MITSUBISHI ELECTRIC

Numerical Protection Relay

MELPRO™-D Series

MOTOR PROTECTION RELAY

MODEL

CMP1-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 vapor, 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 mal-operation.
- 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 mal-operation.
- 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 mal-operation.
- All power supplies to the equipment must be of suitable capacity and rated load to avoid the risk of malfunction and mal-operation.
- 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 mal-operation.
- 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 mal-operation.

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 × 103 Pa
・Mounting angle	Regular direction ±2°
・Frequency	Rated frequency ±1%
・Waveform (in the case of AC)	Distortion factor 2% or less 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 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 energized. 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

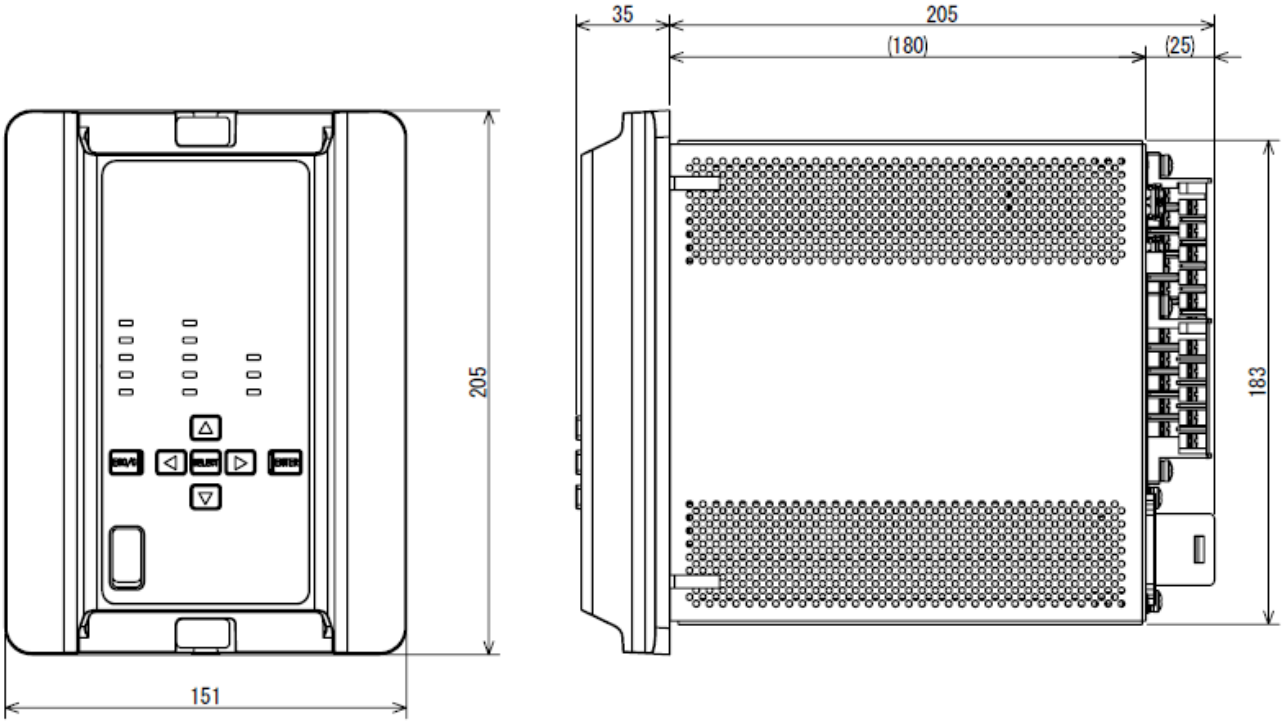


Fig. 1-1 Dimensions of relay

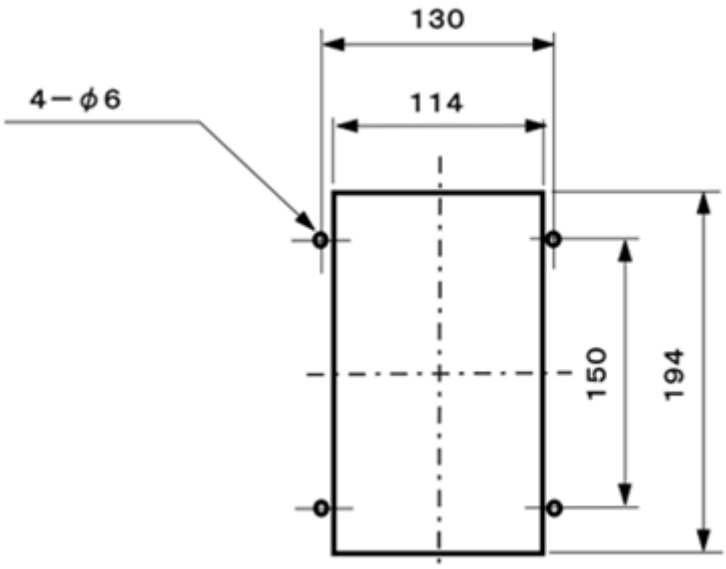


Fig. 1-2 Cut Out dimensions of panel

1.2. Front view of relay

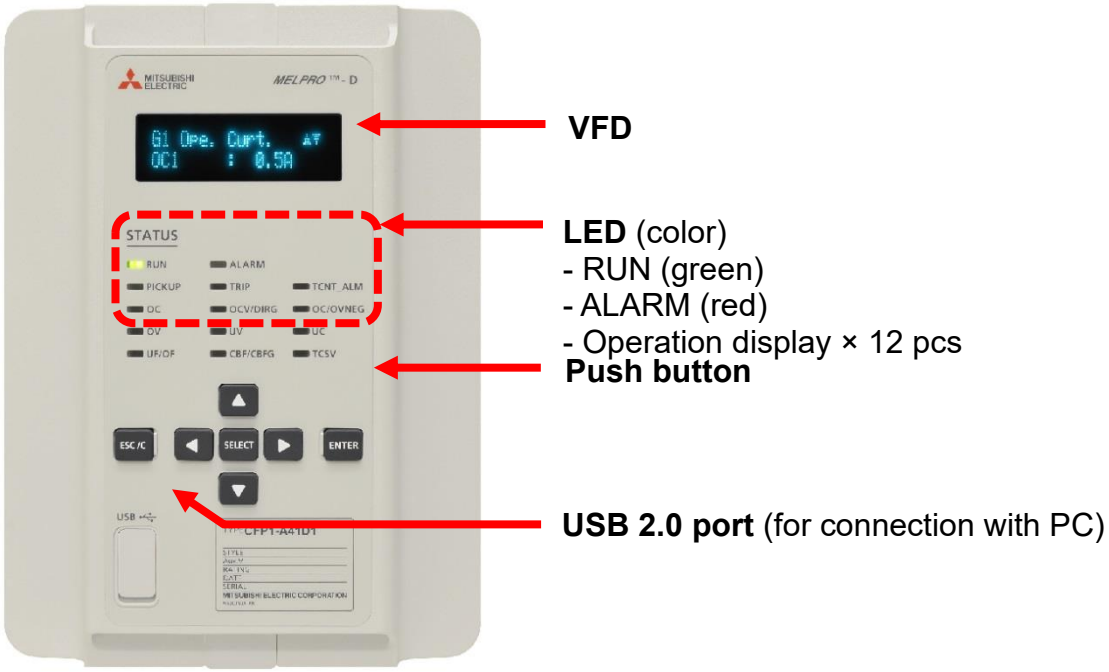


Fig. 1-3 Front view of relay

1.3. Terminal layout on the back plane of relay

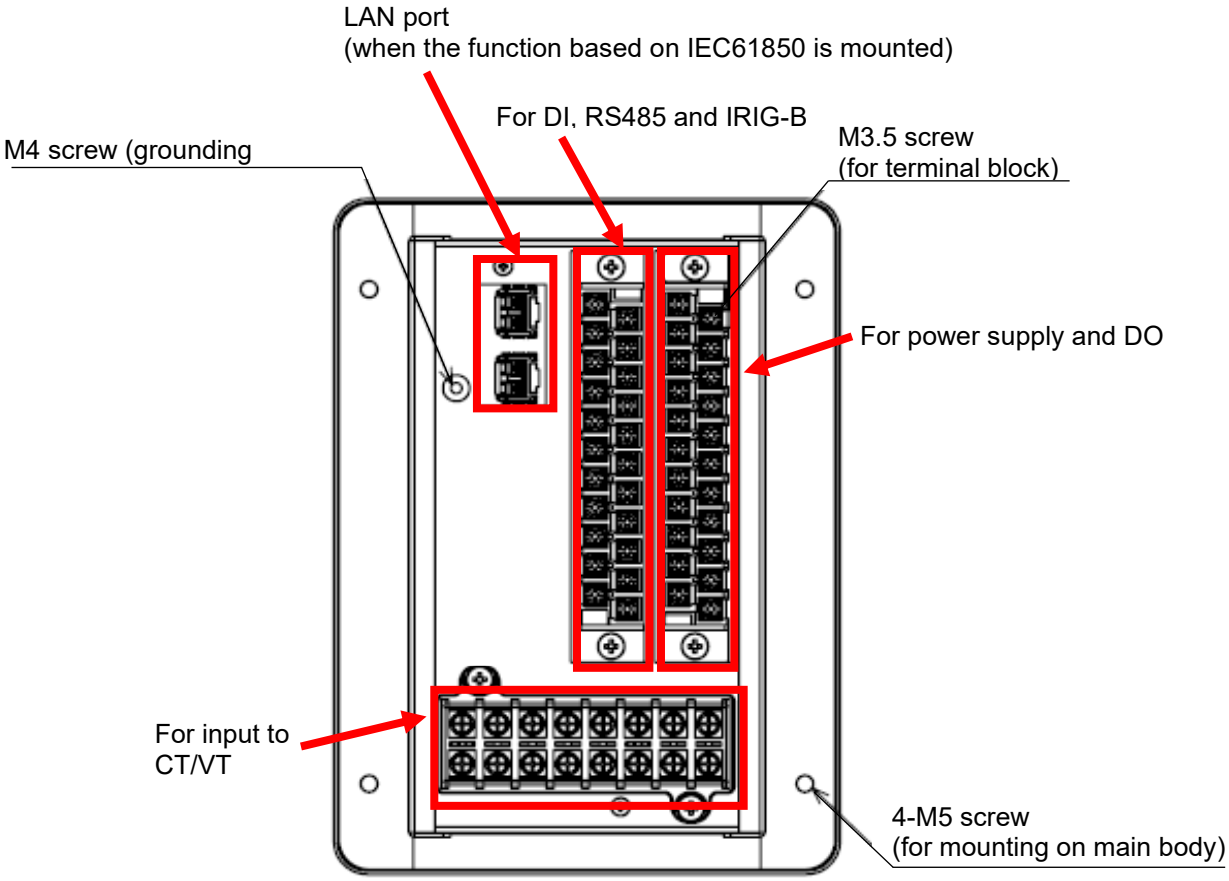


Fig. 1-4 Terminal layout on the back plane of relay

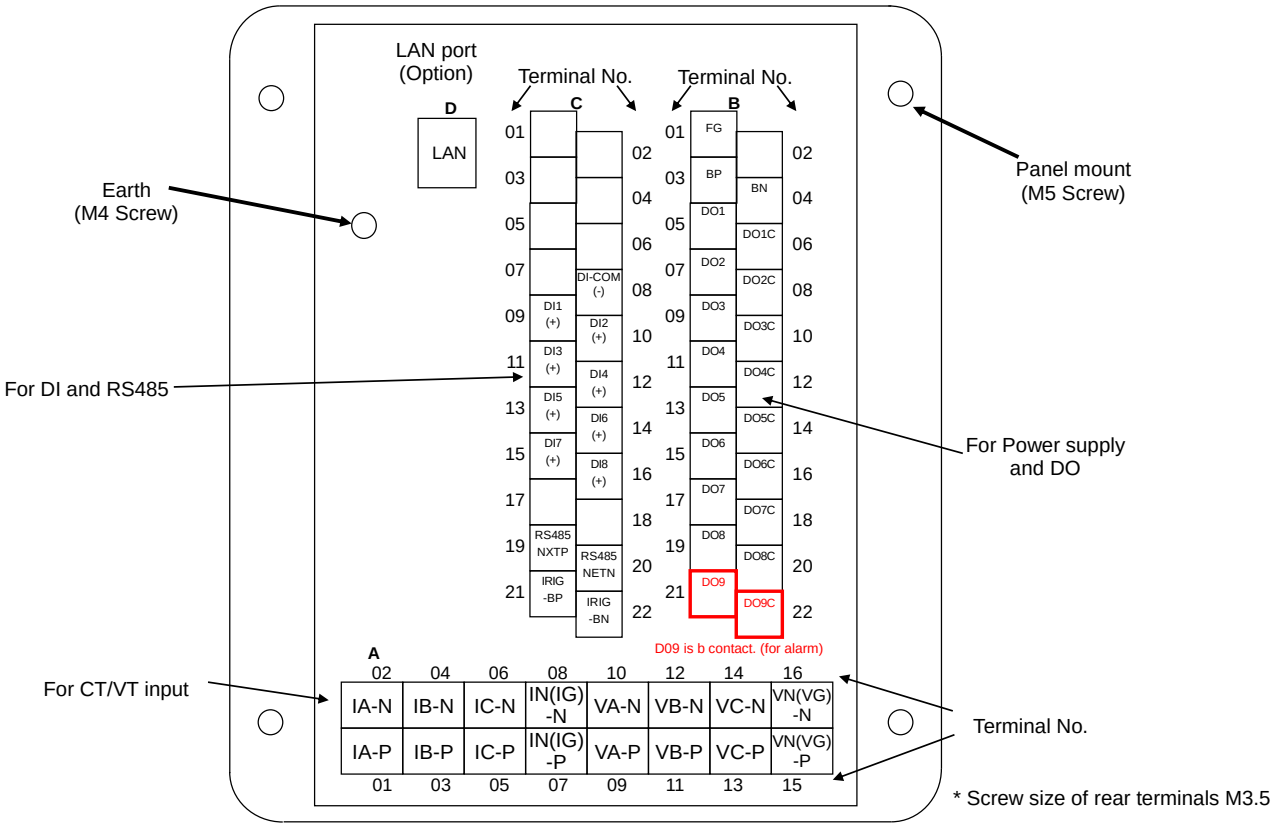


Fig. 1-5 Terminal number on the back plane of relay

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.

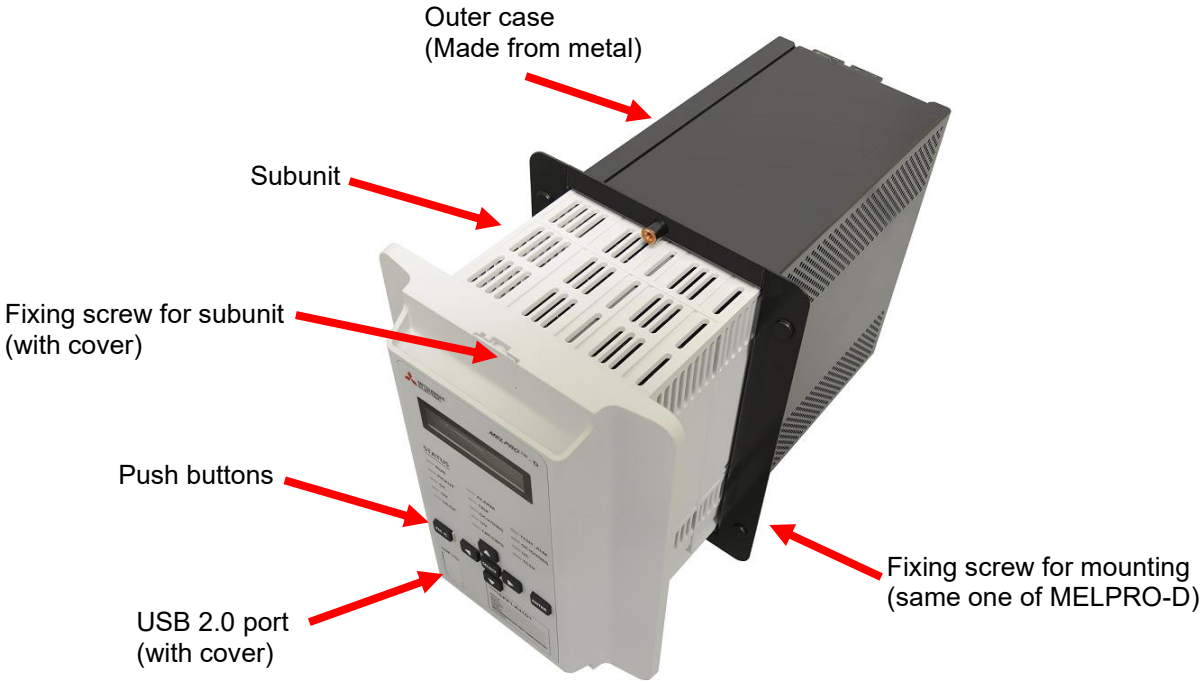


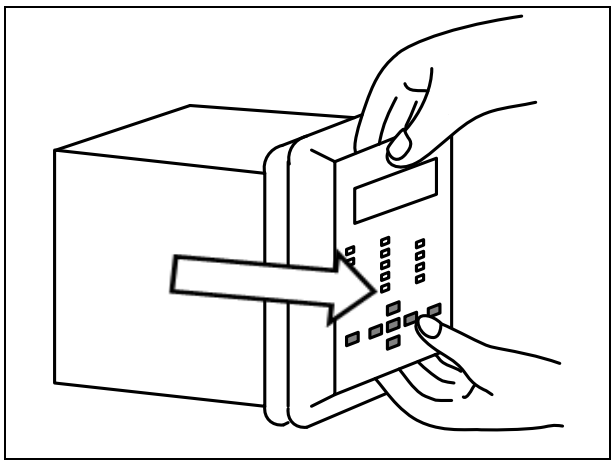
Fig. 1-6 External view of relay

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.

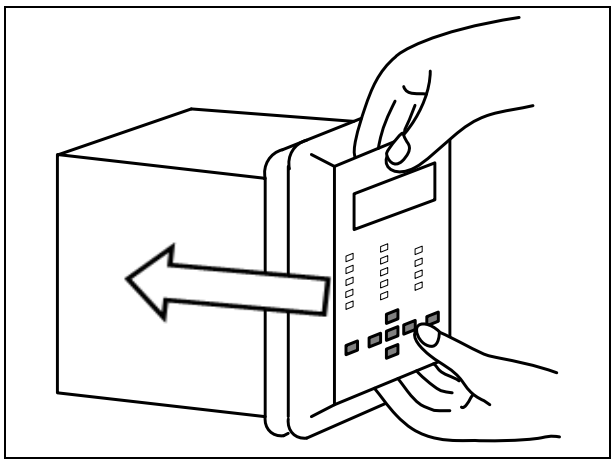
(2) Draw out the subunit



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

1.4.2. Procedures for insert the subunit

(1) Insert the subunit



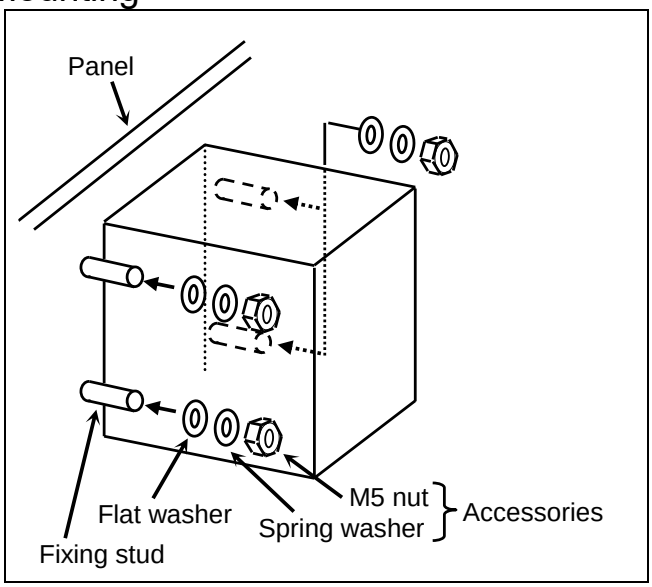
To insert the subunit into the case, using fingers on the upper & lower grooves of it.

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 motor 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.
  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 Rating

Item			Contents
Rating	Current		5A type
	Zero-sequence current		200 mA type (ZCT) 5A type (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: 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

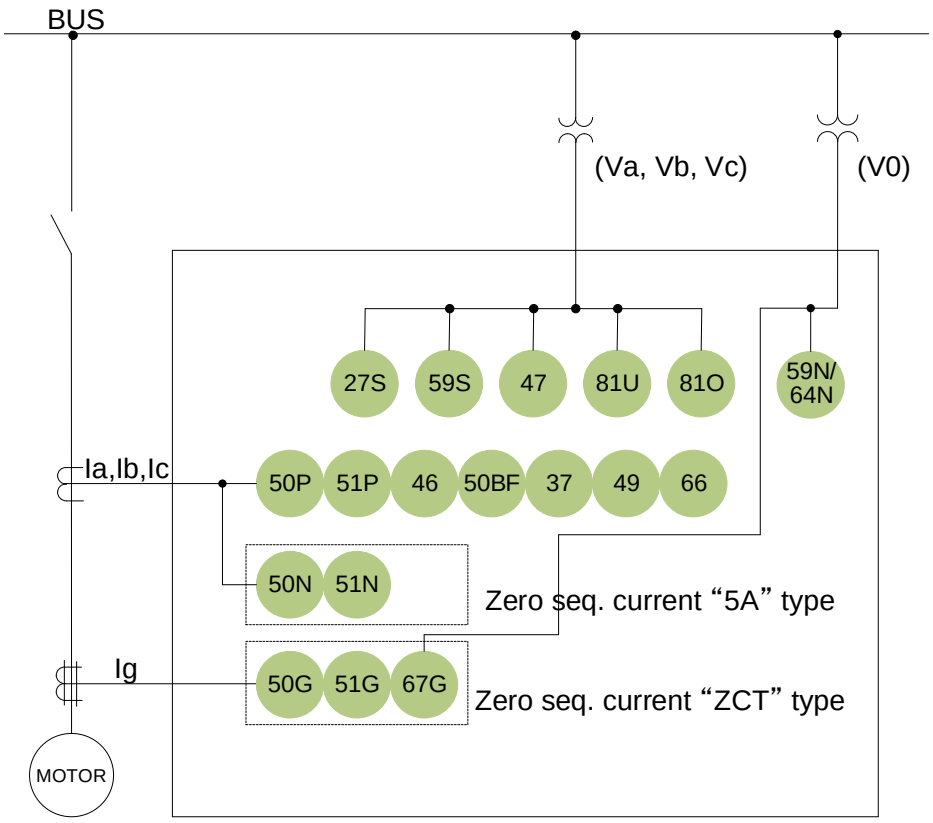


Fig. 2-1 Application and protection element

Device No.	Protection element (Abbreviated name)	Operating value	Operating time	Other setting
50P	Instantaneous Overcurrent	50～2000%	0.0～10.0s	
51P	Time-delayed Overcurrent	200～2000%	—	2 types of operating time characteristics
50N• 51N 50G• 50G	Earth Fault Instantaneous / Definite Time Overcurrent	ZCT type: 1.0 ~ 100.0 mA 5A type: 0.1 ~ 100.0 A	0.0～10.0s	
46	Negative sequence overcurrent element (OCNEG1~2)	25～100%	0.0～10.0s	
37	Undercurrent element (UC1~2)	25～100%	0.0～600.0s	
50BF	CB Failure protection	15～200%	0.0～10.0s	
50BFN • 50BFG	Earth Fault CB Failure protection	1.0～100.0 mA	0.0～10.0s	
49	Thermal Overload (THOL)	105～150%	—	2 types of operating time characteristics
67G	Instantaneous directional ground fault element (by ZCT) (DIRG1~2)	1.0 to 100.0 mA, 2.0 to 100.0 V, 0 to 359° (Lag angle)	0.0 to 10.0 s	
37	Underpower (UP1~2)	1～30%	0.0～10.0s	
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	0.0～10.0s	

Device No.	Protection element (Abbreviated name)	Operating value	Operating time	Other setting
81U	Underfrequency element (UF1~3)	fn-0.5 to fn-5.0 Hz (fn: Rated frequency)	0.1～60.0s	
81O	Overfrequency element (OF1~3)	fn+0.5 to fn+5.0 Hz (fn: Rated frequency)	0.1～60.0s	
66	Starts per hour element (MST)	1 ~ 10	2 ~ 120s	
-	VT fuse failure monitoring element (VTF)	20.0 ~ 120.0 V (VTF-UV) 0.5 ~ 100.0 A (VTF-OCD) 1.0 ~ 100.0 mA (VTF-OCG)	20.0 s (fixed)	For I0=ZCT type

* 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 will be set to the minimum setting.
* For details, refer to Chapter 3.
* As factory default, protection element is disabled, i.e., set to “OFF”, for “*** EN” setting if the element is selectable from enabled and disabled. For protection elements which have no such settings, the minimum value is set as the operating value.

2.4. Measuring element

Contents displayed		Range	Measured value		Fault 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		○	×	×	×
-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	0.0 to 999.9 MVar (0.1 MVar step)	○	×	×	×
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	-1.00 to 1.00 (0.01 step)	○	×	×	×
+Qt	Positive 3-phase reactive electric energy	0 to 999999999 kVarh (1 kVarh step)	○	×	×	×
-Qt	Negative 3-phase reactive electric energy		○	×	×	×

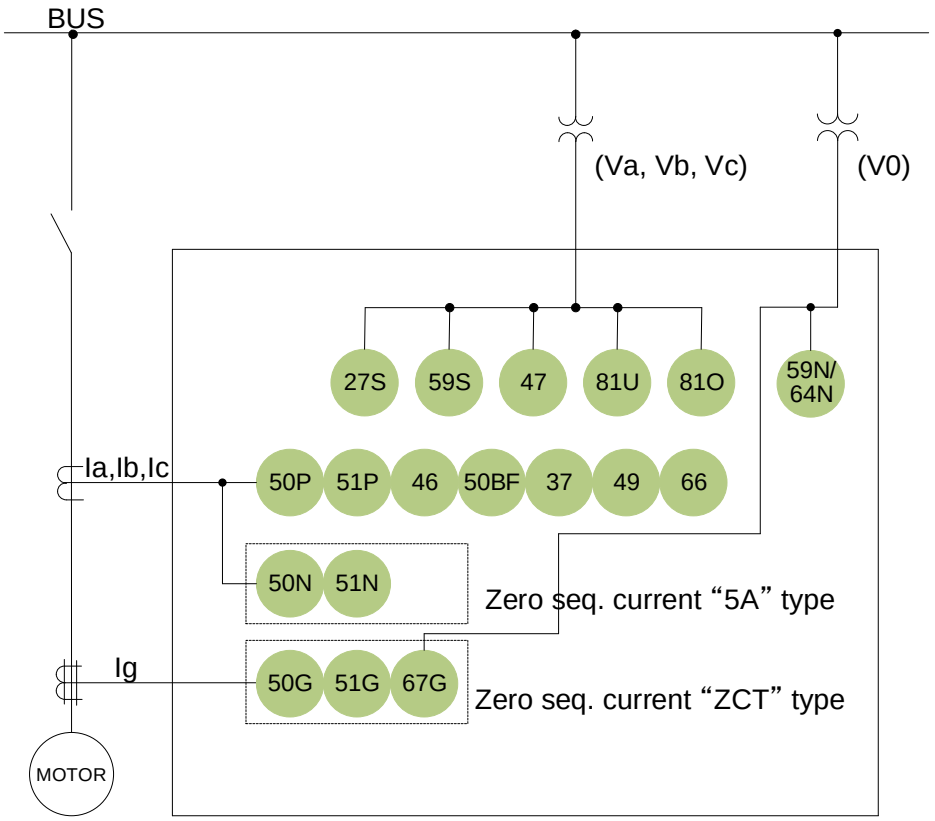
2.5. List of functions

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	×	○
	Motor status (MOTOR STATUS)	○ 4.3.2.1.5	○ 11.11.3	
	Device name (DEVICE NAME)	○ 4.3.2.1.6	○ 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	Communication setting	○	×	×

Menu	Item	Operation system		
		Front panel	PC-HMI	Communication
(CONFIG)	(COMMUNICATION)	4.3.4.3.1		
	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	○
	Motor runtime (MOTOR RUNTIME)	○ 4.3.4.3.6	○ 11.14.11	○
	Disturbance record (DISTURBANCE)	○ 4.3.4.3.7	○ 11.14.6	○
	DI detection voltage value (DI VOLTAGE)	○ 4.3.4.3.8	○ 11.14.5	○
	Password use/unused (PASSWORD USE)	○ 4.3.4.3.9	×	×
	Password registration (PASSWORD REGIST)	○ 4.3.4.3.10	×	×
Test (TEST)	DO contact test (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

The CMP1-A41D1 Relay incorporates protective elements which are necessary and sufficient for the protection of the induction motor.
In this chapter, the protection elements incorporated in CMP1-A41D1 are explained.



3.1. General Setting

This clause shows the general setting which is related to this protection relay setting. The detail which is setting ranges and setting steps are shown in Chapter 10.

Table 3-1 General setting

Category	Display name (Front panel)	Display name (PC-HMI)	Protective function
MOTOR	IM	Rated Motor Curt.	Motor rated current. This setting value is related to all protection element.
	Str. Curt. 1	Str. Curt. 1	Motor current during start up (acceraration) period. This setting value is related to Number-of-starts Limiting Element (MST1 and MST2). More detail, please refer to sub-clause **3.16**.
	Str. Curt. 2	Str. Curt. 2	Motor current when finish the startup (acceraration). This setting value is related to Number-of-starts Limiting Element (MST1 and MST2). More detail, please refer to sub-clause **3.16**.
	Stp. Curt.	Stp. Curt.	Motor current to judge the motor stop. This setting value is related to Number-of-starts Limiting Element (MST1 and MST2). More detail, please refer to sub-clause **3.16**.
	VM	Rated Motor Volt.	Motor rated voltage. This setting value is related to Underpower Element (UP1 and UP2). More detail, please refer to sub-clause **3.9**.

3.2. Overcurrent Element

The CMP1-A41D1 Relay has 3 types of overcurrent element, listed in the table below, which achieve fast detection for a fault affecting the induction motor.
Also, since the overcurrent element with dependent time characteristic has a switchover function of operating sensitivity and time between the time of motor-startup condition and the time after the completion of motor-startup as shown in Fig. 3-1, it prevents unnecessary operation from the motor excitation inrush currents during motor-startup condition.

Device No.	Display name	Protective function
51L/R	OC1	Overcurrent element with dependent time characteristic under motor startup condition (from the detection of motor-startup to the completion of motor-startup) ・ 2 types of operating time characteristics
	OC2	Overcurrent element with dependent time characteristic after motor startup condition (after the completion of motor-startup) motor normal operating condition ・ 2 types of operating time characteristics
50P	OC3	Overcurrent instantaneous element

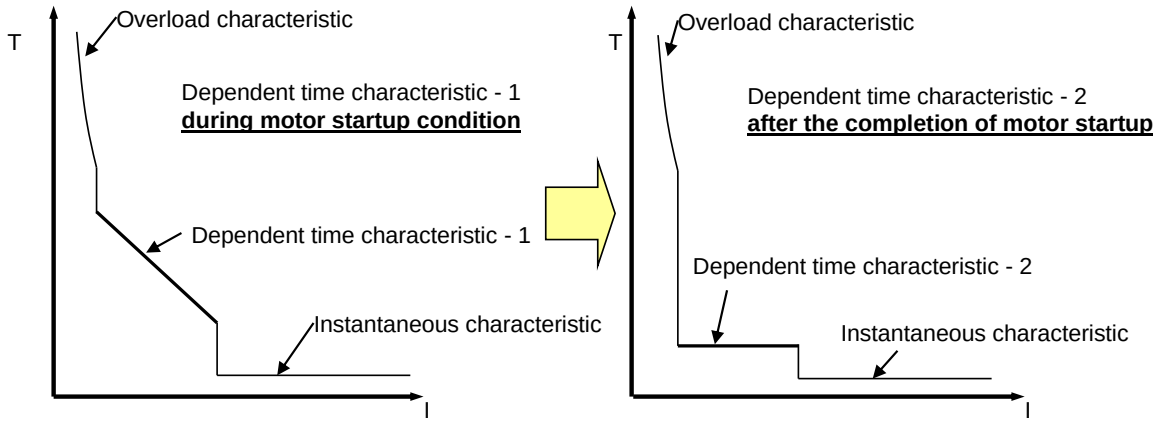


Fig. 3-1 Dependent Time characteristics of switchover function

3.2.1. OC1 Element (Overcurrent with IDMT/DT Element)

OC1 overcurrent element is applied to detect a fault occurring during the flowing condition of motor excitation inrush current at motor-startup, from the detection of motor-startup to the completion of motor-startup. Therefore, it is necessary to set the sensitivity and dependent time settings so as to prevent the element operation from the motor-startup current.
The method for detecting motor-startup is by receiving the closing signal of CB auxiliary contact (52a) for energization of the motor to DI 7 (fixed terminal). Thus, this element is activated when DI 7 is not injected the voltage.

In case of the protection of reciprocating motor, a pulsating current induced by motor current would be superimposed on line current. Since the relay input current with pulsating component generates large error in the results of current calculation of the relay, it is provided the averaging function for current calculation on motor rotating cycle to mitigate the pulsating current affection.

There are two types of dependent time characteristics, long inverse time and definite time.
The internal function block diagram is shown in Fig. 3-2.

OC1 Element outputs a detection signal when the detection output is operative and the dependent time characteristic timer (time-limit timer) period has passed.
The detection output is operative when input current is greater than the detection current setting, selected from ‘Ope. Curt.’ or ‘Ope. Curt. x 1.15’ by IEC Chr. EN setting.
Also, as mentioned above, in case of a reciprocating motor, the current-averaging cycle-number setting (Ave. Cycle) should be set for motor rotating cycle and current-averaging enable/disable setting (Ave. Curt.) should be set to “enable” (ON).
The internal timer (Time-limit timer) counts up in accordance with dependent time characteristic (Ope. Chr.) when current is greater than the operation setting value (Ope. Curt.).
A 200-ms reset timer is incorporated to prevent chattering on the contact.
In addition, OC1 Element outputs an operating signal only when its enable/disable setting (OC1 EN) is set ON. The setting of ‘OC1 EN = OFF’ prevents the unnecessary operation of the element.

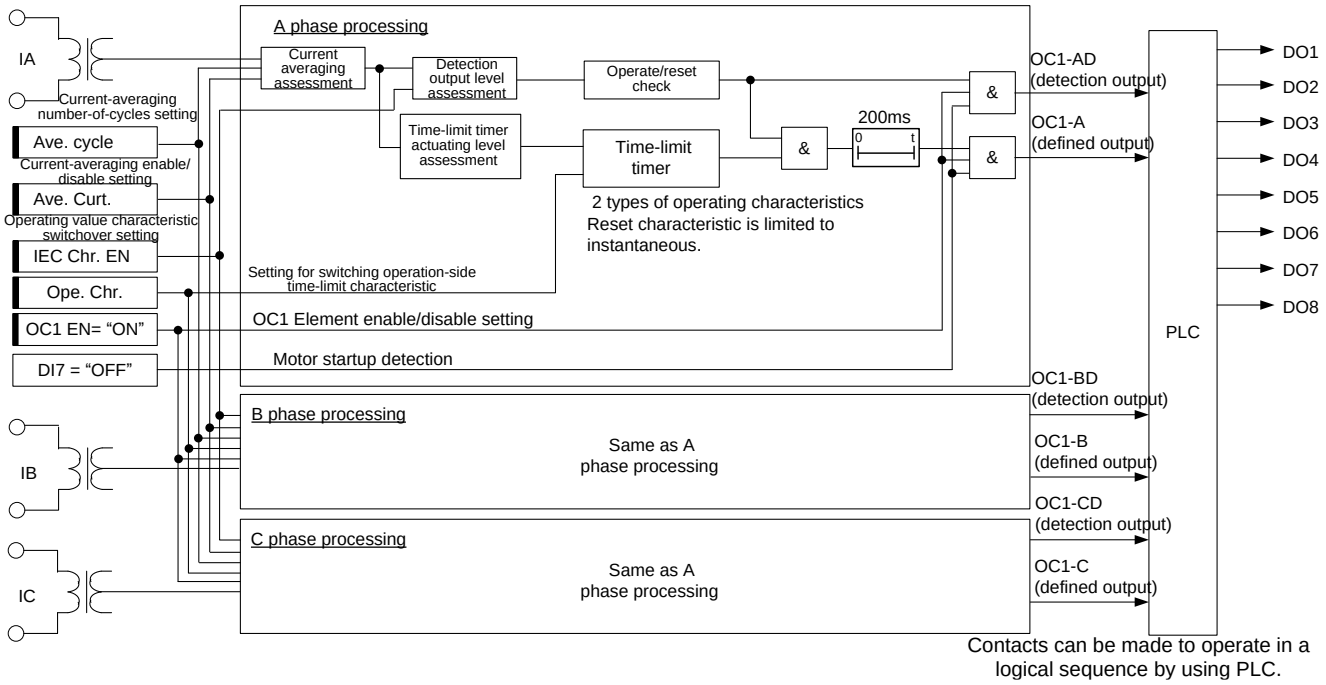


Fig. 3-2 OC1 Element – internal function block diagram

Table 3-2 OC1 Element - setting items

Display name	Name of setting value	Setting		Supplement
		Range of setting	step	
OC1	OC1 EN	OFF, ON	-	OFF: disable, ON: enable If you want to use this element, set it ON.
	Ave. Curt.	OFF, ON	-	OFF: disable, ON: enable If you want to use averaged current for this element, set it ON.
	Ope. Curt.	200 - 2000%	2%	Operating current (magnification applied to motor's rated current)
	Ope. Koct	4 - 240	1	Operating time magnification Indicated by the value "Koct." in the operating time characteristic equation given in Section3.2.3.
	Ope. Chr.	LI, DT	-	Inverse-time operating time characteristics For information about each characteristic, see Section3.2.3.
	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 3.2.2.

3.2.2. Operating Time Characteristics

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. 3-3.

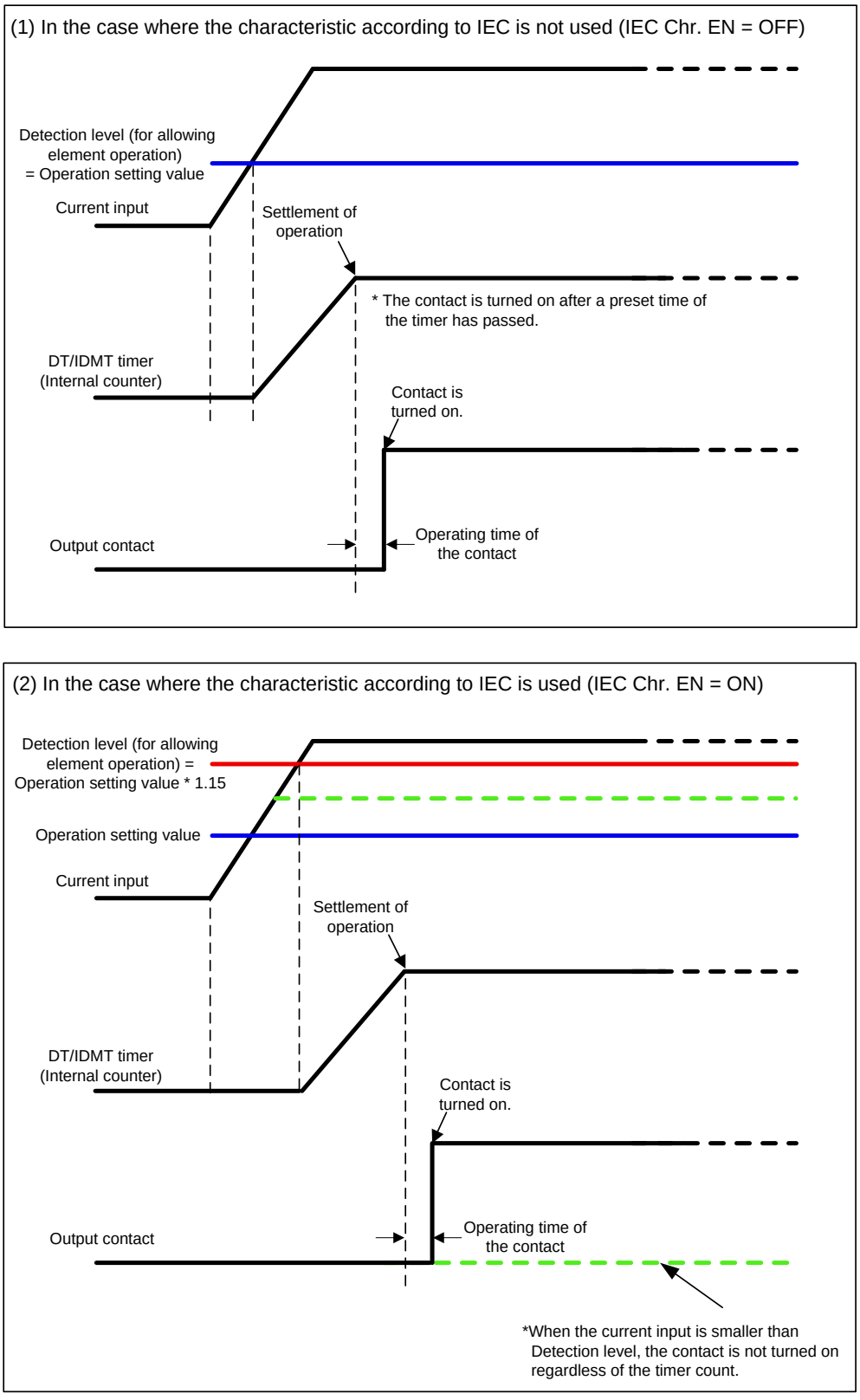


Fig. 3-3 Comparison of the operation between IEC Chr. EN = ON and IEC Chr. EN = OFF

3.2.3. IDMT Characteristic

OC1 Element incorporates 2 types of operating time characteristics.

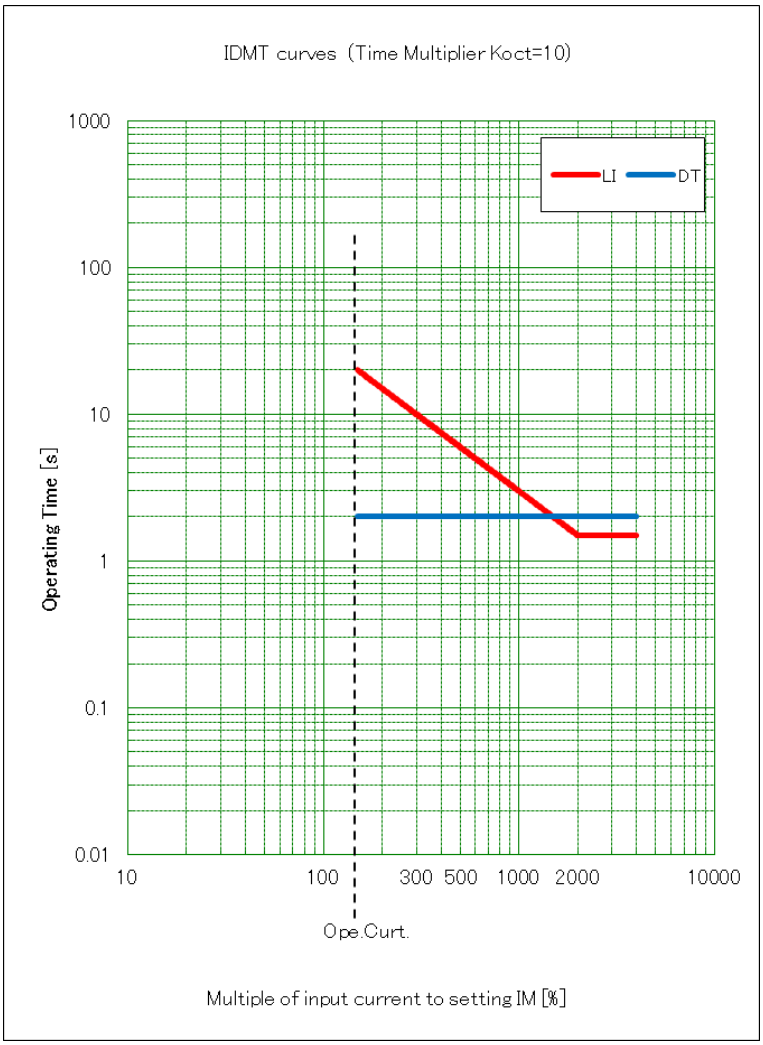


Fig. 3-4 Operating time characteristics

[1] Inverse-time characteristic (LI)

$$t = 3 \times \frac{Koct}{I}(s)$$

[2] Definite-time characteristic (DT)

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

t: Operating time (s)
I: Multiple of motor rated current (IM) relative to setting value (n times)

$$I = InputCurrent / settingIM$$

K_{oct}: Operating time multiplier setting (n times)

Table 3-3 Long inverse-time characteristics (LI) – operating time control table

LI Operating time (theoretical equation)

$t = 3 \times \frac{K_{oct}}{I}$

	Magnification of input current applied to motor's rated current (I)										Unit s
Magnification of operating time (Koct)	200%	300%	500%	700%	1000%	1200%	1500%	1800%	2000%	2200%	2400%
4	6.0	4.0	2.4	1.714	1.2	1.0	1.0	1.0	1.0	1.0	1.0
5	7.5	5.0	3.0	2.143	1.5	1.3	1.0	1.0	1.0	1.0	1.0
6	9.0	6.0	3.6	2.571	1.8	1.5	1.2	1.0	1.0	1.0	1.0
7	10.5	7.0	4.2	3.0	2.1	1.75	1.4	1.167	1.05	1.05	1.05
8	12.0	8.0	4.8	3.429	2.4	2.0	1.6	1.333	1.2	1.2	1.2
9	13.5	9.0	5.4	3.857	2.7	2.25	1.8	1.5	1.35	1.35	1.35
10	15.0	10.0	6.0	4.286	3.0	2.5	2.0	1.667	1.5	1.5	1.5
20	30.0	20.0	12.0	8.571	6.0	5.0	4.0	3.333	3.0	3.0	3.0
30	45.0	30.0	18.0	12.857	9.0	7.5	6.0	5.0	4.5	4.5	4.5
40	60.0	40.0	24.0	17.143	12.0	10.0	8.0	6.667	6.0	6.0	6.0
50	75.0	50.0	30.0	21.429	15.0	12.5	10.0	8.333	7.5	7.5	7.5
60	90.0	60.0	36.0	25.714	18.0	15.0	12.0	10.0	9.0	9.0	9.0
70	105.0	70.0	42.0	30.0	21.0	17.5	14.0	11.667	10.5	10.5	10.5
80	120.0	80.0	48.0	34.286	24.0	20.0	16.0	13.333	12.0	12.0	12.0
90	135.0	90.0	54.0	38.571	27.0	22.5	18.0	15.0	13.5	13.5	13.5
100	150.0	100.0	60.0	42.857	30.0	25.0	20.0	16.667	15.0	15.0	15.0
150	225.0	150.0	90.0	64.286	45.0	37.5	30.0	25.0	22.5	22.5	22.5
200	300.0	200.0	120.0	85.714	60.0	50.0	40.0	33.333	30.0	30.0	30.0
240	360.0	240.0	144.0	102.857	72.0	60.0	48.0	40.0	36.0	36.0	36.0

Table 3-4 Long inverse-time characteristics (LI) – operating time error control table

	Magnification of input current applied to motor's rated current (I)										
	200%	300%	500%	700%	1000%	1200%	1500%	1800%	2000%	2200%	2400%
Error standard	Within ±12%	Within ±12%	Within ±7%	Within ±7%	Within ±5%	Within ±5%	Within ±5%	Within ±5%	Within ±5%	Within ±5%	Within ±5%

Operating time accuracy: Within ±x% (Table 3-4) of nominal operating time or ±100 ms, whichever is greater.

Table 3-5 Definite-time characteristics (DT) – operating time control table

DT Operating time (theoretical equation)

$t = 2 \times \frac{K_{oct}}{10}$

	Magnification of input current applied to motor's rated current (I)										Unit s
Magnification of operating time (Koct)	200%	300%	500%	700%	1000%	1200%	1500%	1800%	2000%	2200%	2400%
4	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
5	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
6	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
7	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4
8	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6
9	1.8	1.8	1.8	1.8	1.8	1.80	1.8	1.8	1.8	1.8	1.8
10	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
20	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
30	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
40	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0
50	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
60	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0
70	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0
80	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0
90	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0
100	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0
150	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0
200	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0
240	48.0	48.0	48.0	48.0	48.0	48.0	48.0	48.0	48.0	48.0	48.0

Operating time accuracy: Within ±5% of nominal operating time or ±50 ms, whichever is greater.

3.2.4. Setting of Ave. Cycle

In case of the protection of reciprocating motor (pumping motor), a pulsating current induced by motor current would be superimposed on the current of electric power system. Since the relay input current with pulsating component generates a large error in the results of calculation in the relay, it is provided the averaging function for current calculation on motor rotating cycle to mitigate the pulsating current.

An example of the pulsating current by the reciprocating motor is shown in Fig. 3-5.
In Fig. 3-5, the black dash line indicates a motor current of instantaneous values, the blue dash line indicates an envelope of the instantaneous motor current (the calculated peak values when the Ave. Cycle = OFF), and the red solid line indicates the considering the pulsating current (the calculated peak values when the Ave. Cycle = ON).
We assume following condition.

- The power system frequency sets 60 Hz.
- The period of the pulsating current − black dash line − sets about 6 Hz (360 rpm).

The setting Ave. Cycle can be obtained by following equation.

(power system frequency) / (frequency of the motor pulsating current)
= 60 Hz / 6 Hz = 10 [cycle]

Then, in this example, the 10 cycle is applied as setting Ave. Cycle. And the red solid line should be obtained in Fig. 3-5.

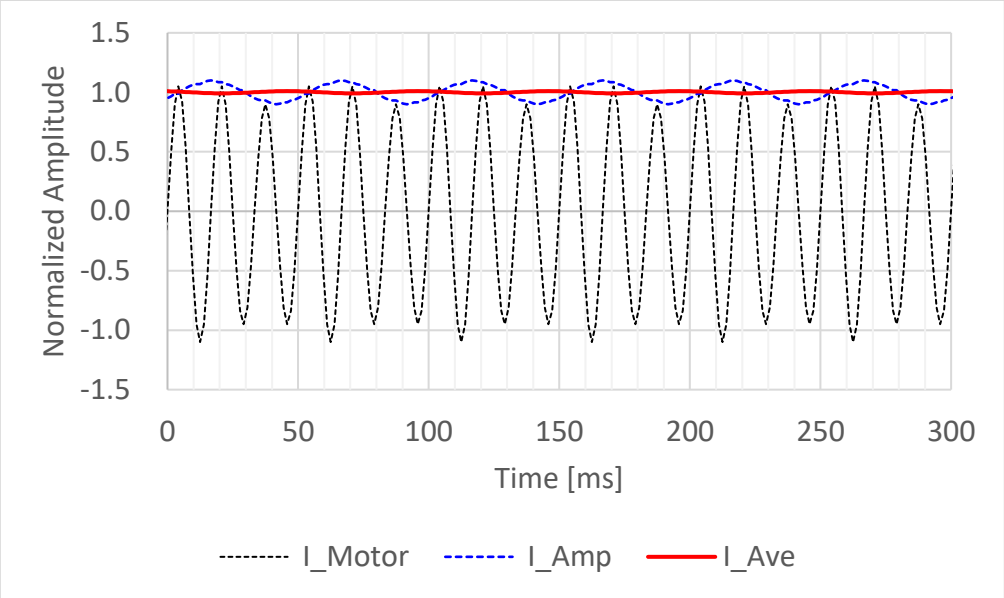


Fig. 3-5 An example of the reciprocating motor current

3.2.5. OC2 Element (Overcurrent with IDMT/DT Element)

OC2 overcurrent element is applied to detect a fault after the time at which the motor excitation inrush current disappears after the completion of motor startup. Therefore, it is necessary to make sensitivity and time settings so as to be suitable for motor normal operating condition.

The method for detecting conditions for the completion of motor startup is by receiving the CB auxliary contact (52a) signal to DI 7 (fixed terminal) for turning the motor ON/OFF. Thus, this element becomes operable when the signal is applied to DI 7.

Also, considering the case of reciprocating motor, OC2 Element provides the averaging function for current calculation on motor rotating cycle to mitigate the pulsating current affection as same as OC1 Element.

OC2 Element provides two types of dependent time characteristics, long inverse time and definite time. The internal function block diagram is shown in Fig. 3-6.

OC2 Element outputs a detection signal when detection output is “operative” and the time-limit timer period has passed.

The detection output is delivered when input current is greater than detection current setting selected by IEC Chr. EN setting of ‘Ope. Curt.’ and ‘Ope. Curt. x 1.15’ by).

Also, as mentioned above, in case of a reciprocating motor, the current-averaging cycle-number setting (Ave. Cycle) should be set for motor rotating cycle and current-averaging enable/disable setting (Ave. Curt.) should be set to “enable” (ON).

The internal timer (Time-limit timer) counts up in accordance with dependent time characteristic (Ope. Chr.) when current is greater than the operation setting value (Ope. Curt.).

A 200-ms reset timer is incorporated to prevent chattering on the contact.

In addition, OC2 Element outputs an operating signal only when its enable/disable setting (OC2 EN) is set ON. The setting of ‘OC2 EN = OFF’ prevents the unnecessary operation of the element.

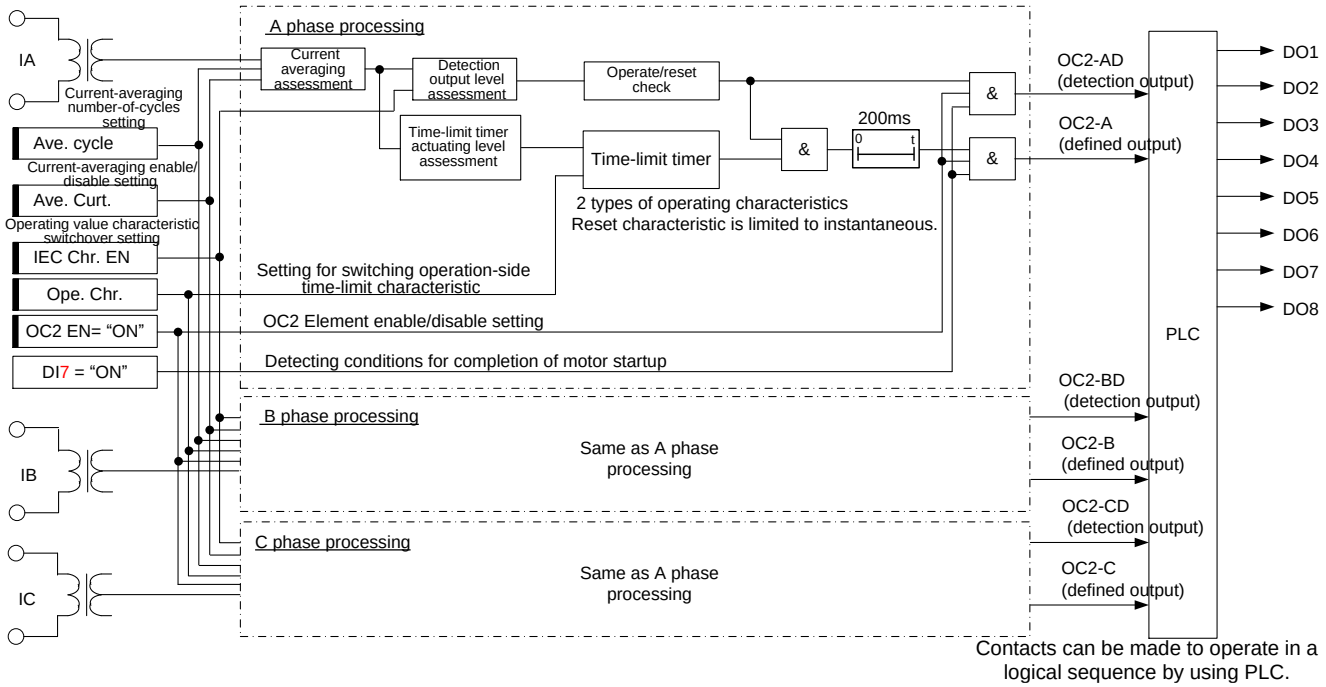


Fig. 3-6 OC2 Element - internal function block diagram

Table 3-6 OC2 Element - setting items

Display name	Name of setting value	Setting		Supplement
		Range of setting	step	
OC2	OC2 EN	OFF, ON	-	OFF: disable, ON: enable If you want to use this element, set it ON.
	Ave. Curt.	OFF, ON	-	OFF: disable, ON: enable If you want to use averaged current for this element, set it ON.
	Ope. Curt.	200 - 2000%	2%	Operating current (magnification applied to motor's rated current)
	Ope. Koct	4 - 240	1	Operating time magnification Indicated by the value "Koct." in the operating time characteristic equation given in Section3.2.3.
	Ope. Chr.	LI, DT	-	Inverse-time operating time characteristics For information about each characteristic, see Section3.2.3.
	IEC Chr. EN	OFF, ON	-	OFF: normal characteristic, ON: IEC characteristic If you want to use this element with IEC60255 151-compliant operating characteristics, set it ON. Setting the element ON will make detection output operating value 1.15 times as high as "Ope. Curt." as is stated in Section3.2.2.

3.2.6. Logic Function of 51LR (Locked Rotor) Timer using OC1 and OC2

This characteristic is installed to the 60Hz model of a combination with 5A positive-sequence and 5A zero-sequence.

This 51LR function is used for a motor protection against locked running rotor.
In the motor starting period, the motor acceleration current is greater than the normal operating current. Therefore using binary input, overcurrent characteristic (OC1 and OC2) is changed. This overcurrent changing function is offered for all models in CMP1-A41D1 series.

And, the situation that occasionally need the time delay from OC1 to OC2 is assumed. For such situation, '51LR Ope. Time' is set.

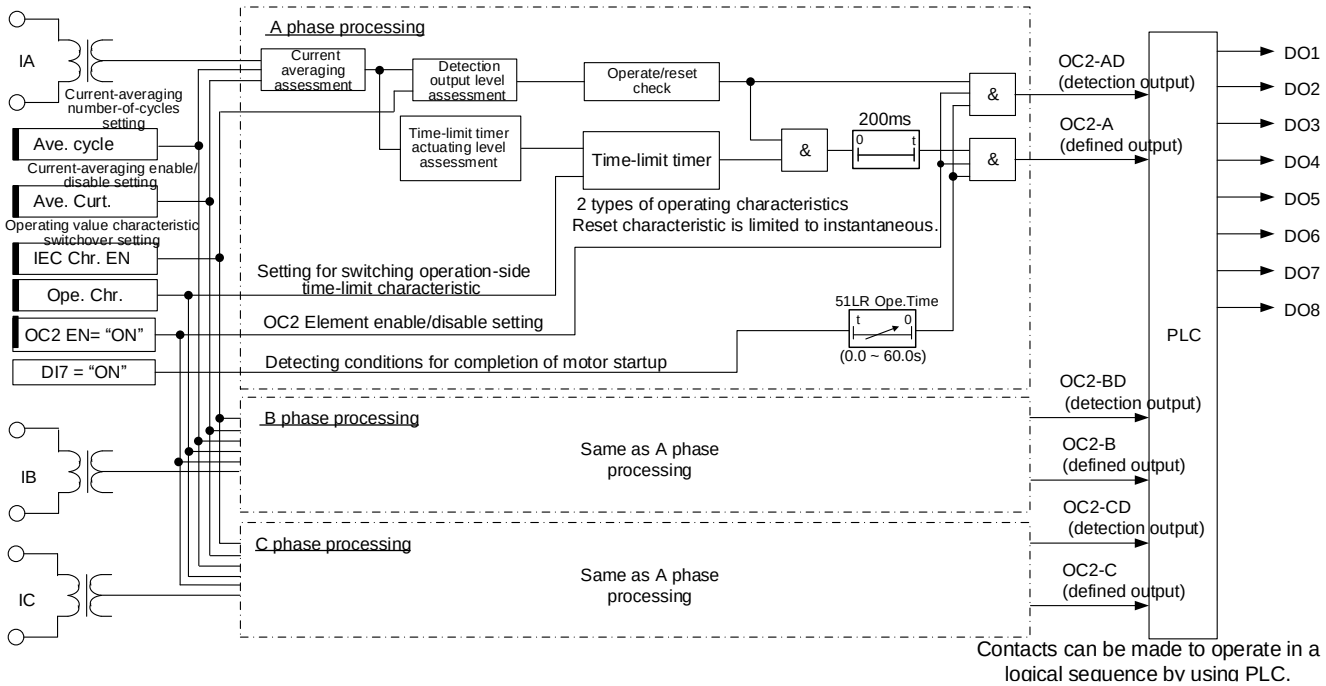


Fig. 3-7 OC2 Element with 51LR Logic Function - internal function block diagram

Table 3-7 Logic Function for 51LR - setting items

Display name	Setting parameter	Setting		Description
		Range	Step	
Logic	51LR Ope.Time	0.0 ~ 60.0s	0.1s	Delay timer for changing characteristic from OC1 to OC2 Element.

3.2.7. OC3 Element (Overcurrent Instantaneous Element)

OC3 is an instantaneous overcurrent element for detecting the large fault current.
Also, considering the protection of a reciprocating motor, it provides the averaging function for current calculation as mentioned in the overcurrent element with dependent time characteristic.
The internal function block diagram is shown in Fig. 3-8.

OC3 Element outputs a detection signal after the lapse of the operation timer period (Ope. Time) if input current is greater than operation setting value (Ope. Curt.).
Also, as mentioned above, in case of a reciprocating motor, the current-averaging cycle-number setting (Ave. Cycle) should be set for motor rotating cycle and current-averaging enable/disable setting (Ave. Curt.) should be set to “enable” (ON).
The internal timer (Time-limit timer) counts up in accordance with dependent time characteristic (Ope. Chr.) when current is greater than the operation setting value (Ope. Curt.).
A 200-ms reset timer is incorporated to prevent chattering on the contact.
In addition, OC3 Element outputs an operating signal only when its enable/disable setting (OC3 EN) is set ON. The setting of ‘OC3 EN = OFF’ prevents the unnecessary operation of the element.

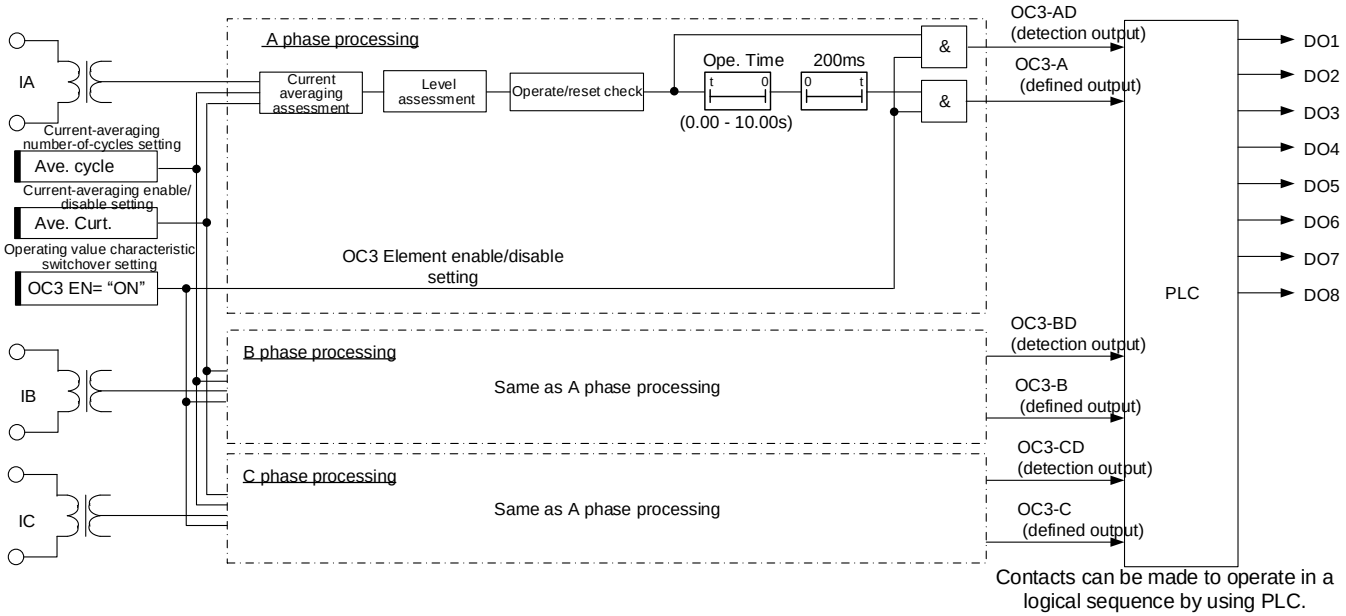


Fig. 3-8 Overcurrent Instantaneous Element (OC3) - internal function block diagram

Table 3-8 Overcurrent Instantaneous Element (OC3) - setting items

Display name	Name of setting value	Setting		Description
		Range of setting	step	
OC3	OC3 EN	OFF, ON	-	OFF: disable, ON: enable OC3 element is effective at ON.
	Ave. Curt.	OFF, ON	-	OFF: disable, ON: enable The current averaging function is effective at ON.
	Ope. Curt.	50 - 2000%	2%	Operating current (magnification applied to motor’s rated current)
	Ope. Time	0.00 - 10.00s	0.01s	Operating time (INST: ≤ 30ms)

3.3. Ground-fault Overcurrent Element

The CMP1-A41D1 Relay incorporates 2 types of ground fault overcurrent element, listed in the table below.

Device No.	Display name	Protective function
50N/51N 50G/51G	OCG1 OCG2	Ground fault overcurrent instantaneous / definite time element

3.3.1. OCG1 Element (Ground-fault Overcurrent Element)

The internal function block diagram of OCG1 Element is shown in Fig. 3-9.
OCG1 Element outputs a detection signal after the lapse of the operation timer period (Ope. Time) if zero-phase current is greater than operation setting value (Ope. Curt.).
A 200-ms reset timer is incorporated to prevent chattering on the contact.
OCG1 Element outputs an operating signal only when its enable/disable setting (OCG1 EN) is set ON. If The setting of 'OCG1 EN = OFF' prevent the unnecessary operation..

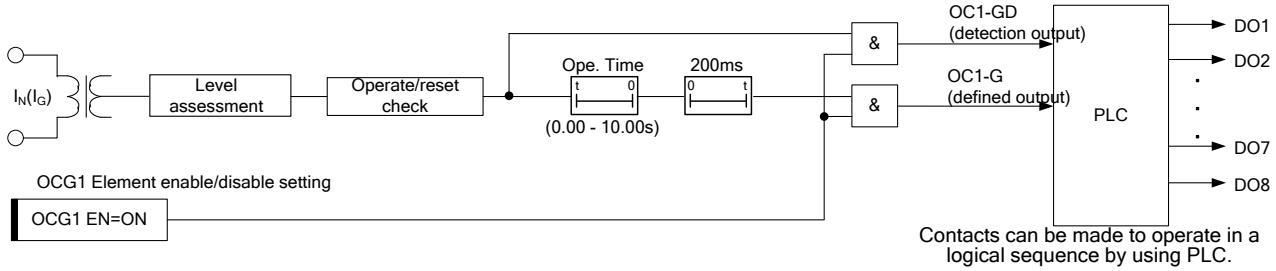


Fig. 3-9 OCG1 Element - internal function block diagram

Table 3-9 OCG1 Element - setting items

Display name	Name of setting value	Setting		Description
		Range of setting	step	
OCG1	OCG1 EN	OFF, ON	-	OFF: disable, ON: enable OCG1 element is effective at ON
	Ope. Curt.	1.0 ~ 100.0 mA (ZCT type) 0.1 ~ 100.0 A (I0 = 5 A type)	0.5mA 0.1 A	Operating current (ZCT type) Operating current (I0 = 5A type)
	Ope. Time	0.00 - 10.00s	0.01s	Operating time (INST: ≤ 30ms)

3.3.2. OCG2 Element (Ground-fault Overcurrent Element)

OCG2 Element is the same characteristic as OCG1 Element.
For information about the element's internal function block diagram, see Section3.3.1.

Table 3-10 OCG2 Element - setting items

Display name	Name of setting value	Setting		Description
		Range of setting	step	
OCG2	OCG2 EN	OFF, ON	-	OFF: disable, ON: enable OCG2 element is effective at ON
	Ope. Curt.	1.0 ~ 100.0 mA (ZCT type) 0.1 ~ 100.0 A (I0 = 5 A type)	0.5mA 0.1 A	Operating current (ZCT type) Operating current (I0 = 5A type)
	Ope. Time	0.00 - 10.00s	0.01s	Operating time (INST: ≤ 30ms)

3.4. Negative-phase Overcurrent / Open Detection Element

The CMP1-A41D1 Relay incorporates 2 types of negative-phase overcurrent element and 1 type of single-phase-open detection element which are listed in the table below.
The relay is designed to calculate a negative-phase current or identify an open phase from a 3-phase current and thus is capable of detecting an unbalanced current which could result from a mistake in the external wiring, open phase, or the like.

Device No.	Display name	Protective function
46	OCNEG1, OCNEG2	Negative-phase overcurrent instantaneous element
	OCNEG3 / SPO	Single phase-open detection element

3.4.1. OCNEG1 Element (Negative-phase Overcurrent Element)

The internal function block diagram of OCNEG1 Element is shown in Fig. 3-10.

OCNEG1 Element calculates a negative-phase sequence current from 3-phase input current. And it outputs a detection signal after the lapse of the operating timer period (Ope. Time) if the calculated negative phase sequence current is greater than the operating current setting.

A 200-ms reset timer is incorporated to prevent chattering on the contact.

In addition, OCNEG1 Element outputs an operating signal only when its enable/disable setting (OCNEG1 EN) is set ON. The setting of 'OCNEG1 EN = OFF' prevent the unnecessary operation of the element.

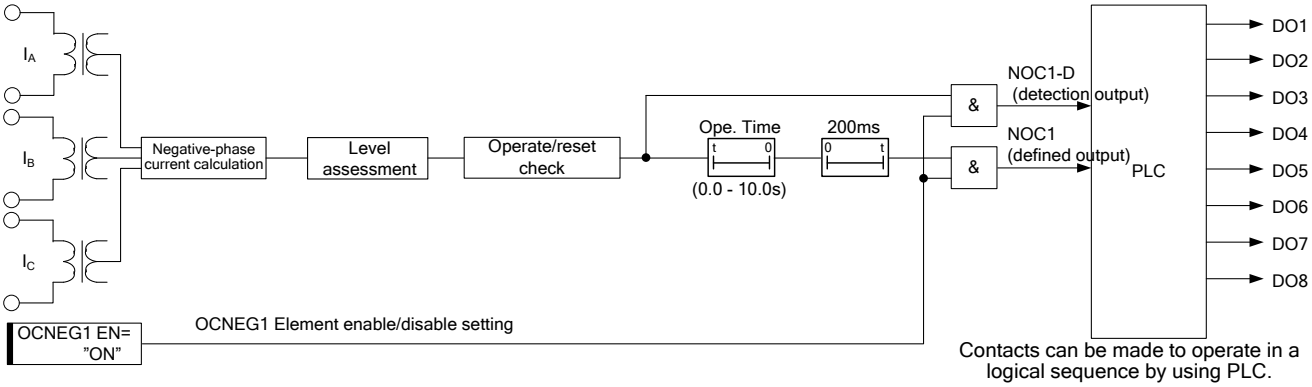


Fig. 3-10 OCNEG1 Element – internal function block diagram

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 3-11 OCNEG1 Element - setting items

Display name	Name of setting value	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.	25 - 100%	1%	Operating current The value of 100% is relevant of Rated Motor Current setting 'IM'. Please refer to sub-clause 3.1.
	Ope. Time	0.0 - 10.0s	0.1s	Operating time (INST: ≤ 50ms)

3.4.2. OCNEG2 Element (Negative-phase Overcurrent Element)

OCNEG2 Element is the same characteristics as OCNEGG1 Element.
For information about the element's internal function block diagram, see Section3.4.1.

Table 3-12 OCNEG2 Element - setting items

Display name	Name of setting value	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.	25 - 100%	1%	Operating current The value of 100% is relevant of Rated Motor Current setting 'IM'. Please refer to sub-clause 3.1.
	Ope. Time	0.0 - 10.0s	0.1s	Operating time (INST: ≤ 50ms)

3.4.3. OCNEG3 / SPO Element (Single phase-open Detection Element)

Fig. 3-11 shows the internal function blocks of Single Phase Open (SPO) element.

When the single phase open phenomenon is occurred, the unbalance current flows. In general, this unbalance condition can be detected by Negative-sequence overcurrent element (Device No. 46 which is named OCNEG in this product).

Under the single phase open condition, a phase current which concern with a breaking wire goes down. This element focuses this current behavior and this element consists of under/over-current elements.

There is 'Loss Curt.' setting to detect a drop down current. The AND logics after the collation timers make sure the condition whether or not a single phase open.

There is ‘Load Curt.’ setting to check that it was worked on a normal operating condition before the occurring of the single phase open phenomenon. To confirm the healthy condition before a fault, there is the average calculation block of 15 minutes.

The operation delay timer (2 seconds) is fixed. An off-delay timer of 200 ms is added in order to prevent chattering of the output contacts. This element is enabled or disabled by the setting (SPO EN).

Note

Using this protection element, it is necessary the 3 CT connection. In case of 2 CT connection, this element cannot offer intended operation.

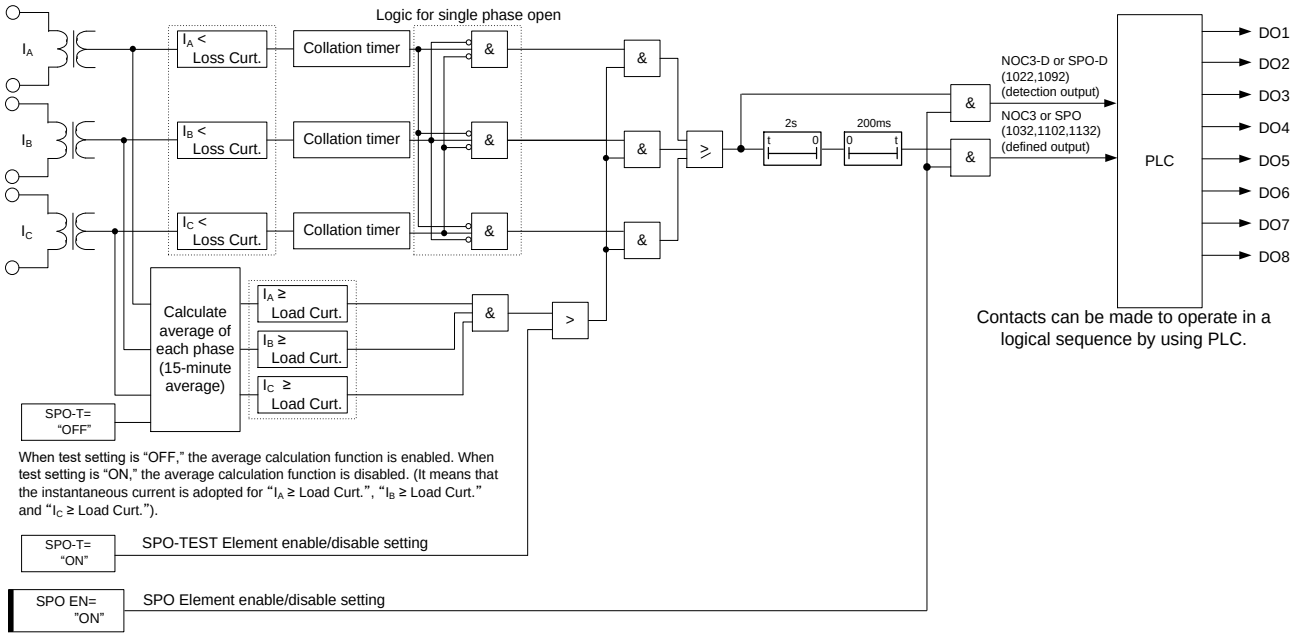


Fig. 3-11 SPO Element – internal function block diagram

Table 3-13 OCNEG3 Element – setting items

Display name	Name of setting value	Setting		Supplement
		Range of setting	step	
OCNEG3 SPO	OCNEG3 EN SPO EN	OFF, ON	-	OFF: Non-use, ON: Use When this element is used, set to ON.
	Load Curt.	20 - 100%	1%	Load current which value should be set smaller than the in-service condition current slightly. The value of 100% is relevant of Rated Motor Current setting 'IM'. Please refer to sub-clause 3.1.
	Loss Curt.	10 - 50%	1%	Open-phase current The value of 100% is relevant of Rated Motor Current setting 'IM'. Please refer to sub-clause 3.1.

3.5. Undercurrent Element

Two undercurrent elements are incorporated in this product.
This element is operated by 1 phase out of 3 phases (OR method of A, B, or C phase).

Device No.	Display name	Protective function
37	UC1, UC2	Undercurrent instantaneous element 2 types of detection method are incorporated: Method 1 (Pick1): Simple UC Method 2 (Pick2): UC with a minimum operating current

3.5.1. UC1 Element (Undercurrent Element)

The internal function block diagrams shown in Fig. 3-12 and Fig. 3-13 explains how UC1 Element works.

[Method 1] In the case where setting is made for Pick up = Pick 1
UC1 Element outputs a deterministic signal after the lapse of the operation timer period (Ope. Time) if input current is less than operation setting value (Ope. Curt.).

A 200-ms reset timer is added on the reset side to prevent chattering on the contact.
By making an appropriate setting (Output. Sel.), you can specify whether a deterministic signal should be outputted on the basis of operation in more than one phase.

Note that a locking capability is provided for UC1 Element in each phase to facilitate the performance of testing on a single-phase input. This locking capability can be set from VFD operation panel or PC tool.
In addition, UC1 Element outputs an operating signal only when its enable/disable setting (UC1 EN) is set for ON. If you do not want to use this element, switch the setting to OFF. This will prevent the unnecessary actuation of the element. In regard to UC1-related setting items, anything else does not have to be set.

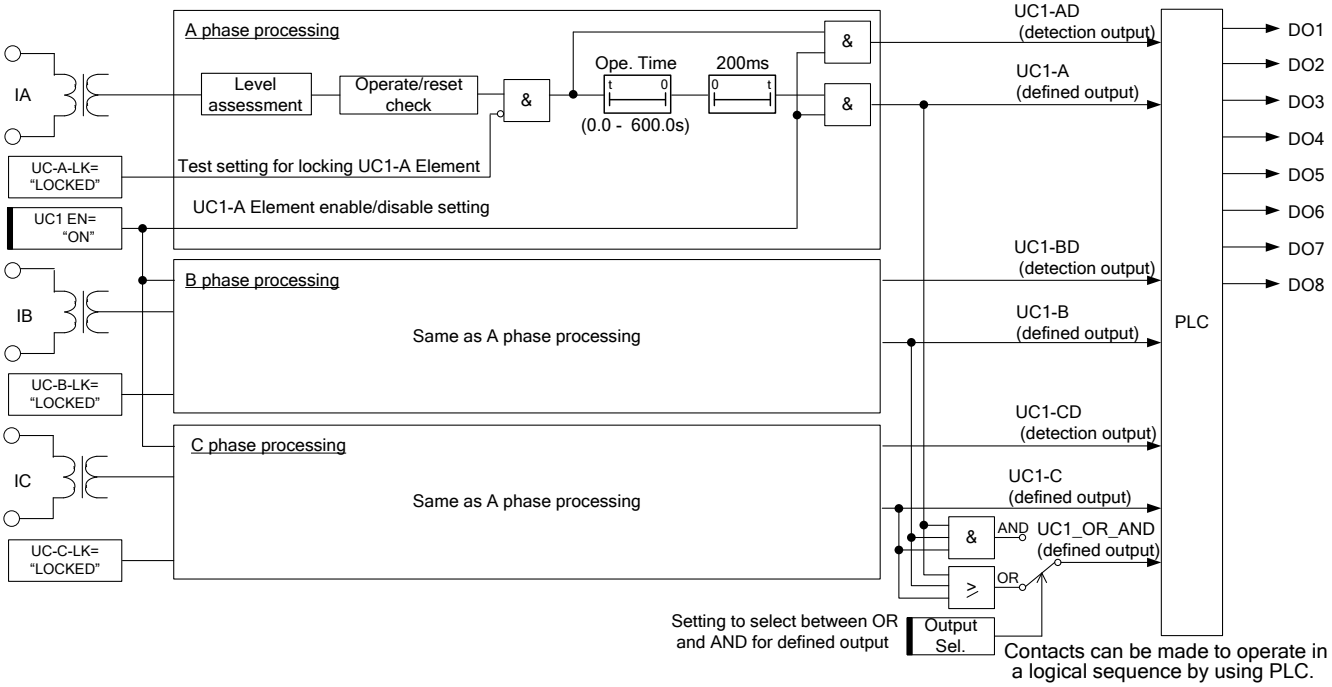


Fig. 3-12 UC1 Element (Method 1) – internal function block diagram

[Method 2] In the case where setting is made for Pick up = Pick 2
UC1 Element outputs a deterministic signal after the lapse of the operation timer period (Ope. Time) if input current is greater than minimum operating current setting value (Min. curt.) and less than operation setting value (Ope. Curt.).

A 200 ms reset timer is added on the reset side to prevent chattering on the contact.
By making an appropriate setting (Output. Sel.), you can specify whether a deterministic signal should be outputted on the basis of operation in more than one phase.

Note that a locking capability is provided for UC1 Element in each phase to facilitate the performance of testing on a single-phase input. This locking capability can be set from VFD operation panel or PC tool.
In addition, UC1 Element outputs an operating signal only when the setting UC1 EN is set for ON. If you do not want to use this element, switch this setting to OFF. This will prevent the unnecessary actuation of the element. In regard to UC1-related setting items, anything else does not have to be set.

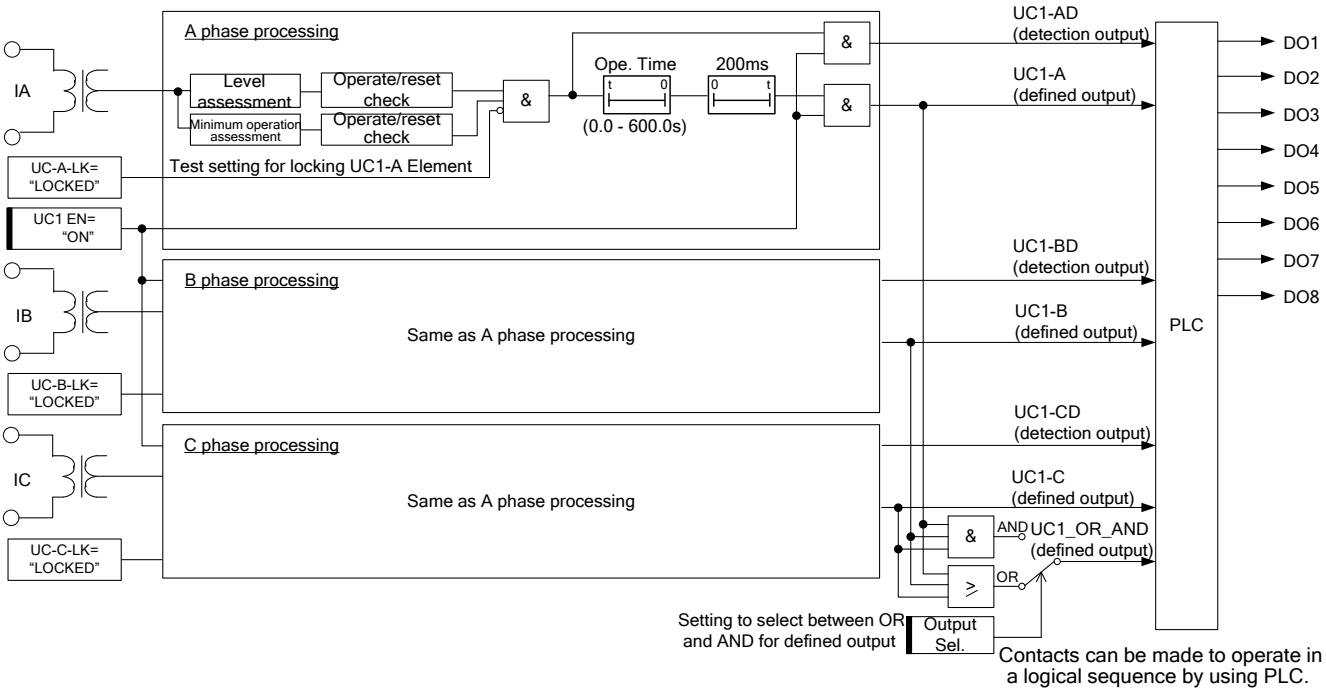


Fig. 3-13 UC1 Element (Method 2) - internal function block diagram

Table 3-14 UC1 Element – setting items

Display name	Name of setting value	Setting		Supplement
		Range of setting	step	
UC1	UC1 EN	OFF, ON	-	OFF: disable, ON: enable If you want to use this element, set it ON.
	Output Sel.	OR	-	This element is operated by 1 phase out of 3 phases (OR method of A, B, or C phase).
	Pick up	Pick1, Pick2	-	Selecting a detection method Pick1: Simple UC Pick2: UC with a minimum operating current tap
	Ope. Curt.	25 - 100%	1%	Operating current (magnification applied to motor's rated current)
	Min. Curt.	25 - 100%	1%	Minimum operating current (magnification applied to motor's rated current)
	Ope. Time	0.0 - 600.0s	0.1s	Operating time INST: ≤ 50ms

3.5.2. UC2 Element (Undercurrent Element)

UC2 Element has characteristics identical to UC1 Element.
For information about the element's internal function block diagram and how it works, see Section3.5.1.

Table 3-15 UC2 Element – setting items

Display name	Name of setting value	Setting		Supplement
		Range of setting	step	
UC2	UC2 EN	OFF, ON	-	OFF: disable, ON: enable If you want to use this element, set it ON.
	Output Sel.	OR	-	This element is operated by 1 phase out of 3 phases (OR method of A, B, or C phase).
	Pick up	Pick1, Pick2	-	Selecting a detection method Pick1: Simple UC Pick2: UC with a minimum operating current tap
	Ope. Curt.	25 - 100%	1%	Operating current (magnification applied to motor's rated current)
	Min. Curt.	25 - 100%	1%	Minimum operating current (magnification applied to motor's rated current)
	Ope. Time	0.0 - 600.0s	0.1s	Operating time INST: ≤ 50ms

3.6. CBF Function

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

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

3.6.1. CBF Element (CBF detecting element)

The internal function block diagram shown in Fig. 3-14 explains how CBF Function works.

CBF Element outputs a deterministic signal after the lapse of an operation timer period (Ope. Time) if a level assessment of input current in each phase and zero phase vs. operation setting value (CBF Curt. and CBFG Curt.) determines that the input current is greater than the operating level and a trip signal is being received from any of other relays. That is, the function is comprised of a circuit which, when a relay trip signal is received upon the occurrence of an accident but a current continues to flow even after the lapse of a certain duration of time, identifies that there is a faulty condition in the breaker. Make a configuration setting so that a trip signal from any of other relays will be received by D/I (DI8).
Note: An optional IE61850 communication card, if installed, makes it possible to receive a trip signal from any of other relays via the GOOSE function. In this case, make a Goose receive setting so that the trip signal will be received by G_TRIP1, G_TRIP2, or G_TRIP3.
In addition, CBF Function outputs an operating signal only when its enable/disable setting (CBF EN and CBFG EN) is set for ON. If you do not want to use this element, switch the setting to OFF. This will prevent the unnecessary actuation of the element. In regard to CBF-related setting items, anything else does not have to be set.

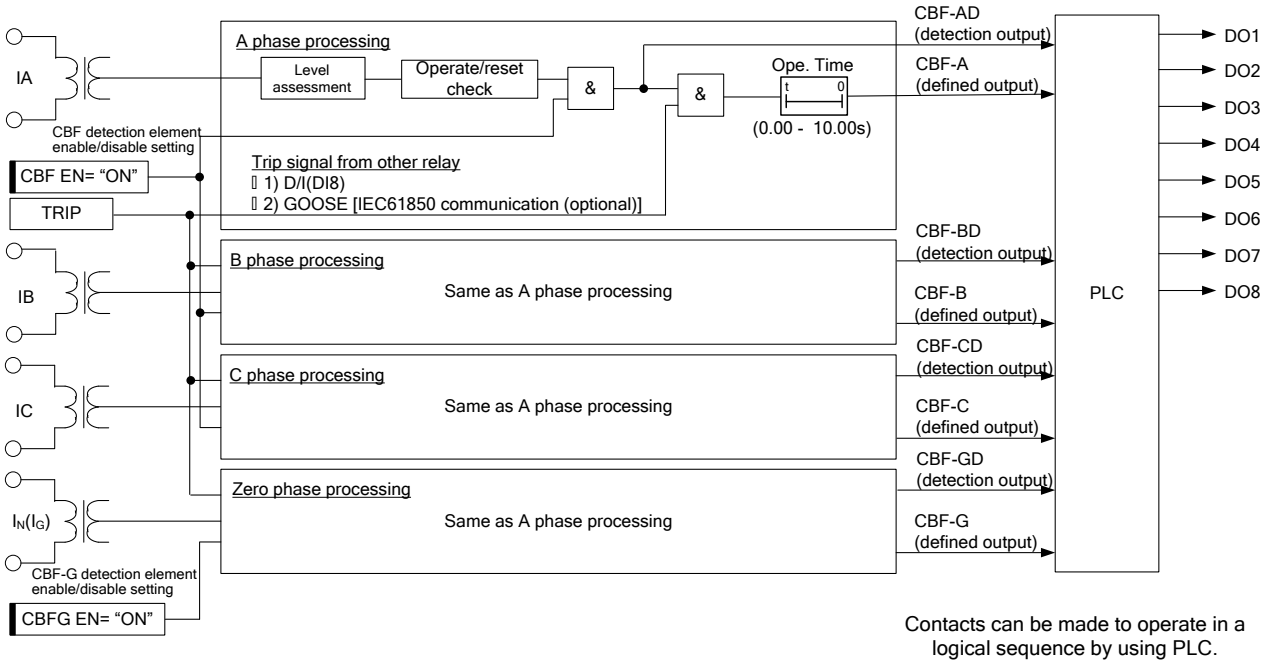


Fig. 3-14 CBF Element – internal function block diagram

Table 3-16 CBF Function: setting items

Display name	Name of setting value	Setting		Supplement
		Range of setting	step	
CBF	CBF EN	OFF, ON	-	OFF: disable, ON: enable (for each phase) If you want to use this element, set it ON.
	CBFG EN	OFF, ON	-	OFF: disable, ON: enable (for zero phase) If you want to use this element, set it ON.
	CBF Curt.	15 - 200%	1%	Operating current for each phase (magnification applied to motor's rated current)
	CBFG Curt.	1.0 - 100.0mA	0.5mA	Operating current for zero phase
	Ope. Time	0.00 - 10.00s	0.01s	Operating time INST: ≤ 30ms

3.7. Thermal Overload Element

The CMP1-A41D1 Relay incorporates 2 types of thermal overload element which are shown below. It also comes with2 types of operating time characteristics, which are user-selectable. Make a selection to suit the application that is concerned.

Device No.	Display name	Protective function
49	THOL	Thermal Overload element ・ 2 types of operating time characteristic

3.7.1. THOL Element (Thermal Overload Element)

This element protects the motor against insulation deterioration, damage or the like which could result from heat generation.

Also, considering the protection of a reciprocating motor, it provides the averaging function for current calculation as mentioned in the OC1 element.

There are two types of operating time characteristics, COLD and HOT.

Fig. 3-15 shows the internal function blocks of the element.

THOL Element calculates positive-/negative sequence current from a 3-phase current and makes a level assessment of calculated current value by Equation 1 below vs. operation setting value (Ope. Curt.), and then outputs a definitive signal after the lapse of a time calculated from the characteristic equation for operate/reset time characteristic switchover setting (THOL Sel.) if the calculated current value is greater than or equal to the operation setting value (Ope. Curt.).

$$Iop = \sqrt{I_1^{\,2} + \left(Neg.K\right) \times I_2^{\,2}} \quad \cdots\cdots \text{(Equation 1)}$$

Where,
Iop: Operating value of THOL element
I_1: Positive sequence current
I_2: Negative sequence current
Neg. K: Negative sequence heat-generation multiplier

As mentioned above, in case of a reciprocating motor, the number of cycles for current-averaging setting (Ave. Cycle) should be set for motor rotating cycle and current-averaging Use/Non-use setting (Ave. Curt.) should be set to ON.

An off-delay timer which corresponds to the COLD/HOT characteristic 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 THOL element (THOL 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 THOL element.

Note

Using this protection element, it is necessary the 3 CT connection. In case of 2 CT connection, this element cannot offer intended operation.

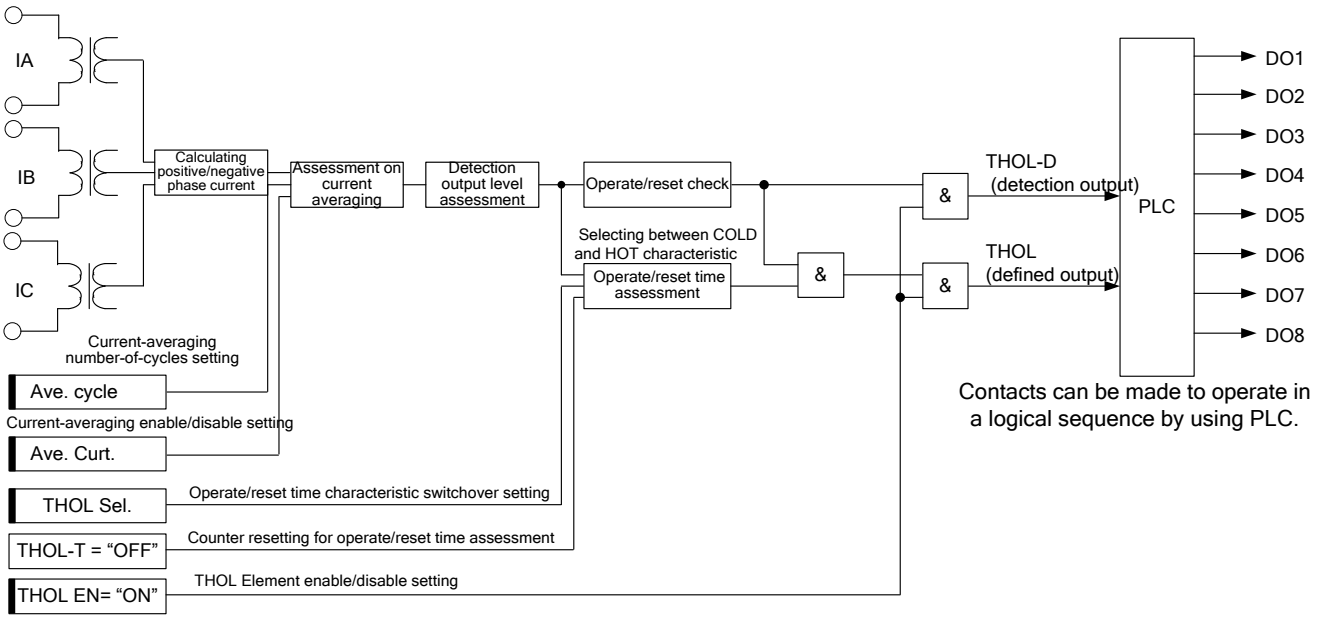


Fig. 3-15 THOL Element – internal function block diagram

Table 3-17 THOL Element - setting items

Display name	Name of setting value	Setting		Supplement
		Range of setting	step	
THOL	THOL EN	OFF, ON	-	OFF: Non-use, ON: Use When this element is used, set to ON.
	THOL Sel.	COLD, HOT	-	Operate/reset time characteristic Refer to sub-clause 3.2.3.
	Ave. Curt.	OFF, ON	-	OFF: Non-use, ON: Use When this element is used, set to ON.
	Ope. Curt.	105 - 150%	1%	Operating current (magnification applied to motor's rated current)
	Ope. Kth	8 - 240	1	Operating time multiplier Indicated by the value "Kth." in the operating time characteristic equation given in Section 3.2.3.
	Neg. K	1 - 10	1	Negative sequence heat generation multiplier

3.7.1.1. Operate/Reset Time Characteristic

The operate/reset time characteristic of the THOL element is expressed by the following equation:

$$OperatingTime[s] = 8.49 \times Kth \times \ln \frac{(I_1^{\,2} + Neg.K \times I_2^{\,2}) - (I_{P1}^{\,2} + Neg.K \times I_{P2}^{\,2})}{(I_1^{\,2} + Neg.K \times I_2^{\,2}) - 1}$$

$$\mathrm{Kth} = \frac{\text{Heat} - \text{generating effect by negative} - \text{phase current}}{\text{Heat} - \text{generating effect by positive} - \text{phase current}}$$

Where,
I_{P1} = Initial positive sequence current (0 for COLD characteristic)
I_{P2} = Initial negative sequence current (0 for COLD characteristic)
I_1 = Positive sequence current
I_2 = Negative sequence current

- COLD characteristic

  The COLD characteristic starts computations from when input has exceeded an operating value.

  When the input has fallen below the operating value after the delivery of an operating output, the characteristic resets itself in 200 ms and resets its computations.

  On the other hand, if the input has fallen below the operating value with the input becoming higher than the operating value but not resulting in the delivery of an operating output, the characteristic reduces the value obtained from its computations.

- HOT characteristic

  The HOT characteristic always performs computations taking heat accumulation into consideration even if input remains below an operating value.

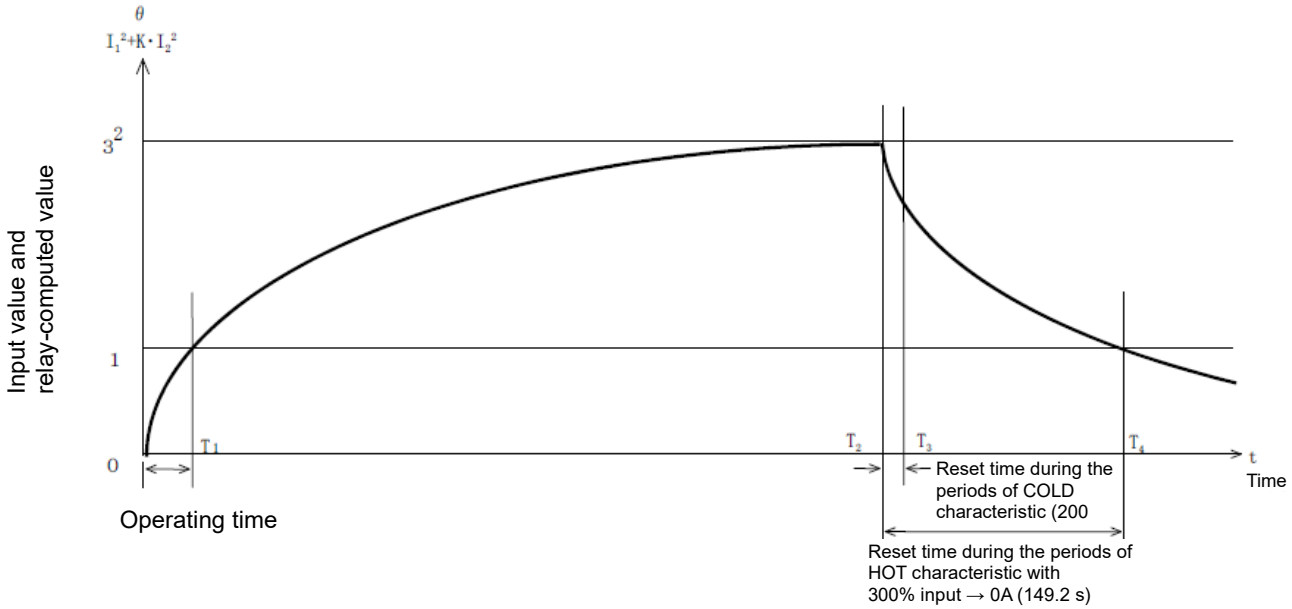


Fig. 3-16 An example of operating time and reset time

0 - T_1: Operating time with input changing 0 → 300%
T_1 - T_3: Output relay contact close time during the periods of COLD characteristic
T_1 - T_4: Output relay contact close time during the periods of HOT characteristic
T_2 - T_3: Reset time during the periods of COLD characteristic
T_2 - T_4: Reset time during the periods of HOT characteristic with normal 300% input changing to 0 input
T_1: Time during which relay-computed value (θn) ≥ 1
T_2: Time it takes relay input to change from 300% to 0
T_4: Time during which relay-computed value (θn) < 1

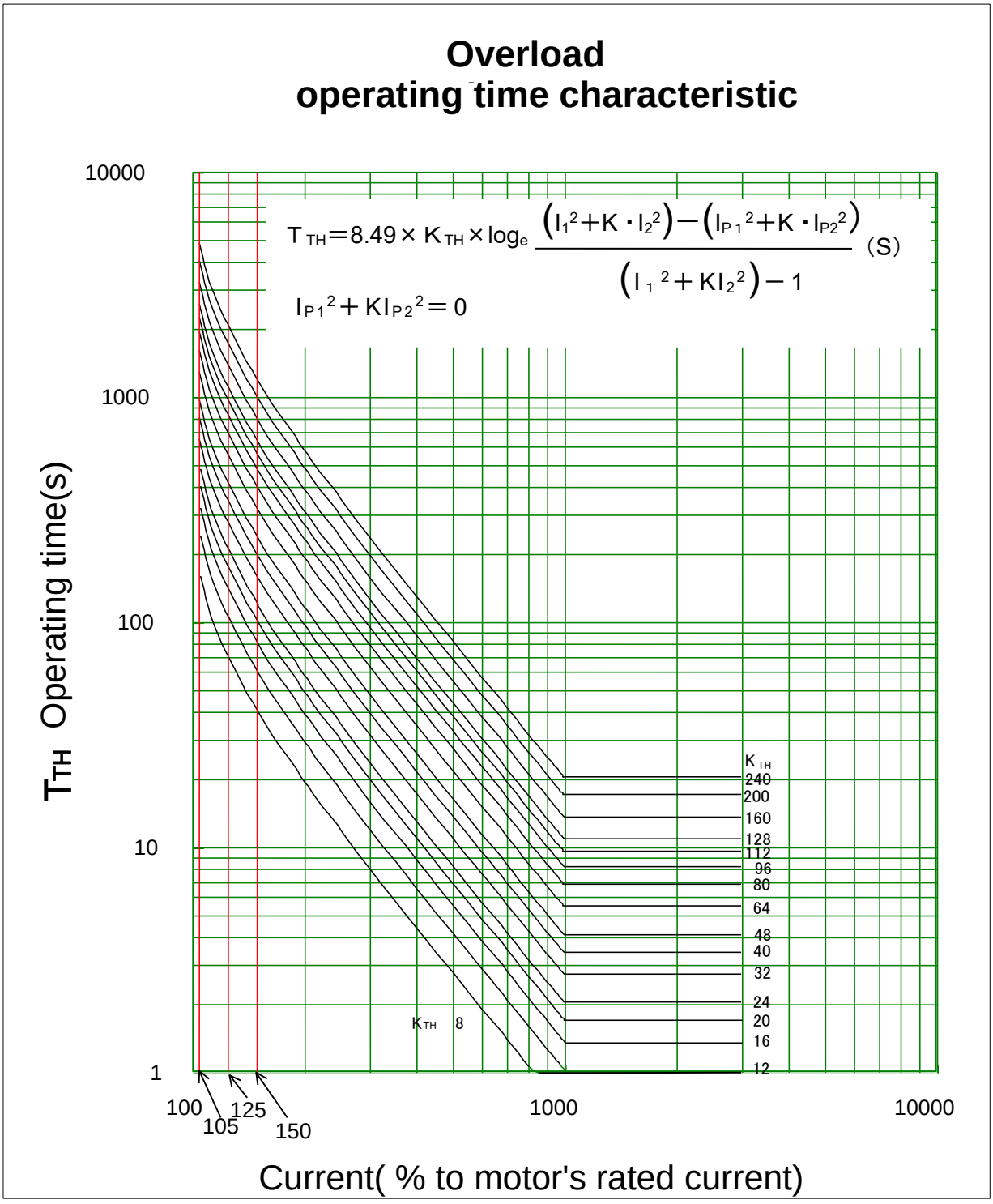


Fig. 3-17 Operating time characteristic of overload element

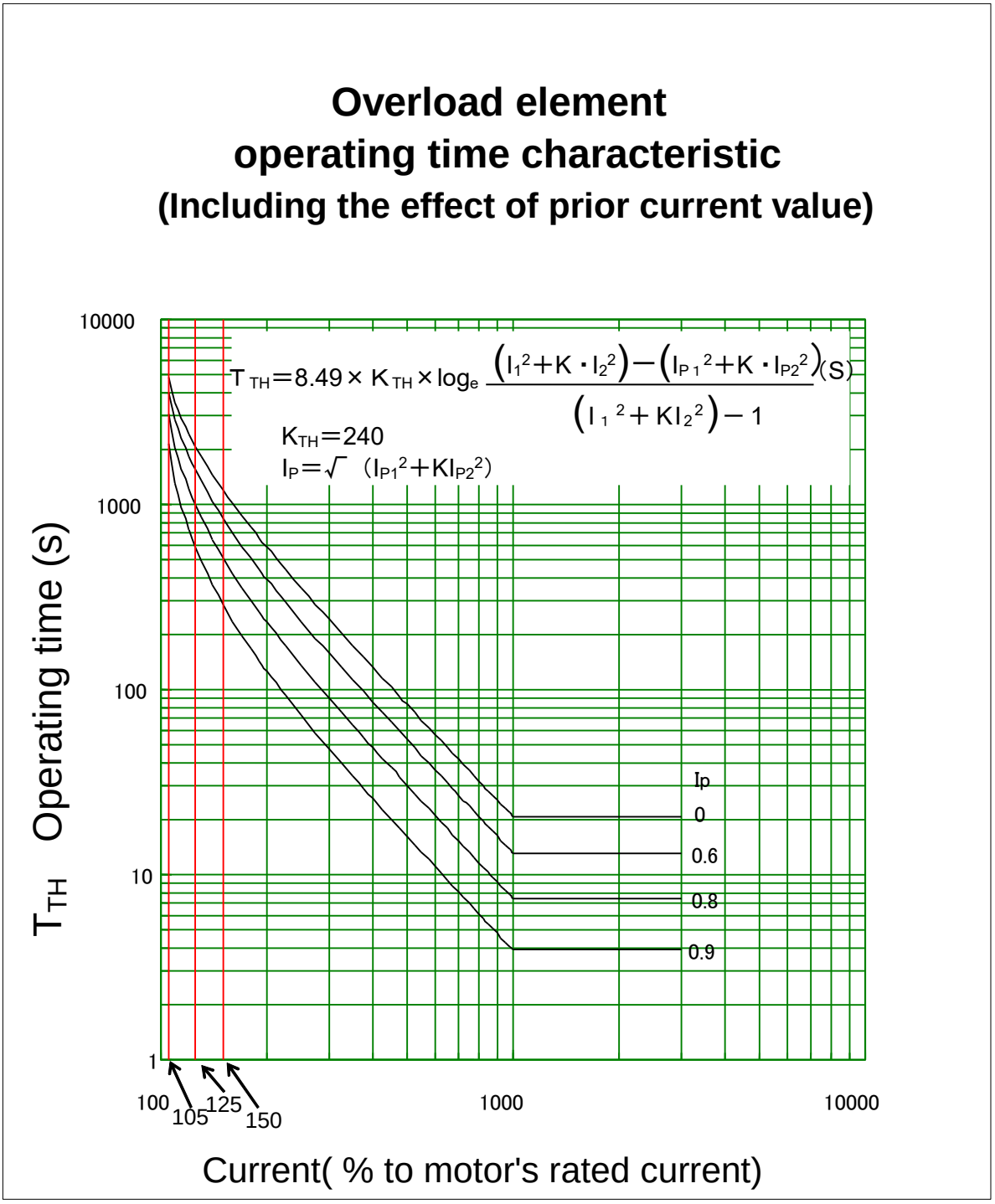


Fig. 3-18 Operating time characteristic of overload element
(Variation dependent on prior current value in HOT characteristic)

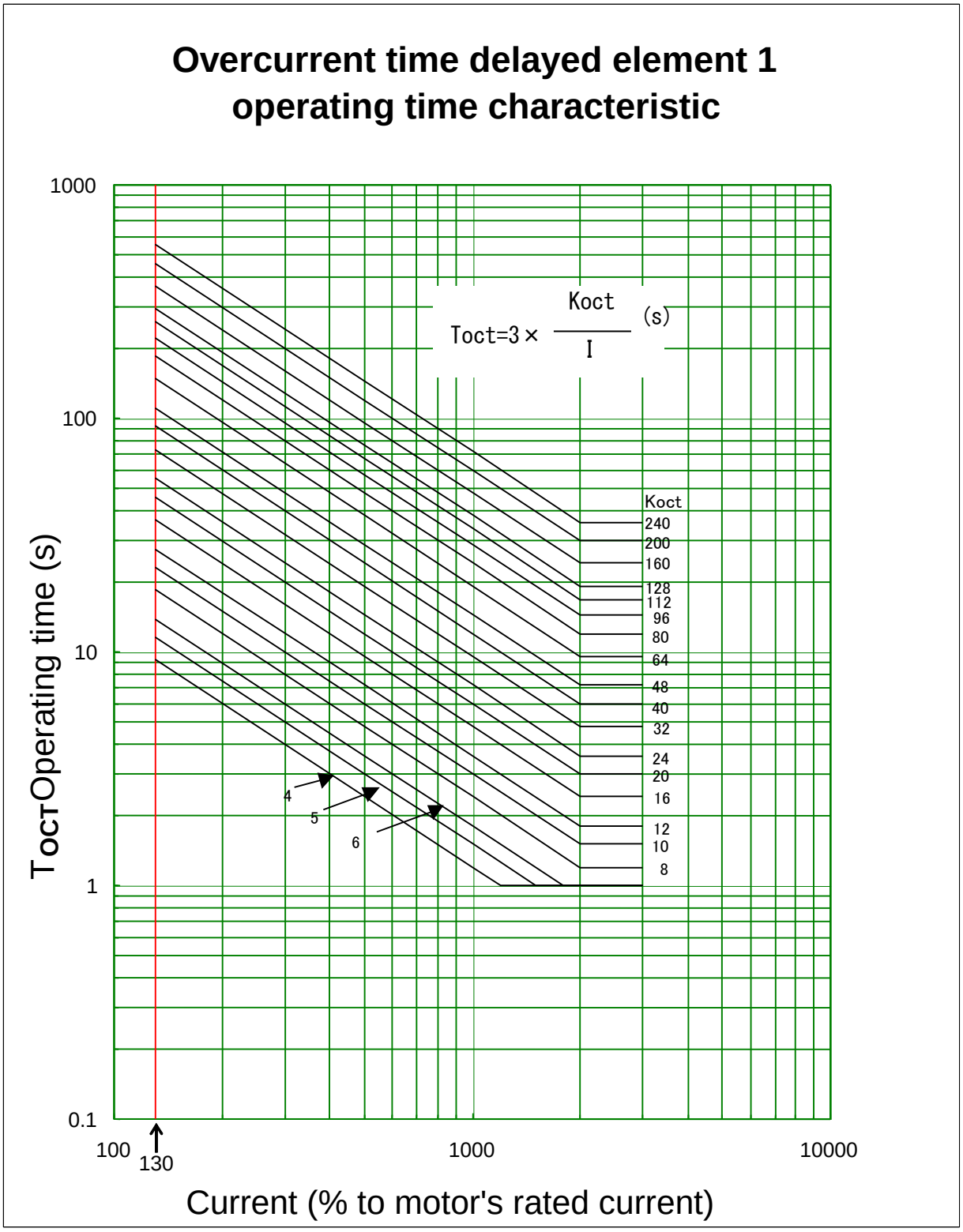


Fig. 3-19 Operating time characteristic of IDMT overcurrent element

3.8. Directional Ground-fault Element

The CMP1-A41D1 Relay incorporates 2 types of directional ground-fault element, listed in the table below, which achieve quick detection of a ground-fault accident occurring in a protected area.

Device No.	Display name	Protective function
67N(67G)	DIRN1(DIRG1) DIRN2(DIRG2)	Directional ground-fault instantaneous element

3.8.1. DIRG1 Element (Directional Ground-fault Element)

The internal function block diagram shown in Fig. 3-20 explains how DIRG1 Element works.
DIRG1 Element outputs a deterministic signal after the lapse of the operation timer period (Ope. Time) if the level assessment of zero-phase current vs. operating current setting value (Ope. Curt.) and zero-phase voltage vs. operating voltage setting value (Ope. Volt) determines that the zero-phase current/voltage is greater than the operating level and phase differences of zero-phase current and voltage remain within an operating range
A 200-ms reset timer is added on the reset side to prevent chattering on the contact.
In addition, DIRG1 Element outputs an operating signal only when its enable/disable setting (DIRG1 EN) is set for ON. If you do not want to use this element, switch the setting to OFF. This will prevent the unnecessary actuation of the element. In regard to DIRG1-related setting items, anything else does not have to be set.

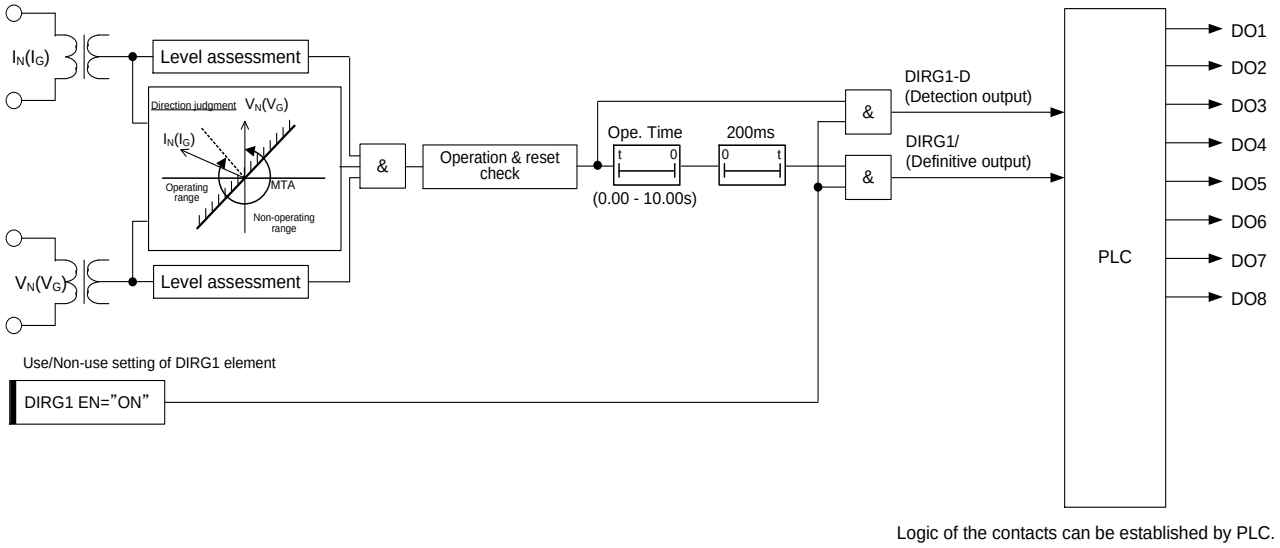


Fig. 3-20 DIRG1 Element – internal function block diagram

Table 3-18 DIRG1 Element – setting items

Display name	Name of setting value	Setting		Supplement
		Range of setting	step	
DIRG	MT Angle	0 - 359° Lag	1°	Maximum sensitivity angle setting common to DIRG1 and DIRG2
DIRG1	DIRG1 EN	OFF, ON	-	OFF: disable, ON: enable If you want to use this element, set it ON.
	Ope. Volt	2.0 - 100.0V	0.1V	Operating voltage
	Ope. Curt.	1.0 - 100.0mA	0.5mA	Operating current
	Ope. Time	0.00 - 10.00s	0.01s	Operating time INST: ≤ 50ms

3.8.2. DIRG2 Element (Directional Ground-fault Element)

DIRG2 Element has characteristics identical to DIRG1 Element.
For information about the element's internal function block diagram and how it works, see Section 3.8.1.

Table 3-19 DIRG2 Element – setting items

Display name	Name of setting value	Setting		Supplement
		Range of setting	step	
DIRG	MT Angle	0 - 359° Lag	1º	Maximum sensitivity angle setting common to DIRG1 and DIRG2
DIRG2	DIRG1 EN	OFF, ON	-	OFF: disable, ON: enable If you want to use this element, set it ON.
	Ope. Volt	2.0 - 100.0V	0.1V	Operating voltage
	Ope. Curt.	1.0 - 100.0mA	0.5mA	Operating current
	Ope. Time	0.00 - 10.00s	0.01s	Operating time INST: ≤ 50ms

3.9. Underpower Element

The CMP1-A41D1 Relay incorporates 2 types of underpower element listed in the table below.

Device No.	Display name	Protective function
37	UP1 UP2	Underpower element

3.9.1. UP1 Element (Underpower Element)

The internal function block diagram shown in Fig. 3-21 explains how UP1 Element works.

UP1 Element calculates a line voltage by using Y-Δ conversion when it has taken in an input voltage in terms of phase voltage whereas it calculates a power value from the line voltage itself (by using Equation 2 below) when it taken in a line voltage.

$$P = I_A \cdot V_{AB} + I_B \cdot V_{BC} + I_C \cdot V_{CA} \qquad \text{(Equation 2)}$$

UP1 Element outputs a deterministic signal after the lapse of the operating timer period (Ope. Time) if the result of the calculation is less than the operation setting value (Ope. Curt.).
A 200-ms reset timer is added on the reset side to prevent chattering on the contact.
In addition, UP1 Element outputs an operating signal only when its enable/disable setting (UP1 EN) is set for ON. If you do not want to use this element, switch the setting to OFF. This will prevent the unnecessary actuation of the element. In regard to UP1-related setting items, anything else does not have to be set.

Note

Using this protection element, it is necessary the 3 CT connection. In case of 2 CT connection, this element cannot offer intended operation.

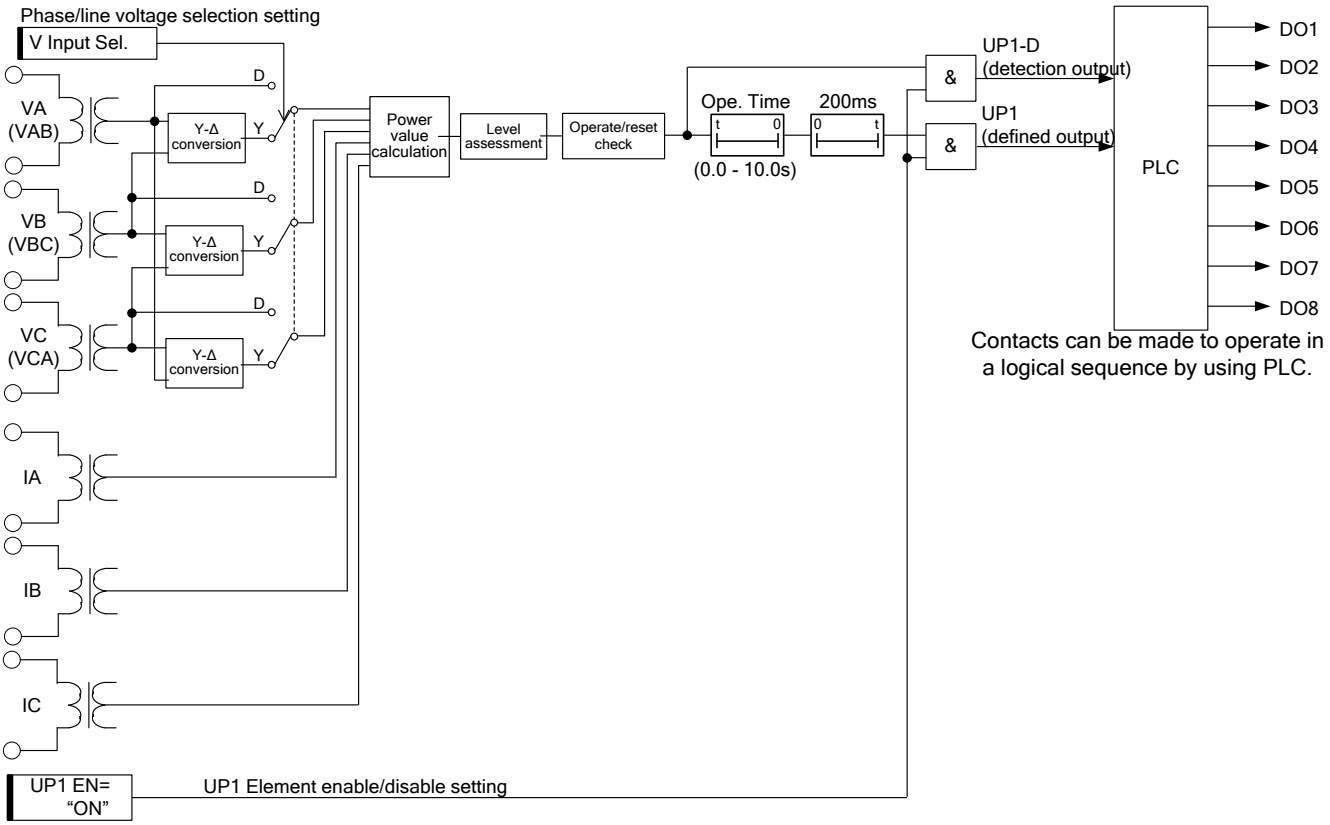


Fig. 3-21 UP1 Element – internal function block diagram

Table 3-20 UP1 Element – setting items

Display name	Name of setting value	Setting		Supplement
		Range of setting	step	
UP1	UP1 EN	OFF, ON	-	OFF: disable, ON: enable If you want to use this element, set it ON.
	Ope. Curt.	1 - 30%	1%	Operating current (magnification applied to motor's rated current)
	Ope. Time	0.0 - 10.0s	0.1s	Operating time INST: ≤ 50ms

3.9.2. UP2 Element (Underpower Element)

UP2 Element has characteristics identical to UP1 Element.
For information about the element's internal function block diagram and how it works, see Section 3.9.1.

Table 3-21 UP2 Element – setting items

Display name	Name of setting value	Setting		Supplement
		Range of setting	step	
UP2	UP2 EN	OFF, ON	-	OFF: disable, ON: enable If you want to use this element, set it ON.
	Ope. Curt.	1 - 30%	1%	Operating current (magnification applied to motor's rated current)
	Ope. Time	0.0 - 10.0s	0.1s	Operating time INST: ≤ 50ms

3.10. Undervoltage Element

Two types of undervoltage elements are provided in this products. 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

3.10.1. UV1 Element (Undervoltage Element)

Fig. 3-22 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

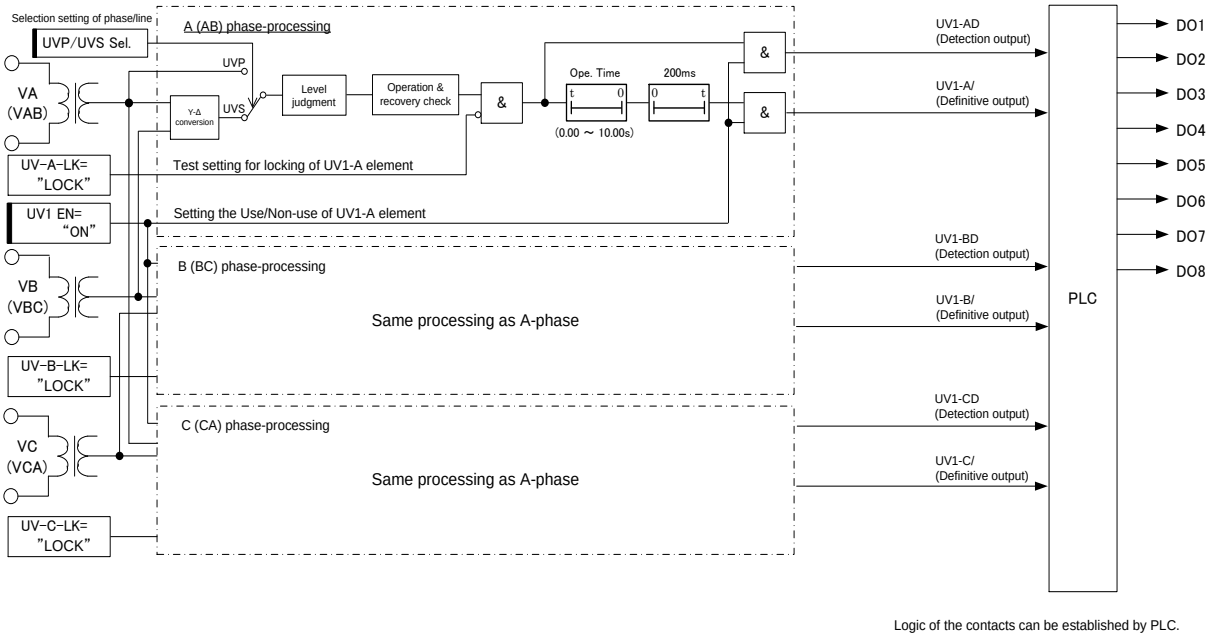


Fig. 3-22 UV1 Element – internal function block diagram

Table 3-22 UV1 Element – setting items

Display name	Name of setting value	Setting		Supplement
		Range of setting	step	
UV1	UV1 EN	OFF, ON	-	OFF: disable, ON: enable If you want to use this element, set it ON.
	UVP/UVS Sel.	UVP, UVS	-	Characteristic selection Selection between UVP (low phase voltage) and UVS (low line voltage)
	Ope. Volt.	20.0 - 120.0V	0.1V	Operating voltage
	Ope. Time	0.00 - 10.00s	0.01s	Operating time INST: ≤ 50ms

The relationship between the setting of V Input sel. in AI Config (sub-clause 0) 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 3-23 Setting items of UVP/UVS SEL

		UVP/UVS SEL	
		UVP	UVS
V Input Sel. (sub-clause 0)	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.

3.10.2. UV2 Element (Undervoltage Element)

The UV2 element has the same characteristics as the UV1 element.
Regarding the internal function block diagram and its operation, refer to sub-clause 3.10.1.

Table 3-24 UV2 Element – setting items

Display name	Name of setting value	Setting		Supplement
		Range of setting	step	
UV2	UV1 EN	OFF, ON	-	OFF: disable, ON: enable If you want to use this element, set it ON.
	UVP/UVS Sel.	UVP, UVS	-	Characteristic selection Selection between UVP (low phase voltage) and UVS (low line voltage)
	Ope. Volt.	20.0 - 120.0V	0.1V	Operating voltage
	Ope. Time	0.00 - 10.00s	0.01s	Operating time INST: ≤ 50ms

3.11. Overvoltage Element

Two types of overvoltage elements are incorporated in the CMP1-A41D1. The overvoltage detection methods can be set to make use of either phase (phase to neutral) voltage or line (phase to phase) voltage.

Device No.	Display name	Protective function
59S	OV1, OV2	Overvoltage instantaneous element ●2 types of detection method are incorporated: Method 1 (OVP): Detection is effected on the basis of a high phase voltage Method 2 (OVS): Detection is effected on the basis of a high line voltage

3.11.1. OV1 Element (Overvoltage Element)

Fig. 3-23 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.

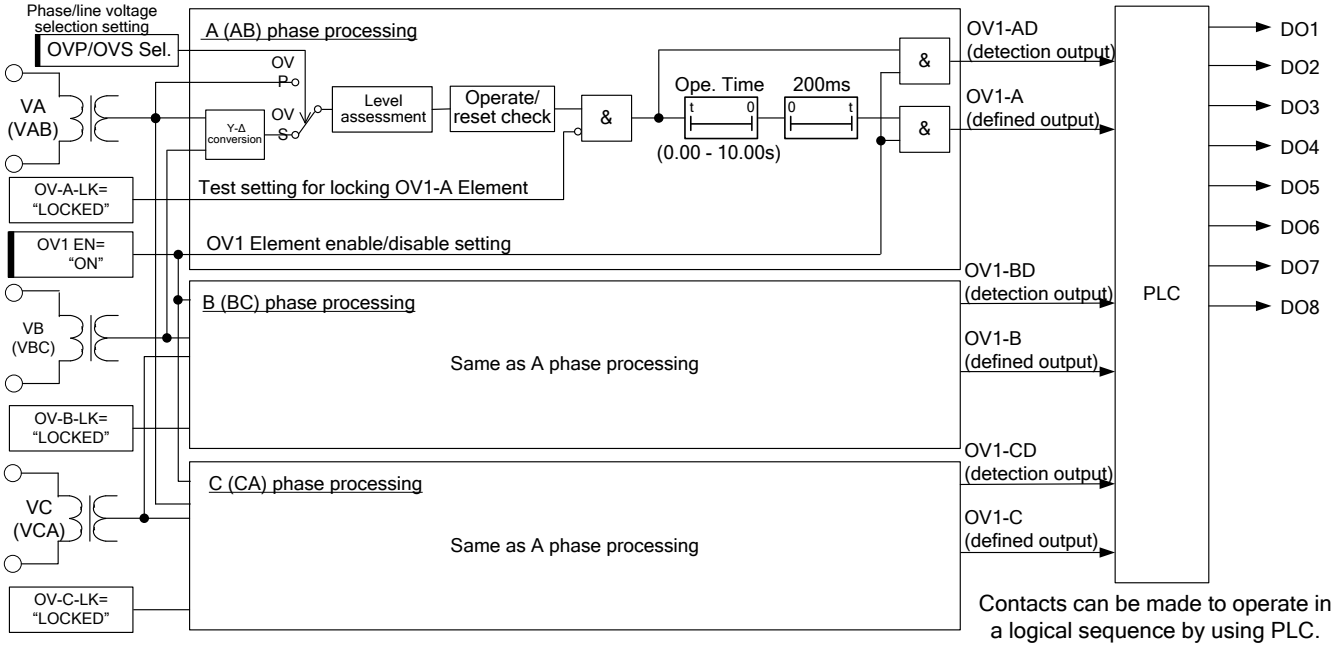


Fig. 3-23 OV1 Element – internal function block diagram

Table 3-25 OV1 Element – setting items

Display name	Setting parameter	Setting		Description
		Range of setting	step	
OV1	OV1 EN	OFF, ON	-	OFF: disable, ON: enable If you want to use this element, set it ON.
	OVP/OVS Sel.	OVP, OVS	-	Characteristic selection Selection between OVP (high phase voltage) and OVS (high line voltage)
	Ope. Volt.	20.0 - 200.0V	0.1V	Operating voltage
	Ope. Time	0.00 - 10.00s	0.01s	Operating time INST: ≤ 50ms

3.11.2. OV2 Element (Overvoltage Element)

OV2 Element has characteristics identical to OV1 Element
For information about the element's internal function block diagram and how it works, see Section 3.11.1.

Table 3-26 OV2 Element – setting items

Display name	Setting parameter	Setting		Description
		Range of setting	Step	
OV2	OV2-EN	OFF, ON	-	OFF: disable, ON: enable If you want to use this element, set it ON.
	OVP/OVS Sel.	OVP, OVS	-	Characteristic selection Selection between OVP (high phase voltage) and OVS (high line voltage)
	Ope. Volt.	20.0 - 200.0V	0.1V	Operating voltage
	Ope. Time	0.00 - 10.00s	0.01s	Operating time INST: ≤ 50ms

3.12. Ground-fault Overvoltage Element

Two types of ground-fault overvoltage elements are incorporated in the CMP1-A41D1.
It is also possible to select 2 types of ground-fault overvoltage detection methods depending on the requirement.

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.

3.12.1. OVG1 Element (Ground-fault Overvoltage Element)

Fig. 3-24 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.

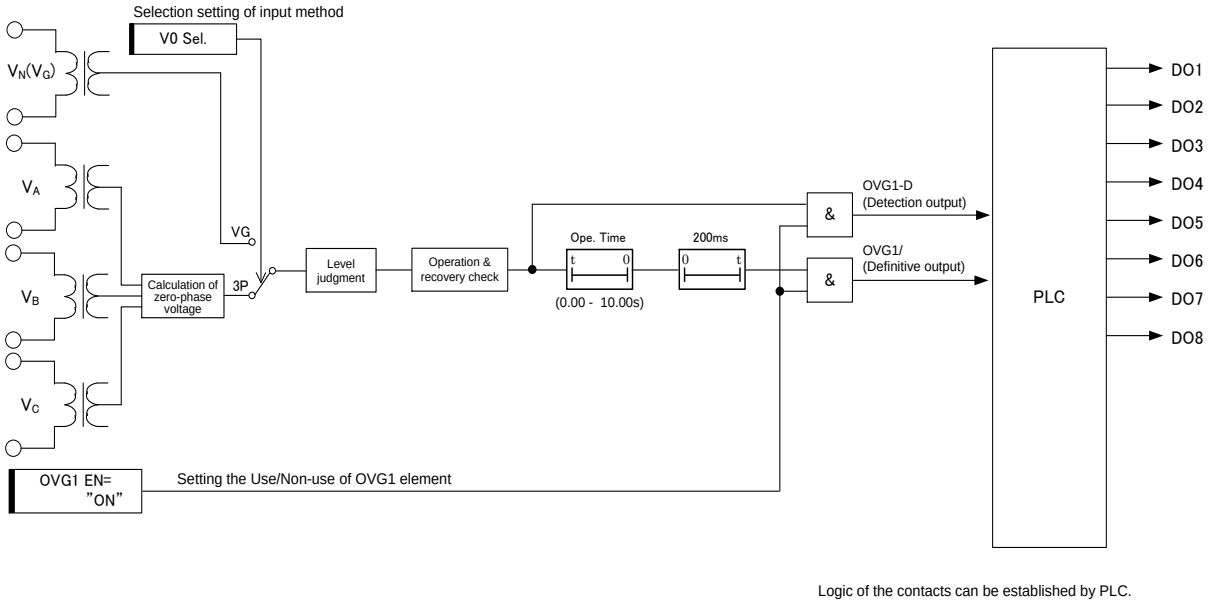


Fig. 3-24 Internal function block diagram of OVG1 element

Table 3-27 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

3.12.2. 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 3.12.1.

Table 3-28 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

3.13. Negative-phase-sequence Overvoltage Element

Two types of negative-phase sequence overvoltage elements are incorporated in the CMP1-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

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

3.13.1. OVNEG1 element (Negative-phase-sequence Overvoltage Element)

Fig. 3-25 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.

The setting value of ‘OVNEG Ope. Volt.’ should set as the phase voltage value whether or not the setting ‘V Input. sel’ which selected Y or D in in AI Config (sub-clause 0).

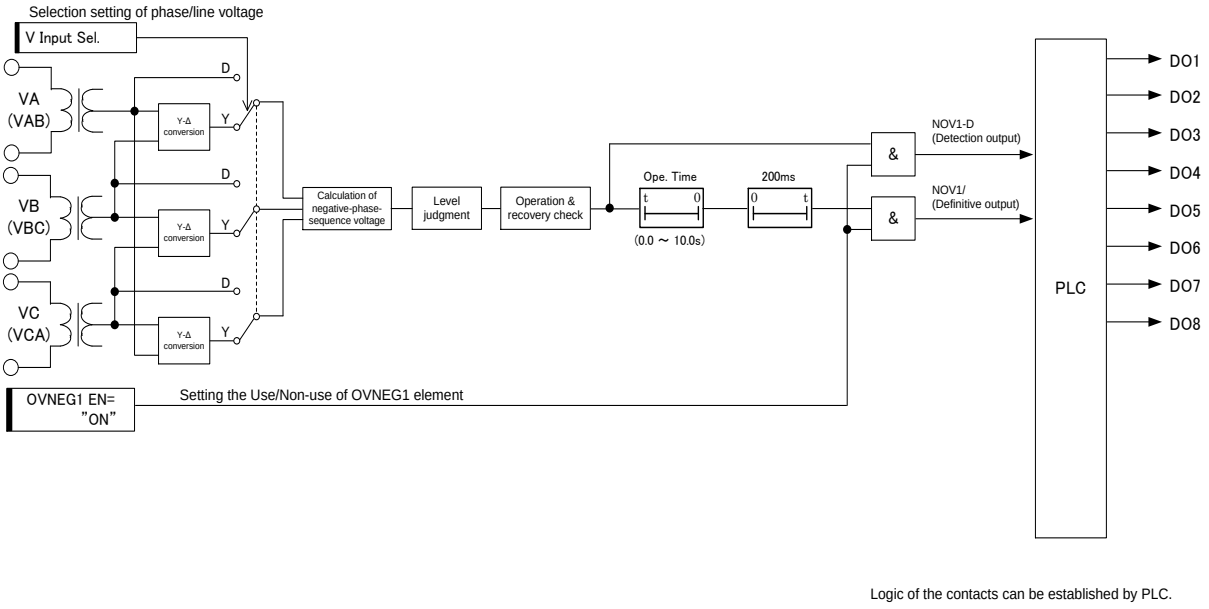


Fig. 3-25 Internal function block diagram of OVNEG1 element

Table 3-29 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

3.13.2. 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 3.13.1.

Table 3-30 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 current
	Ope. Time	0.0 ~ 10.0 s	0.1 s	Operating time INST: ≤ 50 ms

3.14. Underfrequency Element

Three under-frequency elements are incorporated in CMP1-A41D1. It is possible to detect frequency drop due to overload, etc.

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

3.14.1. UF1 Element (Underfrequency Element)

Fig. 3-26 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.

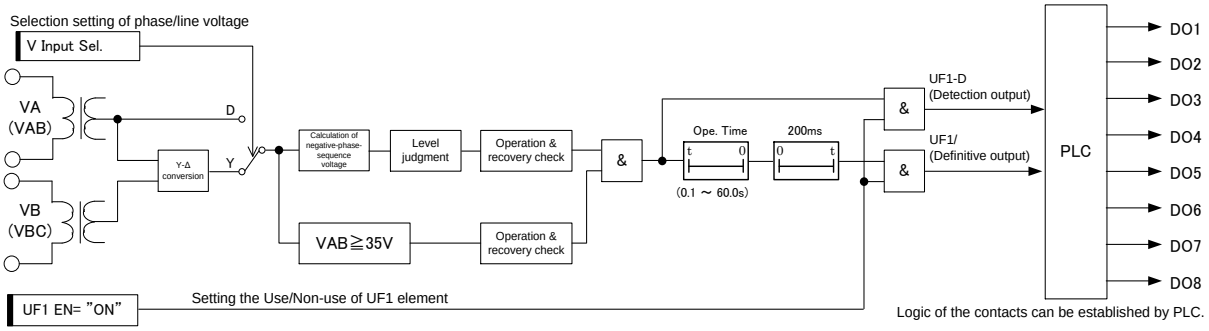


Fig. 3-26 Internal function block diagram of UF1 element

Table 3-31 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

3.14.2. 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 3.14.1.

Table 3-32 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

3.14.3. 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 3.14.1.

Table 3-33 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

3.15. Overfrequency Element

Three over-frequency elements are provided in the CMP1-A41D1. It is possible to detect frequency increase due to load reduction, etc.

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

3.15.1. OF1 Element (Overfrequency Element)

Fig. 3-27 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. 3-27.

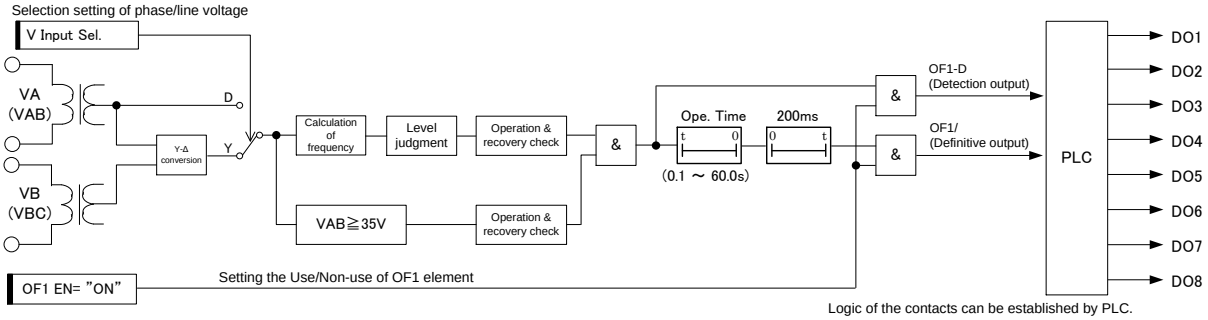


Fig. 3-27 Internal function block diagram of OF1 element

Table 3-34 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

3.15.2. 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 3.15.1.

Table 3-35 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

3.15.3. 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 3.15.1.

Table 3-36 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

3.16. Limitation of motor starting time Element

The CMP1-A41D1 Relay incorporates 2 types of number–of-starts limiting element listed in the table below. Generally, the specification / data sheet of a motor describes how many start-stop cycles the motor is allowed to go through in a given duration of time.
This element outputs an operating signal when the motor has exceeded the prescribed number of start-stop cycles.
This element, combined with an external sequence (starting sequence), can prevent the motor from repeating start-stop cycles excessively.

Device No.	Display name	Protective function
66	MST1	Number-of-starts limiting element (accumulated-heat type)
	MST2	Number-of-starts limiting element (simple number-of-starts type)

3.16.1. Limitation of motor starting time Element (Accumulated-heat Type) (MST1)

Fig. 3-28 shows the internal function blocks of MST1 element.

MST1 Element performs a motor start assessment on the basis of A-phase current. The element counts the number of starts up by one each time it detects a motor start and outputs a deterministic signal after the lapse of time which is calculated from number-of-starts setting value (Str. Times) and operation timer period (Str. Time). Described below are motor start condition, start-complete condition and number-of-starts assessment equation:

- Motor start condition
  Current to the motor has changed from 10% below the motor's rated current to 150% over the motor's rated current within a period of approximately 60 ms.

- Start-complete condition
  Current to the motor, following the above-mentioned condition, has stayed 125% below the motor's rated current for a period of 100 ms.
- Number-of-starts assessment equation
  MST1 operation time = (Number of starts – 1) x starting time + 1 second
- Example
  Number of starts (Str. Times) = 4
  Starting time (Str. Time) = 10 seconds,
  "MST1 operation time" = (4 – 1) × 10 + 1 = 31 seconds.

Also, because cumulated time (starting time x number of starts) is reduced in accordance with a decrease rate setting (Dec. Rate), this element resets itself when it has gone down to a level of cumulated time which permits its restart.

Note that MST1 Element is provided with a capability of zero-clearing the number of starts to facilitate the performance of testing. This capability can be set from the front panel or PC tool.

In addition, MST1 Element outputs an operating signal only when its enable/disable setting (MST1 EN) is set for ON. If you do not want to use this element, switch the setting to OFF. This will prevent the unnecessary actuation of the element. In regard to MST1-related setting items, anything else does not have to be set.

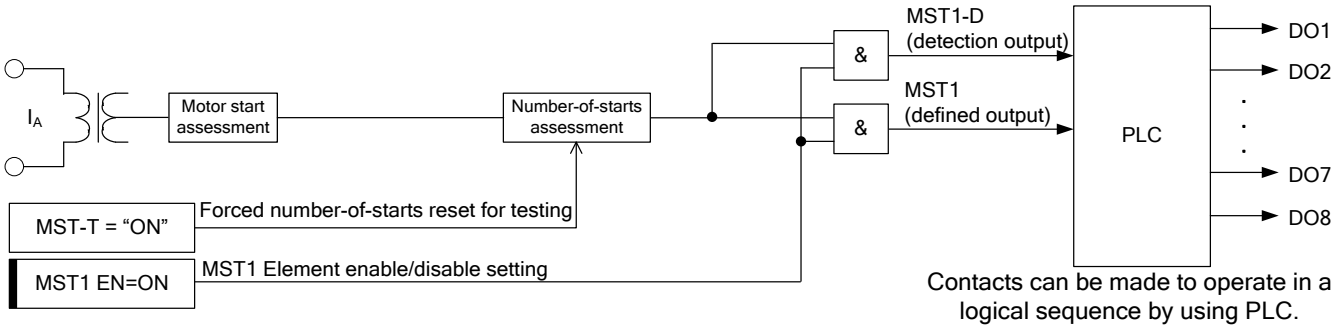


Fig. 3-28 MST1 Element – internal function block diagram

Table 3-37 MST1 Element – setting items

Display name	Name of setting value	Setting		Supplement
		Range of setting	step	
MST1	MST1 EN	OFF, ON	-	OFF – disable, ON – enable If you want to use this element, set it ON.
	Str. Times	1 - 10	-	Number of starting
	Str. Time	2 - 120s	1s	Starting time
	Dec. Rate	2.0 - 250.0s/h	0.1s/h	Decrease rate

3.16.2. Limitation of motor starting time Element (Simple Number-of-starts Type) (MST2)

The internal function block diagram shown in Fig. 3-29 explains how the limitation of motor starting time element (Simple Number-of-starts type) works.

MST2 Element acquires the A-phase current to judge the motor starting condition. The element counts the number of starts up by one each time it detects the motor start condition which is described below and allows a detection output to activate when the number of starts has reached a setting value (Str. Times) within a certain duration of time (one hour) and outputs a deterministic signal after the lapse of one second. Described below is the motor start condition and start-complete condition:

- ◆ Motor start condition..... Current to the motor has changed from 10% below the motor's rated current to 150% over the motor's rated current within a period of approximately 60 ms.
- ◆ Start-complete condition.... Current to the motor, following the above-mentioned condition, has stayed 125% below the motor's rated current for a period of 100 ms.

The setting 'Str. Times' means that one hour is required for internal counter reducing to zero hour after the motor operates once.

Setting Example 1

Str. Times = 1 time

When the motor starting up once a time, the MST2 signal turns ON. And after one (1) hour, the internal counter is reset to zero (0) and 2nd time of the motor starting up is enable.

Setting Example 2

Str. Times = 3 time

When the motor starting up 3rd times, the MST2 signal turns ON. And after three (3) hours, the internal counter is reset to zero (0) and 4th time of the motor starting up is enable.

More detail of the MST2 behavior such as the motor acceleration before the internal counter reset to zero, please refer to below "Behavior Examples".

The setting of reset timer (Rst. Time) means that keeping time of the MST2 element operation signal (MST2) after the operation. When user assigns this signal to the relay contact output (DO), the DO keeps for the setting time of Rst. Time.

Note that MST2 Element is provided with a capability of zero-clearing the number of starts to facilitate the performance of testing. This capability can be set from the front panel or PC tool.
In addition, MST2 Element outputs an operating signal only when its enable/disable setting (MST2 EN) is set for ON. If you do not want to use this element, switch the setting to OFF. This will prevent the unnecessary actuation of the element. In regard to MST2-related setting items, anything else does not have to be set.

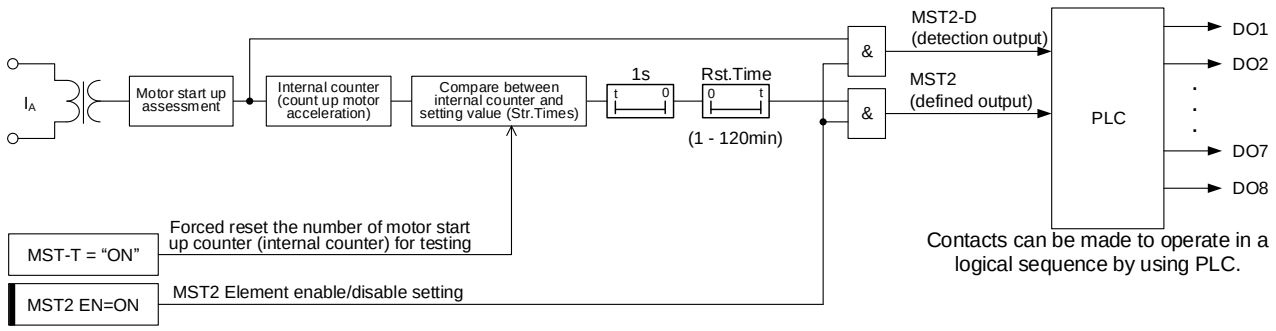


Fig. 3-29 MST2 Element – internal function block diagram

Table 3-38 MST2 Element – setting items

Display name	Name of setting value	Setting		Supplement
		Range of setting	step	
MST2	MST2 EN	OFF, ON	-	OFF – disable, ON – enable If you want to use this element, set it ON.
	Str. Times	1 - 10	-	Limitation number of motor start up.
	Rst. Time	1 - 120min	1min	Keep time of relay contact output.

3.16.2.1. Operation behavior

Following example, please set that the internal signal ‘MST2-D’ and ‘MST2’ are assigned to DO via PC-HMI >> PLC function.

The indicated value on HMI means that user can confirm ‘MST2 Counter’ via VFD on front panel or PC-HMI (refer to Fig. 3-30). This ‘MST2 Counter’ shows the rounded off the number of internal counter.

Behavior Example 1

Under the following relay setting, the example of the motor operating sequence is shown in Table 3-39.

Example of Relay Setting
MST2 Str. Times = 3 times
MST2 Rst. Time = 5 min

Table 3-39 Motor operating sequence in behavior example 1

Time	Motor condition	Internal counter	Internal counter (Indicated value on HMI)	MST2-D signal output	MST2 signal output	Description / Note
T0	Before motor starts up.	0 hour	0	OFF	OFF	
T1	Motor starts up (1st).	1.0 hour	1	OFF	OFF	When the MST2 detects motor starting up or acceleration, the internal counter is added 1.0 hour.
		0.83 hour (= 1.0 hour – 0.17 hour)	1	OFF	OFF	Time between T2 and T1 is 10 min (=0.17 hour).
T2	Motor starts up or acceleration (2nd).	1.83 hour (=0.83 hour + 1.0 hour)	2	OFF	OFF	The adding 1.0 hour sequence is same as T1.
		1.66 hour (=1.83 hour – 0.17 hour)	2	OFF	OFF	Time between T3 and T2 is 10 min.
T3	Motor starts up or acceleration (3rd).	2.66 hour (=1.66 hour + 1.0 hour)	3	ON	ON	The adding 1.0 hour sequence is same as T1.
T4	Motor stops or remains normal in-service condition.	2.577 hour (=2.66 hour – 0.083 hour)	3	ON	OFF	When the setting 'Rst Time’ (= 5 min in this example) is passed, the MST2 signal turns off. Where 5 min = 0.083 hour.

T5	Motor stops or remains normal in-service condition.	2.49 hour (=2.66 hour – 0.17 hour)	2	OFF	OFF	Time between T5 and T3 is 10 min.
T6	Motor stops or remains normal in-service condition.	0 hour (=2.66 hour passed from T3 which is last starting up or accelerating time)	0	OFF	OFF	Time between T6 and T3 −last starting up or accelerating − is around 160 min (2.66 hours).

Behavior Example 2

Under the following relay setting, the example of the motor operating sequence is shown in Table 3-40.

Relay Setting

MST2 Str. Times = 3 times

MST2 Rst. Time = 60 min

Table 3-40 Motor operating sequence in behavior example 2

Time	Motor condition	Internal counter	Internal counter (Indicated value on HMI)	MST2-D signal output	MST2 signal output	Description / Note
T0	Before motor starts up.	0 hour	0	OFF	OFF	
T1	Motor starts up (1st).	1.0 hour	1	OFF	OFF	When the MST2 detects motor starting up or acceleration, the internal counter is added 1.0 hour.
		0.67 hour (= 1.0 hour – 0.33 hour)	1	OFF	OFF	Time between T2 and T1 is 20 min (=0.33 hour).
T2	Motor starts up or acceleration (2nd).	1.67 hour (=0.67 hour + 1.0 hour)	2	OFF	OFF	The adding 1.0 hour sequence is same as T1.
		1.34 hour (=1.67 hour – 0.33 hour)	2	OFF	OFF	Time between T3 and T2 is 20 min.
T3	Motor starts up or acceleration (3rd).	2.34 hour (=1.34 hour + 1.0 hour)	3	ON	ON	The adding 1.0 hour sequence is same as T1.
		2.01 hour (=2.34 hour – 0.33 hour)	2	ON	ON	Time between T4 and T3 is 20 min.
T4	Motor starts up or acceleration (4th).	3.01 hour (=2.01 hour + 1.0 hour)	3	ON	ON	The adding 1.0 hour sequence is same as T1. The MST2 keeps ON and the motor acceleration is prohibited by this signal. This relay count up the number of the motor acceleration trying.

		2.68 hour (=3.01 hour – 0.33 hour)	3	ON	ON	Time between T5 and T4 is 20 min.
T5	Motor starts up or acceleration (5th).	3.68 hour (=2.68 hour + 1.0 hour)	4	ON	ON	The adding 1.0 hour sequence is same as T1.
T6	Motor stops or remains normal in-service condition.	2.68 hour (3.68 hour – 1.0 hour)	3	ON	OFF	When the setting 'Rst Time' (= 60 min in this example) is passed, the MST2 signal turns off.
T7	Motor stops or remains normal in-service condition.	2.49 hour (=3.68 hour – 1.19 hour)	2	OFF	OFF	Time between T7 and T5 −last starting up or accelerating − is around 71.4 min (1.19 hours). After this time, the motor can be started up or acceleration.

3.16.2.2. Confirmation of MST2 internal counter on HMI

The indicated value on HMI means that user can confirm 'MST2 Counter' via VFD on front panel or PC-HMI.
For checking on VFD, please refer to clause 4.3.2.1.
For checking on PC-HMI, please refer to following captured screen (Fig. 3-30).
This 'MST2 Counter' shows the rounded off the number of internal counter.

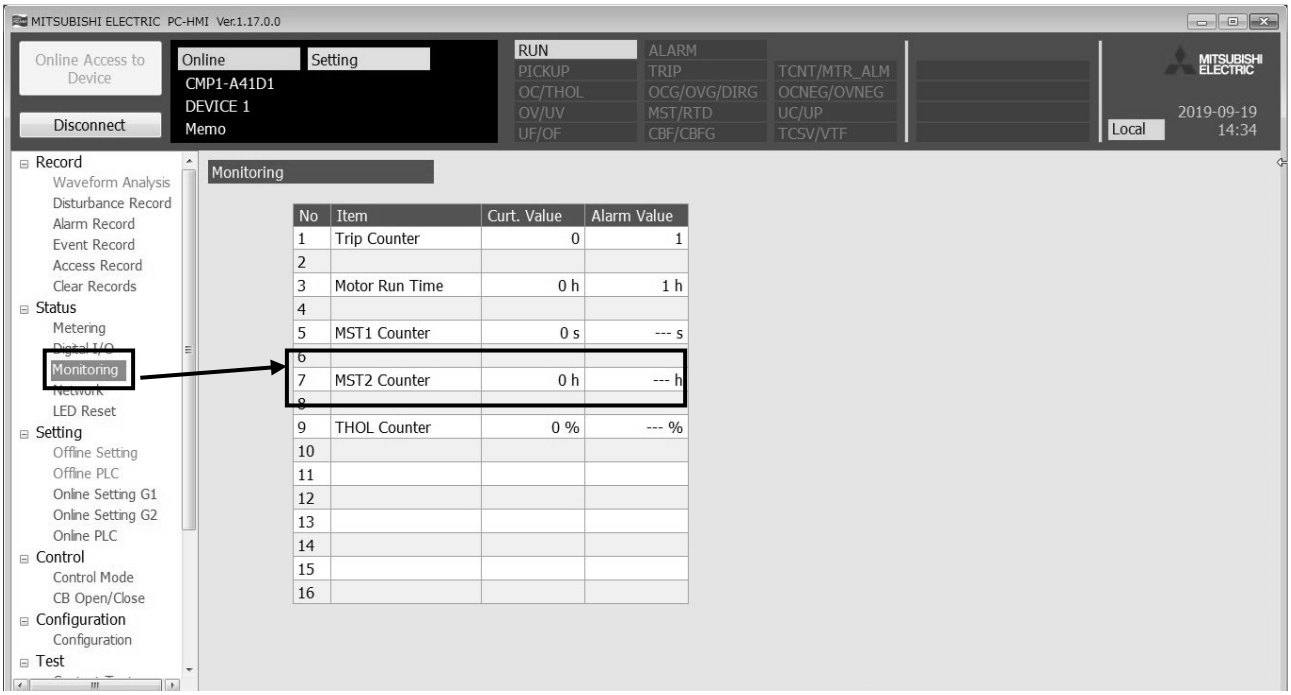


Fig. 3-30 Internal counter monitoring of MST2 element (example of PC-HMI)

3.17. VTF Function

3.17.1. Protection Description

VTF Function is incorporated for the purpose of precluding the unnecessary actuation by detecting a faulty condition in the VT, a break in cable or the like and thus locking the voltage element.
Internal function block diagram shown in Fig. 3-31 explains how VTF Function works.

This function outputs a VTF detection signal and outputs a defined VTF signal after the lapse of 20 seconds if 3-phase OR signal for line UV element (UV-D) is operative, 3-phase OR signal for current change detection element (OCD-D) and ground-fault overcurrent element are inoperative, DI6 is ON, and VTF function enable/disable setting is ON (VTF EN = ON).

By connecting the auxiliary “a” contact of the switchgear (CB or the like) to DI6, an erroneous detection of VTF is prevented from occurring while the switchgear is open. That is, if a low voltage is detected despite the absence of current changes and the switchgear being in closed state, it is assumed that any accident has not taken place and instead there is something wrong with VT. Thus, an unnecessary actuation can be prevented by locking the voltage element instantaneously.

Setting Example 1

Hardware connection

VT connection: Y (star)

Relay Setting

AI Config. > V Input Sel.＝Y

“VTF UV” Setting

$$(PhaseVoltage)\times\sqrt{3}\times(Percentage\,of\,VTF\,Detection)$$

If you use phase voltage is set as 63.5 V and VTF detection value is set as 70%, the setting value is obtained by following equation.

$$(63.5V)\times\sqrt{3}\times(70\%)=76.99...\approx 77V$$

Setting Example 2

Hardware connection

VT connection: D (delta)

Relay Setting

AI Config. > V Input Sel.＝D

“VTF UV” Setting

$$(Line-LineVoltage)\times(Percentage\,of\,VTF\,Detection)$$

If you use line-line voltage is set as 110 V and VTF detection value is set as 70%, the setting value is obtained by following equation.

$$(110V)\times(70\%)=76.99...\approx 77V$$

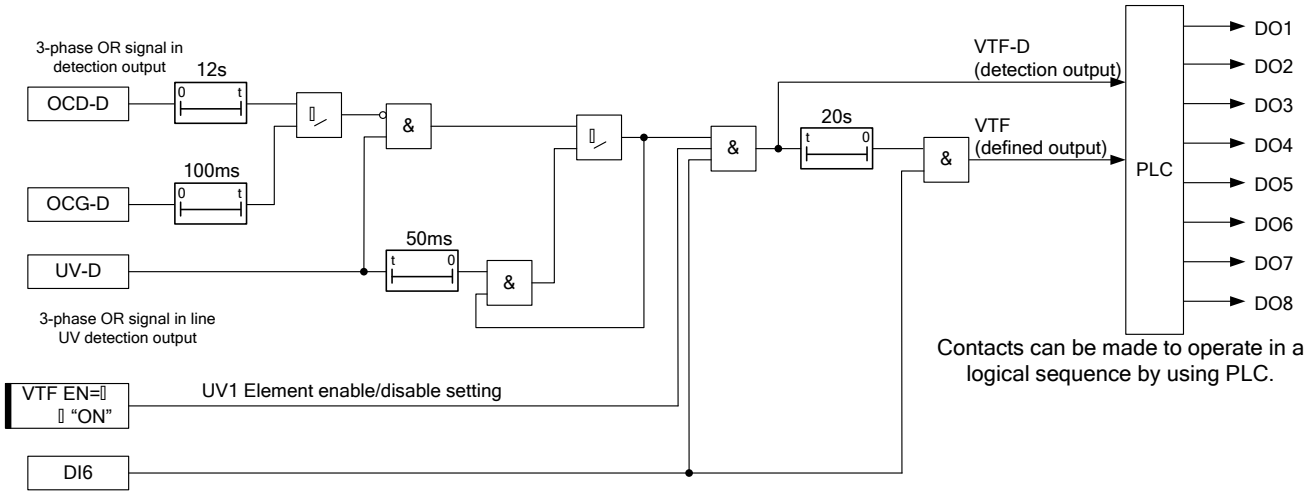


Fig. 3-31 VTF Element – internal function block diagram

Table 3-41 VTF Function - setting items

Display name	Name of setting value	Setting		Supplement
		Range of setting	step	
VTF	VTF EN	OFF, ON	-	OFF – disable, ON – enable If you want to use this element, set it ON.
	VTF UV	20.0 - 120.0V	0.1V	Operating voltage Please set as line-line voltage. More information, please refer to above Setting Example 1 or 2.
	VTF OCD	0.5 - 100.0A	0.1A	Operating current
	VTF OCG	1.0 - 100.0mA	0.5mA	Operating current for zero phase

The VTF element similar to this protection element is adopted to particular use case in Korea. Please contact us for information.

3.17.2. Protection Application

The configuration example has been shown in this clause when coordinate the behavior of the undervoltage (UV) element using VTF element.
Fig. 3-32 shows a configuration example. In general, the UV element would be operated when voltage drops even if the cause is VT fuse failure.

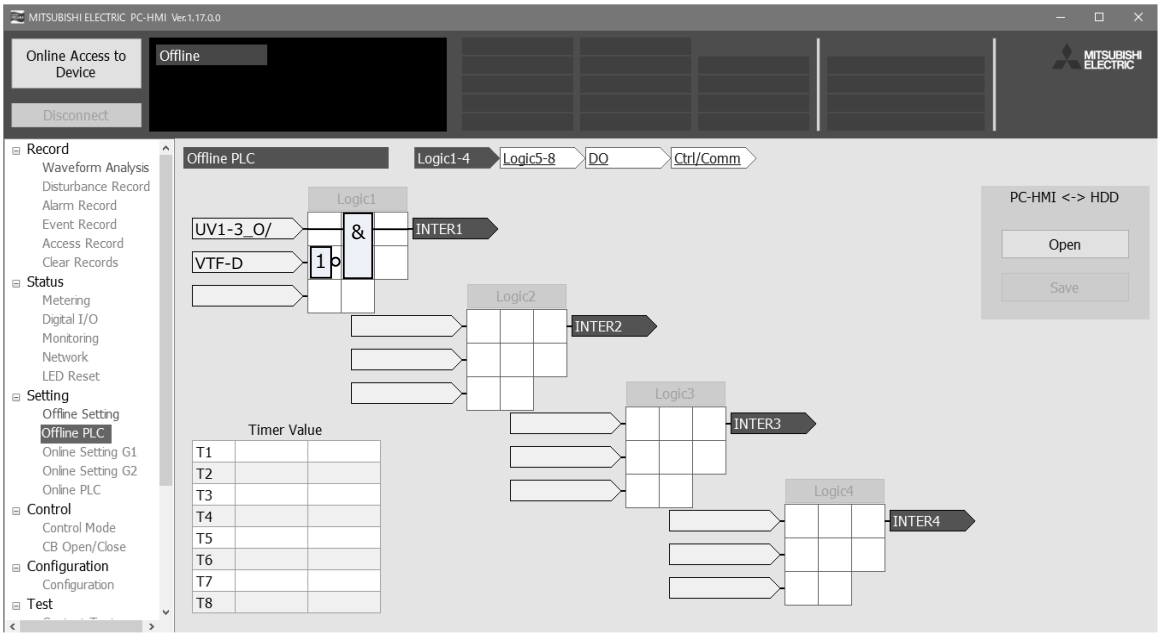


Fig. 3-32 Example logic configuration: Use VTF element to coordinate the behavior of UV element

3.18. Supervision of zero-sequence voltage

This protection relay 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. 3-33.

When the voltage amplitude of 'VA + VB + VC – 3xV0' exceeds the operating value (10 V), the alarm signal issues after the preset time of the operation timer (Ope. Time) has passed.

A setting 'V0 SEL' is provided in order to select whether the zero-sequence voltage V0 in the arithmetic expression is derived by [(VA+VB+VC)/3], or whether it is taken directly taken from the VN(VG) terminal.

Note that, due to characteristics of the arithmetic expression, this monitoring does not correctly function when the voltage taken into this equipment is set to the line voltage and in this case, it shall be set Use/Non-use '3PBV EN' = OFF..

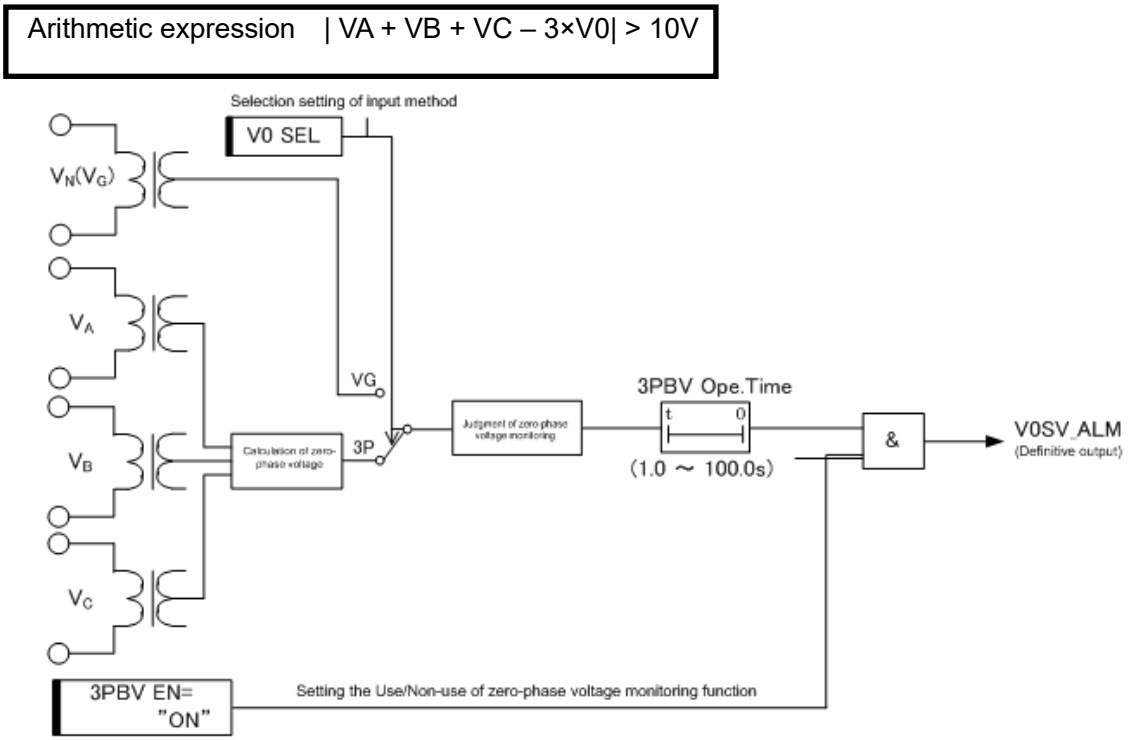


Fig. 3-33 Internal function block diagram of the supervision of zero-sequence voltage element

Table 3-42 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

3.19. AI-Configulation setting

Table 3-43 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.

3.19.1. Relationship between “V Input Sel.” And “V 3P/2P Sel.”

Table 3-44 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 input. The phase voltage value are not indicated in metering function.
	2P	2 phase to phase voltages are input.. 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. The operation method (2) will be described in Chapter 11.

4.1. Pushbutton switches and indication display

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

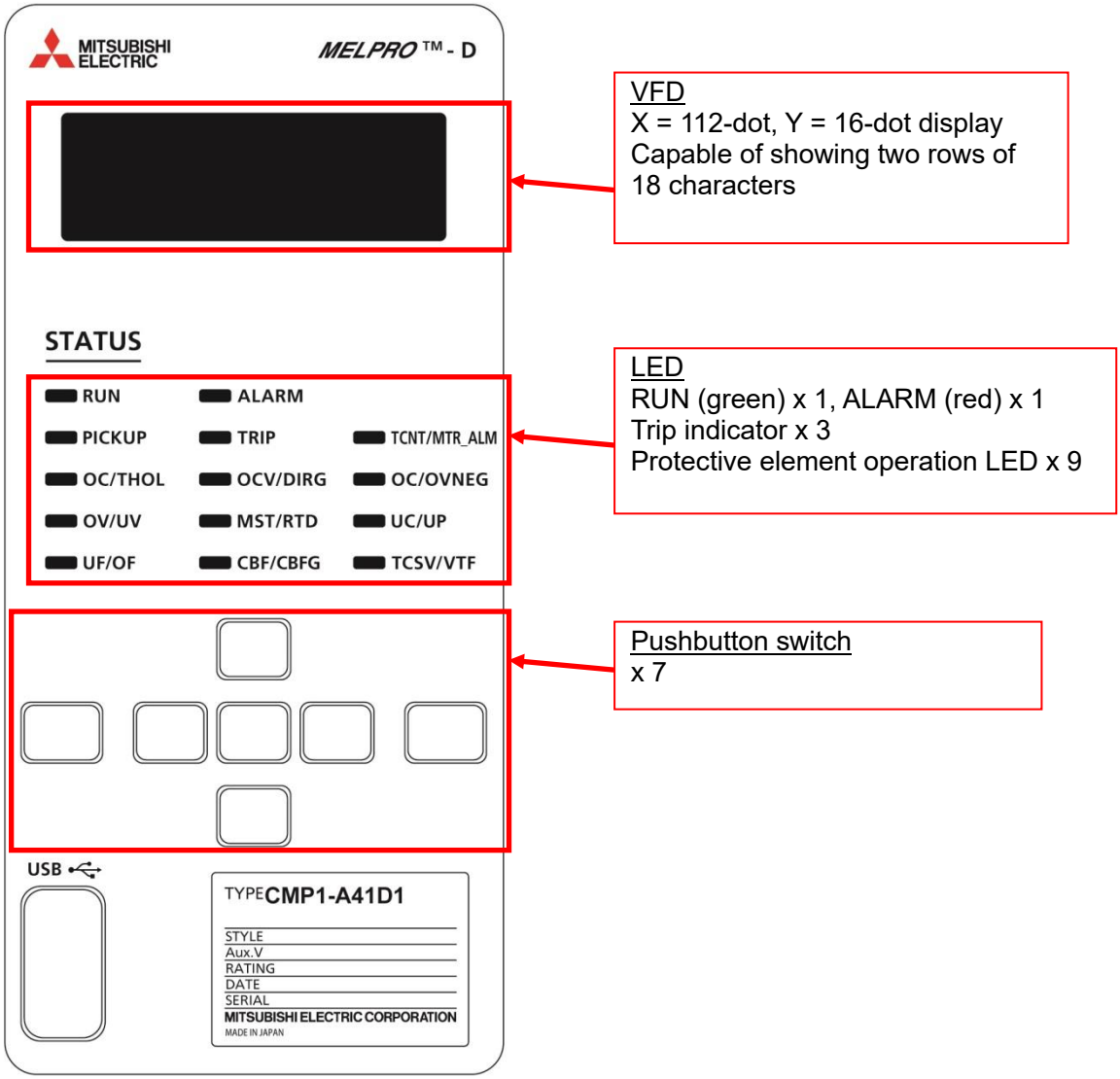


Fig. 4-1 Front panel section description

Table 4-1 Front panel section description

Name			Description
VFD			Shows various menus of the DISPLAY/SETTING mode.
LED	RUN	Green	Shows the result of constant supervision. Illuminated for a normal condition.
	ALARM	Red	Shows the result of constant supervision. Illuminated for an abnormal condition.
	PICKUP	Yellow	Illuminated for detection of PICKUP (OR of all elements).
	TRIP	Red	Illuminated for detection of TRIP (OR of all elements).
	TCNT/MTR_ALM	Red	Illuminated for activation of trip counter/Motor ALARM.
	OC/THOL	Red	Illuminated for activation of OC/THOL.
	OCV/DIRG	Red	Illuminated for activation of OCG/OVG/DIRG.
	OC/OVNEG	Red	Illuminated for activation of OCNEG/OVNEG.
	OV/UV	Red	Illuminated for activation of OV/UV.
	MST	Red	Illuminated for activation of MST.
	UC/UP	Red	Illuminated for activation of UC/UP.
	UF/OF	Red	Illuminated for activation of UF/OF.
	CBF/CBFG	Red	Illuminated for activation of CBF/CBFG.
	VTF	Red	Illuminated for activation of VTF function.
Pushbutton switch	SELECT		• Moves to lower level menu • 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

4.2. List of menus

The operation mode includes the DISPLAY and SETTING modes, which respectively have different menus available.
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)	○	-
	Motor status (MOTOR STATUS)	○	-
	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)	○	⊙
	Motor runtime (MOTOR RUNTIME)	○	⊙
	Disturbance record (DISTURBANCE)	○	⊙
	DI detection voltage value (DI VOLTAGE)	○	⊙
	Password use/non-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

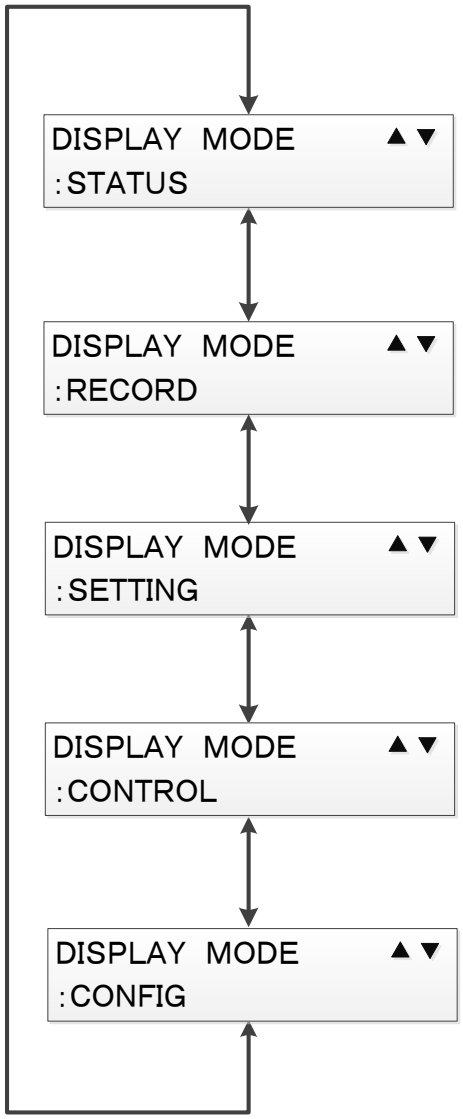
This section describes the operations for mode selection and various menus.

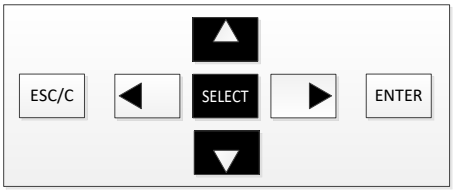
4.3.1. DISPLAY/SETTING mode selection

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.



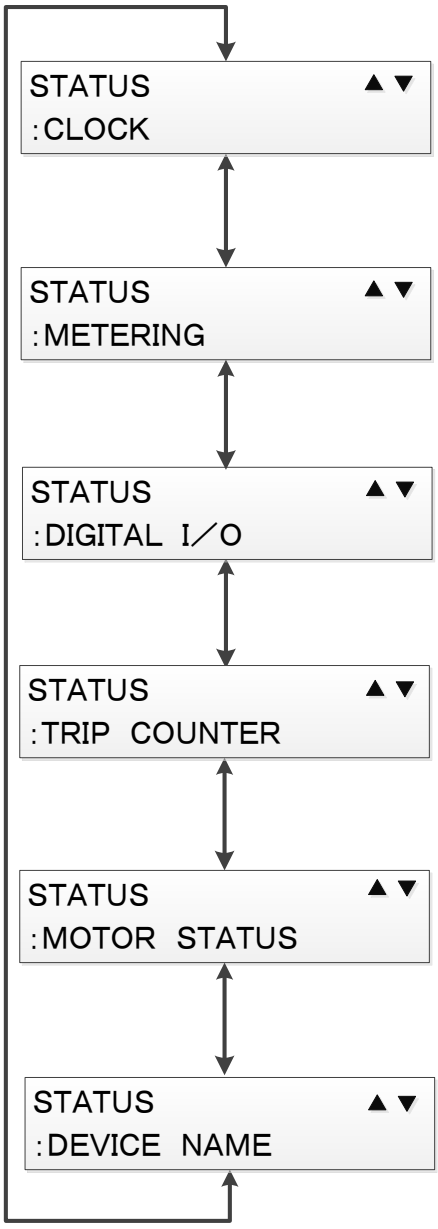


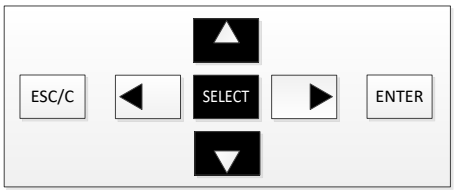
Use ▲ and ▼ to switch between items and press SELECT to select an item

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 sub-clause 4.3.4.3.3.

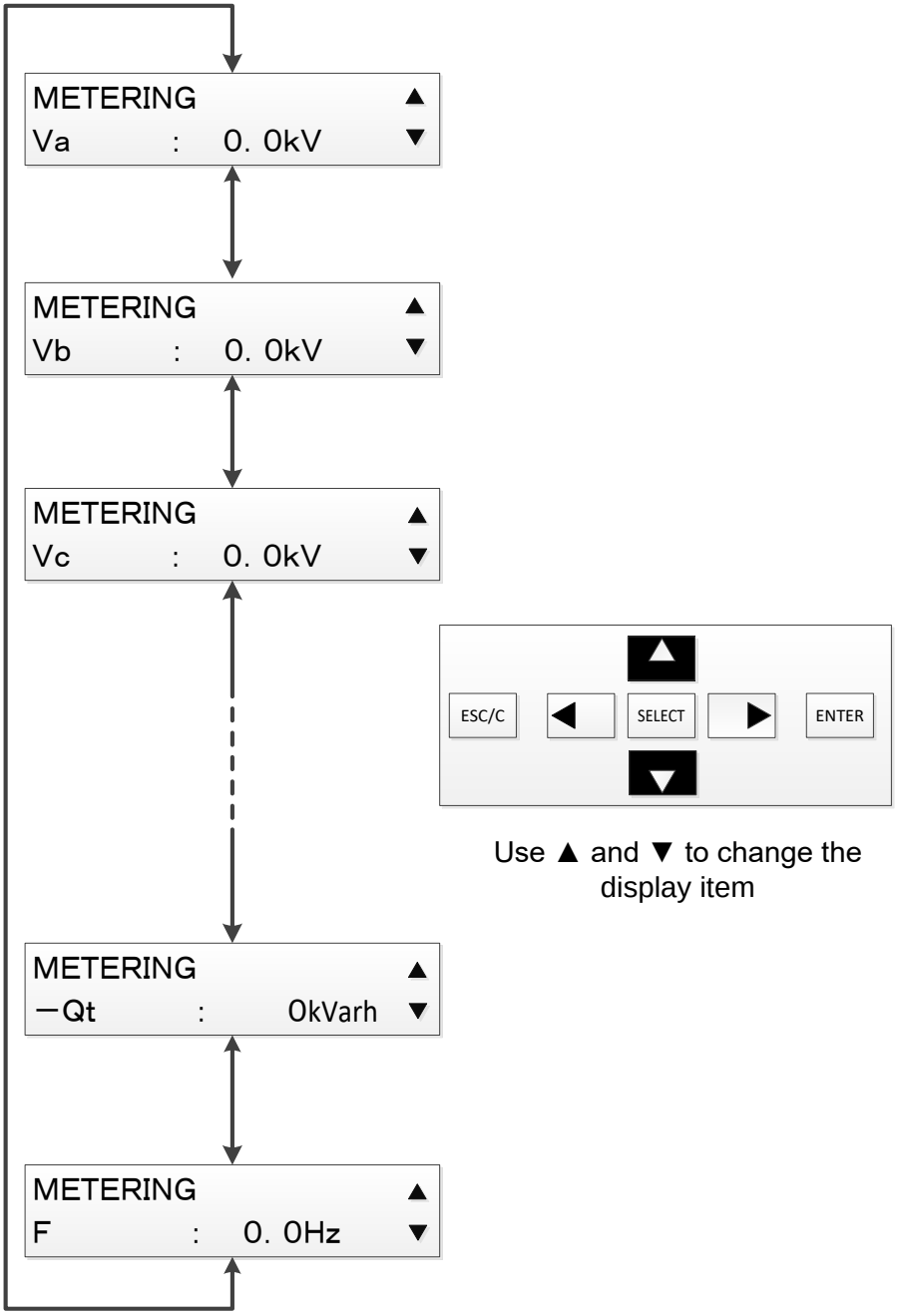


Table 4-3 Measured value display items

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;

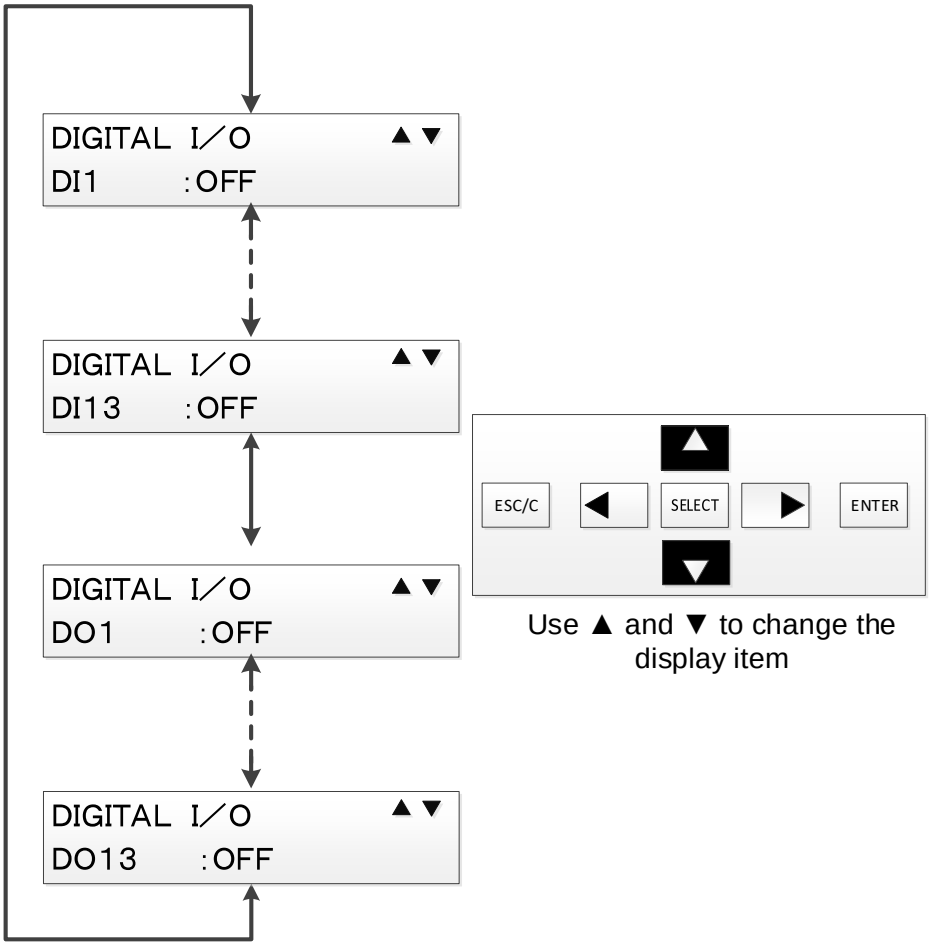


Table 4-4 Show DI/DO status Display items

No.	Signal name	No.	Signal name
1	DI1	14	DO1
2	DI2	15	DO2
3	DI3	16	DO3
4	DI4	17	DO4
5	DI5	18	DO5
6	DI6	19	DO6
7	DI7	20	DO7
8	DI8	21	DO8
9	DI9	22	DO9
10	DI10	23	DO10
11	DI11	24	DO11
12	DI12	25	DO12
13	DI13	26	DO13

4.3.2.1.4. Trip counter (TRIP COUNTER) menu

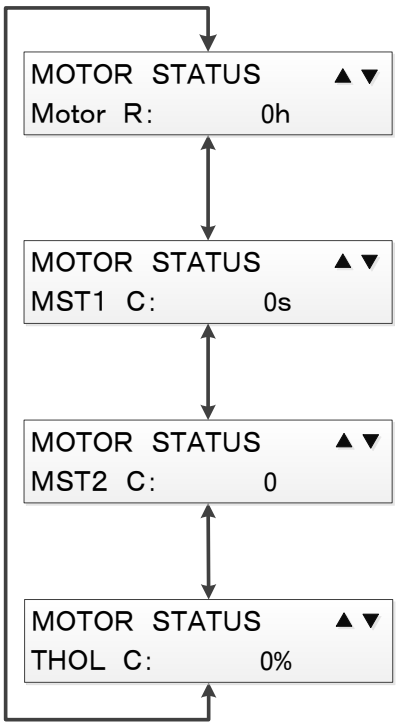
[Operation path] DISPLAY MODE > STATUS > TRIP COUNTER

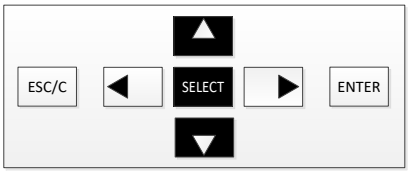
The Trip counter (TRIP COUNTER) menu allows viewing of the number of trips.

4.3.2.1.5. Motor status (MOTOR STATUS) menu

[Operation path] DISPLAY MODE > STATUS > MOTOR STATUS

Motor status menu shows following items.
Motor R: Motor run time
MST1 C: Count value of MST1 element. More detail, please refer to sub-clause 3.16.1.
MST2 C: Count value of MST1 element. More detail, please refer to sub-clause 3.16.2.
THOL C: Count value of THOL element. More detail, please refer to sub-clause 3.6.1.





Use ▲ and ▼ to switch between items.

4.3.2.1.6. Device name (DEVICE NAME) menu

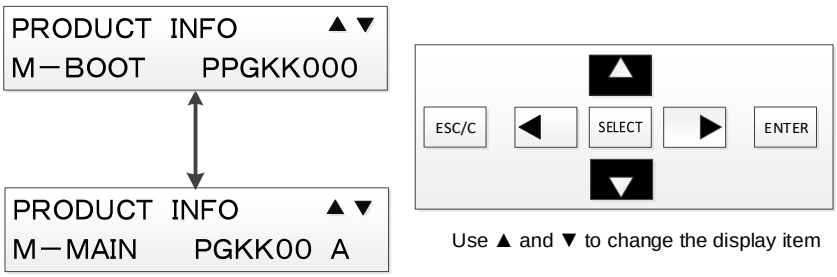
[Operation path] DISPLAY MODE > STATUS > DEVICE NAME

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

4.3.2.1.7. Software version (PRODUCT INFO) menu

[Operation path] DISPLAY MODE > STATUS > PRODUCT INFO

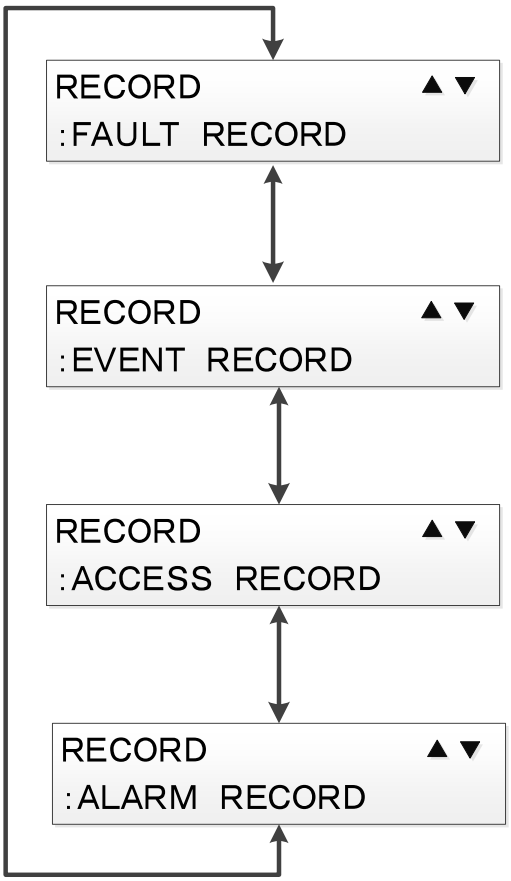
The software (program) version (PRODUCT INFO) menu allows viewing of the Software version information.

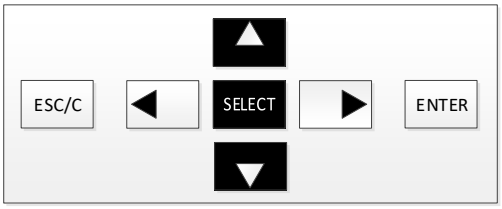


Use ▲ and ▼ to change the display item

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)



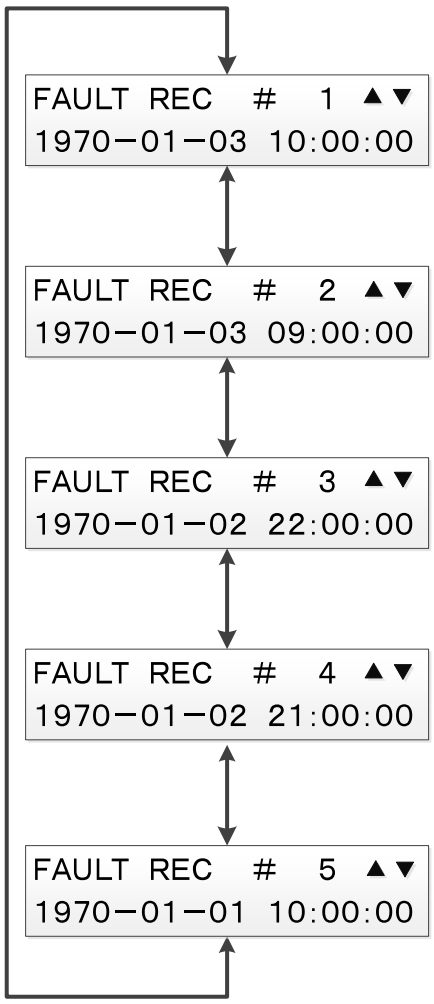


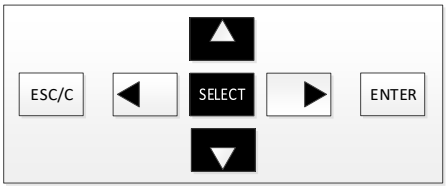
Use ▲ and ▼ to switch between items
and press SELECT to select an item

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.

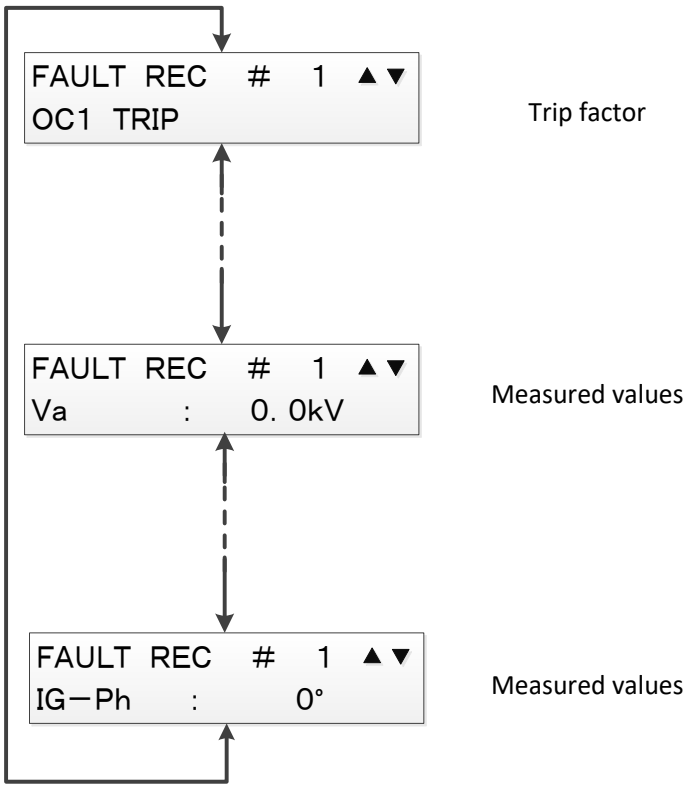


Table 4-5 Elements of fault records

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

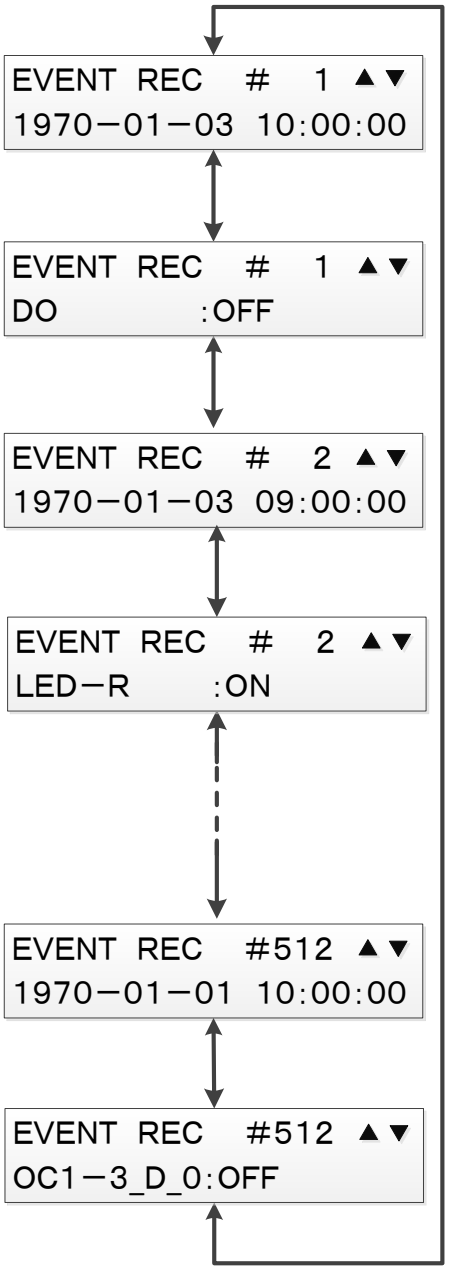
No.	Item	Unit	No.	Signal name	Unit
1	Va	kV	17	Va-ph	°
2	Vb	kV	18	Vb-ph	°
3	Vc	kV	19	Vc-ph	°
4	Vab	kV	20	Vab-ph	°
5	Vbc	kV	21	Vbc-ph	°
6	Vca	kV	22	Vca-ph	°
7	VG	kV	23	VG-ph	°
8	3V0	kV	24	Ia-ph	°
9	V1	kV	25	Ib-ph	°
10	V2	kV	26	Ic-ph	°
11	Ia	A	27	IG-ph	°
12	Ib	A			
13	Ic	A			
14	IG	A			
15	I1	A			
16	I2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

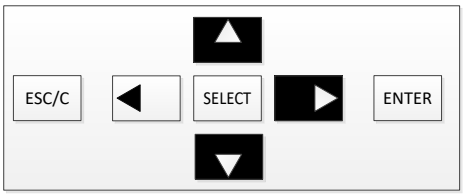
4.3.2.2.2. Event record (EVENT RECORD) menu

[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.





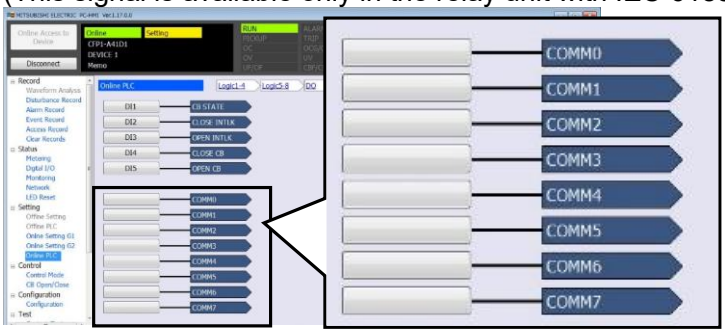
Use ▲ and ▼ to change the display item
Use ► to move from the record currently shown to the date of the tenth record into past

Table 4-7 Event record List of events

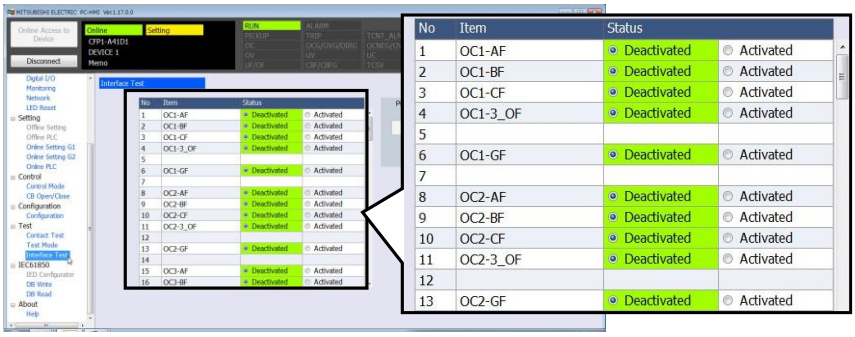
No.	Signal name	Description
1	DI1	Status of DI1 (This signal is available only in the relay unit with a DI card in SLOT-C.)
2	DI2	Status of DI2 (This signal is available only in the relay unit with a DI card in SLOT-C.)
3	DI3	Status of DI3 (This signal is available only in the relay unit with a DI card 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	MTR_ALM	Motor run time alarm
20	CBa1	Status of circuit breaker
21	INT_LK_OP	OPEN signal of INTERLOCK
22	INT_LK_CL	CLOSE signal of INTERLOCK
23	CTL_OP_OK	Condition signal for CB open control. This signal is ON when all conditions are met to control the CB.
24	CTL_CL_OK	Condition signal for CB close control. This signal is ON when all conditions are met to control the CB.
25	CB_CTL_OK	Confirmation signal of CB operation success.
26	CB_CTL_NG	Confirmation signal of CB operation failure.
27	OP_TS	CB open control via local operation.
28	CL_TS	CB close control via local operation.
29	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.)
30	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.)
31	CB_LR	CB operating authority status signal. (Local / Remote) The “CB_LR” = ON means that Local control is authorized.
32	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.)
33	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.)
34	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.)

No.	Signal name	Description
35	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.)
36	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.)
37	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.)
38	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.)
39	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.)
40	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.)
41	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.
42	OP_DI	CB open operation signal. This signal express the condition of “OPEN CB” on PC-HMI. Please refer to Fig. 4-2.
43	P_INT_LK1	CB close interlock signal. This signal express the condition of “CLOSE INTLK” on PC-HMI. Please refer to Fig. 4-2.
44	P_INT_LK2	CB open interlock signal. This signal express the condition of “OPEN INTLK” on PC-HMI. Please refer to Fig. 4-2.
45	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)
46	OC1-GD	Detection signal of 1st instantaneous overcurrent (50) element on zero phase
47	OC2-GD	Detection signal of 2nd instantaneous overcurrent (50) element on zero phase
48	NOC1-D	Detection signal of 1st negative sequence overcurrent (46) element
49	NOC2-D	Detection signal of 2nd negative sequence overcurrent (46) element

No.	Signal name	Description
50	NOC3-D	Detection signal of 3rd negative sequence overcurrent (46) element
51	SPO-D	Detection signal of single phase open (SPO) element
52	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.)
53	THOL-D	Detection signal of thermal overload (THOL) element
54	DIRG1-D	Detection signal of 1st instantaneous directional ground fault (67G) element
55	DIRG2-D	Detection signal of 2nd instantaneous directional ground fault (67G) element
56	UP1-D	Detection signal of 1st under power (37P) element
57	UP2-D	Detection signal of 2nd under power (37P) element
58	OVG1-D	Detection signal of 1st ground fault overvoltage (64N) element
59	OVG2-D	Detection signal of 2nd ground fault overvoltage (64N) element
60	NOV1-D	Detection signal of 1st negative sequence overvoltage (47) element
61	NOV2-D	Detection signal of 2nd negative sequence overvoltage (47) element
62	UF1-D	Detection signal of 1st underfrequency (81UF) element
63	UF2-D	Detection signal of 2nd underfrequency (81UF) element
64	UF3-D	Detection signal of 3rd underfrequency (81UF) element
65	OF1-D	Detection signal of 1st overfrequency (81OF) element
66	OF2-D	Detection signal of 2nd overfrequency (81OF) element
67	OF3-D	Detection signal of 3rd overfrequency (81OF) element
68	MST1-D	Detection signal of the first limitation of motor starting time (MST, 66) element
69	MST2-D	Detection signal of the second limitation of motor starting time (MST, 66) element
70	VTF-D	Detection signal of VT fuse failure element
71	ALARM	Abnormal condition of constant supervision (heavy alarm)
72	ALARM-L	Abnormal condition of constant supervision (light alarm)
73	RY-LOCK	Locking of relay
74	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.
75	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.
76	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.
77	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.
78	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.
79	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.
80	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.
81	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.
82	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.
83	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.
84	TCNT-LK	The operation lock signal for a trip counter function (TCNT). The ON/OFF of this signal is changed via TEST mode.

No.	Signal name	Description
85	OCNEG3-T	The operation lock signal for negative-sequence overcurrent element (OCNEG3). The ON/OFF of this signal is changed via TEST mode.
86	SPO-T	The operation lock signal for single phase open detection element (SPO). The ON/OFF of this signal is changed via TEST mode.
87	THOL-T	The operation lock signal for thermal overload element (THOL). The ON/OFF of this signal is changed via TEST mode.
88	MST-T	The operation lock signal for limitation of motor starting time element (MST1, MST2). The ON/OFF of this signal is changed via TEST mode.
89	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.
90	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.
91	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.
92	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.
93	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.
94	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.
95	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.
96	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.
97	OC1-3D_O	Detection signal of any OC1 of A, B, and C phase
98	OC2-3D_O	Detection signal of any OC2 of A, B, and C phase

No.	Signal name	Description
99	OC3-3D_O	Detection signal of any OC3 of A, B, and C phase
100	UC1-3D_O	Detection signal of any UC1 of A, B, and C phase
101	UC2-3D_O	Detection signal of any UC2 of A, B, and C phase
102	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.)
103	UV1-3D_O	Detection signal of any UV1 of A (AB), B (BC), and C (CA) phase
104	UV2-3D_O	Detection signal of any UV2 of A (AB), B (BC), and C (CA) phase
105	OV1-3D_O	Detection signal of any OV1 of A (AB), B (BC), and C (CA) phase
106	OV2-3D_O	Detection signal of any OV2 of A (AB), B (BC), and C (CA) phase
107	2f-3D_O	Detection signal of any 2f of A, B, and C phase
108	ALLEL-O	Definitive signal of any of all elements (OR of all definitive signals)
109	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.
110	GOOSE1	Assignment of GOOSE received signals (This signal is available only in the relay unit with IEC61850 communication card.)
111	GOOSE2	Assignment of GOOSE received signals (This signal is available only in the relay unit with IEC61850 communication card.)
112	GOOSE3	Assignment of GOOSE received signals (This signal is available only in the relay unit with IEC61850 communication card.)
113	GOOSE4	Assignment of GOOSE received signals (This signal is available only in the relay unit with IEC61850 communication card.)
114	GOOSE5	Assignment of GOOSE received signals (This signal is available only in the relay unit with IEC61850 communication card.)
115	GOOSE6	Assignment of GOOSE received signals (This signal is available only in the relay unit with IEC61850 communication card.)
116	GOOSE7	Assignment of GOOSE received signals (This signal is available only in the relay unit with IEC61850 communication card.)
117	GOOSE8	Assignment of GOOSE received signals (This signal is available only in the relay unit with IEC61850 communication card.)
118	GOOSE9	Assignment of GOOSE received signals (This signal is available only in the relay unit with IEC61850 communication card.)
119	GOOSE10	Assignment of GOOSE received signals (This signal is available only in the relay unit with IEC61850 communication card.)
120	GOOSE11	Assignment of GOOSE received signals (This signal is available only in the relay unit with IEC61850 communication card.)
121	GOOSE12	Assignment of GOOSE received signals (This signal is available only in the relay unit with IEC61850 communication card.)
122	GOOSE13	Assignment of GOOSE received signals (This signal is available only in the relay unit with IEC61850 communication card.)
123	GOOSE14	Assignment of GOOSE received signals (This signal is available only in the relay unit with IEC61850 communication card.)
124	GOOSE15	Assignment of GOOSE received signals (This signal is available only in the relay unit with IEC61850 communication card.)
125	GOOSE16	Assignment of GOOSE received signals (This signal is available only in the relay unit with IEC61850 communication card.)
126	GOOSE17	Assignment of GOOSE received signals (This signal is available only in the relay unit with IEC61850 communication card.)
127	GOOSE18	Assignment of GOOSE received signals (This signal is available only in the relay unit with IEC61850 communication card.)
128	GOOSE19	Assignment of GOOSE received signals (This signal is available only in the relay unit with IEC61850 communication card.)
129	GOOSE20	Assignment of GOOSE received signals (This signal is available only in the relay unit with IEC61850 communication card.)
130	GOOSE21	Assignment of GOOSE received signals (This signal is available only in the relay unit with IEC61850 communication card.)

No.	Signal name	Description
131	GOOSE22	Assignment of GOOSE received signals (This signal is available only in the relay unit with IEC61850 communication card.)
132	GOOSE23	Assignment of GOOSE received signals (This signal is available only in the relay unit with IEC61850 communication card.)
133	GOOSE24	Assignment of GOOSE received signals (This signal is available only in the relay unit with IEC61850 communication card.)
134	GOOSE25	Assignment of GOOSE received signals (This signal is available only in the relay unit with IEC61850 communication card.)
135	GOOSE26	Assignment of GOOSE received signals (This signal is available only in the relay unit with IEC61850 communication card.)
136	GOOSE27	Assignment of GOOSE received signals (This signal is available only in the relay unit with IEC61850 communication card.)
137	GOOSE28	Assignment of GOOSE received signals (This signal is available only in the relay unit with IEC61850 communication card.)
138	GOOSE29	Assignment of GOOSE received signals (This signal is available only in the relay unit with IEC61850 communication card.)
139	GOOSE30	Assignment of GOOSE received signals (This signal is available only in the relay unit with IEC61850 communication card.)
140	GOOSE31	Assignment of GOOSE received signals (This signal is available only in the relay unit with IEC61850 communication card.)
141	GOOSE32	Assignment of GOOSE received signals (This signal is available only in the relay unit with IEC61850 communication card.)
142	GOOSE33	Assignment of GOOSE received signals (This signal is available only in the relay unit with IEC61850 communication card.)
143	GOOSE34	Assignment of GOOSE received signals (This signal is available only in the relay unit with IEC61850 communication card.)
144	GOOSE35	Assignment of GOOSE received signals (This signal is available only in the relay unit with IEC61850 communication card.)
145	GOOSE36	Assignment of GOOSE received signals (This signal is available only in the relay unit with IEC61850 communication card.)
146	GOOSE37	Assignment of GOOSE received signals (This signal is available only in the relay unit with IEC61850 communication card.)
147	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.)
148	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.)
149	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.)
150	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.
151	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.
152	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.

No.	Signal name	Description
153	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.
154	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.
155	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.
156	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.
157	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.
158	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.
159	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.
160	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.
161	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.
162	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.
163	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.
164	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.
165	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.
166	SPO	Definitive signal of SPO or forced operation from PC-HMI. This signal is shown as SPO in Interface Test function on PC-HMI. Please refer to Fig. 4-4.

No.	Signal name	Description
167	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.
168	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.
169	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.
170	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.
171	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.
172	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.
173	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.
174	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.
175	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.
176	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.
177	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.
178	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.
179	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.
180	THOL	Definitive signal of THOL or forced operation from PC-HMI. This signal is shown as THOL in Interface Test function on PC-HMI. Please refer to Fig. 4-4.
181	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.

No.	Signal name	Description
182	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.
183	UP1	Definitive signal of UP1 or forced operation from PC-HMI. This signal is shown as UP1 in Interface Test function on PC-HMI. Please refer to Fig. 4-4.
184	UP2	Definitive signal of UP2 or forced operation from PC-HMI. This signal is shown as UP2 in Interface Test function on PC-HMI. Please refer to Fig. 4-4.
185	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.
186	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.
187	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.
188	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.
189	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.
190	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.
191	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.
192	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.
193	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.
194	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.
195	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.

No.	Signal name	Description
196	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.
197	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.
198	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.
199	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.
200	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.
201	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.
202	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.
203	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.
204	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.
205	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.
206	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.
207	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.
208	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.
209	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.

No.	Signal name	Description
210	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.
211	MST1	Definitive signal of MST1 or forced operation from PC-HMI. This signal is shown as MST1 in Interface Test function on PC-HMI. Please refer to Fig. 4-4.
212	MST2	Definitive signal of MST2 or forced operation from PC-HMI. This signal is shown as MST2 in Interface Test function on PC-HMI. Please refer to Fig. 4-4.
213	VTF	Definitive signal of VTF or forced operation from PC-HMI. This signal is shown as VTF 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

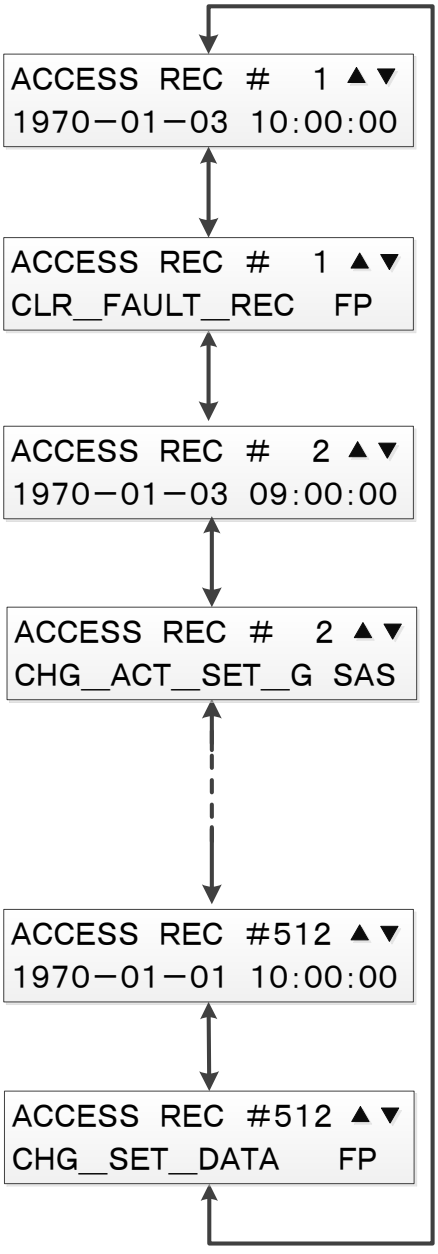
Event name			
LED5-R	DIRG1-D	UV1-3D_O	GOOSE28
LED5-G	DIRG2-D	UV2-3D_O	GOOSE29
LED6-R	DIRG3-D	OV1-3D_O	GOOSE30
LED6-G	DIRG4-D	OV2-3D_O	GOOSE31
LED7-R	2f-AD	ALLEL-O	GOOSE32
LED7-G	2f-BD	GOOSE1	GOOSE33
LED8-R	2f-CD	GOOSE2	GOOSE34
LED8-G	OVG1-D	GOOSE3	GOOSE35
LED9-R	OVG2-D	GOOSE4	GOOSE36
LED9-G	NOV1-D	GOOSE5	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	

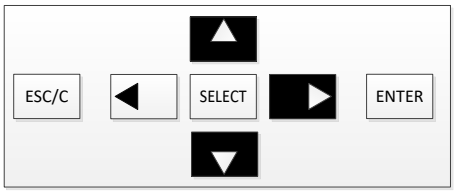
4.3.2.2.3. Access record (ACCESS RECORD) menu

[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)

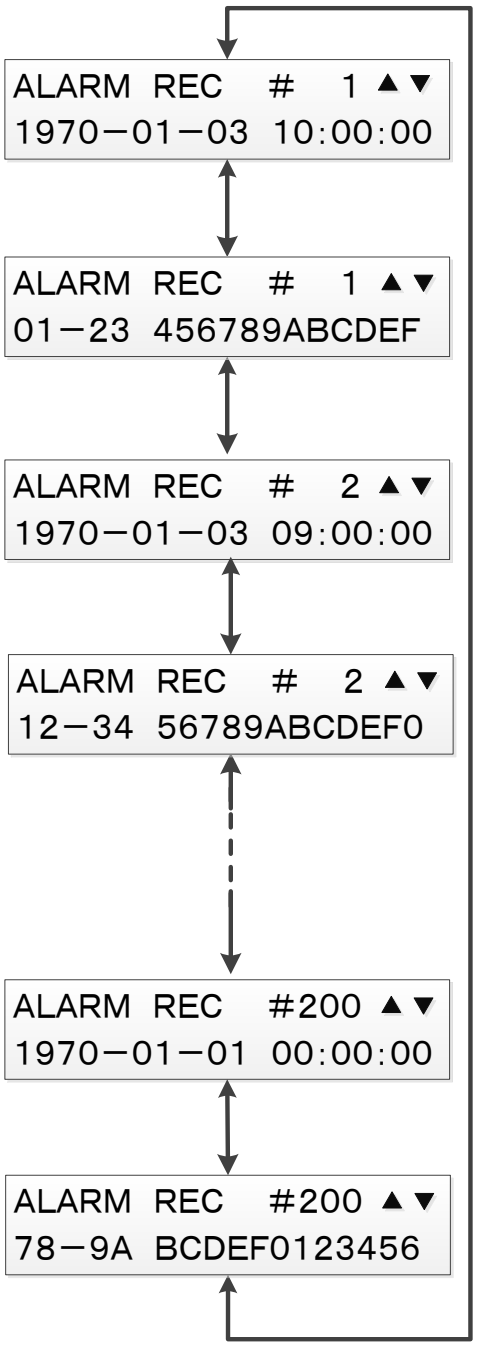
Display item	Operation description
CHG_ACT_SET_G	Change of active setting group
CHG_FREQ	Change of rated frequency
CHG_DI_VOLTAGE	Change of DI detection voltage value
CHG_DIST_REC_T	Change of configuration of disturbance record
CHG_USE_PASSWD	Change of password use setting
CHG_PASSWD	Change of password
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

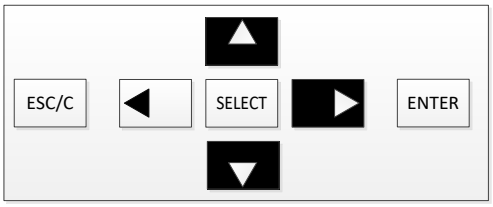
4.3.2.2.4. Alarm record (ALARM RECORD) menu

[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.





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

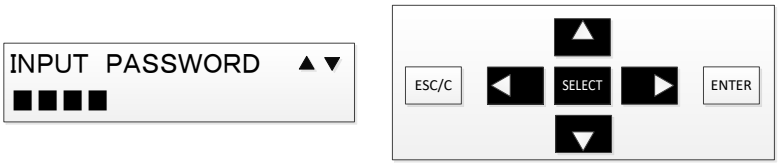
The Configuration menu can be selected in either DISPLAY or SETTING mode. Clock adjustment (CLOCK ADJUST), Password use/no-use (PASSWORD USE) and Password registration (PASSWORD REGIST) can be selected only in the SETTING mode.
For other settings, the DISPLAY mode allows only viewing of the setting values.
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 4.3.4.3.9.
For how to set the password input, see 4.3.4.3.10.



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.

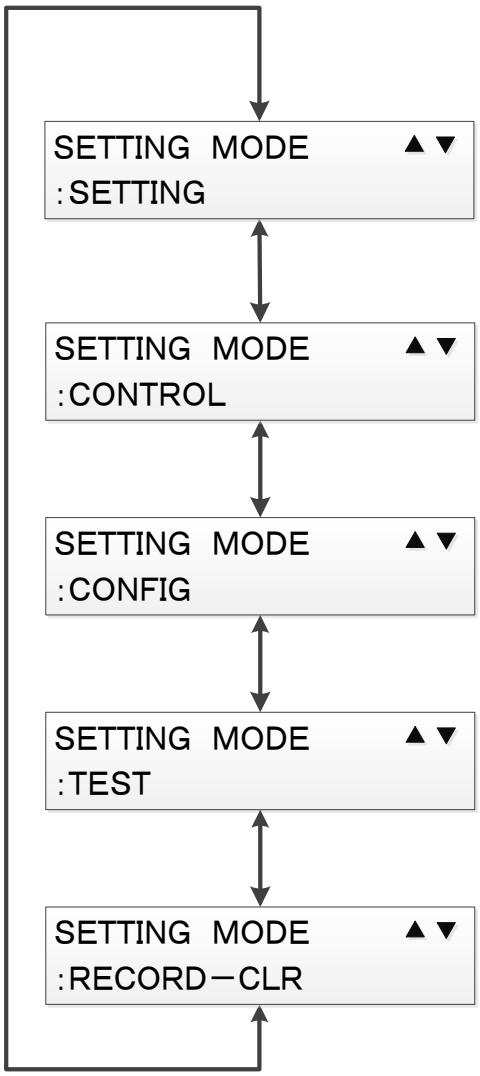
The main menu appears when the correct password has been input.

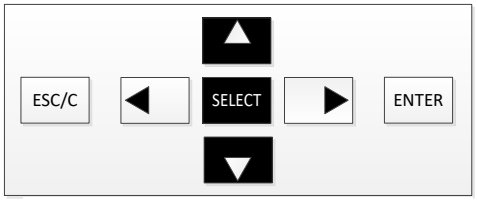
4.3.4. SETTING mode menu operations

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.





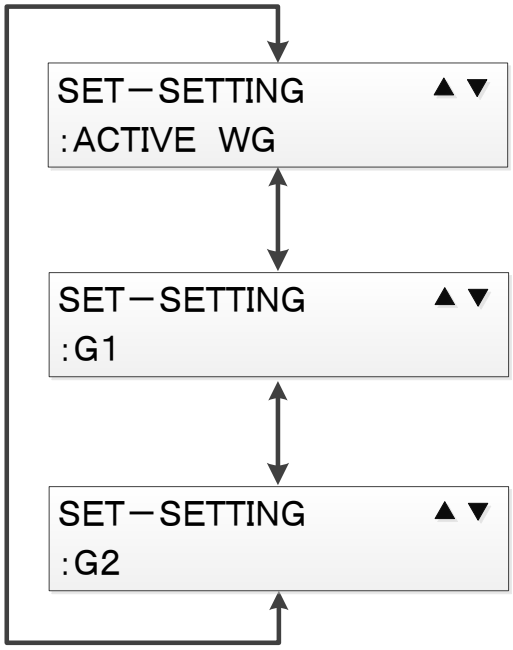
Use ▲ and ▼ to switch between items and press SELECT to select an item

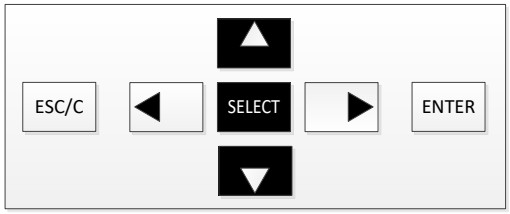
4.3.4.1. Setting (SETTING) menu

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.)



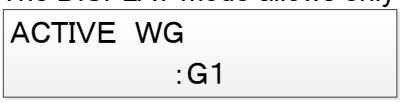


Use ▲ and ▼ to switch between items and press SELECT to select an item

4.3.4.1.1. Active group (ACTIVE WG) menu

[Operation path] SETTING MODE > SETTING > ACTIVE WG

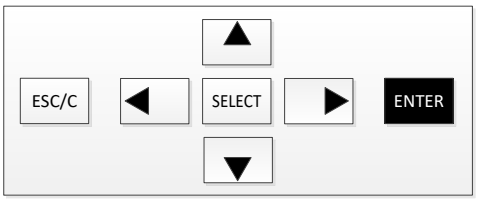
The Active group (ACTIVE WG) menu allows changing of the active group numbers setting.
(Active group numbers can be changed only in the SETTING mode.
The DISPLAY mode allows only viewing of the current group numbers.)



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.

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.



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.

Message for a successful change of the active group.

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.

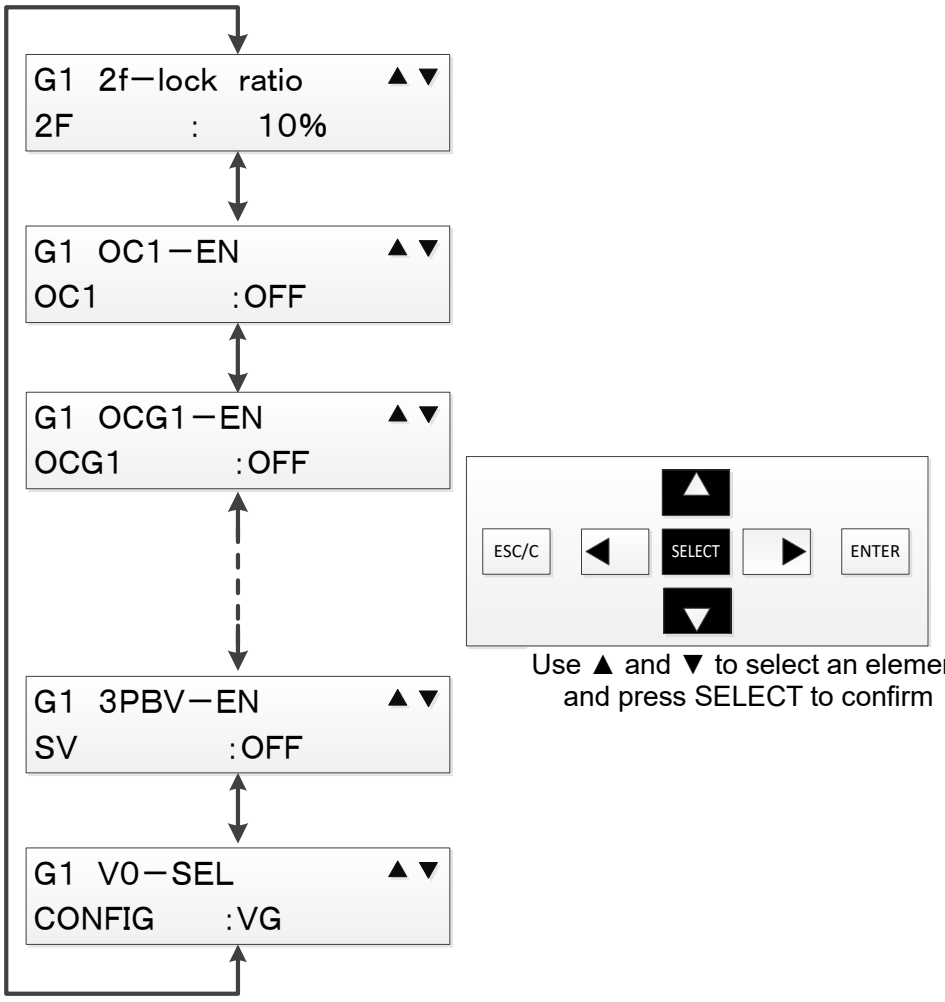
4.3.4.1.2. Group 1 (G1) and Group 2 (G2) menus

[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).

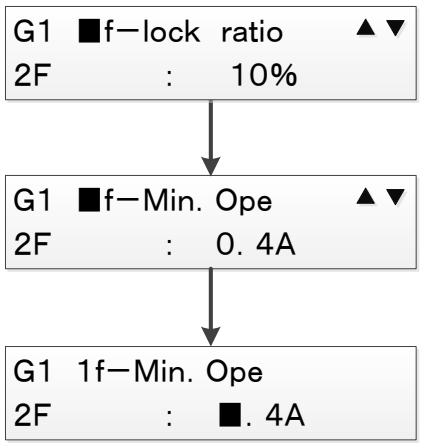
1. First, select the setting value group in the Setting menu to change and press SELECT.

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.

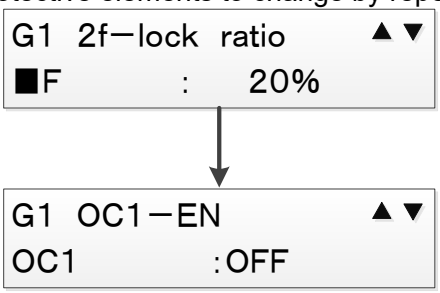
For setting a value as shown on the left,
use ◄ and ► to select the digit to change,
and ▲ and ▼ to set the value
Press SELECT to confirm the change

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

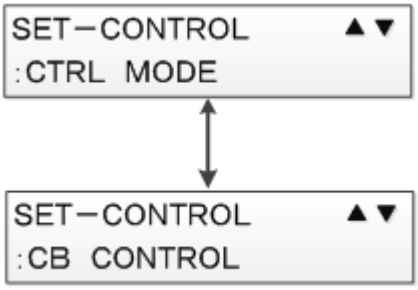
Message for unsuccessful setting value changes

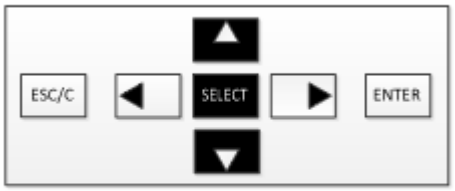
4.3.4.2. CONTROL menu

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.





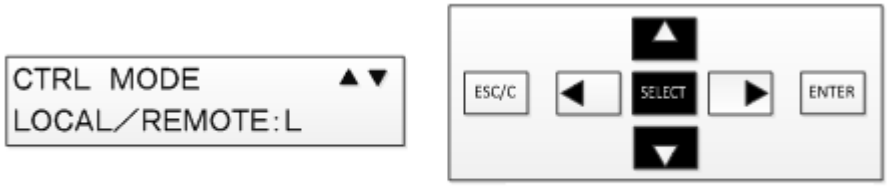
Use ▲ and ▼ to switch between items
and press SELECT to select an item

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.

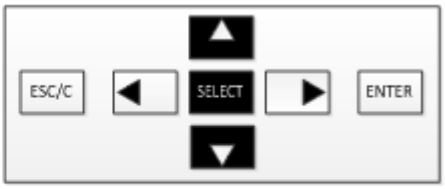
For CB control, the Control mode settings must be as shown in the table below.
For the details about operation for the Control mode, see 4.3.4.2.1.

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

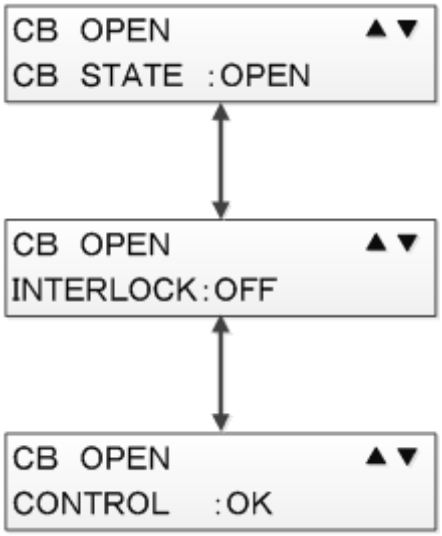
If the Control mode settings do not allow the circuit breaker control, an error message for control condition failure appears.
(The figure below shows the control condition failure that appears for CB open control)

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.

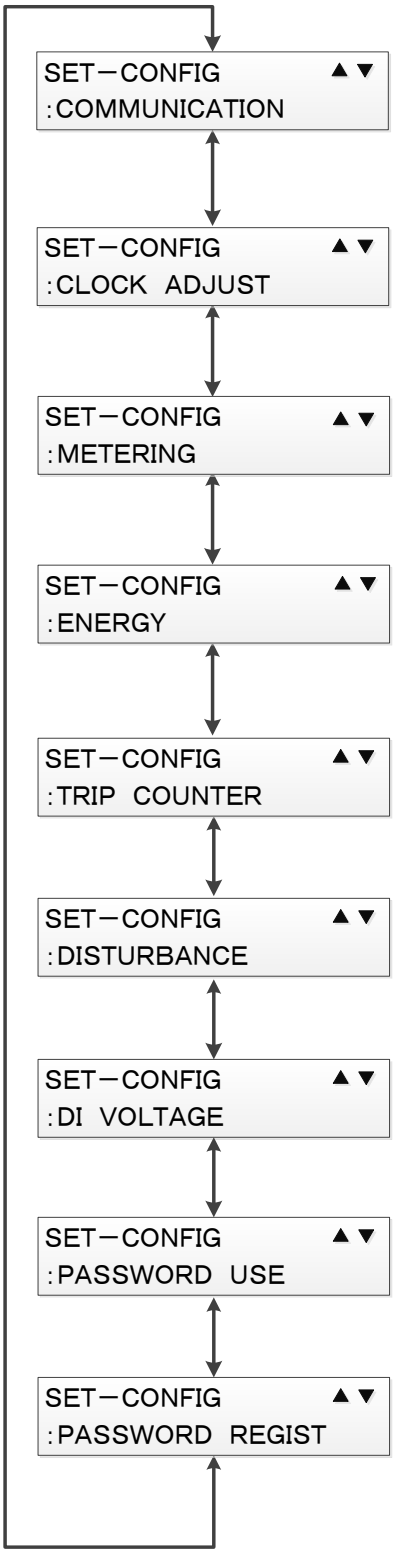
4.3.4.3. Configuration (CONFIG) menu

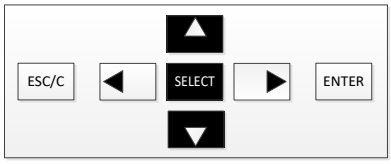
This subsection describes the operations for the Configuration (CONFIG) menu.

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)





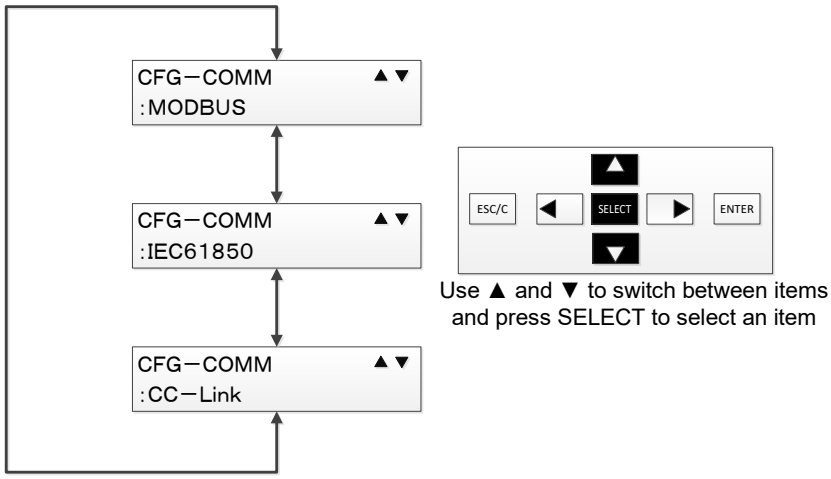
Use ▲ and ▼ to switch between items and press SELECT to select an item

4.3.4.3.1. Communication setting (COMMUNICATION) menu

[Operation path] SETTING MODE > CONFIG > COMMUNICATION

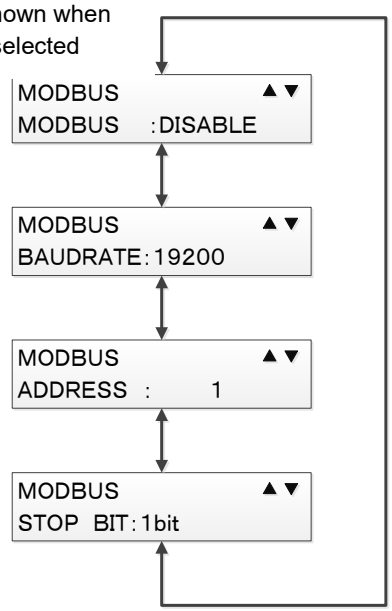
The Communication setting (COMMUNICATION) menu allows viewing and setting of the Modbus, Station bus of IEC61850 and CC-Link configurations.
(The DISPLAY mode only allows viewing of the setting values)
The following describes the operation procedure for showing and changing communication settings.

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.

*Setting items shown when MODBUS is selected



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..

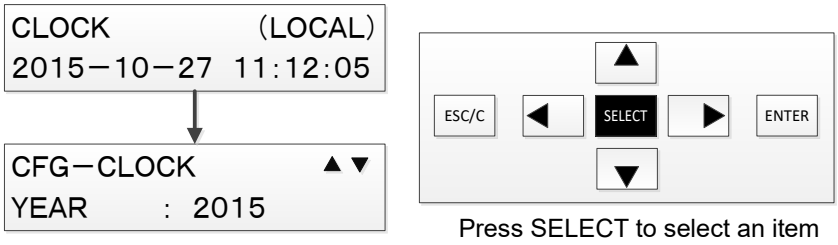
6. Press ENTER and the confirmation message of the selected communication type appears as shown in the figure below.
   Press SELECT to apply the communication settings changed by steps 2. to 5. and complete the communication setting.
   Press the Left key to return the Setting item menu in 2. above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

4.3.4.3.2. Clock adjustment (CLOCK ADJUST) menu

[Operation path] SETTING MODE > CONFIG > CLOCK ADJUST

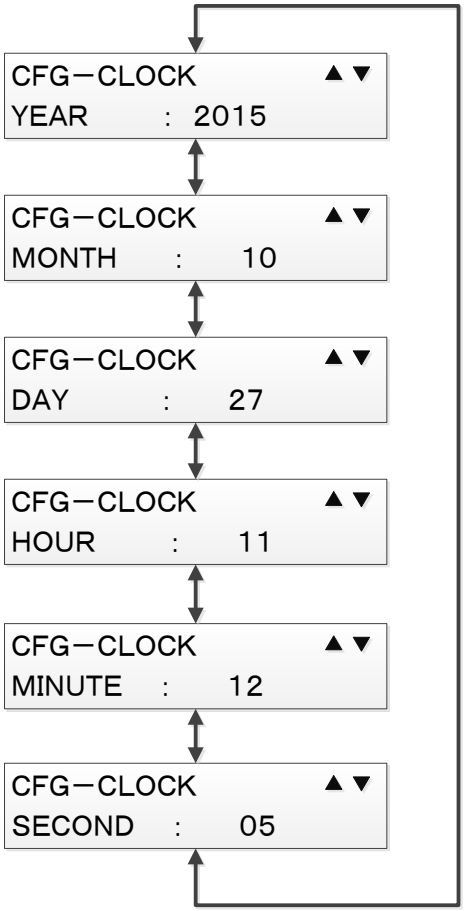
The Clock adjustment (CLOCK ADJUST) menu allows time setting.
This item can be selected only in the SETTING mode.

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.

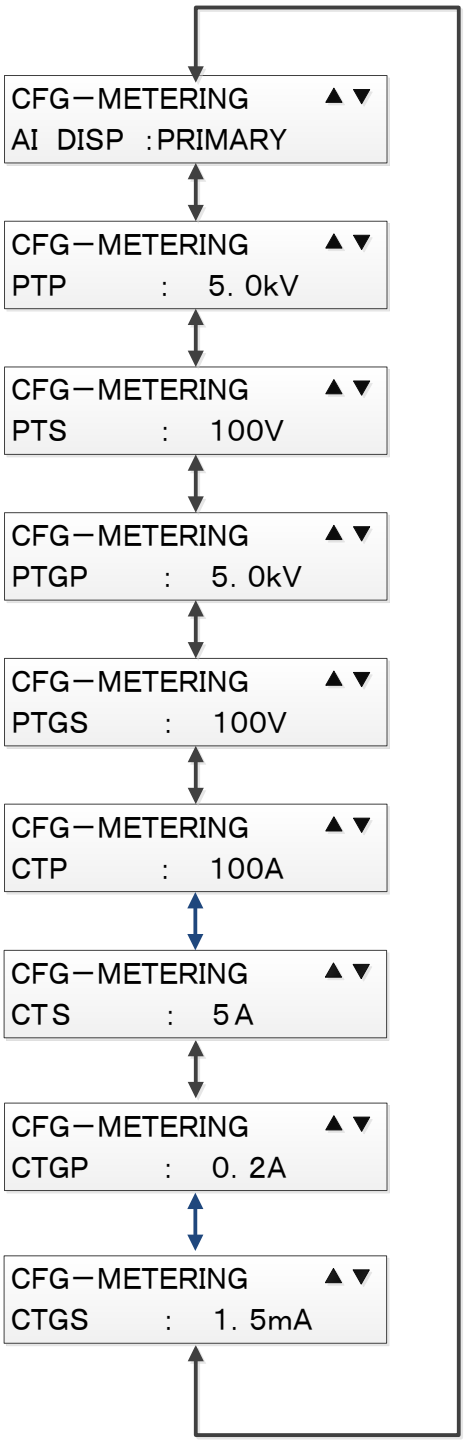
4.3.4.3.3. Measured analog value (METERING) menu

[Operation path] SETTING MODE > CONFIG > METERING

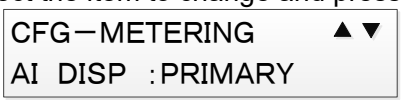
The Measured analog value (METERING) menu allows configuration of the following settings.

(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.

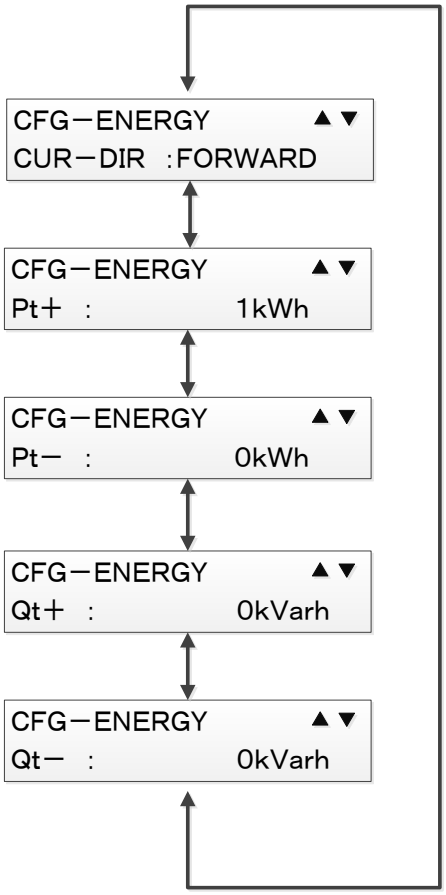
Table 4-11 Setting items of Measured analog value

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	A
9	CTGS	CTG secondary side rating	1.5 1, 5	mA A

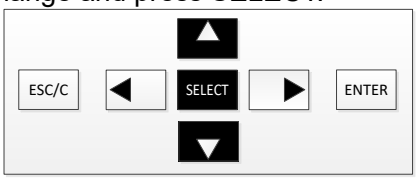
4.3.4.3.4. Electric energy (ENERGY) menu

[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)

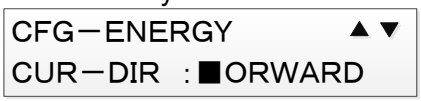


1. Use the Up and Down keys to show the item to change and press SELECT.



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.

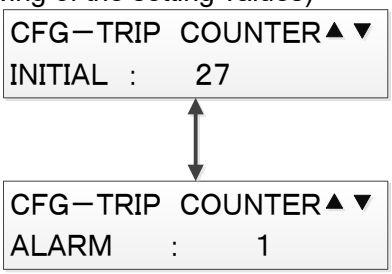
Table 4-12 Setting items of electric energy

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

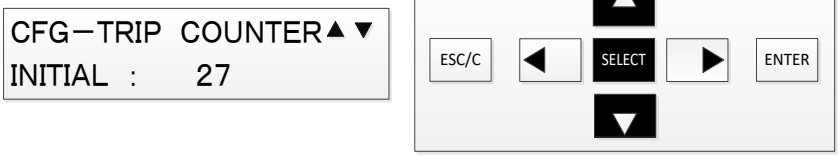
4.3.4.3.5. Trip counter (TRIP COUNTER) menu

[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)

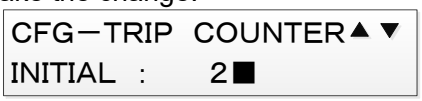


1. The trip counter setting menu appears. Use the Up and Down keys to select the item to change and press SELECT.

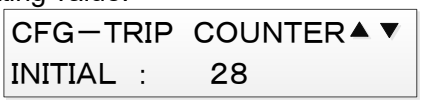


Use ▲ and ▼ to switch between items and press SELECT to select an item

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.

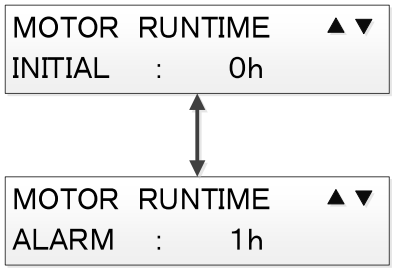
Table 4-13 Setting items of trip counter

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

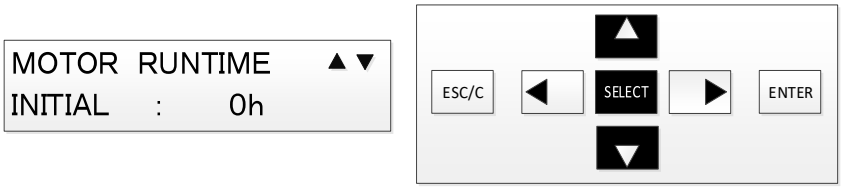
4.3.4.3.6. Motor runtime (MOTOR RUNTIME)

[Operation path] SETTING MODE > CONFIG > MOTOR RUNTIME

The Motor runtime (MOTOR RUNTIME) menu allows configuration of the following settings.
(1) Set the initial value of the motor runtime.
(2) Set the alarm value of the motor runtime.
(The DISPLAY mode only allows viewing of the setting values)

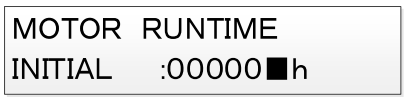


1. Use the Up and Down keys to select the item to change and press SELECT.

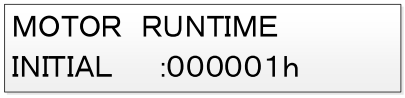


Use ▲ and ▼ to switch between items
and press SELECT to select an item

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 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.

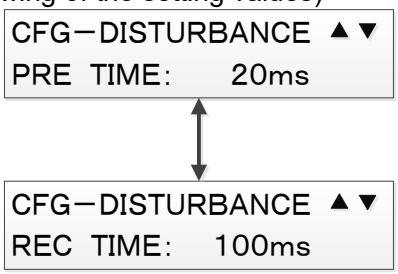
Table 4-14 Setting items of trip counter

No.	Item	Setting description	Setting range	Unit
1	INITIAL	Initial value of the motor runtime	0~10000	h
2	ALARM	Alarm value of the motor runtime	1~10000	h

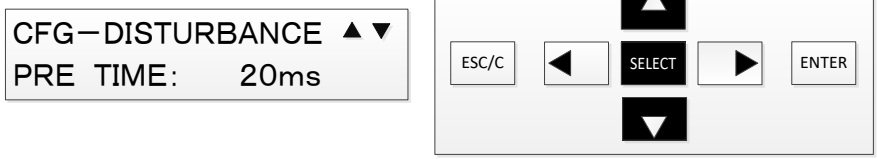
4.3.4.3.7. Disturbance record (DISTURBANCE) menu

[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)

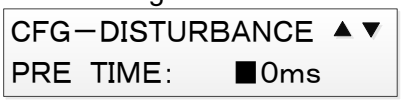


1. Use the Up and Down keys to select the item to change and press SELECT.

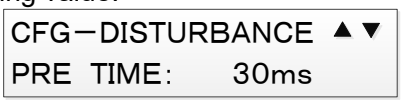


Use ▲ and ▼ to switch between items
and press SELECT to select an item

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 4-15 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”.

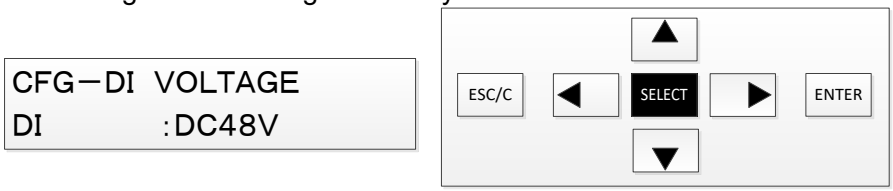
In other words, the setting value of “REC TIME” must be larger than that of “PRE TIME”.

4.3.4.3.8. DI detection voltage value (DI VOLTAGE) menu

[Operation path] SETTING MODE > CONFIG > DI VOLTAGE

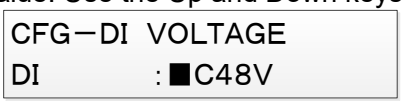
DI detection voltage value (DI VOLTAGE) menu allows setting of the DI rated voltage.
(The DISPLAY mode only allows viewing of the setting values)

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.”

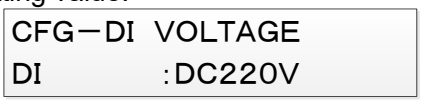


Press SELECT to select an item

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.

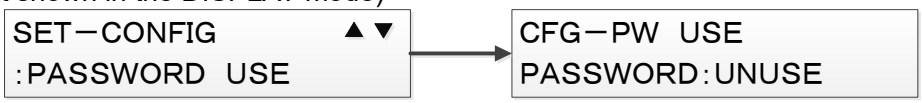
Table 4-16 Setting items of DI detection voltage value

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

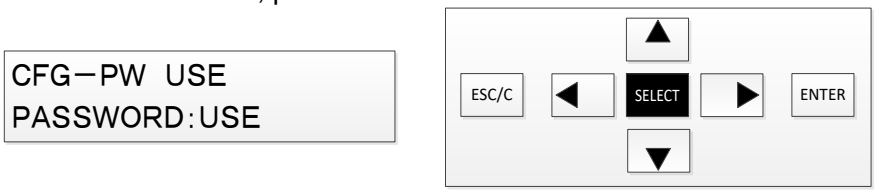
4.3.4.3.9. Password use/unuse (PASSWORD USE) menu

[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)

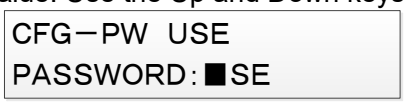


1. In the Password use/no-use menu, press SELECT.



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.

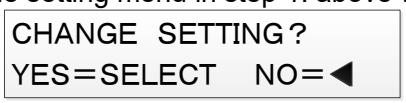


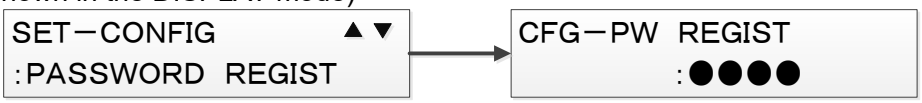
Table 4-17 Setting item of Password use/no-use

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

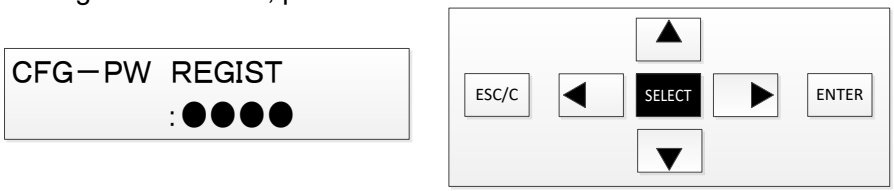
4.3.4.3.10. Password registration (PASSWORD REGIST) menu

[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)



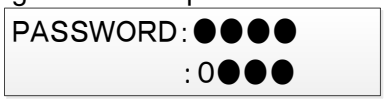
1. In the Password registration menu, press SELECT.



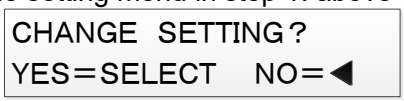
Press SELECT to select an item

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.



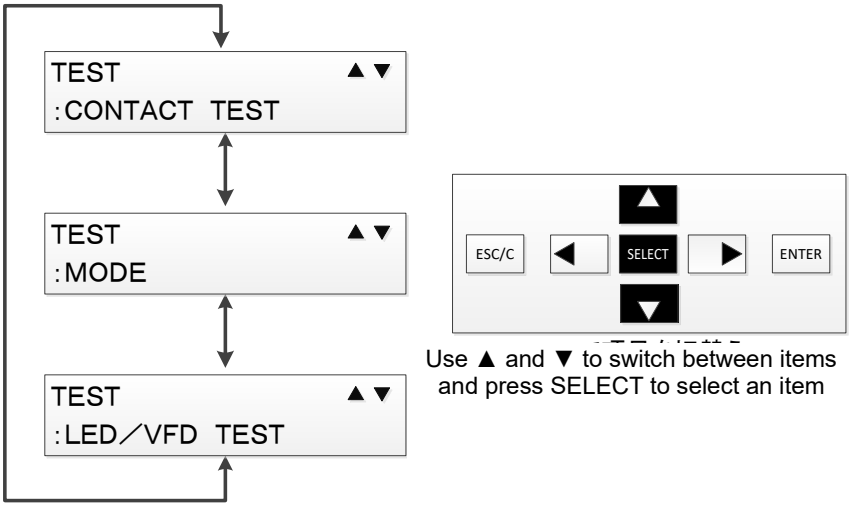
4. If the above two password-inputs in steps 2 and 3 are same, the screen shown in step 1 appears.
   Press ENTER and the confirmation message of the password registration appears.
   Press SELECT to apply the password registration and complete the setting.
   Press the Left key to go back to the setting 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.



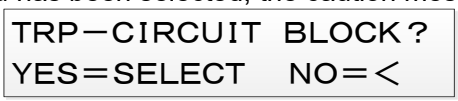
Use ▲ and ▼ to switch between items
and press SELECT to select an item

4.3.4.4.1. DO contact test (CONTACT TEST) menu

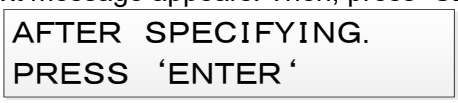
[Operation path] SETTING MODE > TEST > CONTACT TEST

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

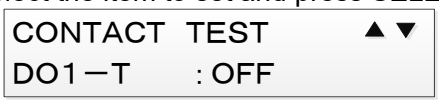
1. When the DO contact test menu has been selected, the caution message appears.



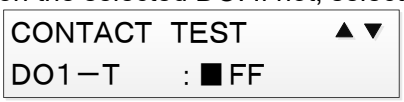
When pressing SELECT, the next message appears. Then, press “SELECT” again.



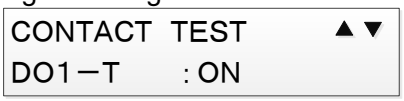
2. The setting screen for the DO contact test appears.
Use the Up and Down keys to select the item to set and press SELECT.



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 4-18 Setting items of DO contact test

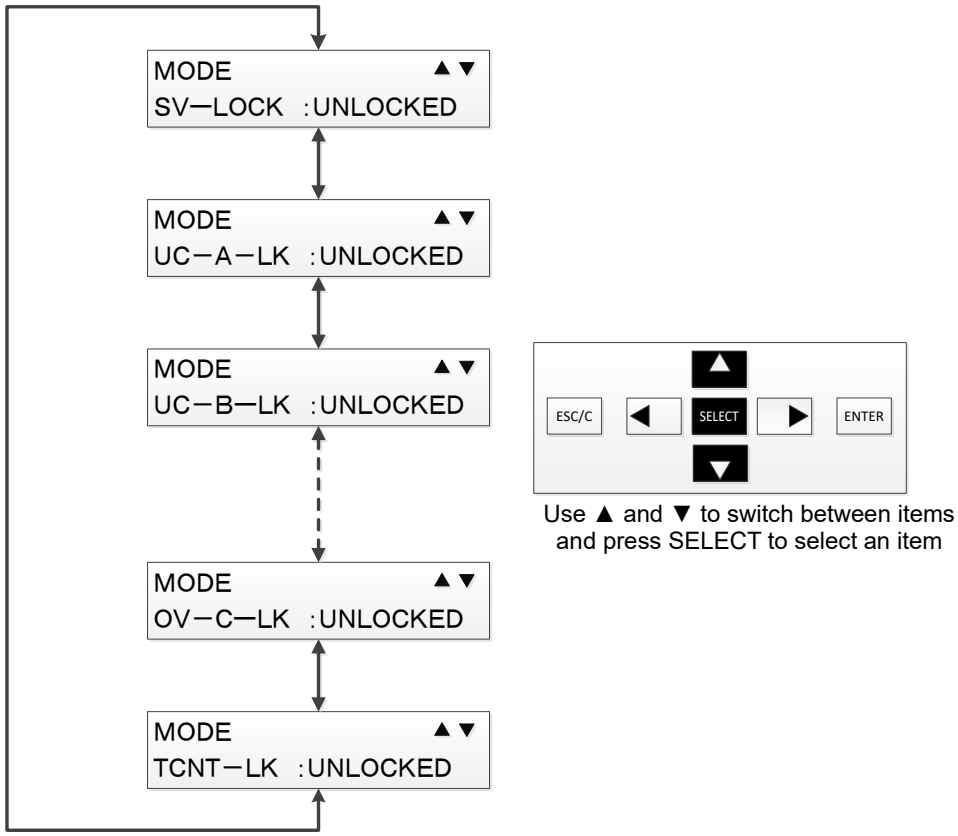
No.	Item
1	DO1-T
2	DO2-T
3	DO3-T
4	DO4-T
5	DO5-T
6	DO6-T
7	DO7-T
8	DO8-T
9	DO9-T
10	DO10-T
11	DO11-T
12	DO12-T
13	DO13-T

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.

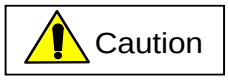


2. The cursor moves to the setting of the selected item. Use the Up and Down keys to switch the setting.

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

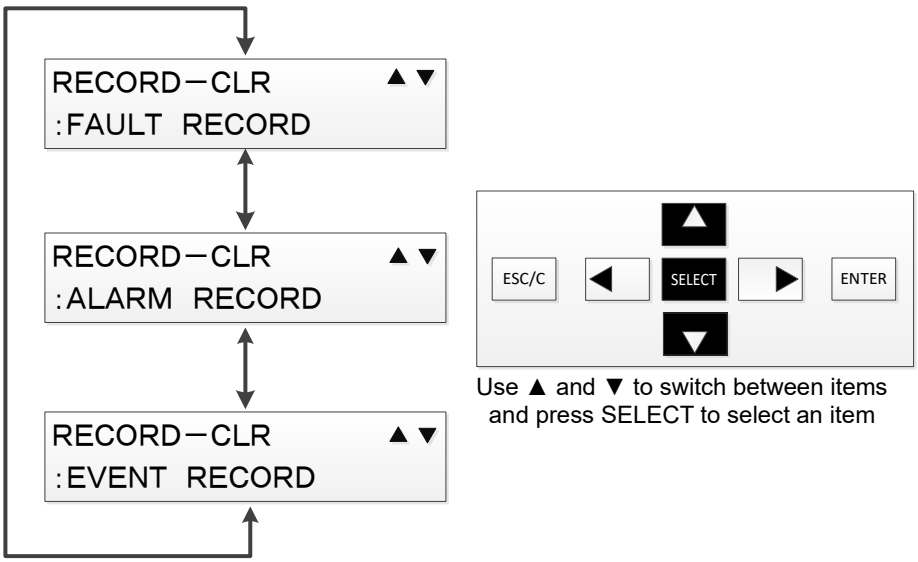
The LED/VFD lighting test (LED/VFD TEST) menu allows lighting of all LEDs/VFDs.

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 CMP1-A41D1

	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 definite time or IDMT overcurrent (51) element on A phase
10	OC1-B/	Definitive signal of 1st definite time or IDMT overcurrent (51) element on B phase
11	OC1-C/	Definitive signal of 1st definite time or IDMT overcurrent (51) 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 definite time or IDMT overcurrent (51) element on A phase
14	OC2-B/	Definitive signal of 2nd definite time or IDMT overcurrent (51) element on B phase
15	OC2-C/	Definitive signal of 2nd definite time or IDMT overcurrent (51) 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	NOC1/	Definitive signal of 1st negative sequence overcurrent (46) element
21	NOC2/	Definitive signal of 2nd negative sequence overcurrent (46) element
22	NOC3/	Definitive signal of 3rd negative sequence overcurrent (single-phase-open) element
23	UC1-A/	Definitive signal of 1st undercurrent (37) element on A phase
24	UC1-B/	Definitive signal of 1st undercurrent (37) element on B phase
25	UC1-C/	Definitive signal of 1st undercurrent (37) element on C phase
26	UC2-A/	Definitive signal of 2nd undercurrent (37) element on A phase
27	UC2-B/	Definitive signal of 2nd undercurrent (37) element on B phase
28	UC2-C/	Definitive signal of 2nd undercurrent (37) element on C phase
29	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.)
30	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.)
31	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.)
32	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.)
33	THOL/	Definitive signal of overload (49) element
34	DIRG1/	Definitive signal of 1st instantaneous directional ground fault (67G) element
35	DIRG2/	Definitive signal of 2nd instantaneous directional ground fault (67G) element
36	UP1/	Definitive signal of 1st underpower (37P) element
37	UP2/	Definitive signal of 2nd underpower (37P) element
38	UV1-A/	Definitive signal of 1st undervoltage (27) element on A (AB) phase
39	UV1-B/	Definitive signal of 1st undervoltage (27) element on B (BC) phase
40	UV1-C/	Definitive signal of 1st undervoltage (27) element on C (CA) phase

	Signal name	Description
41	UV2-A/	Definitive signal of 2nd undervoltage (27) element on A (AB) phase
42	UV2-B/	Definitive signal of 2nd undervoltage (27) element on B (BC) phase
43	UV2-C/	Definitive signal of 2nd undervoltage (27) element on C (CA) phase
44	OV1-A/	Definitive signal of 1st overvoltage (59) element on A (AB) phase
45	OV1-B/	Definitive signal of 1st overvoltage (59) element on B (BC) phase
46	OV1-C/	Definitive signal of 1st overvoltage (59) element on C (CA) phase
47	OV2-A/	Definitive signal of 2nd overvoltage (59) element on A (AB) phase
48	OV2-B/	Definitive signal of 2nd overvoltage (59) element on B (BC) phase
49	OV2-C/	Definitive signal of 2nd overvoltage (59) element on C (CA) phase
50	OVG1/	Definitive signal of 1st ground fault overvoltage (64N) element
51	OVG2/	Definitive signal of 2nd ground fault overvoltage (64N) element
52	NOV1/	Definitive signal of 1st negative sequence overvoltage (47) element
53	NOV2/	Definitive signal of 2nd negative sequence overvoltage (47) element
54	F_UV	Undervoltage element for the calculation lock of frequency (81) elements
55	UF1/	Definitive signal of 1st underfrequency (81UF) element
56	UF2/	Definitive signal of 2nd underfrequency (81UF) element
57	UF3/	Definitive signal of 3rd underfrequency (81UF) element
58	OF1/	Definitive signal of 1st overfrequency (81OF) element
59	OF2/	Definitive signal of 2nd overfrequency (81OF) element
60	OF3/	Definitive signal of 3rd overfrequency (81OF) element
61	MST1/	Definitive signal of 1st limitation of the number of starts (66) element
62	MST2/	Definitive signal of 2nd limitation of the number of starts (66) element
63	VTF/	Definitive signal of VTF element
64	TCNT_ALM	Alarm of trip counter
65	V0SV_ALM	Definitive signal of supervision of zero-sequence voltage
66	MTR_ALM	Alarm of motor runtime
67	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.)
68	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.)
69	OC1-AD	Detection signal of 1st definite time or IDMT overcurrent (51) element on A phase
70	OC1-BD	Detection signal of 1st definite time or IDMT overcurrent (51) element on B phase
71	OC1-CD	Detection signal of 1st definite time or IDMT overcurrent (51) element on C phase
72	OC1-GD	Detection signal of 1st instantaneous overcurrent (50) element on zero phase
73	OC2-AD	Detection signal of 2nd definite time or IDMT overcurrent (51) element on A phase
74	OC2-BD	Detection signal of 2nd definite time or IDMT overcurrent (51) element on B phase
75	OC2-CD	Detection signal of 2nd definite time or IDMT overcurrent (51) element on C phase
76	OC2-GD	Detection signal of 2nd instantaneous overcurrent (50) element on zero phase
77	OC3-AD	Detection signal of 3rd instantaneous overcurrent (50) element on A phase
78	OC3-BD	Detection signal of 3rd instantaneous overcurrent (50) element on B phase
79	OC3-CD	Detection signal of 3rd instantaneous overcurrent (50) element on C phase
80	NOC1-D	Detection signal of 1st negative sequence overcurrent (46) element
81	NOC2-D	Detection signal of 2nd negative sequence overcurrent (46) element
82	NOC3-D	Detection signal of 3rd negative sequence overcurrent (single-phase-open) element
83	UC1-AD	Detection signal of 1st undercurrent (37) element on A phase
84	UC1-BD	Detection signal of 1st undercurrent (37) element on B phase
85	UC1-CD	Detection signal of 1st undercurrent (37) element on C phase
86	UC2-AD	Detection signal of 2nd undercurrent (37) element on A phase
87	UC2-BD	Detection signal of 2nd undercurrent (37) element on B phase
88	UC2-CD	Detection signal of 2nd undercurrent (37) element on C phase
89	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.)
90	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.)

	Signal name	Description
91	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.)
92	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.)
93	DIRG1-D	Detection signal of 1st instantaneous directional ground fault (67G) element
94	DIRG2-D	Detection signal of 2nd instantaneous directional ground fault (67G) element
95	UP1-D	Detection signal of 1st underpower (37P) element
96	UP2-D	Detection signal of 2nd underpower (37P) element
97	UV1-AD	Detection signal of 1st undervoltage (27) element on A (AB) phase
98	UV1-BD	Detection signal of 1st undervoltage (27) element on B (BC) phase
99	UV1-CD	Detection signal of 1st undervoltage (27) element on C (CA) phase
100	UV2-AD	Detection signal of 2nd undervoltage (27) element on A (AB) phase
101	UV2-BD	Detection signal of 2nd undervoltage (27) element on B (BC) phase
102	UV2-CD	Detection signal of 2nd undervoltage (27) element on C (CA) phase
103	OV1-AD	Detection signal of 1st overvoltage (59) element on A (AB) phase
104	OV1-BD	Detection signal of 1st overvoltage (59) element on B (BC) phase
105	OV1-CD	Detection signal of 1st overvoltage (59) element on C (CA) phase
106	OV2-AD	Detection signal of 2nd overvoltage (59) element on A (AB) phase
107	OV2-BD	Detection signal of 2nd overvoltage (59) element on B (BC) phase
108	OV2-CD	Detection signal of 2nd overvoltage (59) element on C (CA) phase
109	OVG1-D	Detection signal of 1st ground fault overvoltage (64N) element
110	OVG2-D	Detection signal of 2nd ground fault overvoltage (64N) element
111	NOV1-D	Detection signal of 1st negative sequence overvoltage (47) element
112	NOV2-D	Detection signal of 2nd negative sequence overvoltage (47) element
113	UF1-D	Detection signal of 1st underfrequency (81UF) element
114	UF2-D	Detection signal of 2nd underfrequency (81UF) element
115	UF3-D	Detection signal of 3rd underfrequency (81UF) element
116	OF1-D	Detection signal of 1st overfrequency (81OF) element
117	OF2-D	Detection signal of 2nd overfrequency (81OF) element
118	OF3-D	Detection signal of 3rd overfrequency (81OF) element
119	MST1-D	Detection signal of 1st limitation of the number of starts (66) element
120	MST2-D	Detection signal of 2nd limitation of the number of starts (66) element
121	VTF-D	Detection signal of VTF element
122	V0SV_ALMD	Detection signal of supervision of zero-sequence voltage
123	ALARM	Abnormal condition of constant supervision (heavy alarm)
124	ALARM-L	Abnormal condition of constant supervision (light alarm)
125	RY-LOCK	Locking of relay
126	RESET	LED reset signal (activated by pushing the “ESC/C” button on the front panel for more than 3 seconds)
127	INTER1	1st intermediate output signal of PLC
128	INTER2	2nd intermediate output signal of PLC
129	INTER3	3rd intermediate output signal of PLC
130	INTER4	4th intermediate output signal of PLC
131	INTER5	5th intermediate output signal of PLC
132	INTER6	6th intermediate output signal of PLC
133	INTER7	7th intermediate output signal of PLC
134	INTER8	8th intermediate output signal of PLC
135	OC1-3D_O	Detection signal of any OC1 of A, B, and C phase
136	OC1-D_O	Detection signal of any OC1 of A, B, C, and zero phase
137	OC2-3D_O	Detection signal of any OC2 of A, B, and C phase
138	OC2-D_O	Detection signal of any OC2 of A, B, C, and zero phase
139	OC3-3D_O	Detection signal of any OC3 of A, B, and C phase
140	UC1-3D_O	Detection signal of any UC1 of A, B, and C phase

	Signal name	Description
141	UC2-3D_O	Detection signal of any UC2 of A, B, and C phase
142	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.)
143	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.)
144	UV1-3D_O	Detection signal of any UV1 of A (AB), B (BC), and C (CA) phase
145	UV2-3D_O	Detection signal of any UV2 of A (AB), B (BC), and C (CA) phase
146	OV1-3D_O	Detection signal of any OV1 of A (AB), B (BC), and C (CA) phase
147	OV2-3D_O	Detection signal of any OV2 of A (AB), B (BC), and C (CA) phase
148	OC-3D_O	Detection signal of any of overcurrent elements on A, B, and C phase
149	OC-D_O	Detection signal of any of overcurrent elements on A, B, C, and zero phase
150	NOC-D_O	Detection signal of any of negative sequence overcurrent (OCNEG) elements
151	NOC12-D_O	Detection signal of OCNEG1 or OCNEG2
152	NOC13-D_O	Detection signal of OCNEG1 or OCNEG3
153	NOC23-D_O	Detection signal of OCNEG2 or OCNEG3
154	UC-3D_O	Detection signal of any of undercurrent elements on A, B, and C phase
155	DIRG-D_O	Detection signal of any of directional ground fault (DIRG) elements
156	UP-D_O	Detection signal of any of underpower elements
157	UV-3D_O	Detection signal of any of undervoltage elements on A, B, and C phase
158	OV-3D_O	Detection signal of any of overvoltage elements on A, B, and C phase
159	OVG-D_O	Detection signal of any of ground fault overvoltage (OVG) elements
160	NOV-D_O	Detection signal of any of negative sequence overvoltage (OVNEG) elements
161	UF-D_O	Detection signal of any of underfrequency elements
162	OF-D_O	Detection signal of any of overfrequency elements
163	MST-D_O	Detection signal of any of limitation of the number of starts
164	ALLEL-D_O	Detection signal of any of all elements (OR of all detection signals)
165	OC1-3_O/	Definitive signal of any OC1 of A, B, and C phase
166	OC1-O	Definitive signal of any OC1 of A, B, C, and zero phase
167	OC2-3_O/	Definitive signal of any OC2 of A, B, and C phase
168	OC2-O	Definitive signal of any OC2 of A, B, C, and zero phase
169	OC3-3_O/	Definitive signal of any OC3 of A, B, and C phase
170	UC1-3_O/	Definitive signal of any UC1 of A, B, and C phase
171	UC2-3_O/	Definitive signal of any UC2 of A, B, and C phase
172	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.)
173	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.)
174	UV1-3_O/	Definitive signal of any UV1 of A (AB), B (BC), and C (CA) phase
175	UV2-3_O/	Definitive signal of any UV2 of A (AB), B (BC), and C (CA) phase
176	OV1-3_O/	Definitive signal of any OV1 of A (AB), B (BC), and C (CA) phase
177	OV2-3_O/	Definitive signal of any OV2 of A (AB), B (BC), and C (CA) phase
178	OC-3_O	Definitive signal of any of overcurrent elements on A, B, and C phase
179	OC-O	Definitive signal of any of overcurrent elements on A, B, C, and zero phase
180	NOC-O	Definitive signal of any of negative sequence overcurrent (OCNEG) elements
181	NOC12-O	Definitive signal of OCNEG1 or OCNEG2
182	NOC13-O	Definitive signal of OCNEG1 or OCNEG3
183	NOC23-O	Definitive signal of OCNEG2 or OCNEG3
184	UC-O	Definitive signal of any of undercurrent elements on A, B, and C phase
185	DIRG-O	Definitive signal of any of directional ground fault (DIRG) elements
186	UP-O	Definitive signal of any of underpower elements
187	UV-O	Definitive signal of any of undervoltage elements on A, B, and C phase
188	OV-O	Definitive signal of any of overvoltage elements on A, B, and C phase
189	OVG-O	Definitive signal of any of ground fault overvoltage (OVG) elements

	Signal name	Description
190	NOV-O	Definitive signal of any of negative sequence overvoltage (OVNEG) elements
191	UF-O	Definitive signal of any of underfrequency elements
192	OF-O	Definitive signal of any of overfrequency elements
193	MST-O	Definitive signal of any of limitation of the number of starts
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)
209	OV2-3_A	Definitive signal of OV2 in all 3 phases (AND of all OV2 definitive signals)
210	OC1-A	Definitive signal of OC1 A-phase or forced operation from PC-HMI
211	OC1-B	Definitive signal of OC1 B-phase or forced operation from PC-HMI
212	OC1-C	Definitive signal of OC1 C-phase or forced operation from PC-HMI
213	OC1-3_O	Definitive signal of any OC1 of A, B, and C phase or forced operation from PC-HMI
214	OC1-G	Definitive signal of OC1 zero-phase or forced operation from PC-HMI
215	OC2-A	Definitive signal of OC2 A-phase or forced operation from PC-HMI
216	OC2-B	Definitive signal of OC2 B-phase or forced operation from PC-HMI
217	OC2-C	Definitive signal of OC2 C-phase or forced operation from PC-HMI
218	OC2-3_O	Definitive signal of any OC2 of A, B, and C phase or forced operation from PC-HMI
219	OC2-G	Definitive signal of OC2 zero-phase or forced operation from PC-HMI
220	OC3-A	Definitive signal of OC3 A-phase or forced operation from PC-HMI
221	OC3-B	Definitive signal of OC3 B-phase or forced operation from PC-HMI
222	OC3-C	Definitive signal of OC3 C-phase or forced operation from PC-HMI
223	OC3-3_O	Definitive signal of any OC3 of A, B, and C phase or forced operation from PC-HMI
224	NOC1	Definitive signal of OCNEG1 or forced operation from PC-HMI
225	NOC2	Definitive signal of OCNEG2 or forced operation from PC-HMI
226	NOC3	Definitive signal of OCNEG3 or forced operation from PC-HMI
227	UC1-A	Definitive signal of UC1 A-phase or forced operation from PC-HMI
228	UC1-B	Definitive signal of UC1 B-phase or forced operation from PC-HMI
229	UC1-C	Definitive signal of UC1 C-phase or forced operation from PC-HMI
230	UC1-3_O	Definitive signal of any UC1 of A, B, and C phase or forced operation from PC-HMI
231	UC2-A	Definitive signal of UC2 A-phase or forced operation from PC-HMI
232	UC2-B	Definitive signal of UC2 B-phase or forced operation from PC-HMI

	Signal name	Description
233	UC2-C	Definitive signal of UC2 C-phase or forced operation from PC-HMI
234	UC2-3_O	Definitive signal of any UC2 of A, B, and C phase or forced operation from PC-HMI
235	CBF-A	Definitive signal of CBF A-phase or forced operation from PC-HMI
236	CBF-B	Definitive signal of CBF B-phase or forced operation from PC-HMI
237	CBF-C	Definitive signal of CBF C-phase or forced operation from PC-HMI
238	CBF-3_O	Definitive signal of any CBF of A, B, and C phase or forced operation from PC-HMI
239	CBF-G	Definitive signal of CBF zero-phase or forced operation from PC-HMI
240	THOL	Definitive signal of THOL or forced operation from PC-HMI
241	DIRG1	Definitive signal of DIRG1 or forced operation from PC-HMI
242	DIRG2	Definitive signal of DIRG2 or forced operation from PC-HMI
243	UP1	Definitive signal of UP1 or forced operation from PC-HMI
244	UP2	Definitive signal of UP2 or forced operation from PC-HMI
245	UV1-A	Definitive signal of UV1 A (AB) phase or forced operation from PC-HMI
246	UV1-B	Definitive signal of UV1 B (BC) phase or forced operation from PC-HMI
247	UV1-C	Definitive signal of UV1 C (CA) phase or forced operation from PC-HMI
248	UV1-3_O	Definitive signal of any UV1 of A (AB), B (BC), and C (CA) phase or forced operation from PC-HMI
249	UV2-A	Definitive signal of UV2 A (AB) phase or forced operation from PC-HMI
250	UV2-B	Definitive signal of UV2 B (BC) phase or forced operation from PC-HMI
251	UV2-C	Definitive signal of UV2 C (CA) phase or forced operation from PC-HMI
252	UV2-3_O	Definitive signal of any UV2 of A (AB), B (BC), and C (CA) phase or forced operation from PC-HMI
253	OV1-A	Definitive signal of OV1 A (AB) phase or forced operation from PC-HMI
254	OV1-B	Definitive signal of OV1 B (BC) phase or forced operation from PC-HMI
255	OV1-C	Definitive signal of OV1 C (CA) phase or forced operation from PC-HMI
256	OV1-3_O	Definitive signal of any OV1 of A (AB), B (BC), and C (CA) phase or forced operation from PC-HMI
257	OV2-A	Definitive signal of OV2 A (AB) phase or forced operation from PC-HMI
258	OV2-B	Definitive signal of OV2 B (BC) phase or forced operation from PC-HMI
259	OV2-C	Definitive signal of OV2 C (CA) phase or forced operation from PC-HMI
260	OV2-3_O	Definitive signal of any OV2 of A (AB), B (BC), and C (CA) phase or forced operation from PC-HMI
261	OVG1	Definitive signal of OVG1 or forced operation from PC-HMI
262	OVG2	Definitive signal of OVG2 or forced operation from PC-HMI
263	NOV1	Definitive signal of OVNEG1 or forced operation from PC-HMI
264	NOV2	Definitive signal of OVNEG2 or forced operation from PC-HMI
265	UF1	Definitive signal of UF1 or forced operation from PC-HMI
266	UF2	Definitive signal of UF2 or forced operation from PC-HMI
267	UF3	Definitive signal of UF3 or forced operation from PC-HMI
268	OF1	Definitive signal of OF1 or forced operation from PC-HMI
269	OF2	Definitive signal of OF2 or forced operation from PC-HMI
270	OF3	Definitive signal of OF3 or forced operation from PC-HMI
271	MST1	Definitive signal of MST1 or forced operation from PC-HMI
272	MST2	Definitive signal of MST2 or forced operation from PC-HMI
273	VTF	Definitive signal of VTF 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 value of UF(OF)	Setting value ± 0.05Hz
	Ground-fault overcurrent element (50N) Ground directional element (67N, 67G)	1) Voltage setting value 2) Current setting value (ZCT) (a) 1.0 ~ 9.9mA (b) 10.0 ~ 100mA 3) Current setting value (Redisual) 0.5 A ≦ Ope.Curt	1) Setting value ±5% 2) (a) Setting value ±10% (b) Setting value ±5% 3) Setting value ±5%
	Other elements	1) Voltage setting value 2) Current setting value	1) Setting value ± 5% 2) Setting value ±5%
Resetting value	Frequency element (81U, 81O)	Setting value of UF(OF)	Setting value ± 0.05 Hz
	Directional Ground fault element (67N, 67G)	1) Voltage setting value 2) Current setting value	1) Voltage operation value × 95% or more 2) Current operation value × 95% or more
	Undervoltage element (27)	Voltage setting value	Voltage operation value × 105% or less
	Undercurrent element (37) Underpower element (37)	Current setting value	Current operation value × 105% or less
	Other elements	1) Voltage setting value 2) Current setting value	1) Voltage operation value × 95% or more 2) Current operation value × 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	Ground directional element (67N, 67G)	Setting value: Current setting value 1) Ope.Curt < 10.0mA 2) 10.0mA ≦ Ope.Curt Voltage setting value = Minimum Voltage input: Zero-phase voltage = Rated voltage × 30% Current input: Zero-phase current = Current setting value × 1000%	1) Maximum sensitivity angle ±10° 2) Maximum sensitivity angle ±5°
Operating time	Overcurrent element (50) Ground-fault overcurrent element (50N)	Setting value: Current setting value = 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%
	Negative-phase-sequence overcurrent element (46) Single-phase open-phase detection element (46)	Setting value: Current setting value = 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%
	Ground directional element (67N, 67G)	Setting value: 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 = 100 V Voltage – Current phase=0° (a) Ope.Time : 0.00 s (b) Ope.Time: 0.01 ~ 10 s	Ope.Time setting ± within 5%
	Undervoltage element (27)	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)	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%
	Underpower element (37)	Setting value: Motor IM setting = Minimum Motor VM setting = Minimum Input: MOTOR_VM setting → 70% × MOTOR_VM setting × Ope.Curt. Current = MOTOR_IM setting value, VA∠IA = 0 deg (a) Ope.Time : 0.00 s (b) Ope.Time: 0.01 ~ 10 s	(a) Within 50 ms (b) Either one of the followings, having a larger error Ope.Time ± within 50 ms Ope.Time ± within 5%
	Frequency element (81U)	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)	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
	Thermal Overload Element (49)	Setting value: Current setting value = 105% Operating time magnification = 8 Negative-phase heat generation Magnification = 1 Input: (a) 0A → MOTOR_IM setting ×300%, (b) 0A → MOTOR_IM setting ×500%, (c) 0A → MOTOR_IM setting ×1000%	(a) Within Theoretical operating time ± 12% (b) Within Theoretical operating time ± 7% (c) Within Theoretical operating time ± 5%
	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%
Limitation of Motor	Number-of-starts Limiting Element (66)	Setting value: Number of starts = 1 Starting time = 2s	1s ± within 5%

Starting Time	(MST1)	Decrease rate = 2.0s/h Input: Current = 0→Ope.Curt.×1000%	
	Number-of-starts Limiting Element (66) (MST2)	Setting value: Number of starts = 1 Input: Current = 0→Ope.Curt.×1000%	1s ± within 5%
Reset time	Overcurrent element (50) Ground-fault overcurrent element (50N) Negative-phase-sequence overcurrent element (46) Single-phase open-phase detection element (46)	Setting : Current setting = Minimum Input: Current = Current setting × 300% → 0	200 ms ± within 25 ms
	Directional Ground fault element (67N, 67G)	Setting : Current setting = Minimum Voltage setting = Minimum Maximum sensitivity angle = 0° Input: Current = Current setting × 1000%, 2000% → 0 Voltage = 100 V (fix) Voltage – Current phase=0°	200 ms ± within 25 ms
	Undervoltage element (27)	Setting : Voltage setting = Maximum Input: Voltage =Voltage setting × 70% → 125V	200 ms ± within 25 ms
	Undercurrent element (37)	Setting : MOTOR_IM = Rated value Current setting = 95% Input: Current=Current setting×70%→ Rated current	200 ms ± within 25 ms
	Underpower element (37)	Setting : MOTOR_IM = Rated value MOTOR_VM = Minimum Current setting value = Minimum Input: Current = MOTOR_IM setting Voltage = 70% × MOTOR_VM setting × Ope.Curt. → MOTOR_VM setting	200 ms ± within 25 ms
	Frequency element (81U) Single stage ~ 3-stage	Setting: UF setting = -5.0 Hz Input: Voltage = Rated voltage Rated frequency+UF- 0.5 Hz → Rated frequency	Ope.Time setting ± 25 ms or ± 5% (greater one)
	Frequency element (81O) Single stage ~ 3-stage	Setting : OF setting = 5.0 Hz Input: Voltage = Rated voltage Rated frequency+OF+0.5 Hz → Rated frequency	Ope.Time setting ± 25 ms or ± 5% (greater one)
	Time delayed overcurrent element (51) Time-delayed ground-fault overcurrent element (51N)	Setting value: Current setting value = Minimum Input: Current setting value × 300% → 0	200 ms ± within 25 ms
	Thermal Overload element (49)	Setting value: Current setting value = 105% Operating time magnification = 8 Negative-phase heat generation Magnification = 1 Input: Current = Ope.Curt.×300% → 0	HOT characteristic (300% input is applied for 5 minutes or more and then input is turned to zero.) 148.6 s ± 5 % COLD characteristic 200 ms ± within 25 ms
	CBF detection	Setting : Current setting = Minimum Input: Current = Current setting × 200% → 0	200 ms ± within 25 ms
	Overvoltage element (59) Ground-fault overvoltage element (64N)	Setting : Voltage setting = Minimum Input: Voltage = Voltage setting × 120% → 0	200 ms ± within 25 ms

	Negative-phase-sequence overvoltage (47)		
Limitation of Motor Starting Time	Number-of-starts Limiting Element (66) (MST1)	Setting value: Number of starts = 1 Starting time = 2s Decrease rate = 250.0s/h Input: Current = 0→Ope.Curt.×1000%(2s) → 0	14.5s ± within 5%
	Number-of-starts Limiting Element (66) (MST2)	Setting value: Number of starts = 1 Reset time = 1 min Input: Current = 0→Ope.Curt.×1000%(2s) → 0	1 min ± within 5%
Temperature characteristics	Time-delayed overcurrent element (51)	Setting value: Current setting value = Minimum Ope. Chr.= Other than DT 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 =DC88 V, DC300 V, AC85 V, AC264 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 characteristics	Time delayed overcurrent element (51)	Frequency: Rated frequency ± 10% Operating characteristics: Other than DT (a) 0→Ope.Curt.×300% (b) 0→Ope.Curt.×500% (c) 0→Ope.Curt.×1000%	Ope.value at rated F: ± within 5%
			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>Immunity against</td><td colspan="4">IEC60255-22-7</td><td>No unnecessary operation,</td></tr>
</table>

Item	Test condition	Standard
commercial frequency	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 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.
Immunity to conducted	IEC60255-26 IEC61000-4-6	No unnecessary operation, no abnormal indication and

Item	Test condition	Standard
disturbance, induced by radio-frequency field	Frequency range: 150 kHz ~ 80 MHz 27, 68 MHz Voltage level: 10 V/m Amplitude modulation: 1 kHz, ±80%AM(1kHz)	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) ・ Test time Number of test: 160 min (20 sweeps x 8 min.) ・ Condition : Non-energized condition	No unnecessary operation, no abnormal indication and etc.
Shock	IEC60255-21-2 class1	No damage

Item	Test condition	Standard
	[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	Measure the operating values of respective elements before & after the test, and the values shall be within the standard.
	[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	
Seismic test	IEC60255-21-3 class2	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.
	• 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	
Dry heat	IEC60068-2-2	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.
	Operating temperature: 60°C, 16 hours Storage temperature: 85°C, 16 hours	
Low temperature	IEC60068-2-1	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.
	Operating temperature: -40°C, 16 hours Storage temperature: -40°C, 16 hours	
Temperature &	To be based on IEC60068-2-30 (JIS-C60068-2-30 variant 2)	Any anomaly such as

Item	Test condition	Standard
humidity cycle test	Cyclic change of temperature & humidity between 40°C/95%RH and 25°C/95%RH. 1 cycle: 24 hours Number of cycles: 56 cycles	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

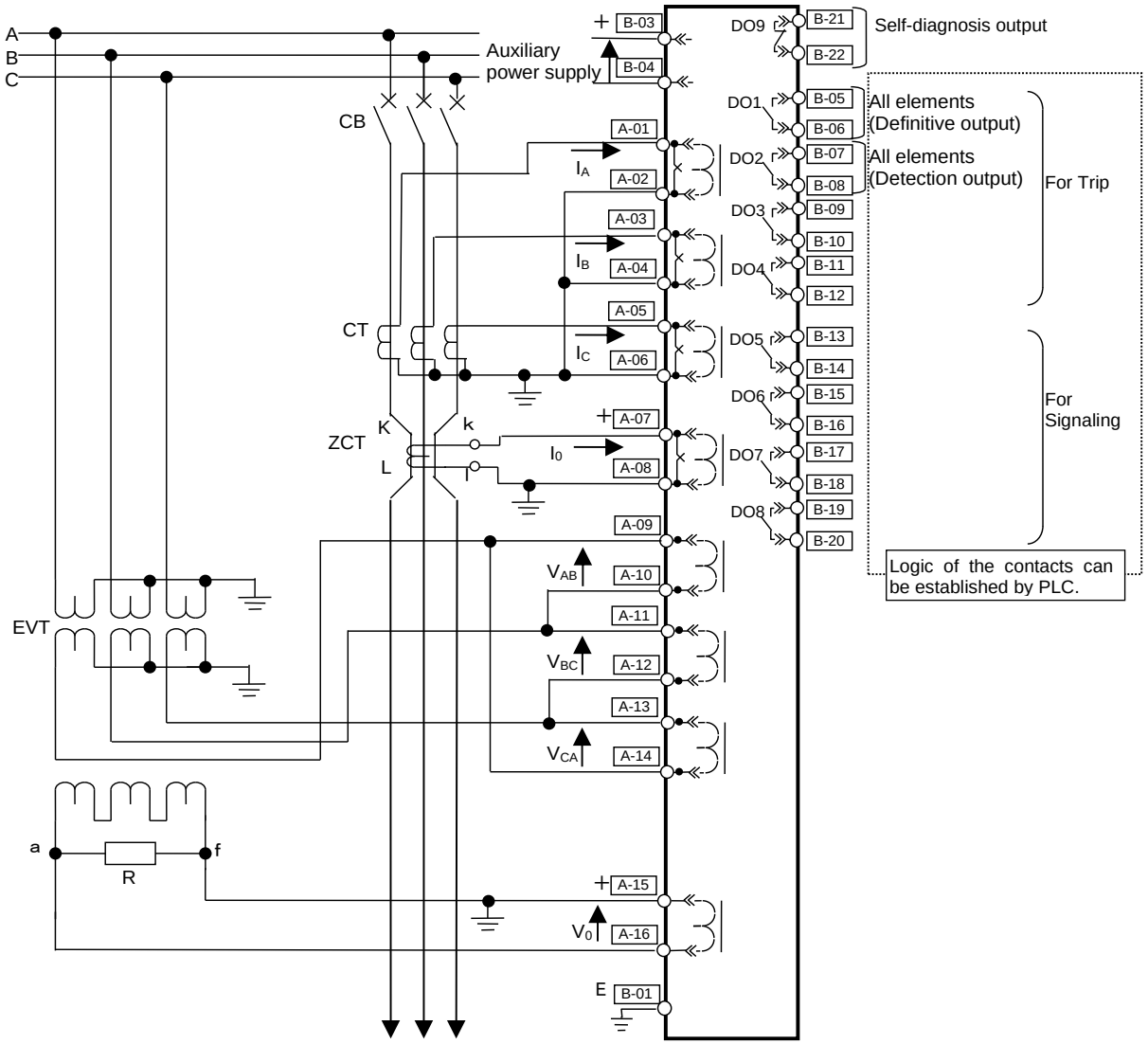


Fig. 7-1 Example connection (phase CT, phase-phase VT, zero-sequence voltage)
Settig AI-Config.: “V Input Sel. = D”, “V 3P/2P Sel. =3P” (refer to sub-clause 0)

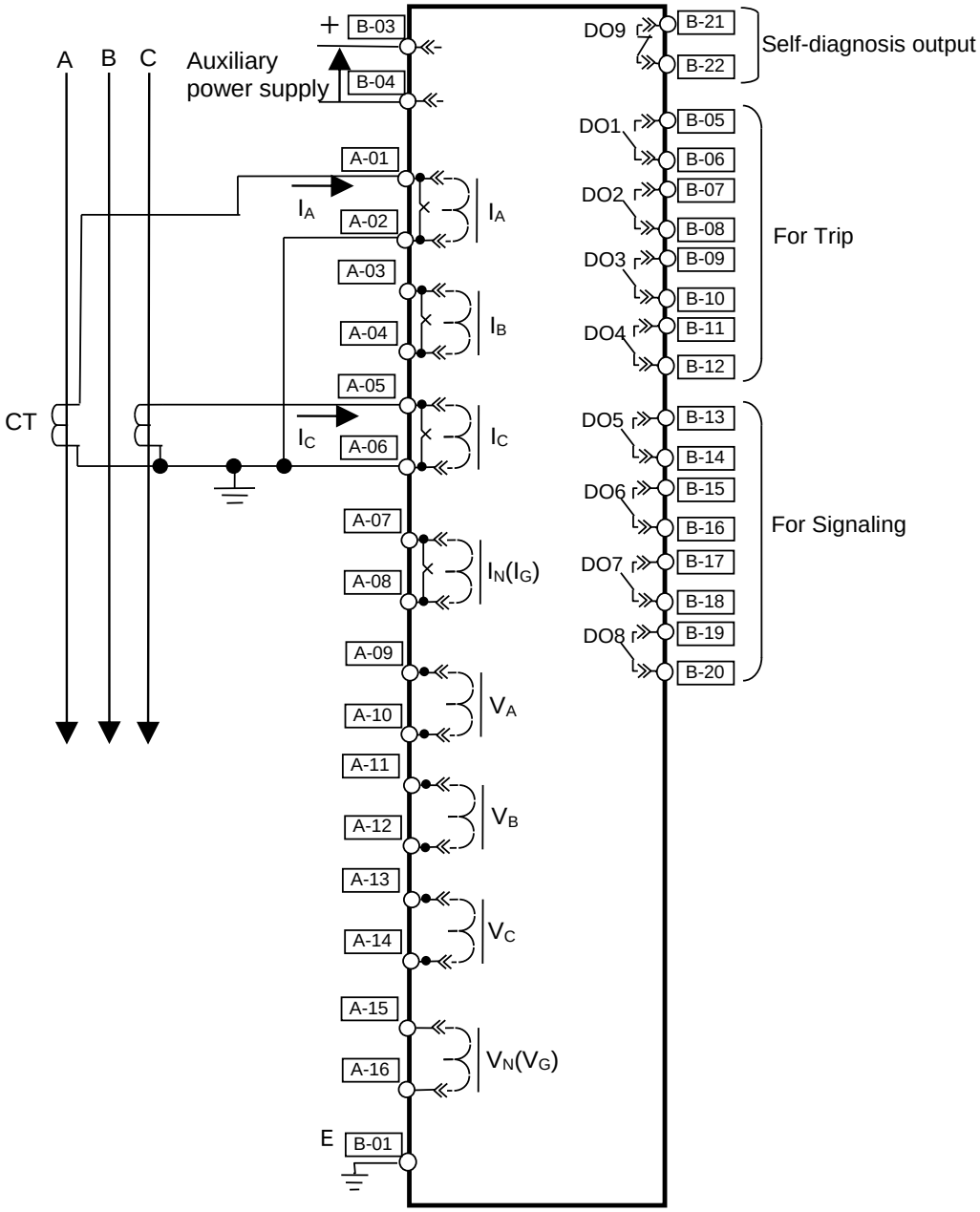


Fig. 7-2 Example connection for 2-phase injection using 2 x CT.
This example is focused on only CT connection. For VT, please refer to previous figure.

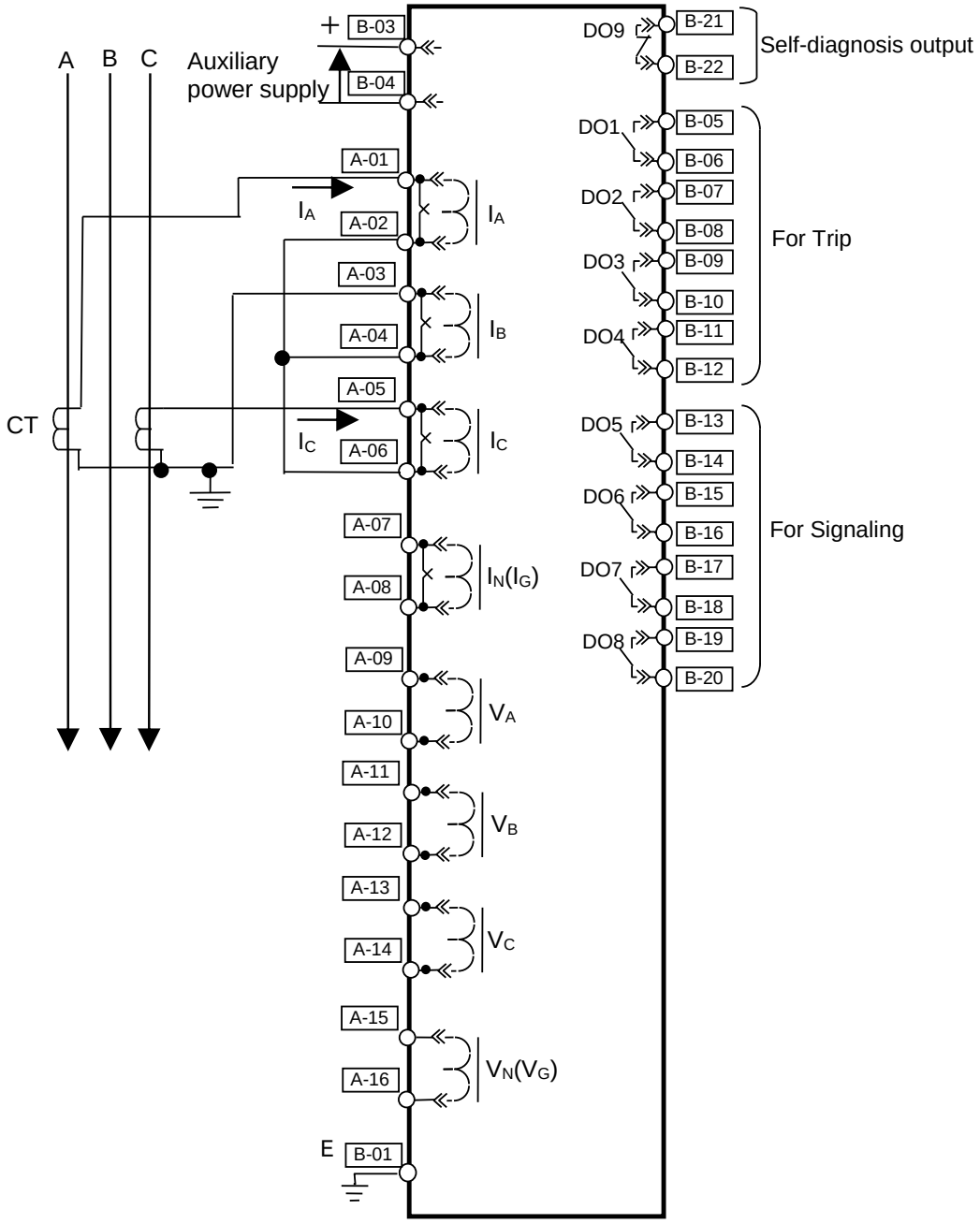


Fig. 7-3 Example connection for 3-phase injection using 2 x CT.
This example is focused on only CT connection. For VT, please refer to previous figure.

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 VT, EVT, 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

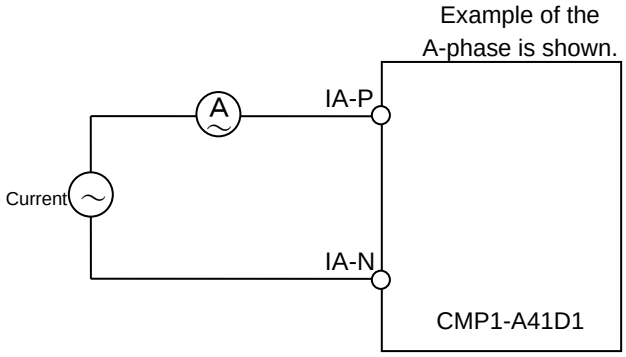
Regardless of equipping or not of the communication card, application of test voltage to the serial communication circuit shall be avoided, at the withstand voltage test and the lightning impulse test.

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, and Number-of-starts limiting element

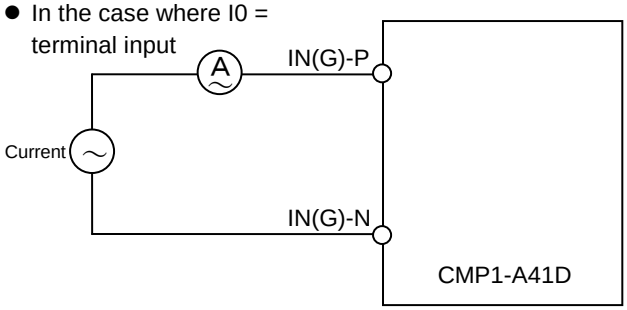


Test phase	Terminal No.
A-phase	IA-P～IA-N
B-phase	IB-P～IB-N
C-phase	IC-P～IC-N

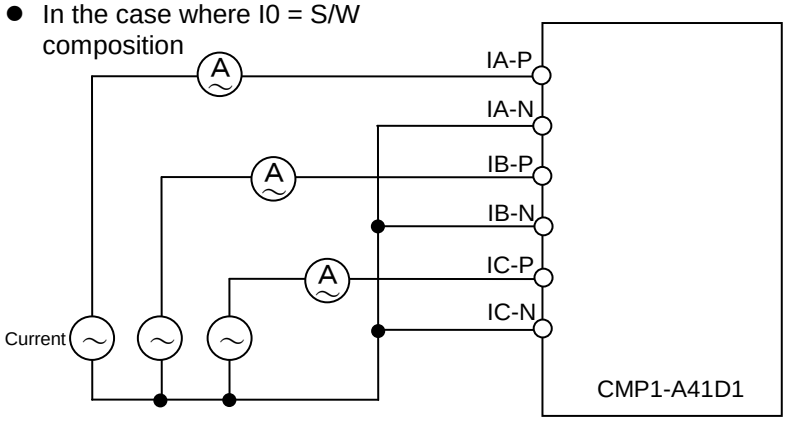
Only A-phase os used for Number of starts Limiting element.

[2] Ground-fault overcurrent element

- In the case where I0 = terminal input

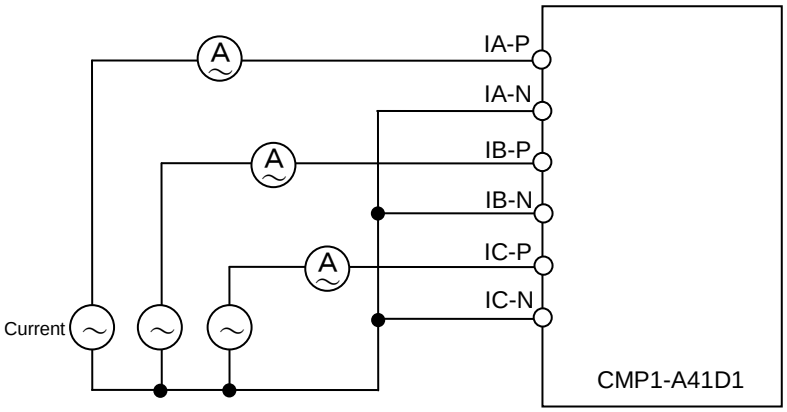


- In the case where I0 = S/W composition

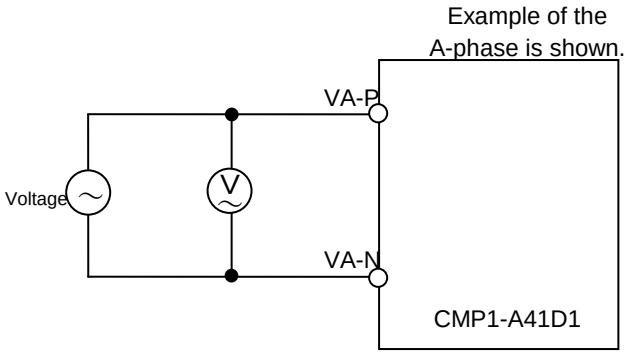


* Terminal input & S/W composition of I0 can be switched by the setting I0-SEL.

[3] Negative-phase-sequence overcurrent element,Single-phase open-phase detection element



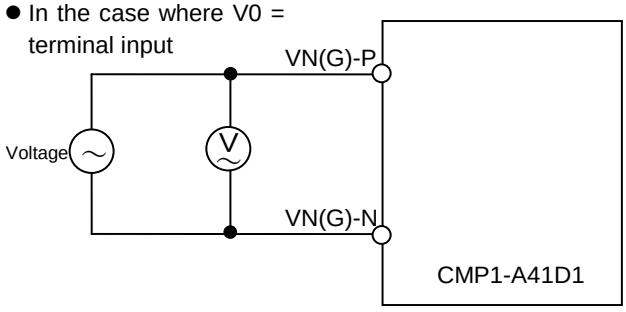
[4] Overvoltage element, Undervoltage element



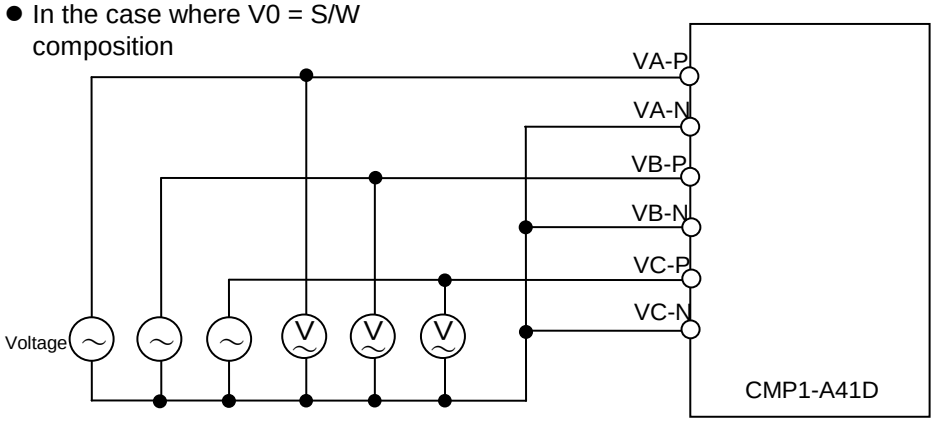
Test phase	Terminal No.
A-phase	VA-P～VA-N
B-phase	VB-P～VB-N
C-phase	VC-P～VC-N

[5] Ground-fault overvoltage element

● In the case where V0 = terminal input

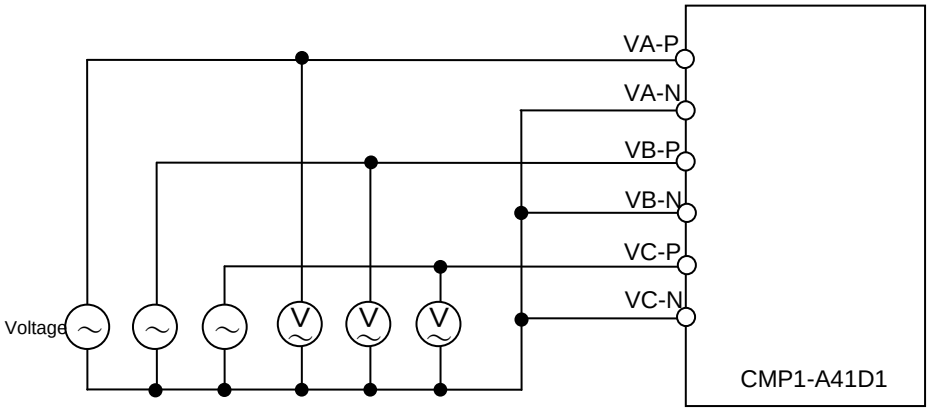


● In the case where V0 = S/W composition



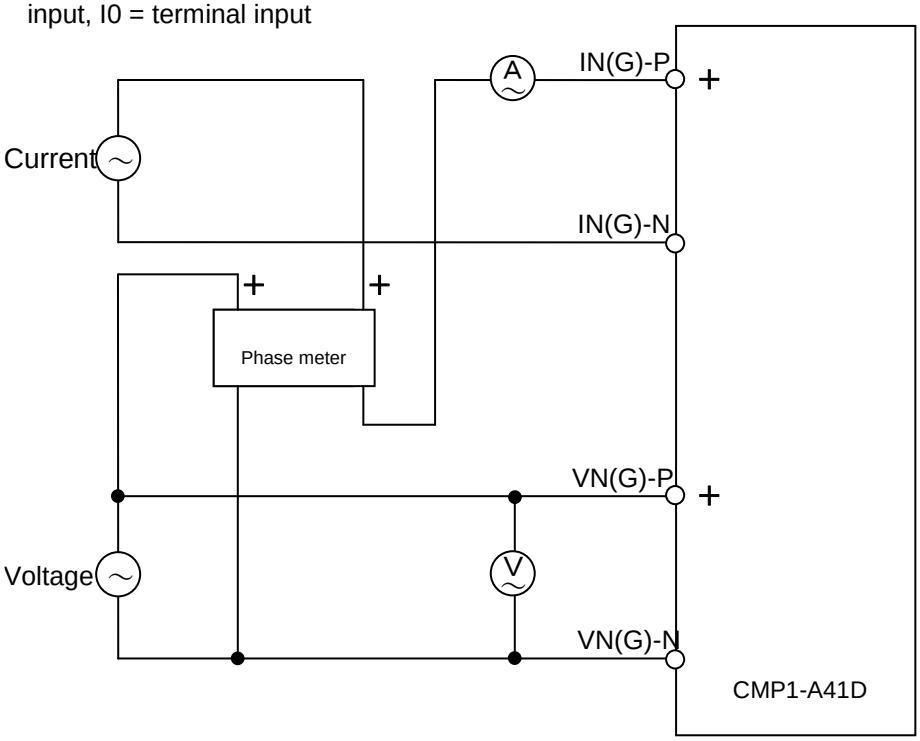
* Terminal input & S/W composition of V0 can be switched by the setting V0-SEL.

[6] Negative-phase-sequence overvoltage element

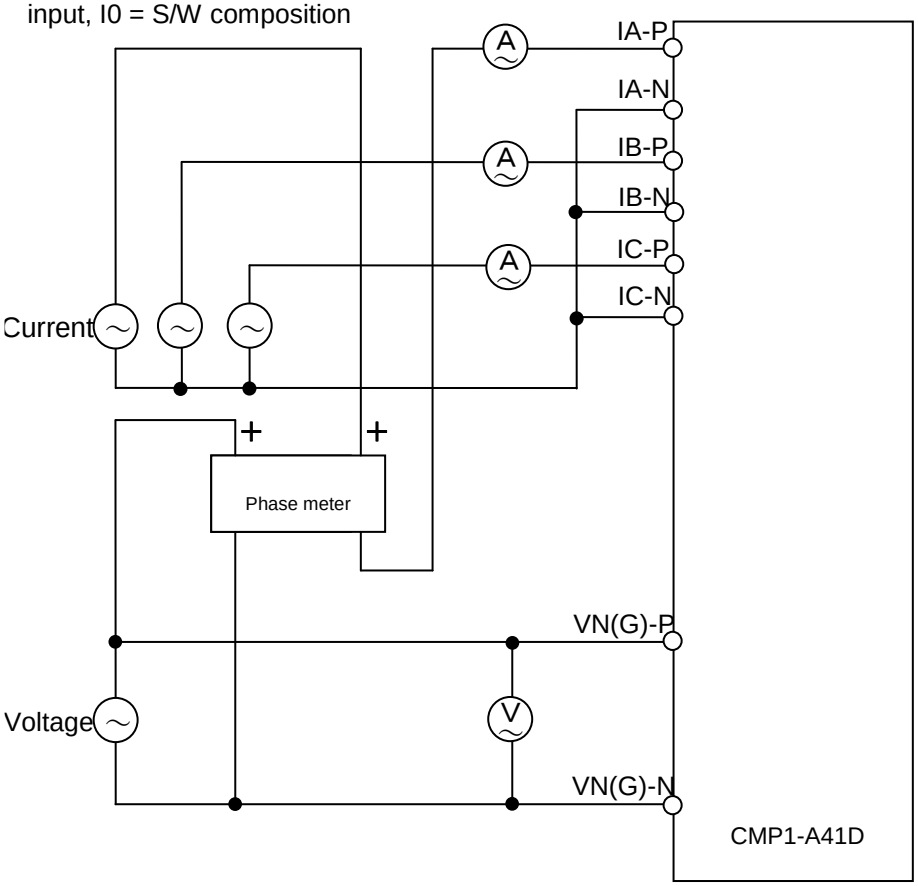


[7] Ground directional element

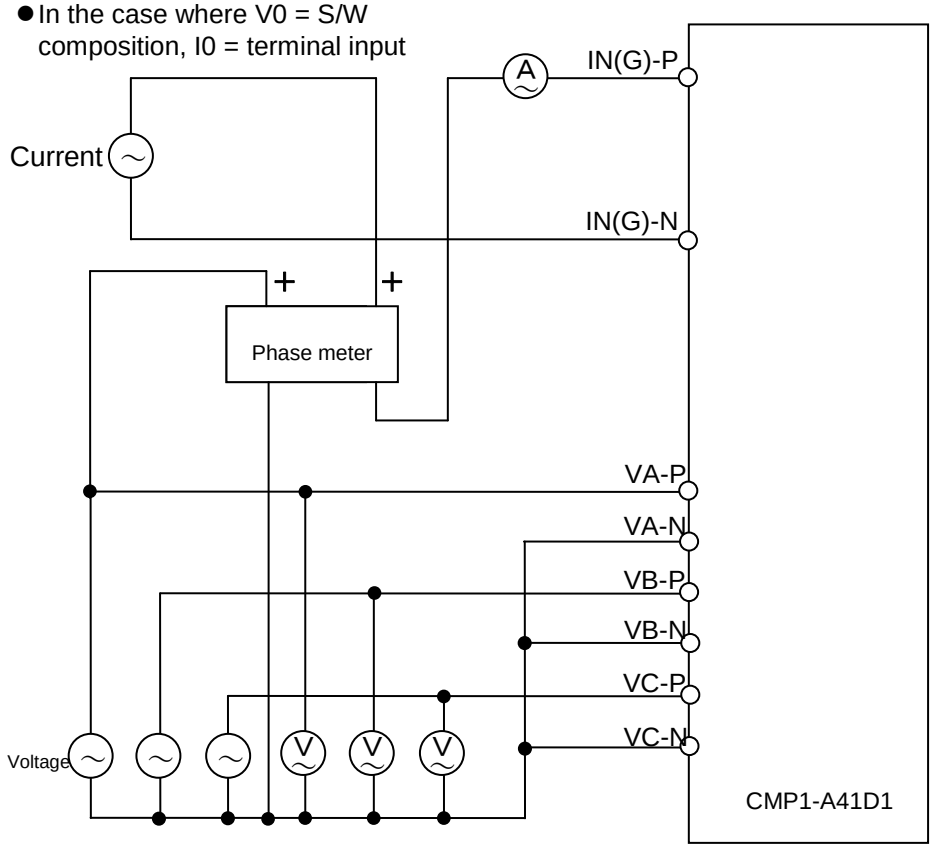
● In the case where V0 = terminal input, I0 = terminal input



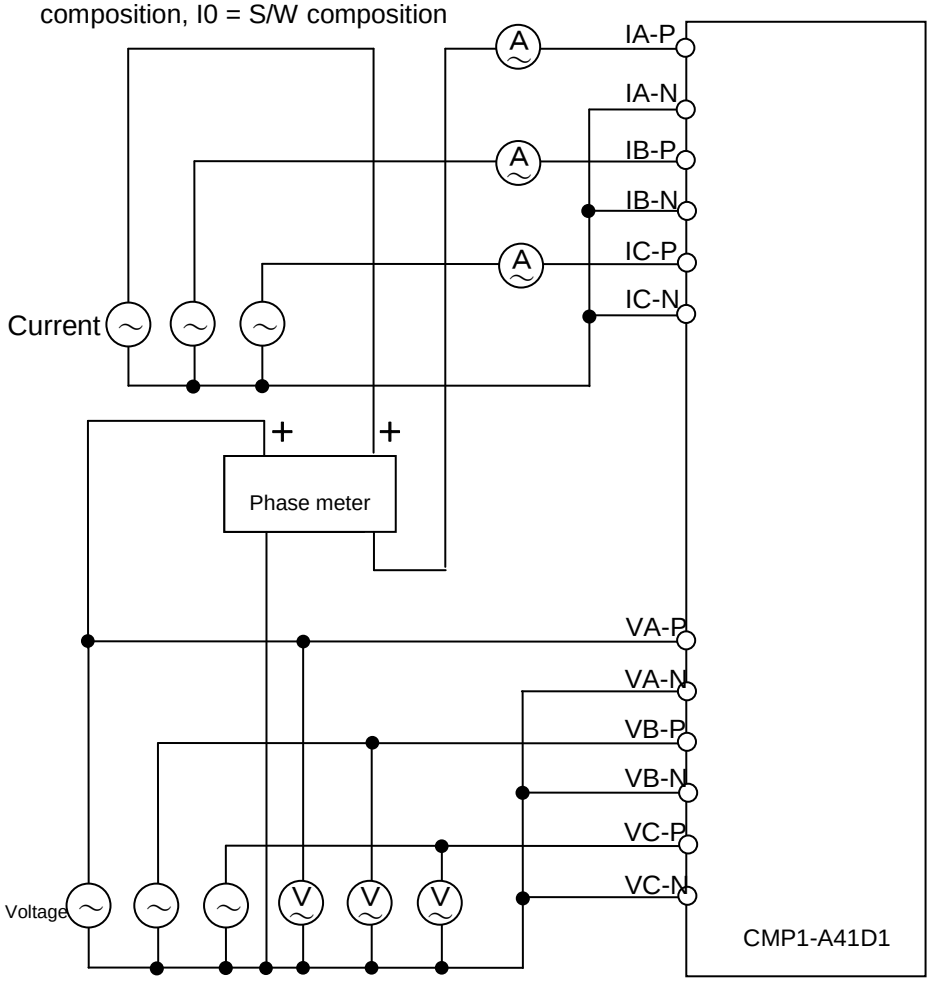
● In the case where V0 = terminal input, I0 = S/W composition



● In the case where V0 = S/W composition, I0 = terminal input



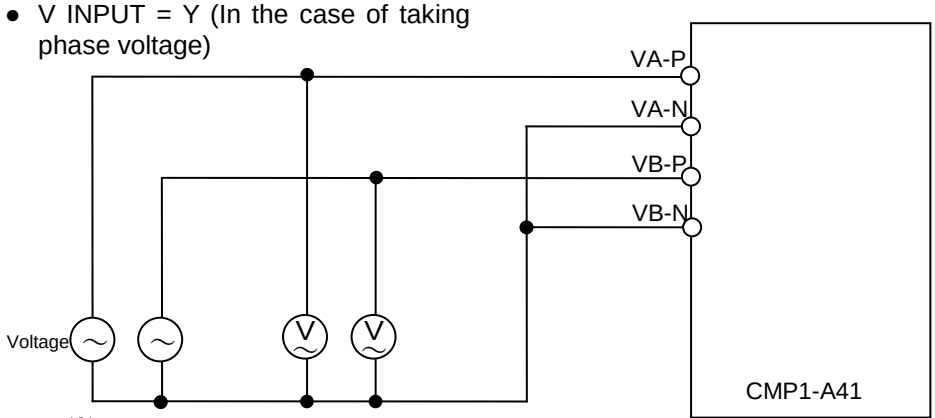
● In the case where V0 = S/W composition, I0 = S/W composition



* Terminal input & S/W composition of I0, and terminal input & S/W composition of V0 can be switched respectively by the setting I0-SEL, and the V0-SEL.

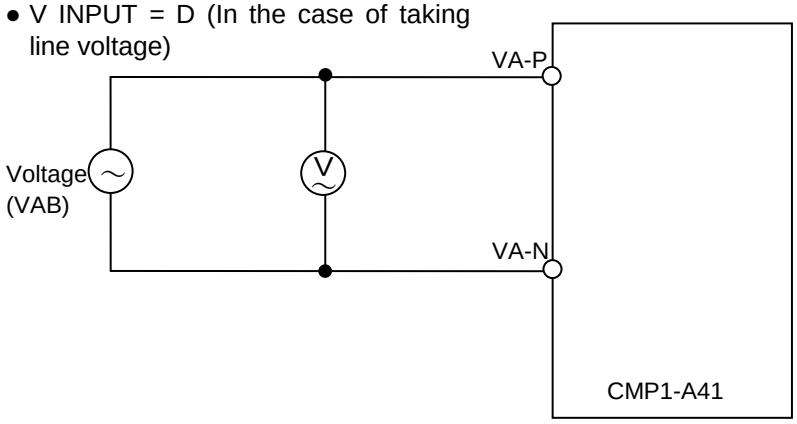
[8] Frequency element

● V INPUT = Y (In the case of taking phase voltage)



※ Phase difference between VA and VB is 120°.

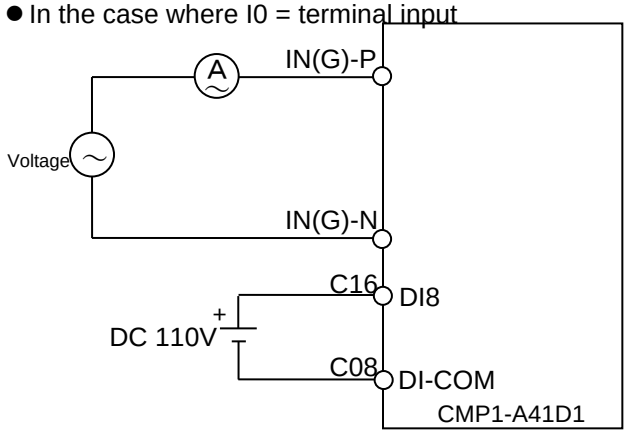
● V INPUT = D (In the case of taking line voltage)



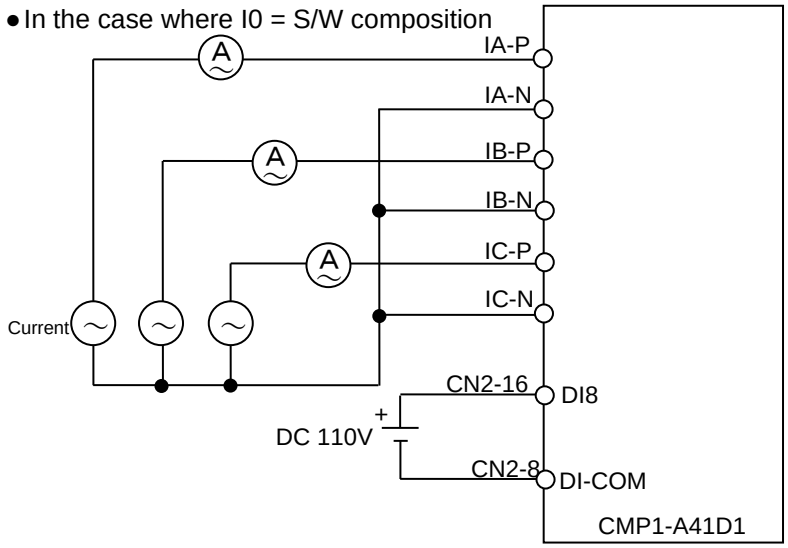
* Taking-in of phase voltage and line voltage of the voltage VAB can be switched by the setting V INPUT.

[9] CBF detection element

● In the case where I0 = terminal input

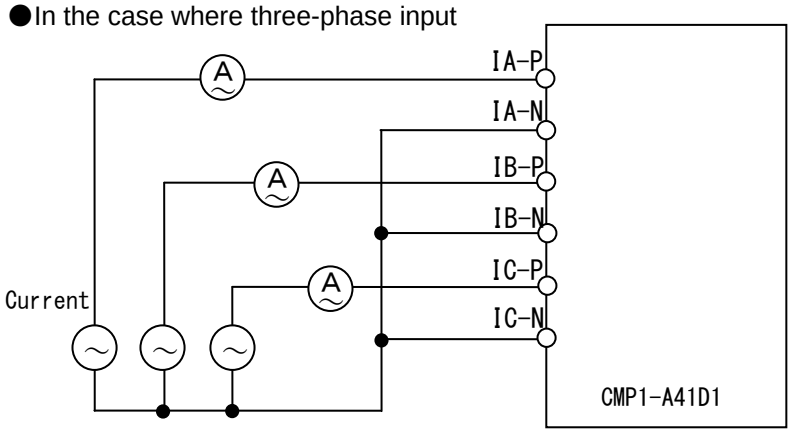


● In the case where I0 = S/W composition

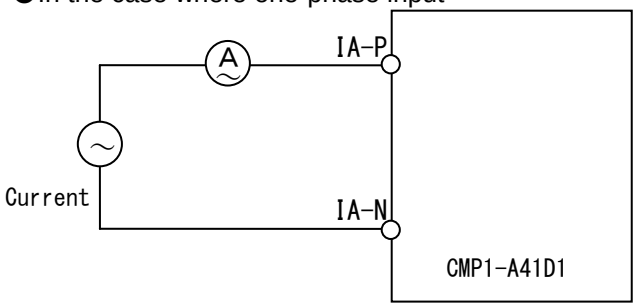


[10] Thermal Overload Element

●In the case where three-phase input

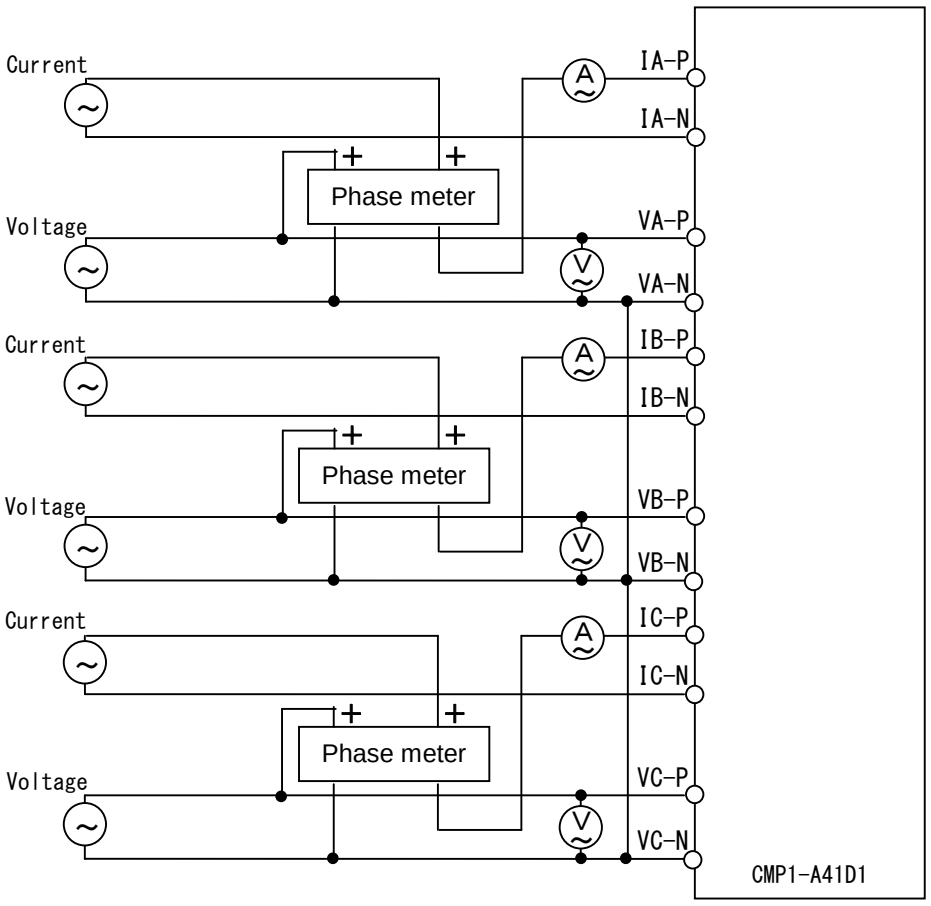


●In the case where one-phase input



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

[11] Underpower element



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.

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

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	Lock of monitoring	UNLOCKED / LOCKED
2	UC-A-LK	Lock of UC-A phase	UNLOCKED / LOCKED
3	UC-B-LK	Lock of UC-B phase	UNLOCKED / LOCKED
4	UC-C-LK	Lock of UC-C phase	UNLOCKED / LOCKED
5	UV-A-LK	Lock of UV-A phase	UNLOCKED / LOCKED
6	UV-B-LK	Lock of UV-B phase	UNLOCKED / LOCKED
7	UV-C-LK	Lock of UV-C phase	UNLOCKED / LOCKED
8	OV-A-LK	Lock of OV-A phase	UNLOCKED / LOCKED
9	OV-B-LK	Lock of OV-B phase	UNLOCKED / LOCKED
10	OV-C-LK	Lock of OV-C phase	UNLOCKED / LOCKED
11	TCNT-LK	Lock 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 Chapter 6.

[4] Operating time test

Refer to the “Operating time” in Chapter 6.

[5] Reset time test

Refer to the “Recovery time” in Chapter 6.

[6] Phase test

Refer to the “Phase characteristic” in Chapter 6.

[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.

- Visual inspection, referring to Section 8.1.
- Characteristic test, 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.
Light alarm ----- This alarm may appear by detecting the abnormal current or voltage input, or abnormality of the circuits which would not affect the relay's trip operation directly.
Heavy alarm --- This alarm may appear by detecting abnormality of the important circuits which would affect the relay's 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

Since the indication of 'ALARM LED' at fault detection is latched, it is necessary to press 'ESC/C' 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).

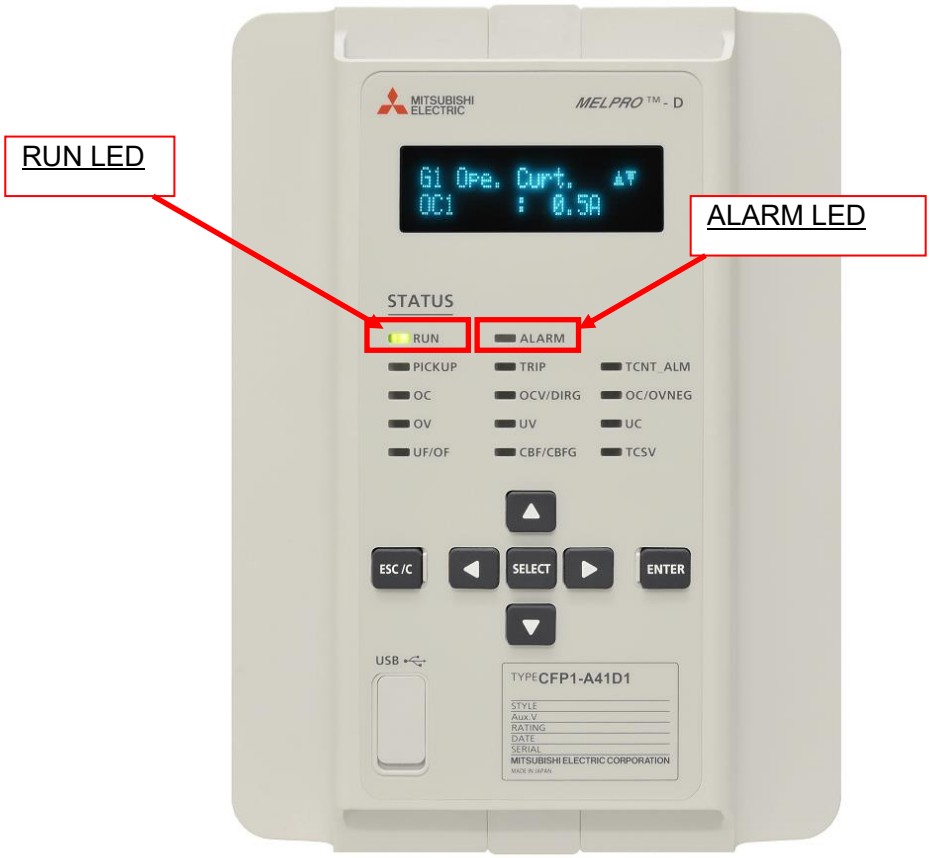


Fig. 9-1 Position of RUN LED, ALARM LED

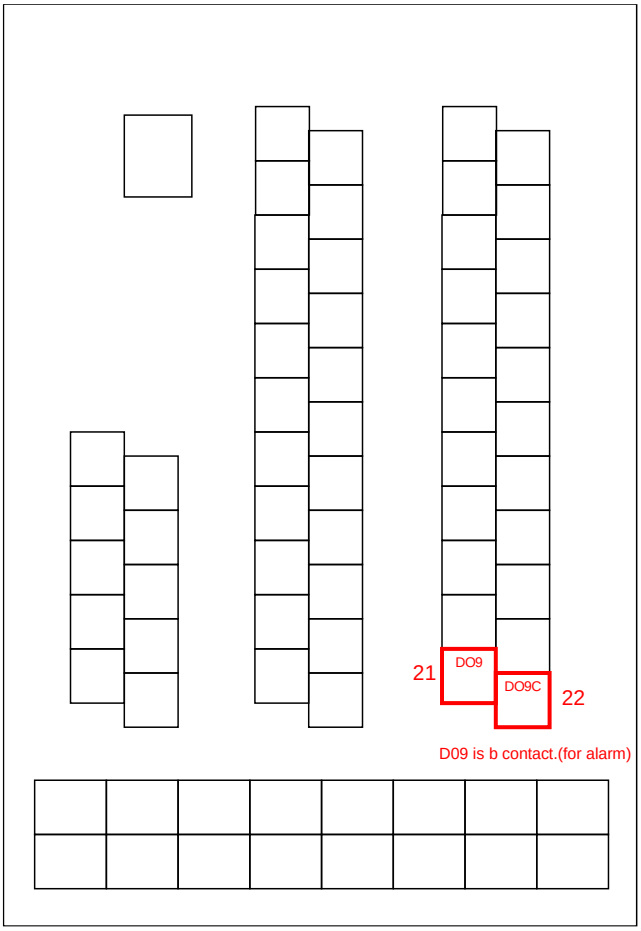


Fig. 9-2 Position of alarm DO

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 3.18)	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 (Order code E*H5Z type)

Table 10-1 Setting values (Order code E*H5Z type)

Category	Element	Item name of setting parameter	Range	Step	Default value	Description
MOTOR	MOTOR	Rated Motor Curt.	1.00 ～ 5.00A	0.05A	1.00A	
		Str. Curt. 1	130 ～ 180%	1%	150%	
		Str. Curt. 2	100 ～ 130%	1%	125%	
		Stp. Curt.	5 ～ 50%	1%	5%	
		Rated Motor Volt.	100.0 ～ 125.0V	0.1V	100.0V	
CURRENT	CURRENT	Ave. cycle	1 ～ 32	1	1	
OC/OCG	OC1	OC1 EN			OFF	
		OC1 Ave. Curt.			OFF	
		OC1 Ope. Curt.	200 ～ 2000%	2%	200%	
		OC1 Ope. Koct	4 ～ 240	1	4	
		OC1 Ope. Chr.			LI	
		OC1 IEC Chr. EN			OFF	
	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 Ave. Curt.			OFF	
		OC2 Ope. Curt.	200 ～ 2000%	2%	200%	
		OC2 Ope. Koct	4 ～ 240	1	4	
		OC2 Ope. Chr.			LI	
		OC2 IEC Chr. 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	
	OC3	OC3 EN			OFF	
		OC3 Ave. Curt.			OFF	
		OC3 Ope. Curt.	50 ～ 2000%	2%	50%	
		OC3 Ope. Time	0.00 ～ 10.00s	0.01s	0.00s	
OCNEG/UC/CBF	OCNEG1	OCNEG1 EN			OFF	
		OCNEG1 Ope. Curt.	25 ～ 100%	1%	25%	
		OCNEG1 Ope. Time	0.0 ～ 10.0s	0.1s	0.0s	
	OCNEG2	OCNEG2 EN			OFF	
		OCNEG2 Ope. Curt.	25 ～ 100%	1%	25%	
		OCNEG2 Ope. Time	0.0 ～ 10.0s	0.1s	0.0s	
	OCNEG3	OCNEG3 EN			OFF	The name is changed to SPO
		OCNEG3 Load Curt.	20 ～ 100%	1%	20%	
		OCNEG3 Loss Curt.	10 ～ 50%	1%	10%	
	SPO	SPO EN			OFF	
		SPO Load Curt.	20 ～ 100%	1%	20%	
		SPO Loss Curt.	10 ～ 50%	1%	10%	
	UC1	UC1 EN			OFF	
		UC1 Pick up			Pick1	
		UC1 Ope. Curt.	25 ～ 100%	1%	25%	
		UC1 Min. Curt.	25 ～ 100%	1%	25%	
		UC1 Ope. Time	0.0 ～ 600.0s	0.1s	0.0s	
	UC2	UC2 EN			OFF	
		UC2 Pick up			Pick1	
		UC2 Ope. Curt.	25 ～ 100%	1%	25%	

Category	Element	Item name of setting parameter	Range	Step	Default value	Description
		UC2 Min. Curt.	25 ～ 100%	1%	25%	
		UC2 Ope. Time	0.0 ～ 600.0s	0.1s	0.0s	
	CBF	CBF EN			OFF	
		CBFG EN			OFF	
		CBF Curt.	15 ～ 200%	1%	15%	
		CBFG Curt.	1.0 ～ 100.0mA	0.5mA	1.0mA	
		CBF Ope. Time	0.00 ～ 10.00s	0.01s	0.00s	
THOL	THOL	THOL EN			OFF	
		THOL Sel.			COLD	
		THOL Ave. Curt.			OFF	
		THOL Ope. Curt.	105 ～ 150%	1%	105%	
		THOL Ope. Kth	8 ～ 240	1	8	
		THOL Neg. K	1 ～ 10	1	1	
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	
UP	UP1	UP1 EN			OFF	
		UP1 Ope. Curt.	1 ～ 30%	1%	1%	
		UP1 Ope. Time	0.0 ～ 10.0s	0.1s	0.0s	
	UP2	UP2 EN			OFF	
		UP2 Ope. Curt.	1 ～ 30%	1%	1%	
		UP2 Ope. Time	0.0 ～ 10.0s	0.1s	0.0s	
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	
F	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	

Category	Element	Item name of setting parameter	Range	Step	Default value	Description
		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	
MST	MST1	MST1 EN				
		MST1 Str. Times	1 ～ 10	1		
		MST1 Str. Time	2 ～ 120s	1s		
		MST1 Dec. Rate	2.0 ～ 250.0s/h	0.1s/h		
	MST2	MST2 EN				
		MST2 Str. Times	1 ～ 10	1		
		MST2 Rst. Time	1 ～ 120min	1min		
VTF	VTF	VTF EN			OFF	
		VTF UV	20.0 ～ 120.0V	0.1V	20.0V	
		VTF OCD	0.5 ～ 100.0A	0.1A	0.5A	
		VTF OCG	1.0 ～ 100.0mA	0.5mA	1.0mA	
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 (Order code E*H55 type)

Table 10-2 Setting values (Order code E*H55 type)

Category	Element	Item name of setting parameter	Range	Step	Default value	Description
MOTOR	MOTOR	Rated Motor Curt.	1.00 ～ 5.00A	0.05A	1.00A	
		Str. Curt. 1	130 ～ 180%	1%	150%	
		Str. Curt. 2	100 ～ 130%	1%	125%	
		Stp. Curt.	5 ～ 50%	1%	5%	
		Rated Motor Volt.	100.0 ～ 125.0V	0.1V	100.0V	
CURRENT	CURRENT	Ave. cycle	1 ～ 32	1	1	
OC/OCG	OC1	OC1 EN			OFF	
		OC1 Ave. Curt.			OFF	
		OC1 Ope. Curt.	200 ～ 2000%	2%	200%	
		OC1 Ope. Koct	4 ～ 240	1	4	
		OC1 Ope. Chr.			LI	
		OC1 IEC Chr. EN			OFF	
	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 Ave. Curt.			OFF	
		OC2 Ope. Curt.	200 ～ 2000%	2%	200%	
		OC2 Ope. Koct	4 ～ 240	1	4	
		OC2 Ope. Chr.			LI	
		OC2 IEC Chr. 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	
	OC3	OC3 EN			OFF	
		OC3 Ave. Curt.			OFF	
		OC3 Ope. Curt.	50 ～ 2000%	2%	50%	
		OC3 Ope. Time	0.00 ～ 10.00s	0.01s	0.00s	
OCNEG/UC/CBF	OCNEG1	OCNEG1 EN			OFF	
		OCNEG1 Ope. Curt.	25 ～ 100%	1%	25%	
		OCNEG1 Ope. Time	0.0 ～ 10.0s	0.1s	0.0s	
	OCNEG2	OCNEG2 EN			OFF	
		OCNEG2 Ope. Curt.	25 ～ 100%	1%	25%	
		OCNEG2 Ope. Time	0.0 ～ 10.0s	0.1s	0.0s	
	OCNEG3	OCNEG3 EN			OFF	The name is changed to SPO
		OCNEG3 Load Curt.	20 ～ 100%	1%	20%	
		OCNEG3 Loss Curt.	10 ～ 50%	1%	10%	
	SPO	SPO EN			OFF	
		SPO Load Curt.	20 ～ 100%	1%	20%	
		SPO Loss Curt.	10 ～ 50%	1%	10%	
	UC1	UC1 EN			OFF	
		UC1 Pick up			Pick1	
		UC1 Ope. Curt.	25 ～ 100%	1%	25%	
		UC1 Min. Curt.	25 ～ 100%	1%	25%	
		UC1 Ope. Time	0.0 ～ 600.0s	0.1s	0.0s	
	UC2	UC2 EN			OFF	
		UC2 Pick up			Pick1	
		UC2 Ope. Curt.	25 ～ 100%	1%	25%	
		UC2 Min. Curt.	25 ～ 100%	1%	25%	
		UC2 Ope. Time	0.0 ～ 600.0s	0.1s	0.0s	
	CBF	CBF EN			OFF	

Category	Element	Item name of setting parameter	Range	Step	Default value	Description
		CBF Curt.	15 ～ 200%	1%	15%	
		CBF Ope. Time	0.00 ～ 10.00s	0.01s	0.00s	
THOL	THOL	THOL EN			OFF	
		THOL Sel.			COLD	
		THOL Ave. Curt.			OFF	
		THOL Ope. Curt.	105 ～ 150%	1%	105%	
		THOL Ope. Kth	8 ～ 240	1	8	
		THOL Neg. K	1 ～ 10	1	1	
UP	UP1	UP1 EN			OFF	
		UP1 Ope. Curt.	1 ～ 30%	1%	1%	
		UP1 Ope. Time	0.0 ～ 10.0s	0.1s	0.0s	
	UP2	UP2 EN			OFF	
		UP2 Ope. Curt.	1 ～ 30%	1%	1%	
		UP2 Ope. Time	0.0 ～ 10.0s	0.1s	0.0s	
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	
F	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	

Category	Element	Item name of setting parameter	Range	Step	Default value	Description
MST	MST1	MST1 EN				
		MST1 Str. Times	1 ～ 10	1		
		MST1 Str. Time	2 ～ 120s	1s		
		MST1 Dec. Rate	2.0 ～ 250.0s/h	0.1s/h		
	MST2	MST2 EN				
		MST2 Str. Times	1 ～ 10	1		
		MST2 Rst. Time	1 ～ 120min	1min		
VTF	VTF	VTF EN			OFF	
		VTF UV	20.0 ～ 120.0V	0.1V	20.0V	
		VTF OCD	0.5 ～ 100.0A	0.1A	0.5A	
		VTF OCG	1.0 ～ 100.0mA	0.5mA	1.0mA	
LOGIC	LOGIC	51LR Ope.Time	0.0 ～ 60.0s	0.1s	0.0s	
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	

10.3. 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	– (In V-Check products, it is assigned for MST2 element.)
DI5	All relay elements are locked for trip lock.
DI6	The CB condition input for VTF logic.
DI7	The switching trigger input for OC1 and OC2.
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.

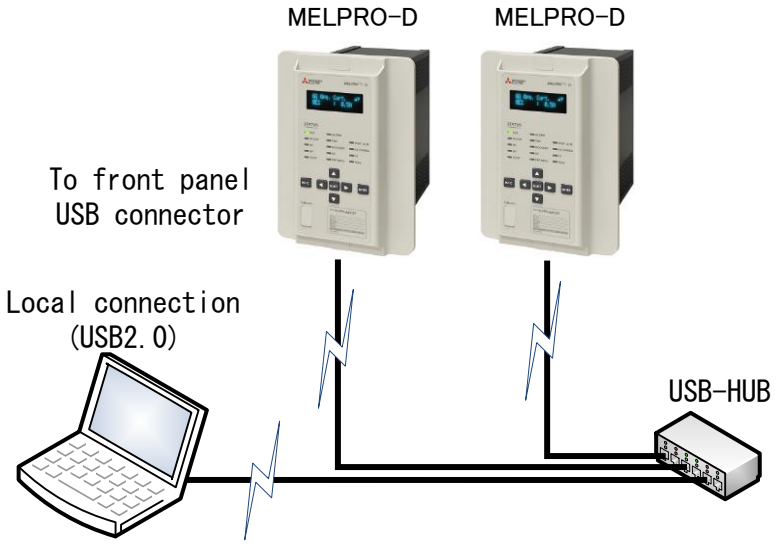
11.3.2. Display

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.

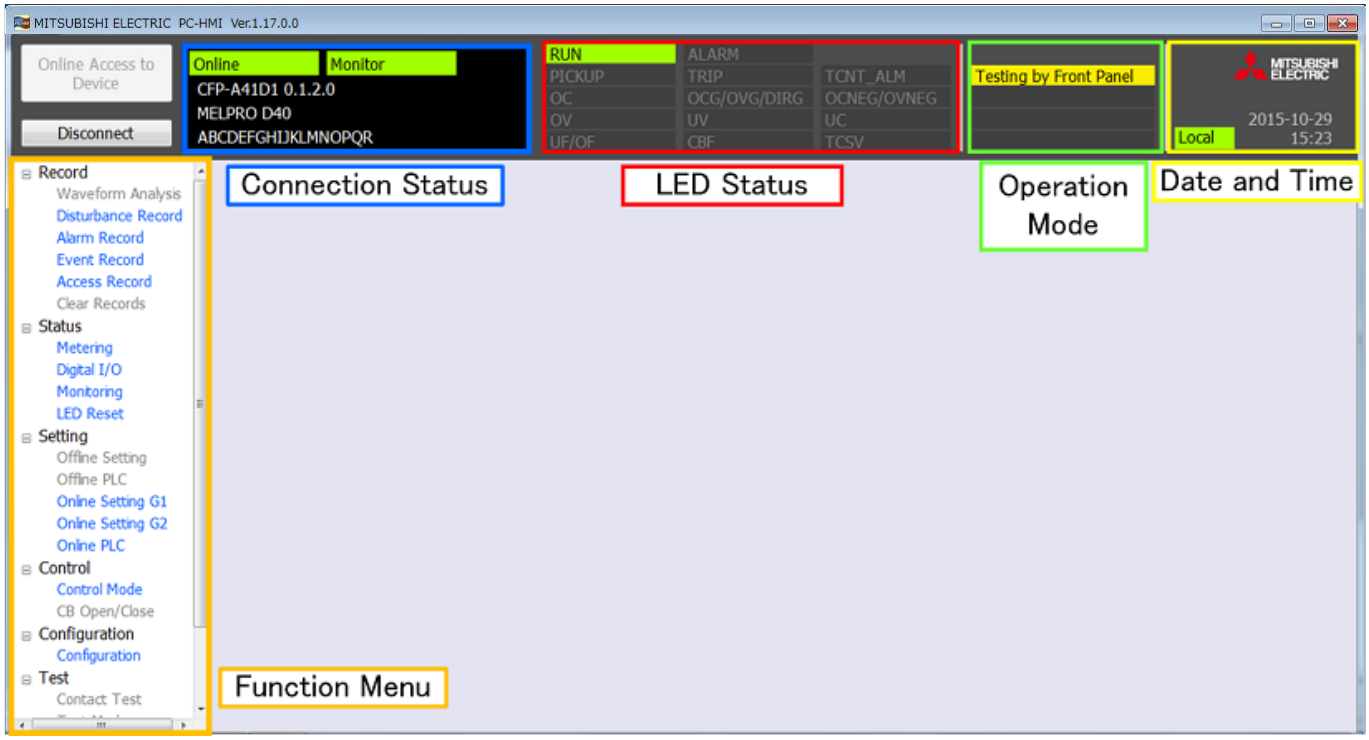
1) Click
   The action of pressing the left mouse button.

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.

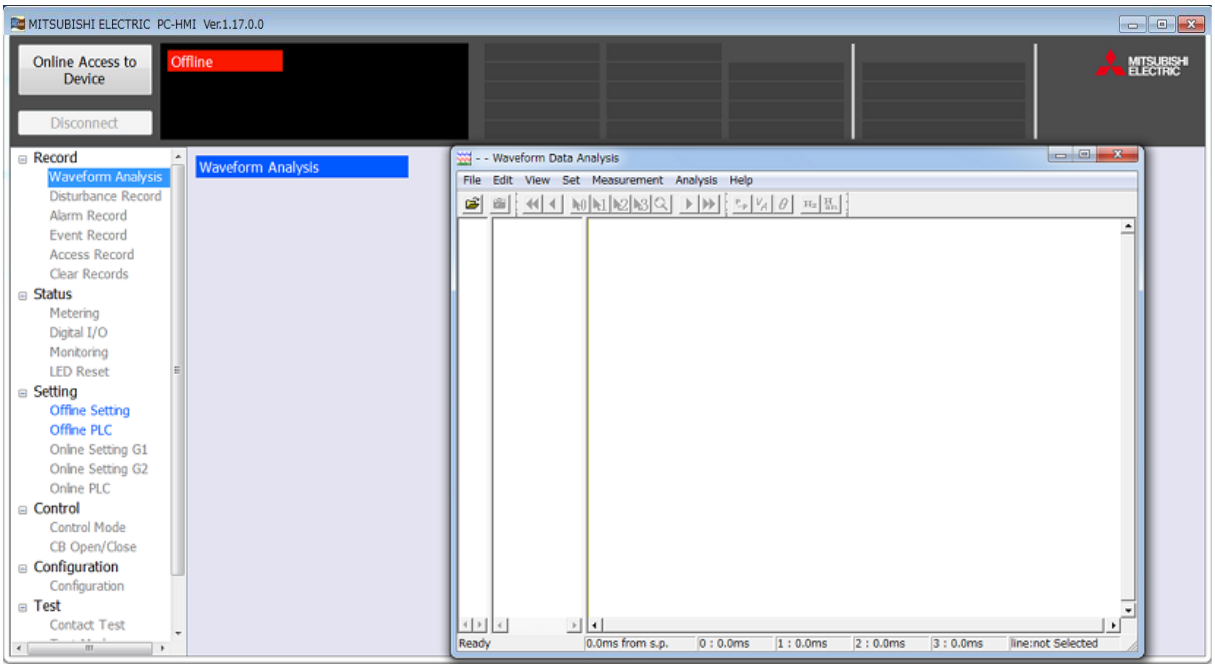
11.7. Operation in offline mode

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.

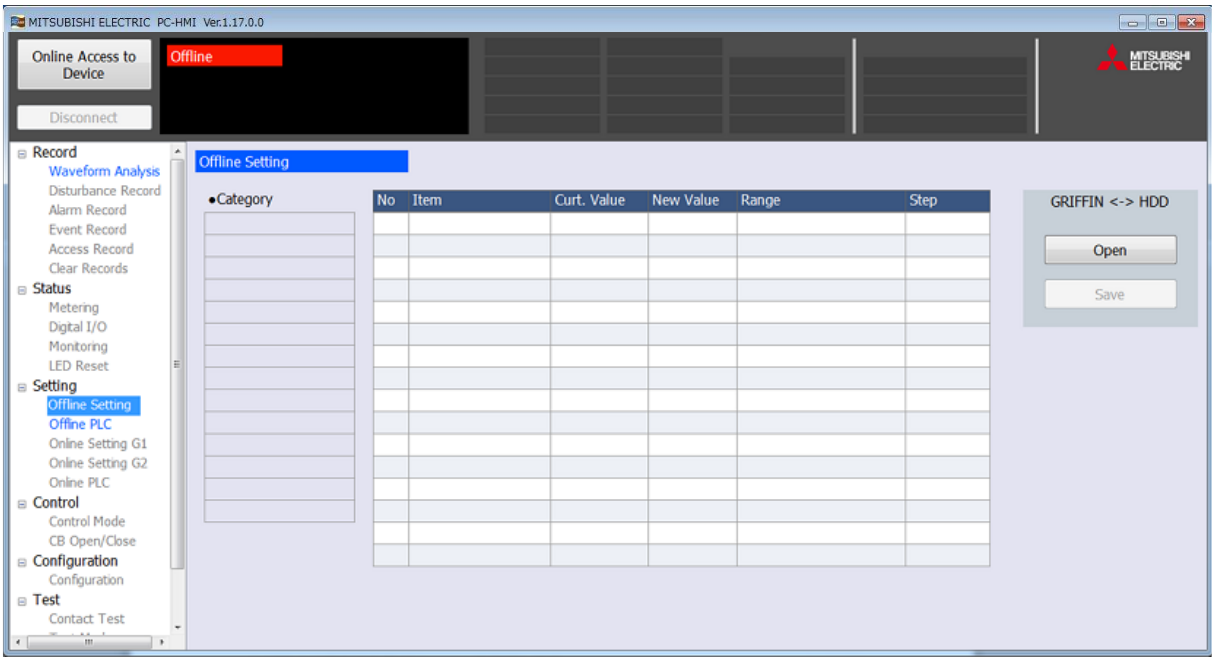


3. From the File menu of the waveform analysis software, select a waveform data file.
   (For the details about the waveform analysis software, see Chapter 12.)

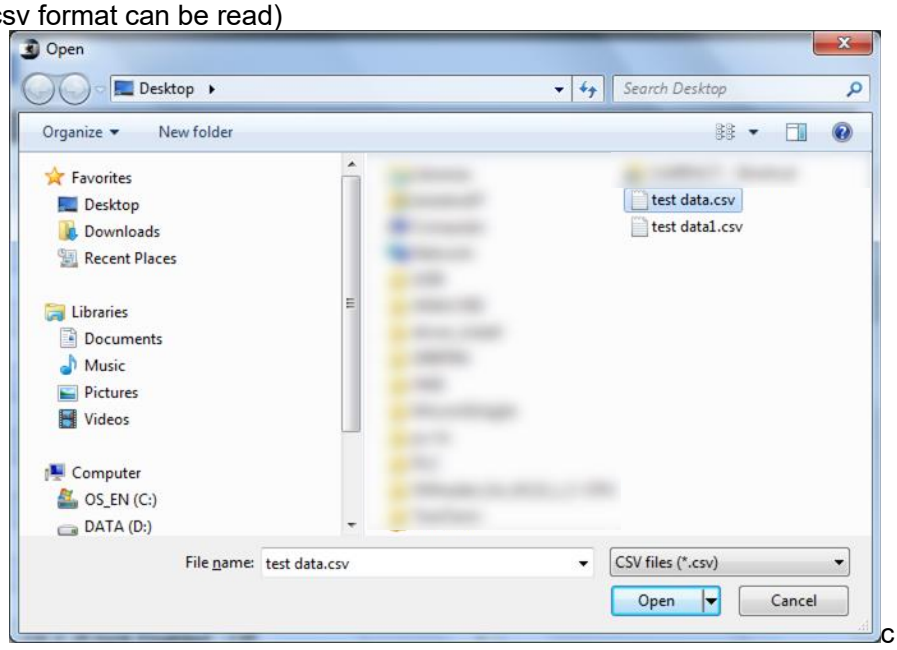
11.7.2. Reading, editing and saving setting files

[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.”

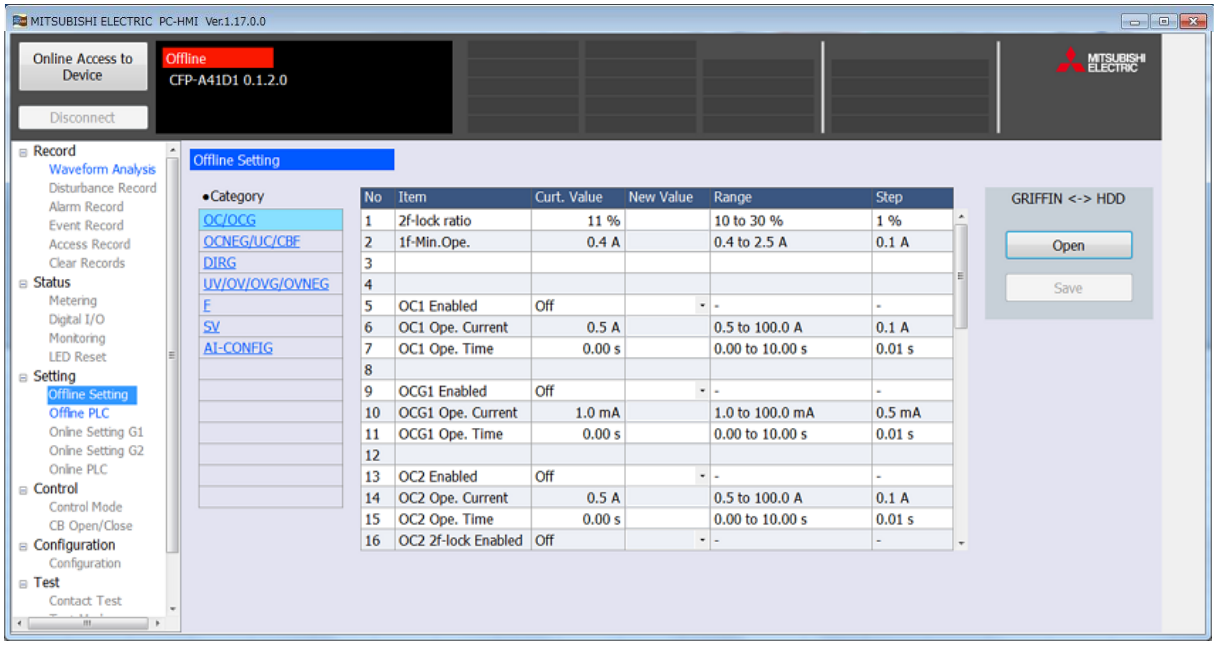


3. Select the setting file to read from the HDD.
   (Files in the .csv format can be read)



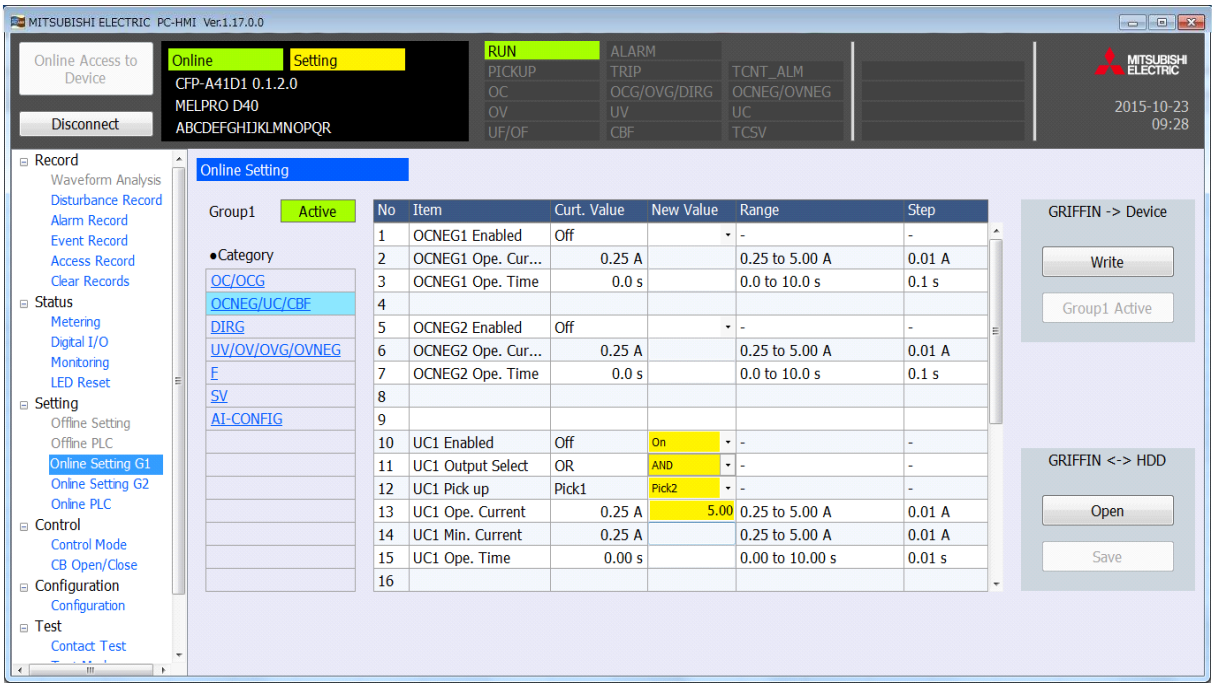
C

4. The setting file is read as shown below.

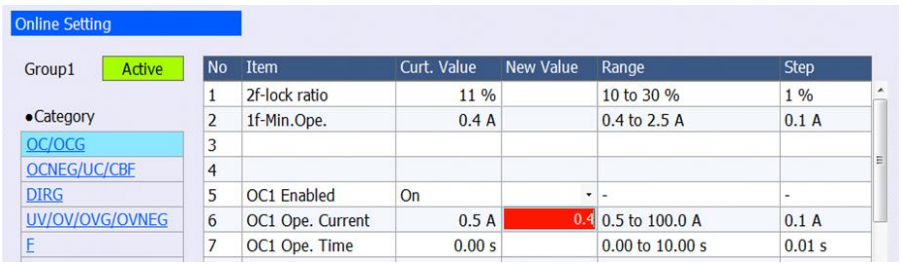


[Editing setting files]

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.

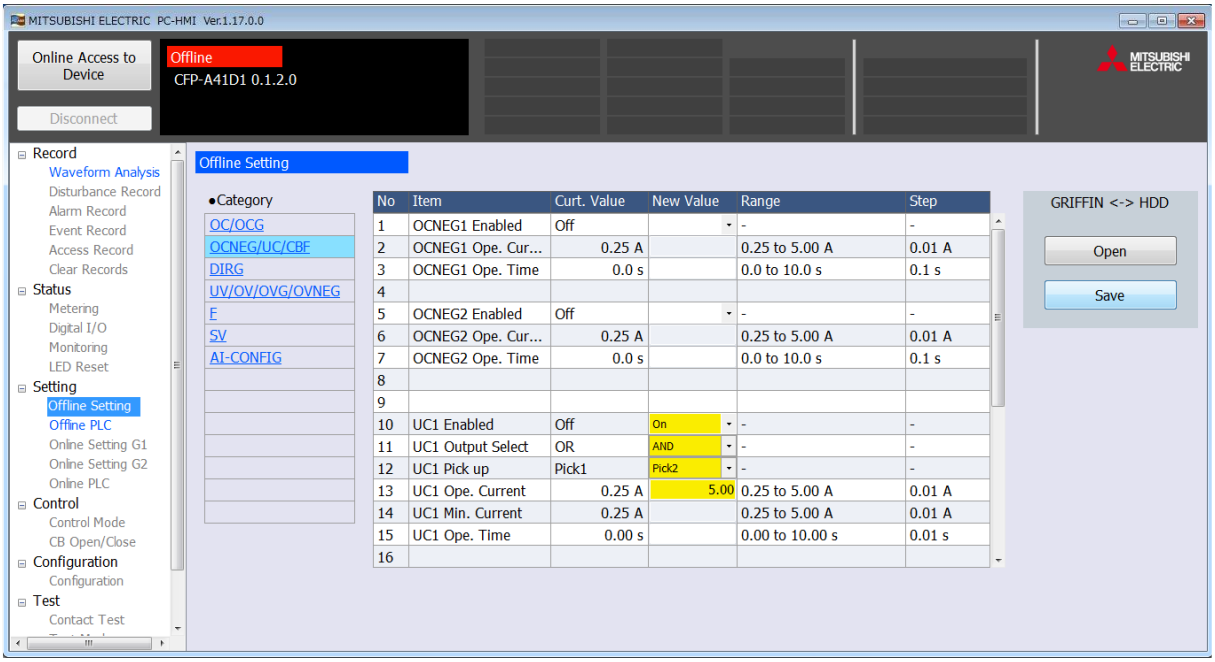


Note) If any value out of the setting range is entered, an error indication as shown below is given.

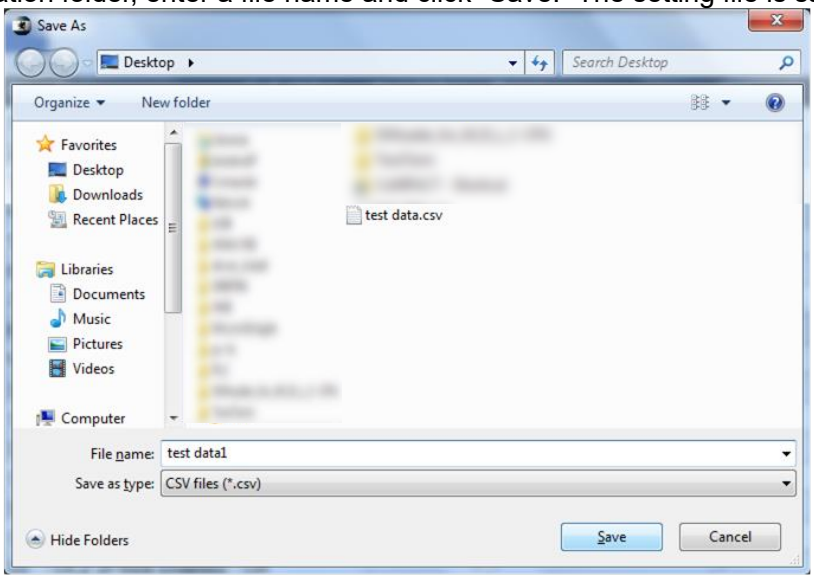


[Saving setting files]

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



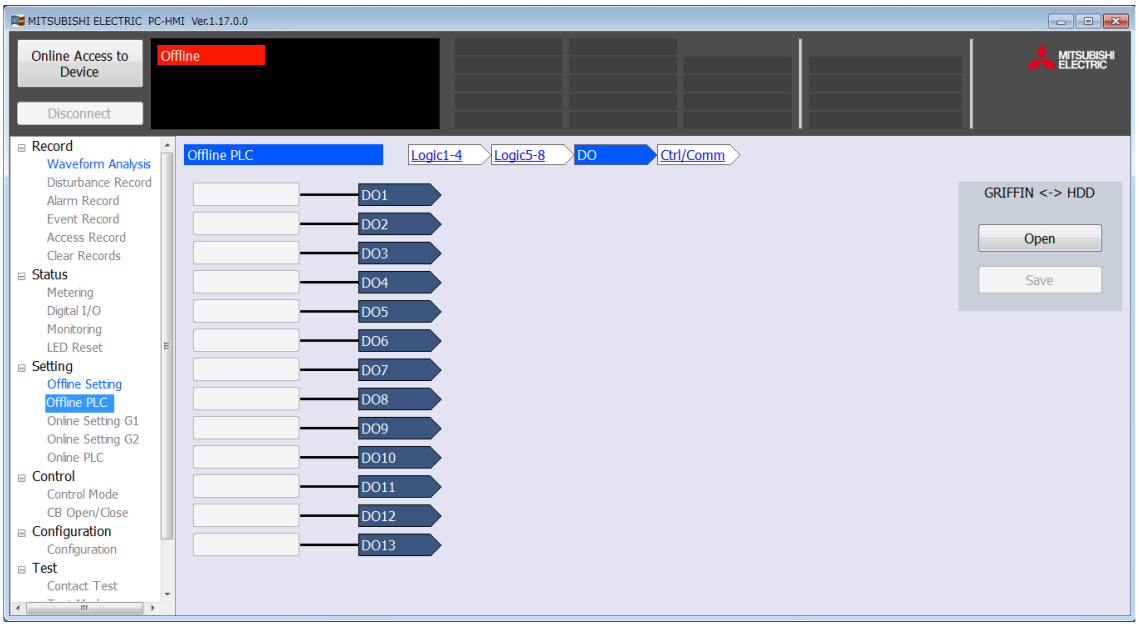
2. Select the destination folder, enter a file name and click “Save.” The setting file is saved.



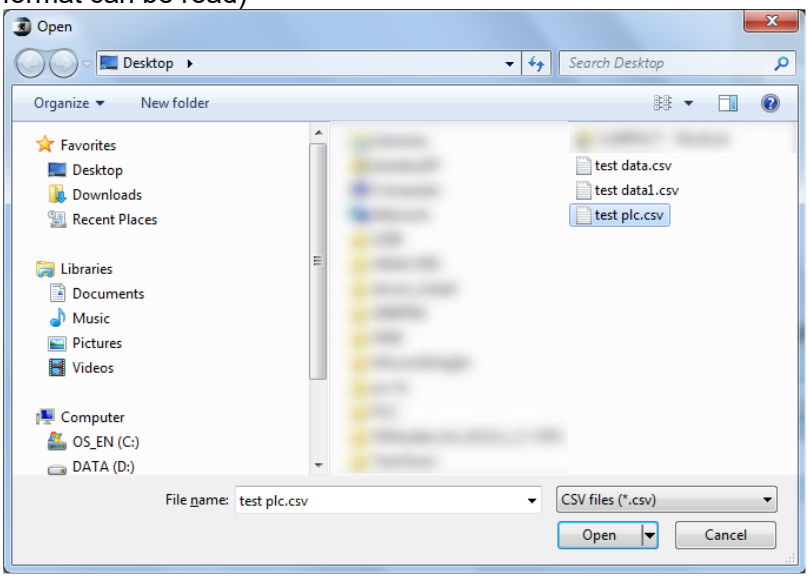
11.7.3. Reading, editing and saving PLC files

[Reading PLC files]

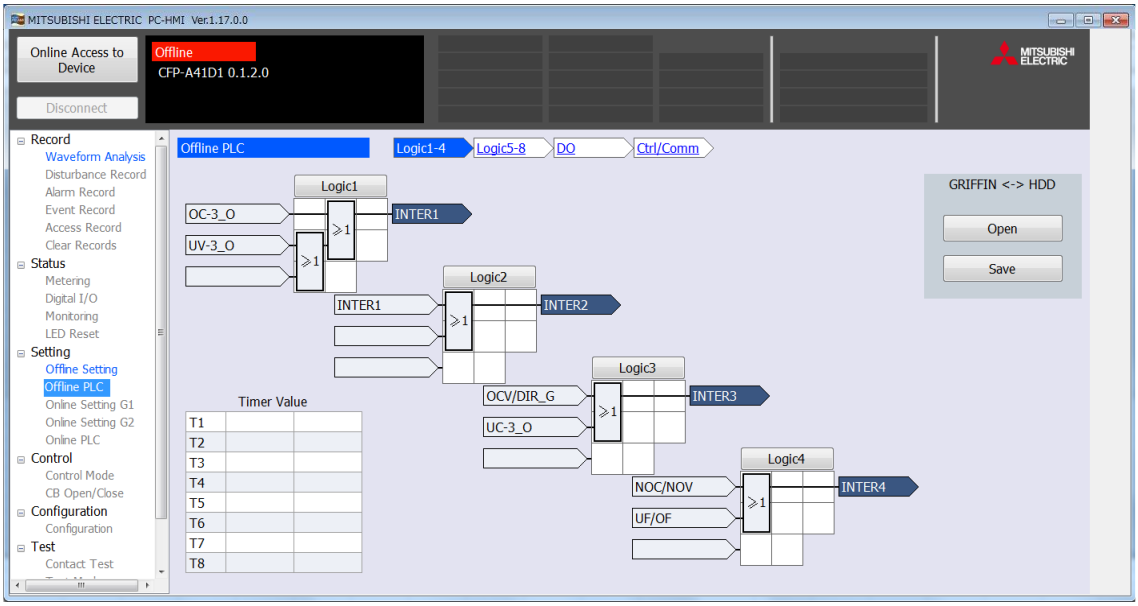
1. From the Function menu, click Offline PLC.
2. From PC-HMI <-> HDD in the upper right part of the main screen, click “Open.”



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.

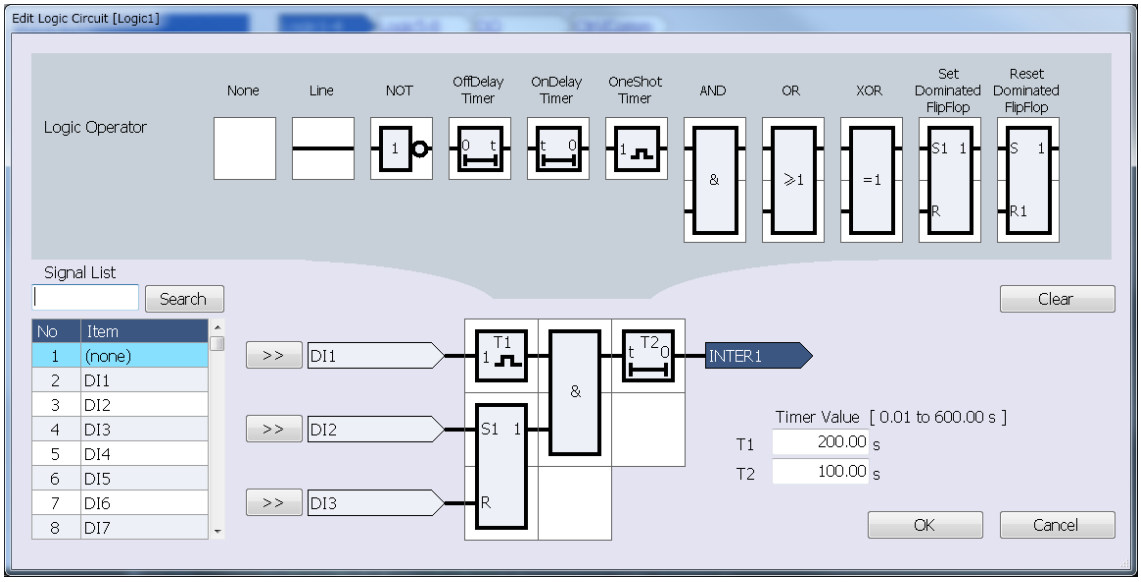


[Editing PLC files]

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)

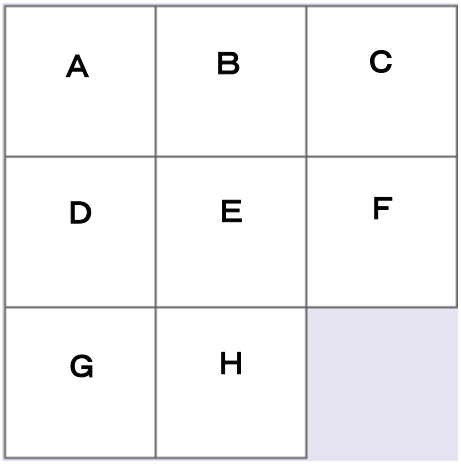


3. From the Item list, select the signal to input and click. The selected signal is shown in light blue. Click “>>” to select the input signal.

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.

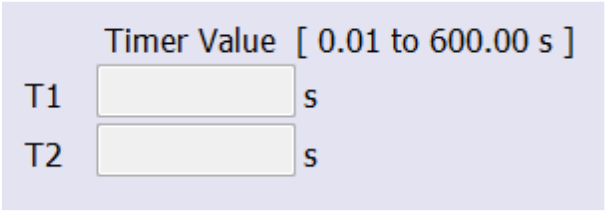
Note) Logic components that can and cannot be placed in certain areas are as shown below.



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	

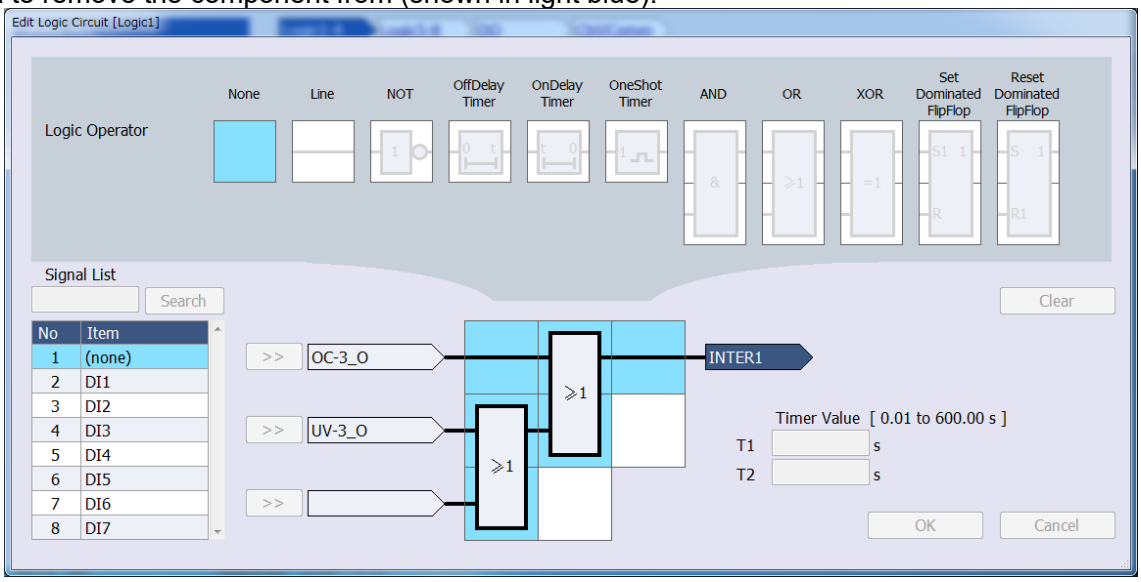
(*1): The component needs to have been placed.
(*2): Up to two timer components can be placed in a logic area.
(More than two timers cannot be placed.)

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.

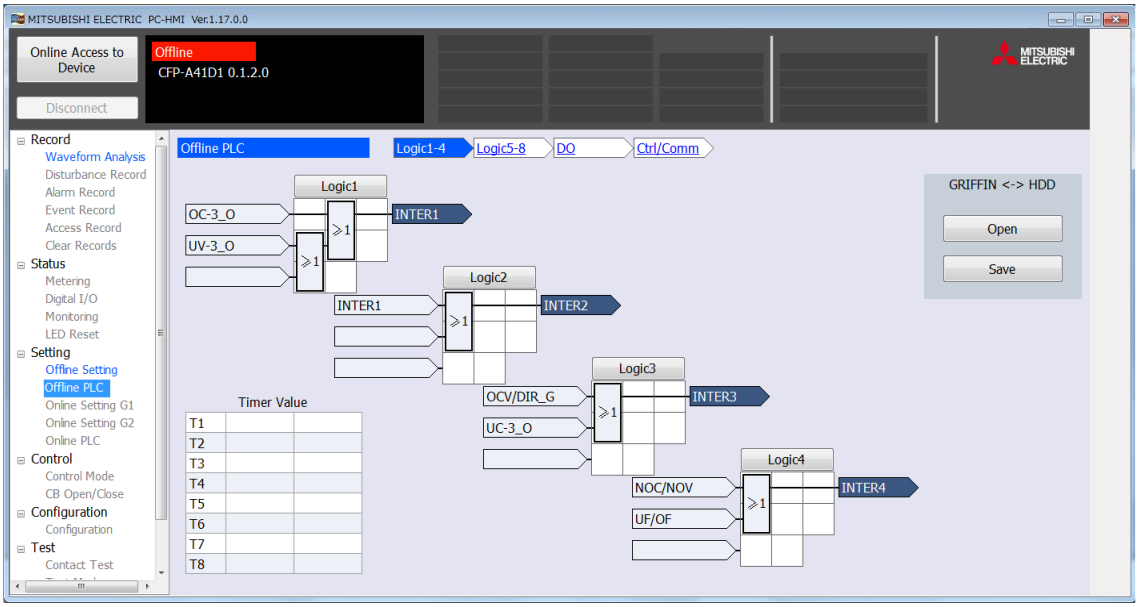
To remove any logic component that has been placed, select a None logic component and click the logic area to remove the component from (shown in light blue).



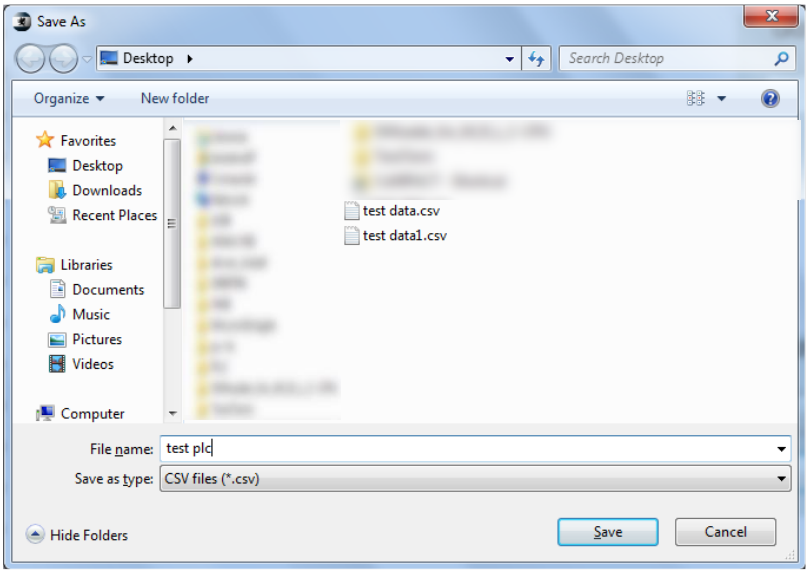
Clicking “Clear” brings back to the initial state with no input signal set, logic component placed or timer setting configured.

[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.

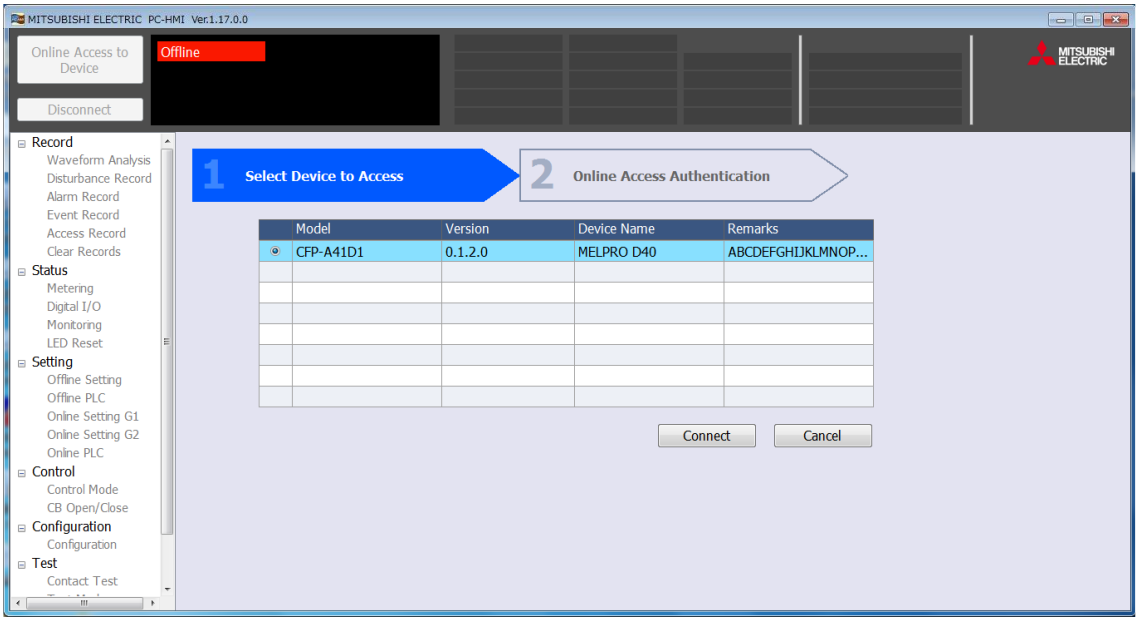


11.8. Log In (connection) and Log out (disconnection) to relay device via PC-HMI

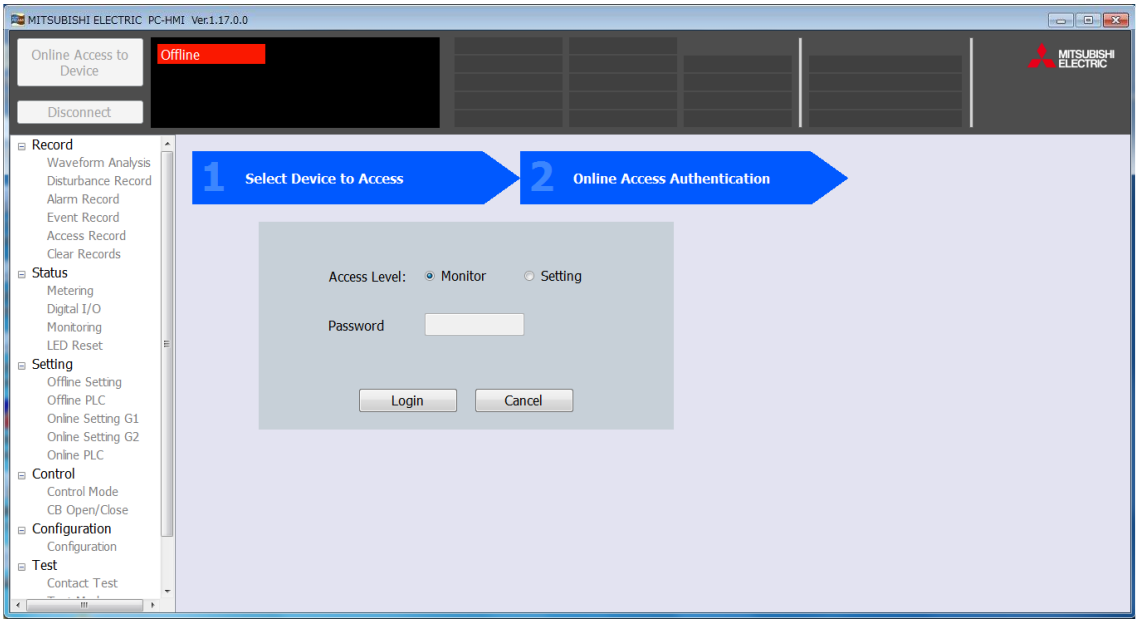
11.8.1. Log in (connection)

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.)

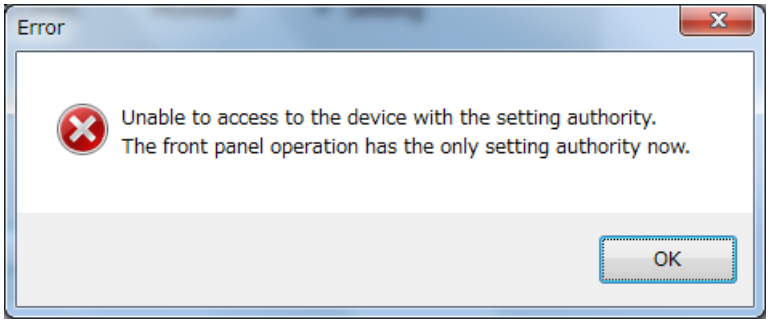


3. The access authentication screen appears. Click the radio button for the desired access level. (Monitor: view permission, Setting: write permission)



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.



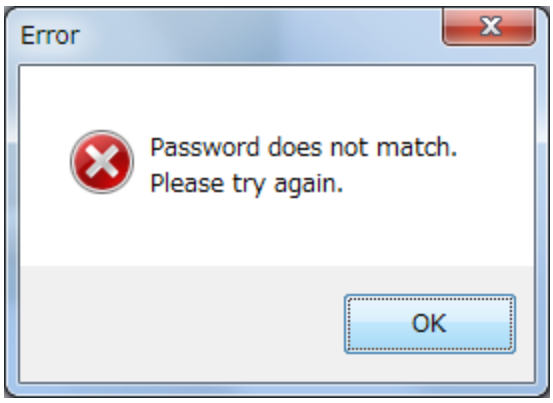
4. Enter the password (when a password is used and the device is accessed with the Setting permission).

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 4.3.4.3.9 of Chapter 4.)

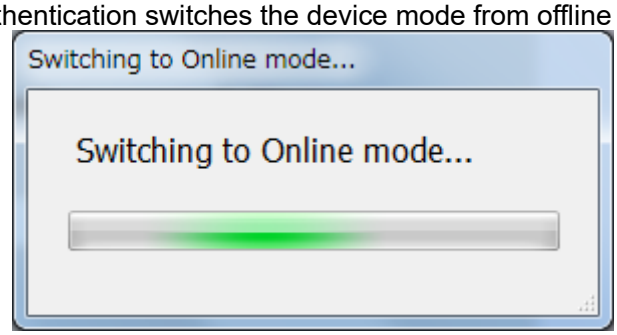
When no password is used or the device is accessed with the Monitor permission, password entry is not required. Simply click “Login” to log in.

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.”

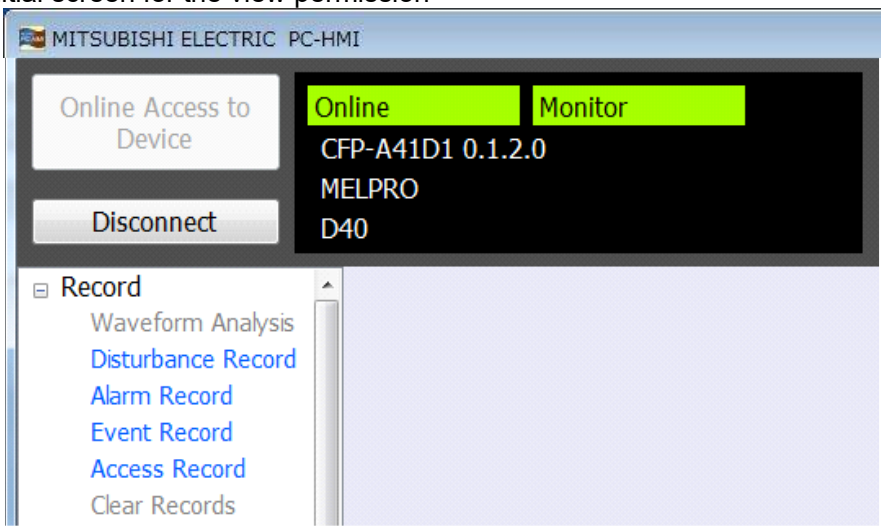
If a wrong password is given, the error message as shown below appears. Click “OK” and enter the password again.



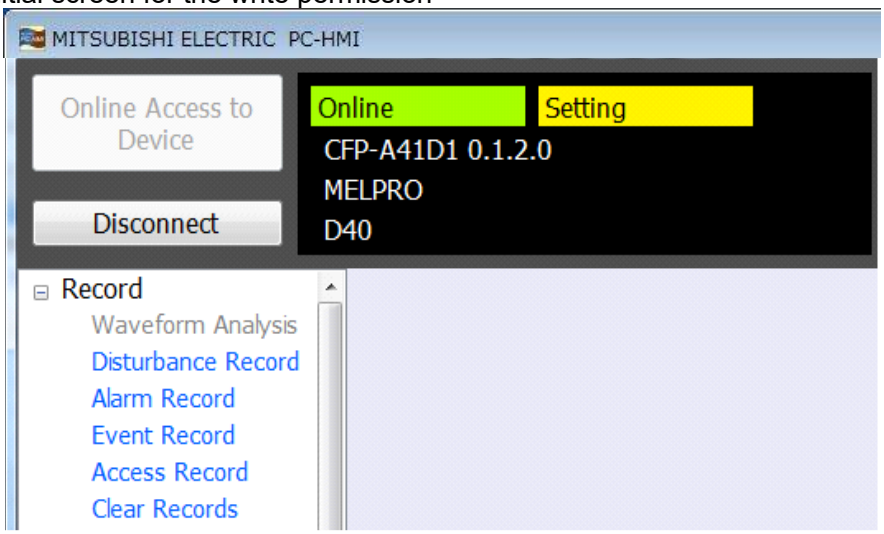
5. Successful password authentication switches the device mode from offline to online.



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

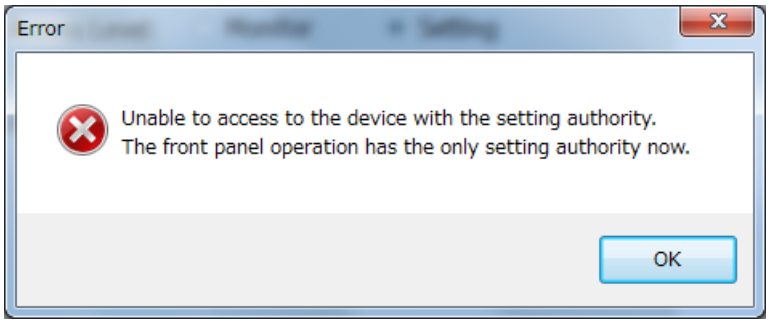
Type	Item	Offline mode	Online mode	
			View permission	Write permission
Record	Waveform Analysis	Y	N	N
	Disturbance Record	N	Y	Y
	Alarm Record	N	Y	Y
	Event Record	N	Y	Y
	Access Record	N	Y	Y
	Clear Records	N	N	Y
Status	Metering	N	Y	Y
	Digital I/O	N	Y	Y
	Monitoring	N	Y	Y
	LED Reset	N	Y	Y
Setting	Offline 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.

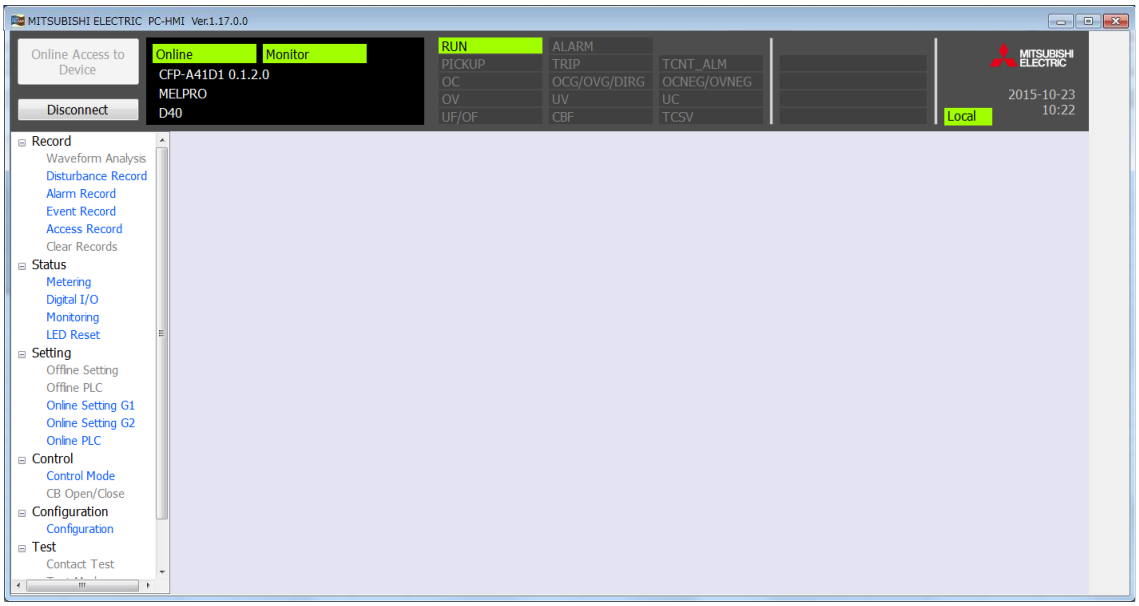
N: The menu is shown but grayed out and does not allow access to a function screen.
Neither display nor operation of the function screen is possible.

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

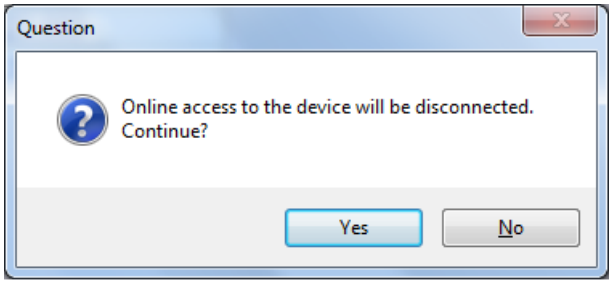


11.8.2. Log off (disconnection)

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.

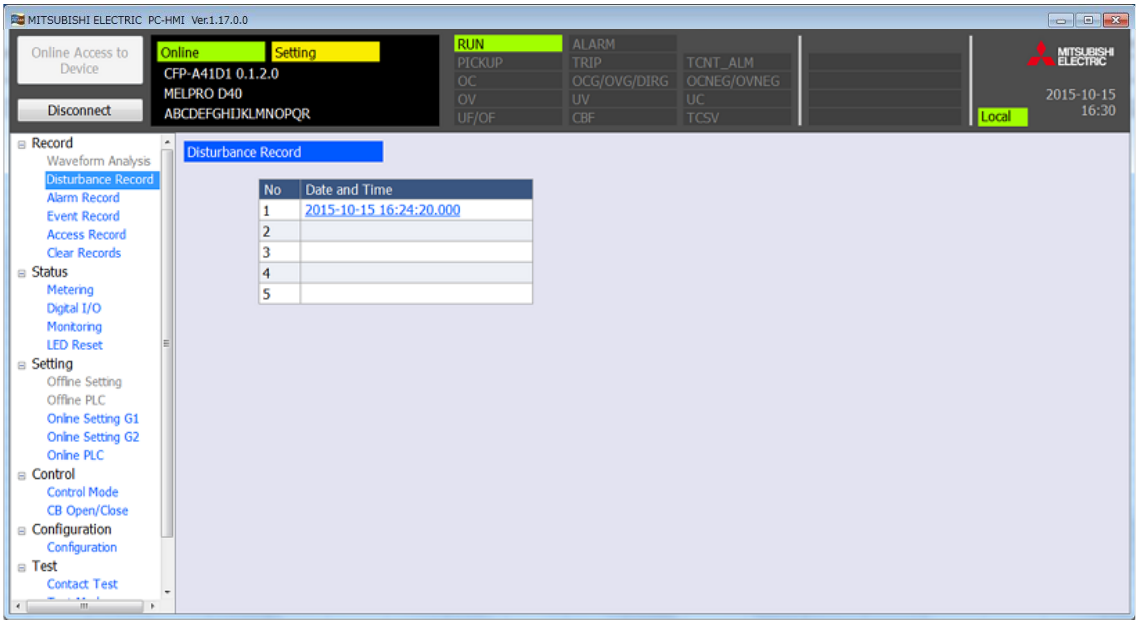
No	Type	Name	Description
1	Record	Waveform Analysis	Starts the waveform analysis tool, a separate application (*1)
2		Disturbance Record	Disturbance record screen
3		Alarm Record	Supervision alarm record screen
4		Event Record	Event record screen
5		Access Record	Access record screen
6		Clear Records	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.



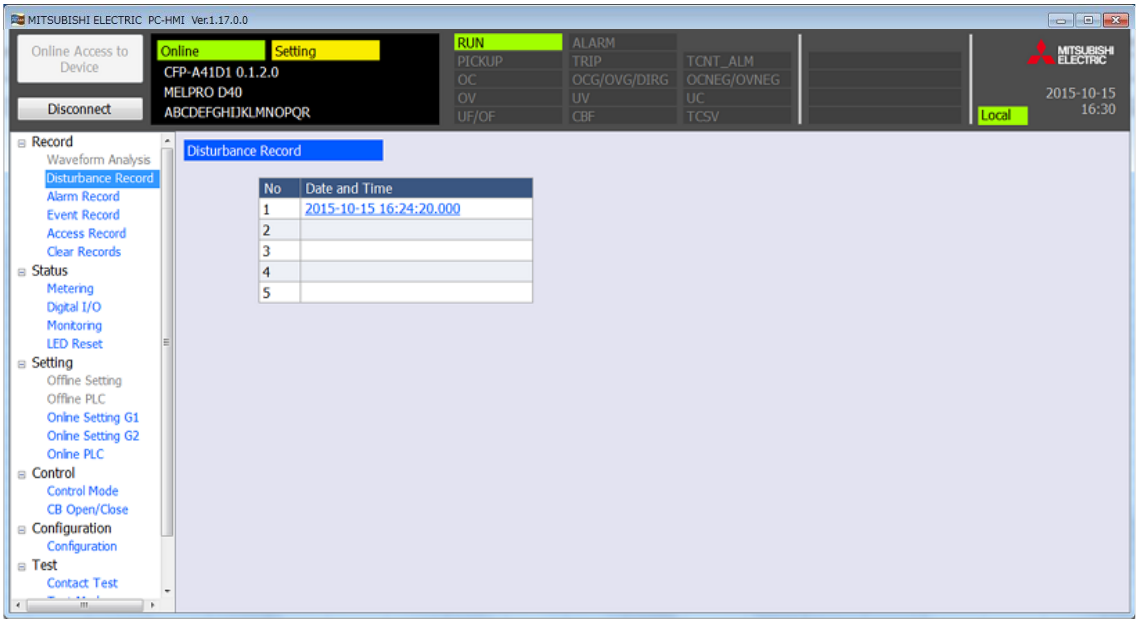
2. The dates and times of disturbance occurrences are listed in the descending order of the date and time. Select the data to retrieve.

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.



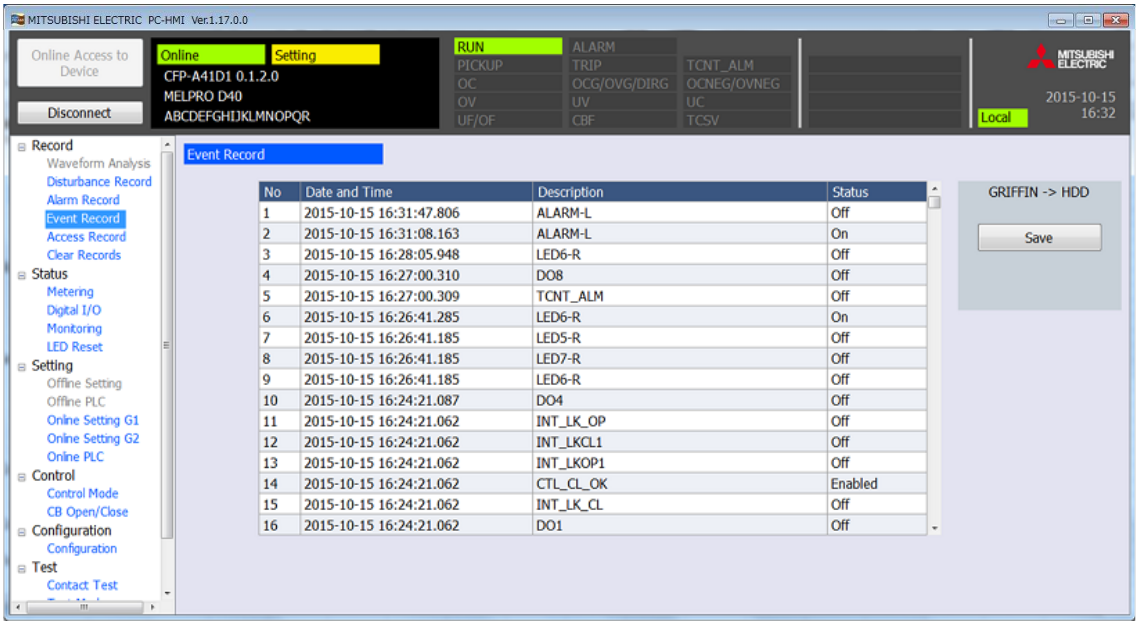
2. The supervision alarm records are listed in the descending order of the date and time. Select the data to retrieve.

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. The explanation of label ‘Date and Time’ are shown in sub-clause 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.

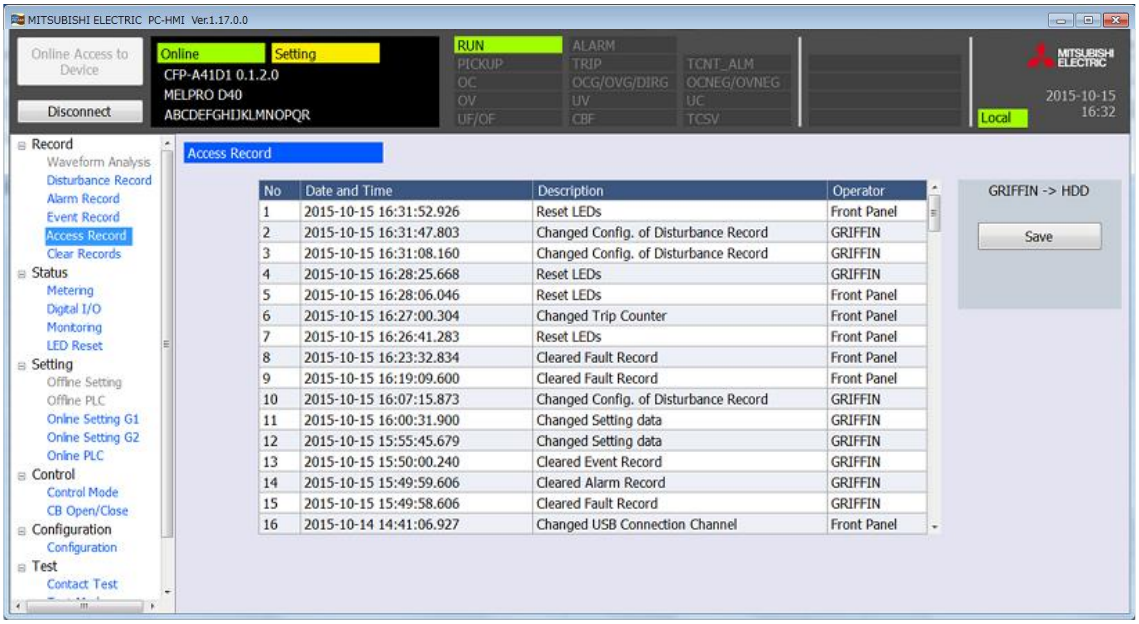
Note) For the events, see 4.3.2.2.2 of Chapter 4.

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. The explanation of label ‘Date and Time’ are shown in sub-clause 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.

Explanation of ‘Operator’ label in Access Record function

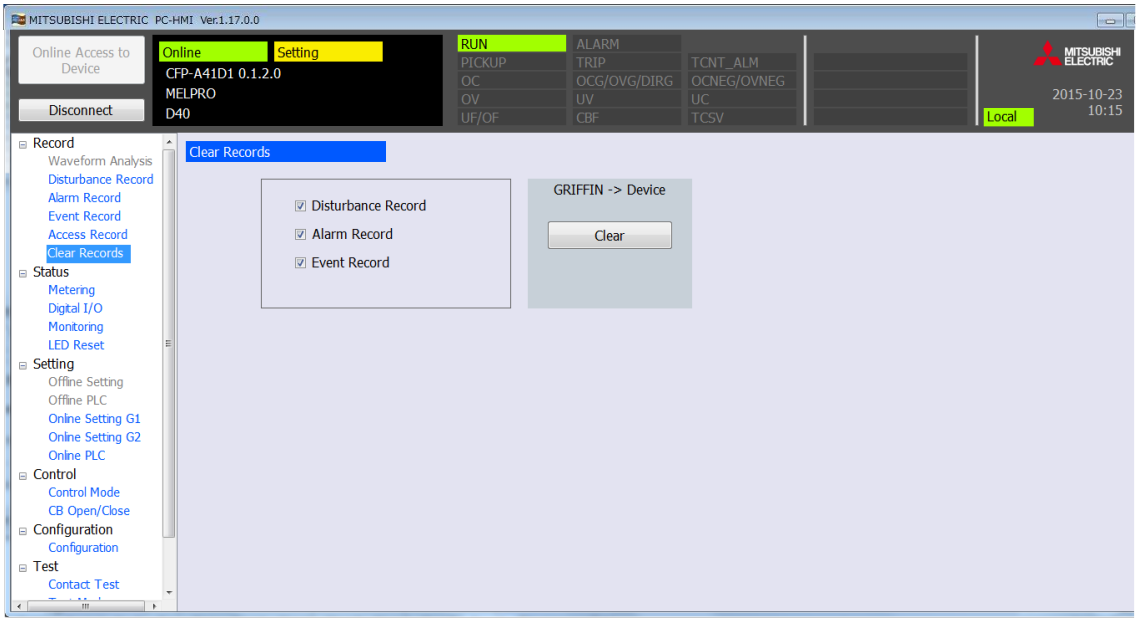
Access operator	PC-HMI indication
Front panel	Front Panel
PC-HMI	PC-HMI
Via Modbus communication I/F	via Modbus
Via TCP/IP communication I/F	via TCP/IP
Via CC-Link communication I/F	via CC-Link
Automatic cancellation on device	Automatic

Explanation of ‘Description’ label in Access Record function

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

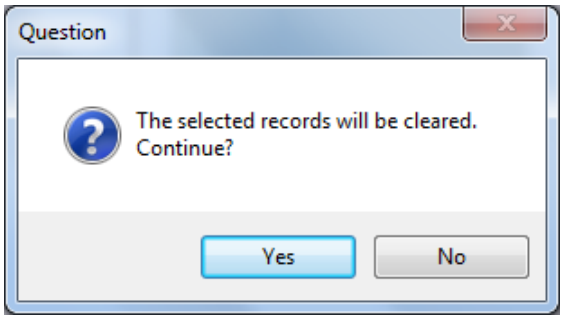
11.10.5. Clear record function

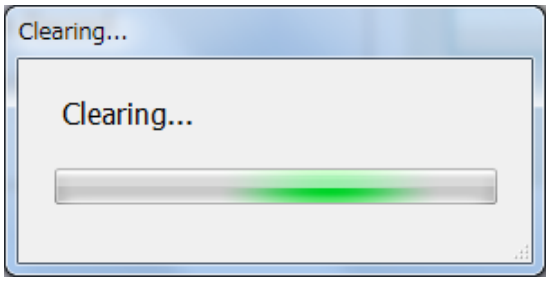
1. From the Function menu, click Clear Records.



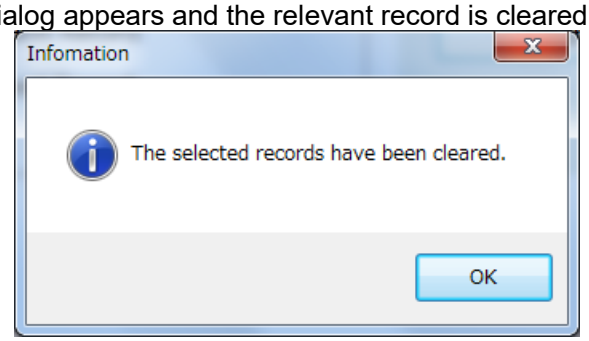
2. Check the box for the record to clear and, from PC-HMI -> Device, click “Clear.”

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

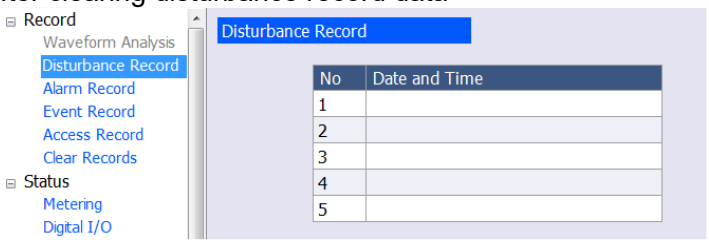




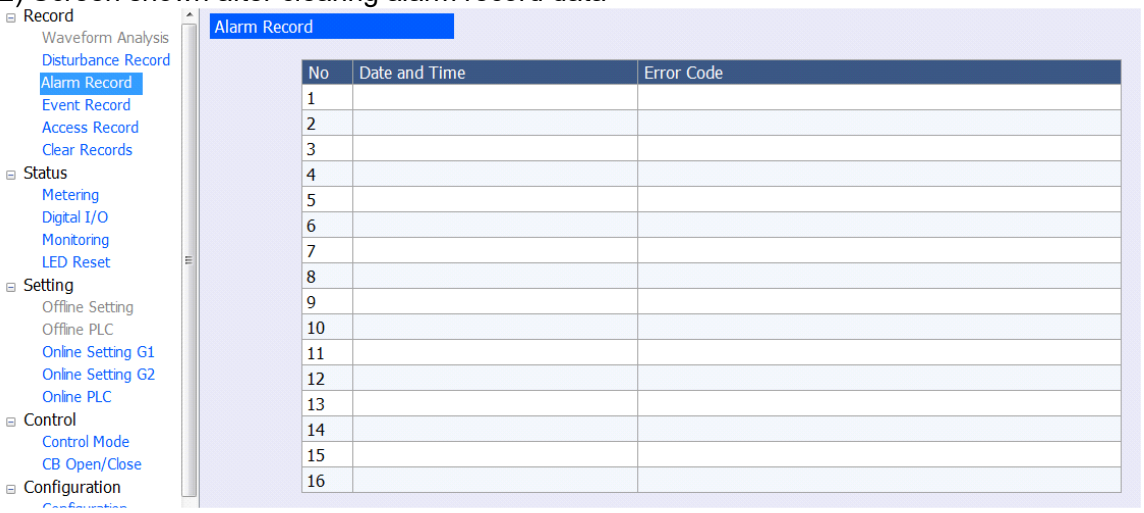
4. The clearing completion dialog appears and the relevant record is cleared.



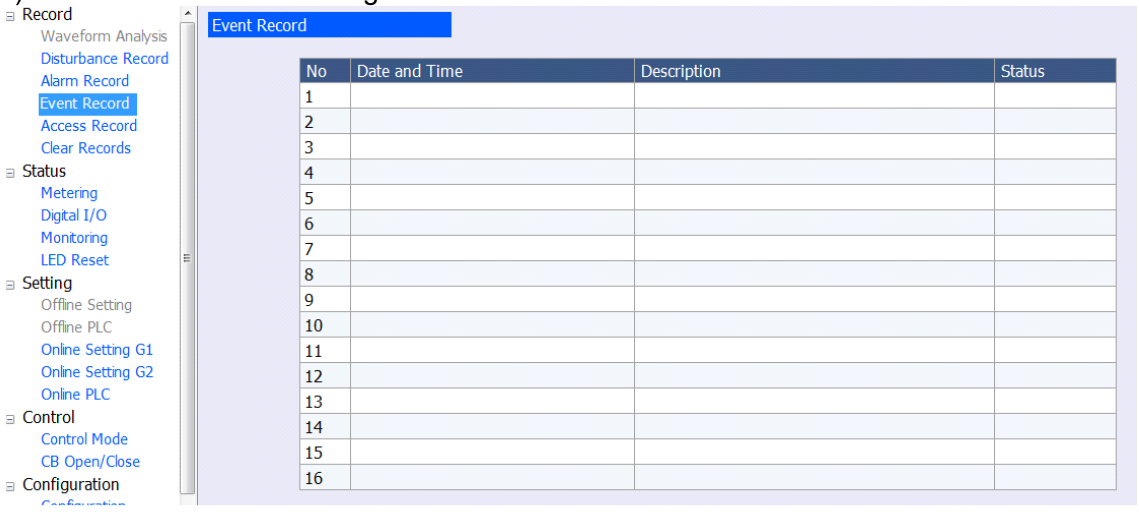
(1) Screen shown after clearing disturbance record data



(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.)

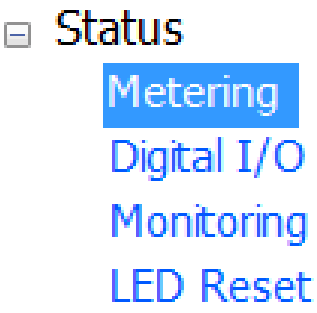
11.11. Status functions

11.11.1. Showing analog values measured

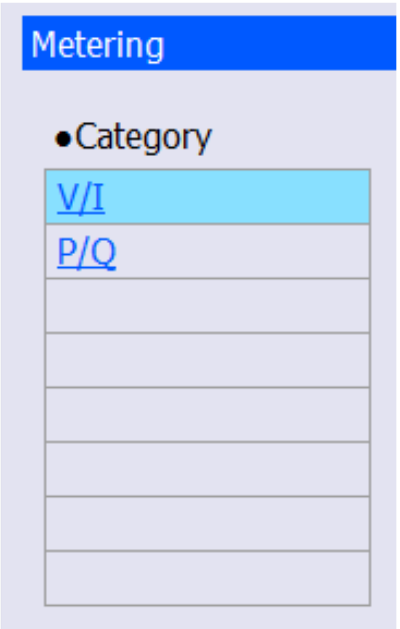
In the analog measurement status mode, the current statuses of analog values measured are listed.

11.11.1.1. Showing the current/voltage

1. From the Function menu, click Metering.

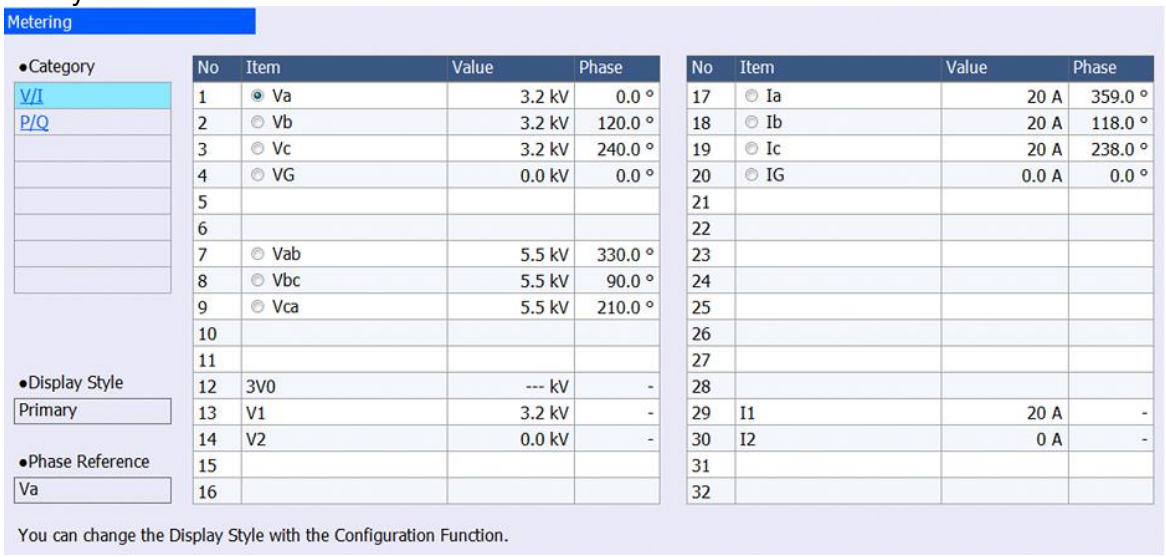


2. From Category, click V/I.



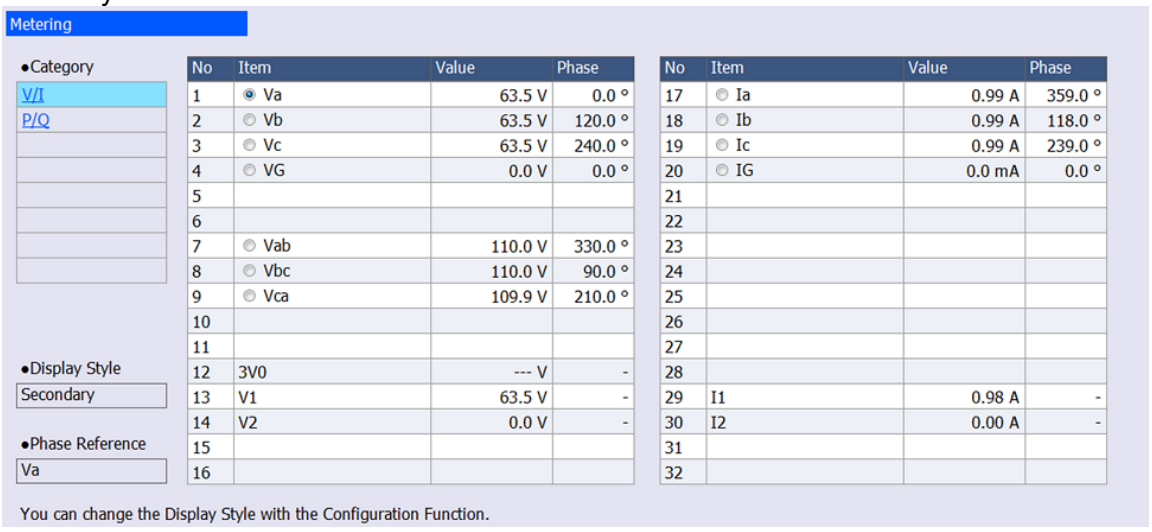
3. The V/I values for the side specified by the configuration are shown.

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			

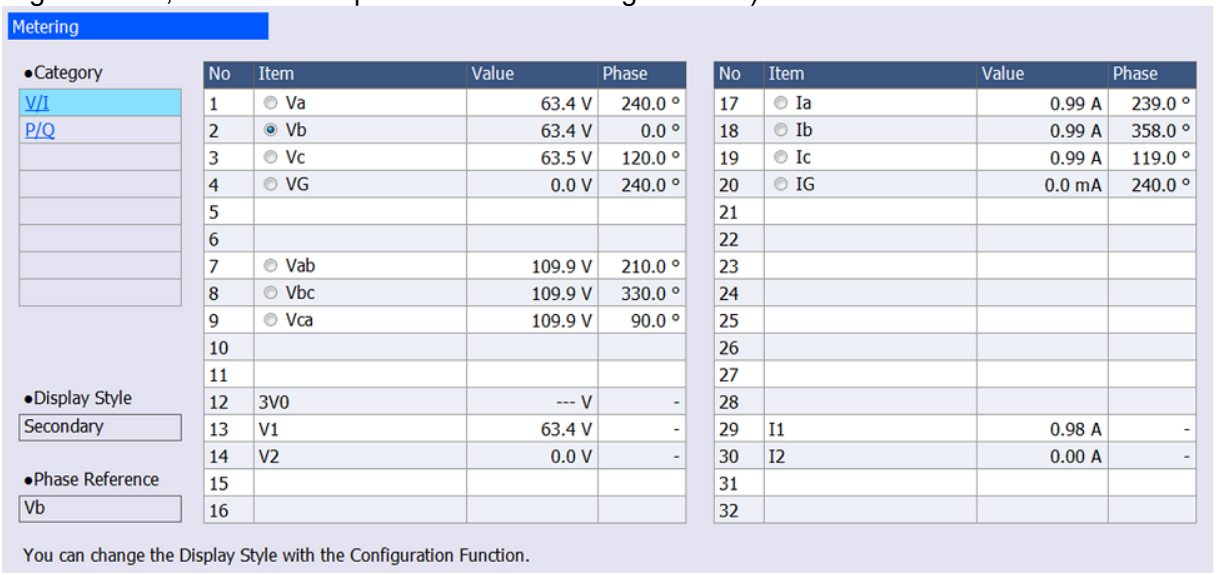
Secondary side



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.)

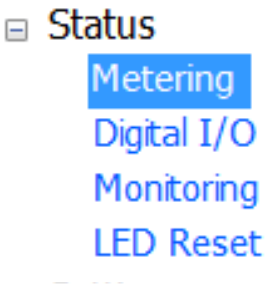


No	Item	Value	Phase
1	Va	63.4 V	240.0 °
2	Vb	63.4 V	0.0 °
3	Vc	63.5 V	120.0 °
4	VG	0.0 V	240.0 °
5			
6			
7	Vab	109.9 V	210.0 °
8	Vbc	109.9 V	330.0 °
9	Vca	109.9 V	90.0 °
10			
11			
12	3V0	--- V	-
13	V1	63.4 V	-
14	V2	0.0 V	-
15			
16			

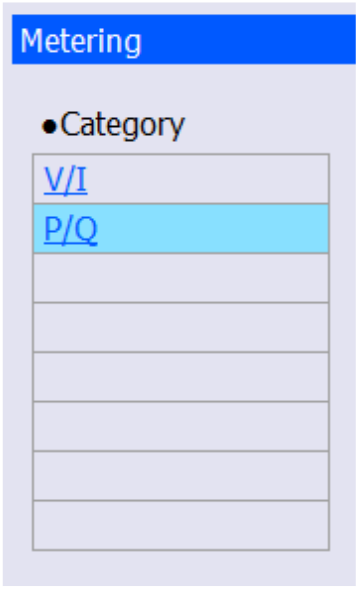
No	Item	Value	Phase
17	Ia	0.99 A	239.0 °
18	Ib	0.99 A	358.0 °
19	Ic	0.99 A	119.0 °
20	IG	0.0 mA	240.0 °
21			
22			
23			
24			
25			
26			
27			
28			
29	I1	0.98 A	-
30	I2	0.00 A	-
31			
32			

11.11.1.2. Showing active/reactive power

1. From the Function menu, click Metering.

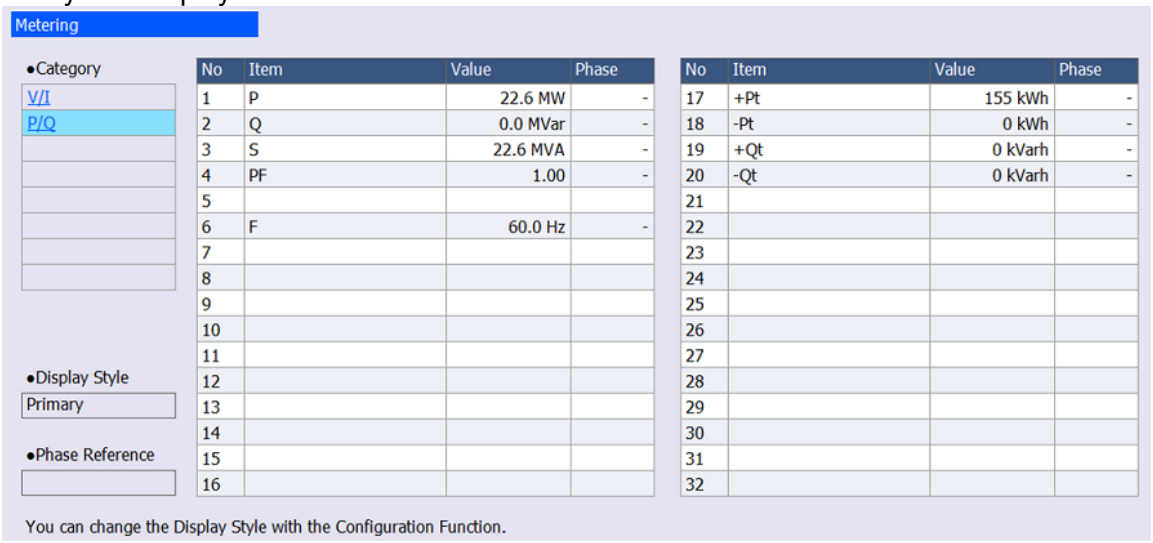


2. From Category, click P/Q.

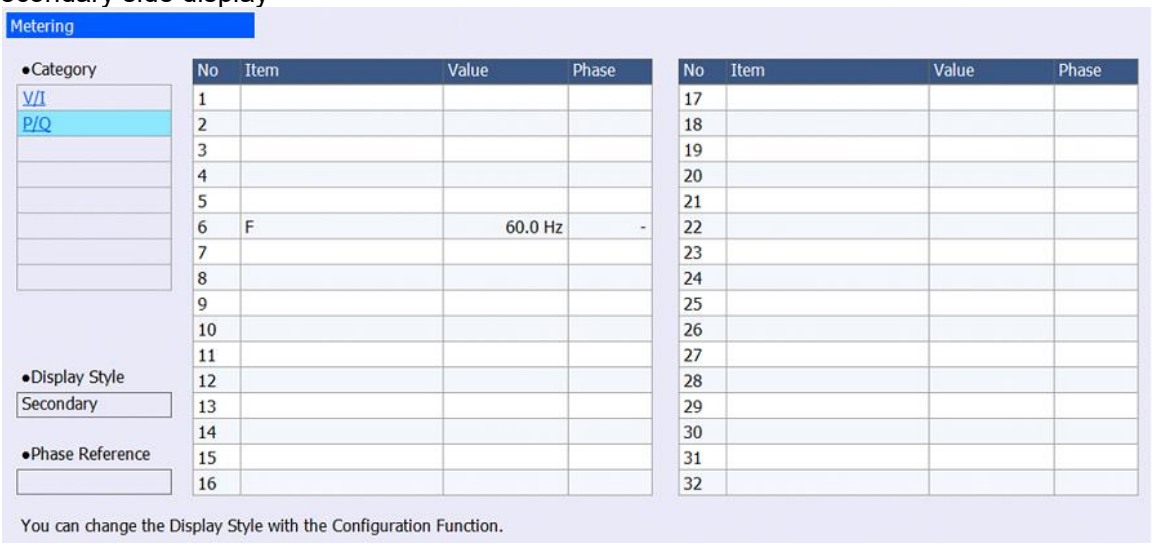


3. The active/reactive power and other values for the side specified by the configuration are shown.

Primary side display



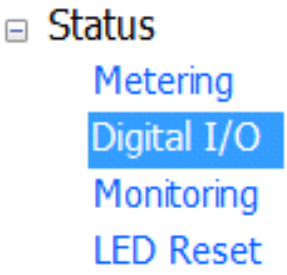
Secondary side display



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

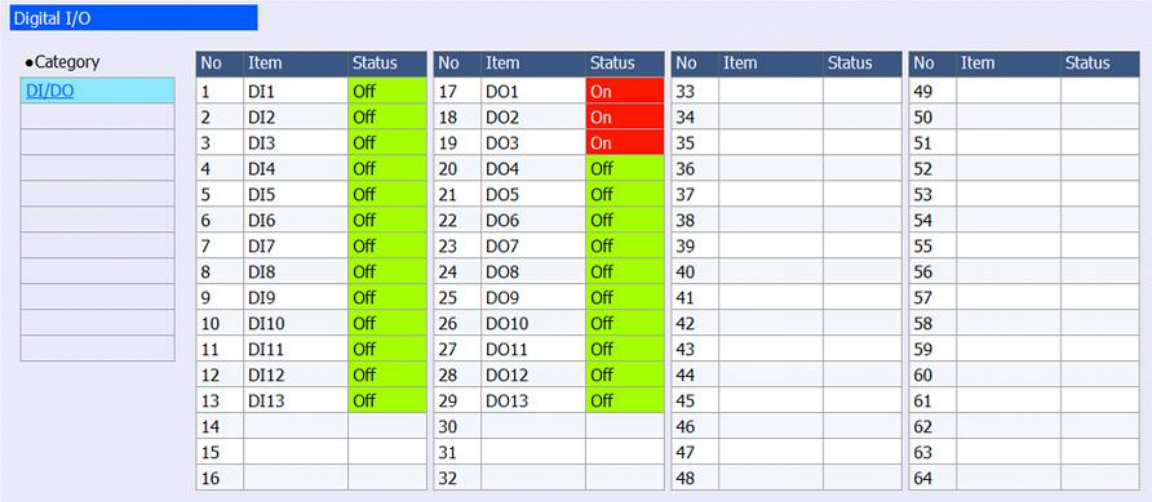
11.11.2. Showing Digital I/O

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



2. From Category, click DI/DO.

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



Digital I/O

•Category

DI/DO

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		

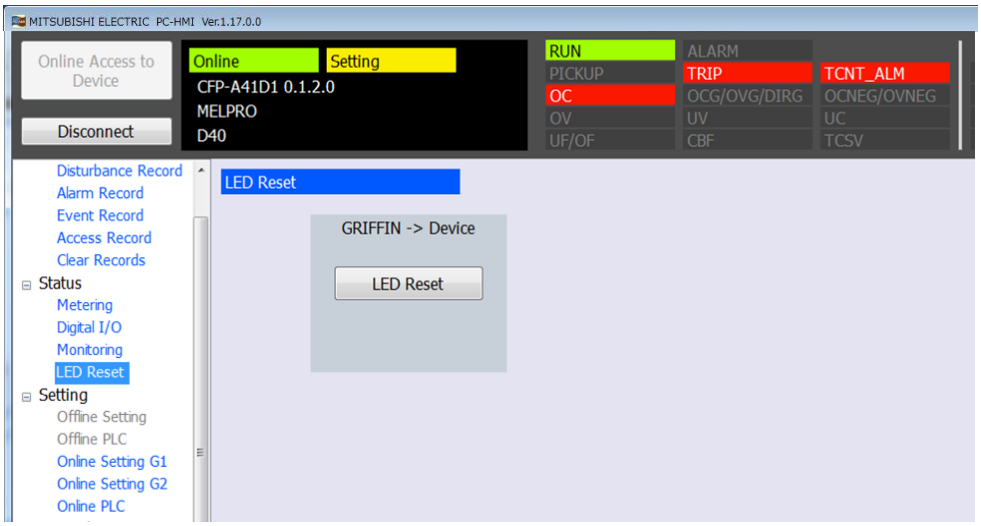
11.11.3. Showing device supervision status

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

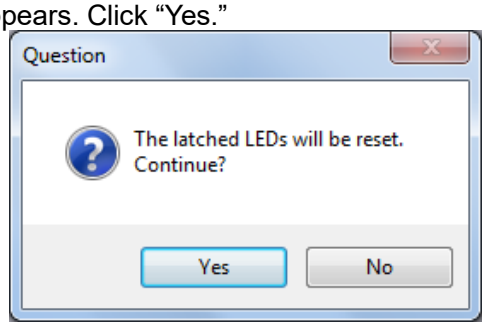
Note) If the current value is equal to or larger than the alarm setting value, an alarm indication is given as shown below.

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.”



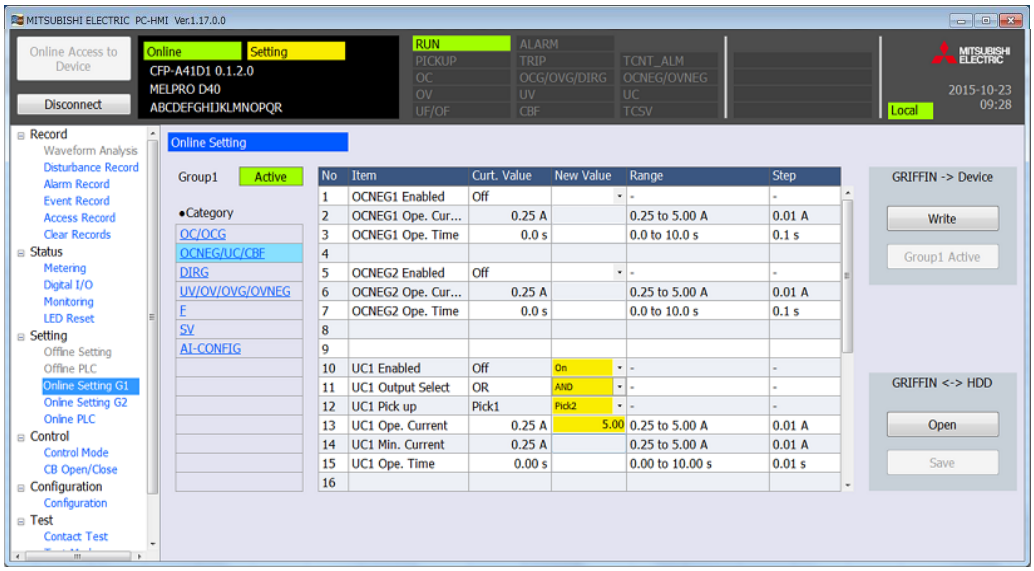
4. The latched LEDs are reset.

11.12. Setting mode

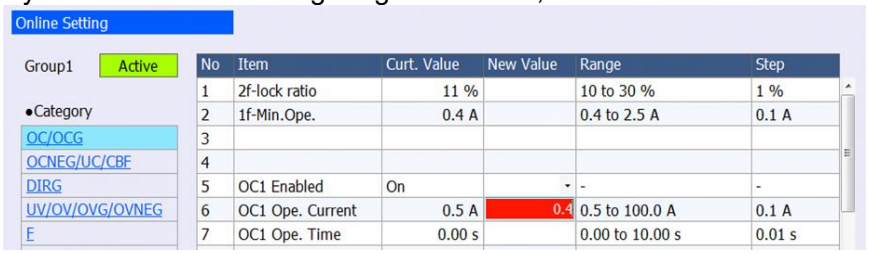
11.12.1. Online setting

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

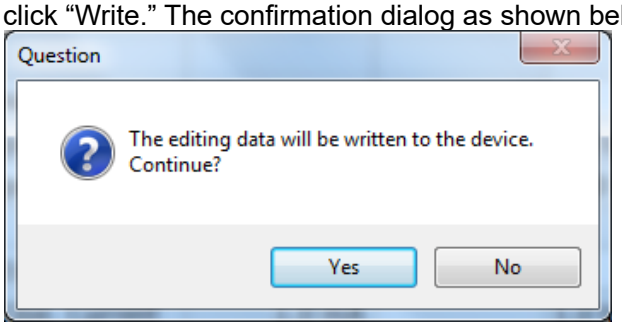
2. Click the item to set from Category. A list of setting values is shown under Item. Click New Value for the item to make a change.
   From the list, make a selection by clicking ▼.
   To enter a value, use the keyboard.



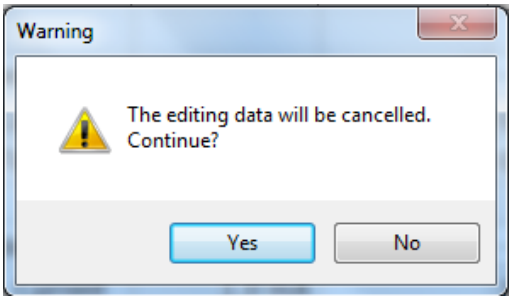
Note) If any value out of the setting range is entered, an error indication as shown below is given.



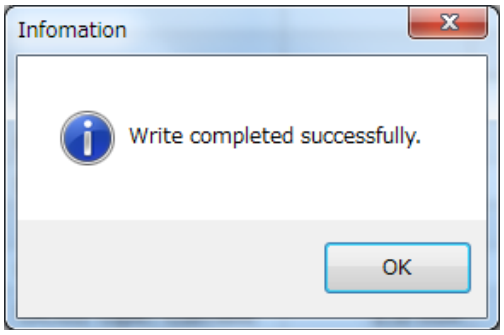
3. From PC-HMI -> Device, click “Write.” The confirmation dialog as shown below appears. Click “Yes.”



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



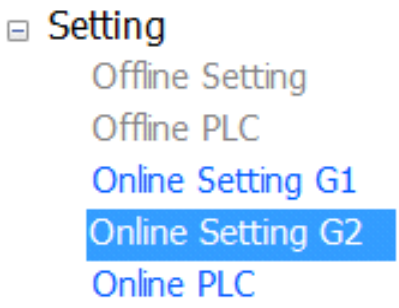
4. Writing of the setting values to the device starts. When it has been completed, the completion message as shown below appears.



11.12.2. Change setting groups to activate or inactivate

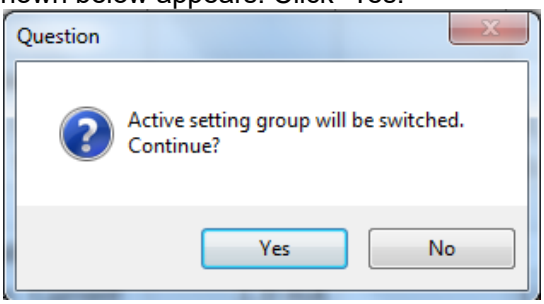
On the Online setting screen, the active group is marked as Active and the inactive group Inactive.

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.)

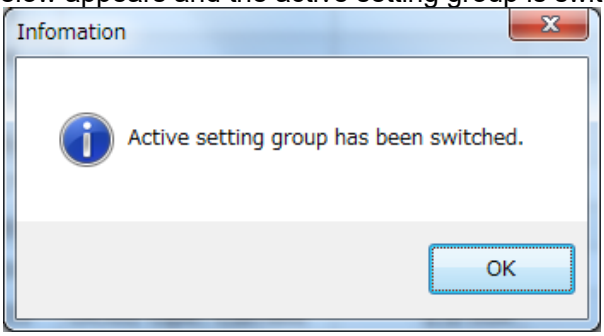


2. From PC-HMI -> Device, click “Group- Active.”

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

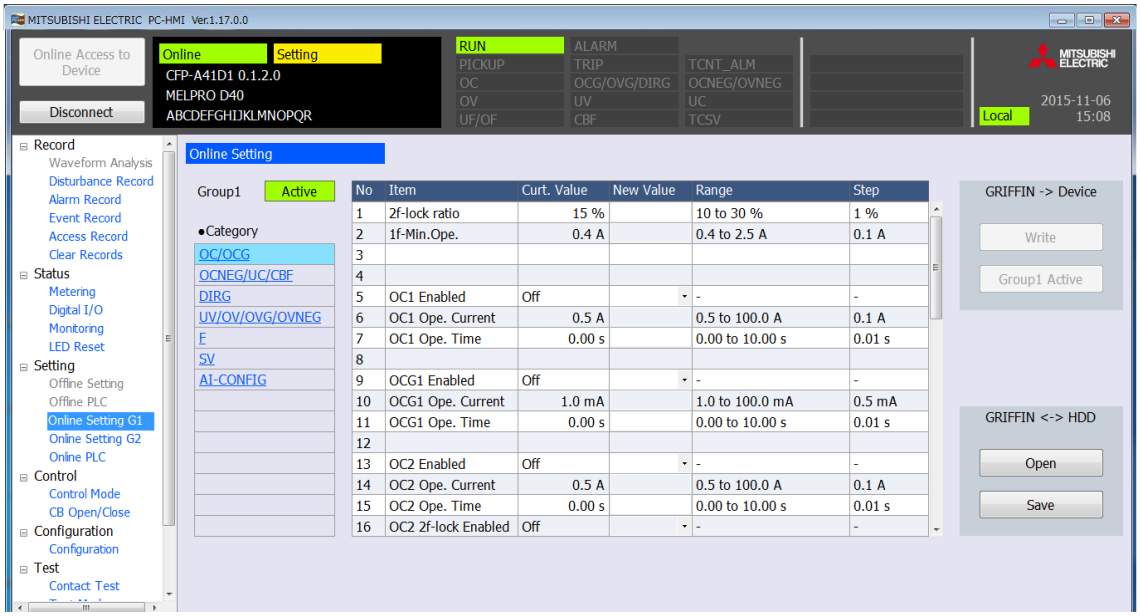


4. The message as shown below appears and the active setting group is switched.

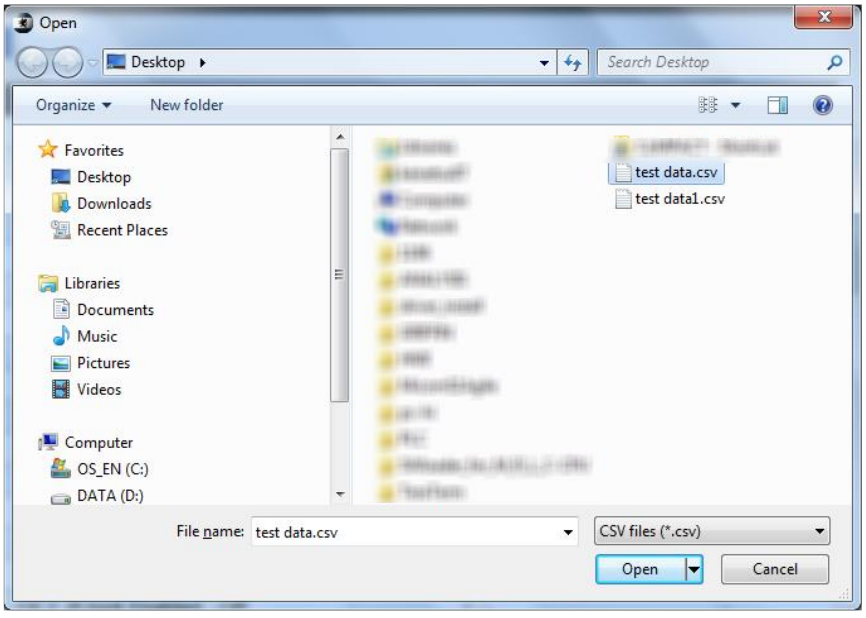


11.12.3. Reading/saving setting files from/to the HDD

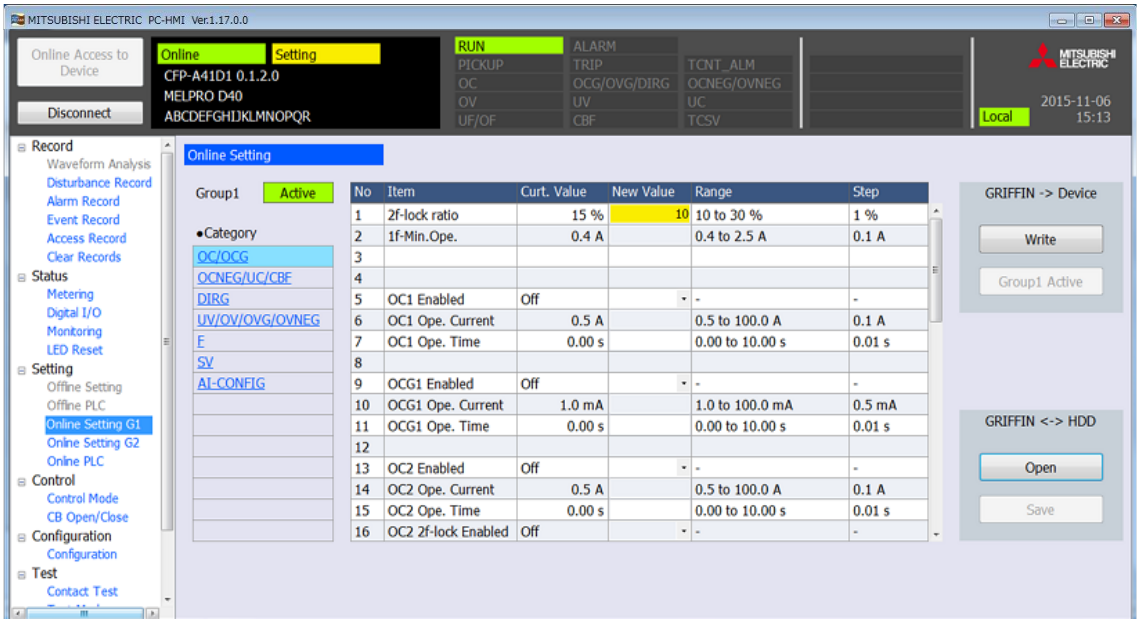
1. From the Function menu, click the group to read setting values.
2. From PC-HMI <-> HDD in the lower right part of the main screen, click “Open.”



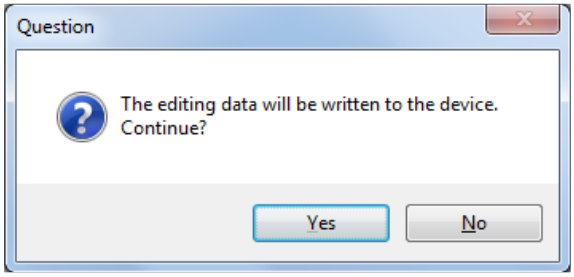
3. Select the file to read and click “Open.”



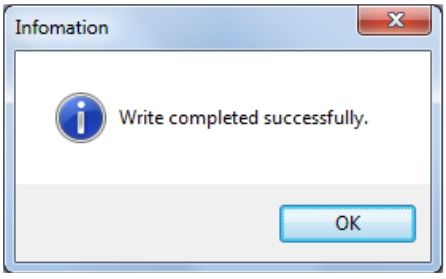
4. The read values are shown on the screen.



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

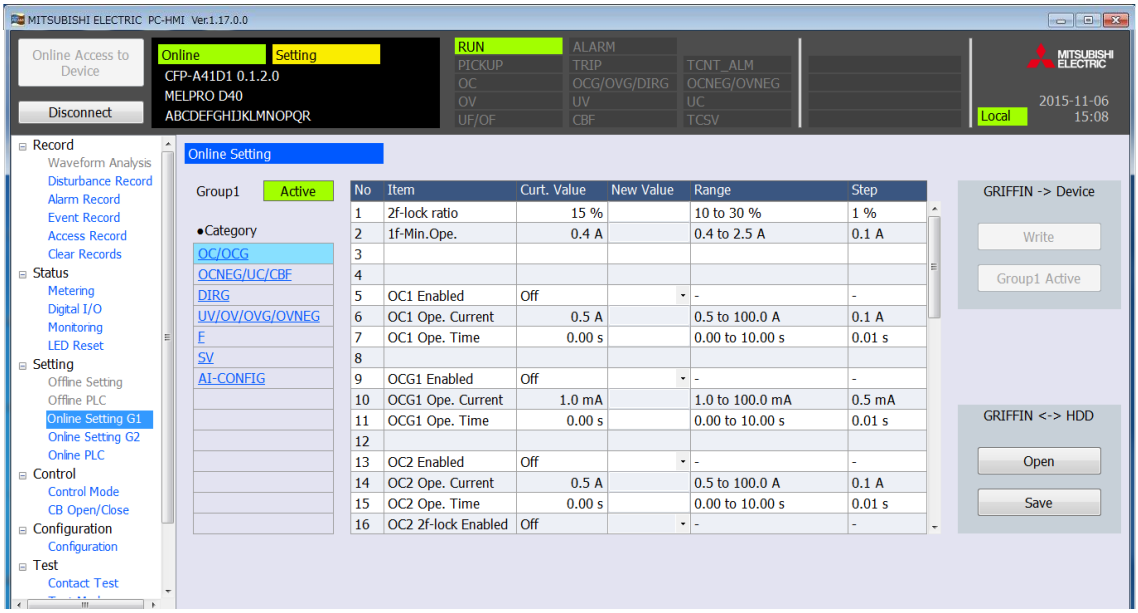


6. Click “Yes” to write the setting values to the device and activate them.

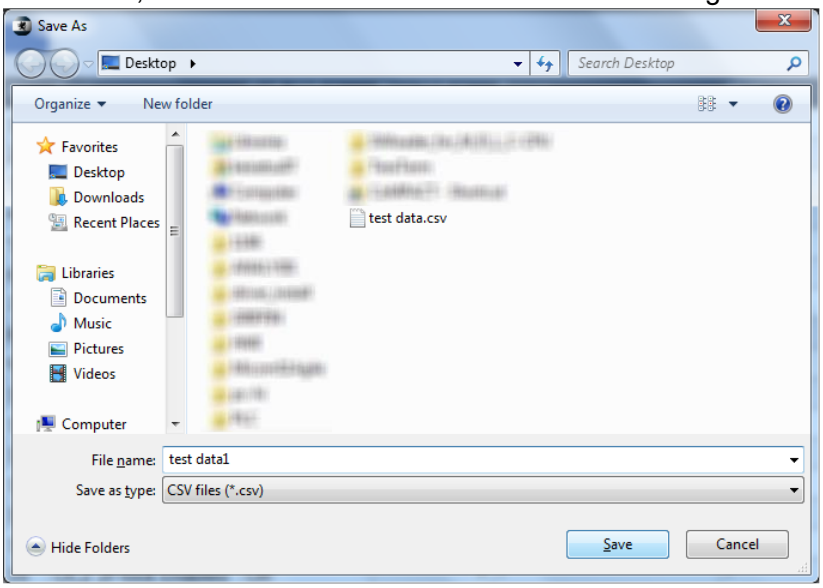


(To save setting value files)

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.

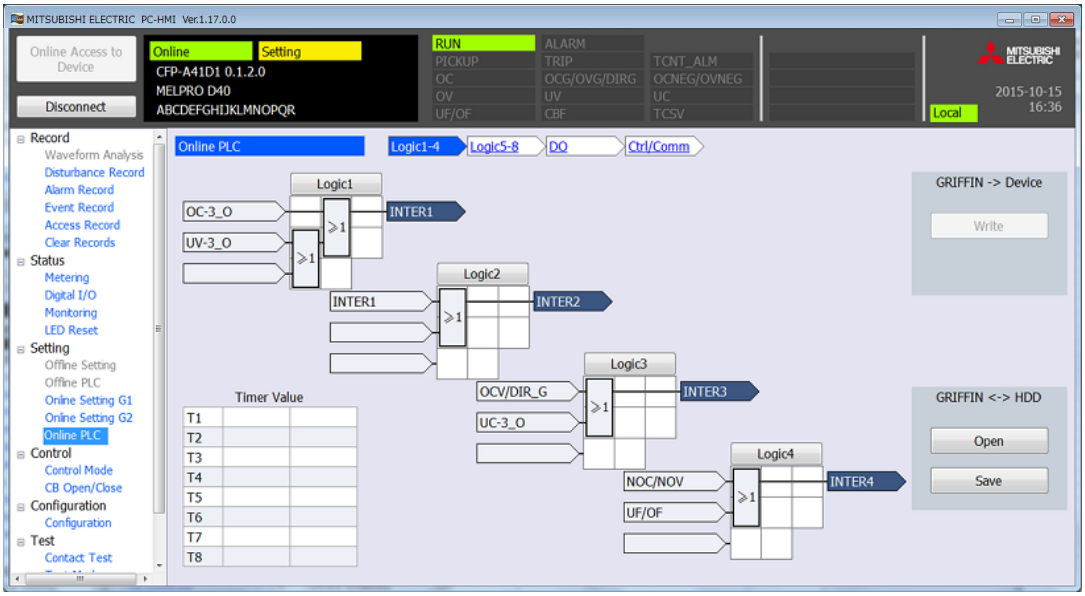


11.12.4. Online PLC

With MELPRO-D, 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.

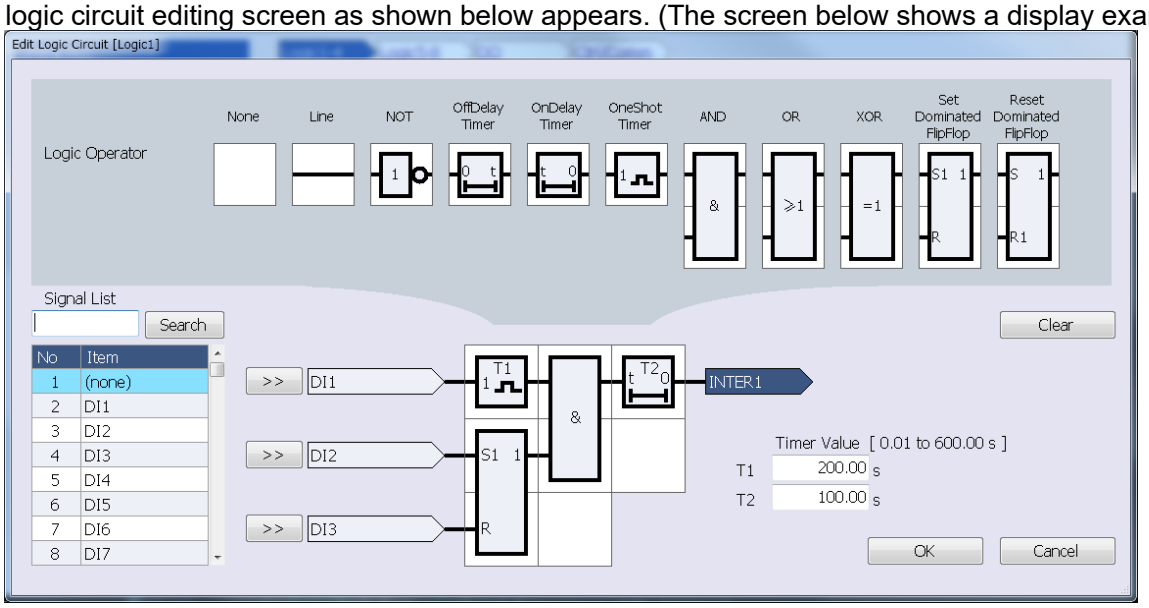


[Adding PLC configuration]

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)

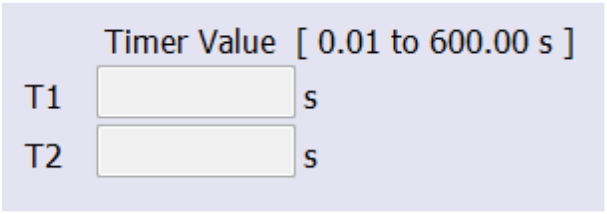


4. From the Item list on the screen above, select the signal to input and click. The selected signal is shown in light blue.
   Click “>>” to select the input signal.

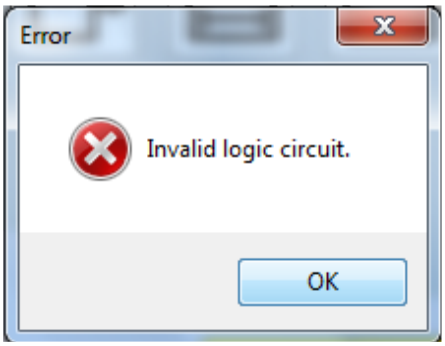
Note) The signal name can be searched by entering it on the Signal List by using the keyboard and clicking “Search.”

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.

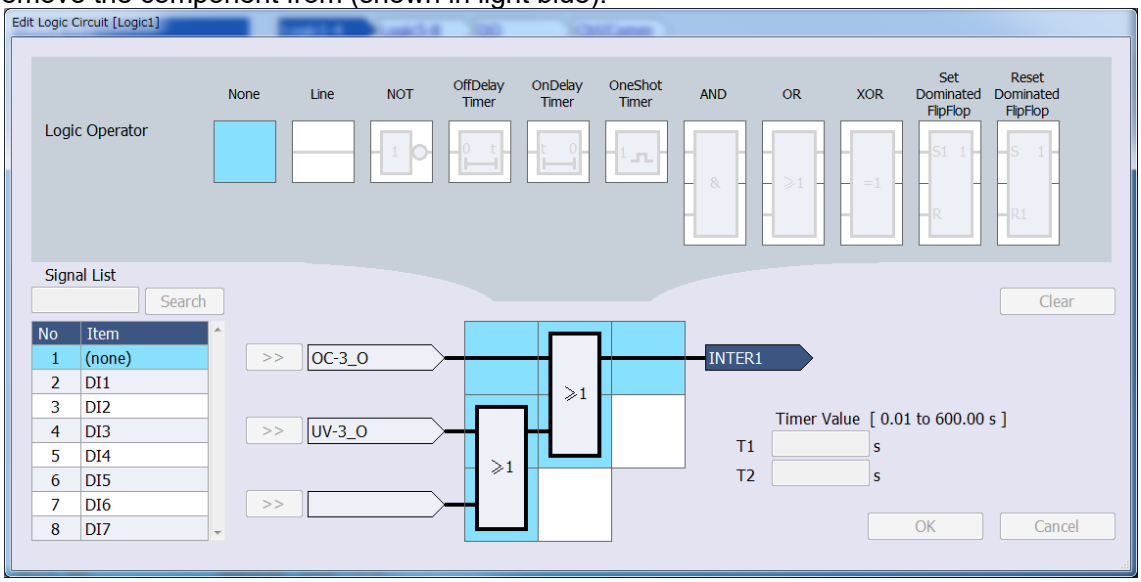
   When providing any timer component, specify the time in the Timer Value field.
   (Up to two timer components can be configured for each of Logics 1 to 8.)



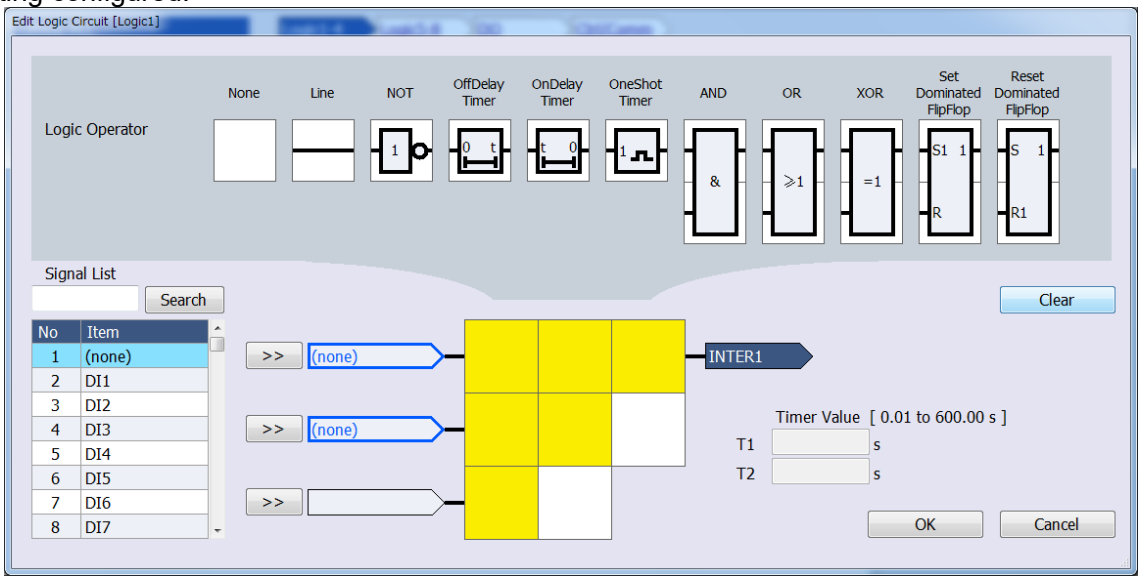
For logic components that can and cannot be placed, see 11.7.3.
Attempting to place a component in an area that does not allow placement, the error message as shown below appears.



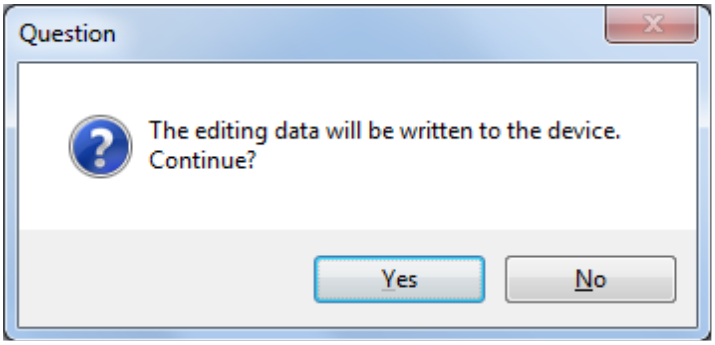
To remove any component that has been placed, select a None logic component and click the logic area to remove the component from (shown in light blue).



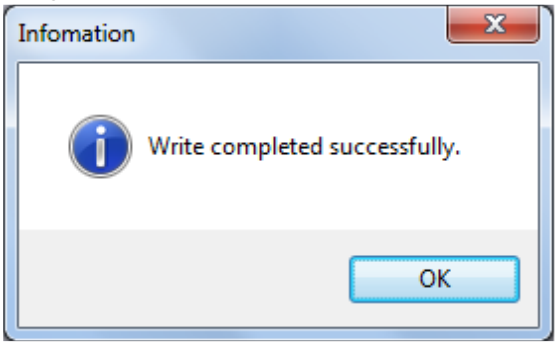
Clicking “Clear” brings back to the initial state with no input signal set, logic component placed or timer setting configured.



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.



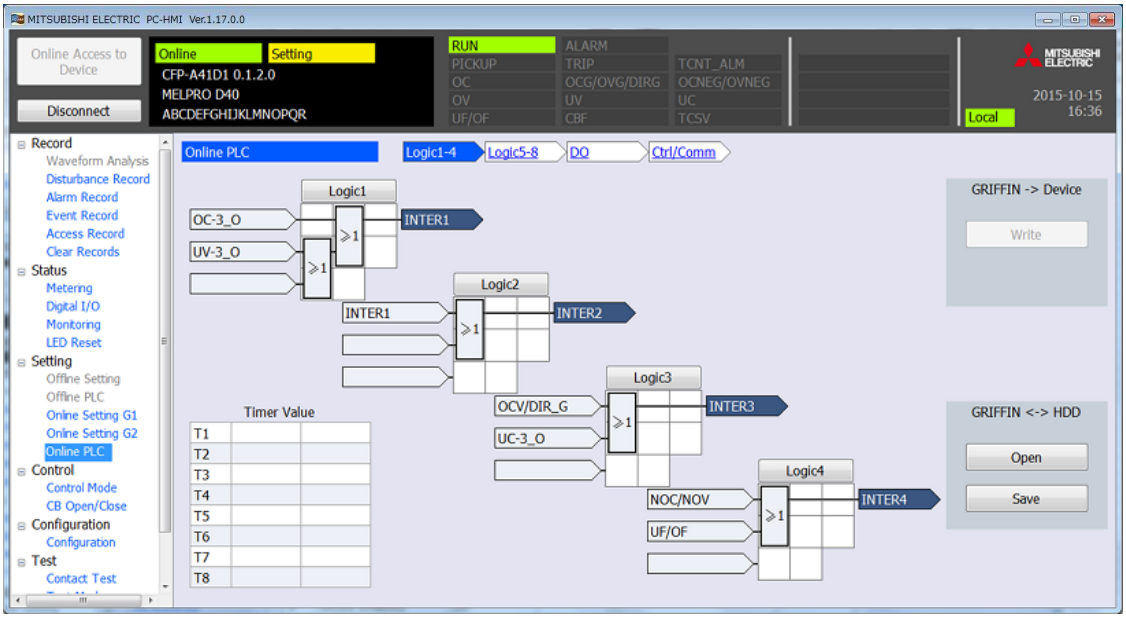
For successful writing, the dialog as shown below appears.



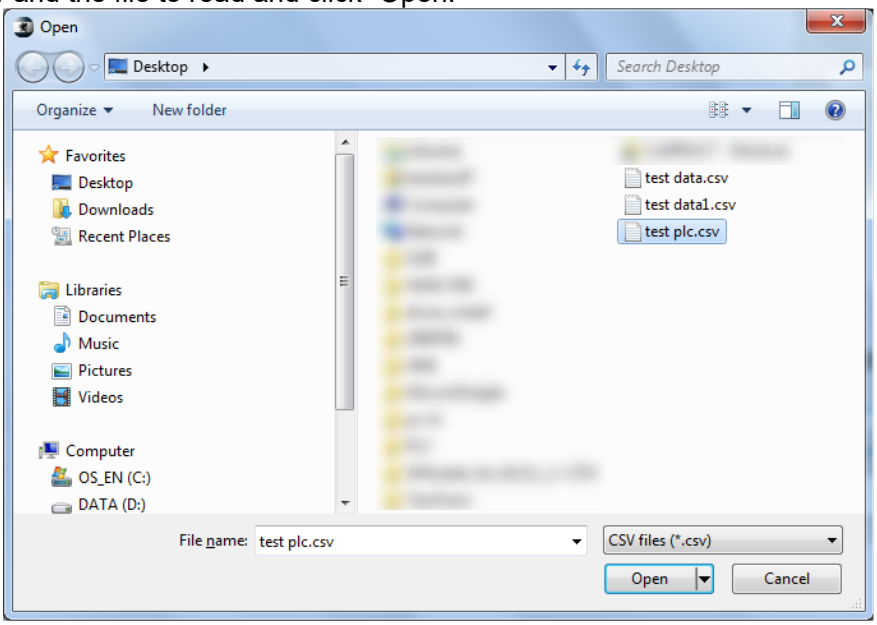
Note) For reading/writing PLC data from/to the PC, perform the following operations.

1) Reading PLC data saved in the PC

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



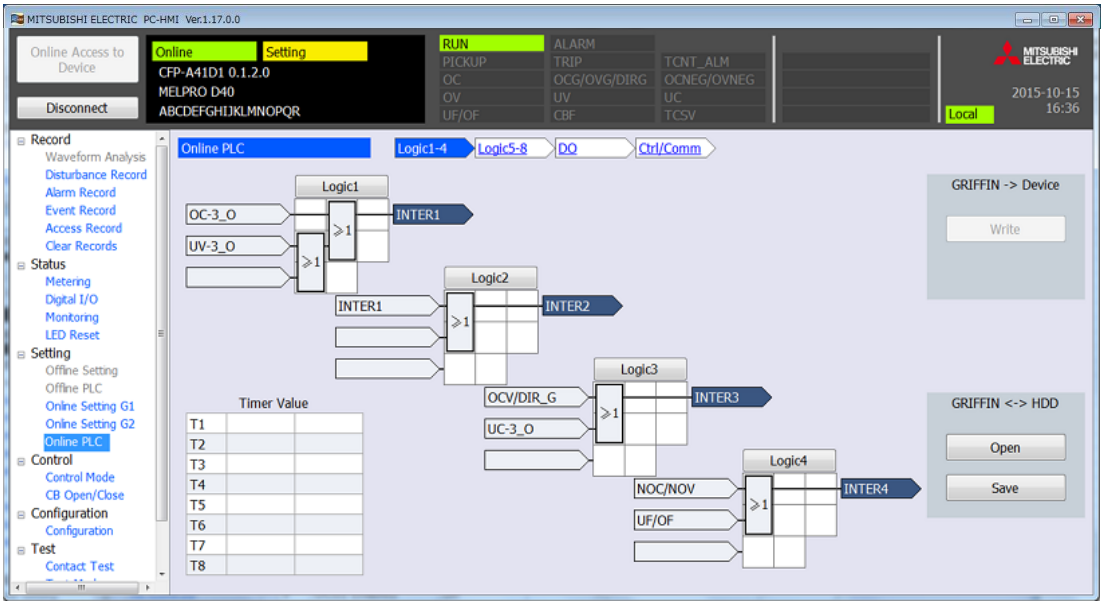
2. Select the folder and the file to read and click “Open.”



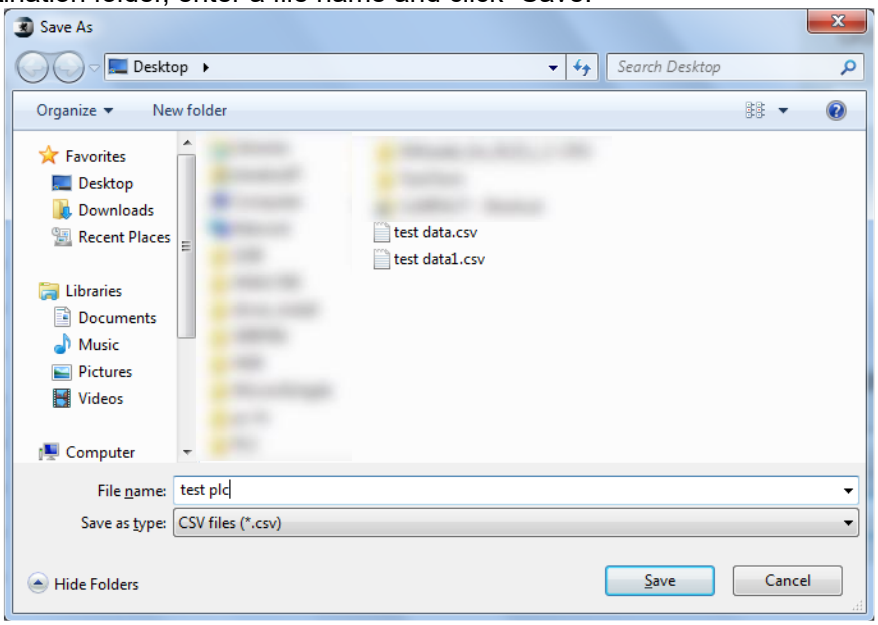
3. The specified PLC data are read to the device.

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.”

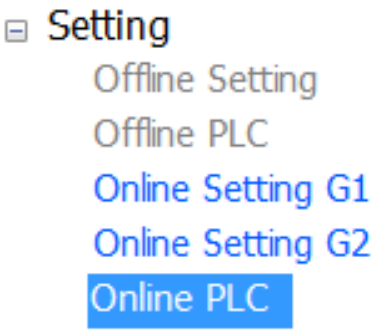


3. The configured PLC data are saved in the specified folder.

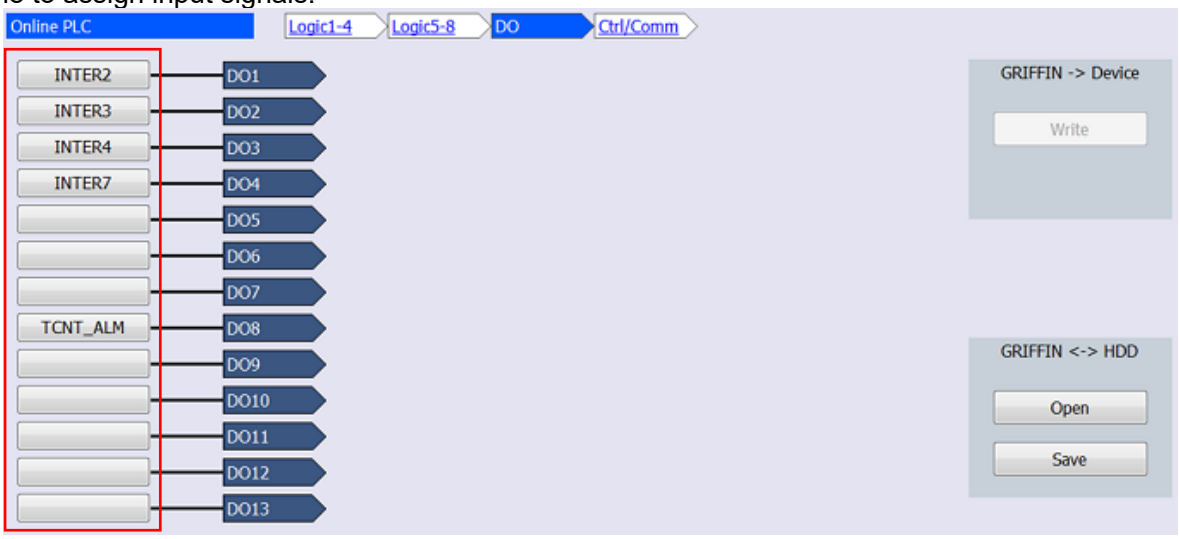
11.12.4.2. DO assignment

DO allows DO configuration of output assignments from the signal list.

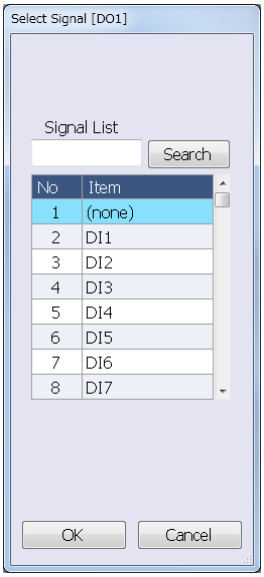
1. From the Function menu, click Online PLC.



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.”)



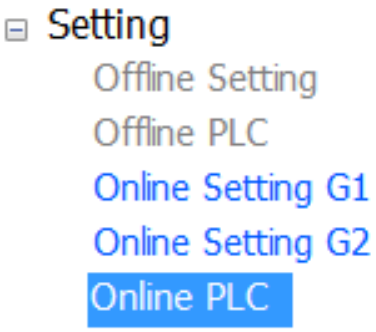
4. From PC-HMI -> Device, click “Write” to write the setting to the device.

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.

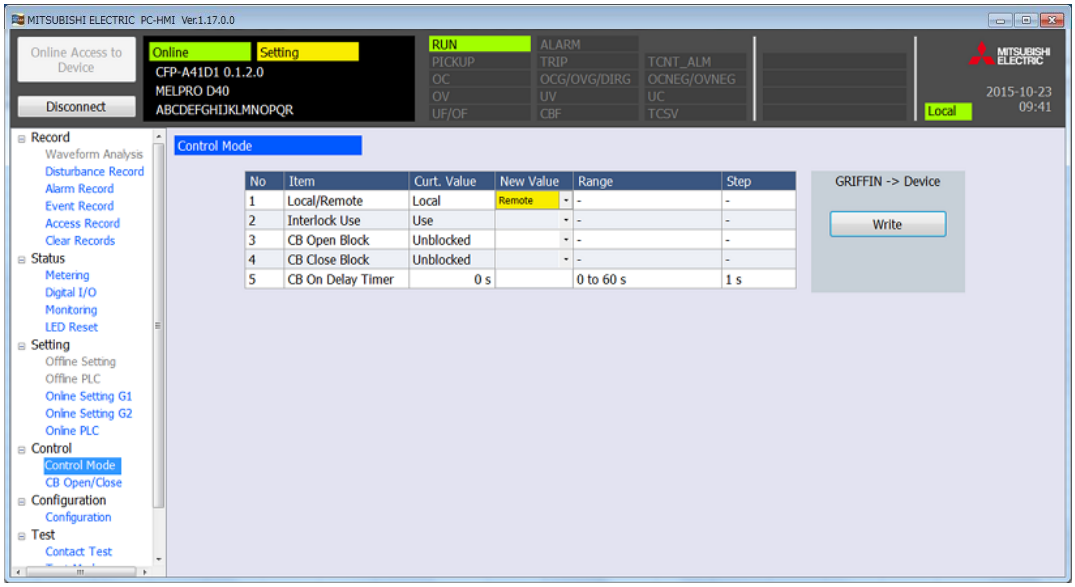
Note) For saving/reading PLC data to/from the PC, perform the same operation as 11.12.4.1.

11.13. Control functions

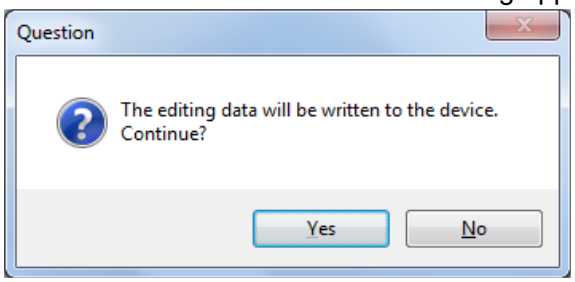
11.13.1. Setting the CB control mode

1. From the Function menu, select Control Mode.

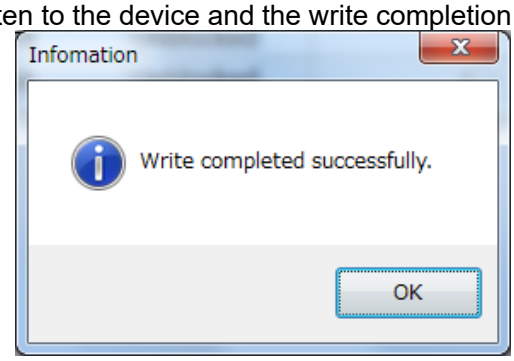
2. The list of CB control mode items appears. Click New Value for the item to make a change.
   From the list, make a selection by clicking ▼.
   To enter a value, use the keyboard.



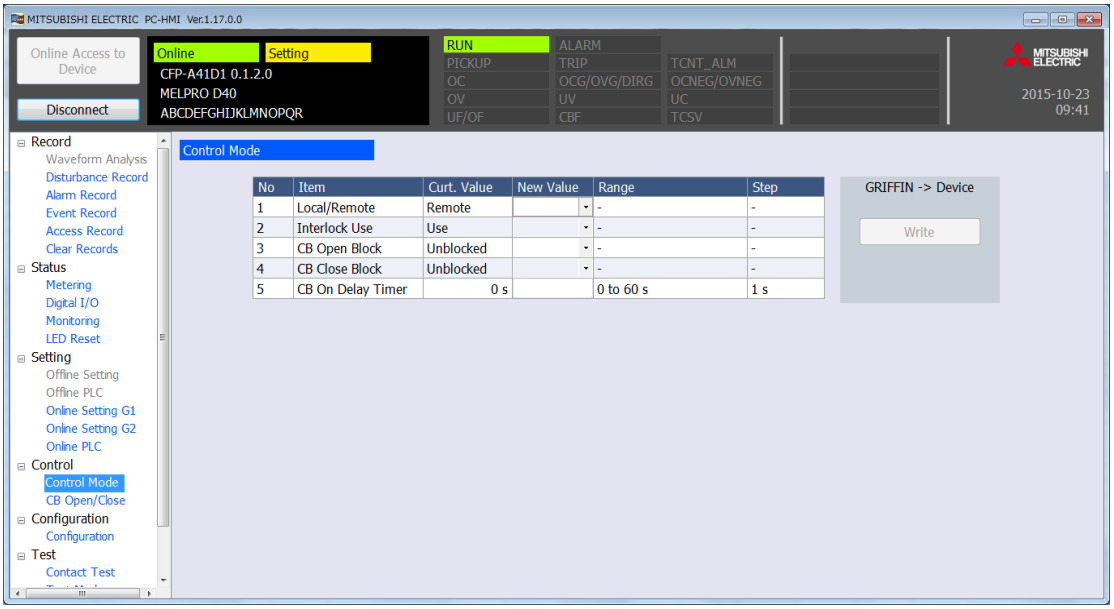
3. From PC-HMI -> Device, click “Write.” The write confirmation dialog appears. Click “Yes.”



4. The new setting value is written to the device and the write completion message appears.

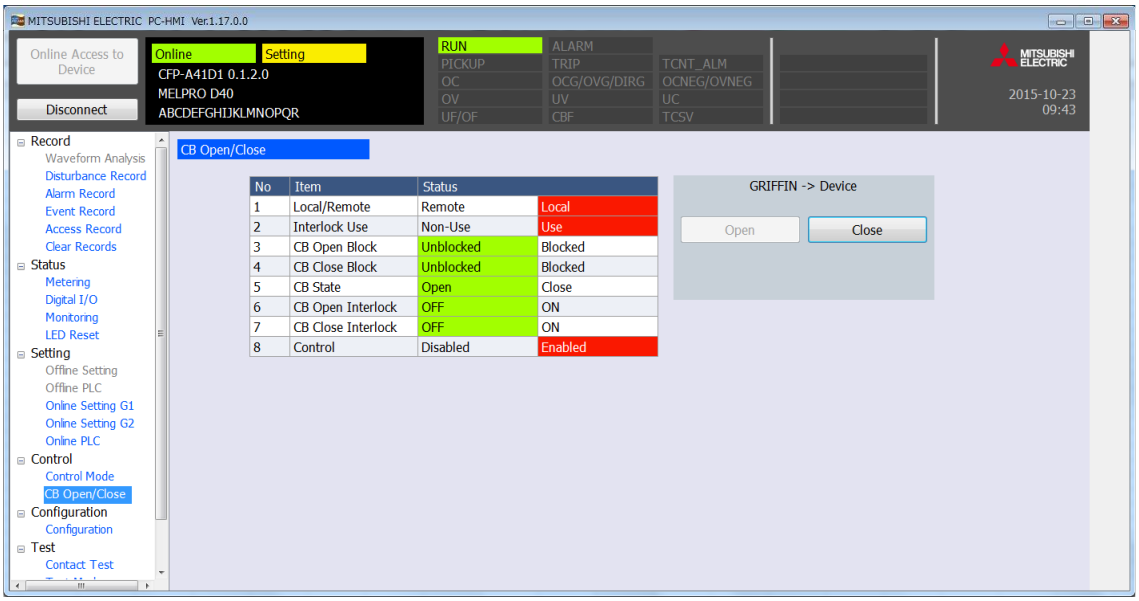


5. As shown below, the new value is set as the Curt. Value (current setting value).



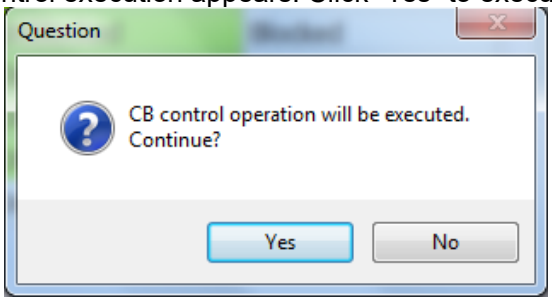
11.13.2. Executing CB control

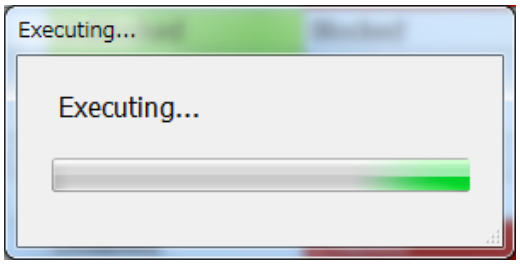
1. From the Function menu, click CB Open/Close.
   CB control can be executed either as open control or close control and the button for the unavailable control operation is disabled.
   Neither of them may be available depending on the addition status of the respective items.



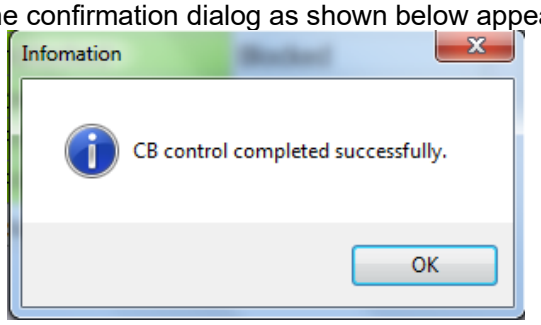
2. From PC-HMI -> Device, click “Open”/“Close.”

3. The dialog to confirm CB control execution appears. Click “Yes” to execute.

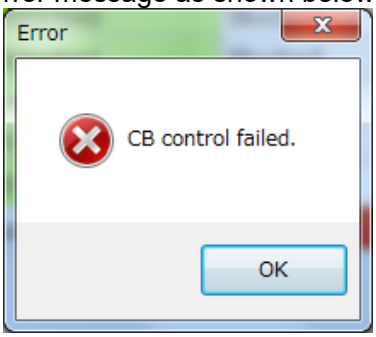




4. For successful CB control, the confirmation dialog as shown below appears.



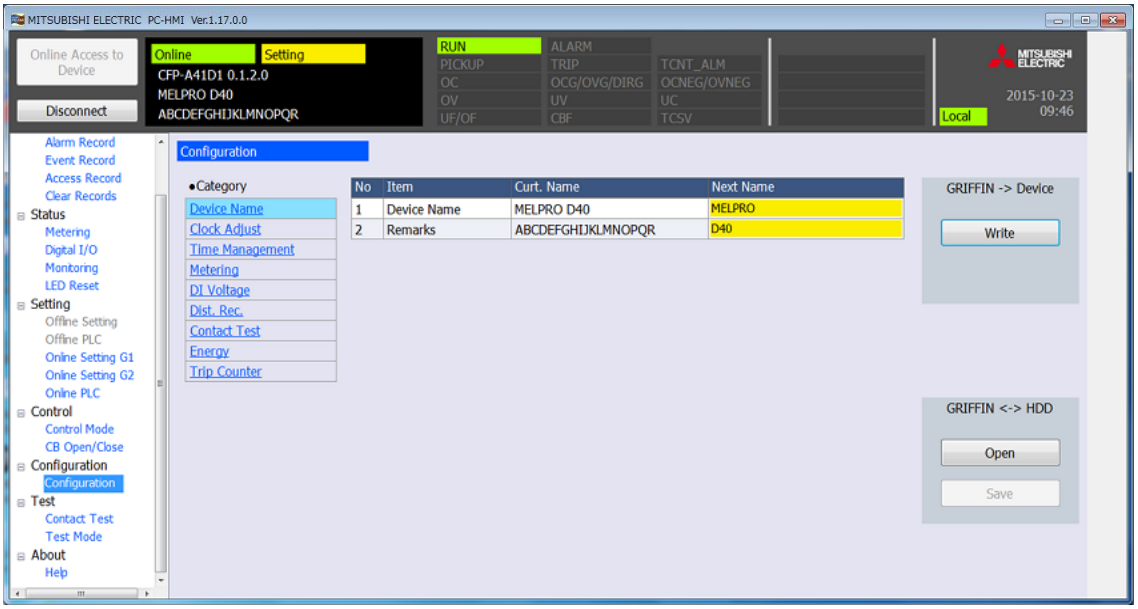
Note) If the selected control failed, the error message as shown below appears.



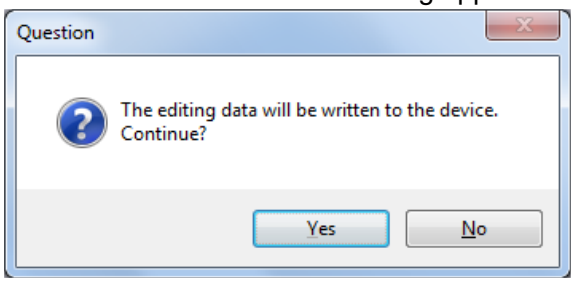
11.14. Device setting

11.14.1. Setting the device name

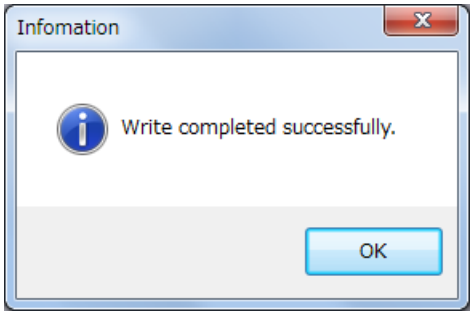
1. From the Function menu, click Configuration.
2. From Category, click Device Name.
3. Enter the new name to set in Next Name.



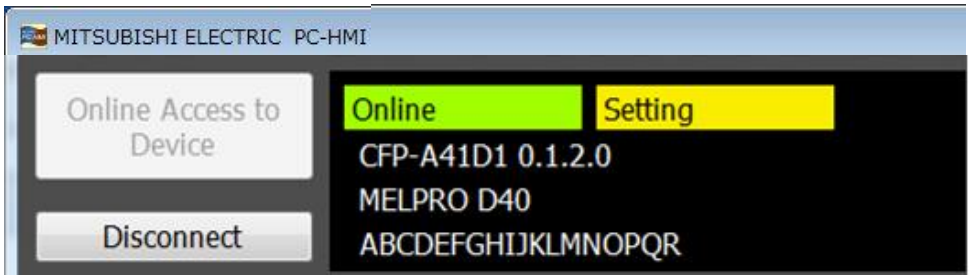
4. From PC-HMI -> Device, click “Write.” The confirmation dialog appears. Click “Yes.”



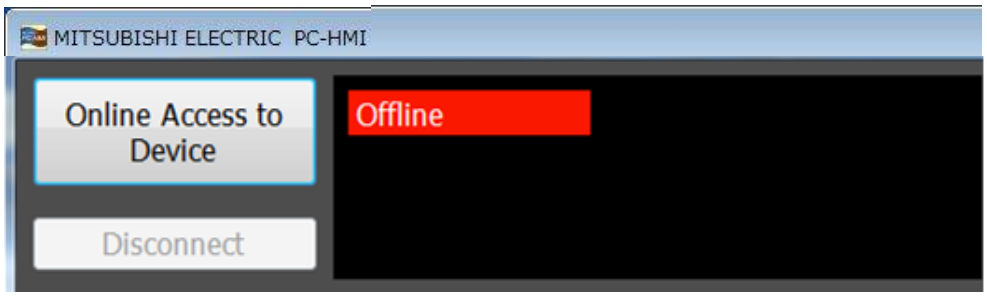
5. The setting is written to the device.



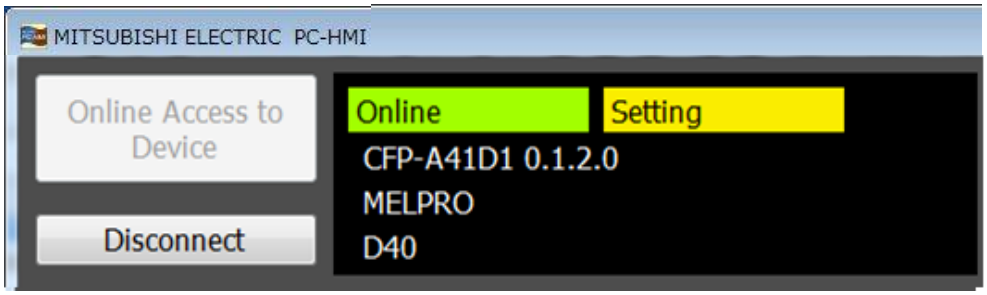
6. The indication is not updated when the setting has been written to the device.
   Click “Disconnect” to log off.



7. Click “Online Access to Device” to log in.
   (For the details about logging in, see 11.8.1.)

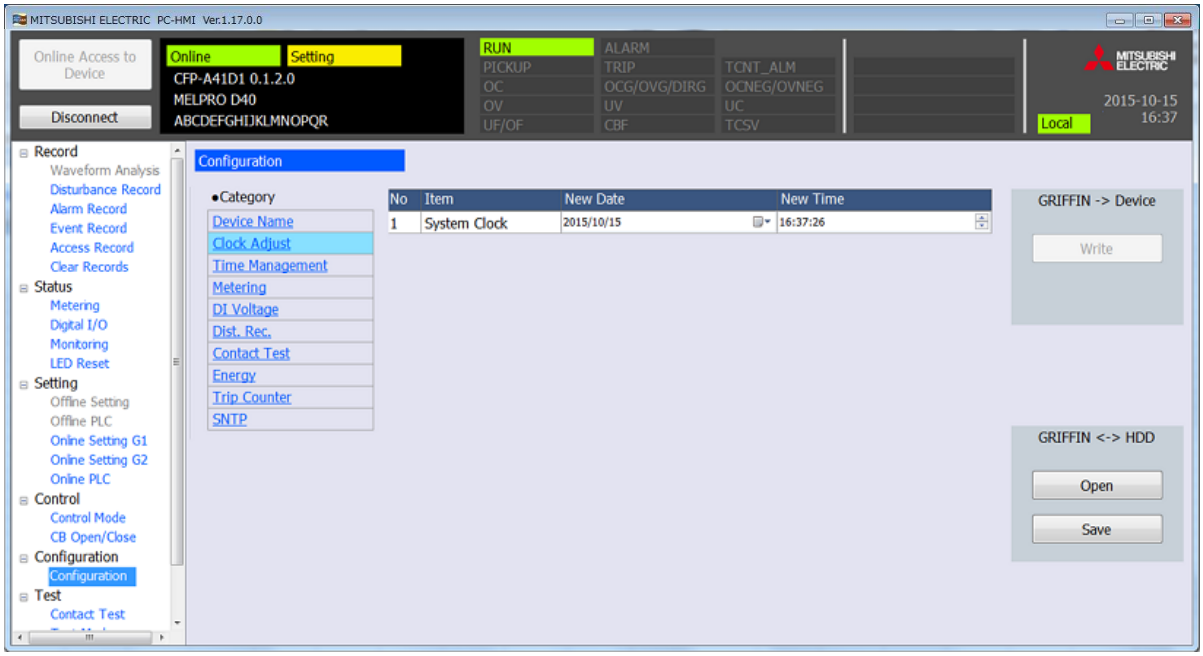


8. The device name indication is updated when the device has been logged in.



11.14.2. Clock Adjust setting

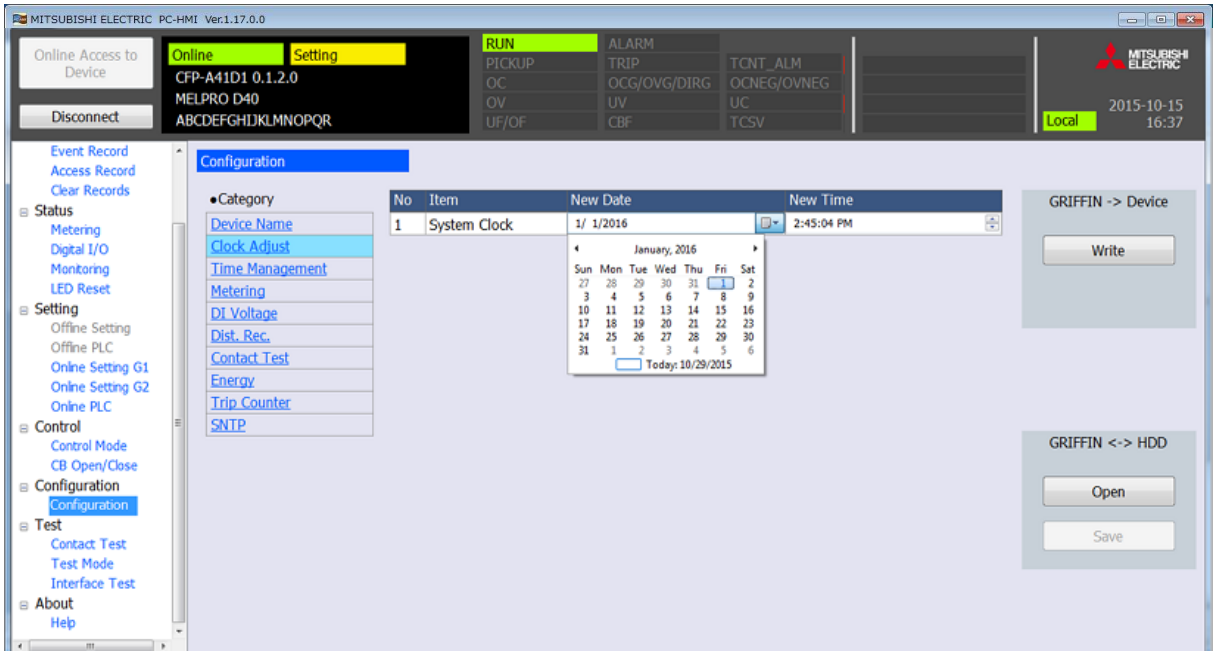
Clock Adjust allows setting of the date and time.



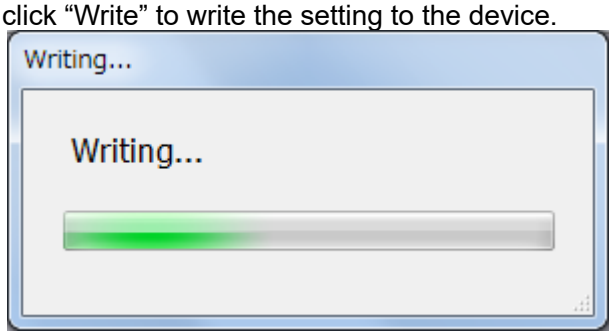
1. From the Function menu, click Configuration.

2. From Category, click Clock Adjust.

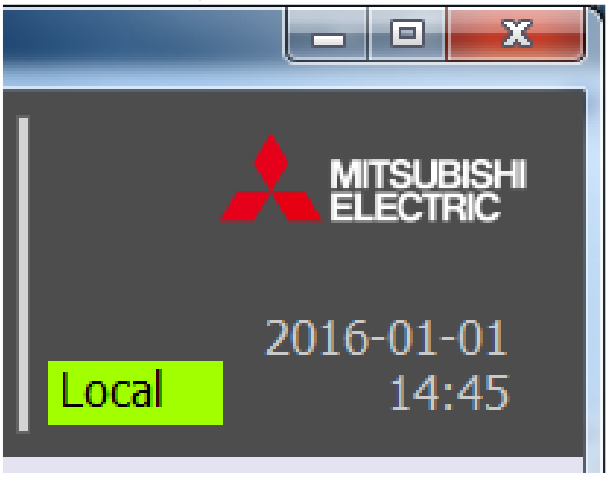
3. Select the date and/or time to adjust.
   New Date: year, month and date setting; New Time: hour, minute and second setting
   Use the mouse to bring the cursor to the setting to change and directly enter with the keyboard or click the button on the right side of the cell to adjust the date and time.



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.

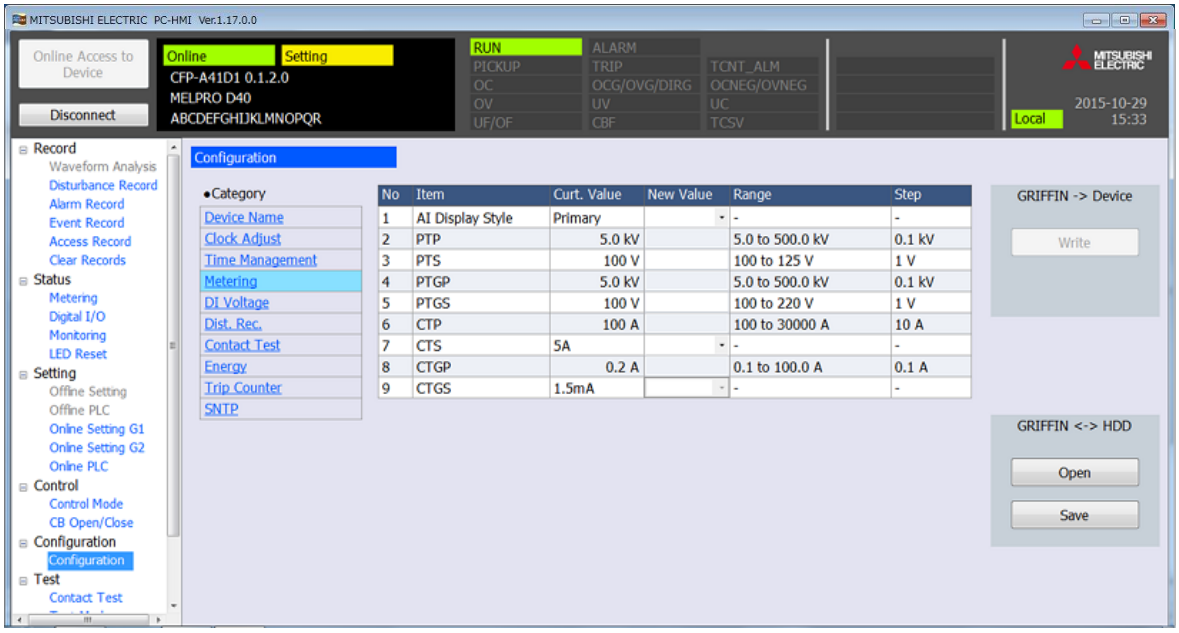
Note) If any value out of the setting range is entered, an error message as shown below appears.
Click “OK” and reenter a value within the range.

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.

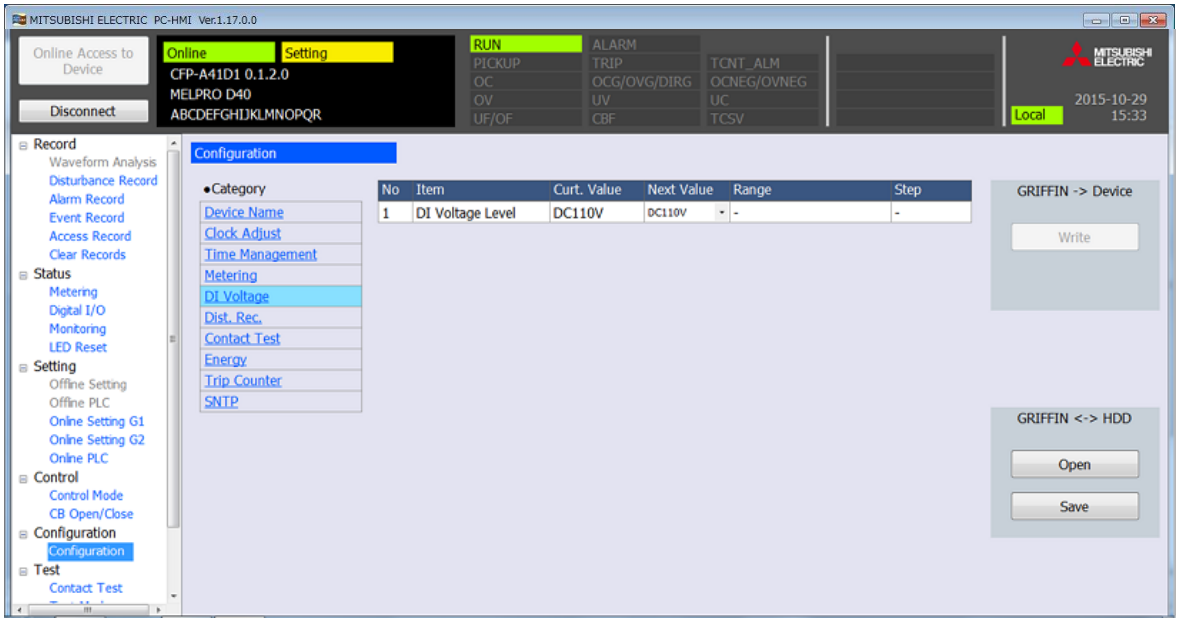
3. Select New Value for the item to change.
   Select the item from the drop-down list.
   For an item that requires entry of a value, use the keyboard to enter directly.

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.

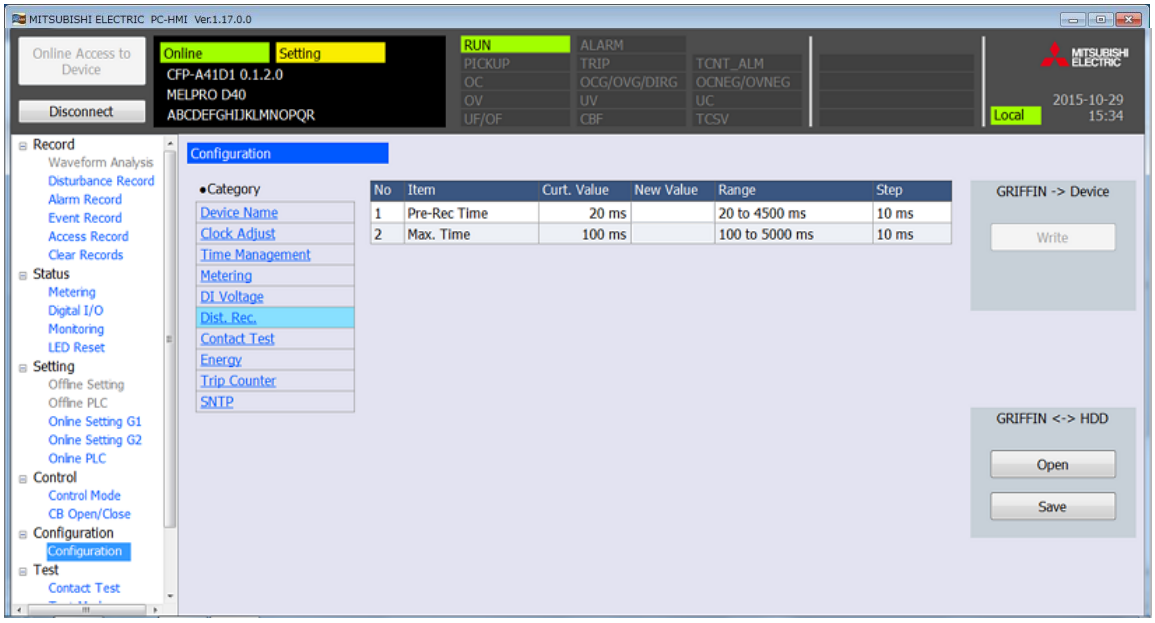


1. From the Function menu, click Configuration.
2. From Category, click DI Voltage.
3. Select a Next Value item.
   Select the value to set from the drop-down list.
4. From PC-HMI -> Device, click “Write” to write the setting to the device.

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.



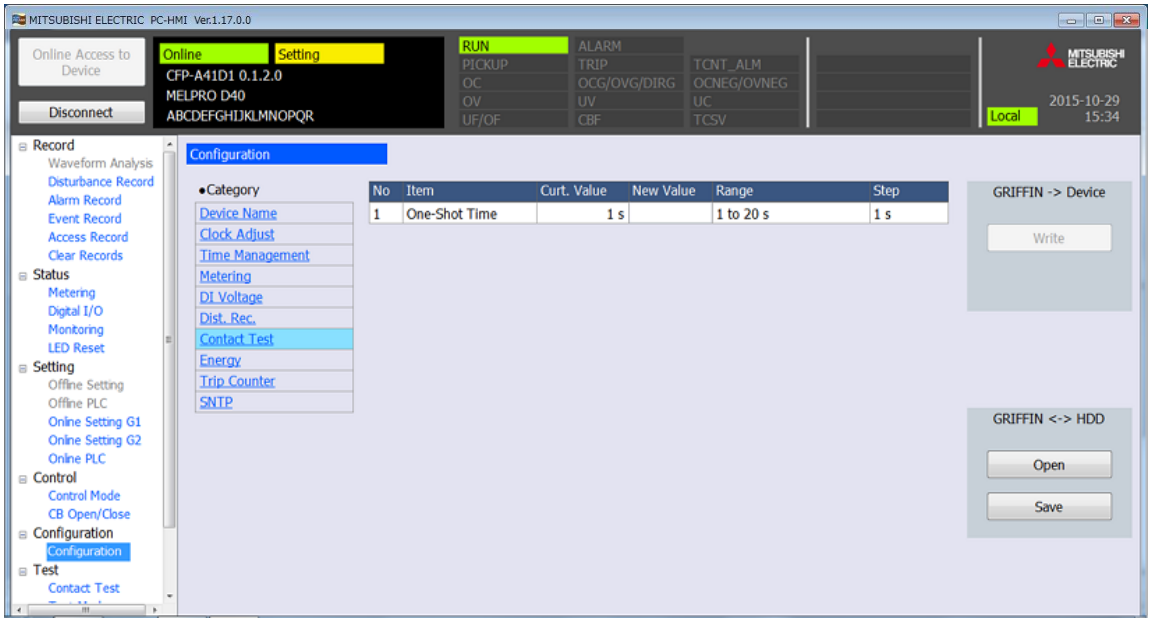
1. From the Function menu, click Configuration.
2. From Category, click Dist. Rec.
3. Select New Value for the item to change.
   For an item that requires entry of a value, use the keyboard to enter directly.

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.

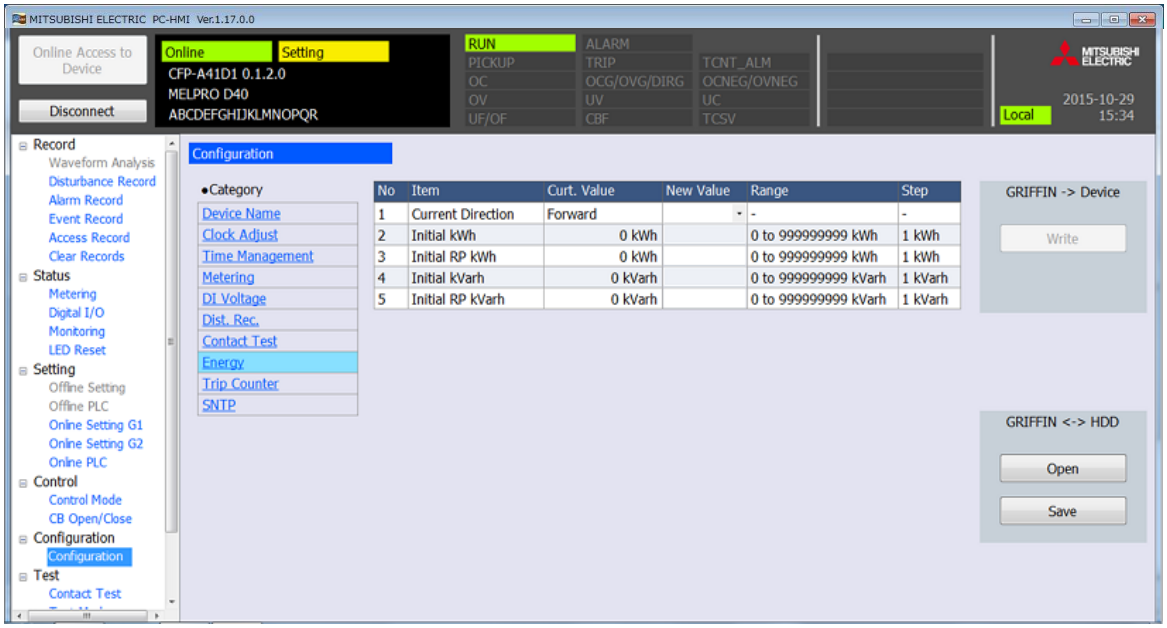
Note) If any value out of the setting range is entered, an error message as shown below appears.
Click “OK” and reenter a value within the range.

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.



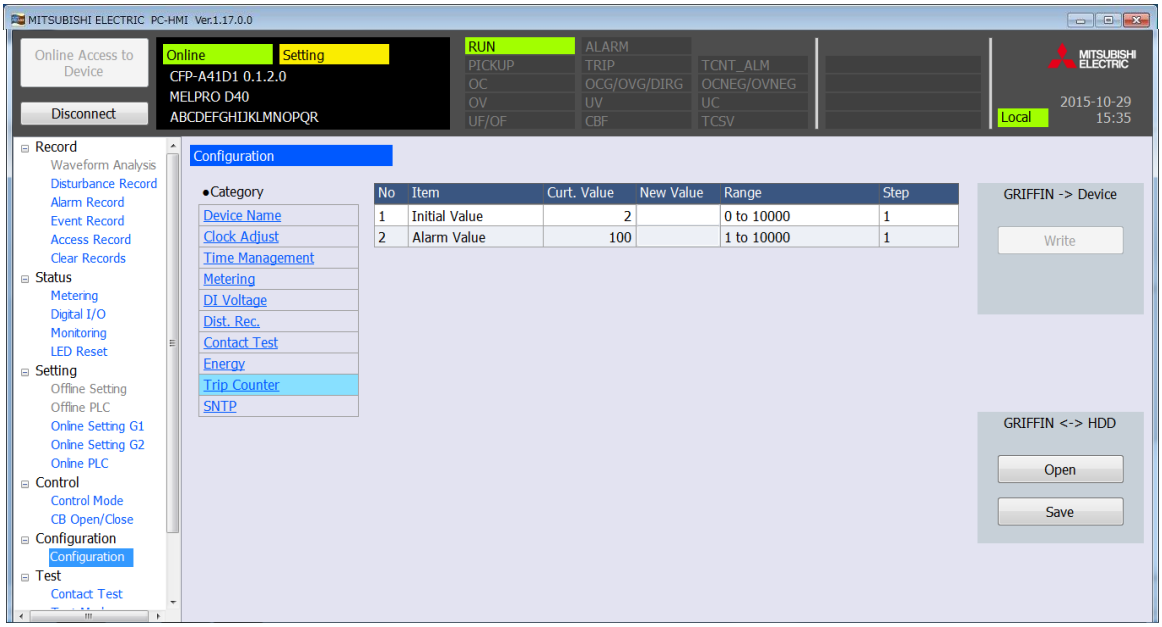
1. From the Function menu, click Configuration.
2. From Category, click Energy.
3. Select New Value for the item to change.
   Select the item from the drop-down list.
   For an item that requires entry of a value, use the keyboard to enter directly.

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.



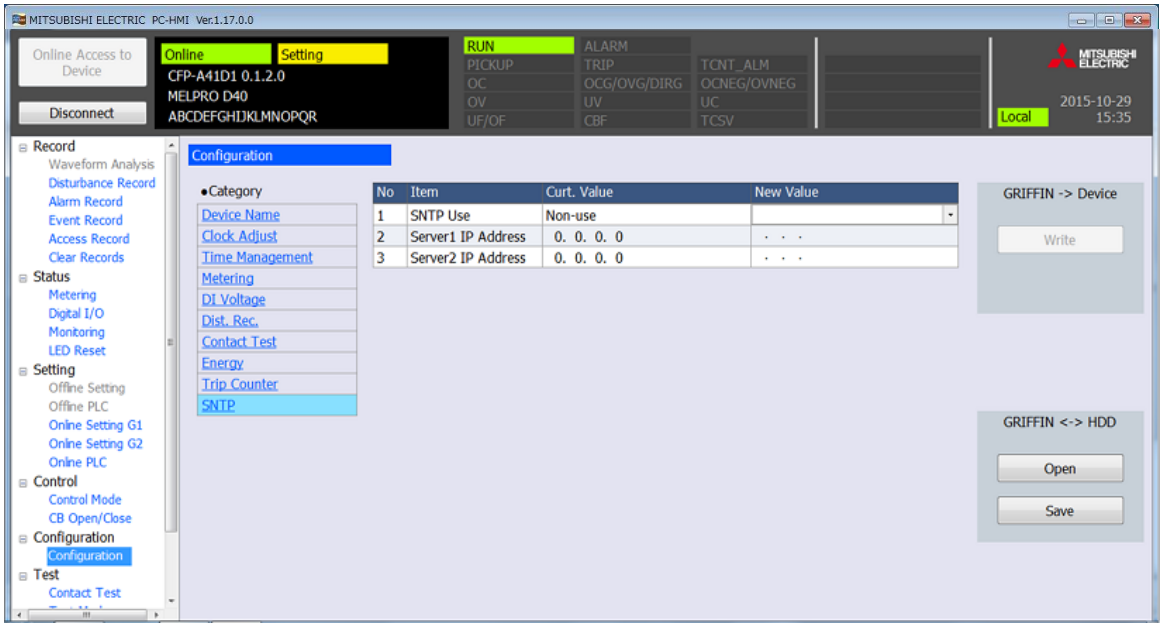
1. From the Function menu, click Configuration.
2. From Category, click Trip Counter.
3. Select New Value for the item to change.
   For an item that requires entry of a value, use the keyboard to enter directly.

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.



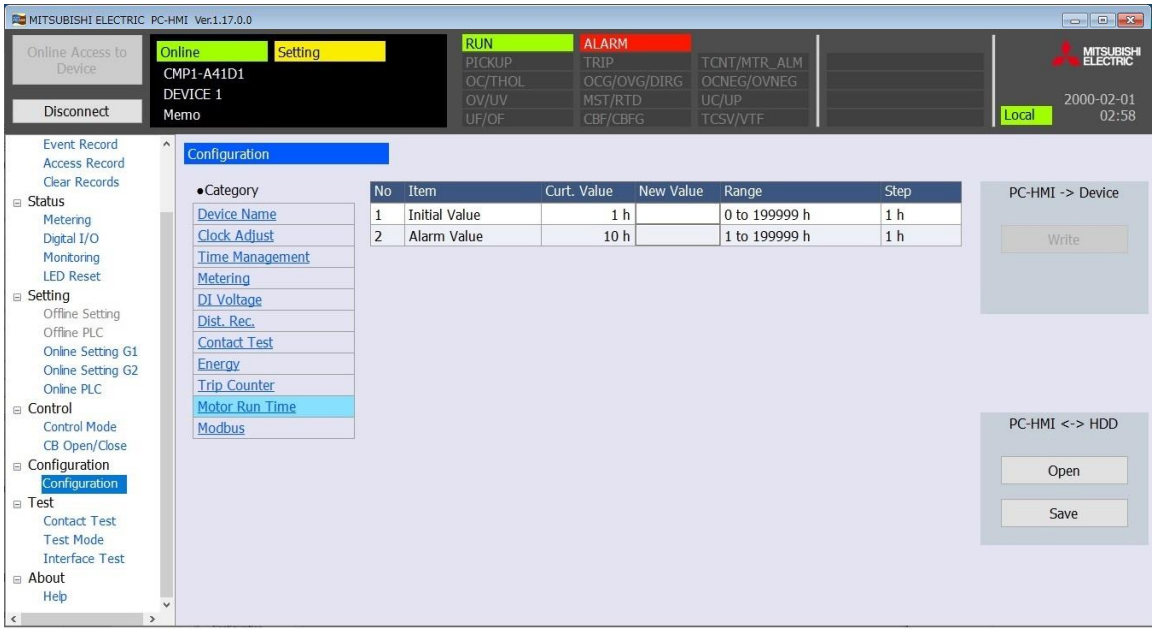
1. From the Function menu, click Configuration.
2. From Category, click SNTP.
3. Select New Value for the item to change.
   For an item that requires entry of a value, use the keyboard to enter directly.

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.

11.14.11. Motor Runtime Setting

Motor Runtime allows setting of Motor runtime initial value and alarm value



1. From the Function menu, click Configuration.
2. From Category, click Motor Run Time.
3. Select New Value for the item to change.
   For an item that requires entry of a value, use the keyboard to enter directly.

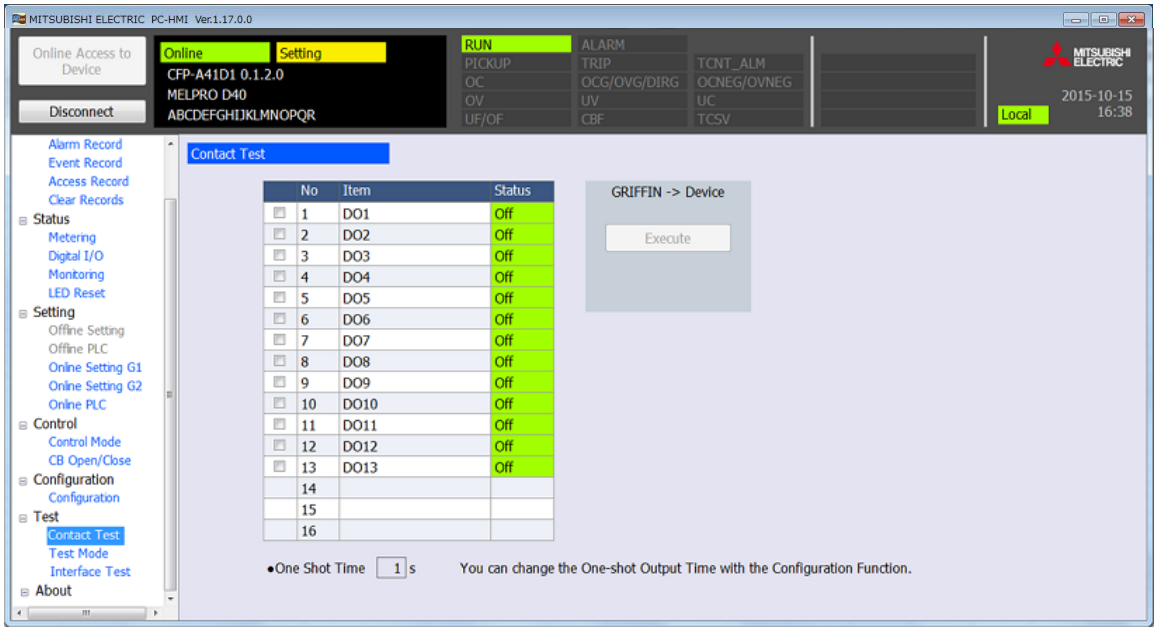
Note) If any value out of the setting range is entered, an error message as shown below appears.
Click “OK” and reenter a value within the range.

4. From PC-HMI -> Device, click “Write” to write the setting to the device.

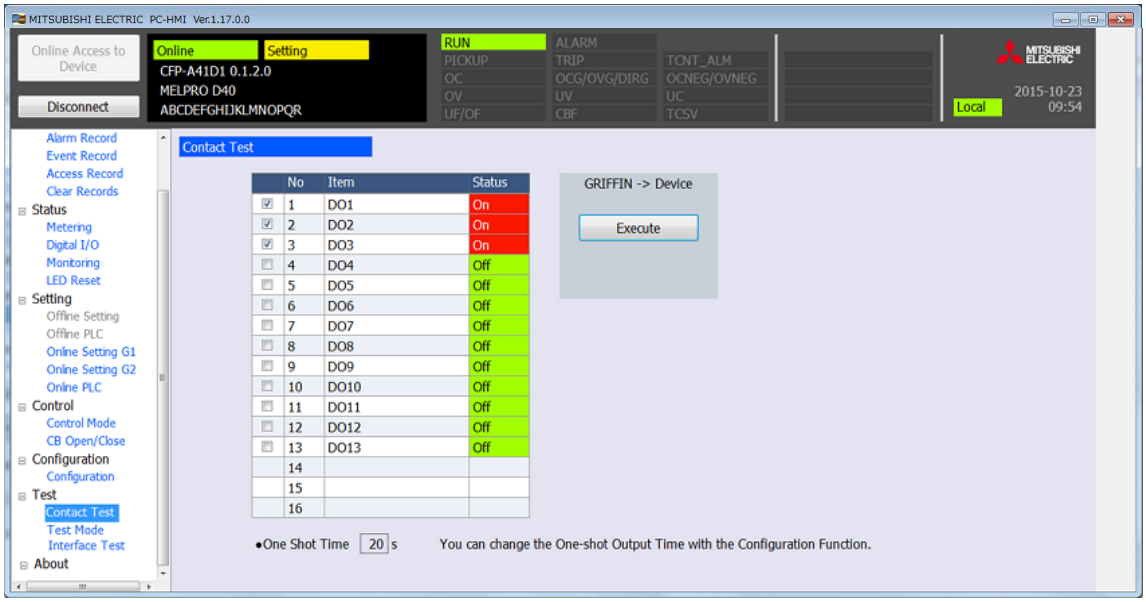
11.15. Test functions

11.15.1. DO Contact Test

Contact Test forces activation of the relay output contact.

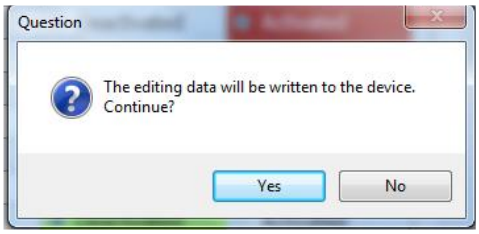


1. From the Function menu, click Contact Test.
2. Click the check box on the left of the item to conduct the DO contact test.
   (The Status of the checked item changes from Off to On.)

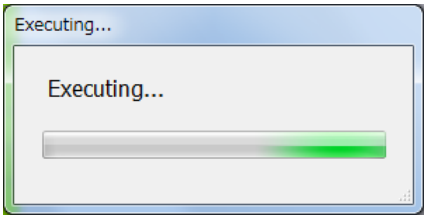


Note) To change the operating time for the contact test, change One Shot Time in 11.14.7.

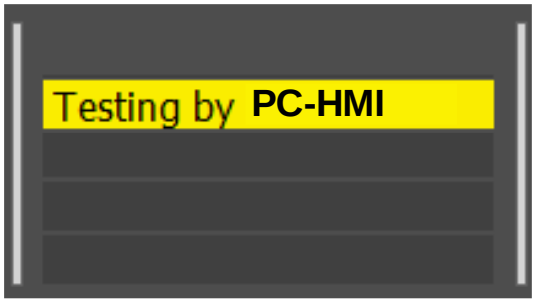
3. From PC-HMI -> Device, click “Execute.” The dialog to confirm execution appears. Click “Yes” to execute.



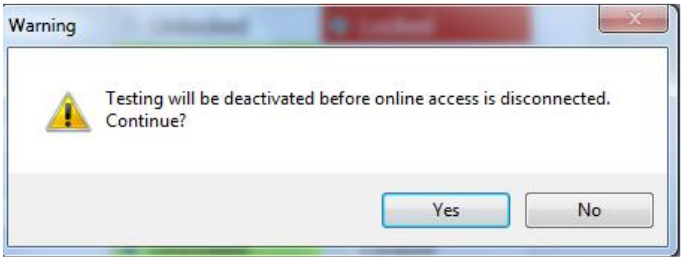
4. The execution dialog as shown below appears and the contact test for the specified DO item is executed.



5. During execution, the Testing indication is given in the status area.



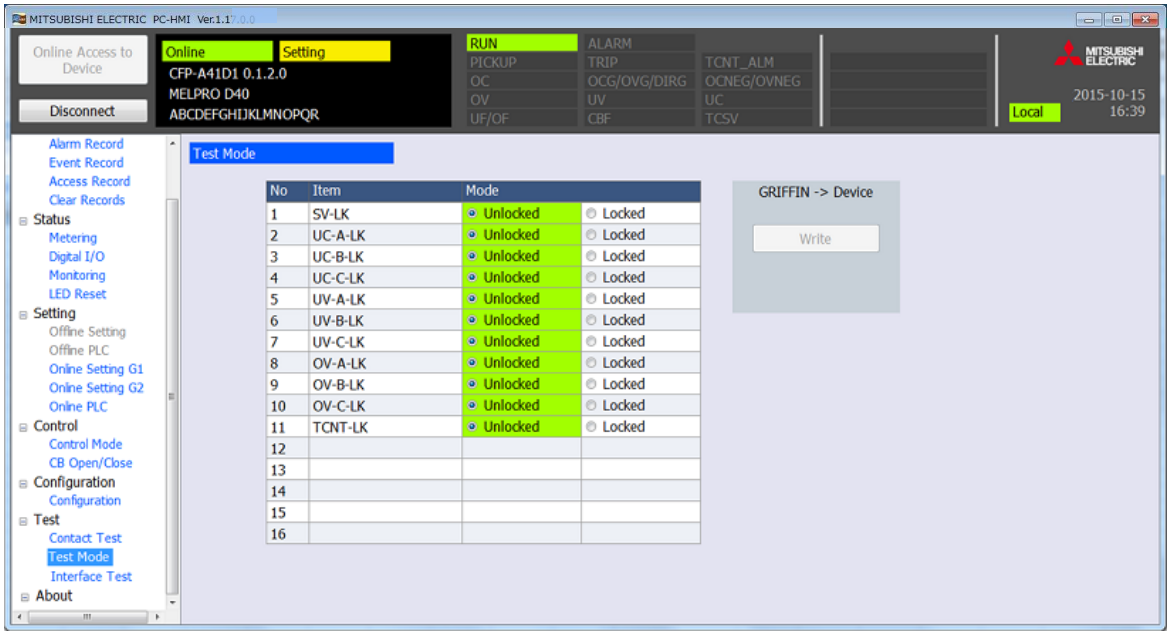
Note) If disconnection or PC-HMI termination is attempted during a contact test, the message to confirm contact test cancellation appears.



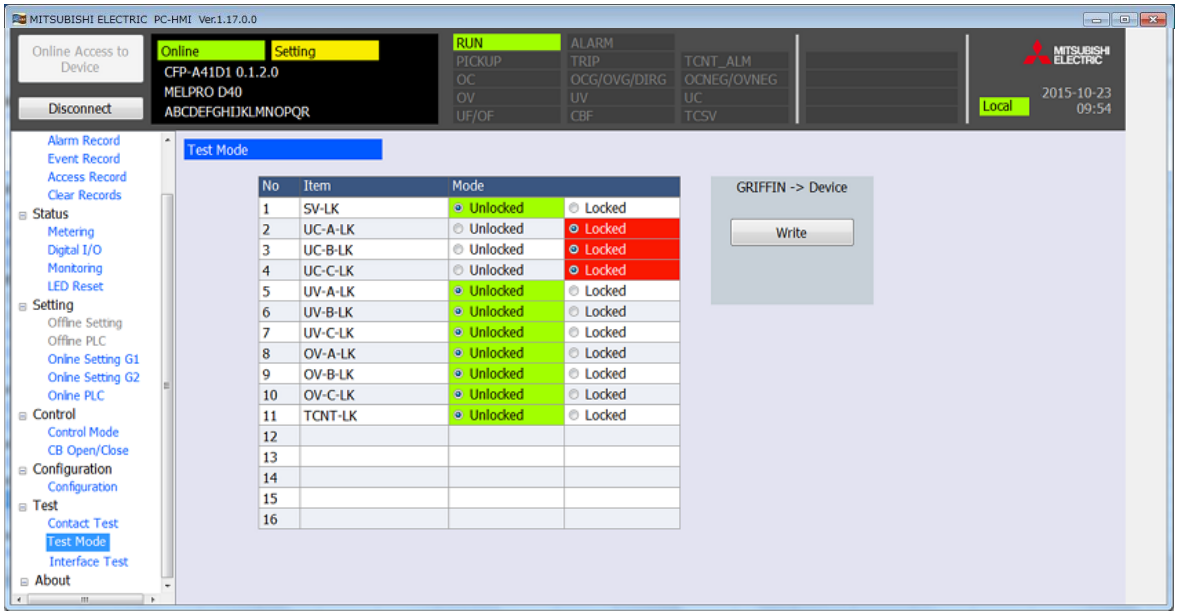
11.15.2. Test Mode

Test Mode allows setting of the temporary test mode for the relay.

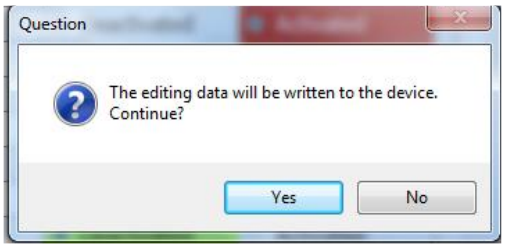
1. From the Function menu, click Test Mode.



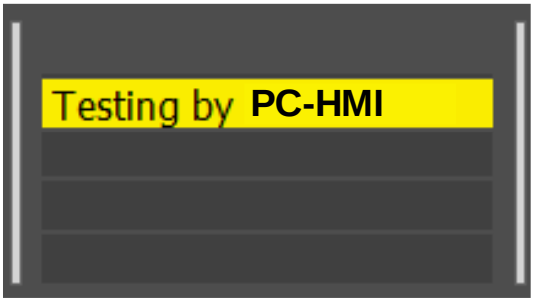
2. Select the mode for each item.
   Unlocked : Test mode disabled
   Locked : Test mode enabled



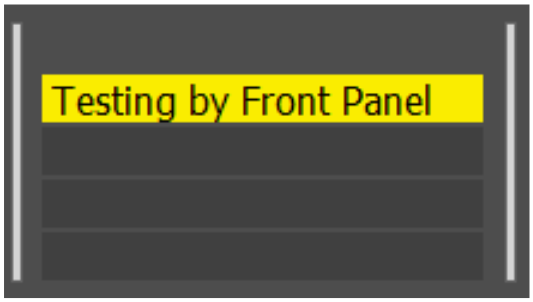
3. From PC-HMI -> Device, click “Write.” The dialog to confirm writing the data to the device appears. Click “Yes” to execute.



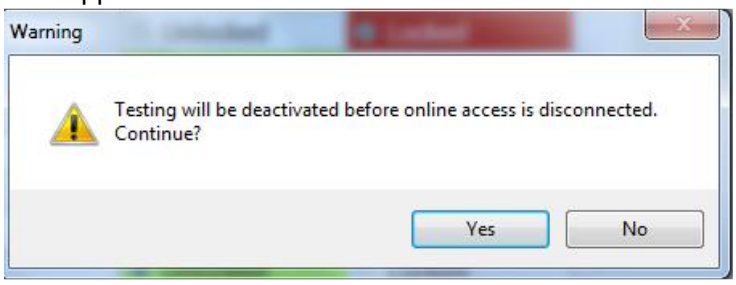
4. During the test, the “Testing by PC-HMI” indication is given in the status area.



Note) During a test from the front panel, the “Testing by Front Panel” indication is given.



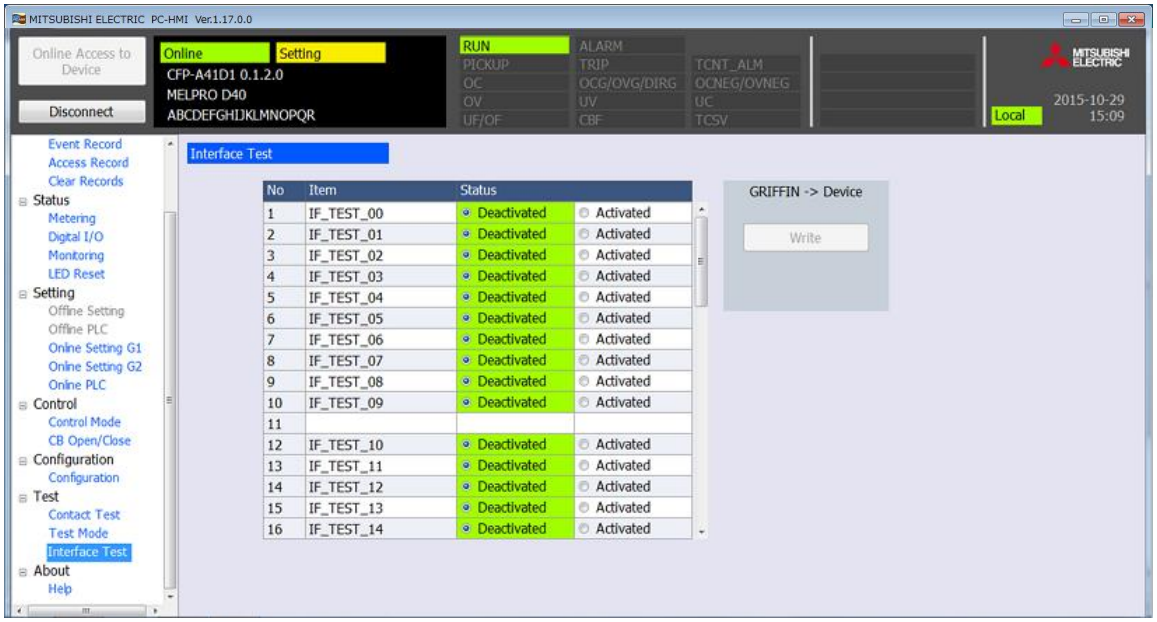
Note) If disconnection or PC-HMI termination is attempted during a contact test, the message to confirm contact test cancellation appears.



11.15.3. Relay Interface Test

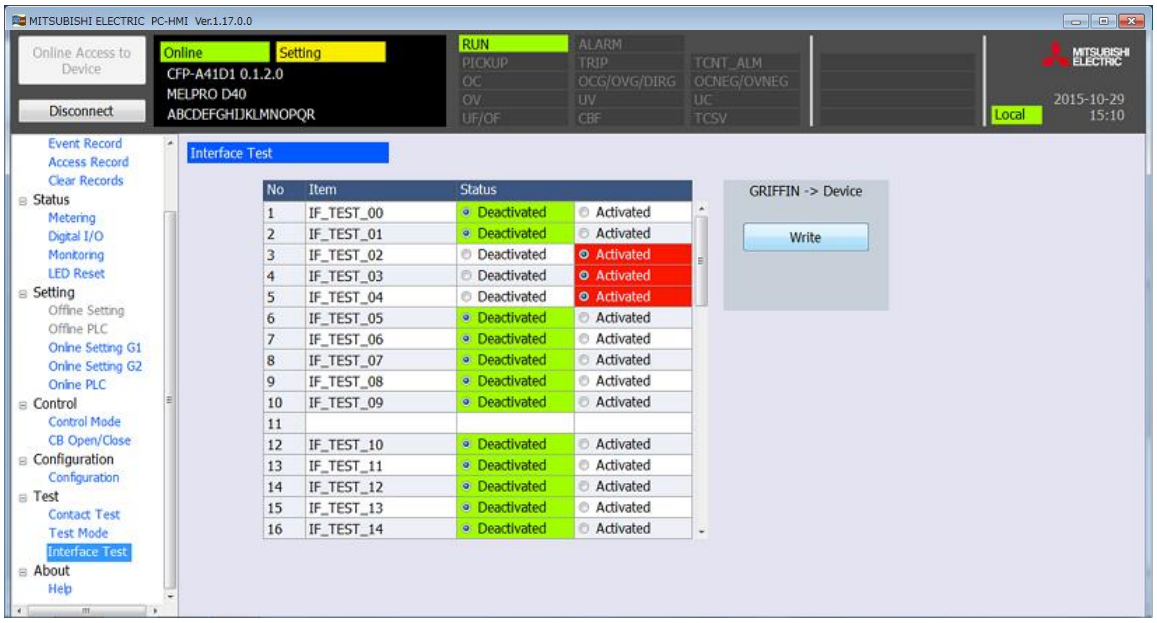
Interface Test allows simulated testing of relay operation without inputting any voltage or current.

1. From the Function menu, click Interface Test.

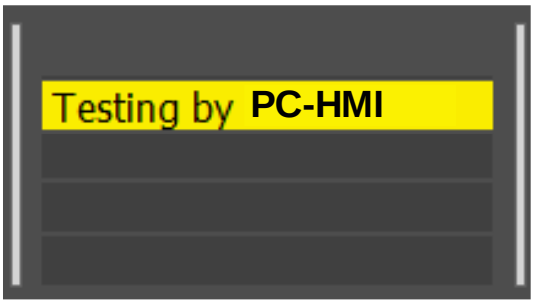


2 . Select the status for each item.

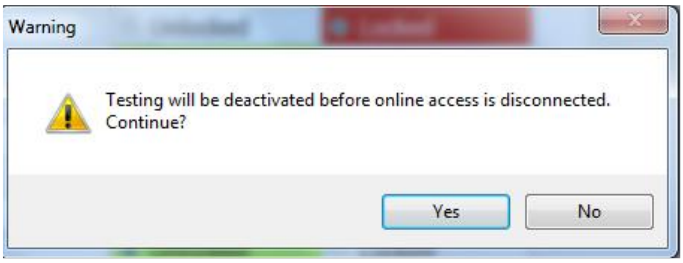
Deactivated : Disables the test.
Activated : Enables the test.



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).