL#143	GOOSE subscription quality for record #143
3100901001	SUB_QUAL#144	GOOSE subscription quality for record #144
3100911001	SUB_QUAL#145	GOOSE subscription quality for record #145
3100921001	SUB_QUAL#146	GOOSE subscription quality for record #146
3100931001	SUB_QUAL#147	GOOSE subscription quality for record #147
3100941001	SUB_QUAL#148	GOOSE subscription quality for record #148
3100951001	SUB_QUAL#149	GOOSE subscription quality for record #149
3100961001	SUB_QUAL#150	GOOSE subscription quality for record #150
3100971001	SUB_QUAL#151	GOOSE subscription quality for record #151
3100981001	SUB_QUAL#152	GOOSE subscription quality for record #152
3100991001	SUB_QUAL#153	GOOSE subscription quality for record #153
31009A1001	SUB_QUAL#154	GOOSE subscription quality for record #154
31009B1001	SUB_QUAL#155	GOOSE subscription quality for record #155
31009C1001	SUB_QUAL#156	GOOSE subscription quality for record #156
31009D1001	SUB_QUAL#157	GOOSE subscription quality for record #157
31009E1001	SUB_QUAL#158	GOOSE subscription quality for record #158
31009F1001	SUB_QUAL#159	GOOSE subscription quality for record #159
3100A01001	SUB_QUAL#160	GOOSE subscription quality for record #160
3100A11001	SUB_QUAL#161	GOOSE subscription quality for record #161
3100A21001	SUB_QUAL#162	GOOSE subscription quality for record #162
3100A31001	SUB_QUAL#163	GOOSE subscription quality for record #163
3100A41001	SUB_QUAL#164	GOOSE subscription quality for record #164
3100A51001	SUB_QUAL#165	GOOSE subscription quality for record #165
3100A61001	SUB_QUAL#166	GOOSE subscription quality for record #166
3100A71001	SUB_QUAL#167	GOOSE subscription quality for record #167
3100A81001	SUB_QUAL#168	GOOSE subscription quality for record #168
3100A91001	SUB_QUAL#169	GOOSE subscription quality for record #169
3100AA1001	SUB_QUAL#170	GOOSE subscription quality for record #170
3100AB1001	SUB_QUAL#171	GOOSE subscription quality for record #171

◆ Monitoring point

GOOSE (Function ID: 301101)

Element ID	Name	Description
3100AC1001	SUB_QUAL#172	GOOSE subscription quality for record #172
3100AD1001	SUB_QUAL#173	GOOSE subscription quality for record #173
3100AE1001	SUB_QUAL#174	GOOSE subscription quality for record #174
3100AF1001	SUB_QUAL#175	GOOSE subscription quality for record #175
3100B01001	SUB_QUAL#176	GOOSE subscription quality for record #176
3100B11001	SUB_QUAL#177	GOOSE subscription quality for record #177
3100B21001	SUB_QUAL#178	GOOSE subscription quality for record #178
3100B31001	SUB_QUAL#179	GOOSE subscription quality for record #179
3100B41001	SUB_QUAL#180	GOOSE subscription quality for record #180
3100B51001	SUB_QUAL#181	GOOSE subscription quality for record #181
3100B61001	SUB_QUAL#182	GOOSE subscription quality for record #182
3100B71001	SUB_QUAL#183	GOOSE subscription quality for record #183
3100B81001	SUB_QUAL#184	GOOSE subscription quality for record #184
3100B91001	SUB_QUAL#185	GOOSE subscription quality for record #185
3100BA1001	SUB_QUAL#186	GOOSE subscription quality for record #186
3100BB1001	SUB_QUAL#187	GOOSE subscription quality for record #187
3100BC1001	SUB_QUAL#188	GOOSE subscription quality for record #188
3100BD1001	SUB_QUAL#189	GOOSE subscription quality for record #189
3100BE1001	SUB_QUAL#190	GOOSE subscription quality for record #190
3100BF1001	SUB_QUAL#191	GOOSE subscription quality for record #191
3100C01001	SUB_QUAL#192	GOOSE subscription quality for record #192
3100C11001	SUB_QUAL#193	GOOSE subscription quality for record #193
3100C21001	SUB_QUAL#194	GOOSE subscription quality for record #194
3100C31001	SUB_QUAL#195	GOOSE subscription quality for record #195
3100C41001	SUB_QUAL#196	GOOSE subscription quality for record #196
3100C51001	SUB_QUAL#197	GOOSE subscription quality for record #197
3100C61001	SUB_QUAL#198	GOOSE subscription quality for record #198
3100C71001	SUB_QUAL#199	GOOSE subscription quality for record #199
3100C81001	SUB_QUAL#200	GOOSE subscription quality for record #200
3100C91001	SUB_QUAL#201	GOOSE subscription quality for record #201
3100CA1001	SUB_QUAL#202	GOOSE subscription quality for record #202
3100CB1001	SUB_QUAL#203	GOOSE subscription quality for record #203
3100CC1001	SUB_QUAL#204	GOOSE subscription quality for record #204
3100CD1001	SUB_QUAL#205	GOOSE subscription quality for record #205
3100CE1001	SUB_QUAL#206	GOOSE subscription quality for record #206
3100CF1001	SUB_QUAL#207	GOOSE subscription quality for record #207
3100D01001	SUB_QUAL#208	GOOSE subscription quality for record #208
3100D11001	SUB_QUAL#209	GOOSE subscription quality for record #209
3100D21001	SUB_QUAL#210	GOOSE subscription quality for record #210
3100D31001	SUB_QUAL#211	GOOSE subscription quality for record #211
3100D41001	SUB_QUAL#212	GOOSE subscription quality for record #212
3100D51001	SUB_QUAL#213	GOOSE subscription quality for record #213

◆ Monitoring point

GOOSE (Function ID: 301101)

Element ID	Name	Description
3100D61001	SUB_QUAL#214	GOOSE subscription quality for record #214
3100D71001	SUB_QUAL#215	GOOSE subscription quality for record #215
3100D81001	SUB_QUAL#216	GOOSE subscription quality for record #216
3100D91001	SUB_QUAL#217	GOOSE subscription quality for record #217
3100DA1001	SUB_QUAL#218	GOOSE subscription quality for record #218
3100DB1001	SUB_QUAL#219	GOOSE subscription quality for record #219
3100DC1001	SUB_QUAL#220	GOOSE subscription quality for record #220
3100DD1001	SUB_QUAL#221	GOOSE subscription quality for record #221
3100DE1001	SUB_QUAL#222	GOOSE subscription quality for record #222
3100DF1001	SUB_QUAL#223	GOOSE subscription quality for record #223
3100E01001	SUB_QUAL#224	GOOSE subscription quality for record #224
3100E11001	SUB_QUAL#225	GOOSE subscription quality for record #225
3100E21001	SUB_QUAL#226	GOOSE subscription quality for record #226
3100E31001	SUB_QUAL#227	GOOSE subscription quality for record #227
3100E41001	SUB_QUAL#228	GOOSE subscription quality for record #228
3100E51001	SUB_QUAL#229	GOOSE subscription quality for record #229
3100E61001	SUB_QUAL#230	GOOSE subscription quality for record #230
3100E71001	SUB_QUAL#231	GOOSE subscription quality for record #231
3100E81001	SUB_QUAL#232	GOOSE subscription quality for record #232
3100E91001	SUB_QUAL#233	GOOSE subscription quality for record #233
3100EA1001	SUB_QUAL#234	GOOSE subscription quality for record #234
3100EB1001	SUB_QUAL#235	GOOSE subscription quality for record #235
3100EC1001	SUB_QUAL#236	GOOSE subscription quality for record #236
3100ED1001	SUB_QUAL#237	GOOSE subscription quality for record #237
3100EE1001	SUB_QUAL#238	GOOSE subscription quality for record #238
3100EF1001	SUB_QUAL#239	GOOSE subscription quality for record #239
3100F01001	SUB_QUAL#240	GOOSE subscription quality for record #240
3100F11001	SUB_QUAL#241	GOOSE subscription quality for record #241
3100F21001	SUB_QUAL#242	GOOSE subscription quality for record #242
3100F31001	SUB_QUAL#243	GOOSE subscription quality for record #243
3100F41001	SUB_QUAL#244	GOOSE subscription quality for record #244
3100F51001	SUB_QUAL#245	GOOSE subscription quality for record #245
3100F61001	SUB_QUAL#246	GOOSE subscription quality for record #246
3100F71001	SUB_QUAL#247	GOOSE subscription quality for record #247
3100F81001	SUB_QUAL#248	GOOSE subscription quality for record #248
3100F91001	SUB_QUAL#249	GOOSE subscription quality for record #249
3100FA1001	SUB_QUAL#250	GOOSE subscription quality for record #250
3100FB1001	SUB_QUAL#251	GOOSE subscription quality for record #251
3100FC1001	SUB_QUAL#252	GOOSE subscription quality for record #252
3100FD1001	SUB_QUAL#253	GOOSE subscription quality for record #253
3100FE1001	SUB_QUAL#254	GOOSE subscription quality for record #254
3100FF1001	SUB_QUAL#255	GOOSE subscription quality for record #255

◆ Monitoring point

GOOSE (Function ID: 301101)

Element ID	Name	Description
3101001001	SUB_QUAL#256	GOOSE subscription quality for record #256
3101011001	SUB_QUAL#257	GOOSE subscription quality for record #257
3101021001	SUB_QUAL#258	GOOSE subscription quality for record #258
3101031001	SUB_QUAL#259	GOOSE subscription quality for record #259
3101041001	SUB_QUAL#260	GOOSE subscription quality for record #260
3101051001	SUB_QUAL#261	GOOSE subscription quality for record #261
3101061001	SUB_QUAL#262	GOOSE subscription quality for record #262
3101071001	SUB_QUAL#263	GOOSE subscription quality for record #263
3101081001	SUB_QUAL#264	GOOSE subscription quality for record #264
3101091001	SUB_QUAL#265	GOOSE subscription quality for record #265
31010A1001	SUB_QUAL#266	GOOSE subscription quality for record #266
31010B1001	SUB_QUAL#267	GOOSE subscription quality for record #267
31010C1001	SUB_QUAL#268	GOOSE subscription quality for record #268
31010D1001	SUB_QUAL#269	GOOSE subscription quality for record #269
31010E1001	SUB_QUAL#270	GOOSE subscription quality for record #270
31010F1001	SUB_QUAL#271	GOOSE subscription quality for record #271
3101101001	SUB_QUAL#272	GOOSE subscription quality for record #272
3101111001	SUB_QUAL#273	GOOSE subscription quality for record #273
3101121001	SUB_QUAL#274	GOOSE subscription quality for record #274
3101131001	SUB_QUAL#275	GOOSE subscription quality for record #275
3101141001	SUB_QUAL#276	GOOSE subscription quality for record #276
3101151001	SUB_QUAL#277	GOOSE subscription quality for record #277
3101161001	SUB_QUAL#278	GOOSE subscription quality for record #278
3101171001	SUB_QUAL#279	GOOSE subscription quality for record #279
3101181001	SUB_QUAL#280	GOOSE subscription quality for record #280
3101191001	SUB_QUAL#281	GOOSE subscription quality for record #281
31011A1001	SUB_QUAL#282	GOOSE subscription quality for record #282
31011B1001	SUB_QUAL#283	GOOSE subscription quality for record #283
31011C1001	SUB_QUAL#284	GOOSE subscription quality for record #284
31011D1001	SUB_QUAL#285	GOOSE subscription quality for record #285
31011E1001	SUB_QUAL#286	GOOSE subscription quality for record #286
31011F1001	SUB_QUAL#287	GOOSE subscription quality for record #287
3101201001	SUB_QUAL#288	GOOSE subscription quality for record #288
3101211001	SUB_QUAL#289	GOOSE subscription quality for record #289
3101221001	SUB_QUAL#290	GOOSE subscription quality for record #290
3101231001	SUB_QUAL#291	GOOSE subscription quality for record #291
3101241001	SUB_QUAL#292	GOOSE subscription quality for record #292
3101251001	SUB_QUAL#293	GOOSE subscription quality for record #293
3101261001	SUB_QUAL#294	GOOSE subscription quality for record #294
3101271001	SUB_QUAL#295	GOOSE subscription quality for record #295
3101281001	SUB_QUAL#296	GOOSE subscription quality for record #296
3101291001	SUB_QUAL#297	GOOSE subscription quality for record #297

◆ Monitoring point

GOOSE (Function ID: 301101)

Element ID	Name	Description
31012A1001	SUB_QUAL#298	GOOSE subscription quality for record #298
31012B1001	SUB_QUAL#299	GOOSE subscription quality for record #299
31012C1001	SUB_QUAL#300	GOOSE subscription quality for record #300
31012D1001	SUB_QUAL#301	GOOSE subscription quality for record #301
31012E1001	SUB_QUAL#302	GOOSE subscription quality for record #302
31012F1001	SUB_QUAL#303	GOOSE subscription quality for record #303
3101301001	SUB_QUAL#304	GOOSE subscription quality for record #304
3101311001	SUB_QUAL#305	GOOSE subscription quality for record #305
3101321001	SUB_QUAL#306	GOOSE subscription quality for record #306
3101331001	SUB_QUAL#307	GOOSE subscription quality for record #307
3101341001	SUB_QUAL#308	GOOSE subscription quality for record #308
3101351001	SUB_QUAL#309	GOOSE subscription quality for record #309
3101361001	SUB_QUAL#310	GOOSE subscription quality for record #310
3101371001	SUB_QUAL#311	GOOSE subscription quality for record #311
3101381001	SUB_QUAL#312	GOOSE subscription quality for record #312
3101391001	SUB_QUAL#313	GOOSE subscription quality for record #313
31013A1001	SUB_QUAL#314	GOOSE subscription quality for record #314
31013B1001	SUB_QUAL#315	GOOSE subscription quality for record #315
31013C1001	SUB_QUAL#316	GOOSE subscription quality for record #316
31013D1001	SUB_QUAL#317	GOOSE subscription quality for record #317
31013E1001	SUB_QUAL#318	GOOSE subscription quality for record #318
31013F1001	SUB_QUAL#319	GOOSE subscription quality for record #319

10.3 USB communication

The IED has an USB port in B-type connector; the user PC can be connected with the IED through that. The USB port places on the IED front panel. The communication operates in the serial transmission; its speed is fixed at 115.2kbps.

11 User interface

11.1 Outline

Users can perform maintenance on the IED from the front panel. Monitoring is also possible locally by using a PC connected through the USB cable. This section discusses the configuration of the front panel and the basic configuration of the screen-menu hierarchy of the Human Machine Interface (HMI).

(i) Front Panel

As shown in Figure 11.1-1, the front panel is provided with a screen (LCD Screen), 26 light emitting diodes (LEDs), 11 operation keys, seven function keys (in the later section the function keys are referred to as F1 to F7.), monitoring jacks and a USB receptacle.

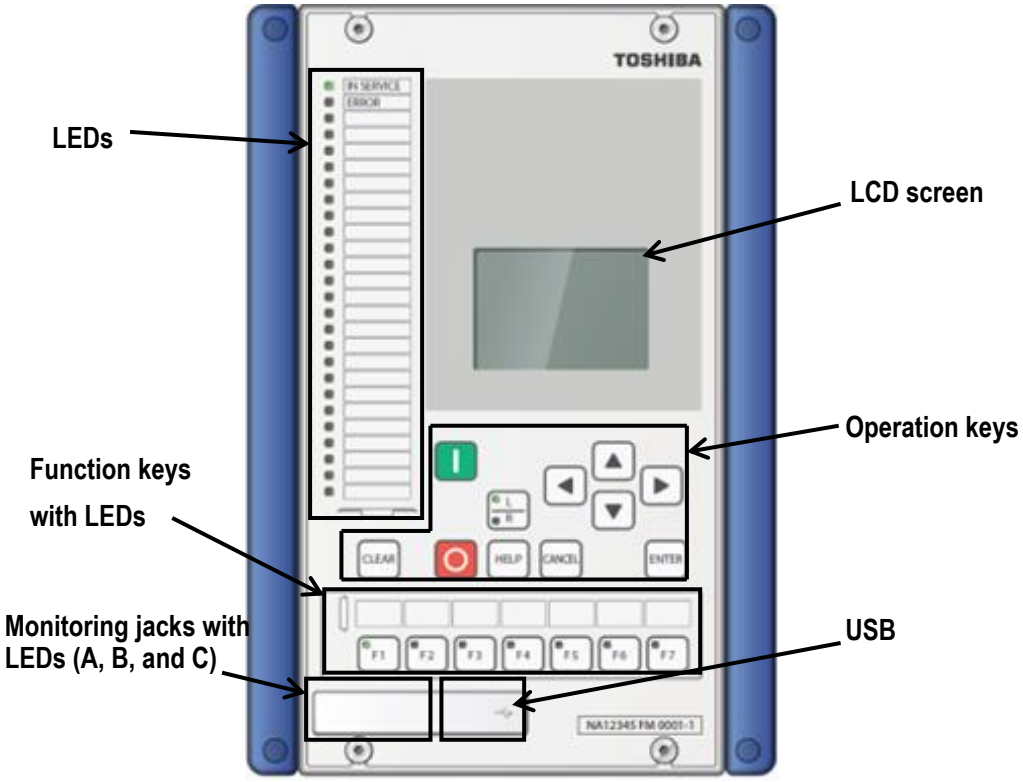


Figure 11.1-1 Front Panel

(ii) LCD screen

The LCD screen provides the user with detailed internal information provided by the IED such as records, monitoring and settings. Normally, the LCD screen appears blank unless an operation key is pressed, by pressing any of the operation keys, the LCD screen will display the top menu.

If the top menu is shown on the LCD screen, the user can turn off the screen backlight by pressing the operation key ◀. When operation is idle for some time, the screen backlight turns off. By pressing any key except the CLEAR key, the backlight turns on, and the previous menu will be displayed on the LCD screen.

(iii) LEDs

As shown inTable 11.1-1, 26 LEDs, each having signal labels and colors, are defined:

Table 11.1-1 LED labels and their color

LED No.	Label	Color	User configurable setting[2]	Remarks
1	IN SERVICE	Green	N/A	Lit up when the IED is in service.
2	ERROR	Red	N/A	Lit up when an error is occurred.
3[1]	N/A	N/A	✔	
4[1]	TRIP	Red	✔	Default
5[1]	N/A	N/A	✔	
6[1]	TEST	Yellow	✔	Default
7[1]	N/A	N/A	✔	
.	N/A	N/A	✔	.
.	.	.	.	.
.	.	.	.	.
.	.	.	.	.
26[1]	N/A	N/A	✔	

[1]Note: LED #3 to LED #26 is user-configurable LEDs. User can assign a signal with or without latch function.

[2]Note: For setting LEDs, see section **11.6(iv)**.

(iv) Monitoring jacks

There are three monitoring jacks on the front panel; the three monitoring jacks have LEDs, A, B, and C respectively. For example, if the user wishes to undertake test work[1], two monitoring-jacks (A and B) are available for use. By selecting the Data ID of an object signal from the Data ID list, and by keying this Data ID into the IED, the object signal can be displayed on the selected LEDs (A and B). The user can also observe this object signal at the output of the monitoring jacks (A and B) on an oscilloscope.

(v) Function keys

The IED provides seven function keys (F1 to F7) with the following two features; a LED is attached on each function key. Table 11.1-2 shows the features for these keys.

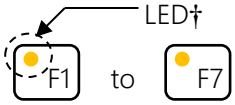
- Skip to a specific screen directly, set by the user.

Used for skipping to a set page by pressing the function keys. Press again to return to the previous page. Set by pressing the function key for 2 seconds on the selected page. (See section 11.5(v)-1)

- Control the signal setting easily.

A convenient method that can be used for operating binary signals. Set by assigning the signal in the settings menu. (See section 11.5(v)-2)

Table 11.1-2 Features of Function keys (F1 to F7)

Labels on Keys	Feature and Remark
	Skip to a specific screen directly. Control for the operation of pre-assigned binary signals.

†Note: Like in the LEDs of Table 11.1-1, the user can set to light the above LEDs by itself. Setting the above LEDs are similar to the ones of the Table 11.1-1 (For setting, see section 11.6(iv)). Note the manufacture programs to light the respective LEDs in default prior to shipping.

(vi) Operation keys

By using the operation keys, the user can display records, relay status etc. Input of setting values is performed using these keys. The operation keys are tabulated in Table 11.1-3.

Table 11.1-3 Features of operation keys

Label	Functions and Remarks
▲	Move the cursor up / Scroll up / Count up[1]
▼	Move the cursor down / Scroll down / Count down[1]
◀	Previous page / Move to the left digit.
▶	Next page / Move to the right digit
ENTER	Enter edit mode, if item is active / Executive operation / Accept alarm message.
CANCEL	Exit edit mode / Cancel operation.
CLEAR	Clear all latched LEDs (Except [In service] and [Error] LEDs).
HELP	Display the help message, for cases where the active item has a help function.
L / R	Switch between Local mode and Remote mode.
I	Control key. (Close)
O	Control key. (Open)
MENU / MIMIC	Switch for using MIMIC[2] mode or for returning back to the menu screen. This key is not provided for standard LCD screen[2].

[1]Note: To scroll up or scroll down quickly, press keys ▲ or ▼ respectively along with key ▶.

[2]Note: The MIMIC key is only available when a large LCD screen is mounted on the front panel. The pixel resolution (dot) is 240(W) × 320(H). Note that this mode is only provided when the user programmed the feature using the engineering tool. See chapter *Engineering tool: MIMIC configuration tool*.

11.2 HMI operation

By using the LCD screen, the operation keys and the function keys, the user can access functions such as recording, monitoring, relay setting and testing.

Note: The operation of the LCD screen is more or less common in all IED models.
However, the contents of the LCD screen depend upon the IED model.

(i) Screen and LEDs during normal HMI operation

When the IED is operating normally, the green "IN SERVICE" LED is lit. Press any key except the key **CLEAR**; and then the backlight of the LCD screen is turned on[1]. If the IED detects a fault, the fault message will appear in a pop-up screen. At the same time, the "TRIP"[2] LED is lit.

[1]Note: If another fault occurs during the period of time for which the previous fault pop-up screen, is displayed, the previous fault information will be overwritten by the new fault on the pop-up screen. Press the key **CANCEL** to remove the pop-up screen for "Latest Fault" to return to the previous screen.

[2]Note: Press the key **CLEAR** to turn off the LED.

(ii) Main-menu and Sub-menu

- Main-menu

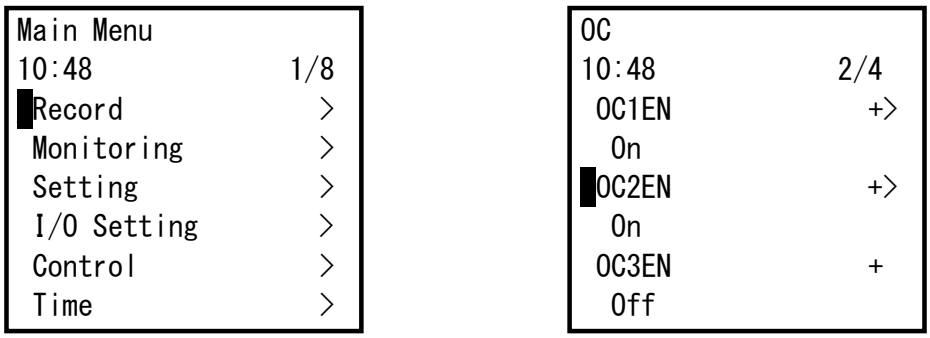
  If LCD screen is turned off, press any key, except the key **CLEAR**. "Main-Menu" will appear on the LCD screen (see the left of Figure 11.2-1). To go to the next level of hierarchy, press the key ▶.

- Sub-menu

  An example of setting the sub-menu screen is shown in the right of Figure 11.2-1. By using the key ▼ and the key ▲, the user can move the cursor downward or upward to view all of the items. By using the keys ◀ ▶, the user can return to a previous level of hierarchy or go to the next level of hierarchy.

- Screen structure

  The screen is composed of a title area and a data area. The title area is fixed on the top two lines. The first line displays the screen title. The second line on the left-hand side displays local time, whereas the right-hand side displays either the current line number, cursor position number and the maximum page number, or the item number. For example, the display "2/4" means the current cursor position, which is at the second item of a maximum of four items.



a. Main Menu b. Sub Menu

Figure 11.2-1 LCD screen for Main-Menu and Sub-menu

Figure 11.2-2 shows the menu hierarchy. The menu consists of a Main-Menu and several Sub-menus. Table 11.2-1 shows the configuration of Main-Menu.

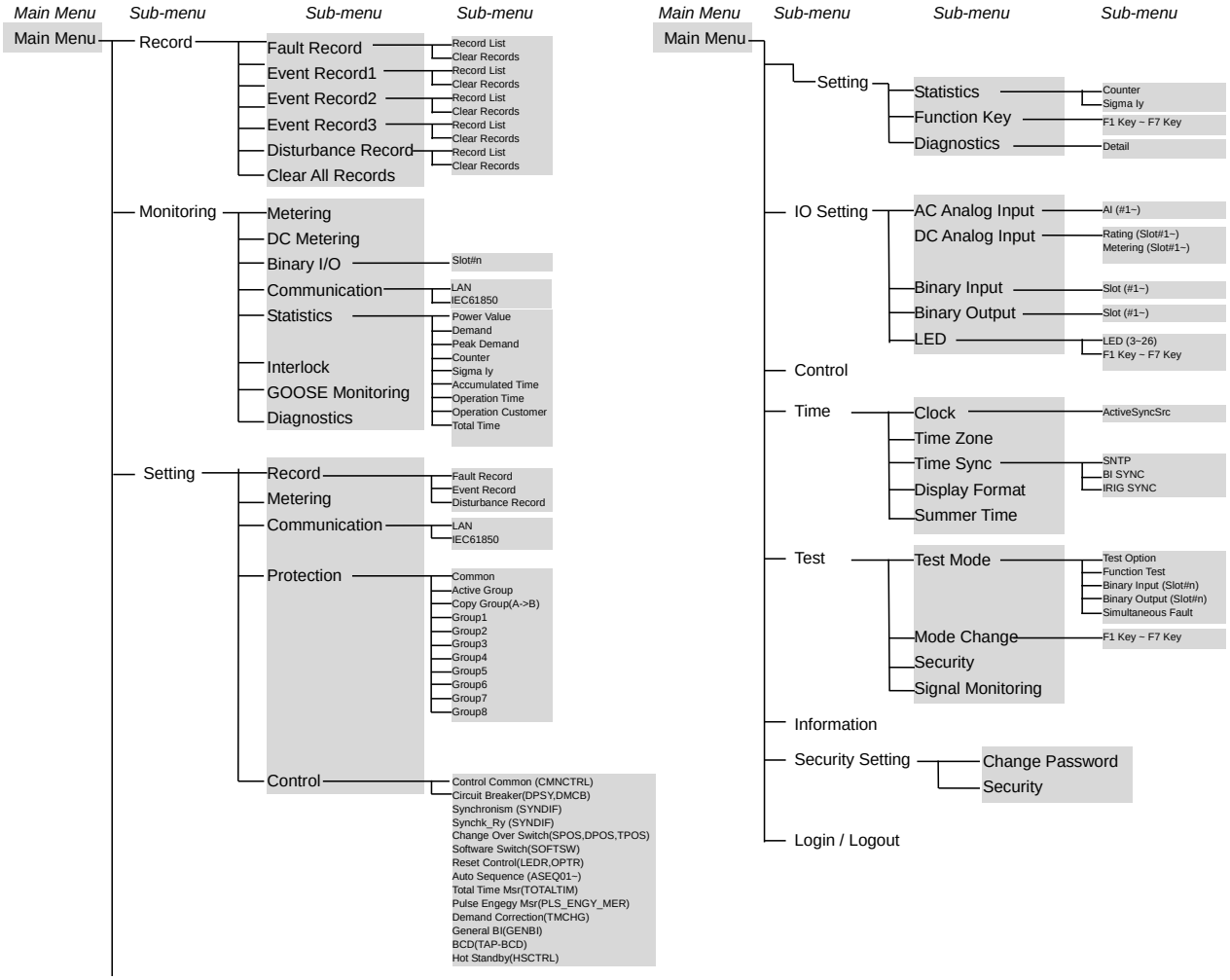


Figure 11.2-2 Menu hierarchy

Table 11.2-1 Outline of Main-menu and their purposes

Sub-menu	Purpose and functions
Record	The "Record" sub-menu provides fault record, event record and disturbance record. The user can erase each record individually or can clear all records at the same time. The user can assign event records to three distributed “Event Record” sub-menus as required.
Monitoring	The "Monitoring" sub-menu displays all of the status values for the IED, such as Metering, Binary I/O, Communication, Relay Element, Statistics, Interlock, GOOSE Monitoring, and Diagnostics.
Setting	The "Setting" sub-menu is used to view or change the settings: Record, Metering, Communication and Protection.
I/O Setting	The "I/O Setting" sub-menu is used to view or change the settings for inputs, configurable binary inputs, configurable binary outputs, and configurable LEDs.
Control†	The “Control” sub-menu is used to manipulate an external gear such as circuit breaker (CB), isolator, etc. manipulated control applications.
Time	The "Time" sub-menu provides settings for calendar clock, time zone, the source of time synchronization and the display format of the calendar clock.
Test	The "Test" sub-menu is used to set and to test the following: a trip circuit, forcible operation of binary outputs from the IED, time measurement of variable timers, and observation of the binary signals in logic circuits.
Information	The "Information" sub-menu displays information about the IED such as hardware, software, communication, etc.
Security Setting	The "Security Setting" sub-menu is used to change the password and access level, providing high levels of security by assigning users different levels of access.
Login/Logout	When the "Security Setting” sub-menu is ON, the “Login/Logout” sub-menu is displayed.

†Note:‘Control’ item will not be displayed for Large LCD screen (MIMIC).

11.3 Record sub-menu

The Record sub-menu is composed of several sub-menus: fault record, event record, disturbance record, and clearance of all records. In each sub-menu, the user can clear records separately.

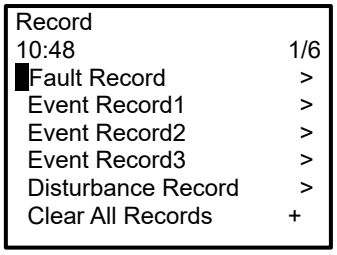


Figure 11.3-1 Display of Record

Table 11.3-1 Operation and display in Record sub-menu

Display	Operation key	Remark
[>]	▶	Press the key ▶ to go to the sub-menu
[+]	ENTER	Press the key **ENTER** for executing "Clear all records". Confirmation dialog screen will be displayed.

(i) Fault Record

The "Fault Record" sub-menu displays the date and time of fault occurrence, fault phase, tripping mode, and the power system quantities, as shown in Figure 11.3-2.

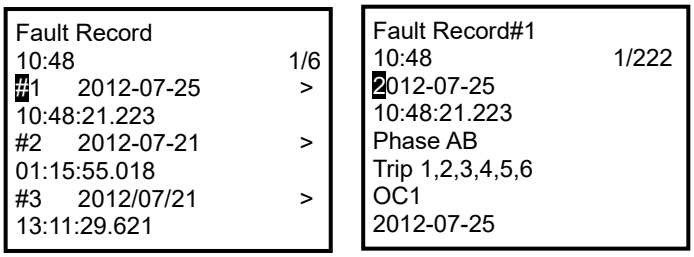
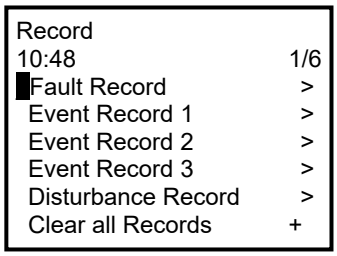


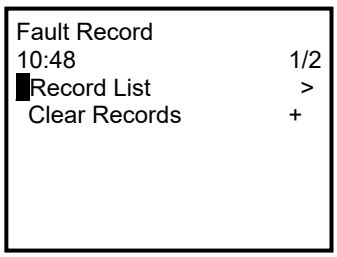
Figure 11.3-2 Display of Fault Record

(i)-1 Display fault record

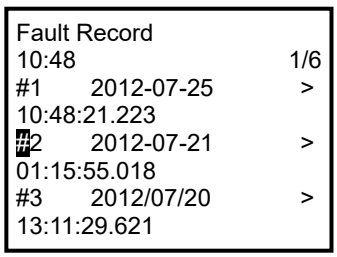
Figure 11.3-3 shows how to see the screen of fault record list and the details.



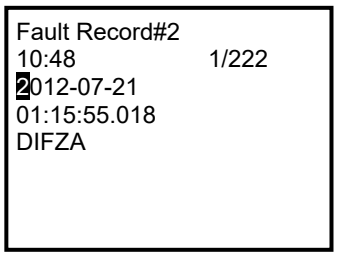
1). Move cursor to the Fault Record menu and press ▶.



2). Fault Record screen is displayed. Press ▶ at the Record List sub menu.



3). Fault record list in the Fault Record screen is displayed. Move cursor to a desired item by ▲ or ▼ and press ▶.

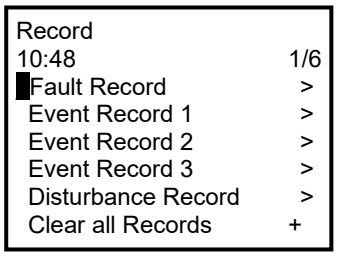


4). Press ▲ or ▼ to move display items.

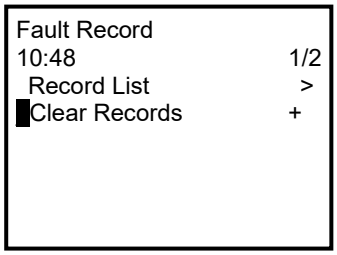
Figure 11.3-3 Fault Record

(i)-2 Clear fault record

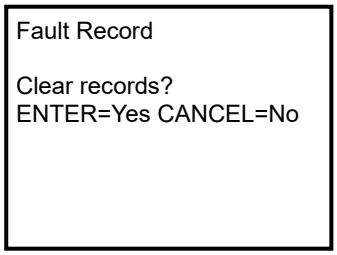
Figure 11.3-4 shows the steps to clear the fault record list.



1). Move cursor to the Fault Record menu and press ▶.



2). Move cursor to Clear Records and press ENTER.

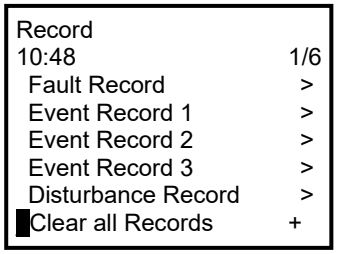


3). Clear records if ENTER is pressed. Back to display of "Fault Record" directly if CANCEL is pressed.

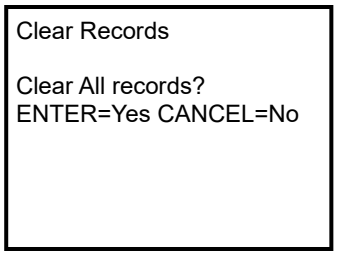
Figure 11.3-4 Clear Record

(i)-3 Clear all information in Fault Record

Figure 11.3-5 shows the steps to clear all the records.



1). Move cursor to the Clear all Records sub menu and press ENTER.



2). Clear all records if ENTER is pressed. Back to display of "Record" directly if CANCEL is pressed.

Figure 11.3-5 All clear

(ii) Event Record

The "Event Record" sub-menu provides three parts namely, "Event Record1", "Event Record2" and "Event Record3". In each Event Record sub-menu, the data and time, device name, and the operation of the device are displayed as shown in the example below.

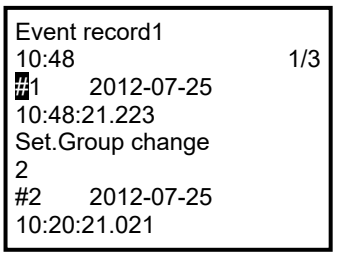
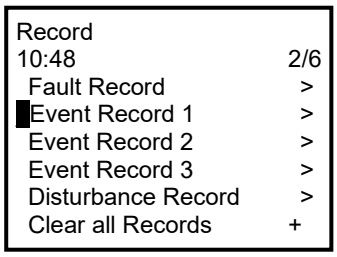


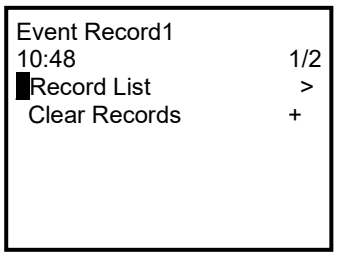
Figure 11.3-6 Display of Event Record

(ii)-1 Display of Event Record

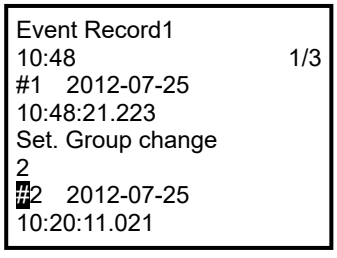
Figure 11.3-7 shows the steps to display and erase event records. To clear all records, refer to section (i)-3.



1). Move cursor to Event Record 1, 2, or 3 sub menu and press ▶.



2). Event Record screen is displayed. Press ▶ at the Record List sub menu.

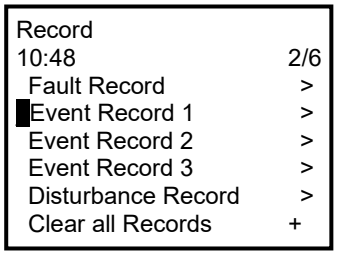


3). Press ▲ or ▼ to move display items.

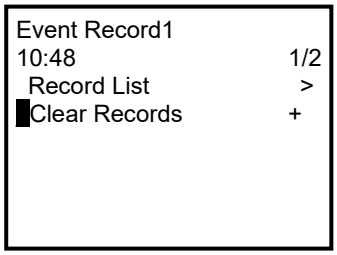
Figure 11.3-7 Display events

(ii)-2 Clear of Event Records

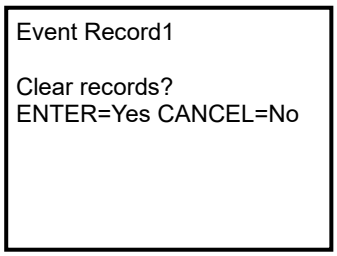
Figure 11.3-8 shows the steps to display and erase event records. To clear all records, refer to section (i)-3.



1). Move cursor to Event Record 1, 2, or 3 sub menu and press ▶.



2). Event Record screen is displayed. Press ENTER at the Clear Records sub menu.



3). Clear all Event records if ENTER is pressed. Back to display of Event Record directly if CANCEL is pressed.

Figure 11.3-8 Clear Event

(iii) Disturbance Record

Disturbance Records can be displayed graphically on the PC screen by using GR-TIEMS. The IED screen displays only the recorded date and times, which are stored in the IED as the entire disturbance data, as shown in the following example:

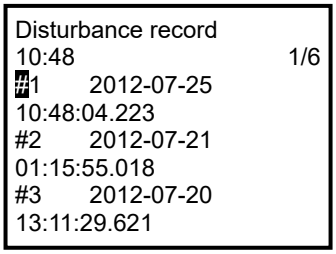
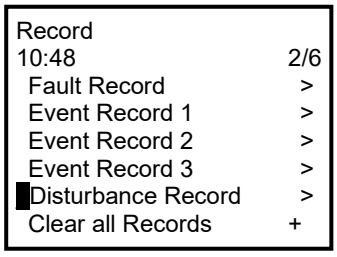


Figure 11.3-9 Display of Disturbance Record

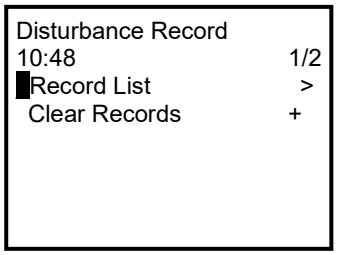
The following shows the steps to display and erase disturbance records.

(iii)-1 Display of disturbance Record

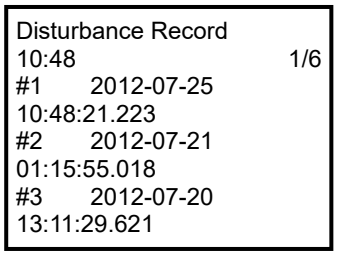
Figure 11.3-10 shows the steps to display and erase event records. To clear all records, refer to section (i)-3.



1). Move cursor to Disturbance Record sub menu and press ►.



2). Disturbance Record screen is displayed. Press ► at the Record List sub menu.

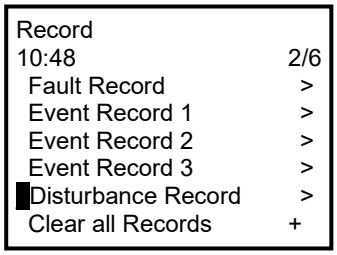


3). Press ▲ or ▼ to move display items.

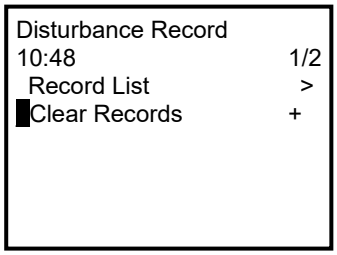
Figure 11.3-10 Disturbance

(iii)-2 Clear of Disturbance Records

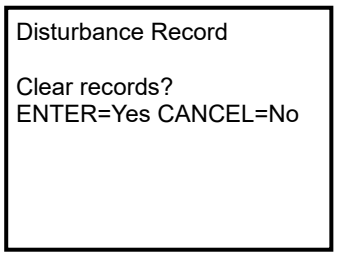
Figure 11.3-11 shows the steps to display and erase disturbance records. To clear all records, refer to section (i)-3.



1). Move cursor to Disturbance Record sub menu and press ▶.



2). Disturbance Record screen is displayed. Press ENTER at the Clear Records sub menu.



3). Clear all Disturbance records if ENTER is pressed. Back to display of "Disturbance Record" directly if CANCEL is pressed.

Figure 11.3-11 Clear records

11.4 Monitoring sub-menu

"Monitoring" sub-menu is used to display the current status of the IED. The data is updated every second on the LCD screen. The user can view the following functions from the Monitoring sub-menu:

i. Metering sub-menu
ii. Binary I/O sub-menu
iii. Communication sub-menu
iv. Relay Elements sub-menu
v. Statistics sub-menu
vi. GOOSE Monitoring sub-menu
vii. Diagnostics sub-menu

(i) Metering

The value and direction of current, voltage etc. can be displayed. The user can change the units as required by using the appropriate setting. Figure 11.4-1 shows an example of the Metering sub-menu.

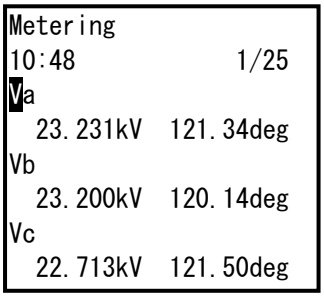


Figure 11.4-1 Display for Metering

(ii) Binary I/O

"Binary I/O" sub-menu can be used to display the respective status of the binary IO module circuits. The LCD displays the binary input or output signal number, the signal name[1] assigned to the circuits of the binary IO modules and their status in a line. The status for the binary output circuit is shown by a logic level ("1" or "0"). Figure 11.4-2 provides an example for binary IO module at IO#1 (Slot#1).

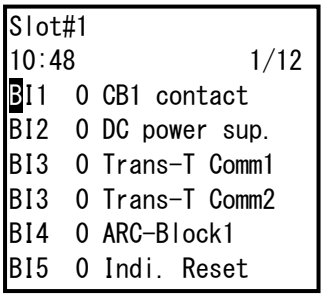


Figure 11.4-2 Display of Binary I/O status

[1]Note: The user can set the names of binary signals with GR-TIEMS.

Figure 11.4-3 shows the steps required to display the status of the binary inputs and outputs.

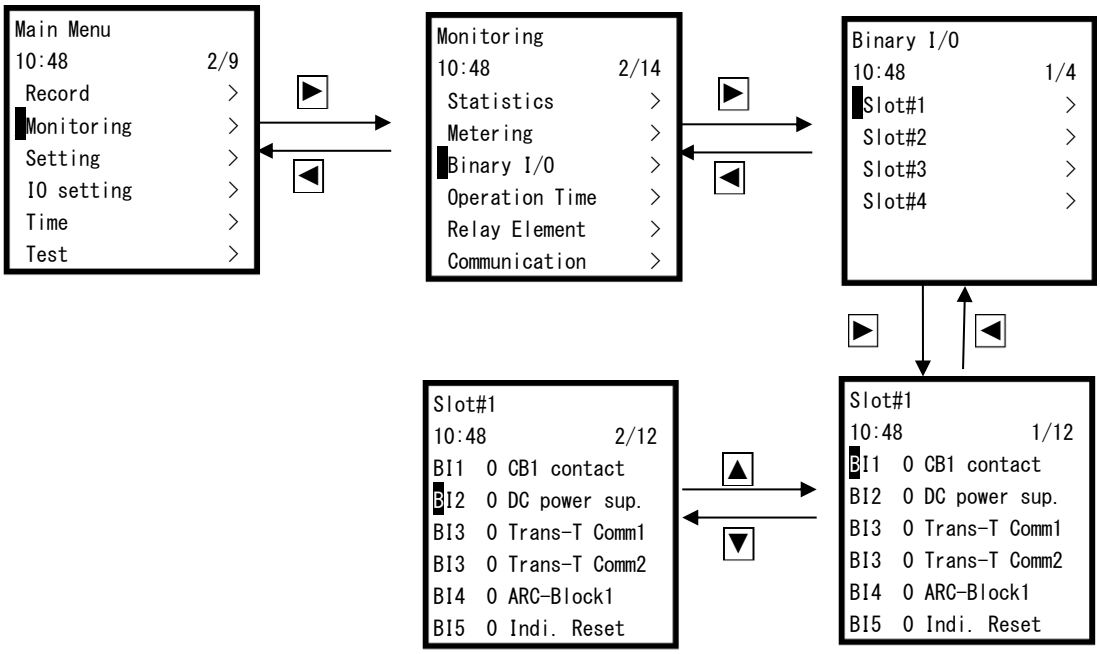


Figure 11.4-3 Steps to display Binary I/O status

(iii) Communication

The "Communication" sub-menu provides several sub-menus as shown in Figure 11.4-4.

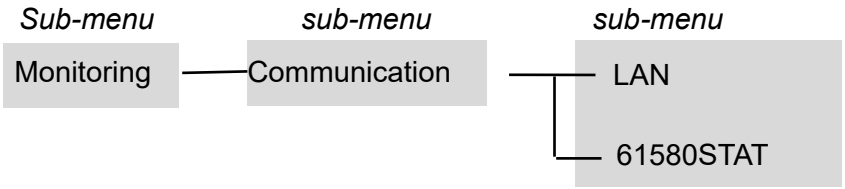


Figure 11.4-4 Menu hierarchy for Communication sub-menu

The display structure for each sub-menu is explained in the following sections:

(iii)-1 **LAN sub-menu**: the communication port name and status are shown in a line. When the IED has single communication module, or when the IED has communication modules but a communication module is allowed to operate in the IED, an operation status of the communication ports is shown, as shown in Figure 11.4-5.

"LAN" sub-menu can display "PortStatus" and "NetMonitor status". If "NetMonitor" is running (active), the LCD screen will display a ">"mark.

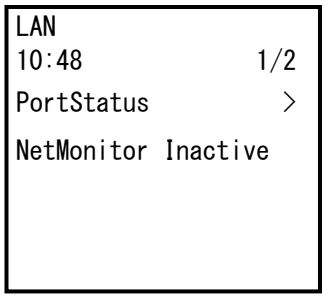
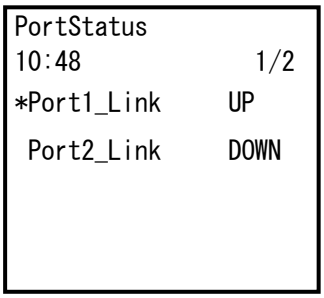


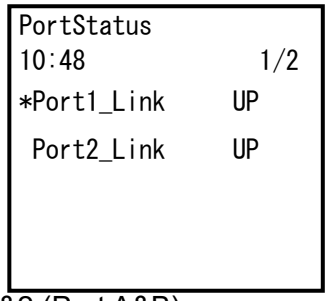
Figure 11.4-5 Display for LAN

If the status of a port is "UP", it means that the communication link is working; if the status of a port is "DOWN, it means that the LAN cable is not connected to the port.

The following two sub-menus are displayed to show the communication status when the IED has dual LAN communication modules.



Port 1(Port A) is connected.
Port 2(Port B) is not connected.



Port 1&2 (Port A&B) are connected.

Figure 11.4-6 Communication status

(iii)-2 **IEC61850 sub-menu**: IP addresses of the devices connecting in IEC61850 are shown in a straight line. Configurations of those IP addresses are available with GR-TIEMS.

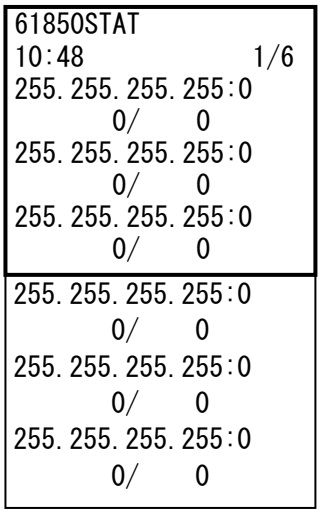


Figure 11.4-7 Display of IEC61850

(iv) Relay Elements

The names of relay elements and statuses of the operation are shown in respective columns. To view all of the relay elements, the user has to press keys ▲ and ▼.

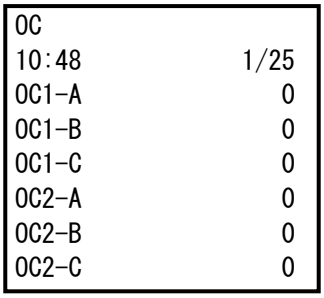


Figure 11.4-8 Displaying Relay Elements

Figure 11.4-9 shows the steps necessary to display the status of the measuring elements.

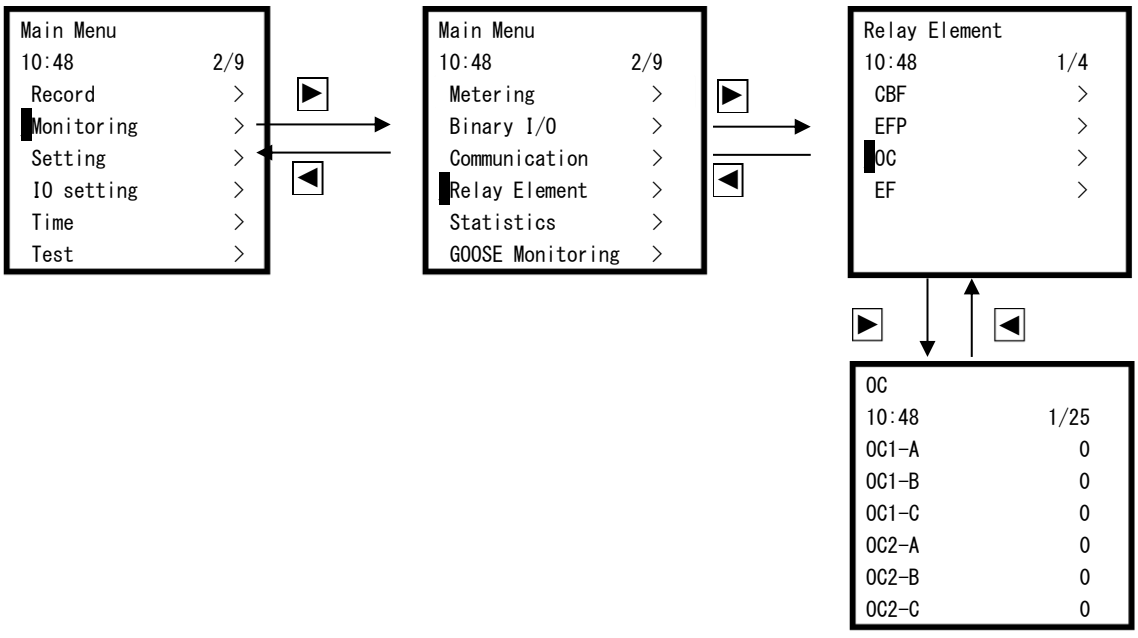


Figure 11.4-9 Steps to display the status of measuring elements

(v) Statistics

"Statistics" sub-menu has several sub-menus.

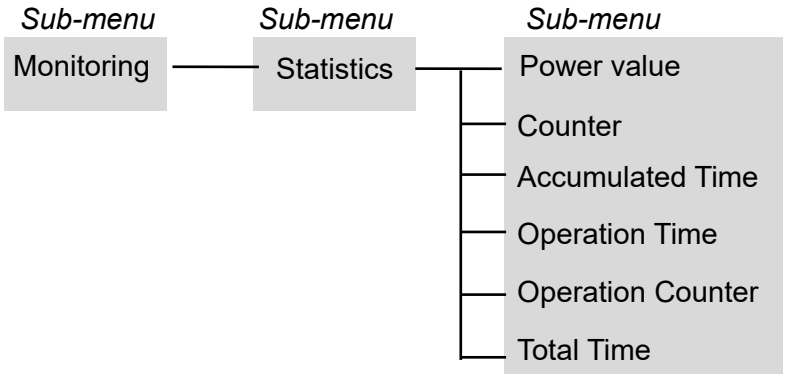


Figure 11.4-10 Menu hierarchy for Statistics

For each statistical item, with the exception of displaying their status, the data can be reset or revised.

(v)-1 **Power Value sub-menu**: With regard to statistics item, the name and its value are shown below. The user can also change the unit of each value by the setting[1]. It is allowed to reset or revise the statistics value[2].

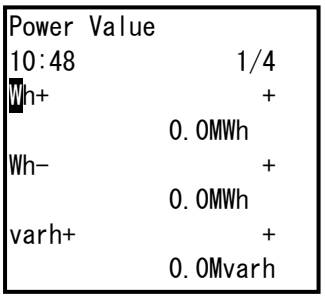


Figure 11.4-11 Display of Power Value

Table 11.4-1 Operation means for data reset or data revise

Step	Display	Operation key	Remark
1	[>]	▶	Press ▶ key to go to the sub-menu
2	[+]	ENTER	Press ENTER key to execute reset or revise. After executing, a confirmation dialog screen displays.

[1]**Note:** In order to secure the reliability, the reset and revision items are controlled by the vendor.

[2]**Note**: The number of digits for the power value can be reduced based on the units kW, MW and kvar+. For instance, when the power is measured as "123,456kW" then it is displayed as "123MW". If this value has to be changed then the user can key in a new compensated value. For example, if "78MW" should be displayed on the IED screen even though the measured value is "123,456kW" then the user should key in the new value of "78MW". Note that the compensated value "78MW" is "78,000kW",

and it is not "78,456kW" or "123,456kW". Note that the compensated value will be affected when there is a change in CT ratio setting. That is, when the user key in a value of "78MW" for the CT ratio of "2000:1" and later when the CT ratio is changed from "2000:1" to "4000:1", then the value is displayed as "156MW" on the IED screen. Therefore when the CT ratio setting is changed, the user should key in the value of "78MW" again to display the compensated value.

(v)-2 **Counter sub-menu**: the name and number of statistical items are shown in two lines. When an item is revised, a [+] mark is shown at the end of the first line.

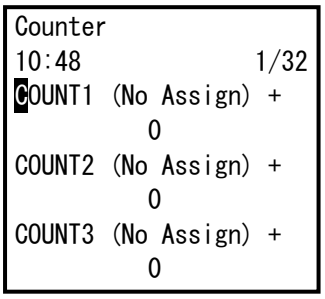


Figure 11.4-12 Display for Counter sub-menu

To change the counter number, follow the steps as shown in Figure 11.4-13.

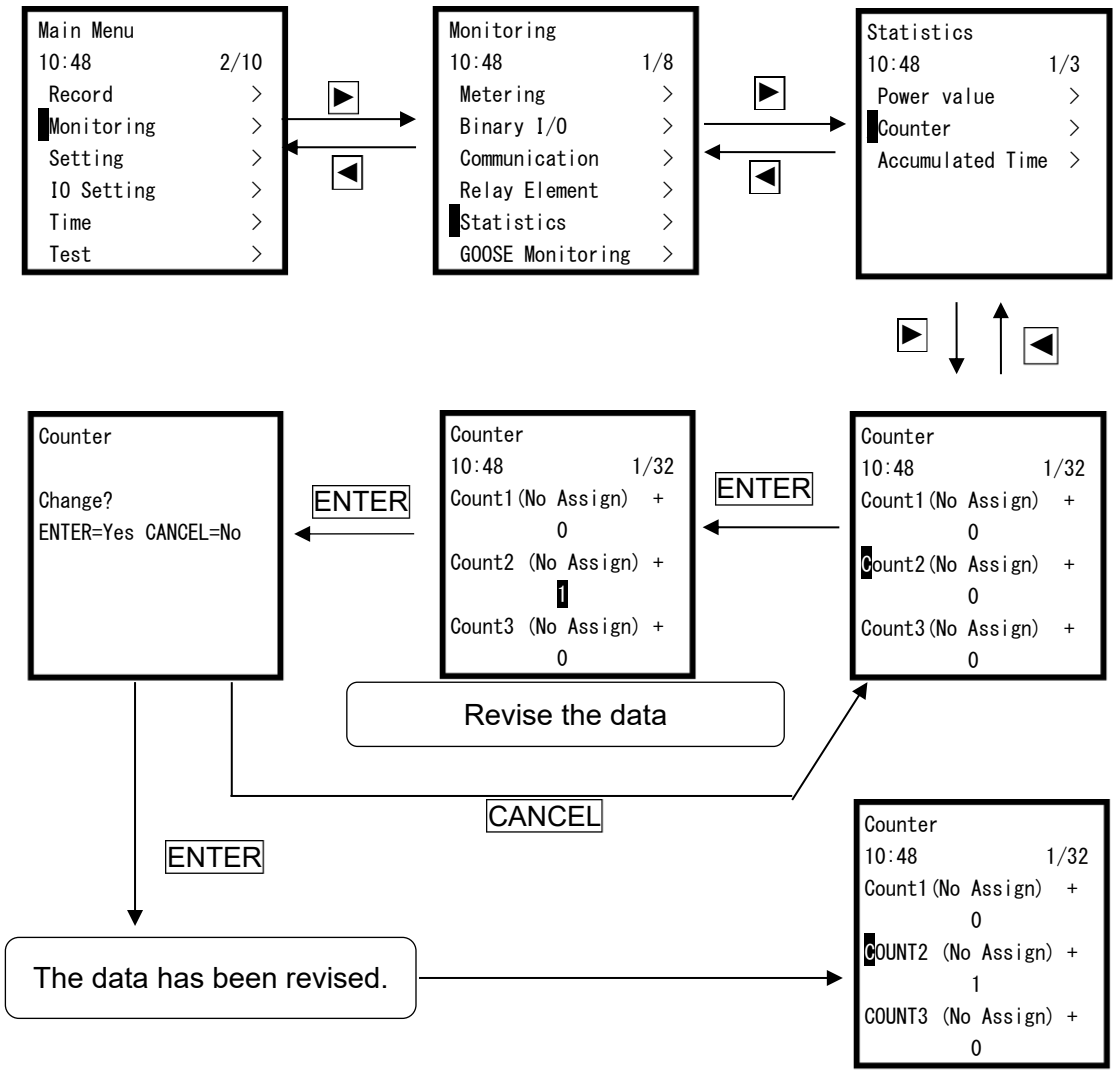


Figure 11.4-13 Steps for changing the counter number

(v)-3 **Accumulated Time sub-menu**: Total time for which the IED has been running is shown in "d (date) h (hour) m (minute)" format. The user can clear the total time value by clear operation (reset), which is shown in Figure 11.4-14.

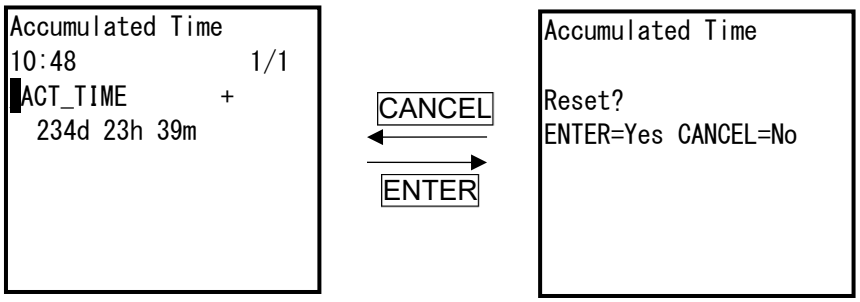


Figure 11.4-14 Display for Accumulated Time

(vi) GOOSE monitoring

The status of the GOOSE subscription information is shown for each record-unit, as shown in Figure 10.2-24. Each IED name (for example, "GRx200-11-603") has been defined in the

GOOSE subscription information.

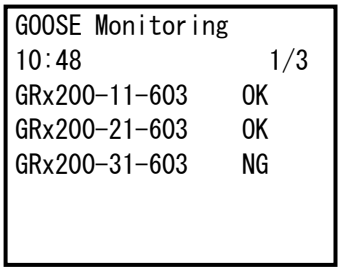


Figure 11.4-15 Display for GOOSE Monitoring

(vii) Diagnostics

Error message will be published in Automatic supervision. If there are no errors, an error message is not displayed.

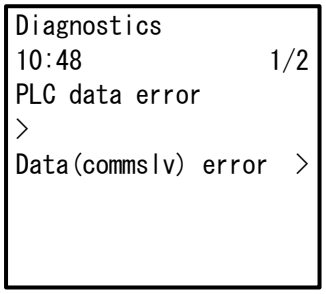


Figure 11.4-16 Display of Supervision items

11.5 Setting sub-menu

"Setting" sub-menu is used to view and change settings for the following functions: Recording, Metering, Communication interface, Relay application, and Monitoring. In this section, we show the "Setting method for elements, switches, and list selection", "Protection setting", and others. Furthermore, this section describes the confirmation of setting, and the "On/Off" function that is used to hide some unnecessary settings.

Note: The meaning of settings and their setting process are beyond the scope of this section. The figures in this chapter are examples only. The user should confirm setting values after their values are changed.

(i) Setting method

In "Setting" sub-menu, four setting modes are provided as follows:

1. Element Setting Mode
2. Switch Setting Mode
3. List Selection Mode (items selection)
4. Signal Selection Mode (signal selection)

(i)-1 **Element Setting Mode**: The "Element Setting Mode" is used for setting numerical values. For each setting, the setting name, setting value and the unit are displayed in two lines. Figure 11.5-1 provides an example of the element setting mode.

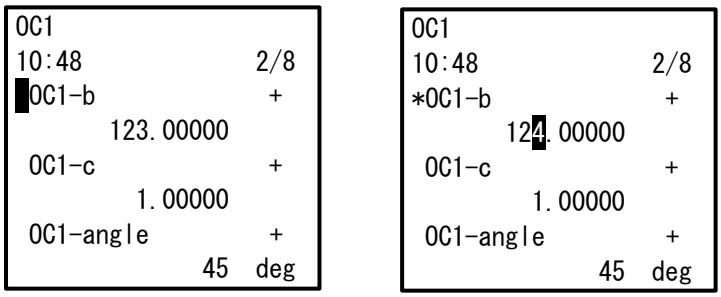


Figure 11.5-1 Example of Element Setting Mode

To begin the setting process, press the key **ENTER**. Once the setting has been changed, the [*] mark will appear alongside the name of the setting. Once the change is canceled or confirmed, the [*] mark will disappear automatically. For the setting of a value, follow the steps as shown in Figure 11.5-2[1]:

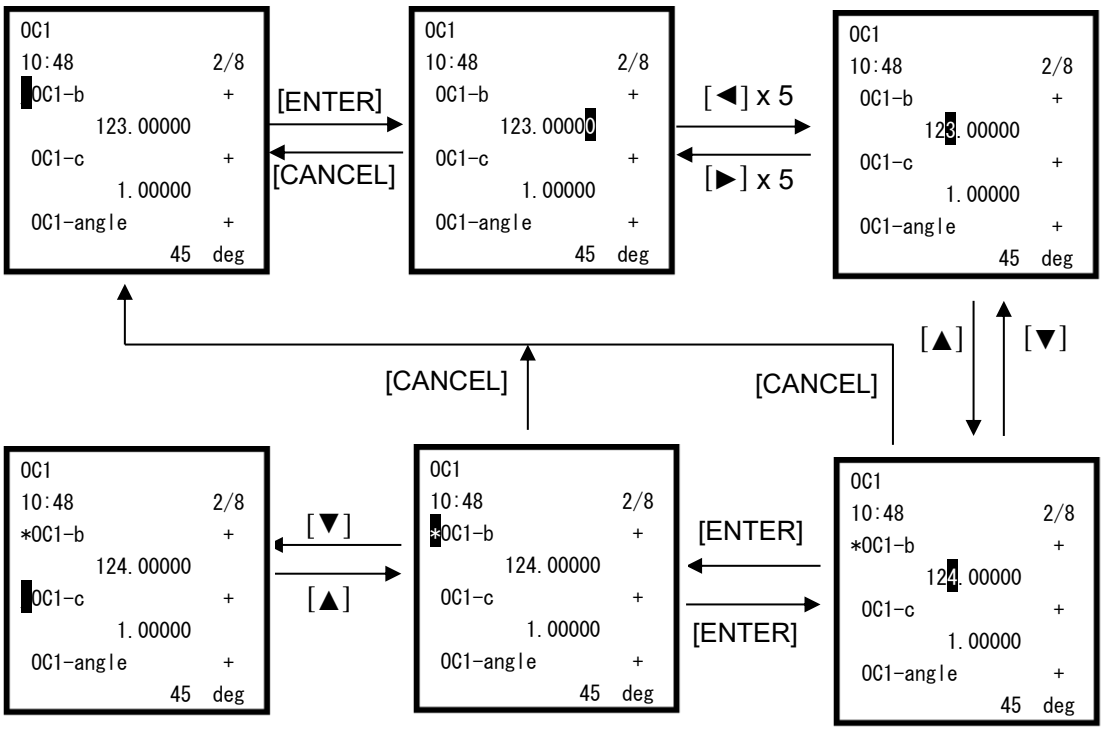


Figure 11.5-2 Steps for setting the value

[1]Note: The meaning of settings and their setting process are beyond the scope of this section. The figure above is provided by way of example. The user should confirm the setting values after making any changes to their values. For verification, refer to "Confirmation of Setting" discussed later.

[2]Note: The operation keys have several features enabling the user to key values for setting items. Table 11.5-1 shows values that have been changed before and after the user presses the operation keys.

Table 11.5-1 Operation example when the operation keys are pressed.

Before	Key	After
1 2 6 7 9	[▲] [▼]	1 2 6 8 0
9 1 7		1 0 1 7
9 1 7		1 0 9 1 7
9 . 1		1 0 9 . 1
6 7 5	[◄] [►]	6 7 5
1 . 7 5		1 . 7 5
2 1 : 2 3		2 1 : 2 3

(i)-2 **Switch Setting Mode**: The "Switch Setting Mode" is a setting used for the selection of two modes. Figure 11.5-3 provides an example of the switch setting mode. For each setting, the setting name and the selected item are

displayed on two lines.

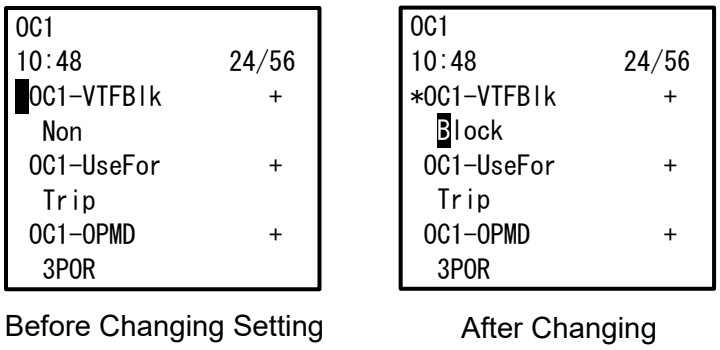


Figure 11.5-3 Display Example of Switch Setting Mode

To begin the setting process, press the key **ENTER**. Once the setting is changed, the [*] mark will appear alongside the name of the setting. When the change is canceled or confirmed, the [*] mark will disappear automatically. Figure 11.5-4 shows the operation of the switch setting mode.

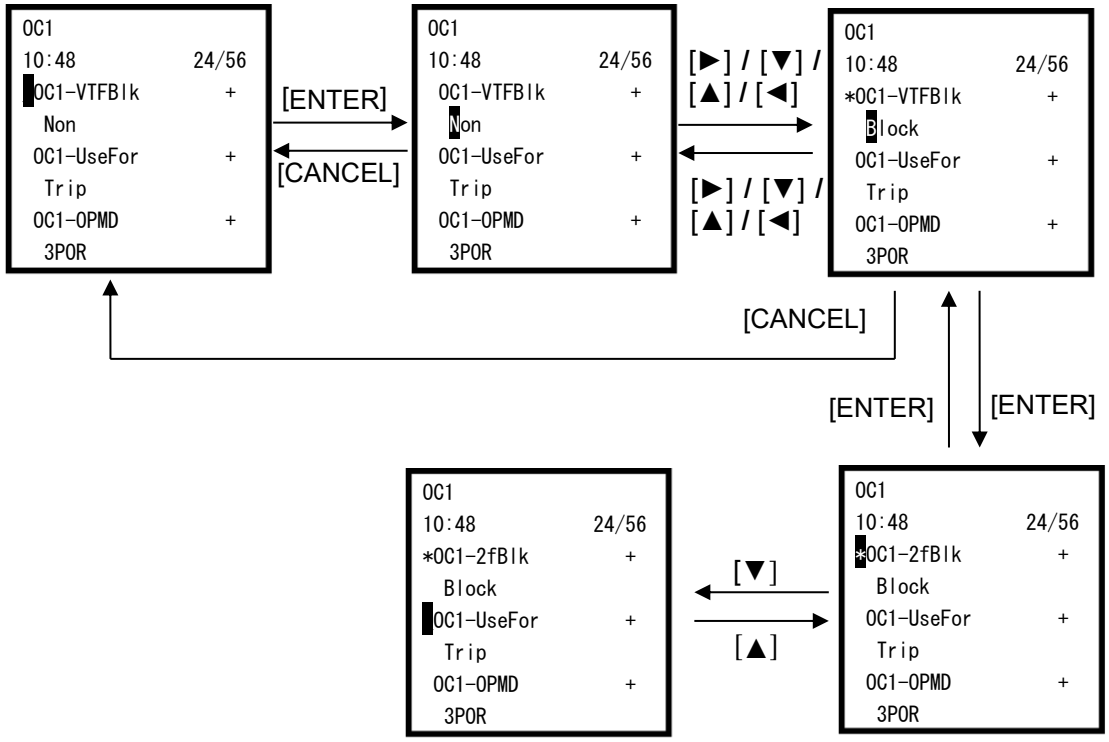


Figure 11.5-4 Operation of Switch Setting Mode

Note: The meaning of settings and their setting process are beyond the scope of this section. The above figure is provided by way of example. The user should confirm setting values after making any changes to their values. For verification, refer to "Confirmation of Setting" discussed later.

(i)-3 **List Selection Mode**: The "List Selection Mode" is composed of main-setting-screens and selection-list-screens as shown in Figure 11.5-5. In the main-

setting-screen, the setting name and the selected item are displayed. Press the key **ENTER** to begin the setting process; the screen for selection list will appear. Once a setting has been changed, the [*] mark will appear alongside the name of the setting. When the change is canceled or confirmed, the [*] mark will disappear automatically.

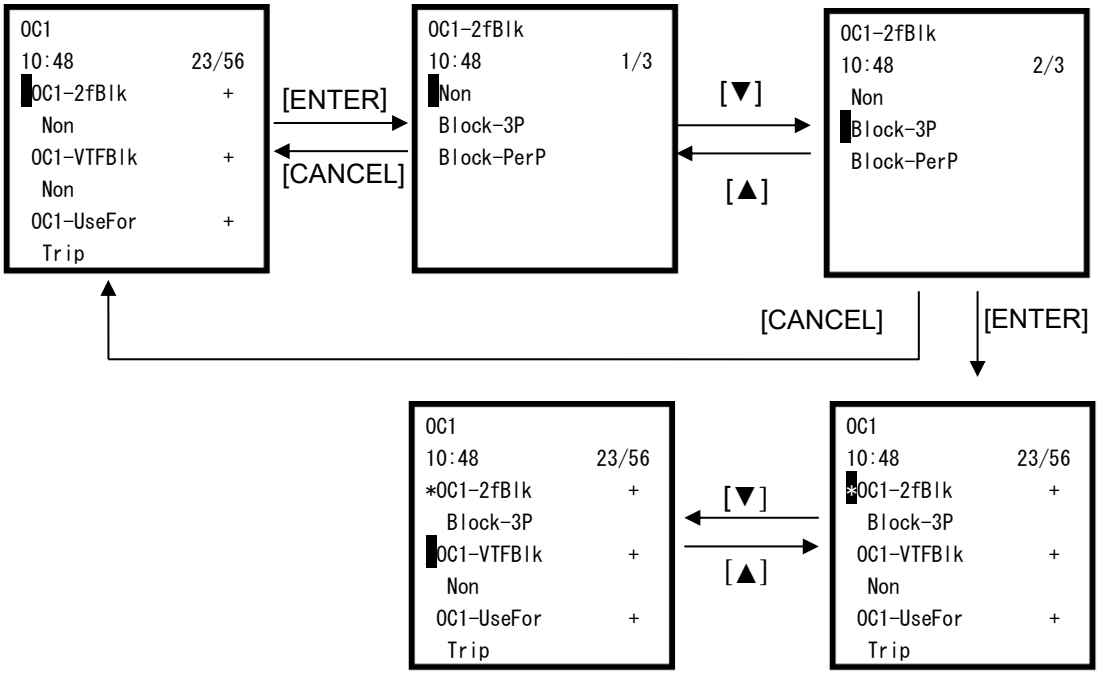


Figure 11.5-5 Operation of List Selection Mode

(i)-4 **Signal Selection Mode**: Figure 11.5-6 shows the steps to select a signal.

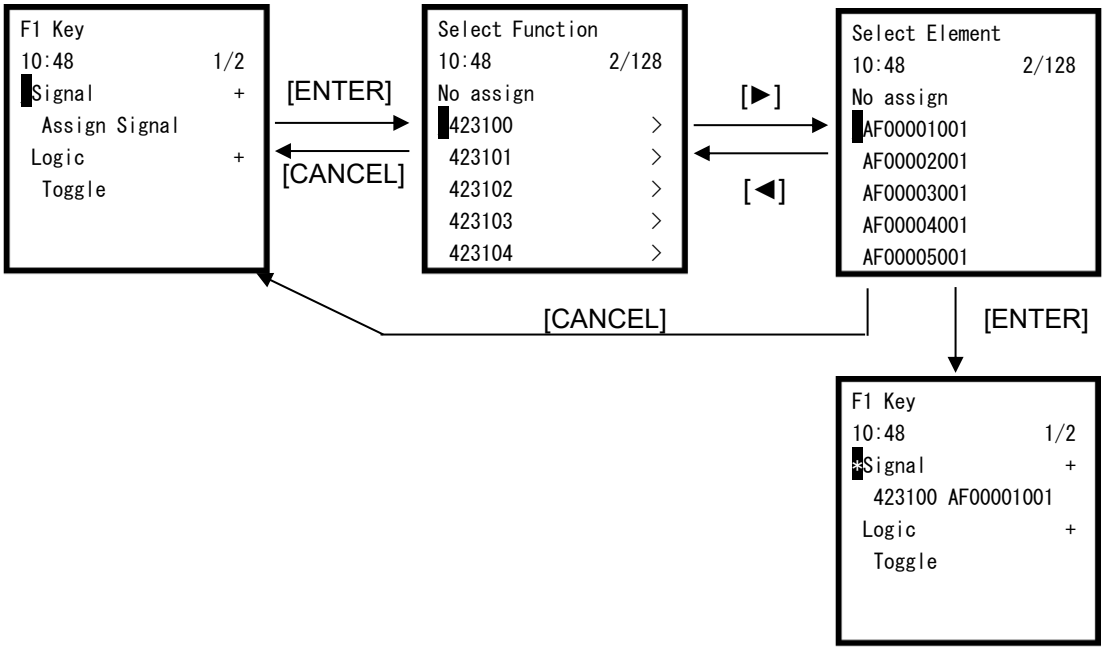


Figure 11.5-6 Operation of signal selection

(ii) Confirmation dialog in each sub-menu

In "Setting" menu, a confirmation dialog #1 and #2 appears in the sub-menu and lower-level menu, as shown in Figure 11.5-7

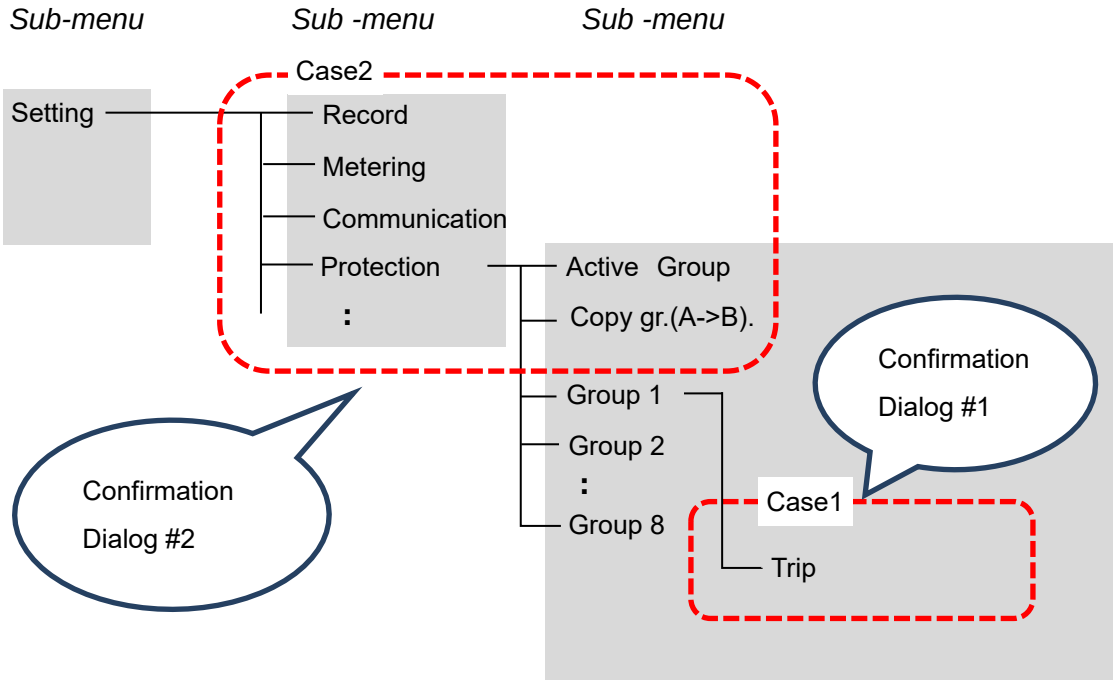


Figure 11.5-7 Confirmation dialog setting

- Case1: Confirmation dialog #1

  Suppose the setting of each group is changed; the confirmation dialog will appear when returning to the screen of the "Protection" sub-menu, as shown in Figure 11.5-8.

- Case2: Confirmation dialog #2

  Suppose a setting is changed; the confirmation dialog will appear when returning to the "Upper Menu", as shown in Figure 11.5-9.

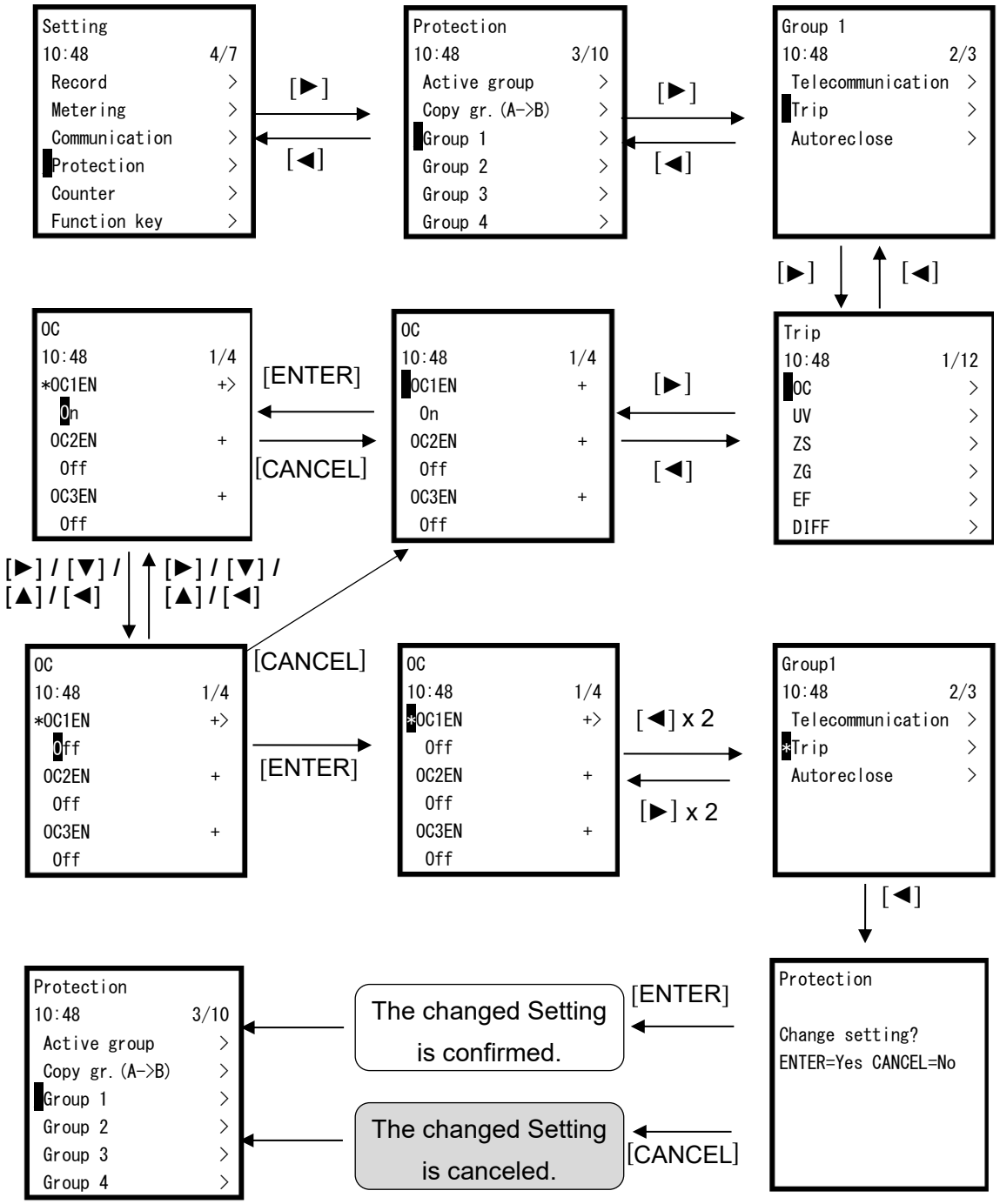


Figure 11.5-8 Setting example in case #1

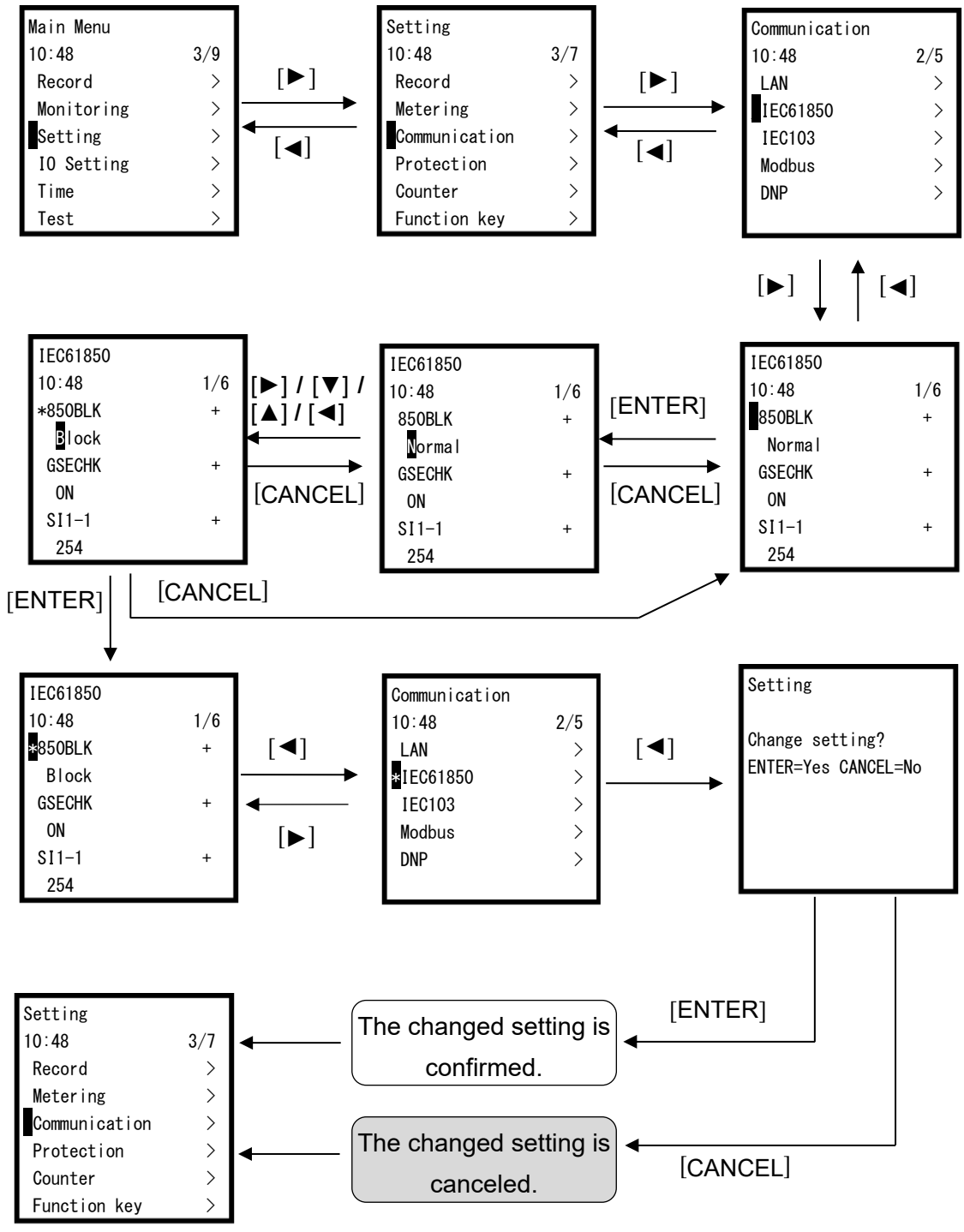


Figure 11.5-9 Setting example in case #2

(iii) On/Off function

When the "Setting->Protection->Group (1 to 8)" sub-menu is displayed, the "On/OFF function" is used to hide some unnecessary settings.

"On" indicates that the setting is enabled; the mark [>] will appear. More detail of the settings provided within the hierarchy are described later.

"Off" indicates that the setting is disabled; the detailed settings are hidden, the mark [>] is not indicated. The following figure shows the usage of On/Off function.

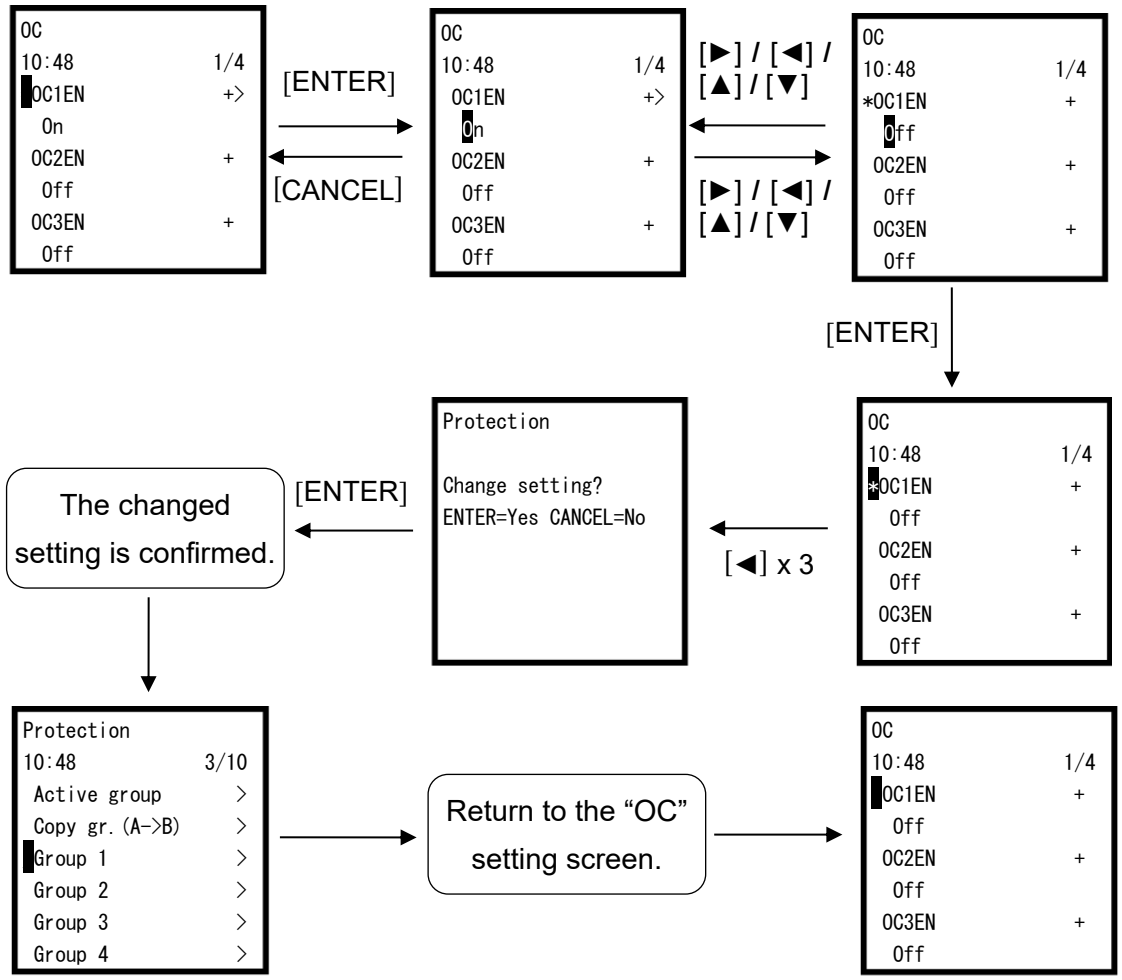


Figure 11.5-10 Operation of On/Off function

Table 11.5-2 Explanation of [+>] mark in On/Off function

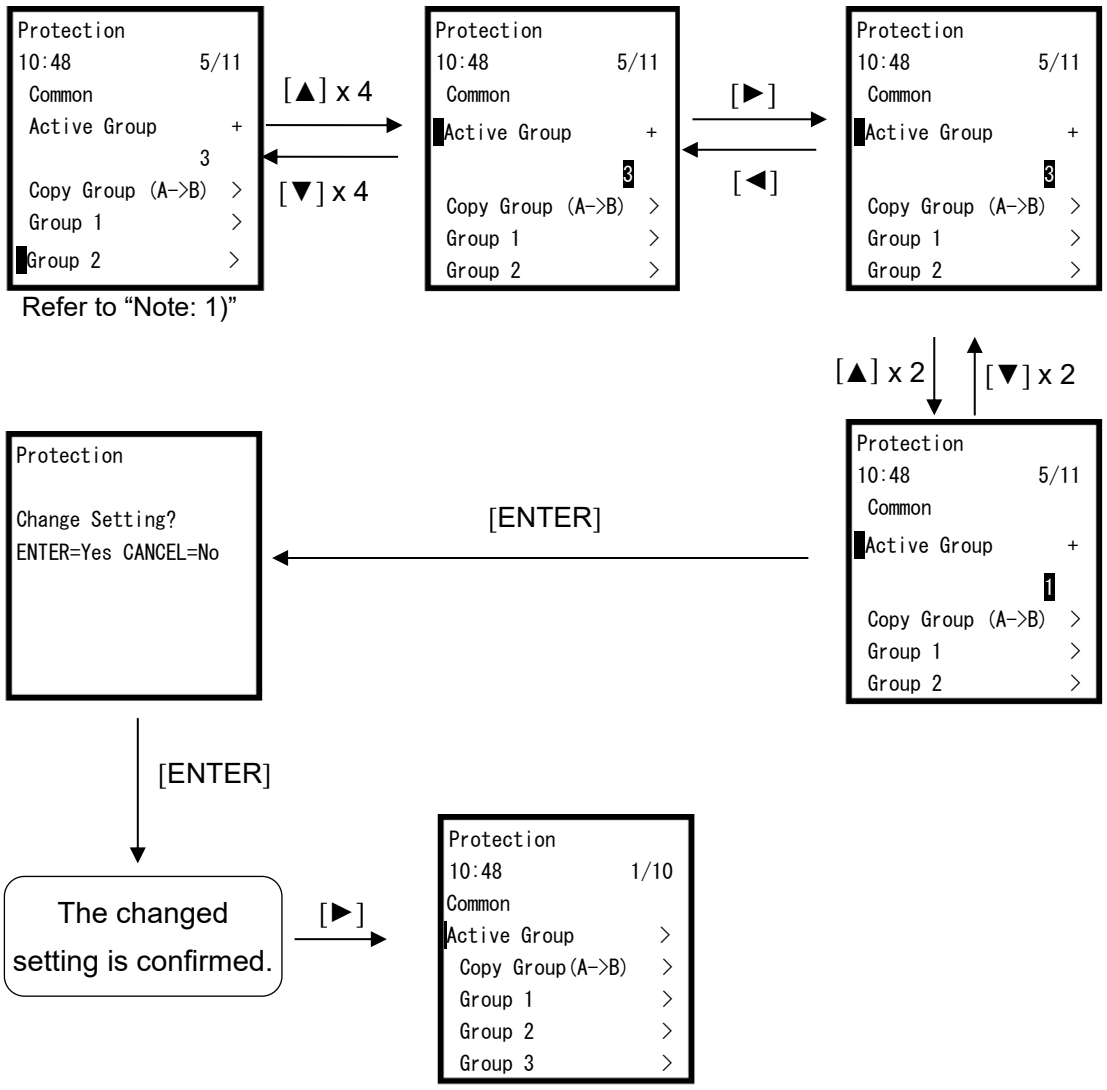
Display	Operation	Remark
[+>]	▶	Go to the sub-menu
	ENTER	Change setting.

(iv) Protection group setting

The IED provides eight setting groups for the protection of the power system; the user can choose an alternative setting group from one of the eight groups in response to a change in the

operation of the power system. In the "Protection" sub-menu, the user can change the active group and can copy the group settings. Jump to the "Element Setting Menu" if a relay setting is required.

(iv)-1 Change active group: An example for changing the active group is shown in the following figure.



†Note: When the screen moves to the "Protection" sub-menu from the "Setting" sub-menu, the cursor will appear alongside the current active group.

Figure 11.5-11 Operation of changing active group

(iv)-2 **Copy group setting:** The user can copy an active setting from one group to another group. As an example, in the following figure "Group3" will be copied to "Group2", as shown in Figure 11.5-12.

Note: In the "Copy Group (A->B)" screen, the number displayed at A is the current active group number.

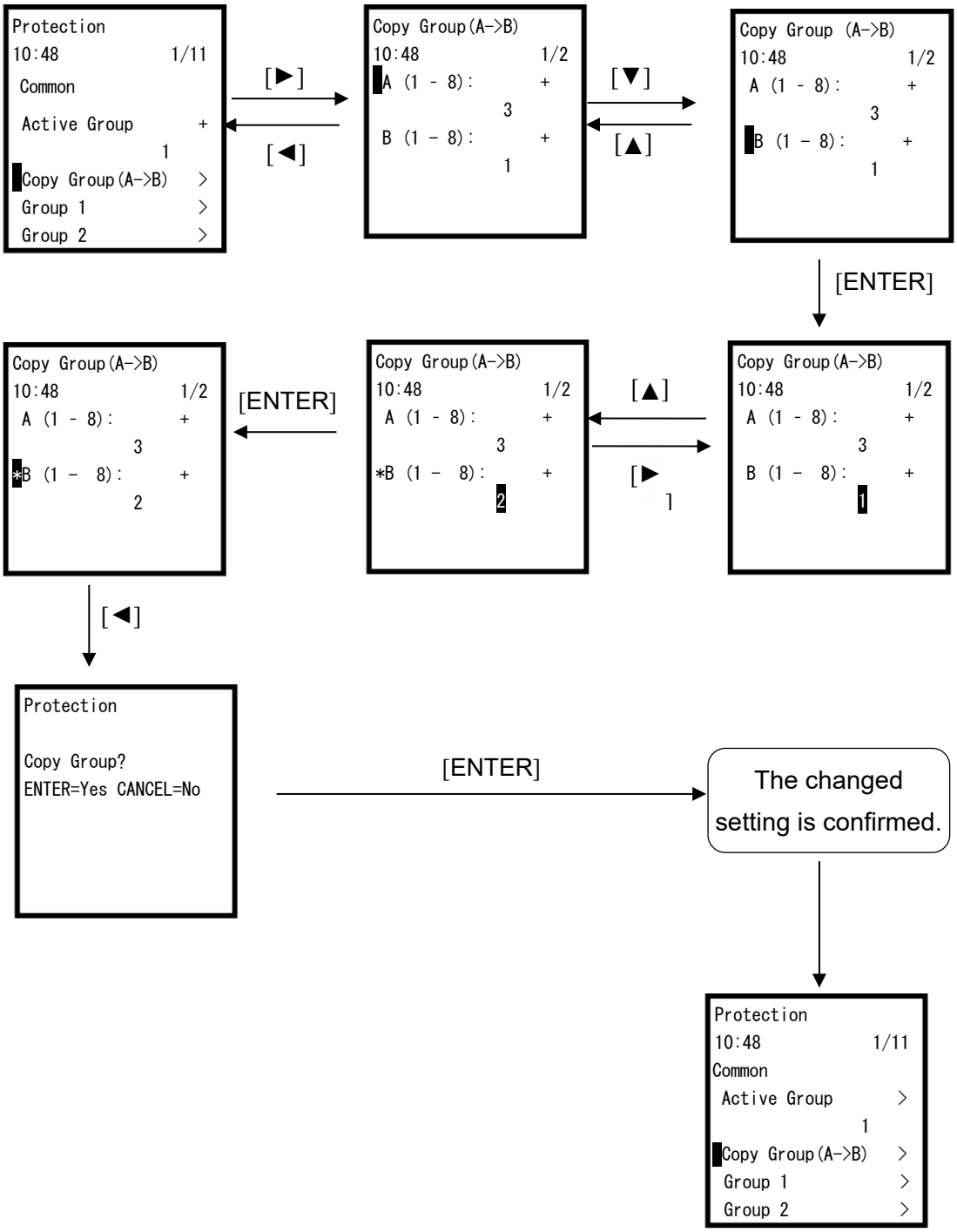


Figure 11.5-12 Copy group setting

(iv)-3 **Change group settings**: Upon shipment from the factory, the default settings are set. Therefore, in each group, the user can change the settings of the protection functions and other features. To change the settings in each group, refer to the setting method discussed in section 11.5(i).

(v) Configuration of Function keys

Function keys (F1 to F7) on the IED front panel provide a feature to navigate to a specific screen, which is configurable by the user. These keys have their own LED, which can be

programmed using settings. Six screens are configured for six of the function keys (F1 to F6), respectively, as the default settings shown in Table 4.8-3.

Table 11.5-3 Function keys which are configured to navigate a menu

Function Key configured	Menus
F1	Metering
F2	Fault Record
F3	Event Record1
F4	Event Record2
F5	Event Record3
F6	Diagnostics

(v)-1 Screen jump function: To configure the screen jump function, follow the steps as shown in the figure below.

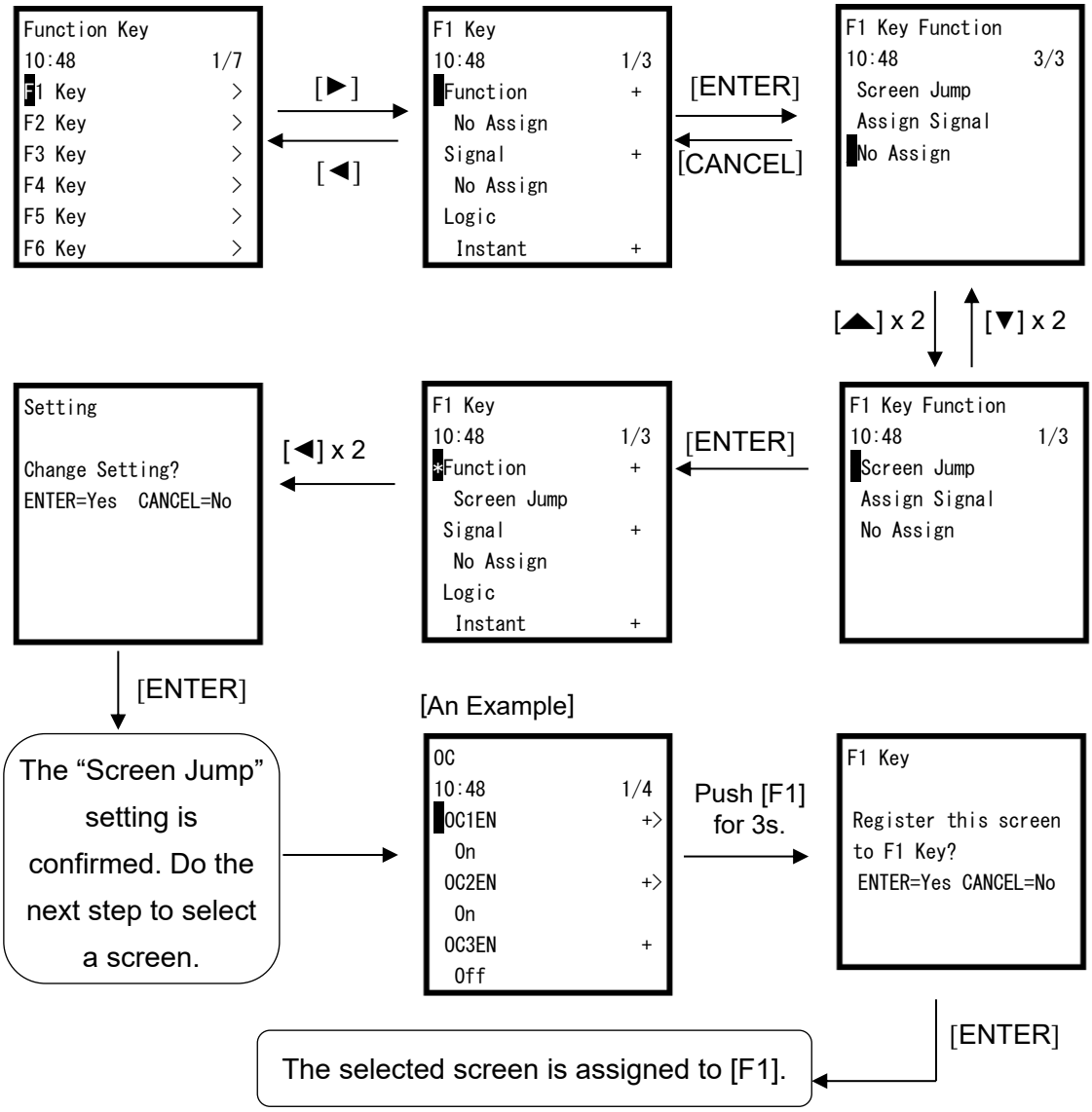


Figure 11.5-13 Operation of screen jump setting

On any screen, press the screen-jump function key to display a screen, refer to the following figure:

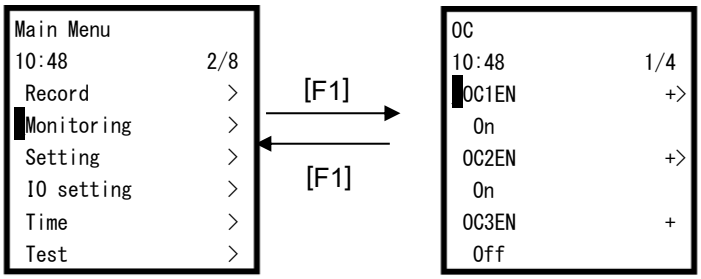


Figure 11.5-14 Operation of screen jump function

To cancel the screen-jump function, follow the procedure provided in Figure 11.5-15.

Note: 1) Once a screen is configured to a function key, it will not be deleted until a new screen is configured for the same function key.

2) If a configured screen is disabled by "On/Off Function" setting (refer to section 11.5(iii)), the screen jump function is also disabled for the function key.

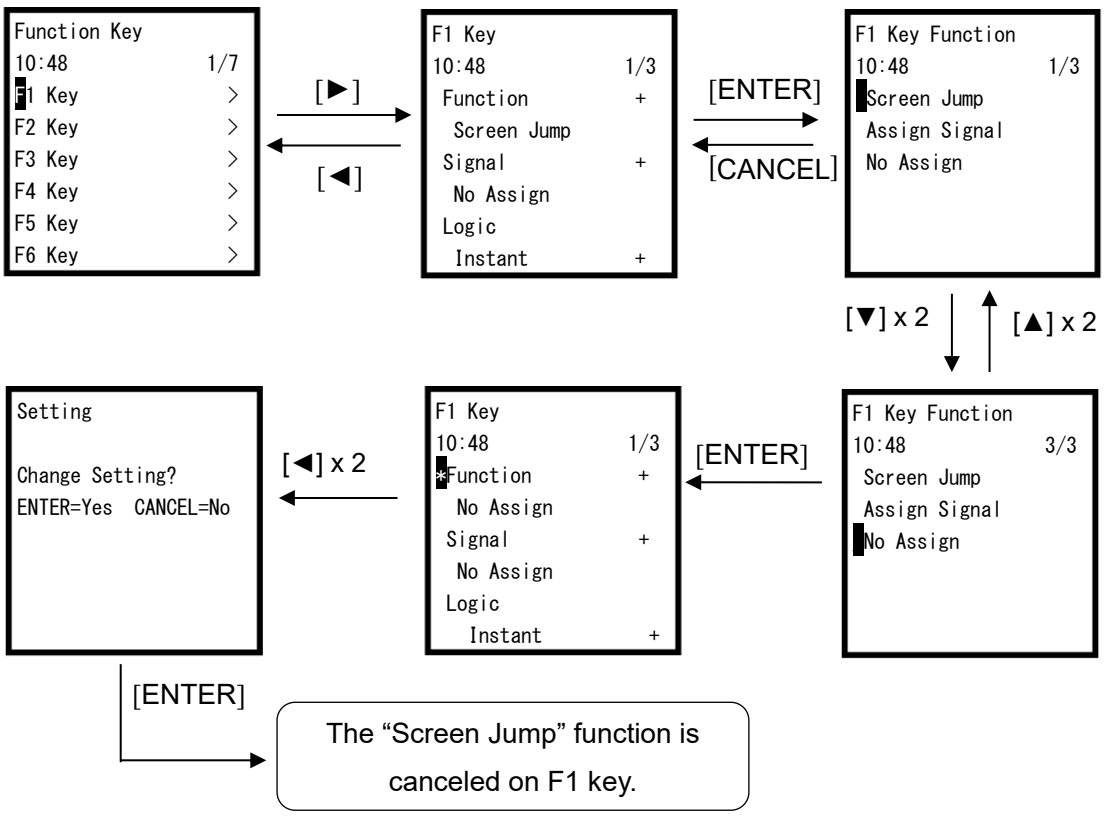


Figure 11.5-15 Cancelling screen jump function

(v)-2 **Signal control function:** To assign a test signal to a function key, follow the steps as shown in Figure 11.5-16.

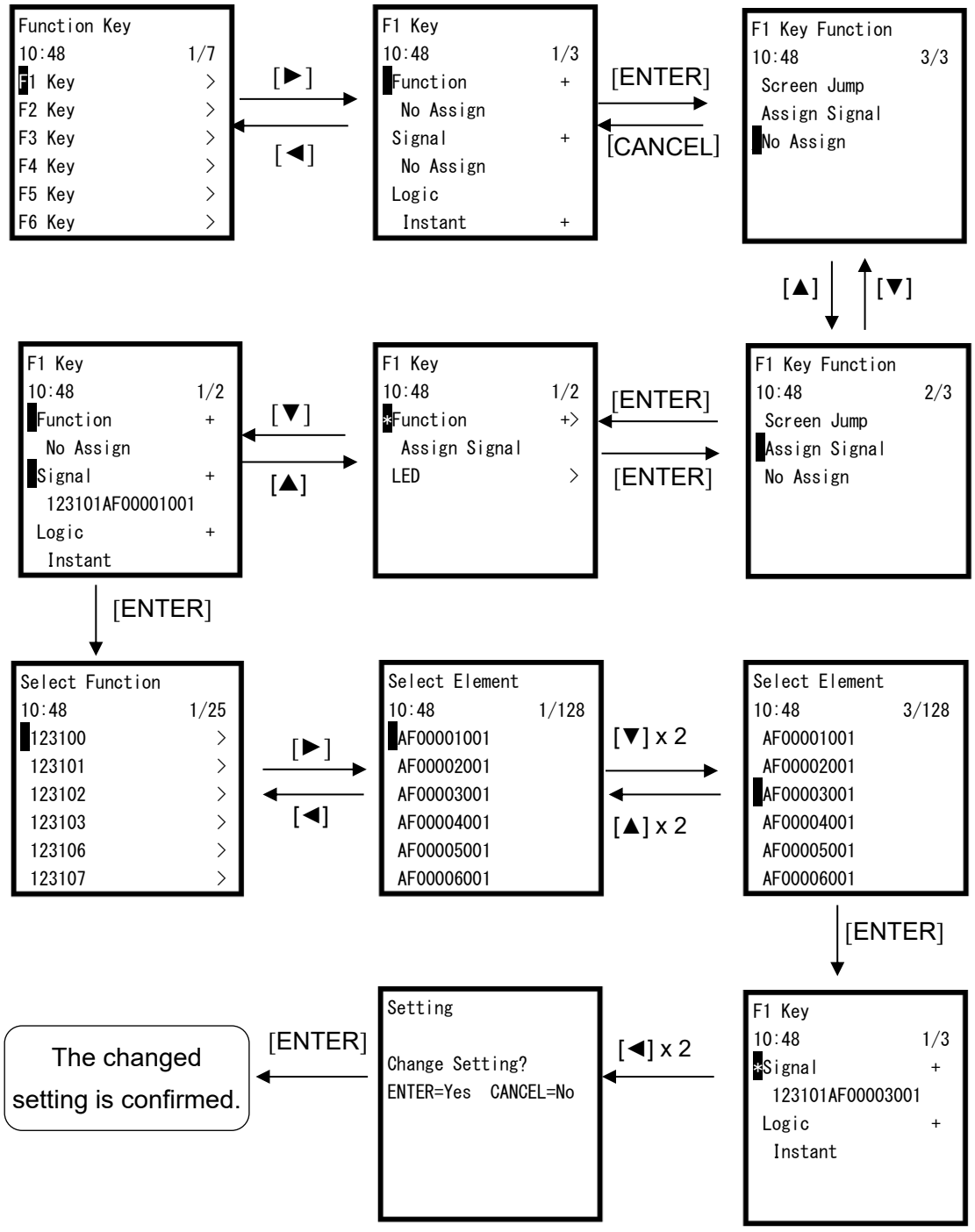


Figure 11.5-16 Assigning a signal to the function key

11.6 I/O setting sub-menu

The "I/O Setting" sub-menu is used to set or change settings for the following items:

(i) AC Analog Input

(ii) Binary Input

(iii) Binary Output

(iv) LED

This section explains the details of the setting method.

(i) AC analog input

For the AC analog inputs in the VCT module, the user can configure a ratio for each AC analog channel. With regard to the ratio, the user can key the value of the ratio from the sub-menu.

(i)-1 **Selection of ratio**: For example, Figure 4.2-1 shows how the channel selection is made for the AC analog input on a VCT module (AI#1 = VCT#1). Move the cursor by pressing keys ▲ and ▼. Then, press key ▶ to go to the next level in the hierarchy.

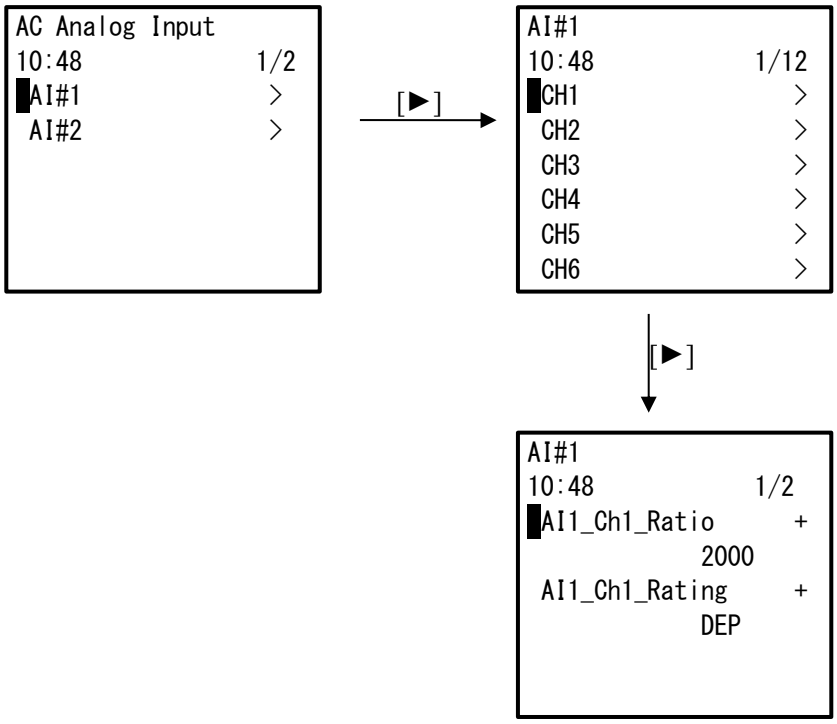


Figure 11.6-1 AC analog input screen

Note: This screen is a sample. The AI numbers displayed are dependent upon the configuration of VCT modules in each IED.

(i)-2 **Check of rating**: Figure 11.6-2 is an example of rating in channel#1. From this screen, the user can find a rating defined for each channel.

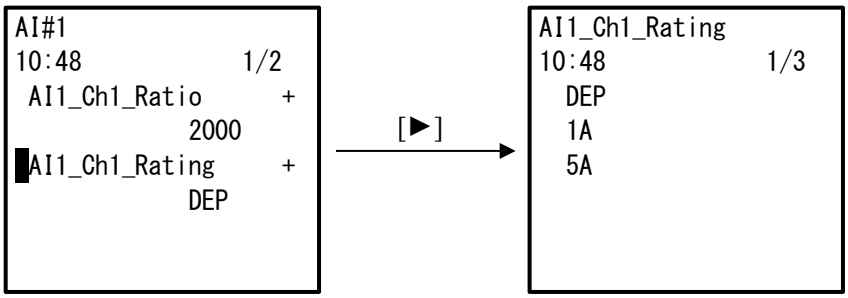


Figure 11.6-2 Check of rating

Note: Term "DEP" means that a rating value follows the default setting at the manufacture when it is carried out customer's ordering. For more information of ordering, see *Appendix: Ordering*.

(ii) Binary input

All binary input circuits provided in the IED are user-configurable; the user can set common programmable logic (CPL) for each binary input circuit. (For more information of CPL, see Chapter *Technical description: Binary IO module: Binary input circuit*)

The user can activate or turn off the above timers and switches using the setting function. To configure the binary input circuits, the user should follow the procedure in steps ((ii)-1 and (ii)-2)

(ii)-1 **Selection of binary input circuit**: For example, Figure 11.6-3 illustrates the selection of a binary input circuit on a binary IO module. Move the cursor by pressing keys [▲] and [▼]. Then, press key [►] to go to the next hierarchy.

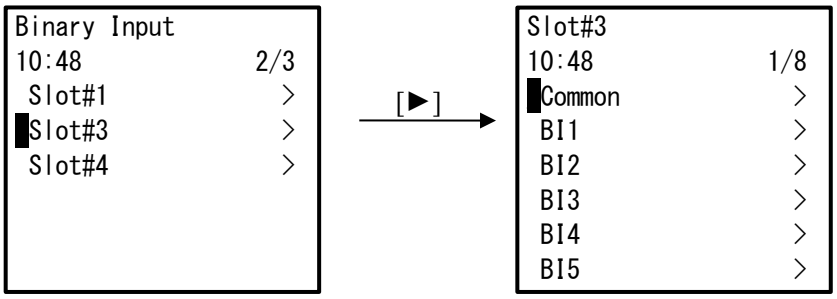


Figure 11.6-3 Selection of slot and binary input circuit

Note: This screen is a sample. The slot numbers displayed depend upon the configuration of the binary IO module in each IED.

(ii)-2 **CPL setting**: Figure 11.6-4 is an example of a "Common" setting. From this screen, the user can set a threshold level and the number of comparisons feature for contact chatter for all binary input circuits.

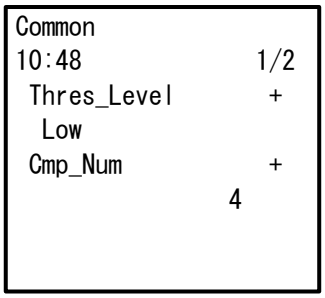


Figure 11.6-4 Common screen

For example, Figure 11.6-5 shows the CPL setting for binary input circuit (BI1). The timer and the inverse switch can be activated when **On** or **Off** is set for setting [**BI1_CPL**]. Press key **ENTER** to commence the setting of a switch or parameter.

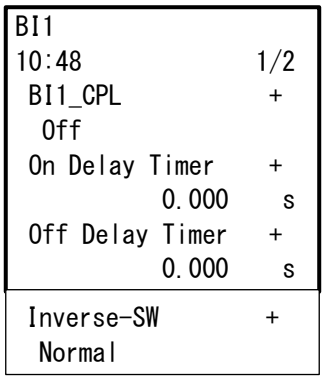


Figure 11.6-5 CPL setting

Note: Setting items "On Delay timer and others" are displayed when the user sets [**BI*_CPL**] **On**.

(iii) Binary output

All binary output circuits provided in the IED are also user-configurable; the user can configure timers and switches using CPL settings. (For more information of CPL, see Chapter *Technical description: Binary IO module: Binary output circuit*)

(iii)-1 **Selection of binary output circuit**: For example, Figure 11.6-6 illustrates the selection of a binary output circuit on a binary IO module. Move the cursor by pressing keys ▲ and ▼. Press key ▶ to go to the next level in the hierarchy.

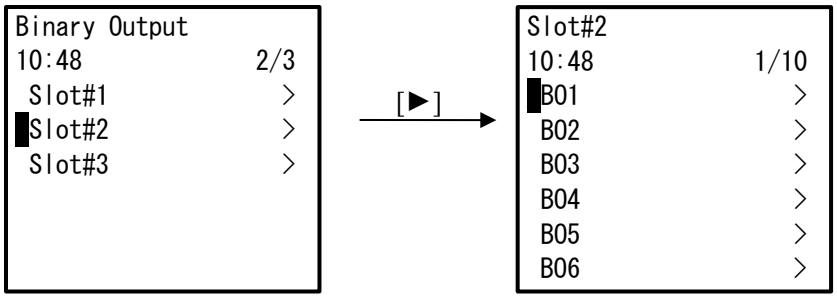


Figure 11.6-6 Selection of slot and binary output circuit

Note: This screen is a sample. The slot numbers displayed are dependent upon the configuration of the binary IO module in each IED case.

(iii)-2 CPL Setting: For example, Figure 11.6-7 illustrates the setting of a binary output circuit (BO1). Using setting [**BI1_CPL**] **On**, the CPL logic in BO1 is available. Similarly, assigned signals, timers and switches can be set in this menu. Note that detailed setting items are shown when **On** is keyed into setting [**BI*_CPL**].

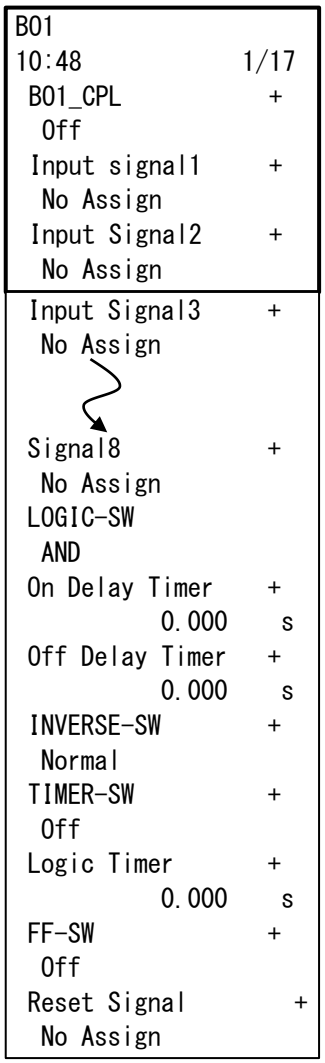


Figure 11.6-7 Binary output setting

Figure 11.6-8 shows how to assign a signal:

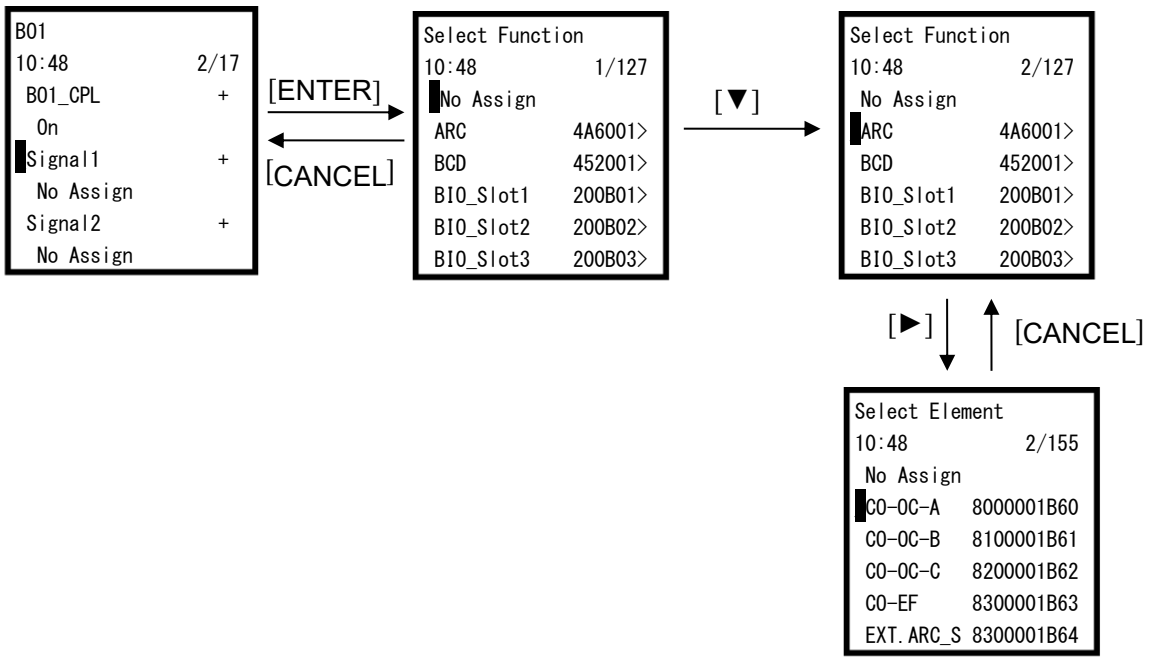


Figure 11.6-8 Assigning a signal

Note: "No Assign" is always displayed on the first line, even when the page is changed.

(iv) Selection and setting of LED

As shown in Figure 11.1-1, the IED provides 26 LEDs and 7 function-keys. The user can configure LEDs ("LED#3" to "LED#26") and the function key LEDs (F1 to F7; each has a LED). Each LED is driven via a logic gate which can be programed to be an AND gate, OR gate or XOR gate operation. Furthermore, each LED has a programmable reset characteristic, settable for instantaneous drop-off, or for latching operation. One or up to eight signals can be assigned to a single LED with selectable LED color.

(iv)-1 **Selection of LED**: Figure 11.6-9 shows the LED selection screen; the user can select a setting item by pressing keys ▲ and ▼. Press key ► to go to the next level in the hierarchy.

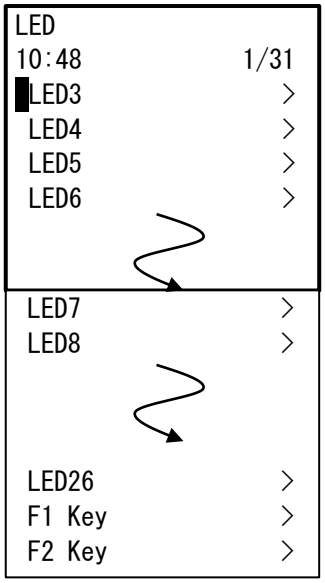


Figure 11.6-9 LED selecting screen

(iv)-2 **LED Setting**: As shown in Figure 11.6-10, the user can set the logical gate, timer, color of LED and assign signals in this screen.

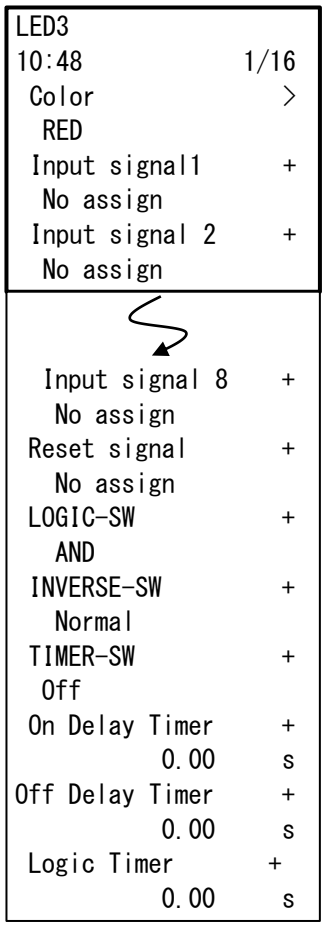


Figure 11.6-10 LED setting screen

11.7 Time sub-menu

In Time sub-menu, the user can change settings of Clock function, such as time zone, time synchronizing source, format of time displaying and so on. Figure below shows the Time sub-menu. (For more information, see *Chapter Technical description: Clock function*)

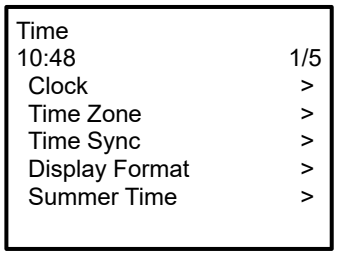


Figure 11.7-1 Time function screen

(i) Clock

The clock can run locally or synchronize with the external time source shown in [ActiveSyncSrc] menu. Figure 11.7-2 shows the Clock screen:

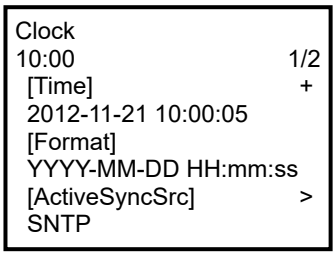
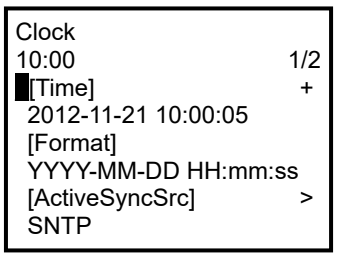


Figure 11.7-2 Clock screen

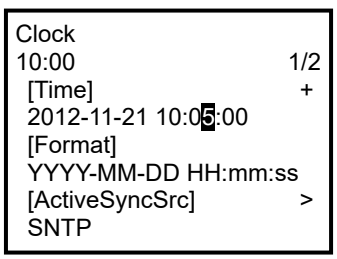
The Clock sub-menu is composed of the [Time] menu, [Format] menu and [ActiveSyncSrc] menu. Time for the IED can be set in the screen. When the active synchronizing source is SNTP, the user can go to another sub-menu to check the current active SNTP server.

Figure 11.7-3 shows how to handle this screen.

(i)-1 Time menu



(1) Move cursor to the Time menu and press ENTER.

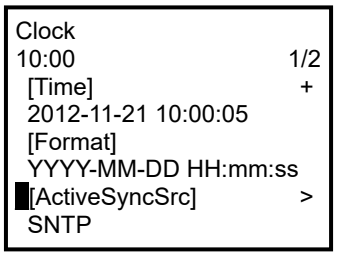


(2) Current time can be changed to press ▲ or ▼.

Figure 11.7-3 Clock format

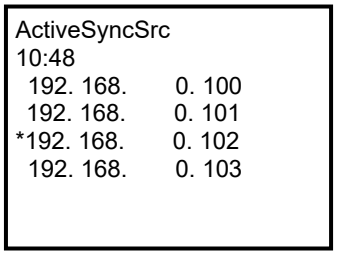
(i)-2 ActiveSyncSrc menu

ActiveSyncSrc can be shown by the following procedure.



(1) Move cursor to the [ActiveSyncSrc] menu and press ►.

*Note: When the active synchronizing source is not SNTP, the > is not shown in the screen.



(2) The ActiveSyncSrc screen shows the active IP address of active SNTP server.

Figure 11.7-4 ActiveSync

(ii) Time zone

The user can input time zone designated by UTC in Time zone screen. Time zone according as local area for the IED should be set. Figure 11.7-5 shows the Time Zone screen:

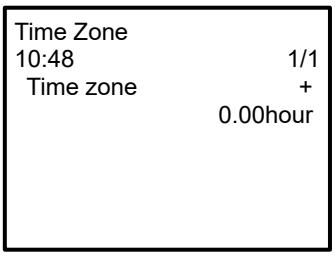
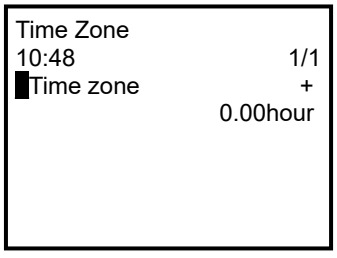


Figure 11.7-5 Time zone setting screen



(1) Move cursor to the Time zone menu and press ENTER.

Time zone can be set by 0.25 hour. The user has to fill the Time zone in accordance with UTC (Coordinate Universal Time).

Figure 11.7-6 TimeZone

(iii) Time synchronization

Time synchronization source can be selected in Time synchronization screen. The synchronization function can be activated by configuration of the On/Off switch in this menu. Figure 11.7-7 shows the configuration screen for the time synchronization function:

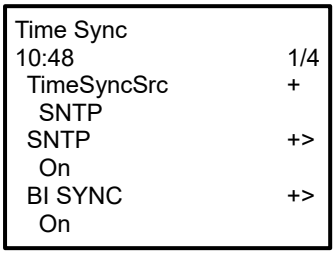
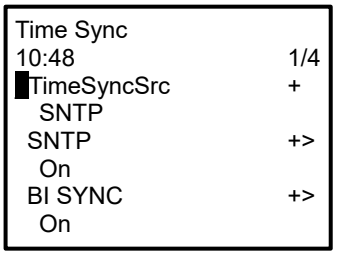


Figure 11.7-7 Time synchronization setting

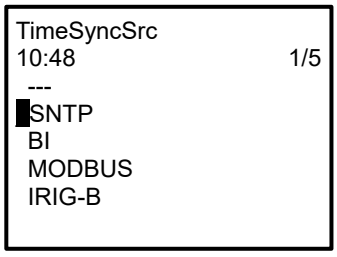
The following shows how to operate in this screen.

(iii)-1 TimeSyncSrc menu

Time SyncSrc (Time Synchronization Source) can be changed by the following procedure.



(1) Move cursor to the TimeSyncSrc menu and press ENTER.



(2) The TimeSyncSrc menu is composed of "---", SNTP, BI, MODBUS and IRIG-B.

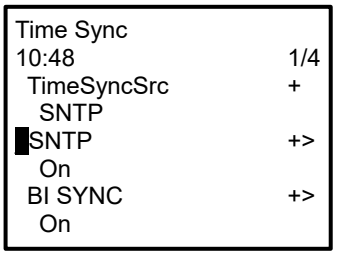
Note: When "---" is selected, it means that time synchronization is not operated.

Figure 11.7-8 TimeSyncSrc

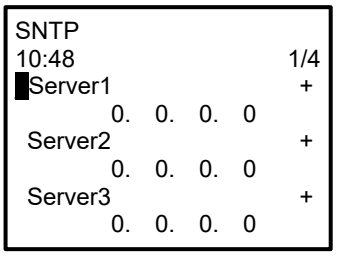
By using time synchronization via Ethernet with a SNTP server, the user can connect up to a maximum of four SNTP servers. If more than one SNTP is used, the priority of the servers can be decided in ascending order of synchronized stratum value (in order of higher-accuracy) and select the server with the smallest value.

(iii)-2 SNTP menu

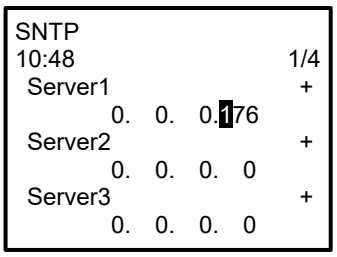
IP address of SNTP server can be set by the following procedure.



(1) To confirm that the SNTP synchronization function has been set for On. Subsequently move cursor to the SNTP menu and press ►.



(2) Move cursor to desired server number and press ENTER.

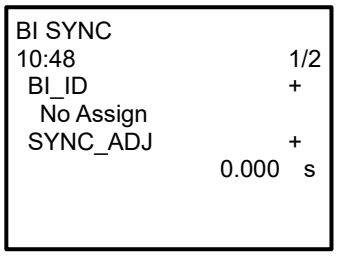


(3) The user can set IP address using ▲ or ▼ by each digit.
When the user has finished setting IP address of the server, press ENTER.

Figure 11.7-9 SNTP

(iii)-3 BI SYNC menu

When the "BI SYNC" is set to **On** in Time Sync menu, the user can choose a binary input circuit (BI) as a synchronization standard. Adjustment setting 'SYNC_ADJ' is provided.
Binary synchronization function can be set by the following procedure.

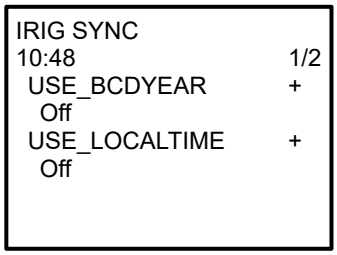


(1) Enter the Data ID of the BI output
(2) Set adjustment time for [**SYNC ADJ**]

Figure 11.7-10 BISYNC

(iii)-4 IRIG SYNC menu

When the "IRIG SYNC" is set to **On** in Time Sync menu, the user can choose IRIG signal for the synchronization.



(1) Set **On** if IRIG-B data is generated in IEEE C37.118/IRIG-B000 format. On the other hand, set On if the IRIG-B is generated with absence the C37.118.

Figure 11.7-11 IRIGSYNC

(iv) Display format

Display format of time in the IED can be selected in Display format screen. All time formats will be displayed according to Date_fmt setting. The IED provides different formats to display the date. Figure 11.7-12 shows display format menu:

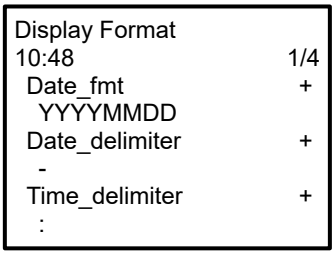
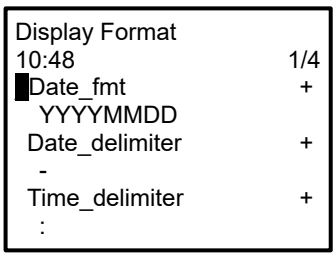


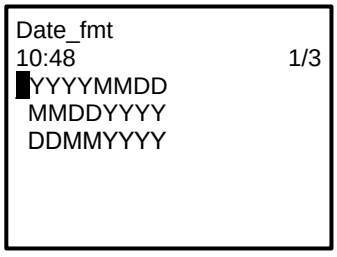
Figure 11.7-12 Display format menu

Display Format sub-menu is composed of Date_fmt menu, Date_delimiter setting Time_delimiter setting and Sec_delimiter setting.

(iv)-1 Date format menu



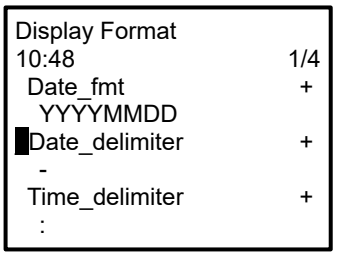
(1) Move cursor to "Date_fmt"; and press ENTER.



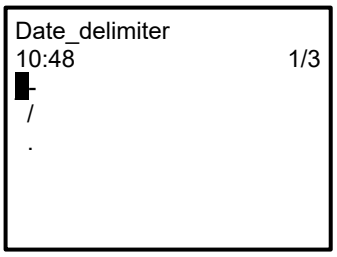
(2) Select desired format by moving cursor.

Figure 11.7-13 Date Format

(iv)-2 Date delimiter menu



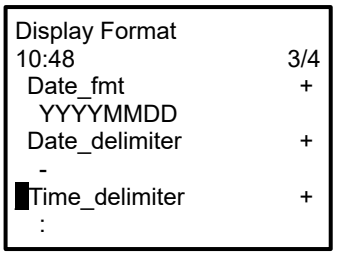
(1) Move cursor to the [Date_delimiter] menu and press ENTER.



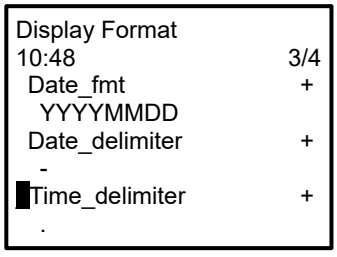
(2) Date delimiter can be selected by moving cursor to the desired format type.

Figure 11.7-14 Date delimite

(iv)-3 Time delimiter menu



(1) Move cursor to the [Time_delimiter] menu and press ENTER.

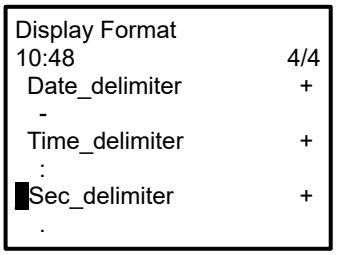


(2) The time delimiter mark is switched.

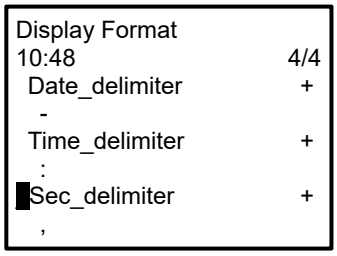
Figure 11.7-15 Time delimite

(iv)-4 Second delimiter menu

Second delimiter can be switched by the following procedure.



(1) Move cursor to the [Sec_delimiter] menu and press ENTER.



(2) The second delimiter mark is switched.

Figure 11.7-16 Second

(v) DST (Summer time)

When DST is **On**, the user is needed to set details:

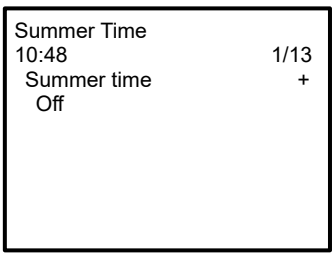
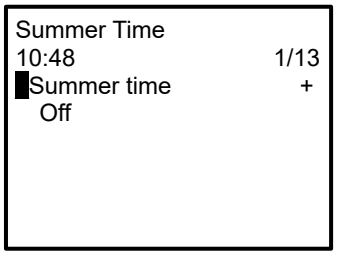
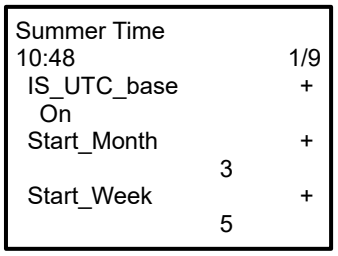


Figure 11.7-17 DST (Summer time) menu

Notice that summertime can be set by the following procedure If summertime is started or ended in the last week of the month, Start_Week and End_Week must be filled “5”. The IED controls starting or ending summer time day to set last week of the month on Start_Week or End_Week automatically.



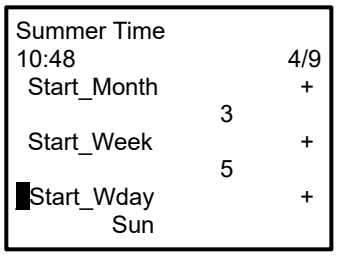
(1) Move cursor to the [Summer time] menu and press ENTER. Summer time mode can be switched On/Off by pressing ▶ or ◀. After Summer time mode is set to **On**, the user can set summer time in detail.



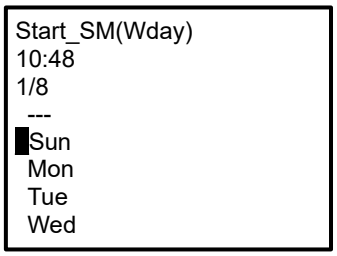
(2) In this screen, details of summer time setting can be set.

Figure 11.7-18 DST setting

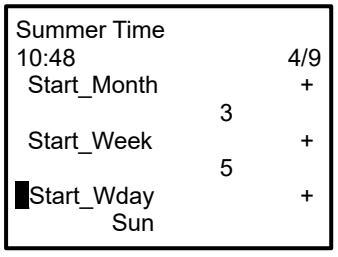
The user can set the starting date and ending of summer time. The following procedure is a case of starting weekday setting.



(1) Move cursor to the [Start_Wday] menu and press ▶.



(2) Move cursor to the desired weekday and press ENTER.



(3) Starting weekday is set.

Figure 11.7-19 DST setting

11.8 Test sub-menu

Test functions can be operated from the test screen available on the front panel of the IED.

(i) Test screen

The Test screen has functions such as Test Mode, Test Flag, Mode Change and Signal Monitoring. The user can select any of these test functions using the following test screen.

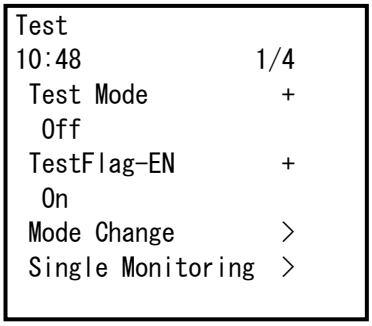


Figure 11.8-1 Test screen

(ii) Test mode screen

The Test Mode screen is shown in Figure 11.8-2. The Test Mode screen has four functions, Test Option, Function Test, Binary Input and Binary Output.

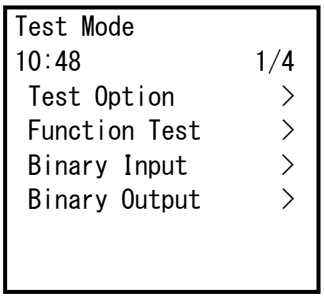


Figure 11.8-2 Test Mode screen

(ii)-1 **Test option screen**: The Test Option screen, shown in Figure 11.8-3, is used to select the following functions and perform a Test flag forced reset.

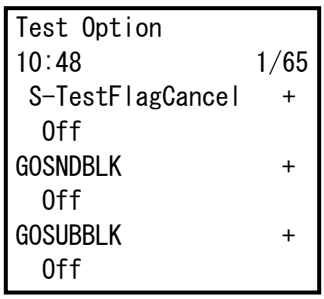


Figure 11.8-3 Test Option screen

- Test flag cancel (S-TestFlagCancel)

  This function is used to forcibly reset the Test flag in the communication packet. The Test flag is set to OFF by default. The Test flag is used in combination with another device in the Test mode. When this option is selected, the Test flag in the communication packet is reset temporarily to

reproduce a pseudo-operation condition.

- GOOSE sending block (GOSNDBLK)
  This function is used for selecting or disabling the GOOSE sending information in Test mode. This function is used when there is a conflict in communication with another active IED while sending a GOOSE signal.

- GOOSE receiving block (GOSUBBLK)
  This function is used for receiving or rejecting GOOSE subscription information from another IED in Test mode. This function is used for testing in case of bad reception (For example, Validation of Interlock determination). The user can simulate a bad reception condition passively by using two GOOSE Sending Blocks.

Note: The user may perform bad reception tests from a remote terminal using the GOSNDBLK function. However, carrying out the GOSNDBLK function at a remote terminal may influence the overall operation of other IEDs, because communication packets will not be received from the remote terminal. In order to avoid that the user can simulate bad reception tests for a particular IED using the GOSUBBLK function. As a result, testing will only affect the particular IED under test i.e. all other terminals will not be influenced by the tests.

(ii)-2 **Function test screen**: Function test screen is provided for testing; the use can program test operations, which can be implemented in protection and control functions. Figure 11.8-4 exemplifies the Test screen. Automatic supervision will stop when the user sets **Off** for A.M.F (for more information about the automatic supervision, see *Chapter Automatic supervision*).

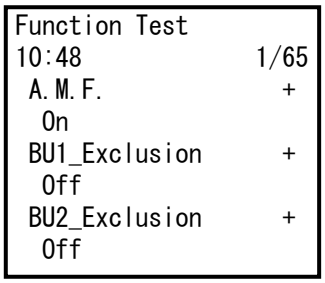


Figure 11.8-4 Function test menu (an example)

(ii)-3 **Binary input test screen**: The user can have a virtual signal to a binary input circuit using the binary input test screen. Figure 11.8-5 shows an example; the user can select IO#1 or IO#3. (Actually, the content displayed will differ depending upon the binary IO module inserted. Refer to Chapter *Technical*

description: Binary IO Module)

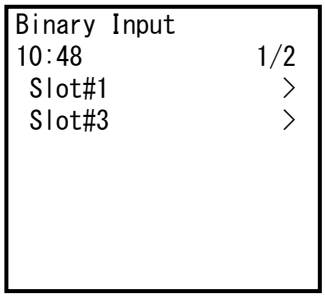


Figure 11.8-5 Binary input menu

Figure 11.8-6 is a case when IO#3 (Slot#03) is selected.

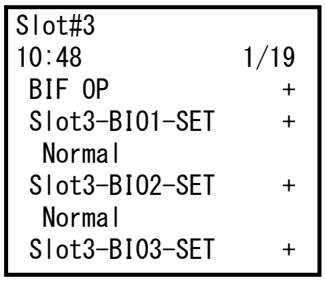


Figure 11.8-6 Setting menu for Slot #3 module

For example, if the user wishes to simulate binary input circuit #1 (BI1) on the BIO1A module at IO#3 slot, the user can select SLOT3-BI01-SET screen, as shown in Figure 11.8-6).

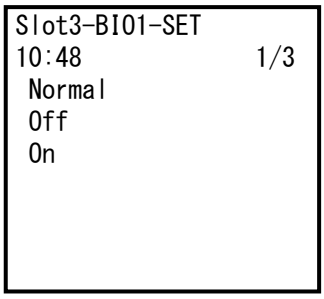


Figure 11.8-7 Setting menu after selecting "Slot #3-BIO1-SET"

The user can then make the following selections on the screen and configure the items required for simulation.

- **ON**: BI1 output is set forcibly to ON(Logic level=high(1)) regardless of the actual input signal.
- **OFF**: BI1 output is set forcibly to OFF(Logic level=low(0)) regardless of the actual input signal.
- **Normal**: Actual inputs are applied.

Use the screen shown in Figure 11.8-7 only to configure the BI signals for the

simulation test. This does not start the simulation.

The setting menu is shown in the manner of the screen illustrated in Figure 11.8-7, if the user needs to configure an Input Circuit other than BI01 (BI02 to BI18 in the screen shown in Figure 11.8-6); the user can configure each BI signal in a manner similar to that described for BI01.
After selecting OP in Figure 11.8-6, use the following screen to start the simulation test.

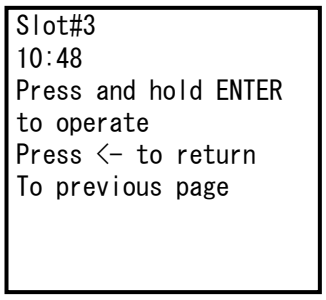


Figure 11.8-8 Execution menu of BI test

If key **ENTER** is pressed in Figure 11.8-8, the status will change to test status. The following screen will be displayed after pressing the key **ENTER**. Figure 11.8-9 shows that the IED is in simulation test mode.

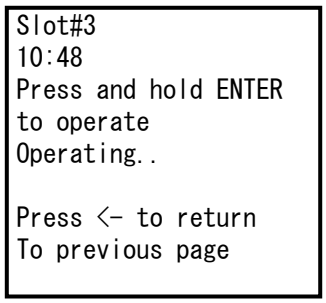


Figure 11.8-9 Running test menu

Note: The user has to continue to depress the key **ENTER** on the IED front panel during the simulation test period. The simulation status will be released if key **ENTER** is not pressed.

(ii)-4 **Binary output test screen**: The user is able to test a binary output circuit. Figure 11.8-10 is an example of how to select a binary output from the Test Mode screen.

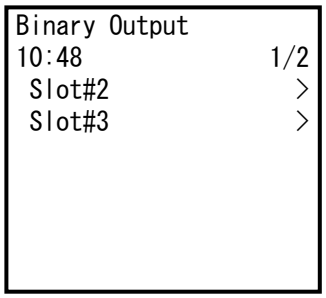


Figure 11.8-10 Binary output menu

Figure 11.8-11 shows selection of IO#2 (Slot #2).

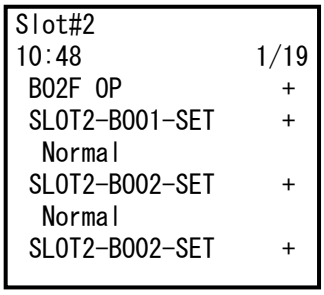


Figure 11.8-11 Setting menu for Slot #2 module

Figure 11.8-12 shows the Output Circuit configuration of BO01 at IO#2 (Slot#2). The procedure for operation is similar to the operation of the binary input circuit. (Refer to Figure 11.8-7 to Figure 11.8-9)

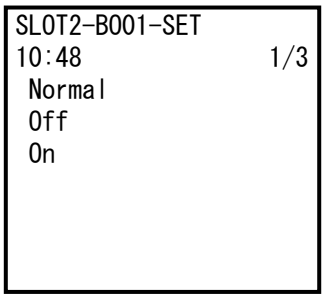


Figure 11.8-12 Setting menu after selecting "SLOT2-BO01-SET"

The user can configure the required settings for the simulation test of the binary output circuit.

- **ON**: Output signal for simulation test is ON
- **OFF**: Output signal for simulation test is OFF
- **Normal**: Actual inputs are applied.

(iii) TestFlag-EN screen

This function can set all communication protocol Test flags to Test mode. The user should select TestFlag-EN in Figure 11.8-1 and select **On** or **Off**.

(iv) Mode change screen

When the user selects "Mode Change" from the Test sub-menu shown in Figure 11.8-1, the following Mode change screen is displayed (Figure 11.8-13). This allows control from a remote device (For example, SAS server) by configuring the MDCTRL-EN setting.

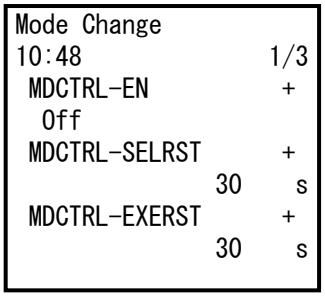


Figure 11.8-13 Mode Change sub-menu

(v) Signal monitoring screen

Figure 11.8-14 shows that the user can assign signal-monitoring points to the monitoring jacks (A, B, and C) on the IED front panel. Incidentally, points have not been assigned for the monitoring jacks in the menu below.

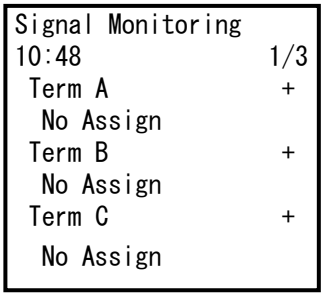


Figure 11.8-14 Signal monitoring sub-menu

When the user wishes to use monitoring jack A to monitor a signal-monitoring point, select "Term A" in the signal monitoring sub-menu (Figure 11.8-15). The user can then assign the signal monitoring point for Term A.

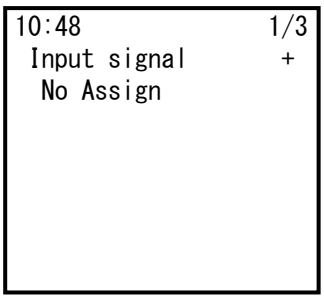


Figure 11.8-15 Selection menu

11.9 Information sub-menu

In the information sub-menu, the user can see the information about the IED. Those of the information are set in a factory, and not changed by the user. Figure 11.9-1 shows the Information sub-menu. Table 11.9-1 shows detail of information that is displayed in this screen.

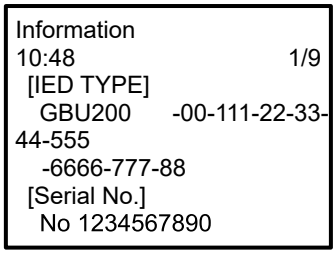


Figure 11.9-1 Information screen

Table 11.9-1 Information details

Display item	Remark
[IED TYPE]	
GBU200 -**-***-**-**-**-*** -****-***-**	Product name Hardware section information of ordering number Software section information of ordering number
[Serial No.]	
**********	Product serial number
[Plant Name]	
No name	Plant name which is input from GR-TIEMS by the user
[Description]	
No name	Information of the IED which is input from GR TIEMS by the user
[CP1M Software]	
**********	Name and version number of Main CPU Software
[CP1S Software]	
**********	Name and version number of Sub CPU Software
[CP2M Software]	
**********	Name and version number of extra CPU Software(This item is displayed in case of extra CPU implemented model only)
[IEC61850 eng]	
**********	Name and version number of IEC61850 engine (This item is displayed in case of IEC61850 implemented model only)
[IEC61850 Date Model]	
**********	Name and version number of IEC61850 Data Model (This item is displayed in case of IEC61850 implemented model only)
[IEC61850 Mapping]	
**********	Name and version number of IEC61850 Mapping (This item is displayed in case of IEC61850 implemented model only)
[GOOSE Subscribe]	
No Data	GOOSE Subscript (This item is displayed in case of IEC61850 implemented model only)
Interlock Data	
**********	Setting data of interlock (This item is displayed in case of interlock function implemented model only)
[PLC Date]	
**********	PLC Data name and version number
[Command Block Data]	
**********	Double command block data

11.10 Security setting sub-menu

The Access control function is accessed using the Security Setting sub-menu. Passwords, active or inactive and several allowed operations can be set for each user ID.

Table 11.10-1 Access control function settings

Display Order		1	2	3	4	5
User ID		Guest	Setting	Test	Operation	Full Access
Password (Default)		N.A	0000	0000	0000	0000
Functions (function keys) allowed to operate	View	✔	✔	✔	✔	✔
	Setting	N.A	✔	N.A	N.A	✔
	Security Setting	N.A	✔	N.A	N.A	✔
	Control	N.A	N.A	N.A	✔	✔
	Test	N.A	N.A	✔	✔	✔
	Clear record	N.A	✔	✔	N.A	✔
	Monitoring (Reset/Revise)	N.A	✔	✔	N.A	✔
	F1	✔	✔	✔	✔	✔
	F2	✔	✔	✔	✔	✔
	F3	✔	✔	✔	✔	✔
	F4	✔	✔	✔	✔	✔
	F5	✔	✔	✔	✔	✔
	F6	✔	✔	✔	✔	✔
	F7	✔	✔	✔	✔	✔

Note: Sign "✔" shows that the user can operate the function. Sign "N.A" shows that the user cannot operate the function. Password can be changed in Change-Password sub-menu in the Security setting.

Table 11.10-2 Meaning of allowed operation

Functions	Meaning
View	All users can see all screens/menus
Setting	In the "Setting" and "IO setting" menu the authorized user can change each setting item. Operation of the "Time" menu is also allowed. (Incidentally, all users can set the time.)
Security setting	Authorized users can change security settings
Control	An operator can control a device. An operator can also change the mode between "Remote" and "Local".
Test	A tester and an operator can access the "Test" menu.
Clear record	An authorized person, except for a guest and an operator can remove record information.
Monitoring	An authorized person, except for a guest and an operator can clear and change statistical data.
F1 to F7	Users can operate a function/an application with a function key.

11.11 Control sub-menu

The user can control external devices using the IED front panel. Control sub-menus are provided to operate; the user can operate the devices by pressing Operation keys. Note that Control sub-menus are only available when the IED is in "LOCAL" mode†. When the IED is in "REMOTE" mode, an error message will be shown on the screen. Remember that the IED will change to "REMOTE" mode if there is no operation for a while; then the IED can be monitored remotely. Figure 11.11-1 shows "Control" sub-menu.

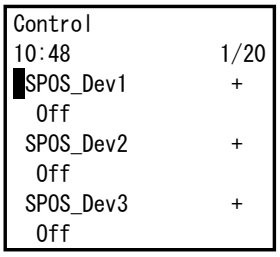


Figure 11.11-1 Control sub-menu on LCD screen

†Note: The IED will have "Local" mode automatically when the following menus are displayed on the LCD screen: "Main Menu", "Control sub-menu", "Selection Executing", "Operating completed", "Operating canceled" or "Operating failed".

Table 11.11-1 shows how to operate by the IED front panel. The IED can have several control functions, which are dependent on the ordering code. For more information, see *Chapter Control and monitoring application* or *Appendix: Ordering* for more information).

Table 11.11-1 Control step in DIR mode or SBO mode

Control Scheme	Operation step
Direct Control Operation Mode‡	1) Set DIR mode in each control function. 2) Select a device and choose DIR, and press **ENTER**. 3) Press **I** (Close) or **O** (Open) 4) A signal of control command is issued; control operation is performed.
Select Before Control Operation Mode‡	1) Set SBO mode in each control function. 2) Select a device and choose SBO, and press **ENTER**. 3) Verify that the selection is performed correctly and normally. 4) Press **I** (Close) or **O** (Open); controlling command is issued. 5) Control operation is carried out.

‡Note: We shall discuss about DIR and SBO modes in *Chapter General control function: Control mode.*

(i) CB operation

Figure 11.11-1 shows how to open CB (Off position).

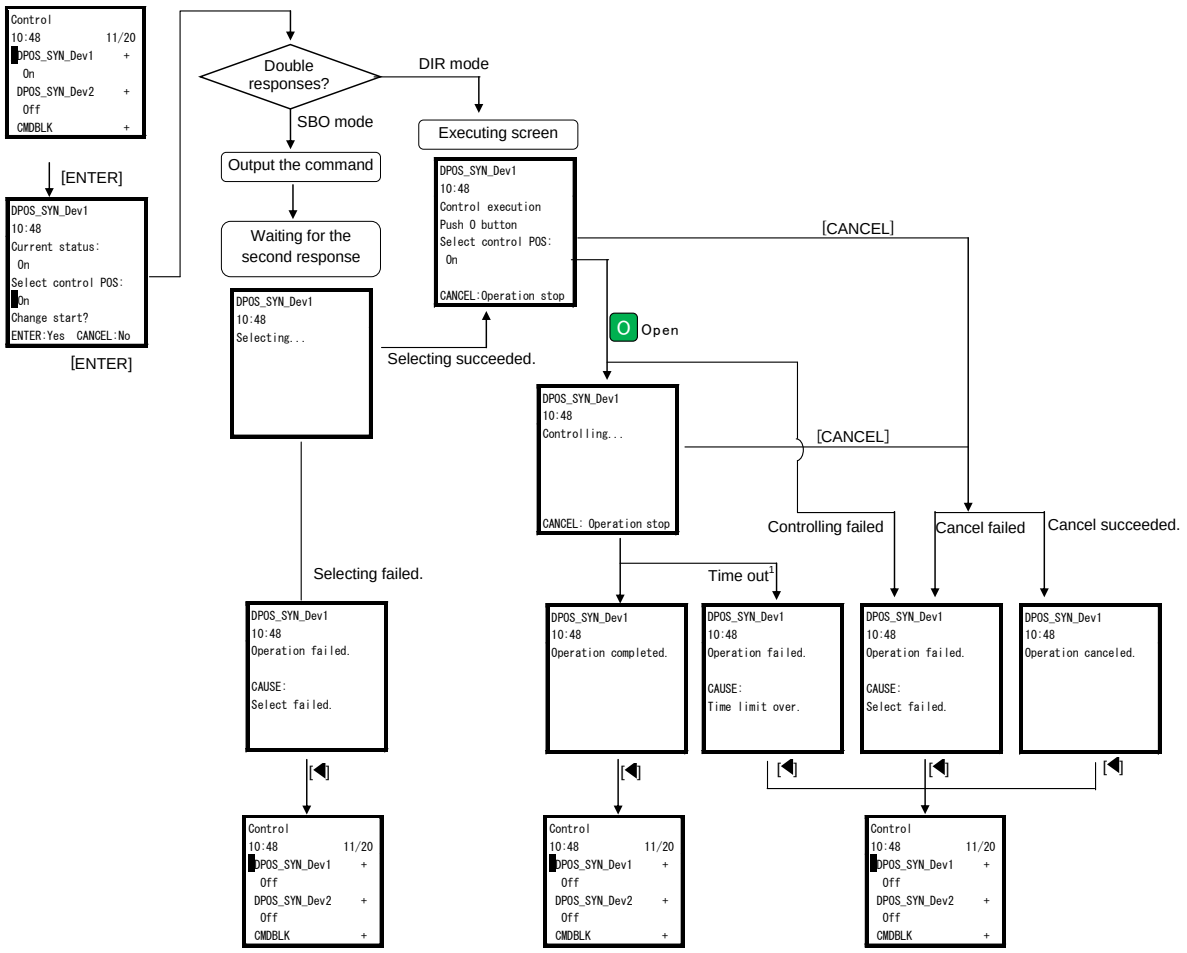


Figure 11.11-2 Operation for opening CB

[1]Note: Time out will occur if no responses come from CB device.

[2]Note: For control 'Circuit breaker', the user should connect 'DPSY01' function with circuit breakers using binary IO modules. See chapter *Control and monitoring application: Double position controller with synchronizing-checking (DPSY)*.

12 Installation and replacement

12.1 Caution for storage

You have to pack an IED in the original box after the IED is inspected, if the IED is not required to be installed now; and you have to store it in dry and clean condition.

Recommended storage condition:

- Temperature: 0 degree Celsius to +40 degree Celsius
- No condensation

12.2 Handling precautions

Modules of the IED should be handled in the electro static charge free environment. That is, the user shall use an anti-electrostatic-wrist-band; and it is grounded.

CAUTION

- Before removing a module, ensure that you are at the same electrostatic potential as the equipment by touching the case.
- Handle the module by its front plate, frame or edges of the printed circuit board. Avoid touching the electronic components, printed circuit board or connectors.
- Place the module on an anti-static surface, or on a conducting surface connected to the earth.

You have to check carefully the electronic circuitry for your handling area, which is defined in the IEC 60747 standard.

12.3 Unpack and inspection of hardware and software

The user should unpack and check the IED before use. Be in touch with Toshiba at email (www.toshiba-relays.com) for any issues.

(i) Opening and inspecting relay (IED) package

Open a relay package and inspect physical damage if any. Ensure that the following items are included in the package. If there is any noticeable physical damage, or any of the above items are missing, contact your agent.

- Relay (IED) unit
- Test record: One report sheet
- Installation guide: One guide sheet
- Instruction manuals: Provided within a CD-ROM
- Flange covers: Left and right covers
- Function keys label: One label sheet
- LEDs Label: One label sheet

(ii) Manufacture settings (In, Vn, fn, Vdc)

Find the hardware nameplate. The user can know the IED has been produced correctly in terms of rated current (In), voltage (Vn), frequency (fn), and DC rating (Vdc). The user can also find them with Factory settings (Figure 12.3-2).

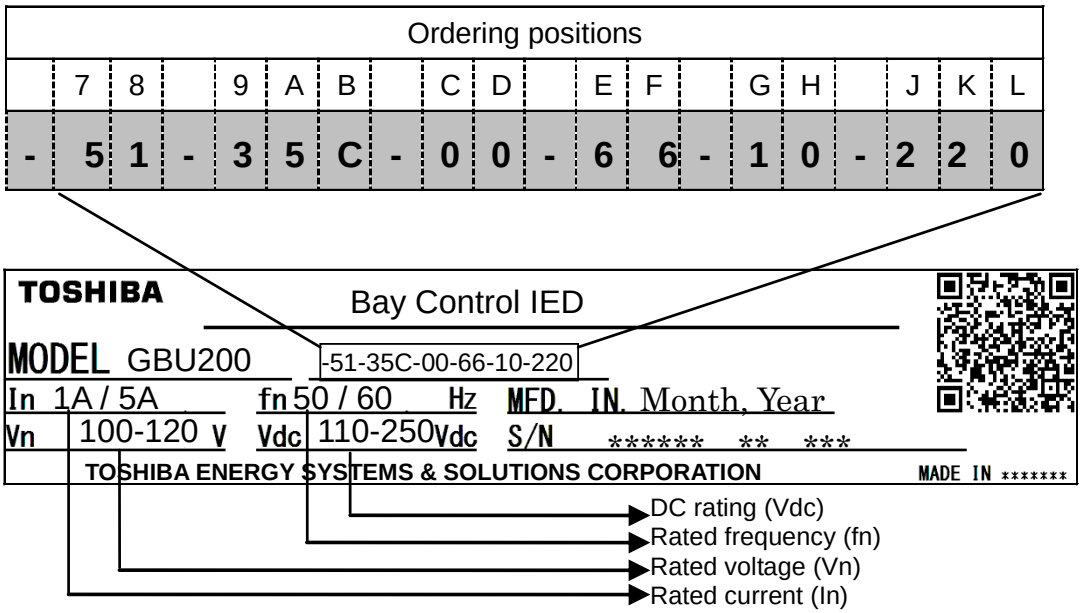


Figure 12.3-1 Hardware nameplate example on the rear

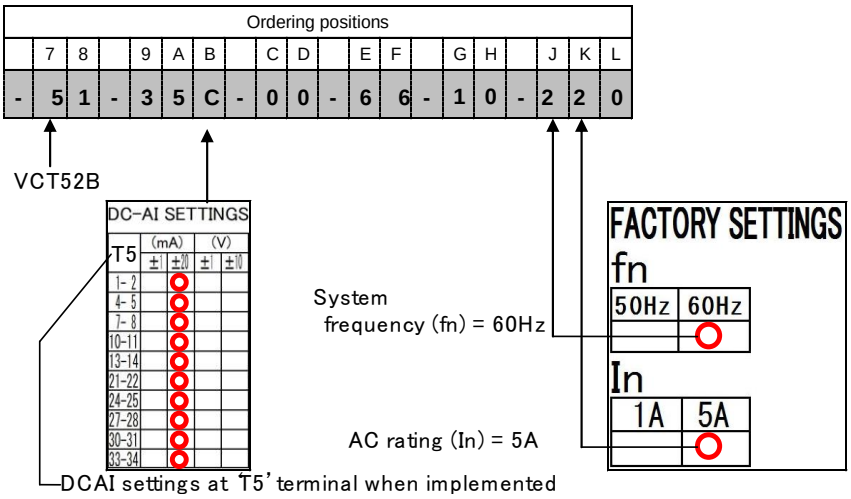


Figure 12.3-2 Factory setting example

Note: The user can change input ranges by inserting jumpers on DCAI module. See *Chapter Technical description: DC analog input module*. However, the user is not able to change rated values (fn and In); therefore, the user should return the IED for the manufacture if the rated ones are required to change.

(iii) Combination of VCT and BIOs

The transformer module (VCT) is located at the far right slot (e.g., at 'VC1' in Figure 12.3-3). Identify the code at Position '7' to know the VCT type (e.g., VCT52B is implemented by the instruction code at Position '7' in Figure 12.3-2).

The user can check the layout of the binary input and output modules (BI, BO, or BIO) using the ordering codes. For example, the user can find BI3A, BO1A, and DCAI2A modules in IED depending the ordering cords "5C" at Positions A&B. The user can also know the configuration with IO configuration label.

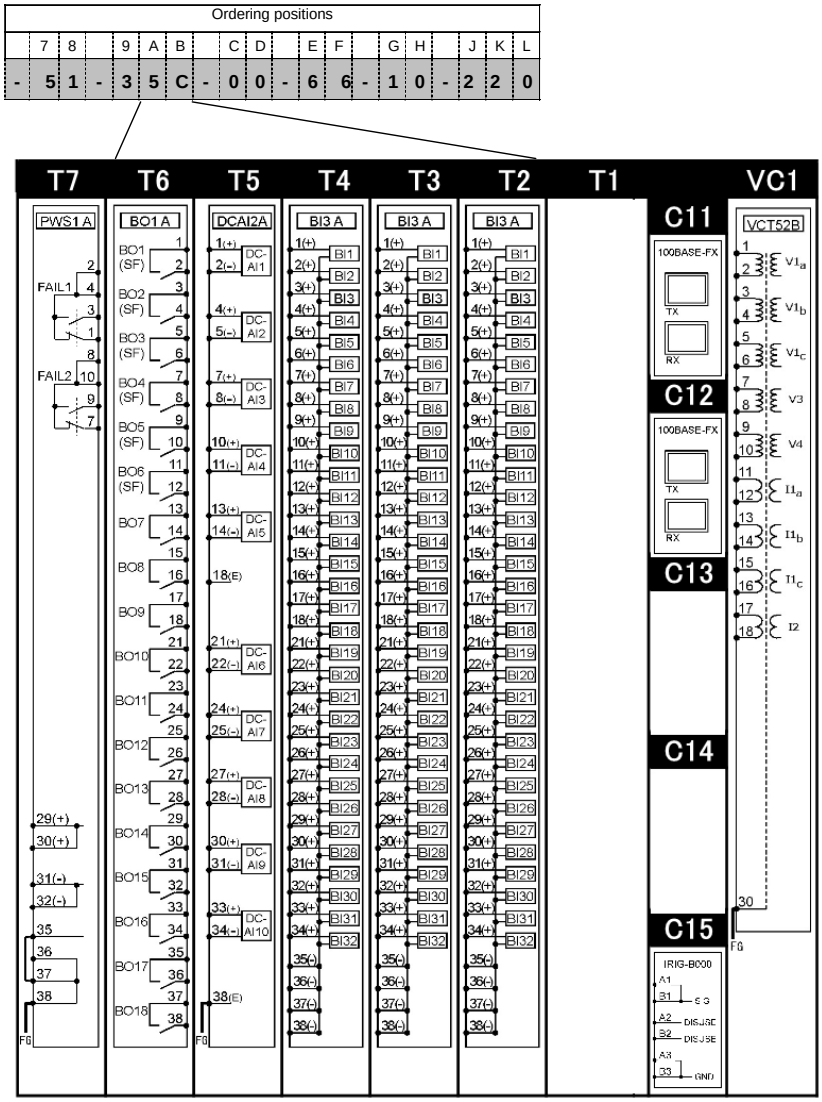


Figure 12.3-3 IO configuration label example (viewing from the back in 3/4 case)

Note: See Section *IED case and module slot* in Chapter *Technical description* to find the structure of IED cases and terminals. For more information about the BI, BO, and BIO circuits, see Section *Binary IO module* in the same chapter.

(iv) Communication modules (LAN and others)

Figure 12.3-3 shows communication modules are implemented at C11 to C15. The layouts of the communication modules are matched with Ordering codes at Positions 'E and F'.

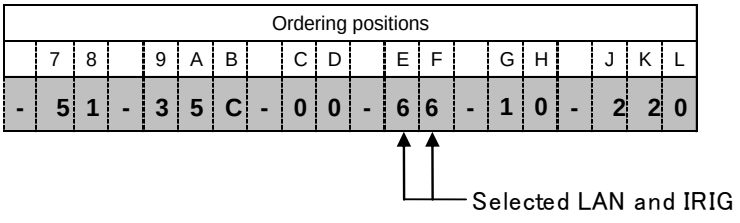


Figure 12.3-4 Example for module selected

(v) Relay and control software

Verifying relay software is possible to check the codes at Positons 'S, G, and T' on Software nameplate. For example of Figure 12.3-5, the IED has '011' software for controlling bay†. This IED can operate in the IEC61850 protocol‡.

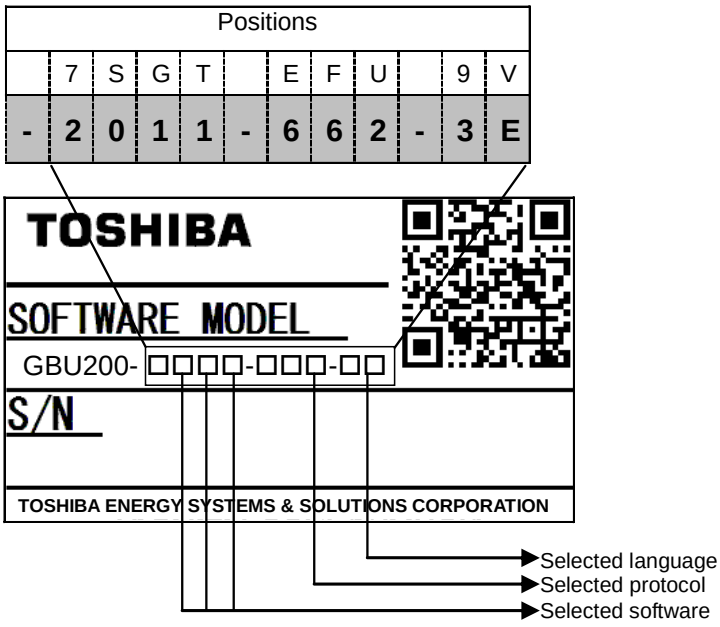


Figure 12.3-5 Software nameplate example on the rear

†Note: For more information about functions, see *Chapter Relay application* or *Chapter Control and monitoring application*.

‡Note: For more information about the communication, see *Chapter Communication protocol*.

(vi) Flange covers and labels

Two flange covers (blue ones in Figure 12.3-6) are included in the package. The user can attach them on the IED when mounting into the rack (see succeeding section *Rack mounting*).

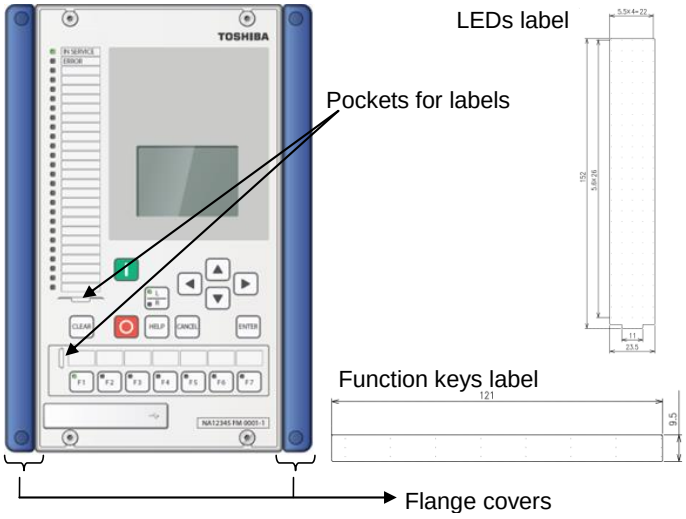


Figure 12.3-6 Flange covers and labels attached on IED

12.4 PWS alarm threshold setting

The IED has power supply module (PWS) at the far left slot. The user can confirm DC rated voltage on the hardware nameplate by checking the cord at Positions '8', but the user should select either alarm thresholds for dropping DC voltage by inserting a jumper on the PWS (Figure 12.4-1). See *Section Power supply module* in *Chapter Technical description*.

Ordering positions																			
	7	8		9	A	B		C	D		E	F		G	H		J	K	L
-	x	1	-	x	x	x	-	x	x	-	x	x	-	x	x	-	x	x	x

DC rated voltage, e.g., 1='110 to 250Vdc', selected by the ordering

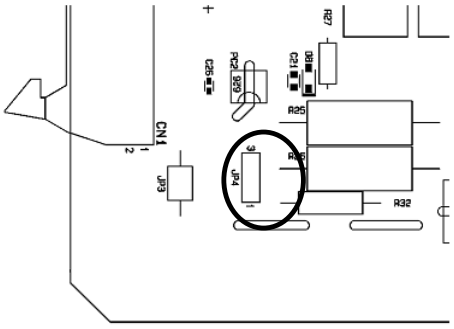


Figure 12.4-1 Alarm threshold can be set on the PWS module

⚠CAUTION

Note: The connection between terminal screw No. 35 and terminal screw No. 37 is made with a short-wire, which is installed by the manufacturer. The user shall remove this short-wire when undertaking the dielectric voltage test for the IED. Remember that the user shall reconnect the terminals with this short-wire after the test (See *Appendix: Notes for the dielectric voltage test*).

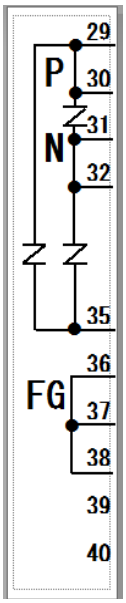


Figure 12.4-2 PWS terminal label

12.5 DCAI input range setting

When the IED has a DC analog input module (DCAI2A), the user should set the input ranges in respective channels. Each channel can have either a voltage range or a current range by inserting a jumper on the DCAI2A module. The user can find the location of DCAI2A module in the IO configuration label on the IED. See *Section DC analog input module* in *Chapter Technical description*.

Table 12.5-1 Input range selection in DCAI2A

Range Selection	Insertion pattern of Jumper connector			
	JP_A	JP_B	JP_C	JP_D
1V	OFF	OFF	ON	ON(2-3)
10V	OFF	ON	OFF	ON(1-2)
1mA	ON(3-4)	OFF	OFF	ON(1-2)
20mA (Default)	ON(1-2)	OFF	OFF	ON(1-2)

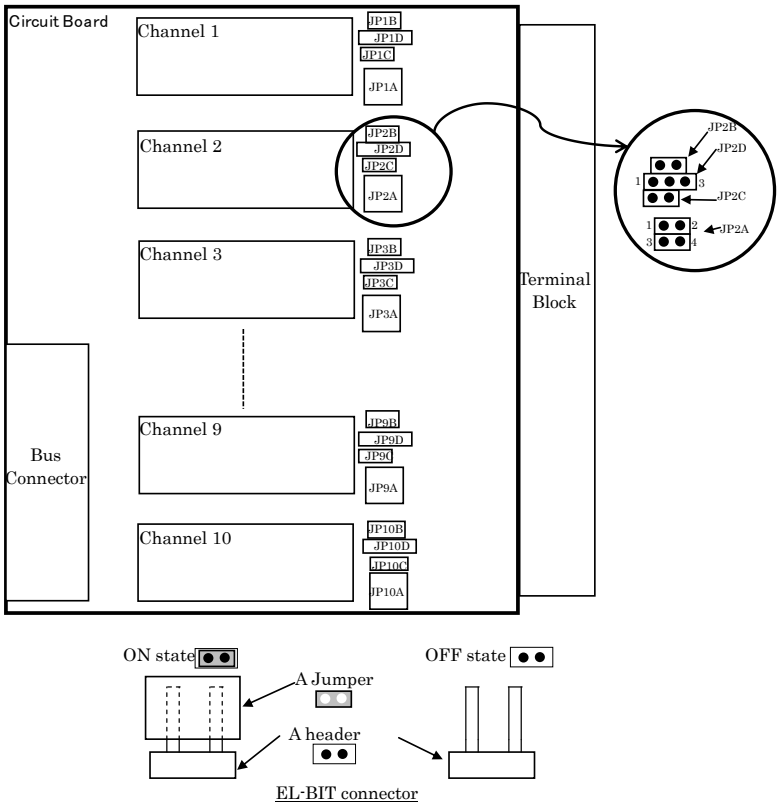
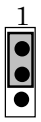
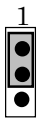


Figure 12.5-1 Jumper locations on DCAI2A

12.6 DCAO output range setting

When the IED has a DC analog output module (DCAO1A), the user should set the output ranges in respective channels. Each channel can have either a voltage range or a current range by inserting a jumper on the module. The user can find the location in the IO configuration label on the IED. See *Section DC analog output module* in *Chapter Technical description*.

Table 12.6-1 Output range selection in DCAO1A

Rage Selection	Insertion pattern of Jumper connector						
	JP1_	JP2_	JP3_	JP4_	JP5_	JP8_	JP9_
20mA	On(1-2) 	On(1-2) 	On(1-2) 	On(1-2) 	On(1-2) 	ON 	OFF 
10V	On(2-3) 	On(2-3) 	On(2-3) 	On(2-3) 	On(2-3) 	OFF 	ON 

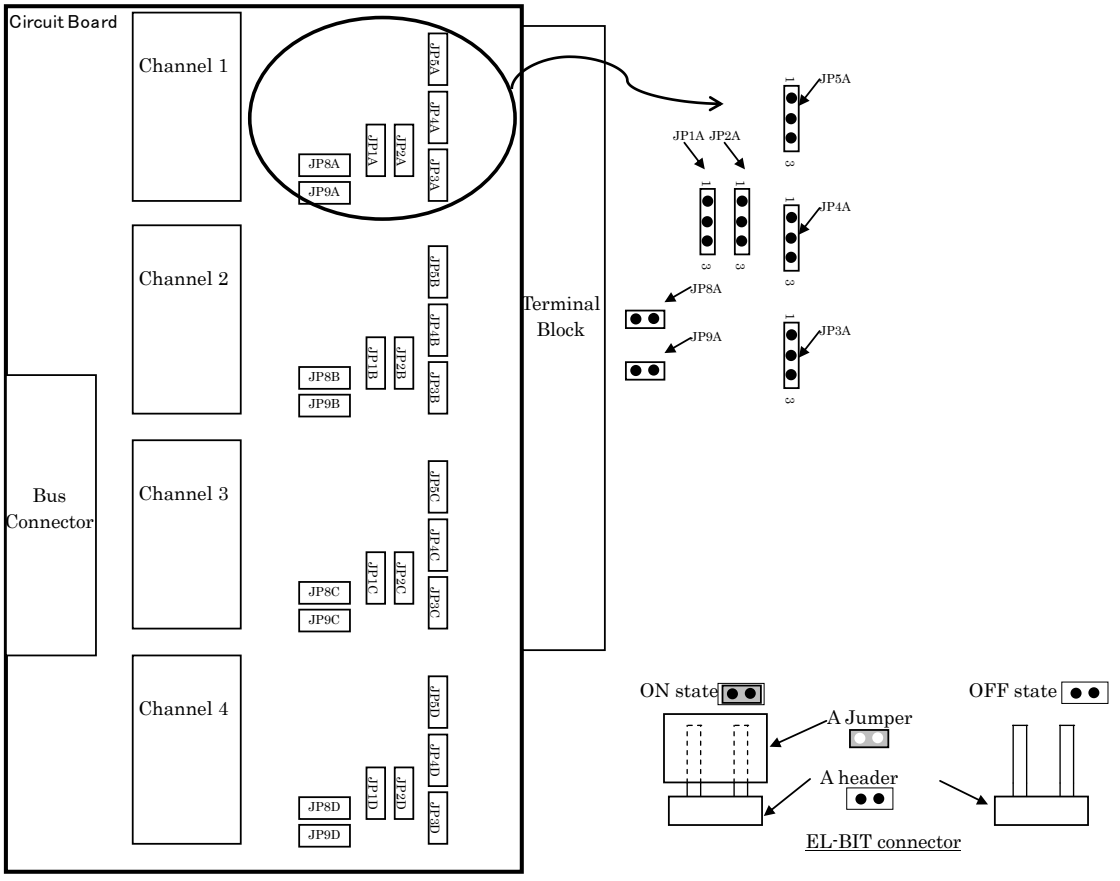


Figure 12.6-1 Jumper locations on DCAO1A

12.7 Removing and installation of an inside module

⚠WARNING

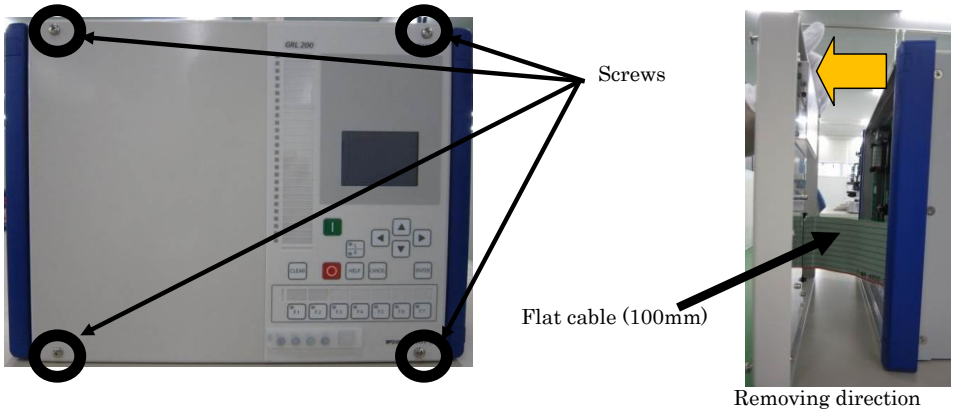
Switch off the DC power supply. Hazardous voltage may remain in the DC circuit just after switching off the DC power supply. It takes about 30 seconds for the voltage to discharge.

⚠CAUTION

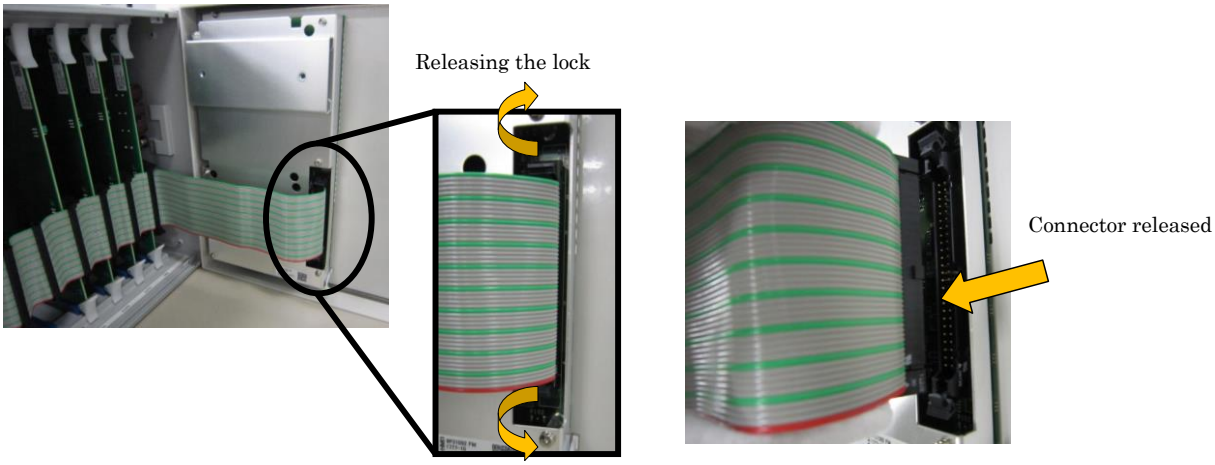
When handling a module, take anti-static measures such as wearing an earthed wrist band and place the modules on an earthed conductive mat. Otherwise, many of the electronic components may get damaged. After replacing the module, check all of the settings including the data related to the PLC, IEC103 and IEC61850, etc. are restored the original settings.

(i) Removal of the front panel and rear terminal

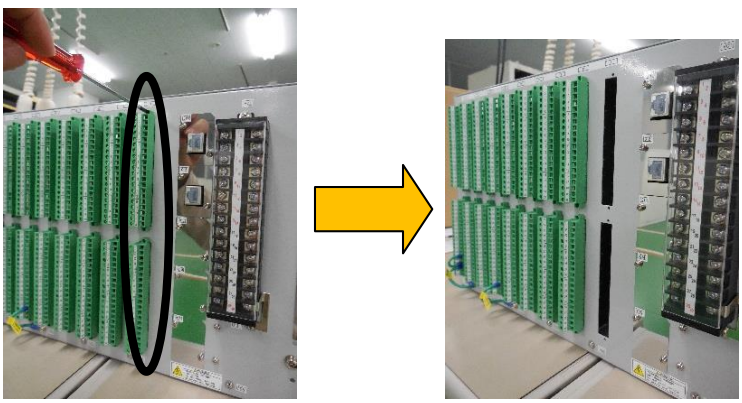
Step 1: Check the power has not been supplied to the equipment. Unscrew four screws on the front panel. Do not pull it forcibly, because inside modules are internally connected using an flat-cable (approximately 100 millimeters length).



Step 2: To remove the flat cable, release the locks at the connector.



Step 3: Detach the terminals where the user wants to replace a broken module with the new one.



(ii) Usage of hook tool for detaching rear terminal blocks

The user can remove the compression terminals using an optional hook tool (Optional code: EP-235). The user should follow the steps, as shown in the below figures.

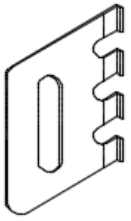
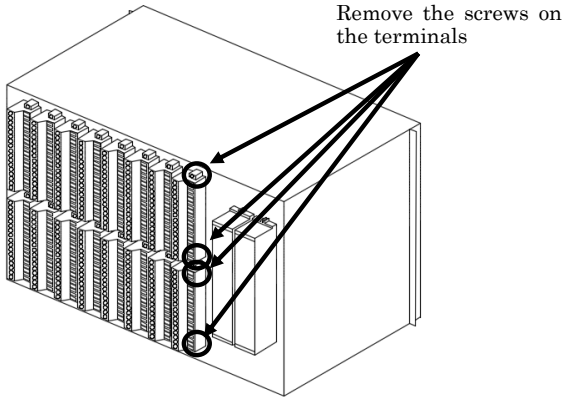
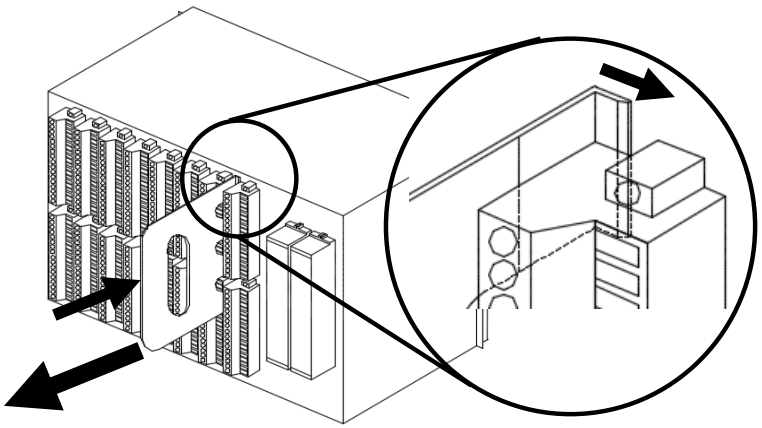


Figure 12.7-1 Hook tool for detaching compression terminals (EP-235)

Step 1: Check whether the power not been supplied for the device. Unscrew four screws on the terminal.

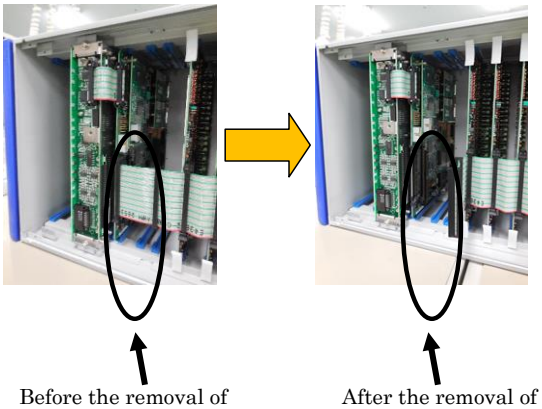


Step 2: For detaching, insert the hook in the gap between the terminal and the rear panel by the means of the illustration below. Check the hook thrusts into the gap between. Then pull the terminal toward you..

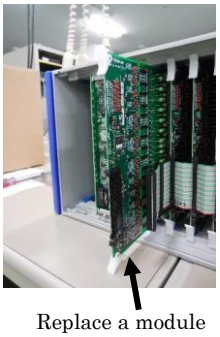


(iii) Replacement of modules

Step 1: Remove a flat cable off, which has been connected between CPU and BIO modules.



Step 2: Take out a module from the case, also insert the new one in the case.

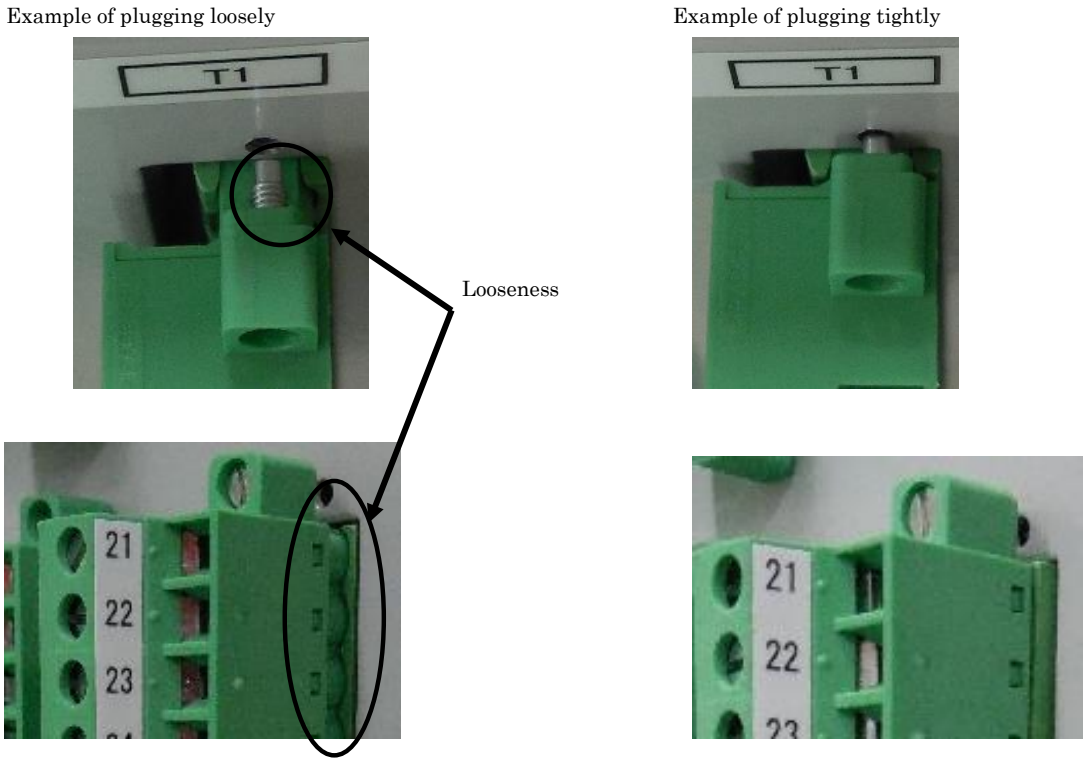


Step 3: Put the flat cable on the edges of the CPU and BIO modules. Check the connection between the modules is made securely by checking locks are enabled at the connector.

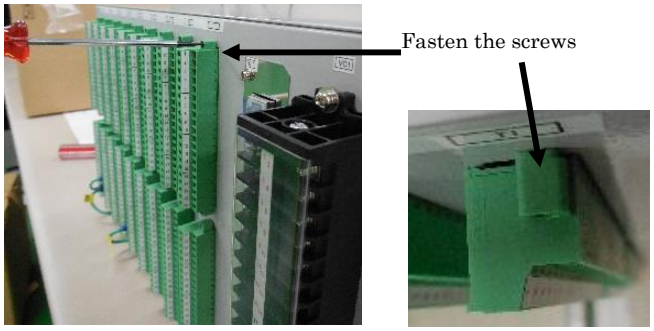


(iv) Installation of terminals

Step 1: Attach the terminal that was detached on the rear. Note that the upper terminal† has 20 screw-numbers denoted '1' to '20', whereas the lower terminal has 20 screw-numbers denoted '21' to '40'. Never attach the upper and lower terminals in the other way. Do not confuse adjacent terminals when the adjacent ones are detached together. Check the terminals are plugged in tightly without any clearances.



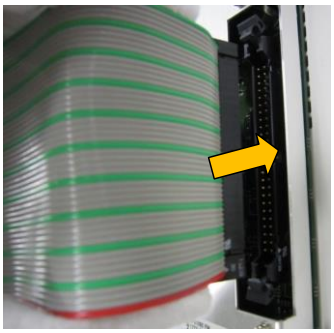
Step 2: Fasten the upper terminal and lower terminals by using the four screws.



†The description is intended for the instruction of the "Compressed type terminal". Hence, the works for other types are not matched, but the user shall check all the terminals including the above terminals are also attached securely.

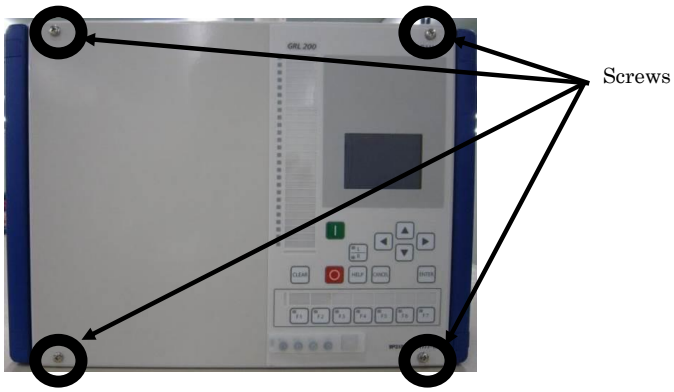
(v) Attachment of the front panel

Step 1: Plug the flat cable. Check the locks are tighten firmly.



Plug the cable in as far as a locking sound is heard.

Step 2: Cover the front panel by tightening the four screws; then the device is ready.



⚠CAUTION

Supply DC power after checking that all the modules are in their original positions and the flat cables are plugged in. If the flat cables are plugged in enough, then the module may get damaged.

12.8 Rack mounting

(i) Mounting 1/1 case

Figure 12.8-1 shows the dimensions for 1/1 case. The mounting procedure is illustrated in Figure 12.8-2. Remember that flange covers for the front panel is provided in the package.

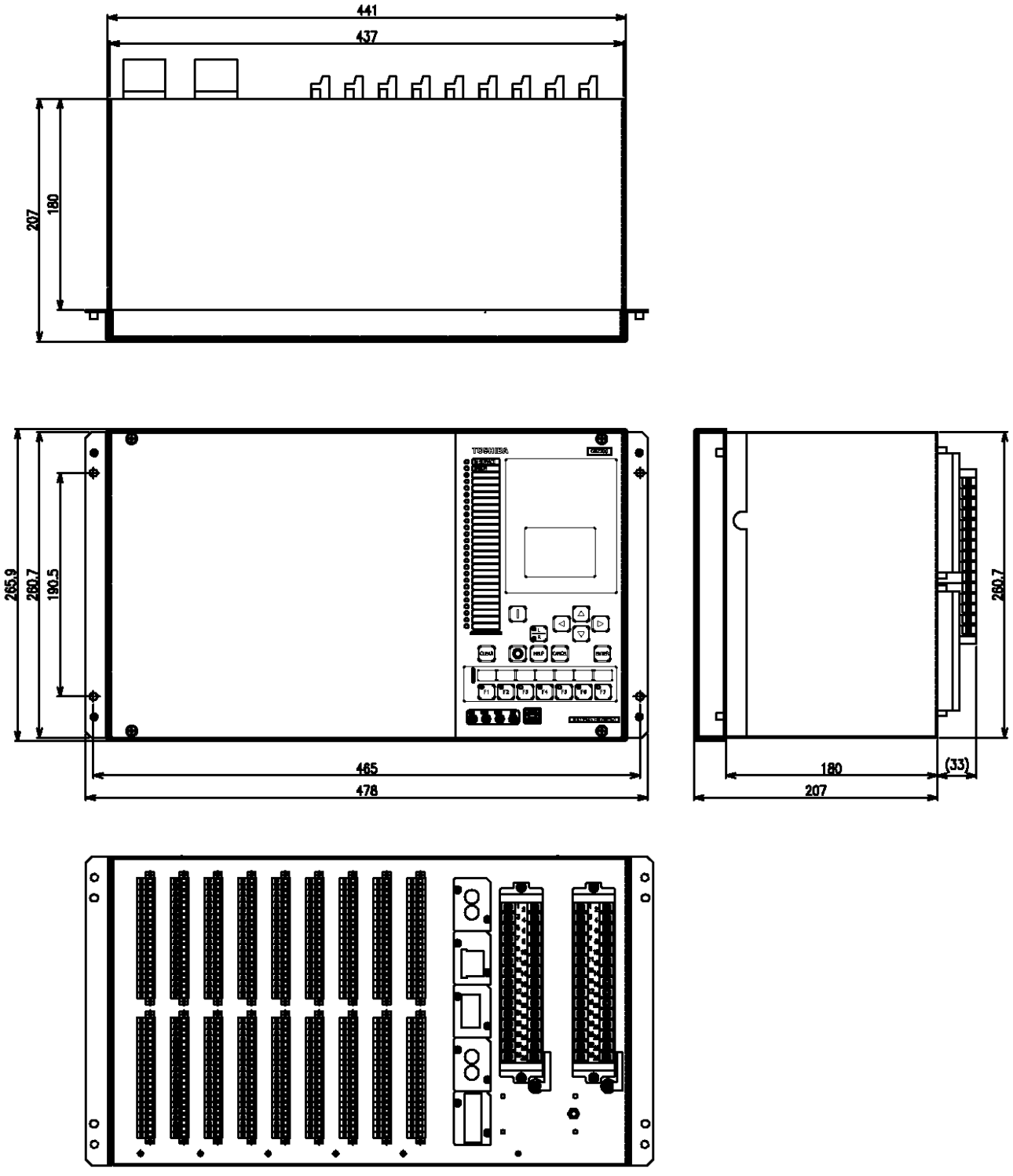


Figure 12.8-1 Dimension (19" × 1/1 size in millimeters)

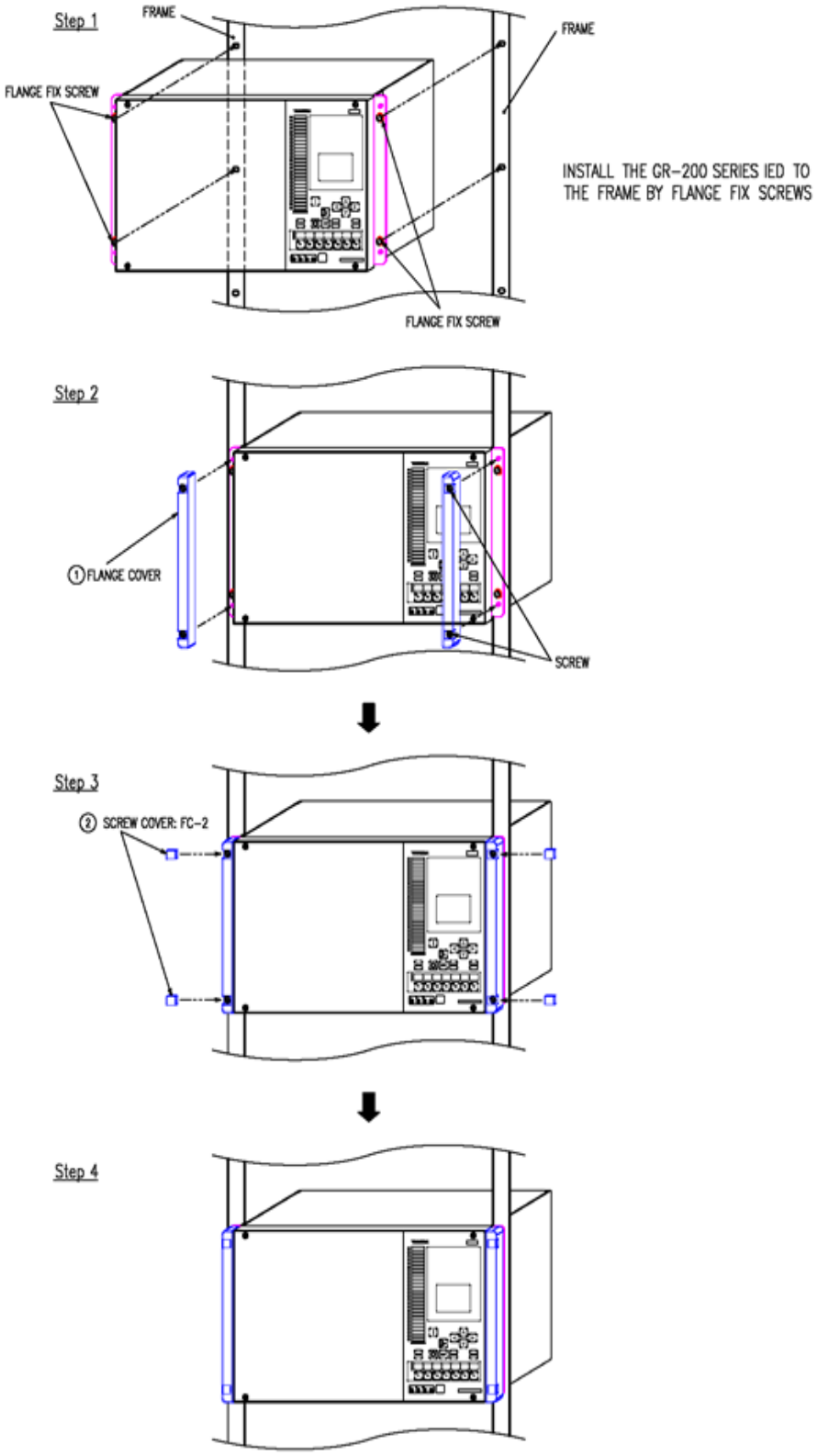


Figure 12.8-2 Mounting procedures

(ii) Mounting 1/2 case and others

For example, the user can mount 1/2 case using a mounting kit (optional accessary) for the rack. Figure 12.8-3 shows the dimension about 1/2 case; Figure 12.8-4 illustrates the IED case

is ready for mounting in the rack when the optional kit is attached on the IED. The procedure to mount the IED for the rack is similar to the instruction of Figure 12.8-2. To find the other cases and kits, see *Appendixes Rack mounting* and *Case outline*.

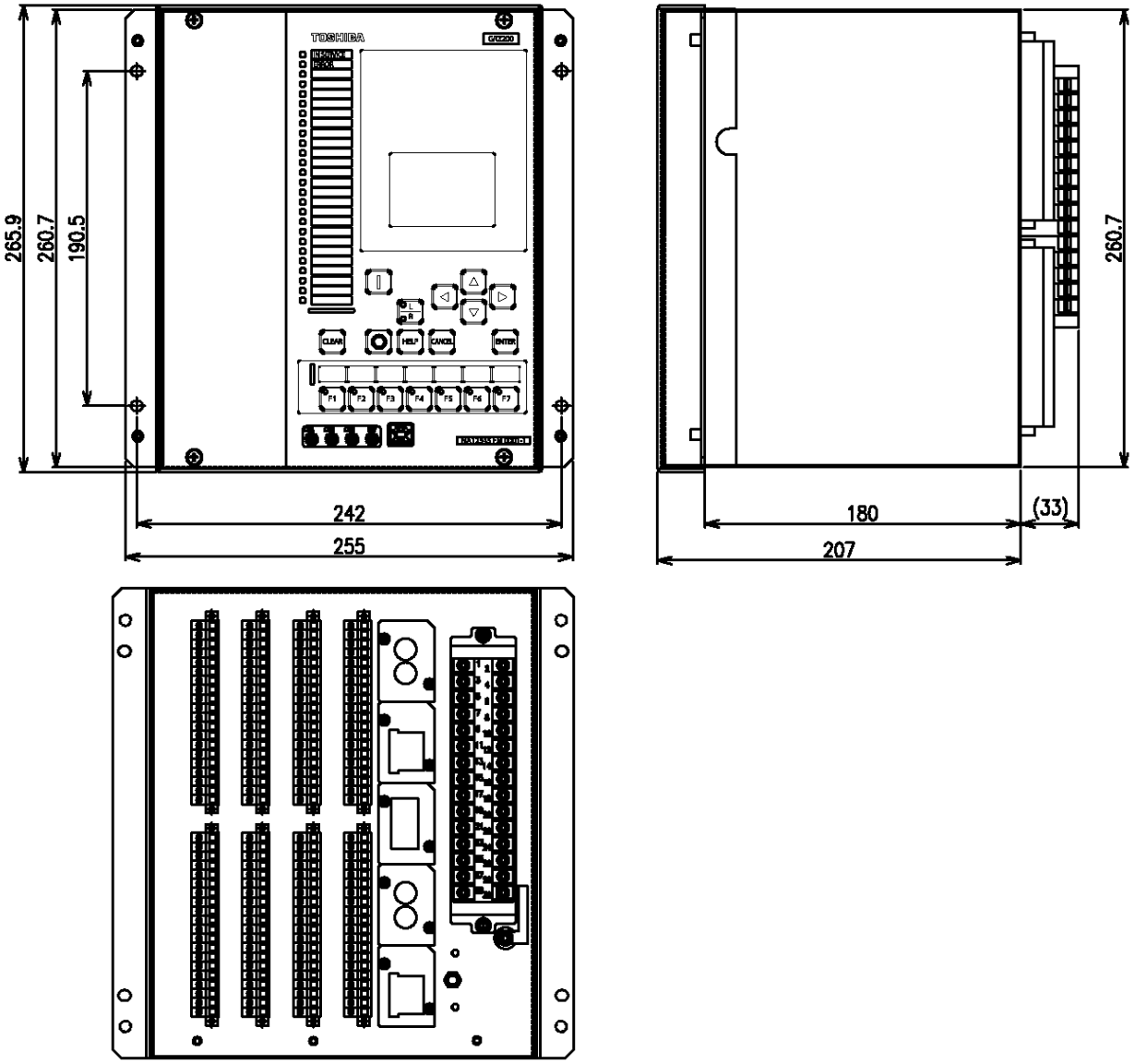


Figure 12.8-3 '1/2 case' dimension (19" × 1/2 size in millimeters)

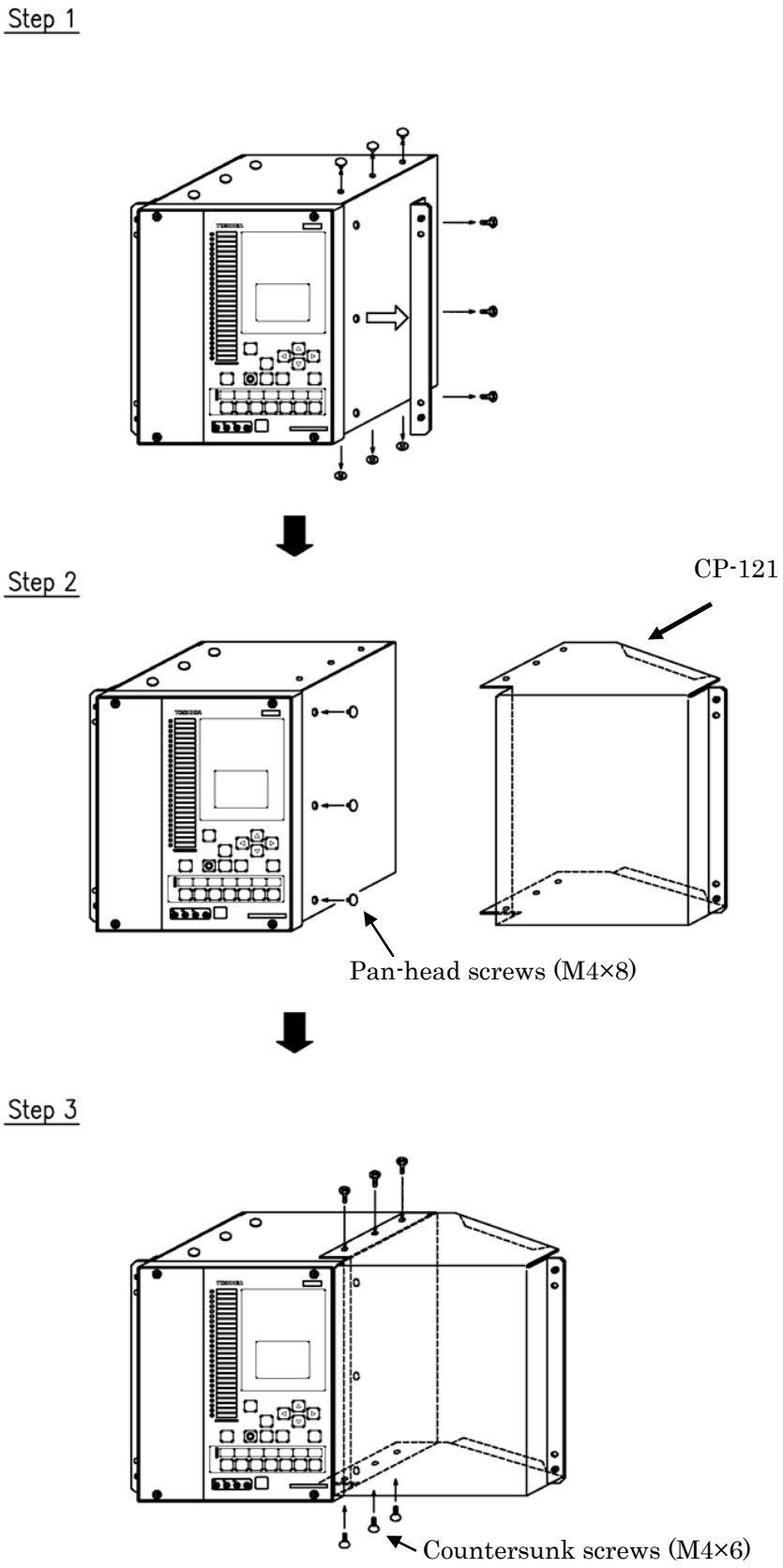


Figure 12.8-4 Optional kit to mount a '1/2 case'

Note: This procedure is not required for flash mounting, but remember that required to attach flange covers.

12.9 Wiring work

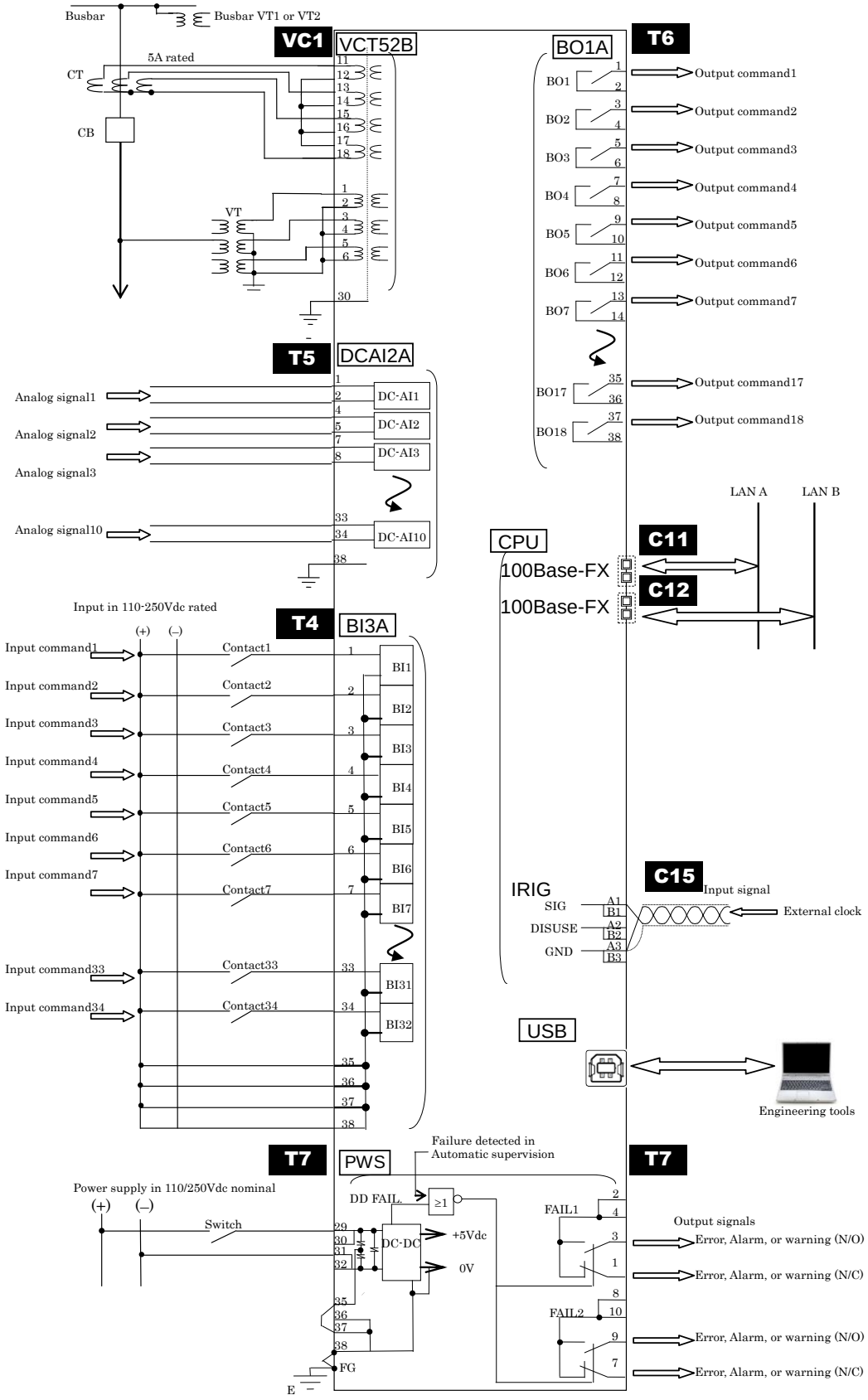


Figure 12.9-1 Cable wiring; example for VCT52B and the other modules

Figure 12.9-1 illustrates example wirings. Power, Current, Voltage, communication signals, contact signals, and signals for engineering tools are connected with the IED.

Table 12.9-1 Wire termination

Connecting for	Wire termination	Wire thickness
BI / BO / PWS	Stripping length = 10 mm (typical)	1.5mm² through 2.5 mm² or AWG14
VCT	M3.5 ring tongue with insulation	2.5 mm² through 5.5 mm²
Protective earth (FG)	M5 ring tongue with insulation	5.5 mm² or larger



Figure 12.9-2 Ring tongue terminations for VCT; ferrule for BI, BO

Note: Use appropriate ferrules depending on the wire thickness.

(i) Power supply module PWS

Power supply module (PWS) can supply power for the relay and control applications when appropriate voltage is provided at Terminals 29 and 31.

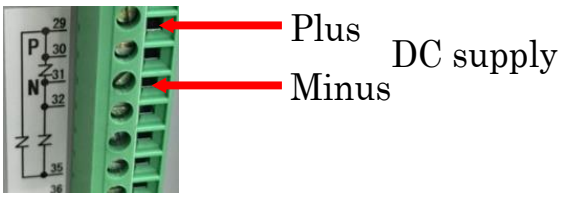


Figure 12.9-3 Terminals for PWS

Note: The error/alarm/warning signals can be also issued on the PWS (See *Chapter Automatic supervision* and *Chapter Technical description: Power supply module*).

(ii) Transformer module VCT

Transformer module (VCT) is provided for AC analog input. The user should connect to VT and CT referring the layout picture of VCT screw terminals.

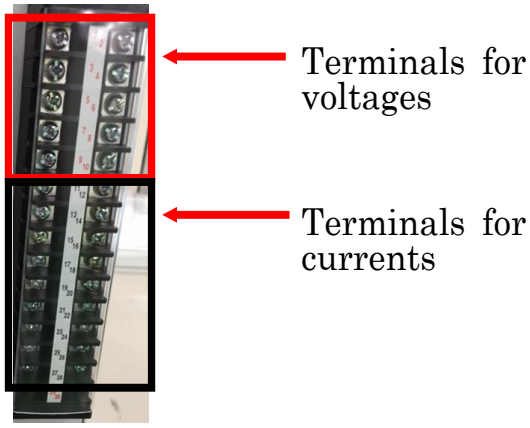


Figure 12.9-4 Terminals for VCT

Note: See *Chapter Technical description: Transformer module for AC analog input* of each IED instruction manual.

(iii) Binary input module BI, Binary output module BO

Terminals in compression type are provided for binary input and output signals. To know the module type and its circuit structure, refer the IO configuration label on the IED side.

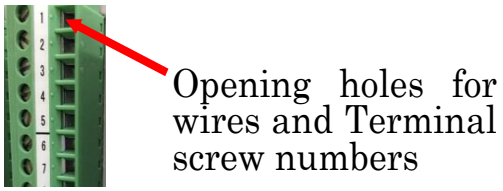


Figure 12.9-5 Terminals for BI and BO

Note: For more information, see *Chapter Technical description: Binary IO module*. The user can program input and output logics using settings.

12.10 Guide for optic cable work

If optic LAN or communication modules are provided, follow the instructions of Figure 12.10-2. For more information about the modules, see *Chapter Technical description: Signal processing and communication module* of each IED instruction manual.

Notice for Optic cable handling

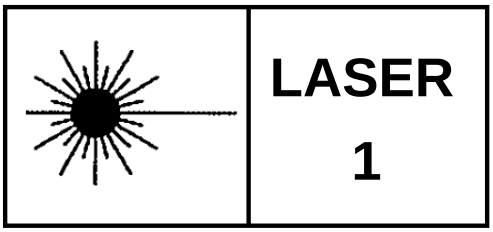


Figure 12.10-1 Class 1 Laser Warning Message

- Do not bend the cable.
- Do not twist the cable.
- Do not kink in the cable.
- Do not put and drop on the cable.

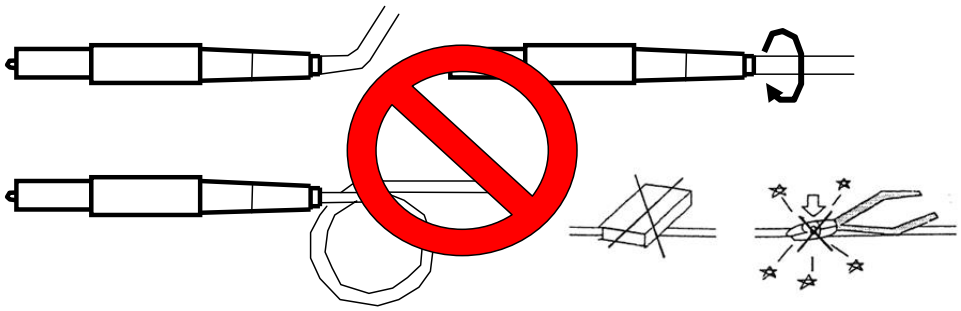


Figure 12.10-2 Fiber Optic Cable Precautions

(i) Communication to a local PC using USB

Figure 12.10-3 illustrates that the user can connect the local PC with the IED (type B receptacle) using a USB cable. Alternatively, the user can connect the local PC with the IED by connecting a RJ45 cable to the LAN port (if available in the IED). In Figure 12.10-4, when using the LAN port, the user has to select the communications option, which can be found from the Main menu in GR-TIEMS (go to "Tool" ->"Option…"; "Option" dialog will be displayed; change communications option with the second tab – 'Communication').

Note: For more information, see *Chapter Engineering tool* and *Chapter Communication protocol*.

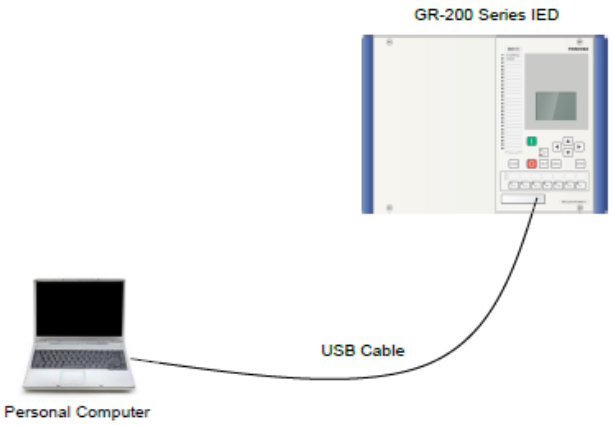


Figure 12.10-3 USB Communications

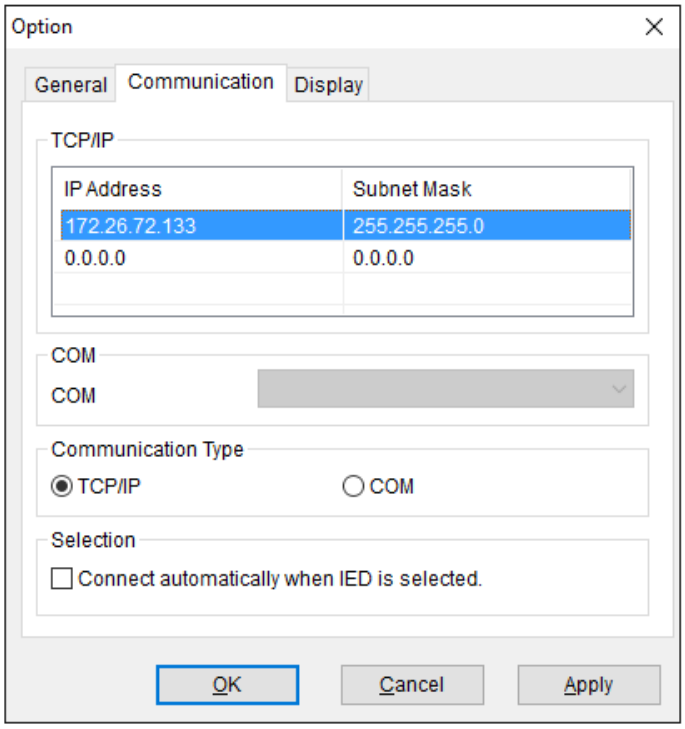


Figure 12.10-4 GR-TIEMs Communications Options

13 Commissioning and maintenance

13.1 Outline of Commissioning Tests

The IED is fully numerical and the hardware is continuously monitored.

Commissioning tests can be kept to a minimum and need only include hardware tests and conjunctive tests. The function tests are at the user's discretion.

In these tests, user interfaces on the front panel of the IED or local PC can be fully applied.

Test personnel must be familiar with general function of IED testing practices and safety precautions to avoid personal injuries or equipment damage.

Hardware tests

These tests are performed for the following hardware to ensure that there is no hardware defect. Defects of hardware circuits other than the following can be detected by monitoring which circuits functions when the DC power is supplied.

User interfaces

Binary input circuits and output circuits

AC input circuits

Function tests

These tests are performed for the following functions that are fully software-based. Tests of the protection schemes and fault locator require a dynamic test set.

Measuring elements

Timers

Conjunctive tests

The tests are performed after the IED is connected with the primary equipment, telecommunication equipment and other external equipment.

The following tests are included in these tests:

On load test: phase sequence check and polarity check

Signaling circuit test

Tripping and reclosing circuit test

13.2 Cautions

(i) Safety Precautions

⚠CAUTION

- The IED rack is provided with a grounding terminal.
  Before starting the work, always make sure the IED rack is grounded.
- When connecting the cable to the back of the IED, firmly fix it to the terminal block and attach the cover provided on top of it.
- Before checking the interior of the IED, be sure to turn off the power.
- Class 1 laser.

Failure to observe any of the precautions above may cause electric shock or malfunction.

(ii) Cautions on Tests

⚠CAUTION

- While the power is on, do not connect/disconnect the flat cable on the front of the printed circuit board (PCB).
- While the power is on, do not mount/dismount the PCB.
- Before the power is on, check the following:
  - Make sure the polarity and voltage of the power supply are correct.
  - Make sure the CT circuit is not open.
  - Make sure the VT circuit is not short-circuited.
- Transformer module is damaged due to an overcurrent or overvoltage.
- Clear test settings after the test; then, set original settings again.

Failure to observe any of the precautions above may cause damage or malfunction of the relay. Before mounting/dismounting the PCB, take antistatic measures such as wearing an earthed wristband.

13.3 Preparations

Test equipment

The following test equipment is required for the commissioning tests.

1 DC power supply

1 Time counter, precision timer

1 PC (not essential)

Visual inspection

After unpacking the product, check for any damage to the IED case. If there is any damage, the internal module might also have been affected. Contact the vendor.

Local PC

To examine the IED with a PC locally, connect the PC with the IED using a USB cable. The GR-TIEMS software is required to install in the PC.

13.4 Test operations

The user can change IED to for Test mode by the operations on the IED front panel with Main/Sub menus, as shown in Figure 13.4-1.

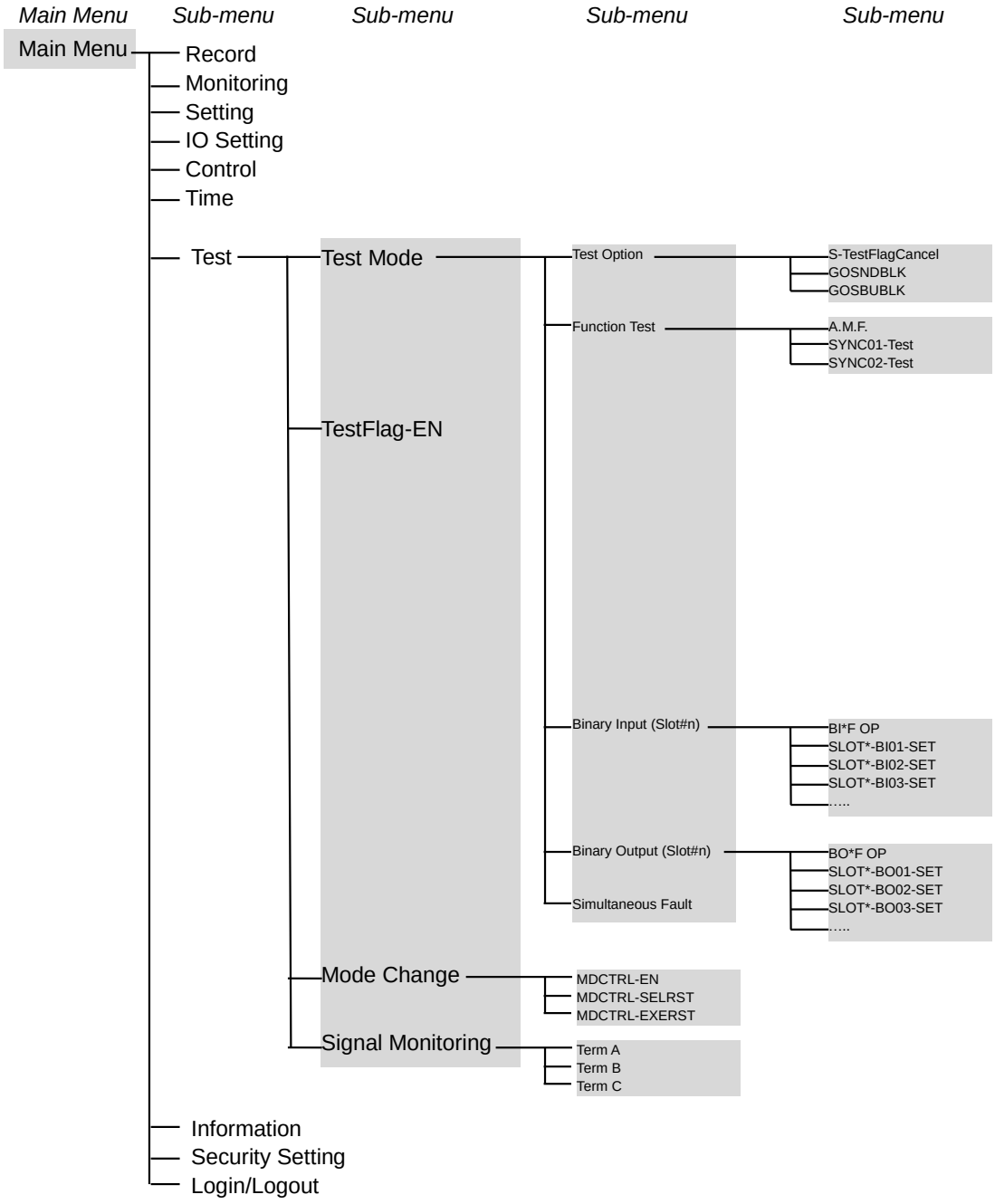


Figure 13.4-1 Structure of test menu

Note: The structure and the contents about sub-menus depend on the software.

13.4.1 Test for communication

(i) GOOSE sending block (GOSNDBLK)

This is used for selecting or disabling the GOOSE sending information where there is a conflict in communication with another active IED while sending a GOOSE signal.

(ii) GOOSE receiving block (GOSUBBLK)

This is used for receiving or rejecting GOOSE subscription information from another IED for testing bad reception. See Chapter *Communication protocol: IEC 61850 communication*.

(iii) Test flag cancel (S-TestFlagCancel)

Test flag in the communication packet will be removed unconditionally, when **On** is set for setting [**Test flag**].

(iv) Test for all communication (TestFlag-EN)

Setting [**TestFlag-EN**]=**On** allows to set test flags at all communication protocol (see Chapter *User interface: Test-submenu*).

13.4.2 Test for relay application

(i) Auto monitoring function (A.M.F)

Issuing alarms will be blocked when **Off** is set for [**A.M.F**]. For the content about the monitoring function, see Chapter *Automatic supervision function*.

13.4.3 Test for control application

(i) Synchronizing check test (SYNC01,02-Test)

Settings [**SYNC01-Test**] and [**SYNC02-Test**]=**On** allows to have test synchronized conditions. See Chapter *Control and monitoring application: Synch check for difference network*.

13.4.4 Test for BI and BO circuits

(i) Binary input circuit test (SLOT*BIxx-SET)

Setting [**SLOT*-BIxx-SET**] allows to have a virtual input at a binary input circuit.

(ii) Binary output circuit test (SLOT*BOxx-SET)

Setting [**SLOT*-BIxx-SET**] allows to have a virtual output at a binary input circuit.

Note: For the BI and BO test operation, see Chapter *User interface: Test sub-menu*, separately.

13.4.5 Test for mode change (MDCTRL)

The function is provided to detect a test mode. For more information, see Chapter *General control function: Mode control function*, separately.

13.4.6 Signal monitor

The function is provided in order that the user can observe IED internal signals. For more information, see Chapter *Technical description: Human machine interface: Monitoring jacks*, separately.

13.4.7 LED light test

The user can perform LED lighting test by pressing the keys ◀ and ▶. Press the both keys on the front panel for a few seconds. If there is no problem, all LEDs will be lit.

Appendix 1 Signal list for common function

◆ Signal monitoring point

CONST_VALUE (Function ID: 100001)

Name	Element ID	Description
C0_BIT	8000001220	Constant value 0 expressed with binary in BIT type
C1_BIT	8000011220	Constant value 1 expressed with binary in BIT type
C0_N8	2000001128	Constant value 0 expressed with unsigned integer in 8 bit
C1_N8	2000011128	Constant value 1 expressed with unsigned integer in 8 bit
C0_N16	2100001129	Constant value 0 expressed with unsigned integer in 16 bit
C1_N16	2100011129	Constant value 1 expressed with unsigned integer in 16 bit
C0_N32	220000112A	Constant value 0 expressed with unsigned integer in 32 bit
C1_N32	220001112A	Constant value 1 expressed with unsigned integer in 32 bit
C0_N64	230000112B	Constant value 0 expressed with unsigned integer in 64 bit
C1_N64	230001112B	Constant value 1 expressed with unsigned integer in 64 bit
C0_S8	2000001120	Constant value 0 expressed with signed integer in 8 bit
C1_S8	2000011120	Constant value 1 expressed with signed integer in 8 bit
C2_S8	2000021120	Constant value 2 expressed with signed integer in 8 bit
C3_S8	2000031120	Constant value 3 expressed with signed integer in 8 bit
C4_S8	2000041120	Constant value 4 expressed with signed integer in 8 bit
C5_S8	2000051120	Constant value 5 expressed with signed integer in 8 bit
C6_S8	2000061120	Constant value 6 expressed with signed integer in 8 bit
C7_S8	2000071120	Constant value 7 expressed with signed integer in 8 bit
C8_S8	2000081120	Constant value 8 expressed with signed integer in 8 bit
C9_S8	2000091120	Constant value 9 expressed with signed integer in 8 bit
C10_S8	20000A1120	Constant value 10 expressed with signed integer in 8 bit
C11_S8	20000B1120	Constant value 11 expressed with signed integer in 8 bit
C12_S8	20000C1120	Constant value 12 expressed with signed integer in 8 bit
C13_S8	20000D1120	Constant value 13 expressed with signed integer in 8 bit
C14_S8	20000E1120	Constant value 14 expressed with signed integer in 8 bit
C15_S8	20000F1120	Constant value 15 expressed with signed integer in 8 bit
C16_S8	2000101120	Constant value 16 expressed with signed integer in 8 bit
C17_S8	2000111120	Constant value 17 expressed with signed integer in 8 bit
C18_S8	2000121120	Constant value 18 expressed with signed integer in 8 bit
C19_S8	2000131120	Constant value 19 expressed with signed integer in 8 bit
C20_S8	2000141120	Constant value 20 expressed with signed integer in 8 bit
C21_S8	2000151120	Constant value 21 expressed with signed integer in 8 bit
C22_S8	2000161120	Constant value 22 expressed with signed integer in 8 bit
C23_S8	2000171120	Constant value 23 expressed with signed integer in 8 bit
C24_S8	2000181120	Constant value 24 expressed with signed integer in 8 bit
C25_S8	2000191120	Constant value 25 expressed with signed integer in 8 bit
C26_S8	20001A1120	Constant value 26 expressed with signed integer in 8 bit
C27_S8	20001B1120	Constant value 27 expressed with signed integer in 8 bit
C28_S8	20001C1120	Constant value 28 expressed with signed integer in 8 bit
C29_S8	20001D1120	Constant value 29 expressed with signed integer in 8 bit
C30_S8	20001E1120	Constant value 30 expressed with signed integer in 8 bit
C31_S8	20001F1120	Constant value 31 expressed with signed integer in 8 bit
C32_S8	2000201120	Constant value 32 expressed with signed integer in 8 bit
C40_S8	2000281120	Constant value 40 expressed with signed integer in 8 bit

◆ Signal monitoring point

CONST_VALUE (Function ID: 100001)

Name	Element ID	Description
C50_S8	2000321120	Constant value 50 expressed with signed integer in 8 bit
C60_S8	20003C1120	Constant value 60 expressed with signed integer in 8 bit
C70_S8	2000461120	Constant value 70 expressed with signed integer in 8 bit
C80_S8	2000501120	Constant value 80 expressed with signed integer in 8 bit
C90_S8	20005A1120	Constant value 90 expressed with signed integer in 8 bit
C100_S8	2000641120	Constant value 100 expressed with signed integer in 8 bit
C0_S16	2100001121	Constant value 0 expressed with signed integer in 16 bit
C1_S16	2100011121	Constant value 1 expressed with signed integer in 16 bit
C2_S16	2100021121	Constant value 2 expressed with signed integer in 16 bit
C3_S16	2100031121	Constant value 3 expressed with signed integer in 16 bit
C4_S16	2100041121	Constant value 4 expressed with signed integer in 16 bit
C5_S16	2100051121	Constant value 5 expressed with signed integer in 16 bit
C6_S16	2100061121	Constant value 6 expressed with signed integer in 16 bit
C7_S16	2100071121	Constant value 7 expressed with signed integer in 16 bit
C8_S16	2100081121	Constant value 8 expressed with signed integer in 16 bit
C9_S16	2100091121	Constant value 9 expressed with signed integer in 16 bit
C10_S16	21000A1121	Constant value 10 expressed with signed integer in 16 bit
C11_S16	21000B1121	Constant value 11 expressed with signed integer in 16 bit
C12_S16	21000C1121	Constant value 12 expressed with signed integer in 16 bit
C13_S16	21000D1121	Constant value 13 expressed with signed integer in 16 bit
C14_S16	21000E1121	Constant value 14 expressed with signed integer in 16 bit
C15_S16	21000F1121	Constant value 15 expressed with signed integer in 16 bit
C16_S16	2100101121	Constant value 16 expressed with signed integer in 16 bit
C17_S16	2100111121	Constant value 17 expressed with signed integer in 16 bit
C18_S16	2100121121	Constant value 18 expressed with signed integer in 16 bit
C19_S16	2100131121	Constant value 19 expressed with signed integer in 16 bit
C20_S16	2100141121	Constant value 20 expressed with signed integer in 16 bit
C21_S16	2100151121	Constant value 21 expressed with signed integer in 16 bit
C22_S16	2100161121	Constant value 22 expressed with signed integer in 16 bit
C23_S16	2100171121	Constant value 23 expressed with signed integer in 16 bit
C24_S16	2100181121	Constant value 24 expressed with signed integer in 16 bit
C25_S16	2100191121	Constant value 25 expressed with signed integer in 16 bit
C26_S16	21001A1121	Constant value 26 expressed with signed integer in 16 bit
C27_S16	21001B1121	Constant value 27 expressed with signed integer in 16 bit
C28_S16	21001C1121	Constant value 28 expressed with signed integer in 16 bit
C29_S16	21001D1121	Constant value 29 expressed with signed integer in 16 bit
C30_S16	21001E1121	Constant value 30 expressed with signed integer in 16 bit
C31_S16	21001F1121	Constant value 31 expressed with signed integer in 16 bit
C32_S16	2100201121	Constant value 32 expressed with signed integer in 16 bit
C40_S16	2100281121	Constant value 40 expressed with signed integer in 16 bit
C50_S16	2100321121	Constant value 50 expressed with signed integer in 16 bit
C60_S16	21003C1121	Constant value 60 expressed with signed integer in 16 bit
C70_S16	2100461121	Constant value 70 expressed with signed integer in 16 bit
C80_S16	2100501121	Constant value 80 expressed with signed integer in 16 bit

◆ Signal monitoring point

CONST_VALUE (Function ID: 100001)

Name	Element ID	Description
C90_S16	21005A1121	Constant value 90 expressed with signed integer in 16 bit
C100_S16	2100641121	Constant value 100 expressed with signed integer in 16 bit
C0_S32	2200001122	Constant value 0 expressed with signed integer in 32 bit
C1_S32	2200011122	Constant value 1 expressed with signed integer in 32 bit
C2_S32	2200021122	Constant value 2 expressed with signed integer in 32 bit
C3_S32	2200031122	Constant value 3 expressed with signed integer in 32 bit
C4_S32	2200041122	Constant value 4 expressed with signed integer in 32 bit
C5_S32	2200051122	Constant value 5 expressed with signed integer in 32 bit
C6_S32	2200061122	Constant value 6 expressed with signed integer in 32 bit
C7_S32	2200071122	Constant value 7 expressed with signed integer in 32 bit
C8_S32	2200081122	Constant value 8 expressed with signed integer in 32 bit
C9_S32	2200091122	Constant value 9 expressed with signed integer in 32 bit
C10_S32	22000A1122	Constant value 10 expressed with signed integer in 32 bit
C11_S32	22000B1122	Constant value 11 expressed with signed integer in 32 bit
C12_S32	22000C1122	Constant value 12 expressed with signed integer in 32 bit
C13_S32	22000D1122	Constant value 13 expressed with signed integer in 32 bit
C14_S32	22000E1122	Constant value 14 expressed with signed integer in 32 bit
C15_S32	22000F1122	Constant value 15 expressed with signed integer in 32 bit
C16_S32	2200101122	Constant value 16 expressed with signed integer in 32 bit
C17_S32	2200111122	Constant value 17 expressed with signed integer in 32 bit
C18_S32	2200121122	Constant value 18 expressed with signed integer in 32 bit
C19_S32	2200131122	Constant value 19 expressed with signed integer in 32 bit
C20_S32	2200141122	Constant value 20 expressed with signed integer in 32 bit
C21_S32	2200151122	Constant value 21 expressed with signed integer in 32 bit
C22_S32	2200161122	Constant value 22 expressed with signed integer in 32 bit
C23_S32	2200171122	Constant value 23 expressed with signed integer in 32 bit
C24_S32	2200181122	Constant value 24 expressed with signed integer in 32 bit
C25_S32	2200191122	Constant value 25 expressed with signed integer in 32 bit
C26_S32	22001A1122	Constant value 26 expressed with signed integer in 32 bit
C27_S32	22001B1122	Constant value 27 expressed with signed integer in 32 bit
C28_S32	22001C1122	Constant value 28 expressed with signed integer in 32 bit
C29_S32	22001D1122	Constant value 29 expressed with signed integer in 32 bit
C30_S32	22001E1122	Constant value 30 expressed with signed integer in 32 bit
C31_S32	22001F1122	Constant value 31 expressed with signed integer in 32 bit
C32_S32	2200201122	Constant value 32 expressed with signed integer in 32 bit
C40_S32	2200281122	Constant value 40 expressed with signed integer in 32 bit
C50_S32	2200321122	Constant value 50 expressed with signed integer in 32 bit
C60_S32	22003C1122	Constant value 60 expressed with signed integer in 32 bit
C70_S32	2200461122	Constant value 70 expressed with signed integer in 32 bit
C80_S32	2200501122	Constant value 80 expressed with signed integer in 32 bit
C90_S32	22005A1122	Constant value 90 expressed with signed integer in 32 bit
C100_S32	2200641122	Constant value 100 expressed with signed integer in 32 bit
C0_S64	2300001123	Constant value 0 expressed with signed integer in 64 bit
C1_S64	2300011123	Constant value 0 expressed with signed integer in 64 bit

◆ Signal monitoring point

CONST_VALUE (Function ID: 100001)

Name	Element ID	Description
C0_U8	3000001124	Constant value 0 expressed with unsigned integer in 8 bit
C1_U8	3000011124	Constant value 1 expressed with unsigned integer in 8 bit
C2_U8	3000021124	Constant value 2 expressed with unsigned integer in 8 bit
C3_U8	3000031124	Constant value 3 expressed with unsigned integer in 8 bit
C4_U8	3000041124	Constant value 4 expressed with unsigned integer in 8 bit
C5_U8	3000051124	Constant value 5 expressed with unsigned integer in 8 bit
C6_U8	3000061124	Constant value 6 expressed with unsigned integer in 8 bit
C7_U8	3000071124	Constant value 7 expressed with unsigned integer in 8 bit
C8_U8	3000081124	Constant value 8 expressed with unsigned integer in 8 bit
C9_U8	3000091124	Constant value 9 expressed with unsigned integer in 8 bit
C10_U8	30000A1124	Constant value 10 expressed with unsigned integer in 8 bit
C11_U8	30000B1124	Constant value 11 expressed with unsigned integer in 8 bit
C12_U8	30000C1124	Constant value 12 expressed with unsigned integer in 8 bit
C13_U8	30000D1124	Constant value 13 expressed with unsigned integer in 8 bit
C14_U8	30000E1124	Constant value 14 expressed with unsigned integer in 8 bit
C15_U8	30000F1124	Constant value 15 expressed with unsigned integer in 8 bit
C16_U8	3000101124	Constant value 16 expressed with unsigned integer in 8 bit
C17_U8	3000111124	Constant value 17 expressed with unsigned integer in 8 bit
C18_U8	3000121124	Constant value 18 expressed with unsigned integer in 8 bit
C19_U8	3000131124	Constant value 19 expressed with unsigned integer in 8 bit
C20_U8	3000141124	Constant value 20 expressed with unsigned integer in 8 bit
C21_U8	3000151124	Constant value 21 expressed with unsigned integer in 8 bit
C22_U8	3000161124	Constant value 22 expressed with unsigned integer in 8 bit
C23_U8	3000171124	Constant value 23 expressed with unsigned integer in 8 bit
C24_U8	3000181124	Constant value 24 expressed with unsigned integer in 8 bit
C25_U8	3000191124	Constant value 25 expressed with unsigned integer in 8 bit
C26_U8	30001A1124	Constant value 26 expressed with unsigned integer in 8 bit
C27_U8	30001B1124	Constant value 27 expressed with unsigned integer in 8 bit
C28_U8	30001C1124	Constant value 28 expressed with unsigned integer in 8 bit
C29_U8	30001D1124	Constant value 29 expressed with unsigned integer in 8 bit
C30_U8	30001E1124	Constant value 30 expressed with unsigned integer in 8 bit
C31_U8	30001F1124	Constant value 31 expressed with unsigned integer in 8 bit
C32_U8	3000201124	Constant value 32 expressed with unsigned integer in 8 bit
C40_U8	3000281124	Constant value 40 expressed with unsigned integer in 8 bit
C50_U8	3000321124	Constant value 50 expressed with unsigned integer in 8 bit
C60_U8	30003C1124	Constant value 60 expressed with unsigned integer in 8 bit
C70_U8	3000461124	Constant value 70 expressed with unsigned integer in 8 bit
C80_U8	3000501124	Constant value 80 expressed with unsigned integer in 8 bit
C90_U8	30005A1124	Constant value 90 expressed with unsigned integer in 8 bit
C100_U8	3000641124	Constant value 100 expressed with unsigned integer in 8 bit
C0_U16	3100001125	Constant value 0 expressed with unsigned integer in 16 bit
C1_U16	3100011125	Constant value 1 expressed with unsigned integer in 16 bit
C2_U16	3100021125	Constant value 2 expressed with unsigned integer in 16 bit
C3_U16	3100031125	Constant value 3 expressed with unsigned integer in 16 bit

◆ Signal monitoring point

CONST_VALUE (Function ID: 100001)

Name	Element ID	Description
C4_U16	3100041125	Constant value 4 expressed with unsigned integer in 16 bit
C5_U16	3100051125	Constant value 5 expressed with unsigned integer in 16 bit
C6_U16	3100061125	Constant value 6 expressed with unsigned integer in 16 bit
C7_U16	3100071125	Constant value 7 expressed with unsigned integer in 16 bit
C8_U16	3100081125	Constant value 8 expressed with unsigned integer in 16 bit
C9_U16	3100091125	Constant value 9 expressed with unsigned integer in 16 bit
C10_U16	31000A1125	Constant value 10 expressed with unsigned integer in 16 bit
C11_U16	31000B1125	Constant value 11 expressed with unsigned integer in 16 bit
C12_U16	31000C1125	Constant value 12 expressed with unsigned integer in 16 bit
C13_U16	31000D1125	Constant value 13 expressed with unsigned integer in 16 bit
C14_U16	31000E1125	Constant value 14 expressed with unsigned integer in 16 bit
C15_U16	31000F1125	Constant value 15 expressed with unsigned integer in 16 bit
C16_U16	3100101125	Constant value 16 expressed with unsigned integer in 16 bit
C17_U16	3100111125	Constant value 17 expressed with unsigned integer in 16 bit
C18_U16	3100121125	Constant value 18 expressed with unsigned integer in 16 bit
C19_U16	3100131125	Constant value 19 expressed with unsigned integer in 16 bit
C20_U16	3100141125	Constant value 20 expressed with unsigned integer in 16 bit
C21_U16	3100151125	Constant value 21 expressed with unsigned integer in 16 bit
C22_U16	3100161125	Constant value 22 expressed with unsigned integer in 16 bit
C23_U16	3100171125	Constant value 23 expressed with unsigned integer in 16 bit
C24_U16	3100181125	Constant value 24 expressed with unsigned integer in 16 bit
C25_U16	3100191125	Constant value 25 expressed with unsigned integer in 16 bit
C26_U16	31001A1125	Constant value 26 expressed with unsigned integer in 16 bit
C27_U16	31001B1125	Constant value 27 expressed with unsigned integer in 16 bit
C28_U16	31001C1125	Constant value 28 expressed with unsigned integer in 16 bit
C29_U16	31001D1125	Constant value 29 expressed with unsigned integer in 16 bit
C30_U16	31001E1125	Constant value 30 expressed with unsigned integer in 16 bit
C31_U16	31001F1125	Constant value 31 expressed with unsigned integer in 16 bit
C32_U16	3100201125	Constant value 32 expressed with unsigned integer in 16 bit
C40_U16	3100281125	Constant value 40 expressed with unsigned integer in 16 bit
C50_U16	3100321125	Constant value 50 expressed with unsigned integer in 16 bit
C60_U16	31003C1125	Constant value 60 expressed with unsigned integer in 16 bit
C70_U16	3100461125	Constant value 70 expressed with unsigned integer in 16 bit
C80_U16	3100501125	Constant value 80 expressed with unsigned integer in 16 bit
C90_U16	31005A1125	Constant value 90 expressed with unsigned integer in 16 bit
C100_U16	3100641125	Constant value 100 expressed with unsigned integer in 16 bit
C0_U32	3200001126	Constant value 0 expressed with unsigned integer in 32 bit
C1_U32	3200011126	Constant value 1 expressed with unsigned integer in 32 bit
C2_U32	3200021126	Constant value 2 expressed with unsigned integer in 32 bit
C3_U32	3200031126	Constant value 3 expressed with unsigned integer in 32 bit
C4_U32	3200041126	Constant value 4 expressed with unsigned integer in 32 bit
C5_U32	3200051126	Constant value 5 expressed with unsigned integer in 32 bit
C6_U32	3200061126	Constant value 6 expressed with unsigned integer in 32 bit
C7_U32	3200071126	Constant value 7 expressed with unsigned integer in 32 bit

◆ Signal monitoring point

CONST_VALUE (Function ID: 100001)

Name	Element ID	Description
C8_U32	3200081126	Constant value 8 expressed with unsigned integer in 32 bit
C9_U32	3200091126	Constant value 9 expressed with unsigned integer in 32 bit
C10_U32	32000A1126	Constant value 10 expressed with unsigned integer in 32 bit
C11_U32	32000B1126	Constant value 11 expressed with unsigned integer in 32 bit
C12_U32	32000C1126	Constant value 12 expressed with unsigned integer in 32 bit
C13_U32	32000D1126	Constant value 13 expressed with unsigned integer in 32 bit
C14_U32	32000E1126	Constant value 14 expressed with unsigned integer in 32 bit
C15_U32	32000F1126	Constant value 15 expressed with unsigned integer in 32 bit
C16_U32	3200101126	Constant value 16 expressed with unsigned integer in 32 bit
C17_U32	3200111126	Constant value 17 expressed with unsigned integer in 32 bit
C18_U32	3200121126	Constant value 18 expressed with unsigned integer in 32 bit
C19_U32	3200131126	Constant value 19 expressed with unsigned integer in 32 bit
C20_U32	3200141126	Constant value 20 expressed with unsigned integer in 32 bit
C21_U32	3200151126	Constant value 21 expressed with unsigned integer in 32 bit
C22_U32	3200161126	Constant value 22 expressed with unsigned integer in 32 bit
C23_U32	3200171126	Constant value 23 expressed with unsigned integer in 32 bit
C24_U32	3200181126	Constant value 24 expressed with unsigned integer in 32 bit
C25_U32	3200191126	Constant value 25 expressed with unsigned integer in 32 bit
C26_U32	32001A1126	Constant value 26 expressed with unsigned integer in 32 bit
C27_U32	32001B1126	Constant value 27 expressed with unsigned integer in 32 bit
C28_U32	32001C1126	Constant value 28 expressed with unsigned integer in 32 bit
C29_U32	32001D1126	Constant value 29 expressed with unsigned integer in 32 bit
C30_U32	32001E1126	Constant value 30 expressed with unsigned integer in 32 bit
C31_U32	32001F1126	Constant value 31 expressed with unsigned integer in 32 bit
C32_U32	3200201126	Constant value 32 expressed with unsigned integer in 32 bit
C40_U32	3200281126	Constant value 40 expressed with unsigned integer in 32 bit
C50_U32	3200321126	Constant value 50 expressed with unsigned integer in 32 bit
C60_U32	32003C1126	Constant value 60 expressed with unsigned integer in 32 bit
C70_U32	3200461126	Constant value 70 expressed with unsigned integer in 32 bit
C80_U32	3200501126	Constant value 80 expressed with unsigned integer in 32 bit
C90_U32	32005A1126	Constant value 90 expressed with unsigned integer in 32 bit
C100_U32	3200641126	Constant value 100 expressed with unsigned integer in 32 bit
C0_U64	3300001127	Constant value 0 expressed with unsigned integer in 64 bit
C1_U64	3300011127	Constant value 1 expressed with unsigned integer in 64 bit

◆ Signal monitoring point

BIO_FORCE (Function ID: 240101)

Name	Element ID	Description
BI1F OP	3110001198	BI1 forced operate start
BI2F OP	3111001198	BI2 forced operate start
BI3F OP	3112001198	BI3 forced operate start
BI4F OP	3113001198	BI4 forced operate start
BI5F OP	3114001198	BI5 forced operate start

◆ Signal monitoring point

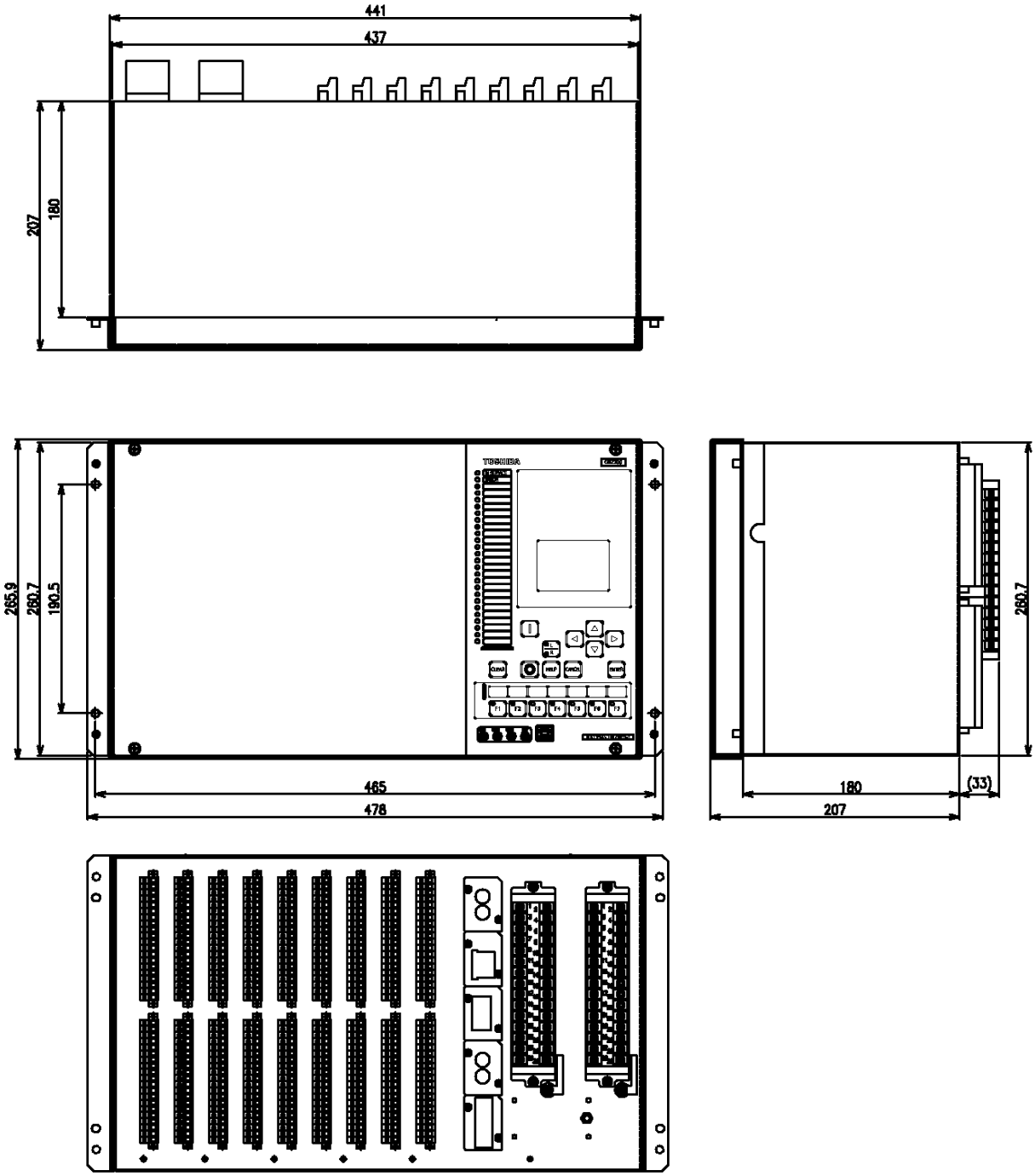
BIO_FORCE (Function ID: 240101)

Name	Element ID	Description
BI6F OP	3115001198	BI6 forced operate start
BI7F OP	3116001198	BI7 forced operate start
BI8F OP	3117001198	BI8 forced operate start
BI9F OP	3118001198	BI9 forced operate start
BI10F OP	3119001198	BI10 forced operate start
BI11F OP	311A001198	BI11 forced operate start
BI12F OP	311B001198	BI12 forced operate start
BI13F OP	311C001198	BI13 forced operate start
BI14F OP	311D001198	BI14 forced operate start
BI15F OP	311E001198	BI15 forced operate start
BI16F OP	311F001198	BI16 forced operate start
BO1F OP	3110201198	BO1 forced operate start
BO2F OP	3111201198	BO2 forced operate start
BO3F OP	3112201198	BO3 forced operate start
BO4F OP	3113201198	BO4 forced operate start
BO5F OP	3114201198	BO5 forced operate start
BO6F OP	3115201198	BO6 forced operate start
BO7F OP	3116201198	BO7 forced operate start
BO8F OP	3117201198	BO8 forced operate start
BO9F OP	3118201198	BO9 forced operate start
BO10F OP	3119201198	BO10 forced operate start
BO11F OP	311A201198	BO11 forced operate start
BO12F OP	311B201198	BO12 forced operate start
BO13F OP	311C201198	BO13 forced operate start
BO14F OP	311D201198	BO14 forced operate start
BO15F OP	311E201198	BO15 forced operate start
BO16F OP	311F201198	BO16 forced operate start
BI1F OP	3110001198	BI1 forced operate start
BI2F OP	3111001198	BI2 forced operate start
BI3F OP	3112001198	BI3 forced operate start
BI4F OP	3113001198	BI4 forced operate start
BI5F OP	3114001198	BI5 forced operate start
BI6F OP	3115001198	BI6 forced operate start
BI7F OP	3116001198	BI7 forced operate start
BI8F OP	3117001198	BI8 forced operate start
BI9F OP	3118001198	BI9 forced operate start
BI10F OP	3119001198	BI10 forced operate start
BI11F OP	311A001198	BI11 forced operate start
BI12F OP	311B001198	BI12 forced operate start
BI13F OP	311C001198	BI13 forced operate start
BI14F OP	311D001198	BI14 forced operate start

Appendix 2 Case outline

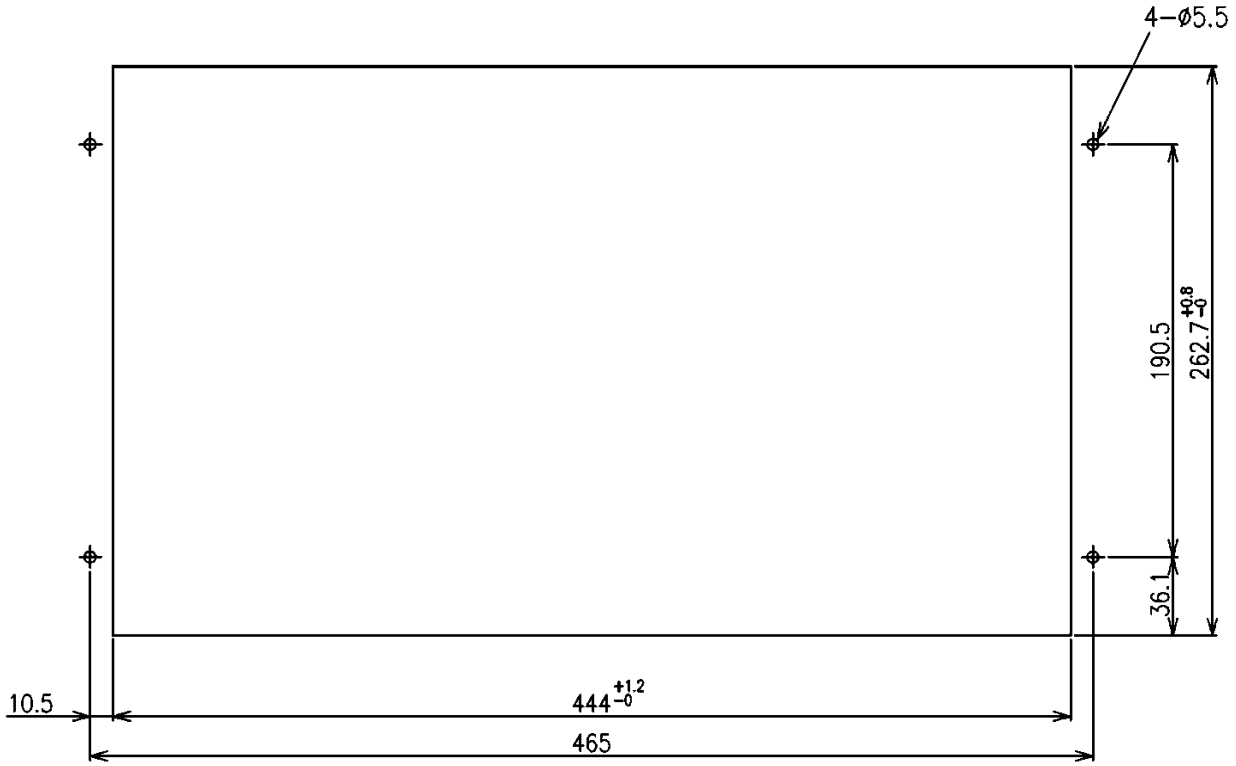
1/1 case size

1. Trihedral figure (1/1×19 inches) for "Compression type terminal" case

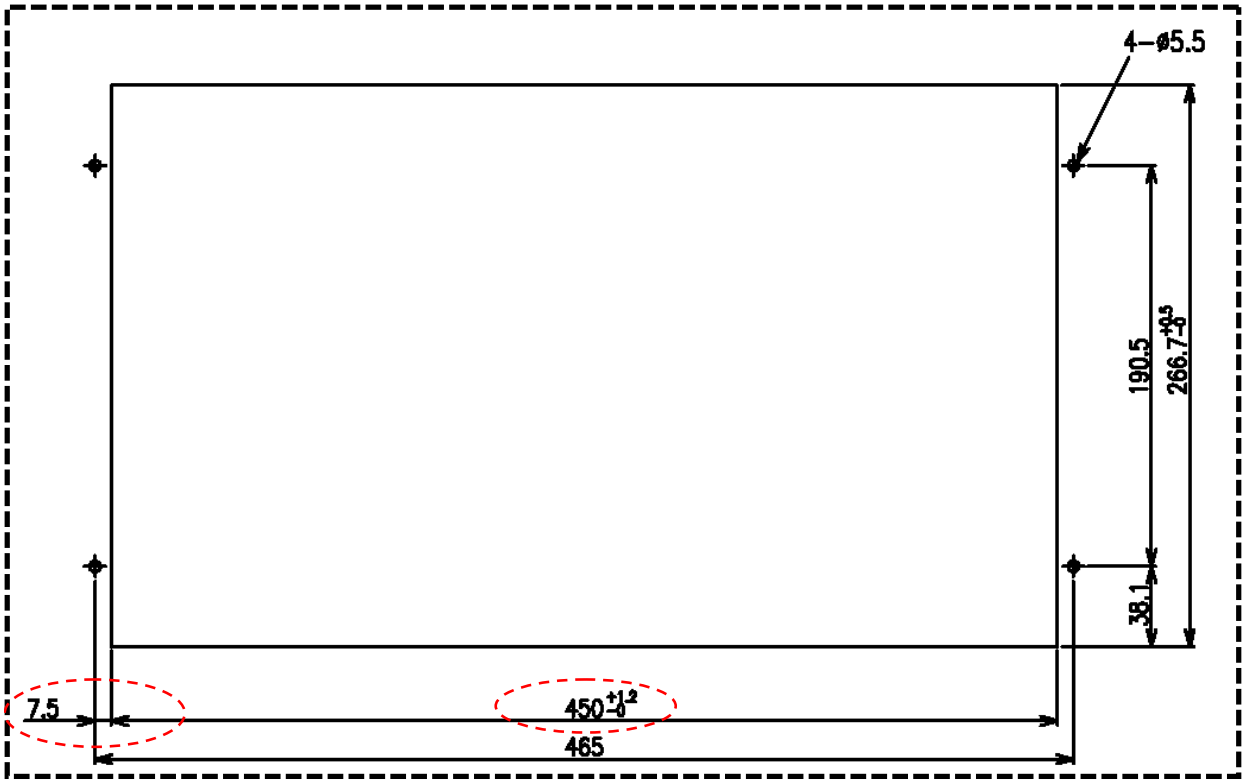


Note: Dimensions shown in millimeters

2. Panel cut out figure (1/1×19 inches) for "Compression type terminal" case



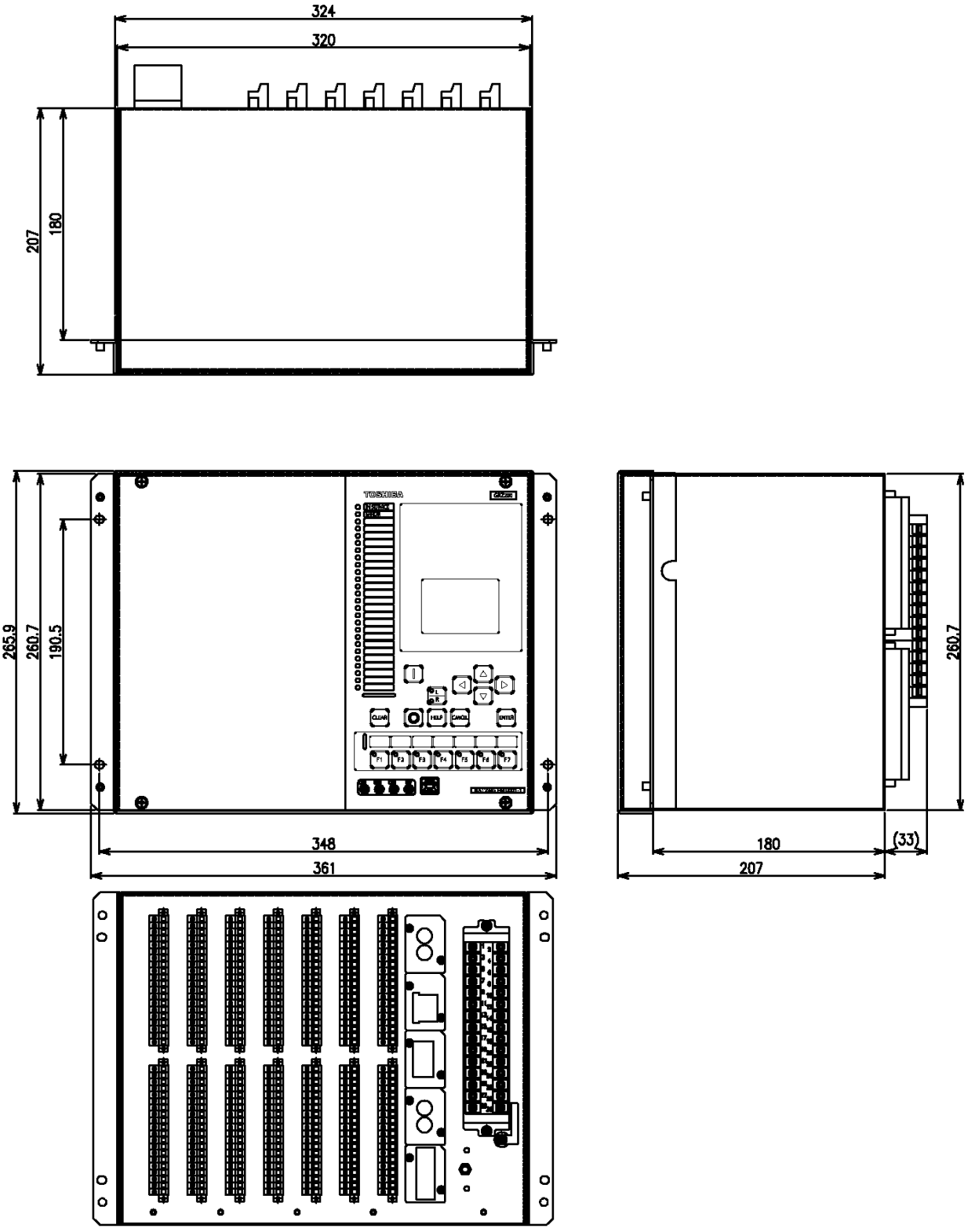
3. Panel cut out figure (1/1×19 inches) when "**Ring lug type terminal**" applied



Note: Dimensions shown in millimeter

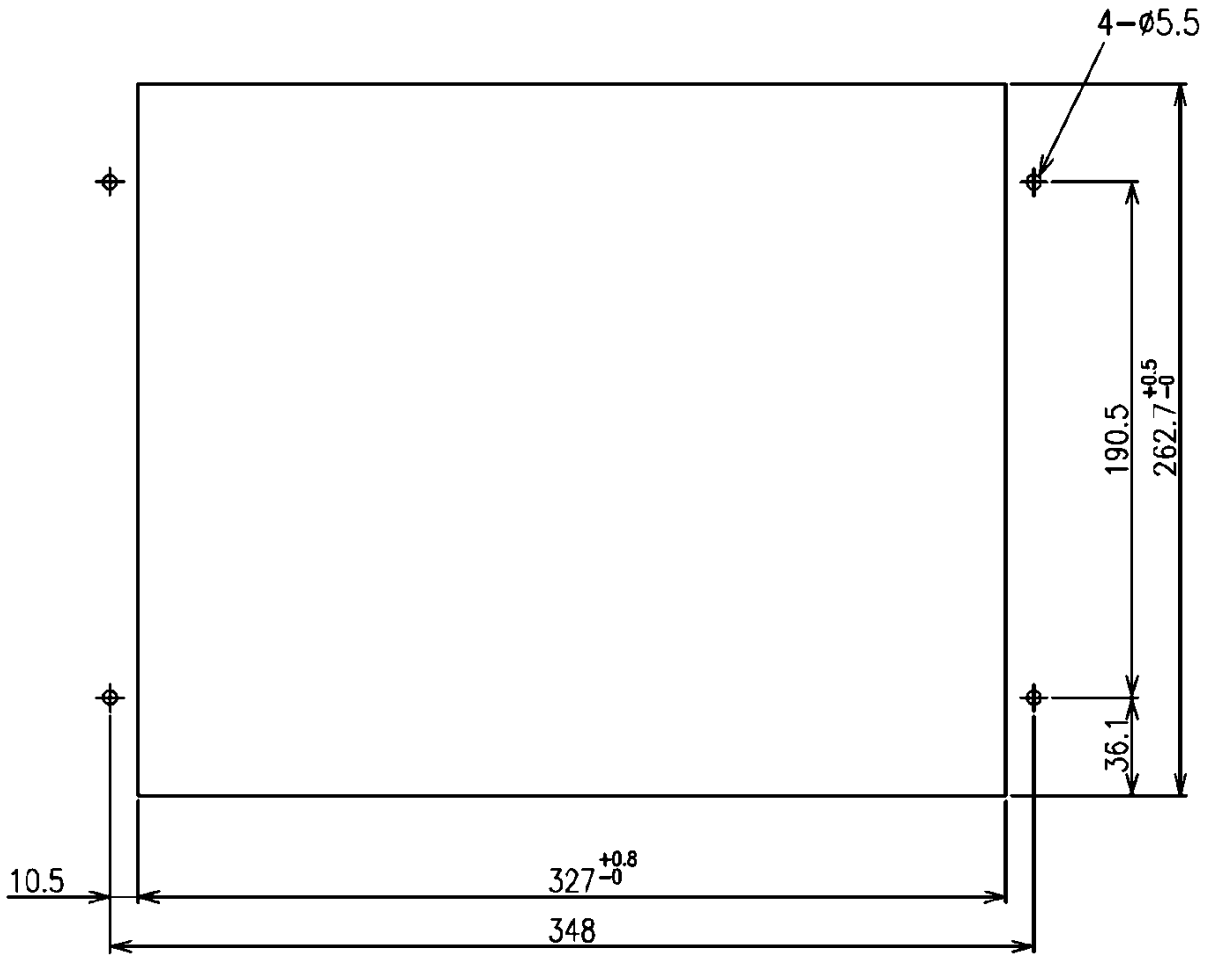
3/4 case size

1. Trihedral figure (3/4×19 inches) for "Compression type terminal" case



Note: Dimensions shown in millimeters

2. Panel cut out figure (3/4×19 inches) for "Compression type terminal" case



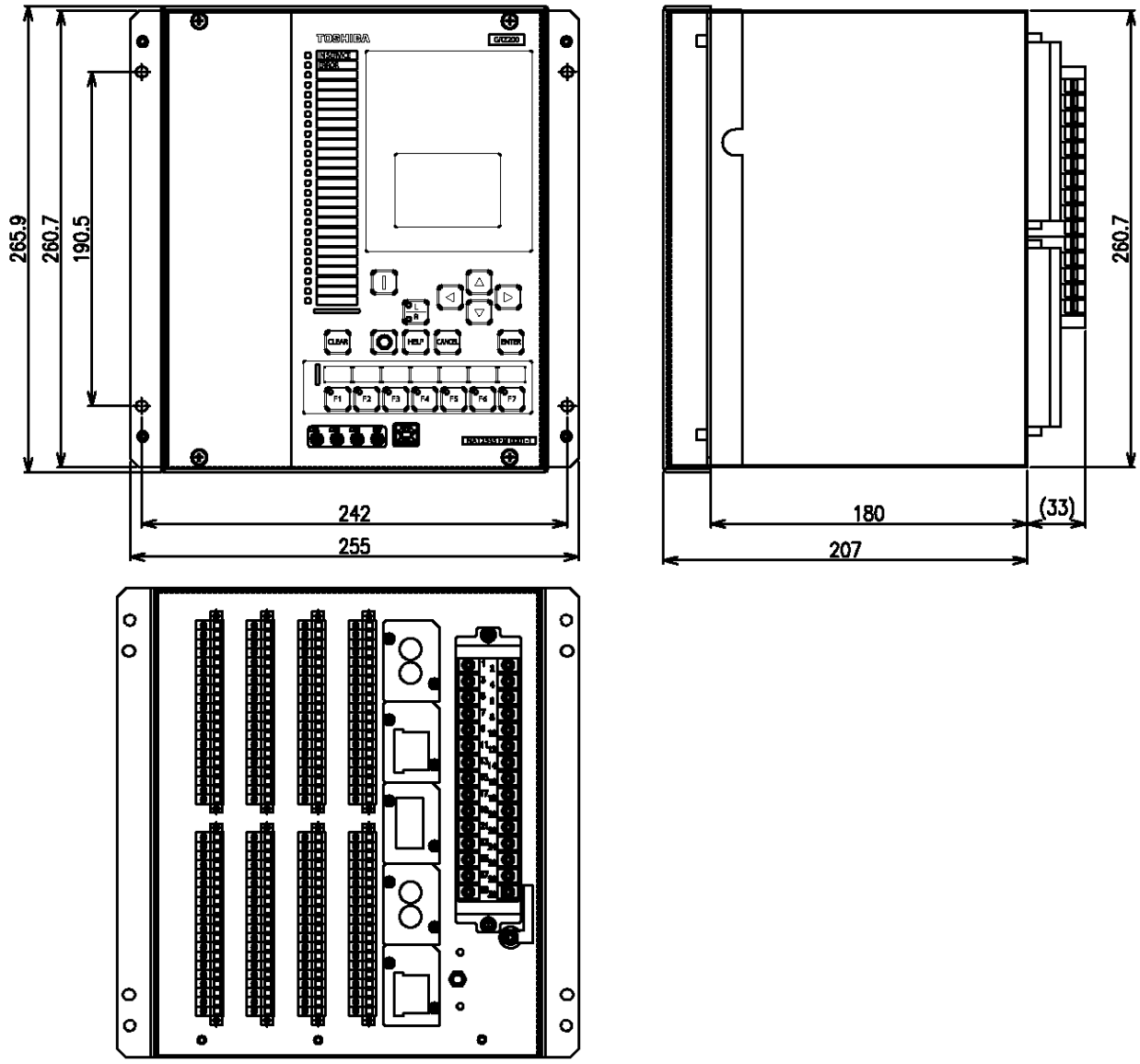
[1]Note: Dimensions shown in millimeters.

[2]Note: When you wish to know about the panel-cut-out-figures corresponding to rack-attachment kits, refer to *Appendix: Rack mounting*.

[3]Note: For the size relating to "Ring type terminal" case, see other figures.

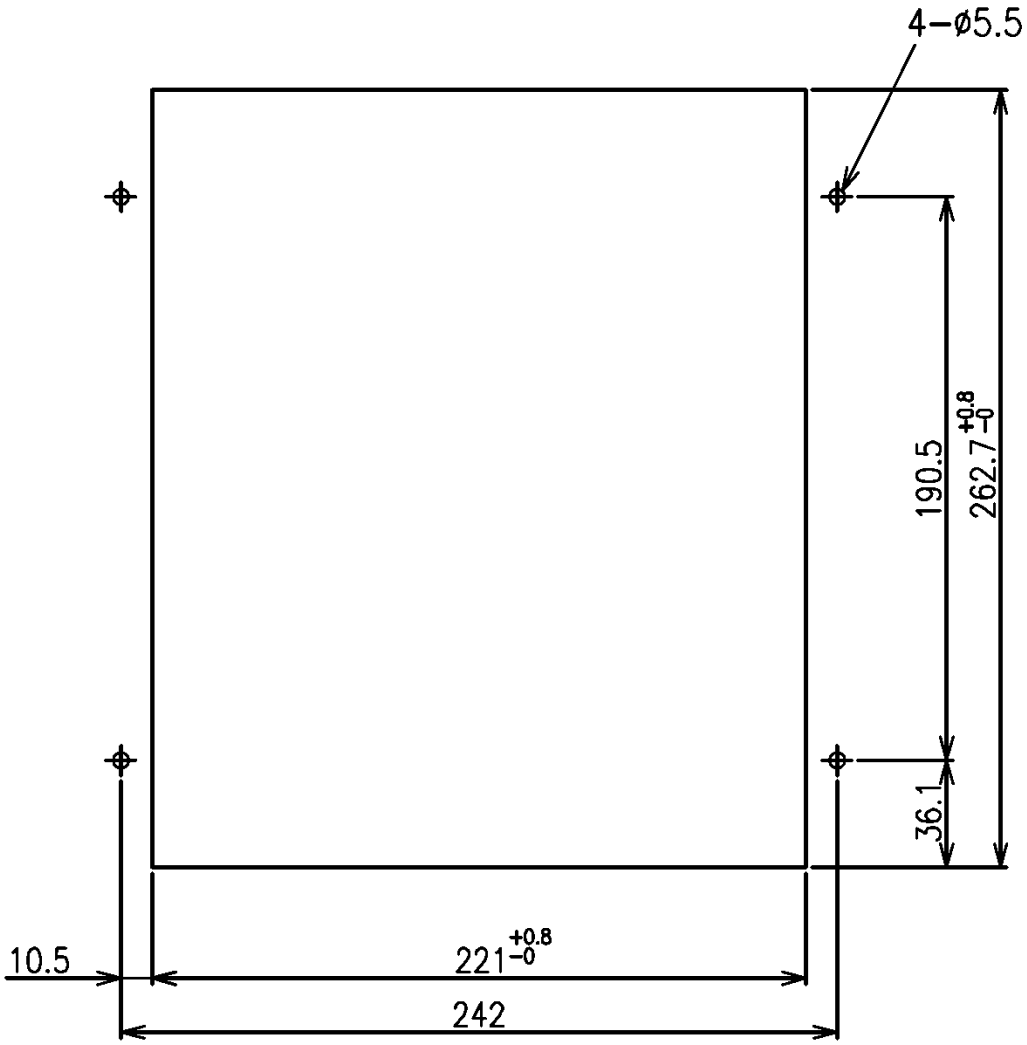
1/2 case size

1. Trihedral figure (1/2×19 inches) for "Compression type terminal" case



Note: Dimensions shown in millimeters

2. Panel cut out figure (1/2×19 inches) for "Compression type terminal" case



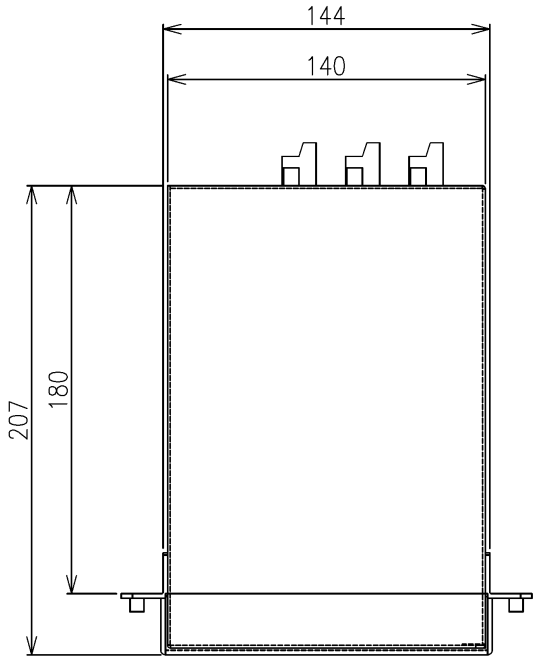
[1]Note: Dimensions shown in millimeters.

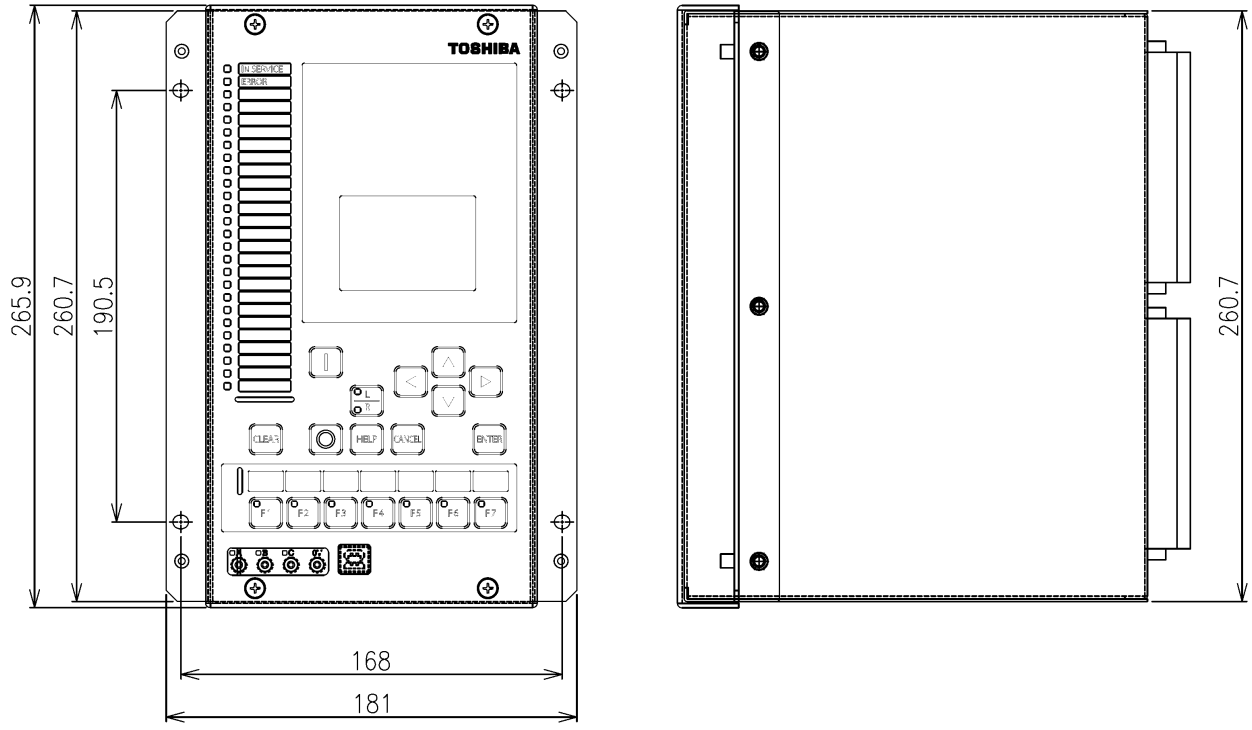
[2]Note: When you wish to know about the panel-cut-out-figures corresponding to rack-attachment kits, refer to *Appendix: Rack mounting*.

[3]Note: For the size relating to "Ring type terminal" case, see other figures.

IFU (1/3) case size

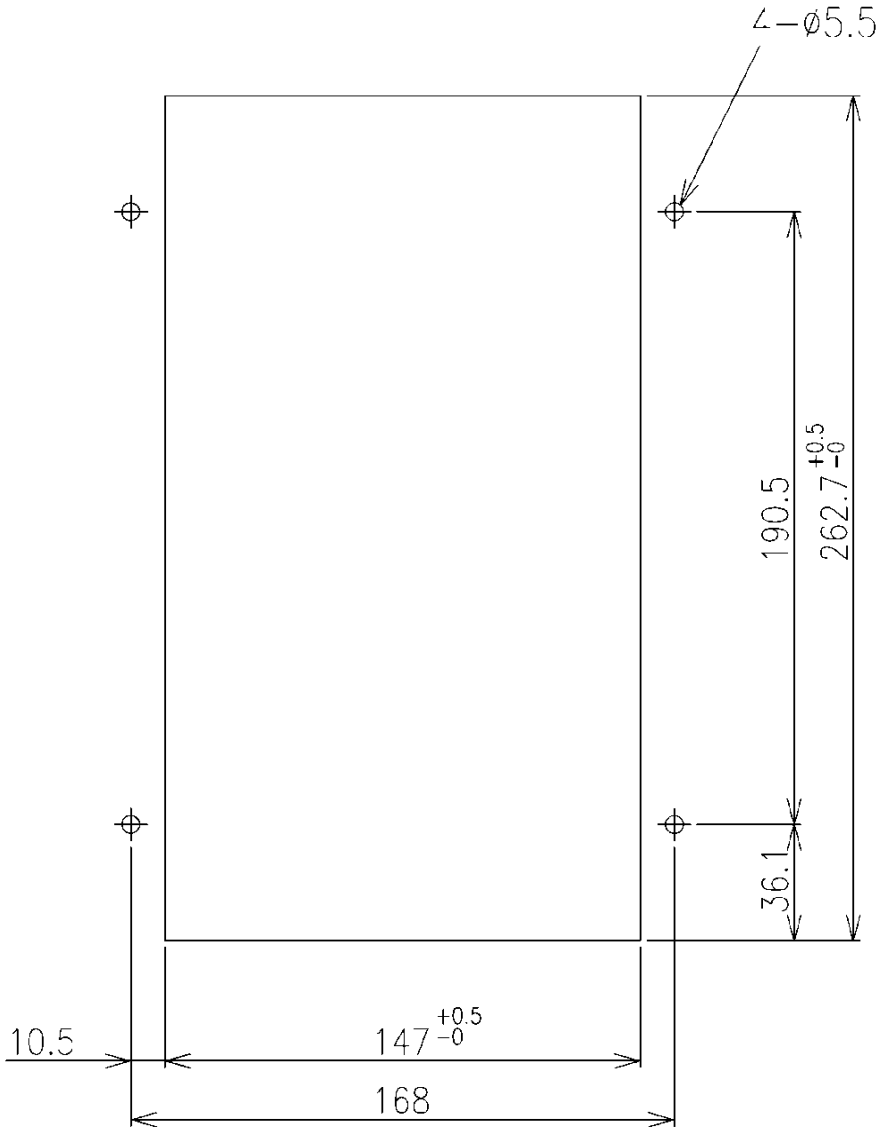
1. Trihedral figure (1/1×19 inches) for “Compression type terminal” case





Note: Dimensions shown in millimeters

2. Panel cut out figure (1/3×19 inches) for "Compression type terminal" case



[1]Note: Dimensions shown in millimeters.

[2]Note: When you wish to know about the panel-cut-out-figures corresponding to rack-attachment kits, refer to *Appendix: Rack mounting*.

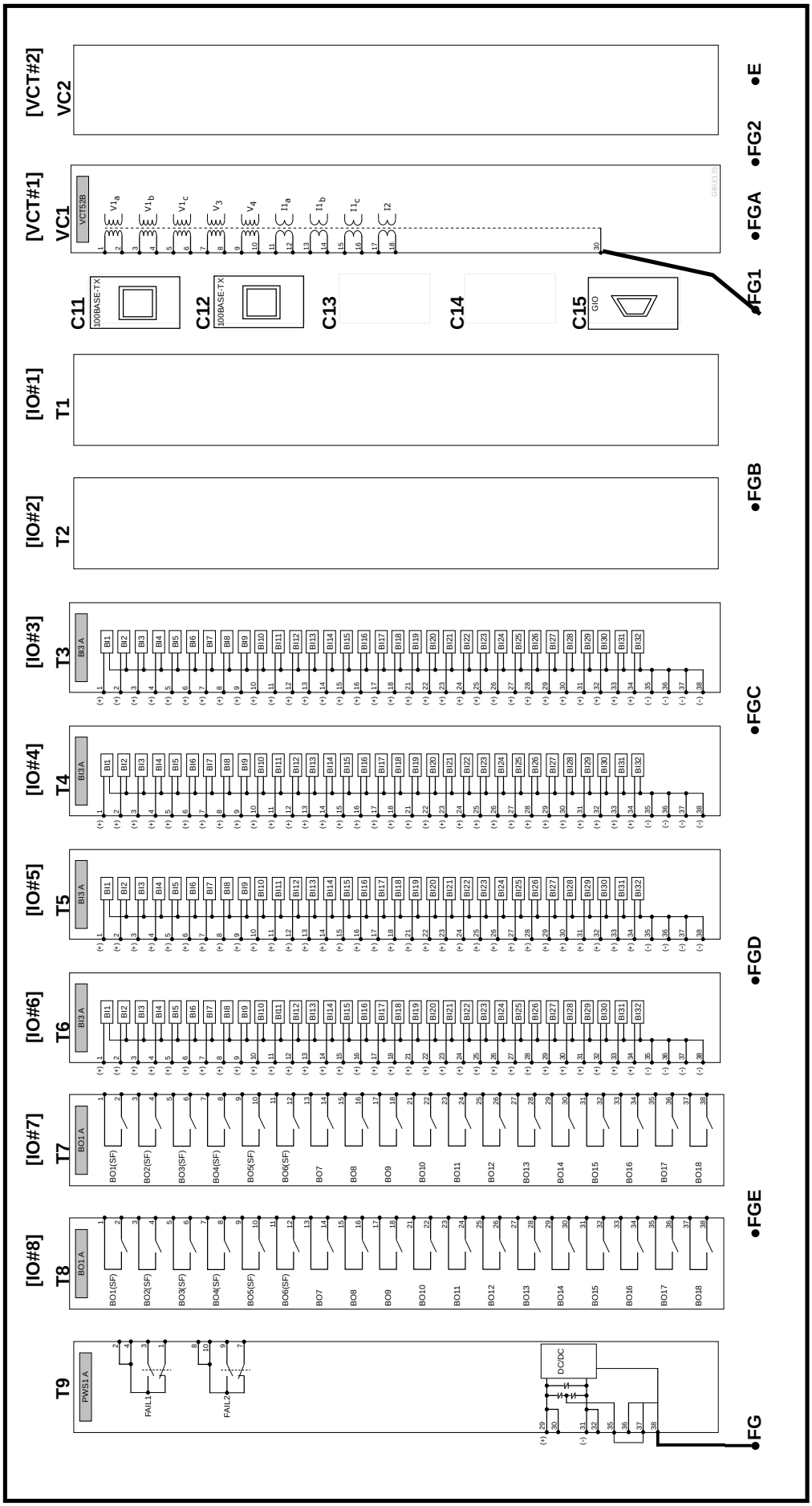
[3]Note: For the size relating to "Ring type terminal" case, see other figures.

Appendix 3 Typical external connection

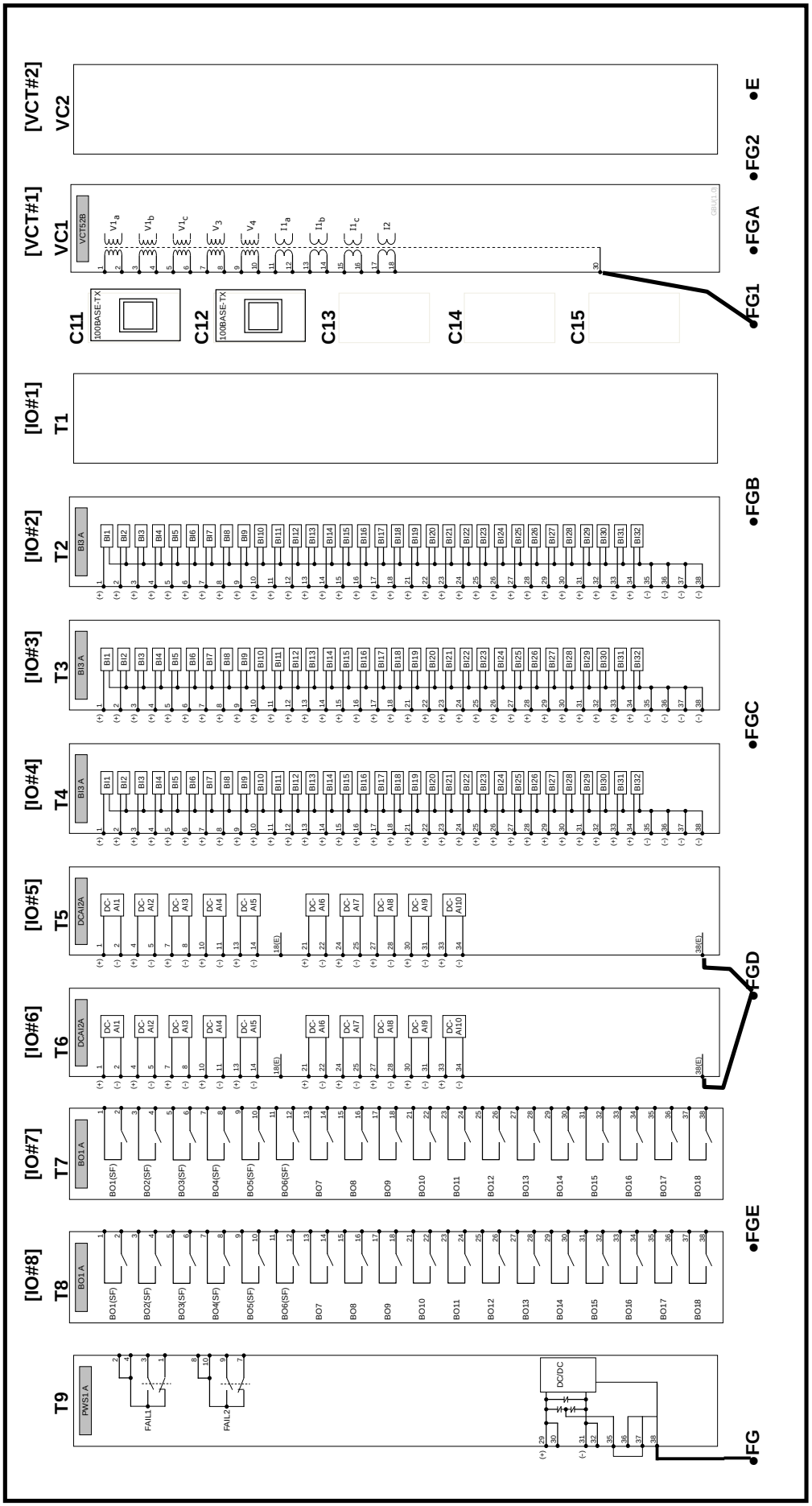
1.1. GBU200-21-863-00-E5-10-110 (1/1 case in 19inch rack for Compression-type terminal)
1.2. GBU200-21-876-00-45-10-110 (1/1 case in 19inch rack for Compression-type terminal)
1.3. GBU200-21-883-00-E5-10-110 (1/1 case in 19inch rack for Compression-type terminal)
1.4. GBU200-31-863-00-E5-10-110 (1/1 case in 19inch rack for Compression-type terminal)
1.5. GBU200-21-863-00-E5-10-110 (1/1 case in 19inch rack for Compression-type terminal)
1.6 GBU200-31-867-00-45-10-110 (1/1 case in 19inch rack for Compression-type terminal)
1.7 GBU200-01-884-00-45-10-110 (1/1 case in 19inch rack for Compression-type terminal)
1.8 GBU200-01-885-00-45-10-110 (1/1 case in 19inch rack for Compression-type terminal)
2 GIO200-01-WX1-00-00-00-00 (1/1 case in 19inch rack for Compression-type terminal)
3 GBU200 (IFU200) (1/3 case in 19inch rack for Compression-type terminal)

Typical external connection diagram for Compression-type terminal

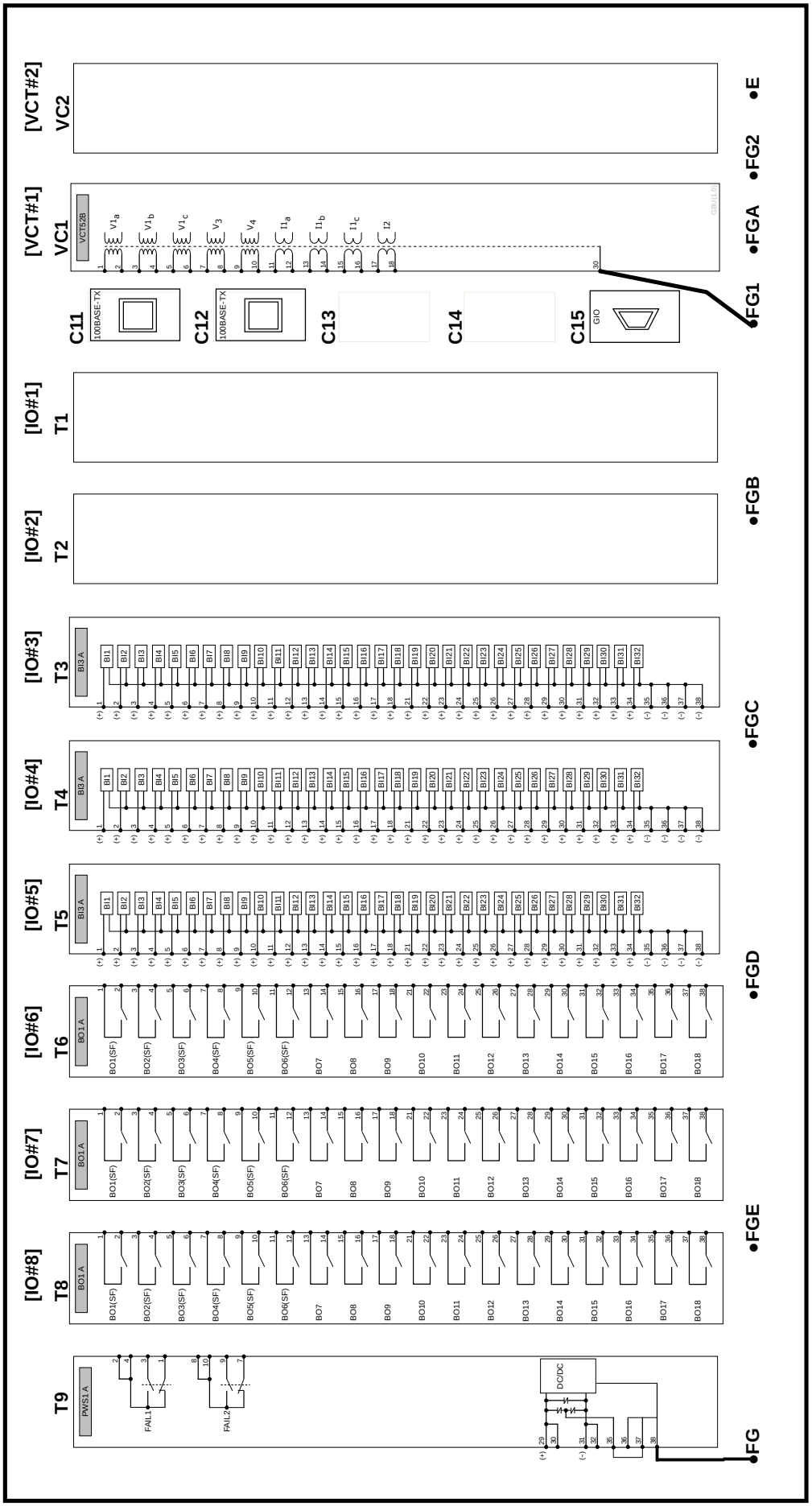
1.1. GBU200-21-863-00-E5-10-110 (1/1 case in 19inch rack for Compression-type terminal)



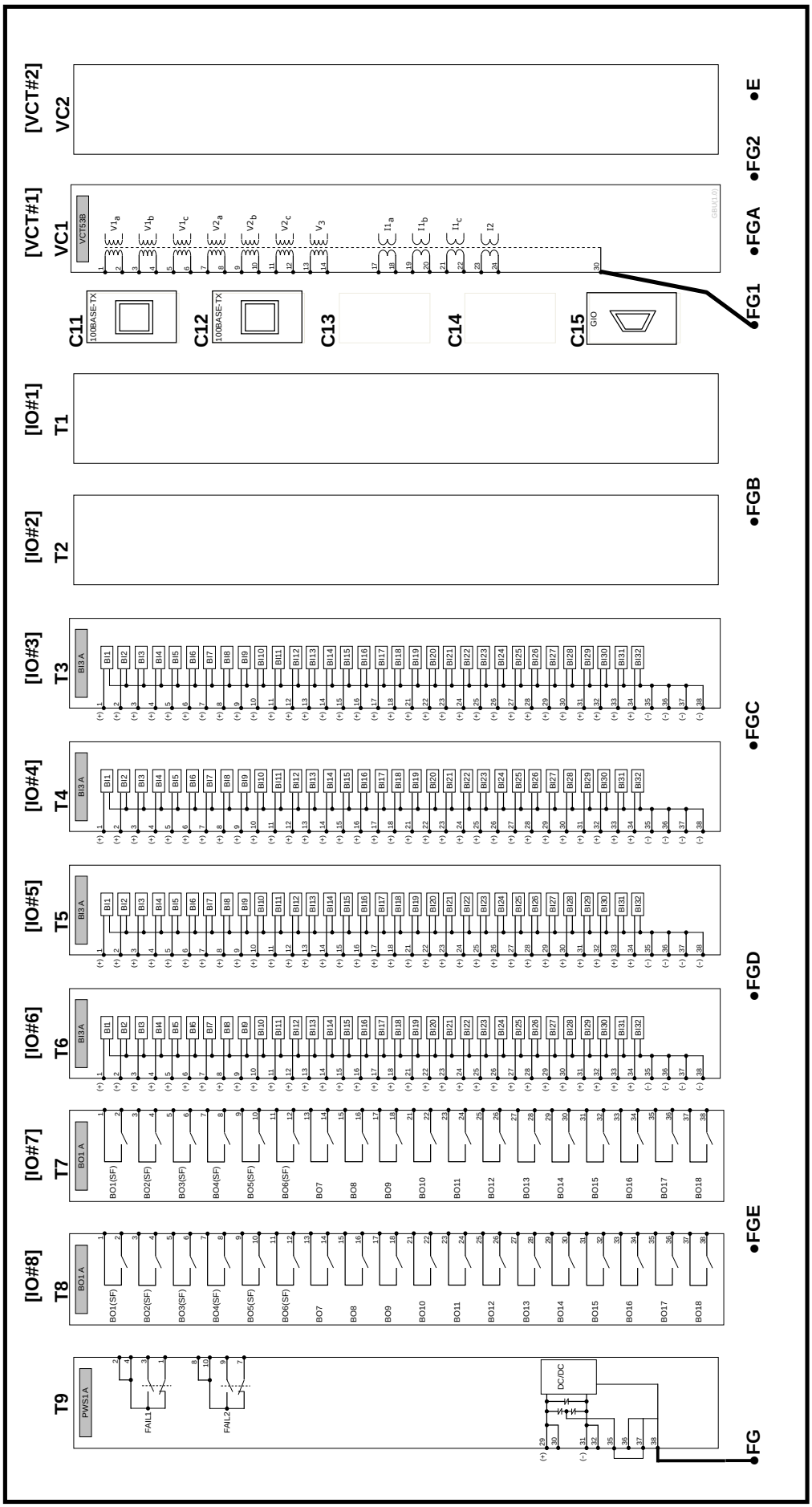
1.2. GBU200-21-876-00-45-10-110 (1/1 case in 19inch rack for Compression-type terminal)



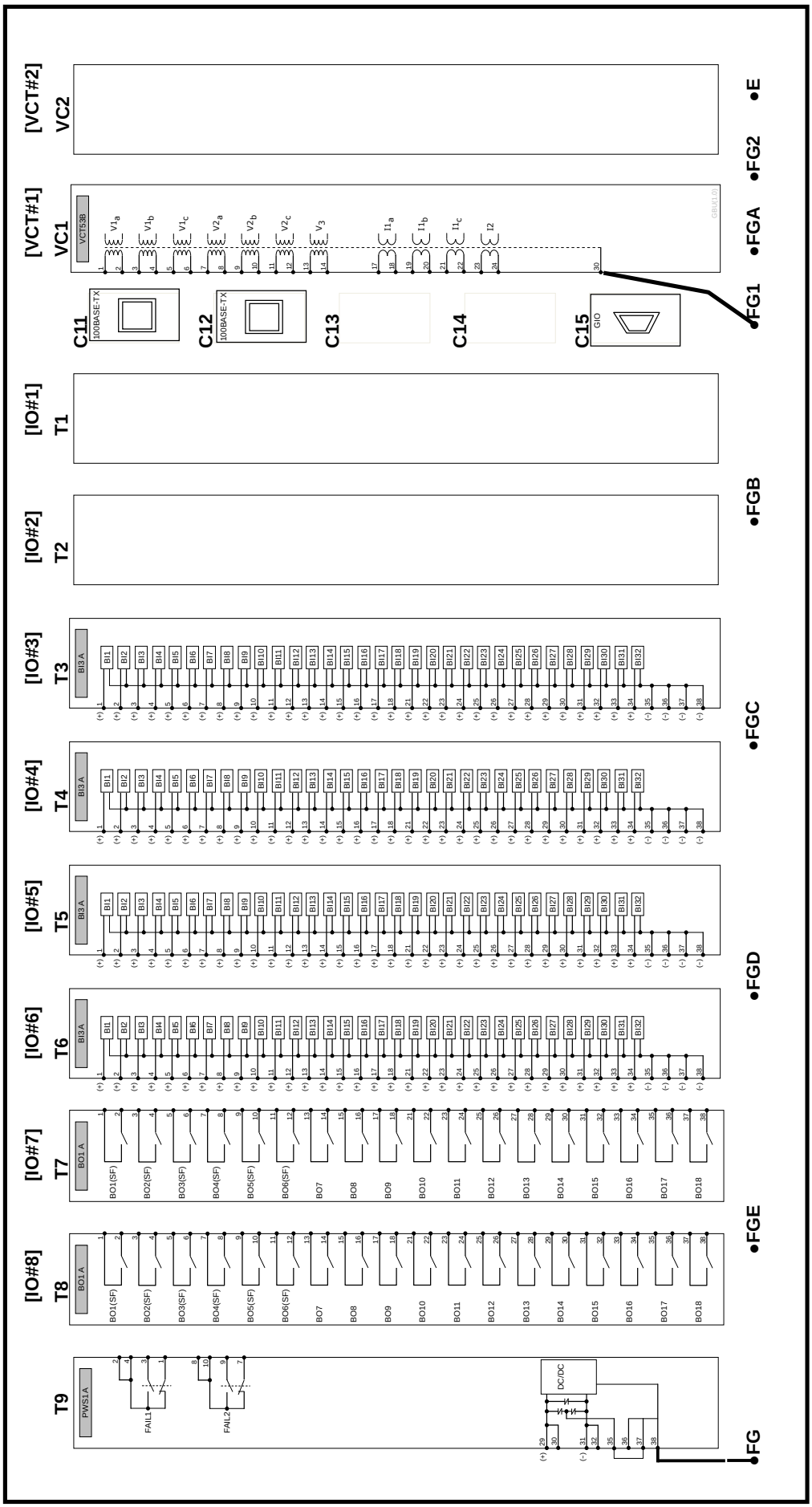
1.3. GBU200-21-883-00-E5-10-110 (1/1 case in 19inch rack for Compression-type terminal)



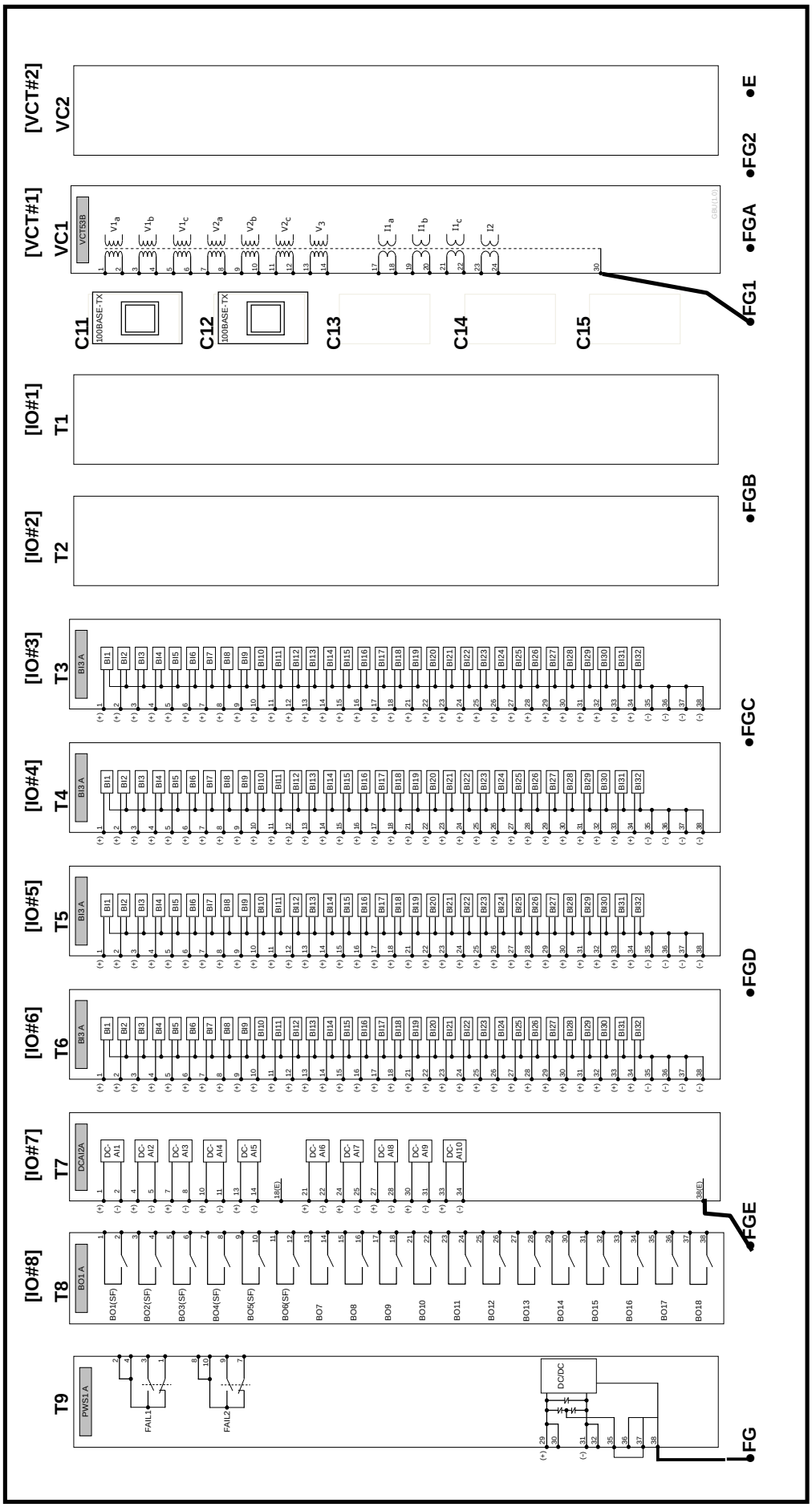
1.4. GBU200-31-863-00-E5-10-110 (1/1 case in 19inch rack for Compression-type terminal)



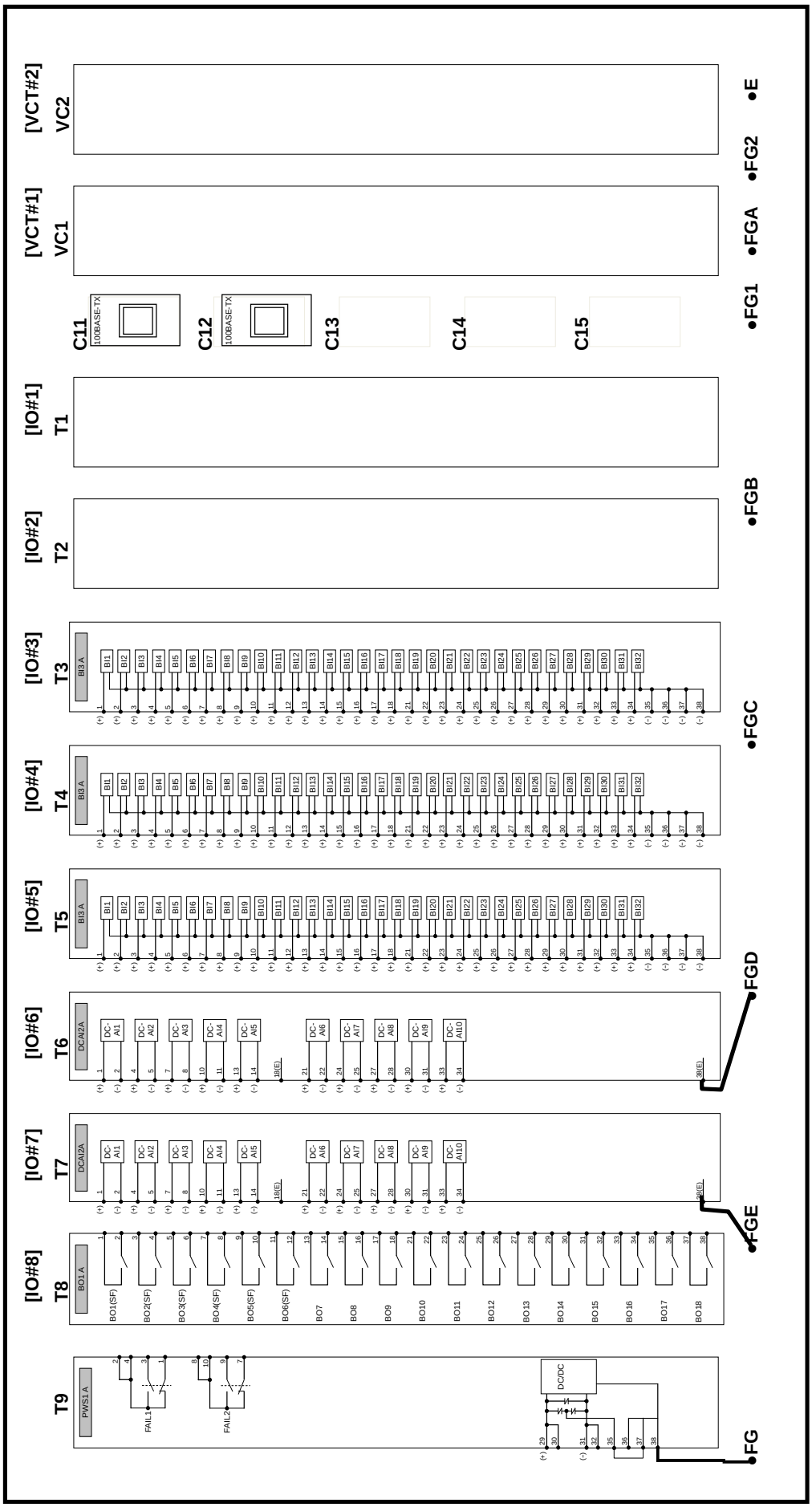
1.5. GBU200-21-863-00-E5-10-110 (1/1 case in 19inch rack for Compression-type terminal)



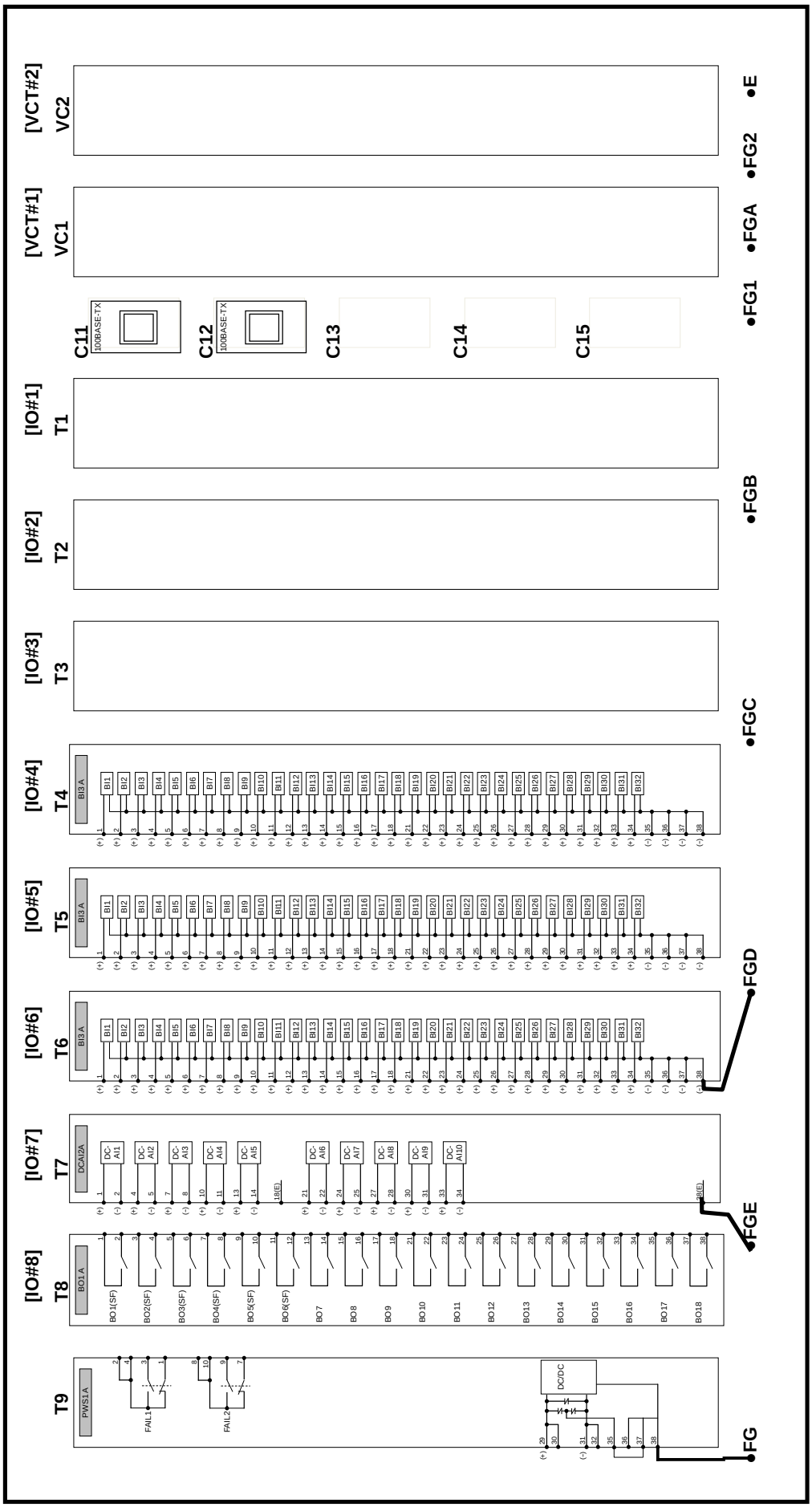
1.6 GBU200-31-867-00-45-10-110 (1/1 case in 19inch rack for Compression-type terminal)



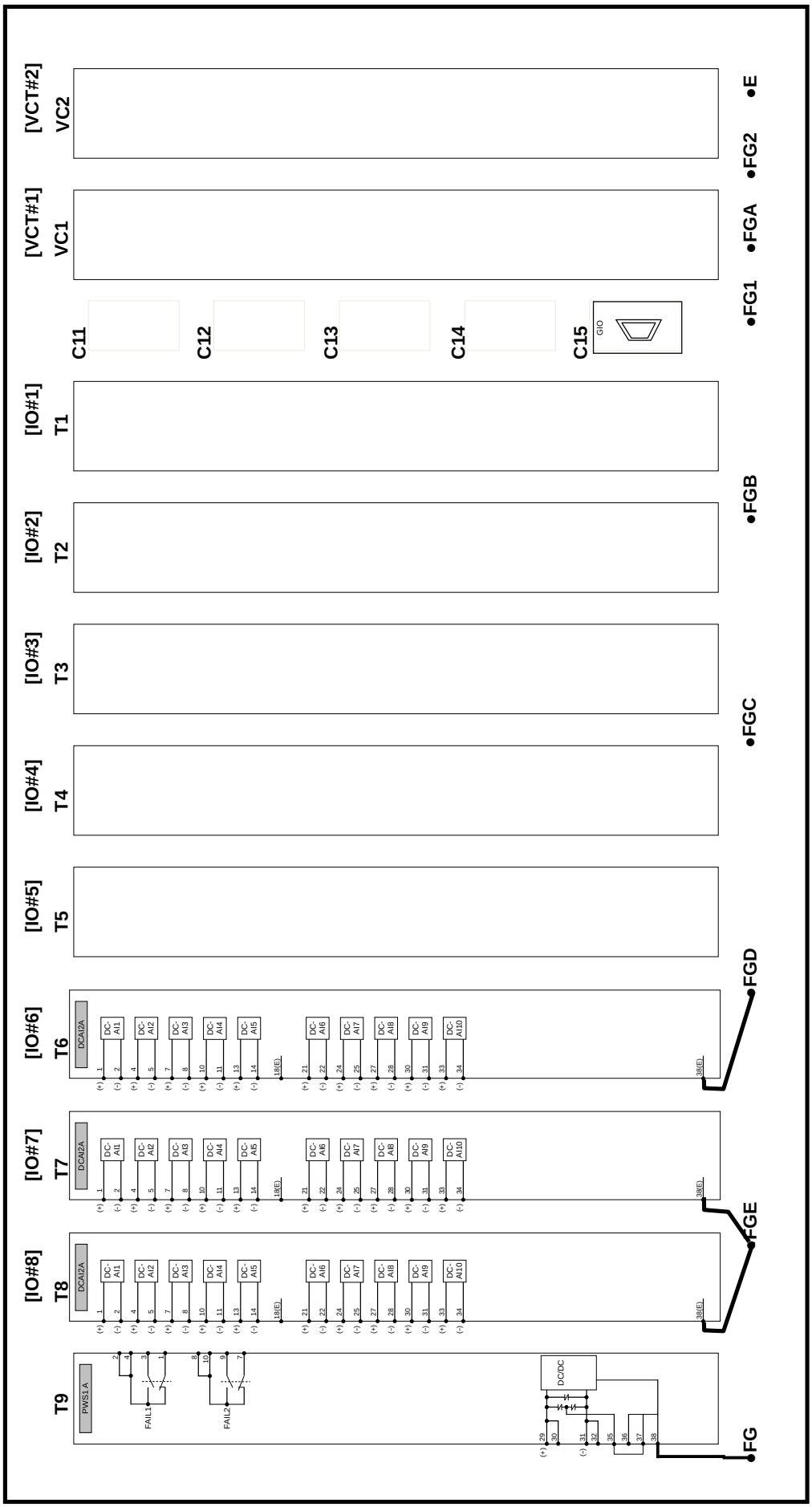
1.7 GBU200-01-884-00-45-10-110 (1/1 case in 19inch rack for Compression-type terminal)



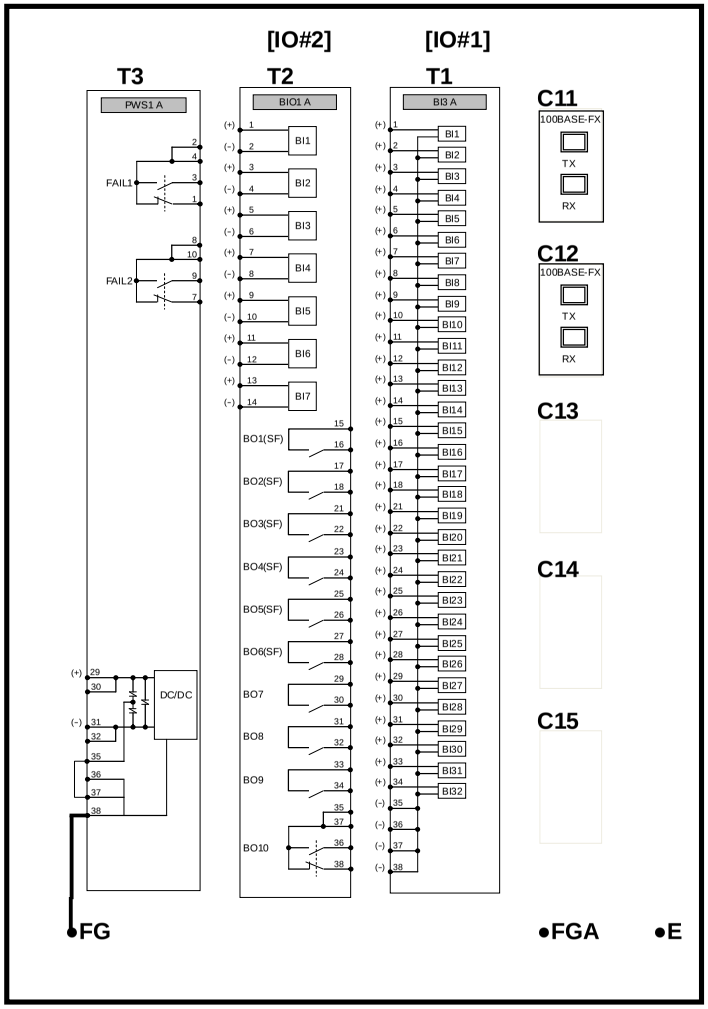
1.8 GBU200-01-885-00-45-10-110 (1/1 case in 19inch rack for Compression-type terminal)



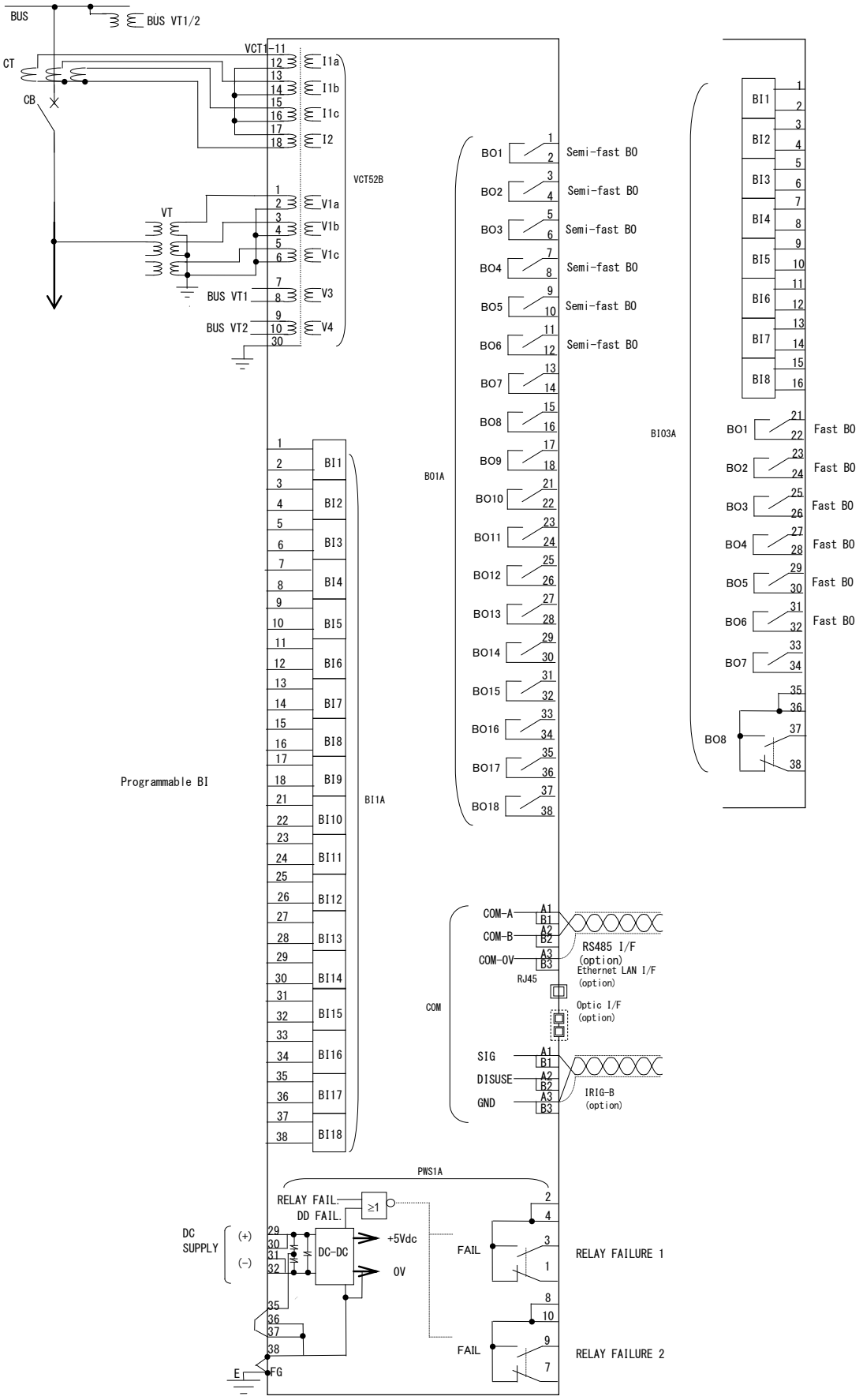
2 GIO200-01-WX1-00-00-00-00 (1/1 case in 19inch rack for Compression-type terminal)



3. GBU200 (GBU200-01-122-00-46-10-000, 'IFU200') (1/3 case in 19inch rack for Compression-type terminal)



Typical external connection diagram – Compression-type terminal (VCT: 52, IO: BI1, BO1 and BIO3)



Appendix 4 IEC61850 MICS, PICS, PIXIT, and TICS

#	Document names	Pages	Provisions
MICS	Model implementation conformance statement	1359	Edition 1
PICS	Protocol implementation conformance statement	1393	Edition 1
PIXIT	Protocol implementation extra information for testing	1400	Edition 1
TICS	Tissues conformance statement	1417	Edition 1

(MICS Edition 1)

IEC61850 Edition 1 Model Implementation Conformance Statement (MICS)

GBU200 (Bay control unit IED)

(Original document#: 6F2S1877 Ver. 0.1).

(MICS Ed.1)

The GBU200 with communication firmware G2M850-01 series version upper than E(G2M850-01-E) supports IEC 61850 logical nodes and common data classes as indicated in the following tables..

Logical nodes in IEC 61850-7-4

Logical Nodes	GBU200
L: System Logical Nodes	
LPHD	Yes
Common Logical Node	Yes
LLN0	Yes
P: Logical Nodes for Protection functions	
PDIF	---
PDIR	---
PDIS	---
PDOP	---
PDUP	---
PFRC	---
PHAR	---
PHIZ	---
PIOC	---
PMRI	---
PMSS	---
POPE	---
PPAM	---
PSCH	---
PSDE	Yes
PTEF	---
PTOC	Yes
PTOF	Yes
PTOV	Yes
PTRC	Yes
PTTR	Yes
PTUC	---
PTUV	Yes
PUPF	---
PTUF	Yes
PVOC	---
PVPH	---
PZSU	---
R: Logical Nodes for protection related functions	
RDRE	---
RADR	---
RBDR	---
RDRS	---
RBRF	---
RDIR	---
RFLO	---
RPSB	---
RREC	---
RSYN	Yes
C: Logical Nodes for Control	
CALH	---
CCGR	---
CILO	Yes
CPOW	---
CSWI	Yes
G: Logical Nodes for Generic references	
GAPC1	Yes
GAPC2	Yes
Logical Nodes	**GBU200**
GGIO1	Yes
GGIO2	Yes
GGIO3	Yes
GGIO4	Yes
GGIO5	Yes
GGIO6	Yes
GGIO7	Yes
GGIO8	Yes
GGIO9	Yes
GGIO10	Yes
GGIO11	Yes
GGIO12	Yes
GGIO_GOOSE	Yes
GSAL	---
I: Logical Nodes for Interfacing and archiving	
IARC	---
IHMI	---
ITCI	---
ITMI	---
A: Logical Nodes for Automatic control	
ANCR	---
ARCO	---
ATCC	---
AVCO	---
M: Logical Nodes for Metering and measurement	
MDIF	---
MHAI	Yes
MHAN	---
MMTR	---
MMXN	Yes
MMXU	Yes
MSQI	Yes
MSTA	---
S: Logical Nodes for Sensors and monitoring	
SARC	---
SIMG	---
SIML	---
SPDC	---
X: Logical Nodes for Switchgear	
XCBR	Yes
XSWI	---
T: Logical Nodes for Instrument transformers	
TCTR	---
TVTR	---
Y: Logical Nodes for Power transformers	
YEFN	---
YLTC	Yes
YPSH	---
YPTR	---

(MICS Ed.1)

Logical nodes in IEC 61850-7-4

Logical Nodes	GBU200
Z: Logical Nodes for Further power system equipment	
ZAXN	---
ZBAT	---
ZCAB	---
ZCAP	---
ZCON	---
ZGEN	---
ZGIL	---
ZLIN	---
ZMOT	---
ZREA	---
ZRRC	---
ZSAR	---
ZTCF	---
ZTCR	---

(MICS Ed.1)

Common data classes in IEC61850-7-3

Common data classes	GBU200
Status information	
SPS	Yes
DPS	---
INS	Yes
ACT	Yes
ACT_ABC	Yes
ACD	Yes
ACD_ABC	Yes
SEC	---
BCR	---
Measured information	
MV	Yes
CMV	Yes
SAV	---
WYE	Yes
WYE_ABCN	---
DEL	Yes
SEQ	Yes
HMV	---
HWYE	---
HDEL	---
Controllable status information	
SPC	Yes
DPC	Yes
INC	Yes
BSC	Yes
ISC	---
Controllable analogue information	
APC	---
Status settings	
SPG	---
ING	Yes
Analogue settings	
ASG	Yes
CURVE	---
Description information	
DPL	Yes
LPL	Yes
CSD	---

(MICS Ed.1)

LPHD class					
Attribute Name	**Attr. Type**	**Explanation**	**T**	**M/O**	**GBU200**
LNName		Shall be inherited from Logical-Node Class (see IEC 61850-7-2)			
Data					
PhyName	DPL	Physical device name plate		M	Y
PhyHealth	INS	Physical device health		M	Y
OutOv	SPS	Output communications buffer overflow		O	N
Proxy	SPS	Indicates if this LN is a proxy		M	Y
InOv	SPS	Input communications buffer overflow		O	N
NumPwrUp	INS	Number of Power ups		O	N
WrmStr	INS	Number of Warm Starts		O	N
WacTrg	INS	Number of watchdog device resets detected		O	N
PwrUp	SPS	Power Up detected		O	N
PwrDn	SPS	Power Down detected		O	N
PwrSupAlm	SPS	External power supply alarm		O	N
RsStat	SPC	Reset device statistics	T	O	N

Common Logical Node class					
Attribute Name	**Attr. Type**	**Explanation**	**T**	**M/O**	**GBU200**
LNName		Shall be inherited from Logical-Node Class (see IEC 61850-7-2)			
Data					
Mandatory Logical Node Information (Shall be inherited by ALL LN but LPHD)					
Mod	INC	Mode		M	Y
Beh	INS	Behaviour		M	Y
Health	INS	Health		M	Y
NamPlt	LPL	Name plate		M	Y
Optional Logical Node Information					
Loc	SPS	Local operation		O	N
EEHealth	INS	External equipment health		O	N
EEName	DPL	External equipment name plate		O	N
OpCntRs	INC	Operation counter resetable		O	N
OpCnt	INS	Operation counter		O	N
OpTmh	INS	Operation time		O	N
Data Sets (see IEC 61850-7-2)					
Inherited and specialized from Logical Node class (see IEC 61850-7-2)					
Control Blocks (see IEC 61850-7-2)					
Inherited and specialized from Logical Node class (see IEC 61850-7-2)					
Services (see IEC 61850-7-2)					
Inherited and specialized from Logical Node class (see IEC 61850-7-2)					

LLNO class					
Attribute Name	**Attr. Type**	**Explanation**	**T**	**M/O**	**GBU200**
LNName		Shall be inherited from Logical-Node Class (see IEC 61850-7-2)			
Data					
Common Logical Node Information					
		LN shall inherit all Mandatory Data from Common Logical Node Class		M	
Loc	SPS	Local operation for complete logical device		O	Y
OpTmh	INS	Operation time		O	N
Controls					
Diag	SPC	Run Diagnostics		O	Y
LEDRs	SPC	LED reset	T	O	Y

(MICS Ed.1)

RSYN class					
Attribute Name	**Attr. Type**	**Explanation**	**T**	**M/O**	**GBU200**
LNName		Shall be inherited from Logical-Node Class (see IEC 61850-7-2)			
Data					
Common Logical Node Information					
		LN shall inherit all Mandatory Data from Common Logical Node Class		M	
OpCntRs	INC	Resetable operation counter		O	N
Controls					
RHz	SPC	Raise Frequency		O	N
LHz	SPC	Lower Frequency		O	N
RV	SPC	Raise Voltage		O	N
LV	SPC	Lower Voltage		O	N
Status Information					
Rel	SPS	Release		M	Y
VInd	SPS	Voltage Difference Indicator		O	Y
AngInd	SPS	Angle Difference Indicator		O	Y
HzInd	SPS	Frequency Difference Indicator		O	Y
SynPrg	SPS	Synchronising in progress		O	Y
Measured values					
DifVClc	MV	Calculated Difference in Voltage		O	Y
DifHzClc	MV	Calculated Difference in Frequency		O	Y
DifAngClc	MV	Calculated Difference of Phase Angle		O	Y
Setting					
DifV	ASG	Difference Voltage		O	Y
DifHz	ASG	Difference Frequency		O	Y
DifAng	ASG	Difference Phase Angle		O	Y
LivDeaMod	ING	Live Dead Mode		O	N
DeaLinVal	ASG	Dead Line Value		O	N
LivLinVal	ASG	Live Line Value		O	N
DeaBusVal	ASG	Dead Bus Value		O	N
LivBusVal	ASG	Live Bus Value		O	N
PlsTmms	ING	Close Pulse Time		O	N
BkrTmms	ING	Closing time of breaker		O	N

(MICS Ed.1)

CILO class					
Attribute Name	**Attr. Type**	**Explanation**	**T**	**M/O**	**GBU200**
LNName		Shall be inherited from Logical-Node Class (see IEC 61850-7-2)			
Data					
Common Logical Node Information					
		LN shall inherit all Mandatory Data from Common Logical Node Class		M	
Status Information					
EnaOpn	SPS	Enable Open		M	Y
EnaCls	SPS	Enable Close		M	Y

CSWI class					
Attribute Name	**Attr. Type**	**Explanation**	**T**	**M/O**	**GBU200**
LNName		Shall be inherited from Logical-Node Class (see IEC 61850-7-2)			
Data					
Common Logical Node Information					
		LN shall inherit all Mandatory Data from Common Logical Node Class		M	
Loc	SPS	Local operation		O	N
OpCntRs	INC	Resetable operation counter		O	Y
Controls					
Pos	DPC	Switch, general		M	Y
PosA	DPC	Switch L1		O	N
PosB	DPC	Switch L2		O	N
PosC	DPC	Switch L3		O	N
OpOpn	ACT	Operation “Open Switch”	T	O	N
OpCls	ACT	Operation “Close Switch”	T	O	N

(MICS Ed.1)

GAPC1 class					
Attribute Name	**Attr. Type**	**Explanation**	**T**	**M/O**	**GBU200**
LNName		Shall be inherited from Logical-Node Class (see IEC 61850-7-2)			
Data					
Common Logical Node Information					
		LN shall inherit all Mandatory Data from Common Logical Node Class		M	
Loc	SPS	Local operation		O	N
OpCntRs	INC	Resetable operation counter		O	N
Controls					
SPCSO	SPC	Single point controllable status output		O	N
DPCSO	DPC	Double point controllable status output		O	N
ISCSO	INC	Integer status controllable status output		O	N
Status Information					
Auto	SPS	Automatic operation		O	N
Str	ACD_ABC	Start		M	Y
Op	ACT_ABC	Operate	T	M	Y
Setting					
StrVal	ASG	Start Value		O	N

Note: For Logical Device “ry”.

GAPC2 class					
Attribute Name	**Attr. Type**	**Explanation**	**T**	**M/O**	**GBU200**
LNName		Shall be inherited from Logical-Node Class (see IEC 61850-7-2)			
Data					
Common Logical Node Information					
		LN shall inherit all Mandatory Data from Common Logical Node Class		M	
Loc	SPS	Local operation		O	N
OpCntRs	INC	Resetable operation counter		O	N
Controls					
SPCSO1	SPC	Single point controllable status output		O	Y
SPCSO2	SPC	Single point controllable status output		O	Y
SPCSO3	SPC	Single point controllable status output		O	Y
SPCSO4	SPC	Single point controllable status output		O	Y
SPCSO5	SPC	Single point controllable status output		O	Y
SPCSO6	SPC	Single point controllable status output		O	Y
DPCSO	DPC	Double point controllable status output		O	N
ISCSO	INC	Integer status controllable status output		O	N
Status Information					
Auto	SPS	Automatic operation		O	N
Str	ACD_ABC	Start		M	Y
Op	ACT_ABC	Operate	T	M	Y
Setting					
StrVal	ASG	Start Value		O	N

Note: For →Logical Device”ctrl”

(MICS Ed.1)

GGIO1 class					
Attribute Name	**Attr. Type**	**Explanation**	**T**	**M/O**	**GBU200**
LNName		Shall be inherited from Logical-Node Class (see IEC 61850-7-2)			
Data					
Common Logical Node Information					
		LN shall inherit all Mandatory Data from Common Logical Node Class		M	
EEHealth	INS	External equipment health (external sensor)		O	N
EEName	DPL	External equipment name plate		O	N
Loc	SPS	Local operation		O	N
OpCntRs	INC	Resetable operation counter		O	N
Measured values					
AnIn	MV	Analogue input		O	N
Controls					
SPCSO	SPC	Single point controllable status output		O	N
DPCSO	DPC	Double point controllable status output		O	N
ISCSO	INC	Integer status controllable status output		O	N
Status Information					
IntIn	INS	Integer status input		O	N
Alm	SPS	General single alarm		O	N
Ind01	SPS	General indication (binary input)		O	Y
Ind02	SPS	General indication (binary input)		O	Y
Ind03	SPS	General indication (binary input)		O	Y
Ind04	SPS	General indication (binary input)		O	Y
Ind05	SPS	General indication (binary input)		O	Y
Ind06	SPS	General indication (binary input)		O	Y
Ind07	SPS	General indication (binary input)		O	Y
Ind08	SPS	General indication (binary input)		O	Y
Ind09	SPS	General indication (binary input)		O	Y
Ind10	SPS	General indication (binary input)		O	Y
		:			
		:			
		:			
Ind32	SPS	General indication (binary input)		O	Y

Note: Term “Ind32” is the maximum number of BI circuits.

(MICS Ed.1)

GGIO2 class					
Attribute Name	**Attr. Type**	**Explanation**	**T**	**M/O**	**GBU200**
LNName		Shall be inherited from Logical-Node Class (see IEC 61850-7-2)			
Data					
Common Logical Node Information					
		LN shall inherit all Mandatory Data from Common Logical Node Class		M	
EEHealth	INS	External equipment health (external sensor)		O	N
EEName	DPL	External equipment name plate		O	N
Loc	SPS	Local operation		O	N
OpCntRs	INC	Resetable operation counter		O	N
Measured values					
AnIn	MV	Analogue input		O	N
Controls					
SPCSO	SPC	Single point controllable status output		O	N
DPCSO	DPC	Double point controllable status output		O	N
ISCSO1	INC	Integer status controllable status output		O	Y
ISCSO2	INC	Integer status controllable status output		O	Y
ISCSO3	INC	Integer status controllable status output		O	Y
ISCSO4	INC	Integer status controllable status output		O	Y
ISCSO5	INC	Integer status controllable status output		O	Y
Status Information					
IntIn	INS	Integer status input		O	N
Alm	SPS	General single alarm		O	N
Ind	SPS	General indication (binary input)		O	N

(MICS Ed.1)

GGIO3 class					
Attribute Name	**Attr. Type**	**Explanation**	**T**	**M/O**	**GBU200**
LNName		Shall be inherited from Logical-Node Class (see IEC 61850-7-2)			
Data					
Common Logical Node Information					
		LN shall inherit all Mandatory Data from Common Logical Node Class		M	
EEHealth	INS	External equipment health (external sensor)		O	N
EEName	DPL	External equipment name plate		O	N
Loc	SPS	Local operation		O	N
OpCntRs	INC	Resetable operation counter		O	N
Measured values					
AnIn1	MV	Analogue input		O	Y
AnIn2	MV	Analogue input		O	Y
AnIn3	MV	Analogue input		O	Y
AnIn4	MV	Analogue input		O	Y
AnIn5	MV	Analogue input		O	Y
AnIn6	MV	Analogue input		O	Y
AnIn7	MV	Analogue input		O	Y
AnIn8	MV	Analogue input		O	Y
AnIn9	MV	Analogue input		O	Y
AnIn10	MV	Analogue input		O	Y
Controls					
SPCSO	SPC	Single point controllable status output		O	N
DPCSO	DPC	Double point controllable status output		O	N
ISCSO	INC	Integer status controllable status output		O	N
Status Information					
IntIn	INS	Integer status input		O	N
Alm	SPS	General single alarm		O	N
Ind	SPS	General indication (binary input)		O	N

(MICS Ed.1)

GGIO4 class					
Attribute Name	**Attr. Type**	**Explanation**	**T**	**M/O**	**GBU200**
LNName		Shall be inherited from Logical-Node Class (see IEC 61850-7-2)			
Data					
Common Logical Node Information					
		LN shall inherit all Mandatory Data from Common Logical Node Class		M	
EEHealth	INS	External equipment health (external sensor)		O	N
EEName	DPL	External equipment name plate		O	N
Loc	SPS	Local operation		O	N
OpCntRs	INC	Resetable operation counter		O	N
Measured values					
AnIn1	MV	Analogue input		O	Y
AnIn2	MV	Analogue input		O	Y
AnIn3	MV	Analogue input		O	Y
AnIn4	MV	Analogue input		O	Y
Controls					
SPCSO	SPC	Single point controllable status output		O	N
DPCSO	DPC	Double point controllable status output		O	N
ISCSO	INC	Integer status controllable status output		O	N
Status Information					
IntIn	INS	Integer status input		O	N
Alm	SPS	General single alarm		O	N
Ind	SPS	General indication (binary input)		O	N

GGIO5 class					
Attribute Name	**Attr. Type**	**Explanation**	**T**	**M/O**	**GBU200**
LNName		Shall be inherited from Logical-Node Class (see IEC 61850-7-2)			
Data					
Common Logical Node Information					
		LN shall inherit all Mandatory Data from Common Logical Node Class		M	
EEHealth	INS	External equipment health (external sensor)		O	N
EEName	DPL	External equipment name plate		O	N
Loc	SPS	Local operation		O	N
OpCntRs	INC	Resetable operation counter		O	N
Measured values					
AnIn	MV	Analogue input		O	N
Controls					
SPCSO	SPC	Single point controllable status output		O	Y
DPCSO	DPC	Double point controllable status output		O	N
ISCSO	INC	Integer status controllable status output		O	N
Status Information					
IntIn	INS	Integer status input		O	N
Alm	SPS	General single alarm		O	N
Ind	SPS	General indication (binary input)		O	N

(MICS Ed.1)

GGIO6 class					
Attribute Name	**Attr. Type**	**Explanation**	**T**	**M/O**	**GBU200**
LNName		Shall be inherited from Logical-Node Class (see IEC 61850-7-2)			
Data					
Common Logical Node Information					
		LN shall inherit all Mandatory Data from Common Logical Node Class		M	
EEHealth	INS	External equipment health (external sensor)		O	N
EEName	DPL	External equipment name plate		O	N
Loc	SPS	Local operation		O	N
OpCntRs	INC	Resetable operation counter		O	N
Measured values					
AnIn	MV	Analogue input		O	N
Controls					
SPCSO	SPC	Single point controllable status output		O	Y
DPCSO	DPC	Double point controllable status output		O	N
ISCSO	INC	Integer status controllable status output		O	N
Status Information					
IntIn	INS	Integer status input		O	N
Alm	SPS	General single alarm		O	N
Ind	SPS	**General indication (binary input)**		O	N

GGIO7 class					
Attribute Name	**Attr. Type**	**Explanation**	**T**	**M/O**	**GBU200**
LNName		Shall be inherited from Logical-Node Class (see IEC 61850-7-2)			
Data					
Common Logical Node Information					
		LN shall inherit all Mandatory Data from Common Logical Node Class		M	
EEHealth	INS	External equipment health (external sensor)		O	N
EEName	DPL	External equipment name plate		O	N
Loc	SPS	Local operation		O	N
OpCntRs	INC	Resetable operation counter		O	N
Measured values					
AnIn1	MV	Analogue input		O	Y
AnIn2	MV	Analogue input		O	Y
AnIn3	MV	Analogue input		O	Y
AnIn4	MV	Analogue input		O	Y
AnIn5	MV	Analogue input		O	Y
AnIn6	MV	Analogue input		O	Y
AnIn7	MV	Analogue input		O	Y
AnIn8	MV	Analogue input		O	Y
AnIn9	MV	Analogue input		O	Y
AnIn10	MV	Analogue input		O	Y
AnIn11	MV	Analogue input		O	Y
AnIn12	MV	Analogue input		O	Y
Controls					
SPCSO	SPC	Single point controllable status output		O	N
DPCSO	DPC	Double point controllable status output		O	N
ISCSO	INC	Integer status controllable status output		O	N
Status Information					
IntIn	INS	Integer status input		O	N
Alm	SPS	General single alarm		O	N
Ind	SPS	General indication (binary input)		O	N

(MICS Ed.1)

GGIO8 class					
Attribute Name	**Attr. Type**	**Explanation**	**T**	**M/O**	**GBU200**
LNName		Shall be inherited from Logical-Node Class (see IEC 61850-7-2)			
Data					
Common Logical Node Information					
		LN shall inherit all Mandatory Data from Common Logical Node Class		M	
EEHealth	INS	External equipment health (external sensor)		O	N
EEName	DPL	External equipment name plate		O	N
Loc	SPS	Local operation		O	N
OpCntRs	INC	Resetable operation counter		O	N
Measured values					
AnIn	MV	Analogue input		O	N
Controls					
SPCSO	SPC	Single point controllable status output		O	N
DPCSO	DPC	Double point controllable status output		O	N
ISCSO1	INC	Integer status controllable status output		O	Y
ISCSO2	INC	Integer status controllable status output		O	Y
ISCSO3	INC	Integer status controllable status output		O	Y
ISCSO4	INC	Integer status controllable status output		O	Y
ISCSO5	INC	Integer status controllable status output		O	Y
ISCSO6	INC	Integer status controllable status output		O	Y
ISCSO7	INC	Integer status controllable status output		O	Y
ISCSO8	INC	Integer status controllable status output		O	Y
Status Information					
IntIn	INS	Integer status input		O	N
Alm	SPS	General single alarm		O	N
Ind	SPS	General indication (binary input)		O	N

GGIO9 class					
Attribute Name	**Attr. Type**	**Explanation**	**T**	**M/O**	**GBU200**
LNName		Shall be inherited from Logical-Node Class (see IEC 61850-7-2)			
Data					
Common Logical Node Information					
		LN shall inherit all Mandatory Data from Common Logical Node Class		M	
EEHealth	INS	External equipment health (external sensor)		O	N
EEName	DPL	External equipment name plate		O	N
Loc	SPS	Local operation		O	N
OpCntRs	INC	Resetable operation counter		O	N
Measured values					
AnIn	MV	Analogue input		O	N
Controls					
SPCSO	SPC	Single point controllable status output		O	N
DPCSO	DPC	Double point controllable status output		O	N
ISCSO1	INC	Integer status controllable status output		O	Y
ISCSO2	INC	Integer status controllable status output		O	Y
ISCSO3	INC	Integer status controllable status output		O	Y
ISCSO4	INC	Integer status controllable status output		O	Y
Status Information					
IntIn	INS	Integer status input		O	N
Alm	SPS	General single alarm		O	N
Ind	SPS	General indication (binary input)		O	N

(MICS Ed.1)

GGIO10 class					
Attribute Name	**Attr. Type**	**Explanation**	**T**	**M/O**	**GBU200**
LNName		Shall be inherited from Logical-Node Class (see IEC 61850-7-2)			
Data					
Common Logical Node Information					
		LN shall inherit all Mandatory Data from Common Logical Node Class		M	
EEHealth	INS	External equipment health (external sensor)		O	N
EEName	DPL	External equipment name plate		O	N
Loc	SPS	Local operation		O	N
OpCntRs	INC	Resetable operation counter		O	N
Measured values					
AnIn	MV	Analogue input		O	N
Controls					
SPCSO	SPC	Single point controllable status output		O	Y
DPCSO	DPC	Double point controllable status output		O	N
ISCSO	INC	Integer status controllable status output		O	N
Status Information					
IntIn	INS	Integer status input		O	N
Alm	SPS	General single alarm		O	N
Ind	SPS	**General indication (binary input)**		O	N

GGIO11 class					
Attribute Name	**Attr. Type**	**Explanation**	**T**	**M/O**	**GBU200**
LNName		Shall be inherited from Logical-Node Class (see IEC 61850-7-2)			
Data					
Common Logical Node Information					
		LN shall inherit all Mandatory Data from Common Logical Node Class		M	
EEHealth	INS	External equipment health (external sensor)		O	N
EEName	DPL	External equipment name plate		O	N
Loc	SPS	Local operation		O	N
OpCntRs	INC	Resetable operation counter		O	N
Measured values					
AnIn	MV	Analogue input		O	N
Controls					
SPCSO	SPC	Single point controllable status output		O	N
DPCSO	DPC	Double point controllable status output		O	N
ISCSO	INC	Integer status controllable status output		O	Y
Status Information					
IntIn	INS	Integer status input		O	N
Alm	SPS	General single alarm		O	N
Ind	SPS	General indication (binary input)		O	N

(MICS Ed.1)

GGIO12 class					
Attribute Name	**Attr. Type**	**Explanation**	**T**	**M/O**	**GBU200**
LNName		Shall be inherited from Logical-Node Class (see IEC 61850-7-2)			
Data					
Common Logical Node Information					
		LN shall inherit all Mandatory Data from Common Logical Node Class		M	
EEHealth	INS	External equipment health (external sensor)		O	N
EEName	DPL	External equipment name plate		O	N
Loc	SPS	Local operation		O	N
OpCntRs	INC	Resetable operation counter		O	N
Measured values					
AnIn	MV	Analogue input		O	N
Controls					
SPCSO	SPC	Single point controllable status output		O	N
DPCSO	DPC	Double point controllable status output		O	N
ISCSO	INC	Integer status controllable status output		O	N
Status Information					
IntIn	INS	Integer status input		O	N
Alm	SPS	General single alarm		O	N
Ind	SPS	**General indication (binary input)**		O	Y

GGIO13 class					
Attribute Name	**Attr. Type**	**Explanation**	**T**	**M/O**	**GBU200**
LNName		Shall be inherited from Logical-Node Class (see IEC 61850-7-2)			
Data					
Common Logical Node Information					
		LN shall inherit all Mandatory Data from Common Logical Node Class		M	
EEHealth	INS	External equipment health (external sensor)		O	N
EEName	DPL	External equipment name plate		O	N
Loc	SPS	Local operation		O	N
OpCntRs	INC	Resetable operation counter		O	N
Measured values					
AnIn	MV	Analogue input		O	N
Controls					
SPCSO	SPC	Single point controllable status output		O	N
DPCSO	DPC	Double point controllable status output		O	N
ISCSO	INC	Integer status controllable status output		O	N
Status Information					
IntIn	INS	Integer status input		O	N
Alm	SPS	General single alarm		O	N
Ind	SPS	**General indication (binary input)**		O	Y

(MICS Ed.1)

GGIO14 class					
Attribute Name	**Attr. Type**	**Explanation**	**T**	**M/O**	**GBU200**
LNName		Shall be inherited from Logical-Node Class (see IEC 61850-7-2)			
Data					
Common Logical Node Information					
		LN shall inherit all Mandatory Data from Common Logical Node Class		M	
EEHealth	INS	External equipment health (external sensor)		O	N
EEName	DPL	External equipment name plate		O	N
Loc	SPS	Local operation		O	N
OpCntRs	INC	Resetable operation counter		O	N
Measured values					
AnIn1	MV	Analogue input		O	Y
AnIn2	MV	Analogue input		O	Y
AnIn3	MV	Analogue input		O	Y
AnIn4	MV	Analogue input		O	Y
AnIn5	MV	Analogue input		O	Y
AnIn6	MV	Analogue input		O	Y
AnIn7	MV	Analogue input		O	Y
AnIn8	MV	Analogue input		O	Y
AnIn9	MV	Analogue input		O	Y
AnIn10	MV	Analogue input		O	Y
		:			
		:			
		:			
AnIn53	MV	Analogue input		O	Y
Controls					
SPCSO	SPC	Single point controllable status output		O	N
DPCSO	DPC	Double point controllable status output		O	N
ISCSO	INC	Integer status controllable status output		O	N
Status Information					
IntIn	INS	Integer status input		O	N
Alm	SPS	General single alarm		O	N
Ind	SPS	**General indication (binary input)**		O	N

(MICS Ed.1)

GGIO_GOOSE class					
Attribute Name	**Attr. Type**	**Explanation**	**T**	**M/O**	**GBU200**
LNName		Shall be inherited from Logical-Node Class (see IEC 61850-7-2)			
Data					
Common Logical Node Information					
		LN shall inherit all Mandatory Data from Common Logical Node Class		M	
EEHealth	INS	External equipment health (external sensor)		O	N
EEName	DPL	External equipment name plate		O	N
Loc	SPS	Local operation		O	N
OpCntRs	INC	Resetable operation counter		O	N
Measured values					
AnIn	MV	Analogue input		O	N
Controls					
SPCSO	SPC	Single point controllable status output		O	N
DPCSO	DPC	Double point controllable status output		O	N
ISCSO	INC	Integer status controllable status output		O	N
Status Information					
IntIn	INS	Integer status input		O	N
Alm	SPS	General single alarm		O	N
Ind01	SPS	General indication (binary input)		O	Y
Ind02	SPS	General indication (binary input)		O	Y
Ind03	SPS	General indication (binary input)		O	Y
Ind04	SPS	General indication (binary input)		O	Y
Ind05	SPS	General indication (binary input)		O	Y
Ind06	SPS	General indication (binary input)		O	Y
Ind07	SPS	General indication (binary input)		O	Y
Ind08	SPS	General indication (binary input)		O	Y
Ind09	SPS	General indication (binary input)		O	Y
Ind10	SPS	General indication (binary input)		O	Y
Ind11	SPS	General indication (binary input)		O	Y
Ind12	SPS	General indication (binary input)		O	Y
Ind13	SPS	General indication (binary input)		O	Y
Ind14	SPS	General indication (binary input)		O	Y
Ind15	SPS	General indication (binary input)		O	Y
Ind16	SPS	General indication (binary input)		O	Y

(MICS Ed.1)

MMXU class					
Attribute Name	**Attr. Type**	**Explanation**	**T**	**M/O**	**GBU200**
LNName		Shall be inherited from Logical-Node Class (see IEC 61850-7-2)			
Data					
Common Logical Node Information					
		LN shall inherit all Mandatory Data from Common Logical Node Class		M	
EEHealth	INS	External equipment health (external sensor)		O	N
Measured values					
TotW	MV	Total Active Power (Total P)		O	N
TotVAr	MV	Total Reactive Power (Total Q)		O	N
TotVA	MV	Total Apparent Power (Total S)		O	N
TotPF	MV	Average Power factor (Total PF)		O	N
Hz	MV	Frequency		O	Y
PPV	DEL	Phase to phase voltages (VL1VL2, …)		O	Y
PhV	WYE	Phase to ground voltages (VL1ER, …)		O	Y
A	WYE	Phase currents (IL1, IL2, IL3)		O	Y
W	WYE	Phase active power (P)		O	Y
VAr	WYE	Phase reactive power (Q)		O	Y
VA	WYE	Phase apparent power (S)		O	Y
PF	WYE	Phase power factor		O	Y
Z	WYE	Phase Impedance		O	N

MSQI class					
Attribute Name	**Attr. Type**	**Explanation**	**T**	**M/O**	**GBU200**
LNName		Shall be inherited from Logical-Node Class (see IEC 61850-7-2)			
Data					
Common Logical Node Information					
		LN shall inherit all Mandatory Data from Common Logical Node Class		M	
EEHealth	INS	External equipment health (external sensor)		O	N
EEName	DPL	External equipment name plate		O	N
Measured values					
SeqA	SEQ	Positive, Negative and Zero Sequence Current		C	Y
SeqV	SEQ	Positive, Negative and Zero Sequence Voltage		C	Y
DQ0Seq	SEQ	DQ0 Sequence		O	N
ImbA	WYE	Imbalance current		O	N
ImbNgA	MV	Imbalance negative sequence current		O	N
ImbNgV	MV	Imbalance negative sequence voltage		O	N
ImbPPV	DEL	Imbalance phase-phase voltage		O	N
ImbV	WYE	Imbalance voltage		O	N
ImbZroA	MV	Imbalance zero sequence current		O	N
ImbZroV	MV	Imbalance zero sequence voltage		O	N
MaxImbA	MV	Maximum imbalance current		O	N
MaxImbPPV	MV	Maximum imbalance phase-phase voltage		O	N
MaxImbV	MV	Maximum imbalance voltage		O	N

Condition C: At least one of either data shall be used.

(MICS Ed.1)

XCBR class					
Attribute Name	**Attr. Type**	**Explanation**	**T**	**M/O**	**GBU200**
LNName		Shall be inherited from Logical-Node Class (see IEC 61850-7-2)			
Data					
Common Logical Node Information					
		LN shall inherit all Mandatory Data from Common Logical Node Class		M	
EEHealth	INS	External equipment health (external sensor)		O	N
EEName	DPL	External equipment name plate		O	N
OpCnt	INS	Operation counter		M	Y
Controls					
Pos	DPC	Switch position		M	Y
BlkOpn	SPC	Block opening		M	Y
BlkCls	SPC	Block closing		M	Y
ChaMotEna	SPC	Charger motor enabled		O	N
Metered Values					
SumSwARs	BCR	Sum of Switched Amperes, resetable		O	N
Status Information					
CBOpCap	INS	Circuit breaker operating capability		M	Y
POWCap	INS	Point On Wave switching capability		O	N
MaxOpCap	INS	Circuit breaker operating capability when fully charged		O	N

YLTC class					
Attribute Name	**Attr. Type**	**Explanation**	**T**	**M/O**	**GBU200**
LNName		Shall be inherited from Logical-Node Class (see IEC 61850-7-2)			
Data					
Common Logical Node Information					
		LN shall inherit all Mandatory Data from Common Logical Node Class		M	
EEHealth	INS	External equipment health (external sensor)		O	N
EEName	DPL	External equipment name plate		O	N
OpCnt	INS	Operation counter		O	N
Measured values					
Torq	MV	Drive torque		O	N
MotDrvA	MV	Motor drive current		O	N
Controls					
TapPos	ISC	Change Tap Position to dedicated position		C	N
TapChg	BSC	Change Tap Position (stop, higher, lower)		C	Y
Status Information					
EndPosR	SPS	Circuit breaker operating capability		M	Y
EndPosL	SPS	Point On Wave switching capability		M	Y
OilFil	SPS	Circuit breaker operating capability when fully charged		O	N

Condition C: depending on the tap-change method, at least one of the two controls TapChg and TapPos shall be used.

(MICS Ed.1)

SPS class						
Attribute Name	**Attribute Type**	**FC**	**TrgOp**	**Value/Value Range**	**M/O/C**	**GBU200**
DataName	Inherited from Data Class (see IEC 61850-7-2)					
DataAttribute						
status						
stVal	BOOLEAN	ST	dchg	TRUE | FALSE	M	Y
q	Quality	ST	qchg		M	Y
t	TimeStamp	ST			M	Y
substitution						
subEna	BOOLEAN	SV			PICS_SUBST	N
subVal	BOOLEAN	SV		TRUE | FALSE	PICS_SUBST	N
subQ	Quality	SV			PICS_SUBST	N
subID	VISIBLE STRING64	SV			PICS_SUBST	N
configuration, description and extension						
d	VISIBLE STRING255	DC		Text	O	N
dU	UNICODE STRING255	DC			O	N
cdcNs	VISIBLE STRING255	EX			AC_DLNDA_M	N
cdcName	VISIBLE STRING255	EX			AC_DLNDA_M	N
dataNs	VISIBLE STRING255	EX			AC_DLN_M	N
Services						
As defined in Table 13						

INS class						
Attribute Name	**Attribute Type**	**FC**	**TrgOp**	**Value/Value Range**	**M/O/C**	**GBU200**
DataName	Inherited from Data Class (see IEC 61850-7-2)					
DataAttribute						
status						
stVal	INT32	ST	dchg		M	Y(*1)
q	Quality	ST	qchg		M	Y
t	TimeStamp	ST			M	Y
Substitution						
subEna	BOOLEAN	SV			PICS_SUBST	N
subVal	INT32	SV			PICS_SUBST	N
subQ	Quality	SV			PICS_SUBST	N
subID	VISIBLE STRING64	SV			PICS_SUBST	N
configuration, description and extension						
d	VISIBLE STRING255	DC		Text	O	N
dU	UNICODE STRING255	DC			O	N
cdcNs	VISIBLE STRING255	EX			AC_DLNDA_M	N
cdcName	VISIBLE STRING255	EX			AC_DLNDA_M	N
dataNs	VISIBLE STRING255	EX			AC_DLN_M	N
Services						
As defined in Table 13						

(*1): “ENUM” type is also used.

(MICS Ed.1)

ACT class						
Attribute Name	**Attribute Type**	**FC**	**TrgOp**	**Value/Value Range**	**M/O/C**	**GBU200**
DataName	Inherited from Data Class (see IEC 61850-7-2)					
DataAttribute						
			status			
general	BOOLEAN	ST	dchg		M	Y
phsA	BOOLEAN	ST	dchg		O	N
phsB	BOOLEAN	ST	dchg		O	N
phsC	BOOLEAN	ST	dchg		O	N
neut	BOOLEAN	ST	dchg		O	N
q	Quality	ST	qchg		M	Y
t	TimeStamp	ST			M	Y
configuration, description and extension						
operTm	TimeStamp	CF			O	N
d	VISIBLE STRING255	DC		Text	O	N
dU	UNICODE STRING255	DC			O	N
cdcNs	VISIBLE STRING255	EX			AC_DLNDA_M	N
cdcName	VISIBLE STRING255	EX			AC_DLNDA_M	N
dataNs	VISIBLE STRING255	EX			AC_DLN_M	N
Services						
As defined in Table 13						

ACT_ABC class						
Attribute Name	**Attribute Type**	**FC**	**TrgOp**	**Value/Value Range**	**M/O/C**	**GBU200**
DataName	Inherited from Data Class (see IEC 61850-7-2)					
DataAttribute						
status						
general	BOOLEAN	ST	dchg		M	Y
phsA	BOOLEAN	ST	dchg		O	Y
phsB	BOOLEAN	ST	dchg		O	Y
phsC	BOOLEAN	ST	dchg		O	Y
neut	BOOLEAN	ST	dchg		O	N
q	Quality	ST	qchg		M	Y
t	TimeStamp	ST			M	Y
configuration, description and extension						
operTm	TimeStamp	CF			O	N
d	VISIBLE STRING255	DC		Text	O	N
dU	UNICODE STRING255	DC			O	N
cdcNs	VISIBLE STRING255	EX			AC_DLNDA_M	N
cdcName	VISIBLE STRING255	EX			AC_DLNDA_M	N
dataNs	VISIBLE STRING255	EX			AC_DLN_M	N
Services						
As defined in Table 13						

(MICS Ed.1)

ACD class						
Attribute Name	**Attribute Type**	**FC**	**TrgOp**	**Value/Value Range**	**M/O/C**	**GBU200**
DataName	Inherited from Data Class (see IEC 61850-7-2)					
DataAttribute						
status						
general	BOOLEAN	ST	dchg		M	Y
dirGeneral	ENUMERATED	ST	dchg	unknown | forward | backward | both	M	Y
phsA	BOOLEAN	ST	dchg		GC_2 (1)	N
dirPhsA	ENUMERATED	ST	dchg	unknown | forward | backward	GC_2 (1)	N
phsB	BOOLEAN	ST	dchg		GC_2 (2)	N
dirPhsB	ENUMERATED	ST	dchg	unknown | forward | backward	GC_2 (2)	N
phsC	BOOLEAN	ST	dchg		GC_2 (3)	N
dirPhsC	ENUMERATED	ST	dchg	unknown | forward | backward	GC_2 (3)	N
neut	BOOLEAN	ST	dchg		GC_2 (4)	N
dirNeut	ENUMERATED	ST	dchg	unknown | forward | backward	GC_2 (4)	N
q	Quality	ST	qchg		M	Y
t	TimeStamp	ST			M	Y
configuration, description and extension						
d	VISIBLE STRING255	DC		Text	O	N
dU	UNICODE STRING255	DC			O	N
cdcNs	VISIBLE STRING255	EX			AC_DLNDA_M	N
cdcName	VISIBLE STRING255	EX			AC_DLNDA_M	N
dataNs	VISIBLE STRING255	EX			AC_DLN_M	N
Services						
As defined in Table 13						

ACD_ABC class						
Attribute Name	**Attribute Type**	**FC**	**TrgOp**	**Value/Value Range**	**M/O/C**	**GBU200**
DataName	Inherited from Data Class (see IEC 61850-7-2)					
DataAttribute						
status						
general	BOOLEAN	ST	dchg		M	Y
dirGeneral	ENUMERATED	ST	dchg	unknown | forward | backward | both	M	Y
phsA	BOOLEAN	ST	dchg		GC_2 (1)	Y
dirPhsA	ENUMERATED	ST	dchg	unknown | forward | backward	GC_2 (1)	Y
phsB	BOOLEAN	ST	dchg		GC_2 (2)	Y
dirPhsB	ENUMERATED	ST	dchg	unknown | forward | backward	GC_2 (2)	Y
phsC	BOOLEAN	ST	dchg		GC_2 (3)	Y
dirPhsC	ENUMERATED	ST	dchg	unknown | forward | backward	GC_2 (3)	Y
neut	BOOLEAN	ST	dchg		GC_2 (4)	N
dirNeut	ENUMERATED	ST	dchg	unknown | forward | backward	GC_2 (4)	N
q	Quality	ST	qchg		M	Y
t	TimeStamp	ST			M	Y
configuration, description and extension						
d	VISIBLE STRING255	DC		Text	O	N
dU	UNICODE STRING255	DC			O	N
cdcNs	VISIBLE STRING255	EX			AC_DLNDA_M	N
cdcName	VISIBLE STRING255	EX			AC_DLNDA_M	N
dataNs	VISIBLE STRING255	EX			AC_DLN_M	N
Services						
As defined in Table 13						

(MICS Ed.1)

MV class						
Attribute Name	**Attribute Type**	**FC**	**TrgOp**	**Value/Value Range**	**M/O/C**	**GBU200**
DataName	Inherited from Data Class (see IEC 61850-7-2)					
DataAttribute						
measured values						
instMag	AnalogueValue	MX			O	N
mag	AnalogueValue	MX	dchg		M	Y
range	ENUMERATED	MX	dchg	normal | high | low | high-high | low-low |…	O	N
q	Quality	MX	qchg		M	Y
t	TimeStamp	MX			M	Y
substitution						
subEna	BOOLEAN	SV			PICS_SUBST	N
subVal	AnalogueValue	SV			PICS_SUBST	N
subQ	Quality	SV			PICS_SUBST	N
subID	VISIBLE STRING64	SV			PICS_SUBST	N
configuration, description and extension						
units	Unit	CF		see Annex A	O	Y
db	INT32U	CF		0 … 100 000	O	N
zeroDb	INT32U	CF		0 … 100 000	O	N
sVC	ScaledValueConfig	CF			AC_SCAV	N
rangeC	RangeConfig	CF			GC_CON	N
smpRate	INT32U	CF			O	N
d	VISIBLE STRING255	DC		Text	O	N
dU	UNICODE STRING255	DC			O	N
cdcNs	VISIBLE STRING255	EX			AC_DLNDA_M	N
cdcName	VISIBLE STRING255	EX			AC_DLNDA_M	N
dataNs	VISIBLE STRING255	EX			AC_DLN_M	N
Services						
As defined in Table 21						

(MICS Ed.1)

CMV class						
Attribute Name	**Attribute Type**	**FC**	**TrgOp**	**Value/Value Range**	**M/O/C**	**GBU200**
DataName	Inherited from Data Class (see IEC 61850-7-2)					
DataAttribute						
measured values						
instCVal	Vector	MX			O	N
cVal	Vector	MX	dchg		M	Y
range	ENUMERATED	MX	dchg	normal | high | low | high-high | low-low |…	O	N
q	Quality	MX	qchg		M	Y
t	TimeStamp	MX			M	Y
substitution						
subEna	BOOLEAN	SV			PICS_SUBST	N
subVal	Vector	SV			PICS_SUBST	N
subQ	Quality	SV			PICS_SUBST	N
subID	VISIBLE STRING64	SV			PICS_SUBST	N
configuration, description and extension						
units	Unit	CF		see Annex A	O	Y
db	INT32U	CF		0 … 100 000	O	N
zeroDb	INT32U	CF		0 … 100 000	O	N
rangeC	RangeConfig	CF			GC_CON	N
magSVC	ScaledValueConfig	CF			AC_SCAV	N
angSVC	ScaledValueConfig	CF			AC_SCAV	N
angRef	ENUMERATED	CF		V | A | other …	O	N
smpRate	INT32U	CF			O	N
d	VISIBLE STRING255	DC		Text	O	N
dU	UNICODE STRING255	DC			O	N
cdcNs	VISIBLE STRING255	EX			AC_DLNDA_M	N
cdcName	VISIBLE STRING255	EX			AC_DLNDA_M	N
dataNs	VISIBLE STRING255	EX			AC_DLN_M	N
Services						
As defined in Table 21						

(MICS Ed.1)

WYE class						
Attribute Name	**Attribute Type**	**FC**	**TrgOp**	**Value/Value Range**	**M/O/C**	**GBU200**
DataName	Inherited from Data Class (see IEC 61850-7-2)					
Data						
phsA	CMV				GC_1	Y
phsB	CMV				GC_1	Y
phsC	CMV				GC_1	Y
neut	CMV				GC_1	N
net	CMV				GC_1	N
res	CMV				GC_1	N
DataAttribute						
configuration, description and extension						
angRef	ENUMERATED	CF		Va | Vb | Vc | Aa | Ab | Ac | Vab | Vbc | Vca | Vother | Aother	O	N
d	VISIBLE STRING255	DC		Text	O	N
dU	UNICODE STRING255	DC			O	N
cdcNs	VISIBLE STRING255	EX			AC_DLNDA_M	N
cdcName	VISIBLE STRING255	EX			AC_DLNDA_M	N
dataNs	VISIBLE STRING255	EX			AC_DLN_M	N
Services						
As defined in Table 21						

WYE_ABCN class						
Attribute Name	**Attribute Type**	**FC**	**TrgOp**	**Value/Value Range**	**M/O/C**	**GBU200**
DataName	Inherited from Data Class (see IEC 61850-7-2)					
Data						
phsA	CMV				GC_1	Y
phsB	CMV				GC_1	Y
phsC	CMV				GC_1	Y
neut	CMV				GC_1	Y
net	CMV				GC_1	N
res	CMV				GC_1	N
DataAttribute						
configuration, description and extension						
angRef	ENUMERATED	CF		Va | Vb | Vc | Aa | Ab | Ac | Vab | Vbc | Vca | Vother | Aother	O	N
d	VISIBLE STRING255	DC		Text	O	N
dU	UNICODE STRING255	DC			O	N
cdcNs	VISIBLE STRING255	EX			AC_DLNDA_M	N
cdcName	VISIBLE STRING255	EX			AC_DLNDA_M	N
dataNs	VISIBLE STRING255	EX			AC_DLN_M	N
Services						
As defined in Table 21						

(MICS Ed.1)

DEL class						
Attribute Name	**Attribute Type**	**FC**	**TrgOp**	**Value/Value Range**	**M/O/C**	**GBU200**
DataName	Inherited from Data Class (see IEC 61850-7-2)					
Data						
phsAB	CMV				GC_1	Y
phsBC	CMV				GC_1	Y
phsCA	CMV				GC_1	Y
DataAttribute						
configuration, description and extension						
angRef	ENUMERATED	CF		Va | Vb | Vc | Aa | Ab | Ac | Vab | Vbc | Vca | Vother | Aother	O	N
d	VISIBLE STRING255	DC		Text	O	N
dU	UNICODE STRING255	DC			O	N
cdcNs	VISIBLE STRING255	EX			AC_DLNDA_M	N
cdcName	VISIBLE STRING255	EX			AC_DLNDA_M	N
dataNs	VISIBLE STRING255	EX			AC_DLN_M	N
Services						
As defined in Table 21						

SEQ class						
Attribute Name	**Attribute Type**	**FC**	**TrgOp**	**Value/Value Range**	**M/O/C**	**GBU200**
DataName	Inherited from Data Class (see IEC 61850-7-2)					
Data						
c1	CMV				M	Y
c2	CMV				M	Y
c3	CMV				M	Y
DataAttribute						
measured attributes						
seqT	ENUMERATED	MX		pos-neg-zero | dir-quad-zero	M	Y
configuration, description and extension						
phsRef	ENUMERATED	CF		A | B | C | …	O	N
d	VISIBLE STRING255	DC		Text	O	N
dU	UNICODE STRING255	DC			O	N
cdcNs	VISIBLE STRING255	EX			AC_DLNDA_M	N
cdcName	VISIBLE STRING255	EX			AC_DLNDA_M	N
dataNs	VISIBLE STRING255	EX			AC_DLN_M	N
Services						
As defined in Table 21						

(MICS Ed.1)

SPC class						
Attribute Name	**Attribute Type**	**FC**	**TrgOp**	**Value/Value Range**	**M/O/C**	**GBU200**
DataName	Inherited from Data Class (see IEC 61850-7-2)					
DataAttribute						
control and status						
ctlVal	BOOLEAN	CO		off (FALSE) | on (TRUE)	AC_CO_M	N
operTm	TimeStamp	CO			AC_CO_O	N
origin	Originator_RO	CO, ST			AC_CO_O	Y
ctlNum	INT8U_RO	CO, ST		0..255	AC_CO_O	N
SBO	VISIBLE STRING65	CO			AC_CO_SBO_N_M	N
SBOw	SBOW	CO			AC_CO_SBOW_E_M	N
Oper	Oper	CO			AC_CO _M	Y
Cancel	Cancel	CO			AC_CO_SBO_N_M and AC_CO_SBOW_E_M and AC_CO_TA_E_M	N
stVal	BOOLEAN	ST	dchg	FALSE | TRUE	AC_ST	Y
q	Quality	ST	qchg		AC_ST	Y
t	TimeStamp	ST			AC_ST	Y
stSeld	BOOLEAN	ST	dchg		AC_CO_O	N
substitution						
subEna	BOOLEAN	SV			PICS_SUBST	N
subVal	BOOLEAN	SV		FALSE | TRUE	PICS_SUBST	N
subQ	Quality	SV			PICS_SUBST	N
subID	VISIBLE STRING64	SV			PICS_SUBST	N
configuration, description and extension						
pulseConfig	PulseConfig	CF			AC_CO_O	N
CtlModel	CtlModels	CF			M	Y
sboTimeout	INT32U	CF			AC_CO_O	N
sboClass	SboClasses	CF			AC_CO_O	N
d	VISIBLE STRING255	DC		Text	O	N
dU	UNICODE STRING255	DC			O	N
cdcNs	VISIBLE STRING255	EX			AC_DLNDA_M	N
cdcName	VISIBLE STRING255	EX			AC_DLNDA_M	N
dataNs	VISIBLE STRING255	EX			AC_DLN_M	N
Services						
As defined in Table 31						

(MICS Ed.1)

DPC class						
Attribute Name	**Attribute Type**	**FC**	**TrgOp**	**Value/Value Range**	**M/O/C**	**GBU200**
DataName	Inherited from Data Class (see IEC 61850-7-2)					
DataAttribute						
control and status						
ctlVal	BOOLEAN	CO		off (FALSE) | on (TRUE)	AC_CO_M	Y
operTm	TimeStamp	CO			AC_CO_O	N
origin	Originator	CO, ST			AC_CO_O	Y
ctlNum	INT8U	CO, ST		0..255	AC_CO_O	Y
SBO	VISIBLE STRING65	CO			AC_CO_SBO_N_M	N
SBOw	SBOW	CO			AC_CO_SBOW_E_M	Y
Oper	Oper	CO			AC_CO _M	Y
Cancel	Cancel	CO			AC_CO_SBO_N_M and AC_CO_SBOW_E_M and AC_CO_TA_E_M	Y
stVal	CODED ENUM	ST	dchg	intermediate-state | off | on | bad-state	M	Y
q	Quality	ST	qchg		M	Y
t	TimeStamp	ST			M	Y
stSeld	BOOLEAN	ST	dchg		AC_CO_O	N
Substitution						
subEna	BOOLEAN	SV			PICS_SUBST	N
subVal	CODED ENUM	SV		intermediate-state | off | on | bad-state	PICS_SUBST	N
subQ	Quality	SV			PICS_SUBST	N
subID	VISIBLE STRING64	SV			PICS_SUBST	N
configuration, description and extension						
pulseConfig	PulseConfig	CF			AC_CO_O	N
ctlModel	CtlModels	CF			M	Y
sboTimeout	INT32U	CF			AC_CO_O	N
sboClass	SboClasses	CF			AC_CO_O	Y
d	VISIBLE STRING255	DC		Text	O	N
dU	UNICODE STRING255	DC			O	N
cdcNs	VISIBLE STRING255	EX			AC_DLNDA_M	N
cdcName	VISIBLE STRING255	EX			AC_DLNDA_M	N
dataNs	VISIBLE STRING255	EX			AC_DLN_M	N
Services						
As defined in Table 31						

(MICS Ed.1)

INC class						
Attribute Name	**Attribute Type**	**FC**	**TrgOp**	**Value/Value Range**	**M/O/C**	**GBU200**
DataName	Inherited from Data Class (see IEC 61850-7-2)					
DataAttribute						
control and status						
ctlVal	INT32	CO			AC_CO_M	N
operTm	TimeStamp	CO			AC_CO_O	N
origin	Originator	CO, ST			AC_CO_O	N
ctlNum	INT8U	CO, ST		0..255	AC_CO_O	N
SBO	VISIBLE STRING65	CO			AC_CO_SBO_N_M	N
SBOw	SBOW	CO			AC_CO_SBOW_E_M	N
Oper	Oper	CO			AC_CO _M	N
Cancel	Cancel	CO			AC_CO_SBO_N_M and AC_CO_SBOW_E_M and AC_CO_TA_E_M	N
stVal	INT32	ST	dchg		M	Y
Q	Quality	ST	qchg		M	Y
T	TimeStamp	ST			M	Y
stSeld	BOOLEAN	ST	dchg		AC_CO_O	N
substitution						
subEna	BOOLEAN	SV			PICS_SUBST	N
subVal	INT32	SV		FALSE | TRUE	PICS_SUBST	N
subQ	Quality	SV			PICS_SUBST	N
subID	VISIBLE STRING64	SV			PICS_SUBST	N
configuration, description and extension						
CtlModel	CtlModels	CF			M	Y
sboTimeout	INT32U	CF			AC_CO_O	N
sboClass	SboClasses	CF			AC_CO_O	N
minVal	INT32	CF			O	N
maxVal	INT32	CF			O	N
stepSize	INT32U	CF		1 … (maxVal – minVal)	O	N
D	VISIBLE STRING255	DC		Text	O	N
dU	UNICODE STRING255	DC			O	N
cdcNs	VISIBLE STRING255	EX			AC_DLNDA_M	N
cdcName	VISIBLE STRING255	EX			AC_DLNDA_M	N
dataNs	VISIBLE STRING255	EX			AC_DLN_M	N
Services						
As defined in Table 31						

(MICS Ed.1)

BSC class						
Attribute Name	Attribute Type	FC	TrgOp	Value/Value Range	M/O/C	GBU200
DataName	Inherited from Data Class (see IEC 61850-7-2)					
DataAttribute						
control and status						
ctlVal	CODED ENUM	CO		stop | lower | higher | reserved	AC_CO_M	N
operTm	TimeStamp	CO			AC_CO_O	N
origin	Originator	CO, ST			AC_CO_O	Y
ctlNum	INT8U_RO	CO, ST		0..255	AC_CO_O	Y
SBO	VISIBLE STRING65	CO			AC_CO_SBO_N_M	N
SBOw	SBOW	CO			AC_CO_SBOW_E_M	Y
Oper	Oper	CO			AC_CO_M	Y
Cancel	Cancel	CO			AC_CO_SBO_N_M and AC_CO_SBOW_E_M and AC_CO_TA_E_M	Y
valWTr	ValWithTrans	ST	dchg		AC_ST	Y
q	Quality	ST	qchg		AC_ST	Y
t	TimeStamp	ST			AC_ST	Y
stSeld	BOOLEAN	ST	dchg		AC_CO_O	N
substitution						
subEna	BOOLEAN	SV			PICS_SUBST	N
subVal	CODED ENUM	SV		intermediate-state | off | on | bad-state	PICS_SUBST	N
subQ	Quality	SV			PICS_SUBST	N
subID	VISIBLE STRING64	SV			PICS_SUBST	N
configuration, description and extension						
persistent	BOOLEAN	CF			M	Y
CtlModel	CtlModels	CF			M	Y
sboTimeout	INT32U	CF			AC_CO_O	N
sboClass	SboClasses	CF			AC_CO_O	Y
minVal	INT8	CF			O	N
maxVal	INT8	CF			O	N
stepSize	INT8U	CF		1 … (maxVal – minVal)	O	N
d	VISIBLE STRING255	DC		Text	O	N
dU	UNICODE STRING255	DC			O	N
cdcNs	VISIBLE STRING255	EX			AC_DLNDA_M	N
cdcName	VISIBLE STRING255	EX			AC_DLNDA_M	N
dataNs	VISIBLE STRING255	EX			AC_DLN_M	N
Services						
As defined in Table 31						

(MICS Ed.1)

ING class						
Attribute Name	**Attribute Type**	**FC**	**TrgOp**	**Value/Value Range**	**M/O/C**	**GBU200**
DataName	Inherited from Data Class (see IEC 61850-7-2)					
DataAttribute						
setting						
setVal	INT32	SP			AC_NSG_M	Y(*3)
setVal	INT32	SG, SE			AC_SG_M	N
configuration, description and extension						
minVal	INT32	CF			O	N
maxVal	INT32	CF			O	N
stepSize	INT32U	CF		1 … (maxVal – minVal)	O	N
d	VISIBLE STRING255	DC		Text	O	N
dU	UNICODE STRING255	DC			O	N
cdcNs	VISIBLE STRING255	EX			AC_DLNDA_M	N
cdcName	VISIBLE STRING255	EX			AC_DLNDA_M	N
dataNs	VISIBLE STRING255	EX			AC_DLN_M	N
Services						
As defined in Table 39						

(*3): “ENUM” type is also used.

ASG class						
Attribute Name	**Attribute Type**	**FC**	**TrgOp**	**Value/Value Range**	**M/O/C**	**GBU200**
DataName	Inherited from Data Class (see IEC 61850-7-2)					
DataAttribute						
setting						
setMag	AnalogueValue	SP			AC_NSG_M	Y
setMag	AnalogueValue	SG, SE			AC_SG_M	N
configuration, description and extension						
units	Unit	CF		see Annex A	O	Y
sVC	ScaledValueConfig	CF			AC_SCAV	Y
minVal	AnalogueValue	CF			O	N
maxVal	AnalogueValue	CF			O	N
stepSize	AnalogueValue	CF		1 … (maxVal – minVal)	O	N
d	VISIBLE STRING255	DC		Text	O	N
dU	UNICODE STRING255	DC			O	N
cdcNs	VISIBLE STRING255	EX			AC_DLNDA_M	N
cdcName	VISIBLE STRING255	EX			AC_DLNDA_M	N
dataNs	VISIBLE STRING255	EX			AC_DLN_M	N
Services						
As defined in Table 42						

(MICS Ed.1)

DPL class						
Attribute Name	**Attribute Type**	**FC**	**TrgOp**	**Value/Value Range**	**M/O/C**	**GBU200**
DataName	Inherited from Data Class (see IEC 61850-7-2)					
DataAttribute						
configuration, description and extension						
vendor	VISIBLE STRING255	DC			M	Y
hwRev	VISIBLE STRING255	DC			O	N
swRev	VISIBLE STRING255	DC			O	Y
serNum	VISIBLE STRING255	DC			O	N
model	VISIBLE STRING255	DC			O	Y
location	VISIBLE STRING255	DC			O	N
cdcNs	VISIBLE STRING255	EX			AC_DLNDA_M	N
cdcName	VISIBLE STRING255	EX			AC_DLNDA_M	N
dataNs	VISIBLE STRING255	EX			AC_DLN_M	N
Services						
As defined in Table 45						

LPL class						
Attribute Name	**Attribute Type**	**FC**	**TrgOp**	**Value/Value Range**	**M/O/C**	**GBU200**
DataName	Inherited from Data Class (see IEC 61850-7-2)					
DataAttribute						
configuration, description and extension						
vendor	VISIBLE STRING255	DC			M	Y
swRev	VISIBLE STRING255	DC			M	Y
d	VISIBLE STRING255	DC			M	Y
dU	UNICODE STRING255	DC			O	N
configRev	VISIBLE STRING255	DC			AC_LN0_M	Y
ldNs	VISIBLE STRING255	EX		shall be included in **LLN0** only; for example "IEC 61850-7-4:2003"	AC_LN0_EX	N
lnNs	VISIBLE STRING255	EX			AC_DLD_M	N
cdcNs	VISIBLE STRING255	EX			AC_DLNDA_M	N
cdcName	VISIBLE STRING255	EX			AC_DLNDA_M	N
dataNs	VISIBLE STRING255	EX			AC_DLN_M	N
Services						
As defined in Table 45						

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(PICS Editon1)

IEC61850 ACSI Conformance Statement for GR200 series IED

(Original document#: 6F2S1874 Ver. 0.6)

(PICS Ed.1)

Introduction

The template of this document is “Protocol Implementation Conformance Statement for the IEC 61850 interface in <device>” version 1.6 published by UCA International Users Group in Nov 19, 2015.

This document specifies the Protocol Implementation Conformance Statement (PICS) of the IEC 61850 interface in G2 series IED with communication firmware G2M850-01 series version equal to or upper than F (G2M850-01-F). Each tables of this document is specified in IEC 61850-7-2 Annex A.3 “ACSI models conformance statement”.

- ASCI basic conformance statement,
- ACSI models conformance statement,
- ACSI service conformance statement

Together with the MICS and the PIXIT, the PICS forms the basis for a conformance test according to IEC 61850-10.

Note: The IED does not support IEC 61850 Edition 2 (**Ed2**) .

(PICS Ed.1)

ASCI basic conformance statement

The basic conformance statement is defined in Table A.1.

Table A.1 – Basic conformance statement

		Client/ Subscriber	Server/ Publisher	Value/ Comments
Client-Server roles				
B11	**Server** side (of TWO-PARTY-APPLICATION-ASSOCIATION)	—	Y	
B12	**Client** side of (TWO-PARTY-APPLICATION-ASSOCIATION)	N	—	
SCSMs supported				
B21	**SCSM: IEC 61850-8-1 used**	Y	Y	Client/Subscriber side is only GOOSE and SNTP.
B22	**SCSM: IEC 61850-9-1 used**			Deprecated Ed2
B23	**SCSM: IEC 61850-9-2 used**			
B24	**SCSM: other**			
Generic substation event model (GSE)				
B31	**Publisher side**	—	Y	
B32	**Subscriber side**	Y	—	
Transmission of sampled value model (SVC)				
B41	**Publisher side**	—	N	
B42	**Subscriber side**	N	—	
- = not applicable Y = supported N or empty = not supported				

(PICS Ed.1)

ACSI models conformance statement

The ACSI models conformance statement is defined in Table A.2.

Table A.2 – ACSI models conformance statement

		Client/ Subscriber	Server/ Publisher	Value/ Comments
If Server or Client side (B11/12) supported				
M1	Logical device	N	Y	
M2	Logical node	N	Y	
M3	Data	N	Y	
M4	Data set	N	Y	
M5	Substitution	N	N	
M6	Setting group control	N	Y	
	Reporting			
M7	Buffered report control	N	Y	
M7-1	sequence-number	N	Y	
M7-2	report-time-stamp	N	Y	
M7-3	reason-for-inclusion	N	Y	
M7-4	data-set-name	N	Y	
M7-5	data-reference	N	Y	
M7-6	buffer-overflow	N	Y	
M7-7	entryID	N	Y	
M7-8	BufTm	N	Y	
M7-9	IntgPd	N	Y	
M7-10	GI	N	Y	
M7-11	conf-revision	N	Y	
M8	Unbuffered report control	N	Y	
M8-1	sequence-number	N	Y	
M8-2	report-time-stamp	N	Y	
M8-3	reason-for-inclusion	N	Y	
M8-4	data-set-name	N	Y	
M8-5	data-reference	N	Y	
M8-6	BufTm	N	Y	
M8-7	IntgPd	N	Y	
M8-8	GI	N	Y	
M8-8	conf-revision	N	Y	
	Logging	N	N	
M9	Log control	N	N	
M9-1	IntgPd	N	N	
M10	Log	N	N	
M11	Control	N	Y	
M17	File Transfer	N	Y	
M18	Application Association	N	Y	
M19	GOOSE Control Block	N	Y	
M20	Sampled Value Control Block	N	N	
If GSE (B31/32) is supported				
M12	GOOSE	Y	Y	
M13	GSSE	N	N	Deprecated Ed2
If SVC (41/42) is supported				
M14	Multicast SVC	N	N	
M15	Unicast SVC	N	N	
For all IEDs				
M16	Time	Y	N	SNTP client functions are supported.
Y = service is supported N or empty = service is not supported				

Note: The IED does not support Ed2 (Edition 2) here.

(PICS Ed.1)

ACSI service conformance statement

The ACSI service conformance statement is defined in Table A.3 (depending on the statements in Table A.1).

Table A.3 – ACSI service Conformance statement(1/3)

	Ed	Services	AA: TP/MC	Client (C)	Server (S)	Comments
Server						
S1	1	GetServerDirectory (LOGICAL-DEVICE)	TP	N	Y	
Application association						
S2	1	Associate	TP	N	Y	
S3	1	Abort	TP	N	Y	
S4	1	Release	TP	N	Y	
Logical device						
S5	1	GetLogicalDeviceDirectory	TP	N	Y	
Logical node						
S6	1	GetLogicalNodeDirectory	TP	N	Y	
S7	1	GetAllDataValues	TP	N	Y	
Data						
S8	1	GetDataValues	TP	N	Y	
S9	1	SetDataValues	TP	N	Y	
S10	1	GetDataDirectory	TP	N	Y	
S11	1	GetDataDefinition	TP	N	Y	
Data set						
S12	1	GetDataSetValues	TP	N	Y	
S13	1	SetDataSetValues	TP	N	N	
S14	1	CreateDataSet	TP	N	N	
S15	1	DeleteDataSet	TP	N	N	
S16	1	GetDataSetDirectory	TP	N	Y	
Substitution						
S17	1	SetDataValues	TP	N	N	
Setting group control						
S18	1	SelectActiveSG	TP	N	Y	
S19	1	SelectEditSG	TP	N	N	
S20	1	SetSGValues	TP	N	N	
S21	1	ConfirmEditSGValues	TP	N	N	
S22	1	GetSGValues	TP	N	N	
S23	1	GetSGCBValues	TP	N	Y	

(PICS Ed.1)

Table A.3 – ACSI service Conformance statement(2/3)

Reporting						
Buffered report control block (BRCB)						
S24	1	Report	TP	N	Y	
S24-1	1	data-change (dchg)		N	Y	
S24-2	1	quality-change (qchg)		N	Y	
S24-3	1	data-update (dupd)		N	N	
S25	1	GetBRCBValues	TP	N	Y	
S26	1	SetBRCBValues	TP	N	Y	
Unbuffered report control block (URCB)						
S27	1	Report	TP	N	Y	
S27-1	1	data-change (dchg)		N	Y	
S27-2	1	quality-change (qchg)		N	Y	
S27-3	1	data-update (dupd)		N	N	
S28	1	GetURCBValues	TP	N	Y	
S29	1	SetURCBValues	TP	N	Y	

Logging						
Log control block						
S30	1	GetLCBValues	TP	N	N	
S31	1	SetLCBValues	TP	N	N	
Log						
S32	1	QueryLogByTime	TP	N	N	
S33	1	QueryLogAfter	TP	N	N	
S34	1	GetLogStatusValues	TP	N	N	

Generic substation event model (GSE)						
GOOSE						
S35	1	SendGOOSEMessage	MC	Y	Y	
GOOSE-CONTROL-BLOCK						
S36	1	GetGoReference	TP	N	N	
S37	1	GetGOOSEElementNumber	TP	N	N	
S38	1	GetGoCBValues	TP	N	Y	
S39	1	SetGoCBValues	TP	N	Y	
GSSE						
S40	1	SendGSSEMessage	MC	N	N	Deprecated in Ed2
GSSE-CONTROL-BLOCK						
S41	1	GetReference	TP	N	N	Deprecated in Ed2
S42	1	GetGSSEElementNumber	TP	N	N	Deprecated in Ed2
S43	1	GetGsCBValues	TP	N	N	Deprecated in Ed2
S44	1	SetGsCBValues	TP	N	N	Deprecated in Ed2

Note: The IED does not support Ed2 (Edition 2) here.

(PICS Ed.1)

Table A.3 – ACSI service Conformance statement(3/3)

Transmission of sampled value model (SVC)						
Multicast SV						
S45	1	SendMSVMessage	MC	N	N	
Multicast Sampled Value Control Block						
S46	1	GetMSVCBValues	TP	N	N	
S47	1	SetMSVCBValues	TP	N	N	
Unicast SV						
S48	1	SendUSVMessage	TP	N	N	
Unicast Sampled Value Control Block						
S49	1	GetUSVCBValues	TP	N	N	
S50	1	SetUSVCBValues	TP	N	N	

Control						
S51	1	Select		N	Y	
S52	1	SelectWithValue	TP	N	Y	
S53	1	Cancel	TP	N	Y	
S54	1	Operate	TP	N	Y	
S55	1	CommandTermination	TP	N	Y	
S56	1	TimeActivatedOperate	TP	N	N	

File transfer						
S57	1	GetFile	TP	N	Y	
S58	1	SetFile	TP	N	N	
S59	1	DeleteFile	TP	N	N	
S60	1	GetFileAttributeValues	TP	N	Y	
S61	1	GetServerDirectory (FILE-SYSTEM)	TP	N	Y	

Time						
T1	1	Time resolution of internal clock			10 (1ms)	nearest negative power of 2 in seconds
T2	1	Time accuracy of internal clock			T1	T0 (10ms) T1 (1ms) T2 (100μs) T3 (25μs) T4 (4μs) T5 (1μs)
T3	1	Supported TimeStamp resolution			10 (1ms)	nearest negative power of 2 in seconds

(PIXIT Edition 1)

Protocol implementation extra information for testing (PIXIT) of the IEC 61850 communication interface in GR200 series IED

Note: The template of this document is "PIXIT template extracted from server test procedures version 1.0 and updated according to TPCL version 1.2.6" published by UCA International Using Group.

(Original document#: 6F2S1875 Ver. 0.10)

(PIXIT Ed.1)

1. Introduction

This document specifies the protocol implementation extra information for testing (PIXIT) of the IEC 61850 interface in G2 Series IED with communication firmware G2M850-02 series version equal & upper than A(G2M850-02-A).

Together with the PICS and the MICS the PIXIT forms the basis for a conformance test according to IEC 61850-10. The PIXIT entries contain information which is not available in the PICS, MICS, TICS documents or SCL file.

Each table specifies the PIXIT for applicable ACSI service model as structured in IEC 61850-10.

Note: The IED does not support IEC 61850 Edition 2 (**Ed2**) .

2. CONTENTS OF THIS DOCUMENT

Each chapter specifies the PIXIT for each applicable ACSI service model as structured in IEC 61850-10.

3. PIXIT FOR DOCUMENTATION

ID	Ed	Description	Value / Clarification
Do1	2	How to expose required firmware versions not present in the data model	NA

(PIXIT Ed.1)

4. PIXIT FOR ASSOCIATION MODEL

ID	Ed	Description	Value / Clarification
As1	1	Maximum number of clients that can set-up an association simultaneously	6
As2	1,2	TCP_KEEPALIVE value. The recommended range is 1..20s	Configurable from 1 to 20 seconds (default is 20 seconds)
As3	1,2	Lost connection detection time	From 10 to 30 seconds (TCP_KEEPALIVE + 10sec.)
As4	-	Authentication is not supported yet	N
As5	1,2	What association parameters are necessary for successful association	Transport selector N Session selector N Presentation selector N AP Title N AE Qualifier N
As6	1,2	If association parameters are necessary for association, describe the correct values e.g.	N.A.
As7	1,2	What is the maximum and minimum MMS PDU size	Max MMS PDU size 16384 Min MMS PDU size Not limited. It depends on a request.
As8	1,2	What is the maximum start up time after a power supply interrupt	Typically about 130 seconds Please check LCD Monitoring -> Communication -> 61850STAT as “Active” (Note) The startup time depends on the type of IED and Its configuration/setting.
As9	1,2	Does this device function only as test equipment? (test equipment need not have a non-volatile configuration; but it cannot be part of the substation automation system)	N

Note: The IED does not support Ed2 (Edition 2) here.

(PIXIT Ed.1)

5. PIXIT FOR SERVER MODEL

ID	Ed	Description	Value / Clarification
Sr1	1,2	Which analogue value (MX) quality bits are supported (can be set by server)	Validity: Y Good, Y Invalid, N Reserved, Y Questionable N Overflow Y* OutofRange N BadReference N Oscillatory Y* Failure N OldData N Inconsistent Y* Inaccurate(OnlyHz) Source: N Process N Substituted Y Test N OperatorBlocked * Supports only for GBU Model
Sr2	1,2	Which status value (ST) quality bits are supported (can be set by server)	Validity: Y Good, Y Invalid, N Reserved, Y Questionable N BadReference Y Oscillatory Y Failure Y OldData Y Inconsistent N Inaccurate Source: N Process N Substituted Y Test N OperatorBlocked
Sr3	-	What is the maximum number of data object references in one GetDataValues request	Deprecated
Sr4	-	What is the maximum number of data object references in one SetDataValues request	Deprecated
Sr5	1	Which Mode values are supported	On Y Blocked N Test Y Test/Blocked N Off N
		<additional items>	
		The order of interpretation of write requests involving a list of variables.	Front-to-back order. This might influence on write request involving RptEna and other variables in the same RCB.

Note: The IED does not support Ed2 (Edition 2) here.

(PIXIT Ed.1)

6. PIXIT for Data set model

ID	Ed	Description	Value / Clarification
Ds1	1	What is the maximum number of data elements in one data set (compare ICD setting)	Not limited by an internal configuration parameter. This IED does not have CreateDataSet service. But any DataSet can be defined by using engineering tool. The maximum number depends on the memory size of IED.
Ds2	1	How many persistent data sets can be created by one or more clients (this number includes predefined datasets)	N.A.
Ds3	1	How many non-persistent data sets can be created by one or more clients	N.A.

7. PIXIT FOR SUBSTITUTION MODEL

Not applicable

8. PIXIT FOR SETTING GROUP CONTROL MODEL

ID	Ed	Description	Value / Clarification
Sg1	1	What is the number of supported setting groups for each logical device	8
Sg2	1,2	What is the effect of when and how the non-volatile storage is updated (compare IEC 61850-8-1 $16.2.4)	Just SelectActiveSG service will be supported according to PICS. When an IED receives correct SelectActiveSG request, the IED returns Response+ within 10 seconds. And the ActSG and LActTm variable are updated within 10 seconds after the Response+. (These times are typical values, and they depend on IED types and its configurations/settings.) After changing setting group number with LED panel, you can see new setting group with GetSGCBValue service.
Sg3	1	Can multiple clients edit the same setting group	N.A.
Sg4	1	What happens if the association is lost while editing a setting group	N.A.
Sg5	1	Is EditSG value 0 allowed	N.A.
Sg6	2	When ResvTms is not present how long is an edit setting group locked	N.A.

Note: The IED does not support Ed2 (Edition 2) here.

(PIXIT Ed.1)

9. PIXIT for Reporting model

ID	Ed	Description	Value / Clarification
Rp1	1	The supported trigger conditions are (compare PICS)	integrity Y data change Y quality change Y data update Y
Rp2	1	The supported optional fields are	sequence-numberY report-time-stamp Y reason-for-inclusion Y data- set-name Y data- reference Y buffer-overflow Y entryID Y conf- rev Y segmentation Y
Rp3	1,2	Can the server send segmented reports (when not supported it is allowed to refuse an association with a smaller than minimum PDU size)	Y
Rp4	1,2	Mechanism on second internal data change notification of the same analogue data value within buffer period (Compare IEC 61850-7-2 $14.2.2.9)	Send report immediately
Rp5	1	Multi client URCB approach (compare IEC 61850-7-2:2003 $14.2.1)	Each URCB is visible to all clients
Rp6	-	What is the format of EntryID	Deprecated

Note: The IED does not support Ed2 (Edition 2) here.

(PIXIT Ed.1)

9. PIXIT for Reporting model (continued)

ID	Ed	Description	Value / Clarification
Rp7	1,2	What is the buffer size for each BRCB or how many reports can be buffered	For example, LLN0STHealth can be stored 408 events.
Rp8	-	Pre-configured RCB attributes that are dynamic, compare SCL report settings	Deprecated
Rp9	1	May the reported data set contain: - structured data objects - data attributes	 Y Y
Rp10	1,2	What is the scan cycle for binary events Is this fixed, configurable	More than 1.6 milliseconds Configurable
Rp11	1	Does the device support to pre-assign a RCB to a specific client in the SCL	N
Rp12	2	After restart of the server is the value of ConfRev restored from the original configuration or retained prior to restart	Restored from original configuration
Rp13	1,2	Does the server accepts any client to configure/enable a BRCB with ResvTms= - 1? What fields are used to do the identification?	N AP - Title N AE - Qualifier N <other field> N
Rp14	2	When BRCB.ResvTms is exposed, what is default value for BRCB.ResvTms if client does not write (must be > 0) Or When BRCB.ResvTms is not exposed, what is the internal reservation time (must be >= 0)	N/A 60 seconds
		<additional items>	
		Is it supported to change LLN0.Mod online?	N

Note: The IED does not support Ed2 (Edition 2) here.

10. PIXIT FOR LOGGING MODEL

Not applicable

(PIXIT Ed.1)

11. PIXIT FOR GOOSE PUBLISH MODEL

ID	Ed	Description	Value / Clarification
Gp1	1,2	Can the test (Ed1) / simulation (Ed2) flag in the published GOOSE be set	N
Gp2	1	What is the behaviour when the GOOSE publish configuration is incorrect	If the configuration is incorrect, the GOOSE isn't published.
Gp3	1,2	Published FCD supported common data classes are	All CDC/data types can be published.
Gp4	1,2	What is the slow retransmission time Is it fixed or configurable	60 seconds with TAL = 120sec. Fixed
Gp5	1,2	What is the fastest retransmission time Is it fixed or configurable	10 milli-sec. with TAL=30 milli-sec. Fixed
Gp6	-	Can the GOOSE publish be turned on / off by using SetGoCBValues(GoEna)	Deprecated See PICS - SetGoCBValues
Gp7	1,2	What is the initial GOOSE sqNum after restart	The device starts sending GOOSE from stNum=1 and sqNum=1.
Gp8	1	May the GOOSE data set contain: - structured data objects (FCD) - timestamp data attributes	 Y Y
Gp9	1,2	Does Server or ICT refuse GOOSE payload dataset length greater than SCSM supports?	Y Server Refuses the Configuration.
		<additional items>	
	1,2	Is the DUT a test equipment	N

Note: The IED does not support Ed2 (Edition 2) here.

(PIXIT Ed.1)

12. PIXIT FOR GOOSE SUBSCRIBE MODEL

ID	Ed	Description	Value / Clarification
Gs1	1,2	What elements of a subscribed GOOSE message are checked to decide the message is valid and the allData values are accepted? If yes, describe the conditions. Notes: the VLAN tag may be removed by a ethernet switch and shall not be checked the simulation flag shall always be checked (Ed2)	Y destination MAC address = as configured Y APPID Y gocbRef N timeAllowedtoLive N datSet Y goID =as configured N t N stNum Y sqNum Y simulation / test N confRev Y ndsCom N numDatSetEntries N out-of-order dataset members
Gs2	1,2	When is a subscribed GOOSE marked as lost (TAL = time allowed to live value from the last received GOOSE message)	[message does not arrive prior to TAL] GOOSE subscribe quality information will become QUESTIONABLE (=1100 0000 0000 0). GOOSE status change is accepted. The behavior can be changed by modifying PLC logic.
Gs3	1,2	What is the behaviour when one or more subscribed GOOSE messages isn't received or syntactically incorrect (missing GOOSE)	[stNum is out-of-order, or missed] No fail will be detected. [sqNum is out-of-order, or missed] GOOSE subscribe quality information will become QUESTIONABLE | INCONSISTENT (=1100 0000 1000 0). After receiving message with correct sqNum order, the quality information is set to GOOD (=0000 0000 0000 0). You can assign the information to any data attribute using our configuration tool. GOOSE status change is ignored The behavior can be changed by modifying PLC logic.

Note: The IED does not support Ed2 (Edition 2) here.

(PIXIT Ed.1)

12. PIXIT FOR GOOSE SUBSCRIBE MODEL (continued)

ID	Ed	Description	Value / Clarification
Gs4	1,2	What is the behaviour when a subscribed GOOSE message is out-of-order	Refer to Gs3
Gs5	1,2	What is the behaviour when a subscribed GOOSE message is duplicated	GOOSE subscribe quality information will become QUESTIONABLE | INCONSISTENT (=1100 0000 1000 0). GOOSE status change is accepted. The behavior can be changed by modifying PLC logic.
Gs6	1	Does the device subscribe to GOOSE messages with/without the VLAN tag	Y, with the VLAN tag Y, without the VLAN tag
Gs7	1	May the GOOSE data set contain: - structured data objects (FCD) - timestamp data attributes	Y N
Gs8	1,2	Subscribed FCD supported common data classes are	[Supported CDC] All, excepts measurand CDC (MV, CMV, SAV, WYE, DEL, SEQ, HMV, HWYE and HDEL) [Supported data type] Boolean BitString Integer Unsigned Integer Other types (TimeStamp, OctetString, etc) will be ignored by IED. (NOTE) But each data size shall be less than 32 bits. Dataset including measurand CDC listed above cannot be subscribed.
Gs9	1,2	Are subscribed GOOSE with test=T (Ed1) / simulation=T (Ed2) accepted in test/simulation mode	GOOSE subscribe quality information will become QUESTIONABLE | TEST (=1100 0000 0001 0). GOOSE status change is ignored. The behavior can be changed by modifying PLC logic.

Note: The IED does not support Ed2 (Edition 2) here.

(PIXIT Ed.1)

12. PIXIT FOR GOOSE SUBSCRIBE MODEL (continued)

ID	Ed	Description	Value / Clarification
Gs10	1,2	Max number of dataset members	64
		<additional items>	
	1,2	Are subscribed GOOSE with ndsCom=T Accepted.	GOOSE subscribe quality information will become QUESTIONABLE | INACCURATE (=1100 0000 0100 0). GOOSE status change is ignored. The behavior can be changed by modifying PLC logic.

13. PIXIT for GOOSE performance

ID	Ed	Description	Value / Clarification	
Gf1	1,2	Performance class	P1(Ed.2) for System/LLN0GOgoST P3(Ed.2) for all other GOOSE	
Gf2	1,2	GOOSE ping-pong processing method	Scan cycle based	
Gf3	1,2	Application logic scan cycle (ms)	Max.	…. 200ms
			Min.	1.38ms in 60Hz
Gf4	1	Maximum number of data attributes in GOOSE dataset (value and quality has to be counted as separate attributes)	The dataset for System/LLN0GOgoST is fixed, and it contains 32 data attributes. All other dataset for GOOSE can be configurable, and there is no particular limitation about the maximum number of data attributes. However, the dataset definition shares the same dynamic memory area as other data model definitions such as LN, RCB, etc., so it is affected by them.	

Note: The IED does not support Ed2 (Edition 2) here.

(PIXIT Ed.1)

14. PIXIT FOR CONTROL MODEL

ID	Ed	Description	Value / Clarification
Ct1	-	What control models are supported (compare ICD file enums for Ed2)	DOns: Y SBOns: Y DOes: Y SBOes: Y
Ct2	1,2	Is the control model fixed, configurable and/or dynamic	Fixed
Ct3	-	Is TimeActivatedOperate supported (compare PICS or SCL)	Deprecated
Ct4	-	Is "operate-many" supported (compare sboClass)	Deprecated
Ct5	1	Will the DUT activate the control output when the test attribute is set in the SelectWithValue and/or Operate request (when N test procedure Ctl2 is applicable)	Y
Ct6	-	What are the conditions for the time (T) attribute in the SelectWithValue and/or Operate request	Deprecated
Ct7	-	Is pulse configuration supported (compare pulseConfig)	Deprecated
Ct8	1	What is the behaviour of the DUT when the check conditions are set Is this behaviour fixed, configurable, online changeable	Y synchrocheck Y interlock-check Both bits are checked. (NOTE) The result of Opening operation (ctval = F) is not Influenced by SynchroCheck bit. This behavior is fixed.

Note: The IED does not support Ed2 (Edition 2) here.

(PIXIT Ed.1)

14. PIXIT FOR CONTROL MODEL(Continued)

ID	Ed	Description	Value / Clarification
Ct9	1,2	Which additional cause diagnosis are supported	Y Unknown Y Not-supported Y Blocked-by-switching-hierarchy Y Select-failed Y Invalid-position Y Position-reached N Step-limit Y Blocked-by-Mode N Blocked-by-process Y Blocked-by-interlocking Y Blocked-by-synchrocheck Y Command-already-in-execution Y Blocked-by-health Y 1-of-n-control Y Abortion-by-cancel Y Time-limit-over Y Abortion-by-trip (only for BCPU) Y Object-not-selected Edition 1 specific values: Y Parameter-change-in-execution Edition 2 specific values: Y Object-already-selected N No-access-authority N Ended-with-overshoot N Abortion-due-to-deviation N Abortion-by-communication-loss N Blocked-by-command N None Y Inconsistent-parameters Y Locked-by-other-client N Parameter-change-in-execution*
Ct10	1,2	How to force a “test-not-ok” respond with SelectWithValue request	Set orCat with unsupported value. See below “Which origin categories are supported?”
Ct11	1,2	How to force a “test-not-ok” respond with Select request	Send SELECT request to the control object which is not mapped to control application.

Note: The IED does not support Ed2 (Edition 2) here.

(PIXIT Ed.1)

14. PIXIT FOR CONTROL MODEL(Continued)

ID	Ed	Description	Value / Clarification
Ct12	1,2	How to force a "test-not-ok" respond with Operate request	DOns, SBOns, DOes: [Example1] Set orCat as unsupported value -> Cause AddCause as "Not-supported(1)" [Example2] Set ctlCat same as stVal -> Cause AddCause as "Position-reached(5)" SBOes: (Only Ed1) Same as above. Or, [Example3] Set Oper parameters as different parameter from the parameter of SelectWithVal -> Cause AddCause as "Parameter-change-in-execution (6)"
Ct13	1,2	Which origin categories are supported / accepted	N bay-control Y station-control Y remote-control N automatic-bay Y automatic-station Y automatic-remote N maintenance N process maintenance (7): N process (8): N
Ct14	1,2	What happens if the orCat value is not supported or invalid	DOns, SBOns, DOes, SBOes: "test-not-ok" IED respond
Ct15	1,2	Does the IED accept a SelectWithValue / Operate with the same control value as the current status value Is this behaviour configurable	DOns, SBOns, DOes, SBOes: N Fixed
Ct16	1,2	Does the IED accept a select/operate on the same control object from 2 different clients at the same time	DOns: N SBOns: N DOes: N SBOes: N Note: Commands are refused until the new position is not reached or a timeout does not occur.

Note: The IED does not support Ed2 (Edition 2) here.

(PIXIT Ed.1)

14. PIXIT FOR CONTROL MODEL(Continued)

ID	Ed	Description	Value / Clarification
Ct17	1	Does the IED accept a Select/SelectWithValue from the same client when the control object is already selected (Tissue #334)	SBOns: N SBOes: N
Ct18	1,2	Is for SBOes the internal validation performed during the SelectWithValue and/or Operate step	Yes for both SelectWithValue and Operate
Ct19	-	Can a control operation be blocked by Mod=Off or [On-]Blocked (Compare PIXIT-Sr5)	Deprecated
Ct20	1,2	Does the IED support local / remote operation	Y
Ct21	1,2	Does the IED send an InformationReport with LastApplError as part of the Operate response-for control with normal security	SBOns: N DOns: N
Ct22	2	How to force a "parameter-change-in-execution"	N.A.
Ct23	1,2	How many SBOns/SBOes control objects can be selected at the same time?	SBOns: n = 1 SBOes: n = 1
Ct24	1,2	Can a controllable object be forced to keep its old state e.g. Internal Controllable Objects may not be accessible to force this, whereas a switch like Circuit Breaker outside the DUT can?	Y Need PLC Logic customization.
Ct25	1,2	When CDC=DPC is supported, is it possible to have DPC (Controllable Double Point) go to the intermediate state? (00)	Y
Ct26	1,2	Name a DOes point (if any) with a finite operate timeout and specify the timeout (in milliseconds)	The timeout time is setting. One example, DPSY01-RST Default value is 300[ms] (10[ms]-1000[ms])
Ct27	2	Does the IED support control objects with external signals?	DOns: N SBOns: N DOes: N SBOes: N

Note: The IED does not support Ed2 (Edition 2) here.

(PIXIT Ed.1)

15. PIXIT FOR TIME AND TIME SYNCHONISATION MODEL

ID	Ed	Description	Value / Clarification
Tm1	1	What time quality bits are supported (may be set by the IED)	Y LeapSecondsKnown N ClockFailure Y ClockNotSynchronized
Tm2	1,2	Describe the behaviour when the time server(s) ceases to respond What is the time server lost detection time	On one time server: IED tries to synchronize with another time server. On all time servers: The quality attribute "ClockNotSynchronized" will be set to TRUE. The lost detection time depends on the network condition.
Tm3	1,2	How long does it take to take over the new time from time server	10 seconds
Tm4	1,2	When is the time quality bit "ClockFailure" set	RTC is out-of-order
Tm5	1,2	When is the time quality bit "Clock not Synchronized" set	It depends on the condition of synchronization. Typically from 1 to 10 minutes.
Tm6	-	Is the timestamp of a binary event adjusted to the configured scan cycle	Deprecated
Tm7	1	Does the device support time zone and daylight saving	Yes for both.
Tm8	1,2	Which attributes of the SNTP response packet are validated	Y Leap indicator not equal to 3? N Mode is equal to SERVER N OriginateTimestamp is equal to value sent by the SNTP client as Transmit Timestamp Y RX/TX timestamp fields are checked for reasonableness Y SNTP version 3 and/or 4 N other (describe)
Tm9	1,2	Do the COMTRADE files have local time or UTC time and is this configurable	UTC Not Configurable

Note: The IED does not support Ed2 (Edition 2) here.

(PIXIT Ed.1)

16. PIXIT FOR FILE TRANSFER MODEL

ID	Ed	Description	Value / Clarification
Ft1	1	What is structure of files and directories	Support tree structure
		Where are the COMTRADE files stored	"/COMTRADE/" directory (NOTE) At root directory in IED, the directory "/COMTRADE/" is Hidden. Therefore a client shall directly access this directory.
		Are comtrade files zipped and what files are included in each zip file	Not zipped
Ft2	1,2	Directory names are separated from the file name by	"/"
Ft3	1	The maximum file name size including path (recommended 64 chars)	64 chars
Ft4	1,2	Are directory/file name case sensitive	N
Ft5	1,2	Maximum file size for SetFile	Not limited by implementation or configuration. It depends on available memory.
Ft6	1	Is the requested file path included in the MMS fileDirectory respond file name	N (Ed2: always complete path)
Ft7	1	Is the wild char supported MMS fileDirectory request	No
Ft8	1,2	Is it allowed that 2 clients get a file at the same time	Y
Ft9	1,2	Which files can be deleted	N.A.

17. PIXIT FOR SERVICE TRACKING MODEL

ID	Ed	Description	Value / Clarification
Tr1	2	Which ACSI services are tracked by LTRK.GenTrk	N.A

Note: The IED does not support Ed2 (Edition 2) here.

(TICS Edition 1)

IEC61850 Tissues conformance statement (TICS) of the IEC 61850 communication interface in GR200 series IED

Note: The template of this document is "TISSUES Implementation Conformance Statement for the IEC 61850 interface in G2 series IED" published by KEMA consulting with document number "2008-v0.2".

(Original document#: 6F2S1876 Ver. 0.5)

(TICS Ed.1)

1. Introduction

According to the UCA IUG QAP the tissue conformance statement is required to perform a conformance test and is referenced on the certificate.

This document is applicable for G2 series IED with communication firmware G2M850-01 series version upper than F (G2M850-01-F).

Note: Term "**Ed**" is mentioning the edition number of IEC 61850. This document describes the IEC 61850 Edition 1 (**Ed1**).
Note that the IED does not support Edition 2 (Ed2).

(TICS Ed.1)

2. Mandatory Intop Tissues

During the October 2006 meeting IEC TC57 working group 10 decided that:

- green Tissues with the category “IntOp” are mandatory for IEC 61850 edition 1
- Tissues with the category “Ed.2” Tissues should not be implemented.

Below table gives an overview of the implemented IntOp Tissues.

Part	Tissue Nr	Description Implemented	Y/n.a.
8-1	116	GetNameList with empty response?	Y
	165	Improper Error Response for GetDataSetValues	Y
	183	GetNameList error handling	Y
7-4	None		
7-3	28	Definition of APC	n.a.
	54	Point def xVal, not cVal	n.a.
	55	Ineut = Ires ?	n.a.
	60	Services missing in tables	Y
	63	mag in CDC CMV	Y
	219	operTm in ACT	n.a.
	270	WYE and DEL rms values	Y
7-2	30	control parameter T	Y
	31	Typo	n.a.
	32	Typo in syntax	n.a.
	35	Typo Syntax Control time	n.a.
	36	Syntax parameter DSet-Ref missing	n.a.
	37	Syntax GOOSE "T" type	Y
	39	Add DstAddr to GoCB	Y
	40	GOOSE Message “AppID” to “GoID”	Y
	41	GsCB “AppID” to “GsID”	n.a.
	42	SV timestamp: “EntryTime” to “TimeStamp"	n.a.
	43	Control "T" semantic	Y
	44	AddCause - Object not sel	n.a.
	45	Missing AddCauses (neg range)	Y
	46	Synchro check cancel	n.a.
	47	"." in LD Name?	Y
	49	BRCB TimeOfEntry (part of #453)	Y
	50	LNName start with number?	Y
	51	ARRAY [0..num] missing	n.a.
	52	Ambiguity GOOSE SqNum	Y
	53	Add DstAddr to GsCB, SV	n.a.
	151	Name constraint for control blocks etc.	Y
	166	DataRef attribute in Log	n.a.
	185	Logging - Integrity periode	n.a.
	189	SV Format	n.a.
	190	BRCB: EntryId and TimeOfEntry (part of #453)	Y
	191	BRCB: Integrity and buffering reports (part of #453)	Y
	234	New type CtxInt (Enums are mapped to 8 bit integer)	n.a.
	275	Confusing statement on GI usage (part of #453)	Y
	278	EntryId not valid for a server (part of #453)	Y
Part 6	1	Syntax	Y
	5	tExtensionAttributeNameEnum is restricted	Y
	8	SIUnit enumeration for W	n.a.
	10	Base type for bitstring usage	Y
	17	DAI/SDI elements syntax	Y
	169	Ordering of enum differs from 7-3	Y
	534	Dbpos	Y

Note: Tissue 49, 190, 191, 275 and 278 are part of the optional tissue #453, all other technical tissues in the table are mandatory if applicable.

Note: Editorial tissues are marked as “n.a.”.

Note: Final proposal on tissue 45 is not defined yet

(TICS Ed.1)

3. Optional IntOp Tissues

After the approval of the server conformance test procedures version 2.2, the following IntOp tissues were added or changed. It is optional to implement these tissues.

Part	Tissue Nr	Description	Implemented Y/N/n.a.
8-1	246	Control negative response (SBOns) with LastApplError	N
8-1	545	Skip file directories with no files	Y
7-2	333	Enabling of an incomplete GoCB	n.a.
7-2	453	Combination of all reporting and logging tissues	N
6	245	Attribute RptId in SCL	N
6	529	Replace sev - Unknown by unknown	n.a.

3. Other Implemented Tissues

Part	Tissue Nr	Description	Implemented Y/N/n.a.
8-1	109	GOOSE, GSE, SV Addresses	Y
	118	File directory	Y
	121	GOOSE subscriber behavior	Y
	344	TimeOfEntry misspelled	Y
7-4	76	CBOpCap and SwOpCap	N
7-3	65	Deadband calculation of a Vector and trigger option	Y
7-2	38	Syntax "AppID" or "GoID"	Y
6	3	Missing ENUMs	Y
	6	ReportControl/OptFields	N
	7	Duplication of attributes	N
	11	Schema for IP Addr?	N
	15	bufOvfl in Schema?	Y

Appendix 5 Ordering

[GBU200 Hardware selection (1/3)]

	1	2	3	4	5	6		7	8		9	A	B		C	D		E	F		G	H		J	K	L
Configurations	**G**	**B**	**U**	**2**	**0**	**0**	**-**			**-**				**-**	**0**	**0**	**-**			**-**			**-**			**0**
Application of power system																											
No VCT module								0																			
For BCU with protection applications (BCPU)																											
Single VCT (VCT51B) with sensitive CT (4 x CTs, 1 x sef CT, 6 x VTs)								1																			
Double VCTs (VCT51B) (8 x CTs, 2 x sef CT, 12 x VTs)								A																			
For BCU without protection application (BCU)																											
Single VCT (VCT52B) (4 x CTs, 5 x VTs)								2																			
Single VCT (VCT53B) for bus section or bus coupler bays (4 x CTs, 7 x VTs)								3																			
Single VCT (VCT52B) with power quality monitoring input (4 x CTs, 5 x VTs)								5																			
Single VCT (VCT53B) with power quality monitoring and power quality monitoring inputs (4 x CTs, 7 x VTs)								6																			
Double VCTs (VCT52B) (8 x CTs, 10 x VTs)								B																			
Double VCTs (VCT53B) (8 x CTs, 14 x VTs)								C																			
System frequency																											
N/A (when code "7" = 0)																									0		
50Hz																									1		
60Hz																									2		
AC rating for phase currents																											
N/A (when code "7" = 0)																										0	
1A																										1	
5A																										2	
DC Rating																											
110-250 Vdc†									1																		

†Note: Operation is not guaranteed in the AC power source (100 - 220Vac).

[GBU200 Hardware selection (2/3)]

	1	2	3	4	5	6		7	8		9	A	B		C	D		E	F		G	H		J	K	L
Configurations	**G**	**B**	**U**	**2**	**0**	**0**	**-**			**-**				**-**	**0**	**0**	**-**			**-**			**-**			**0**

Outline	
Standard LCD, 1/3 x 19'' rack for flush mounting[1]	1
Standard LCD, 1/2 x 19'' rack for flush mounting	2
Standard LCD, 3/4 x 19'' rack for flush mounting	3
Standard LCD, 1/1 x 19'' rack for flush/rack mounting	4
Large LCD, 1/2 x 19'' rack for flush mounting	6
Large LCD, 3/4 x 19'' rack for flush mounting	7
Large LCD, 1/1 x 19'' rack for flush/rack mounting	8
Standard LCD, 1/3 x 19'' rack for rack mounting[2]	E
Standard LCD, 1/2 x 19'' rack for rack mounting[2]	F
Standard LCD, 3/4 x 19'' rack for rack mounting[2]	G
Large LCD, 1/2 x 19'' rack for rack mounting[2]	J
Large LCD, 3/4 x 19'' rack for rack mounting[2]	K
BI/BO Module Selection	
Refer to Number of BI/BO Table	
BI/BO Terminal Type	
Compression plug type terminal	0
Ring type terminal	1
Number of Serial and/or Ethernet Communication and/or Time Synch Port(s) and/or usage of extension IO unit (GIO200)	
1CH	1
1CH + IRIG-B	3
2CH	4
2CH + IRIG-B	6
3CH	7
3CH + IRIG-B	9
1CH + connection terminal for external I/O unit[3] (GIO200)	B
1CH + IRIG-B + connection terminal for external I/O unit[3] (GIO200)	D
2CH + connection terminal for external I/O unit[3] (GIO200)	E
2CH + IRIG-B + connection terminal for external I/O unit[3] (GIO200)	G
3CH + connection terminal for external I/O unit[3] (GIO200)	H
3CH + IRIG-B + connection terminal for external I/O unit[3] (GIO200)	K

[1]Note Selection is only available when Ordering No. '19' is chosen in Function table (at Position "G & T").

[2]Note Joint-kits accessories are required to mount the IED case into 19" rack panel. (See *Appendix: Rack mounting*)

[3]Note We shall see Hardware and Software selections about GIO200 later.

[GBU200 Hardware selection (3/3)]

	1	2	3	4	5	6		7	8		9	A	B		C	D		E	F		G	H		J	K	L
Configurations	**G**	**B**	**U**	**2**	**0**	**0**	**-**			**-**				**-**	**0**	**0**	**-**			**-**			**-**			**0**

Selection of Serial and/or Ethernet Communication Port(s)

100Base-TX x 1 port (When position E = 1 - 3 and B – D)	3
100Base-FX x 1 port (When position E = 1 - 3 and B – D)	4
100Base-TX x 2 ports (When position E = 4 - 6 and E – G)	5
100Base-FX x 2 ports (When position E = 4 - 6 and E – G)	6
RS485 x 1 port + 100Base-TX x 1 port (When position E = 4 - 6 and E – G)	A
RS485 x 1 port + 100Base-TX x 2 ports (When position E = 7 - 9 and H – K)	B
RS485 x 1 port + 100Base-FX x 1 port (When position E = 4 - 6 and E – G)	C
RS485 x 1 port + 100Base-FX x 2 ports (When position E = 7 - 9 and H – K)	D
Fiber optic (for serial) x 1 port + 100Base-TX x 1 port (When position E = 4 - 6 and E – G)	E
Fiber optic (for serial) x 1 port + 100Base-TX x 2 ports (When position E = 7 - 9 and H – K)	F
Fiber optic (for serial) x 1 port + 100Base-FX x 1 port (When position E = 4 - 6 and E – G)	G
Fiber optic (for serial) x 1 port + 100Base-FX x 2 ports (When position E = 7 - 9 and H – K)	H

Function Block (linked with software selection)

See Function table of software selection

[GBU200 Software selection (1/1)]

	1	2	3	4	5	6		7	S	G	T		E	F	U		9	V
Configurations	**G**	**B**	**U**	**2**	**0**	**0**	**-**		**0**			**-**				**-**		
Application of power system																		
Assignment on position "7"																		
Function Block																		
Refer to Function Table																		
Communication for Remote / Time Synch. (1)																		
Assignment on position "E"																		
Communication for Remote / Time Synch. (2)																		
Assignment on position "F"																		
Protocol																		
IEC 61850															2			
IEC 61850 and Modbus (master)															A			
Outline																		
Assignment on position "9"																		
Language																		
English																		E

Note: We share selection codes at '1–7, E, F, and 9' between the hardware selection code and the software selection code.

[GIO200[1] Hardware selection (1/1)]

	1	2	3	4	5	6		7	8		9	A	B		C	D		E	F		G	H		J	K	L
Configurations	**G**	**I**	**O**	**2**	**0**	**0**	**-**	**0**	**1**	**-**	**U**	**X**	**1**	**-**	**0**	**0**	**-**	**0**	**0**	**-**	**0**	**0**	**-**	**0**	**0**	**0**
DC Rating																										
110-250 Vdc[2]									1																	
Outline																										
1/2 x 19'' rack for flush mounting											U															
1/2 x 19'' rack for rack mounting											V															
1/1 x 19'' rack for flush/rack mounting											W															
BI/BO Module Selection																										
Refer to Note[3]												X1														
BI/BO Terminal Type																										
Compression plug type terminal																							0			

[1]Note A connection cable (for the main IED; length approximately 0.5 meters) is provided with GIO200 unit.

[2]Note: Operation is not guaranteed in the AC power source (100 - 220Vac).

[3]Note Code '**X1**' means three DCAI2 modules are provided.

[GIO200 Software selection (1/1)]

	1	2	3	4	5	6		7	S	G	T		E	F	U		9	V
Configurations	**G**	**I**	**O**	**2**	**0**	**0**	**-**	**0**	**0**	**0**	**0**	**-**	**0**	**0**	**0**	**-**	**U**	**0**
Outline																		
Assignment on position "9" (U,V, or W)																	U	

Number of BI/BO

BI/BO 1 x I/O module

Number of BI/BO									Ordering No. (Position "A" to "B")	Configuration
Independent BI	Independent BI (variable)	Common BI	DC-AI	Fast-BO	Semi-fast BO	BO	Heavy duty BO	DC-AO		
7	-	-	-	-	6	4	-	-	**11**	1xBIO1
12	-	-	-	-	3	2	-	-	**12**	1xBIO2
8	-	-	-	6	-	2	-	-	**13**	1xBIO3
-	6	-	-	-	-	2	6	-	**14**	1xBIO4
18	-	-	-	-	-	-	-	-	**15**	1xBI1
-	12	-	-	-	-	-	-	-	**16**	1xBI2
-	-	32	-	-	-	-	-	-	**17**	1xBI3
Other Configuration									**ZZ**	To be specified at ordering

BI/BO 2 x I/O module

Number of BI/BO									Ordering No. (Position "A" to "B")	Configuration
Independent BI	Independent BI (variable)	Common BI	DC-AI	Fast-BO	Semi-fast BO	BO	Heavy duty BO	DC-AO		
-	-	32	-	-	6	12	-	-	**21**	1xBI3+1xBO1
7	-	32	-	-	6	4	-	-	**22**	1xBI3+1xBIO1
12	-	32	-	-	3	2	-	-	**23**	1xBI3+1xBIO2
18	-	-	-	-	6	12	-	-	**24**	1xBI1+1xBO1
25	-	-	-	-	6	4	-	-	**25**	1xBI1+1xBIO1
30	-	-	-	-	3	2	-	-	**26**	1xBI1+1xBIO2
8	-	-	-	6	6	14	-	-	**27**	1xBO1+1xBIO3
15	-	-	-	6	6	6	-	-	**28**	1xBIO1+1xBIO3
7	-	-	-	-	12	16	-	-	**29**	1xBO1+1xBIO1
16	-	-		12	-	4	-	-	**2A**	2xBIO3
-	-	32	-	-	-	-	16	-	**2B**	1xBI3+1xBO2
-	12	-	-	-	6	12	-	-	**2C**	1xBI2 +1xBO1
-	-	32	10	-	-	-	-	-	**2D**	1xBI3A+1xDCAI2
Other Configuration									**ZZ**	To be specified at ordering

BI/BO 3 x I/O module

Number of BI/BO									Ordering No. (Position "A" to "B")	Configuration
Independent BI	Independent BI (variable)	Common BI	DC-AI	Fast-BO	Semi-fast BO	BO	Heavy duty BO	DC-AO		
15	-	-	-	6	12	18	-	-	**31**	1xBO1+1xBIO1+1xBIO3
20	-	-	-	6	9	16	-	-	**32**	1xBO1+1xBIO2+1xBIO3
23	-	-	-	12	6	8	-	-	**33**	1xBIO1+2xBIO3
26	-	-	-	6	6	14	-	-	**34**	1xBI1+1xBO1+1xBIO3
8	-	32	-	6	6	14	-	-	**35**	1xBI3+1xBO1+1xBIO3
24	-	-	-	18	-	6	-	-	**36**	3xBIO3
25	-	-	-	-	12	16	-	-	**37**	1xBI1+1xBO1+1xBIO1
-	-	32	10	-	6	12	-	-	**38**	1xBI3+1xDCAI2+1xBO1
36	-	-	-	-	6	12	-	-	**39**	2xBI1+1xBO1
-	24	-	-	-	6	12	-	-	**3A**	2xBI2+1xBO1
18	6	-	-	-	6	14	6	-	**3B**	1xBI1+1xBO1+1xBIO4
7	-	32	-	-	6	4	16	-	**3C**	1xBI3+1xBIO1+1xBO2
7	-	32	-	-	12	16	-	-	**3D**	1xBI3+1xBO1+1xBIO1
-	-	32	-	-	6	12	16	-	**3E**	1xBI3+1xBO1+1xBO2
18	-	-	10	-	6	12	-	-	**3F**	1XBI1+1xDCAI2+1xBO1
16	-	-	-	12	6	16	-	-	**3G**	1xBO1+2xBIO3
-	6	32	-	-	6	14	6	-	**3H**	1xBI3+1xBO1+1xBIO4
-	-	64	-	-	6	12	-	-	**3K**	2xBI3+1xBO1
14	-	32	-	-	12	8	-	-	**3L**	1xBI3+2xBIO1
-	-	96	-	-	-	-	-	-	**3M**	3xBI3
8	12	-	-	6	6	14	-	-	**3N**	1xBI2+1xBO1+1xBIO3
-	-	32	-	-	12	24	-	-	**3P**	1xBI3 + 2xBO1
36	-	-	-	-	-	-	16	-	**3Q**	2xBI1A+ 1xBO2A
-	-	-	30	-	-	-	-	-	**3R**	3xDCAI2
Other Configuration									**ZZ**	To be specified at ordering

BI/BO 4 x I/O modules

Number of BI/BO									Ordering No. (Position "A" to "B")	Configuration
Independent BI	Independent BI (variable)	Common BI	DC-AI	Fast-BO	Semi-fast BO	BO	Heavy duty BO	DC-AO		
26	-	-	-	6	12	26	-	-	**41**	1xBI1+2xBO1+1xBIO3
32	-	-	-	24	-	8	-	-	**42**	4xBIO3
8	-	32	-	6	12	26	-	-	**43**	1xBI3+2xBO1+1xBIO3
-	-	64	-	-	12	24	-	-	**44**	2xBI3+2xBO1
8	-	32	10	6	6	14	-	-	**45**	1xBI3+1xDCAI2+1xBO1 +1xBIO3
54	-	-	-	-	6	12	-	-	**46**	3xBI1+1xBO1
20	-	32	-	6	9	16	-	-	**47**	1xBI3+1xBO1+1xBIO2 +1xBIO3
-	-	64	10	-	6	12	-	-	**4A**	2xBI3+1xDCAI2+1xBO1
20				6	15	28			**49**	2xBO1+1xBIO2+1xBIO3
-	-	64	10	-	6	12	-	-	**4A**	2xBI3+1xDCAI2+1xBO1
34	-	-	-	12	6	16	-	-	**4B**	1xBI1+1xBO1+2xBIO3
-	-	64	-	-	-	-	32	-	**4C**	2xBI3+2xBO2
21	-	32	-	-	18	12	-	-	**4D**	1xBI3+3xBIO1
-	-	128	-	-	-	-	-	-	**4E**	4xBI3
7		96			6	4			**4F**	3xBI3+1xBIO1
8	24	-	-	6	6	14	-	-	**4G**	2xBI2 +1xBO1 +1xBIO3
-	-	32	-	-	18	36	-	-	**4H**	1xBI3 + 3xBO1
26	12	-	-	6	6	14	-	-	**4J**	1xBI1 + 1xBI2 + 1xBO1 + 1xBIO3
24	-	32	-	-	12	16	-	-	**4K**	1xBI3+1xBO1+2xBIO2
15	-	-	-	6	18	30	-	-	**4L**	2xBO1+1xBIO1+1xBIO3
7	-	-	-	-	24	40	-	-	**4M**	3xBO1+1xBIO1
36	-	-	-	-	12	24	-	-	**4N**	2xBI1A+2xBO1A
8	-	64	-	6	6	14	-	-	**4P**	2xBI3A+1xBO1A+1xBIO3A
36	-	-	-	-	6	12	16	-	**4Q**	2xBI1A+1xBO1A+1xBO2A
Other Configuration									**ZZ**	To be specified at ordering

BI/BO 5 x I/O modules

Number of BI/BO									Ordering No. (Position "A" to "B")	Configuration
Independent BI	Independent BI (variable)	Common BI	DC-AI	Fast-BO	Semi-fast BO	BO	Heavy duty BO	DC-AO		
33	-	-	-	6	6	6	32	-	**51**	1xBI1+1xBIO1+1xBIO3 +2xBO2
44	-	-	-	6	12	26	-	-	**52**	2xBI1+2xBO1+1xBIO3
25	-	96	-	-	6	4	-	-	**53**	1xBI1+3xBI3+1xBIO1
8	-	96	-	6	6	14	-	-	**54**	3xBI3+1xBO1+1xBIO3
-	-	64	10	-	12	24	-	-	**55**	2xBI3+1xDCAI2+2xBO1
62	-	-	-	6	6	14	-	-	**56**	3xBI1+1xBO1+1xBIO3
54	6	-	-	-	6	14	6	-	**57**	3xBI1+1xBO1+1xBIO4
54	-	-	10	-	6	12	-	-	**58**	3xBI1+1xDCAI2+1xBO1
36	-	-	10	-	12	24	-	-	**59**	2xBI1+1xDCAI2+2xBO1
20	-	32	10	6	9	16	-	-	**5A**	1xBI3+1xDCAI2+1xBO1 +1xBIO2+1xBIO3
-	-	96	-	-	12	24	-	-	**5B**	3xBI3+2xBO1
-	-	96	10	-	6	12	-	-	**5C**	3xBI3+1xDCAI2+1xBO1
-	-	64	10	-	-	-	32	-	**5D**	2xBI3+1xDCAI2+2xBO2
-	-	128	-	-	6	12	-	-	**5E**	4xBI3+1xBO1
-	-	160	-	-	6	12	-	-	**5F**	5xBI3
44	12	-	-	6	6	14	-	-	**5G**	2xBI1 + 1xBI2 + 1xBO1 + 1xBIO3
15	-	-	-	6	24	42	-	-	**5H**	3xBO1+1xBIO1+1xBIO3
-	-	64	-	-	18	36	-	-	**5J**	2xBI3+3xBO1
7	-	96	10	-	6	4	-	-	**5K**	3xBI3+1xDCAI2+1xBIO1
-	-	-	-	-	30	60	-	-	**5L**	5xBO1
-	-	64	30	-	-	-	-	-	**5M**	2xBI3+3xDCAI2
-	-	96	20	-	-	-	-	-	**5N**	3xBI3+2xDCAI2
Other Configuration									**ZZ**	To be specified at ordering

BI/BO 6 x I/O modules

Number of BI/BO									Ordering No. (Position "A" to "B")	Configuration
Independent BI	Independent BI (variable)	Common BI	DC-AI	Fast-BO	Semi-fast BO	BO	Heavy duty BO	DC-AO		
51	-	-	-	6	18	30	-	-	**61**	2xBI1+2xBO1+1xBIO1 +1xBIO3
8	-	96	-	6	12	26	-	-	**62**	3xBI3+2xBO1+1xBIO3
-	-	128	-	-	12	24	-	-	**63**	4xBI3+2xBO1
8	-	128	-	6	6	14	-	-	**64**	4xBI3+1xBO1+1xBIO3
8	-	96	10	6	6	14	-	-	**65**	3xBI3+1xDCAI2+1xBO1 +1xBIO3
54	6	-	10	-	6	14	6	-	**66**	3xBI1+1xDCAI2+1xBO1 +1xBIO4
-	-	128	10	-	6	12	-	-	**67**	4xBI3+1xDCAI2+1xBO1
-	-	96	10	-	12	24	-	-	**68**	3xBI3+1xDCAI2+2xBO1
52	-	-	-	12	-	4	32	-	**69**	2xBI1+2xBIO3+2xBO2
52	-	-	-	12	12	28	-	-	**6A**	2xBI1+2xBO1+2xBIO3
36	-	-	-	-	24	48	-	-	**6B**	2xBI1+4xBO1
36	-	64	-	-	12	24	-	-	**6C**	2xBI1+2xBI3+2xBO1
44	-	-	-	6	18	38	-	-	**6D**	2xBI1+3xBO1+1xBIO3
-	-	160	-	-	6	12	-	-	**6E**	5xBI3+1xBO1
7	-	160	-	-	6	4	-	-	**6F**	5xBI3+1xBIO1
Other Configuration									**ZZ**	To be specified at ordering

BI/BO 7 x I/O modules

Number of BI/BO									Ordering No. (Position "A" to "B")	Configuration
Independent BI	Independent BI (variable)	Common BI	DC-AI	Fast-BO	Semi-fast BO	BO	Heavy duty BO	DC-AO		
80	-	-	-	6	12	26	-	-	**71**	4xBI1+2xBO1+1xBIO3
72	6	-	-	-	12	26	6	-	**72**	4xBI1+2xBO1+1xBIO4
8	-	96	-	6	18	38	-	-	**73**	3xBI3+3xBO1+1xBIO3
-	6	96	-	-	18	38	6	-	**74**	3xBI3+3xBO1+1xBIO4
36	12	-	10	-	-	4	44	-	**75**	2xBI1+1xDCAI2+2xBIO4 +2xBO2
-	-	96	20	-	12	24	-	-	**76**	3xBI3+2xDCAI2+2xBO1
7	-	64	20	-	6	4	32	-	**77**	2xBI3+2xDCAI2+1xBIO1 +2xBO2
-	60	-	-	-	6	12	16	-	**78**	5xBI2+1xBO1+1xBO2
-	-	160	-	-	12	24	-	-	**79**	5xBI3+2xBO1
52	-	-	10	12	12	28	-	-	**7A**	2xBI1+1xDCAI2+2xBIO3 +2XBO1
54	-	64	-	-	12	24	-	-	**7B**	3xBI1 + 2xBI3 + 2xBO1
18	-	96	10	-	12	24	-	-	**7C**	1xBI1+3xBI3+1xDCAI2 +2xBO1
-	-	128	-	-	18	36	-	-	**7D**	4xBI3+3xBO1
7	-	160	-	-	12	16	-	-	**7E**	5xBI3+1xBO1+1xBIO1
-	-	192	-	-	6	12	-	-	**7F**	6xBI3+1xBO1
7	-	192	-	-	6	4	-	-	**7G**	6xBI3+1xBIO1
-	-	224	-	-	-	-	-	-	**7H**	7xBI3
26	-	64	20	6	6	14	-	-	**7J**	1xBI1+2xBI3+2xDCAI2 +1xBO1+1xBIO3
-	-	128	30	-	-	-	-	-	**7K**	4xBI3+3xDCAI2
Other Configuration									**ZZ**	To be specified at ordering

BI/BO 8 x I/O modules

Number of BI/BO									Ordering No. (Position "A" to "B")	Configuration
Independent BI	Independent BI (variable)	Common BI	DC-AI	Fast-BO	Semi-fast BO	BO	Heavy duty BO	DC-AO		
-	-	128	10	-	18	36	-	-	**81**	4xBI3+1xDCAI2+3xBO1
54	12	-	10	-	-	4	44	-	**82**	3xBI1+1xDCAI2+2xBIO4 +2xBO2
-	-	160	-	-	18	36	-	-	**83**	5xBI3+3xBO1
-	-	160	20	-	6	12	-	-	**84**	5xBI3+2xDCAI2+1xBO1
-	-	192	10	-	6	12	-	-	**85**	6xBI3+1xDCAI2+1xBO1
-	-	96	10	-	24	48	-	-	**86**	3xBI3+1xDCAI2+4xBO1
-	60	-	-	-	6	12	32	-	**87**	5xBI2+1xBO1+2xBO2
8	-	128	-	6	18	38	-	-	**88**	4xBI3+3xBO1+1xBIO3
14	-	96	30	-	12	8	-	-	**89**	3xBI3+3xDCAI2+2xBIO1
-	-	128	20	-	12	24	-	-	**8A**	4xBI3+2xDCAI2+2xBO1
-	-	192	20	-	-	-	-	-	**8B**	6xBI3+2xDCAI2
-	-	256	-	-	-	-	-	-	**8C**	8xBI3
36	-	64	20	-	12	24	-	-	**8D**	2xBI1+2xBI3+2xDCAI2 +2xBO1
18	-	96	10	-	18	36	-	-	**8E**	1xBI1+3xBI3+1xDCAI2 +3xBO1
-	-	128	10	-	-	-	48	0	**8F**	4xBI3+1xDCAI2+3xBO2
7	-	224	-	-	6	4	-	-	**8G**	7xBI3+1xBIO1
-	-	192	-	-	12	24	-	-	**8H**	6xBI3+2xBO1
7	-	192	-	-	12	16	-	-	**8J**	6xBI3+1xBO1+1xBIO1
21	-	96	10	-	24	24	-	-	**8K**	3xBI3+1xDCAI2+1xBO1 +3xBIO1
-	-	128	30	-	6	12	-	-	**8L**	4xBI3+3xDCAI2+1xBO1
7	-	96	-	-	30	52	-	-	**8M**	3xBI3A+4xBO1A+1xBIO1A
Other Configuration									**ZZ**	To be specified at ordering

Note that the user should contact with the sales staffs when requiring "other configuration (Ordering number: ZZ)" not indicated in the ordering code above.

Function table

Function Block	Description	Ordering No. (Position "G & T")					
		BCU			BCPU		IFU
		11	13	1F	2N	2C	19
[Control function]							
Control (*1)	Select-control	●	●	●	●	●	
Interlock	Interlock	●	●	●	●	●	
AutoSEQ	Automatic sequential control	●	●	●	●	●	
Monitoring	Monitoring	●	●	●	●	●	
DCB	Double command blocking	●	●	●	●	●	
TAP (*1)	TAP control (BCD)	●	●	●	●	●	
DCAI	DC analog input measurement	○	○	○	○	○	
DCAO	DC analog output control	○	○		○	○	
SYNDIF	Synchrocheck between different network (e.g. between transmission line and generator plant)	●	●	●	●	●	
MNOVR	Manual override						
[Protection]							
50/67,51/67	Non-directional / directional phase overcurrent protection (4 steps)				●	●	
50N/67N,51N/67N	Non-directional / directional earth fault overcurrent protection (4 steps)				●	●	
50SEF/51SEF	Non-directional sensitive overcurrent protection (2 steps)				●	●	
46/67	Non-Directional / directional negative sequence phase over-current protection (4 steps)				●	●	
50BF	Circuit breaker failure protection (2 stages)				●	●	
37	Phase under-current protection (2 steps)				●		
46BC	Broken conductor protection				●		
49	Thermal overload protection				●	●	
59	Phase over-voltage protection (4 steps)				●	●	
59N	Earth fault over-voltage protection (4 steps)				●	●	
47	Negative sequence phase over-voltage protection (4 steps)				●		
27	Phase under-voltage protection (4 steps)				●	●	
81	Frequency protection (6 steps)				●		
ROCOF	Rate of change of frequency (df/dt) (6 steps)				●		
51V	Voltage controlled/restraint overcurrent (4 steps)				●	●	
50SOTF	Switch on to fault protection				●		
21FL	Fault locator				●	●	
ICD	Inrush current detection function (2f)				●		
79	Autoreclosing function (upto 5 shots)				●	●	
25	Voltage check for autoreclosing				●	●	
[Common]							
TCS	Trip circuit supervision	●	●	●	●	●	
VTF	VTF detection function	●	●	●	●	●	
CTF	CTF detection function	●	●	●	●	●	
Event	Event and alarm	●	●	●	●	●	●
Measurement	Measurement	●	●	●	●	●	●
PORQTY	Power quality monitoring		●				
Counter	Counter	●	●	●	●	●	
PLC	Programmable logic controller	●	●	●	●	●	●
Communication	Remote communication	○	○	○	○	○	●
		Control	Control + Power quality monitoring	Control (for 60Hz system only)	Control + Protection	Control + Protection (for 60Hz system only)	Interface unit

●: Standard, ○: Equipped depending on the hardware configuration

*1: Maximum device number for control/monitoring

Model	13	1F	2C	Others
DPSY	1/1	2/2	1/1	2/2
DPOS	20/20	20/30	15/15	20/30
SPOS	10/10	10/10	10/10	10/10
TPOS	3/3	3/3	0/0	3/3
TAP	1/1	1/1	1/1	1/1
VPOS	0/1	64/64	64/64	0/0

Appendix 6 Technical data

Technical data

Analog Inputs	
Rated current In	Either 1A or 5A (specified when the ordering)
Rated voltage Vn	100V to 120V
Rated Frequency	Either 50Hz or 60Hz (specified when the ordering)
Overload Rating	
Current inputs	4 times rated current continuous 5 times rated current for 3 minutes 6 times rated current for 2 minutes 30 times rated current for 10 seconds 100 times rated current for 1 second 250 times rated current for one power cycle (20 or 16.6ms)
Voltage inputs	2 times rated voltage continuous 2.5 times rated voltage for 1 second
Burden	
Phase current inputs	≤ 0.1VA at In = 1A, ≤ 0.2VA at In = 5A
Earth current inputs	≤ 0.3VA at In = 1A, ≤ 0.4VA at In = 5A
Sensitive earth fault inputs	≤ 0.3VA at In = 1A, ≤ 0.4VA at In = 5A
Voltage inputs	≤ 0.1VA at Vn
Power Supply	
Rated auxiliary voltage	110/250Vdc (Operative range: 88.0 – 300.0Vdc)
Superimposed AC ripple on DC supply	≤ 15%
Power Supply Interruption Withstand Period (IEC60255-11)	110/250Vdc rating : 50ms
Power consumption	≤ 15W (quiescent) ≤ 25W (maximum)

Binary Inputs	
Input circuit DC voltage	24/48/60Vdc (Operating range: 19.2 – 72Vdc), 48/110Vdc (Operative range: 38.4 – 150Vdc), 110/125/220/250Vdc (Operating range: 88 – 300Vdc) Note: Pick-up setting is available in BI2 and BIO4 (Setting range: 18V to 222V)
Capacitive discharge immunity	10µF charged to maximum supply voltage and discharged into the input terminals, according to ENA TS 48-4 with an external resistor
Maximum permitted voltage	72Vdc for 24/48/60Vdc rating, 300Vdc for 110/250Vdc rating
Power consumption	≤ 0.5W per input at 220Vdc
Binary Outputs	
Fast operating contacts	
Make and carry	5A continuously 30A, 290Vdc for 0.2s (L/R=5ms)
Break	0.15A, 290Vdc (L/R=40ms)
Operating time	Typically 3 ms
Semi-fast operating contacts	
Make and carry	8A continuously 30A, 240Vdc for 1s (L/R=5ms)
Break	0.1A at 250Vdc (L/R=40ms) 0.2A at 125Vdc (L/R=40ms)
Operating time	Typically 6 ms
Auxiliary contacts	
Make and carry	8A continuously 30A, 240Vdc for 1s (L/R=5ms)
Break	0.1A at 250Vdc (L/R=40ms) 0.2A at 125Vdc (L/R=40ms)
Operating time	Typically 8 ms
Hybrid contacts (10 A breaking)	
Make and carry	8A continuously 10A, 220Vdc for 0.5s (L/R=5ms)
Break	10A, 220Vdc (L/R=20ms) 10A, 110Vdc (L/R=40ms)
Operating time	1 ms
Durability	≥ 10,000 operations (loaded contact) ≥ 100,000 operations (unloaded contact)

DC-AI (analog inputs)	
Measurement range	DC 0±1mA, 0±20mA, 4~20mA , 0~10mA, 0~20mA, ±10mA DC –1 ~ 0 ~ +1V, –5 ~ 0 ~ +5V, –10 ~ 0 ~ +10V
Accuracy	±0.5% of full scale
Maximum permitted continuous current	2 times for maximum measurement range
Input resistance	Depend on current and voltage range: ±1mA: 4.7k ohm, ±20mA: 235 ohm ±10V: 38k ohm, ±1V: 580k ohm
DC-AO (analog outputs)	
Measurement range	DC 0 ~ ±20mA DC 0 ~ ±10V
Accuracy	±1% of full scale

Measuring input capability	
Full scale	
Standard current input	≥ 60A (1A rating) or 300A (5A rating)
Sensitive current input	≥ 3A (1A rating) or 15 A (5A rating)
Voltage input	≥ 200V
Sampling rate	48 samples / cycle
Frequency response	< 5% deviation over range 16.7Hz to 600Hz

Mechanical Design	
Installation	Flush mounting
Weight	Approx. 10kg (1/3 size), 12kg (1/2 size), 15kg (3/4 size), 25kg (1/1 size)
Case color	2.5Y7.5/1 (approximation to Munsell value)
LED	
Number	26 (Fixed for "In service" and "ERROR")
Color	Red / Yellow / Green (configurable) except In service (green) and Error (red)
Function keys	
Number	7
Local Interface	
USB	Type B
Maximum cable length	2 meters (less than)
Terminal Block	
CT/VT input	Ring type terminal Ring terminal: M3.5 Cables cross-section: 2.5 mm^2 – 5.5 mm^2
Binary input, Binary output	Compression plug type terminal Cables cross-section: 1.5 mm^2 – 2.5mm^2 (AWG14) Stripping length = 10mm (typical) Ring type terminal Ring terminal: M3.5



Compression plug type



Ring type

System Interface (rear port)	
100BASE-TX	Fast Ethernet
Physical medium	Twisted pair cable, RJ-45 connector
100BASE-FX	Fast Ethernet
Physical medium	50/125 or 62.5/125μm fibre, SC connector
Protocol	IEC 61850

Communication for Miscellaneous (serial communication; rear port)	
RS485	Protocol: IEC 60870-5-103
Connector type	Push-in spring terminal
Cable type	Shielded twisted pair cable

Environmental performance

Atmospheric Environment		
Temperature	IEC 60068-2-1/2 IEC 60068-2-14	Operating range:–25°C to +55°C. Storage / Transit:–25°C to +70°C. Cyclic temperature test as per IEC 60068-2-14
Humidity	IEC 60068-2-30 IEC 60068-2-78	56 days at 40°C and 93% relative humidity. Cyclic temperature with humidity test as per IEC 60068-2-30
Enclosure Protection	IEC 60529	IP52 - Dust and Dripping Water Proof IP20 for rear panel
Mechanical Environment		
Vibration	IEC 60255-21-1	Response - Class 1 Endurance - Class 1
Shock and Bump	IEC 60255-21-2	Shock Response Class 1 Shock Withstand Class 1 Bump Class 1
Seismic	IEC 60255-21-3	Class 1
Electrical Environment		
Dielectric Withstand	IEC 60255-27	2kVrms for 1 minute between all terminals and earth. 2kVrms for 1 minute between independent circuits. 1kVrms for 1 minute across normally open contacts.
High Voltage Impulse	IEC 60255-27 IEEE C37.90	Three positive and three negative impulses of 5kV(peak), 1.2/50μs, 0.5J between all terminals and between all terminals and earth.
Voltage Dips, Interruptions, Variations and Ripple on DC supply	IEC 60255-11, IEC 61000-4-29, IEC 61000-4-17 IEC 60255-26 Ed 3	1. Voltage dips: 0 % residual voltage for 20 ms 40 % residual voltage for 200 ms 70 % residual voltage for 500 ms 2. Voltage interruptions: 0 % residual voltage for 5 s 3. Ripple: 15 % of rated d.c. value, 100 / 120 Hz 4. Gradual shut-down / start-up: 60 s shut-down ramp, 5 min power off, 60s start-up ramp 5. Reversal of d.c. power supply polarity: 1 min
Capacitive Discharge	ENA TS 48-4	10μF charged to maximum supply voltage and discharged into the input terminals with an external resistance

Environmental performance

Electromagnetic Environment		
High Frequency Disturbance / Damped Oscillatory Wave	IEC 60255-22-1 Class 3, IEC 61000-4-18 IEC 60255-26 Ed 3	1 MHz burst in common / differential modes Auxiliary supply and I/O ports: 2.5 kV / 1 kV Communications ports: 1 kV / 0 kV
Electrostatic Discharge	IEC 60255-22-2 Class 4, IEC 61000-4-2 IEEE C37.90.3-2001 IEC 60255-26 Ed 3	Contact: 2, 4, 6, 8kV Air: 2, 4, 8, 15kV
Radiated RF Electromagnetic Disturbance	IEC 60255-22-3, IEC 61000-4-3 Level 3 IEC 60255-26 Ed 3	Sweep test ranges: 80 MHz to 1 GHz and 1.4 GHz to 2.7 GHz. Spot tests at 80, 160, 380, 450, 900, 1850 and 2150 MHz. Field strength: 10 V/m
	IEEE C37.90.2-1995	Field strength 35V/m for frequency sweep of 25MHz to 1GHz.
Fast Transient Disturbance	IEC 60255-22-4 IEC 61000-4-4 IEC 60255-26 Ed 3	5 kHz, 5/50ns disturbance Auxiliary supply and input / output ports: 4 kV Communications ports: 2 kV
Surge Immunity	IEC 60255-22-5 IEC 61000-4-5 IEC 60255-26 Ed 3	1.2/50µms surge in common/differential modes: Auxiliary supply and input / output ports: 4, 2, 1, 0.5 kV / 1, 0.5 kV Communications ports: up to 1, 0.5 kV / 0 kV
Surge Withstand	IEEE C37.90.1-2002	3kV, 1MHZ damped oscillatory wave 4kV, 5/50ns fast transient
Conducted RF Electromagnetic Disturbance	IEC 60255-22-6 IEC 61000-4-6 IEC 60255-26 Ed 3	Sweep test range: 150 kHz to 80MHz Spot tests at 27 and 68 MHz. Voltage level: 10 V r.m.s
Power Frequency Disturbance	IEC 60255-22-7 IEC 61000-4-16 IEC 60255-26 Ed 3	50/60 Hz disturbance for 10 s in common / differential modes† Binary input ports: 300 V / 150 V
Power Frequency Magnetic Field	IEC 61000-4-8 Class 4 IEC 60255-26 Ed 3	Field applied at 50/60Hz with strengths of: 30A/m continuously, 300A/m for 1 second.
Conducted and Radiated Emissions	IEC 60255-25 EN 55022 Class A, EN 61000-6-4 IEC 60255-26 Ed 3	Conducted emissions: 0.15 to 0.50MHz: <79dB (peak) or <66dB (mean) 0.50 to 30MHz: <73dB (peak) or <60dB (mean) Radiated emissions 30 to 230 MHz: < 40 dB(uV/m) 230 to 1000 MHz: < 47 dB(uV/m) Measured at a distance of 10 m

†For differential mode, 'CMP_NUM' setting utilized.

European Commission Directives

European Commission Directives		
CE	2014/30/EU	Compliance with the European Commission Electromagnetic Compatibility Directive is demonstrated according to EN 60255-26:2013
	2014/35/EU	Compliance with the European Commission Low Voltage Directive for electrical safety is demonstrated according EN 60255-27:2014.

Performance and Functional Standards

Performance and Functional Standards	
Category	**Standards**
General	
Common requirements	IEC 60255-1
Data Exchange	IEC 60255-24 / IEEE C37.111 (COMTRADE)
Product Safety	IEC 60255-27

Functional data (Control)

Synchronism Check Function	
Synchronism check angle:	0 – 75° in 1° steps
Frequency difference check:	0.01– 2.00Hz in 0.01Hz steps
Voltage difference check:	1.0 – 150.0V in 0.1V steps
Voltage dead check:	5 – 50V in 1V steps
Voltage live check:	10 – 100V in 1V steps

Power Quality Measurement	
Current harmonic distortion (up to 15th)	± 1.0% In, if Im < 10% In ; ± 10 % Im, if Im>10% In
Voltage harmonic distortion (up to 15th)	± 0.3% Un, if Um<3 % In ; ± 10 % Um, if Um>3% Un

Functional data (Protection)

Directional Phase Overcurrent Protection	
IDMTL Overcurrent threshold:	0.02 – 5.00A in 0.01A steps (1A rating) 0.10 – 25.00A in 0.01A steps (5A rating)
DTL Overcurrent threshold:	0.02 – 50.00A in 0.01A steps (1A rating) 0.10 – 250.00A in 0.01A steps (5A rating)
DO/PU ratio:	10 – 100% in 1% steps
Delay type:	DT, IEC NI, IEC VI, IEC EI, IEC LTI, IEEE MI, IEEE VI, IEEE EI, US CO2 STI, US CO8 I
IDMTL Time Multiplier Setting TMS:	0.010 – 50.000 in 0.001 steps
DTL delay:	0.00 – 300.00s in 0.01s steps
Reset Type:	Definite Time or Dependent Time.
Reset Definite Delay:	0.00 – 300.00s in 0.01s steps
Reset Time Multiplier Setting RTMS:	0.010 – 50.00 in 0.001 steps
Directional Characteristic Angle:	0° to 180° in 1° steps
Polarising voltage	1.0 V(fixed)
Directional Earth Fault Protection	
IDMTL Overcurrent threshold:	0.02 – 5.00A in 0.01A steps (1A rating) 0.10 – 25.00A in 0.01A steps (5A rating)
DTL Overcurrent threshold:	0.02 – 50.00A in 0.01A steps (1A rating) 0.10 – 250.00A in 0.01A steps (5A rating)
DO/PU ratio:	10 – 100% in 1% steps
Delay type:	DT, IEC NI, IEC VI, IEC EI, IEC LTI, IEEE MI, IEEE VI, IEEE EI, US CO2 STI, US CO8 I
IDMTL Time Multiplier Setting TMS:	0.010 – 50.000 in 0.001 steps
DTL delay:	0.00 – 300.00s in 0.01s steps
Reset Type:	Definite Time or Dependent Time.
Reset Definite Delay:	0.00 – 300.00s in 0.01s steps
Reset Time Multiplier Setting RTMS:	0.010 – 50.000 in 0.001 steps
Directional Characteristic Angle:	0° to 180° in 1° steps
Directional Characteristic Polarising Voltage threshold:	0.5 – 100.0V in 0.1V steps
Directional Sensitive Earth Fault Protection	
Overcurrent threshold:	0.002 – 0.200A in 0.001A steps (1A rating) 0.010 – 1.000A in 0.001A steps (5A rating)
Delay Type:	DT, IEC NI, IEC VI, IEC EI, IEC LTI, IEEE MI, IEEE VI, IEEE EI, US CO2 STI, US CO8 I
IDMTL Time Multiplier Setting TMS:	0.010 – 50.000 in 0.001 steps
DTL delay:	0.00 – 300.00s in 0.01s steps
Reset Type:	Definite Time or Dependent Time
Reset Definite Delay:	0.00 – 300.00s in 0.01s steps
Reset Time Multiplier Setting RTMS:	0.010 – 50.000 in 0.001 steps
Directional Characteristic angle:	0° to 180° in 1° steps
Directional Characteristic Boundary of operation:	±87.5°
Directional Characteristic Voltage threshold:	0.5 – 100.0V in 0.1V steps
Residual power threshold:	0.00 – 20.00W in 0.05W (1A rating) 0.00 – 100.00W in 0.25W (5A rating)

Overvoltage Protection	
Overvoltage (OV) thresholds:	1.0 – 220.0V in 0.1V steps
OV delay type:	DTL, IDMTL
OV IDMTL Time Multiplier Setting TMS:	0.010 – 100.000 in 0.001 steps
OV DTL delay:	0.00 – 300.00s in 0.01s steps
DO/PU ratio:	10 – 100% in 1% steps
1st OV Reset Delay:	0.0 – 300.0s in 0.1s steps
Undervoltage Protection	
Undervoltage (UV) thresholds:	5.0 – 130.0V in 0.1V steps
UV delay type:	DTL, IDMTL
UV IDMTL Time Multiplier Setting TMS:	0.010 – 100.000 in 0.001 steps
UV DTL delay:	0.00 – 300.00s in 0.01s steps
UV Reset Delay:	0.0 – 300.0s in 0.1s steps
Under/Over Frequency Protection	
Under/Over frequency threshold:	-10.00 – +10.00Hz in 0.01Hz steps
DTL delay:	0.00 – 300.00s in 0.01s steps
Undervoltage block:	40.0 – 100.0V in 0.1V steps
Voltage Restraint Protection (51V)	
Voltage threshold	10.0 to 120.0V in 0.1V steps
Sensitivity range	20 to 100% of voltage threshold
Thermal Overload Protection	
$I_\theta = k.I_{FLC}$ (Thermal setting):	0.40 – 2.00A in 0.01A steps (1A rating) 2.00 – 10.00A in 0.01A steps (5A rating)
Time constant (τ):	0.5 - 500.0 mins in 0.1min steps
Thermal alarm:	50 - 100% in 1% steps
Accuracy	
IDMTL Overcurrent Pick-up:	Setting value ± 2%
All Other Overcurrent Pick-ups:	Setting value ± 5%
Overcurrent PU/DO ratio:	≥95%
Undercurrent Pick-up:	Setting value ± 2%
Undercurrent PU/DO ratio:	≤105%
IDMTL Overvoltage Pick-up:	Setting value ± 2%
All Other Overvoltage Pick-ups:	Setting value ± 5%
Inverse Time Delays:	± 5% or 30ms (1.5 to 30 times setting)
Definite Time Delays:	± 1% (for more than 50ms setting) or 10ms
Transient Overreach for instant. elements:	< –5% for X/R = 100.

Metering Function	
AC current	Accuracy ± 0.5% (at rating)
DC current	Accuracy ± 0.5% (within the range)
AC voltage	Accuracy ± 0.5% (at rating)
Power (P, Q)	Accuracy ± 1.0% (at rating when power quantities being fed)
Energy (Wh, varh)	Accuracy ± 1.0% (at rating)
Frequency	Accuracy ± 0.03%
GPS Time Synchronisation	
Protocol	SNTP

Cabling

The table below shows the recommended cables in the cross-section and rated-voltage for the connection with the transformer module (VCT), the binary IO module (BI, BO, and BIO), and the power supply module (PWS). Rated-voltage required for the cable is 600Vac.

Table Cables for the connection with module

Connecting for	Wire termination	Wire thickness
BI / BO / PWS	Stripping length = 10 mm (typical)	1.5mm^2 through 2.5 mm^2 or AWG14
VCT	M3.5 ring tongue with insulation	2.5 mm^2 through 5.5 mm^2
Protective earth (FG)	M5 ring tongue with insulation	5.5 mm^2 or larger

Fuses

The table below shows the required fuse in the PWS. DO NOT change the fuse by the user. The fuse is complies with IEC60127-2 Sheet 5.

Table Fuse specification in PWS

Specification	Description
Rated current	3.15A
Rated voltage	500Vac & 400Vdc
Cutoff velocity	Type “T”
Manufacture	Littelfuse, Inc.
Type	04773.15XP

Safety and environment

The table below shows the safety category of the insulation resistance and the environment.

Table Safety and environment requirement

Safety requirement	Definition in IEC	Specification
Insulation resistance	IEC 60255-27	More than 100 M-ohm at 500V d.c.
Protection bonding continuity test	IEC 60255-27	Test current: 10 A a.c. Resistance: less than 0.1 ohm
Protective bonding resistance test	IEC 60255-27	Resistance: less than 0.2 ohm
Creepage distance and clearance	IEC 60255-27	Pollution degree 2 Overvoltage category III
Protective class	IEC 60255-27	Class I

Appendix 7 Interface unit (IFU)

An interface unit (IFU†) is designed to convert the information of binary input and output signals to the information in the IEC 61850 transmission. The IFU consists of binary IO modules, communication modules and power supplies in a 1/3 case in 19 inch rack with control and monitoring applications.

† For ordering, "GBU200-01-122-00-46-10-000; GBU200-0019-462-1E" is defined.

1. Hardware

The code "GBU200-**01-122-00-46-10-000**" defines the IFU hardware. The code also decides the components: a 1/3 case, a BI3A module, a BIO1A module, two 100Base-FX modules, and a power supply module. Respective specifications are shown in chapter *Technical description.* The IFU layout is shown in *Appendix: Typical External connection*.

2. Control and monitoring software (19)

The applications in the IFU are tabulated below; the IFU application can be identified with the code "19" of the "GBU200-00**19**-462-1E". The functional details are discussed in the *Chapter Control and monitoring application*.

Applications	Abbreviations	Function IDs
Common controls	CMNCTRL	5a0001
LED reset	LEDR	528001
Local, remote	LR	530001
Single position device function	SPOS	510001
Double position device function	DPOS	512001
Software switch controller function	SOFTSW	522001
Software Interlock	ILK	570001
Counter function	GCNT	540001
Event detection function	GENBI	580001
Mode control	MDCTRL	550001

3. Communication software

The communication software for LAN and the IEC 61850 is identified in the code "2" of the "GBU200-0019-46**2**-1E". See the chapter *Communication protocol*.

Applications	Abbreviations	Function IDs
IEC 61850 communication	61850	301001
LAN communication	REDLAN	340001, 341001

Appendix 8 Matrix between VCT terminals and relay applications

Matrix table for VCT51B

		Voltage signals and their screw numbers						Current signals and their screw numbers				
		1–2	3–4	5–6	7–8	9–10	11-12	17–18	19–20	21–22	23–24	25–26
Relay applications (Function ID)	Abbreviations	V_{1a}	V_{1b}	V_{1c}	V_0	V3	V4	I_{1a}	I_{1b}	I_{1c}	I_N	I_N SEF
Overcurrent (440001)	OC							X	X	X		
	Directional OC	X	X	X				X	X	X		
Earth fault (441001)	EF										X	
	Directional EF	X	X	X	X1						X	
Sensitive EF (442001)	SEF											X
	Directional SEF	X	X	X	X1							X
Negative sequence OC (443001)	OCN							X	X	X		
	Directional OCN	X	X	X				X	X	X		
Voltage-dependent OC (444001)	OCV	X	X	X				X	X	X		
Undercurrent (450001)	UC							X	X	X		
Thermal overload (451001)	THM							X	X	X		
Broken conductor (452001)	BCD							X	X	X		
Circuit breaker failure (453001)	OC							X	X	X		
	EF										X	
Switch on to fault (454001)	SOTF-OC							X	X	X		
Overvoltage (460101)	OV	X	X	X								
Overvoltage for phases (461101)	OVS	X	X	X								
EF overvoltage (462101)	OVG	X	X	X	X1							
Negative sequence OV (464101)	OVN	X	X	X								
Under-voltage (470101)	UV	X	X	X								

		Voltage signals and their screw numbers						Current signals and their screw numbers				
		1–2	3–4	5–6	7–8	9–10	11-12	17–18	19–20	21–22	23–24	25–26
Relay applications (Function ID)	Abbreviations	V_{1a}	V_{1b}	V_{1c}	V_0	V3	V4	I_{1a}	I_{1b}	I_{1c}	I_N	I_N SEF
Undervoltage for phases(471101)	UVS	X	X	X								
Frequency (475001)	FRQ	X	X	X								
	DFRQ	X	X	X								
Inrush current detection (480001)	ICD							X	X	X		
Protection common (48a001)	UV	X	X	X								
	UVS	X	X	X								
	OCD							X	X	X		
VT failure detection (490001)	UV	X	X	X								
	OVG	X	X	X								
	EF										X	
CT failure detection (491001)	OVG	X	X	X	X1							
	EF							X	X	X		
Fault locator (495001)	FL-A	X	X	X				X	X	X		
Autoreclose (4a7001)	ARC											
Voltage-check (4a8001)	VCHK	X	X	X		X	X					
DRT_LP (4b0001)	OC							X	X	X		
	EF										X	
	UV	X	X	X								
	UVS	X	X	X								
SIGMA_IY (713001)	OC							X	X	X		

Note: X: Applicable

X1: Deriving zero-sequence voltage from the three-phase voltages is applicable.

Blank: Not applicable.

Appendix 9 Rack mounting

Table-1 shows mounting methods for 19" rack; the user can mount non-1/1 case (i.e., 3/4 case, 1/2 case, and 1/3 cases) using optional mounting kits (Table-2). The combined mounting is also available for 1/3 and 1/2 cases. Follow the below steps when mounting:

Step1: Remove the flange(s) on the sides of the case.

Step2: Attach parts of the optional kit; e.g. joint plates, lock bracket, and screws.

Step3: Mount the case for the rack using screws‡

‡Screws are not included in the kit. Prepare the screws by yourself.

Table-1 Methods for rack mounting

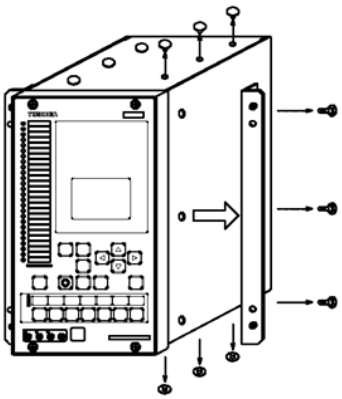
Mounting methods	Applicable sizes
Flush mount	1/3 case, 1/2 case, 3/4 case 1/1 case
Rack mount	1/1 case, 1/3 case†, 1/2 case†, 3/4 case†

†Use a mount kit.

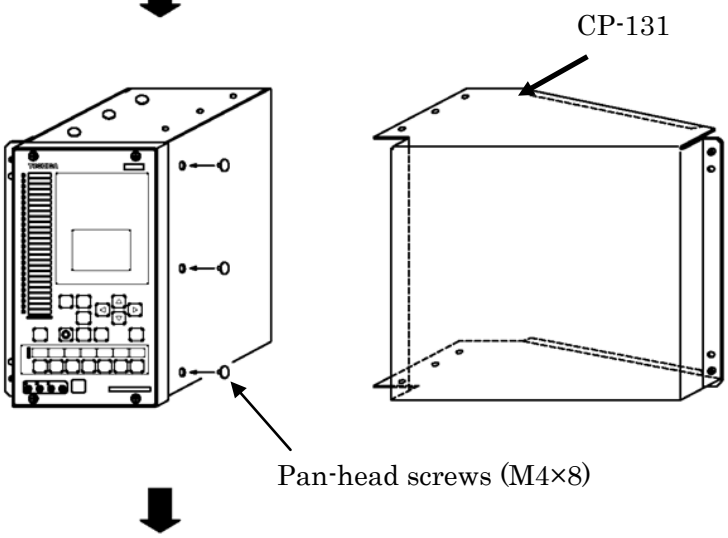
Table-2 Required mounting kits (optional parts)

Mounting for the 19" rack	Optional kit names	Parts codes	References
Simple mounting in a 1/3 case	Joint kits for single 1/3 case	EP−201	Figure-1
Combined mounting in double 1/3 cases	Joint kits for two 1/3 cases	EP−202	Figure-2
Combined mounting in triple 1/3 cases	Joint kits for three 1/3 cases	EP−203	Figure-3
Simple mounting in a 1/2 case	Joint kits for single 1/2 case	EP−204	Figure-4
Combined mounting in double 1/2 cases	Joint kits for two 1/2 case	EP−205	Figure-5
Simple mounting for a 3/4 case	Joint kits for single 3/4 case	EP−206	

Step 1



Step 2



Step 3

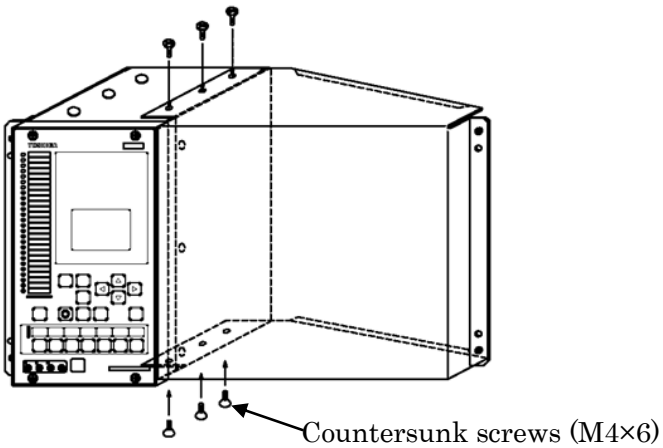


Figure-1 Mounting a 1/3 case for the 19" rack

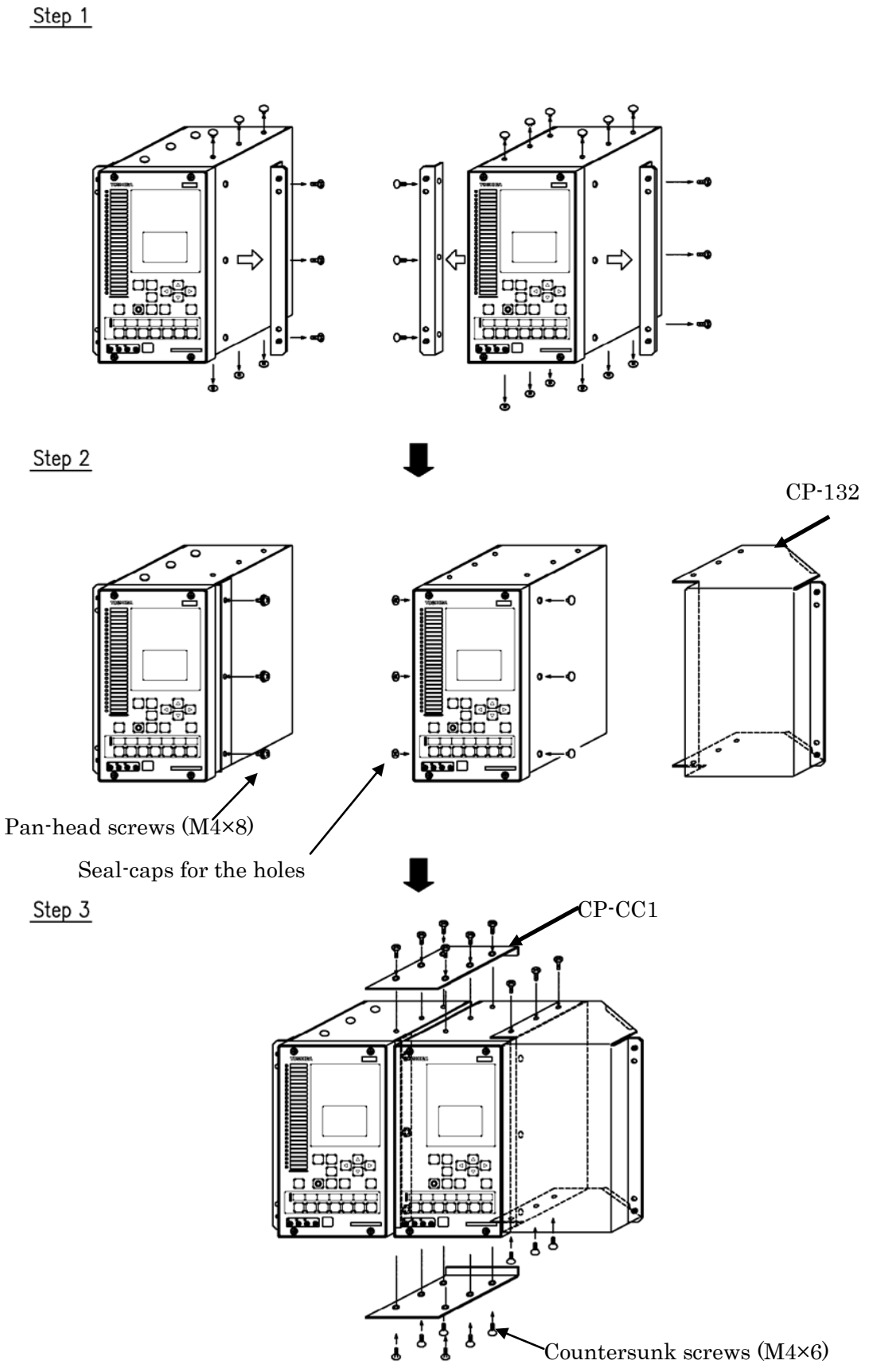


Figure-2 Mounting double 1/3 cases for the rack

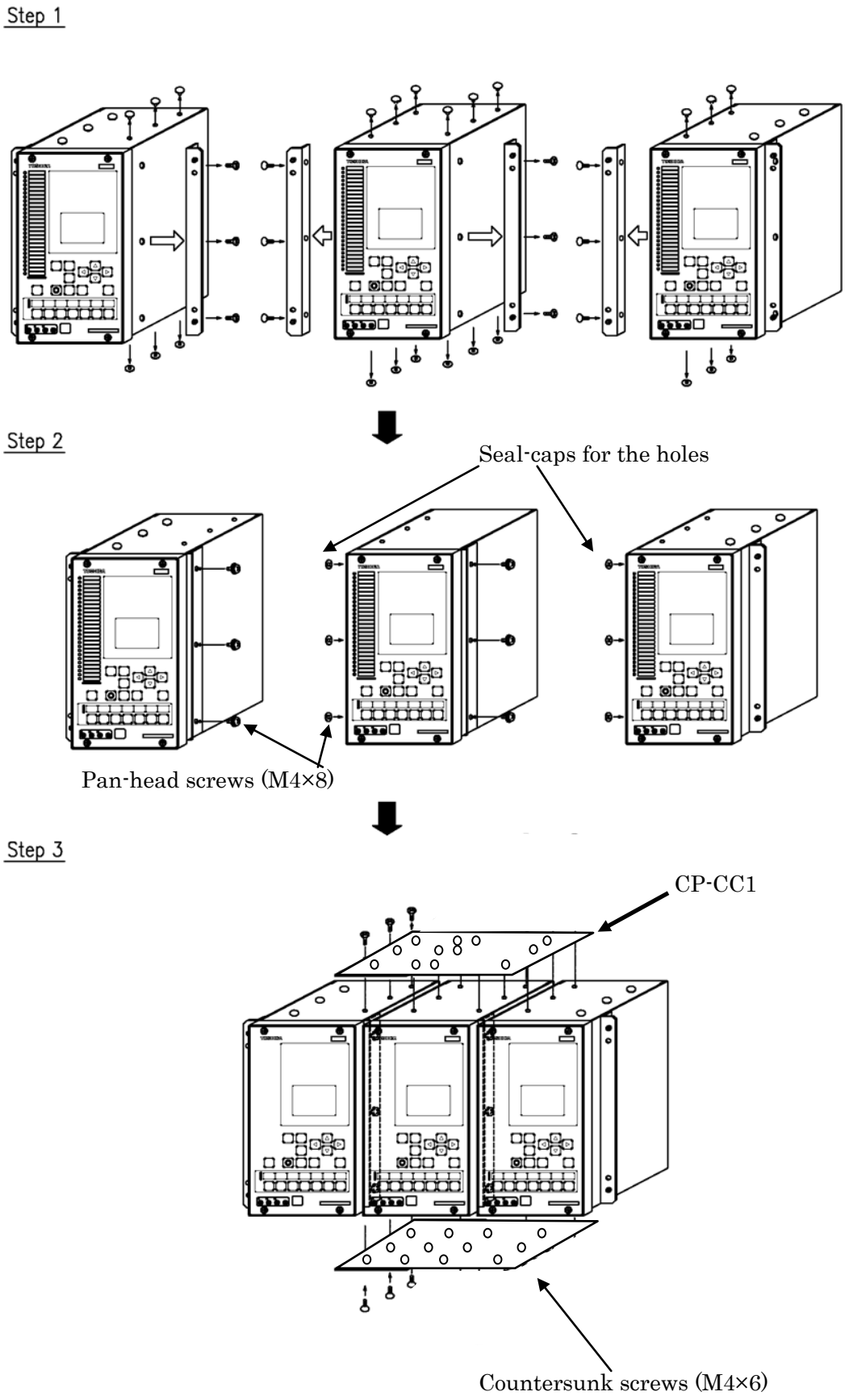


Figure-3 Mounting triple 1/3 cases for the rack

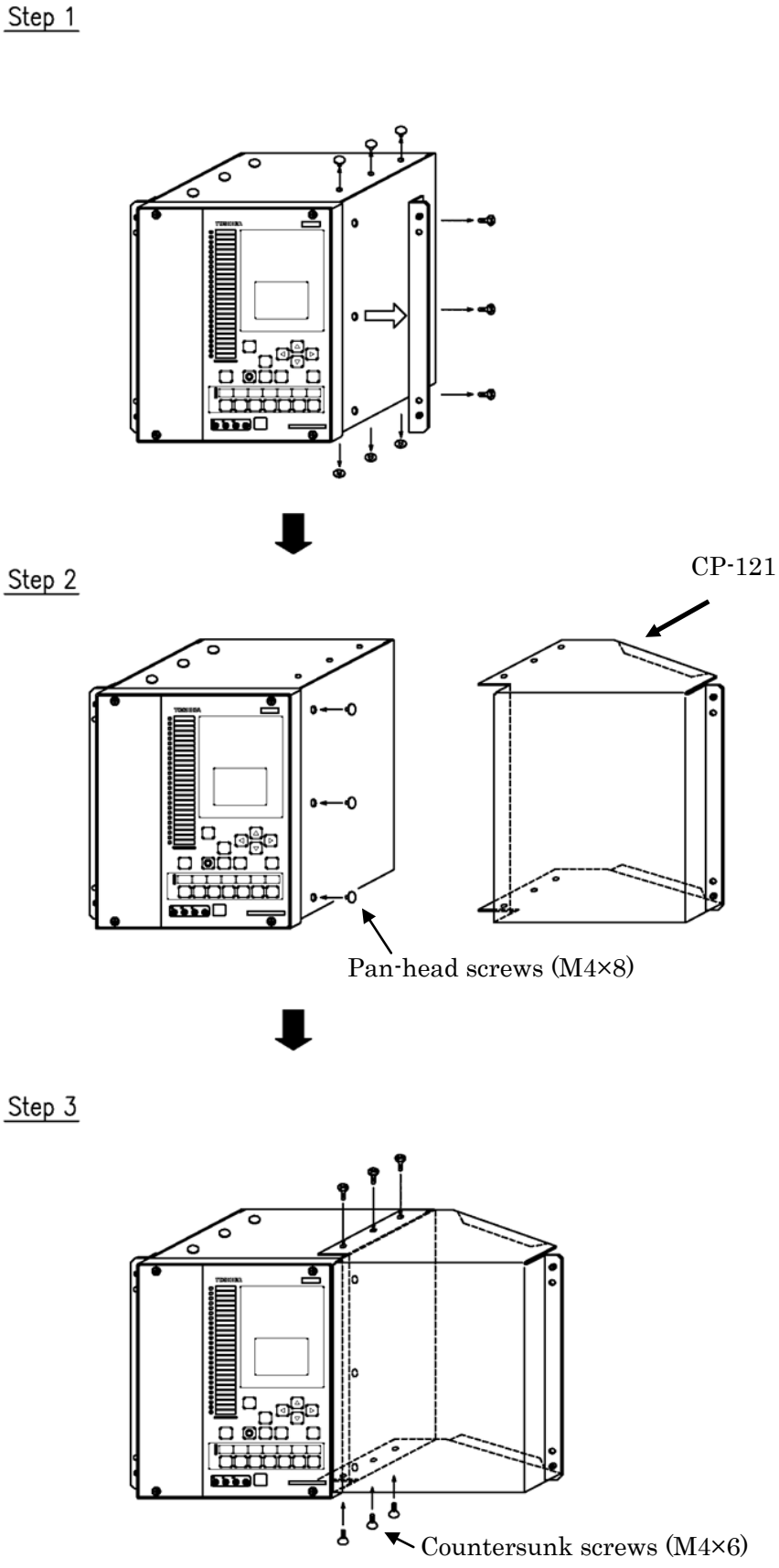


Figure-4 Mounting a 1/2 case for the rack

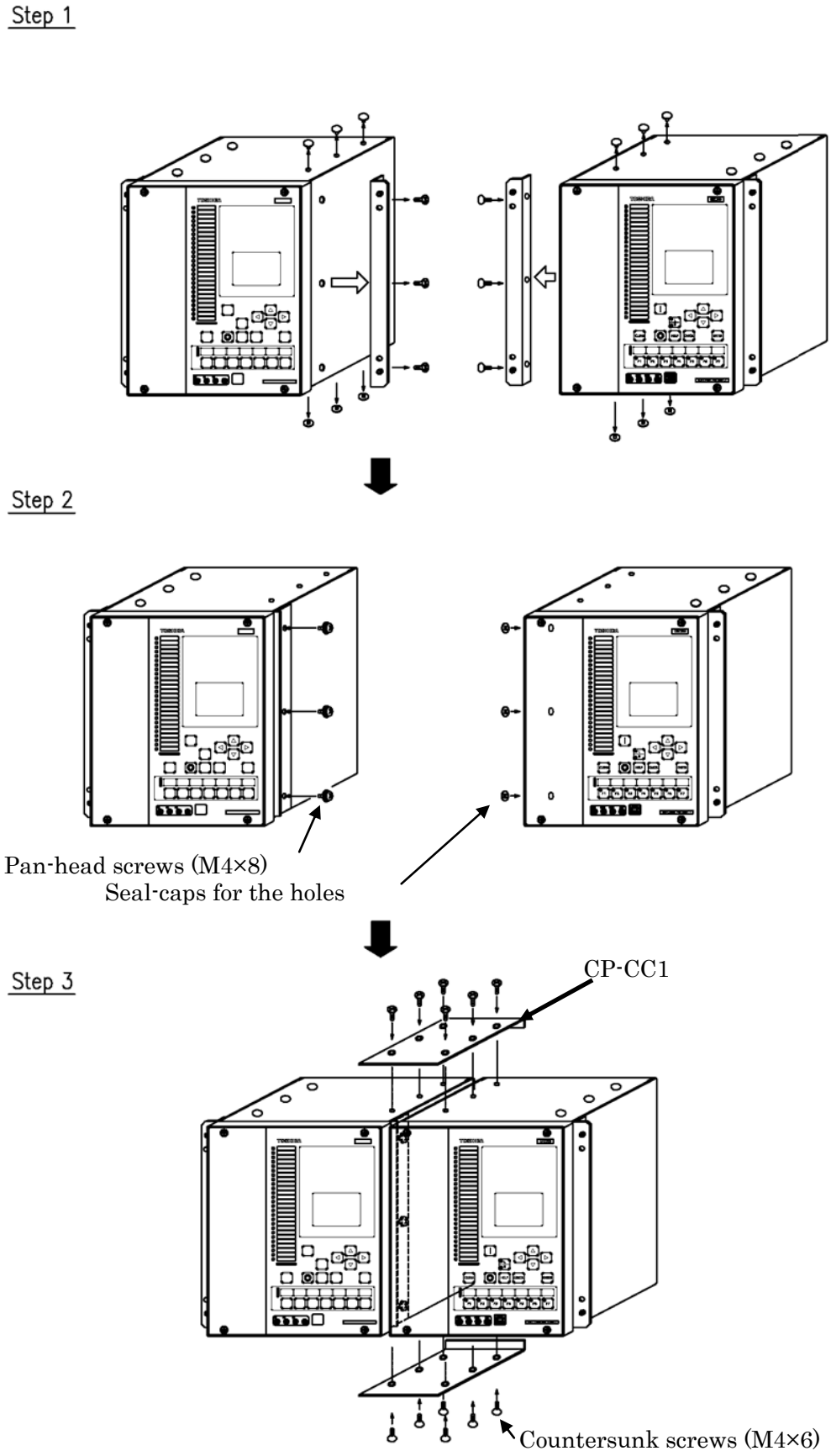


Figure-5 Mounting double 1/2 case for the rack

Appendix 10 CT requirement

1. CT requirement in overcurrent (OC) and earth-fault (EF) protection functions

(i) Standard accuracy class

Protection class current transformers are normally specified in the form shown in Figure 1-1. The CT transforms primary current within the specified accuracy limit, for primary current up to the overcurrent factor, when connected to a secondary circuit of the given burden.

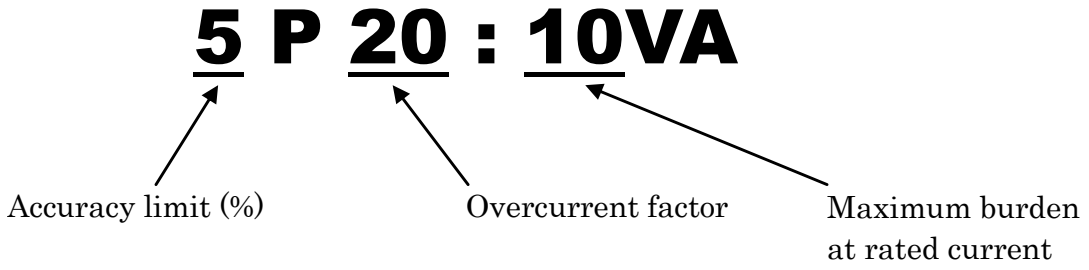


Figure 1-1 Accuracy class of CT

The CT transforms primary current within the specified accuracy limit, for primary current up to the overcurrent factor, when connected to a secondary circuit of the given burden.

Accuracy limit: Typically 5 or 10%. In applications where current grading is to be applied and small grading steps are desirable, then a 5% CT can assist in achieving the necessary accuracy. In less onerous applications, a limit of 10% may be acceptable.

Overcurrent factor: The multiple of the CT rating up to which the accuracy limit is claimed, typically 10 or 20 times. A value of 20 should be specified where maximum fault current is high and accurate inverse time grading is required. In applications where fault current is relatively low, or where inverse time grading is not used, then an overcurrent factor of 10 may be adequate.

Maximum burden: The total burden calculated at rated secondary current of all equipment connected to the CT secondary, including relay input burden, lead burden, and taking the CT's own secondary resistance into account. It is applied that an extremely low AC current burden (typically less than 0.1VA for a 1A phase input) allowing relatively low burden CTs. Relay burden does not vary with settings.

If a burden lower than the maximum specified is connected, the practical overcurrent factor may be scaled accordingly. For the example given above, at a 1A rated current, the maximum value of CT secondary resistance plus secondary circuit resistance (RCT + R2) should be 10 ohms. If a lower value of, say, ($R_{CT} + R_2$) = 5 ohm is applied, then the practical overcurrent factor may be increased by a factor of two, that is, to 40 amperes.

In summary, the example given of a 5P20 CT of suitable rated burden will meet most applications of high fault current and tight grading margins. Many less severe applications

may be served by 5P10 or 10P10 transformers.

(ii) Minimum knee point voltage

An alternative method of specifying a CT is to calculate the minimum knee point voltage, according to the secondary current which will flow during fault conditions:

$$V_k \geq I_f \times (R_{CT} + R_2) \qquad (1\text{–}1)$$

where,

V_k: Knee point voltage
I_f: Maximum secondary fault current
R_{CT}: Resistance of CT secondary winding
R_2 Secondary circuit resistance, including lead resistance

When using this method, it should be noted that it is often not necessary to transform the maximum fault current accurately. The knee point should be chosen with consideration of the settings to be applied and the likely effect of any saturation on protection performance. Further, care should be taken when determining R_2, as this is dependent on the method used to connect the CTs (e.g. residual connection, core balanced CT connection, etc.).

2. CT requirement in sensitive earth-fault (SEF) protection function

A core balance CT should be applied, with a minimum knee point calculated as described in Equation (1–1)

3. CT requirement in restricted earth-fault (REF) protection function

High accuracy CTs should be selected with a knee point voltage (V_k) chosen according to Equation (1–2):

$$V_k \geq 2 \times V_s \qquad (1\text{–}2)$$

where,

V_s: The differential stability voltage setting for the scheme

Appendix 11 PLC_BITs for control and monitoring applications

The PLC_BITs, described in the main control and monitoring application chapter, are provided to connect the user's custom logics with control functions implemented in other CPUs. These drivers allow the user to exchanging data between the main-CPU and the sub-CPUs. The following table is the summary of PLC_BITs; and their functions are available when the PLC function runs.

DataIDs	Connections	Meaning	Monitoring	FB	Destinations
5A0101 800000EF40	PLC_BIT_0001	Control right established at SPOS	5A0101 8000001F40	SPOS	SPOS01IN_TMP_28
5A0101 800001EF40	PLC_BIT_0002	Control right established at SPOS	5A0101 8000011F40	SPOS	SPOS02IN_TMP_28
5A0101 800002EF40	PLC_BIT_0003	Control right established at SPOS	5A0101 8000021F40	SPOS	SPOS03IN_TMP_28
5A0101 800003EF40	PLC_BIT_0004	Control right established at SPOS	5A0101 8000031F40	SPOS	SPOS04IN_TMP_28
5A0101 800004EF40	PLC_BIT_0005	Control right established at SPOS	5A0101 8000041F40	SPOS	SPOS05IN_TMP_28
5A0101 800005EF40	PLC_BIT_0006	Control right established at SPOS	5A0101 8000051F40	SPOS	SPOS06IN_TMP_28
5A0101 800006EF40	PLC_BIT_0007	Control right established at SPOS	5A0101 8000061F40	SPOS	SPOS07IN_TMP_28
5A0101 800007EF40	PLC_BIT_0008	Control right established at SPOS	5A0101 8000071F40	SPOS	SPOS08IN_TMP_28
5A0101 800008EF40	PLC_BIT_0009	Control right established at SPOS	5A0101 8000081F40	SPOS	SPOS09IN_TMP_28
5A0101 800009EF40	PLC_BIT_0010	Control right established at SPOS	5A0101 8000091F40	SPOS	SPOS10IN_TMP_28
5A0101 800010EF40	PLC_BIT_0011	Command to switch Off at SPOS	5A0101 8000101F40	SPOS	DEV01_OP_COMMAND
5A0101 800011EF40	PLC_BIT_0012	Command to switch Off with interlock at SPOS	5A0101 8000111F40	SPOS	DEV01_OP_INTERLOCK
5A0101 800012EF40	PLC_BIT_0013	Command to switch On unconditionally at SPOS	5A0101 8000121F40	SPOS	DEV01_CL_COMMAND
5A0101 800013EF40	PLC_BIT_0014	Command to switch On with interlock at SPOS	5A0101 8000131F40	SPOS	DEV01_CL_INTERLOCK
5A0101 800014EF40	PLC_BIT_0015	Command to switch Off at SPOS	5A0101 8000141F40	SPOS	DEV02_OP_COMMAND
5A0101 800015EF40	PLC_BIT_0016	Command to switch Off with interlock at SPOS	5A0101 8000151F40	SPOS	DEV02_OP_INTERLOCK
5A0101 800016EF40	PLC_BIT_0017	Command to switch On unconditionally at SPOS	5A0101 8000161F40	SPOS	DEV02_CL_COMMAND
5A0101 800017EF40	PLC_BIT_0018	Command to switch On with interlock at SPOS	5A0101 8000171F40	SPOS	DEV02_CL_INTERLOCK
5A0101 800018EF40	PLC_BIT_0019	Command to switch Off at SPOS	5A0101 8000181F40	SPOS	DEV03_OP_COMMAND
5A0101 800019EF40	PLC_BIT_0020	Command to switch Off with interlock at SPOS	5A0101 8000191F40	SPOS	DEV03_OP_INTERLOCK
5A0101 800020EF40	PLC_BIT_0021	Command to switch On unconditionally at SPOS	5A0101 8000201F40	SPOS	DEV03_CL_COMMAND
5A0101 800021EF40	PLC_BIT_0022	Command to switch On with interlock at SPOS	5A0101 8000211F40	SPOS	DEV03_CL_INTERLOCK
5A0101 800022EF40	PLC_BIT_0023	Command to switch Off at SPOS	5A0101 8000221F40	SPOS	DEV04_OP_COMMAND
5A0101 800023EF40	PLC_BIT_0024	Command to switch Off with interlock at SPOS	5A0101 8000231F40	SPOS	DEV04_OP_INTERLOCK
5A0101 800024EF40	PLC_BIT_0025	Command to switch On unconditionally at SPOS	5A0101 8000241F40	SPOS	DEV04_CL_COMMAND
5A0101 800025EF40	PLC_BIT_0026	Command to switch On with interlock at SPOS	5A0101 8000251F40	SPOS	DEV04_CL_INTERLOCK
5A0101 800026EF40	PLC_BIT_0027	Command to switch Off at SPOS	5A0101 8000261F40	SPOS	DEV05_OP_COMMAND
5A0101 800027EF40	PLC_BIT_0028	Command to switch Off with interlock at SPOS	5A0101 8000271F40	SPOS	DEV05_OP_INTERLOCK
5A0101 800028EF40	PLC_BIT_0029	Command to switch On unconditionally at SPOS	5A0101 8000281F40	SPOS	DEV05_CL_COMMAND
5A0101 800029EF40	PLC_BIT_0030	Command to switch On with interlock at SPOS	5A0101 8000291F40	SPOS	DEV05_CL_INTERLOCK
5A0101 800030EF40	PLC_BIT_0031	Command to switch Off at SPOS	5A0101 8000301F40	SPOS	DEV06_OP_COMMAND
5A0101 800031EF40	PLC_BIT_0032	Command to switch Off with interlock at SPOS	5A0101 8000311F40	SPOS	DEV06_OP_INTERLOCK
5A0101 800032EF40	PLC_BIT_0033	Command to switch On unconditionally at SPOS	5A0101 8000321F40	SPOS	DEV06_CL_COMMAND
5A0101 800033EF40	PLC_BIT_0034	Command to switch On with interlock at SPOS	5A0101 8000331F40	SPOS	DEV06_CL_INTERLOCK
5A0101 800034EF40	PLC_BIT_0035	Command to switch Off at SPOS	5A0101 8000341F40	SPOS	DEV07_OP_COMMAND
5A0101 800035EF40	PLC_BIT_0036	Command to switch Off with interlock at SPOS	5A0101 8000351F40	SPOS	DEV07_OP_INTERLOCK
5A0101 800036EF40	PLC_BIT_0037	Command to switch On unconditionally at SPOS	5A0101 8000361F40	SPOS	DEV07_CL_COMMAND
5A0101 800037EF40	PLC_BIT_0038	Command to switch On with interlock at SPOS	5A0101 8000371F40	SPOS	DEV07_CL_INTERLOCK
5A0101 800038EF40	PLC_BIT_0039	Command to switch Off at SPOS	5A0101 8000381F40	SPOS	DEV08_OP_COMMAND
5A0101 800039EF40	PLC_BIT_0040	Command to switch Off with interlock at SPOS	5A0101 8000391F40	SPOS	DEV08_OP_INTERLOCK
5A0101 800040EF40	PLC_BIT_0041	Command to switch On unconditionally at SPOS	5A0101 8000401F40	SPOS	DEV08_CL_COMMAND
5A0101 800041EF40	PLC_BIT_0042	Command to switch On with interlock at SPOS	5A0101 8000411F40	SPOS	DEV08_CL_INTERLOCK
5A0101 800042EF40	PLC_BIT_0043	Command to switch Off at SPOS	5A0101 8000421F40	SPOS	DEV09_OP_COMMAND
5A0101 800043EF40	PLC_BIT_0044	Command to switch Off with interlock at SPOS	5A0101 8000431F40	SPOS	DEV09_OP_INTERLOCK
5A0101 800044EF40	PLC_BIT_0045	Command to switch On unconditionally at SPOS	5A0101 8000441F40	SPOS	DEV09_CL_COMMAND
5A0101 800045EF40	PLC_BIT_0046	Command to switch On with interlock at SPOS	5A0101 8000451F40	SPOS	DEV09_CL_INTERLOCK
5A0101 800046EF40	PLC_BIT_0047	Command to switch Off at SPOS	5A0101 8000461F40	SPOS	DEV10_OP_COMMAND
5A0101 800047EF40	PLC_BIT_0048	Command to switch Off with interlock at SPOS	5A0101 8000471F40	SPOS	DEV10_OP_INTERLOCK
5A0101 800048EF40	PLC_BIT_0049	Command to switch On unconditionally at SPOS	5A0101 8000481F40	SPOS	DEV10_CL_COMMAND
5A0101 800049EF40	PLC_BIT_0050	Command to switch On with interlock at SPOS	5A0101 8000491F40	SPOS	DEV10_CL_INTERLOCK
5A0101 800050EF40	PLC_BIT_0051	Condition of selection completed in SPOS (in PLC)	5A0101 8000501F40	SPOS	SPOS01IN_TMP_29
5A0101 800051EF40	PLC_BIT_0052	Condition of Selection failure at SPOS (in PLC)	5A0101 8000511F40	SPOS	SPOS01IN_TMP_30
5A0101 800052EF40	PLC_BIT_0053	Reason of selection failure at SPOS (in Fixed source)	5A0101 8000521F40	SPOS	SPOS01IN_TMP_31
5A0101 800053EF40	PLC_BIT_0054	Reason of selection failure at SPOS	5A0101 8000531F40	SPOS	SPOS01IN_TMP_32
5A0101 800054EF40	PLC_BIT_0055	Condition of cancel selection at SPOS (in PLC)	5A0101 8000541F40	SPOS	SPOS01IN_TMP_33
5A0101 800055EF40	PLC_BIT_0056	Condition for controlling OFF at SPOS (in PLC)	5A0101 8000551F40	SPOS	SPOS01IN_TMP_34
5A0101 800056EF40	PLC_BIT_0057	Condition for controlling ON at SPOS (in PLC)	5A0101 8000561F40	SPOS	SPOS01IN_TMP_35
5A0101 800057EF40	PLC_BIT_0058	Failure condition for controlling OFF at SPOS (in PLC)	5A0101 8000571F40	SPOS	SPOS01IN_TMP_37
5A0101 800058EF40	PLC_BIT_0059	Failure condition for controlling ON at SPOS (in PLC)	5A0101 8000581F40	SPOS	SPOS01IN_TMP_38
5A0101 800059EF40	PLC_BIT_0060	Reason of selection failure at SPOS (in Fixed source)	5A0101 8000591F40	SPOS	SPOS01IN_TMP_40
5A0101 800060EF40	PLC_BIT_0061	Reason of selection failure at SPOS	5A0101 8000601F40	SPOS	SPOS01IN_TMP_41
5A0101 800061EF40	PLC_BIT_0062	Control output on BO circuit for SPOS	5A0101 8000611F40	SPOS	SPOS01IN_TMP_42
5A0101 800062EF40	PLC_BIT_0063	Success for controlling at SPOS (in PLC)	5A0101 8000621F40	SPOS	SPOS01IN_TMP_44
5A0101 800063EF40	PLC_BIT_0064	Failure for controlling at SPOS (in PLC)	5A0101 8000631F40	SPOS	SPOS01IN_TMP_45
5A0101 800064EF40	PLC_BIT_0065	Cancel reason for controlling at SPOS (in PLC)	5A0101 8000641F40	SPOS	SPOS01IN_TMP_46
5A0101 800065EF40	PLC_BIT_0066	Condition of selection completed in SPOS (in PLC)	5A0101 8000651F40	SPOS	SPOS02IN_TMP_29
5A0101 800066EF40	PLC_BIT_0067	Condition of Selection failure at SPOS (in PLC)	5A0101 8000661F40	SPOS	SPOS02IN_TMP_30
5A0101 800067EF40	PLC_BIT_0068	Reason of selection failure at SPOS (in Fixed source)	5A0101 8000671F40	SPOS	SPOS02IN_TMP_31
5A0101 800068EF40	PLC_BIT_0069	Reason of selection failure at SPOS	5A0101 8000681F40	SPOS	SPOS02IN_TMP_32
5A0101 800069EF40	PLC_BIT_0070	Condition of cancel selection at SPOS (in PLC)	5A0101 8000691F40	SPOS	SPOS02IN_TMP_33
5A0101 800070EF40	PLC_BIT_0071	Condition for controlling OFF at SPOS (in PLC)	5A0101 8000701F40	SPOS	SPOS02IN_TMP_34
5A0101 800071EF40	PLC_BIT_0072	Condition for controlling ON at SPOS (in PLC)	5A0101 8000711F40	SPOS	SPOS02IN_TMP_35
5A0101 800072EF40	PLC_BIT_0073	Failure condition for controlling OFF at SPOS (in PLC)	5A0101 8000721F40	SPOS	SPOS02IN_TMP_37
5A0101 800073EF40	PLC_BIT_0074	Failure condition for controlling ON at SPOS (in PLC)	5A0101 8000731F40	SPOS	SPOS02IN_TMP_38
5A0101 800074EF40	PLC_BIT_0075	Reason of selection failure at SPOS (in Fixed source)	5A0101 8000741F40	SPOS	SPOS02IN_TMP_40
5A0101 800075EF40	PLC_BIT_0076	Reason of selection failure at SPOS	5A0101 8000751F40	SPOS	SPOS02IN_TMP_41
5A0101 800076EF40	PLC_BIT_0077	Control output on BO circuit for SPOS	5A0101 8000761F40	SPOS	SPOS02IN_TMP_42
5A0101 800077EF40	PLC_BIT_0078	Success for controlling at SPOS (in PLC)	5A0101 8000771F40	SPOS	SPOS02IN_TMP_44
5A0101 800078EF40	PLC_BIT_0079	Failure for controlling at SPOS (in PLC)	5A0101 8000781F40	SPOS	SPOS02IN_TMP_45
5A0101 800079EF40	PLC_BIT_0080	Cancel reason for controlling at SPOS (in PLC)	5A0101 8000791F40	SPOS	SPOS02IN_TMP_46
5A0101 800080EF40	PLC_BIT_0081	Condition of selection completed in SPOS (in PLC)	5A0101 8000801F40	SPOS	SPOS03IN_TMP_29
5A0101 800081EF40	PLC_BIT_0082	Condition of Selection failure at SPOS (in PLC)	5A0101 8000811F40	SPOS	SPOS03IN_TMP_30

DataIDs	Connections	Meaning	Monitoring	FB	Destinations
5A0101 800082EF40	PLC_BIT_0083	Reason of selection failure at SPOS (in Fixed source)	5A0101 8000821F40	SPOS	SPOS03IN_TMP_31
5A0101 800083EF40	PLC_BIT_0084	Reason of selection failure at SPOS	5A0101 8000831F40	SPOS	SPOS03IN_TMP_32
5A0101 800084EF40	PLC_BIT_0085	Condition of cancel selection at SPOS (in PLC)	5A0101 8000841F40	SPOS	SPOS03IN_TMP_33
5A0101 800085EF40	PLC_BIT_0086	Condition for controlling OFF at SPOS (in PLC)	5A0101 8000851F40	SPOS	SPOS03IN_TMP_34
5A0101 800086EF40	PLC_BIT_0087	Condition for controlling ON at SPOS (in PLC)	5A0101 8000861F40	SPOS	SPOS03IN_TMP_35
5A0101 800087EF40	PLC_BIT_0088	Failure condition for controlling OFF at SPOS (in PLC)	5A0101 8000871F40	SPOS	SPOS03IN_TMP_37
5A0101 800088EF40	PLC_BIT_0089	Failure condition for controlling ON at SPOS (in PLC)	5A0101 8000881F40	SPOS	SPOS03IN_TMP_38
5A0101 800089EF40	PLC_BIT_0090	Reason of selection failure at SPOS (in Fixed source)	5A0101 8000891F40	SPOS	SPOS03IN_TMP_40
5A0101 800090EF40	PLC_BIT_0091	Reason of selection failure at SPOS	5A0101 8000901F40	SPOS	SPOS03IN_TMP_41
5A0101 800091EF40	PLC_BIT_0092	Control output on BO circuit for SPOS	5A0101 8000911F40	SPOS	SPOS03IN_TMP_42
5A0101 800092EF40	PLC_BIT_0093	Success for controlling at SPOS (in PLC)	5A0101 8000921F40	SPOS	SPOS03IN_TMP_44
5A0101 800093EF40	PLC_BIT_0094	Failure for controlling at SPOS (in PLC)	5A0101 8000931F40	SPOS	SPOS03IN_TMP_45
5A0101 800094EF40	PLC_BIT_0095	Cancel reason for controlling at SPOS (in PLC)	5A0101 8000941F40	SPOS	SPOS03IN_TMP_46
5A0101 800095EF40	PLC_BIT_0096	Condition of selection completed in SPOS (in PLC)	5A0101 8000951F40	SPOS	SPOS04IN_TMP_29
5A0101 800096EF40	PLC_BIT_0097	Condition of Selection failure at SPOS (in PLC)	5A0101 8000961F40	SPOS	SPOS04IN_TMP_30
5A0101 800097EF40	PLC_BIT_0098	Reason of selection failure at SPOS (in Fixed source)	5A0101 8000971F40	SPOS	SPOS04IN_TMP_31
5A0101 800098EF40	PLC_BIT_0099	Reason of selection failure at SPOS	5A0101 8000981F40	SPOS	SPOS04IN_TMP_32
5A0101 800099EF40	PLC_BIT_0100	Condition of cancel selection at SPOS (in PLC)	5A0101 8000991F40	SPOS	SPOS04IN_TMP_33
5A0101 800100EF40	PLC_BIT_0101	Condition for controlling OFF at SPOS (in PLC)	5A0101 8001001F40	SPOS	SPOS04IN_TMP_34
5A0101 800101EF40	PLC_BIT_0102	Condition for controlling ON at SPOS (in PLC)	5A0101 8001011F40	SPOS	SPOS04IN_TMP_35
5A0101 800102EF40	PLC_BIT_0103	Failure condition for controlling OFF at SPOS (in PLC)	5A0101 8001021F40	SPOS	SPOS04IN_TMP_37
5A0101 800103EF40	PLC_BIT_0104	Failure condition for controlling ON at SPOS (in PLC)	5A0101 8001031F40	SPOS	SPOS04IN_TMP_38
5A0101 800104EF40	PLC_BIT_0105	Reason of selection failure at SPOS (in Fixed source)	5A0101 8001041F40	SPOS	SPOS04IN_TMP_40
5A0101 800105EF40	PLC_BIT_0106	Reason of selection failure at SPOS	5A0101 8001051F40	SPOS	SPOS04IN_TMP_41
5A0101 800106EF40	PLC_BIT_0107	Control output on BO circuit for SPOS	5A0101 8001061F40	SPOS	SPOS04IN_TMP_42
5A0101 800107EF40	PLC_BIT_0108	Success for controlling at SPOS (in PLC)	5A0101 8001071F40	SPOS	SPOS04IN_TMP_44
5A0101 800108EF40	PLC_BIT_0109	Failure for controlling at SPOS (in PLC)	5A0101 8001081F40	SPOS	SPOS04IN_TMP_45
5A0101 800109EF40	PLC_BIT_0110	Cancel reason for controlling at SPOS (in PLC)	5A0101 8001091F40	SPOS	SPOS04IN_TMP_46
5A0101 800110EF40	PLC_BIT_0111	Condition of selection completed in SPOS (in PLC)	5A0101 8001101F40	SPOS	SPOS05IN_TMP_29
5A0101 800111EF40	PLC_BIT_0112	Condition of Selection failure at SPOS (in PLC)	5A0101 8001111F40	SPOS	SPOS05IN_TMP_30
5A0101 800112EF40	PLC_BIT_0113	Reason of selection failure at SPOS (in Fixed source)	5A0101 8001121F40	SPOS	SPOS05IN_TMP_31
5A0101 800113EF40	PLC_BIT_0114	Reason of selection failure at SPOS	5A0101 8001131F40	SPOS	SPOS05IN_TMP_32
5A0101 800114EF40	PLC_BIT_0115	Condition of cancel selection at SPOS (in PLC)	5A0101 8001141F40	SPOS	SPOS05IN_TMP_33
5A0101 800115EF40	PLC_BIT_0116	Condition for controlling OFF at SPOS (in PLC)	5A0101 8001151F40	SPOS	SPOS05IN_TMP_34
5A0101 800116EF40	PLC_BIT_0117	Condition for controlling ON at SPOS (in PLC)	5A0101 8001161F40	SPOS	SPOS05IN_TMP_35
5A0101 800117EF40	PLC_BIT_0118	Failure condition for controlling OFF at SPOS (in PLC)	5A0101 8001171F40	SPOS	SPOS05IN_TMP_37
5A0101 800118EF40	PLC_BIT_0119	Failure condition for controlling ON at SPOS (in PLC)	5A0101 8001181F40	SPOS	SPOS05IN_TMP_38
5A0101 800119EF40	PLC_BIT_0120	Reason of selection failure at SPOS (in Fixed source)	5A0101 8001191F40	SPOS	SPOS05IN_TMP_40
5A0101 800120EF40	PLC_BIT_0121	Reason of selection failure at SPOS	5A0101 8001201F40	SPOS	SPOS05IN_TMP_41
5A0101 800121EF40	PLC_BIT_0122	Control output on BO circuit for SPOS	5A0101 8001211F40	SPOS	SPOS05IN_TMP_42
5A0101 800122EF40	PLC_BIT_0123	Success for controlling at SPOS (in PLC)	5A0101 8001221F40	SPOS	SPOS05IN_TMP_44
5A0101 800123EF40	PLC_BIT_0124	Failure for controlling at SPOS (in PLC)	5A0101 8001231F40	SPOS	SPOS05IN_TMP_45
5A0101 800124EF40	PLC_BIT_0125	Cancel reason for controlling at SPOS (in PLC)	5A0101 8001241F40	SPOS	SPOS05IN_TMP_46
5A0101 800125EF40	PLC_BIT_0126	Condition of selection completed in SPOS (in PLC)	5A0101 8001251F40	SPOS	SPOS06IN_TMP_29
5A0101 800126EF40	PLC_BIT_0127	Condition of Selection failure at SPOS (in PLC)	5A0101 8001261F40	SPOS	SPOS06IN_TMP_30
5A0101 800127EF40	PLC_BIT_0128	Reason of selection failure at SPOS (in Fixed source)	5A0101 8001271F40	SPOS	SPOS06IN_TMP_31
5A0101 800128EF40	PLC_BIT_0129	Reason of selection failure at SPOS	5A0101 8001281F40	SPOS	SPOS06IN_TMP_32
5A0101 800129EF40	PLC_BIT_0130	Condition of cancel selection at SPOS (in PLC)	5A0101 8001291F40	SPOS	SPOS06IN_TMP_33
5A0101 800130EF40	PLC_BIT_0131	Condition for controlling OFF at SPOS (in PLC)	5A0101 8001301F40	SPOS	SPOS06IN_TMP_34
5A0101 800131EF40	PLC_BIT_0132	Condition for controlling ON at SPOS (in PLC)	5A0101 8001311F40	SPOS	SPOS06IN_TMP_35
5A0101 800132EF40	PLC_BIT_0133	Failure condition for controlling OFF at SPOS (in PLC)	5A0101 8001321F40	SPOS	SPOS06IN_TMP_37
5A0101 800133EF40	PLC_BIT_0134	Failure condition for controlling ON at SPOS (in PLC)	5A0101 8001331F40	SPOS	SPOS06IN_TMP_38
5A0101 800134EF40	PLC_BIT_0135	Reason of selection failure at SPOS (in Fixed source)	5A0101 8001341F40	SPOS	SPOS06IN_TMP_40
5A0101 800135EF40	PLC_BIT_0136	Reason of selection failure at SPOS	5A0101 8001351F40	SPOS	SPOS06IN_TMP_41
5A0101 800136EF40	PLC_BIT_0137	Control output on BO circuit for SPOS	5A0101 8001361F40	SPOS	SPOS06IN_TMP_42
5A0101 800137EF40	PLC_BIT_0138	Success for controlling at SPOS (in PLC)	5A0101 8001371F40	SPOS	SPOS06IN_TMP_44
5A0101 800138EF40	PLC_BIT_0139	Failure for controlling at SPOS (in PLC)	5A0101 8001381F40	SPOS	SPOS06IN_TMP_45
5A0101 800139EF40	PLC_BIT_0140	Cancel reason for controlling at SPOS (in PLC)	5A0101 8001391F40	SPOS	SPOS06IN_TMP_46
5A0101 800140EF40	PLC_BIT_0141	Condition of selection completed in SPOS (in PLC)	5A0101 8001401F40	SPOS	SPOS07IN_TMP_29
5A0101 800141EF40	PLC_BIT_0142	Condition of Selection failure at SPOS (in PLC)	5A0101 8001411F40	SPOS	SPOS07IN_TMP_30
5A0101 800142EF40	PLC_BIT_0143	Reason of selection failure at SPOS (in Fixed source)	5A0101 8001421F40	SPOS	SPOS07IN_TMP_31
5A0101 800143EF40	PLC_BIT_0144	Reason of selection failure at SPOS	5A0101 8001431F40	SPOS	SPOS07IN_TMP_32
5A0101 800144EF40	PLC_BIT_0145	Condition of cancel selection at SPOS (in PLC)	5A0101 8001441F40	SPOS	SPOS07IN_TMP_33
5A0101 800145EF40	PLC_BIT_0146	Condition for controlling OFF at SPOS (in PLC)	5A0101 8001451F40	SPOS	SPOS07IN_TMP_34
5A0101 800146EF40	PLC_BIT_0147	Condition for controlling ON at SPOS (in PLC)	5A0101 8001461F40	SPOS	SPOS07IN_TMP_35
5A0101 800147EF40	PLC_BIT_0148	Failure condition for controlling OFF at SPOS (in PLC)	5A0101 8001471F40	SPOS	SPOS07IN_TMP_37
5A0101 800148EF40	PLC_BIT_0149	Failure condition for controlling ON at SPOS (in PLC)	5A0101 8001481F40	SPOS	SPOS07IN_TMP_38
5A0101 800149EF40	PLC_BIT_0150	Reason of selection failure at SPOS (in Fixed source)	5A0101 8001491F40	SPOS	SPOS07IN_TMP_40
5A0101 800150EF40	PLC_BIT_0151	Reason of selection failure at SPOS	5A0101 8001501F40	SPOS	SPOS07IN_TMP_41
5A0101 800151EF40	PLC_BIT_0152	Control output on BO circuit for SPOS	5A0101 8001511F40	SPOS	SPOS07IN_TMP_42
5A0101 800152EF40	PLC_BIT_0153	Success for controlling at SPOS (in PLC)	5A0101 8001521F40	SPOS	SPOS07IN_TMP_44
5A0101 800153EF40	PLC_BIT_0154	Failure for controlling at SPOS (in PLC)	5A0101 8001531F40	SPOS	SPOS07IN_TMP_45
5A0101 800154EF40	PLC_BIT_0155	Cancel reason for controlling at SPOS (in PLC)	5A0101 8001541F40	SPOS	SPOS07IN_TMP_46
5A0101 800155EF40	PLC_BIT_0156	Condition of selection completed in SPOS (in PLC)	5A0101 8001551F40	SPOS	SPOS08IN_TMP_29
5A0101 800156EF40	PLC_BIT_0157	Condition of Selection failure at SPOS (in PLC)	5A0101 8001561F40	SPOS	SPOS08IN_TMP_30
5A0101 800157EF40	PLC_BIT_0158	Reason of selection failure at SPOS (in Fixed source)	5A0101 8001571F40	SPOS	SPOS08IN_TMP_31
5A0101 800158EF40	PLC_BIT_0159	Reason of selection failure at SPOS	5A0101 8001581F40	SPOS	SPOS08IN_TMP_32
5A0101 800159EF40	PLC_BIT_0160	Condition of cancel selection at SPOS (in PLC)	5A0101 8001591F40	SPOS	SPOS08IN_TMP_33
5A0101 800160EF40	PLC_BIT_0161	Condition for controlling OFF at SPOS (in PLC)	5A0101 8001601F40	SPOS	SPOS08IN_TMP_34
5A0101 800161EF40	PLC_BIT_0162	Condition for controlling ON at SPOS (in PLC)	5A0101 8001611F40	SPOS	SPOS08IN_TMP_35
5A0101 800162EF40	PLC_BIT_0163	Failure condition for controlling OFF at SPOS (in PLC)	5A0101 8001621F40	SPOS	SPOS08IN_TMP_37
5A0101 800163EF40	PLC_BIT_0164	Failure condition for controlling ON at SPOS (in PLC)	5A0101 8001631F40	SPOS	SPOS08IN_TMP_38
5A0101 800164EF40	PLC_BIT_0165	Reason of selection failure at SPOS (in Fixed source)	5A0101 8001641F40	SPOS	SPOS08IN_TMP_40
5A0101 800165EF40	PLC_BIT_0166	Reason of selection failure at SPOS	5A0101 8001651F40	SPOS	SPOS08IN_TMP_41
5A0101 800166EF40	PLC_BIT_0167	Control output on BO circuit for SPOS	5A0101 8001661F40	SPOS	SPOS08IN_TMP_42
5A0101 800167EF40	PLC_BIT_0168	Success for controlling at SPOS (in PLC)	5A0101 8001671F40	SPOS	SPOS08IN_TMP_44
5A0101 800168EF40	PLC_BIT_0169	Failure for controlling at SPOS (in PLC)	5A0101 8001681F40	SPOS	SPOS08IN_TMP_45
5A0101 800169EF40	PLC_BIT_0170	Cancel reason for controlling at SPOS (in PLC)	5A0101 8001691F40	SPOS	SPOS08IN_TMP_46
5A0101 800170EF40	PLC_BIT_0171	Condition of selection completed in SPOS (in PLC)	5A0101 8001701F40	SPOS	SPOS09IN_TMP_29
5A0101 800171EF40	PLC_BIT_0172	Condition of Selection failure at SPOS (in PLC)	5A0101 8001711F40	SPOS	SPOS09IN_TMP_30
5A0101 800172EF40	PLC_BIT_0173	Reason of selection failure at SPOS (in Fixed source)	5A0101 8001721F40	SPOS	SPOS09IN_TMP_31
5A0101 800173EF40	PLC_BIT_0174	Reason of selection failure at SPOS	5A0101 8001731F40	SPOS	SPOS09IN_TMP_32
5A0101 800174EF40	PLC_BIT_0175	Condition of cancel selection at SPOS (in PLC)	5A0101 8001741F40	SPOS	SPOS09IN_TMP_33
5A0101 800175EF40	PLC_BIT_0176	Condition for controlling OFF at SPOS (in PLC)	5A0101 8001751F40	SPOS	SPOS09IN_TMP_34
5A0101 800176EF40	PLC_BIT_0177	Condition for controlling ON at SPOS (in PLC)	5A0101 8001761F40	SPOS	SPOS09IN_TMP_35
5A0101 800177EF40	PLC_BIT_0178	Failure condition for controlling OFF at SPOS (in PLC)	5A0101 8001771F40	SPOS	SPOS09IN_TMP_37
5A0101 800178EF40	PLC_BIT_0179	Failure condition for controlling ON at SPOS (in PLC)	5A0101 8001781F40	SPOS	SPOS09IN_TMP_38

DataIDs	Connections	Meaning	Monitoring	FB	Destinations
5A0101 800179EF40	PLC_BIT_0180	Reason of selection failure at SPOS (in Fixed source)	5A0101 8001791F40	SPOS	SPOS09IN_TMP_40
5A0101 800180EF40	PLC_BIT_0181	Reason of selection failure at SPOS	5A0101 8001801F40	SPOS	SPOS09IN_TMP_41
5A0101 800181EF40	PLC_BIT_0182	Control output on BO circuit for SPOS	5A0101 8001811F40	SPOS	SPOS09IN_TMP_42
5A0101 800182EF40	PLC_BIT_0183	Success for controlling at SPOS (in PLC)	5A0101 8001821F40	SPOS	SPOS09IN_TMP_44
5A0101 800183EF40	PLC_BIT_0184	Failure for controlling at SPOS (in PLC)	5A0101 8001831F40	SPOS	SPOS09IN_TMP_45
5A0101 800184EF40	PLC_BIT_0185	Cancel reason for controlling at SPOS (in PLC)	5A0101 8001841F40	SPOS	SPOS09IN_TMP_46
5A0101 800185EF40	PLC_BIT_0186	Condition of selection completed in SPOS (in PLC)	5A0101 8001851F40	SPOS	SPOS10IN_TMP_29
5A0101 800186EF40	PLC_BIT_0187	Condition of Selection failure at SPOS (in PLC)	5A0101 8001861F40	SPOS	SPOS10IN_TMP_30
5A0101 800187EF40	PLC_BIT_0188	Reason of selection failure at SPOS (in Fixed source)	5A0101 8001871F40	SPOS	SPOS10IN_TMP_31
5A0101 800188EF40	PLC_BIT_0189	Reason of selection failure at SPOS	5A0101 8001881F40	SPOS	SPOS10IN_TMP_32
5A0101 800189EF40	PLC_BIT_0190	Condition of cancel selection at SPOS (in PLC)	5A0101 8001891F40	SPOS	SPOS10IN_TMP_33
5A0101 800190EF40	PLC_BIT_0191	Condition for controlling OFF at SPOS (in PLC)	5A0101 8001901F40	SPOS	SPOS10IN_TMP_34
5A0101 800191EF40	PLC_BIT_0192	Condition for controlling ON at SPOS (in PLC)	5A0101 8001911F40	SPOS	SPOS10IN_TMP_35
5A0101 800192EF40	PLC_BIT_0193	Failure condition for controlling OFF at SPOS (in PLC)	5A0101 8001921F40	SPOS	SPOS10IN_TMP_37
5A0101 800193EF40	PLC_BIT_0194	Failure condition for controlling ON at SPOS (in PLC)	5A0101 8001931F40	SPOS	SPOS10IN_TMP_38
5A0101 800194EF40	PLC_BIT_0195	Reason of selection failure at SPOS (in Fixed source)	5A0101 8001941F40	SPOS	SPOS10IN_TMP_40
5A0101 800195EF40	PLC_BIT_0196	Reason of selection failure at SPOS	5A0101 8001951F40	SPOS	SPOS10IN_TMP_41
5A0101 800196EF40	PLC_BIT_0197	Control output on BO circuit for SPOS	5A0101 8001961F40	SPOS	SPOS10IN_TMP_42
5A0101 800197EF40	PLC_BIT_0198	Success for controlling at SPOS (in PLC)	5A0101 8001971F40	SPOS	SPOS10IN_TMP_44
5A0101 800198EF40	PLC_BIT_0199	Failure for controlling at SPOS (in PLC)	5A0101 8001981F40	SPOS	SPOS10IN_TMP_45
5A0101 800199EF40	PLC_BIT_0200	Cancel reason for controlling at SPOS (in PLC)	5A0101 8001991F40	SPOS	SPOS10IN_TMP_46
5A0101 800200EF40	PLC_BIT_0201		5A0101 8002001F40		
5A0101 800201EF40	PLC_BIT_0202	Control right established at ASEQ	5A0101 8002011F40	ASEQ	ASEQ01IN_TMP_28
5A0101 800202EF40	PLC_BIT_0203	Control right established at ASEQ	5A0101 8002021F40	ASEQ	ASEQ02IN_TMP_28
5A0101 800203EF40	PLC_BIT_0204	Control right established at ASEQ	5A0101 8002031F40	ASEQ	ASEQ03IN_TMP_28
5A0101 800204EF40	PLC_BIT_0205	Control right established at ASEQ	5A0101 8002041F40	ASEQ	ASEQ04IN_TMP_28
5A0101 800205EF40	PLC_BIT_0206	Control right established at ASEQ	5A0101 8002051F40	ASEQ	ASEQ05IN_TMP_28
5A0101 800206EF40	PLC_BIT_0207	Control right established at ASEQ	5A0101 8002061F40	ASEQ	ASEQ06IN_TMP_28
5A0101 800207EF40	PLC_BIT_0208	Control right established at ASEQ	5A0101 8002071F40	ASEQ	ASEQ07IN_TMP_28
5A0101 800208EF40	PLC_BIT_0209	Control right established at ASEQ	5A0101 8002081F40	ASEQ	ASEQ08IN_TMP_28
5A0101 800209EF40	PLC_BIT_0210	Control right established at ASEQ	5A0101 8002091F40	ASEQ	ASEQ09IN_TMP_28
5A0101 800210EF40	PLC_BIT_0211	Control right established at ASEQ	5A0101 8002101F40	ASEQ	ASEQ10IN_TMP_28
5A0101 800211EF40	PLC_BIT_0212	Control right established at ASEQ	5A0101 8002111F40	ASEQ	ASEQ11IN_TMP_28
5A0101 800212EF40	PLC_BIT_0213	Control right established at ASEQ	5A0101 8002121F40	ASEQ	ASEQ12IN_TMP_28
5A0101 800213EF40	PLC_BIT_0214	Emergency control right to stop established	5A0101 8002131F40	ASEQ	EMERSTOPIN_TMP_28
5A0101 800214EF40	PLC_BIT_0215	Resetting automatic sequence Operation	5A0101 8002141F40	ASEQ	ASEQ01_EXEC_RESET
5A0101 800215EF40	PLC_BIT_0216	Resetting automatic sequence Operation	5A0101 8002151F40	ASEQ	ASEQ02_EXEC_RESET
5A0101 800216EF40	PLC_BIT_0217	Resetting automatic sequence Operation	5A0101 8002161F40	ASEQ	ASEQ03_EXEC_RESET
5A0101 800217EF40	PLC_BIT_0218	Resetting automatic sequence Operation	5A0101 8002171F40	ASEQ	ASEQ04_EXEC_RESET
5A0101 800218EF40	PLC_BIT_0219	Resetting automatic sequence Operation	5A0101 8002181F40	ASEQ	ASEQ05_EXEC_RESET
5A0101 800219EF40	PLC_BIT_0220	Resetting automatic sequence Operation	5A0101 8002191F40	ASEQ	ASEQ06_EXEC_RESET
5A0101 800220EF40	PLC_BIT_0221	Resetting automatic sequence Operation	5A0101 8002201F40	ASEQ	ASEQ07_EXEC_RESET
5A0101 800221EF40	PLC_BIT_0222	Resetting automatic sequence Operation	5A0101 8002211F40	ASEQ	ASEQ08_EXEC_RESET
5A0101 800222EF40	PLC_BIT_0223	Resetting automatic sequence Operation	5A0101 8002221F40	ASEQ	ASEQ09_EXEC_RESET
5A0101 800223EF40	PLC_BIT_0224	Resetting automatic sequence Operation	5A0101 8002231F40	ASEQ	ASEQ10_EXEC_RESET
5A0101 800224EF40	PLC_BIT_0225	Resetting automatic sequence Operation	5A0101 8002241F40	ASEQ	ASEQ11_EXEC_RESET
5A0101 800225EF40	PLC_BIT_0226	Resetting automatic sequence Operation	5A0101 8002251F40	ASEQ	ASEQ12_EXEC_RESET
5A0101 800226EF40	PLC_BIT_0227		5A0101 8002261F40		
5A0101 800227EF40	PLC_BIT_0228		5A0101 8002271F40		
5A0101 800228EF40	PLC_BIT_0229		5A0101 8002281F40		
5A0101 800229EF40	PLC_BIT_0230		5A0101 8002291F40		
5A0101 800230EF40	PLC_BIT_0231		5A0101 8002301F40		
5A0101 800231EF40	PLC_BIT_0232		5A0101 8002311F40		
5A0101 800232EF40	PLC_BIT_0233		5A0101 8002321F40		
5A0101 800233EF40	PLC_BIT_0234		5A0101 8002331F40		
5A0101 800234EF40	PLC_BIT_0235		5A0101 8002341F40		
5A0101 800235EF40	PLC_BIT_0236		5A0101 8002351F40		
5A0101 800236EF40	PLC_BIT_0237		5A0101 8002361F40		
5A0101 800237EF40	PLC_BIT_0238		5A0101 8002371F40		
5A0101 800238EF40	PLC_BIT_0239		5A0101 8002381F40		
5A0101 800239EF40	PLC_BIT_0240		5A0101 8002391F40		
5A0101 800240EF40	PLC_BIT_0241		5A0101 8002401F40		
5A0101 800241EF40	PLC_BIT_0242		5A0101 8002411F40		
5A0101 800242EF40	PLC_BIT_0243		5A0101 8002421F40		
5A0101 800243EF40	PLC_BIT_0244		5A0101 8002431F40		
5A0101 800244EF40	PLC_BIT_0245		5A0101 8002441F40		
5A0101 800245EF40	PLC_BIT_0246		5A0101 8002451F40		
5A0101 800246EF40	PLC_BIT_0247		5A0101 8002461F40		
5A0101 800247EF40	PLC_BIT_0248		5A0101 8002471F40		
5A0101 800248EF40	PLC_BIT_0249		5A0101 8002481F40		
5A0101 800249EF40	PLC_BIT_0250		5A0101 8002491F40		
5A0101 800250EF40	PLC_BIT_0251		5A0101 8002501F40		
5A0101 800251EF40	PLC_BIT_0252		5A0101 8002511F40		
5A0101 800252EF40	PLC_BIT_0253		5A0101 8002521F40		
5A0101 800253EF40	PLC_BIT_0254		5A0101 8002531F40		
5A0101 800254EF40	PLC_BIT_0255		5A0101 8002541F40		
5A0101 800255EF40	PLC_BIT_0256		5A0101 8002551F40		
5A0101 800256EF40	PLC_BIT_0257		5A0101 8002561F40		
5A0101 800257EF40	PLC_BIT_0258		5A0101 8002571F40		
5A0101 800258EF40	PLC_BIT_0259		5A0101 8002581F40		
5A0101 800259EF40	PLC_BIT_0260		5A0101 8002591F40		
5A0101 800260EF40	PLC_BIT_0261		5A0101 8002601F40		
5A0101 800261EF40	PLC_BIT_0262		5A0101 8002611F40		
5A0101 800262EF40	PLC_BIT_0263		5A0101 8002621F40		
5A0101 800263EF40	PLC_BIT_0264		5A0101 8002631F40		
5A0101 800264EF40	PLC_BIT_0265		5A0101 8002641F40		
5A0101 800265EF40	PLC_BIT_0266		5A0101 8002651F40		
5A0101 800266EF40	PLC_BIT_0267		5A0101 8002661F40		
5A0101 800267EF40	PLC_BIT_0268		5A0101 8002671F40		
5A0101 800268EF40	PLC_BIT_0269		5A0101 8002681F40		
5A0101 800269EF40	PLC_BIT_0270		5A0101 8002691F40		
5A0101 800270EF40	PLC_BIT_0271		5A0101 8002701F40		
5A0101 800271EF40	PLC_BIT_0272		5A0101 8002711F40		
5A0101 800272EF40	PLC_BIT_0273		5A0101 8002721F40		
5A0101 800273EF40	PLC_BIT_0274		5A0101 8002731F40		
5A0101 800274EF40	PLC_BIT_0275		5A0101 8002741F40		
5A0101 800275EF40	PLC_BIT_0276		5A0101 8002751F40		

DataIDs	Connections	Meaning	Monitoring	FB	Destinations
5A0101 800276EF40	PLC_BIT_0277		5A0101 8002761F40		
5A0101 800277EF40	PLC_BIT_0278		5A0101 8002771F40		
5A0101 800278EF40	PLC_BIT_0279		5A0101 8002781F40		
5A0101 800279EF40	PLC_BIT_0280		5A0101 8002791F40		
5A0101 800280EF40	PLC_BIT_0281		5A0101 8002801F40		
5A0101 800281EF40	PLC_BIT_0282		5A0101 8002811F40		
5A0101 800282EF40	PLC_BIT_0283		5A0101 8002821F40		
5A0101 800283EF40	PLC_BIT_0284		5A0101 8002831F40		
5A0101 800284EF40	PLC_BIT_0285		5A0101 8002841F40		
5A0101 800285EF40	PLC_BIT_0286		5A0101 8002851F40		
5A0101 800286EF40	PLC_BIT_0287		5A0101 8002861F40		
5A0101 800287EF40	PLC_BIT_0288		5A0101 8002871F40		
5A0101 800288EF40	PLC_BIT_0289		5A0101 8002881F40		
5A0101 800289EF40	PLC_BIT_0290		5A0101 8002891F40		
5A0101 800290EF40	PLC_BIT_0291		5A0101 8002901F40		
5A0101 800291EF40	PLC_BIT_0292		5A0101 8002911F40		
5A0101 800292EF40	PLC_BIT_0293		5A0101 8002921F40		
5A0101 800293EF40	PLC_BIT_0294		5A0101 8002931F40		
5A0101 800294EF40	PLC_BIT_0295		5A0101 8002941F40		
5A0101 800295EF40	PLC_BIT_0296		5A0101 8002951F40		
5A0101 800296EF40	PLC_BIT_0297		5A0101 8002961F40		
5A0101 800297EF40	PLC_BIT_0298		5A0101 8002971F40		
5A0101 800298EF40	PLC_BIT_0299		5A0101 8002981F40		
5A0101 800299EF40	PLC_BIT_0300	Control right established at VPOS	5A0101 8002991F40	VPOS	VPOS01 control right to PLC
5A0101 800300EF40	PLC_BIT_0301	Control right established at VPOS	5A0101 8003001F40	VPOS	VPOS02 control right to PLC
5A0101 800301EF40	PLC_BIT_0302	Control right established at VPOS	5A0101 8003011F40	VPOS	VPOS03 control right to PLC
5A0101 800302EF40	PLC_BIT_0303	Control right established at VPOS	5A0101 8003021F40	VPOS	VPOS04 control right to PLC
5A0101 800303EF40	PLC_BIT_0304	Control right established at VPOS	5A0101 8003031F40	VPOS	VPOS05 control right to PLC
5A0101 800304EF40	PLC_BIT_0305	Control right established at VPOS	5A0101 8003041F40	VPOS	VPOS06 control right to PLC
5A0101 800305EF40	PLC_BIT_0306	Control right established at VPOS	5A0101 8003051F40	VPOS	VPOS07 control right to PLC
5A0101 800306EF40	PLC_BIT_0307	Control right established at VPOS	5A0101 8003061F40	VPOS	VPOS08 control right to PLC
5A0101 800307EF40	PLC_BIT_0308	Control right established at VPOS	5A0101 8003071F40	VPOS	VPOS09 control right to PLC
5A0101 800308EF40	PLC_BIT_0309	Control right established at VPOS	5A0101 8003081F40	VPOS	VPOS10 control right to PLC
5A0101 800309EF40	PLC_BIT_0310	Control right established at VPOS	5A0101 8003091F40	VPOS	VPOS11 control right to PLC
5A0101 800310EF40	PLC_BIT_0311	Control right established at VPOS	5A0101 8003101F40	VPOS	VPOS12 control right to PLC
5A0101 800311EF40	PLC_BIT_0312	Control right established at VPOS	5A0101 8003111F40	VPOS	VPOS13 control right to PLC
5A0101 800312EF40	PLC_BIT_0313	Control right established at VPOS	5A0101 8003121F40	VPOS	VPOS14 control right to PLC
5A0101 800313EF40	PLC_BIT_0314	Control right established at VPOS	5A0101 8003131F40	VPOS	VPOS15 control right to PLC
5A0101 800314EF40	PLC_BIT_0315	Control right established at VPOS	5A0101 8003141F40	VPOS	VPOS16 control right to PLC
5A0101 800315EF40	PLC_BIT_0316	Control right established at VPOS	5A0101 8003151F40	VPOS	VPOS17 control right to PLC
5A0101 800316EF40	PLC_BIT_0317	Control right established at VPOS	5A0101 8003161F40	VPOS	VPOS18 control right to PLC
5A0101 800317EF40	PLC_BIT_0318	Control right established at VPOS	5A0101 8003171F40	VPOS	VPOS19 control right to PLC
5A0101 800318EF40	PLC_BIT_0319	Control right established at VPOS	5A0101 8003181F40	VPOS	VPOS20 control right to PLC
5A0101 800319EF40	PLC_BIT_0320	Control right established at VPOS	5A0101 8003191F40	VPOS	VPOS21 control right to PLC
5A0101 800320EF40	PLC_BIT_0321	Control right established at VPOS	5A0101 8003201F40	VPOS	VPOS22 control right to PLC
5A0101 800321EF40	PLC_BIT_0322	Control right established at VPOS	5A0101 8003211F40	VPOS	VPOS23 control right to PLC
5A0101 800322EF40	PLC_BIT_0323	Control right established at VPOS	5A0101 8003221F40	VPOS	VPOS24 control right to PLC
5A0101 800323EF40	PLC_BIT_0324	Control right established at VPOS	5A0101 8003231F40	VPOS	VPOS25 control right to PLC
5A0101 800324EF40	PLC_BIT_0325	Control right established at VPOS	5A0101 8003241F40	VPOS	VPOS26 control right to PLC
5A0101 800325EF40	PLC_BIT_0326	Control right established at VPOS	5A0101 8003251F40	VPOS	VPOS27 control right to PLC
5A0101 800326EF40	PLC_BIT_0327	Control right established at VPOS	5A0101 8003261F40	VPOS	VPOS28 control right to PLC
5A0101 800327EF40	PLC_BIT_0328	Control right established at VPOS	5A0101 8003271F40	VPOS	VPOS29 control right to PLC
5A0101 800328EF40	PLC_BIT_0329	Control right established at VPOS	5A0101 8003281F40	VPOS	VPOS30 control right to PLC
5A0101 800329EF40	PLC_BIT_0330	Control right established at VPOS	5A0101 8003291F40	VPOS	VPOS31 control right to PLC
5A0101 800330EF40	PLC_BIT_0331	Control right established at VPOS	5A0101 8003301F40	VPOS	VPOS32 control right to PLC
5A0101 800331EF40	PLC_BIT_0332	Control right established at VPOS	5A0101 8003311F40	VPOS	VPOS33 control right to PLC
5A0101 800332EF40	PLC_BIT_0333	Control right established at VPOS	5A0101 8003321F40	VPOS	VPOS34 control right to PLC
5A0101 800333EF40	PLC_BIT_0334	Control right established at VPOS	5A0101 8003331F40	VPOS	VPOS35 control right to PLC
5A0101 800334EF40	PLC_BIT_0335	Control right established at VPOS	5A0101 8003341F40	VPOS	VPOS36 control right to PLC
5A0101 800335EF40	PLC_BIT_0336	Control right established at VPOS	5A0101 8003351F40	VPOS	VPOS37 control right to PLC
5A0101 800336EF40	PLC_BIT_0337	Control right established at VPOS	5A0101 8003361F40	VPOS	VPOS38 control right to PLC
5A0101 800337EF40	PLC_BIT_0338	Control right established at VPOS	5A0101 8003371F40	VPOS	VPOS39 control right to PLC
5A0101 800338EF40	PLC_BIT_0339	Control right established at VPOS	5A0101 8003381F40	VPOS	VPOS40 control right to PLC
5A0101 800339EF40	PLC_BIT_0340	Control right established at VPOS	5A0101 8003391F40	VPOS	VPOS41 control right to PLC
5A0101 800340EF40	PLC_BIT_0341	Control right established at VPOS	5A0101 8003401F40	VPOS	VPOS42 control right to PLC
5A0101 800341EF40	PLC_BIT_0342	Control right established at VPOS	5A0101 8003411F40	VPOS	VPOS43 control right to PLC
5A0101 800342EF40	PLC_BIT_0343	Control right established at VPOS	5A0101 8003421F40	VPOS	VPOS44 control right to PLC
5A0101 800343EF40	PLC_BIT_0344	Control right established at VPOS	5A0101 8003431F40	VPOS	VPOS45 control right to PLC
5A0101 800344EF40	PLC_BIT_0345	Control right established at VPOS	5A0101 8003441F40	VPOS	VPOS46 control right to PLC
5A0101 800345EF40	PLC_BIT_0346	Control right established at VPOS	5A0101 8003451F40	VPOS	VPOS47 control right to PLC
5A0101 800346EF40	PLC_BIT_0347	Control right established at VPOS	5A0101 8003461F40	VPOS	VPOS48 control right to PLC
5A0101 800347EF40	PLC_BIT_0348	Control right established at VPOS	5A0101 8003471F40	VPOS	VPOS49 control right to PLC
5A0101 800348EF40	PLC_BIT_0349	Control right established at VPOS	5A0101 8003481F40	VPOS	VPOS50 control right to PLC
5A0101 800349EF40	PLC_BIT_0350	Control right established at VPOS	5A0101 8003491F40	VPOS	VPOS51 control right to PLC
5A0101 800350EF40	PLC_BIT_0351	Control right established at VPOS	5A0101 8003501F40	VPOS	VPOS52 control right to PLC
5A0101 800351EF40	PLC_BIT_0352	Control right established at VPOS	5A0101 8003511F40	VPOS	VPOS53 control right to PLC
5A0101 800352EF40	PLC_BIT_0353	Control right established at VPOS	5A0101 8003521F40	VPOS	VPOS54 control right to PLC
5A0101 800353EF40	PLC_BIT_0354	Control right established at VPOS	5A0101 8003531F40	VPOS	VPOS55 control right to PLC
5A0101 800354EF40	PLC_BIT_0355	Control right established at VPOS	5A0101 8003541F40	VPOS	VPOS56 control right to PLC
5A0101 800355EF40	PLC_BIT_0356	Control right established at VPOS	5A0101 8003551F40	VPOS	VPOS57 control right to PLC
5A0101 800356EF40	PLC_BIT_0357	Control right established at VPOS	5A0101 8003561F40	VPOS	VPOS58 control right to PLC
5A0101 800357EF40	PLC_BIT_0358	Control right established at VPOS	5A0101 8003571F40	VPOS	VPOS59 control right to PLC
5A0101 800358EF40	PLC_BIT_0359	Control right established at VPOS	5A0101 8003581F40	VPOS	VPOS60 control right to PLC
5A0101 800359EF40	PLC_BIT_0360	Control right established at VPOS	5A0101 8003591F40	VPOS	VPOS61 control right to PLC
5A0101 800360EF40	PLC_BIT_0361	Control right established at VPOS	5A0101 8003601F40	VPOS	VPOS62 control right to PLC
5A0101 800361EF40	PLC_BIT_0362	Control right established at VPOS	5A0101 8003611F40	VPOS	VPOS63 control right to PLC
5A0101 800362EF40	PLC_BIT_0363	Control right established at VPOS	5A0101 8003621F40	VPOS	VPOS64 control right to PLC
5A0101 800363EF40	PLC_BIT_0364	Switch to On control at VPOS	5A0101 8003631F40	VPOS	VPOS01 change to ON
5A0101 800364EF40	PLC_BIT_0365	Switch to On control at VPOS	5A0101 8003641F40	VPOS	VPOS02 change to ON
5A0101 800365EF40	PLC_BIT_0366	Switch to On control at VPOS	5A0101 8003651F40	VPOS	VPOS03 change to ON
5A0101 800366EF40	PLC_BIT_0367	Switch to On control at VPOS	5A0101 8003661F40	VPOS	VPOS04 change to ON
5A0101 800367EF40	PLC_BIT_0368	Switch to On control at VPOS	5A0101 8003671F40	VPOS	VPOS05 change to ON
5A0101 800368EF40	PLC_BIT_0369	Switch to On control at VPOS	5A0101 8003681F40	VPOS	VPOS06 change to ON
5A0101 800369EF40	PLC_BIT_0370	Switch to On control at VPOS	5A0101 8003691F40	VPOS	VPOS07 change to ON
5A0101 800370EF40	PLC_BIT_0371	Switch to On control at VPOS	5A0101 8003701F40	VPOS	VPOS08 change to ON
5A0101 800371EF40	PLC_BIT_0372	Switch to On control at VPOS	5A0101 8003711F40	VPOS	VPOS09 change to ON
5A0101 800372EF40	PLC_BIT_0373	Switch to On control at VPOS	5A0101 8003721F40	VPOS	VPOS10 change to ON

DataIDs	Connections	Meaning	Monitoring	FB	Destinations
5A0101 800373EF40	PLC_BIT_0374	Switch to On control at VPOS	5A0101 8003731F40	VPOS	VPOS11 change to ON
5A0101 800374EF40	PLC_BIT_0375	Switch to On control at VPOS	5A0101 8003741F40	VPOS	VPOS12 change to ON
5A0101 800375EF40	PLC_BIT_0376	Switch to On control at VPOS	5A0101 8003751F40	VPOS	VPOS13 change to ON
5A0101 800376EF40	PLC_BIT_0377	Switch to On control at VPOS	5A0101 8003761F40	VPOS	VPOS14 change to ON
5A0101 800377EF40	PLC_BIT_0378	Switch to On control at VPOS	5A0101 8003771F40	VPOS	VPOS15 change to ON
5A0101 800378EF40	PLC_BIT_0379	Switch to On control at VPOS	5A0101 8003781F40	VPOS	VPOS16 change to ON
5A0101 800379EF40	PLC_BIT_0380	Switch to On control at VPOS	5A0101 8003791F40	VPOS	VPOS17 change to ON
5A0101 800380EF40	PLC_BIT_0381	Switch to On control at VPOS	5A0101 8003801F40	VPOS	VPOS18 change to ON
5A0101 800381EF40	PLC_BIT_0382	Switch to On control at VPOS	5A0101 8003811F40	VPOS	VPOS19 change to ON
5A0101 800382EF40	PLC_BIT_0383	Switch to On control at VPOS	5A0101 8003821F40	VPOS	VPOS20 change to ON
5A0101 800383EF40	PLC_BIT_0384	Switch to On control at VPOS	5A0101 8003831F40	VPOS	VPOS21 change to ON
5A0101 800384EF40	PLC_BIT_0385	Switch to On control at VPOS	5A0101 8003841F40	VPOS	VPOS22 change to ON
5A0101 800385EF40	PLC_BIT_0386	Switch to On control at VPOS	5A0101 8003851F40	VPOS	VPOS23 change to ON
5A0101 800386EF40	PLC_BIT_0387	Switch to On control at VPOS	5A0101 8003861F40	VPOS	VPOS24 change to ON
5A0101 800387EF40	PLC_BIT_0388	Switch to On control at VPOS	5A0101 8003871F40	VPOS	VPOS25 change to ON
5A0101 800388EF40	PLC_BIT_0389	Switch to On control at VPOS	5A0101 8003881F40	VPOS	VPOS26 change to ON
5A0101 800389EF40	PLC_BIT_0390	Switch to On control at VPOS	5A0101 8003891F40	VPOS	VPOS27 change to ON
5A0101 800390EF40	PLC_BIT_0391	Switch to On control at VPOS	5A0101 8003901F40	VPOS	VPOS28 change to ON
5A0101 800391EF40	PLC_BIT_0392	Switch to On control at VPOS	5A0101 8003911F40	VPOS	VPOS29 change to ON
5A0101 800392EF40	PLC_BIT_0393	Switch to On control at VPOS	5A0101 8003921F40	VPOS	VPOS30 change to ON
5A0101 800393EF40	PLC_BIT_0394	Switch to On control at VPOS	5A0101 8003931F40	VPOS	VPOS31 change to ON
5A0101 800394EF40	PLC_BIT_0395	Switch to On control at VPOS	5A0101 8003941F40	VPOS	VPOS32 change to ON
5A0101 800395EF40	PLC_BIT_0396	Switch to On control at VPOS	5A0101 8003951F40	VPOS	VPOS33 change to ON
5A0101 800396EF40	PLC_BIT_0397	Switch to On control at VPOS	5A0101 8003961F40	VPOS	VPOS34 change to ON
5A0101 800397EF40	PLC_BIT_0398	Switch to On control at VPOS	5A0101 8003971F40	VPOS	VPOS35 change to ON
5A0101 800398EF40	PLC_BIT_0399	Switch to On control at VPOS	5A0101 8003981F40	VPOS	VPOS36 change to ON
5A0101 800399EF40	PLC_BIT_0400	Switch to On control at VPOS	5A0101 8003991F40	VPOS	VPOS37 change to ON
5A0101 800400EF40	PLC_BIT_0401	Switch to On control at VPOS	5A0101 8004001F40	VPOS	VPOS38 change to ON
5A0101 800401EF40	PLC_BIT_0402	Switch to On control at VPOS	5A0101 8004011F40	VPOS	VPOS39 change to ON
5A0101 800402EF40	PLC_BIT_0403	Switch to On control at VPOS	5A0101 8004021F40	VPOS	VPOS40 change to ON
5A0101 800403EF40	PLC_BIT_0404	Switch to On control at VPOS	5A0101 8004031F40	VPOS	VPOS41 change to ON
5A0101 800404EF40	PLC_BIT_0405	Switch to On control at VPOS	5A0101 8004041F40	VPOS	VPOS42 change to ON
5A0101 800405EF40	PLC_BIT_0406	Switch to On control at VPOS	5A0101 8004051F40	VPOS	VPOS43 change to ON
5A0101 800406EF40	PLC_BIT_0407	Switch to On control at VPOS	5A0101 8004061F40	VPOS	VPOS44 change to ON
5A0101 800407EF40	PLC_BIT_0408	Switch to On control at VPOS	5A0101 8004071F40	VPOS	VPOS45 change to ON
5A0101 800408EF40	PLC_BIT_0409	Switch to On control at VPOS	5A0101 8004081F40	VPOS	VPOS46 change to ON
5A0101 800409EF40	PLC_BIT_0410	Switch to On control at VPOS	5A0101 8004091F40	VPOS	VPOS47 change to ON
5A0101 800410EF40	PLC_BIT_0411	Switch to On control at VPOS	5A0101 8004101F40	VPOS	VPOS48 change to ON
5A0101 800411EF40	PLC_BIT_0412	Switch to On control at VPOS	5A0101 8004111F40	VPOS	VPOS49 change to ON
5A0101 800412EF40	PLC_BIT_0413	Switch to On control at VPOS	5A0101 8004121F40	VPOS	VPOS50 change to ON
5A0101 800413EF40	PLC_BIT_0414	Switch to On control at VPOS	5A0101 8004131F40	VPOS	VPOS51 change to ON
5A0101 800414EF40	PLC_BIT_0415	Switch to On control at VPOS	5A0101 8004141F40	VPOS	VPOS52 change to ON
5A0101 800415EF40	PLC_BIT_0416	Switch to On control at VPOS	5A0101 8004151F40	VPOS	VPOS53 change to ON
5A0101 800416EF40	PLC_BIT_0417	Switch to On control at VPOS	5A0101 8004161F40	VPOS	VPOS54 change to ON
5A0101 800417EF40	PLC_BIT_0418	Switch to On control at VPOS	5A0101 8004171F40	VPOS	VPOS55 change to ON
5A0101 800418EF40	PLC_BIT_0419	Switch to On control at VPOS	5A0101 8004181F40	VPOS	VPOS56 change to ON
5A0101 800419EF40	PLC_BIT_0420	Switch to On control at VPOS	5A0101 8004191F40	VPOS	VPOS57 change to ON
5A0101 800420EF40	PLC_BIT_0421	Switch to On control at VPOS	5A0101 8004201F40	VPOS	VPOS58 change to ON
5A0101 800421EF40	PLC_BIT_0422	Switch to On control at VPOS	5A0101 8004211F40	VPOS	VPOS59 change to ON
5A0101 800422EF40	PLC_BIT_0423	Switch to On control at VPOS	5A0101 8004221F40	VPOS	VPOS60 change to ON
5A0101 800423EF40	PLC_BIT_0424	Switch to On control at VPOS	5A0101 8004231F40	VPOS	VPOS61 change to ON
5A0101 800424EF40	PLC_BIT_0425	Switch to On control at VPOS	5A0101 8004241F40	VPOS	VPOS62 change to ON
5A0101 800425EF40	PLC_BIT_0426	Switch to On control at VPOS	5A0101 8004251F40	VPOS	VPOS63 change to ON
5A0101 800426EF40	PLC_BIT_0427	Switch to On control at VPOS	5A0101 8004261F40	VPOS	VPOS64 change to ON
5A0101 800427EF40	PLC_BIT_0428	Control right established for calibration	5A0101 8004271F40	GENCNT	5A0101 8004271F40
5A0101 800428EF40	PLC_BIT_0429	PLC signal for GCNT	5A0101 8004281F40	GENCNT	5A0101 8004281F40
5A0101 800429EF40	PLC_BIT_0430	PLC signal for GCNT	5A0101 8004291F40	GENCNT	5A0101 8004291F40
5A0101 800430EF40	PLC_BIT_0431	PLC signal for GCNT	5A0101 8004301F40	GENCNT	5A0101 8004301F40
5A0101 800431EF40	PLC_BIT_0432	PLC signal for GCNT	5A0101 8004311F40	GENCNT	5A0101 8004311F40
5A0101 800432EF40	PLC_BIT_0433	PLC signal for GCNT	5A0101 8004321F40	GENCNT	5A0101 8004321F40
5A0101 800433EF40	PLC_BIT_0434	PLC signal for GCNT	5A0101 8004331F40	GENCNT	5A0101 8004331F40
5A0101 800434EF40	PLC_BIT_0435	PLC signal for GCNT	5A0101 8004341F40	GENCNT	5A0101 8004341F40
5A0101 800435EF40	PLC_BIT_0436	PLC signal for GCNT	5A0101 8004351F40	GENCNT	5A0101 8004351F40
5A0101 800436EF40	PLC_BIT_0437	PLC signal for GCNT	5A0101 8004361F40	GENCNT	5A0101 8004361F40
5A0101 800437EF40	PLC_BIT_0438	PLC signal for GCNT	5A0101 8004371F40	GENCNT	5A0101 8004371F40
5A0101 800438EF40	PLC_BIT_0439	PLC signal for GCNT	5A0101 8004381F40	GENCNT	5A0101 8004381F40
5A0101 800439EF40	PLC_BIT_0440	PLC signal for GCNT	5A0101 8004391F40	GENCNT	5A0101 8004391F40
5A0101 800440EF40	PLC_BIT_0441	PLC signal for GCNT	5A0101 8004401F40	GENCNT	5A0101 8004401F40
5A0101 800441EF40	PLC_BIT_0442	PLC signal for GCNT	5A0101 8004411F40	GENCNT	5A0101 8004411F40
5A0101 800442EF40	PLC_BIT_0443	PLC signal for GCNT	5A0101 8004421F40	GENCNT	5A0101 8004421F40
5A0101 800443EF40	PLC_BIT_0444	PLC signal for GCNT	5A0101 8004431F40	GENCNT	5A0101 8004431F40
5A0101 800444EF40	PLC_BIT_0445	PLC signal for GCNT	5A0101 8004441F40	GENCNT	5A0101 8004441F40
5A0101 800445EF40	PLC_BIT_0446	PLC signal for GCNT	5A0101 8004451F40	GENCNT	5A0101 8004451F40
5A0101 800446EF40	PLC_BIT_0447	PLC signal for GCNT	5A0101 8004461F40	GENCNT	5A0101 8004461F40
5A0101 800447EF40	PLC_BIT_0448	PLC signal for GCNT	5A0101 8004471F40	GENCNT	5A0101 8004471F40
5A0101 800448EF40	PLC_BIT_0449	PLC signal for GCNT	5A0101 8004481F40	GENCNT	5A0101 8004481F40
5A0101 800449EF40	PLC_BIT_0450	PLC signal for GCNT	5A0101 8004491F40	GENCNT	5A0101 8004491F40
5A0101 800450EF40	PLC_BIT_0451	PLC signal for GCNT	5A0101 8004501F40	GENCNT	5A0101 8004501F40
5A0101 800451EF40	PLC_BIT_0452	PLC signal for GCNT	5A0101 8004511F40	GENCNT	5A0101 8004511F40
5A0101 800452EF40	PLC_BIT_0453	PLC signal for GCNT	5A0101 8004521F40	GENCNT	5A0101 8004521F40
5A0101 800453EF40	PLC_BIT_0454	PLC signal for GCNT	5A0101 8004531F40	GENCNT	5A0101 8004531F40
5A0101 800454EF40	PLC_BIT_0455	PLC signal for GCNT	5A0101 8004541F40	GENCNT	5A0101 8004541F40
5A0101 800455EF40	PLC_BIT_0456	PLC signal for GCNT	5A0101 8004551F40	GENCNT	5A0101 8004551F40
5A0101 800456EF40	PLC_BIT_0457	PLC signal for GCNT	5A0101 8004561F40	GENCNT	5A0101 8004561F40
5A0101 800457EF40	PLC_BIT_0458	PLC signal for GCNT	5A0101 8004571F40	GENCNT	5A0101 8004571F40
5A0101 800458EF40	PLC_BIT_0459	PLC signal for GCNT	5A0101 8004581F40	GENCNT	5A0101 8004581F40
5A0101 800459EF40	PLC_BIT_0460	PLC signal for GCNT	5A0101 8004591F40	GENCNT	5A0101 8004591F40
5A0101 800460EF40	PLC_BIT_0461		5A0101 8004601F40		
5A0101 800461EF40	PLC_BIT_0462	Control right established	5A0101 8004611F40	TOTALTIM	TOTAL00IN_TMP_51
5A0101 800462EF40	PLC_BIT_0463	PLC signal in TOTALTIM	5A0101 8004621F40	TOTALTIM	TOTAL01_PLC_SGNL
5A0101 800463EF40	PLC_BIT_0464	PLC signal in TOTALTIM	5A0101 8004631F40	TOTALTIM	TOTAL02_PLC_SGNL
5A0101 800464EF40	PLC_BIT_0465	PLC signal in TOTALTIM	5A0101 8004641F40	TOTALTIM	TOTAL03_PLC_SGNL
5A0101 800465EF40	PLC_BIT_0466	PLC signal in TOTALTIM	5A0101 8004651F40	TOTALTIM	TOTAL04_PLC_SGNL
5A0101 800466EF40	PLC_BIT_0467	PLC signal in TOTALTIM	5A0101 8004661F40	TOTALTIM	TOTAL05_PLC_SGNL
5A0101 800467EF40	PLC_BIT_0468	PLC signal in TOTALTIM	5A0101 8004671F40	TOTALTIM	TOTAL06_PLC_SGNL
5A0101 800468EF40	PLC_BIT_0469	PLC signal in TOTALTIM	5A0101 8004681F40	TOTALTIM	TOTAL07_PLC_SGNL
5A0101 800469EF40	PLC_BIT_0470	PLC signal in TOTALTIM	5A0101 8004691F40	TOTALTIM	TOTAL08_PLC_SGNL

DataIDs	Connections	Meaning	Monitoring	FB	Destinations
5A0101 800470EF40	PLC_BIT_0471	PLC signal in TOTALTIM	5A0101 8004701F40	TOTALTIM	TOTAL09_PLC_SGNL
5A0101 800471EF40	PLC_BIT_0472	PLC signal in TOTALTIM	5A0101 8004711F40	TOTALTIM	TOTAL10_PLC_SGNL
5A0101 800472EF40	PLC_BIT_0473	PLC signal in TOTALTIM	5A0101 8004721F40	TOTALTIM	TOTAL11_PLC_SGNL
5A0101 800473EF40	PLC_BIT_0474	PLC signal in TOTALTIM	5A0101 8004731F40	TOTALTIM	TOTAL12_PLC_SGNL
5A0101 800474EF40	PLC_BIT_0475		5A0101 8004741F40		
5A0101 800475EF40	PLC_BIT_0476	Control right established for count Calibration	5A0101 8004751F40	PLSMEA	PLSM00IN_TMP_51
5A0101 800476EF40	PLC_BIT_0477		5A0101 8004761F40	PLSMEA	
5A0101 800477EF40	PLC_BIT_0478		5A0101 8004771F40	PLSMEA	
5A0101 800478EF40	PLC_BIT_0479		5A0101 8004781F40	PLSMEA	
5A0101 800479EF40	PLC_BIT_0480		5A0101 8004791F40	PLSMEA	
5A0101 800480EF40	PLC_BIT_0481		5A0101 8004801F40	PLSMEA	
5A0101 800481EF40	PLC_BIT_0482		5A0101 8004811F40	PLSMEA	
5A0101 800482EF40	PLC_BIT_0483		5A0101 8004821F40	PLSMEA	
5A0101 800483EF40	PLC_BIT_0484		5A0101 8004831F40	PLSMEA	
5A0101 800484EF40	PLC_BIT_0485		5A0101 8004841F40		
5A0101 800485EF40	PLC_BIT_0486	Switching On or Off without synchronization	5A0101 8004851F40	SYNCHK	SYNC01_SBP_ECP
5A0101 800486EF40	PLC_BIT_0487	Condition to establish canceling synchronization	5A0101 8004861F40	SYNCHK	SYNC01_SBP_SSP
5A0101 800487EF40	PLC_BIT_0488	Condition abandoning to switch On	5A0101 8004871F40	SYNCHK	SYNC01_SCL_F_ECP
5A0101 800488EF40	PLC_BIT_0489	Established condition to abandoning switching On	5A0101 8004881F40	SYNCHK	SYNC01_SCL_SSP
5A0101 800489EF40	PLC_BIT_0490	Condition to Switching On with synchronization	5A0101 8004891F40	SYNCHK	SYNC01_SCL_CSP
5A0101 800490EF40	PLC_BIT_0491	Condition to switch On or Off for different network	5A0101 8004901F40	SYNCHK	SYNC01_SPS_CL_ECP
5A0101 800491EF40	PLC_BIT_0492	Condition to switch On or Off for loop network	5A0101 8004911F40	SYNCHK	SYNC01_LPS_CL_ECP
5A0101 800492EF40	PLC_BIT_0493	Condition of voltages availability at both terminals to switch On or Off	5A0101 8004921F40	SYNCHK	SYNC01_LLV_CL_ECP
5A0101 800493EF40	PLC_BIT_0494	A condition of voltage availability at either terminals to switch On or Off	5A0101 8004931F40	SYNCHK	SYNC01_LDV_CL_ECP
5A0101 800494EF40	PLC_BIT_0495	Other condition of voltage availability at either terminals to switch On or Off	5A0101 8004941F40	SYNCHK	SYNC01_DLV_CL_ECP
5A0101 800495EF40	PLC_BIT_0496	Condition of voltages absent at both terminals to switch On or Off	5A0101 8004951F40	SYNCHK	SYNC01_DDV_CL_ECP
5A0101 800496EF40	PLC_BIT_0497	Condition blocking synchronization	5A0101 8004961F40	SYNCHK	SYNC01_SBK_CSP
5A0101 800497EF40	PLC_BIT_0498	State for establishment of voltage condition	5A0101 8004971F40	SYNCHK	SYNC01_SS_VCS_PLC
5A0101 800498EF40	PLC_BIT_0499	Condition to use relay element1	5A0101 8004981F40	SYNCHK	SYNC01_RY1_USE_STS
5A0101 800499EF40	PLC_BIT_0500	Condition to use relay element2	5A0101 8004991F40	SYNCHK	SYNC01_RY2_USE_STS
5A0101 800500EF40	PLC_BIT_0501	Switching On or Off without synchronization	5A0101 8005001F40	SYNCHK	SYNC02_SBP_ECP
5A0101 800501EF40	PLC_BIT_0502	Condition to establish canceling synchronization	5A0101 8005011F40	SYNCHK	SYNC02_SBP_SSP
5A0101 800502EF40	PLC_BIT_0503	Condition abandoning to switch On	5A0101 8005021F40	SYNCHK	SYNC02_SCL_F_ECP
5A0101 800503EF40	PLC_BIT_0504	Established condition to abandoning switching On	5A0101 8005031F40	SYNCHK	SYNC02_SCL_SSP
5A0101 800504EF40	PLC_BIT_0505	Condition to Switching On with synchronization	5A0101 8005041F40	SYNCHK	SYNC02_SCL_CSP
5A0101 800505EF40	PLC_BIT_0506	Condition to switch On or Off for different network	5A0101 8005051F40	SYNCHK	SYNC02_SPS_CL_ECP
5A0101 800506EF40	PLC_BIT_0507	Condition to switch On or Off for loop network	5A0101 8005061F40	SYNCHK	SYNC02_LPS_CL_ECP
5A0101 800507EF40	PLC_BIT_0508	Condition of voltages availability at both terminals to switch On or Off	5A0101 8005071F40	SYNCHK	SYNC02_LLV_CL_ECP
5A0101 800508EF40	PLC_BIT_0509	A condition of voltage availability at either terminals to switch On or Off	5A0101 8005081F40	SYNCHK	SYNC02_LDV_CL_ECP
5A0101 800509EF40	PLC_BIT_0510	Other condition of voltage availability at either terminals to switch On or Off	5A0101 8005091F40	SYNCHK	SYNC02_DLV_CL_ECP
5A0101 800510EF40	PLC_BIT_0511	Condition of voltages absent at both terminals to switch On or Off	5A0101 8005101F40	SYNCHK	SYNC02_DDV_CL_ECP
5A0101 800511EF40	PLC_BIT_0512	Condition blocking synchronization	5A0101 8005111F40	SYNCHK	SYNC02_SBK_CSP
5A0101 800512EF40	PLC_BIT_0513	State for establishment of voltage condition	5A0101 8005121F40	SYNCHK	SYNC02_SS_VCS_PLC
5A0101 800513EF40	PLC_BIT_0514	Condition to use relay element1	5A0101 8005131F40	SYNCHK	SYNC02_RY1_USE_STS
5A0101 800514EF40	PLC_BIT_0515	Condition to use relay element2	5A0101 8005141F40	SYNCHK	SYNC02_RY2_USE_STS
5A0101 800515EF40	PLC_BIT_0516		5A0101 8005151F40		
5A0101 800516EF40	PLC_BIT_0517	Control right established in DPSY01 (in PLC)	5A0101 8005161F40	DPSY	DPSY01IN_TMP_28
5A0101 800517EF40	PLC_BIT_0518	Control right to calibrated counter in DPSY01(in PLC)	5A0101 8005171F40	DPSY	DPSY01IN_TMP_47
5A0101 800518EF40	PLC_BIT_0519	Control right for resetting measurement values in DPSY01(in PLC)	5A0101 8005181F40	DPSY	DPSY01IN_TMP_48
5A0101 800519EF40	PLC_BIT_0520	Control right established in DPSY02 (in PLC)	5A0101 8005191F40	DPSY	DPSY02IN_TMP_28
5A0101 800520EF40	PLC_BIT_0521	Control right to calibrate counter in DPSY02(in PLC)	5A0101 8005201F40	DPSY	DPSY02IN_TMP_47
5A0101 800521EF40	PLC_BIT_0522	Control right for resetting measurement values in DPSY02(in PLC)	5A0101 8005211F40	DPSY	DPSY02IN_TMP_48
5A0101 800522EF40	PLC_BIT_0523	Command to switch Off in DPSY01	5A0101 8005221F40	DPSY	DEV01_OP_COMMAND
5A0101 800523EF40	PLC_BIT_0524	Command to switch Off with interlock in DPSY01	5A0101 8005231F40	DPSY	DEV01_OP_INTERLOCK
5A0101 800524EF40	PLC_BIT_0525	Command to switch On in DPSY01	5A0101 8005241F40	DPSY	DEV01_CL_COMMAND
5A0101 800525EF40	PLC_BIT_0526	Command to switch On with interlock in DPSY01	5A0101 8005251F40	DPSY	DEV01_CL_INTERLOCK
5A0101 800526EF40	PLC_BIT_0527	Command to switch On with synchronization	5A0101 8005261F40	DPSY	DEV01_CL_SYNC
5A0101 800527EF40	PLC_BIT_0528	Command to switch On with interlock and synchronization	5A0101 8005271F40	DPSY	DEV01_CL_SYNC_INTER
5A0101 800528EF40	PLC_BIT_0529	Blocking synchronization at DPSY01	5A0101 8005281F40	DPSY	DPSY01IN_TMP_25
5A0101 800529EF40	PLC_BIT_0530	Condition of selection completed in DPSY (in PLC)	5A0101 8005291F40	DPSY	DPSY01IN_TMP_29
5A0101 800530EF40	PLC_BIT_0531	Condition of Selection failure at DPSY (in PLC)	5A0101 8005301F40	DPSY	DPSY01IN_TMP_30
5A0101 800531EF40	PLC_BIT_0532	Reason of selection failure at DPSY (in Fixed source)(in PLC)	5A0101 8005311F40	DPSY	DPSY01IN_TMP_31
5A0101 800532EF40	PLC_BIT_0533	Reason of selection failure at DPSY(in PLC)	5A0101 8005321F40	DPSY	DPSY01IN_TMP_32
5A0101 800533EF40	PLC_BIT_0534	Condition of cancel selection at DPSY (in PLC)	5A0101 8005331F40	DPSY	DPSY01IN_TMP_33
5A0101 800534EF40	PLC_BIT_0535	Condition for controlling OFF at DPSY (in PLC)	5A0101 8005341F40	DPSY	DPSY01IN_TMP_34
5A0101 800535EF40	PLC_BIT_0536	Condition for controlling ON at DPSY (in PLC)	5A0101 8005351F40	DPSY	DPSY01IN_TMP_35
5A0101 800536EF40	PLC_BIT_0537	Failure condition for controlling OFF at DPSY (in PLC)	5A0101 8005361F40	DPSY	DPSY01IN_TMP_37
5A0101 800537EF40	PLC_BIT_0538	Failure condition for controlling ON at DPSY (in PLC)	5A0101 8005371F40	DPSY	DPSY01IN_TMP_38
5A0101 800538EF40	PLC_BIT_0539	Reason of selection failure at DPSY (in Fixed source)(in PLC)	5A0101 8005381F40	DPSY	DPSY01IN_TMP_40
5A0101 800539EF40	PLC_BIT_0540	Reason of selection failure at DPSY(in PLC)	5A0101 8005391F40	DPSY	DPSY01IN_TMP_41
5A0101 800540EF40	PLC_BIT_0541	Control Off output on BO circuit in DPSY	5A0101 8005401F40	DPSY	DPSY01IN_TMP_42
5A0101 800541EF40	PLC_BIT_0542	Control On output on BO circuit in DPSY	5A0101 8005411F40	DPSY	DPSY01IN_TMP_43
5A0101 800542EF40	PLC_BIT_0543	Success for controlling at DPSY (in PLC)	5A0101 8005421F40	DPSY	DPSY01IN_TMP_44
5A0101 800543EF40	PLC_BIT_0544	Failure for controlling at DPSY (in PLC)	5A0101 8005431F40	DPSY	DPSY01IN_TMP_45
5A0101 800544EF40	PLC_BIT_0545	Cancel reason for controlling at DPSY (in PLC)	5A0101 8005441F40	DPSY	DPSY01IN_TMP_46
5A0101 800545EF40	PLC_BIT_0546	Command to switch Off in DPSY02	5A0101 8005451F40	DPSY	DPSY02IN_TMP_25
5A0101 800546EF40	PLC_BIT_0547	Command to switch Off with interlock in DPSY02	5A0101 8005461F40	DPSY	DEV02_OP_COMMAND
5A0101 800547EF40	PLC_BIT_0548	Command to switch On in DPSY02	5A0101 8005471F40	DPSY	DEV02_OP_INTERLOCK
5A0101 800548EF40	PLC_BIT_0549	Command to switch On with interlock in DPSY02	5A0101 8005481F40	DPSY	DEV02_CL_COMMAND
5A0101 800549EF40	PLC_BIT_0550	Command to switch On with synchronization	5A0101 8005491F40	DPSY	DEV02_CL_INTERLOCK
5A0101 800550EF40	PLC_BIT_0551	Command to switch On with interlock and synchronization	5A0101 8005501F40	DPSY	DEV02_CL_SYNC
5A0101 800551EF40	PLC_BIT_0552	Blocking synchronization at DPSY02	5A0101 8005511F40	DPSY	DEV02_CL_SYNC_INTER
5A0101 800552EF40	PLC_BIT_0553	Condition of selection completed in DPSY (in PLC)	5A0101 8005521F40	DPSY	DPSY02IN_TMP_29
5A0101 800553EF40	PLC_BIT_0554	Condition of Selection failure at DPSY (in PLC)	5A0101 8005531F40	DPSY	DPSY02IN_TMP_30
5A0101 800554EF40	PLC_BIT_0555	Reason of selection failure at DPSY (in Fixed source)(in PLC)	5A0101 8005541F40	DPSY	DPSY02IN_TMP_31
5A0101 800555EF40	PLC_BIT_0556	Reason of selection failure at DPSY(in PLC)	5A0101 8005551F40	DPSY	DPSY02IN_TMP_32
5A0101 800556EF40	PLC_BIT_0557	Condition of cancel selection at DPSY (in PLC)	5A0101 8005561F40	DPSY	DPSY02IN_TMP_33
5A0101 800557EF40	PLC_BIT_0558	Condition for controlling OFF at DPSY (in PLC)	5A0101 8005571F40	DPSY	DPSY02IN_TMP_34
5A0101 800558EF40	PLC_BIT_0559	Condition for controlling ON at DPSY (in PLC)	5A0101 8005581F40	DPSY	DPSY02IN_TMP_35
5A0101 800559EF40	PLC_BIT_0560	Failure condition for controlling OFF at DPSY (in PLC)	5A0101 8005591F40	DPSY	DPSY02IN_TMP_37
5A0101 800560EF40	PLC_BIT_0561	Failure condition for controlling ON at DPSY (in PLC)	5A0101 8005601F40	DPSY	DPSY02IN_TMP_38
5A0101 800561EF40	PLC_BIT_0562	Reason of selection failure at DPSY (in Fixed source)(in PLC)	5A0101 8005611F40	DPSY	DPSY02IN_TMP_40
5A0101 800562EF40	PLC_BIT_0563	Reason of selection failure at DPSY(in PLC)	5A0101 8005621F40	DPSY	DPSY02IN_TMP_41
5A0101 800563EF40	PLC_BIT_0564	Control Off output on BO circuit in DPSY	5A0101 8005631F40	DPSY	DPSY02IN_TMP_42
5A0101 800564EF40	PLC_BIT_0565	Control On output on BO circuit in DPSY	5A0101 8005641F40	DPSY	DPSY02IN_TMP_43
5A0101 800565EF40	PLC_BIT_0566	Success for controlling at DPSY (in PLC)	5A0101 8005651F40	DPSY	DPSY02IN_TMP_44
5A0101 800566EF40	PLC_BIT_0567	Failure for controlling at DPSY (in PLC)	5A0101 8005661F40	DPSY	DPSY02IN_TMP_45

DataIDs	Connections	Meaning	Monitoring	FB	Destinations
5A0101 800567EF40	PLC_BIT_0568	Cancel reason for controlling at DPSY (in PLC)	5A0101 8005671F40	DPSY	DPSY02IN_TMP_46
5A0101 800568EF40	PLC_BIT_0569		5A0101 8005681F40		
5A0101 800569EF40	PLC_BIT_0570	Establishing control right at DPOS (PLC)	5A0101 8005691F40	DPOS	DPOS01IN_TMP_28
5A0101 800570EF40	PLC_BIT_0571	Establishing control right for calibrating counter values at DPOS(PLC)	5A0101 8005701F40	DPOS	DPOS01IN_TMP_45
5A0101 800571EF40	PLC_BIT_0572	Establishing control right for resetting measurement value at DPOS(PLC)	5A0101 8005711F40	DPOS	DPOS01IN_TMP_46
5A0101 800572EF40	PLC_BIT_0573	Establishing control right at DPOS (PLC)	5A0101 8005721F40	DPOS	DPOS02IN_TMP_28
5A0101 800573EF40	PLC_BIT_0574	Establishing control right for calibrating counter values at DPOS(PLC)	5A0101 8005731F40	DPOS	DPOS02IN_TMP_45
5A0101 800574EF40	PLC_BIT_0575	Establishing control right for resetting measurement value at DPOS(PLC)	5A0101 8005741F40	DPOS	DPOS02IN_TMP_46
5A0101 800575EF40	PLC_BIT_0576	Establishing control right at DPOS (PLC)	5A0101 8005751F40	DPOS	DPOS03IN_TMP_28
5A0101 800576EF40	PLC_BIT_0577	Establishing control right for calibrating counter values at DPOS(PLC)	5A0101 8005761F40	DPOS	DPOS03IN_TMP_45
5A0101 800577EF40	PLC_BIT_0578	Establishing control right for resetting measurement value at DPOS(PLC)	5A0101 8005771F40	DPOS	DPOS03IN_TMP_46
5A0101 800578EF40	PLC_BIT_0579	Establishing control right at DPOS (PLC)	5A0101 8005781F40	DPOS	DPOS04IN_TMP_28
5A0101 800579EF40	PLC_BIT_0580	Establishing control right for calibrating counter values at DPOS(PLC)	5A0101 8005791F40	DPOS	DPOS04IN_TMP_45
5A0101 800580EF40	PLC_BIT_0581	Establishing control right for resetting measurement value at DPOS(PLC)	5A0101 8005801F40	DPOS	DPOS04IN_TMP_46
5A0101 800581EF40	PLC_BIT_0582	Establishing control right at DPOS (PLC)	5A0101 8005811F40	DPOS	DPOS05IN_TMP_28
5A0101 800582EF40	PLC_BIT_0583	Establishing control right for calibrating counter values at DPOS(PLC)	5A0101 8005821F40	DPOS	DPOS05IN_TMP_45
5A0101 800583EF40	PLC_BIT_0584	Establishing control right for resetting measurement value at DPOS(PLC)	5A0101 8005831F40	DPOS	DPOS05IN_TMP_46
5A0101 800584EF40	PLC_BIT_0585	Establishing control right at DPOS (PLC)	5A0101 8005841F40	DPOS	DPOS06IN_TMP_28
5A0101 800585EF40	PLC_BIT_0586	Establishing control right for calibrating counter values at DPOS(PLC)	5A0101 8005851F40	DPOS	DPOS06IN_TMP_45
5A0101 800586EF40	PLC_BIT_0587	Establishing control right for resetting measurement value at DPOS(PLC)	5A0101 8005861F40	DPOS	DPOS06IN_TMP_46
5A0101 800587EF40	PLC_BIT_0588	Establishing control right at DPOS (PLC)	5A0101 8005871F40	DPOS	DPOS07IN_TMP_28
5A0101 800588EF40	PLC_BIT_0589	Establishing control right for calibrating counter values at DPOS(PLC)	5A0101 8005881F40	DPOS	DPOS07IN_TMP_45
5A0101 800589EF40	PLC_BIT_0590	Establishing control right for resetting measurement value at DPOS(PLC)	5A0101 8005891F40	DPOS	DPOS07IN_TMP_46
5A0101 800590EF40	PLC_BIT_0591	Establishing control right at DPOS (PLC)	5A0101 8005901F40	DPOS	DPOS08IN_TMP_28
5A0101 800591EF40	PLC_BIT_0592	Establishing control right for calibrating counter values at DPOS(PLC)	5A0101 8005911F40	DPOS	DPOS08IN_TMP_45
5A0101 800592EF40	PLC_BIT_0593	Establishing control right for resetting measurement value at DPOS(PLC)	5A0101 8005921F40	DPOS	DPOS08IN_TMP_46
5A0101 800593EF40	PLC_BIT_0594	Establishing control right at DPOS (PLC)	5A0101 8005931F40	DPOS	DPOS09IN_TMP_28
5A0101 800594EF40	PLC_BIT_0595	Establishing control right for calibrating counter values at DPOS(PLC)	5A0101 8005941F40	DPOS	DPOS09IN_TMP_45
5A0101 800595EF40	PLC_BIT_0596	Establishing control right for resetting measurement value at DPOS(PLC)	5A0101 8005951F40	DPOS	DPOS09IN_TMP_46
5A0101 800596EF40	PLC_BIT_0597	Establishing control right at DPOS (PLC)	5A0101 8005961F40	DPOS	DPOS10IN_TMP_28
5A0101 800597EF40	PLC_BIT_0598	Establishing control right for calibrating counter values at DPOS(PLC)	5A0101 8005971F40	DPOS	DPOS10IN_TMP_45
5A0101 800598EF40	PLC_BIT_0599	Establishing control right for resetting measurement value at DPOS(PLC)	5A0101 8005981F40	DPOS	DPOS10IN_TMP_46
5A0101 800599EF40	PLC_BIT_0600	Establishing control right at DPOS (PLC)	5A0101 8005991F40	DPOS	DPOS11IN_TMP_28
5A0101 800600EF40	PLC_BIT_0601	Establishing control right for calibrating counter values at DPOS(PLC)	5A0101 8006001F40	DPOS	DPOS11IN_TMP_45
5A0101 800601EF40	PLC_BIT_0602	Establishing control right for resetting measurement value at DPOS(PLC)	5A0101 8006011F40	DPOS	DPOS11IN_TMP_46
5A0101 800602EF40	PLC_BIT_0603	Establishing control right at DPOS (PLC)	5A0101 8006021F40	DPOS	DPOS12IN_TMP_28
5A0101 800603EF40	PLC_BIT_0604	Establishing control right for calibrating counter values at DPOS(PLC)	5A0101 8006031F40	DPOS	DPOS12IN_TMP_45
5A0101 800604EF40	PLC_BIT_0605	Establishing control right for resetting measurement value at DPOS(PLC)	5A0101 8006041F40	DPOS	DPOS12IN_TMP_46
5A0101 800605EF40	PLC_BIT_0606	Establishing control right at DPOS (PLC)	5A0101 8006051F40	DPOS	DPOS13IN_TMP_28
5A0101 800606EF40	PLC_BIT_0607	Establishing control right for calibrating counter values at DPOS(PLC)	5A0101 8006061F40	DPOS	DPOS13IN_TMP_45
5A0101 800607EF40	PLC_BIT_0608	Establishing control right for resetting measurement value at DPOS(PLC)	5A0101 8006071F40	DPOS	DPOS13IN_TMP_46
5A0101 800608EF40	PLC_BIT_0609	Establishing control right at DPOS (PLC)	5A0101 8006081F40	DPOS	DPOS14IN_TMP_28
5A0101 800609EF40	PLC_BIT_0610	Establishing control right for calibrating counter values at DPOS(PLC)	5A0101 8006091F40	DPOS	DPOS14IN_TMP_45
5A0101 800610EF40	PLC_BIT_0611	Establishing control right for resetting measurement value at DPOS(PLC)	5A0101 8006101F40	DPOS	DPOS14IN_TMP_46
5A0101 800611EF40	PLC_BIT_0612	Establishing control right at DPOS (PLC)	5A0101 8006111F40	DPOS	DPOS15IN_TMP_28
5A0101 800612EF40	PLC_BIT_0613	Establishing control right for calibrating counter values at DPOS(PLC)	5A0101 8006121F40	DPOS	DPOS15IN_TMP_45
5A0101 800613EF40	PLC_BIT_0614	Establishing control right for resetting measurement value at DPOS(PLC)	5A0101 8006131F40	DPOS	DPOS15IN_TMP_46
5A0101 800614EF40	PLC_BIT_0615	Establishing control right at DPOS (PLC)	5A0101 8006141F40	DPOS	DPOS16IN_TMP_28
5A0101 800615EF40	PLC_BIT_0616	Establishing control right for calibrating counter values at DPOS(PLC)	5A0101 8006151F40	DPOS	DPOS16IN_TMP_45
5A0101 800616EF40	PLC_BIT_0617	Establishing control right for resetting measurement value at DPOS(PLC)	5A0101 8006161F40	DPOS	DPOS16IN_TMP_46
5A0101 800617EF40	PLC_BIT_0618	Establishing control right at DPOS (PLC)	5A0101 8006171F40	DPOS	DPOS17IN_TMP_28
5A0101 800618EF40	PLC_BIT_0619	Establishing control right for calibrating counter values at DPOS(PLC)	5A0101 8006181F40	DPOS	DPOS17IN_TMP_45
5A0101 800619EF40	PLC_BIT_0620	Establishing control right for resetting measurement value at DPOS(PLC)	5A0101 8006191F40	DPOS	DPOS17IN_TMP_46
5A0101 800620EF40	PLC_BIT_0621	Establishing control right at DPOS (PLC)	5A0101 8006201F40	DPOS	DPOS18IN_TMP_28
5A0101 800621EF40	PLC_BIT_0622	Establishing control right for calibrating counter values at DPOS(PLC)	5A0101 8006211F40	DPOS	DPOS18IN_TMP_45
5A0101 800622EF40	PLC_BIT_0623	Establishing control right for resetting measurement value at DPOS(PLC)	5A0101 8006221F40	DPOS	DPOS18IN_TMP_46
5A0101 800623EF40	PLC_BIT_0624	Establishing control right at DPOS (PLC)	5A0101 8006231F40	DPOS	DPOS19IN_TMP_28
5A0101 800624EF40	PLC_BIT_0625	Establishing control right for calibrating counter values at DPOS(PLC)	5A0101 8006241F40	DPOS	DPOS19IN_TMP_45
5A0101 800625EF40	PLC_BIT_0626	Establishing control right for resetting measurement value at DPOS(PLC)	5A0101 8006251F40	DPOS	DPOS19IN_TMP_46
5A0101 800626EF40	PLC_BIT_0627	Establishing control right at DPOS (PLC)	5A0101 8006261F40	DPOS	DPOS20IN_TMP_28
5A0101 800627EF40	PLC_BIT_0628	Establishing control right for calibrating counter values at DPOS(PLC)	5A0101 8006271F40	DPOS	DPOS20IN_TMP_45
5A0101 800628EF40	PLC_BIT_0629	Establishing control right for resetting measurement value at DPOS(PLC)	5A0101 8006281F40	DPOS	DPOS20IN_TMP_46
5A0101 800629EF40	PLC_BIT_0630	Command for switching Off in DPOS	5A0101 8006291F40	DPOS	DEV01_OP_COMMAND
5A0101 800630EF40	PLC_BIT_0631	Command for switching Off with interlock in DPOS	5A0101 8006301F40	DPOS	DEV01_OP_INTERLOCK
5A0101 800631EF40	PLC_BIT_0632	Command for switching On in DPOS	5A0101 8006311F40	DPOS	DEV01_CL_COMMAND
5A0101 800632EF40	PLC_BIT_0633	Command for switching On with interlock in DPOS	5A0101 8006321F40	DPOS	DEV01_CL_INTERLOCK
5A0101 800633EF40	PLC_BIT_0634	Condition of selection completed in DPOS (in PLC)	5A0101 8006331F40	DPOS	DPOS01IN_TMP_29
5A0101 800634EF40	PLC_BIT_0635	Condition of Selection failure at DPOS (in PLC)	5A0101 8006341F40	DPOS	DPOS01IN_TMP_30
5A0101 800635EF40	PLC_BIT_0636	Reason of selection failure at DPOS (in Fixed source)(in PLC)	5A0101 8006351F40	DPOS	DPOS01IN_TMP_31
5A0101 800636EF40	PLC_BIT_0637	Reason of selection failure at DPOS(in PLC)	5A0101 8006361F40	DPOS	DPOS01IN_TMP_32
5A0101 800637EF40	PLC_BIT_0638	Condition of cancel selection at DPOS (in PLC)	5A0101 8006371F40	DPOS	DPOS01IN_TMP_33
5A0101 800638EF40	PLC_BIT_0639	Condition for controlling OFF at DPOS (in PLC)	5A0101 8006381F40	DPOS	DPOS01IN_TMP_34
5A0101 800639EF40	PLC_BIT_0640	Condition for controlling ON at DPOS (in PLC)	5A0101 8006391F40	DPOS	DPOS01IN_TMP_35
5A0101 800640EF40	PLC_BIT_0641	Failure condition for controlling OFF at DPOS (in PLC)	5A0101 8006401F40	DPOS	DPOS01IN_TMP_36
5A0101 800641EF40	PLC_BIT_0642	Failure condition for controlling ON at DPOS (in PLC)	5A0101 8006411F40	DPOS	DPOS01IN_TMP_37
5A0101 800642EF40	PLC_BIT_0643	Reason of selection failure at DPOS (in Fixed source)(in PLC)	5A0101 8006421F40	DPOS	DPOS01IN_TMP_38
5A0101 800643EF40	PLC_BIT_0644	Reason of selection failure at DPOS(in PLC)	5A0101 8006431F40	DPOS	DPOS01IN_TMP_39
5A0101 800644EF40	PLC_BIT_0645	Control Off output on BO circuit in DPOS	5A0101 8006441F40	DPOS	DPOS01IN_TMP_40
5A0101 800645EF40	PLC_BIT_0646	Control On output on BO circuit in DPOS	5A0101 8006451F40	DPOS	DPOS01IN_TMP_41
5A0101 800646EF40	PLC_BIT_0647	Success for controlling at DPOS (in PLC)	5A0101 8006461F40	DPOS	DPOS01IN_TMP_42
5A0101 800647EF40	PLC_BIT_0648	Failure for controlling at DPOS (in PLC)	5A0101 8006471F40	DPOS	DPOS01IN_TMP_43
5A0101 800648EF40	PLC_BIT_0649	Cancel reason for controlling at DPOS (in PLC)	5A0101 8006481F40	DPOS	DPOS01IN_TMP_44
5A0101 800649EF40	PLC_BIT_0650	Command for switching Off in DPOS2	5A0101 8006491F40	DPOS	DEV02_OP_COMMAND
5A0101 800650EF40	PLC_BIT_0651	Command for switching Off with interlock in DPOS2	5A0101 8006501F40	DPOS	DEV02_OP_INTERLOCK
5A0101 800651EF40	PLC_BIT_0652	Command for switching On in DPOS2	5A0101 8006511F40	DPOS	DEV02_CL_COMMAND
5A0101 800652EF40	PLC_BIT_0653	Command for switching On with interlock in DPOS2	5A0101 8006521F40	DPOS	DEV02_CL_INTERLOCK
5A0101 800653EF40	PLC_BIT_0654	Condition of selection completed in DPOS (in PLC)	5A0101 8006531F40	DPOS	DPOS02IN_TMP_29
5A0101 800654EF40	PLC_BIT_0655	Condition of Selection failure at DPOS (in PLC)	5A0101 8006541F40	DPOS	DPOS02IN_TMP_30
5A0101 800655EF40	PLC_BIT_0656	Reason of selection failure at DPOS (in Fixed source)(in PLC)	5A0101 8006551F40	DPOS	DPOS02IN_TMP_31
5A0101 800656EF40	PLC_BIT_0657	Reason of selection failure at DPOS(in PLC)	5A0101 8006561F40	DPOS	DPOS02IN_TMP_32
5A0101 800657EF40	PLC_BIT_0658	Condition of cancel selection at DPOS (in PLC)	5A0101 8006571F40	DPOS	DPOS02IN_TMP_33
5A0101 800658EF40	PLC_BIT_0659	Condition for controlling OFF at DPOS (in PLC)	5A0101 8006581F40	DPOS	DPOS02IN_TMP_34
5A0101 800659EF40	PLC_BIT_0660	Condition for controlling ON at DPOS (in PLC)	5A0101 8006591F40	DPOS	DPOS02IN_TMP_35
5A0101 800660EF40	PLC_BIT_0661	Failure condition for controlling OFF at DPOS (in PLC)	5A0101 8006601F40	DPOS	DPOS02IN_TMP_36
5A0101 800661EF40	PLC_BIT_0662	Failure condition for controlling ON at DPOS (in PLC)	5A0101 8006611F40	DPOS	DPOS02IN_TMP_37
5A0101 800662EF40	PLC_BIT_0663	Reason of selection failure at DPOS (in Fixed source)(in PLC)	5A0101 8006621F40	DPOS	DPOS02IN_TMP_38
5A0101 800663EF40	PLC_BIT_0664	Reason of selection failure at DPOS(in PLC)	5A0101 8006631F40	DPOS	DPOS02IN_TMP_39

DataIDs	Connections	Meaning	Monitoring	FB	Destinations
5A0101 800664EF40	PLC_BIT_0665	Control Off output on BO circuit in DPOS	5A0101 8006641F40	DPOS	DPOS02IN_TMP_40
5A0101 800665EF40	PLC_BIT_0666	Control On output on BO circuit in DPOS	5A0101 8006651F40	DPOS	DPOS02IN_TMP_41
5A0101 800666EF40	PLC_BIT_0667	Success for controlling at DPOS (in PLC)	5A0101 8006661F40	DPOS	DPOS02IN_TMP_42
5A0101 800667EF40	PLC_BIT_0668	Failure for controlling at DPOS (in PLC)	5A0101 8006671F40	DPOS	DPOS02IN_TMP_43
5A0101 800668EF40	PLC_BIT_0669	Cancel reason for controlling at DPOS (in PLC)	5A0101 8006681F40	DPOS	DPOS02IN_TMP_44
5A0101 800669EF40	PLC_BIT_0670	Command for switching Off in DPOS	5A0101 8006691F40	DPOS	DEV03_OP_COMMAND
5A0101 800670EF40	PLC_BIT_0671	Command for switching Off with interlock in DPOS	5A0101 8006701F40	DPOS	DEV03_OP_INTERLOCK
5A0101 800671EF40	PLC_BIT_0672	Command for switching On in DPOS	5A0101 8006711F40	DPOS	DEV03_CL_COMMAND
5A0101 800672EF40	PLC_BIT_0673	Command for switching On with interlock in DPOS	5A0101 8006721F40	DPOS	DEV03_CL_INTERLOCK
5A0101 800673EF40	PLC_BIT_0674	Condition of selection completed in DPOS (in PLC)	5A0101 8006731F40	DPOS	DPOS03IN_TMP_29
5A0101 800674EF40	PLC_BIT_0675	Condition of Selection failure at DPOS (in PLC)	5A0101 8006741F40	DPOS	DPOS03IN_TMP_30
5A0101 800675EF40	PLC_BIT_0676	Reason of selection failure at DPOS (in Fixed source)(in PLC)	5A0101 8006751F40	DPOS	DPOS03IN_TMP_31
5A0101 800676EF40	PLC_BIT_0677	Reason of selection failure at DPOS(in PLC)	5A0101 8006761F40	DPOS	DPOS03IN_TMP_32
5A0101 800677EF40	PLC_BIT_0678	Condition of cancel selection at DPOS (in PLC)	5A0101 8006771F40	DPOS	DPOS03IN_TMP_33
5A0101 800678EF40	PLC_BIT_0679	Condition for controlling OFF at DPOS (in PLC)	5A0101 8006781F40	DPOS	DPOS03IN_TMP_34
5A0101 800679EF40	PLC_BIT_0680	Condition for controlling ON at DPOS (in PLC)	5A0101 8006791F40	DPOS	DPOS03IN_TMP_35
5A0101 800680EF40	PLC_BIT_0681	Failure condition for controlling OFF at DPOS (in PLC)	5A0101 8006801F40	DPOS	DPOS03IN_TMP_36
5A0101 800681EF40	PLC_BIT_0682	Failure condition for controlling ON at DPOS (in PLC)	5A0101 8006811F40	DPOS	DPOS03IN_TMP_37
5A0101 800682EF40	PLC_BIT_0683	Reason of selection failure at DPOS (in Fixed source)(in PLC)	5A0101 8006821F40	DPOS	DPOS03IN_TMP_38
5A0101 800683EF40	PLC_BIT_0684	Reason of selection failure at DPOS(in PLC)	5A0101 8006831F40	DPOS	DPOS03IN_TMP_39
5A0101 800684EF40	PLC_BIT_0685	Control Off output on BO circuit in DPOS	5A0101 8006841F40	DPOS	DPOS03IN_TMP_40
5A0101 800685EF40	PLC_BIT_0686	Control On output on BO circuit in DPOS	5A0101 8006851F40	DPOS	DPOS03IN_TMP_41
5A0101 800686EF40	PLC_BIT_0687	Success for controlling at DPOS (in PLC)	5A0101 8006861F40	DPOS	DPOS03IN_TMP_42
5A0101 800687EF40	PLC_BIT_0688	Failure for controlling at DPOS (in PLC)	5A0101 8006871F40	DPOS	DPOS03IN_TMP_43
5A0101 800688EF40	PLC_BIT_0689	Cancel reason for controlling at DPOS (in PLC)	5A0101 8006881F40	DPOS	DPOS03IN_TMP_44
5A0101 800689EF40	PLC_BIT_0690	Command for switching Off in DPOS	5A0101 8006891F40	DPOS	DEV04_OP_COMMAND
5A0101 800690EF40	PLC_BIT_0691	Command for switching Off with interlock in DPOS	5A0101 8006901F40	DPOS	DEV04_OP_INTERLOCK
5A0101 800691EF40	PLC_BIT_0692	Command for switching On in DPOS	5A0101 8006911F40	DPOS	DEV04_CL_COMMAND
5A0101 800692EF40	PLC_BIT_0693	Command for switching On with interlock in DPOS	5A0101 8006921F40	DPOS	DEV04_CL_INTERLOCK
5A0101 800693EF40	PLC_BIT_0694	Condition of selection completed in DPOS (in PLC)	5A0101 8006931F40	DPOS	DPOS04IN_TMP_29
5A0101 800694EF40	PLC_BIT_0695	Condition of Selection failure at DPOS (in PLC)	5A0101 8006941F40	DPOS	DPOS04IN_TMP_30
5A0101 800695EF40	PLC_BIT_0696	Reason of selection failure at DPOS (in Fixed source)(in PLC)	5A0101 8006951F40	DPOS	DPOS04IN_TMP_31
5A0101 800696EF40	PLC_BIT_0697	Reason of selection failure at DPOS(in PLC)	5A0101 8006961F40	DPOS	DPOS04IN_TMP_32
5A0101 800697EF40	PLC_BIT_0698	Condition of cancel selection at DPOS (in PLC)	5A0101 8006971F40	DPOS	DPOS04IN_TMP_33
5A0101 800698EF40	PLC_BIT_0699	Condition for controlling OFF at DPOS (in PLC)	5A0101 8006981F40	DPOS	DPOS04IN_TMP_34
5A0101 800699EF40	PLC_BIT_0700	Condition for controlling ON at DPOS (in PLC)	5A0101 8006991F40	DPOS	DPOS04IN_TMP_35
5A0101 800700EF40	PLC_BIT_0701	Failure condition for controlling OFF at DPOS (in PLC)	5A0101 8007001F40	DPOS	DPOS04IN_TMP_36
5A0101 800701EF40	PLC_BIT_0702	Failure condition for controlling ON at DPOS (in PLC)	5A0101 8007011F40	DPOS	DPOS04IN_TMP_37
5A0101 800702EF40	PLC_BIT_0703	Reason of selection failure at DPOS (in Fixed source)(in PLC)	5A0101 8007021F40	DPOS	DPOS04IN_TMP_38
5A0101 800703EF40	PLC_BIT_0704	Reason of selection failure at DPOS(in PLC)	5A0101 8007031F40	DPOS	DPOS04IN_TMP_39
5A0101 800704EF40	PLC_BIT_0705	Control Off output on BO circuit in DPOS	5A0101 8007041F40	DPOS	DPOS04IN_TMP_40
5A0101 800705EF40	PLC_BIT_0706	Control On output on BO circuit in DPOS	5A0101 8007051F40	DPOS	DPOS04IN_TMP_41
5A0101 800706EF40	PLC_BIT_0707	Success for controlling at DPOS (in PLC)	5A0101 8007061F40	DPOS	DPOS04IN_TMP_42
5A0101 800707EF40	PLC_BIT_0708	Failure for controlling at DPOS (in PLC)	5A0101 8007071F40	DPOS	DPOS04IN_TMP_43
5A0101 800708EF40	PLC_BIT_0709	Cancel reason for controlling at DPOS (in PLC)	5A0101 8007081F40	DPOS	DPOS04IN_TMP_44
5A0101 800709EF40	PLC_BIT_0710	Command for switching Off in DPOS	5A0101 8007091F40	DPOS	DEV05_OP_COMMAND
5A0101 800710EF40	PLC_BIT_0711	Command for switching Off with interlock in DPOS	5A0101 8007101F40	DPOS	DEV05_OP_INTERLOCK
5A0101 800711EF40	PLC_BIT_0712	Command for switching On in DPOS	5A0101 8007111F40	DPOS	DEV05_CL_COMMAND
5A0101 800712EF40	PLC_BIT_0713	Command for switching On with interlock in DPOS	5A0101 8007121F40	DPOS	DEV05_CL_INTERLOCK
5A0101 800713EF40	PLC_BIT_0714	Condition of selection completed in DPOS (in PLC)	5A0101 8007131F40	DPOS	DPOS05IN_TMP_29
5A0101 800714EF40	PLC_BIT_0715	Condition of Selection failure at DPOS (in PLC)	5A0101 8007141F40	DPOS	DPOS05IN_TMP_30
5A0101 800715EF40	PLC_BIT_0716	Reason of selection failure at DPOS (in Fixed source)(in PLC)	5A0101 8007151F40	DPOS	DPOS05IN_TMP_31
5A0101 800716EF40	PLC_BIT_0717	Reason of selection failure at DPOS(in PLC)	5A0101 8007161F40	DPOS	DPOS05IN_TMP_32
5A0101 800717EF40	PLC_BIT_0718	Condition of cancel selection at DPOS (in PLC)	5A0101 8007171F40	DPOS	DPOS05IN_TMP_33
5A0101 800718EF40	PLC_BIT_0719	Condition for controlling OFF at DPOS (in PLC)	5A0101 8007181F40	DPOS	DPOS05IN_TMP_34
5A0101 800719EF40	PLC_BIT_0720	Condition for controlling ON at DPOS (in PLC)	5A0101 8007191F40	DPOS	DPOS05IN_TMP_35
5A0101 800720EF40	PLC_BIT_0721	Failure condition for controlling OFF at DPOS (in PLC)	5A0101 8007201F40	DPOS	DPOS05IN_TMP_36
5A0101 800721EF40	PLC_BIT_0722	Failure condition for controlling ON at DPOS (in PLC)	5A0101 8007211F40	DPOS	DPOS05IN_TMP_37
5A0101 800722EF40	PLC_BIT_0723	Reason of selection failure at DPOS (in Fixed source)(in PLC)	5A0101 8007221F40	DPOS	DPOS05IN_TMP_38
5A0101 800723EF40	PLC_BIT_0724	Reason of selection failure at DPOS(in PLC)	5A0101 8007231F40	DPOS	DPOS05IN_TMP_39
5A0101 800724EF40	PLC_BIT_0725	Control Off output on BO circuit in DPOS	5A0101 8007241F40	DPOS	DPOS05IN_TMP_40
5A0101 800725EF40	PLC_BIT_0726	Control On output on BO circuit in DPOS	5A0101 8007251F40	DPOS	DPOS05IN_TMP_41
5A0101 800726EF40	PLC_BIT_0727	Success for controlling at DPOS (in PLC)	5A0101 8007261F40	DPOS	DPOS05IN_TMP_42
5A0101 800727EF40	PLC_BIT_0728	Failure for controlling at DPOS (in PLC)	5A0101 8007271F40	DPOS	DPOS05IN_TMP_43
5A0101 800728EF40	PLC_BIT_0729	Cancel reason for controlling at DPOS (in PLC)	5A0101 8007281F40	DPOS	DPOS05IN_TMP_44
5A0101 800729EF40	PLC_BIT_0730	Command for switching Off in DPOS	5A0101 8007291F40	DPOS	DEV06_OP_COMMAND
5A0101 800730EF40	PLC_BIT_0731	Command for switching Off with interlock in DPOS	5A0101 8007301F40	DPOS	DEV06_OP_INTERLOCK
5A0101 800731EF40	PLC_BIT_0732	Command for switching On in DPOS	5A0101 8007311F40	DPOS	DEV06_CL_COMMAND
5A0101 800732EF40	PLC_BIT_0733	Command for switching On with interlock in DPOS	5A0101 8007321F40	DPOS	DEV06_CL_INTERLOCK
5A0101 800733EF40	PLC_BIT_0734	Condition of selection completed in DPOS (in PLC)	5A0101 8007331F40	DPOS	DPOS06IN_TMP_29
5A0101 800734EF40	PLC_BIT_0735	Condition of Selection failure at DPOS (in PLC)	5A0101 8007341F40	DPOS	DPOS06IN_TMP_30
5A0101 800735EF40	PLC_BIT_0736	Reason of selection failure at DPOS (in Fixed source)(in PLC)	5A0101 8007351F40	DPOS	DPOS06IN_TMP_31
5A0101 800736EF40	PLC_BIT_0737	Reason of selection failure at DPOS(in PLC)	5A0101 8007361F40	DPOS	DPOS06IN_TMP_32
5A0101 800737EF40	PLC_BIT_0738	Condition of cancel selection at DPOS (in PLC)	5A0101 8007371F40	DPOS	DPOS06IN_TMP_33
5A0101 800738EF40	PLC_BIT_0739	Condition for controlling OFF at DPOS (in PLC)	5A0101 8007381F40	DPOS	DPOS06IN_TMP_34
5A0101 800739EF40	PLC_BIT_0740	Condition for controlling ON at DPOS (in PLC)	5A0101 8007391F40	DPOS	DPOS06IN_TMP_35
5A0101 800740EF40	PLC_BIT_0741	Failure condition for controlling OFF at DPOS (in PLC)	5A0101 8007401F40	DPOS	DPOS06IN_TMP_36
5A0101 800741EF40	PLC_BIT_0742	Failure condition for controlling ON at DPOS (in PLC)	5A0101 8007411F40	DPOS	DPOS06IN_TMP_37
5A0101 800742EF40	PLC_BIT_0743	Reason of selection failure at DPOS (in Fixed source)(in PLC)	5A0101 8007421F40	DPOS	DPOS06IN_TMP_38
5A0101 800743EF40	PLC_BIT_0744	Reason of selection failure at DPOS(in PLC)	5A0101 8007431F40	DPOS	DPOS06IN_TMP_39
5A0101 800744EF40	PLC_BIT_0745	Control Off output on BO circuit in DPOS	5A0101 8007441F40	DPOS	DPOS06IN_TMP_40
5A0101 800745EF40	PLC_BIT_0746	Control On output on BO circuit in DPOS	5A0101 8007451F40	DPOS	DPOS06IN_TMP_41
5A0101 800746EF40	PLC_BIT_0747	Success for controlling at DPOS (in PLC)	5A0101 8007461F40	DPOS	DPOS06IN_TMP_42
5A0101 800747EF40	PLC_BIT_0748	Failure for controlling at DPOS (in PLC)	5A0101 8007471F40	DPOS	DPOS06IN_TMP_43
5A0101 800748EF40	PLC_BIT_0749	Cancel reason for controlling at DPOS (in PLC)	5A0101 8007481F40	DPOS	DPOS06IN_TMP_44
5A0101 800749EF40	PLC_BIT_0750	Command for switching Off in DPOS	5A0101 8007491F40	DPOS	DEV07_OP_COMMAND
5A0101 800750EF40	PLC_BIT_0751	Command for switching Off with interlock in DPOS	5A0101 8007501F40	DPOS	DEV07_OP_INTERLOCK
5A0101 800751EF40	PLC_BIT_0752	Command for switching On in DPOS	5A0101 8007511F40	DPOS	DEV07_CL_COMMAND
5A0101 800752EF40	PLC_BIT_0753	Command for switching On with interlock in DPOS	5A0101 8007521F40	DPOS	DEV07_CL_INTERLOCK
5A0101 800753EF40	PLC_BIT_0754	Condition of selection completed in DPOS (in PLC)	5A0101 8007531F40	DPOS	DPOS07IN_TMP_29
5A0101 800754EF40	PLC_BIT_0755	Condition of Selection failure at DPOS (in PLC)	5A0101 8007541F40	DPOS	DPOS07IN_TMP_30
5A0101 800755EF40	PLC_BIT_0756	Reason of selection failure at DPOS (in Fixed source)(in PLC)	5A0101 8007551F40	DPOS	DPOS07IN_TMP_31
5A0101 800756EF40	PLC_BIT_0757	Reason of selection failure at DPOS(in PLC)	5A0101 8007561F40	DPOS	DPOS07IN_TMP_32
5A0101 800757EF40	PLC_BIT_0758	Condition of cancel selection at DPOS (in PLC)	5A0101 8007571F40	DPOS	DPOS07IN_TMP_33
5A0101 800758EF40	PLC_BIT_0759	Condition for controlling OFF at DPOS (in PLC)	5A0101 8007581F40	DPOS	DPOS07IN_TMP_34
5A0101 800759EF40	PLC_BIT_0760	Condition for controlling ON at DPOS (in PLC)	5A0101 8007591F40	DPOS	DPOS07IN_TMP_35
5A0101 800760EF40	PLC_BIT_0761	Failure condition for controlling OFF at DPOS (in PLC)	5A0101 8007601F40	DPOS	DPOS07IN_TMP_36

DataIDs	Connections	Meaning	Monitoring	FB	Destinations
5A0101 800761EF40	PLC_BIT_0762	Failure condition for controlling ON at DPOS (in PLC)	5A0101 8007611F40	DPOS	DPOS07IN_TMP_37
5A0101 800762EF40	PLC_BIT_0763	Reason of selection failure at DPOS (in Fixed source)(in PLC)	5A0101 8007621F40	DPOS	DPOS07IN_TMP_38
5A0101 800763EF40	PLC_BIT_0764	Reason of selection failure at DPOS(in PLC)	5A0101 8007631F40	DPOS	DPOS07IN_TMP_39
5A0101 800764EF40	PLC_BIT_0765	Control Off output on BO circuit in DPOS	5A0101 8007641F40	DPOS	DPOS07IN_TMP_40
5A0101 800765EF40	PLC_BIT_0766	Control On output on BO circuit in DPOS	5A0101 8007651F40	DPOS	DPOS07IN_TMP_41
5A0101 800766EF40	PLC_BIT_0767	Success for controlling at DPOS (in PLC)	5A0101 8007661F40	DPOS	DPOS07IN_TMP_42
5A0101 800767EF40	PLC_BIT_0768	Failure for controlling at DPOS (in PLC)	5A0101 8007671F40	DPOS	DPOS07IN_TMP_43
5A0101 800768EF40	PLC_BIT_0769	Cancel reason for controlling at DPOS (in PLC)	5A0101 8007681F40	DPOS	DPOS07IN_TMP_44
5A0101 800769EF40	PLC_BIT_0770	Command for switching Off in DPOS	5A0101 8007691F40	DPOS	DEV08_OP_COMMAND
5A0101 800770EF40	PLC_BIT_0771	Command for switching Off with interlock in DPOS	5A0101 8007701F40	DPOS	DEV08_OP_INTERLOCK
5A0101 800771EF40	PLC_BIT_0772	Command for switching On in DPOS	5A0101 8007711F40	DPOS	DEV08_CL_COMMAND
5A0101 800772EF40	PLC_BIT_0773	Command for switching On with interlock in DPOS	5A0101 8007721F40	DPOS	DEV08_CL_INTERLOCK
5A0101 800773EF40	PLC_BIT_0774	Condition of selection completed in DPOS (in PLC)	5A0101 8007731F40	DPOS	DPOS08IN_TMP_29
5A0101 800774EF40	PLC_BIT_0775	Condition of Selection failure at DPOS (in PLC)	5A0101 8007741F40	DPOS	DPOS08IN_TMP_30
5A0101 800775EF40	PLC_BIT_0776	Reason of selection failure at DPOS (in Fixed source)(in PLC)	5A0101 8007751F40	DPOS	DPOS08IN_TMP_31
5A0101 800776EF40	PLC_BIT_0777	Reason of selection failure at DPOS(in PLC)	5A0101 8007761F40	DPOS	DPOS08IN_TMP_32
5A0101 800777EF40	PLC_BIT_0778	Condition of cancel selection at DPOS (in PLC)	5A0101 8007771F40	DPOS	DPOS08IN_TMP_33
5A0101 800778EF40	PLC_BIT_0779	Condition for controlling OFF at DPOS (in PLC)	5A0101 8007781F40	DPOS	DPOS08IN_TMP_34
5A0101 800779EF40	PLC_BIT_0780	Condition for controlling ON at DPOS (in PLC)	5A0101 8007791F40	DPOS	DPOS08IN_TMP_35
5A0101 800780EF40	PLC_BIT_0781	Failure condition for controlling OFF at DPOS (in PLC)	5A0101 8007801F40	DPOS	DPOS08IN_TMP_36
5A0101 800781EF40	PLC_BIT_0782	Failure condition for controlling ON at DPOS (in PLC)	5A0101 8007811F40	DPOS	DPOS08IN_TMP_37
5A0101 800782EF40	PLC_BIT_0783	Reason of selection failure at DPOS (in Fixed source)(in PLC)	5A0101 8007821F40	DPOS	DPOS08IN_TMP_38
5A0101 800783EF40	PLC_BIT_0784	Reason of selection failure at DPOS(in PLC)	5A0101 8007831F40	DPOS	DPOS08IN_TMP_39
5A0101 800784EF40	PLC_BIT_0785	Control Off output on BO circuit in DPOS	5A0101 8007841F40	DPOS	DPOS08IN_TMP_40
5A0101 800785EF40	PLC_BIT_0786	Control On output on BO circuit in DPOS	5A0101 8007851F40	DPOS	DPOS08IN_TMP_41
5A0101 800786EF40	PLC_BIT_0787	Success for controlling at DPOS (in PLC)	5A0101 8007861F40	DPOS	DPOS08IN_TMP_42
5A0101 800787EF40	PLC_BIT_0788	Failure for controlling at DPOS (in PLC)	5A0101 8007871F40	DPOS	DPOS08IN_TMP_43
5A0101 800788EF40	PLC_BIT_0789	Cancel reason for controlling at DPOS (in PLC)	5A0101 8007881F40	DPOS	DPOS08IN_TMP_44
5A0101 800789EF40	PLC_BIT_0790	Command for switching Off in DPOS	5A0101 8007891F40	DPOS	DEV09_OP_COMMAND
5A0101 800790EF40	PLC_BIT_0791	Command for switching Off with interlock in DPOS	5A0101 8007901F40	DPOS	DEV09_OP_INTERLOCK
5A0101 800791EF40	PLC_BIT_0792	Command for switching On in DPOS	5A0101 8007911F40	DPOS	DEV09_CL_COMMAND
5A0101 800792EF40	PLC_BIT_0793	Command for switching On with interlock in DPOS	5A0101 8007921F40	DPOS	DEV09_CL_INTERLOCK
5A0101 800793EF40	PLC_BIT_0794	Condition of selection completed in DPOS (in PLC)	5A0101 8007931F40	DPOS	DPOS09IN_TMP_29
5A0101 800794EF40	PLC_BIT_0795	Condition of Selection failure at DPOS (in PLC)	5A0101 8007941F40	DPOS	DPOS09IN_TMP_30
5A0101 800795EF40	PLC_BIT_0796	Reason of selection failure at DPOS (in Fixed source)(in PLC)	5A0101 8007951F40	DPOS	DPOS09IN_TMP_31
5A0101 800796EF40	PLC_BIT_0797	Reason of selection failure at DPOS(in PLC)	5A0101 8007961F40	DPOS	DPOS09IN_TMP_32
5A0101 800797EF40	PLC_BIT_0798	Condition of cancel selection at DPOS (in PLC)	5A0101 8007971F40	DPOS	DPOS09IN_TMP_33
5A0101 800798EF40	PLC_BIT_0799	Condition for controlling OFF at DPOS (in PLC)	5A0101 8007981F40	DPOS	DPOS09IN_TMP_34
5A0101 800799EF40	PLC_BIT_0800	Condition for controlling ON at DPOS (in PLC)	5A0101 8007991F40	DPOS	DPOS09IN_TMP_35
5A0101 800800EF40	PLC_BIT_0801	Failure condition for controlling OFF at DPOS (in PLC)	5A0101 8008001F40	DPOS	DPOS09IN_TMP_36
5A0101 800801EF40	PLC_BIT_0802	Failure condition for controlling ON at DPOS (in PLC)	5A0101 8008011F40	DPOS	DPOS09IN_TMP_37
5A0101 800802EF40	PLC_BIT_0803	Reason of selection failure at DPOS (in Fixed source)(in PLC)	5A0101 8008021F40	DPOS	DPOS09IN_TMP_38
5A0101 800803EF40	PLC_BIT_0804	Reason of selection failure at DPOS(in PLC)	5A0101 8008031F40	DPOS	DPOS09IN_TMP_39
5A0101 800804EF40	PLC_BIT_0805	Control Off output on BO circuit in DPOS	5A0101 8008041F40	DPOS	DPOS09IN_TMP_40
5A0101 800805EF40	PLC_BIT_0806	Control On output on BO circuit in DPOS	5A0101 8008051F40	DPOS	DPOS09IN_TMP_41
5A0101 800806EF40	PLC_BIT_0807	Success for controlling at DPOS (in PLC)	5A0101 8008061F40	DPOS	DPOS09IN_TMP_42
5A0101 800807EF40	PLC_BIT_0808	Failure for controlling at DPOS (in PLC)	5A0101 8008071F40	DPOS	DPOS09IN_TMP_43
5A0101 800808EF40	PLC_BIT_0809	Cancel reason for controlling at DPOS (in PLC)	5A0101 8008081F40	DPOS	DPOS09IN_TMP_44
5A0101 800809EF40	PLC_BIT_0810	Command for switching Off in DPOS	5A0101 8008091F40	DPOS	DEV10_OP_COMMAND
5A0101 800810EF40	PLC_BIT_0811	Command for switching Off with interlock in DPOS	5A0101 8008101F40	DPOS	DEV10_OP_INTERLOCK
5A0101 800811EF40	PLC_BIT_0812	Command for switching On in DPOS	5A0101 8008111F40	DPOS	DEV10_CL_COMMAND
5A0101 800812EF40	PLC_BIT_0813	Command for switching On with interlock in DPOS	5A0101 8008121F40	DPOS	DEV10_CL_INTERLOCK
5A0101 800813EF40	PLC_BIT_0814	Condition of selection completed in DPOS (in PLC)	5A0101 8008131F40	DPOS	DPOS10IN_TMP_29
5A0101 800814EF40	PLC_BIT_0815	Condition of Selection failure at DPOS (in PLC)	5A0101 8008141F40	DPOS	DPOS10IN_TMP_30
5A0101 800815EF40	PLC_BIT_0816	Reason of selection failure at DPOS (in Fixed source)(in PLC)	5A0101 8008151F40	DPOS	DPOS10IN_TMP_31
5A0101 800816EF40	PLC_BIT_0817	Reason of selection failure at DPOS(in PLC)	5A0101 8008161F40	DPOS	DPOS10IN_TMP_32
5A0101 800817EF40	PLC_BIT_0818	Condition of cancel selection at DPOS (in PLC)	5A0101 8008171F40	DPOS	DPOS10IN_TMP_33
5A0101 800818EF40	PLC_BIT_0819	Condition for controlling OFF at DPOS (in PLC)	5A0101 8008181F40	DPOS	DPOS10IN_TMP_34
5A0101 800819EF40	PLC_BIT_0820	Condition for controlling ON at DPOS (in PLC)	5A0101 8008191F40	DPOS	DPOS10IN_TMP_35
5A0101 800820EF40	PLC_BIT_0821	Failure condition for controlling OFF at DPOS (in PLC)	5A0101 8008201F40	DPOS	DPOS10IN_TMP_36
5A0101 800821EF40	PLC_BIT_0822	Failure condition for controlling ON at DPOS (in PLC)	5A0101 8008211F40	DPOS	DPOS10IN_TMP_37
5A0101 800822EF40	PLC_BIT_0823	Reason of selection failure at DPOS (in Fixed source)(in PLC)	5A0101 8008221F40	DPOS	DPOS10IN_TMP_38
5A0101 800823EF40	PLC_BIT_0824	Reason of selection failure at DPOS(in PLC)	5A0101 8008231F40	DPOS	DPOS10IN_TMP_39
5A0101 800824EF40	PLC_BIT_0825	Control Off output on BO circuit in DPOS	5A0101 8008241F40	DPOS	DPOS10IN_TMP_40
5A0101 800825EF40	PLC_BIT_0826	Control On output on BO circuit in DPOS	5A0101 8008251F40	DPOS	DPOS10IN_TMP_41
5A0101 800826EF40	PLC_BIT_0827	Success for controlling at DPOS (in PLC)	5A0101 8008261F40	DPOS	DPOS10IN_TMP_42
5A0101 800827EF40	PLC_BIT_0828	Failure for controlling at DPOS (in PLC)	5A0101 8008271F40	DPOS	DPOS10IN_TMP_43
5A0101 800828EF40	PLC_BIT_0829	Cancel reason for controlling at DPOS (in PLC)	5A0101 8008281F40	DPOS	DPOS10IN_TMP_44
5A0101 800829EF40	PLC_BIT_0830	Command for switching Off in DPOS	5A0101 8008291F40	DPOS	DEV11_OP_COMMAND
5A0101 800830EF40	PLC_BIT_0831	Command for switching Off with interlock in DPOS	5A0101 8008301F40	DPOS	DEV11_OP_INTERLOCK
5A0101 800831EF40	PLC_BIT_0832	Command for switching On in DPOS	5A0101 8008311F40	DPOS	DEV11_CL_COMMAND
5A0101 800832EF40	PLC_BIT_0833	Command for switching On with interlock in DPOS	5A0101 8008321F40	DPOS	DEV11_CL_INTERLOCK
5A0101 800833EF40	PLC_BIT_0834	Condition of selection completed in DPOS (in PLC)	5A0101 8008331F40	DPOS	DPOS11IN_TMP_29
5A0101 800834EF40	PLC_BIT_0835	Condition of Selection failure at DPOS (in PLC)	5A0101 8008341F40	DPOS	DPOS11IN_TMP_30
5A0101 800835EF40	PLC_BIT_0836	Reason of selection failure at DPOS (in Fixed source)(in PLC)	5A0101 8008351F40	DPOS	DPOS11IN_TMP_31
5A0101 800836EF40	PLC_BIT_0837	Reason of selection failure at DPOS(in PLC)	5A0101 8008361F40	DPOS	DPOS11IN_TMP_32
5A0101 800837EF40	PLC_BIT_0838	Condition of cancel selection at DPOS (in PLC)	5A0101 8008371F40	DPOS	DPOS11IN_TMP_33
5A0101 800838EF40	PLC_BIT_0839	Condition for controlling OFF at DPOS (in PLC)	5A0101 8008381F40	DPOS	DPOS11IN_TMP_34
5A0101 800839EF40	PLC_BIT_0840	Condition for controlling ON at DPOS (in PLC)	5A0101 8008391F40	DPOS	DPOS11IN_TMP_35
5A0101 800840EF40	PLC_BIT_0841	Failure condition for controlling OFF at DPOS (in PLC)	5A0101 8008401F40	DPOS	DPOS11IN_TMP_36
5A0101 800841EF40	PLC_BIT_0842	Failure condition for controlling ON at DPOS (in PLC)	5A0101 8008411F40	DPOS	DPOS11IN_TMP_37
5A0101 800842EF40	PLC_BIT_0843	Reason of selection failure at DPOS (in Fixed source)(in PLC)	5A0101 8008421F40	DPOS	DPOS11IN_TMP_38
5A0101 800843EF40	PLC_BIT_0844	Reason of selection failure at DPOS(in PLC)	5A0101 8008431F40	DPOS	DPOS11IN_TMP_39
5A0101 800844EF40	PLC_BIT_0845	Control Off output on BO circuit in DPOS	5A0101 8008441F40	DPOS	DPOS11IN_TMP_40
5A0101 800845EF40	PLC_BIT_0846	Control On output on BO circuit in DPOS	5A0101 8008451F40	DPOS	DPOS11IN_TMP_41
5A0101 800846EF40	PLC_BIT_0847	Success for controlling at DPOS (in PLC)	5A0101 8008461F40	DPOS	DPOS11IN_TMP_42
5A0101 800847EF40	PLC_BIT_0848	Failure for controlling at DPOS (in PLC)	5A0101 8008471F40	DPOS	DPOS11IN_TMP_43
5A0101 800848EF40	PLC_BIT_0849	Cancel reason for controlling at DPOS (in PLC)	5A0101 8008481F40	DPOS	DPOS11IN_TMP_44
5A0101 800849EF40	PLC_BIT_0850	Command for switching Off in DPOS	5A0101 8008491F40	DPOS	DEV12_OP_COMMAND
5A0101 800850EF40	PLC_BIT_0851	Command for switching Off with interlock in DPOS	5A0101 8008501F40	DPOS	DEV12_OP_INTERLOCK
5A0101 800851EF40	PLC_BIT_0852	Command for switching On in DPOS	5A0101 8008511F40	DPOS	DEV12_CL_COMMAND
5A0101 800852EF40	PLC_BIT_0853	Command for switching On with interlock in DPOS	5A0101 8008521F40	DPOS	DEV12_CL_INTERLOCK
5A0101 800853EF40	PLC_BIT_0854	Condition of selection completed in DPOS (in PLC)	5A0101 8008531F40	DPOS	DPOS12IN_TMP_29
5A0101 800854EF40	PLC_BIT_0855	Condition of Selection failure at DPOS (in PLC)	5A0101 8008541F40	DPOS	DPOS12IN_TMP_30
5A0101 800855EF40	PLC_BIT_0856	Reason of selection failure at DPOS (in Fixed source)(in PLC)	5A0101 8008551F40	DPOS	DPOS12IN_TMP_31
5A0101 800856EF40	PLC_BIT_0857	Reason of selection failure at DPOS(in PLC)	5A0101 8008561F40	DPOS	DPOS12IN_TMP_32
5A0101 800857EF40	PLC_BIT_0858	Condition of cancel selection at DPOS (in PLC)	5A0101 8008571F40	DPOS	DPOS12IN_TMP_33

DataIDs	Connections	Meaning	Monitoring	FB	Destinations
5A0101 800858EF40	PLC_BIT_0859	Condition for controlling OFF at DPOS (in PLC)	5A0101 8008581F40	DPOS	DPOS12IN_TMP_34
5A0101 800859EF40	PLC_BIT_0860	Condition for controlling ON at DPOS (in PLC)	5A0101 8008591F40	DPOS	DPOS12IN_TMP_35
5A0101 800860EF40	PLC_BIT_0861	Failure condition for controlling OFF at DPOS (in PLC)	5A0101 8008601F40	DPOS	DPOS12IN_TMP_36
5A0101 800861EF40	PLC_BIT_0862	Failure condition for controlling ON at DPOS (in PLC)	5A0101 8008611F40	DPOS	DPOS12IN_TMP_37
5A0101 800862EF40	PLC_BIT_0863	Reason of selection failure at DPOS (in Fixed source)(in PLC)	5A0101 8008621F40	DPOS	DPOS12IN_TMP_38
5A0101 800863EF40	PLC_BIT_0864	Reason of selection failure at DPOS(in PLC)	5A0101 8008631F40	DPOS	DPOS12IN_TMP_39
5A0101 800864EF40	PLC_BIT_0865	Control Off output on BO circuit in DPOS	5A0101 8008641F40	DPOS	DPOS12IN_TMP_40
5A0101 800865EF40	PLC_BIT_0866	Control On output on BO circuit in DPOS	5A0101 8008651F40	DPOS	DPOS12IN_TMP_41
5A0101 800866EF40	PLC_BIT_0867	Success for controlling at DPOS (in PLC)	5A0101 8008661F40	DPOS	DPOS12IN_TMP_42
5A0101 800867EF40	PLC_BIT_0868	Failure for controlling at DPOS (in PLC)	5A0101 8008671F40	DPOS	DPOS12IN_TMP_43
5A0101 800868EF40	PLC_BIT_0869	Cancel reason for controlling at DPOS (in PLC)	5A0101 8008681F40	DPOS	DPOS12IN_TMP_44
5A0101 800869EF40	PLC_BIT_0870	Command for switching Off in DPOS	5A0101 8008691F40	DPOS	DEV13_OP_COMMAND
5A0101 800870EF40	PLC_BIT_0871	Command for switching Off with interlock in DPOS	5A0101 8008701F40	DPOS	DEV13_OP_INTERLOCK
5A0101 800871EF40	PLC_BIT_0872	Command for switching On in DPOS	5A0101 8008711F40	DPOS	DEV13_CL_COMMAND
5A0101 800872EF40	PLC_BIT_0873	Command for switching On with interlock in DPOS	5A0101 8008721F40	DPOS	DEV13_CL_INTERLOCK
5A0101 800873EF40	PLC_BIT_0874	Condition of selection completed in DPOS (in PLC)	5A0101 8008731F40	DPOS	DPOS13IN_TMP_29
5A0101 800874EF40	PLC_BIT_0875	Condition of Selection failure at DPOS (in PLC)	5A0101 8008741F40	DPOS	DPOS13IN_TMP_30
5A0101 800875EF40	PLC_BIT_0876	Reason of selection failure at DPOS (in Fixed source)(in PLC)	5A0101 8008751F40	DPOS	DPOS13IN_TMP_31
5A0101 800876EF40	PLC_BIT_0877	Reason of selection failure at DPOS(in PLC)	5A0101 8008761F40	DPOS	DPOS13IN_TMP_32
5A0101 800877EF40	PLC_BIT_0878	Condition of cancel selection at DPOS (in PLC)	5A0101 8008771F40	DPOS	DPOS13IN_TMP_33
5A0101 800878EF40	PLC_BIT_0879	Condition for controlling OFF at DPOS (in PLC)	5A0101 8008781F40	DPOS	DPOS13IN_TMP_34
5A0101 800879EF40	PLC_BIT_0880	Condition for controlling ON at DPOS (in PLC)	5A0101 8008791F40	DPOS	DPOS13IN_TMP_35
5A0101 800880EF40	PLC_BIT_0881	Failure condition for controlling OFF at DPOS (in PLC)	5A0101 8008801F40	DPOS	DPOS13IN_TMP_36
5A0101 800881EF40	PLC_BIT_0882	Failure condition for controlling ON at DPOS (in PLC)	5A0101 8008811F40	DPOS	DPOS13IN_TMP_37
5A0101 800882EF40	PLC_BIT_0883	Reason of selection failure at DPOS (in Fixed source)(in PLC)	5A0101 8008821F40	DPOS	DPOS13IN_TMP_38
5A0101 800883EF40	PLC_BIT_0884	Reason of selection failure at DPOS(in PLC)	5A0101 8008831F40	DPOS	DPOS13IN_TMP_39
5A0101 800884EF40	PLC_BIT_0885	Control Off output on BO circuit in DPOS	5A0101 8008841F40	DPOS	DPOS13IN_TMP_40
5A0101 800885EF40	PLC_BIT_0886	Control On output on BO circuit in DPOS	5A0101 8008851F40	DPOS	DPOS13IN_TMP_41
5A0101 800886EF40	PLC_BIT_0887	Success for controlling at DPOS (in PLC)	5A0101 8008861F40	DPOS	DPOS13IN_TMP_42
5A0101 800887EF40	PLC_BIT_0888	Failure for controlling at DPOS (in PLC)	5A0101 8008871F40	DPOS	DPOS13IN_TMP_43
5A0101 800888EF40	PLC_BIT_0889	Cancel reason for controlling at DPOS (in PLC)	5A0101 8008881F40	DPOS	DPOS13IN_TMP_44
5A0101 800889EF40	PLC_BIT_0890	Command for switching Off in DPOS	5A0101 8008891F40	DPOS	DEV14_OP_COMMAND
5A0101 800890EF40	PLC_BIT_0891	Command for switching Off with interlock in DPOS	5A0101 8008901F40	DPOS	DEV14_OP_INTERLOCK
5A0101 800891EF40	PLC_BIT_0892	Command for switching On in DPOS	5A0101 8008911F40	DPOS	DEV14_CL_COMMAND
5A0101 800892EF40	PLC_BIT_0893	Command for switching On with interlock in DPOS	5A0101 8008921F40	DPOS	DEV14_CL_INTERLOCK
5A0101 800893EF40	PLC_BIT_0894	Condition of selection completed in DPOS (in PLC)	5A0101 8008931F40	DPOS	DPOS14IN_TMP_29
5A0101 800894EF40	PLC_BIT_0895	Condition of Selection failure at DPOS (in PLC)	5A0101 8008941F40	DPOS	DPOS14IN_TMP_30
5A0101 800895EF40	PLC_BIT_0896	Reason of selection failure at DPOS (in Fixed source)(in PLC)	5A0101 8008951F40	DPOS	DPOS14IN_TMP_31
5A0101 800896EF40	PLC_BIT_0897	Reason of selection failure at DPOS(in PLC)	5A0101 8008961F40	DPOS	DPOS14IN_TMP_32
5A0101 800897EF40	PLC_BIT_0898	Condition of cancel selection at DPOS (in PLC)	5A0101 8008971F40	DPOS	DPOS14IN_TMP_33
5A0101 800898EF40	PLC_BIT_0899	Condition for controlling OFF at DPOS (in PLC)	5A0101 8008981F40	DPOS	DPOS14IN_TMP_34
5A0101 800899EF40	PLC_BIT_0900	Condition for controlling ON at DPOS (in PLC)	5A0101 8008991F40	DPOS	DPOS14IN_TMP_35
5A0101 800900EF40	PLC_BIT_0901	Failure condition for controlling OFF at DPOS (in PLC)	5A0101 8009001F40	DPOS	DPOS14IN_TMP_36
5A0101 800901EF40	PLC_BIT_0902	Failure condition for controlling ON at DPOS (in PLC)	5A0101 8009011F40	DPOS	DPOS14IN_TMP_37
5A0101 800902EF40	PLC_BIT_0903	Reason of selection failure at DPOS (in Fixed source)(in PLC)	5A0101 8009021F40	DPOS	DPOS14IN_TMP_38
5A0101 800903EF40	PLC_BIT_0904	Reason of selection failure at DPOS(in PLC)	5A0101 8009031F40	DPOS	DPOS14IN_TMP_39
5A0101 800904EF40	PLC_BIT_0905	Control Off output on BO circuit in DPOS	5A0101 8009041F40	DPOS	DPOS14IN_TMP_40
5A0101 800905EF40	PLC_BIT_0906	Control On output on BO circuit in DPOS	5A0101 8009051F40	DPOS	DPOS14IN_TMP_41
5A0101 800906EF40	PLC_BIT_0907	Success for controlling at DPOS (in PLC)	5A0101 8009061F40	DPOS	DPOS14IN_TMP_42
5A0101 800907EF40	PLC_BIT_0908	Failure for controlling at DPOS (in PLC)	5A0101 8009071F40	DPOS	DPOS14IN_TMP_43
5A0101 800908EF40	PLC_BIT_0909	Cancel reason for controlling at DPOS (in PLC)	5A0101 8009081F40	DPOS	DPOS14IN_TMP_44
5A0101 800909EF40	PLC_BIT_0910	Command for switching Off in DPOS	5A0101 8009091F40	DPOS	DEV15_OP_COMMAND
5A0101 800910EF40	PLC_BIT_0911	Command for switching Off with interlock in DPOS	5A0101 8009101F40	DPOS	DEV15_OP_INTERLOCK
5A0101 800911EF40	PLC_BIT_0912	Command for switching On in DPOS	5A0101 8009111F40	DPOS	DEV15_CL_COMMAND
5A0101 800912EF40	PLC_BIT_0913	Command for switching On with interlock in DPOS	5A0101 8009121F40	DPOS	DEV15_CL_INTERLOCK
5A0101 800913EF40	PLC_BIT_0914	Condition of selection completed in DPOS (in PLC)	5A0101 8009131F40	DPOS	DPOS15IN_TMP_29
5A0101 800914EF40	PLC_BIT_0915	Condition of Selection failure at DPOS (in PLC)	5A0101 8009141F40	DPOS	DPOS15IN_TMP_30
5A0101 800915EF40	PLC_BIT_0916	Reason of selection failure at DPOS (in Fixed source)(in PLC)	5A0101 8009151F40	DPOS	DPOS15IN_TMP_31
5A0101 800916EF40	PLC_BIT_0917	Reason of selection failure at DPOS(in PLC)	5A0101 8009161F40	DPOS	DPOS15IN_TMP_32
5A0101 800917EF40	PLC_BIT_0918	Condition of cancel selection at DPOS (in PLC)	5A0101 8009171F40	DPOS	DPOS15IN_TMP_33
5A0101 800918EF40	PLC_BIT_0919	Condition for controlling OFF at DPOS (in PLC)	5A0101 8009181F40	DPOS	DPOS15IN_TMP_34
5A0101 800919EF40	PLC_BIT_0920	Condition for controlling ON at DPOS (in PLC)	5A0101 8009191F40	DPOS	DPOS15IN_TMP_35
5A0101 800920EF40	PLC_BIT_0921	Failure condition for controlling OFF at DPOS (in PLC)	5A0101 8009201F40	DPOS	DPOS15IN_TMP_36
5A0101 800921EF40	PLC_BIT_0922	Failure condition for controlling ON at DPOS (in PLC)	5A0101 8009211F40	DPOS	DPOS15IN_TMP_37
5A0101 800922EF40	PLC_BIT_0923	Reason of selection failure at DPOS (in Fixed source)(in PLC)	5A0101 8009221F40	DPOS	DPOS15IN_TMP_38
5A0101 800923EF40	PLC_BIT_0924	Reason of selection failure at DPOS(in PLC)	5A0101 8009231F40	DPOS	DPOS15IN_TMP_39
5A0101 800924EF40	PLC_BIT_0925	Control Off output on BO circuit in DPOS	5A0101 8009241F40	DPOS	DPOS15IN_TMP_40
5A0101 800925EF40	PLC_BIT_0926	Control On output on BO circuit in DPOS	5A0101 8009251F40	DPOS	DPOS15IN_TMP_41
5A0101 800926EF40	PLC_BIT_0927	Success for controlling at DPOS (in PLC)	5A0101 8009261F40	DPOS	DPOS15IN_TMP_42
5A0101 800927EF40	PLC_BIT_0928	Failure for controlling at DPOS (in PLC)	5A0101 8009271F40	DPOS	DPOS15IN_TMP_43
5A0101 800928EF40	PLC_BIT_0929	Cancel reason for controlling at DPOS (in PLC)	5A0101 8009281F40	DPOS	DPOS15IN_TMP_44
5A0101 800929EF40	PLC_BIT_0930	Command for switching Off in DPOS	5A0101 8009291F40	DPOS	DEV16_OP_COMMAND
5A0101 800930EF40	PLC_BIT_0931	Command for switching Off with interlock in DPOS	5A0101 8009301F40	DPOS	DEV16_OP_INTERLOCK
5A0101 800931EF40	PLC_BIT_0932	Command for switching On in DPOS	5A0101 8009311F40	DPOS	DEV16_CL_COMMAND
5A0101 800932EF40	PLC_BIT_0933	Command for switching On with interlock in DPOS	5A0101 8009321F40	DPOS	DEV16_CL_INTERLOCK
5A0101 800933EF40	PLC_BIT_0934	Condition of selection completed in DPOS (in PLC)	5A0101 8009331F40	DPOS	DPOS16IN_TMP_29
5A0101 800934EF40	PLC_BIT_0935	Condition of Selection failure at DPOS (in PLC)	5A0101 8009341F40	DPOS	DPOS16IN_TMP_30
5A0101 800935EF40	PLC_BIT_0936	Reason of selection failure at DPOS (in Fixed source)(in PLC)	5A0101 8009351F40	DPOS	DPOS16IN_TMP_31
5A0101 800936EF40	PLC_BIT_0937	Reason of selection failure at DPOS(in PLC)	5A0101 8009361F40	DPOS	DPOS16IN_TMP_32
5A0101 800937EF40	PLC_BIT_0938	Condition of cancel selection at DPOS (in PLC)	5A0101 8009371F40	DPOS	DPOS16IN_TMP_33
5A0101 800938EF40	PLC_BIT_0939	Condition for controlling OFF at DPOS (in PLC)	5A0101 8009381F40	DPOS	DPOS16IN_TMP_34
5A0101 800939EF40	PLC_BIT_0940	Condition for controlling ON at DPOS (in PLC)	5A0101 8009391F40	DPOS	DPOS16IN_TMP_35
5A0101 800940EF40	PLC_BIT_0941	Failure condition for controlling OFF at DPOS (in PLC)	5A0101 8009401F40	DPOS	DPOS16IN_TMP_36
5A0101 800941EF40	PLC_BIT_0942	Failure condition for controlling ON at DPOS (in PLC)	5A0101 8009411F40	DPOS	DPOS16IN_TMP_37
5A0101 800942EF40	PLC_BIT_0943	Reason of selection failure at DPOS (in Fixed source)(in PLC)	5A0101 8009421F40	DPOS	DPOS16IN_TMP_38
5A0101 800943EF40	PLC_BIT_0944	Reason of selection failure at DPOS(in PLC)	5A0101 8009431F40	DPOS	DPOS16IN_TMP_39
5A0101 800944EF40	PLC_BIT_0945	Control Off output on BO circuit in DPOS	5A0101 8009441F40	DPOS	DPOS16IN_TMP_40
5A0101 800945EF40	PLC_BIT_0946	Control On output on BO circuit in DPOS	5A0101 8009451F40	DPOS	DPOS16IN_TMP_41
5A0101 800946EF40	PLC_BIT_0947	Success for controlling at DPOS (in PLC)	5A0101 8009461F40	DPOS	DPOS16IN_TMP_42
5A0101 800947EF40	PLC_BIT_0948	Failure for controlling at DPOS (in PLC)	5A0101 8009471F40	DPOS	DPOS16IN_TMP_43
5A0101 800948EF40	PLC_BIT_0949	Cancel reason for controlling at DPOS (in PLC)	5A0101 8009481F40	DPOS	DPOS16IN_TMP_44
5A0101 800949EF40	PLC_BIT_0950	Command for switching Off in DPOS	5A0101 8009491F40	DPOS	DEV17_OP_COMMAND
5A0101 800950EF40	PLC_BIT_0951	Command for switching Off with interlock in DPOS	5A0101 8009501F40	DPOS	DEV17_OP_INTERLOCK
5A0101 800951EF40	PLC_BIT_0952	Command for switching On in DPOS	5A0101 8009511F40	DPOS	DEV17_CL_COMMAND
5A0101 800952EF40	PLC_BIT_0953	Command for switching On with interlock in DPOS	5A0101 8009521F40	DPOS	DEV17_CL_INTERLOCK
5A0101 800953EF40	PLC_BIT_0954	Condition of selection completed in DPOS (in PLC)	5A0101 8009531F40	DPOS	DPOS17IN_TMP_29
5A0101 800954EF40	PLC_BIT_0955	Condition of Selection failure at DPOS (in PLC)	5A0101 8009541F40	DPOS	DPOS17IN_TMP_30

DataIDs	Connections	Meaning	Monitoring	FB	Destinations
5A0101 800955EF40	PLC_BIT_0956	Reason of selection failure at DPOS (in Fixed source)(in PLC)	5A0101 8009551F40	DPOS	DPOS17IN_TMP_31
5A0101 800956EF40	PLC_BIT_0957	Reason of selection failure at DPOS(in PLC)	5A0101 8009561F40	DPOS	DPOS17IN_TMP_32
5A0101 800957EF40	PLC_BIT_0958	Condition of cancel selection at DPOS (in PLC)	5A0101 8009571F40	DPOS	DPOS17IN_TMP_33
5A0101 800958EF40	PLC_BIT_0959	Condition for controlling OFF at DPOS (in PLC)	5A0101 8009581F40	DPOS	DPOS17IN_TMP_34
5A0101 800959EF40	PLC_BIT_0960	Condition for controlling ON at DPOS (in PLC)	5A0101 8009591F40	DPOS	DPOS17IN_TMP_35
5A0101 800960EF40	PLC_BIT_0961	Failure condition for controlling OFF at DPOS (in PLC)	5A0101 8009601F40	DPOS	DPOS17IN_TMP_36
5A0101 800961EF40	PLC_BIT_0962	Failure condition for controlling ON at DPOS (in PLC)	5A0101 8009611F40	DPOS	DPOS17IN_TMP_37
5A0101 800962EF40	PLC_BIT_0963	Reason of selection failure at DPOS (in Fixed source)(in PLC)	5A0101 8009621F40	DPOS	DPOS17IN_TMP_38
5A0101 800963EF40	PLC_BIT_0964	Reason of selection failure at DPOS(in PLC)	5A0101 8009631F40	DPOS	DPOS17IN_TMP_39
5A0101 800964EF40	PLC_BIT_0965	Control Off output on BO circuit in DPOS	5A0101 8009641F40	DPOS	DPOS17IN_TMP_40
5A0101 800965EF40	PLC_BIT_0966	Control On output on BO circuit in DPOS	5A0101 8009651F40	DPOS	DPOS17IN_TMP_41
5A0101 800966EF40	PLC_BIT_0967	Success for controlling at DPOS (in PLC)	5A0101 8009661F40	DPOS	DPOS17IN_TMP_42
5A0101 800967EF40	PLC_BIT_0968	Failure for controlling at DPOS (in PLC)	5A0101 8009671F40	DPOS	DPOS17IN_TMP_43
5A0101 800968EF40	PLC_BIT_0969	Cancel reason for controlling at DPOS (in PLC)	5A0101 8009681F40	DPOS	DPOS17IN_TMP_44
5A0101 800969EF40	PLC_BIT_0970	Command for switching Off in DPOS	5A0101 8009691F40	DPOS	DEV18_OP_COMMAND
5A0101 800970EF40	PLC_BIT_0971	Command for switching Off with interlock in DPOS	5A0101 8009701F40	DPOS	DEV18_OP_INTERLOCK
5A0101 800971EF40	PLC_BIT_0972	Command for switching On in DPOS	5A0101 8009711F40	DPOS	DEV18_CL_COMMAND
5A0101 800972EF40	PLC_BIT_0973	Command for switching On with interlock in DPOS	5A0101 8009721F40	DPOS	DEV18_CL_INTERLOCK
5A0101 800973EF40	PLC_BIT_0974	Condition of selection completed in DPOS (in PLC)	5A0101 8009731F40	DPOS	DPOS18IN_TMP_29
5A0101 800974EF40	PLC_BIT_0975	Condition of Selection failure at DPOS (in PLC)	5A0101 8009741F40	DPOS	DPOS18IN_TMP_30
5A0101 800975EF40	PLC_BIT_0976	Reason of selection failure at DPOS (in Fixed source)(in PLC)	5A0101 8009751F40	DPOS	DPOS18IN_TMP_31
5A0101 800976EF40	PLC_BIT_0977	Reason of selection failure at DPOS(in PLC)	5A0101 8009761F40	DPOS	DPOS18IN_TMP_32
5A0101 800977EF40	PLC_BIT_0978	Condition of cancel selection at DPOS (in PLC)	5A0101 8009771F40	DPOS	DPOS18IN_TMP_33
5A0101 800978EF40	PLC_BIT_0979	Condition for controlling OFF at DPOS (in PLC)	5A0101 8009781F40	DPOS	DPOS18IN_TMP_34
5A0101 800979EF40	PLC_BIT_0980	Condition for controlling ON at DPOS (in PLC)	5A0101 8009791F40	DPOS	DPOS18IN_TMP_35
5A0101 800980EF40	PLC_BIT_0981	Failure condition for controlling OFF at DPOS (in PLC)	5A0101 8009801F40	DPOS	DPOS18IN_TMP_36
5A0101 800981EF40	PLC_BIT_0982	Failure condition for controlling ON at DPOS (in PLC)	5A0101 8009811F40	DPOS	DPOS18IN_TMP_37
5A0101 800982EF40	PLC_BIT_0983	Reason of selection failure at DPOS (in Fixed source)(in PLC)	5A0101 8009821F40	DPOS	DPOS18IN_TMP_38
5A0101 800983EF40	PLC_BIT_0984	Reason of selection failure at DPOS(in PLC)	5A0101 8009831F40	DPOS	DPOS18IN_TMP_39
5A0101 800984EF40	PLC_BIT_0985	Control Off output on BO circuit in DPOS	5A0101 8009841F40	DPOS	DPOS18IN_TMP_40
5A0101 800985EF40	PLC_BIT_0986	Control On output on BO circuit in DPOS	5A0101 8009851F40	DPOS	DPOS18IN_TMP_41
5A0101 800986EF40	PLC_BIT_0987	Success for controlling at DPOS (in PLC)	5A0101 8009861F40	DPOS	DPOS18IN_TMP_42
5A0101 800987EF40	PLC_BIT_0988	Failure for controlling at DPOS (in PLC)	5A0101 8009871F40	DPOS	DPOS18IN_TMP_43
5A0101 800988EF40	PLC_BIT_0989	Cancel reason for controlling at DPOS (in PLC)	5A0101 8009881F40	DPOS	DPOS18IN_TMP_44
5A0101 800989EF40	PLC_BIT_0990	Command for switching Off in DPOS	5A0101 8009891F40	DPOS	DEV19_OP_COMMAND
5A0101 800990EF40	PLC_BIT_0991	Command for switching Off with interlock in DPOS	5A0101 8009901F40	DPOS	DEV19_OP_INTERLOCK
5A0101 800991EF40	PLC_BIT_0992	Command for switching On in DPOS	5A0101 8009911F40	DPOS	DEV19_CL_COMMAND
5A0101 800992EF40	PLC_BIT_0993	Command for switching On with interlock in DPOS	5A0101 8009921F40	DPOS	DEV19_CL_INTERLOCK
5A0101 800993EF40	PLC_BIT_0994	Condition of selection completed in DPOS (in PLC)	5A0101 8009931F40	DPOS	DPOS19IN_TMP_29
5A0101 800994EF40	PLC_BIT_0995	Condition of Selection failure at DPOS (in PLC)	5A0101 8009941F40	DPOS	DPOS19IN_TMP_30
5A0101 800995EF40	PLC_BIT_0996	Reason of selection failure at DPOS (in Fixed source)(in PLC)	5A0101 8009951F40	DPOS	DPOS19IN_TMP_31
5A0101 800996EF40	PLC_BIT_0997	Reason of selection failure at DPOS(in PLC)	5A0101 8009961F40	DPOS	DPOS19IN_TMP_32
5A0101 800997EF40	PLC_BIT_0998	Condition of cancel selection at DPOS (in PLC)	5A0101 8009971F40	DPOS	DPOS19IN_TMP_33
5A0101 800998EF40	PLC_BIT_0999	Condition for controlling OFF at DPOS (in PLC)	5A0101 8009981F40	DPOS	DPOS19IN_TMP_34
5A0101 800999EF40	PLC_BIT_1000	Condition for controlling ON at DPOS (in PLC)	5A0101 8009991F40	DPOS	DPOS19IN_TMP_35
5A0101 801000EF40	PLC_BIT_1001	Failure condition for controlling OFF at DPOS (in PLC)	5A0101 8010001F40	DPOS	DPOS19IN_TMP_36
5A0101 801001EF40	PLC_BIT_1002	Failure condition for controlling ON at DPOS (in PLC)	5A0101 8010011F40	DPOS	DPOS19IN_TMP_37
5A0101 801002EF40	PLC_BIT_1003	Reason of selection failure at DPOS (in Fixed source)(in PLC)	5A0101 8010021F40	DPOS	DPOS19IN_TMP_38
5A0101 801003EF40	PLC_BIT_1004	Reason of selection failure at DPOS(in PLC)	5A0101 8010031F40	DPOS	DPOS19IN_TMP_39
5A0101 801004EF40	PLC_BIT_1005	Control Off output on BO circuit in DPOS	5A0101 8010041F40	DPOS	DPOS19IN_TMP_40
5A0101 801005EF40	PLC_BIT_1006	Control On output on BO circuit in DPOS	5A0101 8010051F40	DPOS	DPOS19IN_TMP_41
5A0101 801006EF40	PLC_BIT_1007	Success for controlling at DPOS (in PLC)	5A0101 8010061F40	DPOS	DPOS19IN_TMP_42
5A0101 801007EF40	PLC_BIT_1008	Failure for controlling at DPOS (in PLC)	5A0101 8010071F40	DPOS	DPOS19IN_TMP_43
5A0101 801008EF40	PLC_BIT_1009	Cancel reason for controlling at DPOS (in PLC)	5A0101 8010081F40	DPOS	DPOS19IN_TMP_44
5A0101 801009EF40	PLC_BIT_1010	Command for switching Off in DPOS	5A0101 8010091F40	DPOS	DEV20_OP_COMMAND
5A0101 801010EF40	PLC_BIT_1011	Command for switching Off with interlock in DPOS	5A0101 8010101F40	DPOS	DEV20_OP_INTERLOCK
5A0101 801011EF40	PLC_BIT_1012	Command for switching On in DPOS	5A0101 8010111F40	DPOS	DEV20_CL_COMMAND
5A0101 801012EF40	PLC_BIT_1013	Command for switching On with interlock in DPOS	5A0101 8010121F40	DPOS	DEV20_CL_INTERLOCK
5A0101 801013EF40	PLC_BIT_1014	Condition of selection completed in DPOS (in PLC)	5A0101 8010131F40	DPOS	DPOS20IN_TMP_29
5A0101 801014EF40	PLC_BIT_1015	Condition of Selection failure at DPOS (in PLC)	5A0101 8010141F40	DPOS	DPOS20IN_TMP_30
5A0101 801015EF40	PLC_BIT_1016	Reason of selection failure at DPOS (in Fixed source)(in PLC)	5A0101 8010151F40	DPOS	DPOS20IN_TMP_31
5A0101 801016EF40	PLC_BIT_1017	Reason of selection failure at DPOS(in PLC)	5A0101 8010161F40	DPOS	DPOS20IN_TMP_32
5A0101 801017EF40	PLC_BIT_1018	Condition of cancel selection at DPOS (in PLC)	5A0101 8010171F40	DPOS	DPOS20IN_TMP_33
5A0101 801018EF40	PLC_BIT_1019	Condition for controlling OFF at DPOS (in PLC)	5A0101 8010181F40	DPOS	DPOS20IN_TMP_34
5A0101 801019EF40	PLC_BIT_1020	Condition for controlling ON at DPOS (in PLC)	5A0101 8010191F40	DPOS	DPOS20IN_TMP_35
5A0101 801020EF40	PLC_BIT_1021	Failure condition for controlling OFF at DPOS (in PLC)	5A0101 8010201F40	DPOS	DPOS20IN_TMP_36
5A0101 801021EF40	PLC_BIT_1022	Failure condition for controlling ON at DPOS (in PLC)	5A0101 8010211F40	DPOS	DPOS20IN_TMP_37
5A0101 801022EF40	PLC_BIT_1023	Reason of selection failure at DPOS (in Fixed source)(in PLC)	5A0101 8010221F40	DPOS	DPOS20IN_TMP_38
5A0101 801023EF40	PLC_BIT_1024	Reason of selection failure at DPOS(in PLC)	5A0101 8010231F40	DPOS	DPOS20IN_TMP_39
5A0101 801024EF40	PLC_BIT_1025	Control Off output on BO circuit in DPOS	5A0101 8010241F40	DPOS	DPOS20IN_TMP_40
5A0101 801025EF40	PLC_BIT_1026	Control On output on BO circuit in DPOS	5A0101 8010251F40	DPOS	DPOS20IN_TMP_41
5A0101 801026EF40	PLC_BIT_1027	Success for controlling at DPOS (in PLC)	5A0101 8010261F40	DPOS	DPOS20IN_TMP_42
5A0101 801027EF40	PLC_BIT_1028	Failure for controlling at DPOS (in PLC)	5A0101 8010271F40	DPOS	DPOS20IN_TMP_43
5A0101 801028EF40	PLC_BIT_1029	Cancel reason for controlling at DPOS (in PLC)	5A0101 8010281F40	DPOS	DPOS20IN_TMP_44
5A0101 801029EF40	PLC_BIT_1030		5A0101 8010291F40		
5A0101 801030EF40	PLC_BIT_1031	Establishing control right at TPOS (PLC)	5A0101 8010301F40	TPOS	TPOS01IN_TMP_21
5A0101 801031EF40	PLC_BIT_1032	Establishing control right for calibrating counter values at TPOS(PLC)	5A0101 8010311F40	TPOS	TPOS01IN_TMP_41
5A0101 801032EF40	PLC_BIT_1033	Establishing control right for resetting measurement value at TPOS(PLC)	5A0101 8010321F40	TPOS	TPOS01IN_TMP_42
5A0101 801033EF40	PLC_BIT_1034	Establishing control right at TPOS (PLC)	5A0101 8010331F40	TPOS	TPOS02IN_TMP_21
5A0101 801034EF40	PLC_BIT_1035	Establishing control right for calibrating counter values at TPOS(PLC)	5A0101 8010341F40	TPOS	TPOS02IN_TMP_41
5A0101 801035EF40	PLC_BIT_1036	Establishing control right for resetting measurement value at TPOS(PLC)	5A0101 8010351F40	TPOS	TPOS02IN_TMP_42
5A0101 801036EF40	PLC_BIT_1037	Establishing control right at TPOS (PLC)	5A0101 8010361F40	TPOS	TPOS03IN_TMP_21
5A0101 801037EF40	PLC_BIT_1038	Establishing control right for calibrating counter values at TPOS(PLC)	5A0101 8010371F40	TPOS	TPOS03IN_TMP_41
5A0101 801038EF40	PLC_BIT_1039	Establishing control right for resetting measurement value at TPOS(PLC)	5A0101 8010381F40	TPOS	TPOS03IN_TMP_42
5A0101 801039EF40	PLC_BIT_1040	Command "P1" in TPOS	5A0101 8010391F40	TPOS	DEV01_P1_COMMAND
5A0101 801040EF40	PLC_BIT_1041	Command "P1" with interlock in TPOS	5A0101 8010401F40	TPOS	DEV01_P1_INTERLOCK
5A0101 801041EF40	PLC_BIT_1042	Command "P2" in TPOS	5A0101 8010411F40	TPOS	DEV01_P2_COMMAND
5A0101 801042EF40	PLC_BIT_1043	Command "P2" with interlock in TPOS	5A0101 8010421F40	TPOS	DEV01_P2_INTERLOCK
5A0101 801043EF40	PLC_BIT_1044	Command "P3" in TPOS	5A0101 8010431F40	TPOS	DEV01_P3_COMMAND
5A0101 801044EF40	PLC_BIT_1045	Command "P3" with interlock in TPOS	5A0101 8010441F40	TPOS	DEV01_P3_INTERLOCK
5A0101 801045EF40	PLC_BIT_1046	Condition of selection completed in TPOS (in PLC)	5A0101 8010451F40	TPOS	TPOS01IN_TMP_22
5A0101 801046EF40	PLC_BIT_1047	Condition of Selection failure at TPOS (in PLC)	5A0101 8010461F40	TPOS	TPOS01IN_TMP_23
5A0101 801047EF40	PLC_BIT_1048	Reason of selection failure at TPOS (in Fixed source)(in PLC)	5A0101 8010471F40	TPOS	TPOS01IN_TMP_24
5A0101 801048EF40	PLC_BIT_1049	Reason of selection failure at TPOS(in PLC)	5A0101 8010481F40	TPOS	TPOS01IN_TMP_25
5A0101 801049EF40	PLC_BIT_1050	Condition of cancel selection at TPOS (in PLC)	5A0101 8010491F40	TPOS	TPOS01IN_TMP_26
5A0101 801050EF40	PLC_BIT_1051	Condition for "P1" controlling at TPOS (in PLC)	5A0101 8010501F40	TPOS	TPOS01IN_TMP_27
5A0101 801051EF40	PLC_BIT_1052	Condition for "P2" controlling at TPOS (in PLC)	5A0101 8010511F40	TPOS	TPOS01IN_TMP_28

DataIDs	Connections	Meaning	Monitoring	FB	Destinations
5A0101 801052EF40	PLC_BIT_1053	Condition for "P3" controlling at TPOS (in PLC)	5A0101 8010521F40	TPOS	TPOS01IN_TMP_29
5A0101 801053EF40	PLC_BIT_1054	Failure condition for controlling "P1" at TPOS (in PLC)	5A0101 8010531F40	TPOS	TPOS01IN_TMP_30
5A0101 801054EF40	PLC_BIT_1055	Failure condition for controlling "P2" at TPOS (in PLC)	5A0101 8010541F40	TPOS	TPOS01IN_TMP_31
5A0101 801055EF40	PLC_BIT_1056	Failure condition for controlling "P3" at TPOS (in PLC)	5A0101 8010551F40	TPOS	TPOS01IN_TMP_32
5A0101 801056EF40	PLC_BIT_1057	Reason of selection failure at TPOS (in Fixed source)	5A0101 8010561F40	TPOS	TPOS01IN_TMP_33
5A0101 801057EF40	PLC_BIT_1058	Reason of selection failure at TPOS	5A0101 8010571F40	TPOS	TPOS01IN_TMP_34
5A0101 801058EF40	PLC_BIT_1059	Control "P1" output on BO circuit in TPOS	5A0101 8010581F40	TPOS	TPOS01IN_TMP_35
5A0101 801059EF40	PLC_BIT_1060	Control "P2" output on BO circuit in TPOS	5A0101 8010591F40	TPOS	TPOS01IN_TMP_36
5A0101 801060EF40	PLC_BIT_1061	Control "P3" output on BO circuit in TPOS	5A0101 8010601F40	TPOS	TPOS01IN_TMP_37
5A0101 801061EF40	PLC_BIT_1062	Success for controlling at TPOS (in PLC)	5A0101 8010611F40	TPOS	TPOS01IN_TMP_38
5A0101 801062EF40	PLC_BIT_1063	Failure for controlling at TPOS (in PLC)	5A0101 8010621F40	TPOS	TPOS01IN_TMP_39
5A0101 801063EF40	PLC_BIT_1064	Cancel reason for controlling at TPOS (in PLC)	5A0101 8010631F40	TPOS	TPOS01IN_TMP_40
5A0101 801064EF40	PLC_BIT_1065	Command "P1" in TPOS	5A0101 8010641F40	TPOS	DEV02_P1_COMMAND
5A0101 801065EF40	PLC_BIT_1066	Command "P1" with interlock in TPOS	5A0101 8010651F40	TPOS	DEV02_P1_INTERLOCK
5A0101 801066EF40	PLC_BIT_1067	Command "P2" in TPOS	5A0101 8010661F40	TPOS	DEV02_P2_COMMAND
5A0101 801067EF40	PLC_BIT_1068	Command "P2" with interlock in TPOS	5A0101 8010671F40	TPOS	DEV02_P2_INTERLOCK
5A0101 801068EF40	PLC_BIT_1069	Command "P3" in TPOS	5A0101 8010681F40	TPOS	DEV02_P3_COMMAND
5A0101 801069EF40	PLC_BIT_1070	Command "P3" with interlock in TPOS	5A0101 8010691F40	TPOS	DEV02_P3_INTERLOCK
5A0101 801070EF40	PLC_BIT_1071	Condition of selection completed in TPOS (in PLC)	5A0101 8010701F40	TPOS	TPOS02IN_TMP_22
5A0101 801071EF40	PLC_BIT_1072	Condition of Selection failure at TPOS (in PLC)	5A0101 8010711F40	TPOS	TPOS02IN_TMP_23
5A0101 801072EF40	PLC_BIT_1073	Reason of selection failure at TPOS (in Fixed source)(in PLC)	5A0101 8010721F40	TPOS	TPOS02IN_TMP_24
5A0101 801073EF40	PLC_BIT_1074	Reason of selection failure at TPOS(in PLC)	5A0101 8010731F40	TPOS	TPOS02IN_TMP_25
5A0101 801074EF40	PLC_BIT_1075	Condition of cancel selection at TPOS (in PLC)	5A0101 8010741F40	TPOS	TPOS02IN_TMP_26
5A0101 801075EF40	PLC_BIT_1076	Condition for "P1" controlling at TPOS (in PLC)	5A0101 8010751F40	TPOS	TPOS02IN_TMP_27
5A0101 801076EF40	PLC_BIT_1077	Condition for "P2" controlling at TPOS (in PLC)	5A0101 8010761F40	TPOS	TPOS02IN_TMP_28
5A0101 801077EF40	PLC_BIT_1078	Condition for "P3" controlling at TPOS (in PLC)	5A0101 8010771F40	TPOS	TPOS02IN_TMP_29
5A0101 801078EF40	PLC_BIT_1079	Failure condition for controlling "P1" at TPOS (in PLC)	5A0101 8010781F40	TPOS	TPOS02IN_TMP_30
5A0101 801079EF40	PLC_BIT_1080	Failure condition for controlling "P2" at TPOS (in PLC)	5A0101 8010791F40	TPOS	TPOS02IN_TMP_31
5A0101 801080EF40	PLC_BIT_1081	Failure condition for controlling "P3" at TPOS (in PLC)	5A0101 8010801F40	TPOS	TPOS02IN_TMP_32
5A0101 801081EF40	PLC_BIT_1082	Reason of selection failure at TPOS (in Fixed source)	5A0101 8010811F40	TPOS	TPOS02IN_TMP_33
5A0101 801082EF40	PLC_BIT_1083	Reason of selection failure at TPOS	5A0101 8010821F40	TPOS	TPOS02IN_TMP_34
5A0101 801083EF40	PLC_BIT_1084	Control "P1" output on BO circuit in TPOS	5A0101 8010831F40	TPOS	TPOS02IN_TMP_35
5A0101 801084EF40	PLC_BIT_1085	Control "P2" output on BO circuit in TPOS	5A0101 8010841F40	TPOS	TPOS02IN_TMP_36
5A0101 801085EF40	PLC_BIT_1086	Control "P3" output on BO circuit in TPOS	5A0101 8010851F40	TPOS	TPOS02IN_TMP_37
5A0101 801086EF40	PLC_BIT_1087	Success for controlling at TPOS (in PLC)	5A0101 8010861F40	TPOS	TPOS02IN_TMP_38
5A0101 801087EF40	PLC_BIT_1088	Failure for controlling at TPOS (in PLC)	5A0101 8010871F40	TPOS	TPOS02IN_TMP_39
5A0101 801088EF40	PLC_BIT_1089	Cancel reason for controlling at TPOS (in PLC)	5A0101 8010881F40	TPOS	TPOS02IN_TMP_40
5A0101 801089EF40	PLC_BIT_1090	Command "P1" in TPOS	5A0101 8010891F40	TPOS	DEV03_P1_COMMAND
5A0101 801090EF40	PLC_BIT_1091	Command "P1" with interlock in TPOS	5A0101 8010901F40	TPOS	DEV03_P1_INTERLOCK
5A0101 801091EF40	PLC_BIT_1092	Command "P2" in TPOS	5A0101 8010911F40	TPOS	DEV03_P2_COMMAND
5A0101 801092EF40	PLC_BIT_1093	Command "P2" with interlock in TPOS	5A0101 8010921F40	TPOS	DEV03_P2_INTERLOCK
5A0101 801093EF40	PLC_BIT_1094	Command "P3" in TPOS	5A0101 8010931F40	TPOS	DEV03_P3_COMMAND
5A0101 801094EF40	PLC_BIT_1095	Command "P3" with interlock in TPOS	5A0101 8010941F40	TPOS	DEV03_P3_INTERLOCK
5A0101 801095EF40	PLC_BIT_1096	Condition of selection completed in TPOS (in PLC)	5A0101 8010951F40	TPOS	TPOS03IN_TMP_22
5A0101 801096EF40	PLC_BIT_1097	Condition of Selection failure at TPOS (in PLC)	5A0101 8010961F40	TPOS	TPOS03IN_TMP_23
5A0101 801097EF40	PLC_BIT_1098	Reason of selection failure at TPOS (in Fixed source)(in PLC)	5A0101 8010971F40	TPOS	TPOS03IN_TMP_24
5A0101 801098EF40	PLC_BIT_1099	Reason of selection failure at TPOS(in PLC)	5A0101 8010981F40	TPOS	TPOS03IN_TMP_25
5A0101 801099EF40	PLC_BIT_1100	Condition of cancel selection at TPOS (in PLC)	5A0101 8010991F40	TPOS	TPOS03IN_TMP_26
5A0101 801100EF40	PLC_BIT_1101	Condition for "P1" controlling at TPOS (in PLC)	5A0101 8011001F40	TPOS	TPOS03IN_TMP_27
5A0101 801101EF40	PLC_BIT_1102	Condition for "P2" controlling at TPOS (in PLC)	5A0101 8011011F40	TPOS	TPOS03IN_TMP_28
5A0101 801102EF40	PLC_BIT_1103	Condition for "P3" controlling at TPOS (in PLC)	5A0101 8011021F40	TPOS	TPOS03IN_TMP_29
5A0101 801103EF40	PLC_BIT_1104	Failure condition for controlling "P1" at TPOS (in PLC)	5A0101 8011031F40	TPOS	TPOS03IN_TMP_30
5A0101 801104EF40	PLC_BIT_1105	Failure condition for controlling "P2" at TPOS (in PLC)	5A0101 8011041F40	TPOS	TPOS03IN_TMP_31
5A0101 801105EF40	PLC_BIT_1106	Failure condition for controlling "P3" at TPOS (in PLC)	5A0101 8011051F40	TPOS	TPOS03IN_TMP_32
5A0101 801106EF40	PLC_BIT_1107	Reason of selection failure at TPOS (in Fixed source)	5A0101 8011061F40	TPOS	TPOS03IN_TMP_33
5A0101 801107EF40	PLC_BIT_1108	Reason of selection failure at TPOS	5A0101 8011071F40	TPOS	TPOS03IN_TMP_34
5A0101 801108EF40	PLC_BIT_1109	Control "P1" output on BO circuit in TPOS	5A0101 8011081F40	TPOS	TPOS03IN_TMP_35
5A0101 801109EF40	PLC_BIT_1110	Control "P2" output on BO circuit in TPOS	5A0101 8011091F40	TPOS	TPOS03IN_TMP_36
5A0101 801110EF40	PLC_BIT_1111	Control "P3" output on BO circuit in TPOS	5A0101 8011101F40	TPOS	TPOS03IN_TMP_37
5A0101 801111EF40	PLC_BIT_1112	Success for controlling at TPOS (in PLC)	5A0101 8011111F40	TPOS	TPOS03IN_TMP_38
5A0101 801112EF40	PLC_BIT_1113	Failure for controlling at TPOS (in PLC)	5A0101 8011121F40	TPOS	TPOS03IN_TMP_39
5A0101 801113EF40	PLC_BIT_1114	Cancel reason for controlling at TPOS (in PLC)	5A0101 8011131F40	TPOS	TPOS03IN_TMP_40
5A0101 801114EF40	PLC_BIT_1115		5A0101 8011141F40		
5A0101 801115EF40	PLC_BIT_1116	Establishing control right at SOTFSW	5A0101 8011151F40	SOFTSW	S4301_CTRL_RIGHT
5A0101 801116EF40	PLC_BIT_1117	Establishing control right at SOTFSW	5A0101 8011161F40	SOFTSW	S4302_CTRL_RIGHT
5A0101 801117EF40	PLC_BIT_1118	Establishing control right at SOTFSW	5A0101 8011171F40	SOFTSW	S4303_CTRL_RIGHT
5A0101 801118EF40	PLC_BIT_1119	Establishing control right at SOTFSW	5A0101 8011181F40	SOFTSW	S4304_CTRL_RIGHT
5A0101 801119EF40	PLC_BIT_1120	Establishing control right at SOTFSW	5A0101 8011191F40	SOFTSW	S4305_CTRL_RIGHT
5A0101 801120EF40	PLC_BIT_1121	Establishing control right at SOTFSW	5A0101 8011201F40	SOFTSW	S4306_CTRL_RIGHT
5A0101 801121EF40	PLC_BIT_1122	Establishing control right at SOTFSW	5A0101 8011211F40	SOFTSW	S4307_CTRL_RIGHT
5A0101 801122EF40	PLC_BIT_1123	Establishing control right at SOTFSW	5A0101 8011221F40	SOFTSW	S4308_CTRL_RIGHT
5A0101 801123EF40	PLC_BIT_1124	Off switch signal for Function key in SOFTSW	5A0101 8011231F40	SOFTSW	S4301_CHG_TO_OFF
5A0101 801124EF40	PLC_BIT_1125	On switch signal for Function key in SOFTSW	5A0101 8011241F40	SOFTSW	S4301_CHG_TO_ON
5A0101 801125EF40	PLC_BIT_1126	Off switch signal for Function key in SOFTSW	5A0101 8011251F40	SOFTSW	S4302_CHG_TO_OFF
5A0101 801126EF40	PLC_BIT_1127	On switch signal for Function key in SOFTSW	5A0101 8011261F40	SOFTSW	S4302_CHG_TO_ON
5A0101 801127EF40	PLC_BIT_1128	Off switch signal for Function key in SOFTSW	5A0101 8011271F40	SOFTSW	S4303_CHG_TO_OFF
5A0101 801128EF40	PLC_BIT_1129	On switch signal for Function key in SOFTSW	5A0101 8011281F40	SOFTSW	S4303_CHG_TO_ON
5A0101 801129EF40	PLC_BIT_1130	Off switch signal for Function key in SOFTSW	5A0101 8011291F40	SOFTSW	S4304_CHG_TO_OFF
5A0101 801130EF40	PLC_BIT_1131	On switch signal for Function key in SOFTSW	5A0101 8011301F40	SOFTSW	S4304_CHG_TO_ON
5A0101 801131EF40	PLC_BIT_1132	Off switch signal for Function key in SOFTSW	5A0101 8011311F40	SOFTSW	S4305_CHG_TO_OFF
5A0101 801132EF40	PLC_BIT_1133	On switch signal for Function key in SOFTSW	5A0101 8011321F40	SOFTSW	S4305_CHG_TO_ON
5A0101 801133EF40	PLC_BIT_1134	Off switch signal for Function key in SOFTSW	5A0101 8011331F40	SOFTSW	S4306_CHG_TO_OFF
5A0101 801134EF40	PLC_BIT_1135	On switch signal for Function key in SOFTSW	5A0101 8011341F40	SOFTSW	S4306_CHG_TO_ON
5A0101 801135EF40	PLC_BIT_1136	Off switch signal for Function key in SOFTSW	5A0101 8011351F40	SOFTSW	S4307_CHG_TO_OFF
5A0101 801136EF40	PLC_BIT_1137	On switch signal for Function key in SOFTSW	5A0101 8011361F40	SOFTSW	S4307_CHG_TO_ON
5A0101 801137EF40	PLC_BIT_1138	Off switch signal for Function key in SOFTSW	5A0101 8011371F40	SOFTSW	S4308_CHG_TO_OFF
5A0101 801138EF40	PLC_BIT_1139	On switch signal for Function key in SOFTSW	5A0101 8011381F40	SOFTSW	S4308_CHG_TO_ON
5A0101 801139EF40	PLC_BIT_1140		5A0101 8011391F40		
5A0101 801140EF40	PLC_BIT_1141	Establishing control right in LEDR	5A0101 8011401F40	LEDRST	LEDR01_CTRL_RIGHT
5A0101 801141EF40	PLC_BIT_1142		5A0101 8011411F40		
5A0101 801142EF40	PLC_BIT_1143	Travelling signal (in PLC)	5A0101 8011421F40	CMNCTRL	TRAVELLING_PLC
5A0101 801143EF40	PLC_BIT_1144	Selection failure of Automatic sequence control in PLC logic	5A0101 8011431F40	CMNCTRL	PLC_I_001
5A0101 801144EF40	PLC_BIT_1145	Establishment failure of control right in Automatic sequence in PLC logic	5A0101 8011441F40	CMNCTRL	PLC_I_002
5A0101 801145EF40	PLC_BIT_1146	Condition for blocking control in Automatic sequence in PLC logic	5A0101 8011451F40	CMNCTRL	PLC_I_003
5A0101 801146EF40	PLC_BIT_1147	Condition not to establish synchronization in Automatic sequence in PLC	5A0101 8011461F40	CMNCTRL	PLC_I_004
5A0101 801147EF40	PLC_BIT_1148	Condition for BCU failure in Automatic sequence in PLC logic	5A0101 8011471F40	CMNCTRL	PLC_I_005
5A0101 801148EF40	PLC_BIT_1149	Condition not to generate multiple selections in Automatic sequence in PLC	5A0101 8011481F40	CMNCTRL	PLC_I_006

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5A0101 801149EF40	PLC_BIT_1150	Reception of stop command in Automatic sequence in PLC logic	5A0101 8011491F40	CMNCTRL	PLC_I_007
5A0101 801150EF40	PLC_BIT_1151	Event information from PLC	5A0101 8011501F40	CMNCTRL	PLC_I_008
5A0101 801151EF40	PLC_BIT_1152	Event information from PLC	5A0101 8011511F40	CMNCTRL	PLC_I_009
5A0101 801152EF40	PLC_BIT_1153	Event information from PLC	5A0101 8011521F40	CMNCTRL	PLC_I_010
5A0101 801153EF40	PLC_BIT_1154	Event information from PLC	5A0101 8011531F40	CMNCTRL	PLC_I_011
5A0101 801154EF40	PLC_BIT_1155	Event information from PLC	5A0101 8011541F40	CMNCTRL	PLC_I_012
5A0101 801155EF40	PLC_BIT_1156	Event information from PLC	5A0101 8011551F40	CMNCTRL	PLC_I_013
5A0101 801156EF40	PLC_BIT_1157	Event information from PLC	5A0101 8011561F40	CMNCTRL	PLC_I_014
5A0101 801157EF40	PLC_BIT_1158	Event information from PLC	5A0101 8011571F40	CMNCTRL	PLC_I_015
5A0101 801158EF40	PLC_BIT_1159	Event information from PLC	5A0101 8011581F40	CMNCTRL	PLC_I_016
5A0101 801159EF40	PLC_BIT_1160	Event information from PLC	5A0101 8011591F40	CMNCTRL	PLC_I_017
5A0101 801160EF40	PLC_BIT_1161	Event information from PLC	5A0101 8011601F40	CMNCTRL	PLC_I_018
5A0101 801161EF40	PLC_BIT_1162	Event information from PLC	5A0101 8011611F40	CMNCTRL	PLC_I_019
5A0101 801162EF40	PLC_BIT_1163	Event information from PLC	5A0101 8011621F40	CMNCTRL	PLC_I_020
5A0101 801163EF40	PLC_BIT_1164	Event information from PLC	5A0101 8011631F40	CMNCTRL	PLC_I_021
5A0101 801164EF40	PLC_BIT_1165	Event information from PLC	5A0101 8011641F40	CMNCTRL	PLC_I_022
5A0101 801165EF40	PLC_BIT_1166	Event information from PLC	5A0101 8011651F40	CMNCTRL	PLC_I_023
5A0101 801166EF40	PLC_BIT_1167	Event information from PLC	5A0101 8011661F40	CMNCTRL	PLC_I_024
5A0101 801167EF40	PLC_BIT_1168	Event information from PLC	5A0101 8011671F40	CMNCTRL	PLC_I_025
5A0101 801168EF40	PLC_BIT_1169	Event information from PLC	5A0101 8011681F40	CMNCTRL	PLC_I_026
5A0101 801169EF40	PLC_BIT_1170	Event information from PLC	5A0101 8011691F40	CMNCTRL	PLC_I_027
5A0101 801170EF40	PLC_BIT_1171	Event information from PLC	5A0101 8011701F40	CMNCTRL	PLC_I_028
5A0101 801171EF40	PLC_BIT_1172	Event information from PLC	5A0101 8011711F40	CMNCTRL	PLC_I_029
5A0101 801172EF40	PLC_BIT_1173	Event information from PLC	5A0101 8011721F40	CMNCTRL	PLC_I_030
5A0101 801173EF40	PLC_BIT_1174	Event information from PLC	5A0101 8011731F40	CMNCTRL	PLC_I_031
5A0101 801174EF40	PLC_BIT_1175	Event information from PLC	5A0101 8011741F40	CMNCTRL	PLC_I_032
5A0101 801175EF40	PLC_BIT_1176	Event information from PLC	5A0101 8011751F40	CMNCTRL	PLC_I_033
5A0101 801176EF40	PLC_BIT_1177	Event information from PLC	5A0101 8011761F40	CMNCTRL	PLC_I_034
5A0101 801177EF40	PLC_BIT_1178	Event information from PLC	5A0101 8011771F40	CMNCTRL	PLC_I_035
5A0101 801178EF40	PLC_BIT_1179	Event information from PLC	5A0101 8011781F40	CMNCTRL	PLC_I_036
5A0101 801179EF40	PLC_BIT_1180	Event information from PLC	5A0101 8011791F40	CMNCTRL	PLC_I_037
5A0101 801180EF40	PLC_BIT_1181	Event information from PLC	5A0101 8011801F40	CMNCTRL	PLC_I_038
5A0101 801181EF40	PLC_BIT_1182	Event information from PLC	5A0101 8011811F40	CMNCTRL	PLC_I_039
5A0101 801182EF40	PLC_BIT_1183	Event information from PLC	5A0101 8011821F40	CMNCTRL	PLC_I_040
5A0101 801183EF40	PLC_BIT_1184	Event information from PLC	5A0101 8011831F40	CMNCTRL	PLC_I_041
5A0101 801184EF40	PLC_BIT_1185	Event information from PLC	5A0101 8011841F40	CMNCTRL	PLC_I_042
5A0101 801185EF40	PLC_BIT_1186	Event information from PLC	5A0101 8011851F40	CMNCTRL	PLC_I_043
5A0101 801186EF40	PLC_BIT_1187	Event information from PLC	5A0101 8011861F40	CMNCTRL	PLC_I_044
5A0101 801187EF40	PLC_BIT_1188	Event information from PLC	5A0101 8011871F40	CMNCTRL	PLC_I_045
5A0101 801188EF40	PLC_BIT_1189	Event information from PLC	5A0101 8011881F40	CMNCTRL	PLC_I_046
5A0101 801189EF40	PLC_BIT_1190	Event information from PLC	5A0101 8011891F40	CMNCTRL	PLC_I_047
5A0101 801190EF40	PLC_BIT_1191	Event information from PLC	5A0101 8011901F40	CMNCTRL	PLC_I_048
5A0101 801191EF40	PLC_BIT_1192	Event information from PLC	5A0101 8011911F40	CMNCTRL	PLC_I_049
5A0101 801192EF40	PLC_BIT_1193	Event information from PLC	5A0101 8011921F40	CMNCTRL	PLC_I_050
5A0101 801193EF40	PLC_BIT_1194	Event information from PLC	5A0101 8011931F40	CMNCTRL	PLC_I_051
5A0101 801194EF40	PLC_BIT_1195	Event information from PLC	5A0101 8011941F40	CMNCTRL	PLC_I_052
5A0101 801195EF40	PLC_BIT_1196	Event information from PLC	5A0101 8011951F40	CMNCTRL	PLC_I_053
5A0101 801196EF40	PLC_BIT_1197	Event information from PLC	5A0101 8011961F40	CMNCTRL	PLC_I_054
5A0101 801197EF40	PLC_BIT_1198	Event information from PLC	5A0101 8011971F40	CMNCTRL	PLC_I_055
5A0101 801198EF40	PLC_BIT_1199	Event information from PLC	5A0101 8011981F40	CMNCTRL	PLC_I_056
5A0101 801199EF40	PLC_BIT_1200	Event information from PLC	5A0101 8011991F40	CMNCTRL	PLC_I_057
5A0101 801200EF40	PLC_BIT_1201	Event information from PLC	5A0101 8012001F40	CMNCTRL	PLC_I_058
5A0101 801201EF40	PLC_BIT_1202	Event information from PLC	5A0101 8012011F40	CMNCTRL	PLC_I_059
5A0101 801202EF40	PLC_BIT_1203	Event information from PLC	5A0101 8012021F40	CMNCTRL	PLC_I_060
5A0101 801203EF40	PLC_BIT_1204	Event information from PLC	5A0101 8012031F40	CMNCTRL	PLC_I_061
5A0101 801204EF40	PLC_BIT_1205	Event information from PLC	5A0101 8012041F40	CMNCTRL	PLC_I_062
5A0101 801205EF40	PLC_BIT_1206	Event information from PLC	5A0101 8012051F40	CMNCTRL	PLC_I_063
5A0101 801206EF40	PLC_BIT_1207	Event information from PLC	5A0101 8012061F40	CMNCTRL	PLC_I_064
5A0101 801207EF40	PLC_BIT_1208	Event information from PLC	5A0101 8012071F40	CMNCTRL	PLC_I_065
5A0101 801208EF40	PLC_BIT_1209	Event information from PLC	5A0101 8012081F40	CMNCTRL	PLC_I_066
5A0101 801209EF40	PLC_BIT_1210	Event information from PLC	5A0101 8012091F40	CMNCTRL	PLC_I_067
5A0101 801210EF40	PLC_BIT_1211	Event information from PLC	5A0101 8012101F40	CMNCTRL	PLC_I_068
5A0101 801211EF40	PLC_BIT_1212	Event information from PLC	5A0101 8012111F40	CMNCTRL	PLC_I_069
5A0101 801212EF40	PLC_BIT_1213	Event information from PLC	5A0101 8012121F40	CMNCTRL	PLC_I_070
5A0101 801213EF40	PLC_BIT_1214	Event information from PLC	5A0101 8012131F40	CMNCTRL	PLC_I_071
5A0101 801214EF40	PLC_BIT_1215	Event information from PLC	5A0101 8012141F40	CMNCTRL	PLC_I_072
5A0101 801215EF40	PLC_BIT_1216	Event information from PLC	5A0101 8012151F40	CMNCTRL	PLC_I_073
5A0101 801216EF40	PLC_BIT_1217	Event information from PLC	5A0101 8012161F40	CMNCTRL	PLC_I_074
5A0101 801217EF40	PLC_BIT_1218	Event information from PLC	5A0101 8012171F40	CMNCTRL	PLC_I_075
5A0101 801218EF40	PLC_BIT_1219	Event information from PLC	5A0101 8012181F40	CMNCTRL	PLC_I_076
5A0101 801219EF40	PLC_BIT_1220	Event information from PLC	5A0101 8012191F40	CMNCTRL	PLC_I_077
5A0101 801220EF40	PLC_BIT_1221	Event information from PLC	5A0101 8012201F40	CMNCTRL	PLC_I_078
5A0101 801221EF40	PLC_BIT_1222	Event information from PLC	5A0101 8012211F40	CMNCTRL	PLC_I_079
5A0101 801222EF40	PLC_BIT_1223	Event information from PLC	5A0101 8012221F40	CMNCTRL	PLC_I_080
5A0101 801223EF40	PLC_BIT_1224	Event information from PLC	5A0101 8012231F40	CMNCTRL	PLC_I_081
5A0101 801224EF40	PLC_BIT_1225	Event information from PLC	5A0101 8012241F40	CMNCTRL	PLC_I_082
5A0101 801225EF40	PLC_BIT_1226	Event information from PLC	5A0101 8012251F40	CMNCTRL	PLC_I_083
5A0101 801226EF40	PLC_BIT_1227	Event information from PLC	5A0101 8012261F40	CMNCTRL	PLC_I_084
5A0101 801227EF40	PLC_BIT_1228	Event information from PLC	5A0101 8012271F40	CMNCTRL	PLC_I_085
5A0101 801228EF40	PLC_BIT_1229	Event information from PLC	5A0101 8012281F40	CMNCTRL	PLC_I_086
5A0101 801229EF40	PLC_BIT_1230	Event information from PLC	5A0101 8012291F40	CMNCTRL	PLC_I_087
5A0101 801230EF40	PLC_BIT_1231	Event information from PLC	5A0101 8012301F40	CMNCTRL	PLC_I_088
5A0101 801231EF40	PLC_BIT_1232	Event information from PLC	5A0101 8012311F40	CMNCTRL	PLC_I_089
5A0101 801232EF40	PLC_BIT_1233	Event information from PLC	5A0101 8012321F40	CMNCTRL	PLC_I_090
5A0101 801233EF40	PLC_BIT_1234	Event information from PLC	5A0101 8012331F40	CMNCTRL	PLC_I_091
5A0101 801234EF40	PLC_BIT_1235	Event information from PLC	5A0101 8012341F40	CMNCTRL	PLC_I_092
5A0101 801235EF40	PLC_BIT_1236	Event information from PLC	5A0101 8012351F40	CMNCTRL	PLC_I_093
5A0101 801236EF40	PLC_BIT_1237	Event information from PLC	5A0101 8012361F40	CMNCTRL	PLC_I_094
5A0101 801237EF40	PLC_BIT_1238	Event information from PLC	5A0101 8012371F40	CMNCTRL	PLC_I_095
5A0101 801238EF40	PLC_BIT_1239	Event information from PLC	5A0101 8012381F40	CMNCTRL	PLC_I_096
5A0101 801239EF40	PLC_BIT_1240	Event information from PLC	5A0101 8012391F40	CMNCTRL	PLC_I_097
5A0101 801240EF40	PLC_BIT_1241	Event information from PLC	5A0101 8012401F40	CMNCTRL	PLC_I_098
5A0101 801241EF40	PLC_BIT_1242	Event information from PLC	5A0101 8012411F40	CMNCTRL	PLC_I_099
5A0101 801242EF40	PLC_BIT_1243	Event information from PLC	5A0101 8012421F40	CMNCTRL	PLC_I_100
5A0101 801243EF40	PLC_BIT_1244	Condition for blocking Power quality measurement	5A0101 8012431F40	PWRQTY	PWRQ__HAR_LOCK
5A0101 801244EF40	PLC_BIT_1245	Establishing control right in OPTIMRST	5A0101 8012441F40	OPTIMRST	OPTR01_CTRL_RIGHT
5A0101 801245EF40	PLC_BIT_1246		5A0101 8012451F40		

DataIDs	Connections	Meaning	Monitoring	FB	Destinations
5A0101 801246EF40	PLC_BIT_1247	Establishing control right in TMCHG	5A0101 8012461F40	TMCHG	DEV01_CTRL_RIGHT
5A0101 801247EF40	PLC_BIT_1248	Establishing control right in TMCHG	5A0101 8012471F40	TMCHG	DEV02_CTRL_RIGHT
5A0101 801248EF40	PLC_BIT_1249	Establishing control right in TMCHG	5A0101 8012481F40	TMCHG	DEV03_CTRL_RIGHT
5A0101 801249EF40	PLC_BIT_1250	Establishing control right in TMCHG	5A0101 8012491F40	TMCHG	DEV04_CTRL_RIGHT
5A0101 801250EF40	PLC_BIT_1251	Establishing control right in TMCHG	5A0101 8012501F40	TMCHG	DEV05_CTRL_RIGHT
5A0101 801251EF40	PLC_BIT_1252	Establishing control right in TMCHG	5A0101 8012511F40	TMCHG	DEV06_CTRL_RIGHT
5A0101 801252EF40	PLC_BIT_1253	Establishing control right in TMCHG	5A0101 8012521F40	TMCHG	DEV07_CTRL_RIGHT
5A0101 801253EF40	PLC_BIT_1254	Establishing control right in TMCHG	5A0101 8012531F40	TMCHG	DEV08_CTRL_RIGHT
5A0101 801254EF40	PLC_BIT_1255	Establishing control right in TMCHG	5A0101 8012541F40	TMCHG	DEV09_CTRL_RIGHT
5A0101 801255EF40	PLC_BIT_1256	Establishing control right in TMCHG	5A0101 8012551F40	TMCHG	DEV10_CTRL_RIGHT
5A0101 801256EF40	PLC_BIT_1257	Establishing control right in TMCHG	5A0101 8012561F40	TMCHG	DEV11_CTRL_RIGHT
5A0101 801257EF40	PLC_BIT_1258	Establishing control right in TMCHG	5A0101 8012571F40	TMCHG	DEV12_CTRL_RIGHT
5A0101 801258EF40	PLC_BIT_1259	Establishing control right in TMCHG	5A0101 8012581F40	TMCHG	DEV13_CTRL_RIGHT
5A0101 801259EF40	PLC_BIT_1260		5A0101 8012591F40	TMCHG	
5A0101 801260EF40	PLC_BIT_1261		5A0101 8012601F40		
5A0101 801261EF40	PLC_BIT_1262	Establishing control right in TMCHG(PLC)	5A0101 8012611F40	DMCB	DMCB01IN_TMP_28
5A0101 801262EF40	PLC_BIT_1263		5A0101 8012621F40		
5A0101 801263EF40	PLC_BIT_1264	PLC signal 1	5A0101 8012631F40	LOCRMT	LRSW01_PLC_SGN01
5A0101 801264EF40	PLC_BIT_1265	PLC signal 2	5A0101 8012641F40	LOCRMT	LRSW01_PLC_SGN02
5A0101 801265EF40	PLC_BIT_1266		5A0101 8012651F40		
5A0101 801266EF40	PLC_BIT_1267	Establishing control right at TAP	5A0101 8012661F40	BCD	BCD01IN_TMP_28
5A0101 801267EF40	PLC_BIT_1268	Condition of selection completed in TAP (in PLC)	5A0101 8012671F40	BCD	BCD01IN_TMP_29
5A0101 801268EF40	PLC_BIT_1269	Condition of Selection failure at TAP (in PLC)	5A0101 8012681F40	BCD	BCD01IN_TMP_30
5A0101 801269EF40	PLC_BIT_1270	Reason of selection failure at TAP (in Fixed source)(in PLC)	5A0101 8012691F40	BCD	BCD01IN_TMP_31
5A0101 801270EF40	PLC_BIT_1271	Reason of selection failure at TAP (in PLC)	5A0101 8012701F40	BCD	BCD01IN_TMP_32
5A0101 801271EF40	PLC_BIT_1272	Condition of cancel selection at TAP (in PLC)	5A0101 8012711F40	BCD	BCD01IN_TMP_33
5A0101 801272EF40	PLC_BIT_1273	Condition for "Down" controlling at TAP (in PLC)	5A0101 8012721F40	BCD	BCD01IN_TMP_34
5A0101 801273EF40	PLC_BIT_1274	Condition for "UP" controlling at TAP (in PLC)	5A0101 8012731F40	BCD	BCD01IN_TMP_35
5A0101 801274EF40	PLC_BIT_1275	Failure condition for controlling "DOWN" at TAP (in PLC)	5A0101 8012741F40	BCD	BCD01IN_TMP_37
5A0101 801275EF40	PLC_BIT_1276	Failure condition for controlling "UP" at TAP (in PLC)	5A0101 8012751F40	BCD	BCD01IN_TMP_38
5A0101 801276EF40	PLC_BIT_1277	Reason of selection failure at TAP (in Fixed source)(in PLC)	5A0101 8012761F40	BCD	BCD01IN_TMP_40
5A0101 801277EF40	PLC_BIT_1278	Reason of selection failure at TAP(in PLC)	5A0101 8012771F40	BCD	BCD01IN_TMP_41
5A0101 801278EF40	PLC_BIT_1279	Control "DOWN" output on BO circuit in TPOS	5A0101 8012781F40	BCD	BCD01IN_TMP_42
5A0101 801279EF40	PLC_BIT_1280	Control "UP" output on BO circuit in TPOS	5A0101 8012791F40	BCD	BCD01IN_TMP_43
5A0101 801280EF40	PLC_BIT_1281	Success for controlling at TAP (in PLC)	5A0101 8012801F40	BCD	BCD01IN_TMP_44
5A0101 801281EF40	PLC_BIT_1282	Failure for controlling at TAP (in PLC)	5A0101 8012811F40	BCD	BCD01IN_TMP_45
5A0101 801282EF40	PLC_BIT_1283	Cancel reason for controlling at TAP (in PLC)	5A0101 8012821F40	BCD	BCD01IN_TMP_46
5A0101 801283EF40	PLC_BIT_1284	Upper limit in Tap	5A0101 8012831F40	BCD	BCD01IN_TAP_HIGH
5A0101 801284EF40	PLC_BIT_1285	Bottom limit in Tap	5A0101 8012841F40	BCD	BCD01IN_TAP_LOW
5A0101 801285EF40	PLC_BIT_1286	Range limit between Upper and Lower in Tap	5A0101 8012851F40	BCD	BCD01IN_TAP_HIGHLOW
5A0101 801286EF40	PLC_BIT_1287	Establishment of Power quality control right	5A0101 8012861F40	PWRQTY	PWRQ__CTRL_RIGHT
5A0101 801287EF40	PLC_BIT_1288	Establishment of mode change control right	5A0101 8012871F40	MDCTRL	MDCTRL01IN_TMP_28
5A0101 801288EF40	PLC_BIT_1289	Dev1 State of use in relay module3	5A0101 8012881F40	SYNCHK	SYNC01_RY3_USE_STS
5A0101 801289EF40	PLC_BIT_1290	Reserved	5A0101 8012891F40	PLC Logic	PLC Temporary signal
5A0101 801290EF40	PLC_BIT_1291	Reserved	5A0101 8012901F40	PLC Logic	PLC Temporary signal
5A0101 801291EF40	PLC_BIT_1292	Reserved	5A0101 8012911F40	PLC Logic	PLC Temporary signal
5A0101 801292EF40	PLC_BIT_1293	Reserved	5A0101 8012921F40	PLC Logic	PLC Temporary signal
5A0101 801293EF40	PLC_BIT_1294	Reserved	5A0101 8012931F40	PLC Logic	PLC Temporary signal
5A0101 801294EF40	PLC_BIT_1295	Reserved	5A0101 8012941F40	PLC Logic	PLC Temporary signal
5A0101 801295EF40	PLC_BIT_1296	Reserved	5A0101 8012951F40	PLC Logic	PLC Temporary signal
5A0101 801296EF40	PLC_BIT_1297	Dev1 State of use in relay module4	5A0101 8012961F40	SYNCHK	SYNC01_RY4_USE_STS
5A0101 801297EF40	PLC_BIT_1298	Dev2 State of use in relay module3	5A0101 8012971F40	SYNCHK	SYNC02_RY3_USE_STS
5A0101 801298EF40	PLC_BIT_1299	Dev2 State of use in relay module4	5A0101 8012981F40	SYNCHK	SYNC02_RY4_USE_STS
5A0101 801299EF40	PLC_BIT_1300		5A0101 8012991F40		
5A0101 801300EF40	PLC_BIT_1301		5A0101 8013001F40		
5A0101 801301EF40	PLC_BIT_1302		5A0101 8013011F40		
5A0101 801302EF40	PLC_BIT_1303		5A0101 8013021F40		
5A0101 801303EF40	PLC_BIT_1304		5A0101 8013031F40		
5A0101 801304EF40	PLC_BIT_1305		5A0101 8013041F40		
5A0101 801305EF40	PLC_BIT_1306		5A0101 8013051F40		
5A0101 801306EF40	PLC_BIT_1307		5A0101 8013061F40		
5A0101 801307EF40	PLC_BIT_1308		5A0101 8013071F40		
5A0101 801308EF40	PLC_BIT_1309		5A0101 8013081F40		
5A0101 801309EF40	PLC_BIT_1310		5A0101 8013091F40		
5A0101 801310EF40	PLC_BIT_1311		5A0101 8013101F40		
5A0101 801311EF40	PLC_BIT_1312		5A0101 8013111F40		
5A0101 801312EF40	PLC_BIT_1313		5A0101 8013121F40		
5A0101 801313EF40	PLC_BIT_1314		5A0101 8013131F40		
5A0101 801314EF40	PLC_BIT_1315		5A0101 8013141F40		
5A0101 801315EF40	PLC_BIT_1316		5A0101 8013151F40		
5A0101 801316EF40	PLC_BIT_1317		5A0101 8013161F40		
5A0101 801317EF40	PLC_BIT_1318		5A0101 8013171F40		
5A0101 801318EF40	PLC_BIT_1319		5A0101 8013181F40		
5A0101 801319EF40	PLC_BIT_1320	Reserved	5A0101 8013191F40		PLC Temp Signal
5A0101 801320EF40	PLC_BIT_1321	Reserved	5A0101 8013201F40		PLC Temp Signal
5A0101 801321EF40	PLC_BIT_1322	Reserved	5A0101 8013211F40		PLC Temp Signal
5A0101 801322EF40	PLC_BIT_1323	Reserved	5A0101 8013221F40		PLC Temp Signal
5A0101 801323EF40	PLC_BIT_1324	Reserved	5A0101 8013231F40		PLC Temp Signal
5A0101 801324EF40	PLC_BIT_1325	Reserved	5A0101 8013241F40		PLC Temp Signal
5A0101 801325EF40	PLC_BIT_1326	Reserved	5A0101 8013251F40		PLC Temp Signal
5A0101 801326EF40	PLC_BIT_1327	Reserved	5A0101 8013261F40		PLC Temp Signal
5A0101 801327EF40	PLC_BIT_1328	Reserved	5A0101 8013271F40		PLC Temp Signal
5A0101 801328EF40	PLC_BIT_1329	Reserved	5A0101 8013281F40		VPOS01 change to OFF
5A0101 801329EF40	PLC_BIT_1330	Reserved	5A0101 8013291F40		VPOS02 change to OFF
5A0101 801330EF40	PLC_BIT_1331	Reserved	5A0101 8013301F40		VPOS03 change to OFF
5A0101 801331EF40	PLC_BIT_1332	Reserved	5A0101 8013311F40		VPOS04 change to OFF
5A0101 801332EF40	PLC_BIT_1333	Reserved	5A0101 8013321F40		VPOS05 change to OFF
5A0101 801333EF40	PLC_BIT_1334	Reserved	5A0101 8013331F40		VPOS06 change to OFF
5A0101 801334EF40	PLC_BIT_1335	Reserved	5A0101 8013341F40		VPOS07 change to OFF
5A0101 801335EF40	PLC_BIT_1336	Reserved	5A0101 8013351F40		VPOS08 change to OFF
5A0101 801336EF40	PLC_BIT_1337	Reserved	5A0101 8013361F40		VPOS09 change to OFF
5A0101 801337EF40	PLC_BIT_1338	Reserved	5A0101 8013371F40		VPOS10 change to OFF
5A0101 801338EF40	PLC_BIT_1339	Reserved	5A0101 8013381F40		VPOS11 change to OFF
5A0101 801339EF40	PLC_BIT_1340	Reserved	5A0101 8013391F40		VPOS12 change to OFF
5A0101 801340EF40	PLC_BIT_1341	Reserved	5A0101 8013401F40		VPOS13 change to OFF
5A0101 801341EF40	PLC_BIT_1342	Reserved	5A0101 8013411F40		VPOS14 change to OFF
5A0101 801342EF40	PLC_BIT_1343	Reserved	5A0101 8013421F40		VPOS15 change to OFF

DataIDs	Connections	Meaning	Monitoring	FB	Destinations
5A0101 801343EF40	PLC_BIT_1344	Reserved	5A0101 8013431F40		VPOS16 change to OFF
5A0101 801344EF40	PLC_BIT_1345	Reserved	5A0101 8013441F40		VPOS17 change to OFF
5A0101 801345EF40	PLC_BIT_1346	Reserved	5A0101 8013451F40		VPOS18 change to OFF
5A0101 801346EF40	PLC_BIT_1347	Reserved	5A0101 8013461F40		VPOS19 change to OFF
5A0101 801347EF40	PLC_BIT_1348	Reserved	5A0101 8013471F40		VPOS20 change to OFF
5A0101 801348EF40	PLC_BIT_1349	Reserved	5A0101 8013481F40		VPOS21 change to OFF
5A0101 801349EF40	PLC_BIT_1350	Reserved	5A0101 8013491F40		VPOS22 change to OFF
5A0101 801350EF40	PLC_BIT_1351	Reserved	5A0101 8013501F40		VPOS23 change to OFF
5A0101 801351EF40	PLC_BIT_1352	Reserved	5A0101 8013511F40		VPOS24 change to OFF
5A0101 801352EF40	PLC_BIT_1353	Reserved	5A0101 8013521F40		VPOS25 change to OFF
5A0101 801353EF40	PLC_BIT_1354	Reserved	5A0101 8013531F40		VPOS26 change to OFF
5A0101 801354EF40	PLC_BIT_1355	Reserved	5A0101 8013541F40		VPOS27 change to OFF
5A0101 801355EF40	PLC_BIT_1356	Reserved	5A0101 8013551F40		VPOS28 change to OFF
5A0101 801356EF40	PLC_BIT_1357	Reserved	5A0101 8013561F40		VPOS29 change to OFF
5A0101 801357EF40	PLC_BIT_1358	Reserved	5A0101 8013571F40		VPOS30 change to OFF
5A0101 801358EF40	PLC_BIT_1359	Reserved	5A0101 8013581F40		VPOS31 change to OFF
5A0101 801359EF40	PLC_BIT_1360	Reserved	5A0101 8013591F40		VPOS32 change to OFF
5A0101 801360EF40	PLC_BIT_1361	Reserved	5A0101 8013601F40		VPOS33 change to OFF
5A0101 801361EF40	PLC_BIT_1362	Reserved	5A0101 8013611F40		VPOS34 change to OFF
5A0101 801362EF40	PLC_BIT_1363	Reserved	5A0101 8013621F40		VPOS35 change to OFF
5A0101 801363EF40	PLC_BIT_1364	Reserved	5A0101 8013631F40		VPOS36 change to OFF
5A0101 801364EF40	PLC_BIT_1365	Reserved	5A0101 8013641F40		VPOS37 change to OFF
5A0101 801365EF40	PLC_BIT_1366	Reserved	5A0101 8013651F40		VPOS38 change to OFF
5A0101 801366EF40	PLC_BIT_1367	Reserved	5A0101 8013661F40		VPOS39 change to OFF
5A0101 801367EF40	PLC_BIT_1368	Reserved	5A0101 8013671F40		VPOS40 change to OFF
5A0101 801368EF40	PLC_BIT_1369	Reserved	5A0101 8013681F40		VPOS41 change to OFF
5A0101 801369EF40	PLC_BIT_1370	Reserved	5A0101 8013691F40		VPOS42 change to OFF
5A0101 801370EF40	PLC_BIT_1371	Reserved	5A0101 8013701F40		VPOS43 change to OFF
5A0101 801371EF40	PLC_BIT_1372	Reserved	5A0101 8013711F40		VPOS44 change to OFF
5A0101 801372EF40	PLC_BIT_1373	Reserved	5A0101 8013721F40		VPOS45 change to OFF
5A0101 801373EF40	PLC_BIT_1374	Reserved	5A0101 8013731F40		VPOS46 change to OFF
5A0101 801374EF40	PLC_BIT_1375	Reserved	5A0101 8013741F40		VPOS47 change to OFF
5A0101 801375EF40	PLC_BIT_1376	Reserved	5A0101 8013751F40		VPOS48 change to OFF
5A0101 801376EF40	PLC_BIT_1377	Reserved	5A0101 8013761F40		VPOS49 change to OFF
5A0101 801377EF40	PLC_BIT_1378	Reserved	5A0101 8013771F40		VPOS50 change to OFF
5A0101 801378EF40	PLC_BIT_1379	Reserved	5A0101 8013781F40		VPOS51 change to OFF
5A0101 801379EF40	PLC_BIT_1380	Reserved	5A0101 8013791F40		VPOS52 change to OFF
5A0101 801380EF40	PLC_BIT_1381	Reserved	5A0101 8013801F40		VPOS53 change to OFF
5A0101 801381EF40	PLC_BIT_1382	Reserved	5A0101 8013811F40		VPOS54 change to OFF
5A0101 801382EF40	PLC_BIT_1383	Reserved	5A0101 8013821F40		VPOS55 change to OFF
5A0101 801383EF40	PLC_BIT_1384	Reserved	5A0101 8013831F40		VPOS56 change to OFF
5A0101 801384EF40	PLC_BIT_1385	Reserved	5A0101 8013841F40		VPOS57 change to OFF
5A0101 801385EF40	PLC_BIT_1386	Reserved	5A0101 8013851F40		VPOS58 change to OFF
5A0101 801386EF40	PLC_BIT_1387	Reserved	5A0101 8013861F40		VPOS59 change to OFF
5A0101 801387EF40	PLC_BIT_1388	Reserved	5A0101 8013871F40		VPOS60 change to OFF
5A0101 801388EF40	PLC_BIT_1389	Reserved	5A0101 8013881F40		VPOS61 change to OFF
5A0101 801389EF40	PLC_BIT_1390	Reserved	5A0101 8013891F40		VPOS62 change to OFF
5A0101 801390EF40	PLC_BIT_1391	Reserved	5A0101 8013901F40		VPOS63 change to OFF
5A0101 801391EF40	PLC_BIT_1392	Reserved	5A0101 8013911F40		VPOS64 change to OFF
5A0101 801392EF40	PLC_BIT_1393	PLSM01 signal	5A0101 8013921F40	PLSMEA	PLSM01_PLC_SGNL
5A0101 801393EF40	PLC_BIT_1394	PLSM02 signal	5A0101 8013931F40	PLSMEA	PLSM02_PLC_SGNL
5A0101 801394EF40	PLC_BIT_1395	PLSM03 signal	5A0101 8013941F40	PLSMEA	PLSM03_PLC_SGNL
5A0101 801395EF40	PLC_BIT_1396	PLSM04 signal	5A0101 8013951F40	PLSMEA	PLSM04_PLC_SGNL
5A0101 801396EF40	PLC_BIT_1397	PLSM05 signal	5A0101 8013961F40	PLSMEA	PLSM05_PLC_SGNL
5A0101 801397EF40	PLC_BIT_1398	PLSM06 signal	5A0101 8013971F40	PLSMEA	PLSM06_PLC_SGNL
5A0101 801398EF40	PLC_BIT_1399	PLSM07 signal	5A0101 8013981F40	PLSMEA	PLSM07_PLC_SGNL
5A0101 801399EF40	PLC_BIT_1400	PLSM08 signal	5A0101 8013991F40	PLSMEA	PLSM08_PLC_SGNL
5A0101801400EF40	PLC_BIT_1401	(Prepared for 1F and 2C software codes at G&T positions)	5A0101 8014001F40		
5A0101 801401EF40	PLC_BIT_1402	(Prepared for 1F and 2C software codes at G&T positions)	5A0101 8014011F40		
5A0101 801402EF40	PLC_BIT_1403	(Prepared for 1F and 2C software codes at G&T positions)	5A0101 8014021F40		
5A0101 801403EF40	PLC_BIT_1404	(Prepared for 1F and 2C software codes at G&T positions)	5A0101 8014031F40		
5A0101 801404EF40	PLC_BIT_1405	(Prepared for 1F and 2C software codes at G&T positions)	5A0101 8014041F40		
5A0101 801405EF40	PLC_BIT_1406	(Prepared for 1F and 2C software codes at G&T positions)	5A0101 8014051F40		
5A0101 801406EF40	PLC_BIT_1407	(Prepared for 1F and 2C software codes at G&T positions)	5A0101 8014061F40		
5A0101 801407EF40	PLC_BIT_1408	(Prepared for 1F and 2C software codes at G&T positions)	5A0101 8014071F40		
5A0101 801408EF40	PLC_BIT_1409	(Prepared for 1F and 2C software codes at G&T positions)	5A0101 8014081F40		
5A0101 801409EF40	PLC_BIT_1410	(Prepared for 1F and 2C software codes at G&T positions)	5A0101 8014091F40		
5A0101 801410EF40	PLC_BIT_1411	(Prepared for 1F and 2C software codes at G&T positions)	5A0101 8014101F40		
5A0101 801411EF40	PLC_BIT_1412	(Prepared for 1F and 2C software codes at G&T positions)	5A0101 8014111F40		
5A0101 801412EF40	PLC_BIT_1413	(Prepared for 1F and 2C software codes at G&T positions)	5A0101 8014121F40		
5A0101 801413EF40	PLC_BIT_1414	(Prepared for 1F and 2C software codes at G&T positions)	5A0101 8014131F40		
5A0101 801414EF40	PLC_BIT_1415	(Prepared for 1F and 2C software codes at G&T positions)	5A0101 8014141F40		
5A0101 801415EF40	PLC_BIT_1416	(Prepared for 1F and 2C software codes at G&T positions)	5A0101 8014151F40		
5A0101 801416EF40	PLC_BIT_1417	(Prepared for 1F and 2C software codes at G&T positions)	5A0101 8014161F40		
5A0101 801417EF40	PLC_BIT_1418	(Prepared for 1F and 2C software codes at G&T positions)	5A0101 8014171F40		
5A0101 801418EF40	PLC_BIT_1419	(Prepared for 1F and 2C software codes at G&T positions)	5A0101 8014181F40		
5A0101 801419EF40	PLC_BIT_1420	(Prepared for 1F and 2C software codes at G&T positions)	5A0101 8014191F40		
5A0101 801420EF40	PLC_BIT_1421	(Prepared for 1F and 2C software codes at G&T positions)	5A0101 8014201F40		
5A0101 801421EF40	PLC_BIT_1422	(Prepared for 1F and 2C software codes at G&T positions)	5A0101 8014211F40		
5A0101 801422EF40	PLC_BIT_1423	(Prepared for 1F and 2C software codes at G&T positions)	5A0101 8014221F40		
5A0101 801423EF40	PLC_BIT_1424	(Prepared for 1F and 2C software codes at G&T positions)	5A0101 8014231F40		
5A0101 801424EF40	PLC_BIT_1425	(Prepared for 1F and 2C software codes at G&T positions)	5A0101 8014241F40		
5A0101 801425EF40	PLC_BIT_1426	(Prepared for 1F and 2C software codes at G&T positions)	5A0101 8014251F40		
5A0101 801426EF40	PLC_BIT_1427	(Prepared for 1F and 2C software codes at G&T positions)	5A0101 8014261F40		
5A0101 801427EF40	PLC_BIT_1428	(Prepared for 1F and 2C software codes at G&T positions)	5A0101 8014271F40		
5A0101 801428EF40	PLC_BIT_1429	(Prepared for 1F and 2C software codes at G&T positions)	5A0101 8014281F40		
5A0101 801429EF40	PLC_BIT_1430	(Prepared for 1F and 2C software codes at G&T positions)	5A0101 8014291F40		
5A0101 801430EF40	PLC_BIT_1431	(Prepared for 1F and 2C software codes at G&T positions)	5A0101 8014301F40		
5A0101 801431EF40	PLC_BIT_1432	(Prepared for 1F and 2C software codes at G&T positions)	5A0101 8014311F40		
5A0101 801432EF40	PLC_BIT_1433	(Prepared for 1F and 2C software codes at G&T positions)	5A0101 8014321F40		
5A0101 801433EF40	PLC_BIT_1434	(Prepared for 1F and 2C software codes at G&T positions)	5A0101 8014331F40		
5A0101 801434EF40	PLC_BIT_1435	(Prepared for 1F and 2C software codes at G&T positions)	5A0101 8014341F40		
5A0101 801435EF40	PLC_BIT_1436	(Prepared for 1F and 2C software codes at G&T positions)	5A0101 8014351F40		
5A0101 801436EF40	PLC_BIT_1437	(Prepared for 1F and 2C software codes at G&T positions)	5A0101 8014361F40		
5A0101 801437EF40	PLC_BIT_1438	(Prepared for 1F and 2C software codes at G&T positions)	5A0101 8014371F40		
5A0101 801438EF40	PLC_BIT_1439	(Prepared for 1F and 2C software codes at G&T positions)	5A0101 8014381F40		
5A0101 801439EF40	PLC_BIT_1440	(Prepared for 1F and 2C software codes at G&T positions)	5A0101 8014391F40		

DataIDs	Connections	Meaning	Monitoring	FB	Destinations
5A0101 801440EF40	PLC_BIT_1441	(Prepared for 1F and 2C software codes at G&T positions)	5A0101 8014401F40		
5A0101 801441EF40	PLC_BIT_1442	(Prepared for 1F and 2C software codes at G&T positions)	5A0101 8014411F40		
5A0101 801442EF40	PLC_BIT_1443	(Prepared for 1F and 2C software codes at G&T positions)	5A0101 8014421F40		
5A0101 801443EF40	PLC_BIT_1444	(Prepared for 1F and 2C software codes at G&T positions)	5A0101 8014431F40		
5A0101 801444EF40	PLC_BIT_1445	(Prepared for 1F and 2C software codes at G&T positions)	5A0101 8014441F40		
5A0101 801445EF40	PLC_BIT_1446	(Prepared for 1F and 2C software codes at G&T positions)	5A0101 8014451F40		
5A0101 801446EF40	PLC_BIT_1447	(Prepared for 1F and 2C software codes at G&T positions)	5A0101 8014461F40		
5A0101 801447EF40	PLC_BIT_1448	(Prepared for 1F and 2C software codes at G&T positions)	5A0101 8014471F40		
5A0101 801448EF40	PLC_BIT_1449	(Prepared for 1F and 2C software codes at G&T positions)	5A0101 8014481F40		
5A0101 801449EF40	PLC_BIT_1450	(Prepared for 1F and 2C software codes at G&T positions)	5A0101 8014491F40		
5A0101 801450EF40	PLC_BIT_1451	(Prepared for 1F and 2C software codes at G&T positions)	5A0101 8014501F40		
5A0101 801451EF40	PLC_BIT_1452	(Prepared for 1F and 2C software codes at G&T positions)	5A0101 8014511F40		
5A0101 801452EF40	PLC_BIT_1453	(Prepared for 1F and 2C software codes at G&T positions)	5A0101 8014521F40		
5A0101 801453EF40	PLC_BIT_1454	(Prepared for 1F and 2C software codes at G&T positions)	5A0101 8014531F40		
5A0101 801454EF40	PLC_BIT_1455	(Prepared for 1F and 2C software codes at G&T positions)	5A0101 8014541F40		
5A0101 801455EF40	PLC_BIT_1456	(Prepared for 1F and 2C software codes at G&T positions)	5A0101 8014551F40		
5A0101 801456EF40	PLC_BIT_1457	(Prepared for 1F and 2C software codes at G&T positions)	5A0101 8014561F40		
5A0101 801457EF40	PLC_BIT_1458	(Prepared for 1F and 2C software codes at G&T positions)	5A0101 8014571F40		
5A0101 801458EF40	PLC_BIT_1459	(Prepared for 1F and 2C software codes at G&T positions)	5A0101 8014581F40		
5A0101 801459EF40	PLC_BIT_1460	(Prepared for 1F and 2C software codes at G&T positions)	5A0101 8014591F40		
5A0101 801460EF40	PLC_BIT_1461	(Prepared for 1F and 2C software codes at G&T positions)	5A0101 8014601F40		
5A0101 801461EF40	PLC_BIT_1462	(Prepared for 1F and 2C software codes at G&T positions)	5A0101 8014611F40		
5A0101 801462EF40	PLC_BIT_1463	(Prepared for 1F and 2C software codes at G&T positions)	5A0101 8014621F40		
5A0101 801463EF40	PLC_BIT_1464	(Prepared for 1F and 2C software codes at G&T positions)	5A0101 8014631F40		
5A0101 801464EF40	PLC_BIT_1465	(Prepared for 1F and 2C software codes at G&T positions)	5A0101 8014641F40		
5A0101 801465EF40	PLC_BIT_1466	(Prepared for 1F and 2C software codes at G&T positions)	5A0101 8014651F40		
5A0101 801466EF40	PLC_BIT_1467	(Prepared for 1F and 2C software codes at G&T positions)	5A0101 8014661F40		
5A0101 801467EF40	PLC_BIT_1468	(Prepared for 1F and 2C software codes at G&T positions)	5A0101 8014671F40		
5A0101 801468EF40	PLC_BIT_1469	(Prepared for 1F and 2C software codes at G&T positions)	5A0101 8014681F40		
5A0101 801469EF40	PLC_BIT_1470	(Prepared for 1F and 2C software codes at G&T positions)	5A0101 8014691F40		
5A0101 801470EF40	PLC_BIT_1471	(Prepared for 1F and 2C software codes at G&T positions)	5A0101 8014701F40		
5A0101 801471EF40	PLC_BIT_1472	(Prepared for 1F and 2C software codes at G&T positions)	5A0101 8014711F40		
5A0101 801472EF40	PLC_BIT_1473	(Prepared for 1F and 2C software codes at G&T positions)	5A0101 8014721F40		
5A0101 801473EF40	PLC_BIT_1474	(Prepared for 1F and 2C software codes at G&T positions)	5A0101 8014731F40		
5A0101 801474EF40	PLC_BIT_1475	(Prepared for 1F and 2C software codes at G&T positions)	5A0101 8014741F40		
5A0101 801475EF40	PLC_BIT_1476	(Prepared for 1F and 2C software codes at G&T positions)	5A0101 8014751F40		
5A0101 801476EF40	PLC_BIT_1477	(Prepared for 1F and 2C software codes at G&T positions)	5A0101 8014761F40		
5A0101 801477EF40	PLC_BIT_1478	(Prepared for 1F and 2C software codes at G&T positions)	5A0101 8014771F40		
5A0101 801478EF40	PLC_BIT_1479	(Prepared for 1F and 2C software codes at G&T positions)	5A0101 8014781F40		
5A0101 801479EF40	PLC_BIT_1480	(Prepared for 1F and 2C software codes at G&T positions)	5A0101 8014791F40		
5A0101 801480EF40	PLC_BIT_1481	(Prepared for 1F and 2C software codes at G&T positions)	5A0101 8014801F40		
5A0101 801481EF40	PLC_BIT_1482	(Prepared for 1F and 2C software codes at G&T positions)	5A0101 8014811F40		
5A0101 801482EF40	PLC_BIT_1483	(Prepared for 1F and 2C software codes at G&T positions)	5A0101 8014821F40		
5A0101 801483EF40	PLC_BIT_1484	(Prepared for 1F and 2C software codes at G&T positions)	5A0101 8014831F40		
5A0101 801484EF40	PLC_BIT_1485	(Prepared for 1F and 2C software codes at G&T positions)	5A0101 8014841F40		
5A0101 801485EF40	PLC_BIT_1486	(Prepared for 1F and 2C software codes at G&T positions)	5A0101 8014851F40		
5A0101 801486EF40	PLC_BIT_1487	(Prepared for 1F and 2C software codes at G&T positions)	5A0101 8014861F40		
5A0101 801487EF40	PLC_BIT_1488	(Prepared for 1F and 2C software codes at G&T positions)	5A0101 8014871F40		
5A0101 801488EF40	PLC_BIT_1489	(Prepared for 1F and 2C software codes at G&T positions)	5A0101 8014881F40		
5A0101 801489EF40	PLC_BIT_1490	(Prepared for 1F and 2C software codes at G&T positions)	5A0101 8014891F40		
5A0101 801490EF40	PLC_BIT_1491	(Prepared for 1F and 2C software codes at G&T positions)	5A0101 8014901F40		
5A0101 801491EF40	PLC_BIT_1492	(Prepared for 1F and 2C software codes at G&T positions)	5A0101 8014911F40		
5A0101 801492EF40	PLC_BIT_1493	(Prepared for 1F and 2C software codes at G&T positions)	5A0101 8014921F40		
5A0101 801493EF40	PLC_BIT_1494	(Prepared for 1F and 2C software codes at G&T positions)	5A0101 8014931F40		
5A0101 801494EF40	PLC_BIT_1495	(Prepared for 1F and 2C software codes at G&T positions)	5A0101 8014941F40		
5A0101 801495EF40	PLC_BIT_1496	(Prepared for 1F and 2C software codes at G&T positions)	5A0101 8014951F40		
5A0101 801496EF40	PLC_BIT_1497	(Prepared for 1F and 2C software codes at G&T positions)	5A0101 8014961F40		
5A0101 801497EF40	PLC_BIT_1498	(Prepared for 1F and 2C software codes at G&T positions)	5A0101 8014971F40		
5A0101 801498EF40	PLC_BIT_1499	(Prepared for 1F and 2C software codes at G&T positions)	5A0101 8014981F40		
5A0101 801499EF40	PLC_BIT_1500	(Prepared for 1F and 2C software codes at G&T positions)	5A0101 8014991F40		
5A0101 310000EF41	PLC_UINT_1		5A0101 3100001F41	PLSMEA	PLSM01_PLC_QUALITY
5A0101 310001EF41	PLC_UINT_2		5A0101 3100011F41	PLSMEA	PLSM02_PLC_QUALITY
5A0101 310002EF41	PLC_UINT_3		5A0101 3100021F41	PLSMEA	PLSM03_PLC_QUALITY
5A0101 310003EF41	PLC_UINT_4		5A0101 3100031F41	PLSMEA	PLSM04_PLC_QUALITY
5A0101 310004EF41	PLC_UINT_5		5A0101 3100041F41	PLSMEA	PLSM05_PLC_QUALITY
5A0101 310005EF41	PLC_UINT_6		5A0101 3100051F41	PLSMEA	PLSM06_PLC_QUALITY
5A0101 310006EF41	PLC_UINT_7		5A0101 3100061F41	PLSMEA	PLSM07_PLC_QUALITY
5A0101 310007EF41	PLC_UINT_8		5A0101 3100071F41	PLSMEA	PLSM08_PLC_QUALITY
5A0101 310008EF41	PLC_UINT_9		5A0101 3100081F41		
5A0101 310009EF41	PLC_UINT_10	Use for 61 850 mapping	5A0101 3100091F41	61 850FB	Serious Err
5A0101 310010EF41	PLC_UINT_11	Use for 61 850 mapping	5A0101 3100101F41	61 851FB	Serious Err(Com)
5A0101 310011EF41	PLC_UINT_12	Use for 61 850 mapping	5A0101 3100111F41	61 852FB	Minor err
5A0101 310012EF41	PLC_UINT_13	Use for 61 850 mapping	5A0101 3100121F41	61 853FB	Warning
5A0101 310013EF41	PLC_UINT_14	Use for 61 850 mapping	5A0101 3100131F41	61 854FB	Alarm
5A0101 310014EF41	PLC_UINT_15		5A0101 3100141F41		
5A0101 000000EF42	PLC_BOOL_1		5A0101 0000001F42	BCD	DEV01_DOWN_COMMAND
5A0101 000001EF42	PLC_BOOL_2		5A0101 0000011F42	BCD	DEV01_DOWN_INTERLOCK
5A0101 000002EF42	PLC_BOOL_3		5A0101 0000021F42	BCD	DEV01_UP_COMMAND
5A0101 000003EF42	PLC_BOOL_4		5A0101 0000031F42	BCD	DEV01_UP_INTERLOCK
5A0101 000004EF42	PLC_BOOL_5		5A0101 0000041F42		
5A0101 000005EF42	PLC_BOOL_6	Use for 61 850 mapping	5A0101 0000051F42	PwrUp	
5A0101 000006EF42	PLC_BOOL_7		5A0101 0000061F42		
5A0101 000007EF42	PLC_BOOL_8		5A0101 0000071F42		
5A0101 000008EF42	PLC_BOOL_9		5A0101 0000081F42		
5A0101 000009EF42	PLC_BOOL_10		5A0101 0000091F42		
5A0101 000010EF42	PLC_BOOL_11		5A0101 0000101F42		
5A0101 000011EF42	PLC_BOOL_12		5A0101 0000111F42		
5A0101 000012EF42	PLC_BOOL_13		5A0101 0000121F42		
5A0101 000013EF42	PLC_BOOL_14		5A0101 0000131F42		
5A0101 000014EF42	PLC_BOOL_15		5A0101 0000141F42		
5A0101 3100001F43	SERI_ERR		5A0101 3100001F43	Serious Err	
5A0101 310015EF41	PLC_UINT_16		5A0101 3100151F41		
5A0101 310016EF41	PLC_UINT_17		5A0101 3100161F41		
5A0101 310017EF41	PLC_UINT_1 8		5A0101 3100171F41		
5A0101 31001 8EF41	PLC_UINT_19		5A0101 31001 81F41		
5A0101 310019EF41	PLC_UINT_20		5A0101 3100191F41		
5A0101 320014EF43	PLC_UINT32_15		5A0101 3200141F44		

DataIDs	Connections	Meaning	Monitoring	FB	Destinations
5A0101 320015EF43	PLC_UINT32_16		5A0101 3200151F44		
5A0101 320016EF43	PLC_UINT32_17		5A0101 3200161F44		
5A0101 320017EF43	PLC_UINT32_1 8		5A0101 3200171F44		
5A0101 32001 8EF43	PLC_UINT32_19		5A0101 32001 81F44		
5A0101 320019EF43	PLC_UINT32_20		5A0101 3200191F44		
5A0101 800000EF40	PLC_BIT_0001	Control right established at SPOS	5A0101 8000001F40	SPOS	SPOS01IN_TMP_28
5A0101 800001EF40	PLC_BIT_0002	Control right established at SPOS	5A0101 8000011F40	SPOS	SPOS02IN_TMP_28
5A0101 800002EF40	PLC_BIT_0003	Control right established at SPOS	5A0101 8000021F40	SPOS	SPOS03IN_TMP_28
5A0101 800003EF40	PLC_BIT_0004	Control right established at SPOS	5A0101 8000031F40	SPOS	SPOS04IN_TMP_28
5A0101 800004EF40	PLC_BIT_0005	Control right established at SPOS	5A0101 8000041F40	SPOS	SPOS05IN_TMP_28
5A0101 800005EF40	PLC_BIT_0006	Control right established at SPOS	5A0101 8000051F40	SPOS	SPOS06IN_TMP_28
5A0101 800006EF40	PLC_BIT_0007	Control right established at SPOS	5A0101 8000061F40	SPOS	SPOS07IN_TMP_28
5A0101 800007EF40	PLC_BIT_0008	Control right established at SPOS	5A0101 8000071F40	SPOS	SPOS08IN_TMP_28
5A0101 800008EF40	PLC_BIT_0009	Control right established at SPOS	5A0101 8000081F40	SPOS	SPOS09IN_TMP_28
5A0101 800009EF40	PLC_BIT_0010	Control right established at SPOS	5A0101 8000091F40	SPOS	SPOS10IN_TMP_28
5A0101 800010EF40	PLC_BIT_0011	Command to switch Off at SPOS	5A0101 8000101F40	SPOS	DEV01_OP_COMMAND
5A0101 800011EF40	PLC_BIT_0012	Command to switch Off with interlock at SPOS	5A0101 8000111F40	SPOS	DEV01_OP_INTERLOCK
5A0101 800012EF40	PLC_BIT_0013	Command to switch On unconditionally at SPOS	5A0101 8000121F40	SPOS	DEV01_CL_COMMAND
5A0101 800013EF40	PLC_BIT_0014	Command to switch On with interlock at SPOS	5A0101 8000131F40	SPOS	DEV01_CL_INTERLOCK
5A0101 800014EF40	PLC_BIT_0015	Command to switch Off at SPOS	5A0101 8000141F40	SPOS	DEV02_OP_COMMAND
5A0101 800015EF40	PLC_BIT_0016	Command to switch Off with interlock at SPOS	5A0101 8000151F40	SPOS	DEV02_OP_INTERLOCK
5A0101 800016EF40	PLC_BIT_0017	Command to switch On unconditionally at SPOS	5A0101 8000161F40	SPOS	DEV02_CL_COMMAND
5A0101 800017EF40	PLC_BIT_001 8	Command to switch On with interlock at SPOS	5A0101 8000171F40	SPOS	DEV02_CL_INTERLOCK
5A0101 80001 8EF40	PLC_BIT_0019	Command to switch Off at SPOS	5A0101 80001 81F40	SPOS	DEV03_OP_COMMAND
5A0101 800019EF40	PLC_BIT_0020	Command to switch Off with interlock at SPOS	5A0101 8000191F40	SPOS	DEV03_OP_INTERLOCK
5A0101 800020EF40	PLC_BIT_0021	Command to switch On unconditionally at SPOS	5A0101 8000201F40	SPOS	DEV03_CL_COMMAND
5A0101 800021EF40	PLC_BIT_0022	Command to switch On with interlock at SPOS	5A0101 8000211F40	SPOS	DEV03_CL_INTERLOCK
5A0101 800022EF40	PLC_BIT_0023	Command to switch Off at SPOS	5A0101 8000221F40	SPOS	DEV04_OP_COMMAND
5A0101 800023EF40	PLC_BIT_0024	Command to switch Off with interlock at SPOS	5A0101 8000231F40	SPOS	DEV04_OP_INTERLOCK
5A0101 800024EF40	PLC_BIT_0025	Command to switch On unconditionally at SPOS	5A0101 8000241F40	SPOS	DEV04_CL_COMMAND
5A0101 800025EF40	PLC_BIT_0026	Command to switch On with interlock at SPOS	5A0101 8000251F40	SPOS	DEV04_CL_INTERLOCK
5A0101 800026EF40	PLC_BIT_0027	Command to switch Off at SPOS	5A0101 8000261F40	SPOS	DEV05_OP_COMMAND
5A0101 800027EF40	PLC_BIT_0028	Command to switch Off with interlock at SPOS	5A0101 8000271F40	SPOS	DEV05_OP_INTERLOCK
5A0101 800028EF40	PLC_BIT_0029	Command to switch On unconditionally at SPOS	5A0101 8000281F40	SPOS	DEV05_CL_COMMAND
5A0101 800029EF40	PLC_BIT_0030	Command to switch On with interlock at SPOS	5A0101 8000291F40	SPOS	DEV05_CL_INTERLOCK
5A0101 800030EF40	PLC_BIT_0031	Command to switch Off at SPOS	5A0101 8000301F40	SPOS	DEV06_OP_COMMAND
5A0101 800031EF40	PLC_BIT_0032	Command to switch Off with interlock at SPOS	5A0101 8000311F40	SPOS	DEV06_OP_INTERLOCK
5A0101 800032EF40	PLC_BIT_0033	Command to switch On unconditionally at SPOS	5A0101 8000321F40	SPOS	DEV06_CL_COMMAND
5A0101 800033EF40	PLC_BIT_0034	Command to switch On with interlock at SPOS	5A0101 8000331F40	SPOS	DEV06_CL_INTERLOCK
5A0101 800034EF40	PLC_BIT_0035	Command to switch Off at SPOS	5A0101 8000341F40	SPOS	DEV07_OP_COMMAND
5A0101 800035EF40	PLC_BIT_0036	Command to switch Off with interlock at SPOS	5A0101 8000351F40	SPOS	DEV07_OP_INTERLOCK
5A0101 800036EF40	PLC_BIT_0037	Command to switch On unconditionally at SPOS	5A0101 8000361F40	SPOS	DEV07_CL_COMMAND
5A0101 800037EF40	PLC_BIT_0038	Command to switch On with interlock at SPOS	5A0101 8000371F40	SPOS	DEV07_CL_INTERLOCK
5A0101 800038EF40	PLC_BIT_0039	Command to switch Off at SPOS	5A0101 8000381F40	SPOS	DEV08_OP_COMMAND
5A0101 800039EF40	PLC_BIT_0040	Command to switch Off with interlock at SPOS	5A0101 8000391F40	SPOS	DEV08_OP_INTERLOCK
5A0101 800040EF40	PLC_BIT_0041	Command to switch On unconditionally at SPOS	5A0101 8000401F40	SPOS	DEV08_CL_COMMAND
5A0101 800041EF40	PLC_BIT_0042	Command to switch On with interlock at SPOS	5A0101 8000411F40	SPOS	DEV08_CL_INTERLOCK
5A0101 800042EF40	PLC_BIT_0043	Command to switch Off at SPOS	5A0101 8000421F40	SPOS	DEV09_OP_COMMAND
5A0101 800043EF40	PLC_BIT_0044	Command to switch Off with interlock at SPOS	5A0101 8000431F40	SPOS	DEV09_OP_INTERLOCK
5A0101 800044EF40	PLC_BIT_0045	Command to switch On unconditionally at SPOS	5A0101 8000441F40	SPOS	DEV09_CL_COMMAND
5A0101 800045EF40	PLC_BIT_0046	Command to switch On with interlock at SPOS	5A0101 8000451F40	SPOS	DEV09_CL_INTERLOCK
5A0101 800046EF40	PLC_BIT_0047	Command to switch Off at SPOS	5A0101 8000461F40	SPOS	DEV10_OP_COMMAND
5A0101 800047EF40	PLC_BIT_0048	Command to switch Off with interlock at SPOS	5A0101 8000471F40	SPOS	DEV10_OP_INTERLOCK
5A0101 800048EF40	PLC_BIT_0049	Command to switch On unconditionally at SPOS	5A0101 8000481F40	SPOS	DEV10_CL_COMMAND
5A0101 800049EF40	PLC_BIT_0050	Command to switch On with interlock at SPOS	5A0101 8000491F40	SPOS	DEV10_CL_INTERLOCK
5A0101 800050EF40	PLC_BIT_0051	Condition of selection completed in SPOS (in PLC)	5A0101 8000501F40	SPOS	SPOS01IN_TMP_29
5A0101 800051EF40	PLC_BIT_0052	Condition of Selection failure at SPOS (in PLC)	5A0101 8000511F40	SPOS	SPOS01IN_TMP_30
5A0101 800052EF40	PLC_BIT_0053	Reason of selection failure at SPOS (in Fixed source)	5A0101 8000521F40	SPOS	SPOS01IN_TMP_31
5A0101 800053EF40	PLC_BIT_0054	Reason of selection failure at SPOS	5A0101 8000531F40	SPOS	SPOS01IN_TMP_32
5A0101 800054EF40	PLC_BIT_0055	Condition of cancel selection at SPOS (in PLC)	5A0101 8000541F40	SPOS	SPOS01IN_TMP_33
5A0101 800055EF40	PLC_BIT_0056	Condition for controlling OFF at SPOS (in PLC)	5A0101 8000551F40	SPOS	SPOS01IN_TMP_34
5A0101 800056EF40	PLC_BIT_0057	Condition for controlling ON at SPOS (in PLC)	5A0101 8000561F40	SPOS	SPOS01IN_TMP_35
5A0101 800057EF40	PLC_BIT_0058	Failure condition for controlling OFF at SPOS (in PLC)	5A0101 8000571F40	SPOS	SPOS01IN_TMP_37

Appendix 12 PLC drivers for relay applications

The PLC drivers, described in the main relay application chapter, are provided to connect the user's custom logics with relay applications implemented in other CPUs. These drivers allow the user to exchanging data between the main-CPU and the sub-CPUs. The following table is the summary of PLC drivers; and their functions are available when the PLC function runs.

PLC driver	Function + Element ID	to	Destination	PLC connection point	Relay applications
PMX3_0_0	230301 8810001BB0	→	OC1_BLOCK	440001 800001EBB0	OC
PMX3_0_1	230301 8910001BB1	→	OC2_BLOCK	440001 810002EBB1	OC
PMX3_0_2	230301 8A10001BB2	→	OC3_BLOCK	440001 820003EBB2	OC
PMX3_0_3	230301 8B10001BB3	→	OC4_BLOCK	440001 830004EBB3	OC
PMX3_0_4	230301 8C10001BB4	→	OC1_INST_OP	440001 800001EBB4	OC
PMX3_0_5	230301 8D10001BB5	→	OC2_INST_OP	440001 810002EBB5	OC
PMX3_0_6	230301 8E10001BB6	→	OC3_INST_OP	440001 820003EBB6	OC
PMX3_0_7	230301 8F10001BB7	→	OC4_INST_OP	440001 830004EBB7	OC
PMX3_1_0	230301 8010001BB8	→	EF1_BLOCK	441001 800001EBB0	EF
PMX3_1_1	230301 8110001BB9	→	EF2_BLOCK	441001 810002EBB0	EF
PMX3_1_2	230301 8210001BBA	→	EF3_BLOCK	441001 820003EBB0	EF
PMX3_1_3	230301 8310001BBB	→	EF4_BLOCK	441001 830004EBB0	EF
PMX3_1_4	230301 8410001BBC	→	EF1_INST_OP	441001 800001EBB1	EF
PMX3_1_5	230301 8510001BBD	→	EF2_INST_OP	441001 810002EBB1	EF
PMX3_1_6	230301 8610001BBE	→	EF3_INST_OP	441001 820003EBB1	EF
PMX3_1_7	230301 8710001BBF	→	EF4_INST_OP	441001 830004EBB1	EF
PMX3_2_0	230301 8810011BB0	→	OCN1_BLOCK	443001 800001EBB0	OCN
PMX3_2_1	230301 8910011BB1	→	OCN2_BLOCK	443001 810002EBB0	OCN
PMX3_2_2	230301 8A10011BB2	→	OCN3_BLOCK	443001 820003EBB0	OCN
PMX3_2_3	230301 8B10011BB3	→	OCN4_BLOCK	443001 830004EBB0	OCN
PMX3_2_4	230301 8C10011BB4	→	OCN1_INST_OP	443001 800001EBB1	OCN
PMX3_2_5	230301 8D10011BB5	→	OCN2_INST_OP	443001 810002EBB1	OCN
PMX3_2_6	230301 8E10011BB6	→	OCN3_INST_OP	443001 820003EBB1	OCN
PMX3_2_7	230301 8F10011BB7	→	OCN4_INST_OP	443001 830004EBB1	OCN
PMX3_3_0	230301 8010011BB8	→	OCV1_BLOCK	444001 800001EBB0	OCV
PMX3_3_1	230301 8110011BB9	→	OCV2_BLOCK	444001 810002EBB1	OCV
PMX3_3_2	230301 8210011BBA	→	OCV3_BLOCK	444001 820003EBB2	OCV
PMX3_3_3	230301 8310011BBB	→	OCV4_BLOCK	444001 830004EBB3	OCV
PMX3_3_4	230301 8410011BBC	→	UC1_BLOCK	450001 800001EBB0	UC
PMX3_3_5	230301 8510011BBD	→	UC2_BLOCK	450001 810002EBB0	UC
PMX3_3_6	230301 8610011BBE	→	THMA_BLOCK	451001 800001EBB0	THM
PMX3_3_7	230301 8710011BBF	→	THMT_BLOCK	451001 810002EBB0	THM
PMX3_4_0	230301 8810021BB0	→	BCD_BLOCK	452001 800000EBB0	BCD
PMX3_4_1	230301 8910021BB1	→	EXT.CBF1_START-A	453001 800001EBB0	CBF
PMX3_4_2	230301 8A10021BB2	→	EXT.CBF1_START-B	453001 810001EBB1	CBF
PMX3_4_3	230301 8B10021BB3	→	EXT.CBF1_START-C	453001 820001EBB2	CBF
PMX3_4_4	230301 8C10021BB4	→	EXT.CBF1_START	453001 830001EBB3	CBF
PMX3_4_5	230301 8D10021BB5	→	CBF1_BLOCK	453001 800001EBB4	CBF
PMX3_4_6	230301 8E10021BB6	→	CBF1-RE_INST	453001 810001EBB5	CBF
PMX3_4_7	230301 8F10021BB7	→	CBF1-TP_INST	453001 820001EBB6	CBF
PMX3_5_0	230301 8010021BB8	→	EXT.CBF2_START-A	453001 800002EBB0	CBF
PMX3_5_1	230301 8110021BB9	→	EXT.CBF2_START-B	453001 810002EBB1	CBF
PMX3_5_2	230301 8210021BBA	→	EXT.CBF2_START-C	453001 820002EBB2	CBF

PLC driver	Function + Element ID	to	Destination	PLC connection point	Relay applications
PMX3_5_3	230301 8310021BBB	→	EXT.CBF2_START	453001 830002EBB3	CBF
PMX3_5_4	230301 8410021BBC	→	CBF2_BLOCK	453001 800002EBB4	CBF
PMX3_5_5	230301 8510021BBD	→	CBF2-RE_INST	453001 810002EBB5	CBF
PMX3_5_6	230301 8610021BBE	→	CBF2-TP_INST	453001 820002EBB6	CBF
PMX3_5_7	230301 8710021BBF	→	SOTFOC_BLOCK	454001 800000EBB0	SOTFOC
PMX3_6_0	230301 8810031BB0	→	OV1_BLOCK	460101 800001EBB0	OV
PMX3_6_1	230301 8910031BB1	→	OV2_BLOCK	460101 810002EBB0	OV
PMX3_6_2	230301 8A10031BB2	→	OV3_BLOCK	460101 820003EBB0	OV
PMX3_6_3	230301 8B10031BB3	→	OV4_BLOCK	460101 830004EBB0	OV
PMX3_6_4	230301 8C10031BB4	→	OVS1_BLOCK	461101 800001EBB0	OVS
PMX3_6_5	230301 8D10031BB5	→	OVS2_BLOCK	461101 810002EBB0	OVS
PMX3_6_6	230301 8E10031BB6	→	OVS3_BLOCK	461101 820003EBB0	OVS
PMX3_6_7	230301 8F10031BB7	→	OVS4_BLOCK	461101 830004EBB0	OVS
PMX3_7_0	230301 8010031BB8	→	OVG1_BLOCK	462101 800001EBB0	OVG
PMX3_7_1	230301 8110031BB9	→	OVG2_BLOCK	462101 810002EBB0	OVG
PMX3_7_2	230301 8210031BBA	→	OVG3_BLOCK	462101 820003EBB0	OVG
PMX3_7_3	230301 8310031BBB	→	OVG4_BLOCK	462101 830004EBB0	OVG
PMX3_7_4	230301 8410031BBC	→	OVN1_BLOCK	464101 800001EBB0	OVN
PMX3_7_5	230301 8510031BBD	→	OVN2_BLOCK	464101 810002EBB0	OVN
PMX3_7_6	230301 8610031BBE	→	OVN3_BLOCK	464101 820003EBB0	OVN
PMX3_7_7	230301 8710031BBF	→	OVN4_BLOCK	464101 830004EBB0	OVN
PMX3_8_0	230301 8810041BB0	→	UV1_BLOCK	470101 800001EBB0	UV
PMX3_8_1	230301 8910041BB1	→	UV2_BLOCK	470101 810002EBB0	UV
PMX3_8_2	230301 8A10041BB2	→	UV3_BLOCK	470101 820003EBB0	UV
PMX3_8_3	230301 8B10041BB3	→	UV4_BLOCK	470101 830004EBB0	UV
PMX3_8_4	230301 8C10041BB4	→	CB_APH_OPEN	470101 800000EBB0	UV
PMX3_8_5	230301 8D10041BB5	→	CB_BPH_OPEN	470101 810000EBB1	UV
PMX3_8_6	230301 8E10041BB6	→	CB_CPH_OPEN	470101 820000EBB2	UV
PMX3_8_7	230301 8F10041BB7	→	UVS1_BLOCK	471101 800001EBB0	UVS
PMX3_9_0	230301 8010041BB8	→	UVS2_BLOCK	471101 810002EBB0	UVS
PMX3_9_1	230301 8110041BB9	→	UVS3_BLOCK	471101 820003EBB0	UVS
PMX3_9_2	230301 8210041BBA	→	UVS4_BLOCK	471101 830004EBB0	UVS
PMX3_9_3	230301 8310041BBB	→	CB_APH_OPEN	471101 800000EBB0	UVS
PMX3_9_4	230301 8410041BBC	→	CB_BPH_OPEN	471101 810000EBB1	UVS
PMX3_9_5	230301 8510041BBD	→	CB_CPH_OPEN	471101 820000EBB2	UVS
PMX3_9_6	230301 8610041BBE	→	FRQ1_BLOCK	475001 800001EBB0	FRQ
PMX3_9_7	230301 8710041BBF	→	FRQ2_BLOCK	475001 810002EBB0	FRQ
PMX3_10_0	230301 8810051BB0	→	FRQ3_BLOCK	475001 820003EBB0	FRQ
PMX3_10_1	230301 8910051BB1	→	FRQ4_BLOCK	475001 830004EBB0	FRQ
PMX3_10_2	230301 8A10051BB2	→	FRQ5_BLOCK	475001 840005EBB0	FRQ
PMX3_10_3	230301 8B10051BB3	→	FRQ6_BLOCK	475001 850006EBB0	FRQ
PMX3_10_4	230301 8C10051BB4	→	FRQ-S1-OPT	475001 800001EBB1	FRQ
PMX3_10_5	230301 8D10051BB5	→	FRQ-S2-OPT	475001 810002EBB1	FRQ
PMX3_10_6	230301 8E10051BB6	→	FRQ-S3-OPT	475001 820003EBB1	FRQ
PMX3_10_7	230301 8F10051BB7	→	FRQ-S4-OPT	475001 830004EBB1	FRQ
PMX3_11_0	230301 8010051BB8	→	FRQ-S5-OPT	475001 840005EBB1	FRQ
PMX3_11_1	230301 8110051BB9	→	FRQ-S6-OPT	475001 850006EBB1	FRQ
PMX3_11_2	230301 8210051BBA	→	DFRQ1_BLOCK	475001 800011EBB0	FRQ
PMX3_11_3	230301 8310051BBB	→	DFRQ2_BLOCK	475001 810012EBB0	FRQ

PLC driver	Function + Element ID	to	Destination	PLC connection point	Relay applications
PMX3_11_4	230301 8410051BBC	→	DFRQ3_BLOCK	475001 820013EBB0	FRQ
PMX3_11_5	230301 8510051BBD	→	DFRQ4_BLOCK	475001 830014EBB0	FRQ
PMX3_11_6	230301 8610051BBE	→	DFRQ5_BLOCK	475001 840015EBB0	FRQ
PMX3_11_7	230301 8710051BBF	→	DFRQ6_BLOCK	475001 850016EBB0	FRQ
PMX3_12_0	230301 8810061BB0	→	DFRQ-S1-OPT	475001 800011EBB1	FRQ
PMX3_12_1	230301 8910061BB1	→	DFRQ-S2-OPT	475001 810012EBB1	FRQ
PMX3_12_2	230301 8A10061BB2	→	DFRQ-S3-OPT	475001 820013EBB1	FRQ
PMX3_12_3	230301 8B10061BB3	→	DFRQ-S4-OPT	475001 830014EBB1	FRQ
PMX3_12_4	230301 8C10061BB4	→	DFRQ-S5-OPT	475001 840015EBB1	FRQ
PMX3_12_5	230301 8D10061BB5	→	DFRQ-S6-OPT	475001 850016EBB1	FRQ
PMX3_12_6	230301 8E10061BB6	→	VTF BLOCK	490001 800000EBB0	VTF
PMX3_12_7	230301 8F10061BB7	→	EXTERNAL VTF	490001 810000EBB1	VTF
PMX3_13_0	230301 8010061BB8	→	CTF BLOCK	491001 800000EBB0	CTF
PMX3_13_1	230301 8110061BB9	→	EXTERNAL CTF	491001 810000EBB1	CTF
PMX3_13_2	230301 8210061BBA	→	SEF1_BLOCK	442001 800001EBB0	SEF
PMX3_13_3	230301 8310061BBB	→	SEF2_BLOCK	442001 810002EBB0	SEF
PMX3_13_4	230301 8410061BBC	→	SEF3_BLOCK	442001 820003EBB0	SEF
PMX3_13_5	230301 8510061BBD	→	SEF4_BLOCK	442001 830004EBB0	SEF
PMX3_13_6	230301 8610061BBE	→	SEF1_INST_OP	442001 800001EBB1	SEF
PMX3_13_7	230301 8710061BBF	→	SEF2_INST_OP	442001 810002EBB1	SEF
PMX3_14_0	230301 8810071BB0	→	SEF3_INST_OP	442001 820003EBB1	SEF
PMX3_14_1	230301 8910071BB1	→	SEF4_INST_OP	442001 830004EBB1	SEF
PMX3_14_2	230301 8A10071BB2		(Not used)		
PMX3_14_3	230301 8B10071BB3		(Not used)		
PMX3_14_4	230301 8C10071BB4		(Not used)		
PMX3_14_5	230301 8D10071BB5		(Not used)		
PMX3_14_6	230301 8E10071BB6		(Not used)		
PMX3_14_7	230301 8F10071BB7		(Not used)		
PMX3_15_0	230301 8010071BB8		(Not used)		
PMX3_15_1	230301 8110071BB9		(Not used)		
PMX3_15_2	230301 8210071BBA		(Not used)		
PMX3_15_3	230301 8310071BBB		(Not used)		
PMX3_15_4	230301 8410071BBC		(Not used)		
PMX3_15_5	230301 8510071BBD		(Not used)		
PMX3_15_6	230301 8610071BBE		(Not used)		
PMX3_15_7	230301 8710071BBF		(Not used)		

Appendix 13 Notes for the dielectric voltage test

Dielectric voltage testing shall be carried out after reading the below notices carefully.

Cable connections

Figure-13.A illustrates external connection around the power supply module (PWS). During dielectric voltage testing, two short-wires attached on PSW shall be carefully handled; follow the below instructions (1) and (2).

(1) Short-wire between terminal screw No.35 and No.37

- ✓ Remove this short-wire for undertaking the dielectric voltage test. If this short-wire is not removed, the IED will be damaged.
- ✓ After the test, reconnect this short-wire to the original positons.

(2) Short-wire between terminal screw No.38 and FG

- ✓ Never remove this short wire. If this short-wire is removed, the IED will be damaged.

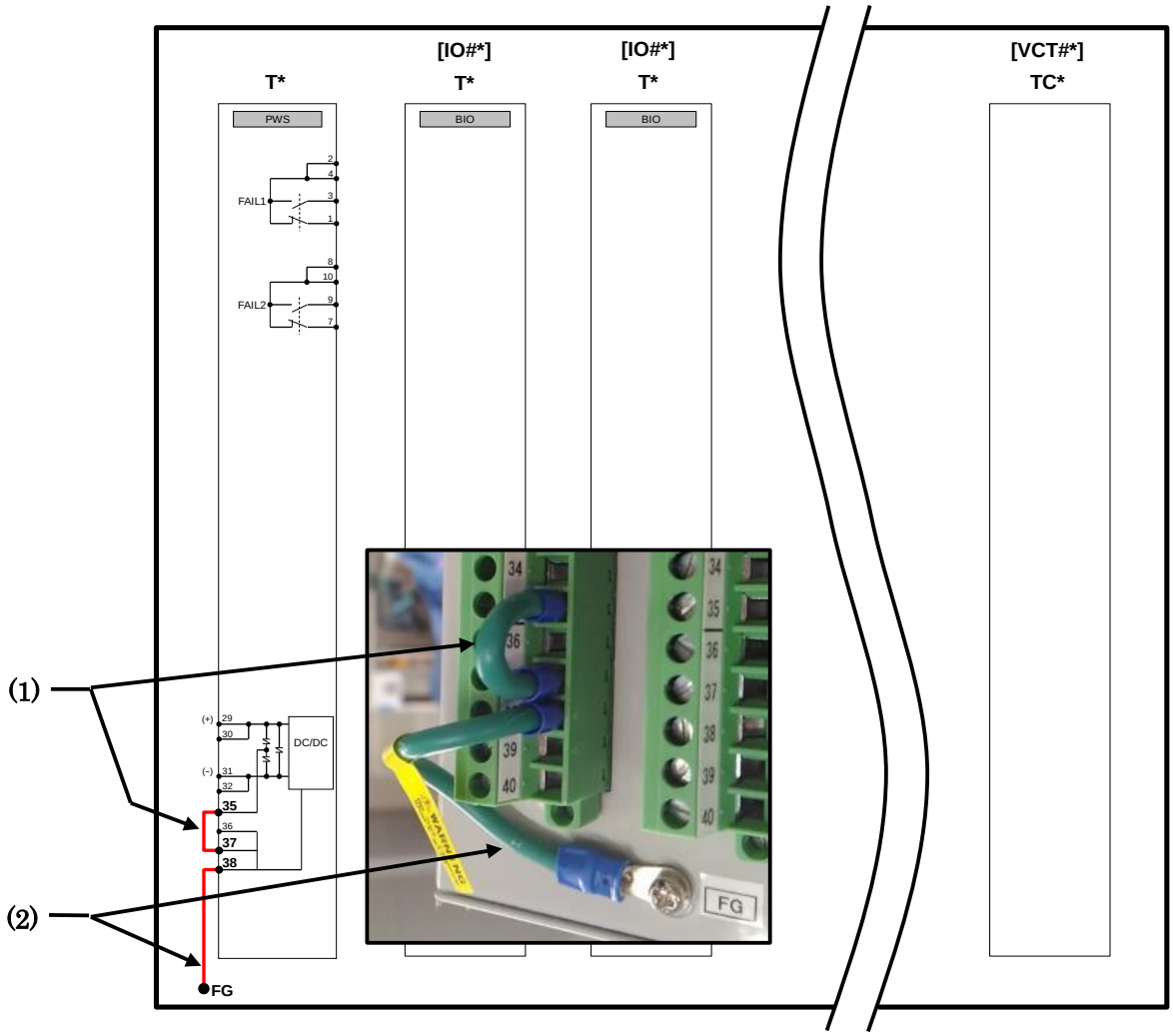


Figure-13.A Short-wires shall be handled with Cautions

Revision -up Records

Rev. and Date	Section (page)	Change place and contents	Approved by	Checked by	Prepared by
-- Nov. 30 2012	–	First issue	T. Utsumi Nov. 30	T. Utsumi Nov. 30	T. Kaneko Nov. 29
0.01 Dec. 8 2012	–	Addition of a number of sections	T. Utsumi Dec. 8	T. Utsumi Dec. 8	T. Kaneko Dec. 7
0.02 Mar.22 2013	Chap. 3 Appendix Appendix	OCN function is added. Case outline is revised. Ordering sheet is revised.	T. Utsumi Mar. 22	T. Utsumi Mar. 22	T. Kaneko Mar. 21
0.03 Aug. 9 2013	Chap. 4 Appendix	Revised due to renovation of terminal blocks Typical external connection sheets are revised.	T. Utsumi Aug. 9	T. Utsumi Aug. 9	T. Kaneko Aug. 8
0.04 May.17 2013	Chap. 4 Appendix	Missing information are added. External connection figures are altered.	T. Utsumi May. 17	T. Utsumi May. 17	T. Kaneko May. 16
0.05 May.22 2013	Chap. 4	Power system module is revised.	T. Utsumi May. 22	T. Utsumi May. 22	T. Kaneko May. 21
0.06 Dec.1 2013	Chap. 2 and 3	Revised the configuration of relay and control functions	T. Utsumi Dec. 1	T. Utsumi Dec. 1	T. Kaneko Nov. 30
0.1 June12 2014	Chap. 4	Added ratio setting in VCT of Chap. 4	T. Utsumi June. 12	T. Utsumi June. 12	T. Kaneko June. 11
0.2 Aug 5, 2014	Chap. 2	SPOS and others revised	T. Utsumi Aug. 5	T. Utsumi Aug. 5	T. Kaneko Aug. 1
0.3 Jan 22, 2015	Chap. 2	CMNCTRL, DPSY, TOPS, SOTFSW, SYNDIF, TAPBCD, LRST, TOPS, GCNT, HSCTR revised	T. Utsumi Jan. 22	T. Utsumi Jan. 22	T. Kaneko Jan. 20
0.31 Jan 27, 2015	Chap. 3	OVS, FRQ added	T. Utsumi Jan. 27	T. Utsumi Jan. 27	T. Kaneko Jan. 26
0.32 Feb 29, 2015	Chap. 3	Added the comparison tables between models	T. Nagano Feb. 29	T. Nagano Feb. 29	T. Kaneko Feb. 26
0.33 Mar. 6, 2015	Chap. 4	Added clock and function key features	K. Kobayashi Mar. 6	T. Ohnari Mar. 5	T. Kaneko Feb. 26
0.34 Mar. 6, 2015	Chap. 4	DCAI2 module revised	T. Sugamoto Mar. 6	T. Sugamoto Mar. 6	T. Kaneko Feb. 26
0.4 Mar 6, 2015	Chap. 2	Refined the expressions	T. Utsumi Mar. 6	T. Utsumi Mar. 6	T. Kaneko Feb. 26
0.41 Mar 12,2015	Chap. 2.10	Modified typos in DPSY	T. Utsumi Mar. 11	K. Ohashi Mar. 10	T. Kaneko Mar. 10
	Chap. 2.16	Refined the expression in the SOFTSW	T. Utsumi Mar. 12	K. Ohashi Mar. 12	T. Kaneko Mar. 10
	Chap. 3.2 Appendix	Added IFU case figure	T. Utsumi Mar. 12	T. Utsumi Mar. 12	T. Kaneko Feb. 26
	Chap. 3.6	Changed the time units to “minutes” in THM	F. Kawano Mar. 10	M. Takazawa Mar. 10	T. Kaneko Mar. 10
	Chap. 4	DCAI2 impedance revised	T. Sugamoto Mar. 9	T. Sugamoto Mar. 9	T. Kaneko Mar. 9
0.42 May 8, 2015	Chap. 3.10 Chap. 3.11 Chap. 3.12 Chap. 3.13 Chap. 3.14 Chap. 3.15 Chap. 3.16 Chap. 3.17 Chap. 3.19 Appendix	Erroneous reset settings revised in OV Erroneous reset settings revised in OVS Erroneous reset settings revised in OVG Erroneous reset settings revised in OVN Erroneous reset settings revised in UV Erroneous reset settings revised in UVS Misusing setting items added in DFRQ Corrected a ramp line in ICD characteristic Typos corrected in VTF Tables of BIO codes modified	N. Nagano Mar. 26	N. Nagano Mar. 26	T. Kaneko Mar. 26

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0.5 May 24,2015	Chap. 2.9 Chap. 2.8-2.12 Chap. 2.12 Chap. 2.16 Chap. 2.17 Appendix	Data corrected in Table 2.9-2 and 3 Corrected setting items in PLSM switches VPOS function added Meaning of "Quality" added in ILK Switch terms revised in SOFTSW Revised ordering tables	J. Nagata May. 22	T. Utsumi May. 22	T. Kaneko May. 19
	Appendix	Added IFU information	S.Katayama May. 22	S.Katayama May. 22	T. Kaneko May. 22
0.6 Sep 11,2015	Chap. 3.16	Added the setting notice about threshold settings for blocking the operation of FRQ	J. Nagata Aug. 20	S. Gondou Aug 20	T. Kaneko Aug. 20
	Chap. 3.18	Revised the contents of the PROT_COM.	J. Nagata Sep.4	N. Nagano Sep 4	T. Kaneko Sep 4
	Chap. 3.22	Revised the contents of the TRC	J. Nagata Sep.11	N. Nagano Sep 5	T. Kaneko Sep 5
	Chap. 3.23	Revised the contents of the ARC	J. Nagata Sep.11	N. Nagano Sep 5	T. Kaneko Sep 5
	Chap. 3.24	Revised the contents of the VCHK	J. Nagata Sep.11	N. Nagano Sep 5	T. Kaneko Sep 5
	Chap. 3.1, 3.2, and 3.3, 4.2, 11.6 Appendix	Revised the definition of rating current	J. Nagata Aug. 1	J. Nagata Aug. 1	T. Kaneko July 30
	Chap. 4.2.8 Appendix 10	Added the setting for zero-sequence voltage Added the matrix table between VCT and Relay	J. Nagata Aug. 1	N. Nagano July 24	T. Kaneko July 24
	Chap. 4.6	Added the explanation of the DCAO1A module	J. Nagata Sep.11	N. Fujiyama Sep 8	T. Kaneko Sep 5
	Chap. 12.6 Appendix 7	Added the instruction for replacing modules Combined the replacing methods with Chap. 12.6	J. Nagata Aug. 1	J. Nagata Aug. 1	T. Kaneko July 20
	Appendix 9	Added the descriptions for the mounting kits	J. Nagata Aug. 1	J. Nagata Aug. 1	T. Kaneko July 30
	Appendix 5	Tables of BIO codes modified	J. Nagata Sep. 11	N. Yokoya Sep 10	T. Kaneko Sep. 9
	Appendix 6	Modified at contact spec. of BO circuits as to Break capability when 0.2A current flowing	T.Sugamoto Sep. 10	T.Sugamoto Sep. 10	T. Kaneko Sep. 10
0.61 Oct. 15 2015	Chap. 4.7	Revised the operation meanings at the FAIL1 and Fail2 contacts; revised the operation conditions	T. Utsumi Oct. 8	T. Ohnari Oct. 5	T. Kaneko Sep. 25
	Chap. 9	Revised whole contents	J. Nagata Oct. 15	T. Utsumi Oct. 14	T. Kaneko Oct. 14
0.62 Nov. 4 2015	Chap. 4.2.8	Revised the setting for zero-sequence voltage	F. Kawano Nov. 4	F. Kawano Nov. 4	T. Kaneko Nov. 4
	Chap. 4.7 Appendix 6	Added the notice not to guarantee the operation on the AC power source	T.Sugamoto Nov. 4	T.Sugamoto Nov. 4	T. Kaneko Nov. 4
	Chap. 9.2.39	Revised the message information	J. Nagata Oct. 30	K. Oohashi Oct. 16	T. Kaneko Oct. 16
	Appendix 1	Organized signal lists	J. Nagata Oct. 30	T. Utsumi Oct. 30	T. Kaneko Oct. 30
	Appendix 4	Added PIXIT and TICS	J. Nagata Oct. 30	T. Utsumi Oct. 30	T. Kaneko Oct. 22
0.63 Nov. 24 2015	Chap. 10.1	Added the description to monitor the LAN communication	M. Okai Nov 19	M. Okai Nov 19	T. Kaneko Nov. 19
	Chap. 10.2	Revised the performance value about GOOSE sending to other Logical Node device in Table 10.2-3	S. Katayama Nov 19	S. Katayama Nov 19	T. Kaneko Nov. 19

Rev. and Date	Section (page)	Change place and contents	Approved by	Checked by	Prepared by
	Appendix 4	PIXIT8: PIXIT FOR REPORTING MODEL: 11: PIXIT FOR CONTROL MODEL: Modified from 'N' to 'Y', '40' to '408', respectively in in "data update" and "The number of events". Changed descriptions from "station-level" to "station-control" based on the standard in. Changed from Y to N at "maintenance" and "process". TICS: Added Dpos in part 6 of2. Mandatory Intop Tissues.	M. Okai Nov. 24	M. Okai Nov. 24	T. Kaneko Nov. 24
	Appendix 5	Tables of BIO codes modified	J. Nagata Nov. 18	N. Yokoya Nov. 18	T. Kaneko Nov. 17
0.64 Dec 18, 2015	Chap. 3.3 Appendix 5	Added and Revised Function block table about SEF function	J. Nagata Dec. 18	T. Nagano Dec. 17	T. Kaneko Dec. 17
	Chap. 8	Revised whole contents about the Monitoring function	J. Nagata Dec. 14	–	T. Kaneko Dec. 11
	Appendix 5	Tables of BIO codes modified Added the ordering information about GIO	J. Nagata Dec. 14	M. Ueda Dec. 1	T. Kaneko Dec. 1
0.65 Feb 5, 2016	Chap. 3.1	Revised the OC logic about the signals coming from the ICD function	J. Nagata Jan. 16	T. Nagano Jan 16	T. Kaneko Jan. 16
	Chap. 3.1	Added the note for the OC signal characterized with the DT and IDMT operations	K. Oohashi Jan. 17	T. Nagano Jan 17	T. Kaneko Jan. 17
	Chap. 3.2	Revised the EF logic about the signals coming from the ICD function	J. Nagata Jan. 16	T. Nagano Jan 16	T. Kaneko Jan. 16
	Chap. 3.2	Added the note for the EF signal characterized with the DT and IDMT operations	K. Oohashi Jan. 17	T. Nagano Jan 17	T. Kaneko Jan. 17
	Chap. 3.3	Revised the SEF logic about the signals coming from the ICD function	J. Nagata Jan. 16	T. Nagano Jan 16	T. Kaneko Jan. 16
	Chap. 3.3	Added the note for the SEF signal characterized with the DT and IDMT operations	K. Oohashi Jan. 17	T. Nagano Jan 17	T. Kaneko Jan. 17
	Chap. 3.4	Revised the OCN logic about the signals coming from the ICD function	J. Nagata Jan. 16	T. Nagano Jan 16	T. Kaneko Jan. 16
	Chap. 3.4	Added the note for the OCN signal characterized with the DT and IDMT operations	K. Oohashi Jan. 17	T. Nagano Jan 17	T. Kaneko Jan. 17
	Chap. 3.5	Revised the OCV logic about the signals coming from the ICD function	J. Nagata Jan. 16	T. Nagano Jan 16	T. Kaneko Jan. 16
	Chap. 3.8	Revised the BCD logic about the signals coming from the ICD function	J. Nagata Jan. 16	T. Nagano Jan 16	T. Kaneko Jan. 16
	Chap. 3.10	Revised the SOTF-OC logic about the signals coming from the ICD function	J. Nagata Jan. 16	T. Nagano Jan 16	T. Kaneko Jan. 16
	Chap. 3.18	Added the destinations for the signals generated in ICD function. Refined the contents	J. Nagata Jan. 16	T. Nagano Jan 16	T. Kaneko Jan. 16
	Chap. 3.23	Added the table for trip command for the CB	J. Nagata Dec. 28	F. Kawano Dec. 27	T. Kaneko Dec. 27
	Chap. 6.3	Corrected the table for the PLC drivers	J. Nagata Jan. 16	T. Nagano Jan 16	T. Kaneko Jan. 16
	Chap. 7	Revised Fault and Disturbance recorders for BUPU. Revised for the contents of Event recorder	J. Nagata Feb. 5	T. Nagano Feb 5	T. Kaneko Jan. 31
	Appendix 5	Tables of BIO codes modified	J. Nagata Jan. 12	N. Yokoya Jan. 12	T. Kaneko Jan. 12
0.66 Feb 15, 2016	Chap. 4.3.2	Added the value of the input register of IRIG-B000 module	J. Nagata Feb. 8	F. Kawano Feb. 8	T. Kaneko Feb. 6
	Chap. 10.2.6	Added the information about the quality signal in IEC 61850 communication	J. Nagata Feb. 12	M. Okai Feb. 10	T. Kaneko Feb. 10

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0.67 Apr 8, 2016	Chap. 4.2.5	Name corrected "AC" to "AI" in the VCT ratio setting table.	J. Nagata Mar. 17	J. Nagata Mar. 17	T. Kaneko Mar. 17
	Chap. 4.4.2(i)	Revised the settings about the variable type in BI2 and BIO4	T.Kawasaki Mar. 30	T.Kawasaki Mar. 30	T. Kaneko Mar. 29
0.68 May16, 2016	Chap. 2.8	Corrected the lists described in the other way around in Table 2.8-2&3 of SPOS	J. Nagata Apr. 20	T. Utsumi Apr. 20	T. Kaneko Apr. 18
	Chap. 2.8	Typos of the PLC connection points about Receiving "operate command On and Off" using PLC logic	J. Nagata Apr. 25	T. Utsumi Apr. 25	T. Kaneko Apr. 23
	Chap. 2.9	Corrected PLC signal name to "PLC_BIT_0639" from "PLC_BIT_0630" in DPOS in Fig. 2.9-22	J. Nagata Apr. 26	T. Utsumi Apr. 26	T. Kaneko Apr. 26
	Chap. 2.10	Corrected signal names to "PLC_BIT_0535/0543" from "PLC_BIT_0643/0635" in Fig. 2.10-30 in DPSY	J. Nagata Apr. 22	T. Utsumi Apr. 22	T. Kaneko Apr. 22
	Chap. 2.11	Deleted erroneous PLC signals in Table 2.11-34 in TPOS	J. Nagata May. 9	T. Utsumi May. 9	T. Kaneko May.9
	Chap. 2.14	Corrected PLC signal name to "PLC_BIT_1141" from "PLC_BIT_1241" in SPOS	J. Nagata Apr. 18	T. Utsumi Apr. 18	T. Kaneko Apr. 18
	Chap. 2.15	Revised the contents of ASEQ	J. Nagata May. 11	T. Utsumi May. 11	T. Kaneko May.10
	Chap. 3.10	Added PLC drivers for OC-RTP_EN and ADD.SOTF_EN in SOTF_OC	J. Nagata May. 16	T. Nagano May. 16	T. Kaneko May.16
	Chap. 4.4.5	Added FG cable for BI2A module in Fig 4.4-8	J. Nagata May 10	N. Fujiyama May 10	T. Kaneko May 10
	Chap. 4.10	Added the contents for the group setting function	J. Nagata May 10	K. Oohashi May 10	T. Kaneko May 10
	Chap.6.3	Revised the PLC drivers lists w.r.t. PMX3_14_2, and PMX3_14_3 for SOTF_OC function	J. Nagata May. 16	T. Nagano May. 16	T. Kaneko May.16
	Chap.9.2.39	Revised the information about Data(commslv) error	J. Nagata May 10	M. Okai May 10	T. Kaneko May 10
	Appendix 5	Tables of BIO codes modified	J. Nagata May. 10	M. Ueda May 10	T. Kaneko May 10
	Appendix 5	Corrected wrong VCT type at the selection "6" at position '7' (52B->53B)	J. Nagata May. 10	T. Utsumi May 10	T. Kaneko May 10
	Appendix 6	Added a CMP_NUM notice in Electromagnetic Environment for the Environmental performance	J. Nagata May 16	K. Oohashi May. 16	T. Kaneko May 16
0.69 May 23,2016	Chap.6.3.1	Added the usage of the PLC drivers	J. Nagata May. 20	T. Nagano May. 20	T. Kaneko May.20
0.70 June28,2016	Chap. 2.8	Corrected the setting name for SPOS01_LGCNFFC in the description above Fig 2.8-18	J. Nagata June 2	J. Nagata June 2	T. Kaneko June. 2
	Chap. 3.25	Added the calibration factor when the rating voltages are different in VCHK	J. Nagata June. 16	T. Nagano June 16	T. Kaneko June. 16
	Chap. 4.4.2(i)-2	Corrected Typo in the notice with regard to the contents about the variable type in BI2 and BIO4	T.Sugamoto June 15	T.Sugamoto June 15	T. Kaneko June 15
	Chap. 4.5	Added notices for Jumper settings for the replace of DCAI2 module	T.Sugamoto June 14	T.Sugamoto June 14	T. Kaneko June. 14
	Appendix 5	Added new code 4M in the ordering about the BIO modules	J. Nagata June 1	M. Ueda June 1	T. Kaneko May 31
	Appendix 5	Deleted '3J', '3Q', and '48' codes in the ordering about the BIO modules	J. Nagata June 21	M. Ueda June 21	T. Kaneko June 21
0.71 July1,2016	Chap. 1.7	Corrected element ID w.r.t 'OC1_BLOCK' in Figure 1.7-1	J. Nagata June 28	T. Nakatsuka June 28	T. Kaneko June 28
	Chap. 2.6	Revised LOCRNT logic in Figure 2.6-1	J. Nagata June 28	T. Nakatsuka June 28	T. Kaneko June 28
	Chap. 3.1.8	Corrected 'OC1_BLOCK' and 'OC1_INST_OP" connection points in Figure 2.15-8	J. Nagata June 28	T. Nakatsuka June 28	T. Kaneko June 28

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	Appendix 6	Deleted 'COMFEDE' in the Data exchange at General performance	S.Katayama June 29	S.Katayama June 29	T. Kaneko June 29
0.72 July 22,2016	Appendix 10	Added the content of CT requirement in new Appendix	J. Nagata July 21	T. Nagano July 21	T. Kaneko July 20
0.73 Aug.8,2016	Chap. 2.6	Added the notice that the local mode will be canceled when key operations are not carried out.	J. Nagata Aug 8	J. Nagata Aug 8	T. Kaneko July 20
	Chap. 4.7	Added the contents of threshold setting for dropping DC voltage generated in the PWS	J. Nagata Aug 8	M. Ueda Aug 8	T. Kaneko Aug 8
	Chap. 9.2.31	Revised the contents for the occurrence of Power errors; added the info. about PWS threshold setting	J. Nagata Aug 8	M. Ueda Aug 8	T. Kaneko Aug 8
0.74 Nov 1,2016	Chap. 2.22	Corrected the counter number of PLS_ERGY_MEA in Table 2.22-2 to -6	J. Nagata Sep 12	J. Nagata Sep 12	T. Kaneko Sep 12
	Chap. 4.3.2	Deleted a fiber optic module used in the IEC 103	J. Nagata Sep 7	J. Nagata Sep 7	T. Kaneko Sep 6
	Chap. 9.1	Corrected the PSW contact outputs in Serious error	J. Nagata Nov. 1	J. Nagata Nov. 1	T. Kaneko Nov 1
	Chap. 9.2	Revised the list orders in Table 9.2-1; rearranged the order of error contents	J. Nagata Oct. 30	J. Nagata Oct. 30	T. Kaneko Oct 14
	Appendix 5	Added new codes '5K' and '7J' in the BIO ordering table	J. Nagata Nov. 1	M. Ueda Nov 1	T. Kaneko Nov 1
	Appendix 6	Revised the range (–10° to +55°C) of the operating temperature for the new one (–25° to +55°C).	T.Sugamoto Sep. 1	T.Sugamoto Sep. 1	T. Kaneko Sep. 1
	Appendix 7	Revised the contents of the CE to comply with 2014 rules	J. Nagata Oct.27	T.Sugamoto Sep. 30	T. Kaneko Sep. 6
0.75 Nov 15,2016	Chap. 4.4	Corrected BIO circuits w.r.t inversion signals in Fig. 4.4-1 and 4.4-5	J. Nagata Nov.15	X. Tung Nov. 11	T. Kaneko Nov. 11
	Chap. 4.8	Corrected LED circuits w.r.t inversion signals in Fig. 4.8-2	J. Nagata Nov.15	G. Suzuki Nov. 14	T. Kaneko Nov. 14
0.76 Nov. 25,2016	Chap. 3.19	Corrected the signal numbers of OCD element of Fig. 3.19-5	J. Nagata Nov.16	K. Oohashi Nov. 16	T. Kaneko Nov. 16
	Appendix 5	Added 1F software code in Function table of Ordering	J. Nagata Nov.25	J. Nagata Nov.25	T. Kaneko Nov. 24
0.77 Jan. 12,2017	Chap. 4.2	Revised the terminal name for residual voltage input in VCT51B	G. Suzuki Jan.7	G. Suzuki Jan.7	T. Kaneko Jan. 7
	Chap. 8.2	Adjusted the size of Table 8.2-2	J. Nagata Nov.29	J. Nagata Nov.29	T. Kaneko Nov. 24
	Chap. 11.1	Added the information about screen resolution of MIMIC	J. Nagata Dec. 28	K. Oohashi Dec. 28	T. Kaneko Dec. 26
	Chap. 12	Revised all contents in Chapter Installation	M. Ueda Jan. 6	M. Ueda Jan. 6	T. Kaneko Dec. 26
	Appendix 5	Added new BIO codes Revised ordering information about GIO200	J. Nagata Dec 26	M. Ueda Dec 26	T. Kaneko Dec. 26
0.78 Apr.14 2017	Chap. 2.12	Revised control logic diagrams in Fig. 2.12-2, -3, - and -4 of VPOS function	J. Nagata Apr. 7	T. Utsumi Apr. 7	T. Kaneko Apr. 6
	Chap. 3.7	Corrected the signal destinations for TRC in Fig. 3.7-2 in THM	J. Nagata Jan. 26	K. Oohashi Jan.26	T. Kaneko Jan. 26
	Chap. 3.16	Corrected the UVS signal destinations for TRC in Fig. 3.16-4	K. Oohashi Mar.27	K. Oohashi Mar.27	T. Kaneko Mar 27
	Chap. 7.2	Added the notice about displaying the event information on GR-TIEMS	K. Oohashi Jan.30	K. Oohashi Jan.30	T. Kaneko Jan. 26
	Chap. 8.12	Revised the table for 61850 and signal lists	J. Nagata Jan 7	J. Nagata Jan 7	T. Kaneko Jan. 26
	Chap. 9	Added time information (i.e., current time) in the error screen in Fig. 9.1-1	T. Kawasaki Jan. 18	T. Kawasaki Jan. 18	T. Kaneko Jan. 18

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	Appendix.11	Added the summery of PLC_BITs identifications provided for Control and monitoring applications	J. Nagata Apr. 14	J. Nagata Apr. 14	T. Kaneko Apr. 14
	Appendix.12	Added the summery of PLC_driver identifications provided for Control and monitoring applications	J. Nagata Apr. 14	J. Nagata Apr. 14	T. Kaneko Apr. 14
0.79 Apr.27 2017	Cover sheet	Revised the notice how to recognize the software codes on the nameplate	J. Nagata Apr.26	J. Nagata Apr.26	T. Kaneko Apr. 26
	Chap. 12.3	Revised the check method about the software code using ordering codes	J. Nagata Apr.26	J. Nagata Apr.26	T. Kaneko Apr. 26
0.80 June23,2017	Chap. 2.5 Appendix.11	Added additional PLC_BIT_1401 signals etc. for 1F and 2C ordering codes	J. Nagata June.22	T. Utsumi June. 22	T. Kaneko June 21
	Chap. 10.1	Added Auto reset function in Communication protocol	K. Nagata June.22	M. Okai June.22	T. Kaneko June 21
	Chap. 10.2	Corrected the definitions of quality bits in IEC61850	J. Nagata June.6	J. Nagata June.6	T. Kaneko June 6
	Appendix 4	Corrected the "Sr1" and "Sr2" validity values " in the PIXIT table	K. Oohashi June.16	K. Oohashi June.16	T. Kaneko June 14
0.81 July 5,2017	Chap. 2.10	Added DPSY01_TMP_xx signals in DPSY function	J. Nagata July 4	T. Utsumi July 4	T. Kaneko June 30
0.82 July 25,2017	Chap. 2.9	Added the contents about DPOS01_TMP_07, 10, 11 signals in DPOS function in Table 2.9-11 and -23	J. Nagata July 25	T. Utsumi July 25	T. Kaneko July 24
	Chap. 2.10	Added the contents about DPSY01_TMP_07, 10, 11 signals in DPSY function in Table 2.10-11 and -23	J. Nagata July 25	T. Utsumi July 25	T. Kaneko July 24
0.83 Aug. 9, 2017	Chap. 2.27	Revised the setting notices about [SyncR1-Angle] and [SYNC01_TSYN] in Sync check relay	T. Utsumi Aug. 9	K. Oohashi July 31	T. Kaneko July 31
	Chap. 3.25	Revised the setting Tips and notices of [SYN1-Angle] and [T_SYN1] in VCHK	T. Utsumi Aug. 9	K. Oohashi July 31	T. Kaneko July 31
	Appendix 13	Added the notes for Dielectric voltage test	J. Nagata Aug 3	T.Sugamoto Aug. 3	T. Kaneko Aug. 2
0.84 Oct.2, 2017	Chap. 2.27.2	Revised the Tips and notices of Synchronism-relays in SYNDIF	J. Nagata Aug. 22	K. Oohashi Aug. 22	T. Kaneko July 31
	Chap. 3.25.2	Corrected the contents of synchronism condition; Revised the Notice and tips for SYN check relay	J. Nagata Aug. 22	K. Oohashi Aug. 22	T. Kaneko Aug. 21
	--	Republished under the spin-off company	J. Nagata Sep. 28	K. Oohashi Sep. 28	T. Kaneko Sep. 28
0.85 Nov. 20,2017	Chap. 9.1	Corrected the notice about 61850 quality value in Table 9.1-1	J. Nagata Oct. 12	K. Oohashi Oct. 12	T. Kaneko Oct. 12
0.86 Feb. 15,2018	Chap. 2.26	Corrected Equation (2.26-14) and the meaning of CB advance time in SYNDIF	K. Oohashi Dec. 18	K. Kobayashi Dec. 18	T. Kaneko Dec. 15
	Chap. 3.9	Corrected and added the blocking ARC signal in Figure 3.9-2&3 of CBF	J. Nagata Dec. 18	K. Oohashi Dec. 18	T. Kaneko Dec. 15
0.87 Mar.30,2018	Chap. 9.2	Corrected the direction of inequality symbol in Eq. (9.2-3) and (9.2-4)	K. Oohashi Mar. 7	K. Kobayashi Mar. 7	T. Kaneko Feb. 7
	Chap. 10.2	Corrected 61850 attributes 'Good & Questionable' regarding 'Alarm and Warning' in Table 10.2-5	K. Oohashi Feb. 20	K. Oohashi Feb. 20	T. Kaneko Feb. 20
0.88 Aug.24, 2018	Chap. 3.7	Added the test operation content in THM	K. Oohashi Aug. 6	K. Kobayashi Aug. 6	T. Kaneko Aug. 4
	Chap. 3.9	Revised information about Retrip settings (3.9.2 and 3.9.5) and corrected typos in Fig. 3.9-2 (CBF)	K. Oohashi July. 5	K. Kobayashi July. 5	T. Kaneko July. 5
	Chap. 3.15	Added the test operation content in UV	K. Oohashi Aug. 6	K. Kobayashi Aug. 6	T. Kaneko Aug. 4
	Chap. 3.16	Added the test operation content in UVS	K. Oohashi Aug. 6	K. Kobayashi Aug. 6	T. Kaneko Aug. 4
	Chap. 3.20	Corrected typos in setting lists (VTF)	K. Oohashi July. 5	K. Kobayashi July. 5	T. Kaneko July. 5

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	Chap. 3.21	Corrected delay timer value and add NOT operation in Fig. 3.21-1. Revised setting content (CTF)	K. Oohashi July. 5	K. Kobayashi July. 5	T. Kaneko July. 5
	Chap. 3.22	Corrected typos in Equations 3.22-2, -3, -7, -8 in FL function	K. Oohashi Aug. 9	K. Kobayashi Aug. 8	T. Kaneko Aug. 8
	Chap. 3.33	Corrected typos of OPT signals in Figure 3.33.5 at TRC-D function	K. Oohashi Aug. 24	K. Kobayashi Aug. 23	T. Kaneko Aug. 23
	Chap. 13.3	Added the operation contents about test settings	K. Oohashi Aug. 6	K. Kobayashi Aug. 6	T. Kaneko Aug. 4
0.89 Dec.14,2018	Chap. 3.11	Corrected the number of decimal places about curve coefficient in Table 2.12-2 in OV function	K. Oohashi Nov. 9	K. Kobayashi Nov. 9	T. Kaneko Nov. 8
	Chap. 3.12	Corrected the number of decimal places about curve coefficient in Table 2.13-2 in OVS function	K. Oohashi Nov. 9	K. Kobayashi Nov. 9	T. Kaneko Nov. 8
	Chap. 3.13	Corrected the number of decimal places about curve coefficient in Table 2.14-2 in OVG function	K. Oohashi Nov. 9	K. Kobayashi Nov. 9	T. Kaneko Nov. 8
	Chap. 3.14	Corrected the number of decimal places about curve coefficient in Table 2.15-2 in OVN function	K. Oohashi Nov. 9	K. Kobayashi Nov. 9	T. Kaneko Nov. 8
	Chap. 3.15	Corrected the number of decimal places about curve coefficient in Table 2.16-2 in UV function	K. Oohashi Nov. 9	K. Kobayashi Nov. 9	T. Kaneko Nov. 8
	Chap. 3.16	Corrected the number of decimal places about curve coefficient in Table 2.17-2 in UVS function	K. Oohashi Nov. 9	K. Kobayashi Nov. 9	T. Kaneko Nov. 8
	Chap. 3.17	Removed the contents about the trip decision timing in FRQ function	K. Oohashi Nov. 9	K. Kobayashi Nov. 9	T. Kaneko Nov. 8
	Chap. 4.4.4(vi)	Added the notice about Latch output during power turn on/off	K. Oohashi Sep. 3	H. Amoh Sep. 3	T. Kaneko Sep. 1
	Chap. 4.8.3	Corrected F7 setting names of Table 4.8-6 in HMI contents	K. Oohashi Oct. 25	K. Kobayashi Oct. 25	T. Kaneko Oct. 24
	Chap. 10.1.5	Added signals for GATEWAYs and SUBNETs in TCPIP_DRV list	K. Oohashi Dec. 4	K. Kobayashi Dec. 4	T. Kaneko Dec. 4
	Chap. 12.3	Modified the inquiry address at Toshiba Energy Systems & Solutions Corporation	K. Oohashi Oct. 1	K. Kobayashi Oct. 1	T. Kaneko Oct. 1
	Chap. 12.8	Corrected required wire thickens in Table 12.8-1	K. Oohashi Nov. 22	M. Ueda Nov. 22	T. Kaneko Nov. 22
	Appendix 6	Corrected the technical information about Power supply data in Technical data	K. Oohashi Dec. 7	K. Kobayashi Dec. 7	T. Kaneko Dec. 5
0.90 Feb.28,2019	Safety precautions	Corrected warning message at Fiber optic (Invisible laser radiation → Class 1 laser product)	K. Oohashi Feb. 19	M. Ueda Feb. 18	T. Kaneko Feb. 18
	Chap. 10.2	Added the contents about GOOSE monitoring status in 61850 communication	K. Oohashi Feb. 5	M. Okai Feb. 5	T. Kaneko Feb. 4
	Chap. 12.9	Revised the content about optical cable handlings and Fig. 12.9-6	K. Oohashi Feb. 19	M. Ueda Feb. 18	T. Kaneko Feb. 18
	Appendix 4	Revised the information about 61850 Ed.1	K. Oohashi Feb. 5	M. Okai Feb. 5	T. Kaneko Feb. 4
0.91 June.14,2019	Chap. 3.10	Corrected the incorrect switch position about OCSOTF-2PBlk in SOTF-OC logic (Fig. 3.10-1)	J. Nagata Jun. 11	G. Suzuki Jun. 11	T. Kaneko Jun. 6
	Chap. 3.21	Removed incorrect input signals in Fig. 3.21-1 and its note comment	K. Oohashi Mar. 11	G. Suzuki Mar. 11	T. Kaneko Mar. 9
0.92 Mar.2,2020	Chap. 2.6	Corrected the information at signal monitoring point of LRSW01_LR_ST_RMT in Table 2.6-5	J. Nagata Jan. 31	T. Utsumi Nov. 25	T. Kaneko Nov. 25
	Chap. 3.2	Corrected EF plc monitoring points' names in Table 3.2-5 and Figure 3.2-6 about EF1 and EF1PU	J. Nagata Feb. 10	Y. Sonobe Jan. 20	T. Kaneko Jan. 10
	Chap. 3.3	Corrected SEF plc monitoring points' names in Tbl. 3.2-5 and Fig. 3.2-6 about SEF1 and SEF1PU	J. Nagata Feb. 10	Y. Sonobe Jan. 20	T. Kaneko Jan. 10
	Chap. 3.4	Corrected OCN plc monitoring points' names in Table 3.4-5 and Fig 3.5-6 about OCN1 and OCN1PU	H. Amoh Feb. 10	Y. Sonobe Jan. 20	T. Kaneko Jan. 10

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	Chap. 3.10	Added a missing signal monitoring point of SOTFOC-TRIP in Fig 3.10-1	J. Nagata Jan. 31	K. Kobayashi Nov. 12	T. Kaneko Nov. 12
	Chap. 3.11	Corrected incorrect signal name regarding OV-ARC-BLOCK (Fig.3.11-4)	J. Nagata Jul. 19	K. Oohashi Jul. 19	T. Kaneko Jul. 19
	Chap. 3.12	Corrected incorrect signal name regarding OVS-ARC-BLOCK (Fig.3.12-4)	J. Nagata Jul. 19	K. Oohashi Jul. 19	T. Kaneko Jul. 19
	Chap. 3.12	Corrected incorrected phase names (OVS) in Fig 3.12-4	J. Nagata Dec. 9	K.Kobayashi Dec. 9	T. Kaneko Dec. 9
	Chap. 3.15	Corrected incorrect positons of logic timer and gate regarding the output of UVBLK element(Fig.3.15-4)	J. Nagata Jul. 3	K.Kobayashi Jul. 3	T. Kaneko Jul. 2
	Chap. 3.16	Corrected CB-phase-open incoming part and modified incorrect phase names in Fig 3.16-4(UVS)	J. Nagata Dec. 9	K.Kobayashi Dec. 9	T. Kaneko Dec. 9
	Chap. 3.16	Corrected incorrect positons of logic and gate regarding output of UVSBLK element(Fig.3.16-4)	J. Nagata Jul. 3	K.Kobayashi Jul. 3	T. Kaneko Jul. 2
	Chap. 9.1	Added new information about [ErrorLED_cond] to turn off In-service for the occurrence of minor error	J. Nagata Feb. 14	K. Oohashi Feb. 13	T. Kaneko Sep. 27
0.93 June.15,2020	Chap. 3.18	Corrected signal numbers in Fig. 3.18-2 of ICD function	J. Nagata Mar. 27	G. Suzuki Mar. 16	T. Kaneko Mar. 16

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