MITSUBISHI ELECTRIC

Numerical Protection Relay

MELPRO™-D Series

FEEDER PROTECTION RELAY

MODEL

CFP1-A41D1

INSTRUCTION MANUAL

– Safety precautions –

Before installation, operation, maintenance, and inspection, please be sure to read this instruction manual and all other attached documents thoroughly in order to work safely with the equipment. Please ensure that you fully understand the equipment, safety information, and precautions that need to be taken before working with the equipment.

Safety precautions are classified as “Danger” and “Caution.”

Danger	The case where a dangerous situation can arise and there is the possibility that death or seriously injury can occur if the equipment is handled incorrectly.
Caution	The case where a dangerous situation can arise and there is the possibility that moderate or minor injuries canl occur, or property damage can take place if the equipment is handled incorrectly.

Furthermore, even with items described as ⚠Caution, there is the possibility of serious consequences depending on the situation. All of the described contents are important. Therefore, be sure to comply with them.

[Transportation]

Caution

- Transport the equipment in the correct orientation.
- Do not apply excessive shock and/or vibration as this could affect the performance and life of the product.

[Storage]

Caution

- The storage environment shall comply with the following conditions. Otherwise, there is a risk of reducing the performance and life of the product.
  - Ambient temperature: –40 to +85°C
    The state where dew condensation or freezing does not occur.
  - Relative humidity: 5 to 95% on daily average
  - Altitude: 2000 m or lower
  - The equipment must not be exposed to abnormal vibration, shock, inclination, or magnetic fields.
  - The equipment must not be exposed to harmful smoke/gas, saline gas, water droplets or vapour, excessive dust or fine powder, explosive gas or fine powder, wind & rain.

[Installation, wiring work]

Danger

- The equipment must be correctly grounded using the designated grounding terminals where they exist. Failure to do so may lead to the risk of electric shock, equipment failure, malfunction or failure to operate.
- Be sure to return all terminal covers, protection covers to their original positions once any work is complete. If they remain uncovered there is a risk of electrical shock.

Caution

- Ensure that the equipment is mounted and connected correctly. Otherwise, there are risks of failure, burning, or maloperation..
- Securely tighten the terminal connection screws. Otherwise, there are risks of failure and burning.
- For tightening torque of screws, refer to the following Table.

Place of use	Nominal dia.	Standard value of torque (steel screw)	Allowable range
Terminal block	M3.5	1.10 N•m (11.2 kgf•cm)	0.932 to 1.27 N•m (9.5 to 12.9 kgf•cm)
Panel mounting	M5.0	3.24 N•m (33 kgf•cm)	2.75 to 3.63 N•m (28 to 37 kgf•cm)

- Ensure that the equipment is connected correctly in accordance with the details shown on the connection terminals. Otherwise, there is the risk of failure, burning, malfunction, or maloperation.
- Ensure that the equipment is connected correctly in accordance with the phase sequence details shown on the connection terminals. Otherwise, there is the risk of failure, burning, malfunction, or maloperation.
- All power supplies to the equipment must be of suitable capacity and rated load to avoid the risk of malfunction and maloperation.
- The appropriate connectors must be used to ensure compatibility with the connector terminals to avoid the risks of failure or fire.

[Operating and Setting the equipment]

Danger

- The equipment must only be operated and handled by qualified personnel. Otherwise, there are risks of electric shock, injury, failure, malfunction, and maloperation.
- Handling and maintenance of the equipment must only be carried out after gaining a thorough understanding of the instruction manual. Otherwise, there is the risk of electric shock, injury, failure, malfunction, or maloperation.

Caution

- The equipment must be used within the following range limits. Otherwise, there is a risk of reducing the performance and life of the product.
  - Variation range of control power supply voltage: Within –15% to +10% of the rated voltage
  - Frequency variation: Within ±5% of the rated frequency
  - Ambient temperature: –40 to +60°C
The state where dew condensation or freezing does not occur
  - Relative humidity: 5 to 95% on daily average
  - Altitude: 2000 m or lower
  - The state where abnormal vibration, shock, inclination, magnetic field are not applied
  - The state where it is not exposed to harmful smoke/gas, saline gas, water droplet or vapor, excessive dust or fine powder, explosive gas or fine powder, wind & rain
- While energized, do not tamper with or remove any components other than those which have been designated. Otherwise, there is a risk of failure, malfunction, or maloperation.
- While energized, do not draw out the internal unit (subunit). Otherwise, there is a risk of electric shock, injury, failure, malfunction, or maloperation.
- When changing the setting value during the energized state, ensure that all trip circuits are locked in order not to operate. Otherwise, there is a risk of malfunction.

[Maintenance and Inspection]

Danger

- The equipment must only be operated and handled by qualified personnel. Otherwise, there are risks of electric shock, injury, failure, malfunction, and maloperation.
- Handling and maintenance of the equipment must only be carried out after gaining a thorough understanding of the instruction manual. Otherwise, there is the risk of electric shock, injury, failure, malfunction, or maloperation.
- Do not touch any live parts, such as terminals, etc. Otherwise, there is a risk of electric shock.

Caution

- When replacing the equipment, use a product of same model, rating, and specifications. Otherwise, there is the risk of failure or fire.. If any other product is to be used, the manufacturer must be consulted.
- We recommend that any tests or inspections are carried out under the following conditions, as well as any additional conditions described in the instruction manual.

• Ambient temperature	20 ± 10°C
• Relative humidity	90% or less
• External magnetic field	80 A/m or less
• Atmospheric pressure	86 to 106 × 10^3 Pa
• Mounting angle	Regular direction ±2°
• Frequency	Rated frequency ±1%
• Waveform (in the case of AC)	Distortion factor 2% or less

$$\text{Distortion factor} = \frac{\text{Effective value of higher harmonics only}}{\text{Effective value of fundamental wave}} \times 100\ (\%)$$

- AC component (in the case of DC) Ripple factor 3% or less

$$\text{Ripple factor} = \frac{\text{Max. value} - \text{Min. value}}{\text{Average value of DC}} \times 100\ (\%)$$

- Control power supply voltage Rated voltage ±2%

- Do not exceed the overload capacity for voltage and current. Otherwise,equipment failure or fire could occur.
- Do not clean the equipment while energised. When the cover needs to be cleaned, make use of a damp cloth.

[Repair and modification]

Caution

- When carrying out repair and/or modification, please consult with the manufacturer in advance.of carrying out the work. We will not take any responsibility for any repair and/or modification (including software) which has been carried out without prior consent.

[Disposal]

Caution

- Disposal must take place in accordance with the applicable legislation

– Improvement on the reliability of protection function –

Any parts and materials applied to the protection relay have limited life time which will bring the degradation to the relay.
The degree of degradation will be variable and depend on the purpose, period in use, applied circumstance and unevenness on the performance of each part.
MITSUBISHI ELECTRIC CORPORATION design the relay so as to realize that the recommended replaced duration is more than 15 years.
However, there may be some possibilities to occur some defects before reaching 15 years due to above mentioned the degree of degradation of parts and materials being depended on the condition in use.
To prevent unwanted operation or no operation of relay due to above reasons, it is recommended to apply the relay with self-diagnosis function and/or multiplexing relay system such as dual or duplex scheme.

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1. Structure

1.1. Dimensions of relay and Cut-Out dimensions of panel

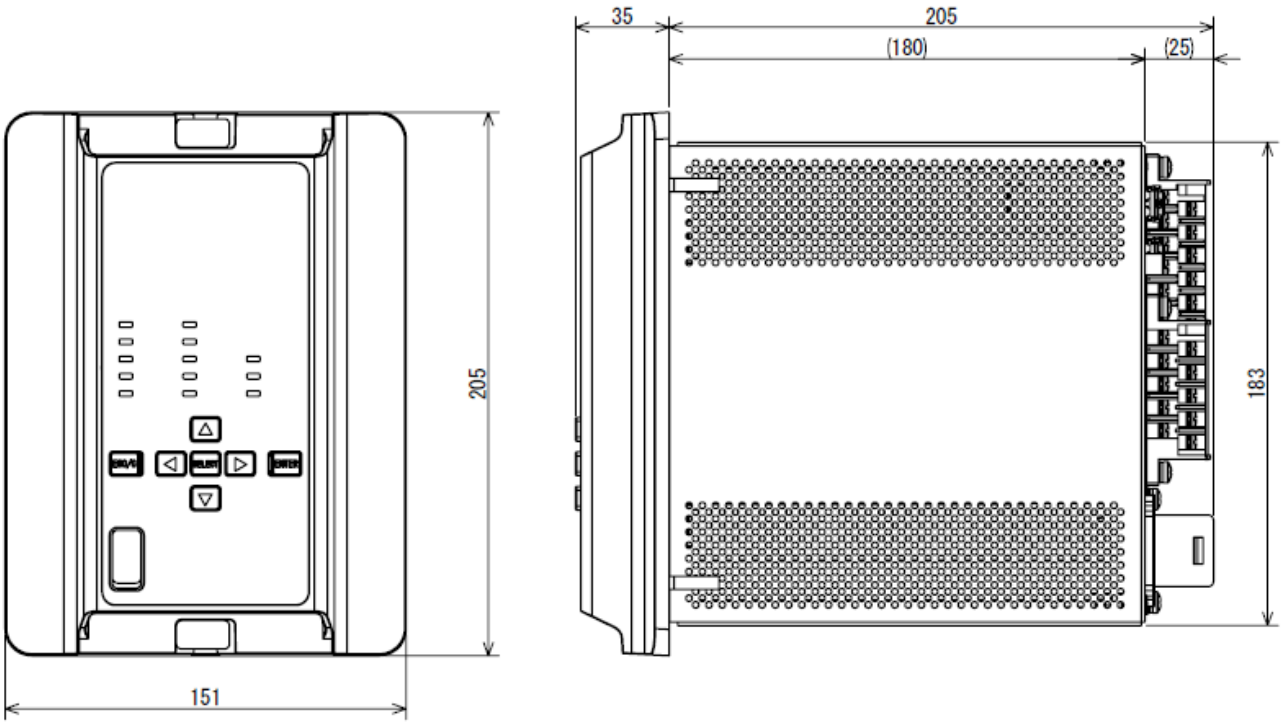


Fig. 1-1 Dimensions of relay

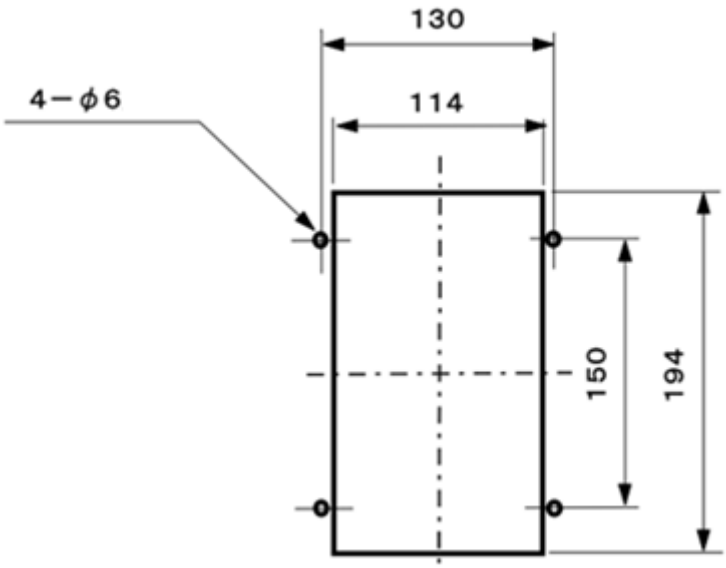


Fig. 1-2 Cut Out dimensions of panel

1.2. Front view of relay

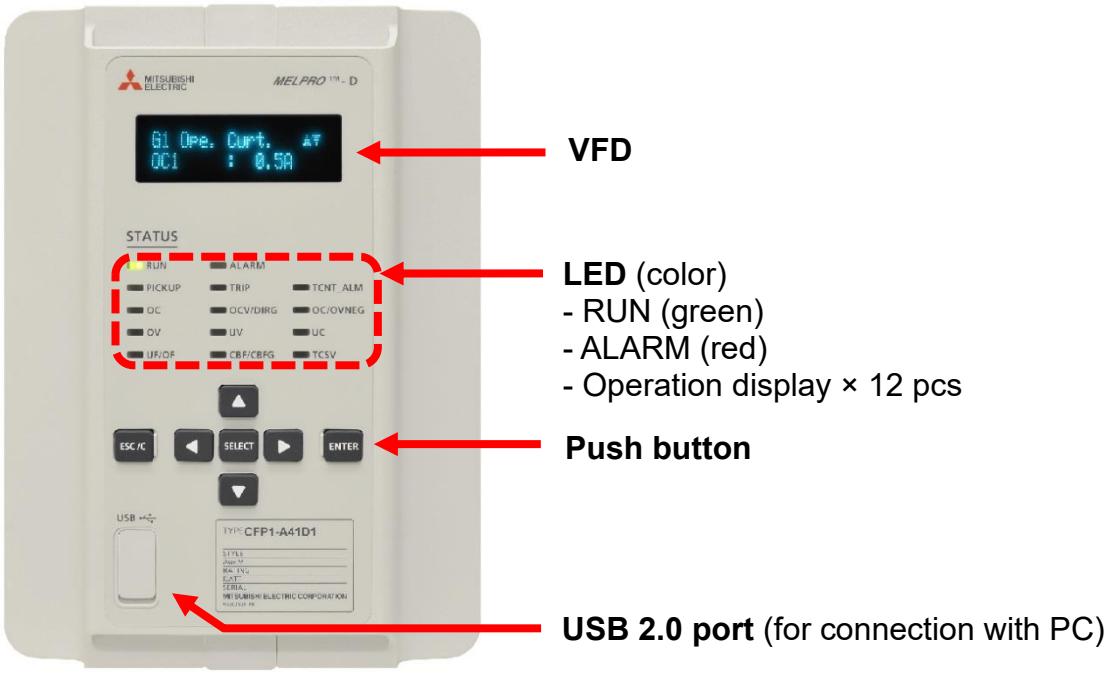


Fig. 1-3 Front view of relay

1.3. Terminal layout on the back plane of relay

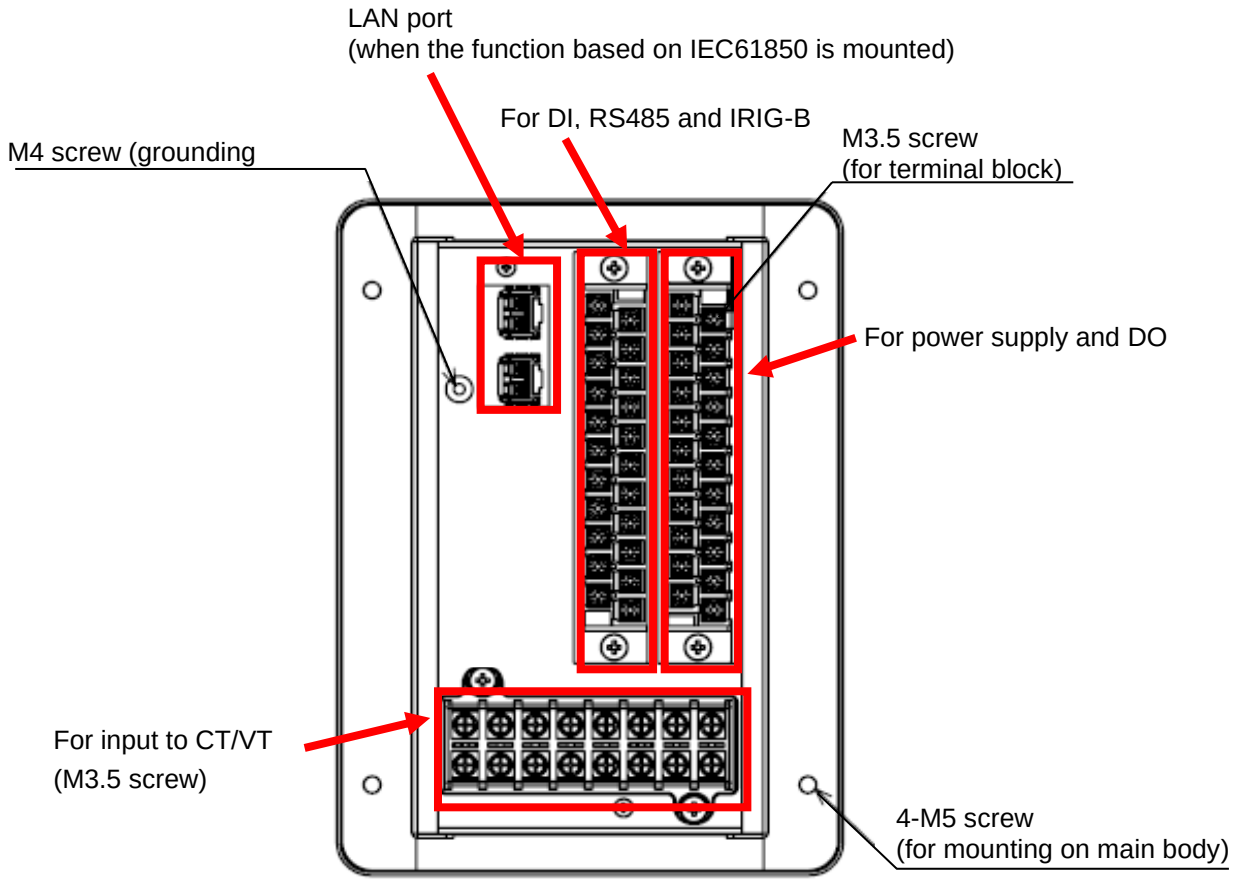


Fig. 1-4 Terminal layout on the back plane of relay

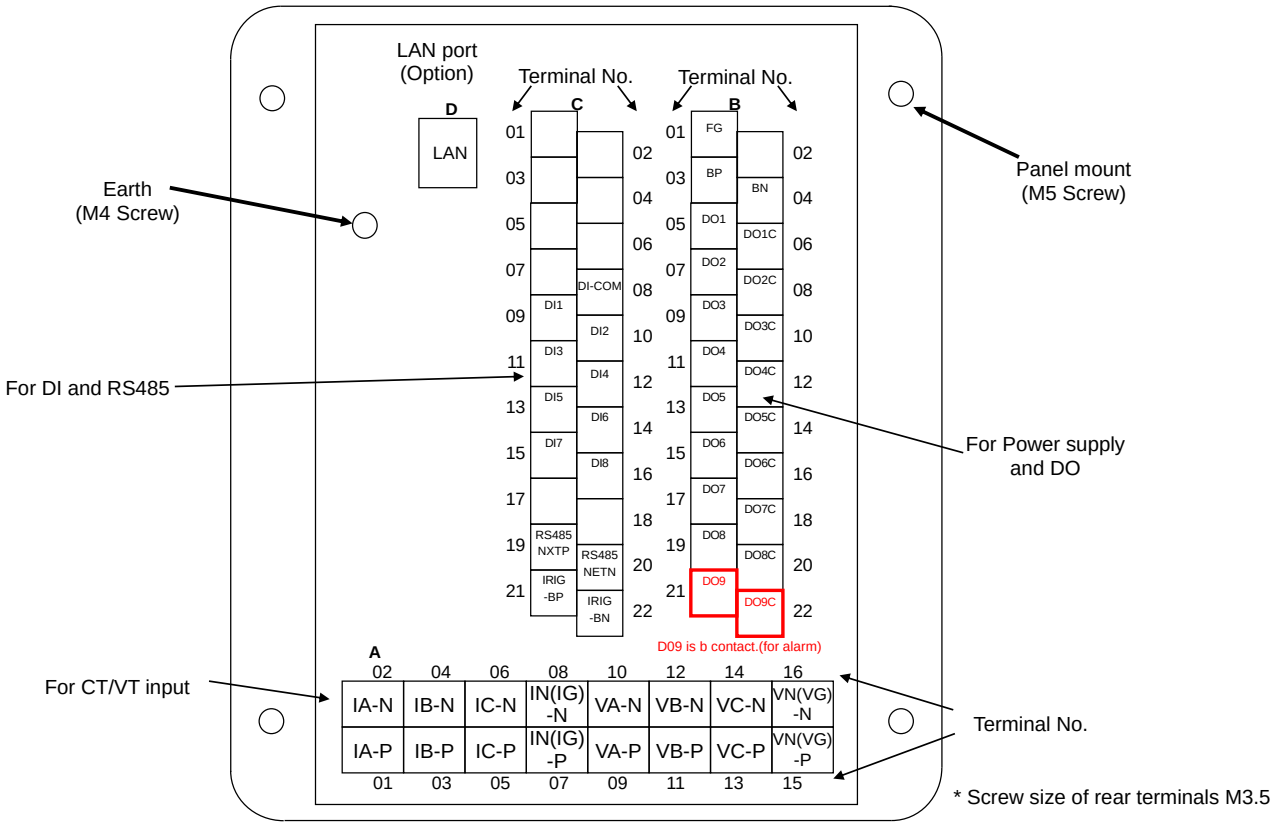


Fig. 1-5 Terminal number on the back plane of relay

1.4. External view of relay

The relay is of draw-out construction to facilitate inspection and testing. Therefore, it is possible to draw out the sub-unit without disconnecting the external wiring
When drawing out the subunit, be sure to take the following steps to avoid the unwanted operation of primary equipment:

- Isolate the relay supplies
- Take care that the appropriate circuit is isolated
- Separate / bridge the CT circuit
- Lock out the operation of circuit breakers etc
- Disconnect the control circuits

As an additional precaution, the CT circuit is provided with an automatic short-circuiting mechanism. This will ensure that the CT secondary circuit is not opened when the sub-unit is removed even if the CT circuits have not been separately bridged.

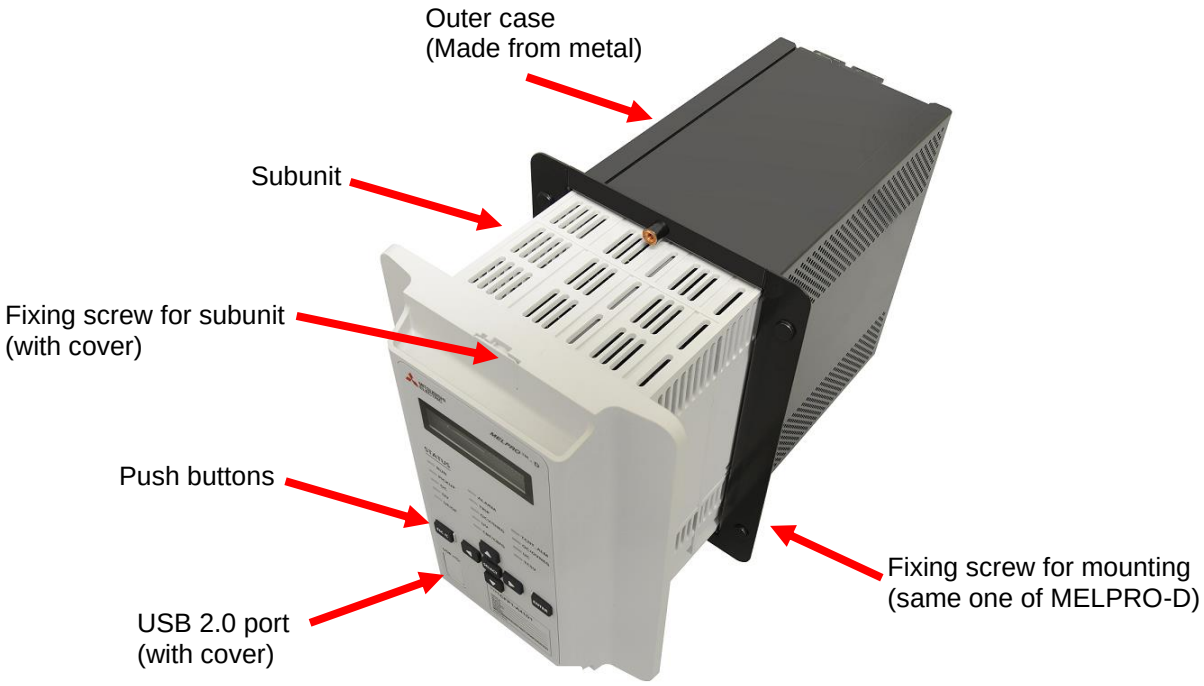


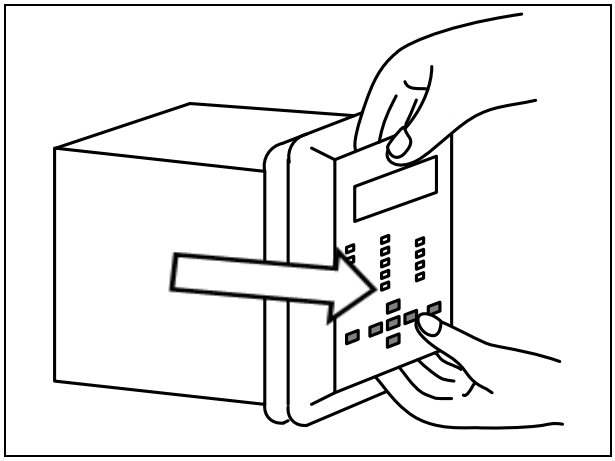
Fig. 1-6 External view of relay

1.4.1. Procedures for drawing out subunit

(1) Removing screws

To draw out the subunit from the case, remove upper & lower screws at the front side of the subunit.

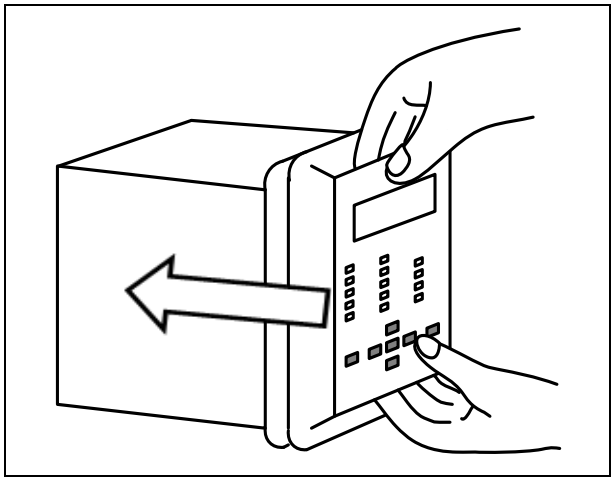
(2) Draw out the subunit



Then, draw out the subunit using fingers on the upper & lower grooves of it.

1.4.2. Procedures for housing subunit

(1) Insert the subunit



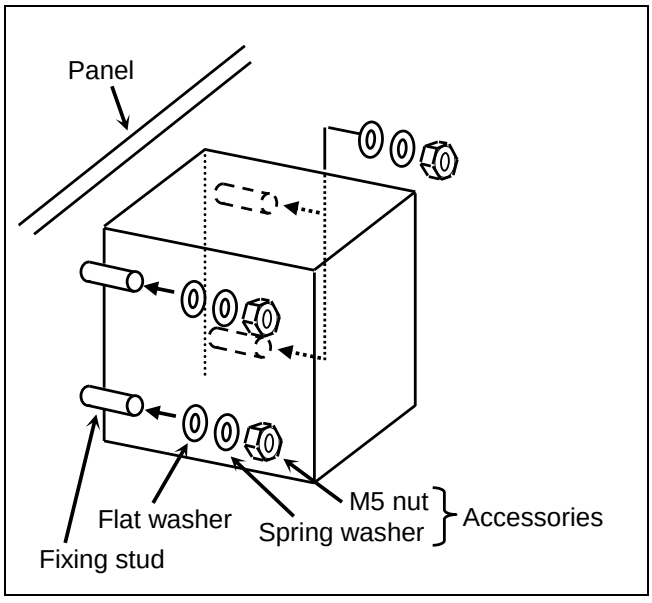
To insert the subunit into the case, using fingers on the upper & lower grooves of it.

Ensure that there is no gap between front side of the subunit and outer case.

(2) Fixing screws

Then, fix upper & lower screws at the front side of the subunit.

1.5. Mounting



When inserting this relay into control panel, take care in order not to damage it.
After inserting, fix this relay with washers and nuts which are supplied with the product.

2. Rating, Specification

2.1. Features (product conforming to IEC60255)

(1) Multi-function
- The relay incorporates a variety of protection functions which are required for feeder protection. Therefore, it is possible to protect the feeder with the use of a single relay.
- The relay has two Group settings sets. Therefore, it can be used for different purposes, such as operation/test, or quickly adapted to meet load conditions.
- Control of a circuit breaker is possible via the font panel, PC-HMI, or remote communication (option).

(2) High-precision measuring functions
- Measurement functions are enhanced.
  Current, voltage, electric power, quantity of electricity, frequency, can be viewed via the front panel display on the relay or using interface software on a PC.
- Fault / Disturbance Recording
  The relay stores up to 5 fault / disturbance records which can be used for fault investigations. Fault record function is the record of analog input values (as RMS) at the time when relay elements are operated. Disturbance record function is the record of waveform data for the prescribed period before and after occurrence of fault at sampling rate of 24 samples/cycle.

(3) Selection of communication networks
- Modbus (RS485)
  Modbus communication function is incorporated as standard.
- IEC61850 (Ethernet Station Bus)
  An optional communication card will enable communication based on IEC61850 with GOOSE messaging.
  IEC61850-8-1 Edition 1 or Edition 2 can be selectable at ordering when selected IEC61850 communication
  A two-port optical connector or a single port electrical connector is provided. If the optical two-port connector is selected, HSR (High-availability Seamless Redundancy) and PRP (Parallel Redundancy Protocol) can be configured to improve the reliability of communication.

(4) Programmable Output Contacts provide flexibility
The configuration of output contact is possible by PLC (Programmable Logic Controller), which enables to apply the relay to various systems.

(5) Advanced constant monitoring function improves reliability
The relay continuously monitors the electronic circuits and can detect internal component failure, which enables to improve reliability.
The relay's behavior is as follows:
- In normal conditions: RUN LED lights.
- In abnormal conditions: ALARM LED lights.
  During serious abnormal conditions, the protection elements are locked to prevent an unnecessary output, and the relay fail alarm is issued.

(6) The draw-out Subunit improves maintainability
The provision of an automatic CT shorting mechanism at the time of drawing out the unit makes it very easy to maintain the relay.
Remarks: This mechanism is installed only in relay devices with current protection element.

2.2. Standard Ratings

Item			Contents
Rating	Current		5A type
	Zero-sequence current		200 mA type (ZCT) 5A type (ZCT or residual current)
	Voltage		100 to 125 V (phase-to-phase)
	Frequency		50 Hz, 60 Hz
	Power Supply	Voltage	DC110 to 250 V, AC100 to 240 V
		Variation range	DC88 to 300 V, AC85 to 264 V
Communication function*	Modbus		Option
	IEC61850		Option: Electric 1 ch or Optical 2 ch
Time synchronization function	IRIG-B		Standard equipment
	SNTP		Provided in the case where the IEC61850 communication card is mounted

* When IEC61850 is used, Modbus cannot be used and vice-versa. (Only one communications protocol can be selected at a time)

2.3. Protection elements

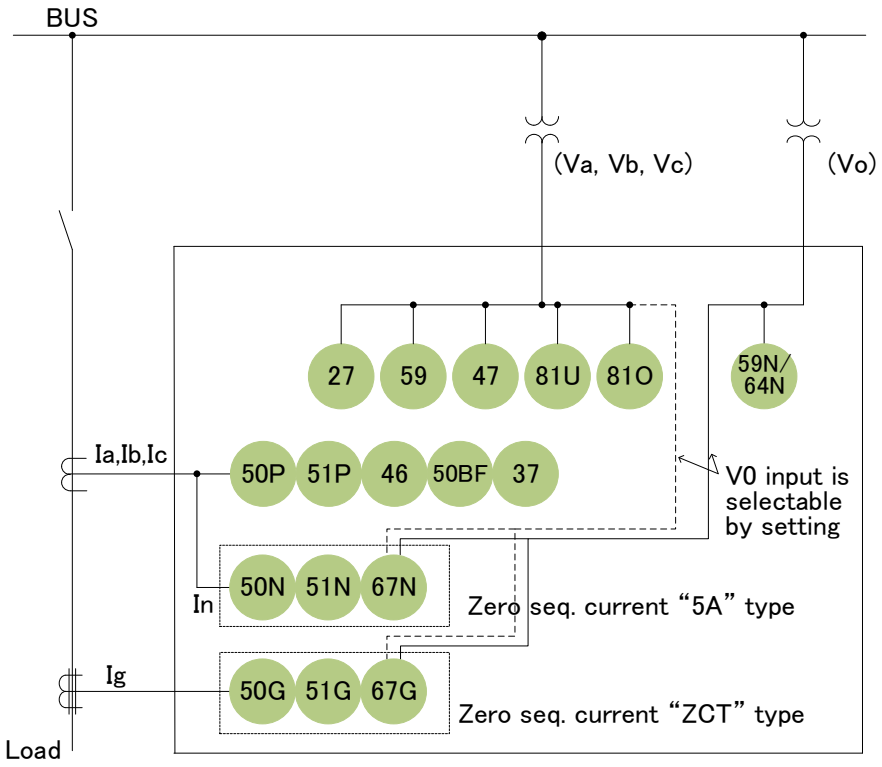


Fig. 2-1 Application and protection element

Device No.	Protection element (Abbreviated name)	Operating value	Operating time	Other settings
50P	Instantaneous overcurrent element (OC1~3)	5 A type: 0.5 to 100.0 A	0.0 to 10.0 s	
51P	Definite time or IDMT overcurrent element (OC4)	5 A type: 0.5 to 100.0 A	-	14 types of operating time characteristics, 3 types of reset time characteristics
50N • 50G	Instantaneous ground (earth) fault overcurrent element (by residual current or ZCT) (OCN1~3 / OCG1~3)	ZCT type: 1.0 to 100.0 mA I0 = 5 A type: 0.1 to 100.0 A	0.0 to 10.0 s	
51N • 51G	Definite time or IDMT ground (earth) fault overcurrent element (by residual current or ZCT) (OCN4 / OCG4)	ZCT type: 1.0 to 100.0 mA I0 = 5 A type: 0.1 to 100.0 A	-	14 types of operating time characteristics, 3 types of reset time characteristics
46	Negative sequence overcurrent element (OCNEG1~2)	5 A type: 0.25 to 5.00 A	0.0 to 10.0 s	
67N	Instantaneous directional ground fault element (by residual) (DIRG1~3)	0.1 to 100.0 A 2.0 to 100.0 V 0 to 359° (Lag angle)	0.0 to 10.0 s	
67G	Instantaneous directional ground fault element (by ZCT) (DIRG1~3)	1.0 to 100.0 mA, 2.0 to 100.0 V, 0 to 359° (Lag angle)	0.0 to 10.0 s	
67G	Definite time or IDMT directional ground fault element (by ZCT) (DIRG4)	1.0 to 100.0 mA, 2.0 to 100.0 V, 0 to 359° (Lag angle)	-	14 types of operating time characteristics, 3 types of reset time characteristics

50BF	CB failure protection (CBF)	5 A type: 0.15 to 10.00 A	0.0 to 10.0 s	
50BFN • 50BFG	Ground (Earth) fault CB failure protection (CBFG)	ZCT type: 1.0 to 100.0 mA	0.0 to 10.0 s	
37	Undercurrent element (UC1~2)	5 A type: 0.25 to 5.00 A	0.0 to 10.0 s	
27	Undervoltage element (UV1~2)	20 to 120 V	0.0 to 10.0 s	
59	Overvoltage element (OV1~2)	20 to 200 V	0.0 to 10.0 s	
59N / 64N	Ground (Earth) fault overvoltage element (OVG1~2)	2.0 to 100.0 V	0.0 to 10.0 s	
47	Negative sequence overvoltage element (OVNEG1~2)	2.0 to 100.0 V	0.0 to 10.0 s	
81U	Underfrequency element (UF1~3)	fn-0.5 to fn-5.0 Hz (fn: Rated frequency)	0.1 to 60.0 s	
81O	Overfrequency element (OF1~3)	fn+0.5 to fn+5.0 Hz (fn: Rated frequency)	0.1 to 60.0 s	

* Factory settings are set to a default of “Non-use” for the products with setting of Use/Non-use. If the Use/Non-use setting is not applicable, the setting value will be set to the minimum setting.

* For details, refer to Chapter 3.

2.4. Measuring element

Contents displayed		Range	Measured value		Accident record	Waveform record
Name of symbol	Item	(Secondary value/Primary value)	Primary	Secondary	Primary only	Common
Va	A-phase voltage	0.0 to 150.0 V (0.1 V step) / 0.0 to 99.00 kV (0.01 kV step)	○	○	○	○
Vb	B-phase voltage		○	○	○	○
Vc	C-phase voltage		○	○	○	○
Vab	AB-phase voltage (S/W composition)	0.0 to 260.0 V (0.1 V step) / 0.0 to 99.00 kV (0.01 kV step)	○	○	○	×
Vbc	BC-phase voltage (S/W composition)		○	○	○	×
Vca	CA-phase voltage (S/W composition)		○	○	○	×
VN	Zero-phase voltage		○	○	○	○
3V0	Zero-phase voltage (3-phase composition)		○	○	○	×
V1	Positive-phase-sequence voltage (S/W composition)	0.0 to 150.0 V (0.1 V step) / 0.0 to 99.00 kV (0.01 kV step)	○	○	○	×
V2	Negative-phase-sequence voltage (S/W composition)		○	○	○	×
Ia	A-phase current	0.00 to 2 times the rating (0.01 A step)/ 0 to 60000 A (1A step)	○	○	○	○
Ib	B-phase current		○	○	○	○
Ic	C-phase current		○	○	○	○
IG	Zero-phase current (ZCT)	0.0 to 999.9 mA (0.1 mA step) / 0.0 to 999.9A (0.1 A step)	○	○	○	○
IN	Zero-phase current	0.00 to 2 times the rating (0.01 A step)/ 0 to 60000 A (1A step)	○	○	○	○
3I0	Zero-phase current (S/W composition)		○	○	○	×
I1	Positive-phase-sequence current (S/W composition)		○	○	○	×
I2	Negative-phase-sequence current (S/W composition)		○	○	○	×

Continued on next page

Contents displayed		Range	Measured value		Accident record	Waveform record
Name of symbol	Item	(Secondary value/Primary value)	Primary	Secondary	Primary only	Common
Continued from previous page						
Va-phase	A-phase's voltage phase	0.0 to 359.9° (0.1° step) *Va-reference (lagging phase)	○	○	○	×
Vb-phase	B-phase's voltage phase		○	○	○	×
Vc-phase	C-phase's voltage phase		○	○	○	×
Vab-phase	AB-phase's voltage phase		○	○	○	×
Vbc-phase	BC-phase's voltage phase		○	○	○	×
Vca-phase	CA-phase's voltage phase		○	○	○	×
V0-phase	Zero-phase's voltage phase		○	○	○	×
Ia-phase	A-phase's current phase		○	○	○	×
Ib-phase	B-phase's current phase		○	○	○	×
Ic-phase	C-phase's current phase		○	○	○	×
I0-phase	Zero-phase's current phase		○	○	○	×
+P	Positive 3-phase effective power	0.0 to 999.9 MW (0.1 MW step)	○	×	×	×
-P	Negative 3-phase effective power		○	×	×	×
+Q	Positive 3-phase reactive power	0.0 to 999.9 MVar (0.1 MVar step)	○	×	×	×
-Q	Negative 3-phase reactive power		○	×	×	×
S	3-phase apparent power	0.0 to 999.9 MVA (0.1 MVA step)	○	×	×	×
PF	3-phase power factor	-1.00 to 1.00 (0.01 step)	○	×	×	×
+Pt	Positive 3-phase effective electric energy	0 to 999999999 kWh (1 kWh step)	○	×	×	×
-Pt	Negative 3-phase effective electric energy		○	×	×	×
+Qt	Positive 3-phase reactive electric energy	0 to 999999999 kVarh (1 kVarh step)	○	×	×	×
-Qt	Negative 3-phase reactive electric energy		○	×	×	×

2.5. List of functions

Menu	Item	Operation system		
		Front panel	PC-HMI	Communication
Record (RECORD)	Waveform analysis (WAVEFORM ANALYSIS)	×	○ 11.7.1	×
	Disturbance record (DISTURBANCE RECORD)	×	○ 11.10.1	○
	Fault record (FAULT RECORD)	○ 4.3.2.2.1	×	○
	Event record (EVENT RECORD)	○ 4.3.2.2.2	○ 11.10.3	○
	Access record (ACCESS RECORD)	○ 4.3.2.2.3	○ 11.10.4	○
	Alarm record (ALARM RECORD)	○ 4.3.2.2.4	○ 11.10.2	○
Clear record (CLEAR RECORD)	Clear fault record (FAULT REC CLEAR)	○ 4.3.4.5.1	○ 11.10.5	○
	Clear alarm record (ALARM REC CLEAR)	○ 4.3.4.5.2	○ 11.10.5	○
	Clear event record (EVENT REC CLEAR)	○ 4.3.4.5.3	○ 11.10.5	○
Status (STATUS)	Clock (CLOCK)	○ 4.3.2.1.1	×	○
	Measured value (METERING)	○ 4.3.2.1.2	○ 11.11.1	○
	DI/DO status (DIGITAL I/O)	○ 4.3.2.1.3	○ 11.11.2	○
	Trip counter (TRIP COUNTER)	○ 4.3.2.1.4	×	○
	Device name (DEVICE NAME)	○ 4.3.2.1.5	○ 11.14.1	×
Setting (SETTING)	Active group (ACTIVE WG)	○ 4.3.4.1.1	○ 11.12.2	○
	Group 1 setting (G1)	○ 4.3.4.1.2	○ 11.12.1	○
	Group 2 setting (G2)	○ 4.3.4.1.2	○ 11.12.1	○
	Programable logic (PLC)	×	○ 11.12.4	
Control (CONTROL)	Control setting (CTRL MODE)	○ 4.3.4.2.1	○ 11.13.1	○
	Circuit breaker control (CB CONTROL)	○ 4.3.4.2.2	○ 11.13.2	○
Configuration (CONFIG)	Communication setting (COMMUNICATION)	○ 4.3.4.3.1	×	×

Menu	Item	Operation system		
		Front panel	PC-HMI	Communication
	Clock adjustment (CLOCK ADJUST)	○ 4.3.4.3.2	○ 11.14.2	○
	Measured analog value (METERING)	○ 4.3.4.3.3	○ 11.14.4	○
	Electric energy (ENERGY)	○ 4.3.4.3.4	○ 11.14.8	○
	Trip counter (TRIP COUNTER)	○ 4.3.4.3.5	○ 11.14.9	○
	Disturbance record (DISTURBANCE)	○ 4.3.4.3.6	○ 11.14.6	○
	DI detection voltage value (DI VOLTAGE)	○ 4.3.4.3.7	○ 11.14.5	○
	Password use/unused (PASSWORD USE)	○ 4.3.4.3.8	×	×
	Password registration (PASSWORD REGIST)	○ 4.3.4.3.9	×	×
Test (TEST)	Forced control of DO (CONTACT TEST)	○ 4.3.4.4.1	○ 11.15.1	○
	Test mode (MODE)	○ 4.3.4.4.2	○ 11.15.2	○
	LED/VFD lighting test (LED/VFD TEST)	○ 4.3.4.4.3	○ 11.15.3	○

3. Protective function

In the CFP1-A41D1, following protection elements are provided for the purposes of protecting feeders. In this chapter, the protection elements incorporated in CFP1-A41D1 are described.

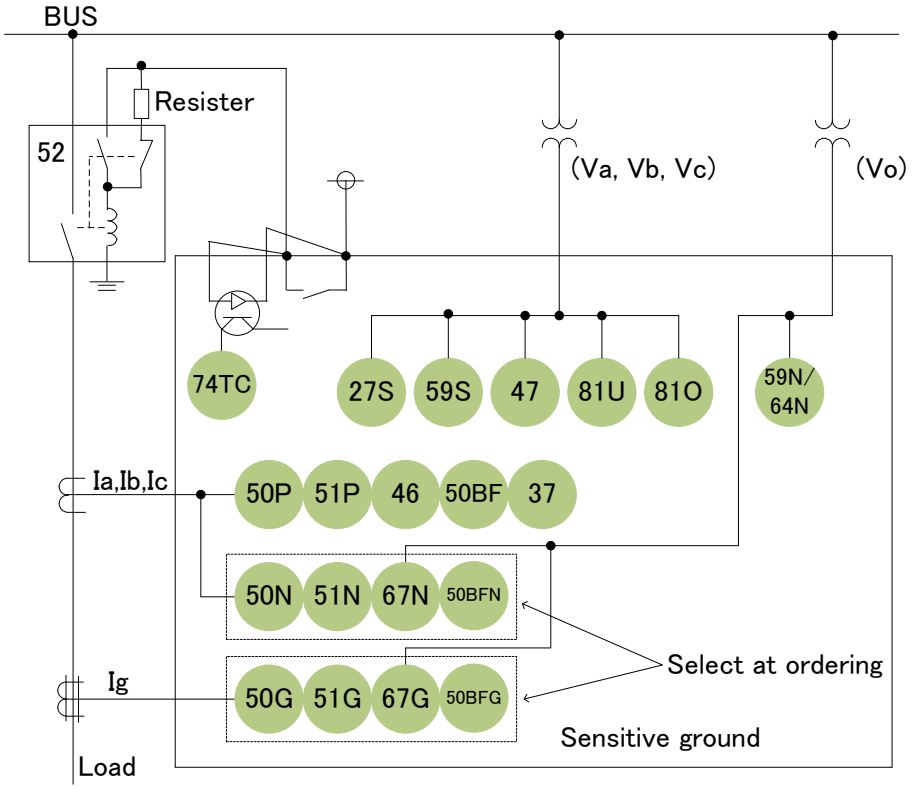


Fig. 3-1 Application and protection element

3.1. Overcurrent Element

Four types of overcurrent elements are incorporated In the CFP1-A41D1 relay, and this enables rapid detection of faults. Furthermore, a variety of protection characteristics are provided which enable effective time coordination as shown in Fig. 3-2. Accordingly, the relay can be applied to protect various systems. Furthermore, second harmonic restraint is incorporated, and this can prevent unnecessary operation due to transformer magnetizing inrush current.

ANSI Device No.	Display name	Protective function
50P	OC1	Instantaneous overcurrent element
	OC2, OC3	Instantaneous overcurrent (two-stage) with selectable 2nd harmonic restraint
51P	OC4	Definite time or IDMT overcurrent element selectable 2nd harmonic restraint; ● Selection of 14 operating time characteristics ● 3 reset time characteristics

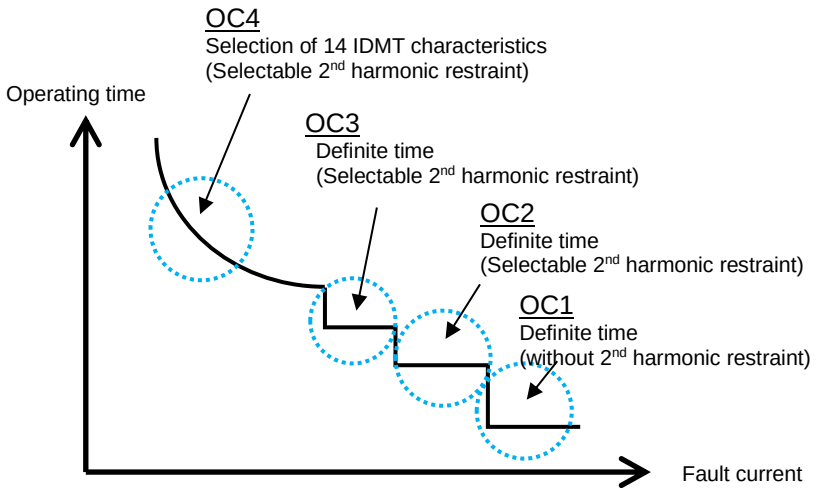


Fig. 3-2 Example of a time coordination curve for overcurrent element

3.1.1. OC1 Element (Instantaneous Overcurrent Element)

As the instantaneous overcurrent element operates without 2nd harmonic restraint, it is possible to achieve high-speed operation for large fault currents. Fig. 3-3 shows the internal function blocks of the element.

OC1 outputs a definitive signal after a preset time of the operation timer (Ope. Time) has passed, when input current is greater than or equal to the operation setting value (Ope. Curt.).
An off-delay timer of 200 ms is added in order to prevent chattering of the output contacts.
Furthermore, this element is enabled only when the setting of Use/Non-use of OC1 (OC1 EN) is set to ON. Therefore, when this element is not used, unnecessary operation can be prevented by setting to OFF. Other setting items with regard to OC1 are not necessary to be set.

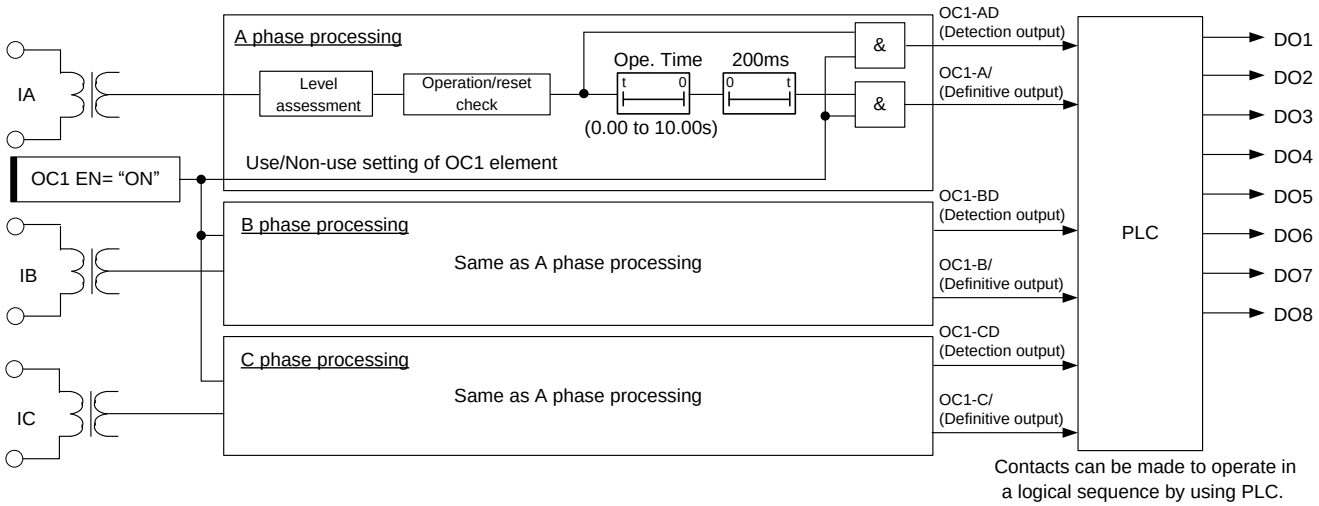


Fig. 3-3 Internal function block diagram of the instantaneous overcurrent element (OC1)

Table 3-1 Setting items of the instantaneous overcurrent element (OC1)

Display name	Setting parameter	Setting		Description
		Range of setting	step	
OC1	OC1 EN	OFF, ON	-	OFF: Non-use, ON: Use When this element is used, set to ON.
	Ope. Curt.	0.5 ~ 100.0 A (5 A type)	0.1 A	Operating current
	Ope. Time	0.00 ~ 10.00 s	0.01 s	Operating time INST: ≤ 30 ms

3.1.2. OC2 Element (Instantaneous Overcurrent Element with 2nd harmonic restraint)

This element includes the selectable 2nd harmonic restraint function so it can prevent unnecessary operation due to transformer magnetizing inrush current.

Fig. 3-4 shows the internal function blocks of the element.

The OC2 element outputs a definitive signal after the preset time of the operation timer (Ope. Time) has passed, when the input current is greater than or equal to the operation setting value (Ope. Curt.), and when 2nd harmonic restraint is not operated.

When the 2nd harmonic restraint function is not used (2f-lock EN=OFF), it is not linked to the operation of the OC2 element.

An off-delay timer of 200 ms is added in order to prevent chattering of the output contacts.

Furthermore, this element outputs the trip signal only when the setting of Use/Non-use of OC2 element (OC2 EN) is ON. Therefore, when this element is not used, unnecessary operation can be prevented by setting to OFF. It is not necessary to set other setting items with regard to OC2 element.

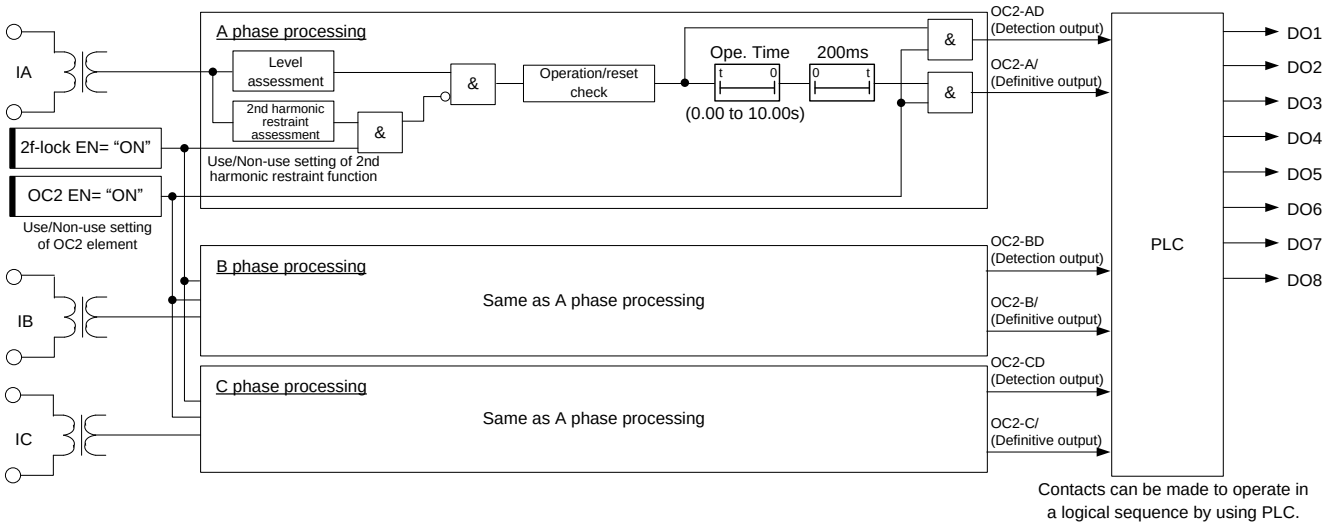


Fig. 3-4 Internal function block diagram of OC2 element

Table 3-2 Setting items of OC2 element

Display name	Setting parameter	Setting		Description
		Range of setting	step	
OC2	OC2 EN	OFF, ON	-	OFF: Non-use, ON: Use When this element is used, set to ON.
	Ope. Curt.	0.5 ~ 100.0 A (5 A type)	0.1 A	Operating current
	Ope. Time	0.00 ~ 10.00 s	0.01 s	Operating time INST: ≤ 40 ms (2f-lock EN=ON)
	2f-lock EN	OFF, ON	-	OFF: Non-use, ON: Use When the 2nd harmonic restraint function is used, set to ON.

3.1.3. 2nd harmonic restraint function

In the CFP1-A41D1 relay, 2nd harmonic restraint function is provided in order to prevent unnecessary operation due to transformer magnetizing inrush current. The operation of 2nd harmonic restraint function is explained by means of the internal function blocks shown in Fig. 3-5.

As there is significant second harmonic component in the transformer magnetizing inrush current, the relay extracts the fundamental and second harmonic components in the input current. It detects the second harmonic when the fundamental component is greater than or equal to the minimum operation setting value (1f-Min. Ope.), and when the 2nd harmonic component is greater than or equal to the setting of content percentage (2f-lock ratio) of fundamental component. Furthermore, in order to reduce chattering of output contacts when the 2f component is near the setting of content percentage, the detection signal is latched when the 2f component is continuously detected during one cycle (*1). (Release of the latch is done after 1.5 cycles when the 2f component has become less than the percentage setting of fundamental component.)

(*1) 1 cycle is calculated by the following formula.
1 cycle (sec) = 1/System frequency----- (16.7 ms @60 Hz, 20 ms @50 Hz)

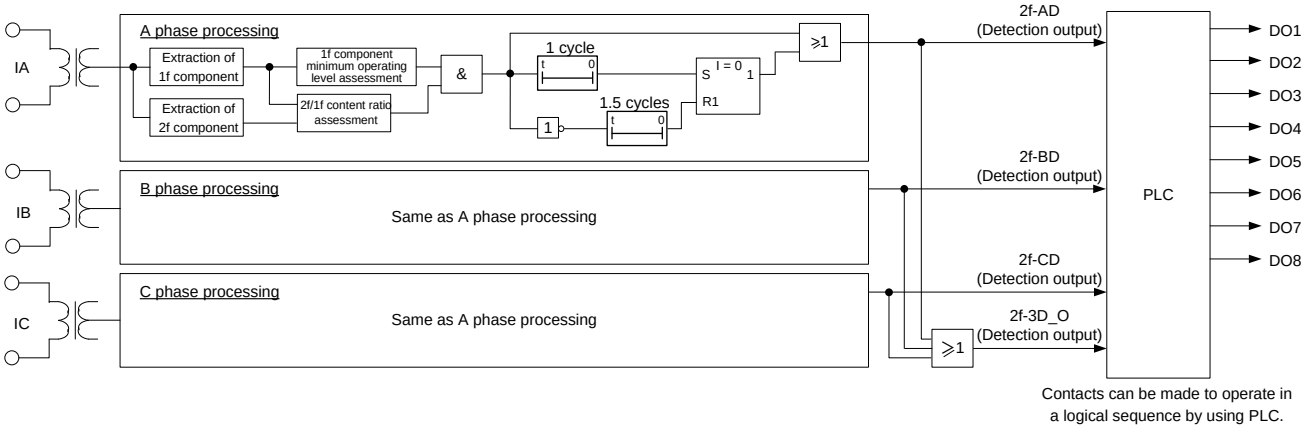


Fig. 3-5 Internal block diagram for 2nd harmonic restraint

Table 3-3 Setting items of 2nd harmonic restraint function

Display name	Setting parameter	Setting		Description
		Range of setting	step	
2F	2f-lock ratio	10 ~ 30%	1%	Content percentage of 2f/1f
	1f-Min. Ope.	0.4 ~ 2.5 A	0.1 A	Minimum operating value of 1f component

3.1.4. OC3 Element (Instantaneous Overcurrent Element with 2nd harmonic restraint)

The OC3 element has the same characteristics as the OC2 element.

Regarding the internal function block diagram and its operation, refer to sub-clause 3.1.1.

Table 3-4 Setting items of OC3 element

Display name	Setting parameter	Setting		Description
		Range of setting	step	
OC3	OC3 EN	OFF, ON	-	OFF: Non-use, ON: Use When this element is used, set to ON.
	Ope. Curt.	0.5 ~ 100.0 A (5 A type)	0.1 A	Operating current
	Ope. Time	0.00 ~ 10.00 s	0.01 s	Operating time INST: ≤ 40 ms (2f-lock EN=ON)
	2f-lock EN	OFF, ON	-	OFF: Non-use, ON: Use When the second harmonic restraint function is used, set to ON.

3.1.5. OC4 Element (Definite time or IDMT Overcurrent with 2nd harmonic restraint)

As selectable second harmonic restraint function is incorporated, unnecessary operation due to transformer magnetizing inrush current can be avoided. Furthermore, 14 kinds of operating time characteristics and 3 types of reset time characteristics are provided.
Fig. 3-6 shows the internal function blocks of the element.

The OC4 element outputs a definitive signal when detection signal operates for longer than a definite time setting.
The detection signal is issued when input current is greater than or equal to the operation setting value (Ope. Curt. or Ope. Curt.×1.15 is to be selected by setting of IEC Chr. EN), and when 2nd harmonic restraint is not operated.

The DT or IDMT timer counts up in accordance with the operating time characteristic (Ope. Chr.), when input current is greater than or equal to the operation setting value (Ope. Curt.), and when 2nd harmonic restraint is not operated.

When the 2nd harmonic restraint function is not used (2f-lock EN=OFF), it is not linked to the operation of the OC4 element.

The reset time characteristic can be selected by setting (Rst. Chr.).
When set to IDMT (inverse definite minimum time) or DT (definite time), it is included an off-delay timer of 200 ms to prevent chattering of the contacts.
When instantaneous reset of the contact is required, the setting (Rst. Chr.) should be set to INST (instantaneous).

Furthermore, this element outputs the definitive signal only when the setting of Use/Non-use of OC4 element (OC4 EN) is ON. Therefore, when this element is not used, unnecessary operation can be prevented by setting to OFF. It is not necessary to set any other settings with regard to the OC4 element.

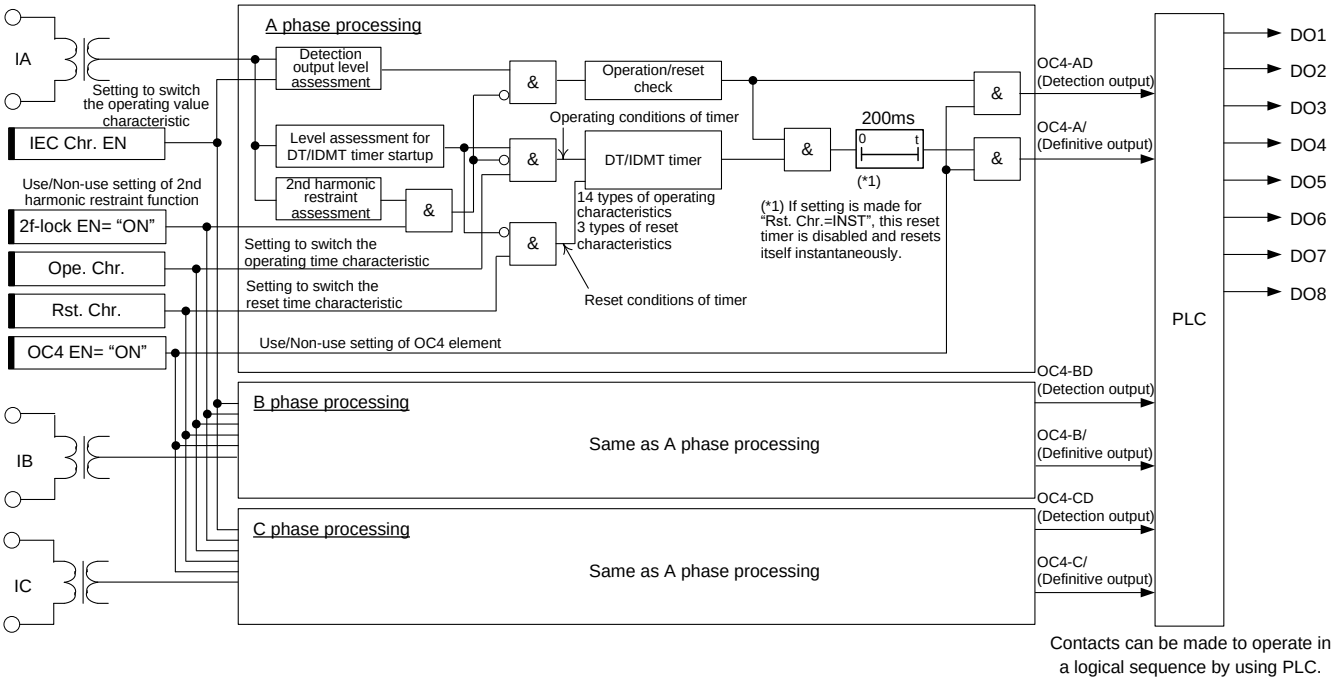


Fig. 3-6 Internal function block diagram of OC4 element

Table 3-5 Setting items of OC4 element

Display name	Setting parameter	Setting		Description
		Range of setting	step	
OC4	OC4 EN	OFF, ON	-	OFF: Non-use, ON: Use When this element is used, set to ON.
	Ope. Curt.	0.5 ~ 100.0 A (5 A type)	0.1 A	Operating current (pickup current)
	Ope. TM	0.25 ~ 50.00	0.01	Operating time multiplier. This is indicated as “M” in the characteristic formula shown in sub-clause 3.1.8.
	Ope. Chr.	NI01, VI01, EI01, LI01, LI02, DT01, NI11, EI11, EI12, NI21, VI21, LI21, NI31, VI31	-	Choice of DT or IDMT operating characteristics. (Refer to IDMT characteristic formula in sub-clause 3.1.8.)
	Rst. Chr.	IDMT,DT,INST	-	Reset time characteristic. IDMT: Inverse definite minimum time. DT: Definite time (fixed to 200 ms) INST: Instantenious (50 ms or less) (Refer to IDMT characteristic formula in sub-clause 3.1.8.)
	2f-lock EN	OFF, ON	-	OFF: Non-use, ON: Use When 2nd harminic restraint is used, set to ON.
	IEC Chr. EN	OFF, ON	-	OFF: Normal characteristic, ON: Characteristic according to IEC When this element is used with the operating characteristic compliant with IEC60255-151, set this parameter to ON. By setting this parameter to ON, the operating value for detection becomes 1.15 times the Ope. Curt., as shown in sub-clause 0.

3.1.6. Operating time characteristic

The characteristic based on IEC60255-151 is incorporated in the OC4 element, and it is possible to select the operation by setting of IEC Chr. EN. The operating time of both settings are same when the applied current is more than 1.15 times of the pickup current setting (Ope.Curt.). The difference is described in Fig. 3-7.

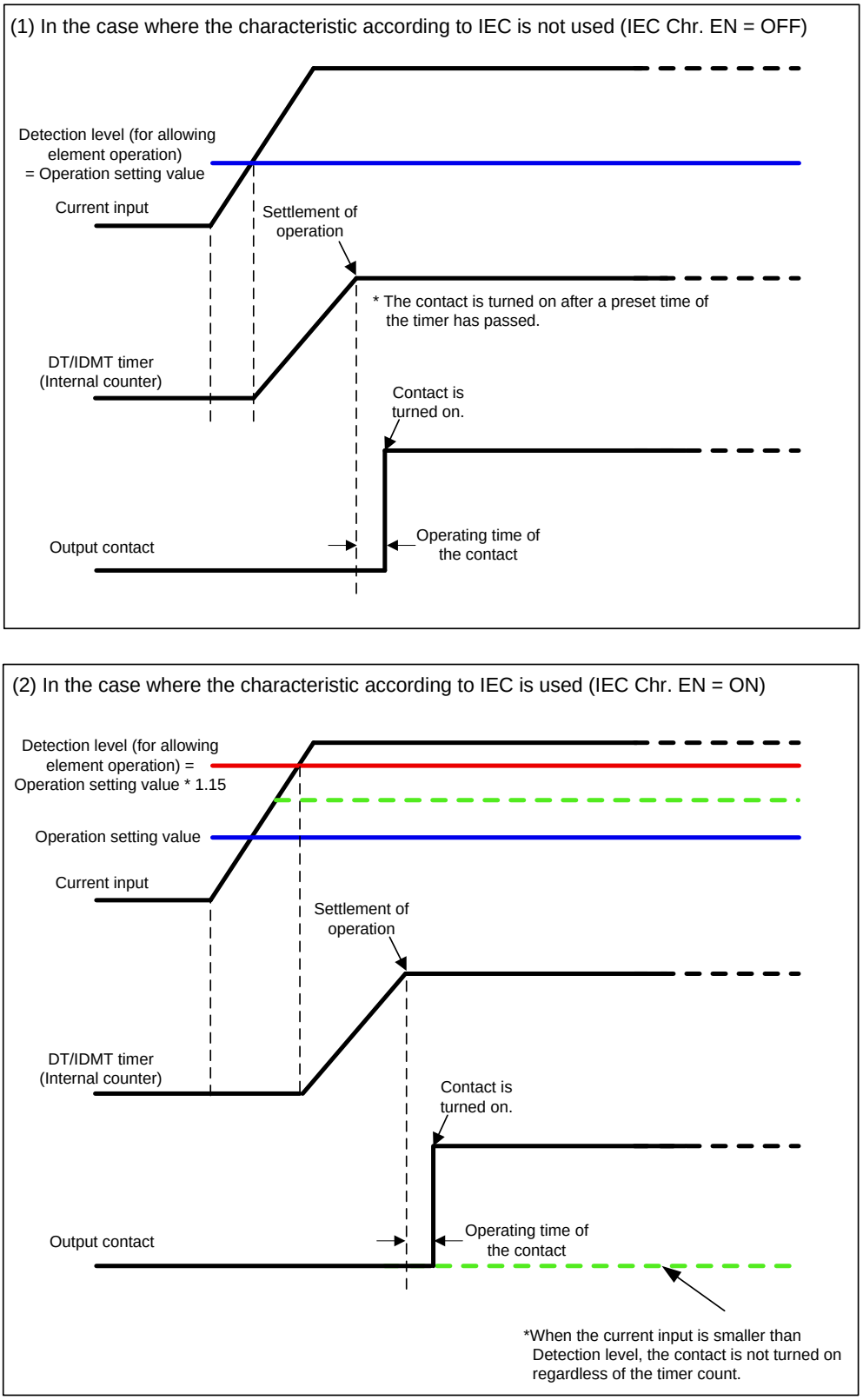


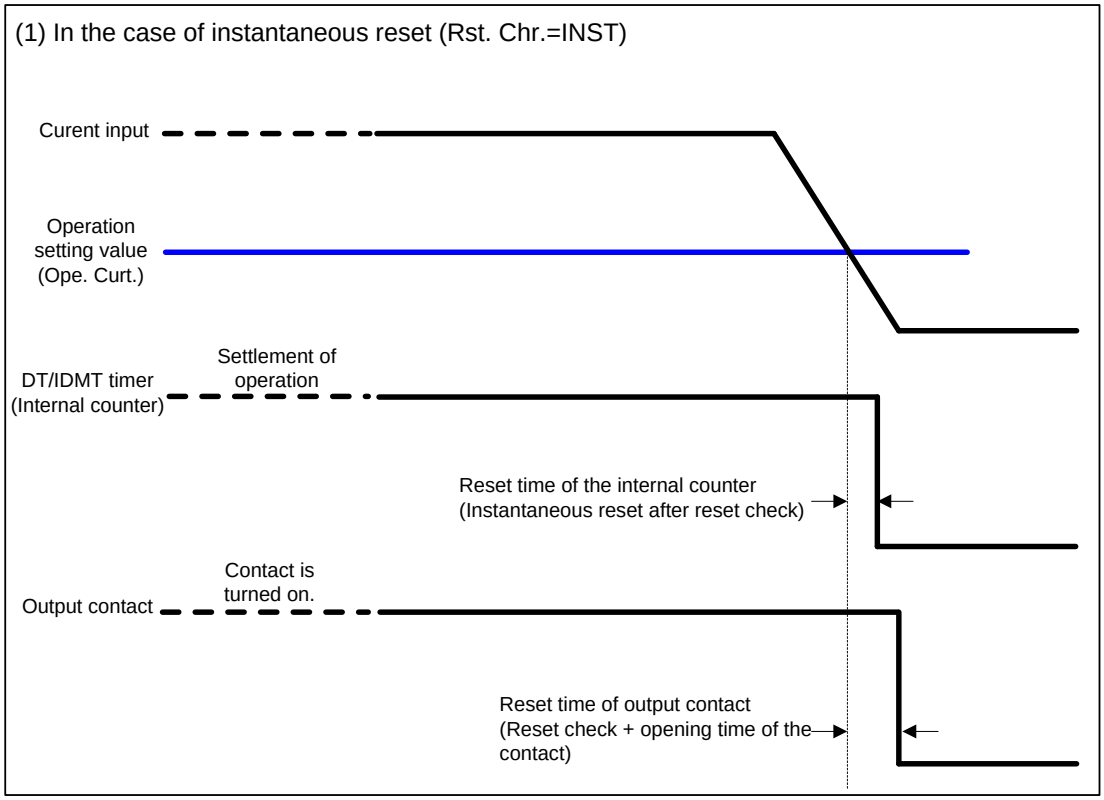
Fig. 3-7 Comparison of the operation between IEC Chr. EN = ON and IEC Chr. EN = OFF

3.1.7. Reset time characteristic

There are 3 types of resetting time characteristics associated with the OC4 element which can be selected.

- Instantaneous reset
- Definite time reset
- IDMT (Inverse definite minimum time) reset

These resetting characteristics are illustrated in Fig. 3-8 and Fig. 3-9 and to be selected in accordance with the customer's requirements.



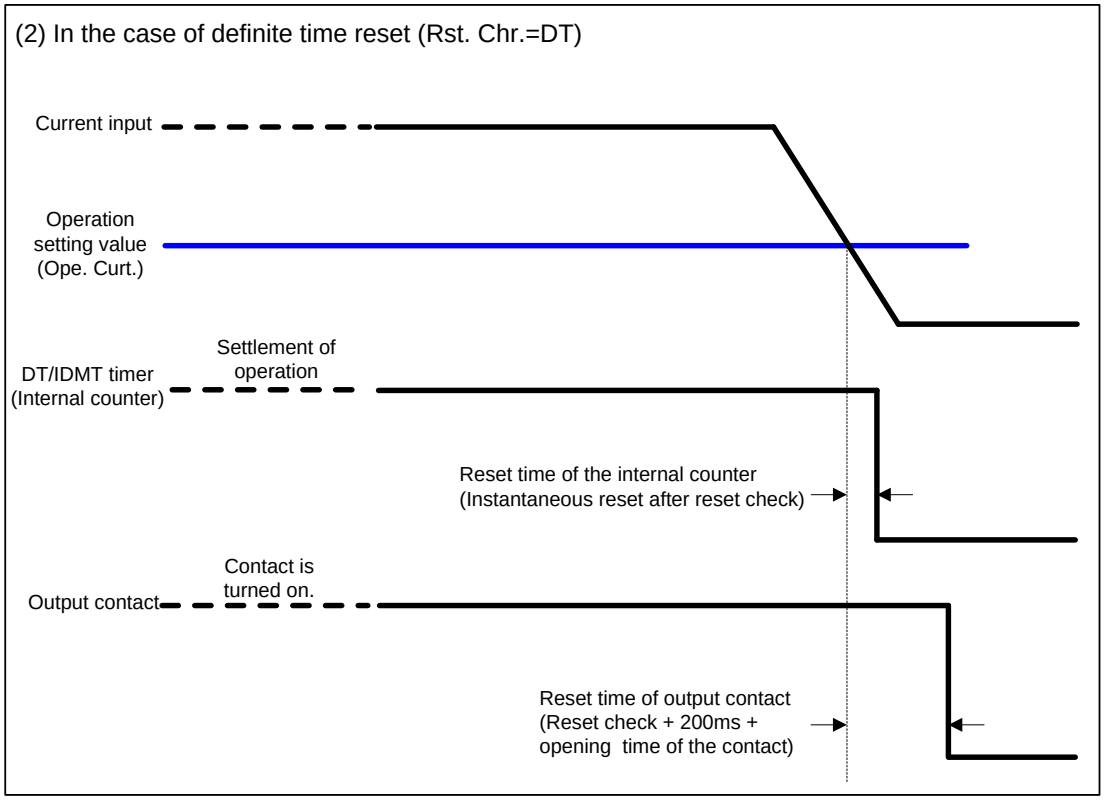


Fig. 3-8 Reset time characteristic (1)

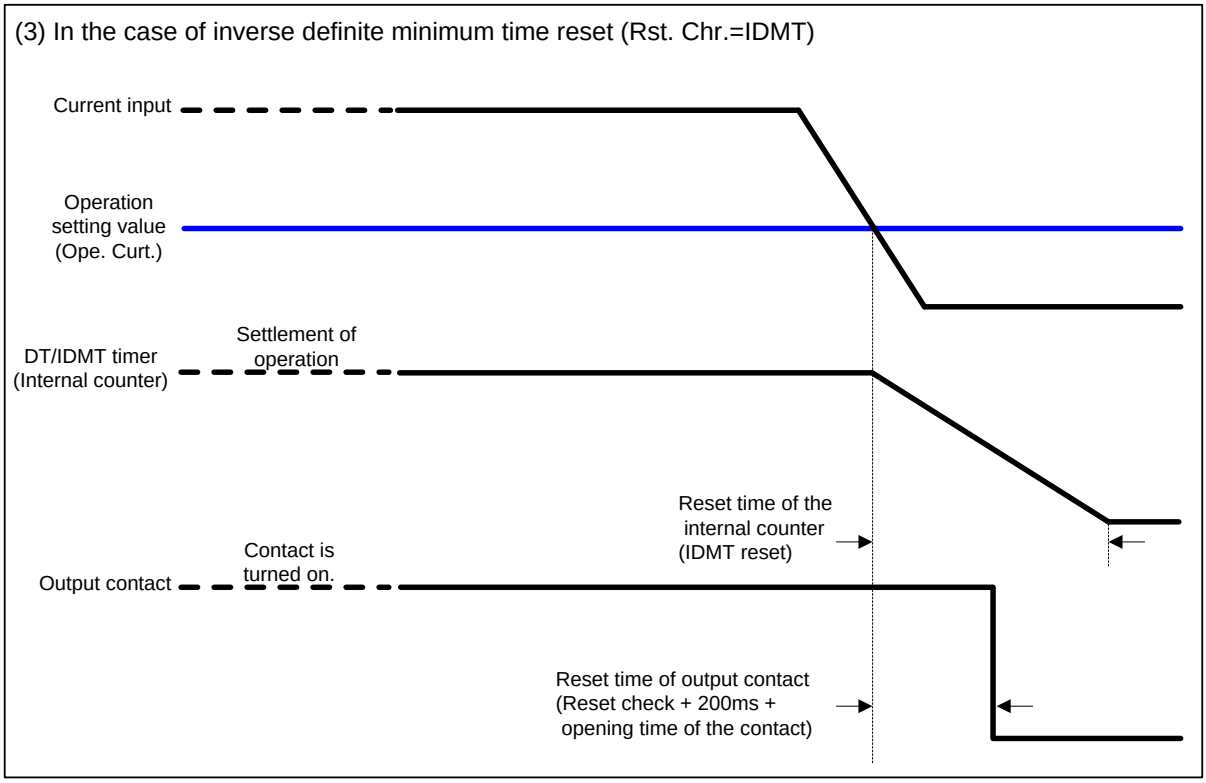


Fig. 3-9 Reset time characteristic (2)

For details in regard to Fig. 3-8, refer to sub-clause 3.1.8.

3.1.8. IDMT characteristic

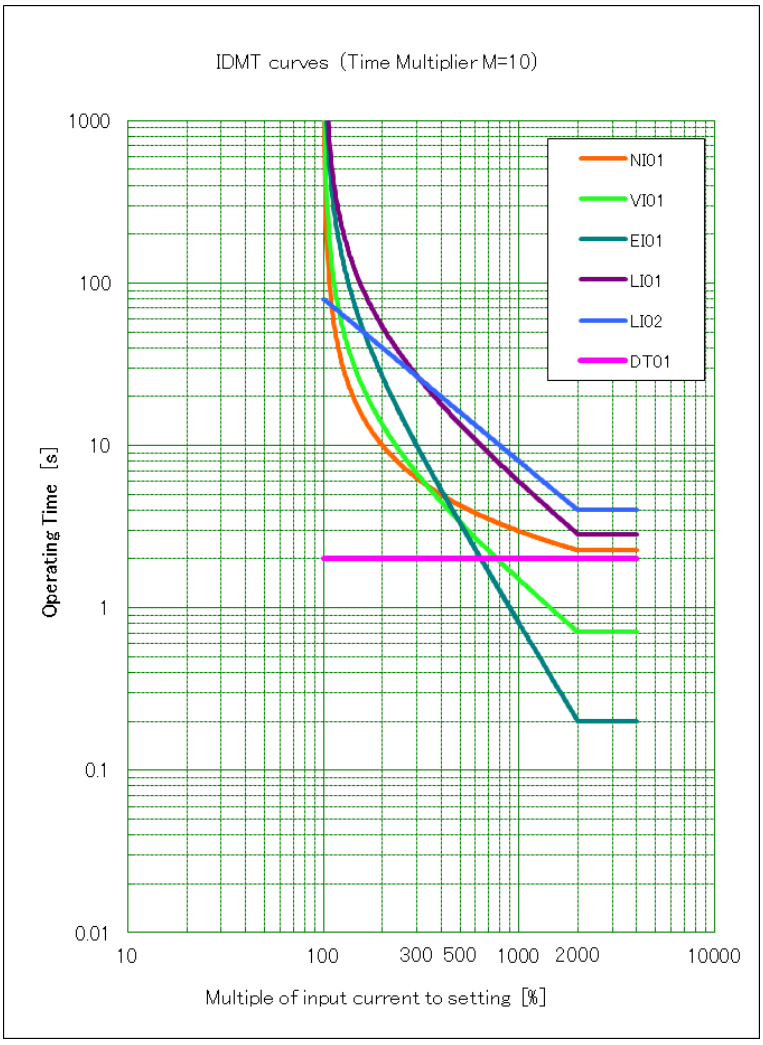
14 types of operating time characteristics and 3 types of reset time characteristics are provided in the OC4 element.

Operation time

$$t = \left\{ \left[\frac{k}{I^{\alpha} - 1} \right] + C \right\} \times \frac{M}{10}$$

Reset time

$$t = \left[\frac{8}{1 - I^{2}} \right] \times \frac{M}{10}$$



[1] IEC Normal Inverse (NI01)

$$t = \frac{0.14}{I^{0.02} - 1} \times \frac{M}{10}(s)$$

[2] IEC Very Inverse (VI01)

$$t = \frac{13.5}{I - 1} \times \frac{M}{10}(s)$$

[3] IEC Extremely Inverse (EI01)

$$t = \frac{80}{I^{2} - 1} \times \frac{M}{10}(s)$$

[4] Long Time Inverse (LI01)

$$t = \frac{54}{I - 1} \times \frac{M}{10}(s)$$

[5] Long Time Inverse (LI02)

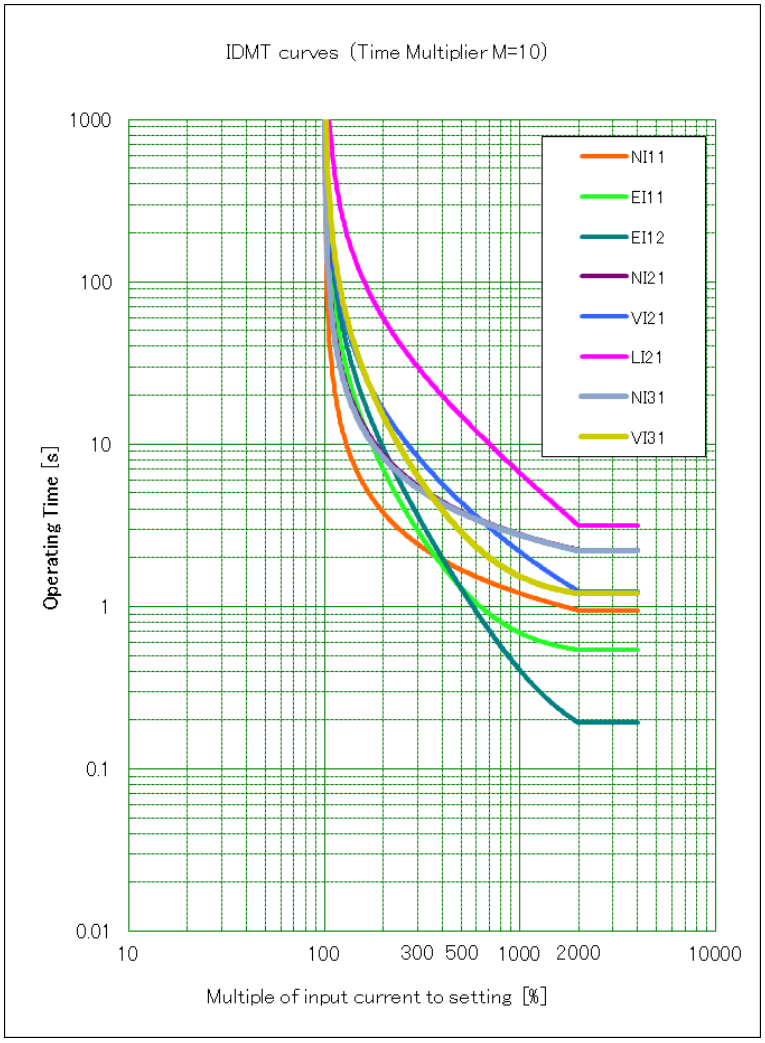
$$t = \frac{80}{I} \times \frac{M}{10}(s)$$

[6] Definite time characteristic (DT01)

$$t = 2 \times \frac{M}{10}(s)$$

t: Operating time (s)
I: Multiple of input current value to the setting value (times)
M: Operating time multiplier setting (times)

Fig. 3-10 Operating time characteristic (1)



[7] IEEE Moderately Inverse (NI11)

$$t = \left(\frac{0.0515}{I^{0.02} - 1} + 0.114 \right) \times \frac{M}{10} (s)$$

[8] IEEE Very Inverse (EI11)

$$t = \left(\frac{19.61}{I^{2} - 1} + 0.491 \right) \times \frac{M}{10} (s)$$

[9] IEEE Extremely Inverse (EI12)

$$t = \left(\frac{28.2}{I^{2} - 1} + 0.1217 \right) \times \frac{M}{10} (s)$$

[10] Normal Inverse (NI21)

$$t = \left(\frac{2.4}{I^{0.4} - 1} + 1.2 \right) \times \frac{M}{10} (s)$$

[11] Very Inverse (VI21)

$$t = \left(\frac{16}{I - 1} + 0.4 \right) \times \frac{M}{10} (s)$$

[12] Long Time Inverse (LI21)

$$t = \frac{60}{I - 1} \times \frac{M}{10} (s)$$

[13] Korean Normal Inverse (NI31)

$$t = \left(\frac{0.11}{I^{0.02} - 1} + 0.42 \right) \times \frac{M}{10} (s)$$

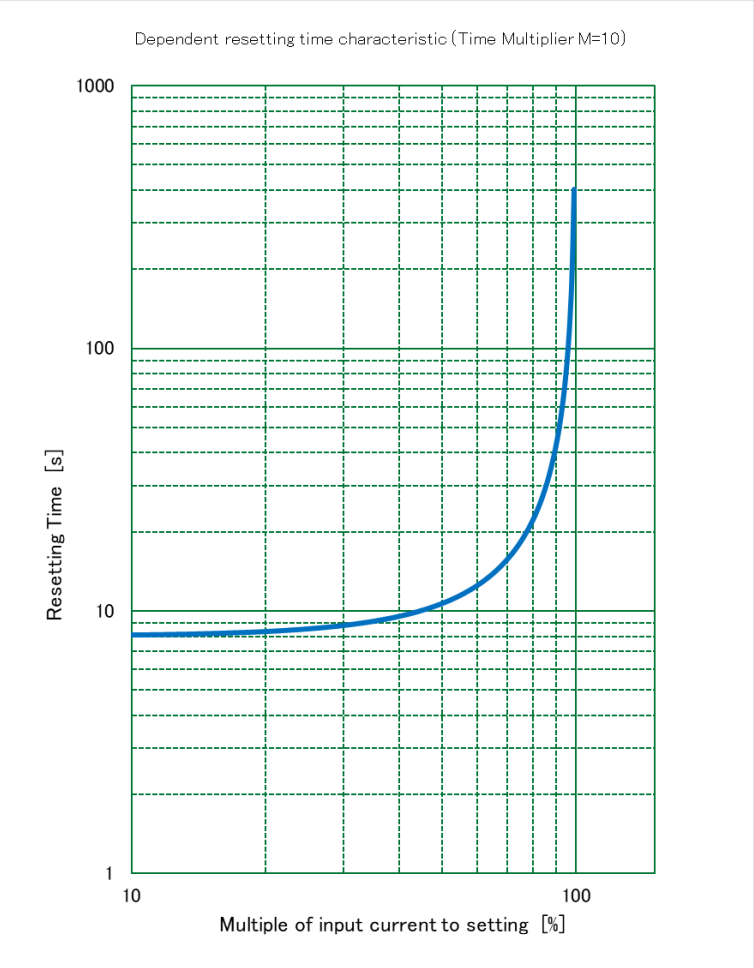
[14] Korean Very Inverse (VI31)

$$t = \left(\frac{39.85}{I^{1.95} - 1} + 1.084 \right) \times \frac{M}{10} (s)$$

t: Operating time (s)
I: Multiple of input current value to the setting value (times)
M: Operating time multiplier setting (times)

Fig. 3-11 Operating time characteristic (2)

Fig. 3-12 shows the dependent resetting time characteristic of the internal counter when the setting of OC4-Rst.Chr. = IDMT is selected.



$$t_r = \frac{8}{1-I^2} \times \frac{M}{10}(s)$$

t_r: Reset time (s)
I: Multiple of input current value to the setting value (times)
M: Reset time multiplier setting (times)

Fig. 3-12 Dependent reset time characteristic

*Note for the IDMT reset characteristic

Although the output contact resets at the definite time (0.2 s) after the input current is smaller than the operation setting value, the internal operation counter will be decreased by the IDMT characteristic which is similar to the reset characteristic of an induction disk type electromechanical overcurrent relay. This reset characteristic may be useful for intermittent overload detection at motor start-up and etc. For details, refer to sub-clause 3.1.7.

Table 3-6 IEC Normal inverse (NI01) Operating time accuracy table

Unit: s

Input value	300%		500%		1000%	
Operating time multiplier setting (M)	Accuracy (ε)	Theoretical operating time Operating time range	Accuracy (ε)	Theoretical operating time Operating time range	Accuracy (ε)	Theoretical operating time Operating time range
0.25	±0.100 (s)	0.158 0.058 ～ 0.258	±0.100 (s)	0.107 * 0.050 ～ 0.207	±0.100 (s)	0.074 * 0.050 ～ 0.174
0.5	±0.100 (s)	0.315 0.215 ～ 0.415	±0.100 (s)	0.214 0.114 ～ 0.314	±0.100 (s)	0.149 0.049 ～ 0.249
1	±0.100 (s)	0.630 0.530 ～ 0.730	±0.100 (s)	0.428 0.328 ～ 0.528	±0.100 (s)	0.297 0.197 ～ 0.397
1.5	±12.00 (%)	0.945 0.832 ～ 1.058	±0.100 (s)	0.642 0.542 ～ 0.742	±0.100 (s)	0.446 0.346 ～ 0.546
2	±12.00 (%)	1.260 1.109 ～ 1.411	±0.100 (s)	0.856 0.756 ～ 0.956	±0.100 (s)	0.594 0.494 ～ 0.694
2.5	±12.00 (%)	1.575 1.386 ～ 1.764	±0.100 (s)	1.070 0.970 ～ 1.170	±0.100 (s)	0.743 0.643 ～ 0.843
3	±12.00 (%)	1.891 1.665 ～ 2.117	±0.100 (s)	1.284 1.184 ～ 1.384	±0.100 (s)	0.891 0.791 ～ 0.991
3.5	±12.00 (%)	2.206 1.942 ～ 2.470	±7.00 (%)	1.498 1.394 ～ 1.602	±0.100 (s)	1.040 0.940 ～ 1.140
4	±12.00 (%)	2.521 2.219 ～ 2.823	±7.00 (%)	1.712 1.593 ～ 1.831	±0.100 (s)	1.188 1.088 ～ 1.288
4.5	±12.00 (%)	2.836 2.496 ～ 3.176	±7.00 (%)	1.926 1.792 ～ 2.060	±0.100 (s)	1.337 1.237 ～ 1.437
5	±12.00 (%)	3.151 2.773 ～ 3.529	±7.00 (%)	2.140 1.991 ～ 2.289	±0.100 (s)	1.485 1.385 ～ 1.585
6	±12.00 (%)	3.781 3.328 ～ 4.234	±7.00 (%)	2.568 2.389 ～ 2.747	±0.100 (s)	1.782 1.682 ～ 1.882
7	±12.00 (%)	4.411 3.882 ～ 4.940	±7.00 (%)	2.996 2.787 ～ 3.205	±5.00 (%)	2.079 1.976 ～ 2.182
8	±12.00 (%)	5.042 4.437 ～ 5.647	±7.00 (%)	3.424 3.185 ～ 3.663	±5.00 (%)	2.376 2.258 ～ 2.494
9	±12.00 (%)	5.672 4.992 ～ 6.352	±7.00 (%)	3.852 3.583 ～ 4.121	±5.00 (%)	2.674 2.541 ～ 2.807
10	±12.00 (%)	6.302 5.546 ～ 7.058	±7.00 (%)	4.280 3.981 ～ 4.579	±5.00 (%)	2.971 2.823 ～ 3.119
15	±12.00 (%)	9.453 8.319 ～ 10.587	±7.00 (%)	6.420 5.971 ～ 6.869	±5.00 (%)	4.456 4.234 ～ 4.678
20	±12.00 (%)	12.604 11.092 ～ 14.116	±7.00 (%)	8.559 7.960 ～ 9.158	±5.00 (%)	5.941 5.644 ～ 6.238
30	±12.00 (%)	18.906 16.638 ～ 21.174	±7.00 (%)	12.839 11.941 ～ 13.737	±5.00 (%)	8.912 8.467 ～ 9.357
40	±12.00 (%)	25.208 22.184 ～ 28.232	±7.00 (%)	17.119 15.921 ～ 18.317	±5.00 (%)	11.882 11.288 ～ 12.476
50	±12.00 (%)	31.510 27.729 ～ 35.291	±7.00 (%)	21.399 19.902 ～ 22.896	±5.00 (%)	14.853 14.111 ～ 15.595

Table 3-7 IEC Very inverse (VI01) Operating time accuracy table

Unit: s

Input value	300%		500%		1000%	
Operating time multiplier setting (M)	Accuracy (ε)	Theoretical operating time Operating time range	Accuracy (ε)	Theoretical operating time Operating time range	Accuracy (ε)	Theoretical operating time Operating time range
0.25	±0.100 (s)	0.169 0.069 ～ 0.269	±0.100 (s)	0.084 * 0.050 ～ 0.184	±0.100 (s)	0.038 * 0.050 ～ 0.138
0.5	±0.100 (s)	0.338 0.238 ～ 0.438	±0.100 (s)	0.169 0.069 ～ 0.269	±0.100 (s)	0.075 * 0.050 ～ 0.175
1	±0.100 (s)	0.675 0.575 ～ 0.775	±0.100 (s)	0.338 0.238 ～ 0.438	±0.100 (s)	0.150 0.050 ～ 0.250
1.5	±12.00 (%)	1.013 0.892 ～ 1.134	±0.100 (s)	0.506 0.406 ～ 0.606	±0.100 (s)	0.225 0.125 ～ 0.325
2	±12.00 (%)	1.350 1.188 ～ 1.512	±0.100 (s)	0.675 0.575 ～ 0.775	±0.100 (s)	0.300 0.200 ～ 0.400
2.5	±12.00 (%)	1.688 1.486 ～ 1.890	±0.100 (s)	0.844 0.744 ～ 0.944	±0.100 (s)	0.375 0.275 ～ 0.475
3	±12.00 (%)	2.025 1.782 ～ 2.268	±0.100 (s)	1.013 0.913 ～ 1.113	±0.100 (s)	0.450 0.350 ～ 0.550
3.5	±12.00 (%)	2.363 2.080 ～ 2.646	±0.100 (s)	1.181 1.081 ～ 1.281	±0.100 (s)	0.525 0.425 ～ 0.625
4	±12.00 (%)	2.700 2.376 ～ 3.024	±0.100 (s)	1.350 1.250 ～ 1.450	±0.100 (s)	0.600 0.500 ～ 0.700
4.5	±12.00 (%)	3.038 2.674 ～ 3.402	±7.00 (%)	1.519 1.413 ～ 1.625	±0.100 (s)	0.675 0.575 ～ 0.775
5	±12.00 (%)	3.375 2.970 ～ 3.780	±7.00 (%)	1.688 1.570 ～ 1.806	±0.100 (s)	0.750 0.650 ～ 0.850
6	±12.00 (%)	4.050 3.564 ～ 4.536	±7.00 (%)	2.025 1.884 ～ 2.166	±0.100 (s)	0.900 0.800 ～ 1.000
7	±12.00 (%)	4.725 4.158 ～ 5.292	±7.00 (%)	2.363 2.198 ～ 2.528	±0.100 (s)	1.050 0.950 ～ 1.150
8	±12.00 (%)	5.400 4.752 ～ 6.048	±7.00 (%)	2.700 2.511 ～ 2.889	±0.100 (s)	1.200 1.100 ～ 1.300
9	±12.00 (%)	6.075 5.346 ～ 6.804	±7.00 (%)	3.038 2.826 ～ 3.250	±0.100 (s)	1.350 1.250 ～ 1.450
10	±12.00 (%)	6.750 5.940 ～ 7.560	±7.00 (%)	3.375 3.139 ～ 3.611	±0.100 (s)	1.500 1.400 ～ 1.600
15	±12.00 (%)	10.125 8.910 ～ 11.340	±7.00 (%)	5.063 4.709 ～ 5.417	±5.00 (%)	2.250 2.138 ～ 2.362
20	±12.00 (%)	13.500 11.880 ～ 15.120	±7.00 (%)	6.750 6.278 ～ 7.222	±5.00 (%)	3.000 2.850 ～ 3.150
30	±12.00 (%)	20.250 17.820 ～ 22.680	±7.00 (%)	10.125 9.417 ～ 10.833	±5.00 (%)	4.500 4.275 ～ 4.725
40	±12.00 (%)	27.000 23.760 ～ 30.240	±7.00 (%)	13.500 12.555 ～ 14.445	±5.00 (%)	6.000 5.700 ～ 6.300
50	±12.00 (%)	33.750 29.700 ～ 37.800	±7.00 (%)	16.875 15.694 ～ 18.056	±5.00 (%)	7.500 7.125 ～ 7.875

Table 3-8 IEC Extremely inverse (EI01) Operating time accuracy table

Unit: s

Input value	300%		500%		1000%	
Operating time multiplier setting (M)	Accuracy (ε)	Theoretical operating time Operating time range	Accuracy (ε)	Theoretical operating time Operating time range	Accuracy (ε)	Theoretical operating time Operating time range
0.25	±0.100 (s)	0.250 0.150 ～ 0.350	±0.100 (s)	0.083 * 0.050 ～ 0.183	±0.100 (s)	0.020 * 0.050 ～ 0.120
0.5	±0.100 (s)	0.500 0.400 ～ 0.600	±0.100 (s)	0.167 0.067 ～ 0.267	±0.100 (s)	0.040 * 0.050 ～ 0.140
1	±12.00 (%)	1.000 0.880 ～ 1.120	±0.100 (s)	0.333 0.233 ～ 0.433	±0.100 (s)	0.081 * 0.050 ～ 0.181
1.5	±12.00 (%)	1.500 1.320 ～ 1.680	±0.100 (s)	0.500 0.400 ～ 0.600	±0.100 (s)	0.121 * 0.050 ～ 0.221
2	±12.00 (%)	2.000 1.760 ～ 2.240	±0.100 (s)	0.667 0.567 ～ 0.767	±0.100 (s)	0.162 0.062 ～ 0.262
2.5	±12.00 (%)	2.500 2.200 ～ 2.800	±0.100 (s)	0.833 0.733 ～ 0.933	±0.100 (s)	0.202 0.102 ～ 0.302
3	±12.00 (%)	3.000 2.640 ～ 3.360	±0.100 (s)	1.000 0.900 ～ 1.100	±0.100 (s)	0.242 0.142 ～ 0.342
3.5	±12.00 (%)	3.500 3.080 ～ 3.920	±0.100 (s)	1.167 1.067 ～ 1.267	±0.100 (s)	0.283 0.183 ～ 0.383
4	±12.00 (%)	4.000 3.520 ～ 4.480	±0.100 (s)	1.333 1.233 ～ 1.433	±0.100 (s)	0.323 0.223 ～ 0.423
4.5	±12.00 (%)	4.500 3.960 ～ 5.040	±7.00 (%)	1.500 1.395 ～ 1.605	±0.100 (s)	0.364 0.264 ～ 0.464
5	±12.00 (%)	5.000 4.400 ～ 5.600	±7.00 (%)	1.667 1.551 ～ 1.783	±0.100 (s)	0.404 0.304 ～ 0.504
6	±12.00 (%)	6.000 5.280 ～ 6.720	±7.00 (%)	2.000 1.860 ～ 2.140	±0.100 (s)	0.485 0.385 ～ 0.585
7	±12.00 (%)	7.000 6.160 ～ 7.840	±7.00 (%)	2.333 2.170 ～ 2.496	±0.100 (s)	0.566 0.466 ～ 0.666
8	±12.00 (%)	8.000 7.040 ～ 8.960	±7.00 (%)	2.667 2.481 ～ 2.853	±0.100 (s)	0.646 0.546 ～ 0.746
9	±12.00 (%)	9.000 7.920 ～ 10.080	±7.00 (%)	3.000 2.790 ～ 3.210	±0.100 (s)	0.727 0.627 ～ 0.827
10	±12.00 (%)	10.000 8.800 ～ 11.200	±7.00 (%)	3.333 3.100 ～ 3.566	±0.100 (s)	0.808 0.708 ～ 0.908
15	±12.00 (%)	15.000 13.200 ～ 16.800	±7.00 (%)	5.000 4.650 ～ 5.350	±0.100 (s)	1.212 1.112 ～ 1.312
20	±12.00 (%)	20.000 17.600 ～ 22.400	±7.00 (%)	6.667 6.201 ～ 7.133	±0.100 (s)	1.616 1.516 ～ 1.716
30	±12.00 (%)	30.000 26.400 ～ 33.600	±7.00 (%)	10.000 9.300 ～ 10.700	±5.00 (%)	2.424 2.303 ～ 2.545
40	±12.00 (%)	40.000 35.200 ～ 44.800	±7.00 (%)	13.333 12.400 ～ 14.266	±5.00 (%)	3.232 3.071 ～ 3.393
50	±12.00 (%)	50.000 44.000 ～ 56.000	±7.00 (%)	16.667 15.501 ～ 17.833	±5.00 (%)	4.040 3.838 ～ 4.242

Table 3-9 Long inverse (LI01) Operating time accuracy table

Unit: s

Input value	300%		500%		1000%	
Operating time multiplier setting (M)	Accuracy (ε)	Theoretical operating time Operating time range	Accuracy (ε)	Theoretical operating time Operating time range	Accuracy (ε)	Theoretical operating time Operating time range
0.25	±0.100 (s)	0.675 0.575 ～ 0.775	±0.100 (s)	0.338 0.238 ～ 0.438	±0.100 (s)	0.150 0.050 ～ 0.250
0.5	±12.00 (%)	1.350 1.188 ～ 1.512	±0.100 (s)	0.675 0.575 ～ 0.775	±0.100 (s)	0.300 0.200 ～ 0.400
1	±12.00 (%)	2.700 2.376 ～ 3.024	±0.100 (s)	1.350 1.250 ～ 1.450	±0.100 (s)	0.600 0.500 ～ 0.700
1.5	±12.00 (%)	4.050 3.564 ～ 4.536	±7.00 (%)	2.025 1.884 ～ 2.166	±0.100 (s)	0.900 0.800 ～ 1.000
2	±12.00 (%)	5.400 4.752 ～ 6.048	±7.00 (%)	2.700 2.511 ～ 2.889	±0.100 (s)	1.200 1.100 ～ 1.300
2.5	±12.00 (%)	6.750 5.940 ～ 7.560	±7.00 (%)	3.375 3.139 ～ 3.611	±0.100 (s)	1.500 1.400 ～ 1.600
3	±12.00 (%)	8.100 7.128 ～ 9.072	±7.00 (%)	4.050 3.767 ～ 4.333	±0.100 (s)	1.800 1.700 ～ 1.900
3.5	±12.00 (%)	9.450 8.316 ～ 10.584	±7.00 (%)	4.725 4.395 ～ 5.055	±5.00 (%)	2.100 1.995 ～ 2.205
4	±12.00 (%)	10.800 9.504 ～ 12.096	±7.00 (%)	5.400 5.022 ～ 5.778	±5.00 (%)	2.400 2.280 ～ 2.520
4.5	±12.00 (%)	12.150 10.692 ～ 13.608	±7.00 (%)	6.075 5.650 ～ 6.500	±5.00 (%)	2.700 2.565 ～ 2.835
5	±12.00 (%)	13.500 11.880 ～ 15.120	±7.00 (%)	6.750 6.278 ～ 7.222	±5.00 (%)	3.000 2.850 ～ 3.150
6	±12.00 (%)	16.200 14.256 ～ 18.144	±7.00 (%)	8.100 7.533 ～ 8.667	±5.00 (%)	3.600 3.420 ～ 3.780
7	±12.00 (%)	18.900 16.632 ～ 21.168	±7.00 (%)	9.450 8.789 ～ 10.111	±5.00 (%)	4.200 3.990 ～ 4.410
8	±12.00 (%)	21.600 19.008 ～ 24.192	±7.00 (%)	10.800 10.044 ～ 11.556	±5.00 (%)	4.800 4.560 ～ 5.040
9	±12.00 (%)	24.300 21.384 ～ 27.216	±7.00 (%)	12.150 11.300 ～ 13.000	±5.00 (%)	5.400 5.130 ～ 5.670
10	±12.00 (%)	27.000 23.760 ～ 30.240	±7.00 (%)	13.500 12.555 ～ 14.445	±5.00 (%)	6.000 5.700 ～ 6.300
15	±12.00 (%)	40.500 35.640 ～ 45.360	±7.00 (%)	20.250 18.833 ～ 21.667	±5.00 (%)	9.000 8.550 ～ 9.450
20	±12.00 (%)	54.000 47.520 ～ 60.480	±7.00 (%)	27.000 25.110 ～ 28.890	±5.00 (%)	12.000 11.400 ～ 12.600
30	±12.00 (%)	81.000 71.280 ～ 90.720	±7.00 (%)	40.500 37.665 ～ 43.335	±5.00 (%)	18.000 17.100 ～ 18.900
40	±12.00 (%)	108.000 95.040 ～ 120.960	±7.00 (%)	54.000 50.220 ～ 57.780	±5.00 (%)	24.000 22.800 ～ 25.200
50	±12.00 (%)	135.000 118.800 ～ 151.200	±7.00 (%)	67.500 62.775 ～ 72.225	±5.00 (%)	30.000 28.500 ～ 31.500

Table 3-10 Long inverse (LI02) Operating time accuracy table

Unit: s

Input value	300%		500%		1000%	
Operating time multiplier setting (M)	Accuracy (ε)	Theoretical operating time Operating time range	Accuracy (ε)	Theoretical operating time Operating time range	Accuracy (ε)	Theoretical operating time Operating time range
0.25	±0.100 (s)	0.667 0.567 ～ 0.767	±0.100 (s)	0.400 0.300 ～ 0.500	±0.100 (s)	0.200 0.100 ～ 0.300
0.5	±12.00 (%)	1.333 1.174 ～ 1.492	±0.100 (s)	0.800 0.700 ～ 0.900	±0.100 (s)	0.400 0.300 ～ 0.500
1	±12.00 (%)	2.667 2.347 ～ 2.987	±7.00 (%)	1.600 1.488 ～ 1.712	±0.100 (s)	0.800 0.700 ～ 0.900
1.5	±12.00 (%)	4.000 3.520 ～ 4.480	±7.00 (%)	2.400 2.232 ～ 2.568	±0.100 (s)	1.200 1.100 ～ 1.300
2	±12.00 (%)	5.333 4.694 ～ 5.972	±7.00 (%)	3.200 2.976 ～ 3.424	±0.100 (s)	1.600 1.500 ～ 1.700
2.5	±12.00 (%)	6.667 5.867 ～ 7.467	±7.00 (%)	4.000 3.720 ～ 4.280	±0.100 (s)	2.000 1.900 ～ 2.100
3	±12.00 (%)	8.000 7.040 ～ 8.960	±7.00 (%)	4.800 4.464 ～ 5.136	±5.00 (%)	2.400 2.280 ～ 2.520
3.5	±12.00 (%)	9.333 8.214 ～ 10.452	±7.00 (%)	5.600 5.208 ～ 5.992	±5.00 (%)	2.800 2.660 ～ 2.940
4	±12.00 (%)	10.667 9.387 ～ 11.947	±7.00 (%)	6.400 5.952 ～ 6.848	±5.00 (%)	3.200 3.040 ～ 3.360
4.5	±12.00 (%)	12.000 10.560 ～ 13.440	±7.00 (%)	7.200 6.696 ～ 7.704	±5.00 (%)	3.600 3.420 ～ 3.780
5	±12.00 (%)	13.333 11.734 ～ 14.932	±7.00 (%)	8.000 7.440 ～ 8.560	±5.00 (%)	4.000 3.800 ～ 4.200
6	±12.00 (%)	16.000 14.080 ～ 17.920	±7.00 (%)	9.600 8.928 ～ 10.272	±5.00 (%)	4.800 4.560 ～ 5.040
7	±12.00 (%)	18.667 16.427 ～ 20.907	±7.00 (%)	11.200 10.416 ～ 11.984	±5.00 (%)	5.600 5.320 ～ 5.880
8	±12.00 (%)	21.333 18.774 ～ 23.892	±7.00 (%)	12.800 11.904 ～ 13.696	±5.00 (%)	6.400 6.080 ～ 6.720
9	±12.00 (%)	24.000 21.120 ～ 26.880	±7.00 (%)	14.400 13.392 ～ 15.408	±5.00 (%)	7.200 6.840 ～ 7.560
10	±12.00 (%)	26.667 23.467 ～ 29.867	±7.00 (%)	16.000 14.880 ～ 17.120	±5.00 (%)	8.000 7.600 ～ 8.400
15	±12.00 (%)	40.000 35.200 ～ 44.800	±7.00 (%)	24.000 22.320 ～ 25.680	±5.00 (%)	12.000 11.400 ～ 12.600
20	±12.00 (%)	53.333 46.934 ～ 59.732	±7.00 (%)	32.000 29.760 ～ 34.240	±5.00 (%)	16.000 15.200 ～ 16.800
30	±12.00 (%)	80.000 70.400 ～ 89.600	±7.00 (%)	48.000 44.640 ～ 51.360	±5.00 (%)	24.000 22.800 ～ 25.200
40	±12.00 (%)	106.667 93.867 ～ 119.467	±7.00 (%)	64.000 59.520 ～ 68.480	±5.00 (%)	32.000 30.400 ～ 33.600
50	±12.00 (%)	133.333 117.334 ～ 149.332	±7.00 (%)	80.000 74.400 ～ 85.600	±5.00 (%)	40.000 38.000 ～ 42.000

Table 3-11 Definite time (DT01) Operating time accuracy table

Unit: s

Input value	300%		500%		1000%	
Operating time multiplier setting (M)	Accuracy (ε)	Theoretical operating time Operating time range	Accuracy (ε)	Theoretical operating time Operating time range	Accuracy (ε)	Theoretical operating time Operating time range
0.25	±0.050 (s)	0.050 * 0.050 ～ 0.100	±0.050 (s)	0.050 * 0.050 ～ 0.100	±0.050 (s)	0.050 * 0.050 ～ 0.100
0.5	±0.050 (s)	0.100 0.050 ～ 0.150	±0.050 (s)	0.100 0.050 ～ 0.150	±0.050 (s)	0.100 0.050 ～ 0.150
1	±0.050 (s)	0.200 0.150 ～ 0.250	±0.050 (s)	0.200 0.150 ～ 0.250	±0.050 (s)	0.200 0.150 ～ 0.250
1.5	±0.050 (s)	0.300 0.250 ～ 0.350	±0.050 (s)	0.300 0.250 ～ 0.350	±0.050 (s)	0.300 0.250 ～ 0.350
2	±0.050 (s)	0.400 0.350 ～ 0.450	±0.050 (s)	0.400 0.350 ～ 0.450	±0.050 (s)	0.400 0.350 ～ 0.450
2.5	±0.050 (s)	0.500 0.450 ～ 0.550	±0.050 (s)	0.500 0.450 ～ 0.550	±0.050 (s)	0.500 0.450 ～ 0.550
3	±0.050 (s)	0.600 0.550 ～ 0.650	±0.050 (s)	0.600 0.550 ～ 0.650	±0.050 (s)	0.600 0.550 ～ 0.650
3.5	±0.050 (s)	0.700 0.650 ～ 0.750	±0.050 (s)	0.700 0.650 ～ 0.750	±0.050 (s)	0.700 0.650 ～ 0.750
4	±0.050 (s)	0.800 0.750 ～ 0.850	±0.050 (s)	0.800 0.750 ～ 0.850	±0.050 (s)	0.800 0.750 ～ 0.850
4.5	±0.050 (s)	0.900 0.850 ～ 0.950	±0.050 (s)	0.900 0.850 ～ 0.950	±0.050 (s)	0.900 0.850 ～ 0.950
5	±5.00 (%)	1.000 0.950 ～ 1.050	±5.00 (%)	1.000 0.950 ～ 1.050	±5.00 (%)	1.000 0.950 ～ 1.050
6	±5.00 (%)	1.200 1.140 ～ 1.260	±5.00 (%)	1.200 1.140 ～ 1.260	±5.00 (%)	1.200 1.140 ～ 1.260
7	±5.00 (%)	1.400 1.330 ～ 1.470	±5.00 (%)	1.400 1.330 ～ 1.470	±5.00 (%)	1.400 1.330 ～ 1.470
8	±5.00 (%)	1.600 1.520 ～ 1.680	±5.00 (%)	1.600 1.520 ～ 1.680	±5.00 (%)	1.600 1.520 ～ 1.680
9	±5.00 (%)	1.800 1.710 ～ 1.890	±5.00 (%)	1.800 1.710 ～ 1.890	±5.00 (%)	1.800 1.710 ～ 1.890
10	±5.00 (%)	2.000 1.900 ～ 2.100	±5.00 (%)	2.000 1.900 ～ 2.100	±5.00 (%)	2.000 1.900 ～ 2.100
15	±5.00 (%)	3.000 2.850 ～ 3.150	±5.00 (%)	3.000 2.850 ～ 3.150	±5.00 (%)	3.000 2.850 ～ 3.150
20	±5.00 (%)	4.000 3.800 ～ 4.200	±5.00 (%)	4.000 3.800 ～ 4.200	±5.00 (%)	4.000 3.800 ～ 4.200
30	±5.00 (%)	6.000 5.700 ～ 6.300	±5.00 (%)	6.000 5.700 ～ 6.300	±5.00 (%)	6.000 5.700 ～ 6.300
40	±5.00 (%)	8.000 7.600 ～ 8.400	±5.00 (%)	8.000 7.600 ～ 8.400	±5.00 (%)	8.000 7.600 ～ 8.400
50	±5.00 (%)	10.000 9.500 ～ 10.500	±5.00 (%)	10.000 9.500 ～ 10.500	±5.00 (%)	10.000 9.500 ～ 10.500

Table 3-12 IEEE Moderate inverse (NI11) Operating time accuracy table

Unit: s

Input value	300%		500%		1000%	
Operating time multiplier setting (M)	Accuracy (ε)	Theoretical operating time Operating time range	Accuracy (ε)	Theoretical operating time Operating time range	Accuracy (ε)	Theoretical operating time Operating time range
0.25	±0.100 (s)	0.061 * 0.050 ～ 0.161	±0.100 (s)	0.042 * 0.050 ～ 0.142	±0.100 (s)	0.030 * 0.050 ～ 0.130
0.5	±0.100 (s)	0.122 * 0.050 ～ 0.222	±0.100 (s)	0.084 * 0.050 ～ 0.184	±0.100 (s)	0.060 * 0.050 ～ 0.160
1	±0.100 (s)	0.243 0.143 ～ 0.343	±0.100 (s)	0.169 0.069 ～ 0.269	±0.100 (s)	0.121 * 0.050 ～ 0.221
1.5	±0.100 (s)	0.365 0.265 ～ 0.465	±0.100 (s)	0.253 0.153 ～ 0.353	±0.100 (s)	0.181 0.081 ～ 0.281
2	±0.100 (s)	0.486 0.386 ～ 0.586	±0.100 (s)	0.338 0.238 ～ 0.438	±0.100 (s)	0.241 0.141 ～ 0.341
2.5	±0.100 (s)	0.608 0.508 ～ 0.708	±0.100 (s)	0.422 0.322 ～ 0.522	±0.100 (s)	0.302 0.202 ～ 0.402
3	±0.100 (s)	0.730 0.630 ～ 0.830	±0.100 (s)	0.506 0.406 ～ 0.606	±0.100 (s)	0.362 0.262 ～ 0.462
3.5	±12.00 (%)	0.851 0.749 ～ 0.953	±0.100 (s)	0.591 0.491 ～ 0.691	±0.100 (s)	0.422 0.322 ～ 0.522
4	±12.00 (%)	0.973 0.857 ～ 1.089	±0.100 (s)	0.675 0.575 ～ 0.775	±0.100 (s)	0.483 0.383 ～ 0.583
4.5	±12.00 (%)	1.094 0.963 ～ 1.225	±0.100 (s)	0.760 0.660 ～ 0.860	±0.100 (s)	0.543 0.443 ～ 0.643
5	±12.00 (%)	1.216 1.071 ～ 1.361	±0.100 (s)	0.844 0.744 ～ 0.944	±0.100 (s)	0.603 0.503 ～ 0.703
6	±12.00 (%)	1.459 1.284 ～ 1.634	±0.100 (s)	1.013 0.913 ～ 1.113	±0.100 (s)	0.724 0.624 ～ 0.824
7	±12.00 (%)	1.703 1.499 ～ 1.907	±0.100 (s)	1.182 1.082 ～ 1.282	±0.100 (s)	0.845 0.745 ～ 0.945
8	±12.00 (%)	1.946 1.713 ～ 2.179	±0.100 (s)	1.351 1.251 ～ 1.451	±0.100 (s)	0.965 0.865 ～ 1.065
9	±12.00 (%)	2.189 1.927 ～ 2.451	±7.00 (%)	1.519 1.413 ～ 1.625	±0.100 (s)	1.086 0.986 ～ 1.186
10	±12.00 (%)	2.432 2.141 ～ 2.723	±7.00 (%)	1.688 1.570 ～ 1.806	±0.100 (s)	1.207 1.107 ～ 1.307
15	±12.00 (%)	3.648 3.211 ～ 4.085	±7.00 (%)	2.532 2.355 ～ 2.709	±0.100 (s)	1.810 1.710 ～ 1.910
20	±12.00 (%)	4.864 4.281 ～ 5.447	±7.00 (%)	3.377 3.141 ～ 3.613	±5.00 (%)	2.414 2.294 ～ 2.534
30	±12.00 (%)	7.297 6.422 ～ 8.172	±7.00 (%)	5.065 4.711 ～ 5.419	±5.00 (%)	3.620 3.439 ～ 3.801
40	±12.00 (%)	9.729 8.562 ～ 10.896	±7.00 (%)	6.753 6.281 ～ 7.225	±5.00 (%)	4.827 4.586 ～ 5.068
50	±12.00 (%)	12.161 10.702 ～ 13.620	±7.00 (%)	8.442 7.852 ～ 9.032	±5.00 (%)	6.034 5.733 ～ 6.335

Table 3-13 IEEE Very inverse (EI11) Operating time accuracy table

Unit: s

Input value	300%		500%		1000%	
Operating time multiplier setting (M)	Accuracy (ε)	Theoretical operating time Operating time range	Accuracy (ε)	Theoretical operating time Operating time range	Accuracy (ε)	Theoretical operating time Operating time range
0.25	±0.100 (s)	0.074 * 0.050 ～ 0.174	±0.100 (s)	0.033 * 0.050 ～ 0.133	±0.100 (s)	0.017 * 0.050 ～ 0.117
0.5	±0.100 (s)	0.147 0.047 ～ 0.247	±0.100 (s)	0.065 * 0.050 ～ 0.165	±0.100 (s)	0.034 * 0.050 ～ 0.134
1	±0.100 (s)	0.294 0.194 ～ 0.394	±0.100 (s)	0.131 * 0.050 ～ 0.231	±0.100 (s)	0.069 * 0.050 ～ 0.169
1.5	±0.100 (s)	0.441 0.341 ～ 0.541	±0.100 (s)	0.196 0.096 ～ 0.296	±0.100 (s)	0.103 * 0.050 ～ 0.203
2	±0.100 (s)	0.588 0.488 ～ 0.688	±0.100 (s)	0.262 0.162 ～ 0.362	±0.100 (s)	0.138 * 0.050 ～ 0.238
2.5	±0.100 (s)	0.736 0.636 ～ 0.836	±0.100 (s)	0.327 0.227 ～ 0.427	±0.100 (s)	0.172 0.072 ～ 0.272
3	±12.00 (%)	0.883 0.778 ～ 0.988	±0.100 (s)	0.392 0.292 ～ 0.492	±0.100 (s)	0.207 0.107 ～ 0.307
3.5	±12.00 (%)	1.030 0.907 ～ 1.153	±0.100 (s)	0.458 0.358 ～ 0.558	±0.100 (s)	0.241 0.141 ～ 0.341
4	±12.00 (%)	1.177 1.036 ～ 1.318	±0.100 (s)	0.523 0.423 ～ 0.623	±0.100 (s)	0.276 0.176 ～ 0.376
4.5	±12.00 (%)	1.324 1.166 ～ 1.482	±0.100 (s)	0.589 0.489 ～ 0.689	±0.100 (s)	0.310 0.210 ～ 0.410
5	±12.00 (%)	1.471 1.295 ～ 1.647	±0.100 (s)	0.654 0.554 ～ 0.754	±0.100 (s)	0.345 0.245 ～ 0.445
6	±12.00 (%)	1.765 1.554 ～ 1.976	±0.100 (s)	0.785 0.685 ～ 0.885	±0.100 (s)	0.413 0.313 ～ 0.513
7	±12.00 (%)	2.060 1.813 ～ 2.307	±0.100 (s)	0.916 0.816 ～ 1.016	±0.100 (s)	0.482 0.382 ～ 0.582
8	±12.00 (%)	2.354 2.072 ～ 2.636	±0.100 (s)	1.046 0.946 ～ 1.146	±0.100 (s)	0.551 0.451 ～ 0.651
9	±12.00 (%)	2.648 2.331 ～ 2.965	±0.100 (s)	1.177 1.077 ～ 1.277	±0.100 (s)	0.620 0.520 ～ 0.720
10	±12.00 (%)	2.942 2.589 ～ 3.295	±0.100 (s)	1.308 1.208 ～ 1.408	±0.100 (s)	0.689 0.589 ～ 0.789
15	±12.00 (%)	4.413 3.884 ～ 4.942	±7.00 (%)	1.962 1.825 ～ 2.099	±0.100 (s)	1.034 0.934 ～ 1.134
20	±12.00 (%)	5.885 5.179 ～ 6.591	±7.00 (%)	2.616 2.433 ～ 2.799	±0.100 (s)	1.378 1.278 ～ 1.478
30	±12.00 (%)	8.827 7.768 ～ 9.886	±7.00 (%)	3.924 3.650 ～ 4.198	±5.00 (%)	2.067 1.964 ～ 2.170
40	±12.00 (%)	11.769 10.357 ～ 13.181	±7.00 (%)	5.232 4.866 ～ 5.598	±5.00 (%)	2.756 2.619 ～ 2.893
50	±12.00 (%)	14.711 12.946 ～ 16.476	±7.00 (%)	6.540 6.083 ～ 6.997	±5.00 (%)	3.445 3.273 ～ 3.617

Table 3-14 IEEE Extremely inverse (EI12) Operating time accuracy table

Unit: s

Input value	300%		500%		1000%	
Operating time multiplier setting (M)	Accuracy (ε)	Theoretical operating time Operating time range	Accuracy (ε)	Theoretical operating time Operating time range	Accuracy (ε)	Theoretical operating time Operating time range
0.25	±0.100 (s)	0.091 * 0.050 ～ 0.191	±0.100 (s)	0.032 * 0.050 ～ 0.132	±0.100 (s)	0.010 * 0.050 ～ 0.110
0.5	±0.100 (s)	0.182 0.082 ～ 0.282	±0.100 (s)	0.065 * 0.050 ～ 0.165	±0.100 (s)	0.020 * 0.050 ～ 0.120
1	±0.100 (s)	0.365 0.265 ～ 0.465	±0.100 (s)	0.130 * 0.050 ～ 0.230	±0.100 (s)	0.041 * 0.050 ～ 0.141
1.5	±0.100 (s)	0.547 0.447 ～ 0.647	±0.100 (s)	0.195 0.095 ～ 0.295	±0.100 (s)	0.061 * 0.050 ～ 0.161
2	±0.100 (s)	0.729 0.629 ～ 0.829	±0.100 (s)	0.259 0.159 ～ 0.359	±0.100 (s)	0.081 * 0.050 ～ 0.181
2.5	±12.00 (%)	0.912 0.803 ～ 1.021	±0.100 (s)	0.324 0.224 ～ 0.424	±0.100 (s)	0.102 * 0.050 ～ 0.202
3	±12.00 (%)	1.094 0.963 ～ 1.225	±0.100 (s)	0.389 0.289 ～ 0.489	±0.100 (s)	0.122 * 0.050 ～ 0.222
3.5	±12.00 (%)	1.276 1.123 ～ 1.429	±0.100 (s)	0.454 0.354 ～ 0.554	±0.100 (s)	0.142 0.042 ～ 0.242
4	±12.00 (%)	1.459 1.284 ～ 1.634	±0.100 (s)	0.519 0.419 ～ 0.619	±0.100 (s)	0.163 0.063 ～ 0.263
4.5	±12.00 (%)	1.641 1.445 ～ 1.837	±0.100 (s)	0.584 0.484 ～ 0.684	±0.100 (s)	0.183 0.083 ～ 0.283
5	±12.00 (%)	1.823 1.605 ～ 2.041	±0.100 (s)	0.648 0.548 ～ 0.748	±0.100 (s)	0.203 0.103 ～ 0.303
6	±12.00 (%)	2.188 1.926 ～ 2.450	±0.100 (s)	0.778 0.678 ～ 0.878	±0.100 (s)	0.244 0.144 ～ 0.344
7	±12.00 (%)	2.553 2.247 ～ 2.859	±0.100 (s)	0.908 0.808 ～ 1.008	±0.100 (s)	0.285 0.185 ～ 0.385
8	±12.00 (%)	2.917 2.567 ～ 3.267	±0.100 (s)	1.037 0.937 ～ 1.137	±0.100 (s)	0.325 0.225 ～ 0.425
9	±12.00 (%)	3.282 2.889 ～ 3.675	±0.100 (s)	1.167 1.067 ～ 1.267	±0.100 (s)	0.366 0.266 ～ 0.466
10	±12.00 (%)	3.647 3.210 ～ 4.084	±0.100 (s)	1.297 1.197 ～ 1.397	±0.100 (s)	0.407 0.307 ～ 0.507
15	±12.00 (%)	5.470 4.814 ～ 6.126	±7.00 (%)	1.945 1.809 ～ 2.081	±0.100 (s)	0.610 0.510 ～ 0.710
20	±12.00 (%)	7.293 6.418 ～ 8.168	±7.00 (%)	2.593 2.412 ～ 2.774	±0.100 (s)	0.813 0.713 ～ 0.913
30	±12.00 (%)	10.940 9.628 ～ 12.252	±7.00 (%)	3.890 3.618 ～ 4.162	±0.100 (s)	1.220 1.120 ～ 1.320
40	±12.00 (%)	14.587 12.837 ～ 16.337	±7.00 (%)	5.187 4.824 ～ 5.550	±0.100 (s)	1.626 1.526 ～ 1.726
50	±12.00 (%)	18.234 16.046 ～ 20.422	±7.00 (%)	6.484 6.031 ～ 6.937	±5.00 (%)	2.033 1.932 ～ 2.134

Table 3-15 Normal inverse (NI21) Operating time accuracy table

Unit: s

Input value	300%		500%		1000%	
Operating time multiplier setting (M)	Accuracy (ε)	Theoretical operating time Operating time range	Accuracy (ε)	Theoretical operating time Operating time range	Accuracy (ε)	Theoretical operating time Operating time range
0.25	±0.100 (s)	0.139 * 0.050 ～ 0.239	±0.100 (s)	0.096 * 0.050 ～ 0.196	±0.100 (s)	0.070 * 0.050 ～ 0.170
0.5	±0.100 (s)	0.277 0.177 ～ 0.377	±0.100 (s)	0.193 0.093 ～ 0.293	±0.100 (s)	0.139 * 0.050 ～ 0.239
1	±0.100 (s)	0.555 0.455 ～ 0.655	±0.100 (s)	0.386 0.286 ～ 0.486	±0.100 (s)	0.279 0.179 ～ 0.379
1.5	±0.100 (s)	0.832 0.732 ～ 0.932	±0.100 (s)	0.578 0.478 ～ 0.678	±0.100 (s)	0.418 0.318 ～ 0.518
2	±12.00 (%)	1.110 0.977 ～ 1.243	±0.100 (s)	0.771 0.671 ～ 0.871	±0.100 (s)	0.557 0.457 ～ 0.657
2.5	±12.00 (%)	1.387 1.221 ～ 1.553	±0.100 (s)	0.964 0.864 ～ 1.064	±0.100 (s)	0.697 0.597 ～ 0.797
3	±12.00 (%)	1.665 1.466 ～ 1.864	±0.100 (s)	1.157 1.057 ～ 1.257	±0.100 (s)	0.836 0.736 ～ 0.936
3.5	±12.00 (%)	1.942 1.709 ～ 2.175	±0.100 (s)	1.350 1.250 ～ 1.450	±0.100 (s)	0.976 0.876 ～ 1.076
4	±12.00 (%)	2.220 1.954 ～ 2.486	±7.00 (%)	1.542 1.435 ～ 1.649	±0.100 (s)	1.115 1.015 ～ 1.215
4.5	±12.00 (%)	2.497 2.198 ～ 2.796	±7.00 (%)	1.735 1.614 ～ 1.856	±0.100 (s)	1.254 1.154 ～ 1.354
5	±12.00 (%)	2.775 2.442 ～ 3.108	±7.00 (%)	1.928 1.794 ～ 2.062	±0.100 (s)	1.394 1.294 ～ 1.494
6	±12.00 (%)	3.329 2.930 ～ 3.728	±7.00 (%)	2.314 2.153 ～ 2.475	±0.100 (s)	1.672 1.572 ～ 1.772
7	±12.00 (%)	3.884 3.418 ～ 4.350	±7.00 (%)	2.699 2.511 ～ 2.887	±0.100 (s)	1.951 1.851 ～ 2.051
8	±12.00 (%)	4.439 3.907 ～ 4.971	±7.00 (%)	3.085 2.870 ～ 3.300	±5.00 (%)	2.230 2.119 ～ 2.341
9	±12.00 (%)	4.994 4.395 ～ 5.593	±7.00 (%)	3.470 3.228 ～ 3.712	±5.00 (%)	2.509 2.384 ～ 2.634
10	±12.00 (%)	5.549 4.884 ～ 6.214	±7.00 (%)	3.856 3.587 ～ 4.125	±5.00 (%)	2.787 2.648 ～ 2.926
15	±12.00 (%)	8.324 7.326 ～ 9.322	±7.00 (%)	5.784 5.380 ～ 6.188	±5.00 (%)	4.181 3.972 ～ 4.390
20	±12.00 (%)	11.098 9.767 ～ 12.429	±7.00 (%)	7.712 7.173 ～ 8.251	±5.00 (%)	5.575 5.297 ～ 5.853
30	±12.00 (%)	16.647 14.650 ～ 18.644	±7.00 (%)	11.568 10.759 ～ 12.377	±5.00 (%)	8.362 7.944 ～ 8.780
40	±12.00 (%)	22.196 19.533 ～ 24.859	±7.00 (%)	15.424 14.345 ～ 16.503	±5.00 (%)	11.150 10.593 ～ 11.707
50	±12.00 (%)	27.745 24.416 ～ 31.074	±7.00 (%)	19.279 17.930 ～ 20.628	±5.00 (%)	13.937 13.241 ～ 14.633

Table 3-16 Very inverse (VI21) Operating time accuracy table

Unit: s

Input value	300%		500%		1000%	
Operating time multiplier setting (M)	Accuracy (ε)	Theoretical operating time Operating time range	Accuracy (ε)	Theoretical operating time Operating time range	Accuracy (ε)	Theoretical operating time Operating time range
0.25	±0.100 (s)	0.210 0.110 ～ 0.310	±0.100 (s)	0.110 * 0.050 ～ 0.210	±0.100 (s)	0.054 * 0.050 ～ 0.154
0.5	±0.100 (s)	0.420 0.320 ～ 0.520	±0.100 (s)	0.220 0.120 ～ 0.320	±0.100 (s)	0.109 * 0.050 ～ 0.209
1	±0.100 (s)	0.840 0.740 ～ 0.940	±0.100 (s)	0.440 0.340 ～ 0.540	±0.100 (s)	0.218 0.118 ～ 0.318
1.5	±12.00 (%)	1.260 1.109 ～ 1.411	±0.100 (s)	0.660 0.560 ～ 0.760	±0.100 (s)	0.327 0.227 ～ 0.427
2	±12.00 (%)	1.680 1.479 ～ 1.881	±0.100 (s)	0.880 0.780 ～ 0.980	±0.100 (s)	0.436 0.336 ～ 0.536
2.5	±12.00 (%)	2.100 1.848 ～ 2.352	±0.100 (s)	1.100 1.000 ～ 1.200	±0.100 (s)	0.544 0.444 ～ 0.644
3	±12.00 (%)	2.520 2.218 ～ 2.822	±0.100 (s)	1.320 1.220 ～ 1.420	±0.100 (s)	0.653 0.553 ～ 0.753
3.5	±12.00 (%)	2.940 2.588 ～ 3.292	±7.00 (%)	1.540 1.433 ～ 1.647	±0.100 (s)	0.762 0.662 ～ 0.862
4	±12.00 (%)	3.360 2.957 ～ 3.763	±7.00 (%)	1.760 1.637 ～ 1.883	±0.100 (s)	0.871 0.771 ～ 0.971
4.5	±12.00 (%)	3.780 3.327 ～ 4.233	±7.00 (%)	1.980 1.842 ～ 2.118	±0.100 (s)	0.980 0.880 ～ 1.080
5	±12.00 (%)	4.200 3.696 ～ 4.704	±7.00 (%)	2.200 2.046 ～ 2.354	±0.100 (s)	1.089 0.989 ～ 1.189
6	±12.00 (%)	5.040 4.436 ～ 5.644	±7.00 (%)	2.640 2.456 ～ 2.824	±0.100 (s)	1.307 1.207 ～ 1.407
7	±12.00 (%)	5.880 5.175 ～ 6.585	±7.00 (%)	3.080 2.865 ～ 3.295	±0.100 (s)	1.524 1.424 ～ 1.624
8	±12.00 (%)	6.720 5.914 ～ 7.526	±7.00 (%)	3.520 3.274 ～ 3.766	±0.100 (s)	1.742 1.642 ～ 1.842
9	±12.00 (%)	7.560 6.653 ～ 8.467	±7.00 (%)	3.960 3.683 ～ 4.237	±0.100 (s)	1.960 1.860 ～ 2.060
10	±12.00 (%)	8.400 7.392 ～ 9.408	±7.00 (%)	4.400 4.092 ～ 4.708	±5.00 (%)	2.178 2.070 ～ 2.286
15	±12.00 (%)	12.600 11.088 ～ 14.112	±7.00 (%)	6.600 6.138 ～ 7.062	±5.00 (%)	3.267 3.104 ～ 3.430
20	±12.00 (%)	16.800 14.784 ～ 18.816	±7.00 (%)	8.800 8.184 ～ 9.416	±5.00 (%)	4.356 4.139 ～ 4.573
30	±12.00 (%)	25.200 22.176 ～ 28.224	±7.00 (%)	13.200 12.276 ～ 14.124	±5.00 (%)	6.533 6.207 ～ 6.859
40	±12.00 (%)	33.600 29.568 ～ 37.632	±7.00 (%)	17.600 16.368 ～ 18.832	±5.00 (%)	8.711 8.276 ～ 9.146
50	±12.00 (%)	42.000 36.960 ～ 47.040	±7.00 (%)	22.000 20.460 ～ 23.540	±5.00 (%)	10.889 10.345 ～ 11.433

Table 3-17 Long inverse (LI21) Operating time accuracy table

Unit: s

Input value	300%		500%		1000%	
Operating time multiplier setting (M)	Accuracy (ε)	Theoretical operating time Operating time range	Accuracy (ε)	Theoretical operating time Operating time range	Accuracy (ε)	Theoretical operating time Operating time range
0.25	±0.100 (s)	0.750 0.650 ～ 0.850	±0.100 (s)	0.375 0.275 ～ 0.475	±0.100 (s)	0.167 0.067 ～ 0.267
0.5	±12.00 (%)	1.500 1.320 ～ 1.680	±0.100 (s)	0.750 0.650 ～ 0.850	±0.100 (s)	0.333 0.233 ～ 0.433
1	±12.00 (%)	3.000 2.640 ～ 3.360	±7.00 (%)	1.500 1.395 ～ 1.605	±0.100 (s)	0.667 0.567 ～ 0.767
1.5	±12.00 (%)	4.500 3.960 ～ 5.040	±7.00 (%)	2.250 2.093 ～ 2.407	±0.100 (s)	1.000 0.900 ～ 1.100
2	±12.00 (%)	6.000 5.280 ～ 6.720	±7.00 (%)	3.000 2.790 ～ 3.210	±0.100 (s)	1.333 1.233 ～ 1.433
2.5	±12.00 (%)	7.500 6.600 ～ 8.400	±7.00 (%)	3.750 3.488 ～ 4.012	±0.100 (s)	1.667 1.567 ～ 1.767
3	±12.00 (%)	9.000 7.920 ～ 10.080	±7.00 (%)	4.500 4.185 ～ 4.815	±0.100 (s)	2.000 1.900 ～ 2.100
3.5	±12.00 (%)	10.500 9.240 ～ 11.760	±7.00 (%)	5.250 4.883 ～ 5.617	±5.00 (%)	2.333 2.217 ～ 2.449
4	±12.00 (%)	12.000 10.560 ～ 13.440	±7.00 (%)	6.000 5.580 ～ 6.420	±5.00 (%)	2.667 2.534 ～ 2.800
4.5	±12.00 (%)	13.500 11.880 ～ 15.120	±7.00 (%)	6.750 6.278 ～ 7.222	±5.00 (%)	3.000 2.850 ～ 3.150
5	±12.00 (%)	15.000 13.200 ～ 16.800	±7.00 (%)	7.500 6.975 ～ 8.025	±5.00 (%)	3.333 3.167 ～ 3.499
6	±12.00 (%)	18.000 15.840 ～ 20.160	±7.00 (%)	9.000 8.370 ～ 9.630	±5.00 (%)	4.000 3.800 ～ 4.200
7	±12.00 (%)	21.000 18.480 ～ 23.520	±7.00 (%)	10.500 9.765 ～ 11.235	±5.00 (%)	4.667 4.434 ～ 4.900
8	±12.00 (%)	24.000 21.120 ～ 26.880	±7.00 (%)	12.000 11.160 ～ 12.840	±5.00 (%)	5.333 5.067 ～ 5.599
9	±12.00 (%)	27.000 23.760 ～ 30.240	±7.00 (%)	13.500 12.555 ～ 14.445	±5.00 (%)	6.000 5.700 ～ 6.300
10	±12.00 (%)	30.000 26.400 ～ 33.600	±7.00 (%)	15.000 13.950 ～ 16.050	±5.00 (%)	6.667 6.334 ～ 7.000
15	±12.00 (%)	45.000 39.600 ～ 50.400	±7.00 (%)	22.500 20.925 ～ 24.075	±5.00 (%)	10.000 9.500 ～ 10.500
20	±12.00 (%)	60.000 52.800 ～ 67.200	±7.00 (%)	30.000 27.900 ～ 32.100	±5.00 (%)	13.333 12.667 ～ 13.999
30	±12.00 (%)	90.000 79.200 ～ 100.800	±7.00 (%)	45.000 41.850 ～ 48.150	±5.00 (%)	20.000 19.000 ～ 21.000
40	±12.00 (%)	120.000 105.600 ～ 134.400	±7.00 (%)	60.000 55.800 ～ 64.200	±5.00 (%)	26.667 25.334 ～ 28.000
50	±12.00 (%)	150.000 132.000 ～ 168.000	±7.00 (%)	75.000 69.750 ～ 80.250	±5.00 (%)	33.333 31.667 ～ 34.999

Table 3-18 Korean Normal inverse (NI31) Operating time accuracy table

Unit: s

Input value	300%		500%		1000%	
Operating time multiplier setting (M)	Accuracy (ε)	Theoretical operating time Operating time range	Accuracy (ε)	Theoretical operating time Operating time range	Accuracy (ε)	Theoretical operating time Operating time range
0.25	±0.100 (s)	0.134 * 0.050 ~ 0.234	±0.100 (s)	0.095 * 0.050 ~ 0.195	±0.100 (s)	0.069 * 0.050 ~ 0.169
0.5	±0.100 (s)	0.269 0.169 ~ 0.369	±0.100 (s)	0.189 0.089 ~ 0.289	±0.100 (s)	0.138 * 0.050 ~ 0.238
1	±0.100 (s)	0.537 0.437 ~ 0.637	±0.100 (s)	0.378 0.278 ~ 0.478	±0.100 (s)	0.275 0.175 ~ 0.375
1.5	±0.100 (s)	0.806 0.706 ~ 0.906	±0.100 (s)	0.567 0.467 ~ 0.667	±0.100 (s)	0.413 0.313 ~ 0.513
2	±12.00 (%)	1.074 0.946 ~ 1.202	±0.100 (s)	0.757 0.657 ~ 0.857	±0.100 (s)	0.551 0.451 ~ 0.651
2.5	±12.00 (%)	1.343 1.182 ~ 1.504	±0.100 (s)	0.946 0.846 ~ 1.046	±0.100 (s)	0.689 0.589 ~ 0.789
3	±12.00 (%)	1.611 1.418 ~ 1.804	±0.100 (s)	1.135 1.035 ~ 1.235	±0.100 (s)	0.826 0.726 ~ 0.926
3.5	±12.00 (%)	1.880 1.655 ~ 2.105	±0.100 (s)	1.324 1.224 ~ 1.424	±0.100 (s)	0.964 0.864 ~ 1.064
4	±12.00 (%)	2.149 1.892 ~ 2.406	±7.00 (%)	1.513 1.408 ~ 1.618	±0.100 (s)	1.102 1.002 ~ 1.202
4.5	±12.00 (%)	2.417 2.127 ~ 2.707	±7.00 (%)	1.702 1.583 ~ 1.821	±0.100 (s)	1.239 1.139 ~ 1.339
5	±12.00 (%)	2.686 2.364 ~ 3.008	±7.00 (%)	1.891 1.759 ~ 2.023	±0.100 (s)	1.377 1.277 ~ 1.477
6	±12.00 (%)	3.223 2.837 ~ 3.609	±7.00 (%)	2.270 2.112 ~ 2.428	±0.100 (s)	1.652 1.552 ~ 1.752
7	±12.00 (%)	3.760 3.309 ~ 4.211	±7.00 (%)	2.648 2.463 ~ 2.833	±0.100 (s)	1.928 1.828 ~ 2.028
8	±12.00 (%)	4.297 3.782 ~ 4.812	±7.00 (%)	3.026 2.815 ~ 3.237	±5.00 (%)	2.203 2.093 ~ 2.313
9	±12.00 (%)	4.834 4.254 ~ 5.414	±7.00 (%)	3.404 3.166 ~ 3.642	±5.00 (%)	2.479 2.356 ~ 2.602
10	±12.00 (%)	5.372 4.728 ~ 6.016	±7.00 (%)	3.783 3.519 ~ 4.047	±5.00 (%)	2.754 2.617 ~ 2.891
15	±12.00 (%)	8.057 7.091 ~ 9.023	±7.00 (%)	5.674 5.277 ~ 6.071	±5.00 (%)	4.131 3.925 ~ 4.337
20	±12.00 (%)	10.743 9.454 ~ 12.032	±7.00 (%)	7.565 7.036 ~ 8.094	±5.00 (%)	5.508 5.233 ~ 5.783
30	±12.00 (%)	16.115 14.182 ~ 18.048	±7.00 (%)	11.348 10.554 ~ 12.142	±5.00 (%)	8.262 7.849 ~ 8.675
40	±12.00 (%)	21.486 18.908 ~ 24.064	±7.00 (%)	15.131 14.072 ~ 16.190	±5.00 (%)	11.016 10.466 ~ 11.566
50	±12.00 (%)	26.858 23.636 ~ 30.080	±7.00 (%)	18.913 17.590 ~ 20.236	±5.00 (%)	13.770 13.082 ~ 14.458

Table 3-19 Korean Very inverse (VI31) Operating time accuracy table

Unit: s

Input value	300%		500%		1000%	
Operating time multiplier setting (M)	Accuracy (ε)	Theoretical operating time Operating time range	Accuracy (ε)	Theoretical operating time Operating time range	Accuracy (ε)	Theoretical operating time Operating time range
0.25	±0.100 (s)	0.160 0.060 ~ 0.260	±0.100 (s)	0.072 * 0.050 ~ 0.172	±0.100 (s)	0.038 * 0.050 ~ 0.138
0.5	±0.100 (s)	0.319 0.219 ~ 0.419	±0.100 (s)	0.144 0.044 ~ 0.244	±0.100 (s)	0.077 * 0.050 ~ 0.177
1	±0.100 (s)	0.638 0.538 ~ 0.738	±0.100 (s)	0.289 0.189 ~ 0.389	±0.100 (s)	0.154 0.054 ~ 0.254
1.5	±12.00 (%)	0.958 0.844 ~ 1.072	±0.100 (s)	0.433 0.333 ~ 0.533	±0.100 (s)	0.230 0.130 ~ 0.330
2	±12.00 (%)	1.277 1.124 ~ 1.430	±0.100 (s)	0.578 0.478 ~ 0.678	±0.100 (s)	0.307 0.207 ~ 0.407
2.5	±12.00 (%)	1.596 1.405 ~ 1.787	±0.100 (s)	0.722 0.622 ~ 0.822	±0.100 (s)	0.384 0.284 ~ 0.484
3	±12.00 (%)	1.915 1.686 ~ 2.144	±0.100 (s)	0.867 0.767 ~ 0.967	±0.100 (s)	0.461 0.361 ~ 0.561
3.5	±12.00 (%)	2.234 1.966 ~ 2.502	±0.100 (s)	1.011 0.911 ~ 1.111	±0.100 (s)	0.538 0.438 ~ 0.638
4	±12.00 (%)	2.554 2.248 ~ 2.860	±0.100 (s)	1.156 1.056 ~ 1.256	±0.100 (s)	0.614 0.514 ~ 0.714
4.5	±12.00 (%)	2.873 2.529 ~ 3.217	±0.100 (s)	1.300 1.200 ~ 1.400	±0.100 (s)	0.691 0.591 ~ 0.791
5	±12.00 (%)	3.192 2.809 ~ 3.575	±7.00 (%)	1.445 1.344 ~ 1.546	±0.100 (s)	0.768 0.668 ~ 0.868
6	±12.00 (%)	3.830 3.371 ~ 4.289	±7.00 (%)	1.734 1.613 ~ 1.855	±0.100 (s)	0.922 0.822 ~ 1.022
7	±12.00 (%)	4.469 3.933 ~ 5.005	±7.00 (%)	2.023 1.882 ~ 2.164	±0.100 (s)	1.075 0.975 ~ 1.175
8	±12.00 (%)	5.107 4.495 ~ 5.719	±7.00 (%)	2.312 2.151 ~ 2.473	±0.100 (s)	1.229 1.129 ~ 1.329
9	±12.00 (%)	5.746 5.057 ~ 6.435	±7.00 (%)	2.601 2.419 ~ 2.783	±0.100 (s)	1.383 1.283 ~ 1.483
10	±12.00 (%)	6.384 5.618 ~ 7.150	±7.00 (%)	2.890 2.688 ~ 3.092	±0.100 (s)	1.536 1.436 ~ 1.636
15	±12.00 (%)	9.576 8.427 ~ 10.725	±7.00 (%)	4.335 4.032 ~ 4.638	±5.00 (%)	2.304 2.189 ~ 2.419
20	±12.00 (%)	12.768 11.236 ~ 14.300	±7.00 (%)	5.780 5.376 ~ 6.184	±5.00 (%)	3.072 2.919 ~ 3.225
30	±12.00 (%)	19.152 16.854 ~ 21.450	±7.00 (%)	8.670 8.064 ~ 9.276	±5.00 (%)	4.609 4.379 ~ 4.839
40	±12.00 (%)	25.536 22.472 ~ 28.600	±7.00 (%)	11.559 10.750 ~ 12.368	±5.00 (%)	6.145 5.838 ~ 6.452
50	±12.00 (%)	31.920 28.090 ~ 35.750	±7.00 (%)	14.449 13.438 ~ 15.460	±5.00 (%)	7.681 7.297 ~ 8.065

Table 3-20 Reset time characteristic

Input: Setting value × 300% → 0

Reset time setting (Rst. Chr.)	Output contact	Reset time of internal timer counter
IDMT: Definite time (200 ms)	200 ms ± 25 ms	Instant
DT: Definite time	200 ms ± 25 ms	About 8 s
INST: Instant (50 ms)	50 ms or less	Instant

◆How to read the operating time accuracy table

* “300%, 500%, and 1000%” which are listed in the table are a multiple to be applied to the current setting value, respectively.
* The upper row shows the theoretical operating time, and the lower row shows the operating time range with accuracy added (The operating time range can be calculated from the below equation).

Operating time range
$\varepsilon = \dfrac{T_M - \dfrac{M}{10} \times T_{10}}{\dfrac{M}{10} \times T_{10}}$

Where,

T_{10} : Nominal operating time at reference operating time setting (M=10)
T_M : Operating time range at the operating time multiplier setting M
ε : Accuracy (%)
M : Operating time multiplier setting

Note: that if the operating time range which has been calculated from the above equation is smaller than the lower limits of ±100ms, accuracy are taken as ±100ms. However, in case of definite time characteristic (DT01), the accuracy lower limit is set to ±50ms.

* The underlined 50 ms marked with * in the tables is a fixed time, as the minimum operating time.

3.2. Ground (Earth) fault Overcurrent Element

This relay incorporates the 4 stages of the ground (earth) fault overcurrent elements which enable rapid detection of ground-faults. And it provides a variety of operations & reset time characteristics as same as the overcurrent elements in Fig. 3-2. Therefore, the relay can be applied to protect various systems. Second harmonic restraint is included and this can prevent unnecessary operation due to transformer magnetizing inrush current.

ANSI Device No.	Display name	Protective function
50N(50G)	OCN1(OCG1)	Instantaneous ground fault overcurrent element
	OCN2(OCG2) OCN3(OCG3)	Instantaneous ground fault overcurrent element (two-stage) with 2nd harmonic restraint
51N(51G)	OCN4(OCG4)	Definite time or IDMT ground fault overcurrent element with second harmonic restraint. ● Selection of 14 operating time characteristics ● Selection of 3 reset characteristics

3.2.1. OCG1 Element (Ground fault Overcurrent Element)

As this element has no 2nd harmonic restraint function, it is possible to achieve high-speed operation for large fault currents.
Fig. 3-13 shows the internal function blocks of the element.

The OCG1 element outputs a definitive signal after a preset time of the operation timer (Ope. Time) has passed, when zero-phase current is greater than or equal to the operation setting value (Ope. Curt.).
An off-delay timer of 200 ms is added in order to prevent chattering of the output contacts.
Furthermore, this element outputs the definitive signal only when the Use/Non-use setting of OCG1 element (OCG1 EN) is ON. Therefore, when this element is not used, unnecessary operation can be prevented by setting to OFF. It is not necessary to adjust any other settings with regard to the OCG1 element.

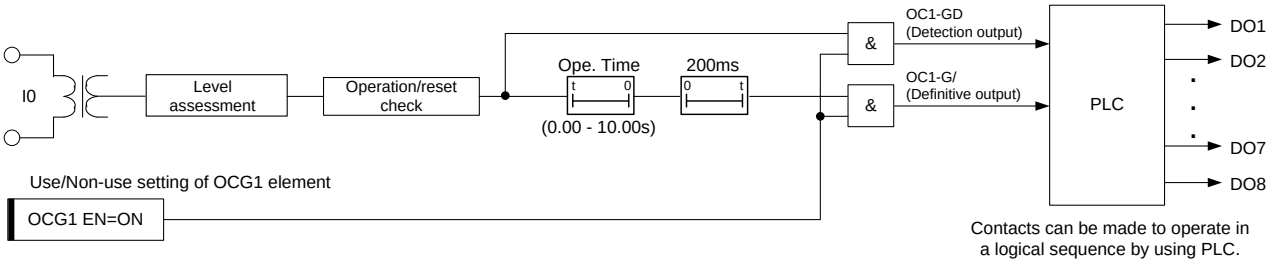


Fig. 3-13 Internal function block diagram of OCG1 element

Table 3-21 Setting items of OCG1 element

Display name	Setting parameter	Setting		Description
		Range of setting	step	
OCG1	OCG1 EN	OFF, ON	-	OFF: Non-use, ON: Use When this element is used, set to ON.
	Ope. Curt.	1.0 ~ 100.0 mA (ZCT type) 0.1 ~ 100.0 A (I0 = 5 A type)	0.5 mA 0.1 A	Operating current
	Ope. Time	0.00 ~ 10.00 s	0.01 s	Operating time INST: ≤ 30 ms

3.2.2. OCG2 Element (Ground fault Overcurrent Element with 2nd harmonic restraint)

This is the definite time ground-fault element with selectable second harmonic restraint.
Second harmonic restraint function can prevent unnecessary operation due to transformer magnetizing inrush current. Fig. 3-14 shows the internal function blocks of the element.

The OCG2 element outputs a definitive signal after a preset time of the operation timer (Ope. Time) has passed, when the zero-phase current is greater than or equal to the operation setting value (Ope. Curt.), and when 2nd harmonic restraint is not operated.

When the 2nd harmonic restraint function is not used (2f-lock EN=OFF), it is not linked to the operation of the OCG2 element.

An off-delay timer of 200 ms is added in order to prevent chattering of the output contacts.

This element outputs the definitive signal only when the setting of Use/Non-use of OCG2 element (OCG2 EN) is ON. Therefore, when this element is not used, unnecessary operation can be prevented by setting it to OFF. It is not necessary to adjust any other settings with regard to the OCG2 element.

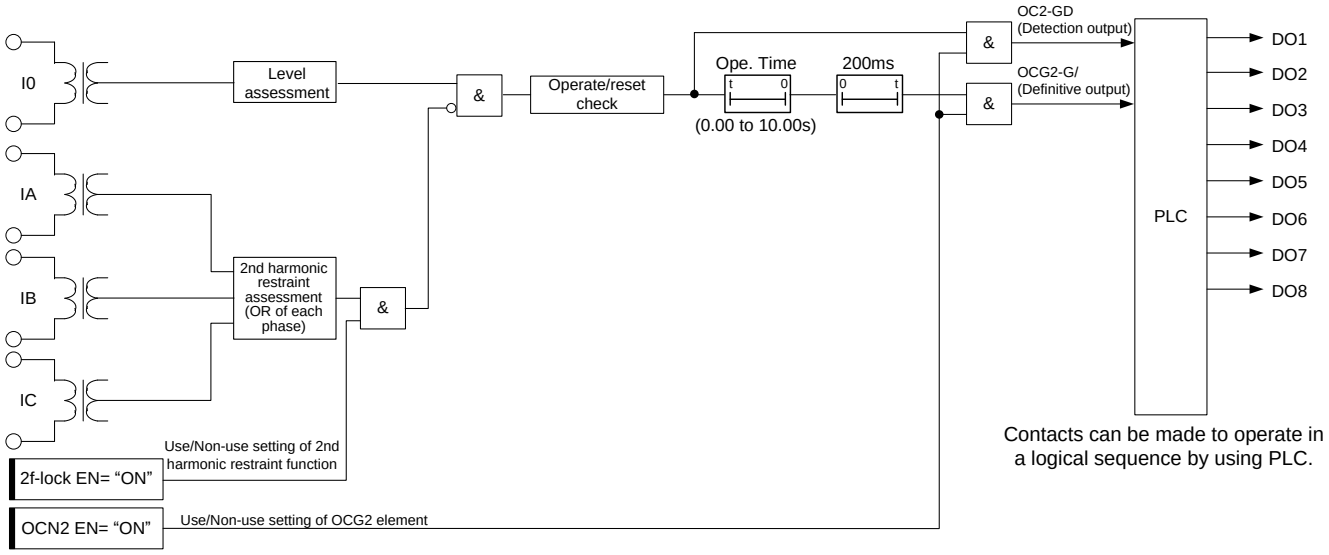


Fig. 3-14 Internal function block diagram of OCG2 element

Table 3-22 Setting items of OCG2 element

Display name	Setting parameter	Setting		Description
		Range of setting	step	
OCG2	OCG2 EN	OFF, ON	-	OFF: Non-use, ON: Use When this element is used, set to ON.
	Ope. Curt.	1.0 ~ 100.0 mA (ZCT type) 0.1 ~ 100.0 A (I0 = 5 A type)	0.5 mA 0.1 A	Operating current
	Ope. Time	0.00 ~ 10.00 s	0.01 s	Operating time INST: ≤ 40 ms (2f-lock EN=ON)
	2f-lock EN	OFF, ON	-	OFF: Non-use, ON: Use When 2nd harmonic restraint function is used, set to ON.

3.2.3. OCG3 Element (Ground fault Overcurrent Element with 2nd harmonic restraint)

This is the definite time ground-fault element with selectable 2nd harmonic restraint.

The OCG3 element has same characteristics as the OCG2 element.

Regarding the internal function block diagram and its operation, refer to sub-clause 3.2.2.

Table 3-23 Setting items of OCG3 element

Display name	Setting parameter	Setting		Description
		Range of setting	step	
OCG3	OCG3 EN	OFF, ON	-	OFF: Non-use, ON: Use When this element is used, set to ON.
	Ope. Curt.	1.0 ~ 100.0 mA (ZCT type) 0.1 ~ 100.0 A (I0 = 5 A type)	0.5 mA 0.1 A	Operating current
	Ope. Time	0.00 ~ 10.00 s	0.01 s	Operating time INST: ≤ 40 ms (2f-lock EN=ON)
	2f-lock EN	OFF, ON	-	OFF: Non-use, ON: Use When 2nd harmonic restraint function is used, set to ON.

3.2.4. OCG4 Element (Definite time or IDMT ground fault Overcurrent Element with second harmonic restraint)

This is the definite time or IDMT ground fault element with selectable 2nd harmonic restraint. Second harmonic restraint can prevent unnecessary operation due to transformer magnetizing inrush current. Furthermore, 14 types of operating time characteristics and 3 types of reset time characteristics are incorporated.
Fig. 3-15 shows the internal function blocks of the element.

The OCG4 element outputs a definitive signal when detection signal operates for longer than a definite time setting.

The detection signal is issued when zero-sequence current is greater than or equal to the operation setting value (Ope. Curt. or Ope. Curt.×1.15 is to be selected by setting of IEC Chr. EN), and when 2nd harmonic restraint is not operated.

The DT or IDMT timer counts up in accordance with the operating time characteristic (Ope. Chr.), when zero-sequence current is greater than or equal to the operation setting value (Ope. Curt.), and when 2nd harmonic restraint is not operated.
Furthermore, when the 2nd harmonic restraint function is not used (2f-lock EN=OFF), it is not linked to the operation of the OCG4 element.

The reset time characteristic can be selected by setting (Rst. Chr.).
When set to IDMT (inverse definite minimum time) or DT (definite time), it is included an off-delay timer of 200 ms to prevent chattering of the contacts.
When instantaneous reset of the contact is required, the setting (Rst. Chr.) should be set to INST (instantaneous).

Furthermore, this element operates only when the setting of Use/Non-use of OCG4 element (OCG4 EN) is ON. Therefore, when this element is not used, unnecessary operation can be prevented by setting to OFF. It is not necessary to adjust any other settings with regard to the OCG4 element.

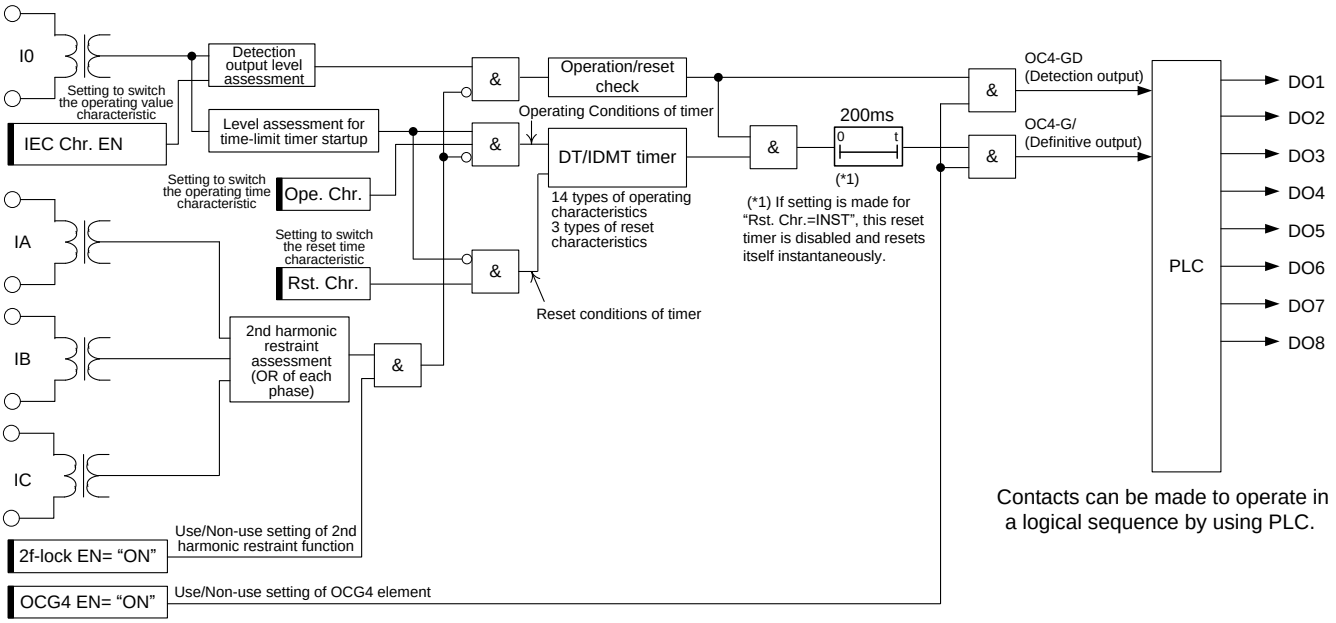


Fig. 3-15 Internal function block diagram of OCG4 element

Table 3-24 Setting items of OCG4 element

Display name	Setting parameter	Setting		Description
		Range of setting	step	
OCG4	OCG4 EN	OFF, ON	-	OFF: Non-use, ON: Use When this element is used, set to ON.
	Ope. Curt.	1.0 ~ 100.0 mA (ZCT type) 0.1 ~ 100.0 A (I0 = 5 A type)	0.5 mA 0.1 A	Operating current
	Ope. TM	0.25 ~ 50.00	0.01	Operating time multiplier. This is indicated as “M” in the characteristic formula shown in sub-clause 3.1.8.
	Ope. Chr.	NI01, VI01, EI01, LI01, LI02, DT01, NI11, EI11, EI12, NI21, VI21, LI21, NI31, VI31	-	Choice of DT and IDMT operating characteristics. (Refer to IDMT characteristic formula in sub-clause 3.1.8.)
	Rst. Chr.	IDMT,DT,INST	-	Recovery time characteristic. IDMT: Inverse definite minimum time DT: Definite time (fixed to 200 ms) INST: Instantenious (50 ms or less) (Refer to IDMT characteristic formula in sub-clause 3.1.8.)
	2f-lock EN	OFF, ON	-	OFF: Non-use, ON: Use When 2nd harmonic restraint is used, set to ON.
	IEC Chr. EN	OFF, ON	-	OFF: Normal characteristic, ON: Characteristic according to IEC When this element is used with the operating characteristic compliant with IEC60255-151, set this parameter to ON. By setting this parameter to ON, the operating value for detection becomes 1.15 times the Ope. Curt., as shown in sub-clause 3.1.6.

3.3. Negative sequence Overcurrent Element

Two negative sequence overcurrent elements are incorporated in the CFP1-A41D1. As the negative sequence current is obtained from 3-phase current, it is possible to detect unbalance current owing to external wiring errors, open phase condition, etc.

ANSI Device No.	Display name	Protective function
46	OCNEG1, OCNEG2	Instantaneous negative sequence overcurrent element

3.3.1. OCNEG1 Element (Negative sequence Overcurrent Element)

Fig. 3-16 shows the internal function blocks of OCNEG1 element.

The OCNEG1 element calculates negative sequence current from 3-phase input current, and compares it with the operation setting value (Ope. Curt.). It outputs a definitive signal after a preset time of the operation timer (Ope. Time) has passed, when the current is greater than or equal to the setting value.

An off-delay timer of 200 ms is added in order to prevent chattering of the contacts.

Furthermore, this element operates only when the setting of Use/Non-use of OCNEG1 element (OCNEG1 EN) is ON. Therefore, when this element is not used, unnecessary operation can be prevented by setting it to OFF. It is not necessary to adjust any other settings with regard to the OCNEG1 element.

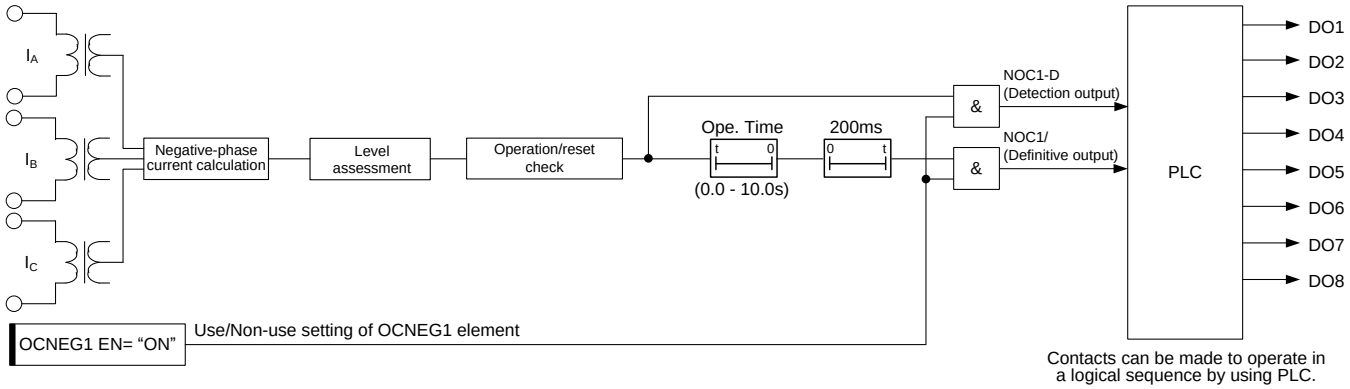


Fig. 3-16 Internal function block diagram of OCNEG1 element

The setting value of operating current is obtained by following equation.

[Notice] By this equation, please set the 3 times (triple value) of the negative-sequence current as this setting value. (=3*I_2)

Ope.Curt. ($3I_2$) = (Ia + a^2*Ib + a*Ic)

Table 3-25 Setting items of OCNEG1 element

Display name	Setting parameter	Setting		Description
		Range of setting	step	
OCNEG1	OCNEG1 EN	OFF, ON	-	OFF: Non-use, ON: Use When this element is used, set to ON.
	Ope. Curt.	0.25 ~ 5.00 A	0.01 A	Operating current Please input the triple negative-sequence current ($3I_2$) as this set value. The I_2 means a negative-sequence current.
	Ope. Time	0.0 ~ 10.0 s	0.1 s	Operating time INST: ≤ 50 ms

3.3.2. OCNEG2 Element (Negative sequence Overcurrent Element)

The OCNEG2 element has the same characteristics as the OCNEG1 element.
Regarding the internal function block diagram and its operation, refer to sub-clause 3.3.1.

Table 3-26 Setting items of OCNEG2 element

Display name	Setting parameter	Setting		Description
		Range of setting	step	
OCNEG2	OCNEG2 EN	OFF, ON	-	OFF: Non-use, ON: Use When this element is used, set to ON.
	Ope. Curt.	0.25 ~ 5.00 A	0.01 A	Operating current
	Ope. Time	0.0 ~ 10.0 s	0.1 s	Operating time INST: ≤ 50 ms

3.4. Undercurrent Element

Two undercurrent elements are incorporated in this product.

This element is operated when the current reduction is occurred more than or equal to one phase (operating OR principle of A, B or C phase).

ANSI Device No.	Display name	Protective function
37	UC1, UC2	Instantaneous undercurrent element 2 methods of detection methods are incorporated. Method 1 (Pick1): Simple UC Method 2 (Pick2): UC with minimum operating current

3.4.1. UC1 Element (Undercurrent Element)

The operation of UC1 element is explained by the internal function blocks shown in Fig. 3-17 and Fig. 3-18.

3.4.1.1.[Method 1] When it is set to UC1 Pick = Pick1

The UC1 element outputs a definitive signal after the preset operation timer (Ope. Time) has expired after the input current is equal to or below the operation setting value (Ope. Curt.).

An off-delay timer of 200 ms is added in order to prevent chattering of the output contacts.
It is possible to select using setting (UC1 SEL), whether the operation will be based on an under-current condition on at least one phase or whether an undercurrent condition will need to be present on all three phases.

Furthermore, for enabling the testing of a single phase, a lock function is provided for the UC1 element of each phase. The lock function can be set from the VFD operation panel or PC tool.
The UC1 element outputs the definitive signal only when the setting of Use/Non-use of UC1 element (UC1 EN) is ON. Therefore, when this element is not used, unnecessary operation can be prevented by setting to OFF. It is not necessary to adjust any other setting with regard to the UC1 element.

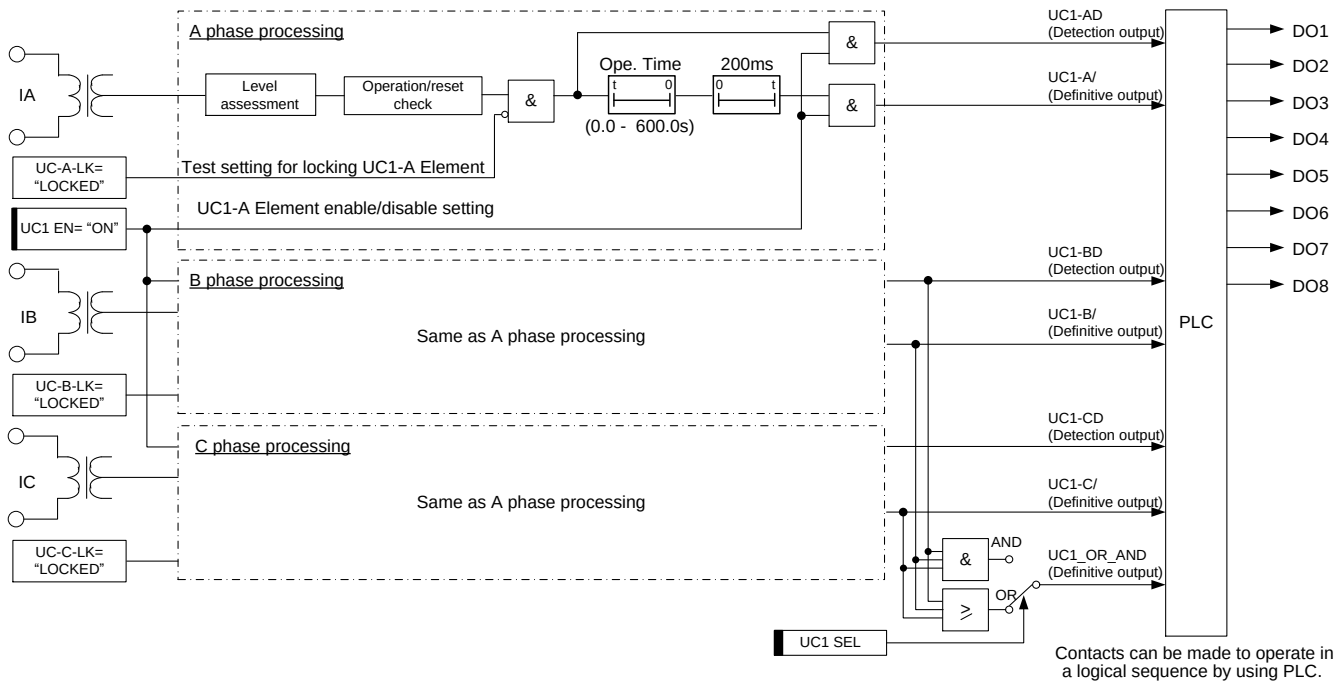


Fig. 3-17 Internal function block diagram of UC1 element (method 1)

3.4.1.2.[Method 2] When it is set to UC1 Pick = Pick2

The UC1 element outputs a definitive signal after the preset operation timer (Ope. Time) has expired, and the input current is greater than or equal to the minimum operation setting value (Min. Curt.) but less than the operation setting value (Ope. Curt.).

A delay in drop off timer of 200 ms is added in order to prevent chattering of the output contacts.

It is possible to select by setting (UC1 SEL), whether the undercurrent element operate on the basis of an under-current condition on at least one phase or whether it will operate on the basis of an under-current condition being present on all three phases.

Furthermore, for enabling the testing of a single phase, a lock function is provided for the UC1 element of each phase. The lock function can be set from the VFD operation panel or PC tool.

The UC1 element outputs the definitive signal only when the setting of Use/Non-use of UC1 element (UC1 EN) is ON. Therefore, when this element is not used, unnecessary operation can be prevented by setting to OFF. It is not necessary to adjust any other setting with regard to the UC1 element.

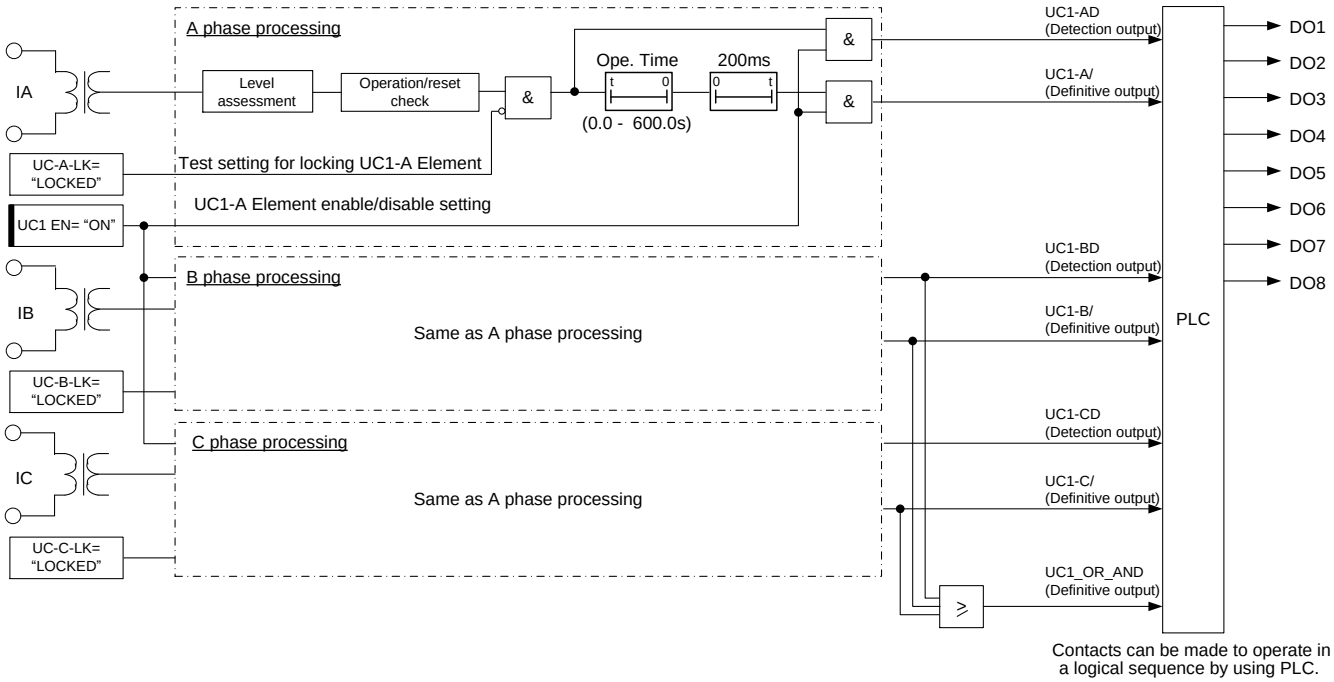


Fig. 3-18 Internal function block diagram of UC1 element (method 2)

Table 3-27 Setting items of UC1 element

Display name	Setting parameter	Setting		Description
		Range of setting	step	
UC1	UC1 EN	OFF, ON	-	OFF: Non-use, ON: Use When this element is used, set to ON.
	UC1 Pick	Pick1, Pick2	-	Selection of detection method Pick1: Simple UC Pick2: UC with the tap of minimum operating current
	Ope. Curt.	0.25 ~ 5.00 A	0.01 A	Operating current
	Min. Curt.	0.25 ~ 5.00 A	0.01 A	Minimum operating current
	Ope. Time	0.00 ~ 10.00 s	0.01 s	Operating time INST: ≤ 50 ms

3.4.2. UC2 Element (Undercurrent Element)

The UC2 element has the same characteristics as the UC1 element.
Regarding the internal function block diagram and its operation, refer to sub-clause 3.4.1.

Table 3-28 Setting items of UC2 element

Display name	Setting parameter	Setting		Description
		Range of setting	step	
UC2	UC2 EN	OFF, ON	-	OFF: Non-use, ON: Use When this element is used, set to ON.
	UC2 Pick	Pick1, Pick2	-	Selection of detection method Pick1: Simple UC Pick2: UC with the tap of minimum operating current
	Ope. Curt.	0.25 ~ 5.00 A	0.01 A	Operating current
	Min. Curt.	0.25 ~ 5.00 A	0.01 A	Minimum operating current
	Ope. Time	0.00 ~ 10.00 s	0.01 s	Operating time INST: ≤ 50 ms

3.5. CBF Function

The circuit braker failure (CBF) elements are incorporated in this relay.

Component number	Display name	Protective function
50BF	CBF	CBF detecting element

3.5.1. CBF Element

Fig. 3-19 shows the internal function blocks of CBF function.

The CBF element outputs a definitive signal after a preset time of the operation timer (Ope. Time) has passed, when the input current of each phase & zero-phase is above a set threshold (CBF Curt. & CBFG Curt.), and a trip signal is received from another relay.

This function detects failure of the circuit breaker when current continues to flow for the set time after a trip signal is received. The trip signal from another relay is received at the digital (binary) input terminal (DI8).

When the optional IEC61850 communication card is mounted, it is possible to receive the trip signal from another relay, by means of the GOOSE function. In this case, reception of a GOOSE trip signal from another relay must be assigned to G_TRIP1, G_TRIP2, and G_TRIP3.

The CBF element outputs the definitive signal only when the setting of Use/Non-use of CBF functions (CBF EN & CBFG EN) is ON. Therefore, when this element is not used, unnecessary operation can be prevented by setting to OFF. It is not necessary to adjust other settings with regard to CBF functions.

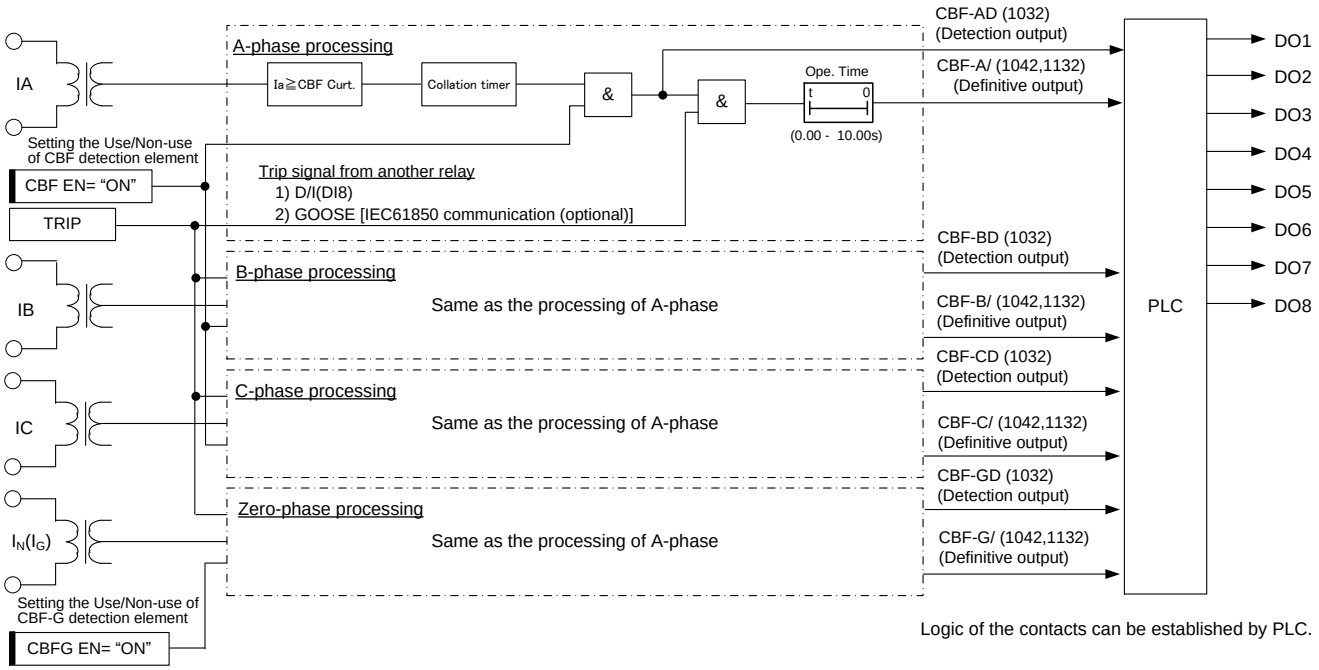


Fig. 3-19 Internal function block diagram of CBF element

Table 3-29 Setting items of CBF function

Display name	Setting parameter	Setting		Description
		Range of setting	step	
CBF	CBF EN	OFF, ON	-	OFF: Non-use, ON: Use (for each phase) When this function is used, set to ON.
	CBFG EN	OFF, ON	-	OFF: Non-use, ON: Use (for zero-phase) When this function is used, set to ON.
	CBF Curt.	0.15 ~ 10.00 A	0.01 A	Operating current (for each phase)
	CBFG Curt.	1.0 ~ 100.0 mA	0.5 mA	Operating current (for zero-phase)
	Ope. Time	0.00 ~ 10.00 s	0.01 s	Operating time INST: ≤ 30 ms

3.6. Directional Ground (Earth) fault element

In the CFP1-A41D1, 4 types of directional ground (earth) fault elements are incorporated, and rapid detection of ground (earth) fault is possible. In addition, a variety of operations & reset characteristics are provided. As with the overcurrent elements, time coordination is easy to achieve as shown. Therefore the elements can be applied to the protection of various systems. Second harmonic restraint is incorporated to prevent unnecessary operation due to transformer magnetizing inrush current.

ANSI Device No.	Display name	Protective function
67G	DIRG1	Instantaneous directional ground fault element
	DIRG2 DIRG3	Instantaneous directional ground fault element (two-stage) with 2nd harmonic restraint
67G	DIRG4	IDMT or definite time directional ground fault element with second harmonic restraint ・ 14 operating time characteristics ・ 3 reset characteristics

3.6.1. DIRG1 element (Directional ground fault element)

Fig. 3-20 shows the internal function blocks of DIRG1 element.

The DIRG1 element outputs a definitive signal after a preset time of the operation timer (Ope. Time) has passed, when

a) the zero sequence current is greater than the setting value (Ope. Curt.) , AND

b) the zero sequence voltage is greater than the setting value (Ope. Volt.), AND

c) the phase difference between the zero-seq. current and zero-seq. voltage is within the operating area.

An off-delay timer of 200 ms is added in order to prevent chattering of the output contacts.

The DIRG1 element outputs the definitive signal only when the setting of Use/Non-use of DIRG1 element (DIRG1 EN) is ON. Therefore, when this element is not used, unnecessary operation can be prevented by setting to OFF. It is not necessary to adjust any other settings with regard to DIRG1 element.

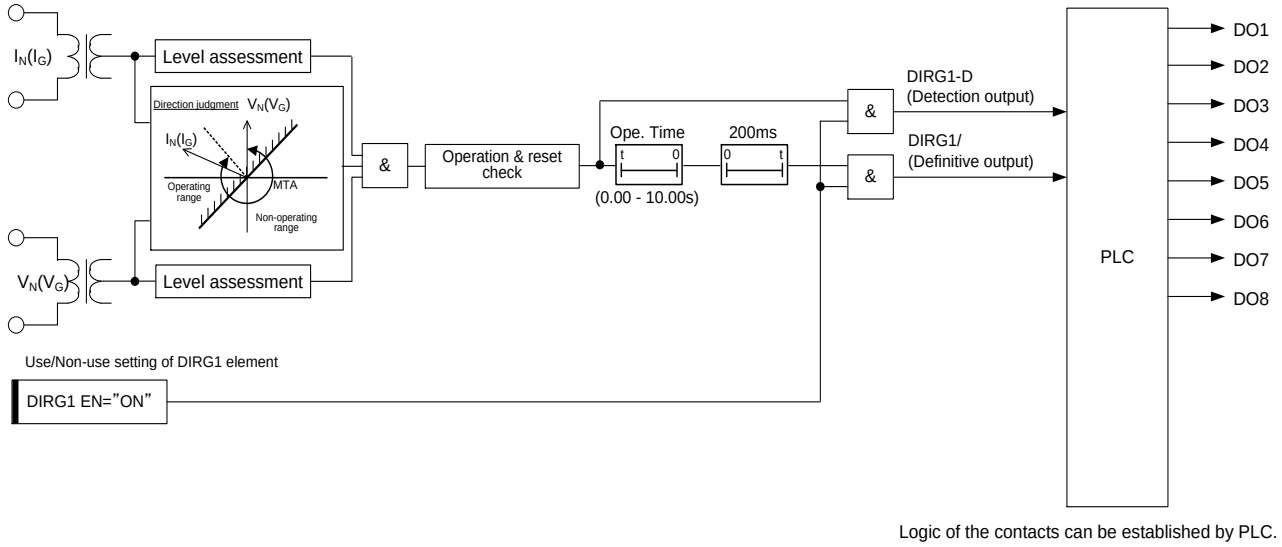


Fig. 3-20 Internal function block diagram of DIRG1 element

Table 3-30 Setting items of DIRG1 element

Display name	Setting parameter	Setting		Description
		Range of setting	step	
DIRG	MTA	0 ~ 359° Lag	1°	Setting the maximum sensitivity angle common to DIRG1 ~ DIRG4
DIRG1	DIRG1 EN	OFF, ON	-	OFF: Non-use, ON: Use When this element is used, set to ON.
	Ope. Volt	2.0 ~ 100.0 V	0.1 V	Operating voltage
	Ope. Curt.	1.0 ~ 100.0 mA (ZCT type) 0.1 ~ 100.0 A (I0 = 5 A type)	0.5 mA 0.1 A	Operating current
	Ope. Time	0.00 ~ 10.00 s	0.01 s	Operating time INST: ≤ 50 ms

3.6.2. DIRG2 element (Directional ground fault element with 2nd harmonic restraint)

Fig. 3-21 shows the internal function blocks of DIRG2 element.

The DIRG2 element outputs a definitive signal after a preset time of the operation timer (Ope. Time) has passed, when

a) the zero sequence current is greater than the setting value (Ope. Curt.) , AND

b) the zero sequence voltage is greater than the setting value (Ope. Volt.), AND

c) the phase difference between the zero-seq. current and zero-seq. voltage is within the operating area, AND

d) second harmonic restraint on each phase is not activated

When second harmonic restraint is not used (2f-lock EN=OFF), detection does not affect the operation of the DIRG2 element.

An off-delay timer of 200 ms is added in order to prevent chattering of the contacts.

The DIRG2 element outputs the definitive signal only when the setting of Use/Non-use of DIRG2 element (DIRG2 EN) is ON. Therefore, when this element is not used, unnecessary operation can be prevented by setting to OFF. It is not necessary to adjust any other settings with regard to the DIRG2 element.

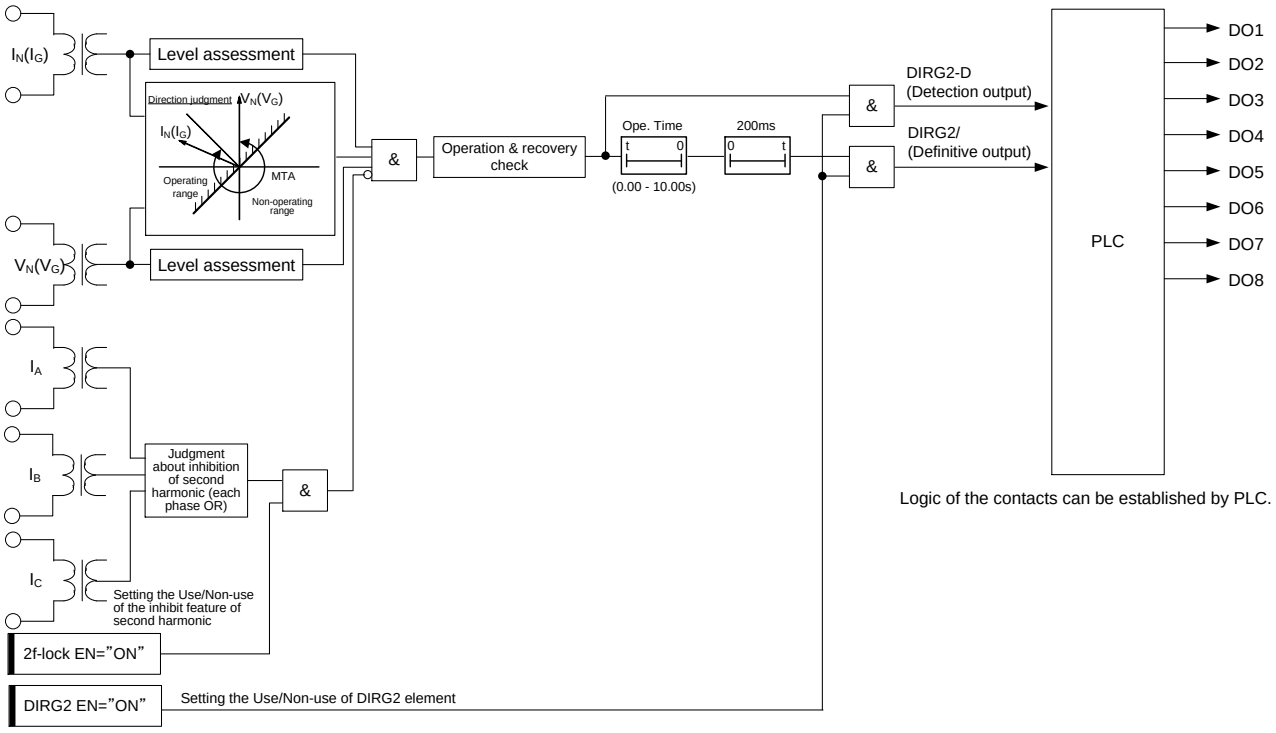


Fig. 3-21 Internal function block diagram of DIRG2 element

Table 3-31 Setting items of DIRG2 element

Display name	Setting parameter	Setting		Description
		Range of setting	step	
DIRG	MTA	0 ~ 359° Lag	1°	Setting the maximum sensitivity angle common to DIRG1 ~ DIRG4
DIRG2	DIRG2 EN	OFF, ON	-	OFF: Non-use, ON: Use When this element is used, set to ON.
	Ope. Volt	2.0 ~ 100.0 V	0.1 V	Operating voltage
	Ope. Curt.	1.0 ~ 100.0 mA (ZCT type) 0.1 ~ 100.0 A (I0 = 5 A type)	0.5 mA 0.1 A	Operating current
	Ope. Time	0.00 ~ 10.00 s	0.01 s	Operating time INST: ≤ 50 ms
	2f-lock EN	OFF, ON	-	OFF: Non-use, ON: Use When 2nd harmonic restraint of this element is used, set to ON.

3.6.3. DIRG3 element (Directional ground fault element with 2nd harmonic restraint)

The DIRG3 element has the same characteristics as the DIRG2 element.
Regarding the internal function block diagram and its operation, refer to sub-clause 3.6.2.

Table 3-32 Setting items of DIRG3 element

Display name	Setting parameter	Setting		Description
		Range of setting	step	
DIRG	MTA	0 ~ 359° Lag	1°	Setting the maximum sensitivity angle common to DIRG1 ~ DIRG4
DIRG3	DIRG3 EN	OFF, ON	-	OFF: Non-use, ON: Use When this element is used, set to ON.
	Ope. Volt	2.0 ~ 100.0 V	0.1 V	Operating voltage
	Ope. Curt.	1.0 ~ 100.0 mA (ZCT type) 0.1 ~ 100.0 A (I0 = 5 A type)	0.5 mA 0.1 A	Operating current
	Ope. Time	0.00 ~ 10.00 s	0.01 s	Operating time INST: ≤ 50 ms
	2f-lock EN	OFF, ON	-	OFF: Non-use, ON: Use When 2nd harmonic restraint of this element is used, set to ON.

3.6.4. DIRG4 element (IDMT or definite time directional ground fault element with second harmonic restraint)

Fig. 3-22 shows the internal function blocks of DIRG4 element.

The DIRG4 element outputs a definitive signal when detection signal operates for longer than a definite time setting.

Detection signal operates by establishment of the following conditions:

a) the zero sequence current is greater than the setting value
(Ope. Curt. or Ope. Curt.×1.15 is to be selected by setting of IEC Chr. EN) , AND

b) the zero sequence voltage is greater than the setting value (Ope. Volt.), AND

c) the phase difference between the zero-seq. current and zero-seq. voltage is within the operating area, AND

d) second harmonic restraint on each phase is not activated

When the above conditions are satisfied, the operation timer counts up according to the operating characteristics (Ope. Chr.)

When 2nd harmonic restraint is not used (2f-lock EN=OFF), second harmonic detection is not linked to the operation of the DIRG4 element.

The reset characteristic can be selected by setting (Rst. Chr.).

When set to IDMT (Inverse definite minimum time) or DT (definite time), it is included an off-delay timer of 200mS to prevent chattering of the contacts.

When instantaneous reset is required, the setting (Rst. Chr.) must be set to INST (instantaneous).

Furthermore, this element outputs the definitive signal only when the setting of Use/Non-use of DIRG4 element (DIRG4 EN) is ON. Therefore, when this element is not used, unnecessary operation can be prevented by setting to OFF. It is not necessary to adjust any other settings for the DIRG4 element.

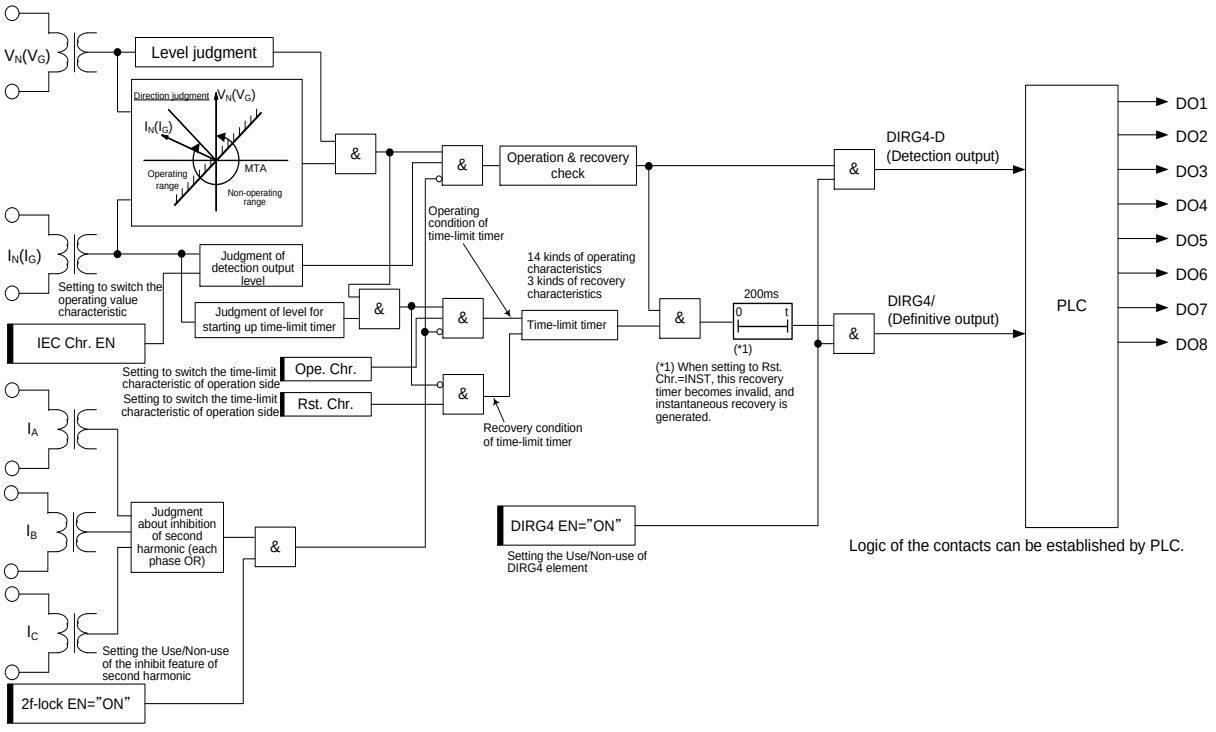


Fig. 3-22 Internal function block diagram of DIRG4 element

Table 3-33 Setting items of DIRG4 element

Display name	Setting parameter	Setting		Descripsion
		Range of setting	step	
DIRG	MTA	0 ~ 359° Lag	1°	Setting the maximum sensitivity angle common to DIRG1 ~ DIRG4
DIRG4	DIRG4 EN	OFF, ON	-	OFF: Non-use, ON: Use When this element is used, set to ON.
	Ope. Volt	2.0 ~ 100.0 V	0.1 V	Operating voltage
	Ope. Curt.	1.0 ~ 100.0 mA (ZCT type) 0.1 ~ 100.0 A (I0 = 5 A type)	0.5 mA 0.1 A	Operating current
	Ope. TM	0.25 ~ 50.00	0.01	Operating time multiplier It is indicated by the value of “M (multiplier)” in the characteristic formula shown in sub-clause 3.1.8.
	Ope. Chr.	NI01, VI01, EI01, LI01, LI02, DT01, NI11, EI11, EI12, NI21, VI21, LI21, NI31, VI31	-	IDMT operating time characteristic (Refer to IDMT characteristic formula in sub-clause 3.1.8.)
	Rst. Chr.	IDMT,DT,INST	-	Internal counter characteristic of IDMT at reset condition IDMT: Inverse time reset DT: Definite time (fixed to 200 ms) INST: Instant (50 ms or less) (Refer to IDMT characteristic formula in sub-clause 3.1.8.)
	2f-lock EN	OFF, ON	-	OFF: Non-use, ON: Use When second harmonic restraint of this element is used, set to ON.
	IEC Chr. EN	OFF, ON	-	OFF: Normal characteristic, ON: Characteristic according to IEC When this element is used with the operating value based on IEC60255-151, set to ON. By putting this setting to ON, the operating value of detection signal becomes 1.15 times the Ope. Curt. as shown in 3.1.6.

3.7. Undervoltage Element

Two types of undervoltage elements are provided in the CFP1-A41D1. It is possible to select two kinds of undervoltage detection by means of a setting.

This element is operated when the voltage reduction is occurred more than or equal to one phase (operating OR principle of A, B or C phase).

ANSI Device No.	Display name	Protective function
27	UV1, UV2	Two types of undervoltage elements ● Method 1 (UVP): Detection is effected on the basis of a low phase voltage ● Method 2 (UVS): Detection is effected on the basis of a low line voltage

3.7.1. UV1 Element (Undervoltage Elements)

Fig. 3-23 shows the internal function blocks of UV1 element.

Setting (UVP/UVS SEL) is used to determine whether phase voltage measurement or line (phase to phase) voltage measurement will take place to determine the under-voltage condition. If the selected input voltage is less than the operation setting value (Ope. Volt.), a definitive signal is issued after expiry of the operation timer (Ope. Time).

An off-delay timer of 200 ms is added in order to prevent chattering of the output contacts.

Setting (UV1 SEL) is used to set whether the operation of the element is based on a single phase voltage measurement or a three phase voltage measurement., To facilitate testing of the single phase operation, a lock function is provided for the UV1 element of each phase. The lock function can be set from the front panel or PC tool.

The UV1 element outputs the definitive signal only when the setting of Use/Non-use of UV1 element (UV1 EN) is ON. Therefore, when this element is not used, unnecessary operation can be prevented by setting to OFF. It is not necessary to adjust any other settings with regard to the UV1 element

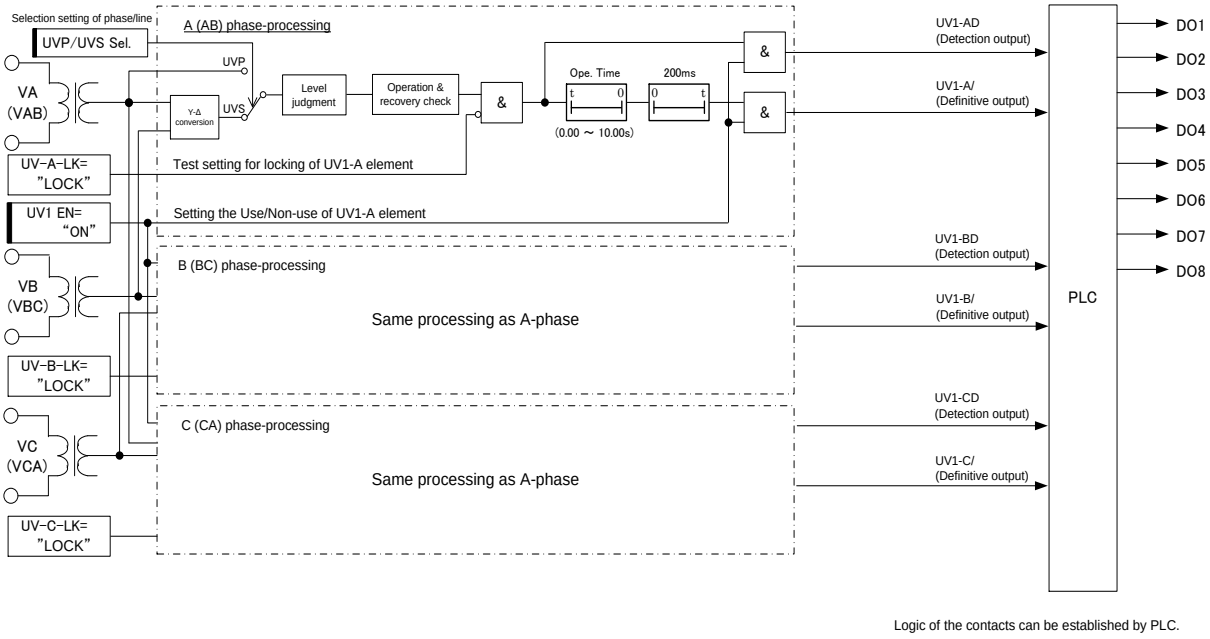


Fig. 3-23 Internal function block diagram of UV1 element

Table 3-34 Setting items of UV1 element

Display name	Setting parameter	Setting		Description
		Range of setting	step	
UV1	UV1 EN	OFF, ON	-	OFF: Non-use, ON: Use When this element is used, set to ON.
	UVP/UVS SEL	UVP, UVS	-	Selection of characteristics Selection from UVP (UV of phase voltage) / UVS (UV of ine(phase to phase) voltage)
	Ope. Volt.	20.0 ~ 120.0 V	0.1 V	Operating voltage
	Ope. Time	0.00 ~ 10.00 s	0.01 s	Operating time INST: ≤ 50 ms

The relationship between the setting of V Input sel. in AI Config (sub-clause 3.15) and the setting of UVP/UVS SEL is as follows.

The recommendation setting is as follows.

- In case of using phase-neutral VT and the protection for a phase-neutral voltage, the setting “V Input Sel.”=Y and the setting “UVP/UVS SEL”=UVP.
- In case of using phase-neutral VT and the protection for a phase-phase (line) voltage, the setting “V Input Sel.”=Y and the setting “UVP/UVS SEL”=UVS.
- In case of using phase-phase (line) VT and the protection for a phase-phase (line) voltage, the setting “V Input Sel.”=D and the setting “UVP/UVS SEL”=UVS.

Table 3-35 Setting items of UVP/UVS SEL

		UVP/UVS SEL	
		UVP	UVS
V Input Sel. (sub-clause 3.15)	Y	The protection calculation uses the values of the voltage terminal inputs as it is.	The protection calculation uses the phase-phase (line) values which is calculated in software from the voltage terminal inputs.
	D	The protection calculation uses the values of the voltage terminal inputs as it is.	The protection calculation uses the values of the voltage terminal inputs as it is.

3.7.2. UV2 Element (Undervoltage Elements)

The UV2 element has the same characteristics as the UV1 element.
Regarding the internal function block diagram and its operation, refer to sub-clause 3.7.1.

Table 3-36 Setting items of UV2 element

Display name	Setting parameter	Setting		Description
		Range of setting	step	
UV2	UV2 EN	OFF, ON	-	OFF: Non-use, ON: Use When this element is used, set to ON.
	UVP/UVS SEL	UVP, UVS	-	Selection of characteristics Selection from UVP (phase voltage reduction)/UVS (line voltage reduction)
	Ope. Volt.	20.0 ~ 120.0 V	0.1 V	Operating voltage
	Ope. Time	0.00 ~ 10.00 s	0.01 s	Operating time INST: ≤ 50 ms

3.8. Overvoltage Element

Two types of overvoltage elements are incorporated in the CFP1-A41D1. The overvoltage detection methods can be set to make use of either phase (phase to neutral) voltage or line (phase to phase) voltage.

ANSI Device No.	Display name	Protective function
59S	OV1, OV2	Instantaneous overvoltage element 2 kinds of detection methods are incorporated. Method 1 (OVP): Detection of phase voltage rise Method 2 (OVS): Detection of line voltage rise

3.8.1. OV1 Element (Overvoltage Elements)

Fig. 3-24 shows the internal function blocks of OV1 element..

It is possible to select by setting (OVP/OVS SEL) whether the phase voltage or line (phase to phase) voltage will be used to detect over-voltage. When the selected input voltage is greater than the operation setting value (Ope. Volt.), a definitive signal is output after the preset time on the operation timer (Ope. Time) has expired.

An off-delay timer of 200 ms is added in order to prevent chattering of the output contacts.

To facilitate the testing of a single phase, a lock function is provided for the OV1 element for each phase. The lock function can be set from the VFD operation panel or PC tool.

The OV1 element outputs the definitive signal only when the setting of Use/Non-use of OV1 element (OV1 EN) is ON. Therefore, when this element is not used, unnecessary operation can be prevented by setting to OFF. It is not necessary to adjust any other settings with regard to the OV1 element.

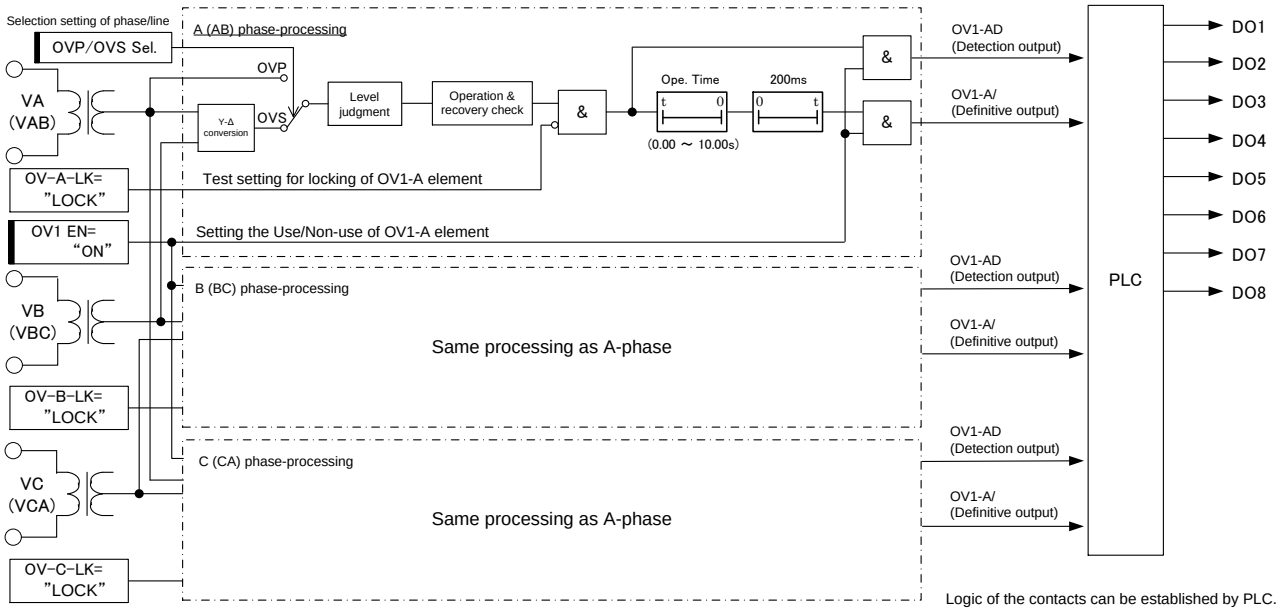


Fig. 3-24 Internal function block diagram of OV1 element

Table 3-37 Setting items of OV1 element

Display name	Setting parameter	Setting		Description
		Range of setting	step	
OV1	OV1 EN	OFF, ON	-	OFF: Non-use, ON: Use When this element is used, set to ON.
	OVP/OVS SEL	OVP, OVS	-	Selection of characteristics Selection from OVP (phase voltage rise)/OVS (line voltage rise)
	Ope. Volt.	20.0 ~ 200.0 V	0.1 V	Operating voltage
	Ope. Time	0.00 ~ 10.00 s	0.01 s	Operating time INST: ≤ 50 ms

3.8.2. OV2 Element (Overvoltage Elements)

The OV2 element has the same characteristics as the OV1 element.
Regarding the internal function block diagram and its operation, refer to sub-clause 3.8.1.

Table 3-38 Setting items of OV2 element

Display name	Setting parameter	Setting		Description
		Range of setting	step	
OV2	OV2-EN	OFF, ON	-	OFF: Non-use, ON: Use When this element is used, set to ON.
	OVP/OVS SEL	OVP, OVS	-	Selection of characteristics Selection from OVP (phase voltage rise)/ OVS (line voltage rise)
	Ope. Volt.	20.0 ~ 200.0 V	0.1 V	Operating voltage
	Ope. Time	0.00 ~ 10.00 s	0.01 s	Operating time INST: ≤ 50 ms

3.9. Ground-fault Overvoltage Element

Two types of ground-fault overvoltage elements are incorporated in the CFP1-A41D1.
It is also possible to select 2 types of ground-fault overvoltage detection methods depending on the requirement.

ANSI Device No.	Display name	Protective function
59N/64N	OVG1, OVG2	Instantaneous ground-fault overvoltage element 2 types of detection methods are incorporated. ・Method 1 (VG): Zero-sequence phase voltage is directly taken from the VG terminal. ・Method 2 (3P): Zero-sequence phase voltage is summed with 3-phase voltages.

3.9.1. OVG1 Element (Ground-fault Overvoltage Element)

Fig. 3-25 shows the internal function blocks of OVG1 element.

It is possible to select by setting (V0 SEL), whether the zero-phase voltage is derived by calculation of [(VA+VB+VC)/3], or to be directly taken from the VN (VG) terminal. When the selected input voltage is greater than the operation setting value (Ope. Volt.), a definitive signal is output after the preset time of the operation timer (Ope. Time) has passed.

An off-delay timer of 200 ms is added in order to prevent chattering of the output contacts.

Furthermore, this element outputs the definitive signal only when the setting of Use/Non-use of OVG1 element (OVG1 EN) is ON. Therefore, when this element is not used, unnecessary operation can be prevented by setting to OFF. It is not necessary to adjust any other settings with regard to the OVG1 element.

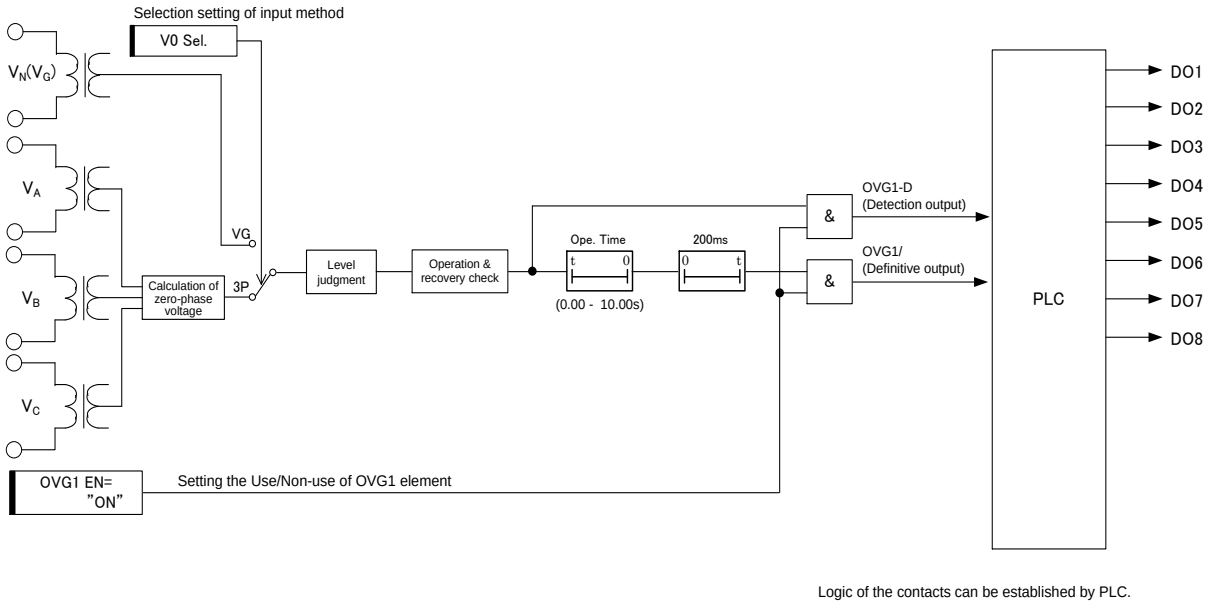


Fig. 3-25 Internal function block diagram of OVG1 element

Table 3-39 Setting items of OVG1 element

Display name	Setting parameter	Setting		Description
		Range of setting	step	
OVG1	OVG1 EN	OFF, ON	-	OFF: Non-use, ON: Use When this element is used, set to ON.
	Ope. Volt.	2.0 ~ 100.0 V	0.1 V	Operating voltage
	Ope. Time	0.00 ~ 10.00 s	0.01 s	Operating time INST: ≤ 50 ms

3.9.2. OVG2 Element (Ground-fault Overvoltage Element)

The OVG2 element has the same characteristics as the OVG1 element.
Regarding the internal function block diagram and its operation, refer to sub-clause 3.9.1.

Table 3-40 Setting items of OVG2 element

Display name	Setting parameter	Setting		Description
		Range of setting	step	
OVG2	OVG2 EN	OFF, ON	-	OFF: Non-use, ON: Use When this element is used, set to ON.
	Ope. Volt.	2.0 ~ 100.0 V	0.1 V	Operating voltage
	Ope. Time	0.00 ~ 10.00 s	0.01 s	Operating time INST: ≤ 50 ms

3.10. Negative-phase-sequence Overvoltage Element

Two types of negative-phase sequence overvoltage elements are incorporated in the CFP1-A41D1. Since the negative-phase-sequence voltage is obtained from 3-phase voltage, it is possible to detect unbalance voltage due to external wiring errors or open phase conditions, etc

ANSI Device No.	Display name	Protective function
47	OVNEG1, OVNEG2	Instantaneous negative-phase-sequence overvoltage element

3.10.1. OVNEG1 Element (Negative-phase-sequence Overvoltage Element)

Fig. 3-26 shows the internal function blocks of OVNEG1 element.

The OVNEG1 element calculates negative-phase sequence voltage from 3-phase line voltage or phase voltage, and compares it against the operation setting value (Ope. Volt.). If the voltage is greater than the setting value, a definitive signal is issued after the preset time of the operation timer (Ope. Time) has passed.

An off-delay timer of 200 ms is added in order to prevent chattering of the output contacts.
The OVNEG1 element outputs the definitive signal only when the setting of Use/Non-use of OVNEG1 element (OVNEG1 EN) is ON. Therefore, when this element is not used, unnecessary operation can be prevented by setting to OFF. It is not necessary to adjust any other settings with regard to the OVNEG1 element.

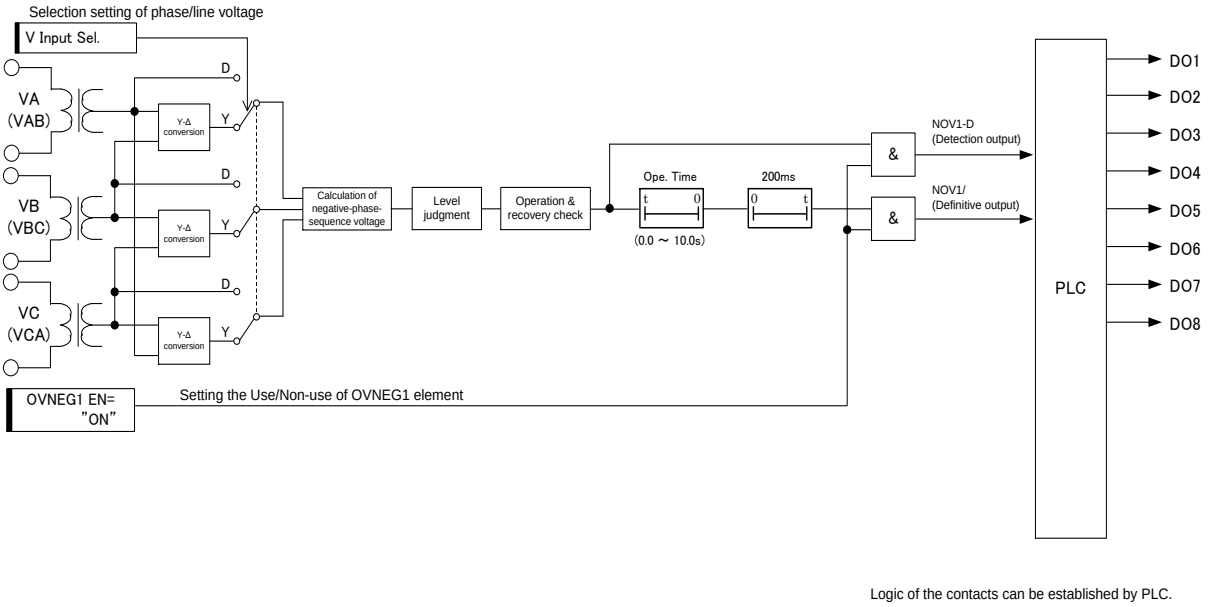


Fig. 3-26 Internal function block diagram of OVNEG1 element

Table 3-41 Setting items of OVNEG1 element

Display name	Setting parameter	Setting		Description
		Range of setting	step	
OVNEG1	OVNEG1 EN	OFF, ON	-	OFF: Non-use, ON: Use When this element is used, set to ON.
	Ope. Volt.	2.0 ~ 100.0 V	0.1 V	Operating voltage
	Ope. Time	0.0 ~ 10.0 s	0.1 s	Operating time INST: ≤ 50 ms

3.10.2. OVNEG2 Element (Negative-phase-sequence Overvoltage Element)

The OVNEG2 element has the same characteristics as the OVNEG1 element.

Regarding the internal function block diagram and its operation, refer to sub-clause 3.10.1.

Table 3-42 Setting items of OVNEG2 element

Display name	Setting parameter	Setting		Description
		Range of setting	step	
OVNEG2	OVNEG2 EN	OFF, ON	-	OFF: Non-use, ON: Use When this element is used, set to ON.
	Ope. Volt.	2.0 ~ 100.0 V	0.1 V	Operating voltage
	Ope. Time	0.0 ~ 10.0 s	0.1 s	Operating time INST: ≤ 50 ms

3.11. Underfrequency Element

Three under-frequency elements are incorporated in CFP1-A41D1. It is possible to detect frequency drop due to overload, etc.

ANSI Device No.	Display name	Protective function
81U	UF1, UF2, UF3	Under-frequency element

3.11.1. UF1 Element (Underfrequency Element)

Fig. 3-27 shows the internal function blocks of UF1 element.

The UF1 element calculates frequency from AB-phase voltage and compares it against the operation setting value (Ope. Freq.). When the frequency is less than the setting value, and the AB-phase voltage is not less than 35 V (*1) it outputs a definitive signal after a preset time of the operation timer (Ope. Time) has passed,

An off¥delay in drop off timer of 200 ms is provided in order to prevent chattering of the output contacts. The UF1 element outputs the definitive signal only when the setting of Use/Non-use of UF1 element (UF1 EN) is ON. Therefore, when this element is not used, unnecessary operation can be prevented by setting to OFF. It is not necessary to adjust any other settings with regard to the UF1 element.

(*1) This condition is added because a minimum voltage level is required to calculate frequency correctly.

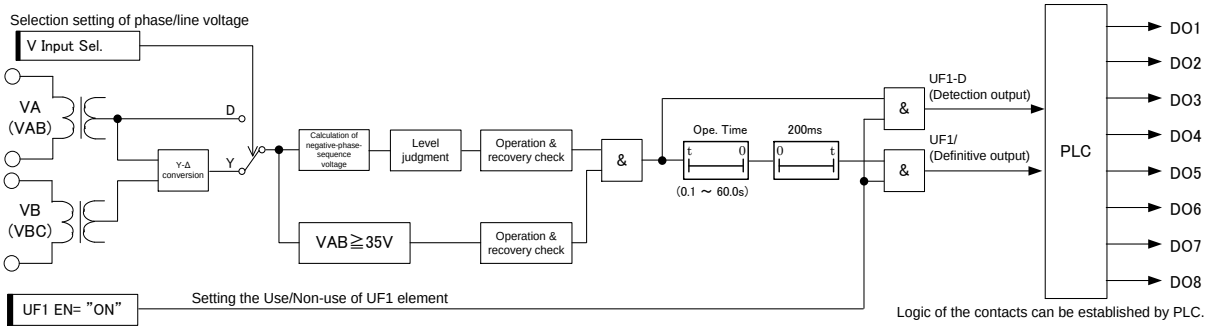


Fig. 3-27 Internal function block diagram of UF1 element

Table 3-43 Setting items of UF1 element

Display name	Setting parameter	Setting		Description
		Range of setting	step	
UF1	UF1 EN	OFF, ON	-	OFF: Non-use, ON: Use When this element is used, set to ON.
	Ope. Freq.	-5.0 ~ -0.5 Hz	0.1 Hz	Operating frequency (difference from rated frequency)
	Ope. Time	0.1 ~ 60.0 s	0.1 s	Operating time

3.11.2. UF2 Element (Underfrequency Element)

The UF2 element has the same characteristics as the UF1 element.
Regarding the internal function block diagram and its operation, refer to sub-clause 3.11.1.

Table 3-44 Setting items of UF2 element

Display name	Setting parameter	Setting		Description
		Range of setting	step	
UF2	UF2 EN	OFF, ON	-	OFF: Non-use, ON: Use When this element is used, set to ON.
	Ope. Freq.	-5.0 ~ -0.5 Hz	0.1 Hz	Operating frequency (difference from rated frequency)
	Ope. Time	0.1 ~ 60.0 s	0.1 s	Operating time

3.11.3. UF3 Element (Underfrequency Element)

The UF3 element has the same characteristics as the UF1 element.
Regarding the internal function block diagram and its operation, refer to sub-clause 3.11.1.

Table 3-45 Setting items of UF3 element

Display name	Setting parameter	Setting		Description
		Range of setting	step	
UF3	UF3 EN	OFF, ON	-	OFF: Non-use, ON: Use When this element is used, set to ON.
	Ope. Freq.	-5.0 ~ -0.5 Hz	0.1 Hz	Operating frequency (difference from rated frequency)
	Ope. Time	0.1 ~ 60.0 s	0.1 s	Operating time

3.12. Overfrequency Element

Three over-frequency elements are provided in the CFP1-A41D1. It is possible to detect frequency increase due to load reduction, etc.

ANSI Device No.	Display name	Protective function
81O	OF1, OF2, OF3	Over-frequency element

3.12.1. OF1 Element (Overfrequency Element)

Fig. 3-28 shows the internal function blocks of OF1 element.

The OF1 element calculates frequency from AB-phase voltage, and compares it with the operation setting value (Ope. Freq.). If the frequency is greater than the setting value and the AB-phase voltage is greater than 35 V (*1), then a definitive signal issued after the preset time of the operation timer (Ope. Time) has passed.

A delay in drop off timer of 200 ms is added in order to prevent chattering of the output contacts.

The OF1 element outputs the definitive signal only when the setting of Use/Non-use of OF1 element (OF1 EN) is ON. Therefore, when this element is not used, unnecessary operation can be prevented by setting to OFF. It is not necessary to adjust any other settings with regard to the OF1 element.

(*1) This condition is added because a minimum voltage is required to calculate frequency correctly.

The operation of OF1 element is explained by means of the internal function blocks described in Fig. 3-28.

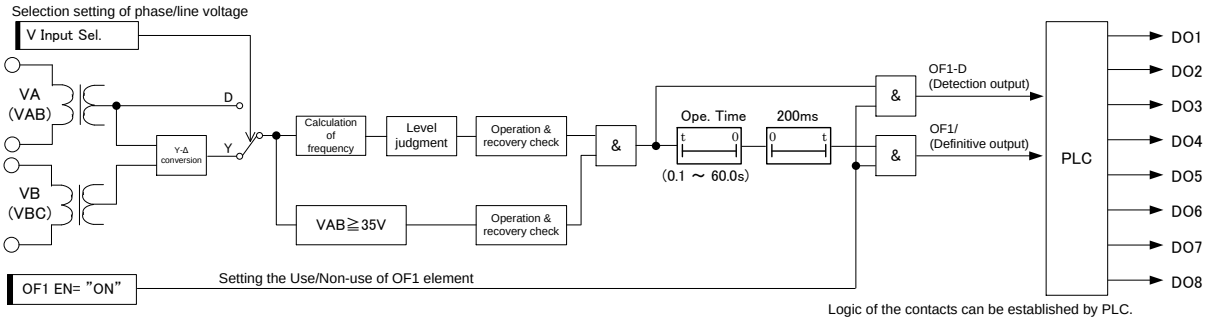


Fig. 3-28 Internal function block diagram of OF1 element

Table 3-46 Setting items of OF1 element

Display name	Setting parameter	Setting		Description
		Range of setting	step	
OF1	OF1 EN	OFF, ON	-	OFF: Non-use, ON: Use When this element is used, set to ON.
	Ope. Freq.	0.5 ~ 5.0 Hz	0.1 Hz	Operating frequency (difference from rated frequency)
	Ope. Time	0.1 ~ 60.0 s	0.1 s	Operating time

3.12.2. OF2 Element (Overfrequency Element)

The OF2 element has the same characteristics as the OF1 element.
Regarding the internal function block diagram and its operation, refer to sub-clause 3.12.1.

Table 3-47 Setting items of OF2 element

Display name	Setting parameter	Setting		Description
		Range of setting	step	
OF2	OF2 EN	OFF, ON	-	OFF: Non-use, ON: Use When this element is used, set to ON.
	Ope. Freq.	0.5 ~ 5.0 Hz	0.1 Hz	Operating frequency (difference from rated frequency)
	Ope. Time	0.1 ~ 60.0 s	0.1 s	Operating time

3.12.3. OF3 Element (Overfrequency Element)

The OF3 element has the same characteristics as the OF1 element.
Regarding the internal function block diagram and its operation, refer to sub-clause 3.12.1.

Table 3-48 Setting items of OF3 element

Display name	Setting parameter	Setting		Description
		Range of setting	step	
OF3	OF3 EN	OFF, ON	-	OFF: Non-use, ON: Use When this element is used, set to ON.
	Ope. Freq.	0.5 ~ 5.0 Hz	0.1 Hz	Operating frequency (difference from rated frequency)
	Ope. Time	0.1 ~ 60.0 s	0.1 s	Operating time

3.13. Supervision of zero-sequence voltage

The CFP1-A41D1 monitors zero- sequence voltage in order to detect the voltage input circuit failure.

The supervision of zero-sequence voltage element is described by means of the internal function blocks shown in Fig. 3-29.
This function is operated by following equation.

| VA + VB + VC – 3×V0| > 10V

By the setting ‘V0 SEL’ in ‘AI Config.’ category, the zero-sequence voltage item (3×V0) in above equation is obtained with selectable from a direct input (set ‘VG’ value) or numerical calculation (set ‘3V0’ value).

If this function alarmed, it suggests the internal failure of this protection relay. And please check “ALARM RECORD” via front panel (refer to chapter 4) or PC-HMI (refer to chapter 11).
When this function detects above condition, the alarm LED of front panel is turned on and error code “42” is putted on record. The detail of this behavior, please refer to clause 9.2.

As a note, this function supervises from the instrumental transformer to the internal circuit of this protection relay. Therefore, this function operates whether hardware failures occurs the instrumental transformer, the cable or the protection relay.
The setting ‘3PBV Ope. Time’ should be set longer than the time period of a power system failure. It is because the unbalance condition is occurred in a power system failure.

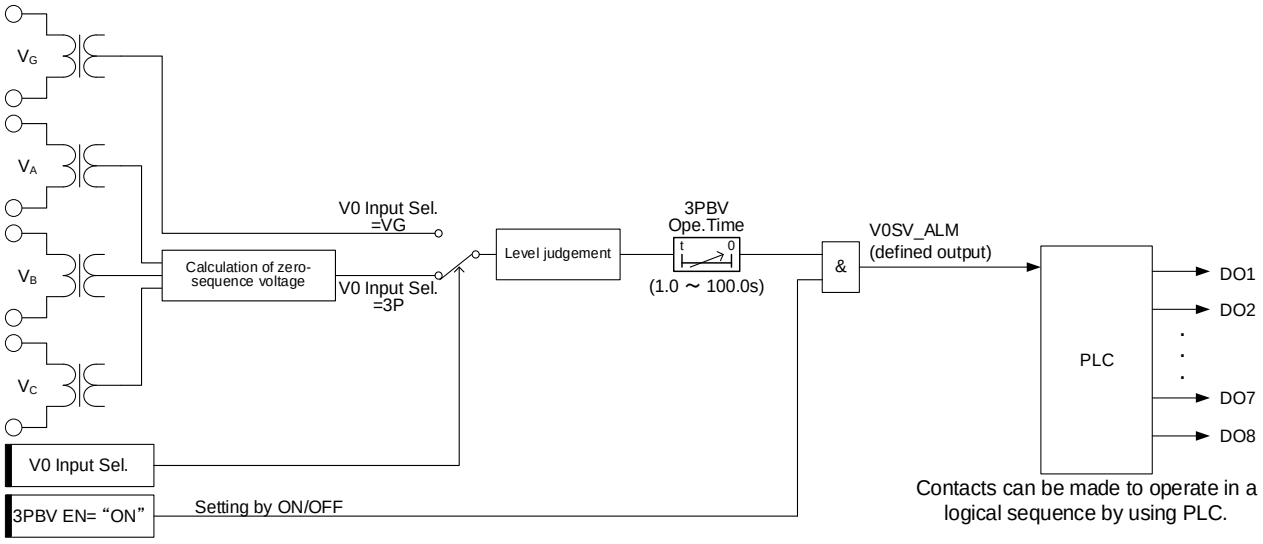


Fig. 3-29 Internal function block diagram of the supervision of zero-sequence voltage element

Table 3-49 Setting items of the supervision of zero-sequence voltage element

Element name	Setting parameter	Setting		Description
		Range of setting	step	
SV	3PBV EN	OFF, ON	-	OFF: Non-use, ON: Use When this monitoring function is used, set to ON.
	3PBV Ope.Time	1.0 ~ 100.0 s	0.1 s	Detection time

3.14. Supervision of zero-sequence current

The supervision of zero-sequence current element is shown in Fig. 3-30.
The supervision functions are provided to detect an unbalance condition by a current circuit failure.

This function is operated by following equation.

| IA + IB + IC – 3×I0| > ε × 3×I0 + α × Max(|IA|, |IB|, |IC|)
wherer ε: 10%
α: 5%

If this function alarmed, it suggests the internal failure of this protection relay. And please check “ALARM RECORD” via front panel (refer to chapter 4) or PC-HMI (refer to chapter 11).
When this function detects above condition, the alarm LED of front panel is turned on and error code “41” is putted on record. The detail of this behavior, please refer to clause 9.2.

As a note, this function supervises from the instrumental transformer to the internal circuit of this protection relay. Therefore, this function operates whether hardware failures occurs the instrumental transformer, the cable or the protection relay.
The setting ‘3PBC Ope. Time’ should be set longer than the time period of a power system failure. It is because the unbalance condition is occurred in a power system failure.

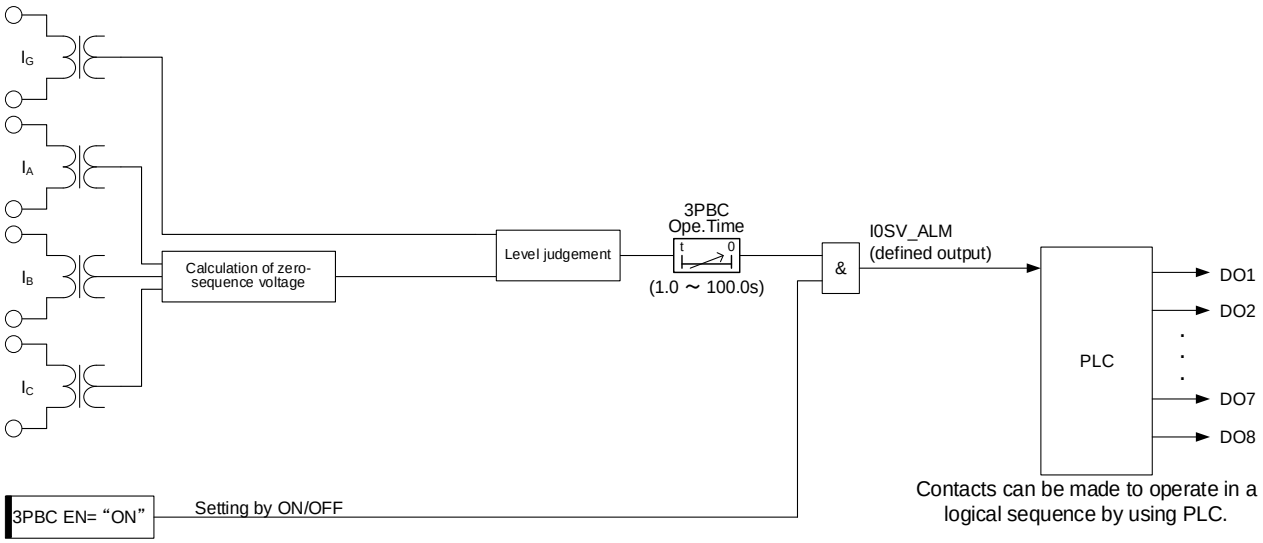


Fig. 3-30 Internal function block diagram of the supervision of zero-sequence current element

Table 3-50 Setting items of the supervision of zero-sequence current element

Element name	Setting parameter	Setting		Description
		Range of setting	step	
SV	3PBC EN	OFF, ON	-	OFF: Non-use, ON: Use When this monitoring function is used, set to ON.
	3PBC Ope.Time	1.0 ~ 100.0 s	0.1 s	Detection time

3.15. AI-Configulation setting

Table 3-51 Setting items of AI-CONFIG.

Display name	Setting parameter	Setting		Description
		Range of setting	step	
CONFIG	V0 Input Sel.	VG, 3P	-	VG: Zero-phase sequence voltage is input to terminal A15-A16 directly. 3P: Zero-phase sequence voltage is calculated by summed 3-phase voltage.
	V Input Sel.	D, Y		D: Voltage terminals are assigned as the phase-phase input. Y: Voltage terminals are assigned as the phase input.
	V 3P/2P Sel.	3P, 2P		3P: 3-phase voltages are input. 2P: 2-phase (Vab and Vbc) voltages are input. Vca is calculated by above 2-phase voltages.

3.15.1. Relationship between “V0 Input Sel.” and metering

The setting “V0 Input Sel.” affects how to acquire the residual voltage.
If “V0 Input Sel.” = VG, the zero-sequence voltage should be connected to V0 terminal. (more detail, please refer to section 7.)
If “V0 Input Sel.” = 3P, the residual voltage should be not connected V0 terminal. (more detail, please refer to section 7.) In this condition, the zero-sequence voltage is calculated by Va, Vb and Vc. Therefore, it is necessary to set “V Input Sel.”=”Y” and “V 3P/2P Sel.”=”3P”.

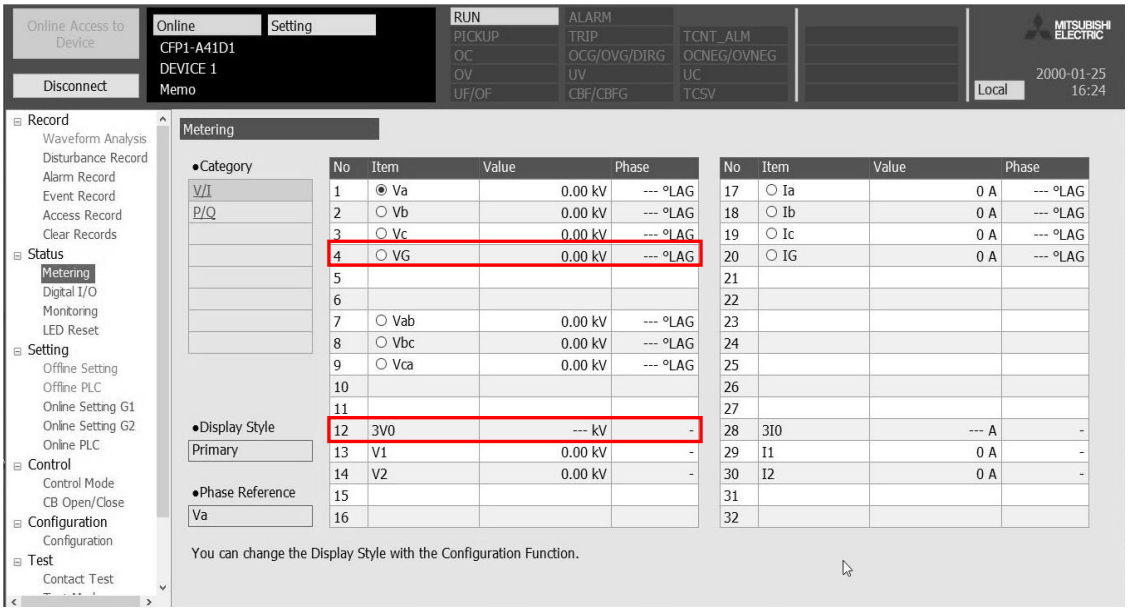


Fig. 3-31 Metering indication when “V0 Input Sel.” is set “VG”

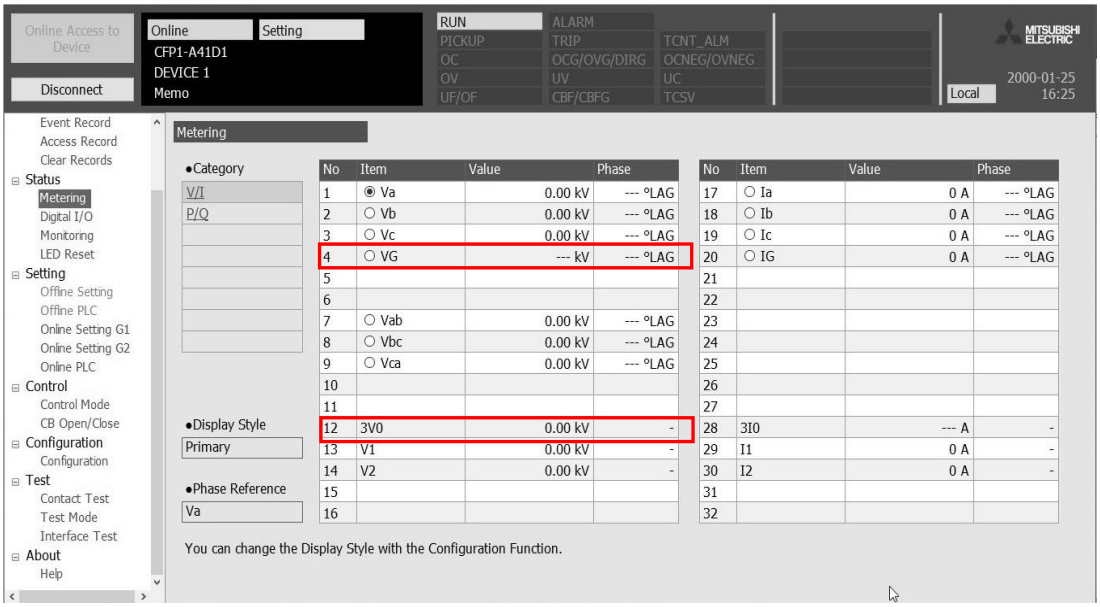


Fig. 3-32 Metering indication when “V0 Input Sel.” is set “3P”

3.15.2. Relationship between “V Input Sel.” and “V 3P/2P Sel.”

Table 3-52 Relationship between “V Input Sel.” and “V 3P/2P Sel.”

V Input Sel.	V 3P/2P Sel.	Description
Y	3P	3 phase voltages are input. The phase-phase voltages are obtained by the relay software from phase to neutral voltages. 3 phase voltages shall be connected when the setting “V Input Sel.” = Y.
	2P	3 phase voltages are input. At “V Input Sel.” = Y, the setting “V 3P/2P Sel.” does NOT affect the relay calculation.
D	3P	3 phase to phase voltages are inputted. The phase voltage values are not indicated in metering function.
	2P	2 phase to phase voltages are inputted. The Vca is calculated by Vab and Vbc in the relay. The phase voltage measurement are not indicated in metering function,

4. Human machine interface

There are two ways to set and operate the relay:

(1) Operation from the front panel

(2) Operation from a locally connected PC

This chapter describes about “(1) Operation from the front panel” by pushbuttons and the indication display. Regarding the operation method (2), please refer to Chapter 11 on this document or PC-HMI Instruction Manual (Doc. No. JEP0-IL9504).

4.1. Pushbutton switches and indication display

This section describes the pushbuttons and indication display on the front panel by using Fig. 4-1 and Table 4-1.

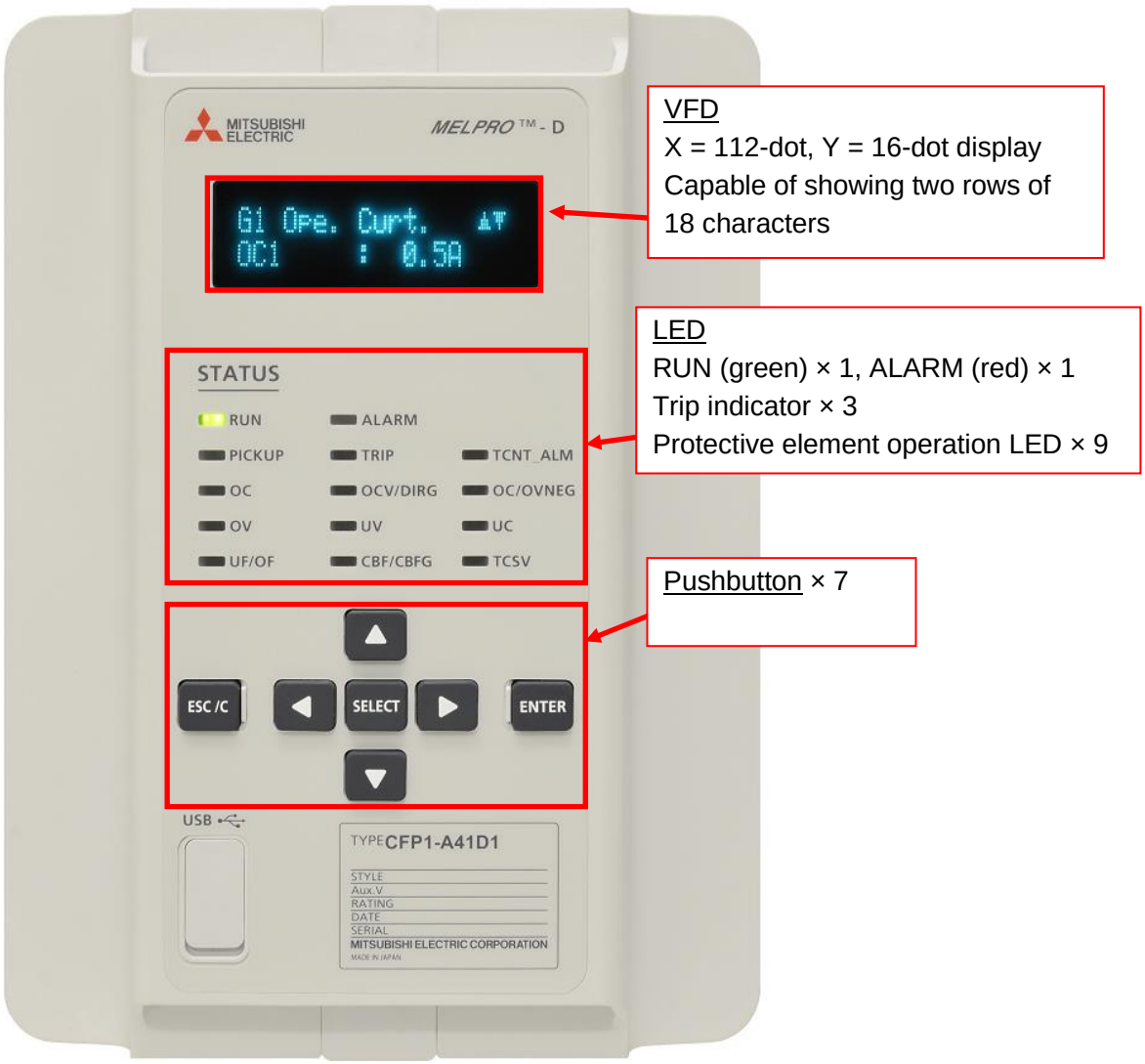


Fig. 4-1 Front panel section description

Table 4-1 Description of front panel

Name			Description
VFD (Vacuum Fluorescent Display) (18 characters x 2 lines)			Shows various menus and values of the DISPLAY/SETTING mode. If you has not operated any push buttons for more than 30 minutes, the VFD is automatically turned off. In the METERING menu, you can expand the character size.
RUN LED		Green	Shows the result of constant supervision. Illuminated for a normal condition. When this LED light is turned off, the relay functions are not working.
ALARM LED		Red	Shows the result of constant supervision. Illuminated for an abnormal condition.
LED	PICKUP	Yellow	Illuminated for detection of protection element (OR of all elements except for VD element). This LED will be turned off after resetting.
	TRIP	Red	Illuminated when the definitive signal (TRIP signal) of protection element is issued (OR of all elements except for VD element). (*)
	TCNT_ALM	Red	Illuminated for activation of trip counter ALARM.
	OC	Red	Illuminated for activation of OC.
	OCV/DIRG	Red	Illuminated for activation of OCG/OVG/DIRG.
	OC/OVNEG	Red	Illuminated for activation of OCNEG/OVNEG.
	OV	Red	Illuminated for activation of OV.
	UV	Red	Illuminated for activation of UV.
	UC	Red	Illuminated for activation of UC.
	UF/OF	Red	Illuminated for activation of UF/OF.
	CBF	Red	Illuminated for activation of CBF.
	-	-	-
			Note: The LED continues lighting after resetting the protection element. You can turn the LED off if the trouble has been resolved. From front panel, please push ESC/C button and from PC-HMI, please follow the tree view on left panel (Status >> LED Reset).
Pushbutton switch	SELECT		• Moves to the menu one level lower • Confirms selection of input item • Confirms input value • Reconfirms after pressing ENTER in SETTING mode
	ENTER		• Starts operation in SETTING mode
	ESC/C		• Turns off VFD • Turns off operation indicator LEDs by holding down (for 3s or longer)
	◀		• Moves to the menu one level higher • Moves to digit on the left in the value input screen • Discards the input value in the input screen and moves to the menu one level higher
	▶		• Moves to digit on the right in the value input screen
	▲ ▼		• Moves to the menu above/below • Increments/decrements the input value in the value input screen
USB2.0 port			USB 2.0 port for PC connection (Type B)

4.2. List of menus

The operation mode includes the DISPLAY and SETTING modes, which respectively have different menus. Table 4-2 lists the menus available in the respective modes.

Table 4-2 List of menu

○: DISPLAY only ⊙: DISPLAY and SETTING -: Not shown

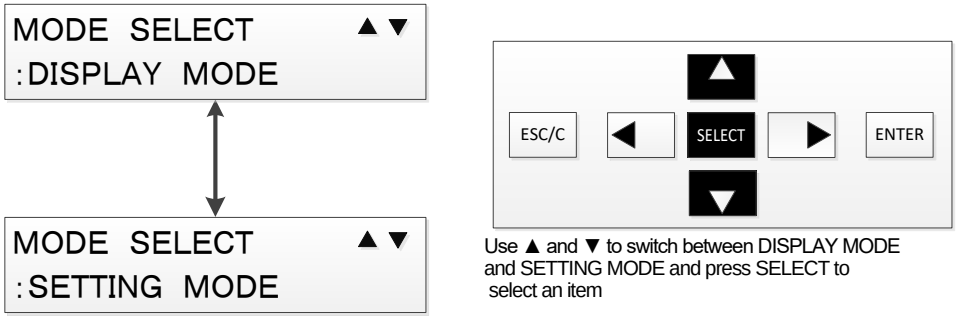
Menu		Operation mode	
		DISPLAY	SETTING
RECORD (RECORD)	Fault record (FAULT RECORD)	○	-
	Event record (EVENT RECORD)	○	-
	Access record (ACCESS RECORD)	○	-
	Alarm record (ALARM RECORD)	○	-
Clear record (CLEAR RECORD)	Clear fault record (FAULT REC CLEAR)	-	⊙
	Clear event record (EVENT REC CLEAR)	-	⊙
	Clear alarm record (ALARM REC CLEAR)	-	⊙
Status (STATUS)	Clock (CLOCK)	○	-
	Measured value (METERING)	○	-
	DI/DO status (DIGITAL I/O)	○	-
	Trip counter (TRIP COUNTER)	○	-
	Device name (DEVICE NAME)	○	-
Setting (SETTING)	Active group (ACTIVE WG)	○	⊙
	Group 1 setting (G1)	○	⊙
	Group 2 setting (G2)	○	⊙
Control (CONTROL)	Control mode (CTRL MODE)	○	⊙
	Circuit breaker control (CB CONTROL)	-	⊙
Configuration (CONFIG)	Communication setting (COMMUNICATION)	○	⊙
	Clock adjustment (CLOCK ADJUST)	-	⊙
	Measured analog value (METERING)	○	⊙
	Electric energy (ENERGY)	○	⊙
	Trip counter (TRIP COUNTER)	○	⊙
	Disturbance record (DISTURBANCE)	○	⊙
	DI detection voltage value (DI VOLTAGE)	○	⊙
	Password use/no-use (PASSWORD USE)	-	⊙
	Password registration (PASSWORD REGIST)	-	⊙
Test (TEST)	DO contact test (CONTACT TEST)	-	⊙
	Test mode (MODE)	-	⊙
	LED/VFD lighting test (LED/VFD TEST)	-	⊙

4.3. Operation method

This section describes the operations for mode selection and various menus.

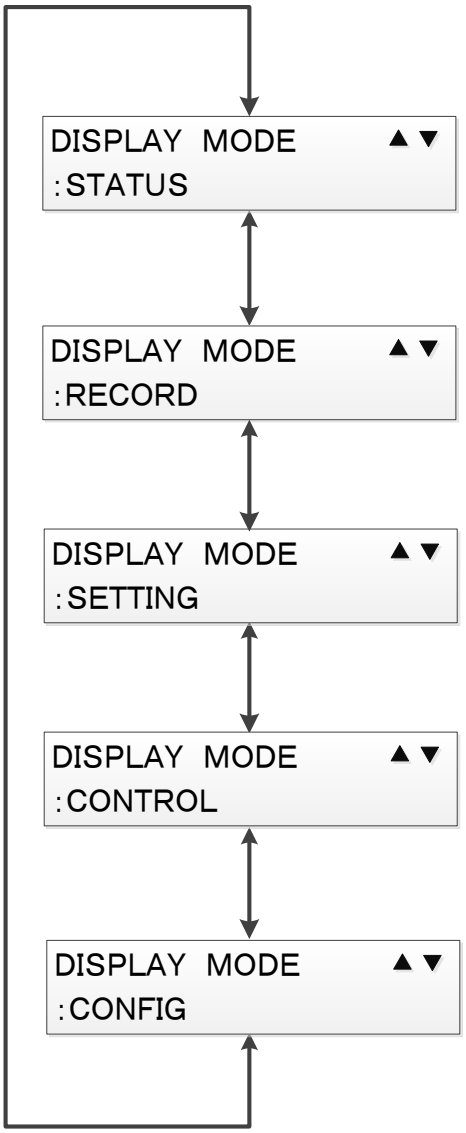
4.3.1. DISPLAY/SETTING mode selection

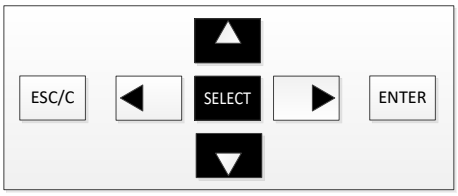
Press a key except for ESC/C when VFD is OFF to show the DISPLAY/SETTING mode selection screen. The DISPLAY and SETTING modes offer different sets of menus available.
For the details about the menus in the respective modes, see Table 4-2.



4.3.2. DISPLAY mode menu operations

This subsection describes the menu operations in the DISPLAY mode.
The menu screen has five selectable items. Use the Up and Down keys to select the item and press SELECT.
For the details about the menus available in the DISPLAY mode, see Table 4-2.

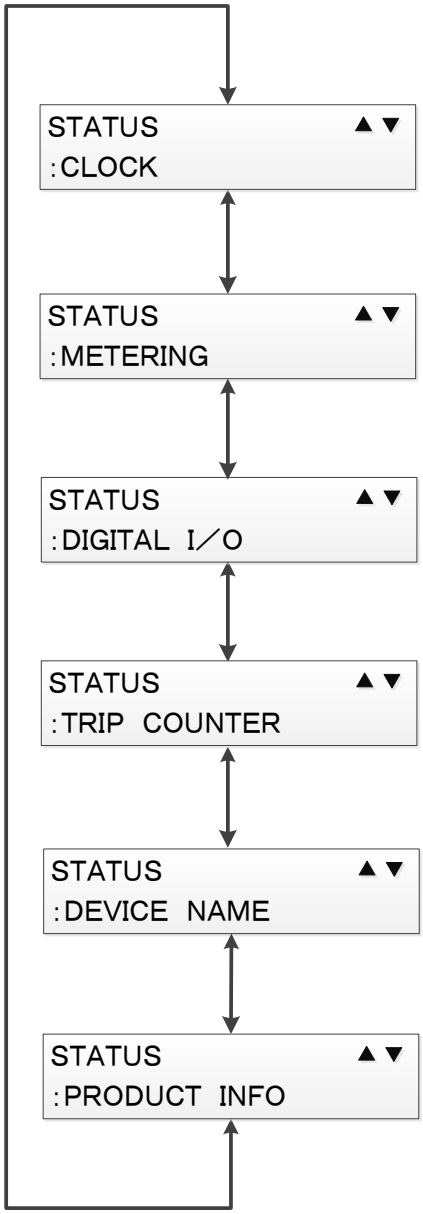


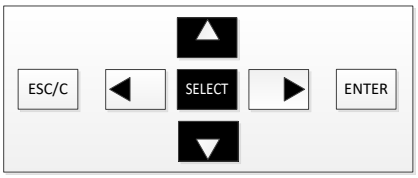


Use ▲ and ▼ to switch between items
and press SELECT to select an item

4.3.2.1.Status (STATUS) menu

This subsection describes the Status (STATUS) menu.
The Status menu shows the current time, measured value, DI/DO status, trip counter, device name and Software version.





Use ▲ and ▼ to switch between items
and press SELECT to select an item

4.3.2.1.1. Clock (CLOCK)

[Operation path] DISPLAY MODE > STATUS > CLOCK

The clock (CLOCK) menu allows viewing of the current time and synchronization type.

The text in the upper right part of the screen indicates the synchronization type for the time shown. (Part showing “LOCAL” in figure above)

Clock synchronization type indication

Synchronization type	Description
SNTP	Synchronizing with SNTP
DI	Synchronizing with the synchronization request signal from DI
ERR	When RTC (real time clock) error reached at maximum time, the time management is disabled.
GPS	Synchronizing with IRIG-B
LOCAL	Relay’s internal clock

4.3.2.1.2. Measured value (METERING) menu

[Operation path] DISPLAY MODE > STATUS > METERING

The Measured value (METERING) menu allows viewing of the current measured value.
The Configuration menu can specify the measured value of the primary or secondary value of CT/VT.
For the setting procedure, see 4.3.4.3.3.

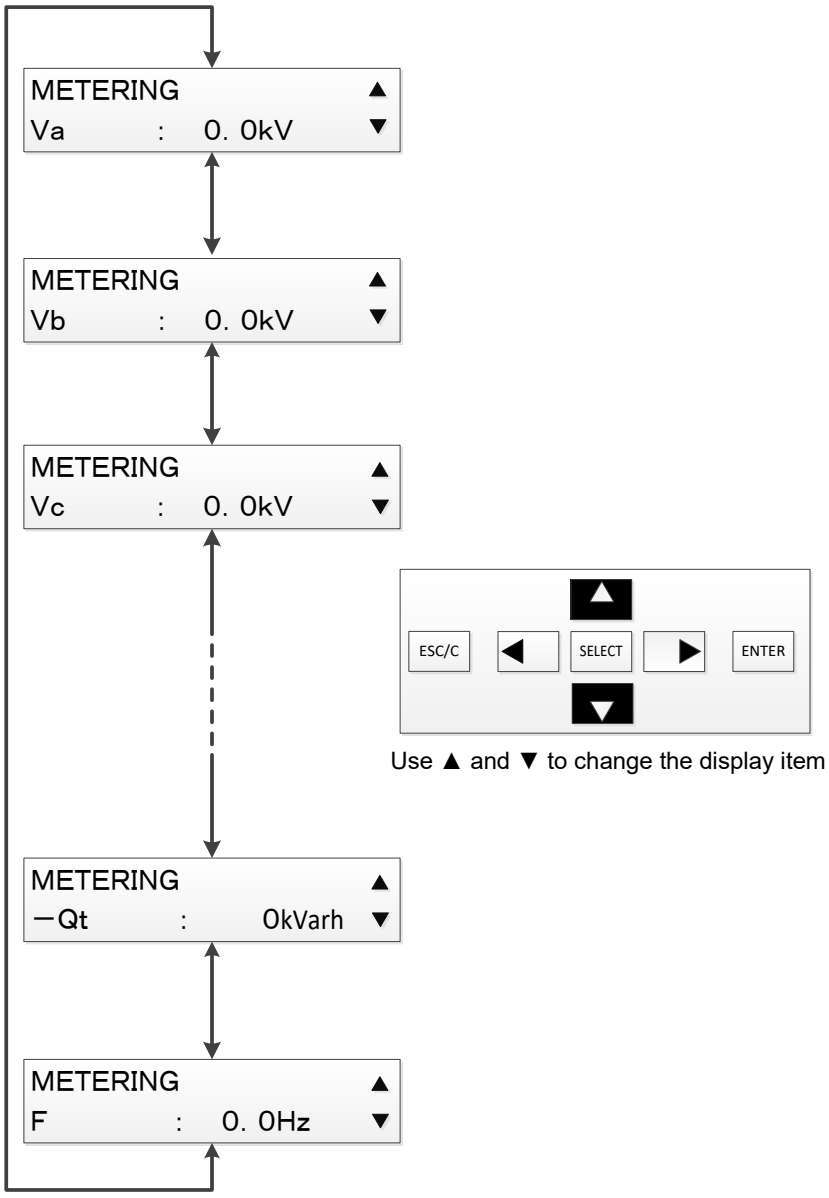


Table 4-3 Measured value display items

No.	Signal name	Unit (primary/secondary)	No.	Signal name	Unit (primary/secondary)
1	Va	kV / V	20	Vab-ph	° / °
2	Vb	kV / V	21	Vbc-ph	° / °
3	Vc	kV / V	22	Vca-ph	° / °
4	Vab	kV / V	23	VG-ph	° / °
5	Vbc	kV / V	24	Ia-ph	° / °
6	Vca	kV / V	25	Ib-ph	° / °
7	VG	kV / V	26	Ic-ph	° / °
8	3V0	kV / V	27	IG-ph	° / °
9	V1	kV / V	28	+P	MW/- *1
10	V2	kV / V	29	-P	MW/- *1
11	Ia	A / A	30	+Q	MVar/- *1
12	Ib	A / A	31	-Q	MVar/- *1
13	Ic	A / A	32	S	MVA/- *1
14	IG	A / mA	33	PF	-/- *1
15	I1	A / A	34	+Pt	kWh/- *1
16	I2	A / A	35	-Pt	kWh/- *1
17	Va-ph	° / °	36	+Qt	kVarh/- *1
18	Vb-ph	° / °	37	-Qt	kVarh/- *1
19	Vc-ph	° / °	38	F	Hz / Hz

*1 The values show only when the measured values are displayed the primary side.

4.3.2.1.3. DI/DO status (DIGITAL I/O) menu

[Operation path] DISPLAY MODE > STATUS > DIGITAL I/O

The DI/DO status (DIGITAL I/O) menu allows viewing of the current DI/DO.

The indication procedure of 'DI/DO status' is shown in next flow;

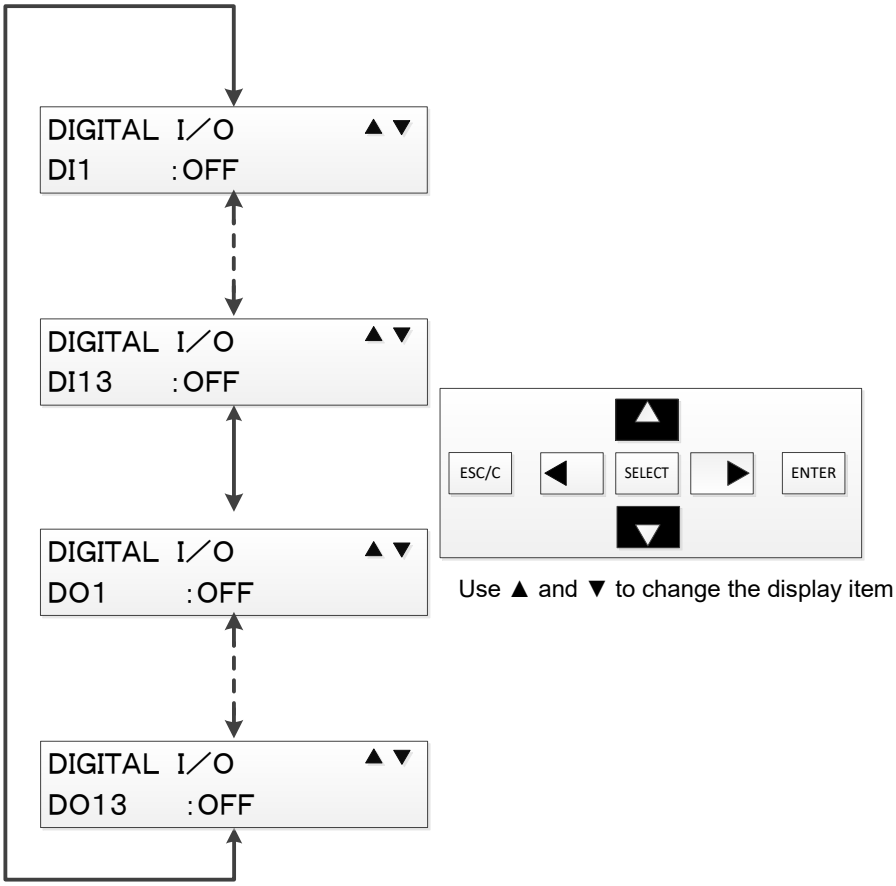


Table 4-4 Show DI/DO status Display items

Signal name	Signal name
DI1	DO1
DI2	DO2
DI3	DO3
DI4	DO4
DI5	DO5
DI6	DO6
DI7	DO7
DI8	DO8

4.3.2.1.4. Trip counter (TRIP COUNTER) menu

[Operation path] DISPLAY MODE > STATUS > TRIP COUNTER

The Trip counter (TRIP COUNTER) menu allows viewing of the number of trips.

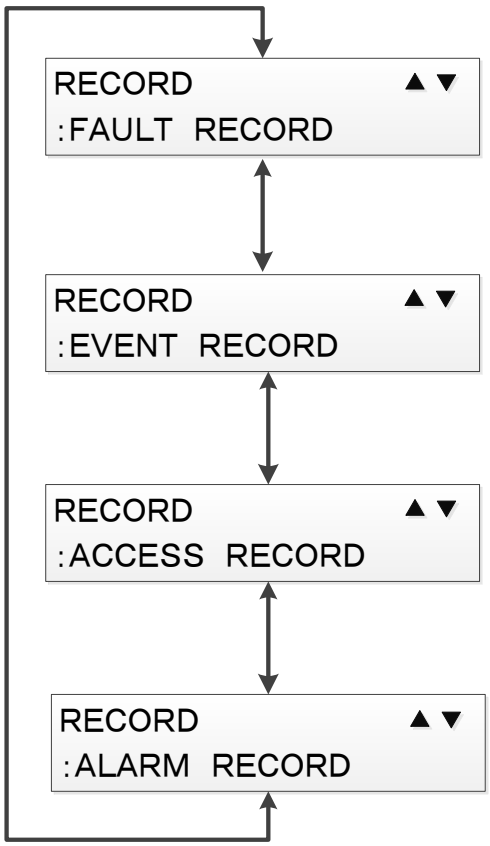
4.3.2.1.5. Device name (DEVICE NAME) menu

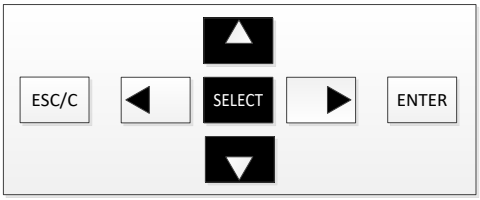
[Operation path] DISPLAY MODE > STATUS > DEVICE NAME

The Device name (DEVICE NAME) menu allows viewing of the device name.

4.3.2.2.Record (RECORD) menu

This subsection describes the operation logs in the Record (RECORD) menu.
The Record menu allows viewing four types of log data.
(Fault record, event record, access record and alarm record)



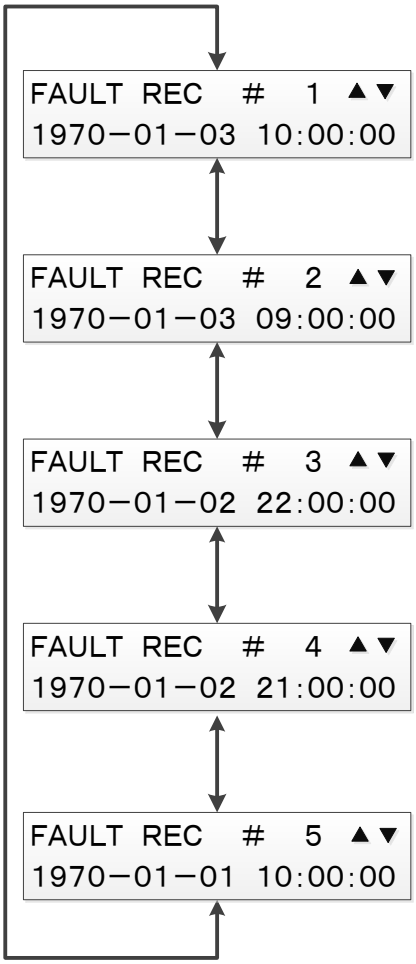


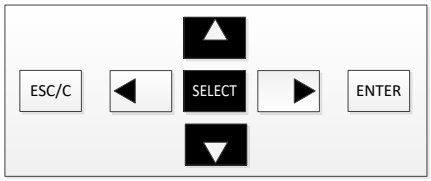
Use ▲ and ▼ to switch between items
and press SELECT to select an item

4.3.2.2.1. Fault record (FAULT RECORD) menu

[Operation path] DISPLAY MODE > RECORD > FAULT RECORD

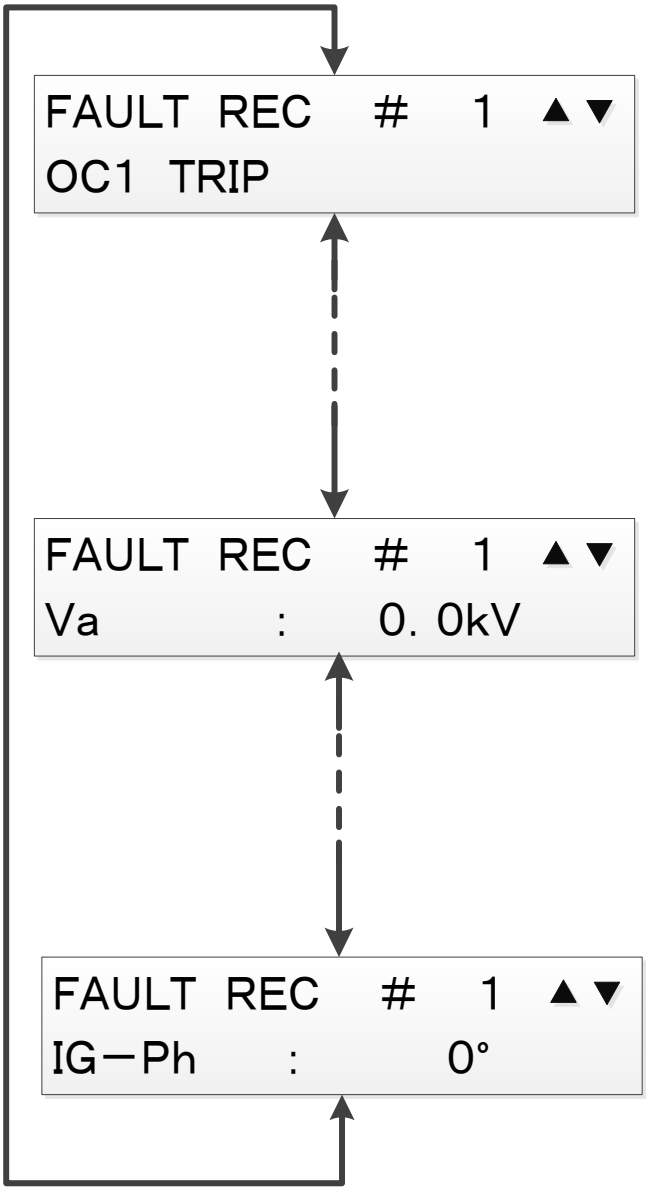
The Fault record (FAULT RECORD) menu allows viewing of the time, operating values and operating elements when the fault is detected. Fault records of up to five phenomena are stored and the respective fault record can be viewed. For selecting record for display, use the Up and Down keys to select the date of the fault record and press SELECT.





Use ▲ and ▼ to switch between items and press SELECT to select an item

After a fault record is selected, use the Up and Down keys to view the trip factors and measured values.



Trip factor

Measured values

Measured values

Table 4-5 Elements of fault records

Element name displayed	Element name displayed
OC1 Trip	UV1 Trip
OCG2 Trip	UV2 Trip
OC3 Trip	OV1 Trip
OCG3 Trip	OV2 Trip
OC4 Trip	OVG1 Trip
OCG4 Trip	OVG2 Trip
OCNEG1 Trip	OVNEG1 Trip
OCNEG2 Trip	OVNEG2 Trip
UC1 Trip	UF1 Trip
UC2 Trip	UF2 Trip
CBF Trip	UF3 Trip
CBFG Trip	OF1 Trip
DIRG1 Trip	OF2 Trip
DIRG2 Trip	OF3 Trip
DIRG3 Trip	
DIRG4 Trip	

Table 4-6 Measured values of fault records

No.	Item	Unit	No.	Signal name	Unit
1	Va	kV	17	Va-ph	°
2	Vb	kV	18	Vb-ph	°
3	Vc	kV	19	Vc-ph	°
4	Vab	kV	20	Vab-ph	°
5	Vbc	kV	21	Vbc-ph	°
6	Vca	kV	22	Vca-ph	°
7	VG	kV	23	VG-ph	°
8	3V0	kV	24	Ia-ph	°
9	V1	kV	25	Ib-ph	°
10	V2	kV	26	Ic-ph	°
11	Ia	A	27	IG-ph	°
12	Ib	A			
13	Ic	A			
14	IG	A			
15	I1	A			
16	I2	A			

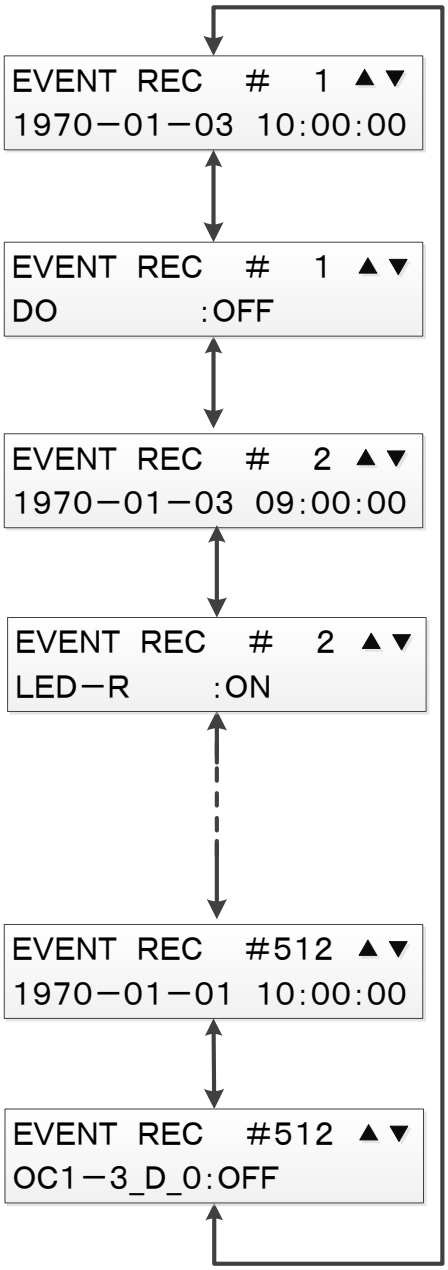
4.3.2.2.2. Event record (EVENT RECORD) menu

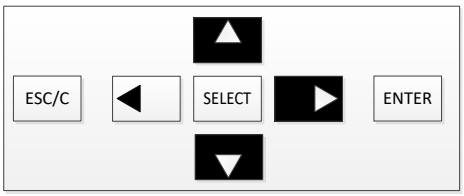
[Operation path] DISPLAY MODE > RECORD > EVENT RECORD

The Event records (EVENT RECORD) menu allows viewing of event records saved.
Event records of up to 512 events are stored and the respective event record can be viewed.
Press the Up and Down keys to switch the indication on the screen as below.

Date of occurrence > Record description > Date of occurrence...

Press the Right key to display from the current event record to the past 10th record.





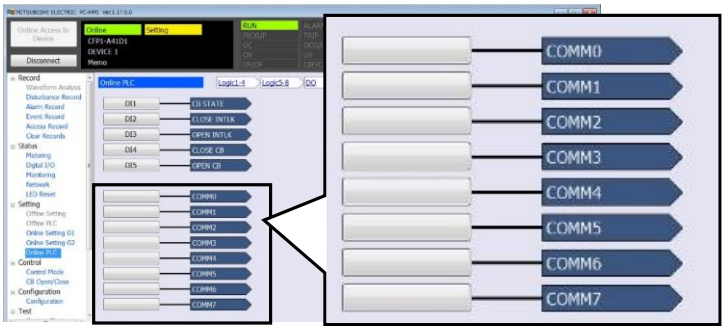
Use ▲ and ▼ to change the display item
Use ► to move from the record currently shown to the date of the tenth record into past

Table 4-7 Event record List of events

No.	Signal name	Description
1	DI1	Status of DI1 (This signal is available only in the relay unit with a DI card in SLOT-C.)
2	DI2	Status of DI2 (This signal is available only in the relay unit with a DI card in SLOT-C.)
3	DI3	Status of DI3 (This signal is available only in the relay unit with a DI card in SLOT-C.)
4	DI4	Status of DI4 (This signal is available only in the relay unit with a DI card in SLOT-C.)
5	DI5	Status of DI5 (This signal is available only in the relay unit with a DI card in SLOT-C.)
6	DI6	Status of DI6 (This signal is available only in the relay unit with a DI card in SLOT-C.)
7	DI7	Status of DI7 (This signal is available only in the relay unit with a DI card in SLOT-C.)
8	DI8	Status of DI8 (This signal is available only in the relay unit with a DI card in SLOT-C.)
9	DO1	Status of DO1
10	DO2	Status of DO2
11	DO3	Status of DO3
12	DO4	Status of DO4
13	DO5	Status of DO5
14	DO6	Status of DO6
15	DO7	Status of DO7
16	DO8	Status of DO8
17	TCNT_ALM	Alarm of trip counter
18	V0SV_ALM	Definitive signal of supervision of zero-sequence voltage
19	CBa1	Status of circuit breaker
20	INT_LK_OP	OPEN signal of INTERLOCK
21	INT_LK_CL	CLOSE signal of INTERLOCK
22	CTL_OP_OK	Condition signal for CB open control. This signal is ON when all conditions are met to control the CB.
23	CTL_CL_OK	Condition signal for CB close control. This signal is ON when all conditions are met to control the CB.
24	CB_CTL_OK	Confirmation signal of CB operation success.
25	CB_CTL_NG	Confirmation signal of CB operation failure.
26	OP_TS	CB open control via local operation.
27	CL_TS	CB close control via local operation.
28	MANU_CLS	Operation signal to close a circuit breaker (This signal is available only in the relay unit with a DI card in SLOT-C.)
29	MANU_OPN	Operation signal to open a circuit breaker (This signal is available only in the relay unit with a DI card in SLOT-C.)
30	CB_LR	CB operating authority status signal. (Local / Remote) The “CB_LR” = ON means that Local control is authorized.

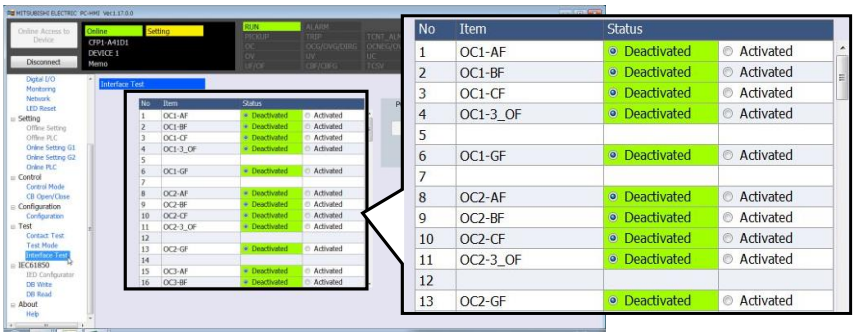
No.	Signal name	Description
31	CTL_BLOP1	Setting condition signal (Use/Non-use) for blocking CB open status. The “CTL_BLOP1” = ON (=Use) means that the CB open operations is blocked. (This signal is available only in the relay unit with IEC 61850 communication card.)
32	CTL_BLCL1	Setting condition signal (Use/Non-use) for blocking CB close status. The “CTL_BLCL1” = ON (=Use) means that the CB close operations is blocked. (This signal is available only in the relay unit with IEC 61850 communication card.)
33	43INT_FLG	Setting condition signal (Use/Non-use) for CB control interlock. (This signal is available only in the relay unit with IEC 61850 communication card.)
34	VL4000000	Operation failure or setting failure status signal. This “VL4000000” signal = ON when any following conditions. ・ The interlock condition doesn't meet. ・ The CB control doesn't be authorized. ・ The CB control direction is same as current condition. (This signal is available only in the relay unit with IEC 61850 communication card.)
35	RES_STS00	Confirmation signal of CB operation success. This “RES_STS00” signal is same as “CB_CTL_OK” signal. (This signal is available only in the relay unit with IEC 61850 communication card.)
36	RES_STS02	Status signal of CB operation failure and cause. This “RES_STS02” signal is ON when any following conditions. ・ The CB control doesn't be authorized. ・ The CB control blocking conditions are met. (This signal is available only in the relay unit with IEC 61850 communication card.)
37	RES_STS05	Status signal of CB operation failure and cause. This “RES_STS05” signal is ON when following condition. ・ The CB control direction is same as current condition. (This signal is available only in the relay unit with IEC 61850 communication card.)
38	RES_STS0A	Status signal of CB operation failure and cause. This “RES_STS0A” signal is ON when following condition. ・ The interlock condition doesn't meet. (This signal is available only in the relay unit with IEC 61850 communication card.)
39	RES_STS10	Status signal of CB operation failure and cause. This “RES_STS10” signal is ON when following condition. ・ The time passes over the timeout setting value (10 sec). (This signal is available only in the relay unit with IEC 61850 communication card.)
40	CL_DI	CB close operation signal. This signal express the condition of “CLOSE CB” on PC-HMI.  Fig. 4-2 CB control signal description on PC-HMI and internal signal name.
41	OP_DI	CB open operation signal. This signal express the condition of “OPEN CB” on PC-HMI. Please refer to Fig. 4-2.

No.	Signal name	Description
42	P_INT_LK1	CB close interlock signal. This signal express the condition of “CLOSE INTLK” on PC-HMI. Please refer to Fig. 4-2.
43	P_INT_LK2	CB open interlock signal. This signal express the condition of “OPEN INTLK” on PC-HMI. Please refer to Fig. 4-2.
44	CB_DI_CTL	Real-time DI status signal for CB control. The “CB_DI_CTL” = ON when the “CL_DI” =ON or the “OP_DI” =ON. The relationship between CB_DI_CTL, CL_DI and OP_DI is following. CB_DI_CTL = OR(CL_DI, OP_DI)
45	OC1-GD	Detection signal of 1st instantaneous overcurrent (50) element on zero phase
46	OC2-GD	Detection signal of 2nd instantaneous overcurrent (50) element on zero phase
47	OC3-GD	Detection signal of 3rd instantaneous overcurrent (50) element on zero phase
48	OC4-GD	Detection signal of definite time or IDMT overcurrent (51) element on zero phase
49	NOC1-D	Detection signal of 1st negative sequence overcurrent (46) element
50	NOC2-D	Detection signal of 2nd negative sequence overcurrent (46) element
51	CBF-GD	Detection signal of overcurrent element for the detection of CBF (50BF) on zero phase (This signal is available only in the relay unit with a DI card or IEC61850 GOOSE.)
52	DIRG1-D	Detection signal of 1st instantaneous directional ground fault (67G) element
53	DIRG2-D	Detection signal of 2nd instantaneous directional ground fault (67G) element
54	DIRG3-D	Detection signal of 3rd instantaneous directional ground fault (67G) element
55	DIRG4-D	Detection signal of definite time or IDMT directional ground fault (67G) element
56	OVG1-D	Detection signal of 1st ground fault overvoltage (64N) element
57	OVG2-D	Detection signal of 2nd ground fault overvoltage (64N) element
58	NOV1-D	Detection signal of 1st negative sequence overvoltage (47) element
59	NOV2-D	Detection signal of 2nd negative sequence overvoltage (47) element
60	UF1-D	Detection signal of 1st underfrequency (81UF) element
61	UF2-D	Detection signal of 2nd underfrequency (81UF) element
62	UF3-D	Detection signal of 3rd underfrequency (81UF) element
63	OF1-D	Detection signal of 1st overfrequency (81OF) element
64	OF2-D	Detection signal of 2nd overfrequency (81OF) element
65	OF3-D	Detection signal of 3rd overfrequency (81OF) element
66	ALARM	Abnormal condition of constant supervision (heavy alarm)
67	ALARM-L	Abnormal condition of constant supervision (light alarm)
68	RY-LOCK	Locking of relay
69	SV-LK	The operation lock signal for monitoring function such as a zero-sequence voltage. The ON/OFF of this signal is changed via TEST mode.
70	UC-A-LK	The operation lock signal for A-Phase operation in undercurrent element (UC1, UC2). The ON/OFF of this signal is changed via TEST mode.
71	UC-B-LK	The operation lock signal for B-Phase operation in undercurrent element (UC1, UC2). The ON/OFF of this signal is changed via TEST mode.
72	UC-C-LK	The operation lock signal for C-Phase operation in undercurrent element (UC1, UC2). The ON/OFF of this signal is changed via TEST mode.

No.	Signal name	Description
73	UV-A-LK	The operation lock signal for A-Phase operation in undervoltage element (UV1, UV2). The ON/OFF of this signal is changed via TEST mode.
74	UV-B-LK	The operation lock signal for B-Phase operation in undervoltage element (UV1, UV2). The ON/OFF of this signal is changed via TEST mode.
75	UV-C-LK	The operation lock signal for C-Phase operation in undervoltage element (UV1, UV2). The ON/OFF of this signal is changed via TEST mode.
76	OV-A-LK	The operation lock signal for A-Phase operation in overvoltage element (OV1, OV2). The ON/OFF of this signal is changed via TEST mode.
77	OV-B-LK	The operation lock signal for B-Phase operation in overvoltage element (OV1, OV2). The ON/OFF of this signal is changed via TEST mode.
78	OV-C-LK	The operation lock signal for C-Phase operation in overvoltage element (OV1, OV2). The ON/OFF of this signal is changed via TEST mode.
79	TCNT-LK	The operation lock signal for a trip counter function (TCNT). The ON/OFF of this signal is changed via TEST mode.
80	COMM0	Assignment to IEC 61850 transmitted signals. This “COMM0” signal is assigned Ind1 of GGIO4 in IEC 61850 model. (This signal is available only in the relay unit with IEC 61850 communication card.)  Fig. 4-3 COMM signal description on PC-HMI.
81	COMM1	Assignment to IEC 61850 transmitted signals. This “COMM1” signal is assigned Ind2 of GGIO4 in IEC 61850 model. (This signal is available only in the relay unit with IEC 61850 communication card.) Please refer to Fig. 4-3.
82	COMM2	Assignment to IEC 61850 transmitted signals. This “COMM2” signal is assigned Ind3 of GGIO4 in IEC 61850 model. (This signal is available only in the relay unit with IEC 61850 communication card.) Please refer to Fig. 4-3.
83	COMM3	Assignment to IEC 61850 transmitted signals. This “COMM3” signal is assigned Ind4 of GGIO4 in IEC 61850 model. (This signal is available only in the relay unit with IEC 61850 communication card.) Please refer to Fig. 4-3.

No.	Signal name	Description
84	COMM4	Assignment to IEC 61850 transmitted signals. This “COMM4” signal is assigned Ind5 of GGIO4 in IEC 61850 model. (This signal is available only in the relay unit with IEC 61850 communication card.) Please refer to Fig. 4-3.
85	COMM5	Assignment to IEC 61850 transmitted signals. This “COMM5” signal is assigned Ind6 of GGIO4 in IEC 61850 model. (This signal is available only in the relay unit with IEC 61850 communication card.) Please refer to Fig. 4-3.
86	COMM6	Assignment to IEC 61850 transmitted signals. This “COMM6” signal is assigned Ind7 of GGIO4 in IEC 61850 model. (This signal is available only in the relay unit with IEC 61850 communication card.) Please refer to Fig. 4-3.
87	COMM7	Assignment to IEC 61850 transmitted signals. This “COMM7” signal is assigned Ind8 of GGIO4 in IEC 61850 model. (This signal is available only in the relay unit with IEC 61850 communication card.) Please refer to Fig. 4-3.
88	OC1-3D_O	Detection signal of any OC1 of A, B, and C phase
89	OC2-3D_O	Detection signal of any OC2 of A, B, and C phase
90	OC3-3D_O	Detection signal of any OC3 of A, B, and C phase
91	OC4-3D_O	Detection signal of any OC4 of A, B, and C phase
92	UC1-3D_O	Detection signal of any UC1 of A, B, and C phase
93	UC2-3D_O	Detection signal of any UC2 of A, B, and C phase
94	UV1-3D_O	Detection signal of any UV1 of A (AB), B (BC), and C (CA) phase
95	UV2-3D_O	Detection signal of any UV2 of A (AB), B (BC), and C (CA) phase
96	OV1-3D_O	Detection signal of any OV1 of A (AB), B (BC), and C (CA) phase
97	OV2-3D_O	Detection signal of any OV2 of A (AB), B (BC), and C (CA) phase
98	CBF-3D_O	Detection signal of any CBF of A, B, and C phase (This signal is available only in the relay unit with a DI card or IEC61850 GOOSE.)
99	2f-3D_O	Detection signal of any 2f of A, B, and C phase
100	ALLEL-O	Definitive signal of any of all elements (OR of all definitive signals)
101	DS_TRIG	Operating status signal of the disturbance recorder –which is also called a data save function. While this "DS_TRIG" signal is ON, the waveform data and binary data are captured and saved.
102	GOOSE1	Assignment of GOOSE received signals (This signal is available only in the relay unit with IEC61850 communication card.)
103	GOOSE2	Assignment of GOOSE received signals (This signal is available only in the relay unit with IEC61850 communication card.)
104	GOOSE3	Assignment of GOOSE received signals (This signal is available only in the relay unit with IEC61850 communication card.)
105	GOOSE4	Assignment of GOOSE received signals (This signal is available only in the relay unit with IEC61850 communication card.)
106	GOOSE5	Assignment of GOOSE received signals (This signal is available only in the relay unit with IEC61850 communication card.)

No.	Signal name	Description
107	GOOSE6	Assignment of GOOSE received signals (This signal is available only in the relay unit with IEC61850 communication card.)
108	GOOSE7	Assignment of GOOSE received signals (This signal is available only in the relay unit with IEC61850 communication card.)
109	GOOSE8	Assignment of GOOSE received signals (This signal is available only in the relay unit with IEC61850 communication card.)
110	GOOSE9	Assignment of GOOSE received signals (This signal is available only in the relay unit with IEC61850 communication card.)
111	GOOSE10	Assignment of GOOSE received signals (This signal is available only in the relay unit with IEC61850 communication card.)
112	GOOSE11	Assignment of GOOSE received signals (This signal is available only in the relay unit with IEC61850 communication card.)
113	GOOSE12	Assignment of GOOSE received signals (This signal is available only in the relay unit with IEC61850 communication card.)
114	GOOSE13	Assignment of GOOSE received signals (This signal is available only in the relay unit with IEC61850 communication card.)
115	GOOSE14	Assignment of GOOSE received signals (This signal is available only in the relay unit with IEC61850 communication card.)
116	GOOSE15	Assignment of GOOSE received signals (This signal is available only in the relay unit with IEC61850 communication card.)
117	GOOSE16	Assignment of GOOSE received signals (This signal is available only in the relay unit with IEC61850 communication card.)
118	GOOSE17	Assignment of GOOSE received signals (This signal is available only in the relay unit with IEC61850 communication card.)
119	GOOSE18	Assignment of GOOSE received signals (This signal is available only in the relay unit with IEC61850 communication card.)
120	GOOSE19	Assignment of GOOSE received signals (This signal is available only in the relay unit with IEC61850 communication card.)
121	GOOSE20	Assignment of GOOSE received signals (This signal is available only in the relay unit with IEC61850 communication card.)
122	GOOSE21	Assignment of GOOSE received signals (This signal is available only in the relay unit with IEC61850 communication card.)
123	GOOSE22	Assignment of GOOSE received signals (This signal is available only in the relay unit with IEC61850 communication card.)
124	GOOSE23	Assignment of GOOSE received signals (This signal is available only in the relay unit with IEC61850 communication card.)
125	GOOSE24	Assignment of GOOSE received signals (This signal is available only in the relay unit with IEC61850 communication card.)
126	GOOSE25	Assignment of GOOSE received signals (This signal is available only in the relay unit with IEC61850 communication card.)
127	GOOSE26	Assignment of GOOSE received signals (This signal is available only in the relay unit with IEC61850 communication card.)
128	GOOSE27	Assignment of GOOSE received signals (This signal is available only in the relay unit with IEC61850 communication card.)
129	GOOSE28	Assignment of GOOSE received signals (This signal is available only in the relay unit with IEC61850 communication card.)
130	GOOSE29	Assignment of GOOSE received signals (This signal is available only in the relay unit with IEC61850 communication card.)

No.	Signal name	Description
131	GOOSE30	Assignment of GOOSE received signals (This signal is available only in the relay unit with IEC61850 communication card.)
132	GOOSE31	Assignment of GOOSE received signals (This signal is available only in the relay unit with IEC61850 communication card.)
133	GOOSE32	Assignment of GOOSE received signals (This signal is available only in the relay unit with IEC61850 communication card.)
134	GOOSE33	Assignment of GOOSE received signals (This signal is available only in the relay unit with IEC61850 communication card.)
135	GOOSE34	Assignment of GOOSE received signals (This signal is available only in the relay unit with IEC61850 communication card.)
136	GOOSE35	Assignment of GOOSE received signals (This signal is available only in the relay unit with IEC61850 communication card.)
137	GOOSE36	Assignment of GOOSE received signals (This signal is available only in the relay unit with IEC61850 communication card.)
138	GOOSE37	Assignment of GOOSE received signals (This signal is available only in the relay unit with IEC61850 communication card.)
139	G_TRIP1	Operating condition of CBF/CBFG element (Trip signal from other relay) (This signal is available only in the relay unit with IEC61850 communication card.)
140	G_TRIP2	Operating condition of CBF/CBFG element (Trip signal from other relay) (This signal is available only in the relay unit with IEC61850 communication card.)
141	G_TRIP3	Operating condition of CBF/CBFG element (Trip signal from other relay) (This signal is available only in the relay unit with IEC61850 communication card.)
142	OC1-A	Definitive signal of OC1 A-phase or forced operation from PC-HMI. This signal is shown as OC1-AF in Interface Test function on PC-HMI.  Fig. 4-4 Signal description of the forced operation and interface test on PC-HMI.
143	OC1-B	Definitive signal of OC1 B-phase or forced operation from PC-HMI This signal is shown as OC1-BF in Interface Test function on PC-HMI. Please refer to Fig. 4-4.
144	OC1-C	Definitive signal of OC1 C-phase or forced operation from PC-HMI. This signal is shown as OC1-CF in Interface Test function on PC-HMI. Please refer to Fig. 4-4.
145	OC1-3_O	Definitive signal of any OC1 of A, B, and C phase or forced operation from PC-HMI. This signal is shown as OC1-3_OF in Interface Test function on PC-HMI. Please refer to Fig. 4-4.

No.	Signal name	Description
146	OC1-G	Definitive signal of OC1 zero-phase or forced operation from PC-HMI. This signal is shown as OC1-GF in Interface Test function on PC-HMI. Please refer to Fig. 4-4.
147	OC2-A	Definitive signal of OC2 A-phase or forced operation from PC-HMI. This signal is shown as OC2-AF in Interface Test function on PC-HMI. Please refer to Fig. 4-4.
148	OC2-B	Definitive signal of OC2 B-phase or forced operation from PC-HMI. This signal is shown as OC2-BF in Interface Test function on PC-HMI. Please refer to Fig. 4-4.
149	OC2-C	Definitive signal of OC2 C-phase or forced operation from PC-HMI. This signal is shown as OC2-CF in Interface Test function on PC-HMI. Please refer to Fig. 4-4.
150	OC2-3_O	Definitive signal of any OC2 of A, B, and C phase or forced operation from PC-HMI. This signal is shown as OC2-3_OF in Interface Test function on PC-HMI. Please refer to Fig. 4-4.
151	OC2-G	Definitive signal of OC2 zero-phase or forced operation from PC-HMI. This signal is shown as OC2-GF in Interface Test function on PC-HMI. Please refer to Fig. 4-4.
152	OC3-A	Definitive signal of OC3 A-phase or forced operation from PC-HMI. This signal is shown as OC3-AF in Interface Test function on PC-HMI. Please refer to Fig. 4-4.
153	OC3-B	Definitive signal of OC3 B-phase or forced operation from PC-HMI. This signal is shown as OC3-BF in Interface Test function on PC-HMI. Please refer to Fig. 4-4.
154	OC3-C	Definitive signal of OC3 C-phase or forced operation from PC-HMI. This signal is shown as OC3-CF in Interface Test function on PC-HMI. Please refer to Fig. 4-4.
155	OC3-3_O	Definitive signal of any OC3 of A, B, and C phase or forced operation from PC-HMI. This signal is shown as OC3-3_OF in Interface Test function on PC-HMI. Please refer to Fig. 4-4.
156	OC3-G	Definitive signal of OC3 zero-phase or forced operation from PC-HMI. This signal is shown as OC3-GF in Interface Test function on PC-HMI. Please refer to Fig. 4-4.

No.	Signal name	Description
157	OC4-A	Definitive signal of OC4 A-phase or forced operation from PC-HMI. This signal is shown as OC4-AF in Interface Test function on PC-HMI. Please refer to Fig. 4-4.
158	OC4-B	Definitive signal of OC4 B-phase or forced operation from PC-HMI. This signal is shown as OC4-BF in Interface Test function on PC-HMI. Please refer to Fig. 4-4.
159	OC4-C	Definitive signal of OC4 C-phase or forced operation from PC-HMI. This signal is shown as OC4-CF in Interface Test function on PC-HMI. Please refer to Fig. 4-4.
160	OC4-3_O	Definitive signal of any OC4 of A, B, and C phase or forced operation from PC-HMI. This signal is shown as OC4-3_OF in Interface Test function on PC-HMI. Please refer to Fig. 4-4.
161	OC4-G	Definitive signal of OC4 zero-phase or forced operation from PC-HMI. This signal is shown as OC4-GF in Interface Test function on PC-HMI. Please refer to Fig. 4-4.
162	NOC1	Definitive signal of OCNEG1 or forced operation from PC-HMI. This signal is shown as NOC1F in Interface Test function on PC-HMI. Please refer to Fig. 4-4.
163	NOC2	Definitive signal of OCNEG2 or forced operation from PC-HMI. This signal is shown as NOC2F in Interface Test function on PC-HMI. Please refer to Fig. 4-4.
164	UC1-A	Definitive signal of UC1 A-phase or forced operation from PC-HMI. This signal is shown as UC1-AF in Interface Test function on PC-HMI. Please refer to Fig. 4-4.
165	UC1-B	Definitive signal of UC1 B-phase or forced operation from PC-HMI. This signal is shown as UC1-BF in Interface Test function on PC-HMI. Please refer to Fig. 4-4.
166	UC1-C	Definitive signal of UC1 C-phase or forced operation from PC-HMI. This signal is shown as UC1-CF in Interface Test function on PC-HMI. Please refer to Fig. 4-4.
167	UC1-3_O	Definitive signal of any UC1 of A, B, and C phase or forced operation from PC-HMI. This signal is shown as UC1-3_OF in Interface Test function on PC-HMI. Please refer to Fig. 4-4.

No.	Signal name	Description
168	UC2-A	Definitive signal of UC2 A-phase or forced operation from PC-HMI. This signal is shown as UC2-AF in Interface Test function on PC-HMI. Please refer to Fig. 4-4.
169	UC2-B	Definitive signal of UC2 B-phase or forced operation from PC-HMI. This signal is shown as UC2-BF in Interface Test function on PC-HMI. Please refer to Fig. 4-4.
170	UC2-C	Definitive signal of UC2 C-phase or forced operation from PC-HMI. This signal is shown as UC2-CF in Interface Test function on PC-HMI. Please refer to Fig. 4-4.
171	UC2-3_O	Definitive signal of any UC2 of A, B, and C phase or forced operation from PC-HMI. This signal is shown as UC2-3_OF in Interface Test function on PC-HMI. Please refer to Fig. 4-4.
172	CBF-A	Definitive signal of CBF A-phase or forced operation from PC-HMI. This signal is shown as CBF-AF in Interface Test function on PC-HMI. Please refer to Fig. 4-4.
173	CBF-B	Definitive signal of CBF B-phase or forced operation from PC-HMI. This signal is shown as CBF-BF in Interface Test function on PC-HMI. Please refer to Fig. 4-4.
174	CBF-C	Definitive signal of CBF C-phase or forced operation from PC-HMI. This signal is shown as CBF-CF in Interface Test function on PC-HMI. Please refer to Fig. 4-4.
175	CBF-3_O	Definitive signal of any CBF of A, B, and C phase or forced operation from PC-HMI. This signal is shown as CBF-3_OF in Interface Test function on PC-HMI. Please refer to Fig. 4-4.
176	CBF-G	Definitive signal of CBF zero-phase or forced operation from PC-HMI. This signal is shown as CBF-GF in Interface Test function on PC-HMI. Please refer to Fig. 4-4.
177	DIRG1	Definitive signal of DIRG1 or forced operation from PC-HMI. This signal is shown as DIRG1F in Interface Test function on PC-HMI. Please refer to Fig. 4-4.
178	DIRG2	Definitive signal of DIRG2 or forced operation from PC-HMI. This signal is shown as DIRG2F in Interface Test function on PC-HMI. Please refer to Fig. 4-4.

No.	Signal name	Description
179	DIRG3	Definitive signal of DIRG3 or forced operation from PC-HMI. This signal is shown as DIRG3F in Interface Test function on PC-HMI. Please refer to Fig. 4-4.
180	DIRG4	Definitive signal of DIRG4 or forced operation from PC-HMI. This signal is shown as DIRG4F in Interface Test function on PC-HMI. Please refer to Fig. 4-4.
181	UV1-A	Definitive signal of UV1 A (AB) phase or forced operation from PC-HMI. This signal is shown as UV1-AF in Interface Test function on PC-HMI. Please refer to Fig. 4-4.
182	UV1-B	Definitive signal of UV1 B (BC) phase or forced operation from PC-HMI. This signal is shown as UV1-BF in Interface Test function on PC-HMI. Please refer to Fig. 4-4.
183	UV1-C	Definitive signal of UV1 C (CA) phase or forced operation from PC-HMI. This signal is shown as UV1-CF in Interface Test function on PC-HMI. Please refer to Fig. 4-4.
184	UV1-3_O	Definitive signal of any UV1 of A (AB), B (BC), and C (CA) phase or forced operation from PC-HMI. This signal is shown as UV1-3_OF in Interface Test function on PC-HMI. Please refer to Fig. 4-4.
185	UV2-A	Definitive signal of UV2 A (AB) phase or forced operation from PC-HMI. This signal is shown as UV2-AF in Interface Test function on PC-HMI. Please refer to Fig. 4-4.
186	UV2-B	Definitive signal of UV2 B (BC) phase or forced operation from PC-HMI. This signal is shown as UV2-BF in Interface Test function on PC-HMI. Please refer to Fig. 4-4.
187	UV2-C	Definitive signal of UV2 C (CA) phase or forced operation from PC-HMI. This signal is shown as UV2-CF in Interface Test function on PC-HMI. Please refer to Fig. 4-4.
188	UV2-3_O	Definitive signal of any UV2 of A (AB), B (BC), and C (CA) phase or forced operation from PC-HMI. This signal is shown as UV2-3_OF in Interface Test function on PC-HMI. Please refer to Fig. 4-4.
189	OV1-A	Definitive signal of OV1 A (AB) phase or forced operation from PC-HMI. This signal is shown as OV1-AF in Interface Test function on PC-HMI. Please refer to Fig. 4-4.

No.	Signal name	Description
190	OV1-B	Definitive signal of OV1 B (BC) phase or forced operation from PC-HMI. This signal is shown as OV1-BF in Interface Test function on PC-HMI. Please refer to Fig. 4-4.
191	OV1-C	Definitive signal of OV1 C (CA) phase or forced operation from PC-HMI. This signal is shown as OV1-CF in Interface Test function on PC-HMI. Please refer to Fig. 4-4.
192	OV1-3_O	Definitive signal of any OV1 of A (AB), B (BC), and C (CA) phase or forced operation from PC-HMI. This signal is shown as OV1-3_OF in Interface Test function on PC-HMI. Please refer to Fig. 4-4.
193	OV2-A	Definitive signal of OV2 A (AB) phase or forced operation from PC-HMI. This signal is shown as OV2-AF in Interface Test function on PC-HMI. Please refer to Fig. 4-4.
194	OV2-B	Definitive signal of OV2 B (BC) phase or forced operation from PC-HMI. This signal is shown as OV2-BF in Interface Test function on PC-HMI. Please refer to Fig. 4-4.
195	OV2-C	Definitive signal of OV2 C (CA) phase or forced operation from PC-HMI. This signal is shown as OV2-CF in Interface Test function on PC-HMI. Please refer to Fig. 4-4.
196	OV2-3_O	Definitive signal of any OV2 of A (AB), B (BC), and C (CA) phase or forced operation from PC-HMI. This signal is shown as OV2-3_OF in Interface Test function on PC-HMI. Please refer to Fig. 4-4.
197	OVG1	Definitive signal of OVG1 or forced operation from PC-HMI. This signal is shown as OVG1F in Interface Test function on PC-HMI. Please refer to Fig. 4-4.
198	OVG2	Definitive signal of OVG2 or forced operation from PC-HMI. This signal is shown as OVG2F in Interface Test function on PC-HMI. Please refer to Fig. 4-4.
199	NOV1	Definitive signal of OVNEG1 or forced operation from PC-HMI. This signal is shown as NOV1F in Interface Test function on PC-HMI. Please refer to Fig. 4-4.
200	NOV2	Definitive signal of OVNEG2 or forced operation from PC-HMI. This signal is shown as NOV2F in Interface Test function on PC-HMI. Please refer to Fig. 4-4.

No.	Signal name	Description
201	UF1	Definitive signal of UF1 or forced operation from PC-HMI. This signal is shown as UF1F in Interface Test function on PC-HMI. Please refer to Fig. 4-4.
202	UF2	Definitive signal of UF2 or forced operation from PC-HMI. This signal is shown as UF2F in Interface Test function on PC-HMI. Please refer to Fig. 4-4.
203	UF3	Definitive signal of UF3 or forced operation from PC-HMI. This signal is shown as UF3F in Interface Test function on PC-HMI. Please refer to Fig. 4-4.
204	OF1	Definitive signal of OF1 or forced operation from PC-HMI. This signal is shown as OF1F in Interface Test function on PC-HMI. Please refer to Fig. 4-4.
205	OF2	Definitive signal of OF2 or forced operation from PC-HMI. This signal is shown as OF2F in Interface Test function on PC-HMI. Please refer to Fig. 4-4.
206	OF3	Definitive signal of OF3 or forced operation from PC-HMI. This signal is shown as OF3F in Interface Test function on PC-HMI. Please refer to Fig. 4-4.

Table 4-8 Event record List of events (just name table)

Event name			
OC1-A	UV1-A	DO3	CL_TS
OC1-B	UV1-B	DO4	MANU_CLS
OC1-C	UV1-C	DO5	MANU_OPN
OC1-G	UV2-A	DO6	CB_LR
OC2-A	UV2-B	DO7	CL_DI
OC2-B	UV2-C	DO8	OP_DI
OC2-C	OV1-A	DO9	P_INT_LK1
OC2-G	OV1-B	DO10	P_INT_LK2
OC3-A	OV1-C	DO11	CB_DI_CTL
OC3-B	OV2-A	DO12	52a
OC3-C	OV2-B	DO13	ALARM
OC3-G	OV2-C	DI1	ALARM-L
OC4-A	OVG1	DI2	RY-LOCK
OC4-B	OVG2	DI3	SV-LK
OC4-C	NOV1	DI4	UC-A-LK
OC4-G	NOV2	DI5	UC-B-LK
NOC1	UF1	DI6	UC-C-LK
NOC2	UF2	DI7	UV-A-LK
UC1-A	UF3	DI8	UV-B-LK
UC1-B	OF1	DI9	UV-C-LK
UC1-C	OF2	DI10	OV-A-LK
UC2-A	OF3	DI11	OV-B-LK
UC2-B	VD-A	DI12	OV-C-LK
UC2-C	VD-B	DI13	TCNT-LK
CBF-A	VD-C	CBa1	LED1-R
CBF-B	VTF	INT_LK_OP	LED1-G
CBF-C	TCNT ALM	INT_LK_CL	LED2-R
CBF-G	TCOIL ALM	CTL_OP_OK	LED2-G
DIRG1	V0SV ALM	CTL_CL_OK	LED3-R
DIRG2	I0SV ALM	CB_CTL_OK	LED3-G
DIRG3	DO1	CB_CTL_NG	LED4-R
DIRG4	DO2	OP_TS	LED4-G

Event name			
LED5-R	DIRG1-D	UV1-3D_O	GOOSE28
LED5-G	DIRG2-D	UV2-3D_O	GOOSE29
LED6-R	DIRG3-D	OV1-3D_O	GOOSE30
LED6-G	DIRG4-D	OV2-3D_O	GOOSE31
LED7-R	2f-AD	ALLEL-O	GOOSE32
LED7-G	2f-BD	GOOSE1	GOOSE33
LED8-R	2f-CD	GOOSE2	GOOSE34
LED8-G	OVG1-D	GOOSE3	GOOSE35
LED9-R	OVG2-D	GOOSE4	GOOSE36
LED9-G	NOV1-D	GOOSE5	GOOSE37
LED10	NOV2-D	GOOSE6	GOOSE38
LED11	UF1-D	GOOSE7	GOOSE39
LED12	UF2-D	GOOSE8	GOOSE40
INT_LKOP1	UF3-D	GOOSE9	DS_TRIG
INT_LKCL1	OF1-D	GOOSE10	
43LR_FLG	OF2-D	GOOSE11	
CTL_BLOP1	OF3-D	GOOSE12	
CTL_BLCL1	PLC_OUT35	GOOSE13	
43INT_FLG	PLC_OUT36	GOOSE14	
VL4000000	PLC_OUT37	GOOSE15	
RES_STS00	PLC_OUT38	GOOSE16	
RES_STS02	PLC_OUT39	GOOSE17	
RES_STS05	PLC_OUT40	GOOSE18	
RES_STS0A	PLC_OUT41	GOOSE19	
RES_STS10	PLC_OUT42	GOOSE20	
OC1-GD	OC1-3D_O	GOOSE21	
OC2-GD	OC2-3D_O	GOOSE22	
OC3-GD	OC3-3D_O	GOOSE23	
OC4-GD	OC4-3D_O	GOOSE24	
NOC1-D	UC1-3D_O	GOOSE25	
NOC2-D	UC2-3D_O	GOOSE26	
CBF-GD	CBF-3D_O	GOOSE27	

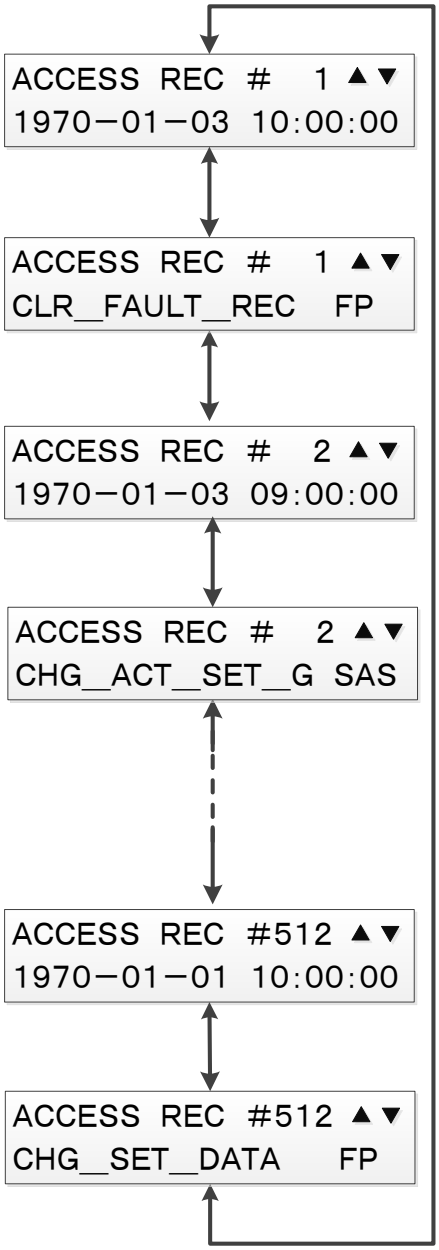
4.3.2.2.3. Access record (ACCESS RECORD) menu

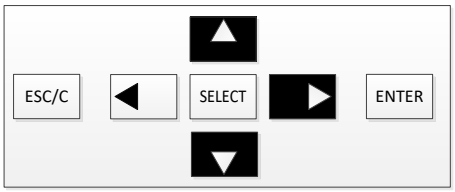
[Operation path] DISPLAY MODE > RECORD > ACCESS RECORD

The Access record (ACCESS RECORD) menu allows viewing of the saved access records.
Access records of up to 512 accesses are stored and the records for the respective accesses can be viewed.
Press the Up and Down keys to switch the indication on the screen as below.

Date of occurrence > Record description > Date of occurrence...

Press the Right key to display from the current access record to the past 10th record.





Use ▲ and ▼ to change the display item
Use ► to move from the record currently shown to the date of the tenth record into past

Access record description registered (operator)

Display item	Operation description
FP	Front panel
PC	PC-HMI
MOD	Modbus
SAS	IEC61850
CCL	CC-Link
AUT	Automatic cancelation on device

Access record description registered (operation description)

Display item	Operation description
CHG_ACT_SET_G	Change of active setting group
CHG_FREQ	Change of rated frequency
CHG_DI_VOLTAGE	Change of DI detection voltage value
CHG_DIST_REC_T	Change of configuration of disturbance record
CHG_USE_PASSWD	Change of password use setting
CHG_PASSWD	Change of password
CHG_USB_CONN	Change of USB connection channel
CHG_VFD_BRIGHT	Change of VFD brightness
CHG_TRIP_CNTR	Change of trip counter
CHG_MOTOR_TIME	Change of motor operating time
CHG_CFG_MODBUS	Change of configuration of Modbus
CHG_CFG_CCLINK	Change of configuration of CC-Link
CHG_IEC61850	Change of configuration of IEC61850
CHG_DEV_NAME	Change of device name
CHG_CFG_METER	Change of configuration of analog measurement status display
CHG_CFG_ENERGY	Change of configuration of electric energy
CHG_TIMEMANAGE	Change of configuration of time management
CHG_CTRL_MODE	Change of CB control mode
CHG_CONTACT_T	Change of configuration of DO contact test
CHG_PLC_DATA	Change of PLC data
CHG_SET_DATA	Change of relay setting
CLR_FAULT_REC	Clearing of fault/disturbance record
CLR_ALARM_REC	Clearing of alarm record
CLR_EVENT_REC	Clearing of event record
CLR_ACCESS_REC	Clearing of access record
ADJ_CLOCK	Adjustment of system clock
ACT_TST_MODE	Activation of test mode
DEACT_TST_MODE	Deactivation of test mode
RESET_LED	LED reset
STA_CONTACTTST	Start of DO contact test
STP_CONTACTTST	Stop of DO contact test
LOCK_SV	Locking of supervision
UNLOCK_SV	Unlocking of supervision
OPERATE_CB	Operation to open/close CB

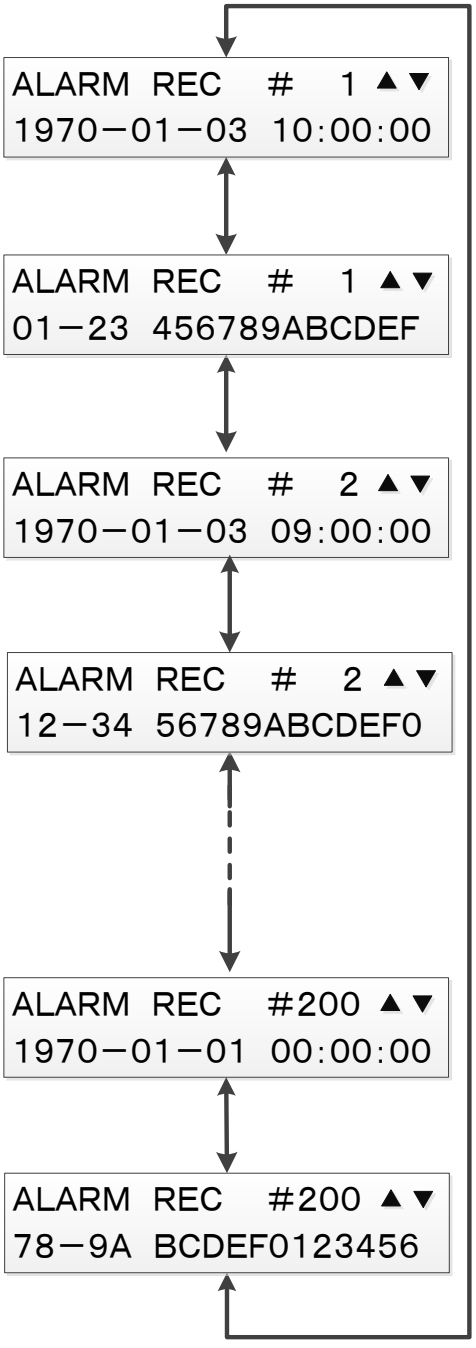
4.3.2.2.4. Alarm record (ALARM RECORD) menu

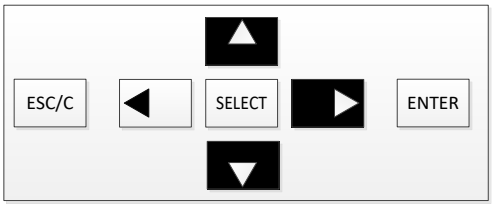
[Operation path] DISPLAY MODE > RECORD > ALARM RECORD

The ALARM RECORD menu allows viewing of the saved alarm records.
Alarm records of up to 200 alarms are stored and the records for the respective alarms can be viewed.
Press the Up and Down keys to switch the indication on the screen as below.

Date of occurrence > Record description > Date of occurrence...

Press the Right key to display from the current alarm record to the past 10th record.
The detail of error code is as shown in Table 9-2 in Chapter 9.





Use ▲ and ▼ to change the display item
Use ► to move from the record currently shown to the date of the tenth record into past

4.3.2.3.Setting (SETTING) menu

The Setting menu can be selected in either DISPLAY or SETTING mode but the DISPLAY mode only allows viewing of the setting values.
The setting values can be changed only in the SETTING mode.

For operations for the Setting menu, see 4.3.4.1.

4.3.2.4.Control (CONTROL) menu

The Control menu can be selected in either DISPLAY or SETTING mode. But the DISPLAY mode only allows viewing of the control mode (CTRL MODE) settings.
The SETTING mode allows viewing and setting of the Control mode and Circuit breaker control (CB CONTROL).

For operations for the Control mode menu, see 4.3.4.2.

4.3.2.5.Configuration (CONFIG) menu

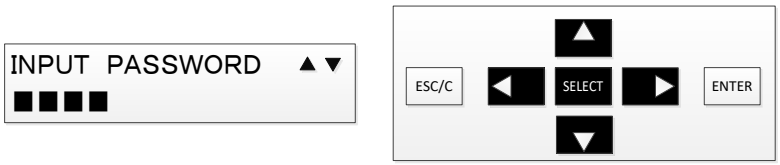
The Configuration menu can be selected in either DISPLAY or SETTING mode. Clock adjustment (CLOCK ADJUST), Password use/no-use (PASSWORD USE) and Password registration (PASSWORD REGIST) can be selected only in the SETTING mode.
For other settings, the DISPLAY mode allows only viewing of the setting values.
The setting values can be changed only in the SETTING mode.

For operations for the Configuration menu, see 4.3.4.3.

4.3.3. Password input screen

If the password use/no-use setting is “USE,” a four-digit password is requested when the SETTING mode is selected.

* For the password use/no-use setting, see 4.3.4.3.8.
For how to set the password input, see 4.3.4.3.9.



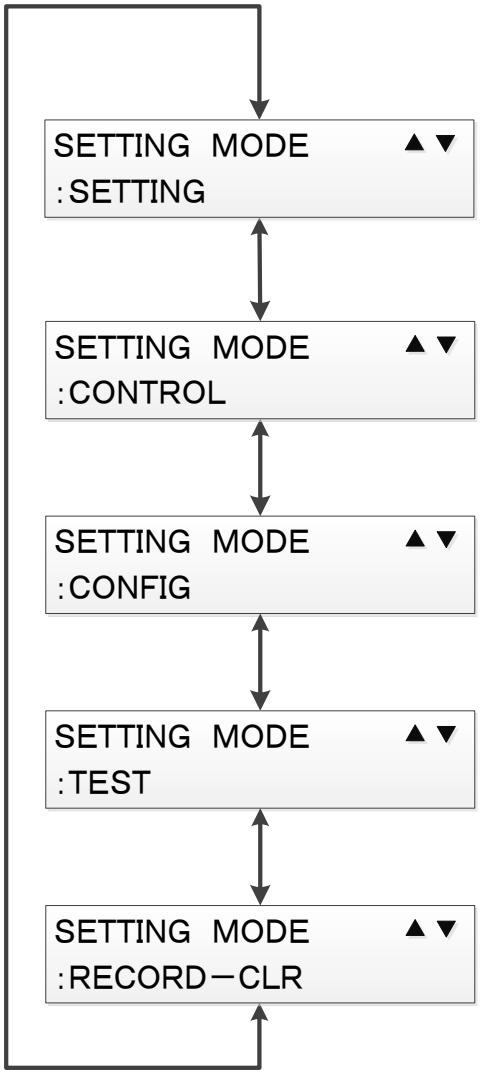
Use ◄ and ► to select the digit to enter a value for the password and ▲ and ▼ to change the value of the digit selected
When the password has been entered, press SELECT

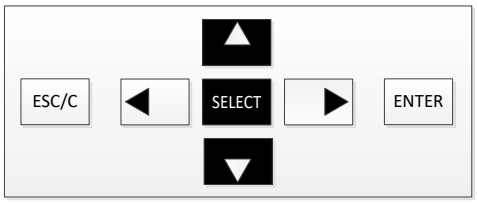
If the password input is wrong, a screen as shown below appears.

The main menu appears when the correct password has been input.

4.3.4. SETTING mode menu operations

This subsection describes the SETTING mode menu.
The menu screen has five selectable items. Use the Up and Down keys to select the item and press SELECT.
For the details about the menus available in the SETTING mode, see Table 4-2.

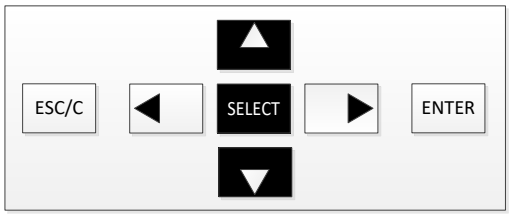




Use ▲ and ▼ to switch between items
and press SELECT to select an item

4.3.4.1.Setting (SETTING) menu

The Setting (SETTING) menu allows viewing/changing of the active setting group and viewing/changing of the group setting values.
The Setting menu can be selected in either DISPLAY or SETTING mode but the setting values can be changed only in the SETTING mode.
(The DISPLAY mode allows only viewing of the setting values.)



Use ▲ and ▼ to switch between items
and press SELECT to select an item

4.3.4.1.1. Active group (ACTIVE WG) menu

[Operation path] SETTING MODE > SETTING > ACTIVE WG

The Active group (ACTIVE WG) menu allows changing of the active group numbers setting.
(Active group numbers can be changed only in the SETTING mode.
The DISPLAY mode allows only viewing of the current group numbers.)

```
ACTIVE WG
          :G1
```

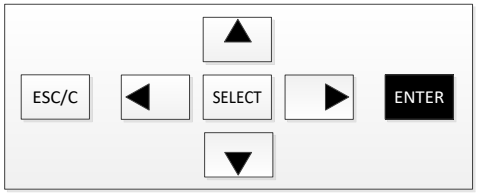
To change the active group number, in the Active group menu, press SELECT.
A cursor appears, which allows the selection of a group number with the Up and Down keys.
Select the group number to change and press SELECT to confirm the change.

```
ACTIVE WG
          :■1
```

Use ▲ and ▼ to switch between group Nos. and press SELECT to confirm the change

Press ENTER to show the confirmation screen below. Press SELECT to initiate the change to the group number selected.
When the new active group setting is not required, press the Left key to return the display back.

```
CHANGE ACTIVE WG?
YES=SELECT  NO=◀
```



Press ENTER to show the screen on the left

The next message shows the Successful or Unsuccessful change of active group number.
Pressing SELECT brings the display back to the Setting menu.

```
SETTING
HAVE CHANGED
```

Message for a successful change of the active group

```
SETTING
FAILED TO CHANGE
```

Message for an unsuccessful change of the active group

The cancel message will appear by pressing the Left key in the Active group menu.
Pressing SELECT exits the Active group menu without changing the active group and brings the display back to the Setting menu.
Pressing the Left key brings the display back to the Active group menu.

```
CANCEL ACTIVE WG?
YES=SELECT  NO=◀
```

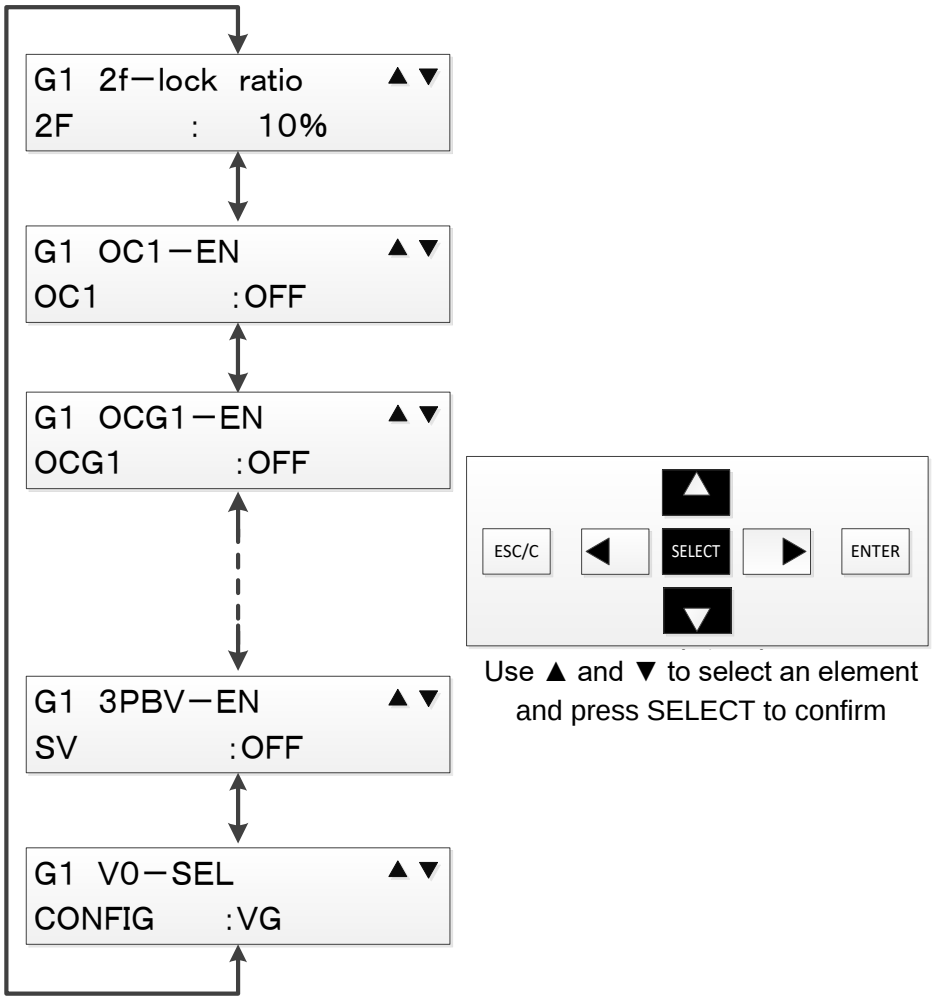
4.3.4.1.2. Group 1 setting (G1) and Group 2 setting (G2) menus

[Operation path] SETTING MODE > SETTING > G1(G2)

The Group 1 setting (G1) and Group 2 setting (G2) menus allow viewing and changing of the setting values for the respective group settings.
(Setting values can be changed only in the SETTING mode. The DISPLAY mode allows only viewing of the setting values)
The operation procedure for changing group settings is explained by changing G1 (for example).

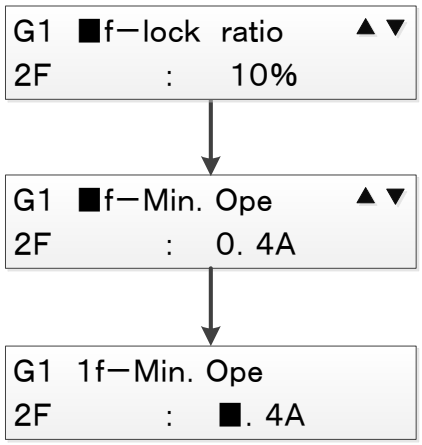
1. First, select the setting value group in the Setting menu to change and press SELECT.

2. The Group setting menu appears.
   Select the protective element to change with pressing the Up and Down key, and press SELECT.



Use ▲ and ▼ to select an element and press SELECT to confirm

3. The cursor moves to the setting parameter indication.
Use the Up and Down keys to select the setting parameter to be changed and press SELECT. The cursor moves to the setting value indication.



Cursor moves to the setting parameter indication.

Select the setting parameter to change and press SELECT.

Cursor moves to the setting value indication.

4. Use the Left and Right keys to select the digit to change and use the Up and Down keys to set the value.

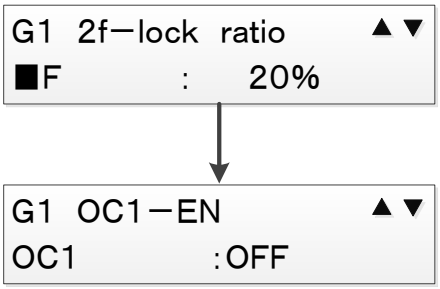
For setting a value as shown on the left,
use ◄ and ► to select the digit to change,
and ▲ and ▼ to set the value
Press SELECT to confirm the change

5. When the value has been changed, press SELECT to move the cursor to the setting parameter indication.

Cursor moves to the setting parameter indication

6. Complete setting of all parameters in the element to change by repeating steps 2 to 5 above.

7. Press the Left key to return the cursor back to the protective element indication.
Complete setting of any other protective elements to change by repeating steps 1 to 6 above.



8. When the all necessary change of the setting values has been completed, press ENTER.
   A confirmation message of the setting value changes appears as shown in the figure below. After confirmation of correct settings, press SELECT. If discarding the setting value changes, press the Left key.

Press SELECT to change the setting.
Press ◄ to discard the change.

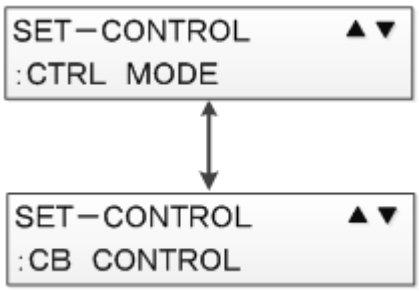
The following messages are shown respectively to check the successful or unsuccessful setting change, The display returns back to the Setting menu by pressing SELECT while either of the messages below.

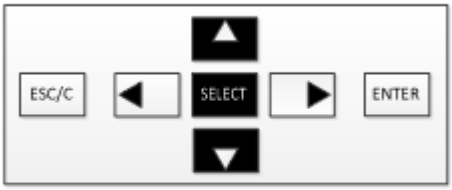
Message for successful setting value changes

Message for unsuccessful setting value changes

4.3.4.2.CONTROL menu

The Control (CONTROL) menu allows viewing and setting of the Control mode (CTRL MODE) and Circuit breaker control (CB CONTROL).
The Control menu can be selected in either DISPLAY or SETTING mode. In the DISPLAY mode, only viewing of the Control mode settings is possible.
The SETTING mode allows viewing and setting of the Control mode and Circuit breaker control.





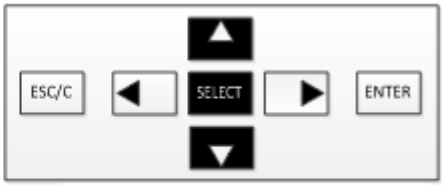
Use ▲ and ▼ to switch between items
and press SELECT to select an item

4.3.4.2.1. Control mode (CTRL MODE) menu

[Operation path] SETTING MODE > CONTROL > CTRL MODE

The Control mode (CTRL MODE) menu allows the setting of the Local/remote control, Interlock selection and Circuit breaker operation inhibit.
(Note that they can be set only in the SETTING mode. The DISPLAY mode only allows viewing of the settings)

1. Use the Up and Down keys to show the control mode item to change and press SELECT for selection.



Use ▲ and ▼ to switch between items and press SELECT to select an item

2. The cursor moves to the setting value. Use the Up and Down keys to change the setting value.
(The setting value below shows a selection setting. For a value setting, use the Left and Right key to change the digit for setting)

3. Press SELECT to change the setting value.

4. Complete all settings to be changed by repeating steps 1 to 3.

5. Press ENTER and the confirmation message of the applied control mode appears as shown in the figure below.
Press SELECT to apply the changed control mode settings by steps 1 to 4 and complete the Control mode setting.
Press the Left key to return the setting menu in (1) above without applying the setting changes.

Table 4-9 Setting items of Control mode

No	Setting item	Description	Setting value
1	LOCAL/REMOTE	Local/remote setting	R / L
2	INTERLOCK	Interlock unuse/use selection setting	UNUSE / USE
3	CB OPEN	Open side block setting	UNBLK / BLK
4	CB CLOSE	Close side block setting	UNBLK / BLK
5	ON TIMER	Control waiting time	Value setting (unit: s)

4.3.4.2.2. Circuit breaker control (CB CONTROL) menu

[Operation path] SETTING MODE > CONTROL > CB CONTROL

The Circuit breaker control (CB CONTROL) menu allows CB OPEN control/CB CLOSE control. This item can be selected for implementing CB control only in the SETTING mode.

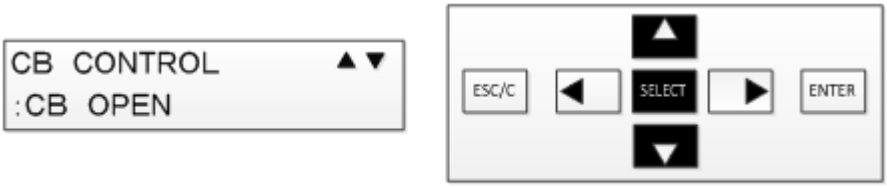
For CB control, the Control mode settings must be as shown in the table below.
For the details about operation for the Control mode, see 4.3.4.2.1.

Table 4-10 Control mode settings of circuit breaker control

Setting item	Description	Setting value
LOCAL/REMOTE	Local/remote setting	L
INTERLOCK	Interlock no-use/use selection setting	No-USE
CB OPEN	Open side block setting	For enabling CB open control: UNBLK
CB CLOSE	Close side block setting	For enabling CB close control: UNBLK

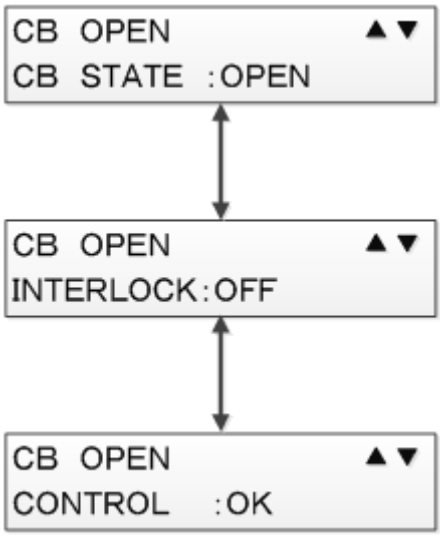
If the Control mode settings do not allow the circuit breaker control, an error message for control condition failure appears.
(The figure below shows the control condition failure that appears for CB open control)

1. Use the Up and Down keys to show the control mode item to change and press SELECT.
   * Select CB OPEN for CB open control and CB CLOSE for CB close control.



Use ▲ and ▼ to switch between items
and press SELECT to select an item

2. The display switches to CB status indication.
   Press the Up and Down keys to select the display of CB status indication.
   * The figure below shows screens that appear when CB OPEN is selected.



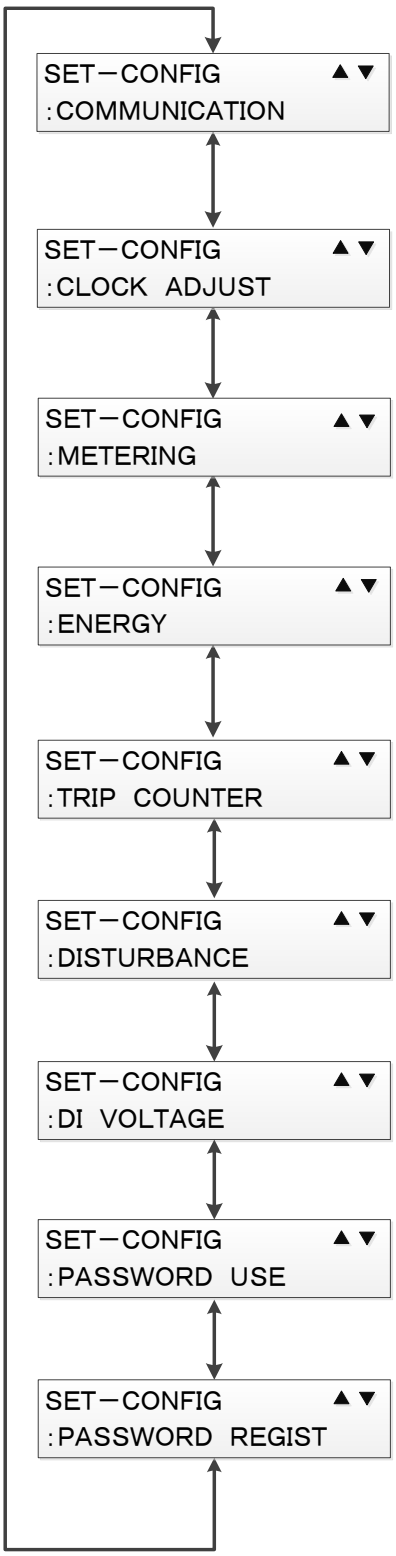
3. At pressing ENTER while the CB status indication screen is shown, it displays a CB control instruction.
   When CB control has been successful, a control succeed message appears.

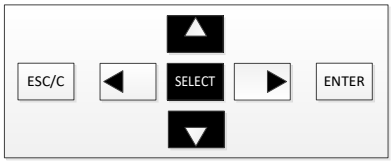
   When CB control has been unsuccessful, a control failed message appears.

   At pressing SELECT while either of the control succeed or failed messages, it brings the display of Setting menu.

4.3.4.3.Configuration (CONFIG) menu

This subsection describes the operations for the Configuration (CONFIG) menu.
The Configuration menu can be selected in either DISPLAY or SETTING mode. Clock adjustment (CLOCK ADJUST), Password use/no-use (PASSWORD USE) and Password registration (PASSWORD REGIST) can be selected only in the SETTING mode.
The other settings can be changed in the SETTING mode only.
(The DISPLAY mode only allows viewing of the setting values)





Use ▲ and ▼ to switch between items
and press SELECT to select an item

4.3.4.3.1. Communication setting (COMMUNICATION) menu

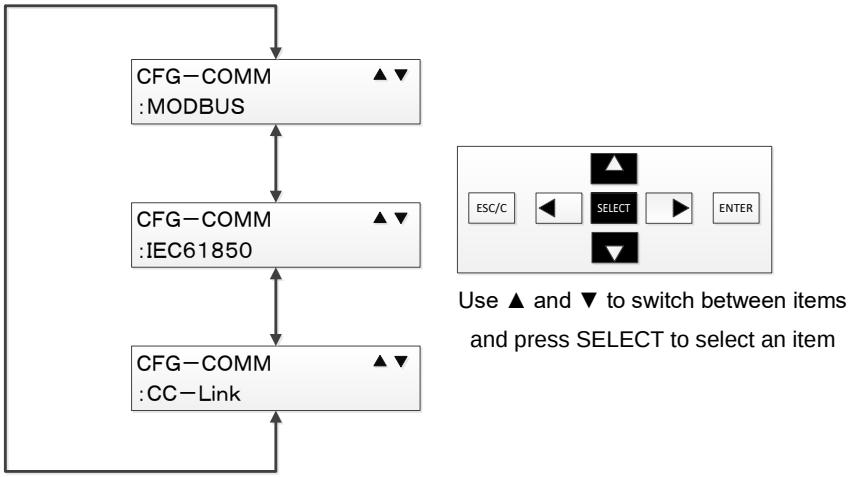
[Operation path] SETTING MODE > CONFIG > COMMUNICATION

The Communication setting (COMMUNICATION) menu allows viewing and setting of the Modbus, Station bus of IEC61850 and CC-Link configurations.

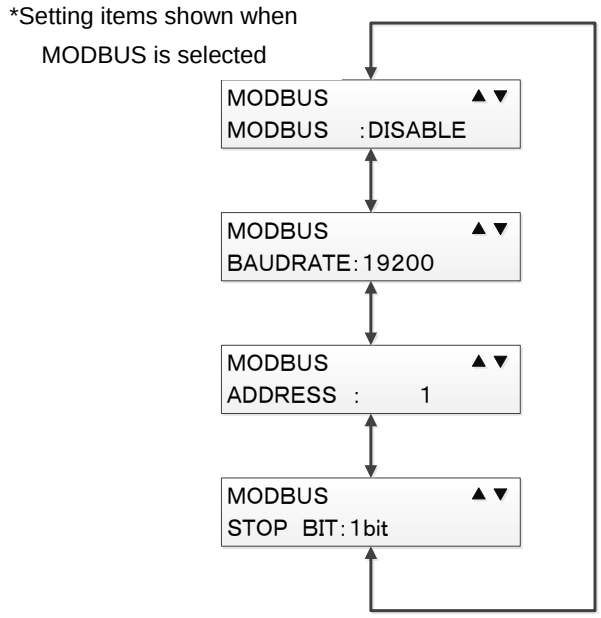
(The DISPLAY mode only allows viewing of the setting values)

The following describes the operation procedure for showing and changing communication settings.

1. Use the Up and Down keys to select the communication type and press SELECT.



2. The setting items according to the selected communication type are shown.
Use the Up and Down keys to select the item to change and press SELECT.



3. The cursor moves to the setting value. Use the Up and Down keys to change the setting value.

4. Press SELECT to change the setting value.

5. Complete all settings to be changed by repeating steps 2. to 4..

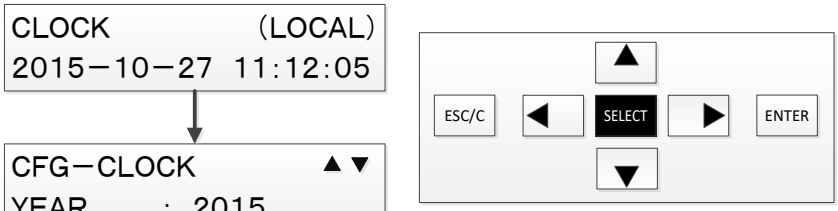
6. Press ENTER and the confirmation message of the selected communication type appears as shown in the figure below.
   Press SELECT to apply the communication settings changed by steps 2. to 5. and complete the communication setting.
   Press the Left key to return the Setting item menu in 2. above without applying the setting changes.

4.3.4.3.2. Clock adjustment (CLOCK ADJUST) menu

[Operation path] SETTING MODE > CONFIG > CLOCK ADJUST

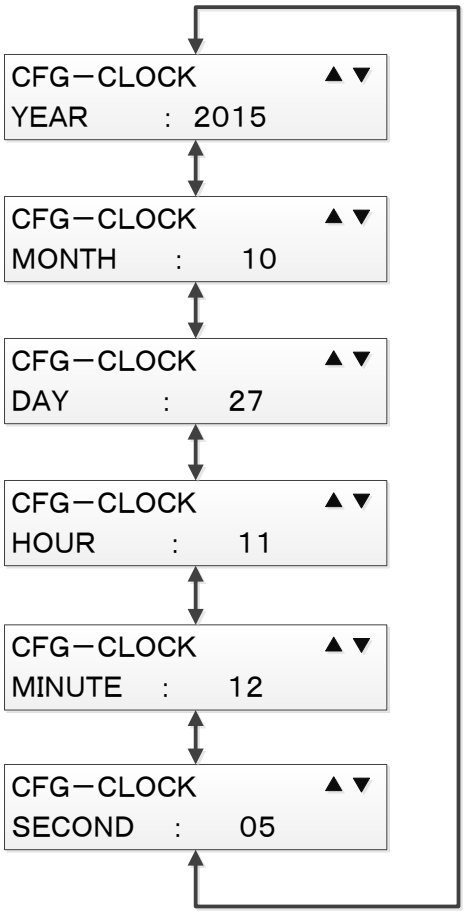
The Clock adjustment (CLOCK ADJUST) menu allows time setting.
This item can be selected only in the SETTING mode.

1. When the Clock adjustment menu is selected, the current time is indicated as shown below.
   Pressing SELECT while this screen is shown allows changing of the year, month, day, hour, minute and second settings.



Press SELECT to select an item

2. Pressing the Up and Down keys cycles through the year, month, day, hour, minute and second selection items. Select the item to change and press SELECT.



3. The cursor moves to the setting value. Use the Up and Down keys to select the value and the Left and Right keys to select the digit to make the change.

4. Press SELECT to change the setting value.

5. Complete setting of all other items to change by repeating steps 1. to 3..

6. Press ENTER and the confirmation message of the time setting appears.
   Press SELECT to apply the time setting changed by steps 1. to 4. and complete the Clock adjustment setting.
   Press the Left key to go back to the Clock adjustment menu without applying the setting changes.

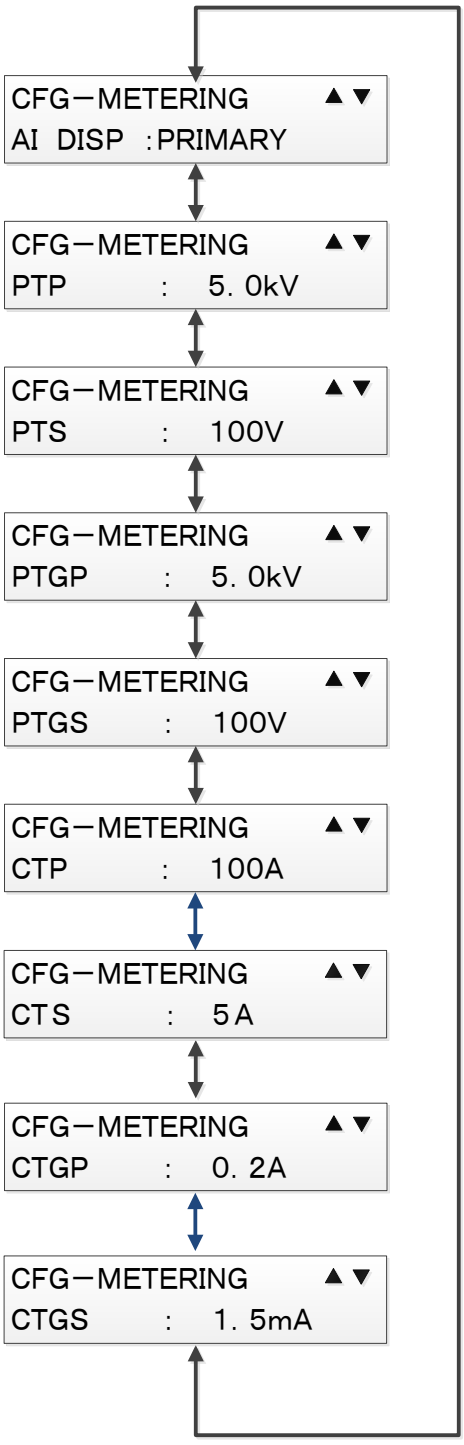
4.3.4.3.3. Measured analog value (METERING) menu

[Operation path] SETTING MODE > CONFIG > METERING

The Measured analog value (METERING) menu allows configuration of the following settings.

(1) Set the indication type from the primary or secondary side of CT/VT
(2) Set the rating of CT/VT.
(The DISPLAY mode only allows viewing of the setting values)

The following describes the operation procedure for viewing and changing the settings for the Measured analog value menu.



1. Use the Up and Down keys to select the item to change and press SELECT for selection.

2. The cursor moves to the setting value. Use the Up and Down keys to select the value and the Left and Right keys to select the digit to make the change.

3. Press SELECT to change the setting value.

4. Complete setting of all other items to change by repeating steps 1. to 3..

5. Press ENTER and the confirmation message of the new measurement settings appears as shown in the figure below.
   Press SELECT to apply the measurement value settings changed by steps 1. to 4. and complete the setting.
   Press the Left key to go back to the Analog value display switching menu without applying the setting changes.

Table 4-11 Setting items of analog value display

No.	Item	Setting description	Setting range	Unit
1	AI DISP	AI display primary value/secondary value selection	PRIMARY / SECONDARY	-
2	PTP	PT primary side rating	0.10 ~ 99.00kV	kV
3	PTS	PT secondary side rating	100~125	V
4	PTGP	PTG primary side rating	0.10 ~ 99.00kV	kV
5	PTGS	PTG secondary side rating	100~220	V
6	CTP	CT primary side rating	1~30000	A
7	CTS	CT secondary side rating	1, 5	A
8	CTGP	CTG primary side rating	0.1~100.0 (ZCT Type) 1~30000 (5A Type)	A
9	CTGS	CTG secondary side rating	1.5 1, 5	mA A

4.3.4.3.4. Electric energy (ENERGY) menu

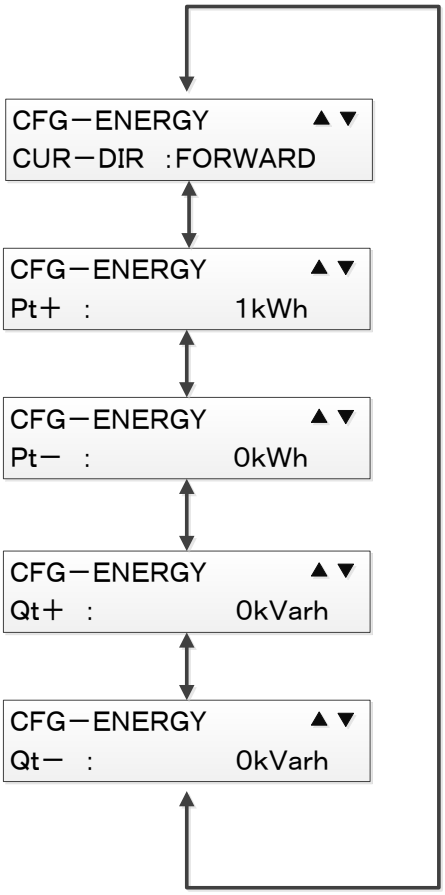
[Operation path] SETTING MODE > CONFIG > ENERGY

The Electric energy (ENERGY) menu allows configuration of the following settings.

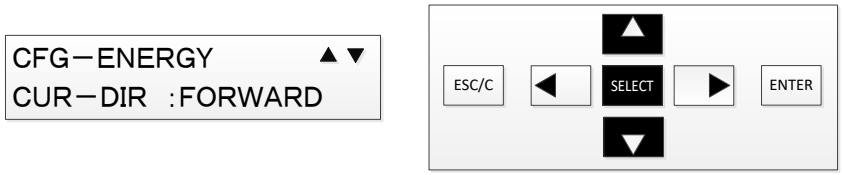
(1) Set the power flow direction in electric energy indication

(2) Set the respective electric energy values to the desired ones

(The DISPLAY mode only allows viewing of the setting values)



1. Use the Up and Down keys to show the item to change and press SELECT.



Use ▲ and ▼ to switch between items
and press SELECT to select an item

2. The cursor moves to the setting value.
For a value setting, use the Up and Down keys to select the value and the Left and Right keys to select the
digit to make the change.
For selection setting, use the Up and Down keys to select the setting.

3. Press SELECT to change the setting value.

4. Complete setting of all other items to change by repeating steps 1. to 3..

5. Press ENTER and the confirmation message of the electric energy settings to be changed appears as shown in the figure below.
Press SELECT to apply the electric energy settings changed by steps 1. to 4. and complete the Electric energy setting.
Press the Left key to go back to the setting menu in step 1. above without applying the setting changes.

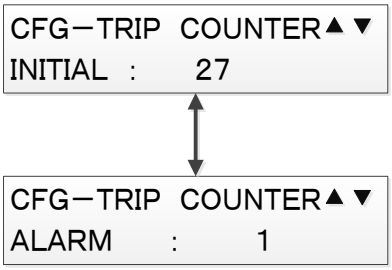
Table 4-12 Setting items of electric energy

No.	Item	Setting description	Setting range	Unit
1	CUR-DIR	Electric energy power flow direction	FORWARD / REVERSE	-
2	Pt+	+PT initial value	0~999999999	kWh
3	Pt-	-PT initial value	0~999999999	kWh
4	Qt+	+Qt initial value	0~999999999	kVarh
5	Qt-	-Qt initial value	0~999999999	kVarh

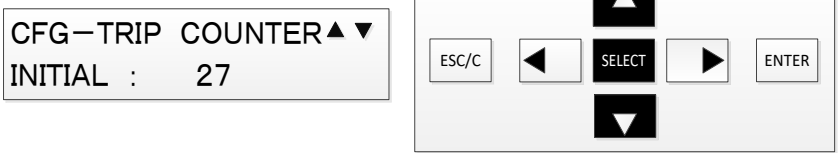
4.3.4.3.5. Trip counter (TRIP COUNTER) menu

[Operation path] SETTING MODE > CONFIG > TRIP COUNTER

The Trip counter (TRIP COUNTER) menu allows setting of the initial counter and alarm counter values. The trip counter will count the number of trip times.
(The DISPLAY mode only allows viewing of the setting values)

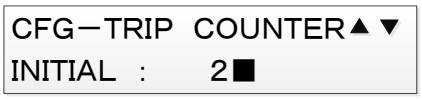


1. The trip counter setting menu appears. Use the Up and Down keys to select the item to change and press SELECT.

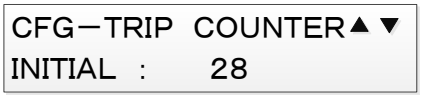


Use ▲ and ▼ to switch between items
and press SELECT to select an item

2. The cursor moves to the setting value. Use the Up and Down keys to select the value and the Left and Right keys to select the digit to make the change.



3. Press SELECT to change the setting value.



4. Complete setting of all other items to change by repeating steps 1. to 3..

5. Press ENTER and the confirmation message of the trip counter settings appears.
Press SELECT to apply the trip counter settings changed by steps 1. to 4. and complete the setting.
Press the Left key to go back to the setting menu in step 1. above without applying the setting changes.

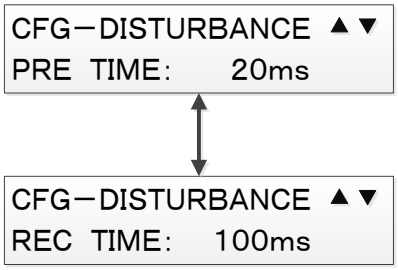
Table 4-13 Setting items of trip counter

No.	Item	Setting description	Setting range	Unit
1	INITIAL	Initial value of trip counter	0~10000	Times
2	ALARM	Alarm value of trip counter	1~10000	Times

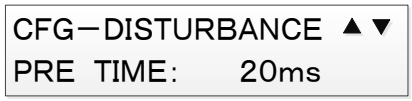
4.3.4.3.6. Disturbance record (DISTURBANCE) menu

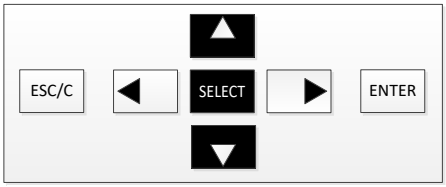
[Operation path] SETTING MODE > CONFIG > DISTURBANCE

The Disturbance record (DISTURBANCE) menu allows setting of maximum recording time and pre-fault recording time of each disturbance (fault) record.
(The DISPLAY mode only allows viewing of the setting values)



1. Use the Up and Down keys to select the item to change and press SELECT.

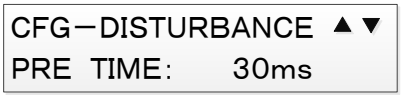




Use ▲ and ▼ to switch between items
and press SELECT to select an item

2. The cursor moves to the setting value. Use the Up and Down keys to select the value and the Left and Right keys to select the digit to make the change.

3. Press SELECT to change the setting value.



4. Complete setting of all other items to change by repeating steps 1. to 3..

5. Press ENTER and the message to confirm application of the disturbance record time settings appears. Press SELECT to apply the disturbance record time settings changed by steps 1. to 4. and complete the setting.
Press the Left key to go back to the setting menu in step 1. above without applying the setting changes.

Table 4-14 Setting items of disturbance record time

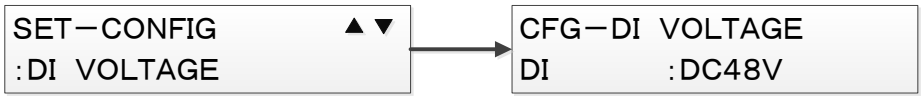
No.	Item	Setting description	Setting range	Unit
1	PRE TIME	Save time of pre-fault waveform data	20~4500	ms
2	REC TIME	Save time of waveform data	100~5000	ms

Note: The save time of “PRE TIME” is included in that of “REC TIME”.
In other words, the setting value of “REC TIME” must be larger than that of “PRE TIME”.

4.3.4.3.7. DI detection voltage value (DI VOLTAGE) menu

[Operation path] SETTING MODE > CONFIG > DI VOLTAGE

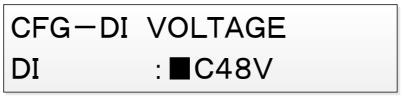
DI detection voltage value (DI VOLTAGE) menu allows setting of the DI rated voltage.
(The DISPLAY mode only allows viewing of the setting values)



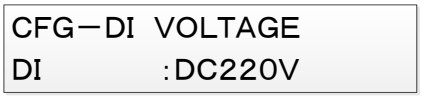
1. In the DI detection voltage value setting menu, show item “DI” and press SELECT.
   *The DI detection voltage value setting menu only has one item: “DI.”

Press SELECT to select an item

2. The cursor moves to the setting value. Use the Up and Down keys to select the setting to be changed..



3. Press SELECT to change the setting value.



4. Press ENTER and the confirmation message of the DI detection voltage value setting appears.
   Press SELECT to apply the DI detection voltage value setting and complete the setting.
   Press the Left key to go back to the setting menu in step 1. above without applying the setting changes.

Table 4-15 Setting items of DI detection voltage value

No.	Item	Setting description	Setting
1	DI	DI detection voltage value setting	24/48/110/220 VDC

4.3.4.3.8. Password use/unuse (PASSWORD USE) menu

[Operation path] SETTING MODE > CONFIG > PASSWORD USE

The Password use/no-use (PASSWORD USE) menu specifies whether to use or not use a password input when the SETTING mode is selected.
(This item is not shown in the DISPLAY mode)

1. In the Password use/no-use menu, press SELECT.

Press SELECT to select an item

2. The cursor moves to the setting value. Use the Up and Down keys to select the setting to be changed.

3. Press SELECT to change the setting value.

4. Press ENTER and the confirmation message of the password use/no-use setting changed appears as shown in the figure below.
   Press SELECT to apply the password use/no-use setting and complete the setting.
   Press the Left key to go back to the setting menu in step 1. above without applying the setting changes.

Table 4-16 Setting item of Password use/no-use

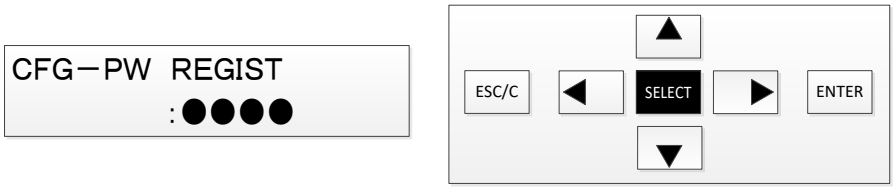
No.	Item	Setting description	Setting
1	PASSWORD	Password use/nonuse setting	USE / UNUSE

4.3.4.3.9. Password registration (PASSWORD REGIST) menu

[Operation path] SETTING MODE > CONFIG > PASSWORD REGIST

Password registration (PASSWORD REGIST) menu allows the setting of the password input when the SETTING mode is selected.
(This item is not shown in the DISPLAY mode)

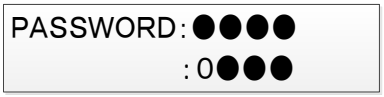
1. In the Password registration menu, press SELECT.



Press SELECT to select an item

2. The Password registration screen appears.
   For registering a password, press SELECT after each digit is entered.
   Pressing SELECT confirms the value for the digit entered and moves the cursor to the digit on the right.
   It is not possible to return to the previous digit by using the Left key.
   Use the Up and Down keys to select a value out of 0 to 9 for each digit.

3. When the four digits have been entered, password input is requested again.
   Enter the same password as that registered in step 2 above.

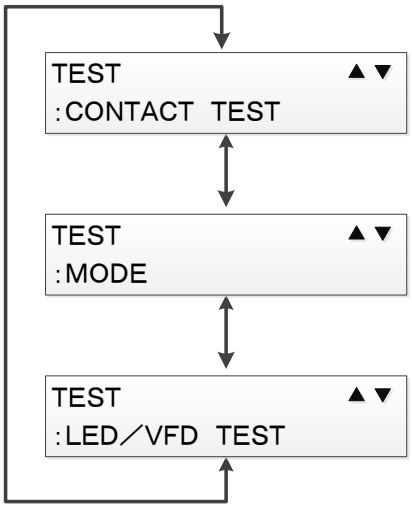


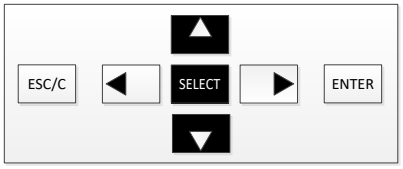
4. If the above two password-inputs in steps 2 and 3 are same, the screen shown in step 1 appears.
   Press ENTER and the confirmation message of the password registration appears.
   Press SELECT to apply the password registration and complete the setting.
   Press the Left key to go back to the setting menu in step 1. above without applying the setting changes.

If the two password-inputs in steps 2 and 3 are not same, an error message as shown below appears.

4.3.4.4.TEST menu

This subsection describes the operations for the Test menu.
The Test menu can be selected only in the SETTING mode.





Use ▲ and ▼ to switch between items
and press SELECT to select an item

4.3.4.4.1. DO contact test (CONTACT TEST) menu

[Operation path] SETTING MODE > TEST > CONTACT TEST

The DO contact test (CONTACT TEST) menu allows contact testing of DO signals (DO1 to DO13).

1. When the DO contact test menu has been selected, the caution message appears.

```
TRP－CIRCUIT BLOCK?
YES＝SELECT  NO＝<
```

When pressing SELECT, the next message appears. Then, press “SELECT” again.

```
AFTER SPECIFYING.
PRESS ‘ENTER‘
```

2. The setting screen for the DO contact test appears.
Use the Up and Down keys to select the item to set and press SELECT.

```
CONTACT TEST ▲▼
DO1－T  : OFF
```

3. The cursor moves to the setting of the selected item.
   Use the Up and Down keys to switch the setting.
   Select ON to conduct a contact test on the selected DO. If not, select OFF.

4. Press SELECT to change the setting and bring the cursor back to the item name.

5. Complete settings of all the items to change by repeating steps 2. to 4. above.

6. After the settings are completed, press ENTER while the setting item selection screen in step 4 is shown in order to operate DO contact test.
   *The selected DO contact(s) is(are) operated while ENTER is held down. The operation of the respective DO contact corresponds to the settings in steps (2) to (5) above.

   To exit the DO contact test setting screen, press the Left key.

Table 4-17 Setting items of DO contact test

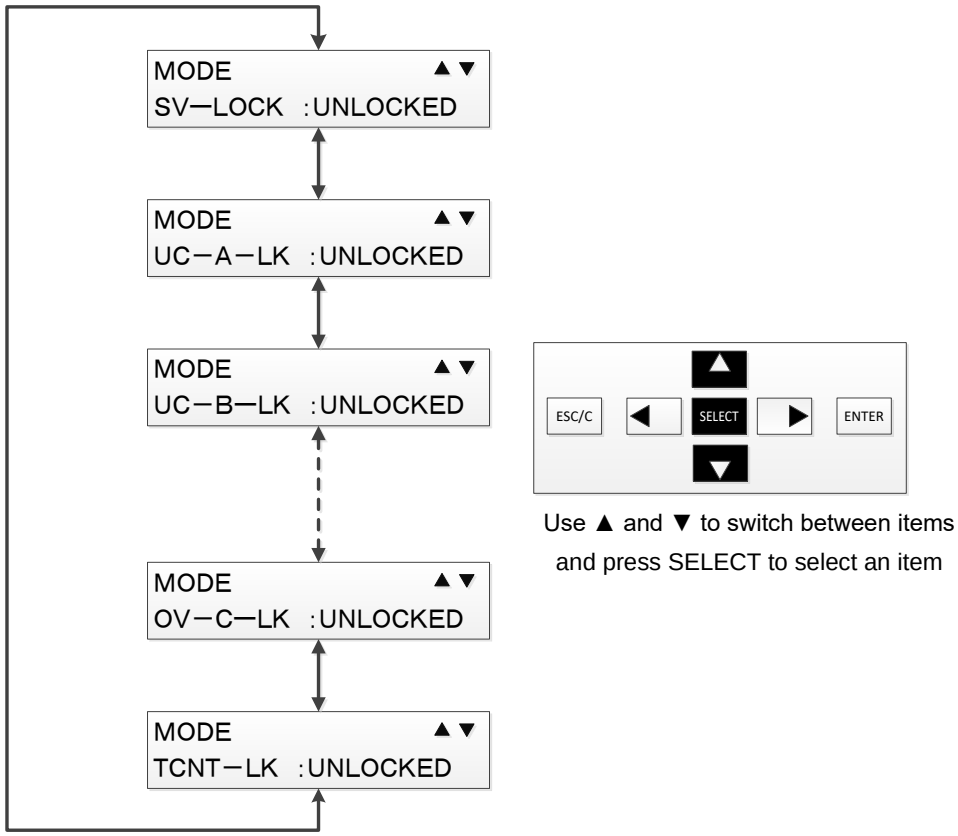
No.	Item
1	DO1-T
2	DO2-T
3	DO3-T
4	DO4-T
5	DO5-T
6	DO6-T
7	DO7-T
8	DO8-T
9	DO9-T
10	DO10-T
11	DO11-T
12	DO12-T
13	DO13-T

4.3.4.4.2. Test mode (MODE) menu

[Operation path] SETTING MODE > TEST > MODE

The Test mode (MODE) menu allows setting of the test mode.

1. Use the Up and Down keys to select the item to set and press SELECT.

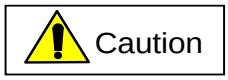


2. The cursor moves to the setting of the selected item. Use the Up and Down keys to switch the setting.

3. Press SELECT to change the setting.

4. Complete setting of all other items to change by repeating steps 1. to 3. above.

5. Press ENTER to be enable the test mode as set in steps 1. to 4. above.
The RUN LED flashes during the test mode.



During the test mode, use of the Left or ESC key to exit the SETTING mode is disabled.
(Operations implemented in the SETTING mode are enabled)
When turning off the VFD screen or moving to the DISPLAY mode, it exits the test mode.

4.3.4.4.3. LED/VFD lighting test (LED/VFD TEST) menu

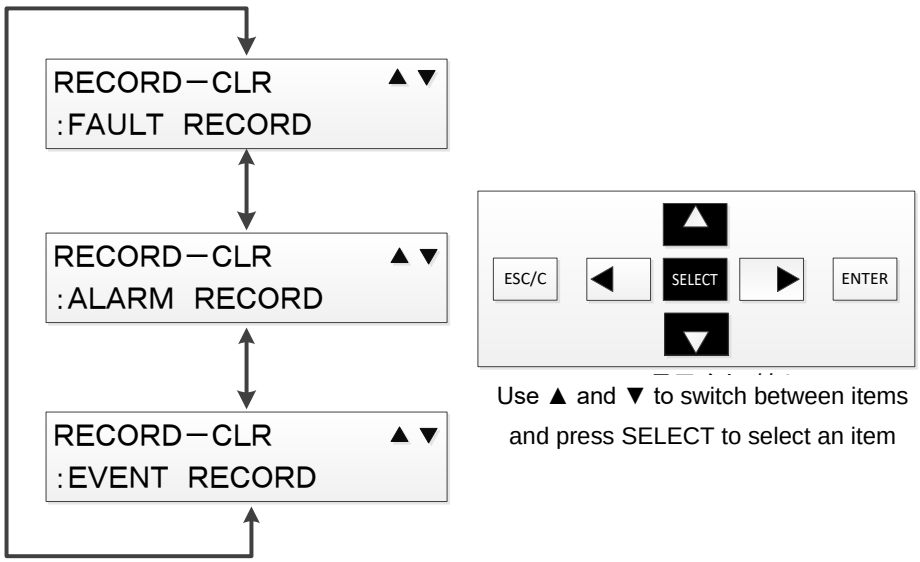
[Operation path] SETTING MODE > TEST > LED/VFD TEST

The LED/VFD lighting test (LED/VFD TEST) menu allows lighting of all LEDs/VFDs.

When LED/VFD TEST is selected in the Test menu, a screen as shown below appears.
Pressing ENTER and all LEDs and VFDs are lighting while the key is held down.
It can be checked the LED/VFD indication visually.

4.3.4.5.Clear record (RECORD-CLR) menu

The Clear record (RECORD-CLR) menu allows clearing three types of log data: fault, event and alarm records.
*Access record log data cannot be cleared.



4.3.4.5.1. Clear fault record (FAULT REC CLEAR) menu

[Operation path] SETTING MODE > RECORD-CLR > FAULT RECORD

The Clear fault record (FAULT REC CLEAR) menu allows clearing of fault records.
In the Clear record menu, select FAULT RECORD and press ENTER. Then, the next screen appears.
Press SELECT to clear the fault records.
When pressing the Left key, the display returns to the selection screen of Clear record menu without clearing the fault records.

When clearing of the fault records are completed, the display returns to the Clear record menu.
If the clearing is unsuccessful, a message screen as shown below appears.
Pressing SELECT while the message below is shown brings the display back to the Clear record menu selection screen.

4.3.4.5.2. Clear alarm record (ALARM REC CLEAR) menu

[Operation path] SETTING MODE > RECORD-CLR > ALARM RECORD

The Clear alarm record (ALARM REC CLEAR) menu allows clearing of alarm records.
In the Clear record menu, select ALARM RECORD and press ENTER. Then, the next screen appears.
Press SELECT to clear the alarm records.
When pressing the Left key, the display returns to the selection screen of Clear record menu without clearing the alarm records.

When clearing of the alarm records are completed, the display returns to the Clear record menu.
If the clearing is unsuccessful, a message screen as shown below appears.
Pressing SELECT while the message below is shown brings the display back to the Clear record menu selection screen.

4.3.4.5.3. Clear event record (EVENT REC CLEAR) menu

[Operation path] SETTING MODE > RECORD-CLR > EVENT RECORD

The Clear event record (EVENT REC CLEAR) menu allows clearing of event records.
In the Clear record menu, select EVENT RECORD and press ENTER. Then, the next screen appears.
Press SELECT to clear the event records.
When pressing the Left key, the display returns to the selection screen of Clear record menu without clearing the event records.

When clearing of the event records are completed, the display returns to the Clear record menu.
If the clearing is unsuccessful, a message screen as shown below appears.
Pressing SELECT while the message below is shown brings the display back to the Clear record menu selection screen.

5. Internal signals

Table 5-1 PLC signals of CFP1-A41D1

No.	Signal name	Description
1	DI1	Status of DI1 (This signal is available only in the relay unit with a DI card in SLOT-C.)
2	DI2	Status of DI2 (This signal is available only in the relay unit with a DI card in SLOT-C.)
3	DI3	Status of DI3 (This signal is available only in the relay unit with a DI card in SLOT-C.)
4	DI4	Status of DI4 (This signal is available only in the relay unit with a DI card in SLOT-C.)
5	DI5	Status of DI5 (This signal is available only in the relay unit with a DI card in SLOT-C.)
6	DI6	Status of DI6 (This signal is available only in the relay unit with a DI card in SLOT-C.)
7	DI7	Status of DI7 (This signal is available only in the relay unit with a DI card in SLOT-C.)
8	DI8	Status of DI8 (This signal is available only in the relay unit with a DI card in SLOT-C.)
9	OC1-A/	Definitive signal of 1st instantaneous overcurrent (50) element on A phase
10	OC1-B/	Definitive signal of 1st instantaneous overcurrent (50) element on B phase
11	OC1-C/	Definitive signal of 1st instantaneous overcurrent (50) element on C phase
12	OC1-G/	Definitive signal of 1st instantaneous overcurrent (50) element on zero phase
13	OC2-A/	Definitive signal of 2nd instantaneous overcurrent (50) element on A phase
14	OC2-B/	Definitive signal of 2nd instantaneous overcurrent (50) element on B phase
15	OC2-C/	Definitive signal of 2nd instantaneous overcurrent (50) element on C phase
16	OC2-G/	Definitive signal of 2nd instantaneous overcurrent (50) element on zero phase
17	OC3-A/	Definitive signal of 3rd instantaneous overcurrent (50) element on A phase
18	OC3-B/	Definitive signal of 3rd instantaneous overcurrent (50) element on B phase
19	OC3-C/	Definitive signal of 3rd instantaneous overcurrent (50) element on C phase
20	OC3-G/	Definitive signal of 3rd instantaneous overcurrent (50) element on zero phase
21	OC4-A/	Definitive signal of definite time or IDMT overcurrent (51) element on A phase
22	OC4-B/	Definitive signal of definite time or IDMT overcurrent (51) element on B phase
23	OC4-C/	Definitive signal of definite time or IDMT overcurrent (51) element on C phase
24	OC4-G/	Definitive signal of definite time or IDMT overcurrent (51) element on zero phase
25	NOC1/	Definitive signal of 1st negative sequence overcurrent (46) element
26	NOC2/	Definitive signal of 2nd negative sequence overcurrent (46) element
27	UC1-A/	Definitive signal of 1st undercurrent (37) element on A phase
28	UC1-B/	Definitive signal of 1st undercurrent (37) element on B phase
29	UC1-C/	Definitive signal of 1st undercurrent (37) element on C phase
30	UC2-A/	Definitive signal of 2nd undercurrent (37) element on A phase
31	UC2-B/	Definitive signal of 2nd undercurrent (37) element on B phase
32	UC2-C/	Definitive signal of 2nd undercurrent (37) element on C phase
33	CBF-A/	Definitive signal of overcurrent element for the detection of CBF (50BF) on A phase (This signal is available only in the relay unit with a DI card or IEC61850 GOOSE.)
34	CBF-B/	Definitive signal of overcurrent element for the detection of CBF (50BF) on B phase (This signal is available only in the relay unit with a DI card or IEC61850 GOOSE.)
35	CBF-C/	Definitive signal of overcurrent element for the detection of CBF (50BF) on C phase (This signal is available only in the relay unit with a DI card or IEC61850 GOOSE.)

No.	Signal name	Description
36	CBF-G/	Definitive signal of overcurrent element for the detection of CBF (50BF) on zero phase (This signal is available only in the relay unit with a DI card or IEC61850 GOOSE.)
37	DIRG1/	Definitive signal of 1st instantaneous directional ground fault (67G) element
38	DIRG2/	Definitive signal of 2nd instantaneous directional ground fault (67G) element
39	DIRG3/	Definitive signal of 3rd instantaneous directional ground fault (67G) element
40	DIRG4/	Definitive signal of definite time or IDMT directional ground fault (67G) element
41	UV1-A/	Definitive signal of 1st undervoltage (27) element on A (AB) phase
42	UV1-B/	Definitive signal of 1st undervoltage (27) element on B (BC) phase
43	UV1-C/	Definitive signal of 1st undervoltage (27) element on C (CA) phase
44	UV2-A/	Definitive signal of 2nd undervoltage (27) element on A (AB) phase
45	UV2-B/	Definitive signal of 2nd undervoltage (27) element on B (BC) phase
46	UV2-C/	Definitive signal of 2nd undervoltage (27) element on C (CA) phase
47	OV1-A/	Definitive signal of 1st overvoltage (59) element on A (AB) phase
48	OV1-B/	Definitive signal of 1st overvoltage (59) element on B (BC) phase
49	OV1-C/	Definitive signal of 1st overvoltage (59) element on C (CA) phase
50	OV2-A/	Definitive signal of 2nd overvoltage (59) element on A (AB) phase
51	OV2-B/	Definitive signal of 2nd overvoltage (59) element on B (BC) phase
52	OV2-C/	Definitive signal of 2nd overvoltage (59) element on C (CA) phase
53	OVG1/	Definitive signal of 1st ground fault overvoltage (64N) element
54	OVG2/	Definitive signal of 2nd ground fault overvoltage (64N) element
55	NOV1/	Definitive signal of 1st negative sequence overvoltage (47) element
56	NOV2/	Definitive signal of 2nd negative sequence overvoltage (47) element
57	F_UV	Undervoltage element for the calculation lock of frequency (81) elements
58	UF1/	Definitive signal of 1st underfrequency (81UF) element
59	UF2/	Definitive signal of 2nd underfrequency (81UF) element
60	UF3/	Definitive signal of 3rd underfrequency (81UF) element
61	OF1/	Definitive signal of 1st overfrequency (81OF) element
62	OF2/	Definitive signal of 2nd overfrequency (81OF) element
63	OF3/	Definitive signal of 3rd overfrequency (81OF) element
64	TCNT_ALM	Alarm of trip counter
65	V0SV_ALM	Definitive signal of supervision of zero-sequence voltage
66	MANU_CLS	Operation signal to close a circuit breaker (This signal is available only in the relay unit with a DI card in SLOT-C.)
67	MANU_OPN	Operation signal to open a circuit breaker (This signal is available only in the relay unit with a DI card in SLOT-C.)
68	OC1-AD	Detection signal of 1st instantaneous overcurrent (50) element on A phase
69	OC1-BD	Detection signal of 1st instantaneous overcurrent (50) element on B phase
70	OC1-CD	Detection signal of 1st instantaneous overcurrent (50) element on C phase
71	OC1-GD	Detection signal of 1st instantaneous overcurrent (50) element on zero phase
72	OC2-AD	Detection signal of 2nd instantaneous overcurrent (50) element on A phase
73	OC2-BD	Detection signal of 2nd instantaneous overcurrent (50) element on B phase
74	OC2-CD	Detection signal of 2nd instantaneous overcurrent (50) element on C phase
75	OC2-GD	Detection signal of 2nd instantaneous overcurrent (50) element on zero phase
76	OC3-AD	Detection signal of 3rd instantaneous overcurrent (50) element on A phase
77	OC3-BD	Detection signal of 3rd instantaneous overcurrent (50) element on B phase
78	OC3-CD	Detection signal of 3rd instantaneous overcurrent (50) element on C phase
79	OC3-GD	Detection signal of 3rd instantaneous overcurrent (50) element on zero phase
80	OC4-AD	Detection signal of definite time or IDMT overcurrent (51) element on A phase

No.	Signal name	Description
81	OC4-BD	Detection signal of definite time or IDMT overcurrent (51) element on B phase
82	OC4-CD	Detection signal of definite time or IDMT overcurrent (51) element on C phase
83	OC4-GD	Detection signal of definite time or IDMT overcurrent (51) element on zero phase
84	NOC1-D	Detection signal of 1st negative sequence overcurrent (46) element
85	NOC2-D	Detection signal of 2nd negative sequence overcurrent (46) element
86	UC1-AD	Detection signal of 1st undercurrent (37) element on A phase
87	UC1-BD	Detection signal of 1st undercurrent (37) element on B phase
88	UC1-CD	Detection signal of 1st undercurrent (37) element on C phase
89	UC2-AD	Detection signal of 2nd undercurrent (37) element on A phase
90	UC2-BD	Detection signal of 2nd undercurrent (37) element on B phase
91	UC2-CD	Detection signal of 2nd undercurrent (37) element on C phase
92	CBF-AD	Detection signal of overcurrent element for the detection of CBF (50BF) on A phase (This signal is available only in the relay unit with a DI card or IEC61850 GOOSE.)
93	CBF-BD	Detection signal of overcurrent element for the detection of CBF (50BF) on B phase (This signal is available only in the relay unit with a DI card or IEC61850 GOOSE.)
94	CBF-CD	Detection signal of overcurrent element for the detection of CBF (50BF) on C phase (This signal is available only in the relay unit with a DI card or IEC61850 GOOSE.)
95	CBF-GD	Detection signal of overcurrent element for the detection of CBF (50BF) on zero phase (This signal is available only in the relay unit with a DI card or IEC61850 GOOSE.)
96	DIRG1-D	Detection signal of 1st instantaneous directional ground fault (67G) element
97	DIRG2-D	Detection signal of 2nd instantaneous directional ground fault (67G) element
98	DIRG3-D	Detection signal of 3rd instantaneous directional ground fault (67G) element
99	DIRG4-D	Detection signal of definite time or IDMT directional ground fault (67G) element
100	2f-AD	Detection signal of 2f on A phase
101	2f-BD	Detection signal of 2f on B phase
102	2f-CD	Detection signal of 2f on C phase
103	UV1-AD	Detection signal of 1st undervoltage (27) element on A (AB) phase
104	UV1-BD	Detection signal of 1st undervoltage (27) element on B (BC) phase
105	UV1-CD	Detection signal of 1st undervoltage (27) element on C (CA) phase
106	UV2-AD	Detection signal of 2nd undervoltage (27) element on A (AB) phase
107	UV2-BD	Detection signal of 2nd undervoltage (27) element on B (BC) phase
108	UV2-CD	Detection signal of 2nd undervoltage (27) element on C (CA) phase
109	OV1-AD	Detection signal of 1st overvoltage (59) element on A (AB) phase
110	OV1-BD	Detection signal of 1st overvoltage (59) element on B (BC) phase
111	OV1-CD	Detection signal of 1st overvoltage (59) element on C (CA) phase
112	OV2-AD	Detection signal of 2nd overvoltage (59) element on A (AB) phase
113	OV2-BD	Detection signal of 2nd overvoltage (59) element on B (BC) phase
114	OV2-CD	Detection signal of 2nd overvoltage (59) element on C (CA) phase
115	OVG1-D	Detection signal of 1st ground fault overvoltage (64N) element
116	OVG2-D	Detection signal of 2nd ground fault overvoltage (64N) element
117	NOV1-D	Detection signal of 1st negative sequence overvoltage (47) element
118	NOV2-D	Detection signal of 2nd negative sequence overvoltage (47) element
119	UF1-D	Detection signal of 1st underfrequency (81UF) element
120	UF2-D	Detection signal of 2nd underfrequency (81UF) element
121	UF3-D	Detection signal of 3rd underfrequency (81UF) element
122	OF1-D	Detection signal of 1st overfrequency (81OF) element
123	OF2-D	Detection signal of 2nd overfrequency (81OF) element
124	OF3-D	Detection signal of 3rd overfrequency (81OF) element
125	V0SV_ALMD	Detection signal of supervision of zero-sequence voltage

No.	Signal name	Description
126	ALARM	Abnormal condition of constant supervision (heavy alarm) This signal is correspond to Heavy alarm in sub-clause 9.2.
127	ALARM-L	Abnormal condition of constant supervision (light alarm) This signal is correspond to Light alarm in sub-clause 9.2.
128	RY-LOCK	Locking of relay
129	RESET	LED reset signal (activated by pushing the “ESC/C” button on the front panel for more than 3 seconds)
130	INTER1	1st intermediate output signal of PLC
131	INTER2	2nd intermediate output signal of PLC
132	INTER3	3rd intermediate output signal of PLC
133	INTER4	4th intermediate output signal of PLC
134	INTER5	5th intermediate output signal of PLC
135	INTER6	6th intermediate output signal of PLC
136	INTER7	7th intermediate output signal of PLC
137	INTER8	8th intermediate output signal of PLC
138	OC1-3D_O	Detection signal of any OC1 of A, B, and C phase
139	OC1-D_O	Detection signal of any OC1 of A, B, C, and zero phase
140	OC2-3D_O	Detection signal of any OC2 of A, B, and C phase
141	OC2-D_O	Detection signal of any OC2 of A, B, C, and zero phase
142	OC3-3D_O	Detection signal of any OC3 of A, B, and C phase
143	OC3-D_O	Detection signal of any OC3 of A, B, C, and zero phase
144	OC4-3D_O	Detection signal of any OC4 of A, B, and C phase
145	OC4-D_O	Detection signal of any OC4 of A, B, C, and zero phase
146	UC1-3D_O	Detection signal of any UC1 of A, B, and C phase
147	UC2-3D_O	Detection signal of any UC2 of A, B, and C phase
148	UV1-3D_O	Detection signal of any UV1 of A (AB), B (BC), and C (CA) phase
149	UV2-3D_O	Detection signal of any UV2 of A (AB), B (BC), and C (CA) phase
150	CBF-3D_O	Detection signal of any CBF of A, B, and C phase (This signal is available only in the relay unit with a DI card or IEC61850 GOOSE.)
151	CBF-D_O	Detection signal of any CBF of A, B, C, and zero phase (This signal is available only in the relay unit with a DI card or IEC61850 GOOSE.)
152	OV1-3D_O	Detection signal of any OV1 of A (AB), B (BC), and C (CA) phase
153	OV2-3D_O	Detection signal of any OV2 of A (AB), B (BC), and C (CA) phase
154	2f-3D_O	Detection signal of any 2f of A, B, and C phase
155	OC-3D_O	Detection signal of any of overcurrent elements on A, B, and C phase
156	OC-D_O	Detection signal of any of overcurrent elements on A, B, C, and zero phase
157	NOC-D_O	Detection signal of any of negative sequence overcurrent (OCNEG) elements
158	UC-3D_O	Detection signal of any of undercurrent elements on A, B, and C phase
159	DIRG-D_O	Detection signal of any of directional ground fault (DIRG) elements
160	UV-3D_O	Detection signal of any of undervoltage elements on A, B, and C phase
161	OV-3D_O	Detection signal of any of overvoltage elements on A, B, and C phase
162	OVG-D_O	Detection signal of any of ground fault overvoltage (OVG) elements
163	NOV-D_O	Detection signal of any of negative sequence overvoltage (OVNEG) elements
164	UF-D_O	Detection signal of any of underfrequency elements
165	OF-D_O	Detection signal of any of overfrequency elements
166	ALLEL-D_O	Detection signal of any of all elements (OR of all detection signals)
167	OC1-3_O/	Definitive signal of any OC1 of A, B, and C phase
168	OC1-O	Definitive signal of any OC1 of A, B, C, and zero phase
169	OC2-3_O/	Definitive signal of any OC2 of A, B, and C phase

No.	Signal name	Description
170	OC2-O	Definitive signal of any OC2 of A, B, C, and zero phase
171	OC3-3_O/	Definitive signal of any OC3 of A, B, and C phase
172	OC3-O	Definitive signal of any OC3 of A, B, C, and zero phase
173	OC4-3_O/	Definitive signal of any OC4 of A, B, and C phase
174	OC4-O	Definitive signal of any OC4 of A, B, C, and zero phase
175	UC1-3_O/	Definitive signal of any UC1 of A, B, and C phase
176	UC2-3_O/	Definitive signal of any UC2 of A, B, and C phase
177	CBF-3_O/	Definitive signal of any CBF of A, B, and C phase (This signal is available only in the relay unit with a DI card or IEC61850 GOOSE.)
178	CBF-O	Definitive signal of any CBF of A, B, C, and zero phase (This signal is available only in the relay unit with a DI card or IEC61850 GOOSE.)
179	UV1-3_O/	Definitive signal of any UV1 of A (AB), B (BC), and C (CA) phase
180	UV2-3_O/	Definitive signal of any UV2 of A (AB), B (BC), and C (CA) phase
181	OV1-3_O/	Definitive signal of any OV1 of A (AB), B (BC), and C (CA) phase
182	OV2-3_O/	Definitive signal of any OV2 of A (AB), B (BC), and C (CA) phase
183	OC-3_O	Definitive signal of any of overcurrent elements on A, B, and C phase
184	OC-O	Definitive signal of any of overcurrent elements on A, B, C, and zero phase
185	NOC-O	Definitive signal of any of negative sequence overcurrent (OCNEG) elements
186	UC-3_O	Definitive signal of any of undercurrent elements on A, B, and C phase
187	DIRG-O	Definitive signal of any of directional ground fault (DIRG) elements
188	UV-3_O	Definitive signal of any of undervoltage elements on A, B, and C phase
189	OV-3_O	Definitive signal of any of overvoltage elements on A, B, and C phase
190	OVG-O	Definitive signal of any of ground fault overvoltage (OVG) elements
191	NOV-O	Definitive signal of any of negative sequence overvoltage (OVNEG) elements
192	UF-O	Definitive signal of any of underfrequency elements
193	OF-O	Definitive signal of any of overfrequency elements
194	OCV/DIR_G	Definitive signal of any of OCG, OVG, and DIRG elements
195	NOC/NOV	Definitive signal of any of OCNEG and OVNEG elements
196	UF/OF	Definitive signal of any of UF and OF elements
197	ALLEL-O	Definitive signal of any of all elements (OR of all definitive signals)
198	UC1-3D_A	Detection signal of UC1 in all 3 phases (AND of all UC1 detection signals)
199	UC2-3D_A	Detection signal of UC2 in all 3 phases (AND of all UC2 detection signals)
200	UV1-3D_A	Detection signal of UV1 in all 3 phases (AND of all UV1 detection signals)
201	UV2-3D_A	Detection signal of UV2 in all 3 phases (AND of all UV2 detection signals)
202	OV1-3D_A	Detection signal of OV1 in all 3 phases (AND of all OV1 detection signals)
203	OV2-3D_A	Detection signal of OV2 in all 3 phases (AND of all OV2 detection signals)
204	UC1-3_A	Definitive signal of UC1 in all 3 phases (AND of all UC1 definitive signals)
205	UC2-3_A	Definitive signal of UC2 in all 3 phases (AND of all UC2 definitive signals)
206	UV1-3_A	Definitive signal of UV1 in all 3 phases (AND of all UV1 definitive signals)
207	UV2-3_A	Definitive signal of UV2 in all 3 phases (AND of all UV2 definitive signals)
208	OV1-3_A	Definitive signal of OV1 in all 3 phases (AND of all OV1 definitive signals)

No.	Signal name	Description
209	OV2-3_A	Definitive signal of OV2 in all 3 phases (AND of all OV2 definitive signals)
210	GOOSE1	Assignment of GOOSE received signals (This signal is available only in the relay unit with IEC61850 communication card.)
211	GOOSE2	Assignment of GOOSE received signals (This signal is available only in the relay unit with IEC61850 communication card.)
212	GOOSE3	Assignment of GOOSE received signals (This signal is available only in the relay unit with IEC61850 communication card.)
213	GOOSE4	Assignment of GOOSE received signals (This signal is available only in the relay unit with IEC61850 communication card.)
214	GOOSE5	Assignment of GOOSE received signals (This signal is available only in the relay unit with IEC61850 communication card.)
215	GOOSE6	Assignment of GOOSE received signals (This signal is available only in the relay unit with IEC61850 communication card.)
216	GOOSE7	Assignment of GOOSE received signals (This signal is available only in the relay unit with IEC61850 communication card.)
217	GOOSE8	Assignment of GOOSE received signals (This signal is available only in the relay unit with IEC61850 communication card.)
218	GOOSE9	Assignment of GOOSE received signals (This signal is available only in the relay unit with IEC61850 communication card.)
219	GOOSE10	Assignment of GOOSE received signals (This signal is available only in the relay unit with IEC61850 communication card.)
220	GOOSE11	Assignment of GOOSE received signals (This signal is available only in the relay unit with IEC61850 communication card.)
221	GOOSE12	Assignment of GOOSE received signals (This signal is available only in the relay unit with IEC61850 communication card.)
222	GOOSE13	Assignment of GOOSE received signals (This signal is available only in the relay unit with IEC61850 communication card.)
223	GOOSE14	Assignment of GOOSE received signals (This signal is available only in the relay unit with IEC61850 communication card.)
224	GOOSE15	Assignment of GOOSE received signals (This signal is available only in the relay unit with IEC61850 communication card.)
225	GOOSE16	Assignment of GOOSE received signals (This signal is available only in the relay unit with IEC61850 communication card.)
226	GOOSE17	Assignment of GOOSE received signals (This signal is available only in the relay unit with IEC61850 communication card.)
227	GOOSE18	Assignment of GOOSE received signals (This signal is available only in the relay unit with IEC61850 communication card.)
228	GOOSE19	Assignment of GOOSE received signals (This signal is available only in the relay unit with IEC61850 communication card.)
229	GOOSE20	Assignment of GOOSE received signals (This signal is available only in the relay unit with IEC61850 communication card.)
230	GOOSE21	Assignment of GOOSE received signals (This signal is available only in the relay unit with IEC61850 communication card.)
231	GOOSE22	Assignment of GOOSE received signals (This signal is available only in the relay unit with IEC61850 communication card.)
232	GOOSE23	Assignment of GOOSE received signals (This signal is available only in the relay unit with IEC61850 communication card.)
233	GOOSE24	Assignment of GOOSE received signals (This signal is available only in the relay unit with IEC61850 communication card.)
234	GOOSE25	Assignment of GOOSE received signals (This signal is available only in the relay unit with IEC61850 communication card.)
235	GOOSE26	Assignment of GOOSE received signals (This signal is available only in the relay unit with IEC61850 communication card.)
236	GOOSE27	Assignment of GOOSE received signals (This signal is available only in the relay unit with IEC61850 communication card.)
237	GOOSE28	Assignment of GOOSE received signals (This signal is available only in the relay unit with IEC61850 communication card.)

No.	Signal name	Description
238	GOOSE29	Assignment of GOOSE received signals (This signal is available only in the relay unit with IEC61850 communication card.)
239	GOOSE30	Assignment of GOOSE received signals (This signal is available only in the relay unit with IEC61850 communication card.)
240	GOOSE31	Assignment of GOOSE received signals (This signal is available only in the relay unit with IEC61850 communication card.)
241	GOOSE32	Assignment of GOOSE received signals (This signal is available only in the relay unit with IEC61850 communication card.)
242	GOOSE33	Assignment of GOOSE received signals (This signal is available only in the relay unit with IEC61850 communication card.)
243	GOOSE34	Assignment of GOOSE received signals (This signal is available only in the relay unit with IEC61850 communication card.)
244	GOOSE35	Assignment of GOOSE received signals (This signal is available only in the relay unit with IEC61850 communication card.)
245	GOOSE36	Assignment of GOOSE received signals (This signal is available only in the relay unit with IEC61850 communication card.)
246	GOOSE37	Assignment of GOOSE received signals (This signal is available only in the relay unit with IEC61850 communication card.)
247	G_TRIP1	Operating condition of CBF/CBFG element (Trip signal from other relay) (This signal is available only in the relay unit with IEC61850 communication card.)
248	G_TRIP2	Operating condition of CBF/CBFG element (Trip signal from other relay) (This signal is available only in the relay unit with IEC61850 communication card.)
249	G_TRIP3	Operating condition of CBF/CBFG element (Trip signal from other relay) (This signal is available only in the relay unit with IEC61850 communication card.)
250	OC1-A	Definitive signal of OC1 A-phase or forced operation from PC-HMI
251	OC1-B	Definitive signal of OC1 B-phase or forced operation from PC-HMI
252	OC1-C	Definitive signal of OC1 C-phase or forced operation from PC-HMI
253	OC1-3_O	Definitive signal of any OC1 of A, B, and C phase or forced operation from PC-HMI
254	OC1-G	Definitive signal of OC1 zero-phase or forced operation from PC-HMI
255	OC2-A	Definitive signal of OC2 A-phase or forced operation from PC-HMI
256	OC2-B	Definitive signal of OC2 B-phase or forced operation from PC-HMI
257	OC2-C	Definitive signal of OC2 C-phase or forced operation from PC-HMI
258	OC2-3_O	Definitive signal of any OC2 of A, B, and C phase or forced operation from PC-HMI
259	OC2-G	Definitive signal of OC2 zero-phase or forced operation from PC-HMI
260	OC3-A	Definitive signal of OC3 A-phase or forced operation from PC-HMI
261	OC3-B	Definitive signal of OC3 B-phase or forced operation from PC-HMI
262	OC3-C	Definitive signal of OC3 C-phase or forced operation from PC-HMI
263	OC3-3_O	Definitive signal of any OC3 of A, B, and C phase or forced operation from PC-HMI
264	OC3-G	Definitive signal of OC3 zero-phase or forced operation from PC-HMI
265	OC4-A	Definitive signal of OC4 A-phase or forced operation from PC-HMI
266	OC4-B	Definitive signal of OC4 B-phase or forced operation from PC-HMI
267	OC4-C	Definitive signal of OC4 C-phase or forced operation from PC-HMI
268	OC4-3_O	Definitive signal of any OC4 of A, B, and C phase or forced operation from PC-HMI
269	OC4-G	Definitive signal of OC4 zero-phase or forced operation from PC-HMI
270	NOC1	Definitive signal of OCNEG1 or forced operation from PC-HMI
271	NOC2	Definitive signal of OCNEG2 or forced operation from PC-HMI
272	UC1-A	Definitive signal of UC1 A-phase or forced operation from PC-HMI
273	UC1-B	Definitive signal of UC1 B-phase or forced operation from PC-HMI
274	UC1-C	Definitive signal of UC1 C-phase or forced operation from PC-HMI
275	UC1-3_O	Definitive signal of any UC1 of A, B, and C phase or forced operation from PC-HMI
276	UC2-A	Definitive signal of UC2 A-phase or forced operation from PC-HMI
277	UC2-B	Definitive signal of UC2 B-phase or forced operation from PC-HMI
278	UC2-C	Definitive signal of UC2 C-phase or forced operation from PC-HMI

No.	Signal name	Description
279	UC2-3_O	Definitive signal of any UC2 of A, B, and C phase or forced operation from PC-HMI
280	CBF-A	Definitive signal of CBF A-phase or forced operation from PC-HMI
281	CBF-B	Definitive signal of CBF B-phase or forced operation from PC-HMI
282	CBF-C	Definitive signal of CBF C-phase or forced operation from PC-HMI
283	CBF-3_O	Definitive signal of any CBF of A, B, and C phase or forced operation from PC-HMI
284	CBF-G	Definitive signal of CBF zero-phase or forced operation from PC-HMI
285	DIRG1	Definitive signal of DIRG1 or forced operation from PC-HMI
286	DIRG2	Definitive signal of DIRG2 or forced operation from PC-HMI
287	DIRG3	Definitive signal of DIRG3 or forced operation from PC-HMI
288	DIRG4	Definitive signal of DIRG4 or forced operation from PC-HMI
289	UV1-A	Definitive signal of UV1 A (AB) phase or forced operation from PC-HMI
290	UV1-B	Definitive signal of UV1 B (BC) phase or forced operation from PC-HMI
291	UV1-C	Definitive signal of UV1 C (CA) phase or forced operation from PC-HMI
292	UV1-3_O	Definitive signal of any UV1 of A (AB), B (BC), and C (CA) phase or forced operation from PC-HMI
293	UV2-A	Definitive signal of UV2 A (AB) phase or forced operation from PC-HMI
294	UV2-B	Definitive signal of UV2 B (BC) phase or forced operation from PC-HMI
295	UV2-C	Definitive signal of UV2 C (CA) phase or forced operation from PC-HMI
296	UV2-3_O	Definitive signal of any UV2 of A (AB), B (BC), and C (CA) phase or forced operation from PC-HMI
297	OV1-A	Definitive signal of OV1 A (AB) phase or forced operation from PC-HMI
298	OV1-B	Definitive signal of OV1 B (BC) phase or forced operation from PC-HMI
299	OV1-C	Definitive signal of OV1 C (CA) phase or forced operation from PC-HMI
300	OV1-3_O	Definitive signal of any OV1 of A (AB), B (BC), and C (CA) phase or forced operation from PC-HMI
301	OV2-A	Definitive signal of OV2 A (AB) phase or forced operation from PC-HMI
302	OV2-B	Definitive signal of OV2 B (BC) phase or forced operation from PC-HMI
303	OV2-C	Definitive signal of OV2 C (CA) phase or forced operation from PC-HMI
304	OV2-3_O	Definitive signal of any OV2 of A (AB), B (BC), and C (CA) phase or forced operation from PC-HMI
305	OVG1	Definitive signal of OVG1 or forced operation from PC-HMI
306	OVG2	Definitive signal of OVG2 or forced operation from PC-HMI
307	NOV1	Definitive signal of OVNEG1 or forced operation from PC-HMI
308	NOV2	Definitive signal of OVNEG2 or forced operation from PC-HMI
309	UF1	Definitive signal of UF1 or forced operation from PC-HMI
310	UF2	Definitive signal of UF2 or forced operation from PC-HMI
311	UF3	Definitive signal of UF3 or forced operation from PC-HMI
312	OF1	Definitive signal of OF1 or forced operation from PC-HMI
313	OF2	Definitive signal of OF2 or forced operation from PC-HMI
314	OF3	Definitive signal of OF3 or forced operation from PC-HMI

6. Standard (Technical data)

Guaranteed performance

Common conditions	Frequency: Rated frequency Control power supply voltage: Rated voltage Ambient temperature: 20°C Humidity: 5-95%	Unless otherwise indicated, the common conditions shall be as described in the left column.

6.1. Relay characteristic data

Item	Test condition		Standard
Operating value	Frequency element (81U, 81O)	Setting of UF(OF)	Setting ± 0.05 Hz
	Ground-fault overcurrent element (50N/51N) Directional ground fault Element (67N, 67G)	1) Voltage setting 2) Current setting (a) 1.0 ~ 9.9mA (b) 10.0 ~ 100mA	1) Setting ± 5% 2) (a) Setting ±10% (b) Setting ±5%
	Other elements	1) Voltage setting 2) Current setting	1) Setting ± 5% 2) Setting ± 5%
Resetting value	Frequency element (81U, 81O)	Setting of UF(OF)	Setting ± 0.05 Hz
	Directional Ground fault element (67N, 67G)	1) Voltage setting 2) Current setting	1) Voltage setting × 95% or more 2) Current setting × 95% or more
	Undervoltage element (27)	Voltage setting	Voltage setting × 105% or less
	Undercurrent element (37)	Current setting	Current setting × 105% or less
	Other elements	1) Voltage setting 2) Current setting	1) Voltage setting × 95% or more 2) Current setting × 95% or more
Overshoot time characteristic	Time delayed overcurrent element (51) Time delayed ground fault overcurrent element (51N)	Setting : Current setting = Minimum Operating time multiplier = Minimum Operating characteristics = All characteristics Current input: Current = 0 → Current setting × 1000% Applied time: Theoretical operating time × 90%	The relay shall not operate.
Phase characteristic	Directional ground fault element (67N, 67G)	Setting : Current setting = (a) 1.0 ~ 9.9mA (b) 10.0 ~ 100mA Voltage setting = Minimum Voltage input: Zero-phase voltage = 100 V Current input: Current setting	(a) Within ± 10% of the theoretical value (b) Within ± 5% of the theoretical value
Operating time	Overcurrent element: (50) (OC1) Ground-fault overcurrent element: (50N) (OCG1)	Setting : Current setting = Minimum Input: Current = 0 → Current setting value × 200% (a) Ope.Time : 0.00 s (b) Ope.Time: 0.01 ~ 10 s	(a) Within 30 ms (b) Larger error of ; Ope.time setting± within 50 ms Ope.time setting± within 5%
	Overcurrent element (50) (OC2, 3) Ground-fault overcurrent element (50N) (OCG2, 3)	Setting : Current setting = Minimum Input: Current = 0 → Current setting value × 200% (a) Ope.Time : 0.00 s (b) Ope.Time: 0.01 ~ 10 s	(a) Within 40 ms (b) Larger error of; Ope.time setting± within 50 ms Ope.time setting± within 5%
	Negative-phase-sequence overcurrent element (46) (OCNEG1, 2)	Setting : Current setting = Minimum Input: Current = 0 → Current setting value × 200% (a) Ope.Time : 0.00 s (b) Ope.Time: 0.01 ~ 10 s	(a) Within 50 ms (b) Larger error of; Ope.time setting± within 50 ms Ope.time setting± within 5%
	Directional Ground fault directional element (67N, 67G) (DIRG1 ~ 3)	Setting : Current setting value = Minimum Voltage setting value = Minimum Maximum sensitivity angle = 0°	(a) Within 50 ms (b) Larger error of; Ope.time setting± within 50 ms

		Input: Current = 0 → Current setting value × 150% Voltage = 0 → 30 V Voltage – Current phase=0° (a) Ope.Time : 0.00 s (b) Ope.Time: 0.01 ~ 10 s	Ope.time setting± within 5%
	Directional Ground fault element (67N, 67G) (DIRG4)	Setting : Voltage setting value = Minimum Current setting value = Minimum Maximum sensitivity angle = 0° Input: Voltage = 0 → 30V Current = (a) 0→Ope.Curt.×300% (b) 0→Ope.Curt.×500% (c) 0→Ope.Curt.×1000% Voltage – Current phase=0°	・ Except for DT01 (a) Ope.time setting± within 12% (b) Ope.time setting± within 7% (c) Larger error of; Ope.time setting± within 5% Ope.time setting± within 100 ms ・ DT01 Larger error of; Ope.time setting± within 5% Ope.time setting± within 50 ms
	Undervoltage element (27) (UV1, 2)	Setting :Voltage setting = Minimum Input: Voltage =Rated voltage → Voltage setting× 70% (a) Ope.Time : 0.00 s (b) Ope.Time: 0.01 ~ 10 s	(a) Within 50 ms (b) Larger error of; Ope.time setting± within 50 ms Ope.time setting± within 5%
	Undercurrent element (37) (UC1, 2)	Setting : Current setting = Minimum Input: Current =Rated current → Current setting× 70% (a) Ope.Time : 0.00 s (b) Ope.Time: 0.01 ~ 10 s	(a) Within 50 ms (b) Larger error of; Ope.time setting± within 50 ms Ope.time setting± within 5%
	Frequency element (81U) (UF1 ~ 3)	Setting : UF setting = -5.0 Hz Input: Voltage = Rated voltage Rated frequency→ Rated frequency +UF- 0.5 Hz	Larger error of; Ope.time setting± within 50 ms Ope.time setting± within 5%
	Frequency element (81O) (OF1 ~ 3)	Setting : OF setting = 5.0 Hz Input: Voltage = Rated voltage Rated frequency→ Rated frequency +OF+0.5 Hz	Larger error of; Ope.Time ± within 50 ms Ope.Time ± within 5%
	Time delayed overcurrent element (51) Time delayed ground-fault overcurrent element (51N)	Setting value: Current setting = Minimum Input: Current = (a) 0→Ope.Curt.×300% (b) 0→Ope.Curt.×500% (c) 0→Ope.Curt.×1000%	・ Except for DT01 (a) Ope.time setting± within 12% (b) Ope.time setting± within 7% (c) Larger error of; Ope.time setting±± within 5% Ope.time setting± within 100 ms ・ DT01 Larger error of; Ope.time setting±± within 5% Ope.time setting± within 50 ms
	CBF detection	Setting : Current setting value = Minimum Input: Current = 0 → Current setting × 200% (a) Ope.Time : 0.00 s (b) Ope.Time: 0.01 ~ 10 s	(a) Within 30 ms (b) Larger error of; Ope.time setting± within 50 ms Ope.time setting± within 5%
	Overvoltage element (59) (OV1, 2) Ground-fault overvoltage element (64N) (OVG1, 2) Negative-phase-sequence overvoltage (47) (OVNEG1, 2)	Setting : Voltage setting = Minimum Input: Voltage = 0 → Voltage setting × 120% (a) Ope.Time : 0.00 s (b) Ope.Time: 0.01 ~ 10 s	(a) Within 50 ms (b) Larger error of; Ope.time setting± within 50 ms Ope.time setting± within 5%
Reset time	Overcurrent element (50) (OC1 ~ 3) Ground-fault overcurrent element (50N) (OCG1 ~ 3) Negative-phase-sequence overcurrent element (46) (OCNEG1, 2)	Setting : Current setting = Minimum Input: Current = Current setting × 300% → 0	200 ms ± within 25 ms
	Directional ground fault	Setting : Current setting = Minimum	200 ms ± within 25 ms

	element (67N, 67G) (DIRG1 ~ 3)	Voltage setting = Minimum Maximum sensitivity angle = 0° Input: Current = Current setting × 1000%, 2000% → 0 Voltage = 100 V Voltage – Current phase=0°	
	Directional ground fault element (67N, 67G) (DIRG4)	Setting :Current setting = Minimum Voltage setting value = Minimum Maximum sensitivity angle = 0° (a) Rst. Chr.=DT (b) Rst. Chr.=IDMT (c) Rst. Chr.=INST Input: Current = Current setting × 300% → 0 Voltage = Rated voltage → 0 V Voltage – Current phase=0°	(a) 200 ms ± within 25 ms (b) 200 ms ± within 25 ms (c) 50 ms or less
	Undervoltage element (27) (UV1, 2)	Setting : Voltage setting = Minimum Input: Voltage =Voltage setting × 70% → Rated voltage	200 ms ± within 25 ms
	Undercurrent element (37) (UC1, 2)	Setting : Current setting = Minimum Input: Current=Current setting×70%→ Rated current	200 ms ± within 25 ms
	Frequency element (81U) (UF1 ~ 3)	Setting: UF setting = -5.0 Hz Input: Voltage = Rated voltage Rated frequency+UF- 0.5 Hz → Rated frequency	200 ms ± within 25 ms
	Frequency element (81O) (OF1 ~ 3)	Setting : OF setting = 5.0 Hz Input: Voltage = Rated voltage Rated frequency+OF+0.5 Hz → Rated frequency	200 ms ± within 25 ms
	Time delayed overcurrent element (51) Time-delayed ground-fault overcurrent element (51N)	Setting value: Current setting = Minimum (a) Rst. Chr.=DT (b) Rst. Chr.=IDMT (c) Rst. Chr.=INST Input: Current setting × 300% → 0	(a) 200 ms ± within 25 ms (b) 200 ms ± within 25 ms (c) 50 ms or less
	CBF detection	Setting : Current setting = Minimum Input: Current = Current setting × 200% → 0	200 ms ± within 25 ms
	Overvoltage element (59) (OV1, 2) Ground-fault overvoltage element (64N) (OVG1, 2) Negative-phase-sequence overvoltage (47) (OVNEG1, 2)	Setting : Voltage setting = Minimum Input: Voltage = Voltage setting × 120% → 0	200 ms ± within 25 ms

Temperature characteristics	Time-delayed overcurrent element, Time-delayed ground fault overcurrent element (51, 51N)	Setting : Current setting = Minimum Ope. Chr.= Other than DT01 Input: Current = (a) 0→Ope.Curt.×300% (b) 0→Ope.Curt.×500% (c) 0→Ope.Curt.×1000%	The error relates to the operating value & time at ambient temperature of 20°C. ● At temperature = 0, 40°C: Operating value ± within 5% (a) Ope.time setting± within 12% (b) Ope.time setting± within 7% (c) Ope.time setting± within 5% ● At temperature = -10, 50°C: Operating value ± within 10% (a)Ope.time setting± within 24% (b)Ope.time setting± within 14% (c)Ope.time setting± within 10% ● At temperature is 40, 60°C: Operating value=± within 20% (a)Ope.time setting± within 48% (b)Ope.time setting± within 28% (c)Ope.time setting± within 20%
	Other elements	(a) 0, 40°C (b) -10, 50°C (c) -40, 60°C	The error relates to the operating value & time at ambient temperature of 20°C. (a)Ope.value at 20°C.± within 5% Ope. time at 20°C± within 5% (b)Ope. value at 20°C ± within 10% Ope. time at 20°C ± 10% (c)Ope. value at 20°C ± within 20% Ope. time at 20°C ± 20%
Power supply voltage characteristics	All elements	Variation range of control power supply =DC 88 V, DC 300 V, AC 85 V, AC 264 V	Within ± 5% of the measured value at rated voltage
Distorted wave characteristics	Ground directional element (67N, 67G)	Third harmonic content: 30% of fundamental component.	The error relates to the operating value at fundamental component (1f) only. Current value at 1f ± within 15% Voltage value at 1f ± within 10% Phase value at 1f± within 10°
		Fifth harmonic content: 30% of fundamental comp.	
		Seventh harmonic content: 30% of fundamental component	
	Frequency element (81U, 81O)	Third harmonic content: 30% of fundamental component.	UF(OF) setting :± within 0.05 Hz
		Fifth harmonic content: 30% of fundamental comp.	
		Seventh harmonic content: 30% of fundamental component	
	Other elements	Third harmonic content: 30% of fundamental component.	Ope. value at 1f ± within 10%
		Fifth harmonic content: 30% of fundamental comp.	
		Seventh harmonic content: 30% of fundamental component	
Frequency	Time delayed overcurrent	Frequency: Rated frequency ± 10%	Ope.value at rated F: ± within 5%

characteristics	element (51) Time delayed ground-fault overcurrent element (51N)	Operating characteristics: Other than DT01 (a) 0→Ope.Curt.×300% (b) 0→Ope.Curt.×500% (c) 0→Ope.Curt.×1000%	Operating time: The error relates to the operating time at rated frequency. (a) ± within 12% (b) ± within 7% (c) ± within 5%
	Other elements	Frequency variation range: Rated frequency ± 10%	Ope.value at rated F ± within 5%
			Ope.time at rated F: ± within 5%
			Ope.phase at rated F: ± within 10%

6.2. General specification data

<table>
<tr><th>Item</th><th colspan="4">Test condition</th><th>Standard</th></tr>
<tr><td rowspan="4">Contact capacity</td><td colspan="2" rowspan="2">Contact for tripping</td><td colspan="2">Closed circuit capacity</td><td>DC250 V:30 A
0.2s L/R=0</td></tr>
<tr><td colspan="2">Open-circuit capacity</td><td>DC250 V:0.2 A
L/R=40 ms</td></tr>
<tr><td colspan="2" rowspan="2">Contact for annunciator</td><td colspan="2">Closed circuit capacity</td><td>DC250 V:0.2 A
L/R=7 ms</td></tr>
<tr><td colspan="2">Open-circuit capacity</td><td>DC250 V:0.2 A
L/R=7 ms</td></tr>
<tr><td rowspan="2">Overload capacity</td><td>Current circuit</td><td colspan="3">Rated current × 3 times Continuous
Rated current × 40 times 2 s, twice, 1 min interval
Rated current × 100 times 1 s</td><td rowspan="2">No unnecessary operation, no abnormal indication and etc.</td></tr>
<tr><td>Voltage circuit</td><td colspan="3">Rated voltage × 1.15 times, 3 hr</td></tr>
<tr><td>Insulation resistance</td><td colspan="4">DC500 V meg-ohm-meter is used.
(1) Between collective electric circuit and ground
(However, the serial communication circuit is excluded.)
(2) Between mutual circuits, between contact poles
(However, the serial communication circuit is excluded.)</td><td>(1) 10 MΩ or more

(2) 5 MΩ or more</td></tr>
<tr><td rowspan="2">Withstand voltage at commercial frequency</td><td colspan="4">IEC60255-5</td><td rowspan="2">No unnecessary operation, no abnormal indication and etc.</td></tr>
<tr><td colspan="4">(1) Between collective electric circuit and ground: AC2000 V, 1 min
(2) Between mutual circuits, between contact poles: AC2000 V, 1 min
(However, the serial communication circuit is excluded.)
(3) Between contact terminals (between poles): AC1000 V, 1 min</td></tr>
<tr><td rowspan="3">Withstand voltage against lightning impulse</td><td colspan="4">IEC60255-5</td><td rowspan="3">No unnecessary operation, no abnormal indication and etc..</td></tr>
<tr><td rowspan="2">Standard shock voltage waveform (1.2/50 μs)

Application for each 3 times by positive or negative pole</td><td>5 kV</td><td colspan="2">・ Between collective electric circuit and ground
・ Between mutual transformer circuits for measuring instruments
・ Between the transformer circuit for measuring instrument and the control circuit
(However, the serial communication circuit is excluded.)</td></tr>
<tr><td>5 kV</td><td colspan="2">・ Between terminals of transformer circuit for measuring instrument
・ Between terminals of control power supply circuit
(However, the serial communication circuit is excluded.)</td></tr>
<tr><td rowspan="2">Trouble of control power supply</td><td colspan="4">IEC60255-11
IEC61000-4-11</td><td rowspan="2">No unnecessary operation, no abnormal indication and etc.</td></tr>
<tr><td colspan="4">Confirm that faulty indication and erroneous operation do not exist at the occasion of turning on/off control power supply, instantaneous interruption of the control power supply, and slow variation of the control power supply.</td></tr>
<tr><td rowspan="2">Immunity against electrostatic discharge</td><td colspan="4">IEC60255-22-2 class4</td><td rowspan="2">No unnecessary operation, no abnormal indication and etc.</td></tr>
<tr><td colspan="4">8 kV: Contact discharge
15 kV: Aerial discharge</td></tr>
<tr><td></td><td colspan="4">Go to next page</td><td></td></tr>
</table>

Item	Test condition	Standard
Immunity against commercial frequency	IEC60255-22-7 Applied point: Between line and ground Test voltage: 300 V, Test time: 10 s Applied point: Between lines Test voltage: 150 V, Test time: 10 s	No unnecessary operation, no abnormal indication and etc.
Immunity against damped oscillatory wave	IEC60255-22-1 ・ Peak value of 1st wave: 2.5 kV ・ Vibration frequency: 1 MHz±10% ・ Damping time to 1/2: 3 ~ 6 cycles ・ Frequency of repetition: 6 ~ 10 times/ 1 cycle of commercial frequency (asynchronous) ・ Output impedance of test circuit: 200 Ω±10% Applied point: Between collective transformer circuit and ground Between collective control power supply circuit and ground Between terminals of control power supply circuit	No unnecessary operation, no abnormal indication and etc.
Electric fast transient/Burst immunity	IEC60255-22-4 Applied voltage: ±4.0 kV (Class A) Repetition frequency: 5.0 KHz, 100 kHz Port under test: Between auxiliary power supply circuit and ground Applied voltage: ±2.0 kV (Class B) Repetition frequency: 5.0 KHz, 100 kHz Port under test: Between CT/VT input circuits and ground Between binary input and output circuits and ground	No unnecessary operation, no abnormal indication and etc.
Surge immunity	IEC60255-22-5 Test voltage : 1.2/50 at open-circuit condition current waveform:8/20μs at short circuit condition Port under test; ・ Between auxiliary power supply terminals: 0.5, 1 kV (0 Ω, 18 μF) ・ Between auxiliary power supply and ground: 0.5, 1, 2 kV (10 Ω, 9 μF) ・ Between binary input/output (communication) and ground; 0.5, 1 kV (0 Ω, 0 μF) ・ Between CT/VT circuits ; 0.5, 1 kV (40 Ω, 0.5 μF) ・ Between CT/VT circuit and ground; 0.5, 1, 2 kV (40 Ω, 0.5 μF)	No unnecessary operation, no abnormal indication and etc..
Power frequency magnetic field immunity test	IEC60255-26 IEC61000-4-8 level5 Magnetic field intensity: 100 A/m continuous 1000 A/m 1 s ~ 3 s * Setting value of the I0 circuit for ZCT input shall be implemented at 5 mA or more.	No unnecessary operation, no abnormal indication and etc.
	Go to next page	

Item	Test condition	Standard
Immunity to conducted disturbance, induced by radio frequency field	IEC60255-26 IEC61000-4-6 Frequency range: 150 kHz ~ 80 MHz 27, 68 MHz Voltage level: 10 V/m Amplitude modulation: 1 kHz, ±80%AM(1kHz)	No unnecessary operation, no abnormal indication and etc.
Radiated, radio-frequency, electromagnetic field immunity test	IEC60255-26 IEC61000-4-3 Frequency range: 80 MHz ~ 1 GHz 1.4 GHz ~ 2.7 GHz 80, 160, 450, 900, 1890, 2150 MHz Electric field intensity: 10 V/m Amplitude modulation: 1 KHz, ±80%AM(1kHz)	No unnecessary operation, no abnormal indication and etc.
Conductive emission	IEC60255-26 CISPR 22 Test condition Perform measurement by using the receiver for measuring average value and the receiver for measuring quasi-peak value.	0.15 ~ 0.5 MHz: Quasi-peak 79 dB(μV) Average value 66 dB(μV) 0.5 ~ 30 MHz: Quasi-peak 73 dB(μV) Average value 60 dB(μV)
Radiated emission	IEC60255-26 [1] CE specification (EMC Directive) (CISPR11) [2] FCC specification (FCC-part15-A) Regarding the both of above-mentioned 2 specifications, perform measurement by using the receiver for measuring quasi-peak value.	[1] CE specification 30 ~ 230 MHz: Quasi-peak 40 dB(μV) 230 ~ 1000 MHz: Quasi-peak 47 dB(μV) [2] FCC specification 30 ~ 88 MHz: Quasi-peak 39.1 B(μV) 88 ~ 216 MHz: Quasi-peak 43.5 dB(μV) 216 ~ 1000 MHz: Quasi-peak 46.4 dB(μV)
Vibration	IEC60255-21-1 class1 [1] Response speed ・ Frequency range: 10 ~ 150 Hz ・ Sweep speed: 1 octave/min., test time : 8 min ・ Crossover frequency: 58 ~ 60 Hz ・ Direction of biaxial: Respective 3 directions in back and forth, right and left, up and down ・ Number of tests: 1 time for each directions [2] Endurance test ・ Frequency range: 10 ~ 150 Hz ・ Sweep speed: 1 octave/min test time : 8 min ・ Acceleration: 9.8 m/s^2 (Peak to peak displacement : 5 ~ 0.022 mm) ・ Number of tests: 160 min (20 sweeps x 8 min.) ・ Condition : Non-energized condition	No unnecessary operation, no abnormal indication and etc.

Item	Test condition	Standard
Shock	IEC60255-21-2 class1 [1] Response test ・ Peak acceleration: 5 G (49 m/s^2), duration of pulse: 11 ms ・ Direction of pulses: Respective 3 directions in back and forth, right and left, up and down (6 directions) ・ Number of pulses in each direction: 3 times for 6 directions ・ Condition : Energized condition [2] Shock withstand test ・ Peak acceleration: 15 G (147 m/s^2), duration of pulse: 11 ms ・Direction of pulses: Respective 3 directions in back and forth, right and left, up and down (6 directions) ・ Number of pulses in each directions: 3 times for 6 directions ・ Condition : Non-energized condition [3] Bump test ・ Peak acceleration: 10 G (98 m/s^2), duration of pulse: 16 ms ・ Direction of impact application: Respective 3 directions in back and forth, right and left, up and down (6 directions) ・ Number of pulses in each directions: 1000 times for 6 directions ・ Condition : Non-energized condition	No damage Measure the operating values of respective elements before & after the test, and the values shall be within the standard.
Seismic test	IEC60255-21-3 class2 • Nominal frequency range: 1 ~ 35 Hz Crossover frequency : 8 Hz Acceleration Peak displacement at 1 ~ 8 Hz : X: 7.5 mm, Y: 3.5 mm Peak acceleration at 8 ~ 35 Hz : X: 2.0 G (19.6 m/s^2), Y: 1.0 G (9.8 m/s^2) ・ Sweep cycle in each axis: 1 Sweep rate : 1octave/min., test time : 10 min ・ Direction of biaxial: Respective 3 directions in back and forth, right and left, up and down ・ Number of test: 1 times for 3 biaxial directions	During vibration, No unnecessary operation, no abnormal indication and etc. After vibration, No change of the operating value and operating time by comparing with the value before the vibration.
Dry heat	IEC60068-2-2 Operating temperature: 60°C, 16 hours Storage temperature: 85°C, 16 hours	Any anomaly such as fissure, crack, or deformation, etc. shall not exist on external appearance & structure. No anomaly shall exist on indication, etc. Measure the operating values of respective elements before & after the test, and the values shall be within the standard.
Low temperature	IEC60068-2-1 Operating temperature: -40°C, 16 hours Storage temperature: -40°C, 16 hours	Any anomaly such as fissure, crack, or deformation, etc. shall not exist on external appearance & structure. No anomaly shall exist on indication, etc. Measure the operating values of respective elements before & after the test, and the values shall be within the standard.
	Go to next page	

Item	Test condition	Standard
Temperature & humidity cycle test	To be based on IEC60068-2-30 (JIS-C60068-2-30 variant 2) Cyclic change of temperature & humidity between 40°C/95%RH and 25°C/95%RH. 1 cycle: 24 hours Number of cycles: 56 cycles	Any anomaly such as fissure, crack, or deformation, etc. shall not exist on external appearance & structure. Measure the operating values of respective elements before & after the test, and confirm that the values are within the standard.
Temperature and humidity combination (cyclic) test	IEC 60068-2-38 Cyclic change of temperature & humidity among 65°C/93%RH, 25°C/93%RH, and -10°C/80%RH. 1 cycle: 24 hours Number of cycles: 5 Control power supply circuit: Rated voltage	Any anomaly such as fissure, crack, or deformation, etc. shall not exist on external appearance & structure. Measure the operating values of respective elements before & after the test, and confirm that the values are within the standard.
Damp heat test	IEC 60068-2-78(3) Temperature/humidity: 40°C/93%RH Number of cycles: 56 days	Any anomaly such as fissure, crack, or deformation, etc. shall not exist on external appearance & structure. Measure the operating values of respective elements before & after the test, and confirm that the values are within the standard.
Load	(1) Current circuit (2) Voltage circuit (3) Zero-phase voltage circuit (4) Control power supply	(1) At the rating of 5 A: 0.6 VA or less (2) 0.1 VA or less (3) 0.1 VA or less (4) 20 W or less
Mass		4 kg or less

7. Connection

7.1. External connection

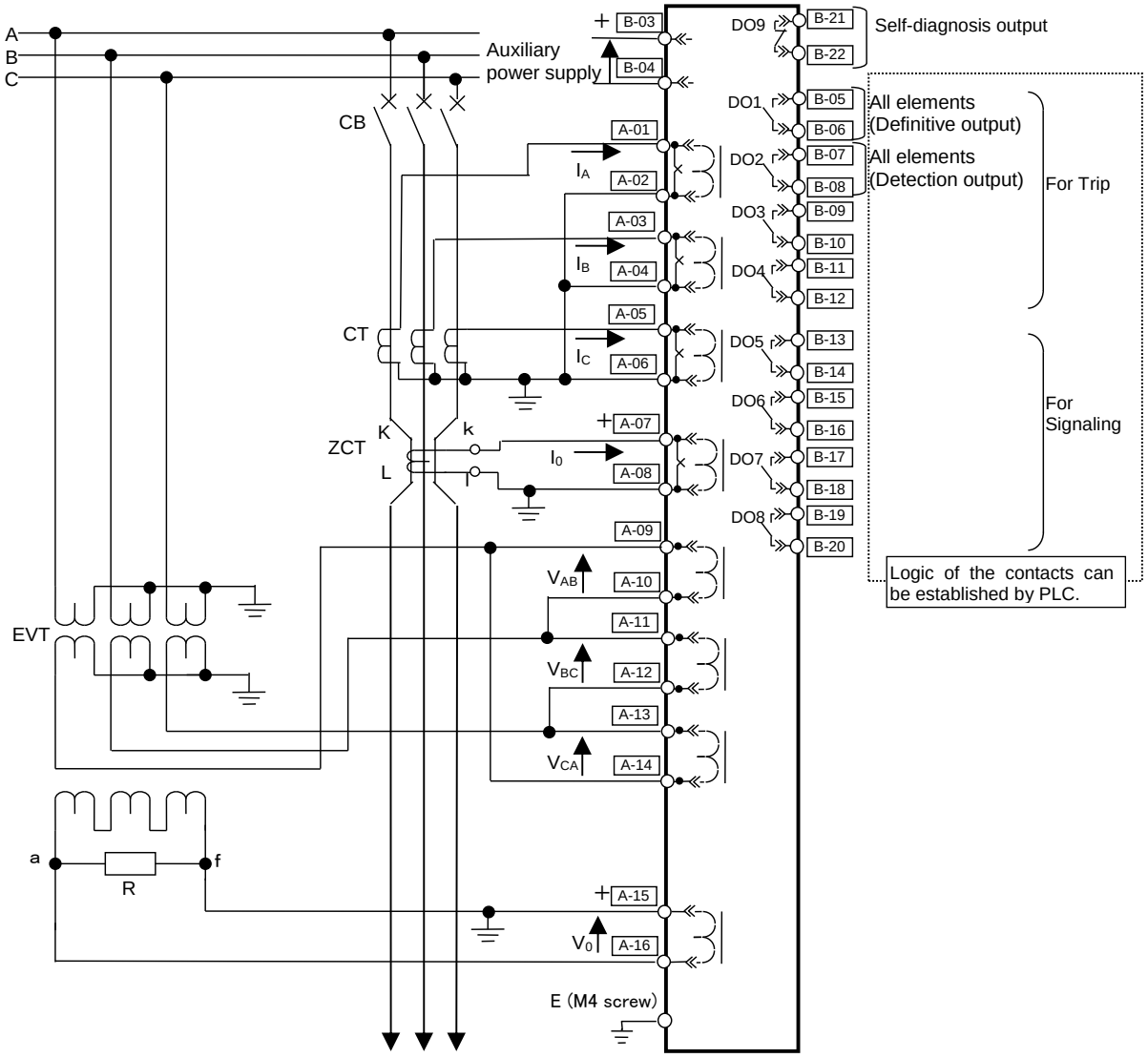


Fig. 7-1 Example connection
(phase CT, ZCT, phase-phase VT, zero-sequence voltage)
Settig AI-Config.: “V Input Sel. = D”, “V 3P/2P Sel. =3P” (refer to sub-clause 3.15)

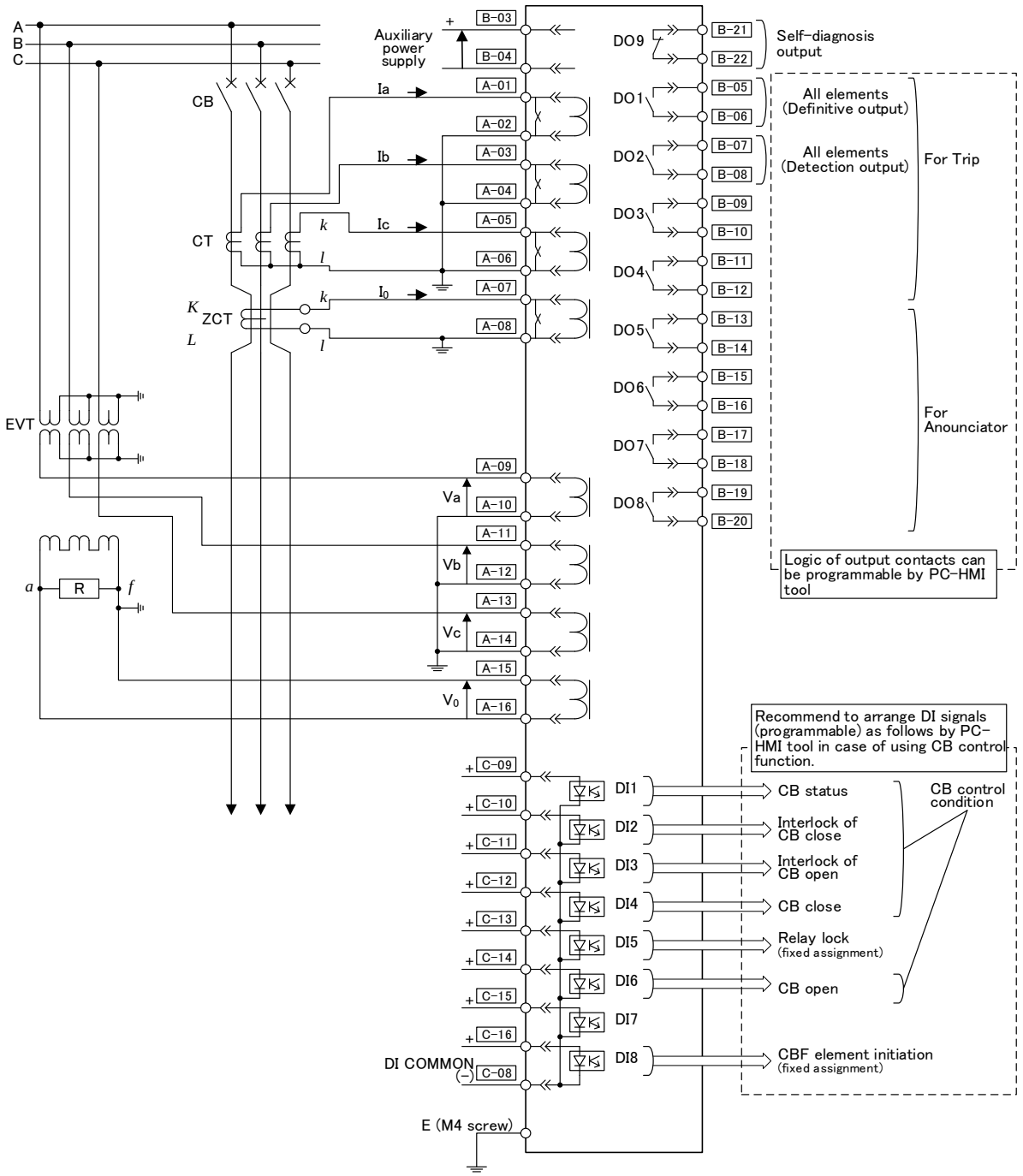


Fig. 7-2 Example connection
(phase CT, ZCT, phase VT, zero-sequence voltage)
Settig AI-Config.: “V Input Sel. = Y”, “V 3P/2P Sel. =3P” (refer to sub-clause 3.15)

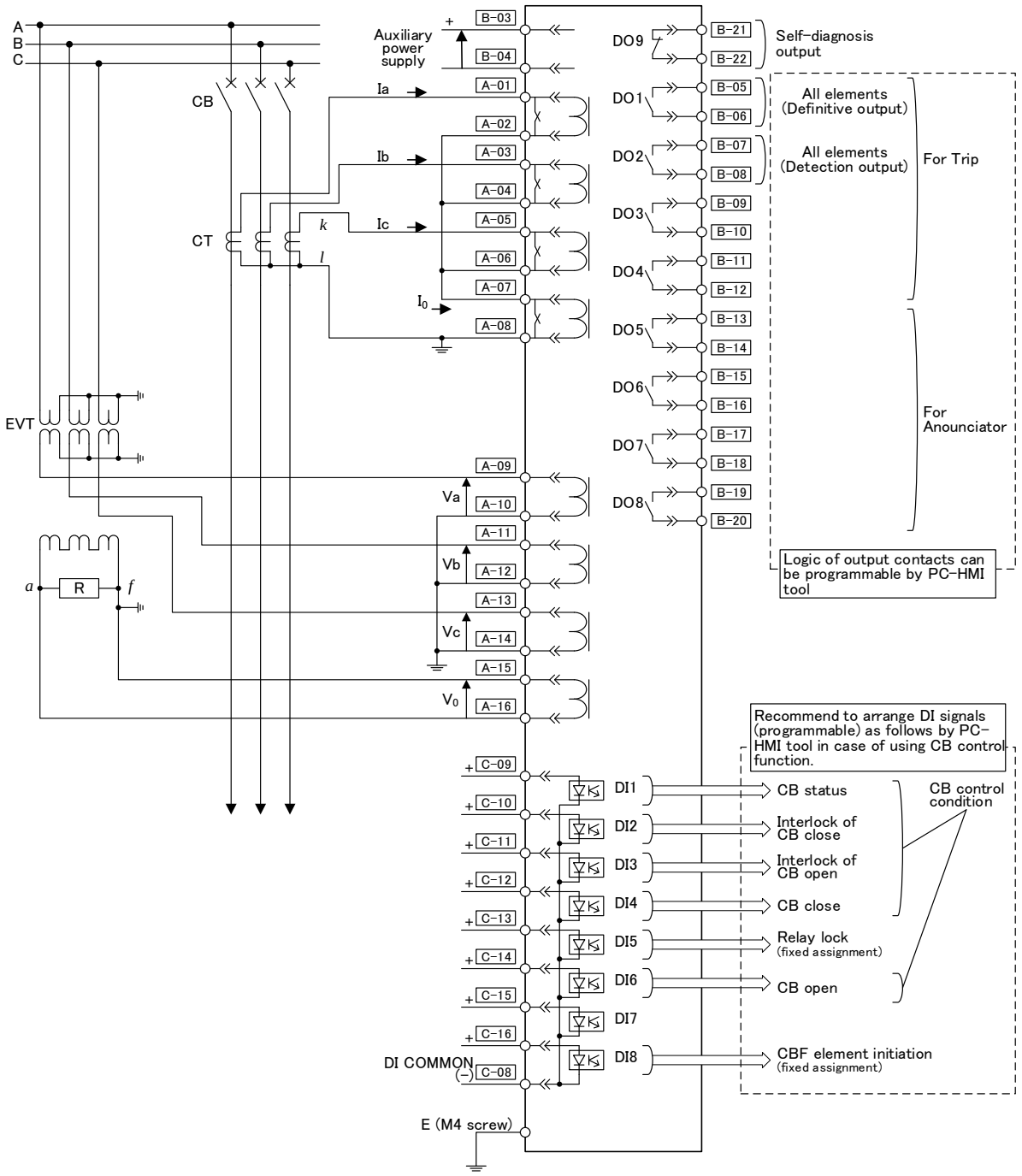


Fig. 7-3 Example connection
(phase CT, residual zero-sequence current phase VT, zero-sequence voltage)
Settig AI-Config.: “V Input Sel. = Y”, “V 3P/2P Sel. =3P” (refer to sub-clause 3.15)

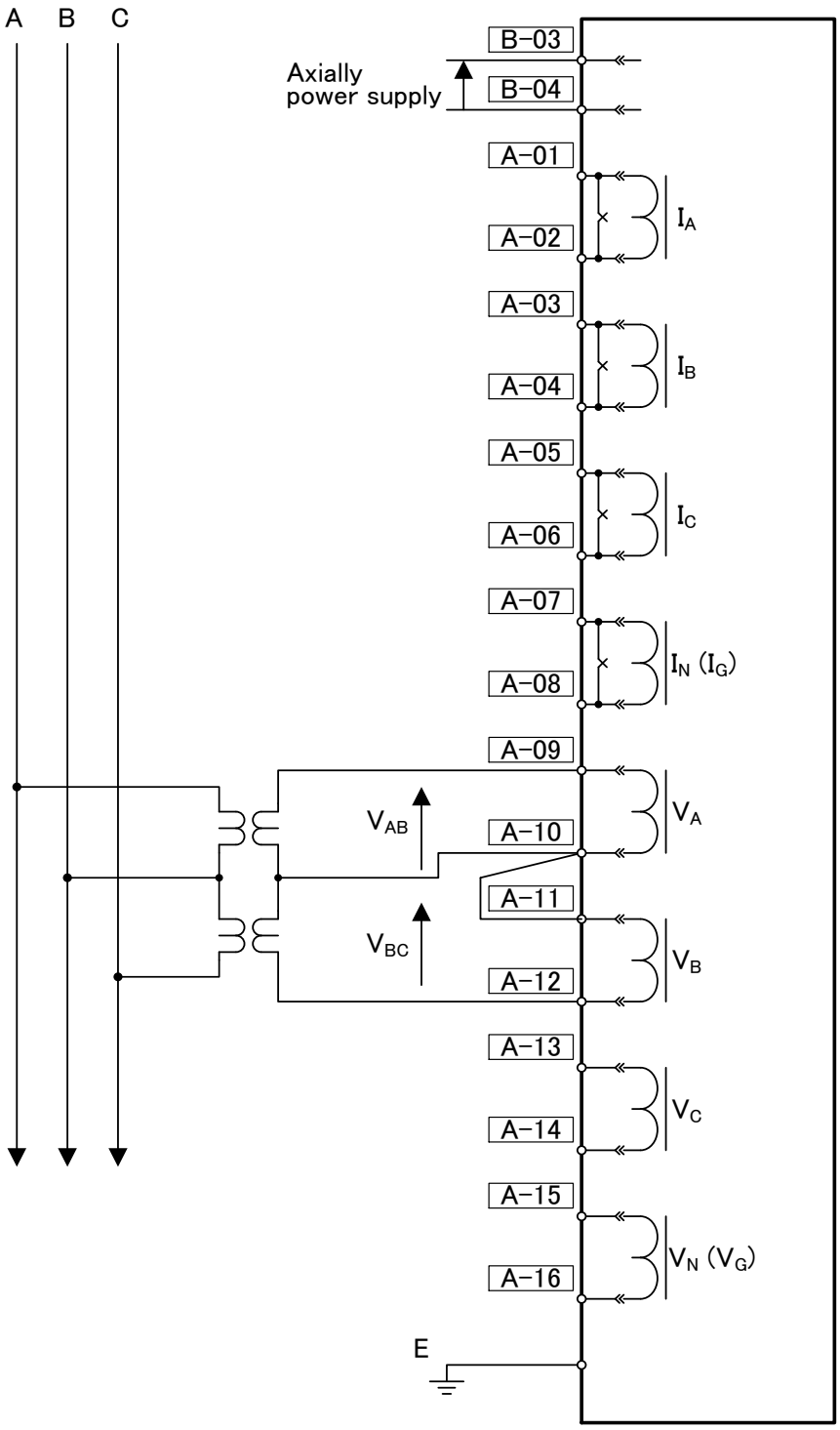


Fig. 7-4 Example connection for 2-phase injection using 2 × VT.
This example is focused on only VT connection. For CT, please refer to other figure.
Settig AI-Config.: “V Input Sel. = D”, “V 3P/2P Sel. =2P” (refer to sub-clause 3.15)

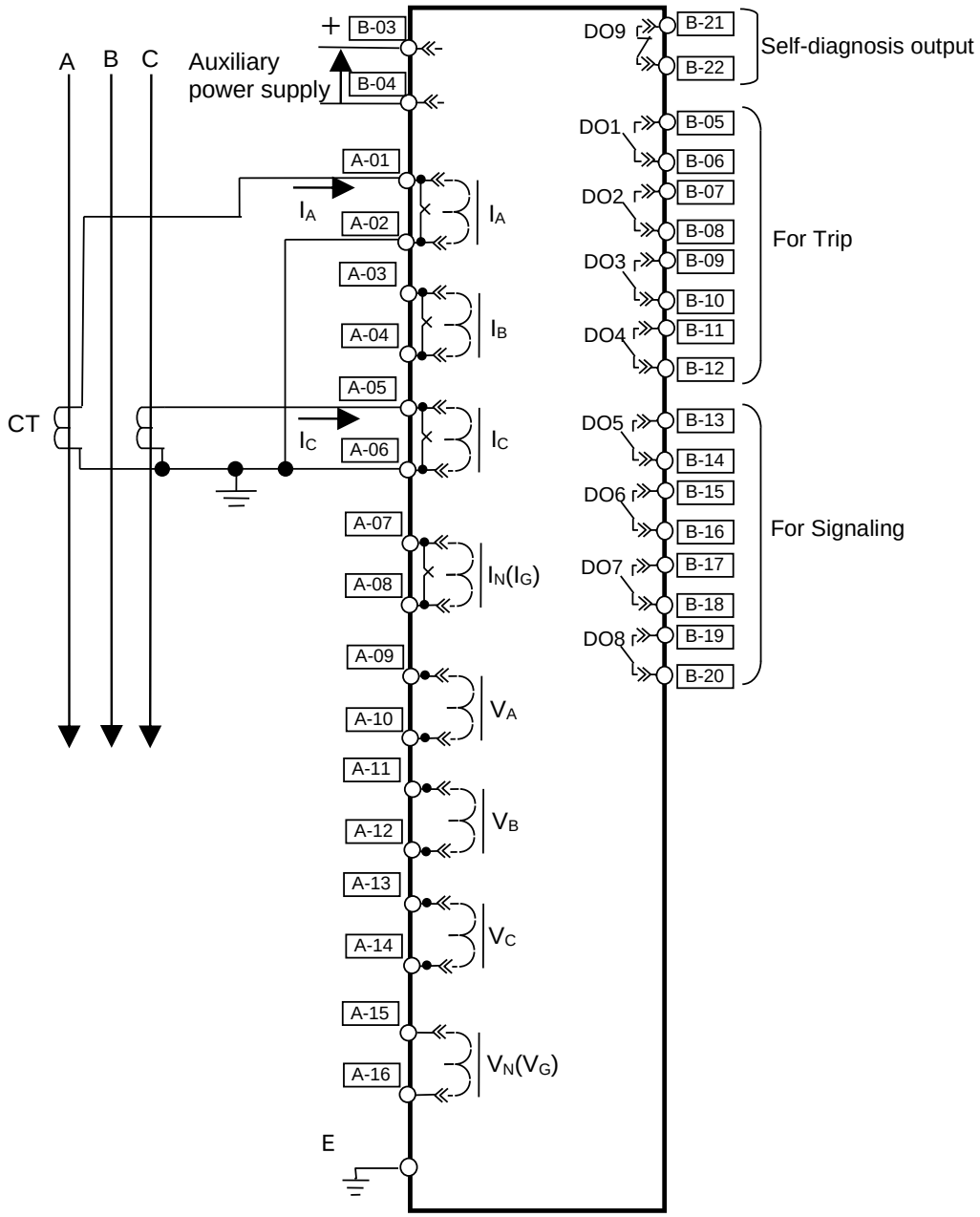


Fig. 7-5 Example connection for 2-phase injection using 2 x CT.
This example is focused on only CT connection. For VT, please refer to previous figure.

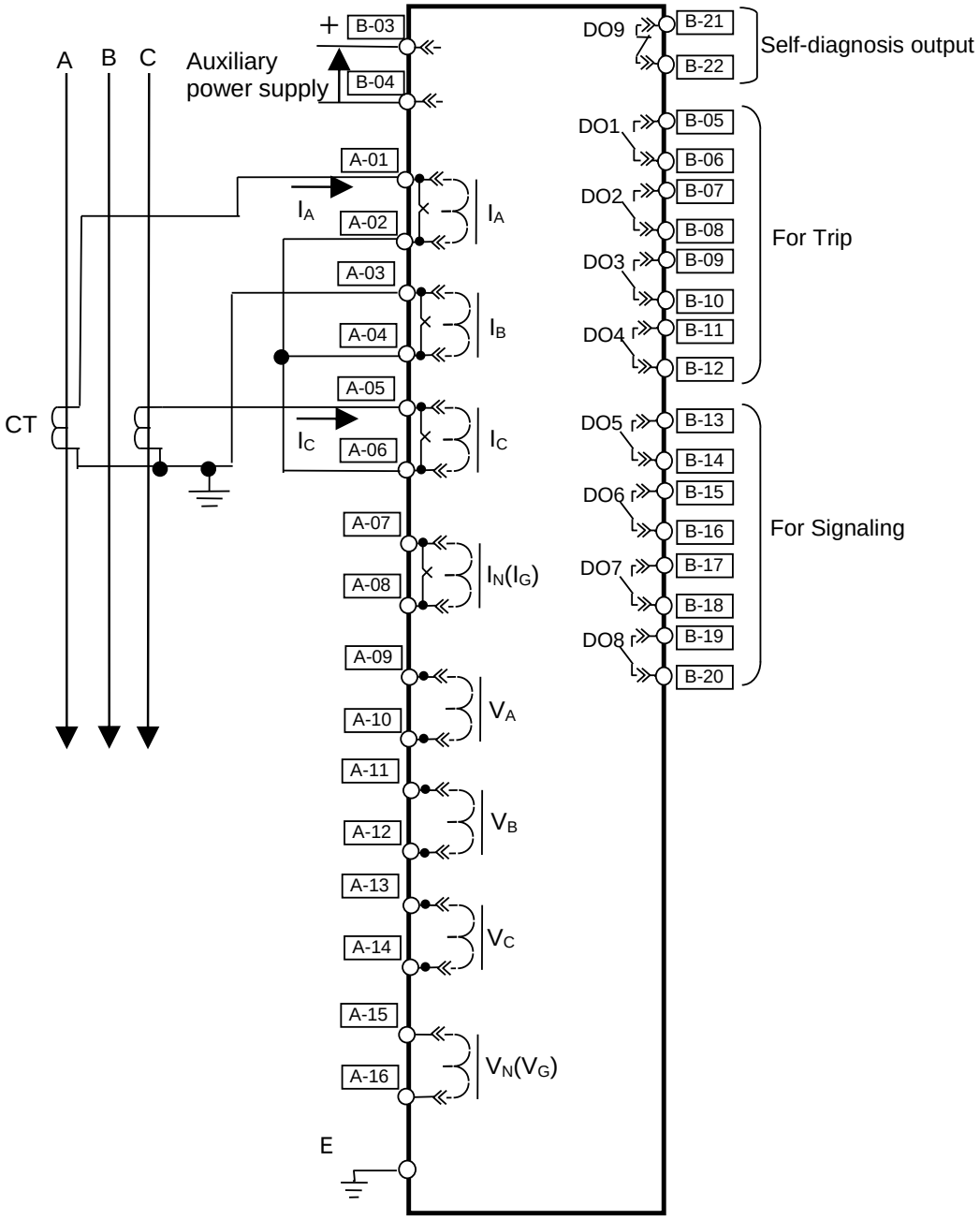


Fig. 7-6 Example connection for 3-phase injection using 2 x CT.
This example is focused on only CT connection. For VT, please refer to previous figure.

8. Test

Although all necessary functional tests are implemented for this relay before shipment from the factory, it is recommendable to perform the tests with reference to the following items, before use.

8.1. Visual inspection

Perform the visual inspection check with reference to the following items.

Inspection item	Contents of inspection
Unit (working part)	(1) No deformation (2) Operational check of the operation key switches (3) Neither discoloration nor deformation of the front name plate (4) No damage at the terminal connectors
Case	No damage including the terminal connectors
Others	No foreign substances, such as dust, iron pieces, etc.

8.2. Characteristic test

8.2.1. Notes related to the tests

(1) Recommended test condition

Regarding the ambient conditions, following conditions shall be complied with, as far as possible. If the test is performed at the condition which is significantly different from the next condition, the correct test results may not be obtained.

- Ambient temperature: 20°C ± 10°C
- Rated frequency: ±1%
- Waveform (AC): Distortion factor 2% or less
- Control voltage: Rated voltage ±2%

(2) Functional control points

Refer to Chapter 6.

The functional control point (standard point) of each relay's element shall be checked by the relay alone. Therefore, when the combined test with external devices such as CT, ZCT, etc. is performed, it shall be considered the error factor of external devices.

Furthermore, if user-defined control point is specified (e.g. accracy of relay characteristic is controlled at service conditions), execute the test at the manufacturer-defined control point (mentioned in Section 6.1) before in-service operation and then check accuracy of the relay. After that, execute the test at the user-defined control point, and set this data to the subsequent standards.

(3) Setting change

Refer to 4.3.4.1 for the setting change.

(4) Judgment of operation

Basically, the measurement of the operating value, operating time, etc. shall be done by open/close of the output relay contact of each element.

(5) Communication card

Regardless of equipping or not of the communication card, the test voltage input to the serial communication circuit shall be avoided at the dielectric test and the impulse voltage test.

Furthermore, when the communication card is equipped with, it is not necessary to disconnect the communication card at the test.

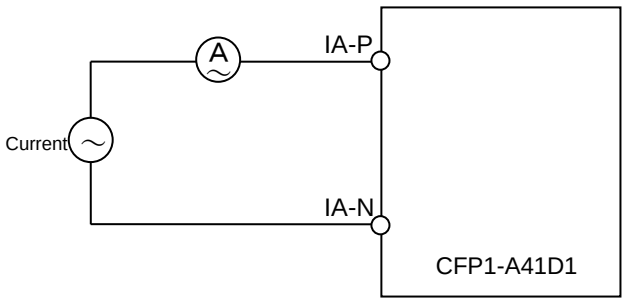
8.2.2. Characteristic test

8.2.2.1. Test circuit

The external connection of AC input circuit is as shown below as a reference.
Refer to Fig. 1-5 for the terminal arrangement.

[1] Overcurrent element, Undercurrent element

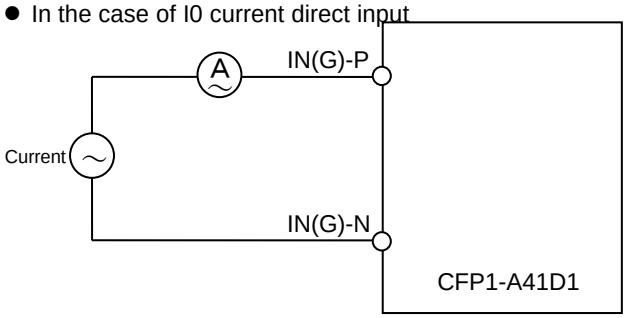
Example of A-phase



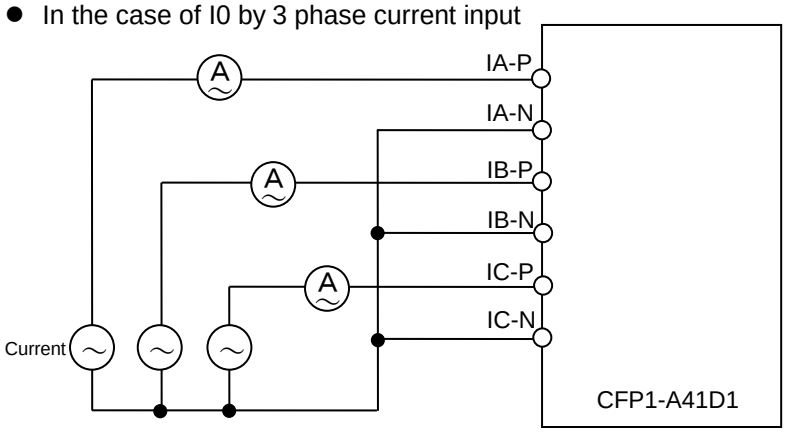
Test phase	Terminal No.
A-phase	IA-P～IA-N
B-phase	IB-P～IB-N
C-phase	IC-P～IC-N

[2] Ground-fault overcurrent element

- In the case of I0 current direct input

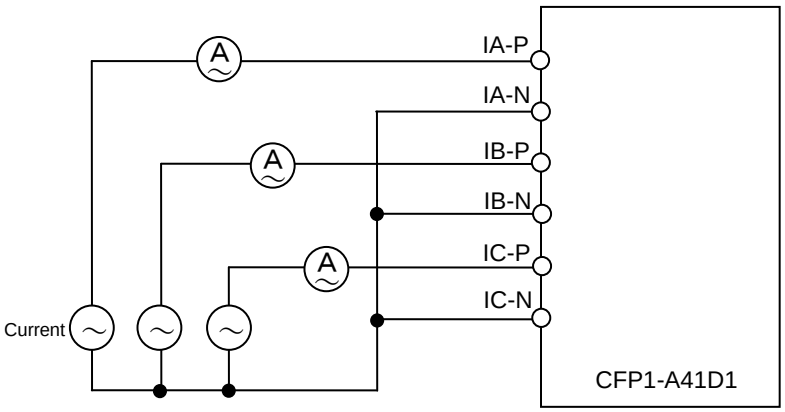


- In the case of I0 by 3 phase current input



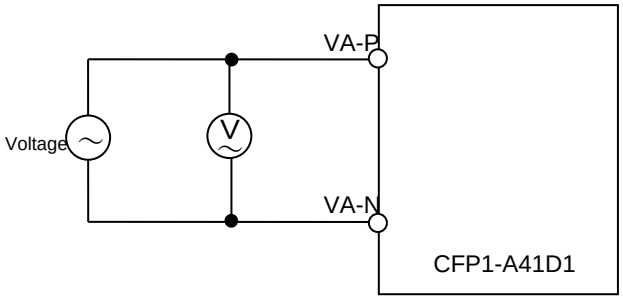
* I0 current by ‘the direct input’ or ‘the composition of 3-phase current’ can be switched by the setting ‘I0-SEL’.

[3] Negative-phase-sequence overcurrent element



[4] Overvoltage element, Undervoltage element

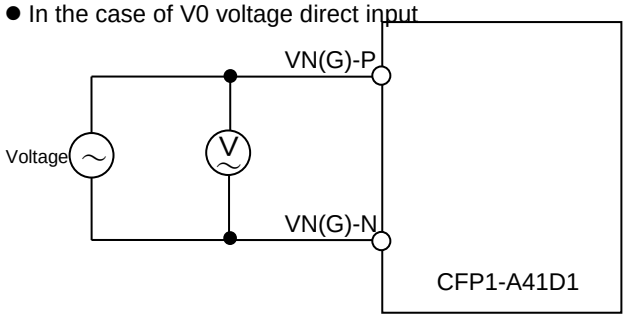
Example of A-phase



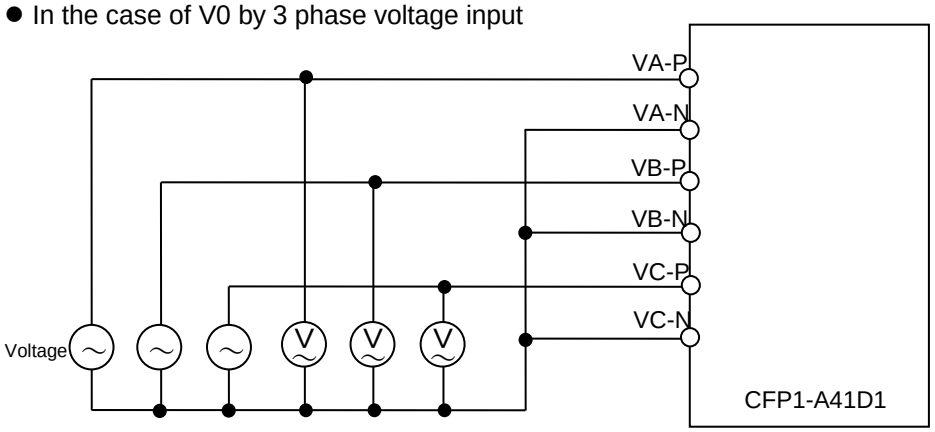
Test phase	Terminal No.
A-phase	VA-P～VA-N
B-phase	VB-P～VB-N
C-phase	VC-P～VC-N

[5] Ground-fault overvoltage element

● In the case of V0 voltage direct input

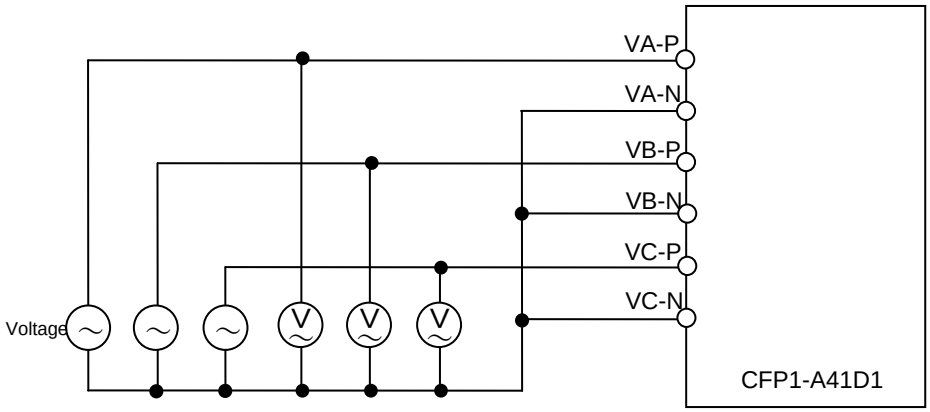


● In the case of V0 by 3 phase voltage input



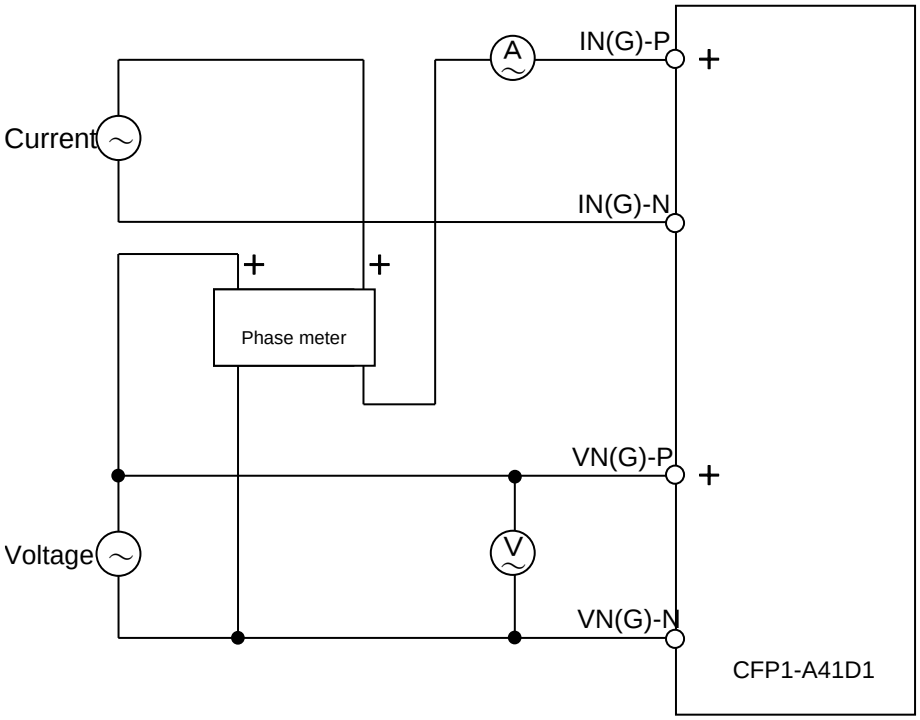
* V0 voltage by ‘the direct input’ or ‘the composition of 3-phase voltage’ can be switched by the setting V0-SEL.

[6] Negative-phase-sequence overvoltage element

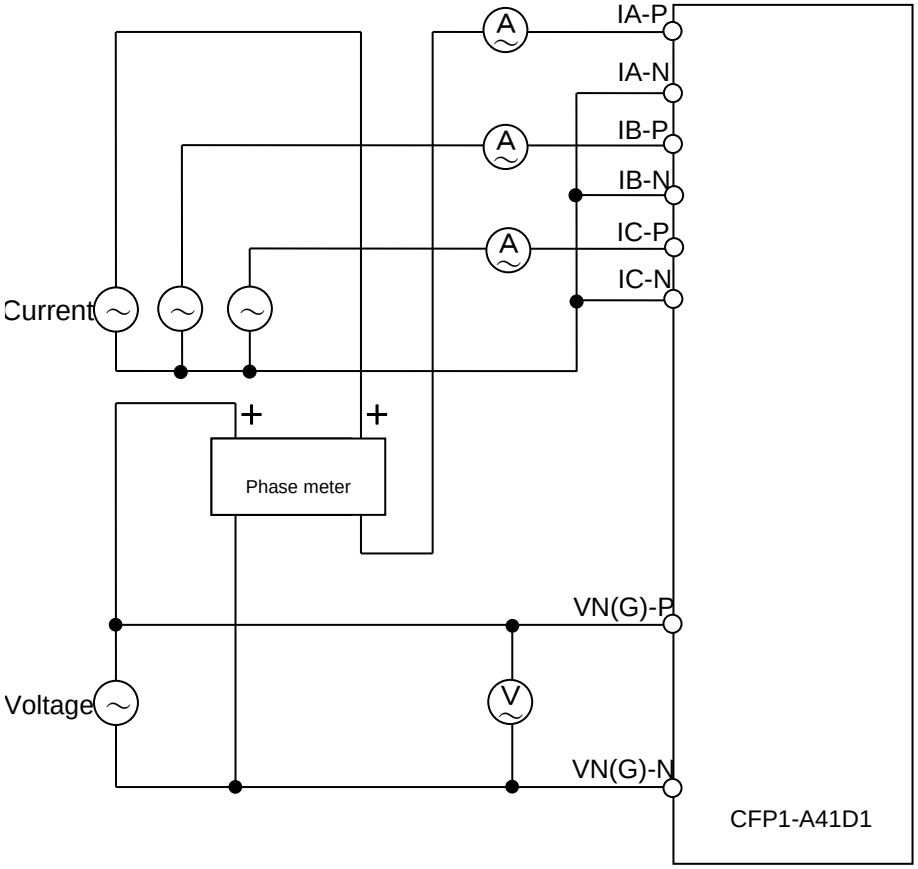


[7] Ground directional element

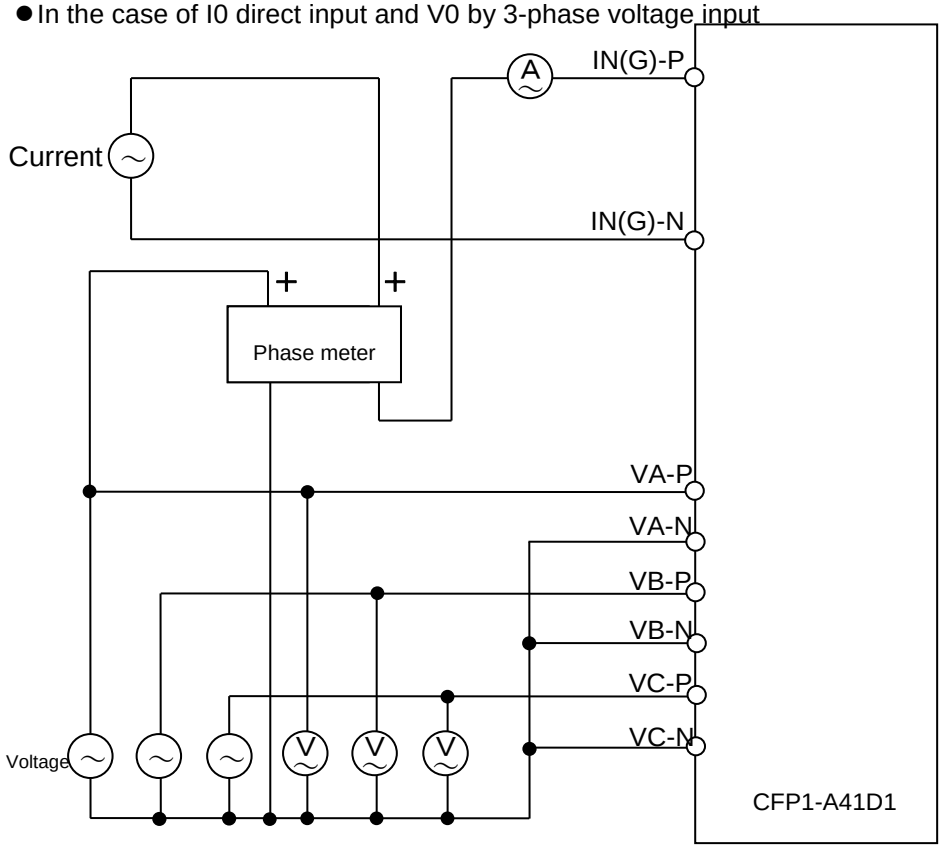
● In the case of both V0 and I0 direct inputs



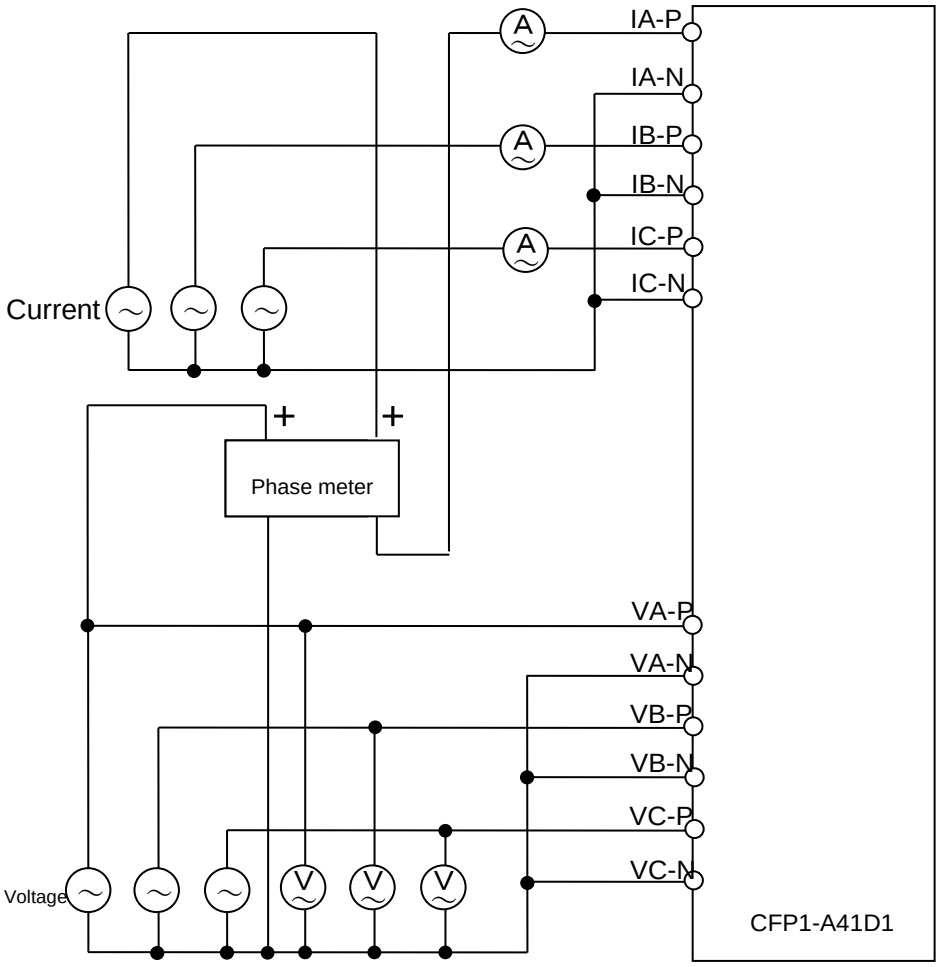
● In the case of V0 direct input and I0 by 3-phase current input



● In the case of I0 direct input and V0 by 3-phase voltage input



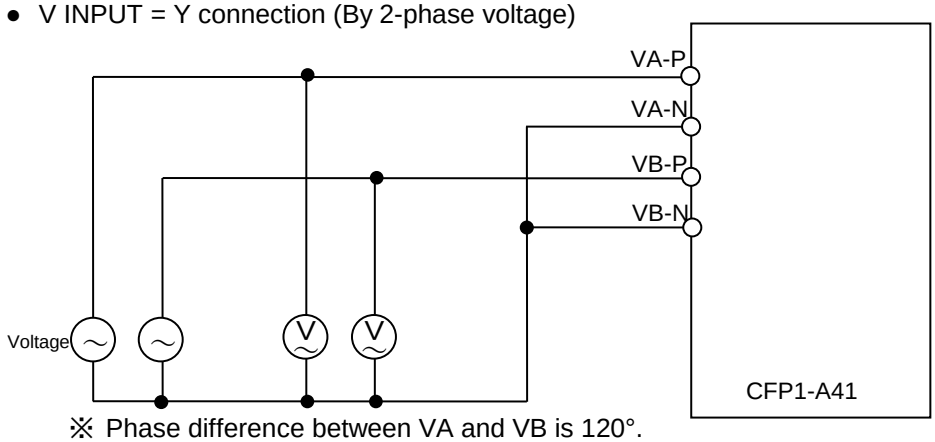
● In the case of both V0 and I0 by 3-phase inputs



* I0 and V0 by ‘the direct input’ or ‘the composition of 3-phase input’ can be switched respectively by the settings ‘I0-SEL’ and ‘V0-SEL’, respectively.

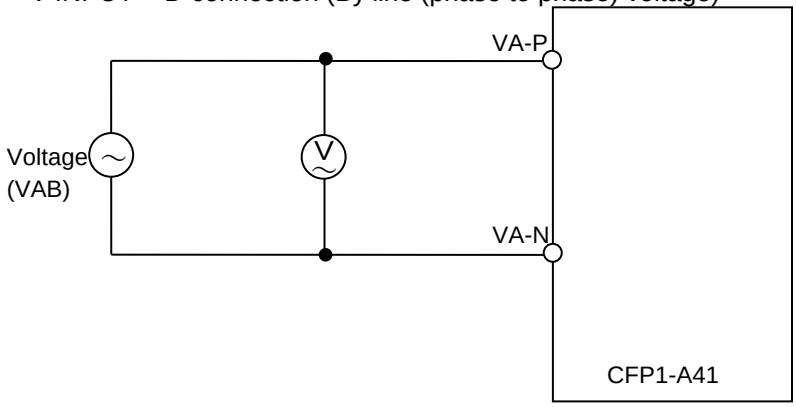
[8] Frequency element

● V INPUT = Y connection (By 2-phase voltage)



※ Phase difference between VA and VB is 120°.

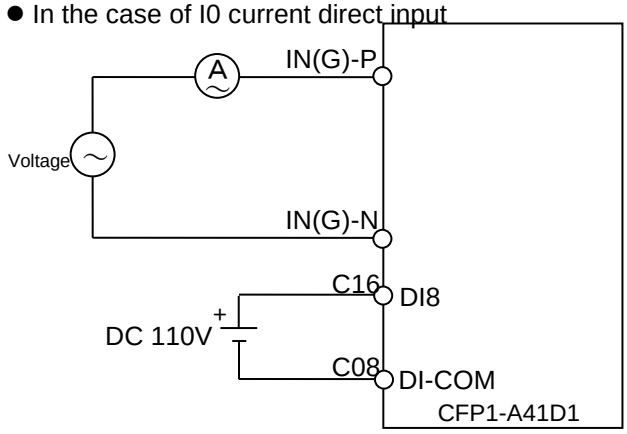
● V INPUT = D connection (By line (phase to phase) voltage)



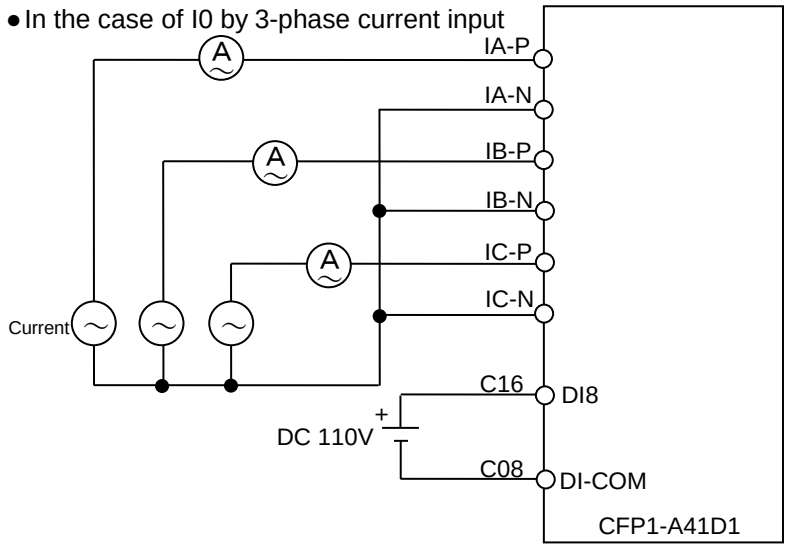
* Voltage (VAB) input by 2-phase voltage and line (phase-phase) voltage can be switched by the setting ‘V INPUT’.

[9] CBF detection element

● In the case of I0 current direct input



● In the case of I0 by 3-phase current input



8.2.2.2.Test items and functional control points

[1] Test setting

Before staring test, it is recommended to to use ‘Test setting’ function in order to lock the operation of un-tested phases and elements for easy testing.

Ex.) When carrying out the test of undervoltage A-phase element, lock the operaion of undervoltage B-phase and C-phase.

As for the method of test setting, refer to 4.3.4.4.2 in Chapter 4.

Furthermore, as for the list of test setting items, refer to the Table shown below.

List of test setting items

No.	Name of items	Contents of setting	Setting
1	SV-LK	Locking of alarm function	UNLOCKED / LOCKED
2	UC-A-LK	Locking of UC-A phase	UNLOCKED / LOCKED
3	UC-B-LK	Locking of UC-B phase	UNLOCKED / LOCKED
4	UC-C-LK	Locking of UC-C phase	UNLOCKED / LOCKED
5	UV-A-LK	Locking of UV-A phase	UNLOCKED / LOCKED
6	UV-B-LK	Locking of UV-B phase	UNLOCKED / LOCKED
7	UV-C-LK	Locking of UV-C phase	UNLOCKED / LOCKED
8	OV-A-LK	Locking of OV-A phase	UNLOCKED / LOCKED
9	OV-B-LK	Locking of OV-B phase	UNLOCKED / LOCKED
10	OV-C-LK	Locking of OV-C phase	UNLOCKED / LOCKED
11	TCNT-LK	Locking of trip counter	UNLOCKED / LOCKED

[2] Forced operation test

Refer to 4.3.4.4.1 in Chapter 4.

[3] Operating value test

Refer to the “Operating value” and “Return value” in Section 6.1.

[4] Operating time test

Refer to the “Operating time” in Section 6.1.

[5] Resetting time test

Refer to the “Recovery time” in Section 6.1.

[6] Phase test

Refer to the “Phase characteristic” in Section 6.1.

[7] LED/VFD full lighting test

Refer to 4.3.4.4.3 in Chapter 4.

9. Maintenance and self diagnosis

9.1. Maintenance

9.1.1. Daily inspection

It is recommended to check the following items daily;

- No dust (such as iron powder, etc) is in/on the relay case
- No abnormal noise is generated
- ‘RUN’ LED is lighting

9.1.2. Periodic inspection

It is recommended to test the following items periodically. The recommended perdic cycle is 5 to 7 years.

- Visual inspection check, referring to Section 8.1.
- Characteristic test using current and voltage input, referring to Section 8.2.

9.2. Self-diagnosis

Monitoring of the electronic circuit as well as the incorporated power supply is performed, and if any trouble is generated, fault display by LED and output by alarm DO (b contact) are executed.

9.2.1. Alarm indication

The relay alarm, which would be appeared at relay failure, is divided two types, Light alarm and Heavy alarm.

Minor failure ---- This alarm may appear by detecting the abnormal current or voltage input, or abnormality of the circuits which would not affect the relay unnecessary trip operation directly.

Serious failure ---This alarm may appear by detecting abnormality of the important circuits which would affect the relay unnecessary trip operation directly.

The operation of LED display and alarm DO output are shown in next table.

Table 9-1 LED display, Alarm DO

Equipment status	Alarm DO	RUN LED	ALARM LED
Light alarm	OFF	ON	ON
Heavy alarm	ON	OFF	ON

Furthermore, since the indication of ‘ALARM LED’ at fault detection is latched, it is necessary to press ‘ESC’ key for 3 sec or more after removing the cause of trouble.

9.2.2. Handling of Alarm indication

When any trouble is generated, please collect the necessary information as shown below which would be useful for finding the cause of trouble.

[1] Confirm the state of LED display and the contact of alarm DO.
Refer to Fig. 9-1, Fig. 9-2 for LED display and alarm DO.

[2] Confirm the error code in monitoring
Refer to 4.3.2.2.4 in Chapter 4 for the confirmation method of the error code,

[3] Please inquire of our company (the nearest Mitsubishi Electric’s branch or sales office).
The inquiry destination is described at the end of the document.

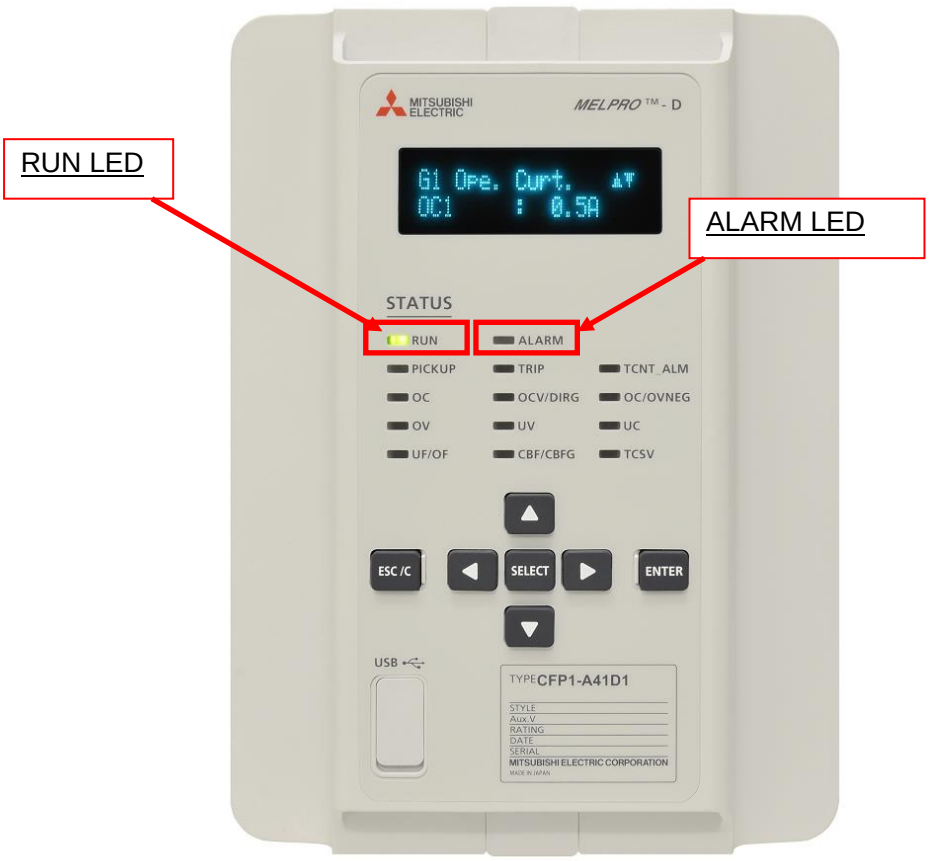


Fig. 9-1 Position of RUN LED, ALARM LED

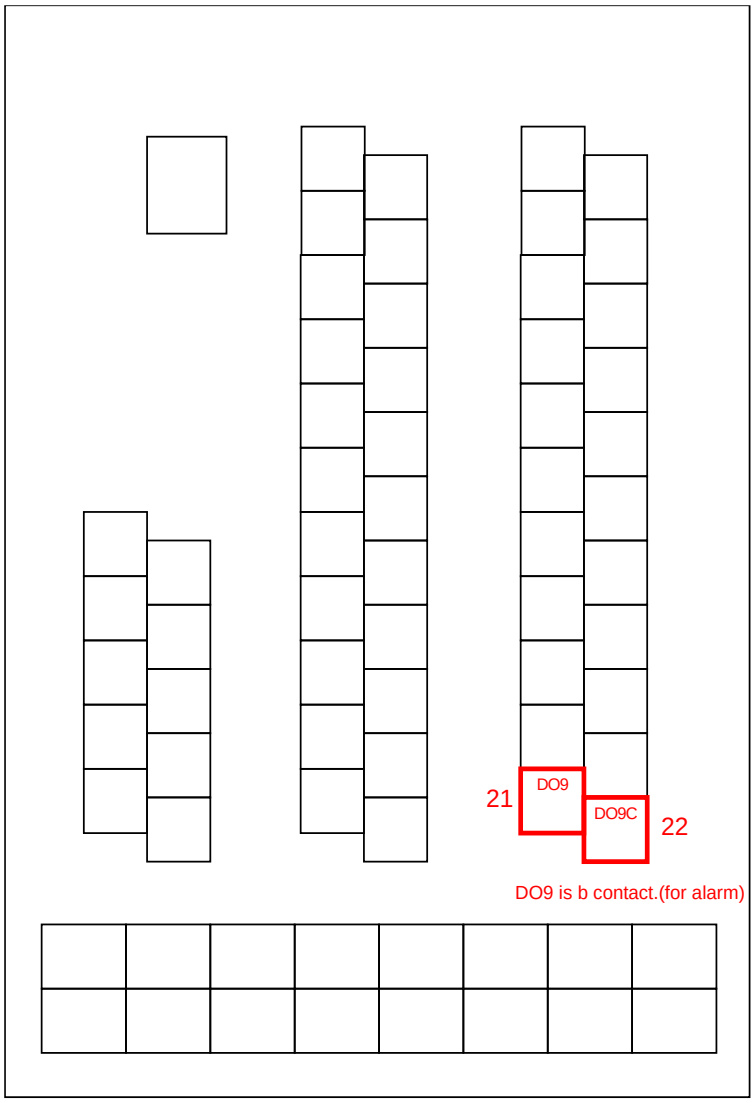


Fig. 9-2 Position of alarm DO

9.2.3. Error code and self diagnosis items

The self-diagnosis items and error codes are shown on Table 9-2. The error code can be confirmed from ALARM RECORD menu via front panel (refer to chapter 4) or PC-HMI (refer to chapter 11).

Table 9-2 Detail of error code on EVENT RECORD function

Error code	Detail	Behavior of the protection relay (Severe cases are as follows)			
		RUN LED	ALARM LED	Alarm DO	Relay calculation
00 ~ 07, 0A, 0F, 20	CPU failure	OFF	ON	Close	Lock
10, 11	RAM check failure	OFF	ON	Close	Lock
12	ROM check failure	OFF	ON	Close	Lock
13	CPU calculation failure	OFF	ON	Close	Lock
15	Communication failure	OFF	ON	Close	Lock
18	Flash memory failure	OFF	ON	Close	Lock
19, 1A, 30	Internal data table failure (information about analog input)	OFF	ON	Close	Lock
23, 48	DO circuit failure	OFF	ON	Close	Lock
25	A/D accuracy failure	OFF	ON	Close	Lock
33	Analog input circuit failure	ON	ON	Open	Run
34	DC offset value of analog circuit failure	ON	ON	Open	Run
35	Setting data table failure	OFF	ON	Close	Lock
37	Configuration setting failure of disturbance recorder (data save function)	ON	ON	Open	Run
38	Internal data failure	ON	ON	Open	Run
42, 43	Supervision function. (Refer to clause 3.13)	ON	OFF	Close	Run
N/A	AUX circuit failure	OFF	OFF	Close	Lock
N/A	CPU stop	OFF	ON	Close	Lock
N/A	Normal condition	ON	OFF	Open	Run

Note: Error code in ALARM RECORD menu is indicated as following

AA BB CCCCCCCCCCCC

- AA: Error code (the numbers are shown in above table.)
- BB: Sub error code. (for Mitsubishi Electric analysis.)
- CCCCCCCCCCCC: Detail code (for Mitsubishi Electric analysis.)

10. Default setting or configuration value

10.1. Setting (Rated current is 5 A, order code E*H5Z type)

Table 10-1 Setting values

Category	Element	Item name of setting parameter	Range	Step	Default value	Description
OC/OCG	2F	2f-lock ratio	10 ～ 30%	1%	10%	
		1f-Min. Ope.	0.4 ～ 2.5A	0.1A	0.4A	
	OC1	OC1 EN			Off	
		OC1 Ope. Curt.	0.5 ～ 100.0A	0.1A	0.5A	
		OC1 Ope. Time	0.00 ～ 10.00s	0.01s	0.00s	
	OCG1	OCG1 EN			Off	
		OCG1 Ope. Curt.	1.0 ～ 100.0mA	0.5mA	1.0mA	
		OCG1 Ope. Time	0.00 ～ 10.00s	0.01s	0.00s	
	OC2	OC2 EN			Off	
		OC2 Ope. Curt.	0.5 ～ 100.0A	0.1A	0.5A	
		OC2 Ope. Time	0.00 ～ 10.00s	0.01s	0.00s	
		OC2 2f-lock EN			Off	
	OCG2	OCG2 EN			Off	
		OCG2 Ope. Curt.	1.0 ～ 100.0mA	0.5mA	1.0mA	
		OCG2 Ope. Time	0.00 ～ 10.00s	0.01s	0.00s	
		OCG2 2f-lock EN			Off	
	OC3	OC3 EN			Off	
		OC3 Ope. Curt.	0.5 ～ 100.0A	0.1A	0.5A	
		OC3 Ope. Time	0.00 ～ 10.00s	0.01s	0.00s	
		OC3 2f-lock EN			Off	
	OCG3	OCG3 EN			Off	
		OCG3 Ope. Curt.	1.0 ～ 100.0mA	0.5mA	1.0mA	
		OCG3 Ope. Time	0.00 ～ 10.00s	0.01s	0.00s	
		OCG3 2f-lock EN			Off	
	OC4	OC4 EN			Off	
		OC4 Ope. Curt.	0.5 ～ 100.0A	0.1A	0.5A	
		OC4 Ope. TM	0.25 ～ 50.00	0.01	10.00	
		OC4 Ope. Chr.			NI01	
		OC4 Rst. Chr.			IDMT	
		OC4 2f-lock EN			Off	
		OC4 IEC Chr. EN			Off	
	OCG4	OCG4 EN			Off	
		OCG4 Ope. Curt.	1.0 ～ 100.0mA	0.5mA	1.0mA	
		OCG4 Ope. TM	0.25 ～ 50.00	0.01	10.00	
		OCG4 Ope. Chr.			NI01	
		OCG4 Rst. Chr.			IDMT	
		OCG4 2f-lock EN			Off	
		OCG4 IEC Chr. EN			Off	
OCNEG/UC/CBF	OCNEG1	OCNEG1 EN			Off	
		OCNEG1 Ope. Curt.	0.25 ～ 5.00A	0.01A	0.25A	
		OCNEG1 Ope. Time	0.0 ～ 10.0s	0.1s	0.0s	
	OCNEG2	OCNEG2 EN			Off	
		OCNEG2 Ope. Curt.	0.25 ～ 5.00A	0.01A	0.25A	
		OCNEG2 Ope. Time	0.0 ～ 10.0s	0.1s	0.0s	
	UC1	UC1 EN			Off	
		UC1 Pick up			Pick1	
		UC1 Ope. Curt.	0.25 ～ 5.00A	0.01A	0.25A	
		UC1 Min. Curt.	0.25 ～ 5.00A	0.01A	0.25A	
		UC1 Ope. Time	0.00 ～ 10.00s	0.01s	0.00s	
	UC2	UC2 EN			Off	
		UC2 Pick up			Pick1	
		UC2 Ope. Curt.	0.25 ～ 5.00A	0.01A	0.25A	

Category	Element	Item name of setting parameter	Range	Step	Default value	Description
		UC2 Min. Curt.	0.25 ~ 5.00A	0.01A	0.25A	
		UC2 Ope. Time	0.00 ~ 10.00s	0.01s	0.00s	
	CBF	CBF EN			Off	
		CBFG EN			Off	
		CBF Curt.	0.15 ~ 10.00A	0.01A	0.15A	
		CBFG Curt.	1.0 ~ 100.0mA	0.5mA	1.0mA	
		CBF Ope. Time	0.00 ~ 10.00s	0.01s	0.00s	
DIRG	DIRG	DIRG MT Angle	0 ~ 359° LAG	1° LAG	0° LAG	
	DIRG1	DIRG1 EN			Off	
		DIRG1 Ope. Volt.	2.0 ~ 100.0V	0.1V	2.0V	
		DIRG1 Ope. Curt.	1.0 ~ 100.0mA	0.5mA	1.0mA	
		DIRG1 Ope. Time	0.00 ~ 10.00s	0.01s	0.00s	
	DIRG2	DIRG2 EN			Off	
		DIRG2 Ope. Volt.	2.0 ~ 100.0V	0.1V	2.0V	
		DIRG2 Ope. Curt.	1.0 ~ 100.0mA	0.5mA	1.0mA	
		DIRG2 Ope. Time	0.00 ~ 10.00s	0.01s	0.00s	
		DIRG2 2f-lock EN			Off	
	DIRG3	DIRG3 EN			Off	
		DIRG3 Ope. Volt.	2.0 ~ 100.0V	0.1V	2.0V	
		DIRG3 Ope. Curt.	1.0 ~ 100.0mA	0.5mA	1.0mA	
		DIRG3 Ope. Time	0.00 ~ 10.00s	0.01s	0.00s	
		DIRG3 2f-lock EN			Off	
	DIRG4	DIRG4 EN			Off	
		DIRG4 Ope. Volt.	2.0 ~ 100.0V	0.1V	2.0V	
		DIRG4 Ope. Curt.	1.0 ~ 100.0mA	0.5mA	1.0mA	
		DIRG4 Ope. TM	0.25 ~ 50.00	0.01	10.00	
		DIRG4 Ope. Chr.			NI01	
		DIRG4 Rst. Chr.			IDMT	
		DIRG4 2f-lock EN			Off	
		DIRG4 IEC Chr. EN			Off	
UV/OV/OVG/OVNEG	UV1	UV1 EN			Off	
		UV1 UVP/UVS Sel.			UVP	
		UV1 Ope. Volt.	20.0 ~ 120.0V	0.1V	20.0V	
		UV1 Ope. Time	0.00 ~ 10.00s	0.01s	0.00s	
	UV2	UV2 EN			Off	
		UV2 UVP/UVS Sel.			UVP	
		UV2 Ope. Volt.	20.0 ~ 120.0V	0.1V	20.0V	
		UV2 Ope. Time	0.00 ~ 10.00s	0.01s	0.00s	
	OV1	OV1 EN			Off	
		OV1 OVP/OVS Sel.			OVP	
		OV1 Ope. Volt.	20.0 ~ 200.0V	0.1V	20.0V	
		OV1 Ope. Time	0.00 ~ 10.00s	0.01s	0.00s	
	OV2	OV2 EN			Off	
		OV2 OVP/OVS Sel.			OVP	
		OV2 Ope. Volt.	20.0 ~ 200.0V	0.1V	20.0V	
		OV2 Ope. Time	0.00 ~ 10.00s	0.01s	0.00s	
	OVG1	OVG1 EN			Off	
		OVG1 Ope. Volt.	2.0 ~ 100.0V	0.1V	2.0V	
		OVG1 Ope. Time	0.00 ~ 10.00s	0.01s	0.00s	
	OVG2	OVG2 EN			Off	
		OVG2 Ope. Volt.	2.0 ~ 100.0V	0.1V	2.0V	
		OVG2 Ope. Time	0.00 ~ 10.00s	0.01s	0.00s	
	OVNEG1	OVNEG1 EN			Off	
		OVNEG1 Ope. Volt.	2.0 ~ 100.0V	0.1V	2.0V	
		OVNEG1 Ope. Time	0.0 ~ 10.0s	0.1s	0.0s	
	OVNEG2	OVNEG2 EN			Off	

Category	Element	Item name of setting parameter	Range	Step	Default value	Description
		OVNEG2 Ope. Volt.	2.0 ～ 100.0V	0.1V	2.0V	
		OVNEG2 Ope. Time	0.0 ～ 10.0s	0.1s	0.0s	
	UF1	UF1 EN			Off	
		UF1 Ope. Freq.	- 5.0 ～ -0.5Hz	0.1Hz	-0.5Hz	
		UF1 Ope. Time	0.1 ～ 60.0s	0.1s	0.1s	
	UF2	UF2 EN			Off	
		UF2 Ope. Freq.	- 5.0 ～ -0.5Hz	0.1Hz	-0.5Hz	
		UF2 Ope. Time	0.1 ～ 60.0s	0.1s	0.1s	
	UF3	UF3 EN			Off	
		UF3 Ope. Freq.	- 5.0 ～ -0.5Hz	0.1Hz	-0.5Hz	
		UF3 Ope. Time	0.1 ～ 60.0s	0.1s	0.1s	
	OF1	OF1 EN			Off	
		OF1 Ope. Freq.	0.5 ～ 5.0Hz	0.1Hz	0.5Hz	
		OF1 Ope. Time	0.1 ～ 60.0s	0.1s	0.1s	
	OF2	OF2 EN			Off	
		OF2 Ope. Freq.	0.5 ～ 5.0Hz	0.1Hz	0.5Hz	
		OF2 Ope. Time	0.1 ～ 60.0s	0.1s	0.1s	
	OF3	OF3 EN			Off	
		OF3 Ope. Freq.	0.5 ～ 5.0Hz	0.1Hz	0.5Hz	
		OF3 Ope. Time	0.1 ～ 60.0s	0.1s	0.1s	
SV	SV	3PB VT EN			Off	
		3PB VT Ope. Time	1.0 ～ 100.0s	0.1s	1.0s	
AI-CONFIG	CONFIG	V0 Input Sel.			VG	
		V Input Sel.			Y	
		V 3P/2P Sel.			3P	

10.2. Setting (Rated current is 5 A, order code E*H55 type)

Table 10-2 Setting values

Category	Element	Item name of setting parameter	Range	Step	Default value	Description
OC/OCG	2F	2f-lock ratio	10 ～ 30%	1%	10%	
		1f-Min. Ope.	0.4 ～ 2.5A	0.1A	0.4A	
	OC1	OC1 EN			Off	
		OC1 Ope. Curt.	0.5 ～ 100.0A	0.1A	0.5A	
		OC1 Ope. Time	0.00 ～ 10.00s	0.01s	0.00s	
	OCG1	OCG1 EN			Off	
		OCG1 Ope. Curt.	0.1 ～ 100.0A	0.1A	0.1A	
		OCG1 Ope. Time	0.00 ～ 10.00s	0.01s	0.00s	
	OC2	OC2 EN			Off	
		OC2 Ope. Curt.	0.5 ～ 100.0A	0.1A	0.5A	
		OC2 Ope. Time	0.00 ～ 10.00s	0.01s	0.00s	
		OC2 2f-lock EN			Off	
	OCG2	OCG2 EN			Off	
		OCG2 Ope. Curt.	0.1 ～ 100.0A	0.1A	0.1A	
		OCG2 Ope. Time	0.00 ～ 10.00s	0.01s	0.00s	
		OCG2 2f-lock EN			Off	
	OC3	OC3 EN			Off	
		OC3 Ope. Curt.	0.5 ～ 100.0A	0.1A	0.5A	
		OC3 Ope. Time	0.00 ～ 10.00s	0.01s	0.00s	
		OC3 2f-lock EN			Off	
	OCG3	OCG3 EN			Off	
		OCG3 Ope. Curt.	0.1 ～ 100.0A	0.1A	0.1A	
		OCG3 Ope. Time	0.00 ～ 10.00s	0.01s	0.00s	
		OCG3 2f-lock EN			Off	
	OC4	OC4 EN			Off	
		OC4 Ope. Curt.	0.5 ～ 100.0A	0.1A	0.5A	
		OC4 Ope. TM	0.25 ～ 50.00	0.01	10.00	
		OC4 Ope. Chr.			NI01	
		OC4 Rst. Chr.			IDMT	
		OC4 2f-lock EN			Off	
		OC4 IEC Chr. EN			Off	
	OCG4	OCG4 EN			Off	
		OCG4 Ope. Curt.	0.1 ～ 100.0A	0.1A	0.1A	
		OCG4 Ope. TM	0.25 ～ 50.00	0.01	10.00	
		OCG4 Ope. Chr.			NI01	
		OCG4 Rst. Chr.			IDMT	
		OCG4 2f-lock EN			Off	
		OCG4 IEC Chr. EN			Off	
OCNEG/UC/CBF	OCNEG1	OCNEG1 EN			Off	
		OCNEG1 Ope. Curt.	0.25 ～ 5.00A	0.01A	0.25A	
		OCNEG1 Ope. Time	0.0 ～ 10.0s	0.1s	0.0s	
	OCNEG2	OCNEG2 EN			Off	
		OCNEG2 Ope. Curt.	0.25 ～ 5.00A	0.01A	0.25A	
		OCNEG2 Ope. Time	0.0 ～ 10.0s	0.1s	0.0s	
	UC1	UC1 EN			Off	
		UC1 Pick up			Pick1	
		UC1 Ope. Curt.	0.25 ～ 5.00A	0.01A	0.25A	
		UC1 Min. Curt.	0.25 ～ 5.00A	0.01A	0.25A	
		UC1 Ope. Time	0.00 ～ 10.00s	0.01s	0.00s	
	UC2	UC2 EN			Off	
		UC2 Pick up			Pick1	
		UC2 Ope. Curt.	0.25 ～ 5.00A	0.01A	0.25A	
		UC2 Min. Curt.	0.25 ～ 5.00A	0.01A	0.25A	

Category	Element	Item name of setting parameter	Range	Step	Default value	Description
		UC2 Ope. Time	0.00 ～ 10.00s	0.01s	0.00s	
	CBF	CBF EN			Off	
		CBF Curt.	0.15 ～ 10.00A	0.01A	0.15A	
		CBF Ope. Time	0.00 ～ 10.00s	0.01s	0.00s	
DIRG	DIRG	DIRG MT Angle	0 ～ 359° LAG	1° LAG	0° LAG	
	DIRG1	DIRG1 EN			Off	
		DIRG1 Ope. Volt.	2.0 ～ 100.0V	0.1V	2.0V	
		DIRG1 Ope. Curt.	0.1 ～ 100.0A	0.1A	0.1A	
		DIRG1 Ope. Time	0.00 ～ 10.00s	0.01s	0.00s	
	DIRG2	DIRG2 EN			Off	
		DIRG2 Ope. Volt.	2.0 ～ 100.0V	0.1V	2.0V	
		DIRG2 Ope. Curt.	0.1 ～ 100.0A	0.1A	0.1A	
		DIRG2 Ope. Time	0.00 ～ 10.00s	0.01s	0.00s	
		DIRG2 2f-lock EN			Off	
	DIRG3	DIRG3 EN			Off	
		DIRG3 Ope. Volt.	2.0 ～ 100.0V	0.1V	2.0V	
		DIRG3 Ope. Curt.	0.1 ～ 100.0A	0.1A	0.1A	
		DIRG3 Ope. Time	0.00 ～ 10.00s	0.01s	0.00s	
		DIRG3 2f-lock EN			Off	
	DIRG4	DIRG4 EN			Off	
		DIRG4 Ope. Volt.	2.0 ～ 100.0V	0.1V	2.0V	
		DIRG4 Ope. Curt.	0.1 ～ 100.0A	0.1A	0.1A	
		DIRG4 Ope. TM	0.25 ～ 50.00	0.01	10.00	
		DIRG4 Ope. Chr.			NI01	
		DIRG4 Rst. Chr.			IDMT	
		DIRG4 2f-lock EN			Off	
		DIRG4 IEC Chr. EN			Off	
UV/OV/OVG/OVNEG	UV1	UV1 EN			Off	
		UV1 UVP/UVS Sel.			UVP	
		UV1 Ope. Volt.	20.0 ～ 120.0V	0.1V	20.0V	
		UV1 Ope. Time	0.00 ～ 10.00s	0.01s	0.00s	
	UV2	UV2 EN			Off	
		UV2 UVP/UVS Sel.			UVP	
		UV2 Ope. Volt.	20.0 ～ 120.0V	0.1V	20.0V	
		UV2 Ope. Time	0.00 ～ 10.00s	0.01s	0.00s	
	OV1	OV1 EN			Off	
		OV1 OVP/OVS Sel.			OVP	
		OV1 Ope. Volt.	20.0 ～ 200.0V	0.1V	20.0V	
		OV1 Ope. Time	0.00 ～ 10.00s	0.01s	0.00s	
	OV2	OV2 EN			Off	
		OV2 OVP/OVS Sel.			OVP	
		OV2 Ope. Volt.	20.0 ～ 200.0V	0.1V	20.0V	
		OV2 Ope. Time	0.00 ～ 10.00s	0.01s	0.00s	
	OVG1	OVG1 EN			Off	
		OVG1 Ope. Volt.	2.0 ～ 100.0V	0.1V	2.0V	
		OVG1 Ope. Time	0.00 ～ 10.00s	0.01s	0.00s	
	OVG2	OVG2 EN			Off	
		OVG2 Ope. Volt.	2.0 ～ 100.0V	0.1V	2.0V	
		OVG2 Ope. Time	0.00 ～ 10.00s	0.01s	0.00s	
	OVNEG1	OVNEG1 EN			Off	
		OVNEG1 Ope. Volt.	2.0 ～ 100.0V	0.1V	2.0V	
		OVNEG1 Ope. Time	0.0 ～ 10.0s	0.1s	0.0s	
	OVNEG2	OVNEG2 EN			Off	
		OVNEG2 Ope. Volt.	2.0 ～ 100.0V	0.1V	2.0V	
		OVNEG2 Ope. Time	0.0 ～ 10.0s	0.1s	0.0s	

Category	Element	Item name of setting parameter	Range	Step	Default value	Description
	UF1	UF1 EN			Off	
		UF1 Ope. Freq.	- 5.0 ～ -0.5Hz	0.1Hz	-0.5Hz	
		UF1 Ope. Time	0.1 ～ 60.0s	0.1s	0.1s	
	UF2	UF2 EN			Off	
		UF2 Ope. Freq.	- 5.0 ～ -0.5Hz	0.1Hz	-0.5Hz	
		UF2 Ope. Time	0.1 ～ 60.0s	0.1s	0.1s	
	UF3	UF3 EN			Off	
		UF3 Ope. Freq.	- 5.0 ～ -0.5Hz	0.1Hz	-0.5Hz	
		UF3 Ope. Time	0.1 ～ 60.0s	0.1s	0.1s	
	OF1	OF1 EN			Off	
		OF1 Ope. Freq.	0.5 ～ 5.0Hz	0.1Hz	0.5Hz	
		OF1 Ope. Time	0.1 ～ 60.0s	0.1s	0.1s	
	OF2	OF2 EN			Off	
		OF2 Ope. Freq.	0.5 ～ 5.0Hz	0.1Hz	0.5Hz	
		OF2 Ope. Time	0.1 ～ 60.0s	0.1s	0.1s	
	OF3	OF3 EN			Off	
		OF3 Ope. Freq.	0.5 ～ 5.0Hz	0.1Hz	0.5Hz	
		OF3 Ope. Time	0.1 ～ 60.0s	0.1s	0.1s	
SV	SV	3PB VT EN			Off	
		3PB VT Ope. Time	1.0 ～ 100.0s	0.1s	1.0s	
		3PB CT EN			Off	
		3PB CT Ope. Time	1.0 ～ 100.0s	0.1s	1.0s	
AI-CONFIG	CONFIG	V0 Input Sel.			VG	
		V Input Sel.			Y	
		V 3P/2P Sel.			3P	

10.3. Terminal assigned

For details about the “Default signal (PLC signal)”, refer to Chapter 5.

Table 10-3 Terminal assigned for digital outputs

	Item name (PC-HMI)	Default signal (PLC signal)	Please make a note about setting.
Contacts for tripping (DO)	DO1	ALLEL-O	
	DO2	ALLEL-D_O	
	DO3	−	
	DO4	−	
Contacts for annunciator (DO)	DO5	−	
	DO6	−	
	DO7	−	
	DO8	−	

Table 10-4 Terminal assigned for digital inputs

Item name	Description
DI1	−
DI2	−
DI3	−
DI4	−
DI5	All relay elements are locked for trip lock.
DI6	−
DI7	−
DI8	Receiving from other relays trip signal, and CBF element on this protection relay operates (trip).

This signals are available only in the relay unit with a DI card in SLOT-C.
The CB control signal assignments between the items and digital inputs can be changed using PC-HMI.

Table 10-5 Terminal assigned for circuit breaker control

Item name (PC-HMI)	Default signal (PLC signal)	Detail
CB STATE	DI1	The “CB STATE” shows a circuit breaker status (condition) such as open or close.
CLOSE INTLK	DI2	The “CLOSE INTLK” means an interlock for close operation of circuit breaker. Disable or enable the interlock can be set. For details, refer to 4.3.4.2 in Chapter 4.
OPEN INTLK	DI3	The “OPEN INTLK” means an interlock for open operation of circuit breaker. Disable or enable the interlock can be set. For details, refer to 4.3.4.2 in Chapter 4.
CLOSE CB	DI4	The “CLOSE CB” means a remote CB operation from other

		devices. Use Case We assumed that a digital output of another device is connected to digital input (in this case, DI4). This protection relay receives the control signal from remote device using DI. Next, this protection relay outputs own DO and operates a connected CB.
OPEN CB	DI5	The “OPEN CB” means a remote CB operation from other devices. Use Case We assumed that a digital output of another device is connected to digital input (in this case, DI5). This protection relay receives the control signal from remote device using DI. Next, this protection relay outputs own DO and operates a connected CB.

11. PC Software (PC-HMI)

11.1. Introduction

The MELPRO-D40 Series provides PC-HMI for implementing analog and digital signal supervision and control (DO contact test and circuit breaker control).
This chapter describes the functions of PC-HMI.

11.2. Precautions on software use

Be sure to observe the following precautions when using this software.

Precautions

1) This software and manual are warranted only against damage to the medium, defects in the product and program execution errors.
2) This manual does not give warranty of merchantability or fitness for a particular purpose for the product. No warranty is given with respect to any damage to equipment or business performance.
3) We shall not be liable for use or reliability of other software not created by us.
4) Use of this software requires one license per PC.
   When using the software on another PC, purchase a separate copy.
5) Duplicating this software for any purpose other than making a backup copy is strictly prohibited.
6) Exercise sufficient caution in handling the original medium containing this software.
7) Alteration or modification of this software is strictly prohibited.
8) Lending or taking out any part or all of this software to a third party without prior permission is prohibited.
9) This manual and medium can be used only for this software.
   Sale of this program or any of its modification to a third party is strictly prohibited.

Note) These precautions apply to all of our products.
Some of the product specifications may not apply.

11.3. Compatible models

11.3.1. PC-HMI operation terminal specifications

The recommended and minimum specifications for the operation terminal to install PC-HMI on are as shown below.

Item	Recommended specification	Minimum specification
OS	Windows7	Windows7
CPU	2.5 GHz or higher (4 CPUs or more)	1.5 GHz (2 CPU)
Memory	2 GB or larger	2 GB
Display color	32-bit (16,770,000 colors)	32-bit (16,770,000 colors)

Note) For use with the waveform analysis software (see Chapter 12), available HDD space of 100 MB or more and separate available space for saving waveform data are required.

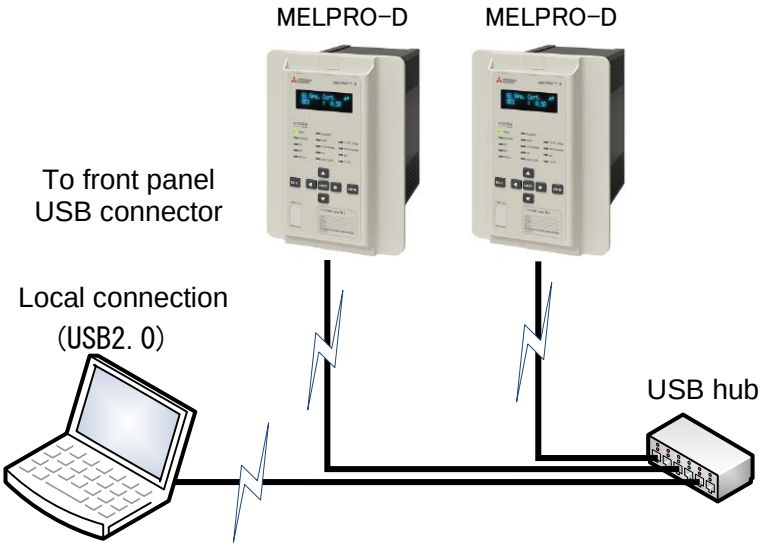
11.3.2. Display

The recommended and minimum specifications for the display for PC-HMI are as shown below.

Item	Recommended specification	Minimum specification
Screen size	15.6 in	11 in
Screen resolution	1366 x 768 WXGA	1366 x 768 WXGA
Dot pitch [mm]	0.253	0.188
Exact size [mm]	W345.598 x H194.304	W243.148 x H136.704

11.4. Basic configuration for PC-HMI

The hardware configuration for PC-HMI is as shown below.



11.5. Basics for operation of PC-HMI

This section provides the knowledge and instructions required for operation of PC-HMI.
For more information about the operation, see the instruction manual of the PC being used.

11.5.1. Mouse operation

This subsection describes the knowledge required for mouse operation.

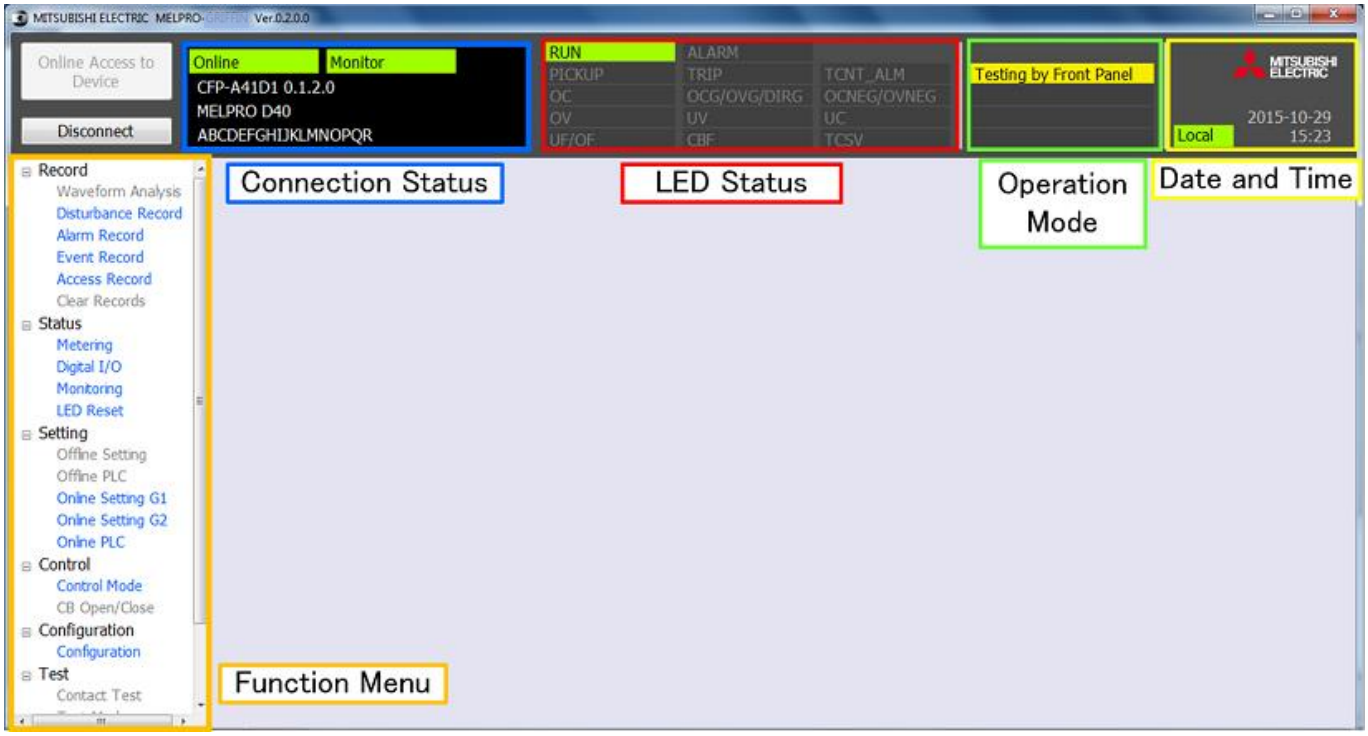
1) Click
   The action of pressing the left mouse button.

2) Double click
   Clicking of a mouse button twice successively.

3) Mouse pointer
   Moving the mouse causes the arrow on the screen to move according to the mouse movement. To select an item on the screen, move the mouse pointer onto the item and click.
   The clicked item is illuminated. When the mouse pointer is moved onto text input, the arrow turns into a cursor.

4) Drag
   Dragging refers to moving the mouse pointer while pressing the mouse button.

11.6. Screen structure of PC-HMI



*The screen shown above is different from how the actual screen looks because the individual menus are outlined with borders for ease of understanding.

The screen structure of PC-HMI is as shown below.

Function Menu	: Clicking the individual items calls the corresponding functions.
Connection Status	: Indicates the connection status and operation permission of devices.
LED Status	: Indicates the operating conditions and failure descriptions of devices.
Operation Mode	: Indicates the operation mode.
Date and Time	: Indicates the time synchronization status and date and time.

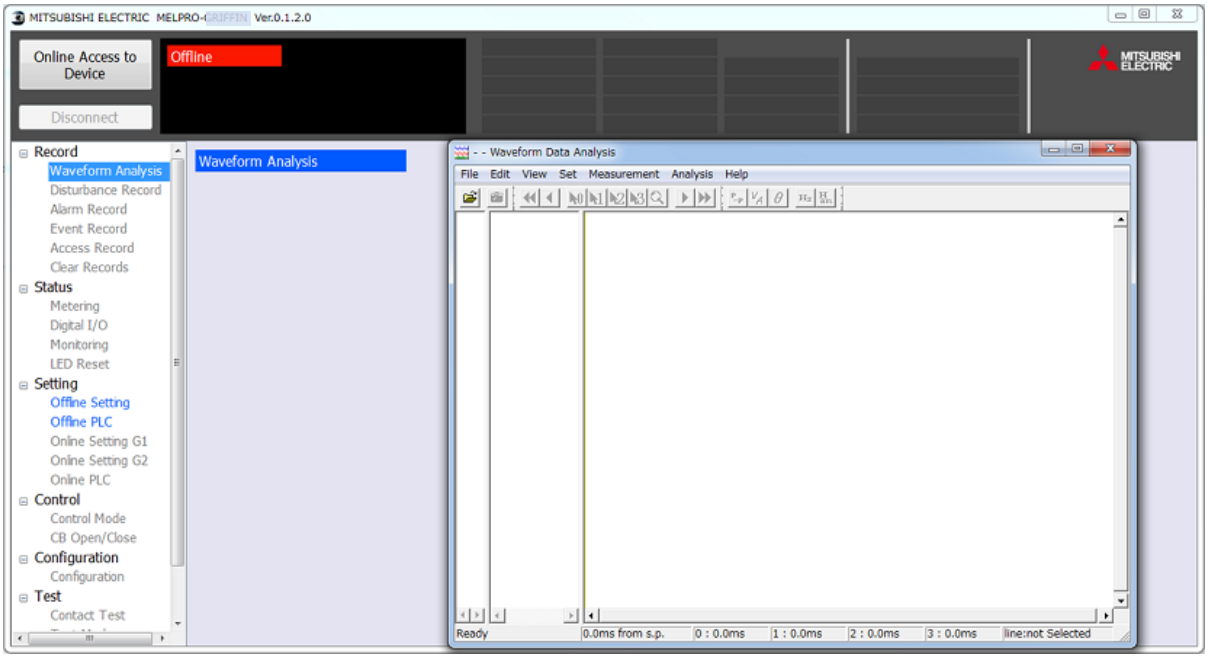
11.7. Operation in offline mode

The Function menu items available in the offline mode are as shown below.

Waveform Analysis : Launches the waveform analysis software.
Offline Setting : Reads, edits and saves setting files.
Offline PLC : Reads, edits and saves PLC configuration files.

11.7.1. Launching the waveform analysis software

1. From the Function menu, click Waveform Analysis.
2. The waveform analysis software is launched in a new window.

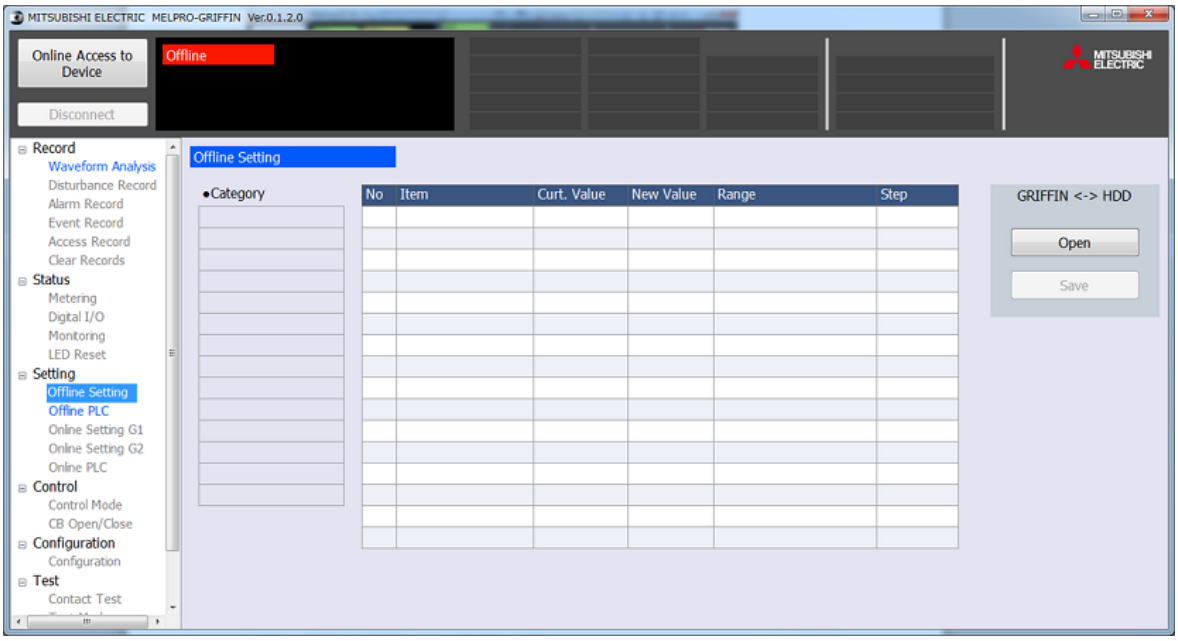


3. From the File menu of the waveform analysis software, select a waveform data file.
   (For the details about the waveform analysis software, see Chapter 12.)

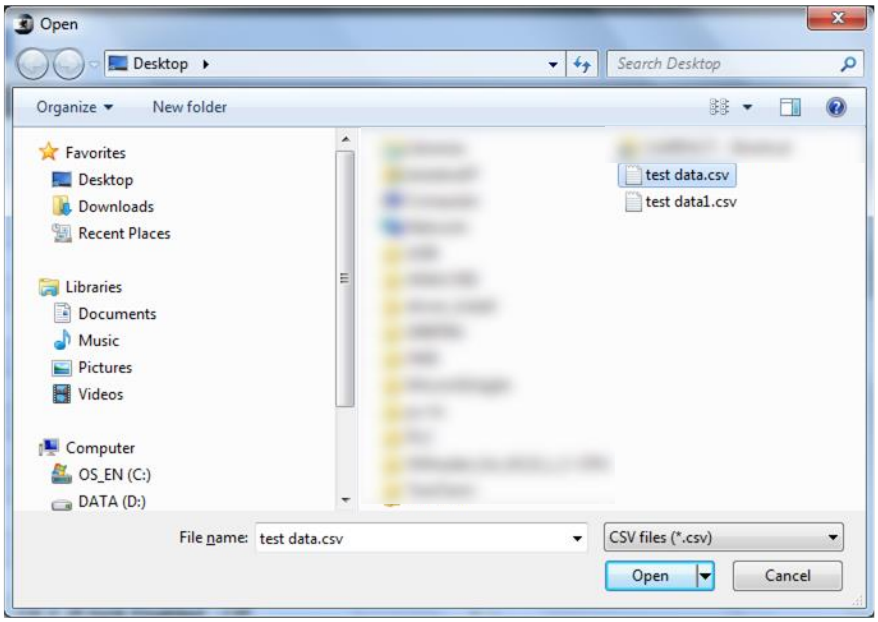
11.7.2. Reading, editing and saving setting files

[Reading setting files]

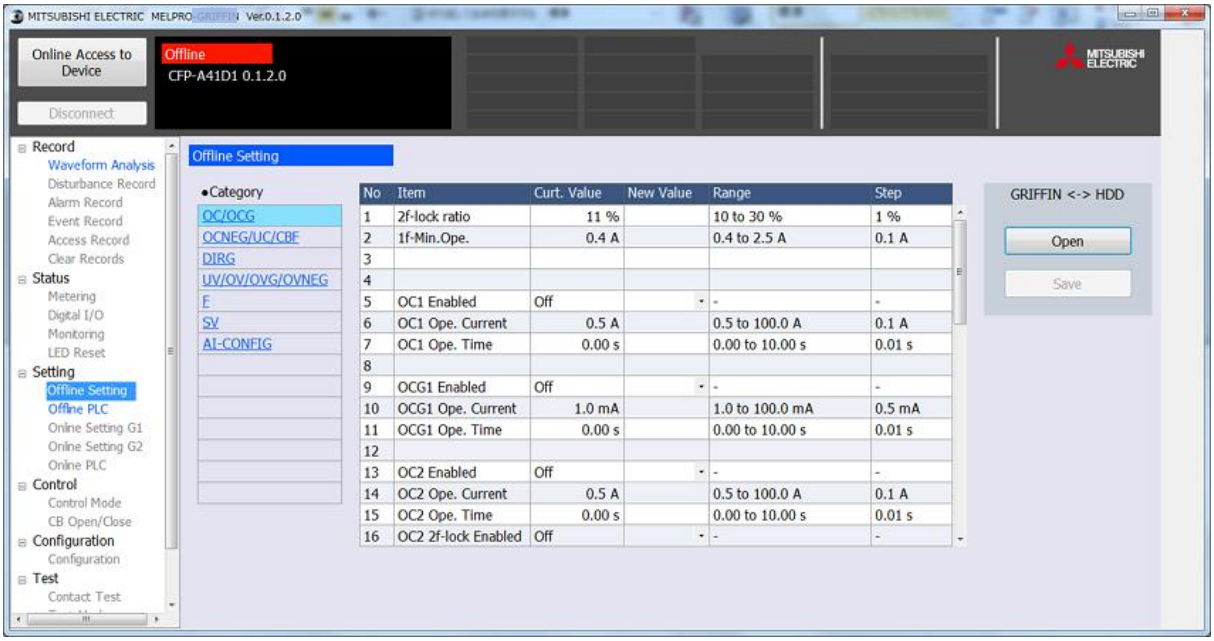
1. From the Function menu, click Offline Setting.
2. From PC-HMI <-> HDD in the upper right part of the main screen, click “Open.”



3. Select the setting file to read from the HDD.
   (Files in the .csv format can be read)

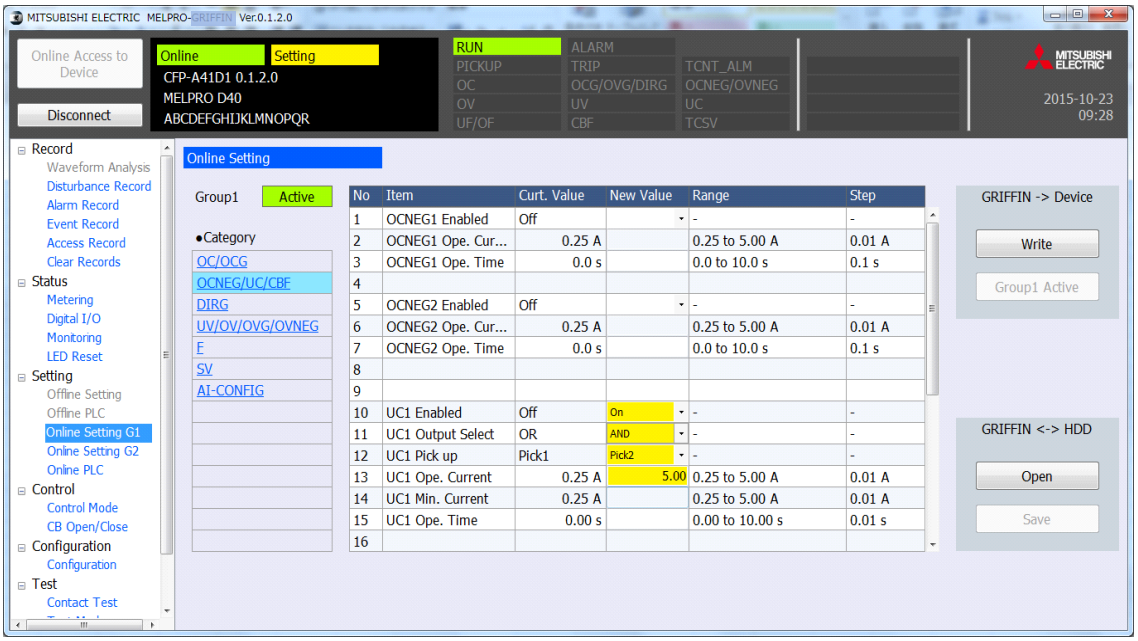


4. The setting file is read as shown below.

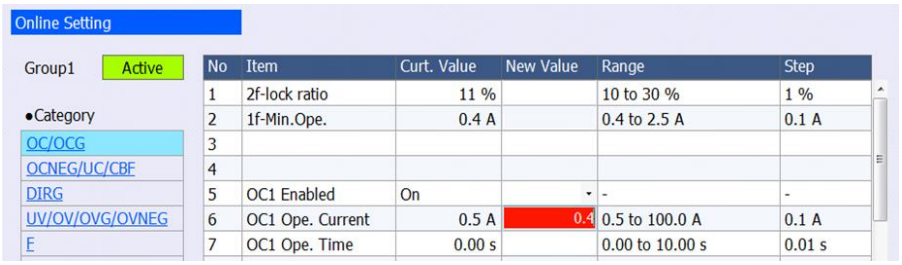


[Editing setting files]

1. Select an item to edit from Category. A list of setting values is shown under Item. Click New Value for the item to make a change.
   From the list, make a selection by clicking ▼.
   To enter a value, use the keyboard.

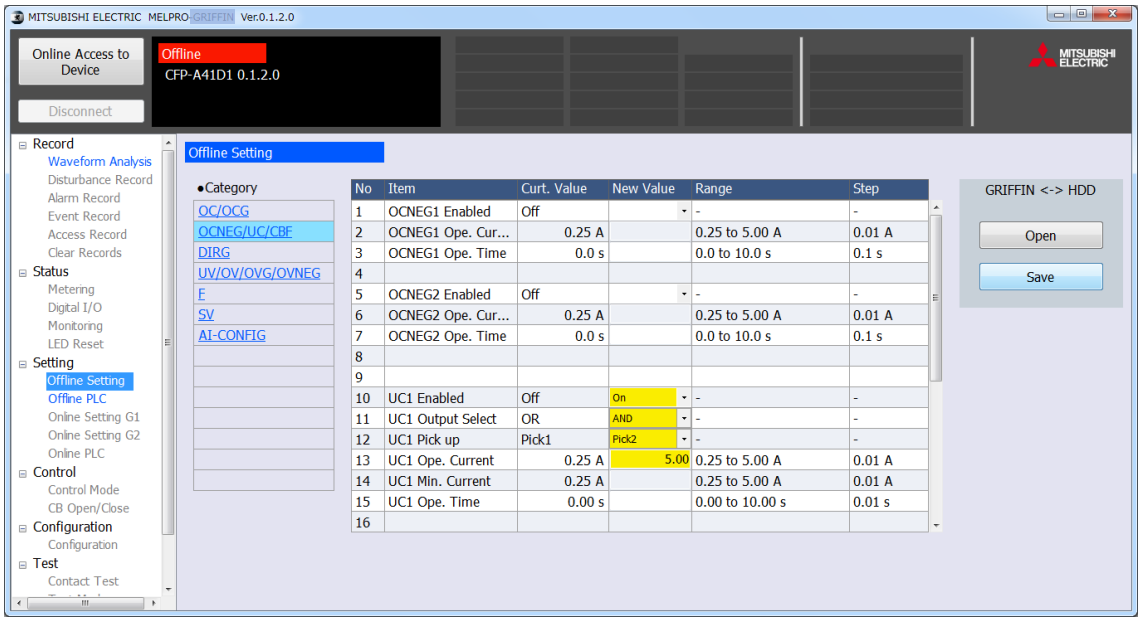


Note) If any value out of the setting range is entered, an error indication as shown below is given.

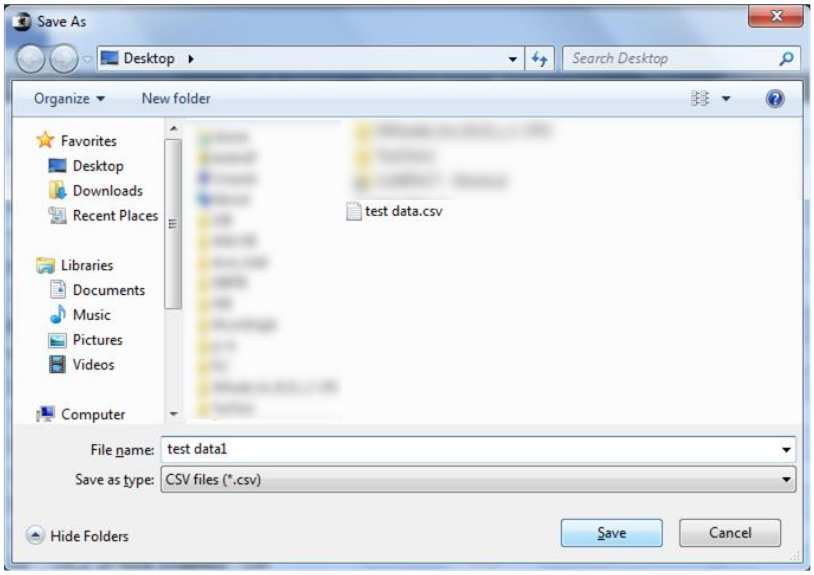


[Saving setting files]

1. From PC-HMI <-> HDD in the upper right part of the main screen, click “Save.”



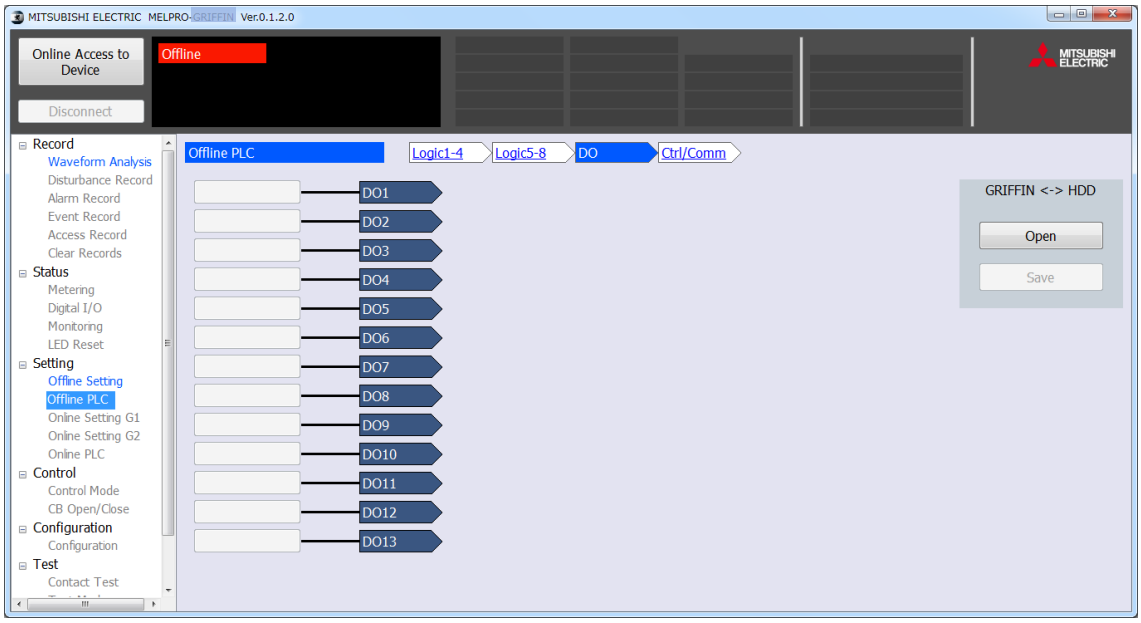
2. Select the destination folder, enter a file name and click “Save.” The setting file is saved.



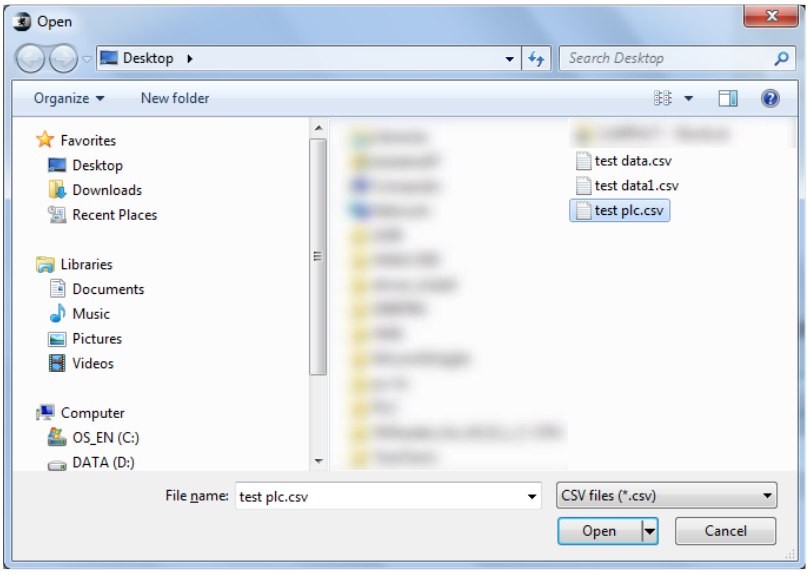
11.7.3. Reading, editing and saving PLC files

[Reading PLC files]

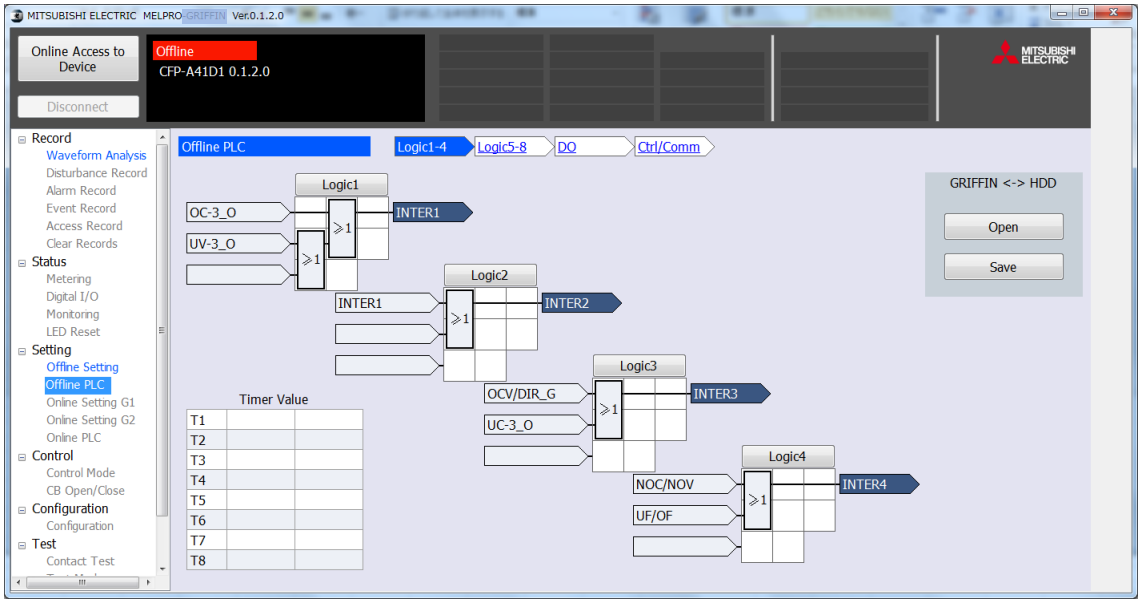
1. From the Function menu, click Offline PLC.
2. From PC-HMI <-> HDD in the upper right part of the main screen, click “Open.”



3. Select the PLC file to read from the HDD.
   (Files in the .csv format can be read)



4. The PLC file is read as shown below.

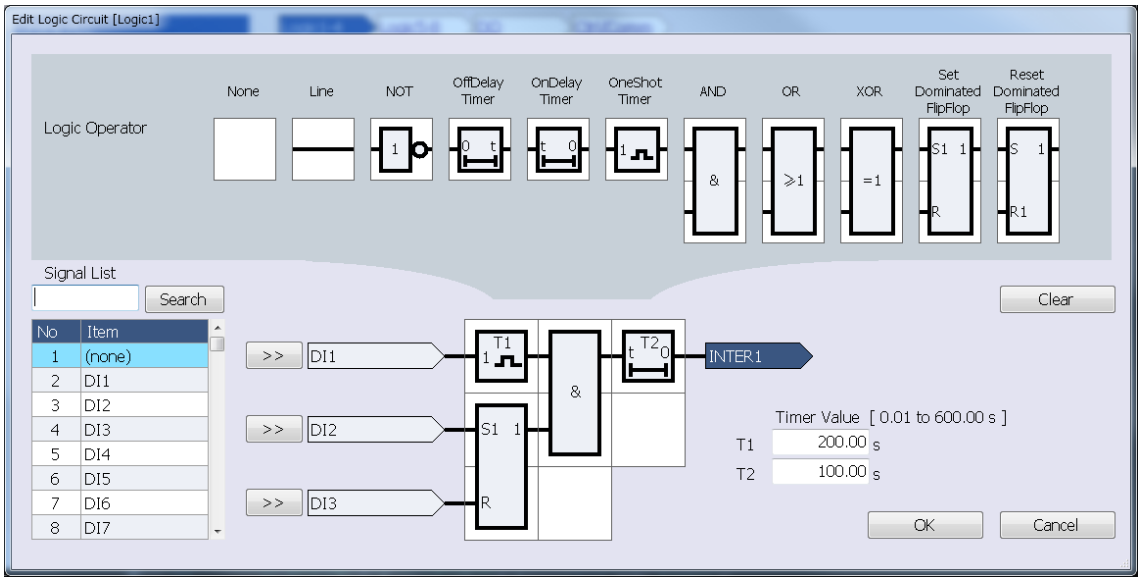


[Editing PLC files]

1. Click the Logic group and Logic to edit.

   Logic1-4 : indication and editing screen for logic circuits 1 to 4
   Logic5-8 : indication and editing screen for logic circuits 5 to 8

2. The logic circuit editing screen as shown below appears. (The screen below shows a display example)

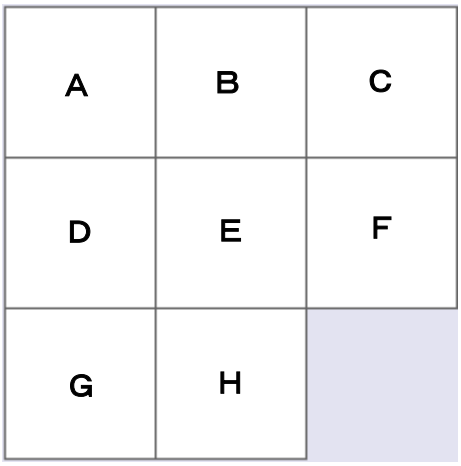


3. From the Item list, select the signal to input and click. The selected signal is shown in light blue. Click “>>” to select the input signal.

Note) The signal name can be searched by entering it on the Signal List by using the keyboard and clicking “Search.”

4. From the list of circuit components, select the logic component to place and click the logic area to place it. The logic component is placed.
   After the placement has been completed, click “OK” to go back to the previous screen.

Note) Logic components that can and cannot be placed in certain areas are as shown below.

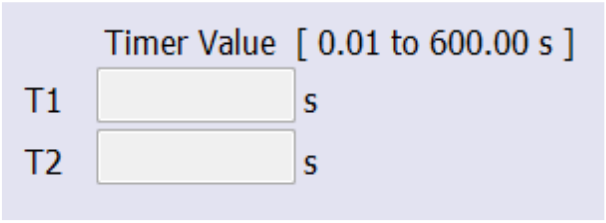


No	Component	A	B	C	D	E	F	G	H	Note
1	None	Y	Y	Y	Y	Y	Y	Y	Y	(*1)
2	Line	Y	Y	Y	Y	Y	N	Y	N	
3	Not	Y	Y	Y	Y	Y	N	Y	N	
4	OffDelay Timer	Y	Y	Y	Y	Y	N	Y	N	(*2)
5	OnDelay Timer	Y	Y	Y	Y	Y	N	Y	N	(*2)
6	OneShot Timer	Y	Y	Y	Y	Y	N	Y	N	(*2)
7	And	Y	Y	Y	Y	Y	N	N	N	
8	Or	Y	Y	Y	Y	Y	N	N	N	
9	Xor	Y	Y	Y	Y	Y	N	N	N	
10	Set FlipFlop	Y	Y	Y	Y	Y	N	N	N	
11	Reset FlipFlop	Y	Y	Y	Y	Y	N	N	N	

(*1): The component needs to have been placed.

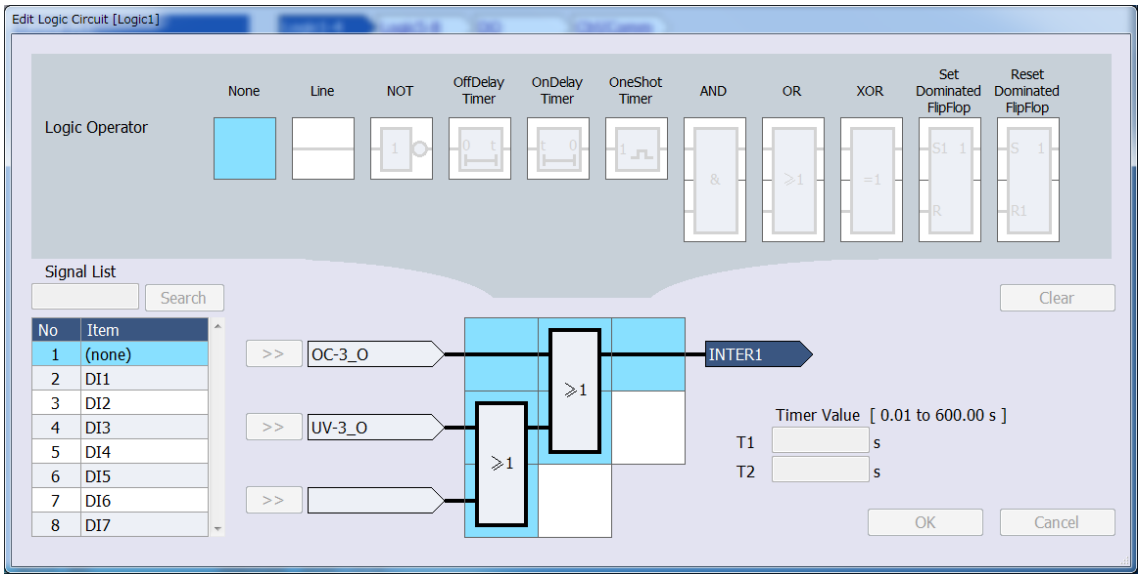
(*2): Up to two timer components can be placed in a logic area.
(More than two timers cannot be placed.)

When providing any timer component, specify the time in the Timer Value field.



Note) Attempting to place a logic component that cannot be placed in a certain logic area generates the error as shown below.

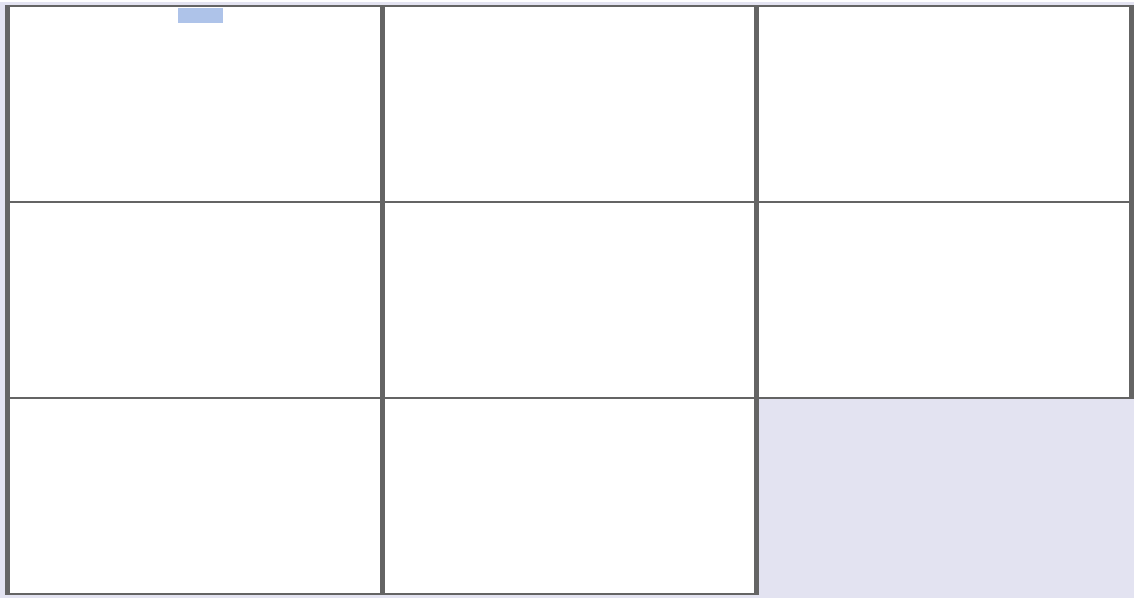
To remove any logic component that has been placed, select a None logic component and click the logic area to remove the component from (shown in light blue).



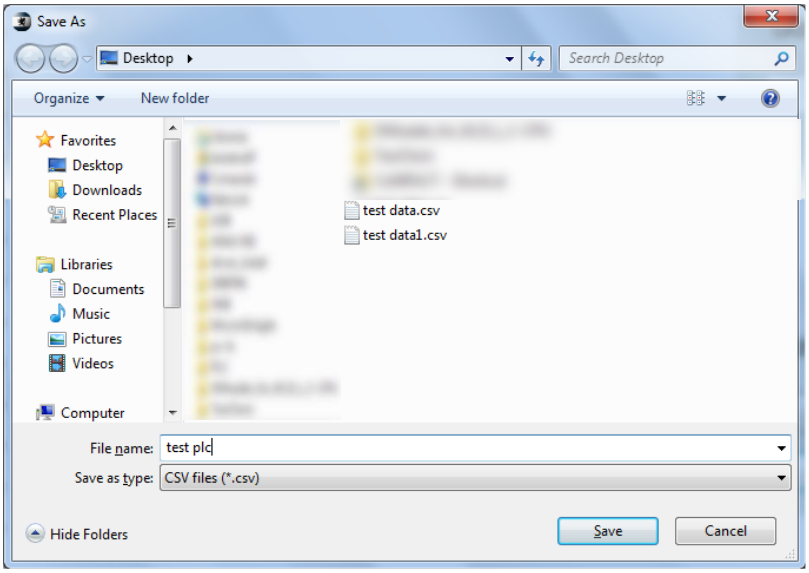
Clicking “Clear” brings back to the initial state with no input signal set, logic component placed or timer setting configured.

[Saving PLC files]

1. To save a PLC file on the HDD, from PC-HMI <-> HDD in the upper right part of the main screen, click “Save.”



2. Select the destination folder, enter a file name and click “Save.” The PLC file is saved.

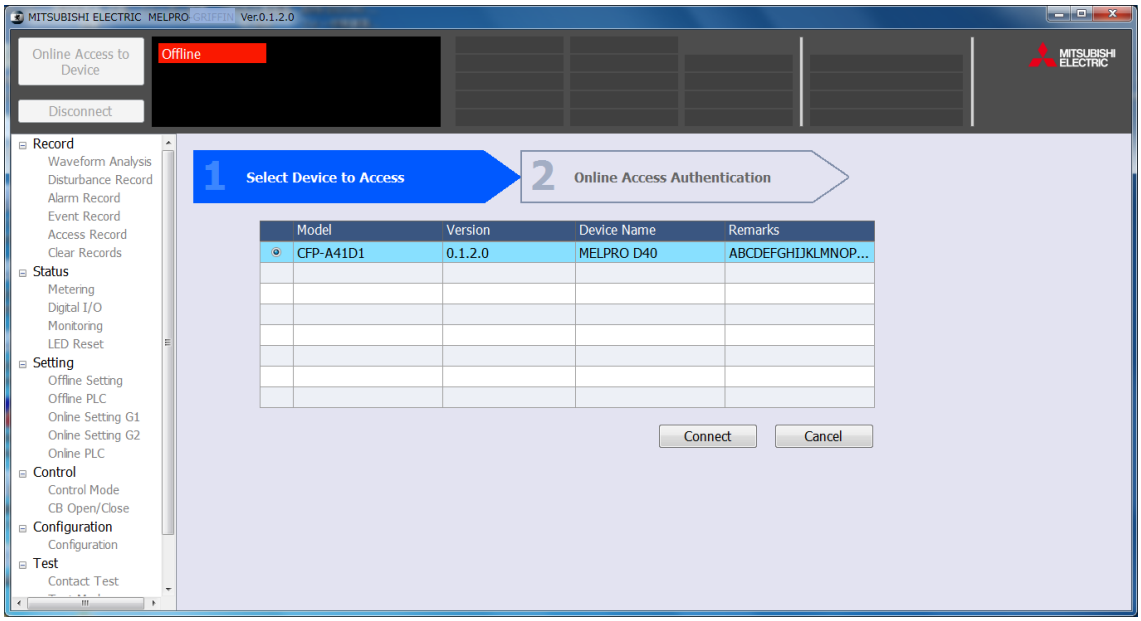


11.8. Logging into and out of the device

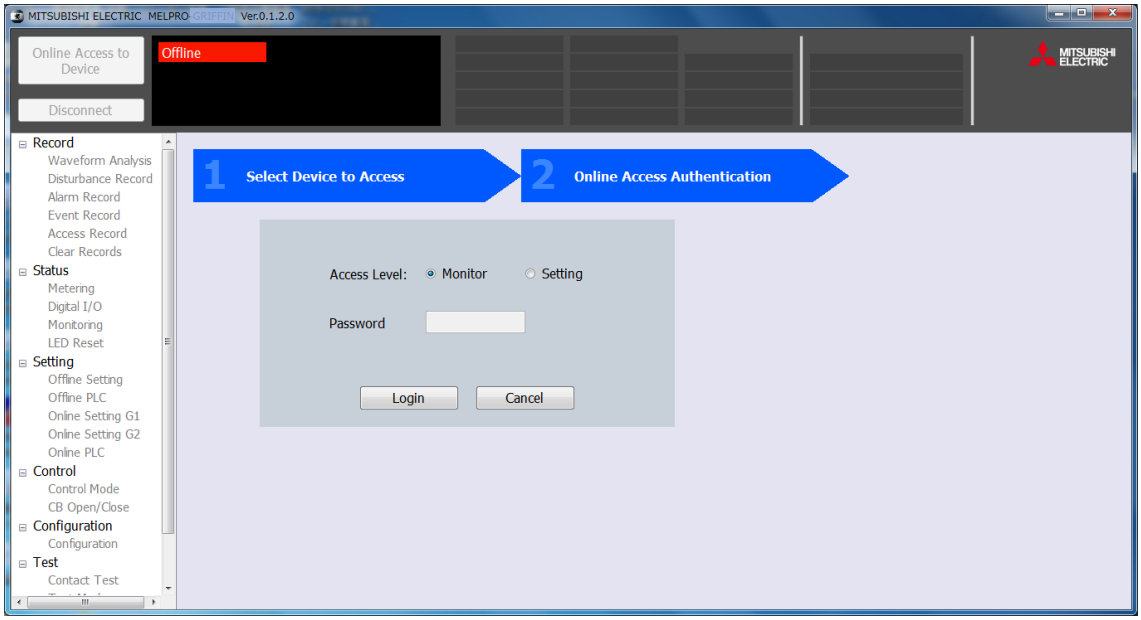
11.8.1. Log in (connection)

1. From the offline screen, click the [Online Access to Device] button. The screen for selecting the device to access appears.

2. A list of devices that can be accessed appears. Click the radio button for the desired device to access under Model and click “Connect.” (To cancel, click “Cancel” to go back to the offline initial screen.)

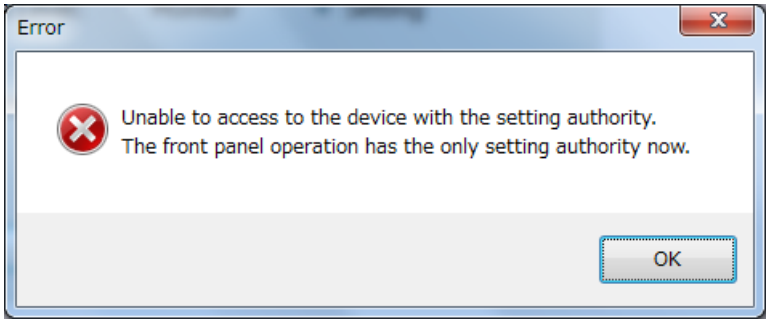


3. The access authentication screen appears. Click the radio button for the desired access level.
(Monitor: view permission, Setting: write permission)



If you do not desire to log in, click “Cancel” to go back to the offline initial screen.

Note) If the Setting permission is selected from the panel, it is not possible to log in from the PC-HMI with the Setting permission.The error message as shown below appears.



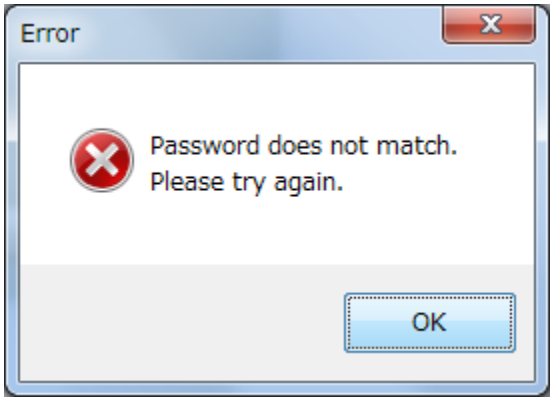
4. Enter the password (when a password is used and the device is accessed with the Setting permission).

Note) This operation is required when the device is accessed with the password use setting and Setting permission.
The password use/unuse setting can be changed by operation from the front panel.
(For how to change the password use/unuse setting, see 4.3.4.3.8 of Chapter 4.)

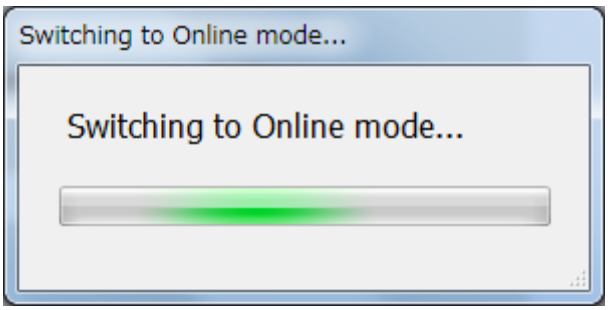
When no password is used or the device is accessed with the Monitor permission, password entry is not required.Simply click “Login” to log in.

After entering the password in the Password field, click “Login.”
Only half-width alphanumeric characters are acceptable to be included in a password.
The default password setting is “0000.”

If a wrong password is given, the error message as shown below appears. Click “OK” and enter the password again.

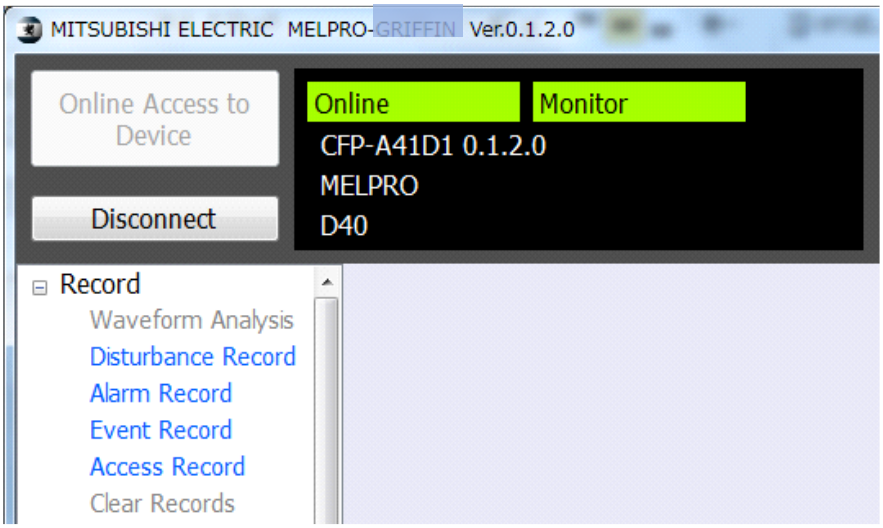


5. Successful password authentication switches the device mode from offline to online.

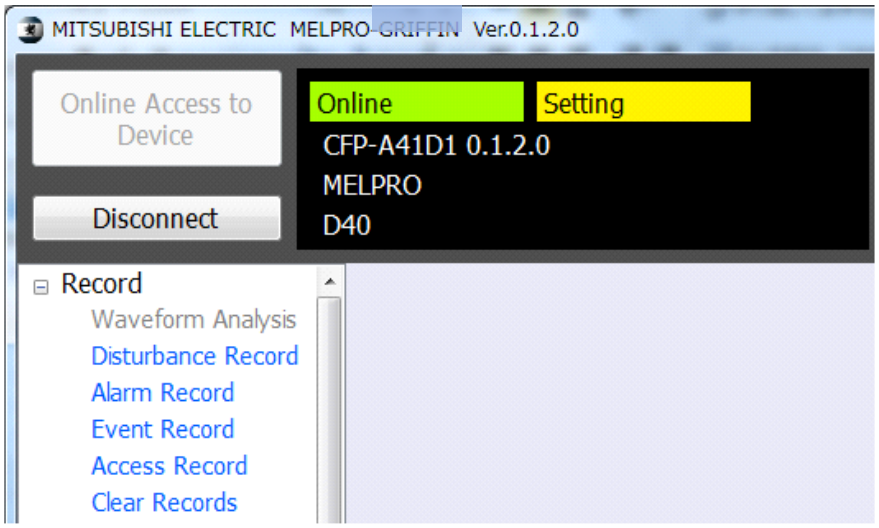


6. After switching to the online mode, the initial screen according to the access level appears.

(1) Online initial screen for the view permission



(2) Online initial screen for the write permission



Operations enabled differ depending on the access level.

Items in blue: enabled

Items in gray: disabled

For operations enabled/disabled depending on the access level, see the list on the next page.

List of operations enabled/disabled for the respective access levels

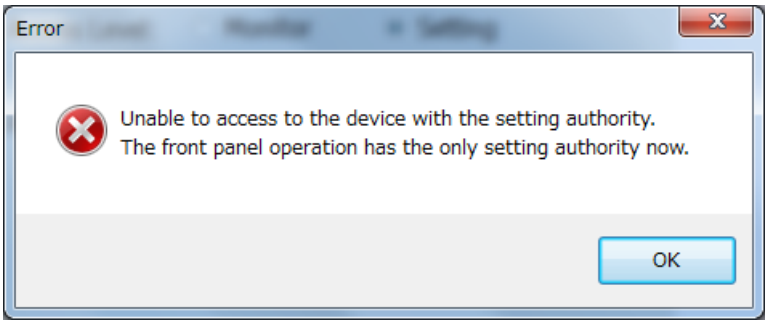
Type	Item	Offline mode	Online mode	
			View permission	Write permission
Record	Waveform Analysis	Y	N	N
	Disturbance Record	N	Y	Y
	Alarm Record	N	Y	Y
	Event Record	N	Y	Y
	Access Record	N	Y	Y
	Clear Records	N	N	Y
Status	Metering	N	Y	Y
	Digital I/O	N	Y	Y
	Monitoring	N	Y	Y
	LED Reset	N	Y	Y
Setting	Offline Setting	Y	N	N
	Offline PLC	Y	N	N
	Online Setting G1	N	Y	Y
	Online Setting G2	N	Y	Y
	Online PLC	N	Y	Y
Control	Control Mode	N	Y	Y
	CB Open/Close	N	N	Y
Configuration	Configuration	N	Y	Y
Test	Contact Test	N	N	Y
	Test Mode	N	N	Y
About	Help	Y	Y	Y

The symbols in the table above have the following meanings.

Y: The menu can be used to access a function screen.
Display of the function screen and operations other than device write are possible.

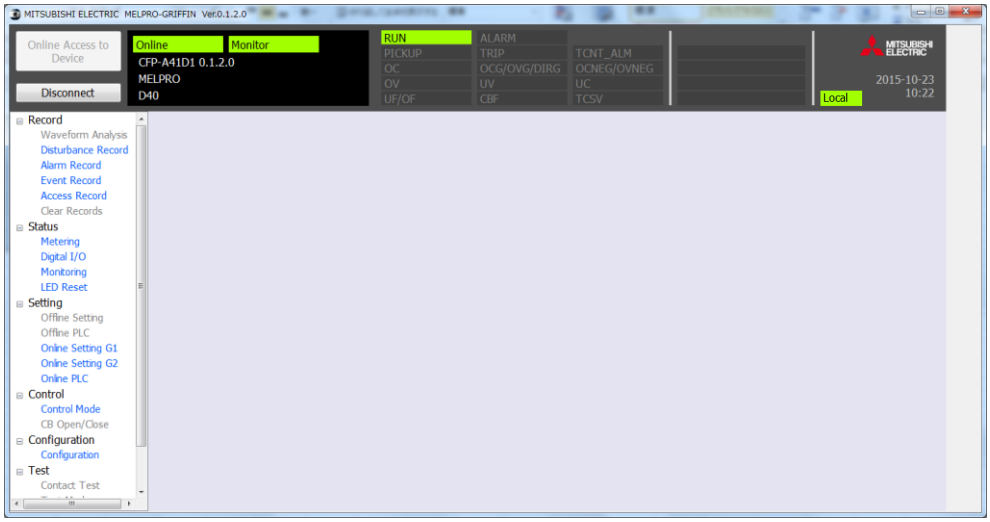
N: The menu is shown but grayed out and does not allow access to a function screen.
Neither display nor operation of the function screen is possible.

Note) Attempting an operation not permitted by the access level generates the error message as shown below.

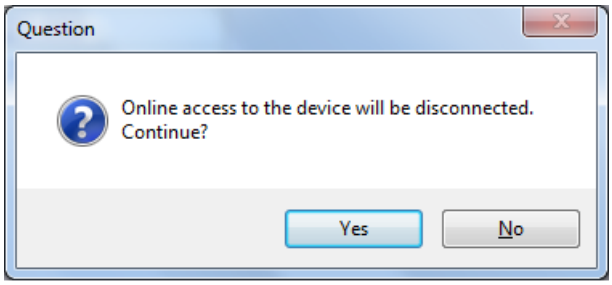


11.8.2. Log off (disconnection)

1. Click the [Disconnect] button in the upper left part of the online mode screen.



2. The dialog to confirm disconnection as shown below appears. Click “Yes.”



3. The device mode is switched to offline.

11.9. PC-HMI operation menu

PC-HMI allows access to the individual items from the list of functions on the left side of the main screen. The name and overview of each item are given in the table below.

No	Type	Name	Description
1	Record	Waveform Analysis	Starts the waveform analysis tool, a separate application (*1)
2		Disturbance Record	Disturbance record screen
3		Alarm Record	Supervision alarm record screen
4		Event Record	Event record screen
5		Access Record	Access record screen
6		Clear Records	Clear record screen
7	Status	Metering	Analog measurement status display screen
8		Digital I/O	DIO status display screen
9		Monitoring	Device supervision status display screen
10		LED Reset	LED reset screen
11	Setting	Offline Setting	Offline setting screen
12		Offline PLC	Offline PLC screen
13		Online Setting G1	Online setting screen (Group 1)
14		Online Setting G2	Online setting screen (Group 2)
15		Online PLC	Online PLC screen
16	Control	Control Mode	CB control mode screen
17		CB Open/Close	CB control execution screen
18	Configuration	Configuration	Configuration screen
19	Test	Contact Test	DO contact test screen
20		Test Mode	Test mode activation screen
21	About	Help	Shows the operation manual as a PDF file in a new window (*2)

Note) Items that cannot be selected are grayed out and not enabled for selection.

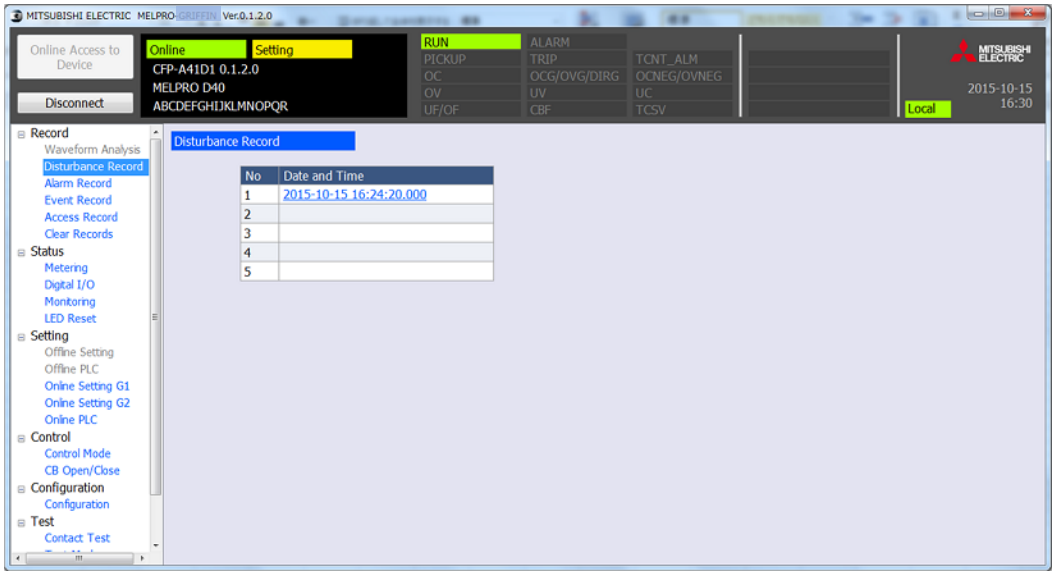
(*1): Implemented by a different application and the menu only allows starting of the application.

(*2): Only allows starting of PDF. If no application is installed that is required for starting PDF, the instruction manual read error message appears.

11.10. Operate record functions

11.10.1. Disturbance record function

1. From the Function menu, select Disturbance Record.



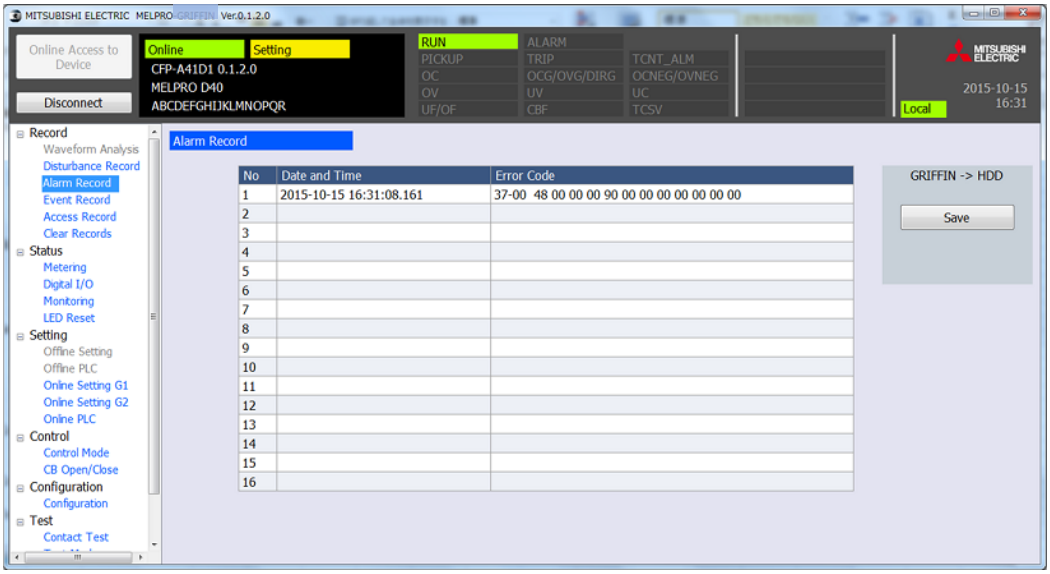
2. The dates and times of disturbance occurrences are listed in the descending order of the date and time. Select the data to retrieve.

3. Save it in an arbitrary location on the HDD.
   (The waveform analysis tool allows analysis of the waveform data saved.)

Note) The dates and times are represented as “-year-month-day- hour:-minute:-second.-millisecond.”
Note) Up to five occurrences can be shown. If the data size is large, the number may be less than five.

11.10.2. Alarm record function (by self-diagnosis function)

1. From the Function menu, select Alarm Record.



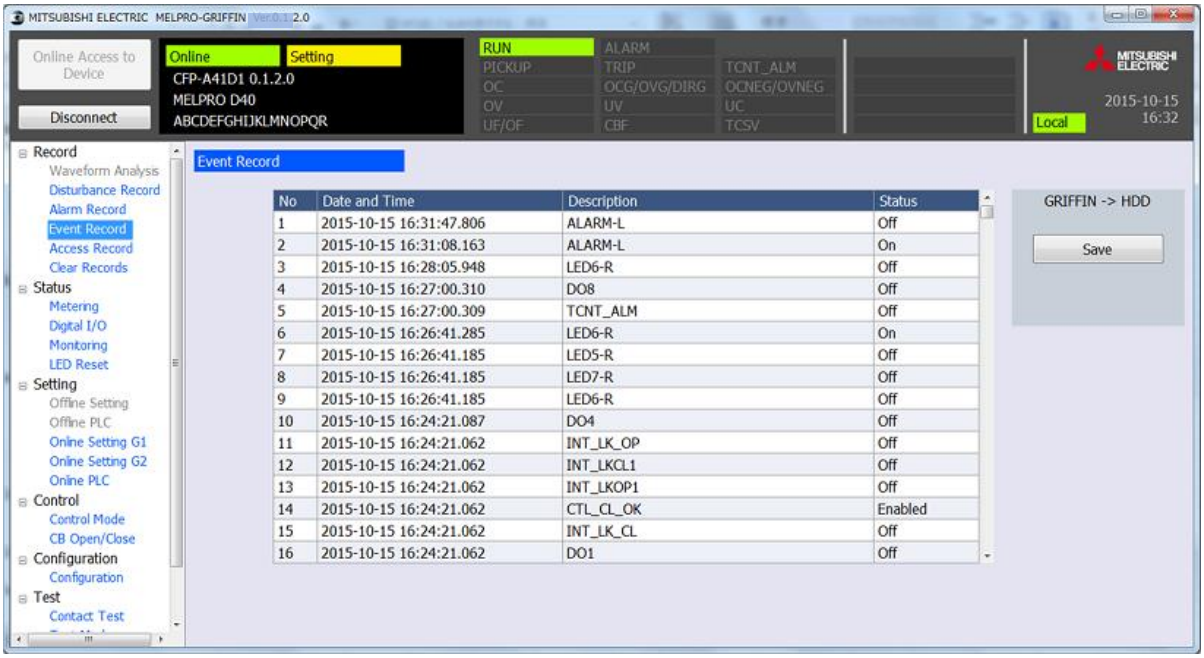
2. The supervision alarm records are listed in the descending order of the date and time. Select the data to retrieve.

3. From PC-HMI -> HDD, click “Save” to save it in an arbitrary location on the HDD.

Note) If the number of record data exceeds 16, use the scroll bar for display.
Up to 200 data can be shown. For the details of the date and time indication, see 11.10.1

11.10.3. Event record function

1. From the Function menu, select Event Record.



2. The record data relating to preregistered events are listed in the descending order of the date and time.

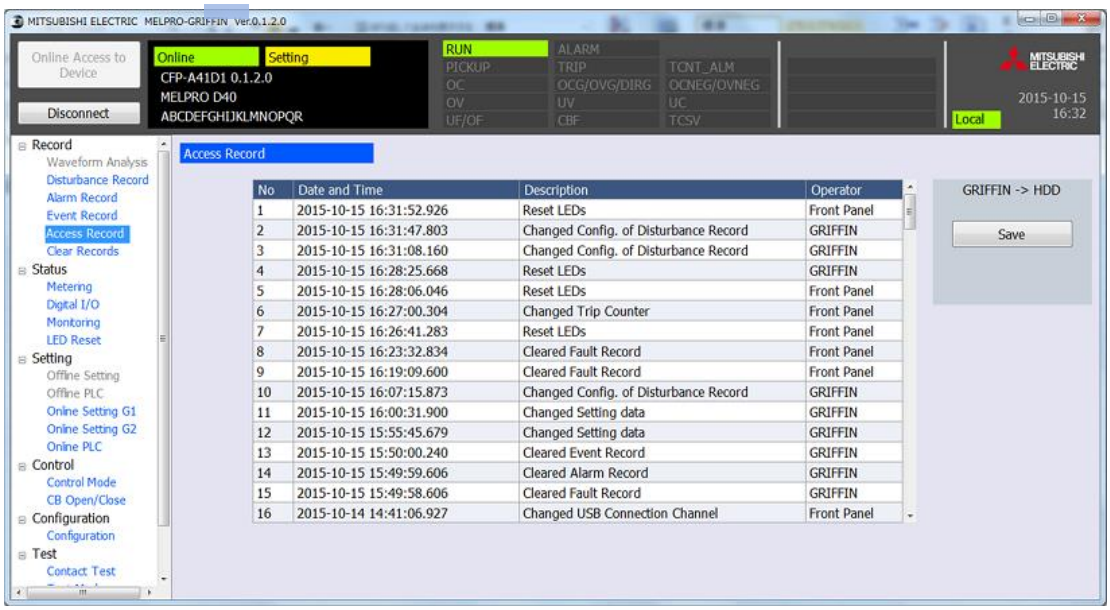
Note) For the events, see 4.3.2.2.2 of Chapter 4.

3. Select the event record to retrieve and, from PC-HMI -> HDD, click “Save” to save it in an arbitrary location on the HDD.

Note) If the number of record data exceeds 16, use the scroll bar for display.
Up to 512 data can be shown. For the details of the date and time indication, see 11.10.1.

11.10.4. Access record function

1. From the Function menu, click Access Record.



2. The record data relating to access to the preregistered device are listed in the descending order of the date and time.

3. From PC-HMI -> HDD, click “Save” to save it in an arbitrary location on the HDD.

Note) If the number of record data exceeds 16, use the scroll bar for display.
Up to 200 data can be shown. For the details of the date and time indication, see 11.10.1.

Note) For access operator and access record description, see the list below.

Access operator list (Operator)

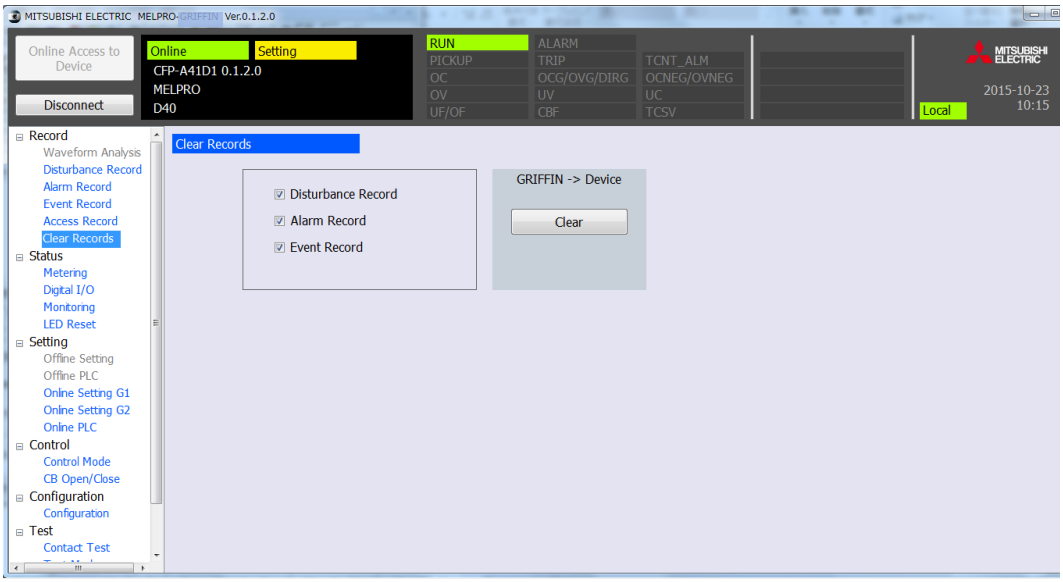
Access operator	PC-HMI indication
Front panel	Front Panel
PC-HMI	PC-HMI
Via Modbus communication I/F	via Modbus
Via TCP/IP communication I/F	via TCP/IP
Via CC-Link communication I/F	via CC-Link
Automatic cancellation on device	Automatic

Access record description list (Description)

Access record description	PC-HMI indication
Change of active setting group	Changed Active Setting Group
Change of DI detection voltage value	Changed DI Voltage
Change of configuration of disturbance record	Changed Config. of Disturbance Record
Change of password use setting	Changed Use of Password
Change of password	Changed Password
Change of USB connection channel	Changed USB Connection Channel
Change of VFD brightness	Changed VFD Brightness
Change of trip counter	Changed Trip Counter
Change of configuration of Modbus	Changed Config. of Modbus
Change of configuration of CC-Link	Changed Config. of CC-Link
Change of configuration of IEC61850	Changed Config. of IEC61850
Change of device name	Changed Device Name
Change of configuration of analog measurement status display	Changed Config. of Metering
Change of configuration of electric energy	Changed Config. of Energy
Change of configuration of time management	Changed Config. of Time Management
Change of CB control mode	Changed CB Control Mode
Change of configuration of DO contact test	Changed Config. of Contact Test
Change of configuration of SNTP	Changed Config. of SNTP
Change of PLC data	Changed PLC data
Change of relay setting	Changed Setting data
Clearing of fault/disturbance record	Cleared Fault/Disturbance Record
Clearing of alarm record	Cleared Alarm Record
Clearing of event record	Cleared Event Record
Adjustment of system clock	Adjusted System Clock
Activation of test mode	Activated Test Mode
Deactivation of test mode	Deactivated Test Mode
LED reset	Reset LEDs
Start of DO contact test	Started Contact Test
Stop of DO contact test	Stopped Contact Test
Locking of supervision	Locked Supervision
Unlocking of supervision	Unlocked Supervision
Start of interface test	Started Interface Test
Stop of interface test	Stopped Interface Test
Operation to open/close CB	Operated to Open/Close CB

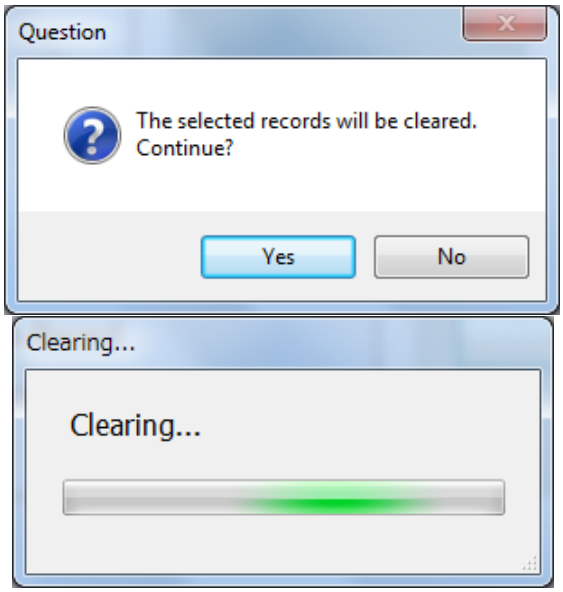
11.10.5. Clear record function

1. From the Function menu, click Clear Records.

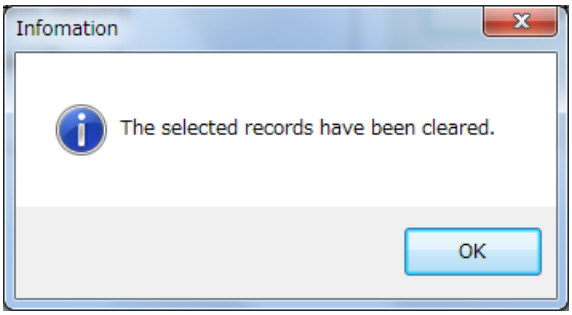


2. Check the box for the record to clear and, from PC-HMI -> Device, click “Clear.”

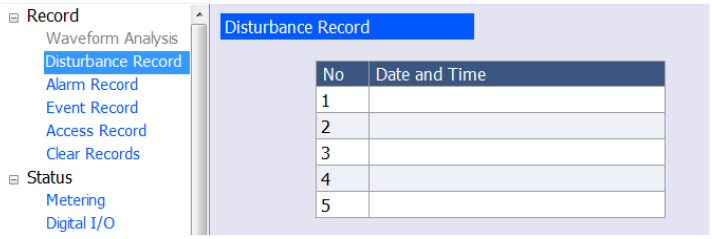
3. The confirmation dialog as shown below appears. Click “Yes” to start clearing.



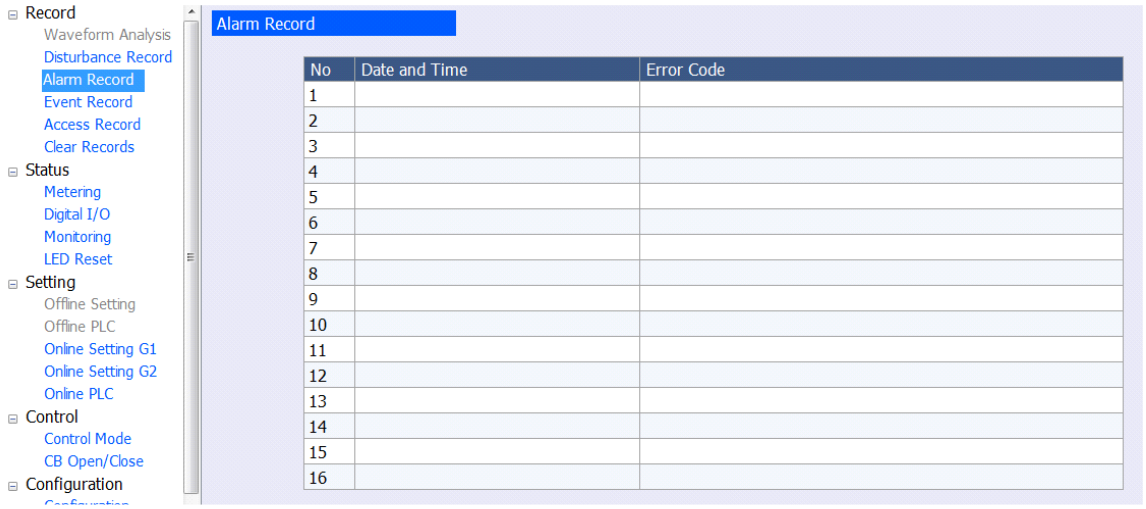
4. The clearing completion dialog appears and the relevant record is cleared.



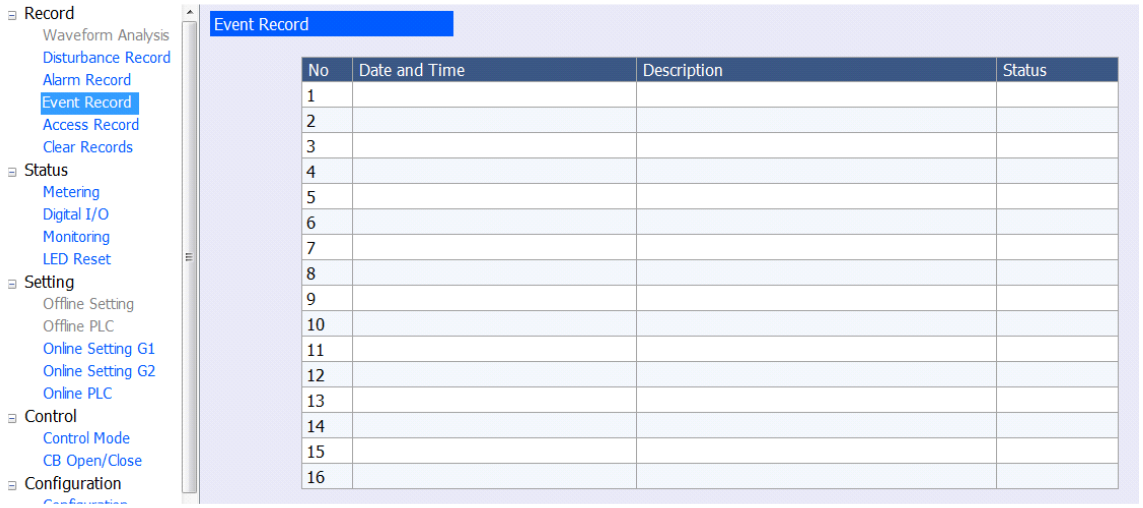
(1) Screen shown after clearing disturbance record data



(2) Screen shown after clearing alarm record data



(3) Screen shown after clearing event record data



Note) The file clearing operation erases the relevant record file
(The system does not allow clearing of access records.)

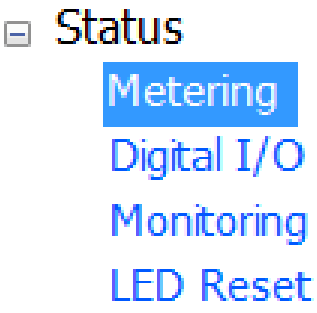
11.11. Status functions

11.11.1. Showing analog values measured

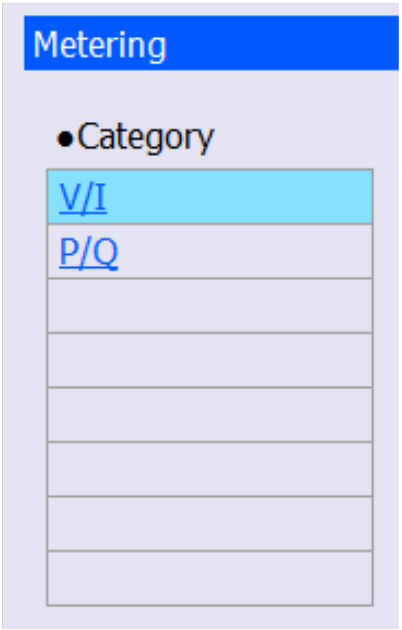
In the analog measurement status mode, the current statuses of analog values measured are listed.

11.11.1.1. Showing the current/voltage

1. From the Function menu, click Metering.

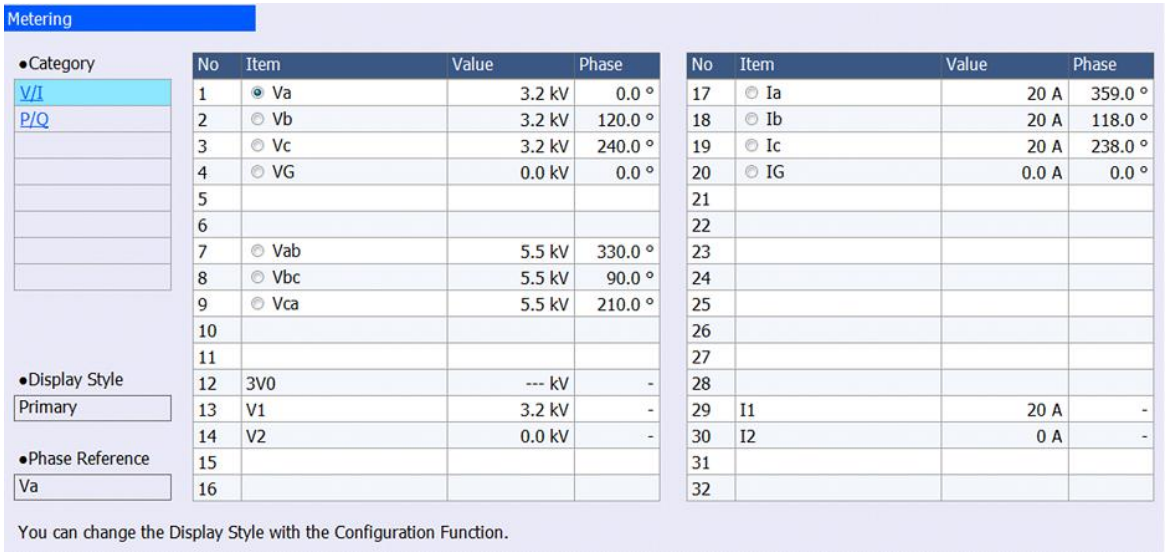


2. From Category, click V/I.



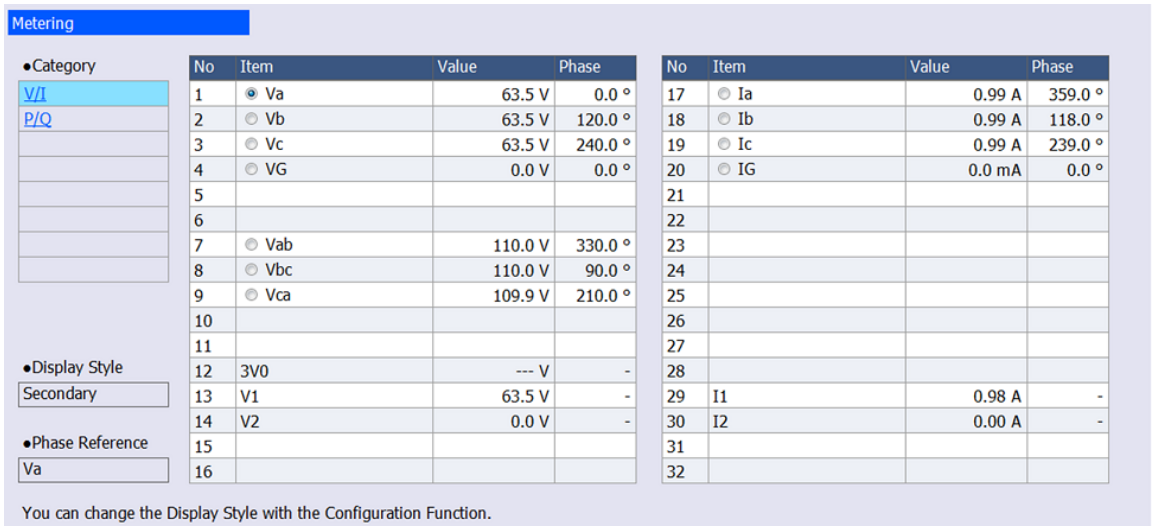
3. The V/I values for the side specified by the configuration are shown.

Primary side



No	Item	Value	Phase	No	Item	Value	Phase
1	Va	3.2 kV	0.0 °	17	Ia	20 A	359.0 °
2	Vb	3.2 kV	120.0 °	18	Ib	20 A	118.0 °
3	Vc	3.2 kV	240.0 °	19	Ic	20 A	238.0 °
4	VG	0.0 kV	0.0 °	20	IG	0.0 A	0.0 °
5				21			
6				22			
7	Vab	5.5 kV	330.0 °	23			
8	Vbc	5.5 kV	90.0 °	24			
9	Vca	5.5 kV	210.0 °	25			
10				26			
11				27			
12	3V0	--- kV	-	28			
13	V1	3.2 kV	-	29	I1	20 A	-
14	V2	0.0 kV	-	30	I2	0 A	-
15				31			
16				32			

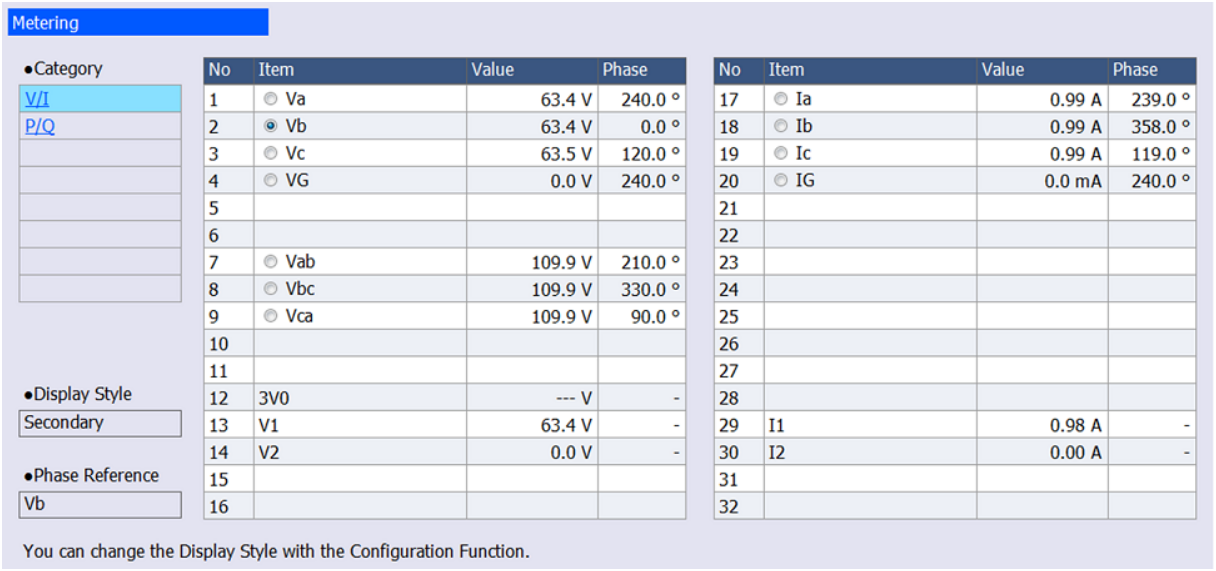
Secondary side



No	Item	Value	Phase	No	Item	Value	Phase
1	Va	63.5 V	0.0 °	17	Ia	0.99 A	359.0 °
2	Vb	63.5 V	120.0 °	18	Ib	0.99 A	118.0 °
3	Vc	63.5 V	240.0 °	19	Ic	0.99 A	239.0 °
4	VG	0.0 V	0.0 °	20	IG	0.0 mA	0.0 °
5				21			
6				22			
7	Vab	110.0 V	330.0 °	23			
8	Vbc	110.0 V	90.0 °	24			
9	Vca	109.9 V	210.0 °	25			
10				26			
11				27			
12	3V0	--- V	-	28			
13	V1	63.5 V	-	29	I1	0.98 A	-
14	V2	0.0 V	-	30	I2	0.00 A	-
15				31			
16				32			

Note) For switching between the primary and secondary indications, see 11.14.4.

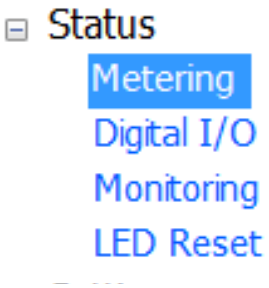
Note) Clicking an Item radio button allows change of the reference phase.
(In the figure below, the reference phase has been changed to Vb.)



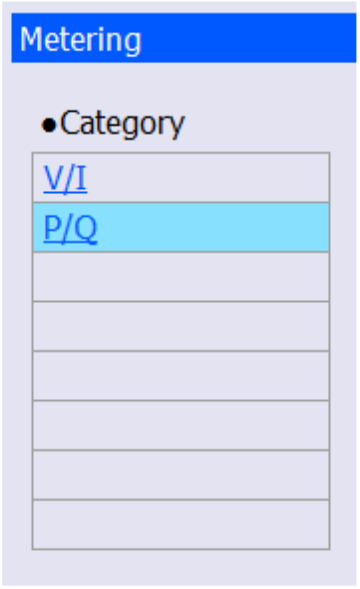
No	Item	Value	Phase	No	Item	Value	Phase
1	Va	63.4 V	240.0 °	17	Ia	0.99 A	239.0 °
2	Vb	63.4 V	0.0 °	18	Ib	0.99 A	358.0 °
3	Vc	63.5 V	120.0 °	19	Ic	0.99 A	119.0 °
4	VG	0.0 V	240.0 °	20	IG	0.0 mA	240.0 °
5				21			
6				22			
7	Vab	109.9 V	210.0 °	23			
8	Vbc	109.9 V	330.0 °	24			
9	Vca	109.9 V	90.0 °	25			
10				26			
11				27			
12	3V0	--- V	-	28			
13	V1	63.4 V	-	29	I1	0.98 A	-
14	V2	0.0 V	-	30	I2	0.00 A	-
15				31			
16				32			

11.11.1.2. Showing active/reactive power

1. From the Function menu, click Metering.

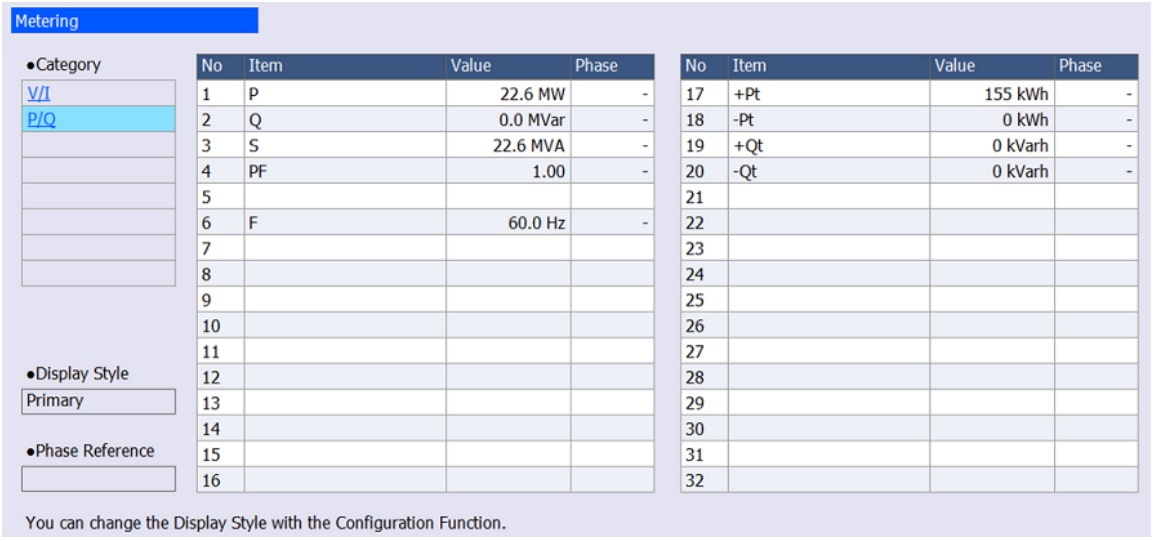


2. From Category, click P/Q.



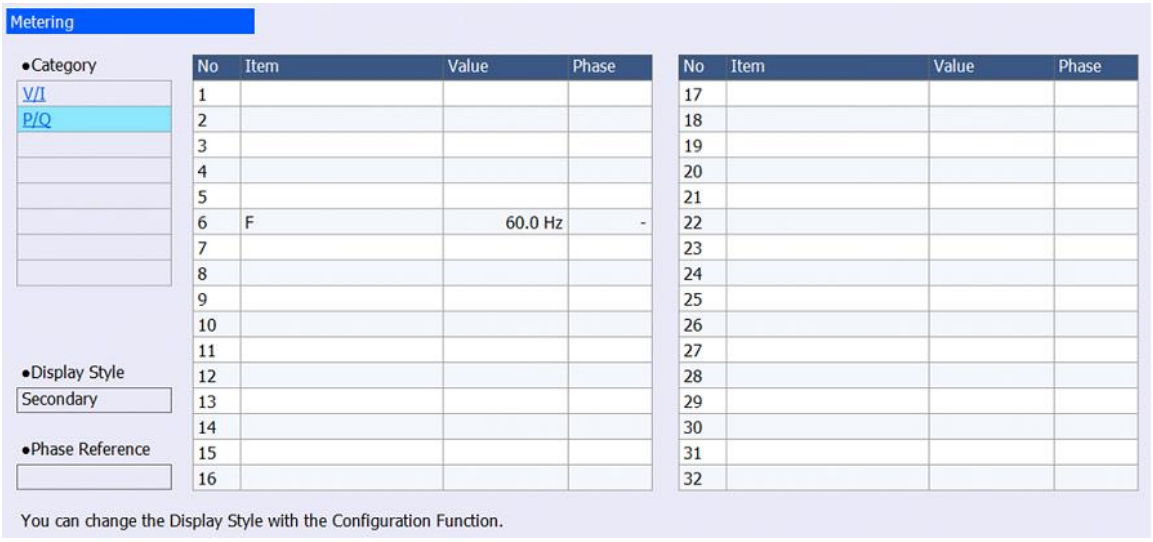
3. The active/reactive power and other values for the side specified by the configuration are shown.

Primary side display



No	Item	Value	Phase	No	Item	Value	Phase
1	P	22.6 MW	-	17	+Pt	155 kWh	-
2	Q	0.0 MVar	-	18	-Pt	0 kWh	-
3	S	22.6 MVA	-	19	+Qt	0 kVarh	-
4	PF	1.00	-	20	-Qt	0 kVarh	-
5				21			
6	F	60.0 Hz	-	22			
7				23			
8				24			
9				25			
10				26			
11				27			
12				28			
13				29			
14				30			
15				31			
16				32			

Secondary side display

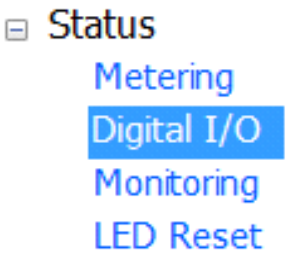


No	Item	Value	Phase	No	Item	Value	Phase
1				17			
2				18			
3				19			
4				20			
5				21			
6	F	60.0 Hz	-	22			
7				23			
8				24			
9				25			
10				26			
11				27			
12				28			
13				29			
14				30			
15				31			
16				32			

Note) Power and electric energy are not shown for the secondary side.

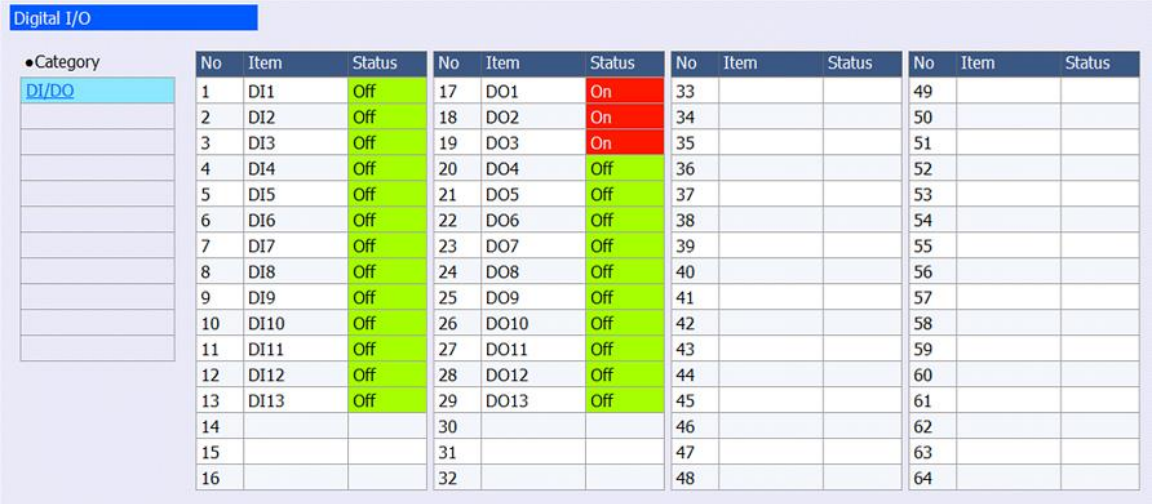
11.11.2. Showing Digital I/O

1. From the Function menu, click Digital I/O.



2. From Category, click DI/DO.

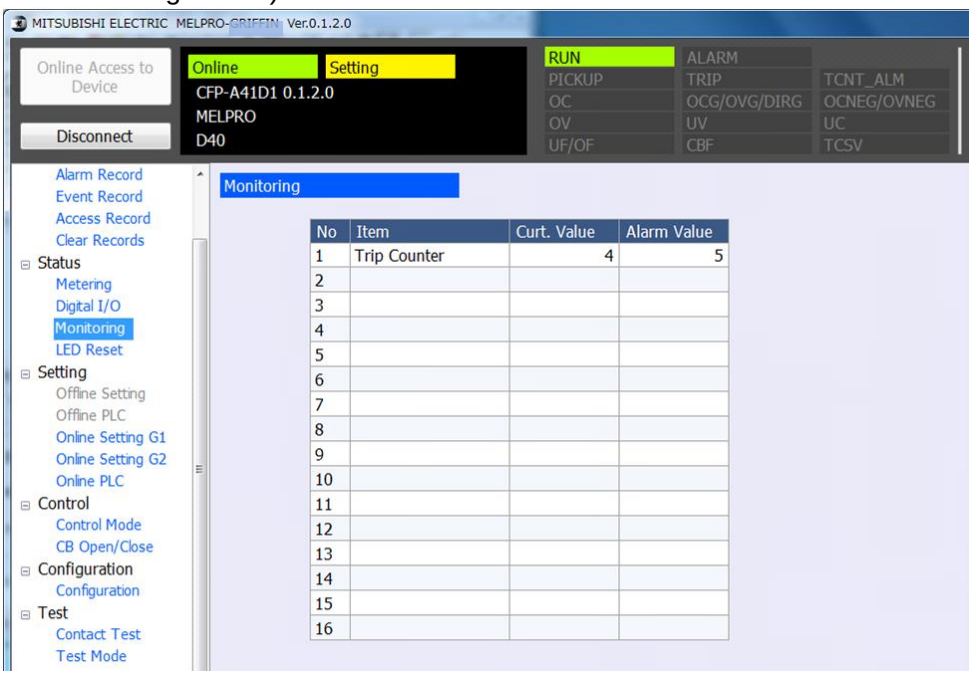
3. The current statuses of DI/DO are listed.



No	Item	Status	No	Item	Status	No	Item	Status	No	Item	Status
1	DI1	Off	17	DO1	On	33			49		
2	DI2	Off	18	DO2	On	34			50		
3	DI3	Off	19	DO3	On	35			51		
4	DI4	Off	20	DO4	Off	36			52		
5	DI5	Off	21	DO5	Off	37			53		
6	DI6	Off	22	DO6	Off	38			54		
7	DI7	Off	23	DO7	Off	39			55		
8	DI8	Off	24	DO8	Off	40			56		
9	DI9	Off	25	DO9	Off	41			57		
10	DI10	Off	26	DO10	Off	42			58		
11	DI11	Off	27	DO11	Off	43			59		
12	DI12	Off	28	DO12	Off	44			60		
13	DI13	Off	29	DO13	Off	45			61		
14			30			46			62		
15			31			47			63		
16			32			48			64		

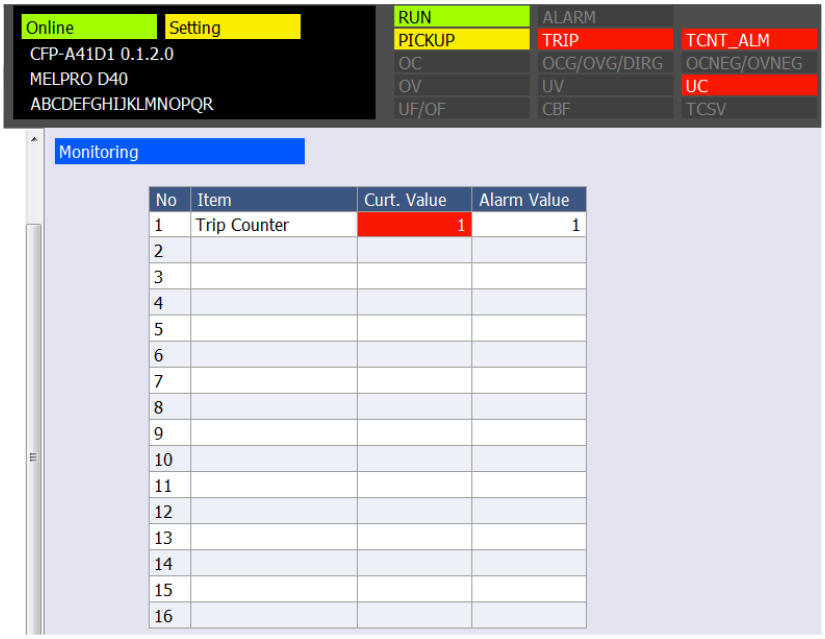
11.11.3. Showing device supervision status

1. From the Function menu, click Monitoring. The device supervision status values (current and alarm setting values) are listed.



No	Item	Curt. Value	Alarm Value
1	Trip Counter	4	5
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			

Note) If the current value is equal to or larger than the alarm setting value, an alarm indication is given as shown below.

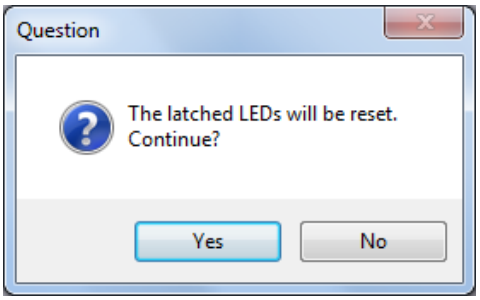


No	Item	Curt. Value	Alarm Value
1	Trip Counter	1	1
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			

11.11.4. Resetting LEDs

1. From the Function menu, click LED Reset.
2. From PC-HMI -> Device, click “LED Reset.”

3. The dialog as shown below appears. Click “Yes.”



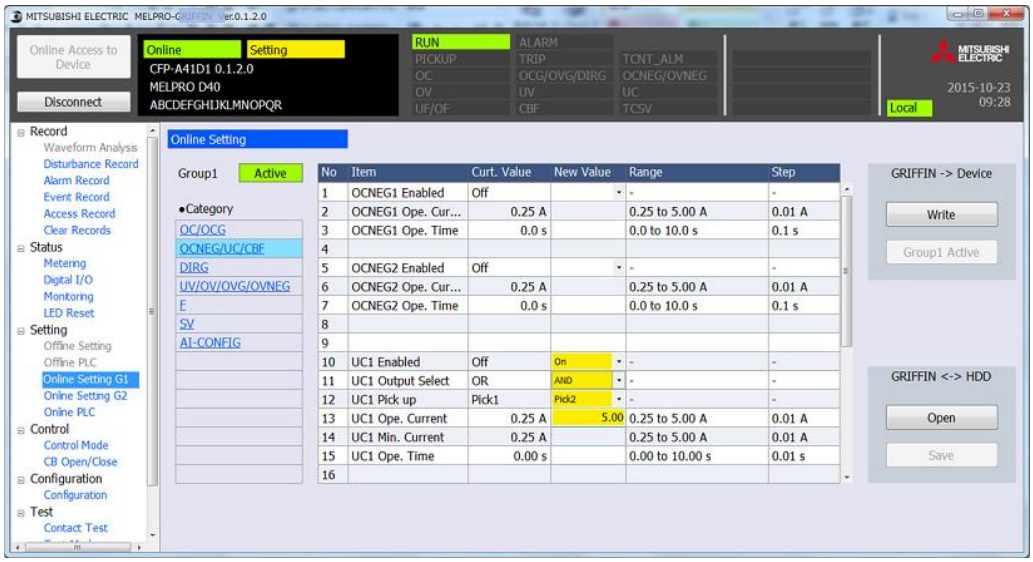
4. The latched LEDs are reset.

11.12. Setting mode

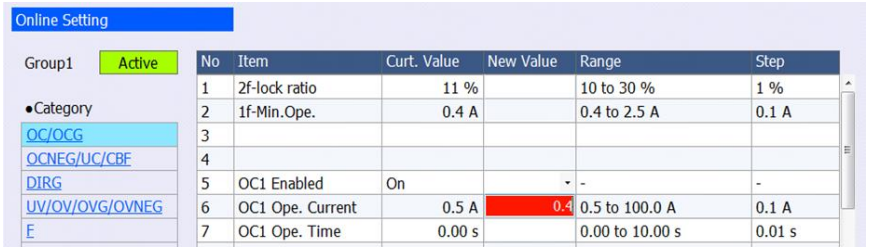
11.12.1. Online setting

1. From the Function menu, click the group to set.
   Online Setting G1: listing and editing of Group 1
   Online Setting G2: listing and editing of Group 2

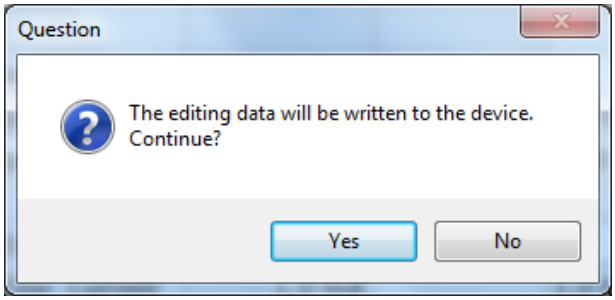
2. Click the item to set from Category. A list of setting values is shown under Item. Click New Value for the item to make a change.
   From the list, make a selection by clicking ▼.
   To enter a value, use the keyboard.



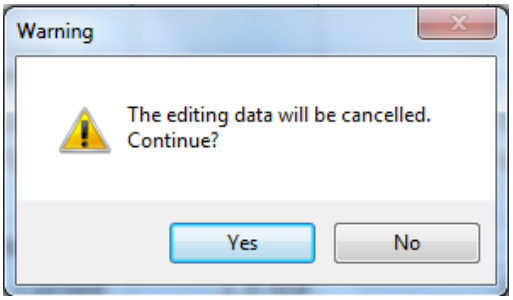
Note) If any value out of the setting range is entered, an error indication as shown below is given.



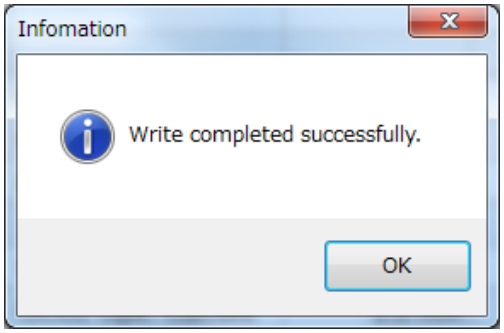
3. From PC-HMI -> Device, click “Write.” The confirmation dialog as shown below appears. Click “Yes.”



Note) To cancel writing of any setting value, click “No.” The confirmation dialog as shown below appears. Click “Yes” to cancel.

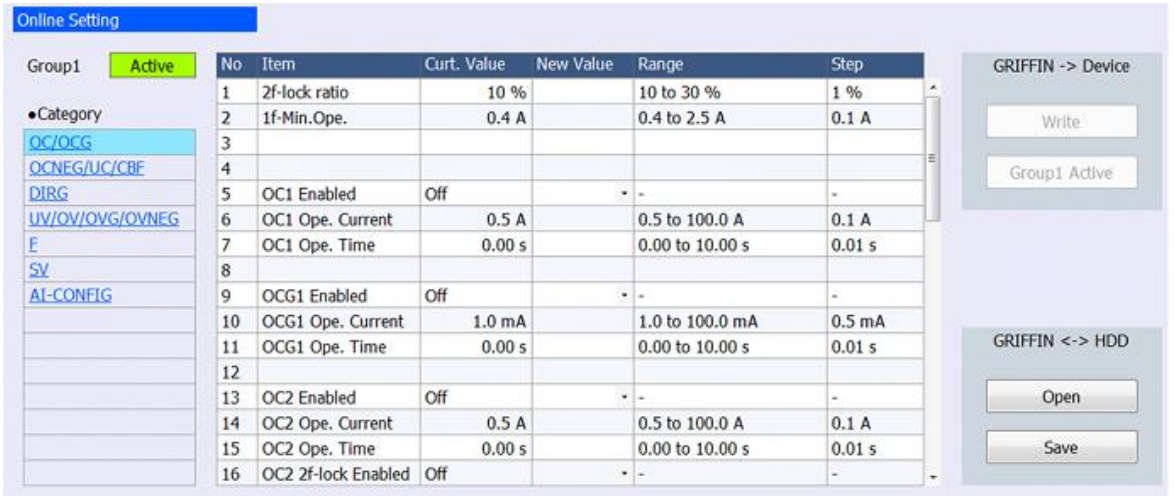


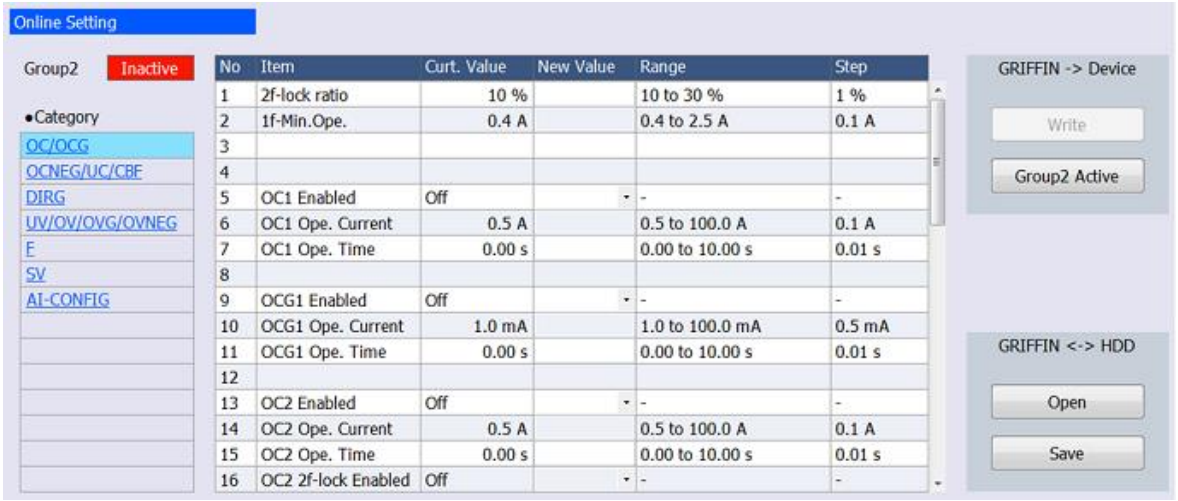
4. Writing of the setting values to the device starts. When it has been completed, the completion message as shown below appears.



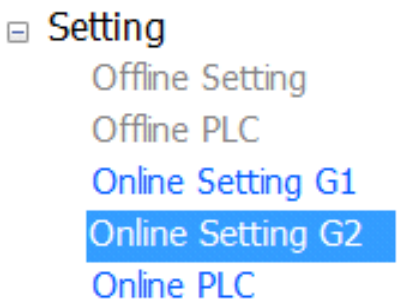
11.12.2. Change setting groups to activate or inactivate

On the Online setting screen, the active group is marked as Active and the inactive group Inactive.



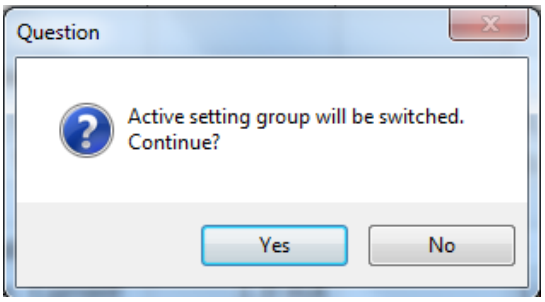


1. From the Function menu, click the setting group to activate.
   (In this example, the active group is switched from Group 1 to Group 2.)

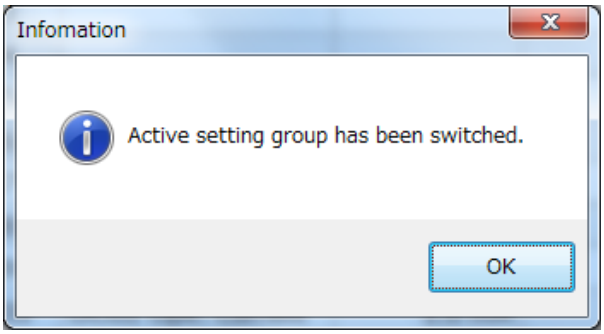


2. From PC-HMI -> Device, click “Group- Active.”

3. The confirmation dialog as shown below appears. Click “Yes.”

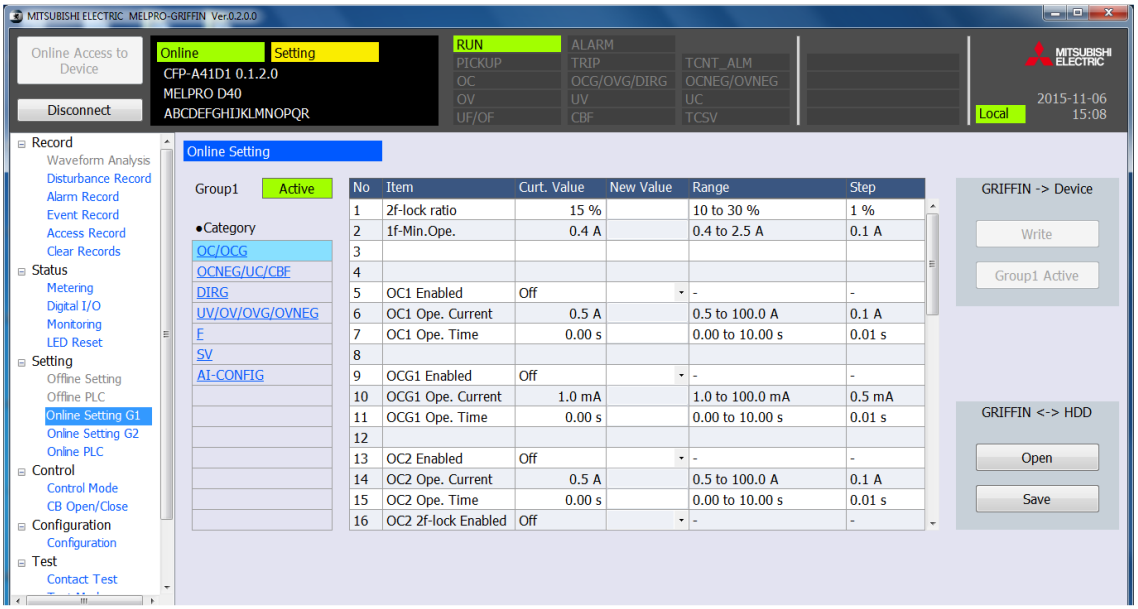


4. The message as shown below appears and the active setting group is switched.

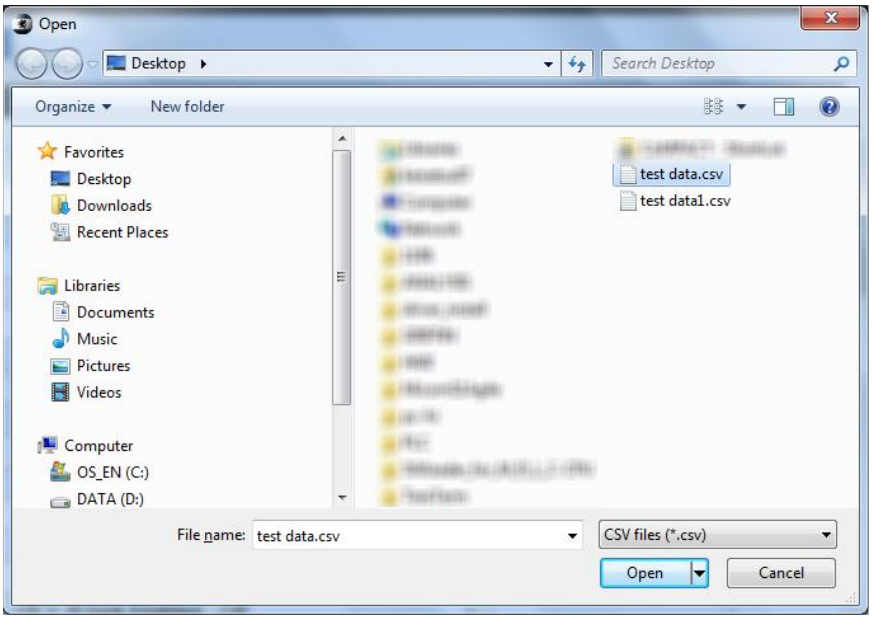


11.12.3. Reading/saving setting files from/to the HDD

1. From the Function menu, click the group to read setting values.
2. From PC-HMI <-> HDD in the lower right part of the main screen, click “Open.”

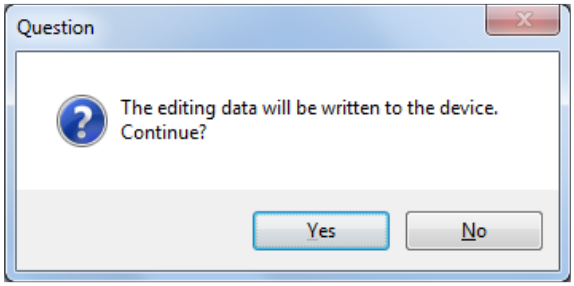


3. Select the file to read and click “Open.”

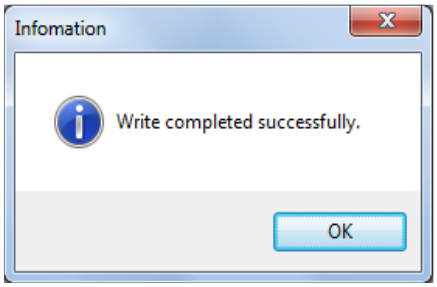


4. The read values are shown on the screen.

5. From PC-HMI -> Device in the upper right part of the main screen, click “Write.” The confirmation dialog appears.

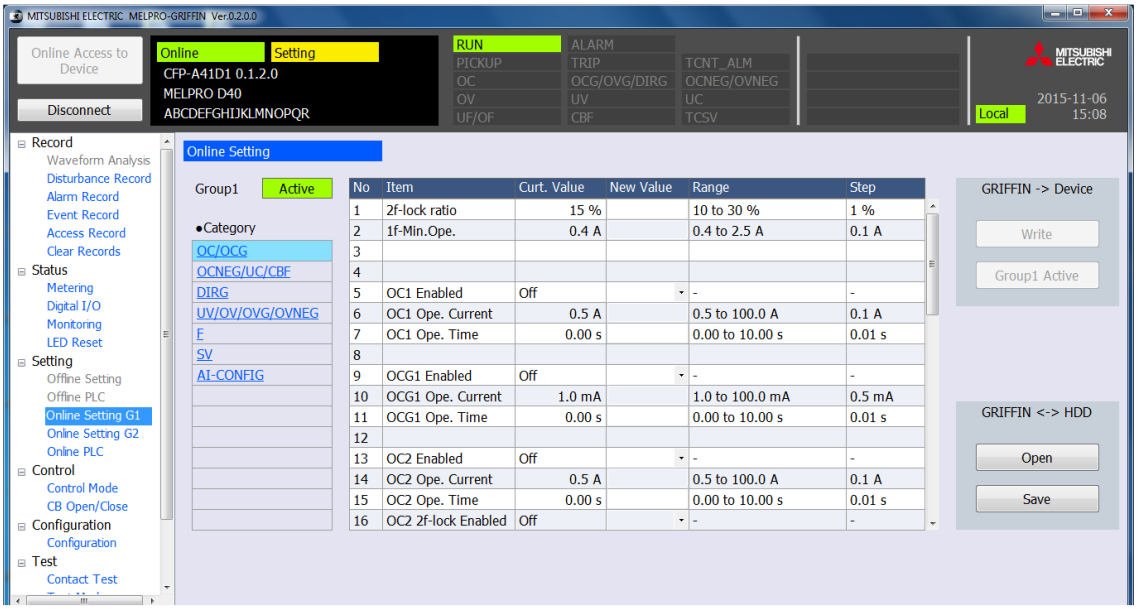


6. Click “Yes” to write the setting values to the device and activate them.

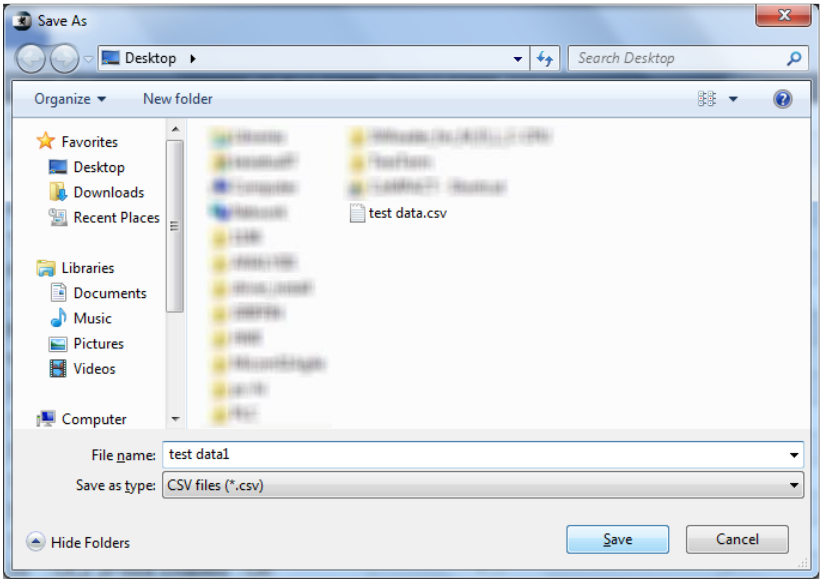


(To save setting value files)

1. From PC-HMI <-> HDD in the lower right part of the main screen, click “Save.”



2. Select the destination folder, enter a file name and click “Save.” The setting file is saved.

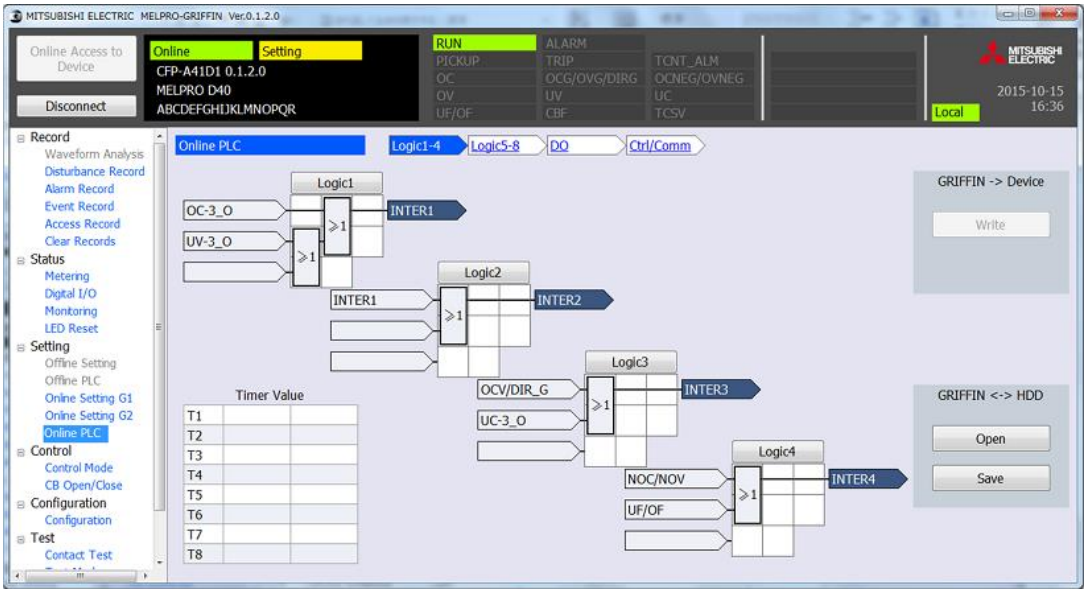


11.12.4. Online PLC

With MELPRO-D40, the PLC function allows the user to configure the sequence in the relay. It is customizable according to the system by assigning the user-configured sequence outputs to contacts, for example.

11.12.4.1. Configuring online PLC (logic circuit)

A sequence can be configured for eight outputs. These sequence outputs can be assigned as DO signals described later.

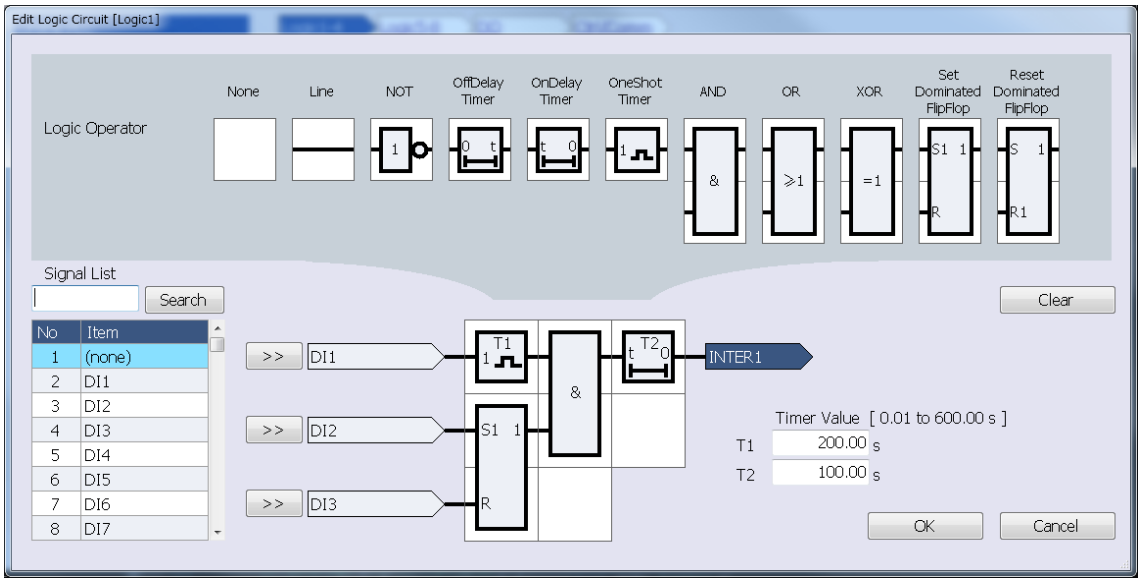


[Adding PLC configuration]

1. From the Function menu, click Online PLC.

2. Click the Logic group and Logic to edit.
   Logic1-4: indication and editing screen for logic circuits 1 to 4
   Logic5-8: indication and editing screen for logic circuits 5 to 8

3. The logic circuit editing screen as shown below appears. (The screen below shows a display example)

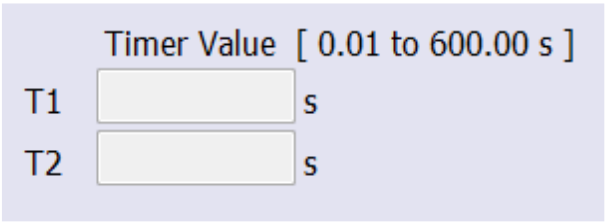


4. From the Item list on the screen above, select the signal to input and click. The selected signal is shown in light blue.
   Click “>>” to select the input signal.

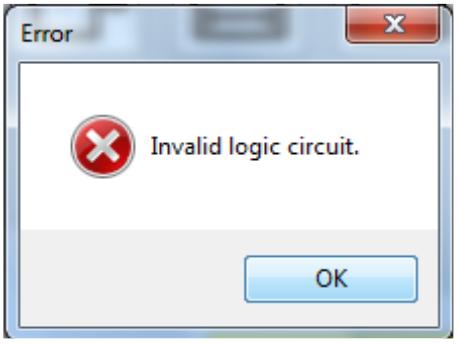
Note) The signal name can be searched by entering it on the Signal List by using the keyboard and clicking “Search.”

5. From the list of circuit components, select the logic component to place and click the logic area to place it. The logic component is placed. After the placement has been completed, click “OK” to go back to the previous screen.

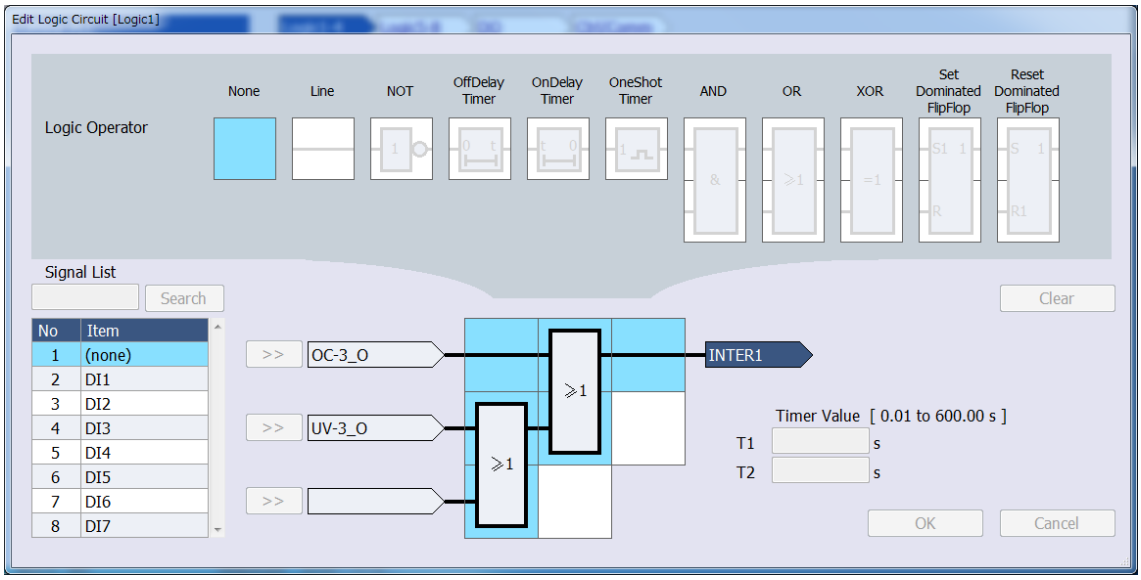
   When providing any timer component, specify the time in the Timer Value field.
   (Up to two timer components can be configured for each of Logics 1 to 8.)



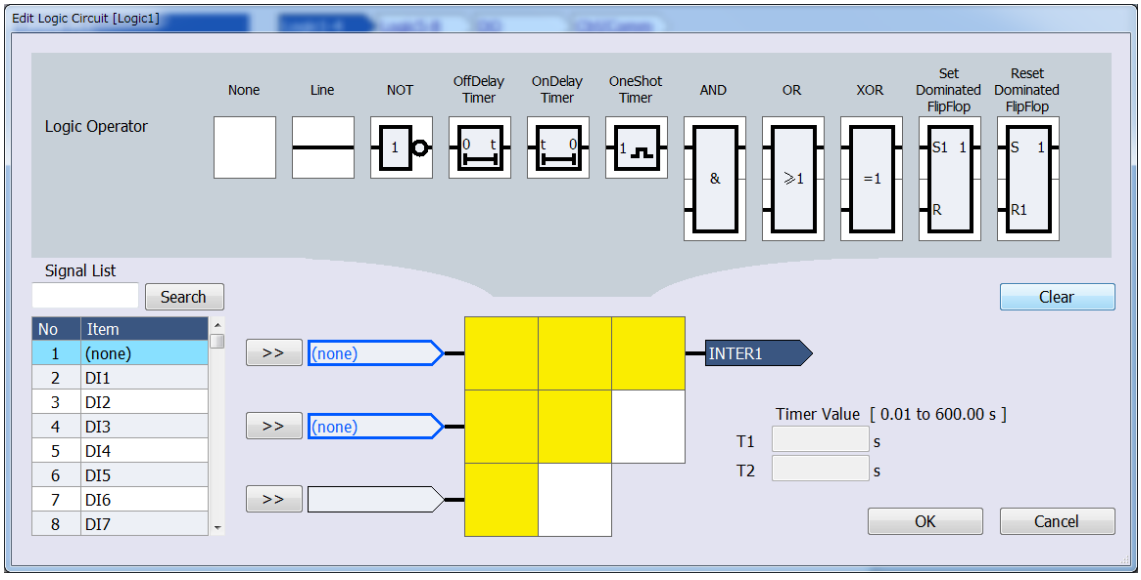
For logic components that can and cannot be placed, see 11.7.3.
Attempting to place a component in an area that does not allow placement, the error message as shown below appears.



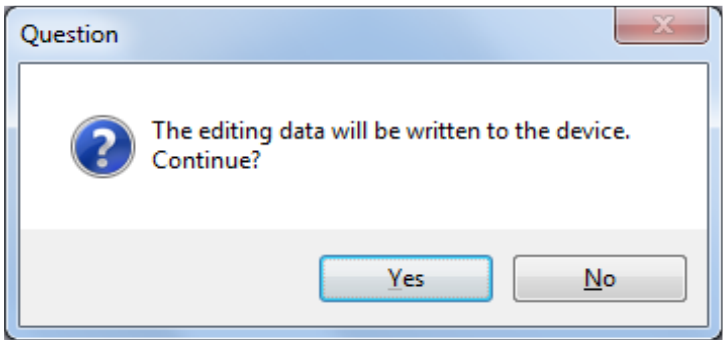
To remove any component that has been placed, select a None logic component and click the logic area
to remove the component from (shown in light blue).



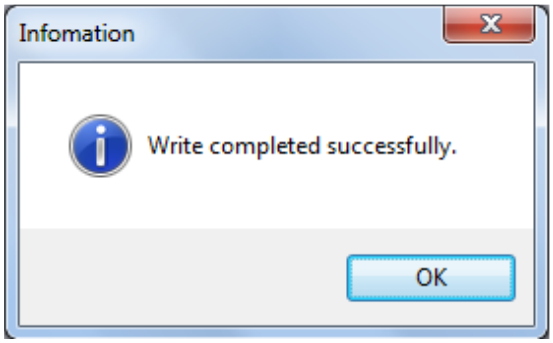
Clicking “Clear” brings back to the initial state with no input signal set, logic component placed or timer setting configured.



6. From PC-HMI -> Device in the upper right part of the main screen, click “Write.” The dialog to confirm writing to the device appears. Click “Yes” to write the setting to the device.



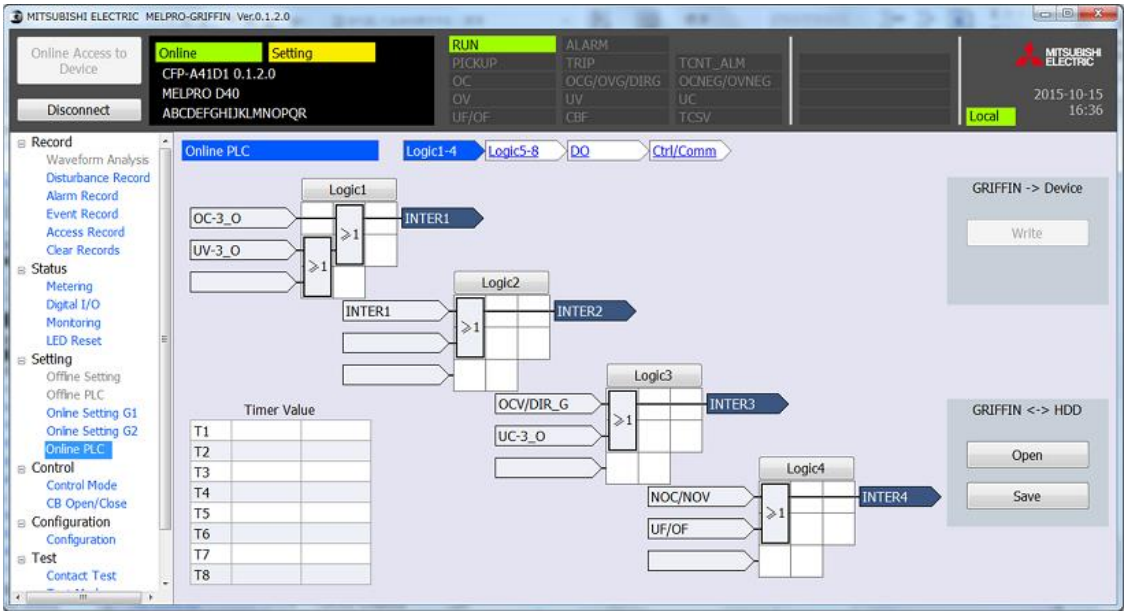
For successful writing, the dialog as shown below appears.



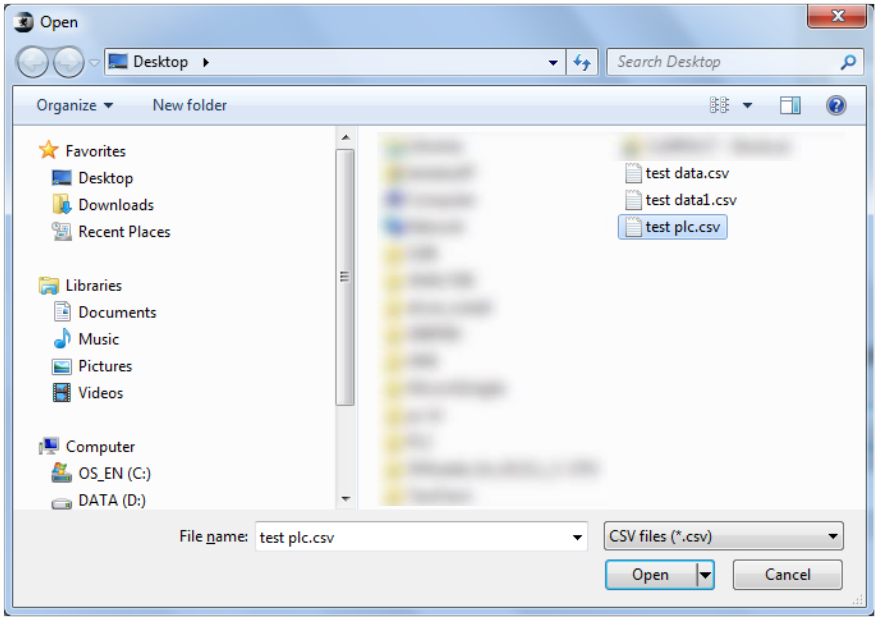
Note) For reading/writing PLC data from/to the PC, perform the following operations.

1) Reading PLC data saved in the PC

1. From PC-HMI <-> HDD in the lower right part of the main screen, click “Open.”



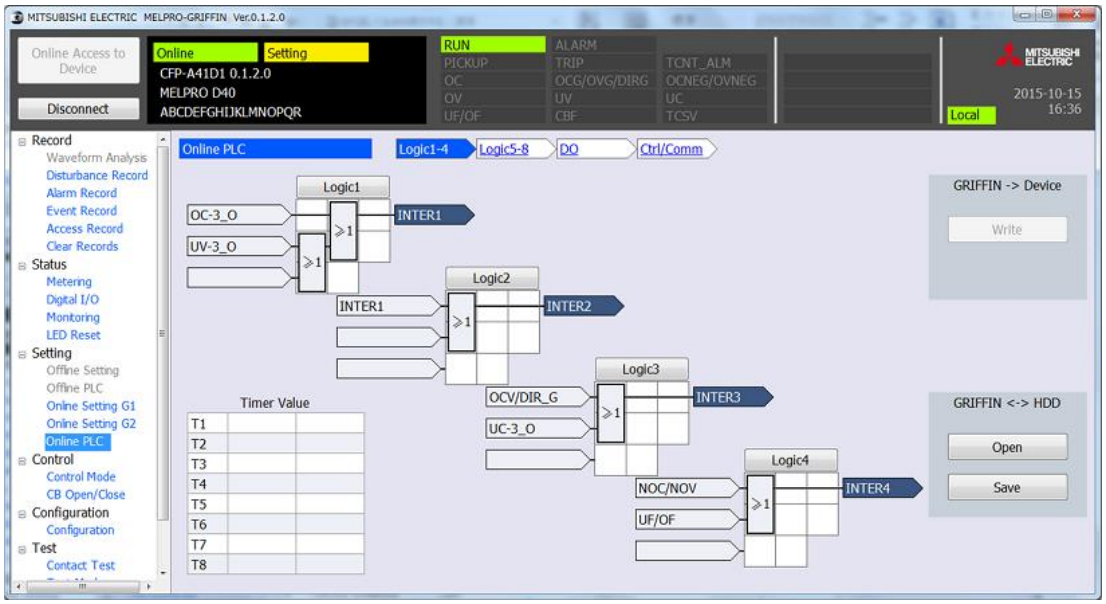
2. Select the folder and the file to read and click “Open.”



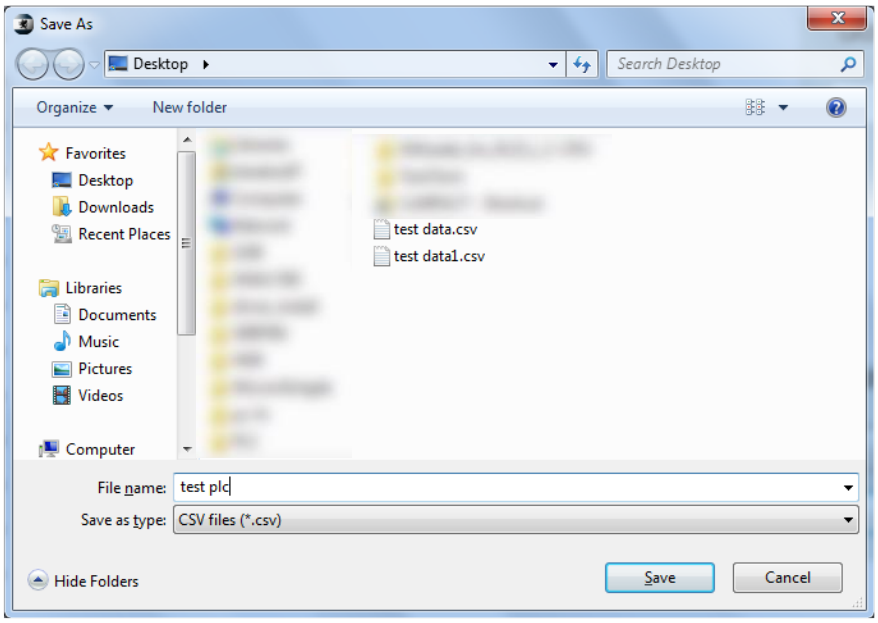
3. The specified PLC data are read to the device.

2) Saving the configured PLC data to the PC

1. From PC-HMI <-> HDD in the lower right part of the main screen, click “Save.”



2. Select the destination folder, enter a file name and click “Save.”

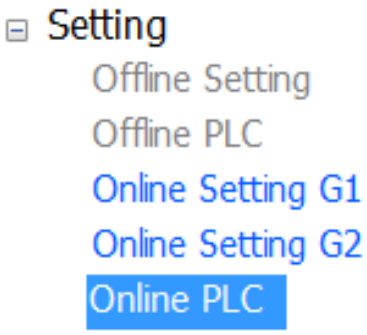


3. The configured PLC data are saved in the specified folder.

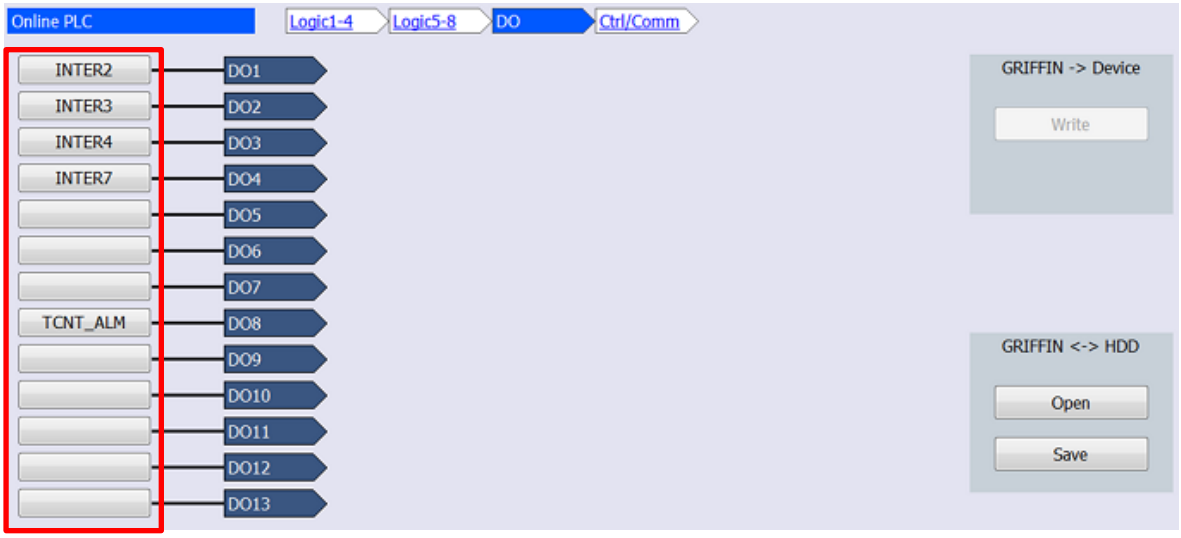
11.12.4.2. DO assignment

DO allows DO configuration of output assignments from the signal list.

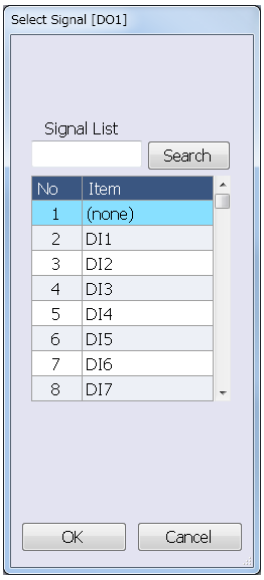
1. From the Function menu, click Online PLC.



2. Click DO. The DO assignment circuit indication and editing screen appears. Click the button in the red frame to assign input signals.



3. Click the input signal button. The signal selection dialog as shown below appears.
From the list, select the desired signal and click “OK.” (To search for a signal, enter the signal name in the
Signal List and click “Search.”)



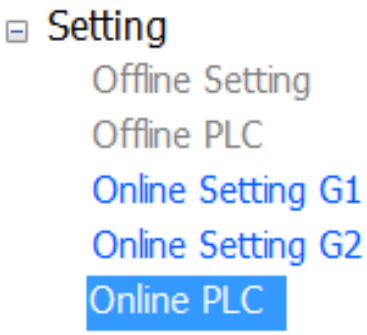
4. From PC-HMI -> Device, click “Write” to write the setting to the device.

Note) For saving/reading PLC data to/from the PC, perform the same operation as 11.12.4.1.

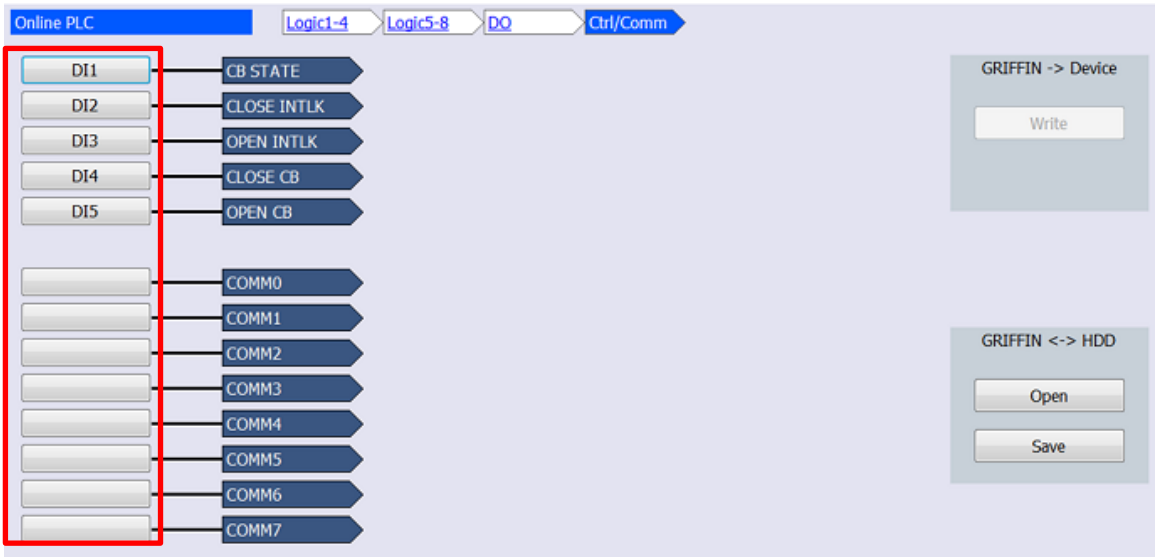
11.12.4.3. Assignment of CB control/communication output signals

Ctrl/Comm allows assignment of the CB control and communication output signals.
(COMM0 to COMM7 are used for assignment of communication outputs (IEC61850).)

1. From the Function menu, click Online PLC.



2. Click Ctrl/Comm. The CB control and communication output signal assignment circuit indication and editing screen appears. Click the button in the red frame to assign input signals.



3. Click the input signal button. The signal selection dialog for selecting a signal to assign appears. From the list, select the signal and click “OK” to assign the signal.
(To search for a signal, enter the signal name in the Signal List and click “Search.”)

   The signal selected from the list and clicked is shown in light blue. Click “OK” to select the signal as an output signal.

4. From PC-HMI -> Device, click “Write” to write the setting to the device.

Note) For saving/reading PLC data to/from the PC, perform the same operation as 11.12.4.1.

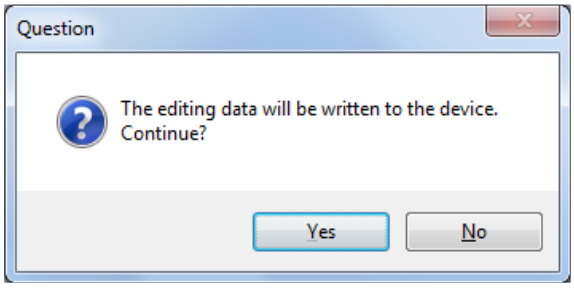
11.13. Control functions

11.13.1. Setting the CB control mode

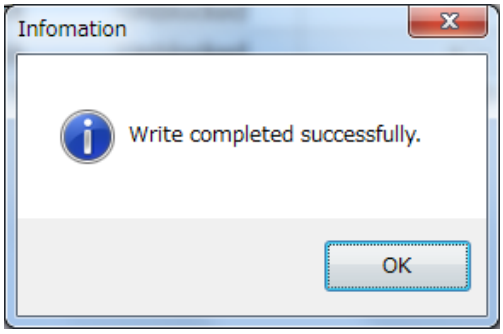
1. From the Function menu, select Control Mode.

2. The list of CB control mode items appears. Click New Value for the item to make a change.
   From the list, make a selection by clicking ▼.
   To enter a value, use the keyboard.

3. From PC-HMI -> Device, click “Write.” The write confirmation dialog appears. Click “Yes.”



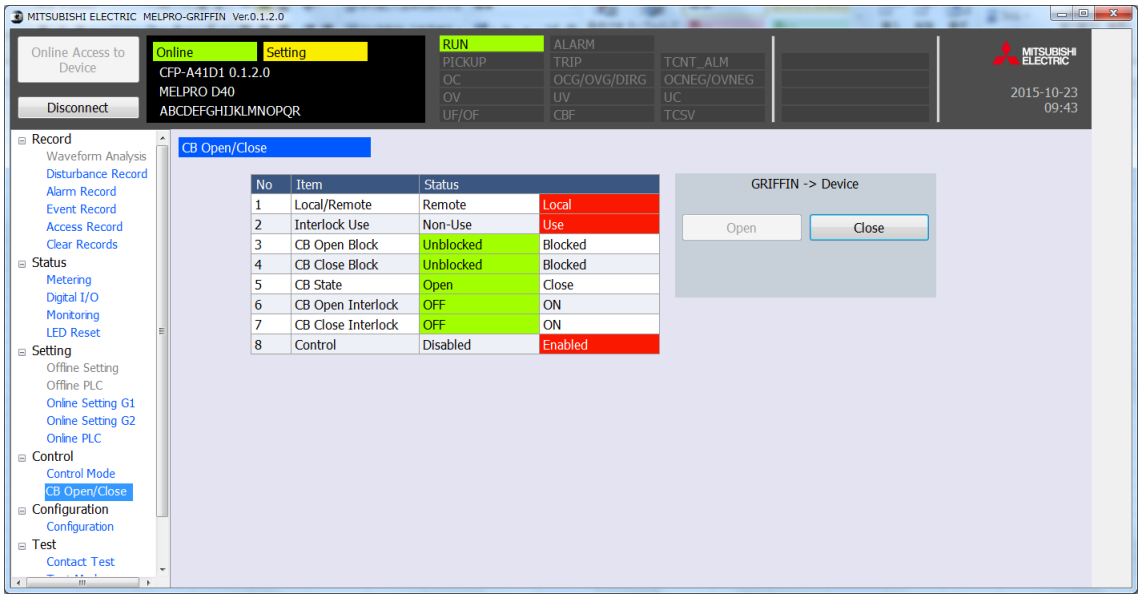
4. The new setting value is written to the device and the write completion message appears.



5. As shown below, the new value is set as the Curt. Value (current setting value).

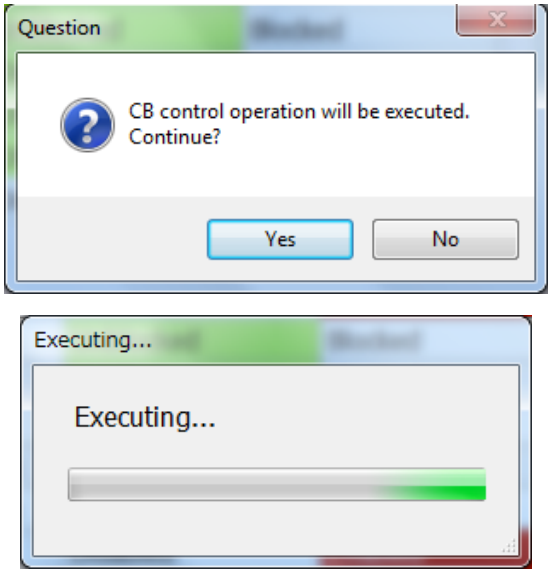
11.13.2. Executing CB control

1. From the Function menu, click CB Open/Close.
   CB control can be executed either as open control or close control and the button for the unavailable control operation is disabled.
   Neither of them may be available depending on the addition status of the respective items.

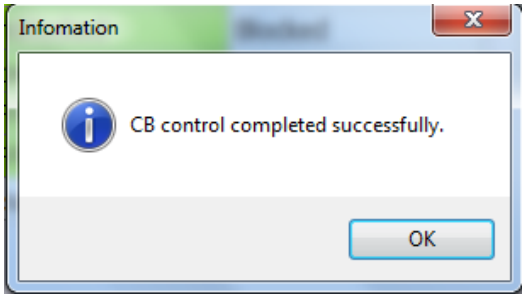


2. From PC-HMI -> Device, click “Open”/“Close.”

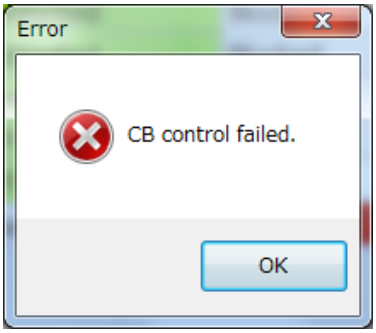
3. The dialog to confirm CB control execution appears. Click “Yes” to execute.



4. For successful CB control, the confirmation dialog as shown below appears.



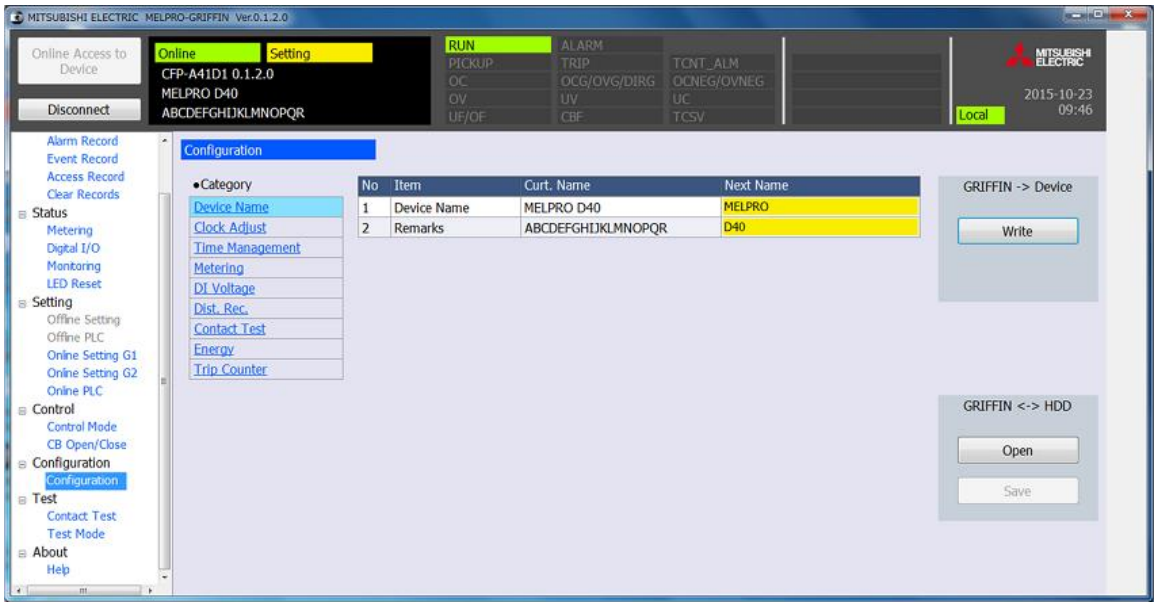
Note) If the selected control failed, the error message as shown below appears.



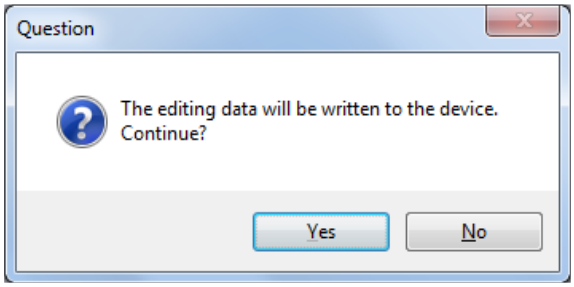
11.14. Device setting

11.14.1. Setting the device name

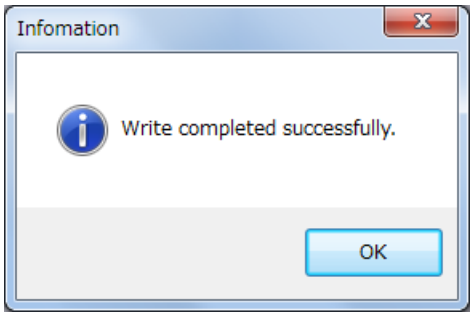
1. From the Function menu, click Configuration.
2. From Category, click Device Name.
3. Enter the new name to set in Next Name.



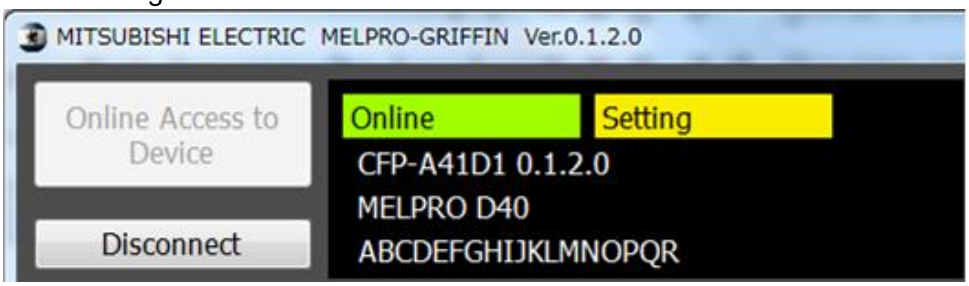
4. From PC-HMI -> Device, click “Write.” The confirmation dialog appears. Click “Yes.”



5. The setting is written to the device.



6. The indication is not updated when the setting has been written to the device.
   Click “Disconnect” to log off.

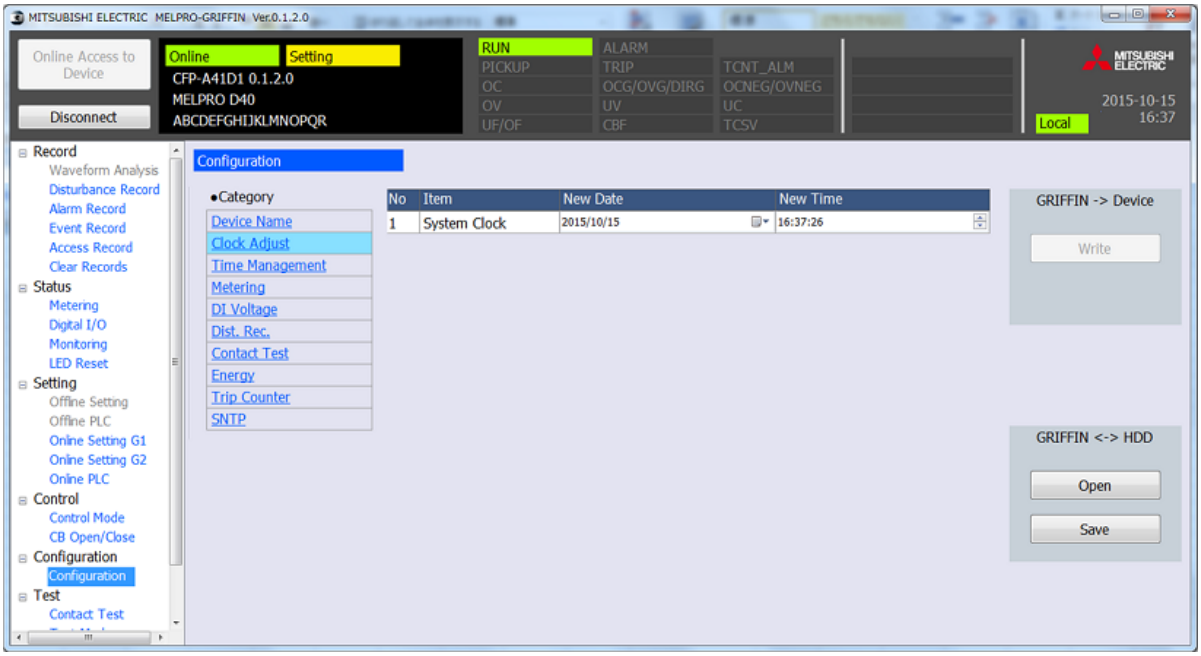


7. Click “Online Access to Device” to log in.
   (For the details about logging in, see 11.8.1.)

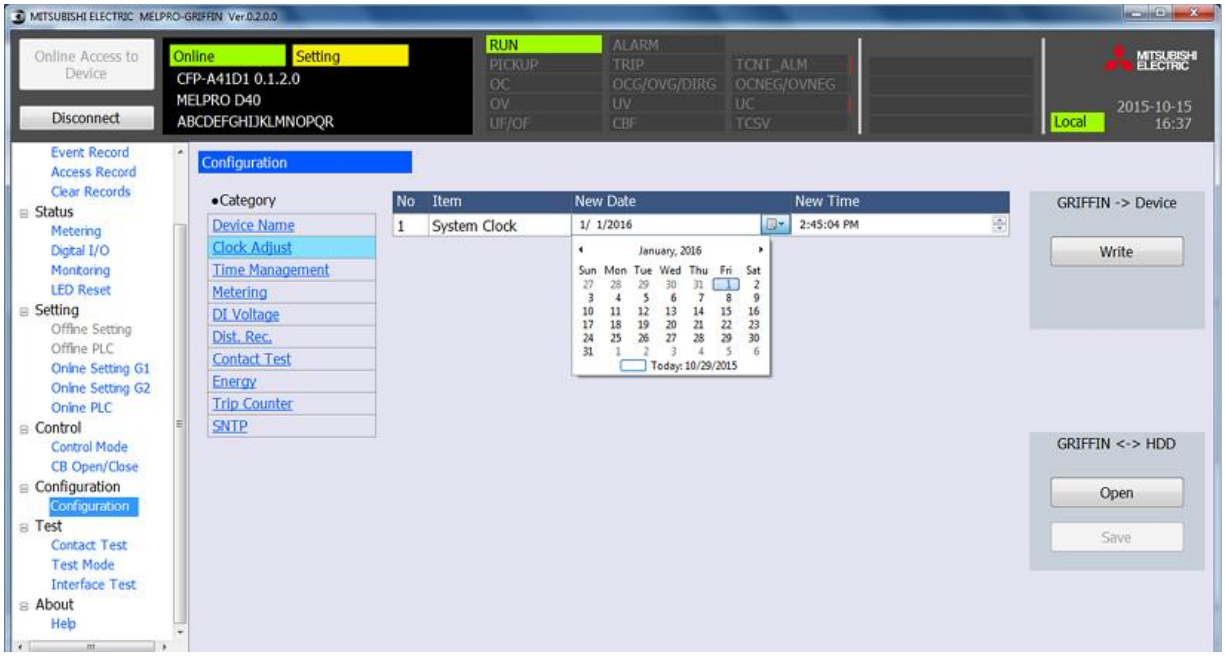
8. The device name indication is updated when the device has been logged in.

11.14.2. Clock Adjust setting

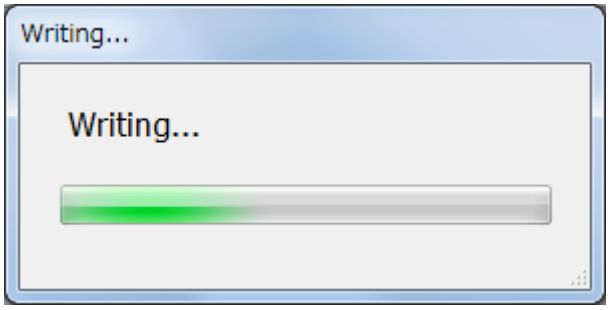
Clock Adjust allows setting of the date and time.



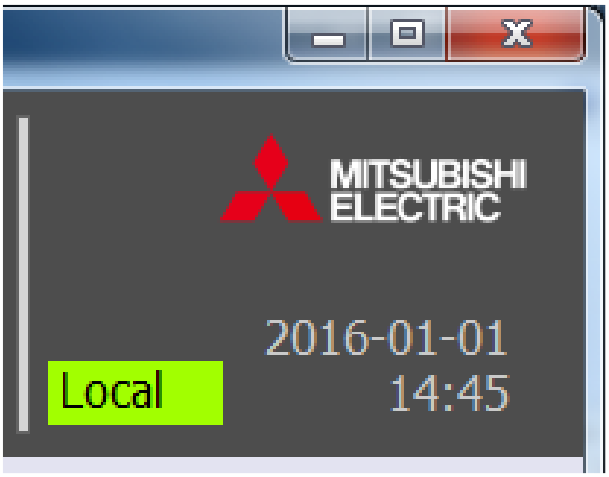
1. From the Function menu, click Configuration.
2. From Category, click Clock Adjust.
3. Select the date and/or time to adjust.
   New Date: year, month and date setting; New Time: hour, minute and second setting
   Use the mouse to bring the cursor to the setting to change and directly enter with the keyboard or click the button on the right side of the cell to adjust the date and time.



4. From PC-HMI -> Device, click “Write” to write the setting to the device.



5. When writing has been completed, the adjusted date and time take effect.



Note) The date and time setting is applied immediately.

11.14.3. Time Management setting

Time Management allows setting of the daylight saving time and time synchronization.

1. From the Function menu, click Configuration.
2. From Category, click Time Management.
3. Select the Next Value for the item to change.
   Select the item from the drop-down list.
   For an item that requires entry of a value, use the keyboard to enter directly.

Note) If any value out of the setting range is entered, an error message as shown below appears.
Click “OK” and reenter a value within the range.

4. From PC-HMI -> Device, click “Write” to write the setting to the device.

Note) To change a Time Management item, power cycling is required for updating with the new setting.

11.14.4. Metering setting

Metering allows setting of the primary and secondary values of the measurement indication.

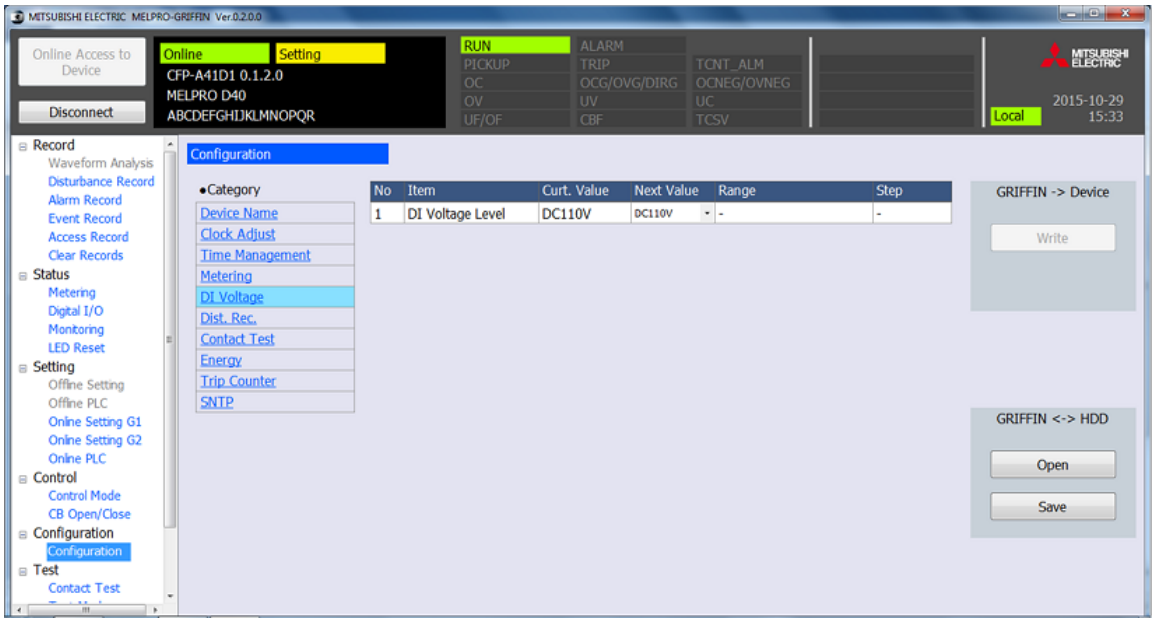
1. From the Function menu, click Configuration.
2. From Category, click Metering.
3. Select New Value for the item to change.
   Select the item from the drop-down list.
   For an item that requires entry of a value, use the keyboard to enter directly.

Note) If any value out of the setting range is entered, an error message as shown below appears.
Click “OK” and reenter a value within the range.

4. From PC-HMI -> Device, click “Write” to write the setting to the device.

11.14.5. DI Voltage setting

DI Voltage allows setting of the voltage level to detect with DI.

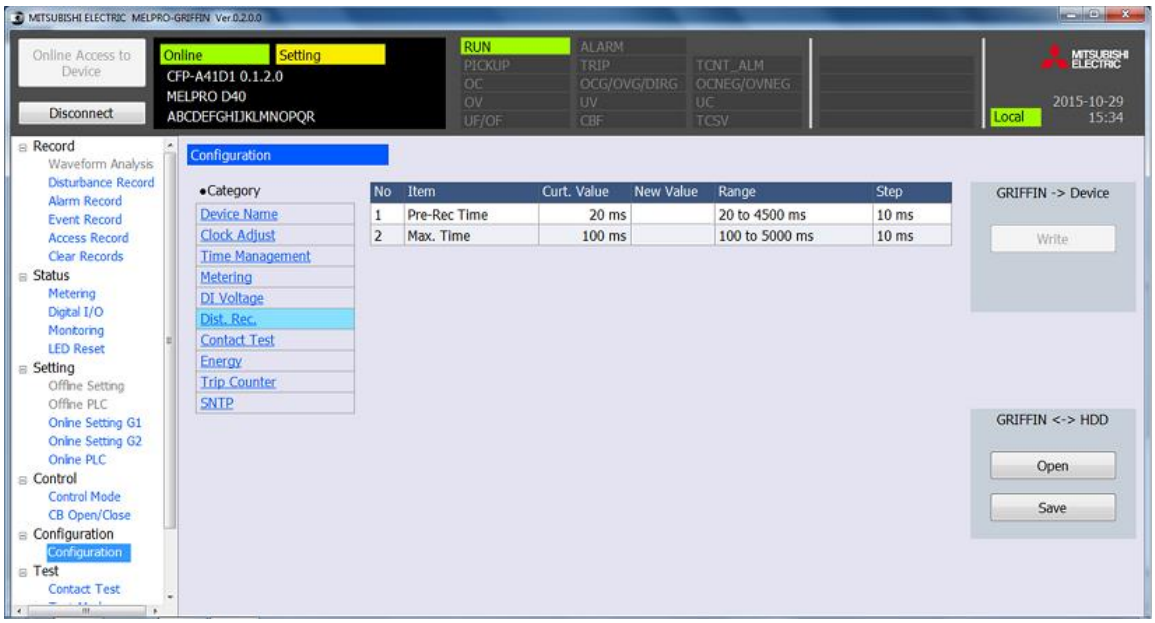


1. From the Function menu, click Configuration.
2. From Category, click DI Voltage.
3. Select a Next Value item.
   Select the value to set from the drop-down list.
4. From PC-HMI -> Device, click “Write” to write the setting to the device.

Note) To change a DI detection voltage item, power cycling is required for updating with the new setting.

11.14.6. Configuring the disturbance record

Dist. Rec. allows setting of the time before relay operation of the waveform record and the maximum time of one phenomenon.



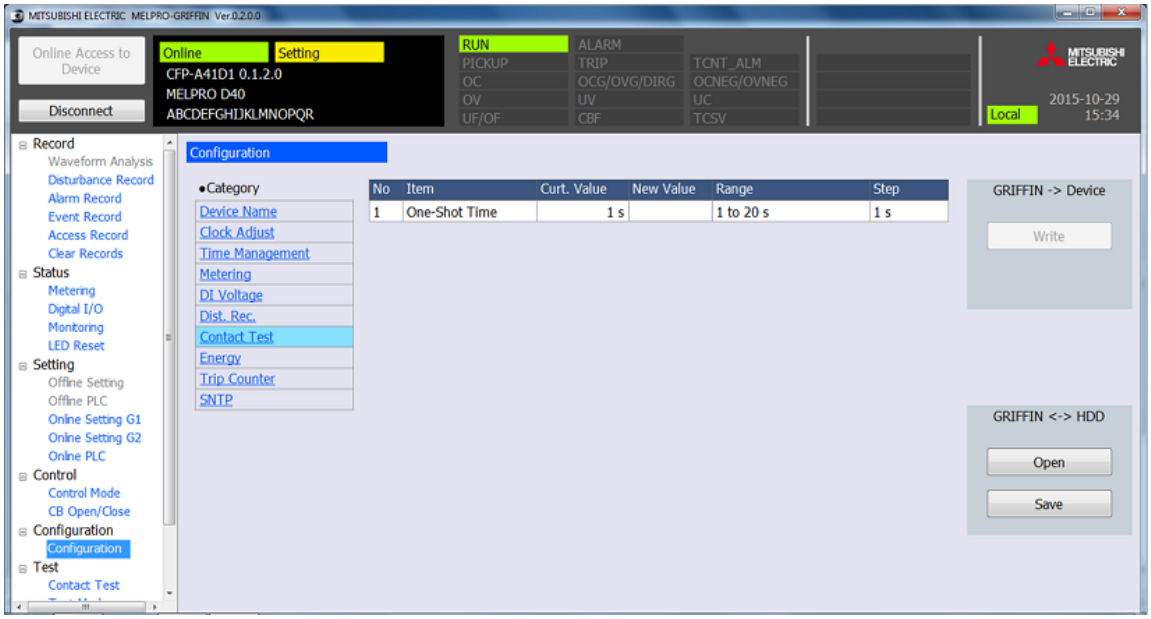
1. From the Function menu, click Configuration.
2. From Category, click Dist. Rec.
3. Select New Value for the item to change.
   For an item that requires entry of a value, use the keyboard to enter directly.

Note) If any value out of the setting range is entered, an error message as shown below appears.
Click “OK” and reenter a value within the range.

4. From PC-HMI -> Device, click “Write” to write the setting to the device.

11.14.7. DO Contact Test setting

Contact Test allows setting of the output time of a contact test.



1. From the Function menu, click Configuration.
2. From Category, click Contact Test.
3. Select a New Value item.
   Use the keyboard to directly enter the value to change.

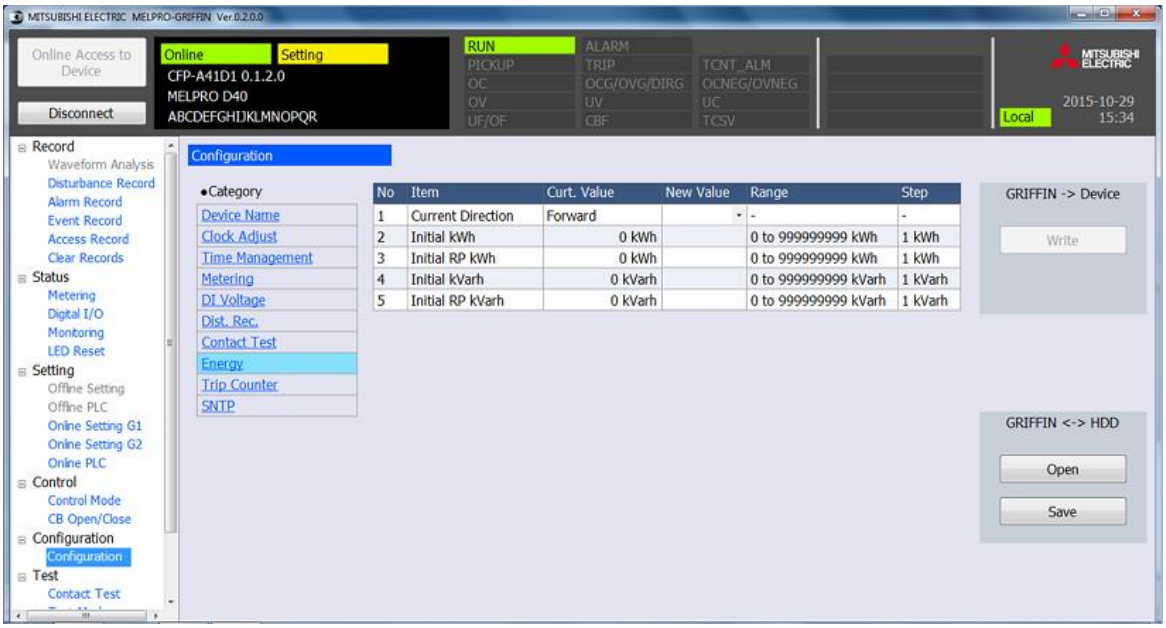
Note) If any value out of the setting range is entered, an error message as shown below appears.
Click “OK” and reenter a value within the range.

4. From PC-HMI -> Device, click “Write” to write the setting to the device.

Note) The One Shot value set is the operating time for DO contact test in 11.15.1.

11.14.8. Electric Energy setting

Energy allows setting of the power flow direction and the initial values of electric energy, reverse electric energy, reactive electric energy and reverse reactive power.



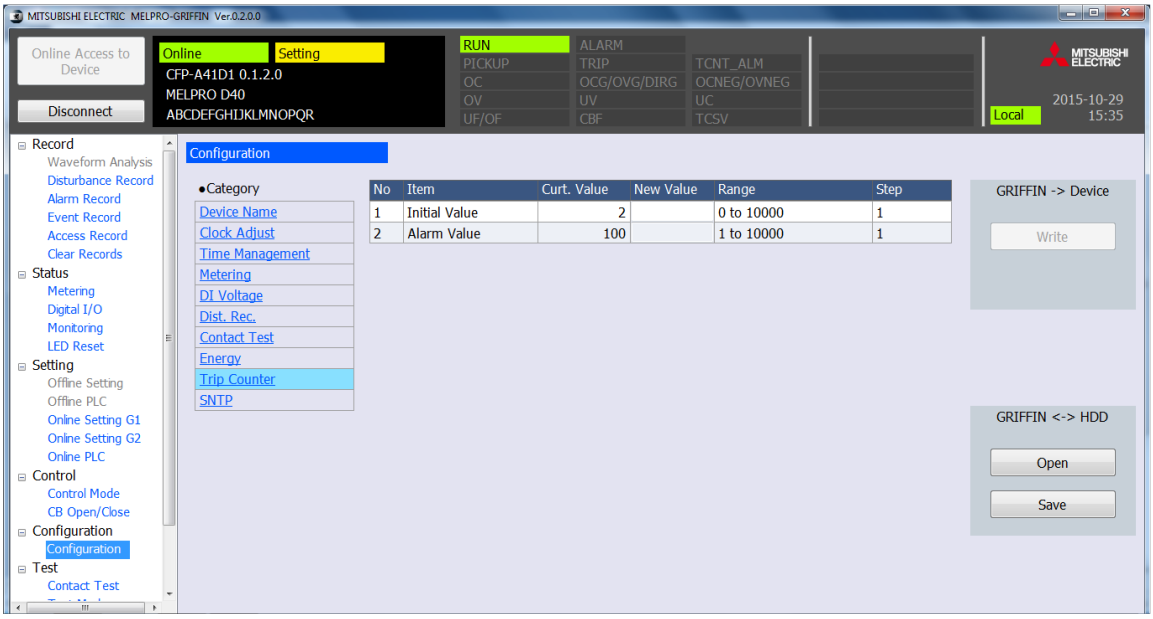
1. From the Function menu, click Configuration.
2. From Category, click Energy.
3. Select New Value for the item to change.
   Select the item from the drop-down list.
   For an item that requires entry of a value, use the keyboard to enter directly.

Note) If any value out of the setting range is entered, an error message as shown below appears.
Click “OK” and reenter a value within the range.

4. From PC-HMI -> Device, click “Write” to write the setting to the device.

11.14.9. Trip Counter setting

Trip Counter allows setting of the trip count initial value and alarm value.



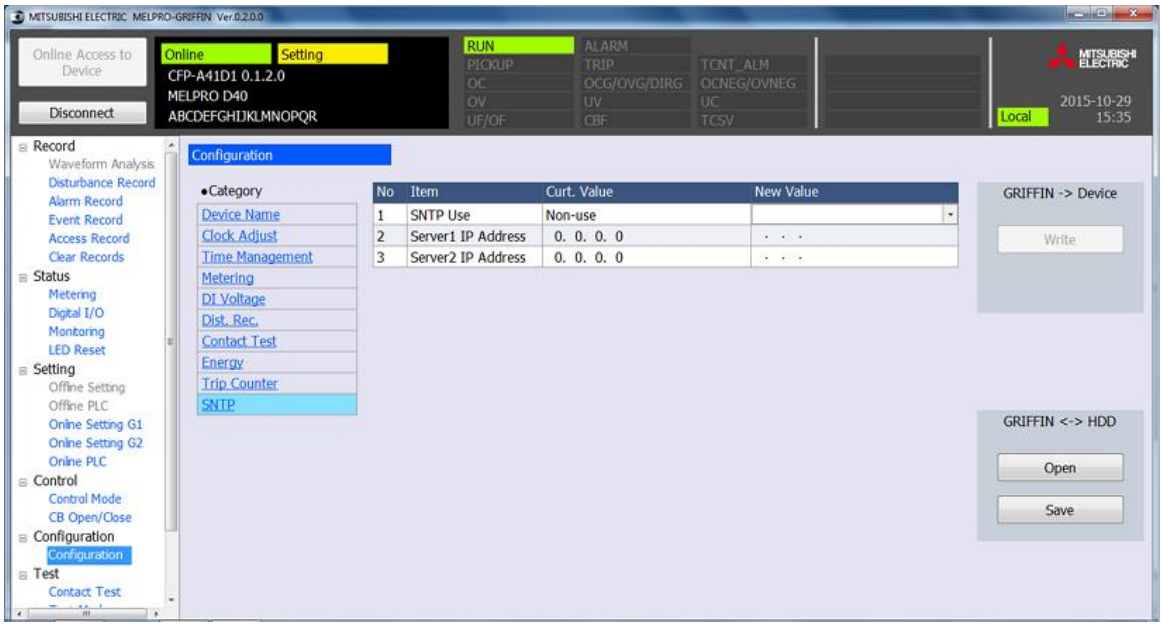
1. From the Function menu, click Configuration.
2. From Category, click Trip Counter.
3. Select New Value for the item to change.
   For an item that requires entry of a value, use the keyboard to enter directly.

Note) If any value out of the setting range is entered, an error message as shown below appears.
Click “OK” and reenter a value within the range.

4. From PC-HMI -> Device, click “Write” to write the setting to the device.

11.14.10. SNTP setting

SNTP allows setting of SNTP use/unuse and server IP address.



1. From the Function menu, click Configuration.
2. From Category, click SNTP.
3. Select New Value for the item to change.
   For an item that requires entry of a value, use the keyboard to enter directly.

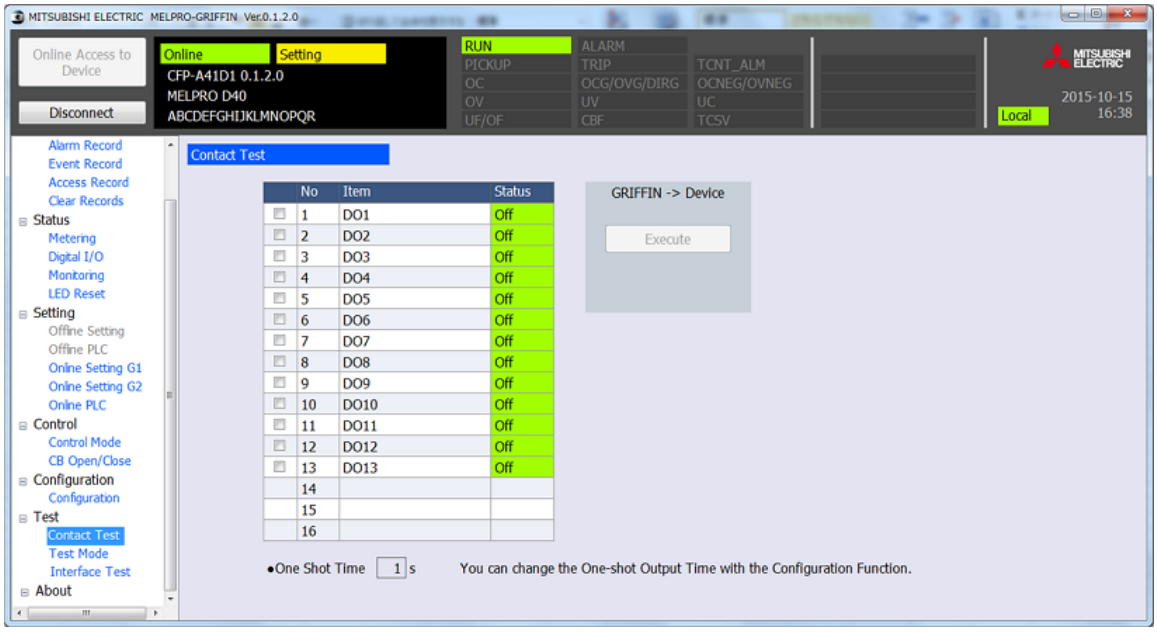
Note) If any value out of the setting range is entered, an error message as shown below appears.
Click “OK” and reenter a value within the range.

4. From PC-HMI -> Device, click “Write” to write the setting to the device.

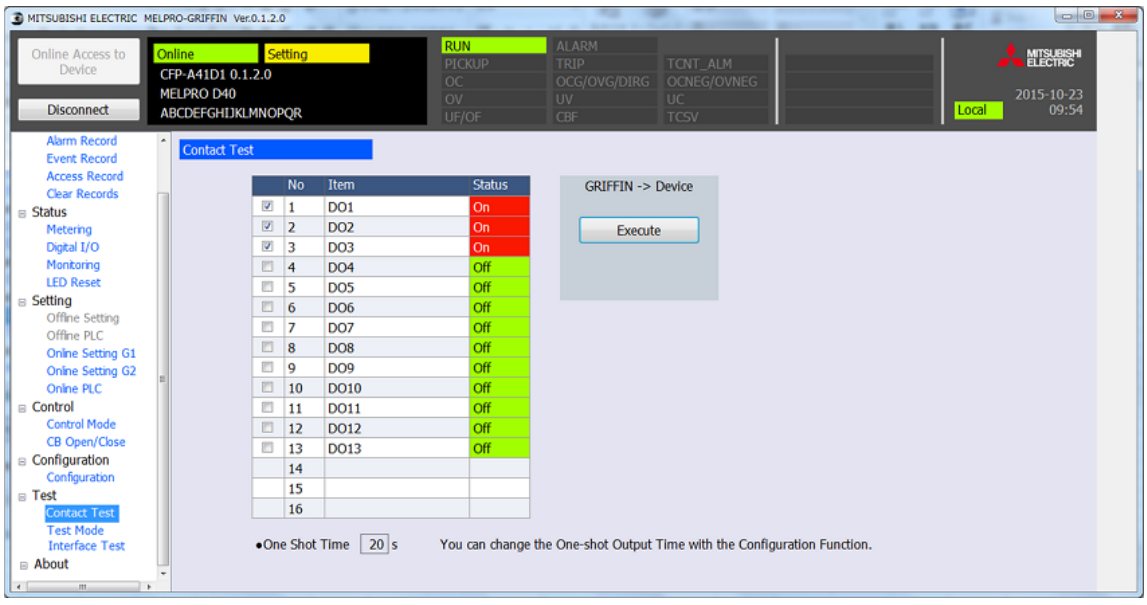
11.15. Test functions

11.15.1. DO Contact Test

Contact Test forces activation of the relay output contact.

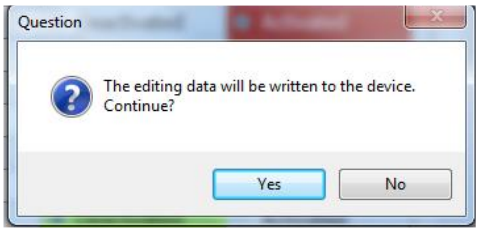


1. From the Function menu, click Contact Test.
2. Click the check box on the left of the item to conduct the DO contact test.
   (The Status of the checked item changes from Off to On.)

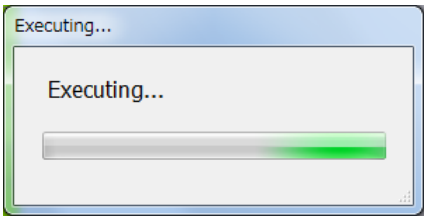


Note) To change the operating time for the contact test, change One Shot Time in 11.14.7.

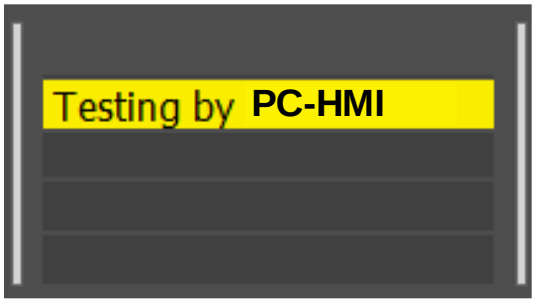
3. From PC-HMI -> Device, click “Execute.” The dialog to confirm execution appears. Click “Yes” to execute.



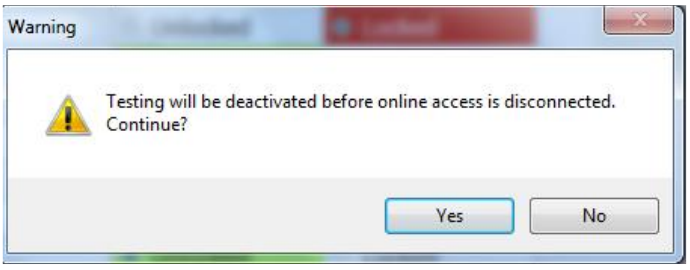
4. The execution dialog as shown below appears and the contact test for the specified DO item is executed.



5. During execution, the Testing indication is given in the status area.



Note) If disconnection or PC-HMI termination is attempted during a contact test, the message to confirm contact test cancellation appears.

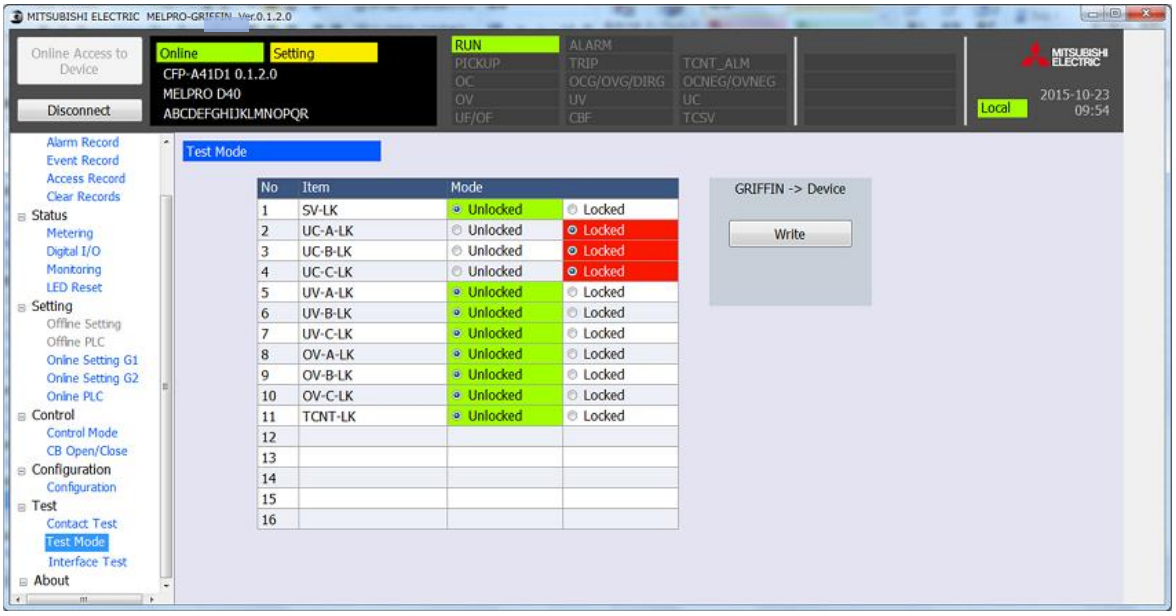


11.15.2. Test Mode

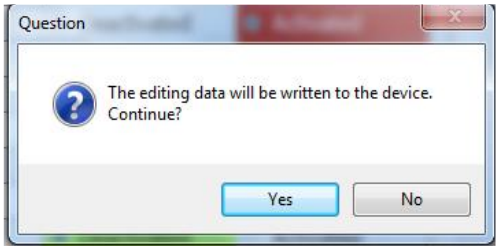
Test Mode allows setting of the temporary test mode for the relay.

1. From the Function menu, click Test Mode.

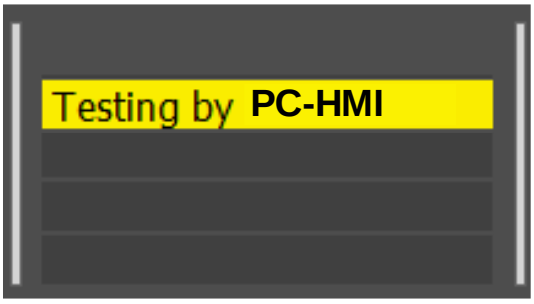
2. Select the mode for each item.
   Unlocked : Test mode disabled
   Locked : Test mode enabled



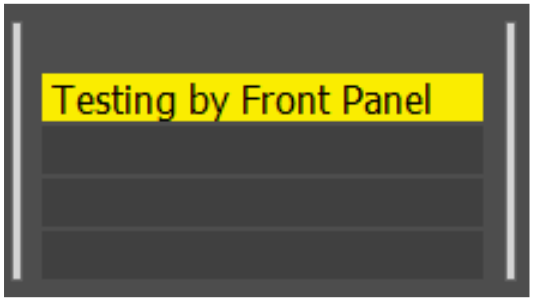
3. From PC-HMI -> Device, click “Write.” The dialog to confirm writing the data to the device appears. Click “Yes” to execute.



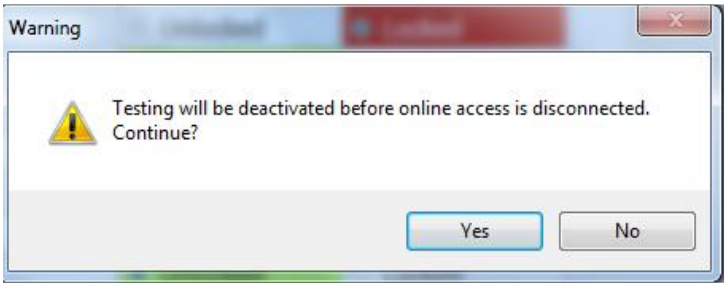
4. During the test, the “Testing by PC-HMI” indication is given in the status area.



Note) During a test from the front panel, the “Testing by Front Panel” indication is given.



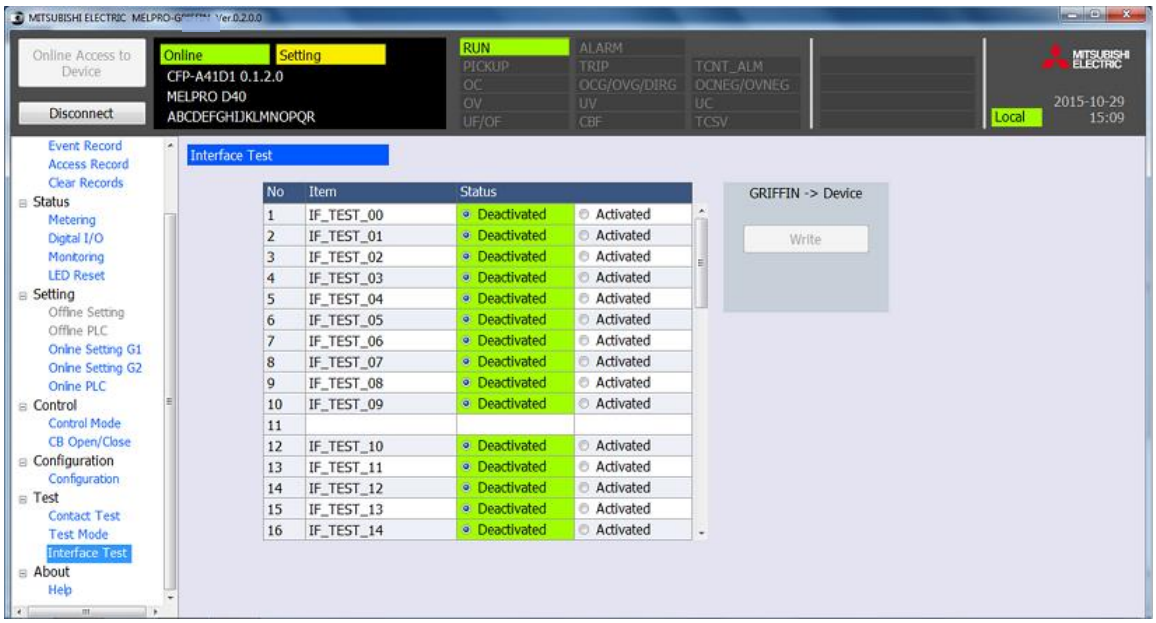
Note) If disconnection or PC-HMI termination is attempted during a contact test, the message to confirm contact test cancellation appears.



11.15.3. Relay Interface Test

Interface Test allows simulated testing of relay operation without inputting any voltage or current.

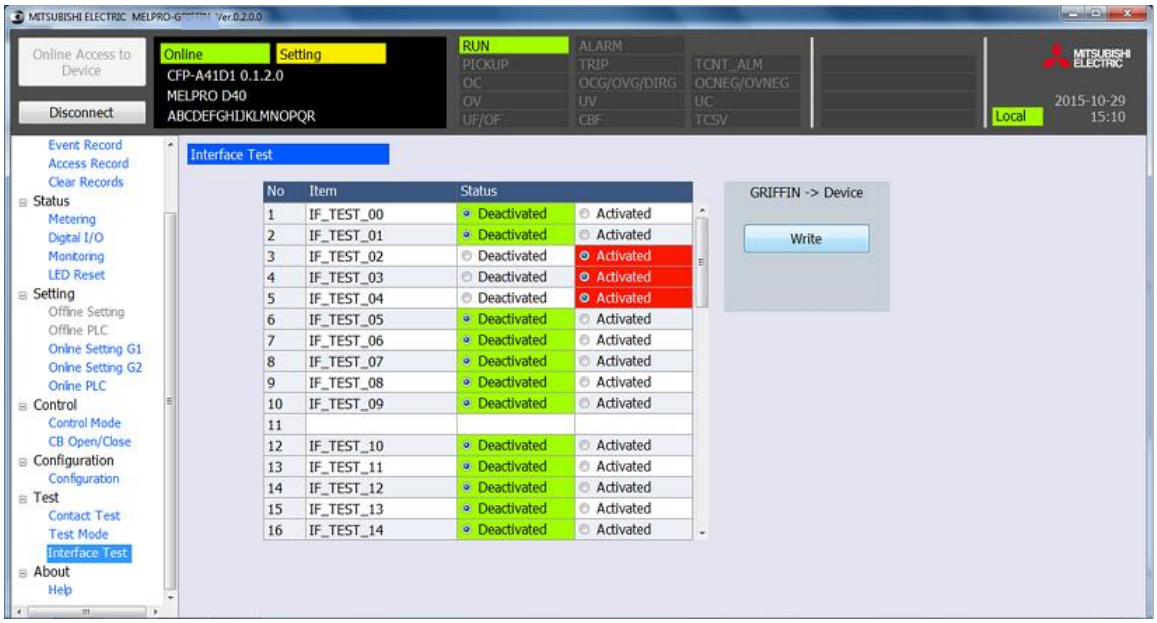
1. From the Function menu, click Interface Test.



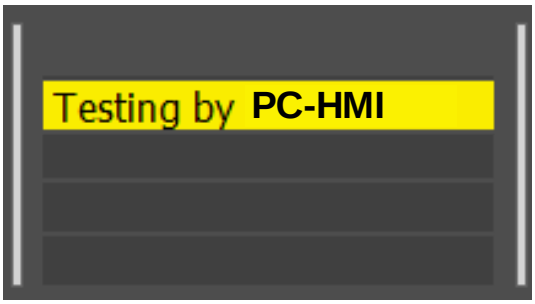
2 . Select the status for each item.

Deactivated : Disables the test.

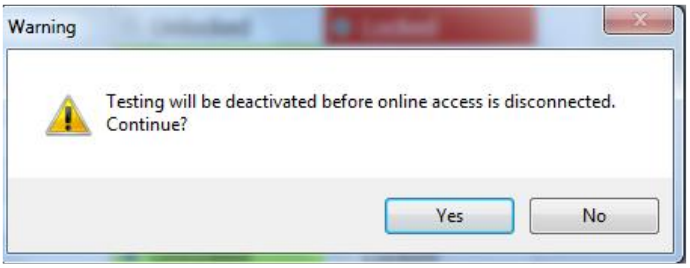
Activated : Enables the test.



3. From PC-HMI -> Device, click “Write” to write the setting to the device.
During the test, the “Testing by PC-HMI” indication is given in the status area.



Note) If disconnection or PC-HMI termination is attempted during an interface test, the message to confirm interface test cancellation appears. The relay interface test is automatically canceled when 30 minutes have elapsed.



11.16. Showing the PC-HMI operation manual

1. From the menu screen, click Help.
2. Acrobat Reader is launched and the PC-HMI operation manual is shown as a pdf file.

Note) If Acrobat Reader is not installed on the PC, an error message appears.

12. Waveform Analysis

12.1. Introduction

Waveform Analysis tool in PC-HMI is provided, which enables the waveform data, the internal signal conditions, the digital inputs, the digital outputs etc.

The details of PC-HMI are described in PC-HMI instruction manual (JEPF-IL9504).