MITSUBISHI ELECTRIC

Numerical Protection Relay

MELPRO™-D Series

VOLTAGE RELAY

MODEL

CBV2-A41D1,CBV3-A41D1

INSTRUCTION MANUAL

■For the latest version of this instruction manual, please download from the URL below.

http://www.mitsubishielectric.co.jp/fa/download/search.do?mode=manual&kisyu=/pror

− 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 (compliant with JEC2500-2010). Otherwise, there is a risk of reducing the performance and life of the product.
  - Ambient temperature: –20 to +60 °C
    The state where dew condensation or freezing does not occur.
  - Relative humidity: 30 to 80 % on daily average
  - Altitude: 2000 m or lower
  - The equipment must not be exposed to abnormal vibration, shock, inclination, or magnetic fields.
  - The equipment must not be exposed to harmful smoke/gas, saline gas, water droplets or vapour, excessive dust or fine powder, explosive gas or fine powder, wind & rain.

[Installation, wiring work]

Danger

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

Caution

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

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

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

[Operating and Setting the equipment]

Danger

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

Caution

- The equipment must be used within the following range limits (compliant with JEC2500-2010). 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: 0 to +40°C (-10 to 50°C is allowable temporarily within few hours a day, but use under the state where dew condensation or freezing does not occur.)
  - Relative humidity: 30 to 80% on daily average
  - Altitude: 2000 m or lower
  - The state where abnormal vibration, shock, inclination, magnetic field are not applied
  - The state where it is not exposed to harmful smoke/gas, saline gas, water droplet or vapor, excessive dust or fine powder, explosive gas or fine powder, wind & rain
- While energized, do not tamper with or remove any components other than those which have been designated. Otherwise, there is a risk of failure, malfunction, or maloperation.
- While energized, do not draw out the internal unit (subunit). Otherwise, there is a risk of electric shock, injury, failure, malfunction, or maloperation.
- When changing the setting value during the energized state, ensure that all trip circuits are locked in order not to operate. Otherwise, there is a risk of malfunction.

[Maintenance and Inspection]

Danger

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

Caution

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

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

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

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

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

- Control power supply voltage Rated voltage ±2%

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

[Repair and modification]

Caution

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

[Disposal]

Caution

- Disposal must take place in accordance with the applicable legislation

Guarantee

1. Guarantee period

The guarantee period of this product should be one year after delivery, unless otherwise specified by both parties.

2. Scope of guarantee

When any fault or defect is detected during the period of guarantee and such fault or defect is proved to be caused apparently at the responsibility of MITSUBISHI ELECTRIC CORPORATION, the defective unit concerned will be repaired or replaced with substitute with free of charge.

However, the fee for our engineer dispatching to site has to be covered by the user.

Also, site retesting or trial operation caused along with replacing the defect units should be out of scope of our responsibilities.

It is to be acknowledged that the following faults and defects should be out of this guarantee.

(1) When the faults or defects are resulted from the use of the equipment at the range exceeding the condition/environment requirements stated in the catalogue and manual.

(2) When the faults or defects are resulted from the reason concerning without our products.

(3) When the faults or defects are resulted from the modification or repair carried out by any other entity than MITSUBISHI ELECTRIC CORPORATION.

(4) When the faults or defects are resulted from a phenomenon which cannot be predicted with the science and technology put into practical use at the time of purchase or contract

(5) In case of integrating our products into your equipment, when damages can be hedged by the proper function or structure in the possession of your equipment which should be completed according to the concept of the de fact standard of industry.

(6) In case of that the faults or defects are resulted from un-proper application being out of instruction of MITSUBISHI ELECTRIC CORPORATION.

(7) In case that the faults or defects are resulted from force majeure such a fire or abnormal voltage and as an act of God such as natural calamity or disaster.

3. Exclusion of loss in opportunity and secondary loss from warranty liability

Regardless of the gratis warranty term, MITSUBISHI ELECTRIC CORPORATION shall not be liable for compensation of damages caused by any cause found not be the responsibility of MITSUBISHI ELECTRIC CORPORATION, loss in opportunity, lost profits incurred to the user by failures of MITSUBISHI ELECTRIC CORPORATION products, special damages and secondary damages whether foreseeable or not, compensation for accidents, and compensation for damages to products other than MITSUBISHI ELECTRIC CORPORATION products and other tasks.

4. Applications of products

(1) The user is requested to confirm the standards, the regulations and the restrictions which should be applied, in case of utilizing products described in this catalogue and another one in combination.

Also, the user is requested to confirm the suitability of our products to your applied system or equipment or apparatus by yourself.

MITSUBISHI ELECTRIC CORPORATION shall not be liable for any suitability of our products to your utilization.

(2) This MITSUBISHI ELECTRIC CORPORATION products described in the catalogue have been designed and manufactured for application in general industries, etc. Thus, application in which the life or an asset could be affected by special application such as medical system for life-sustaining, in nuclear power plants, power plants, aerospace, transportation devices(automobile, train, ship, etc.) shall be excluded from the application. In addition to above, application in which the life or an asset could be affected by potentially chemical contamination or electrical interference and also in which the circumstances and condition are not mentioned in this catalogue shall be excluded from the application.

Note even if the user wants to use for these applications with user's responsibility, the user to be requested to approve the specification of MITSUBISHI ELECTRIC CORPORATION products and to contact to the technical section of MITSUBISHI ELECTRIC CORPORATION prior to such applications.
If the user applies MITSUBISHI ELECTRIC CORPORATION products to such applications without any contact to our technical section, MITSUBISHI ELECTRIC CORPORATION shall not be liable for any items and not be insured, independently from mentioned in this clause.
(3) In using MITSUBISHI ELECTRIC CORPORATION product, the working conditions shall be that the application will not lead to a major accident even if any problem or fault occur, and that backup or duplicate system built in externally which should be decided depend on the importance of facility, is recommended.
(4) The application examples given in this catalogue are reference only and you are requested to confirm function and precaution for equipment and apparatus and then, use our products.
(5) The user is requested to understand and to respect completely all warning and caution items so that unexpected damages of the user or the third party arising out of un-correct application of our products would not be resulted.

5. Onerous repair term after discontinuation of product
(1) MITSUBISHI ELECTRIC CORPORATION shall accept onerous product repairs for 7(seven) years after production of the product is discontinued. (However, please consider the replacement of products after 15 years have been passed from ex-work of products.)
(2)Product supply (including repair parts) is not available after production is discontinued.

6. Changes in product specification
The specification given in the catalogue, manuals or technical documents are subject to change without prior to notice.

7. Scope of service
The technical service fee such as engineer dispatching fee is excluded in the price of our products.
Please contact to our agents if you have such a requirement.

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.

Introduction

Thank for your purchasing MITSUBISHI ELECTRIC ***MELPRO***™ – D Series Digital Protection Relay.
Please read this instruction manual carefully to be familiar with the functions and performances enough to use the product properly.
It is necessary to forward this instruction manual to end users and a person in charge of maintenance.

In regard to the instruction manual for PC software, read the following document.

Title of document	Document No.
MELPRO-D Series Protection Relay PC-HMI Instruction Manual	JEP0-IL9504

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1. General description

Mitsubishi Electric ***MELPRO***™ – D Series is a digital protection relay product with a microprocessor for protection of high/extra-high voltage electric power systems.
With its improved functions, such as PLC (Programmable Logic Controller), data saving at the time when relay elements are operated, and measurement of input value, this series of protection relay allows stable and effective control and monitoring of electric power systems as well as high-reliable protection.

High accurate digital computation
The digital computation with high-speed sampling minimizes the effect of higher harmonics, etc., which enables high accurate protections. As this computation is implemented in software, stable operation without aging is obtained.

Advanced self-diagnosis function improves reliability
The relay continuously monitors electronic circuits from input to output so that it can detect internal component failure, which enables to improve reliability.

Measurement functions
The input values of the relay (e.g. current, voltage, phase and frequency) can be measured at a steady state, which is useful for energy-saving management. Measurement items differ depending on the types of the relay units.

Data saving functions
Various record functions as shown below are useful for fault investigations.
(1) The data savings of input value at the time when relay element are operated.
(2) The operation logs of the relay.

Programmable output contacts with PLC provide flexibility
The operation of output contacts can be set by combining the detection or definitive signals of the protection elements with PLC which incorporates logic circuit (e.g. OR, AND, NOT, and flip-flop) and timer (e.g. on-delay, off-delay, and one-shot). This is useful for easy designing of sequential circuits and reducing labor-hours of wiring.

Forced contact test enables checking of relay sequence
The output contacts can be forced to operate in the test menu, which enables checking of relay sequence easily.

Easy replacement
The cut-out dimensions of panel are the same as MULTICAP-C series or the old model of MELPRO-DASH series. Replacing an existing relay with this new type is easy. (There are some exceptions.)

Easy maintenance
The relay adopts draw-out unit mechanisms with automatic CT shorting at drawing, thereby making it easy to maintain the relay.

Diverse operation and reset characteristics
The relay incorporates various operation and reset characteristics including the standards of IEC 60255-3, which can be adopted to the protection of various types of electric systems.

Communication network (will be supported in the future)
The relay can build a network system which allows monitoring and control of measurement values, operation status, and setting changes, etc., from a remote location. This leads to labor-saving of maintenance.

2. Structure

2.1. Front view of relay

For the details about front panel, refer to Section 5.1.

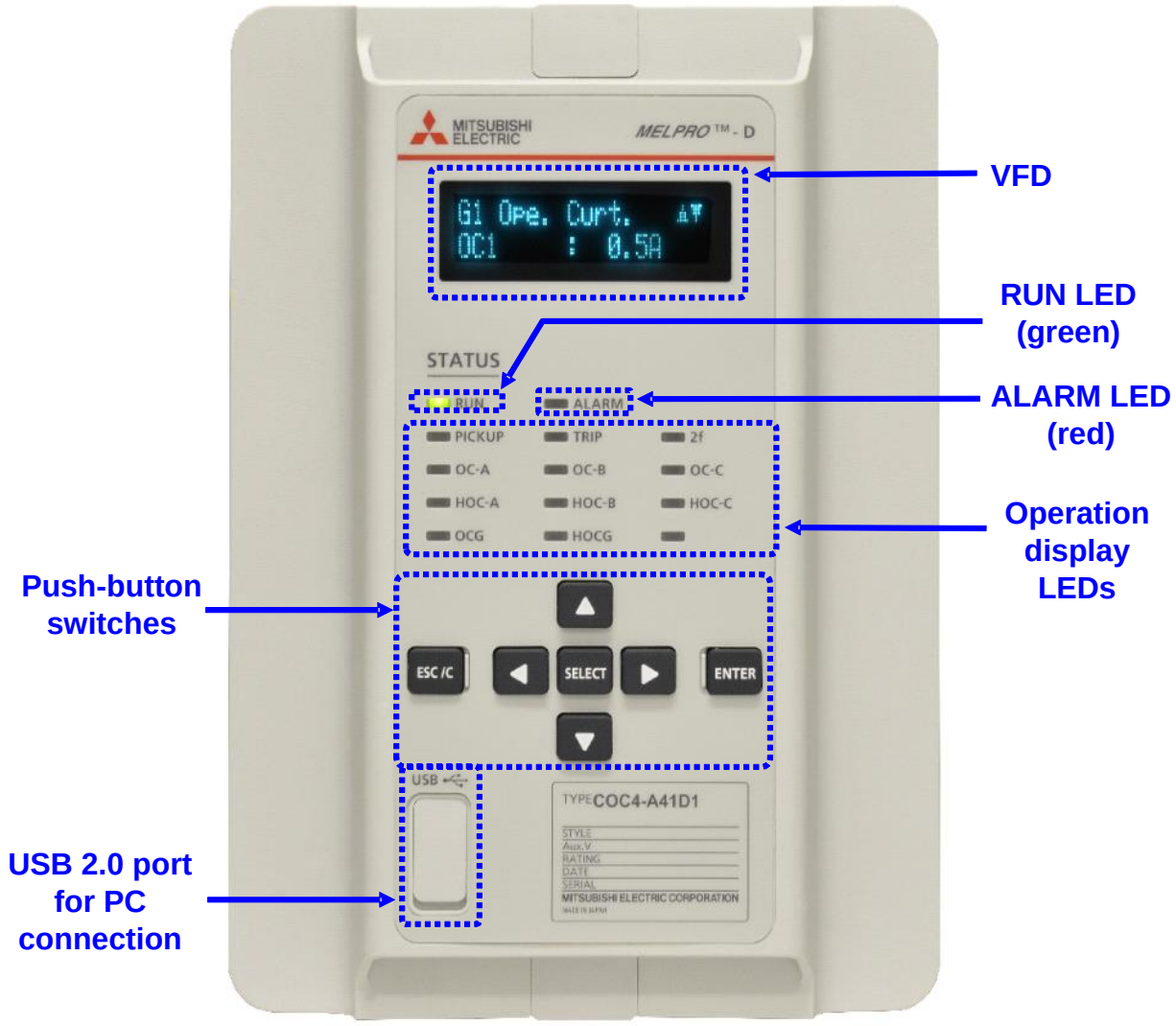


Fig. 2-1 Front view of relay

2.2. Terminal layout on the back of relay

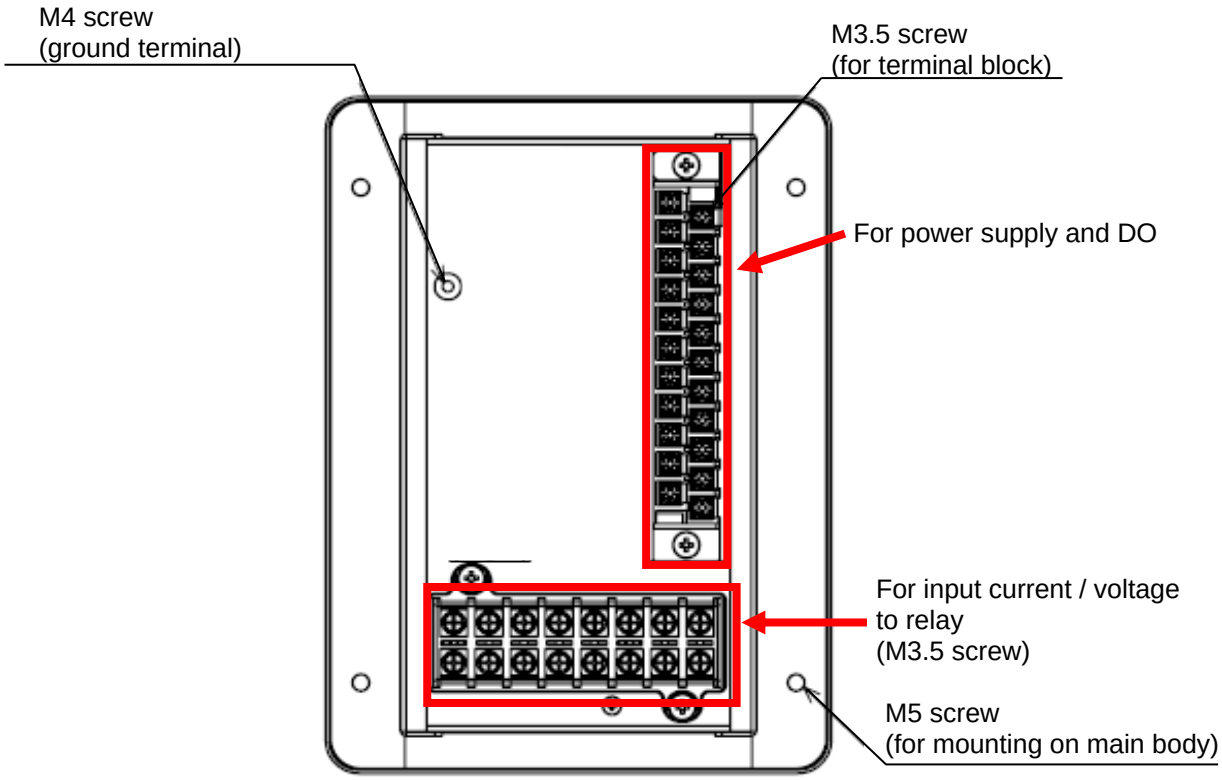


Fig. 2-2 **Terminal layout on the back of relay**

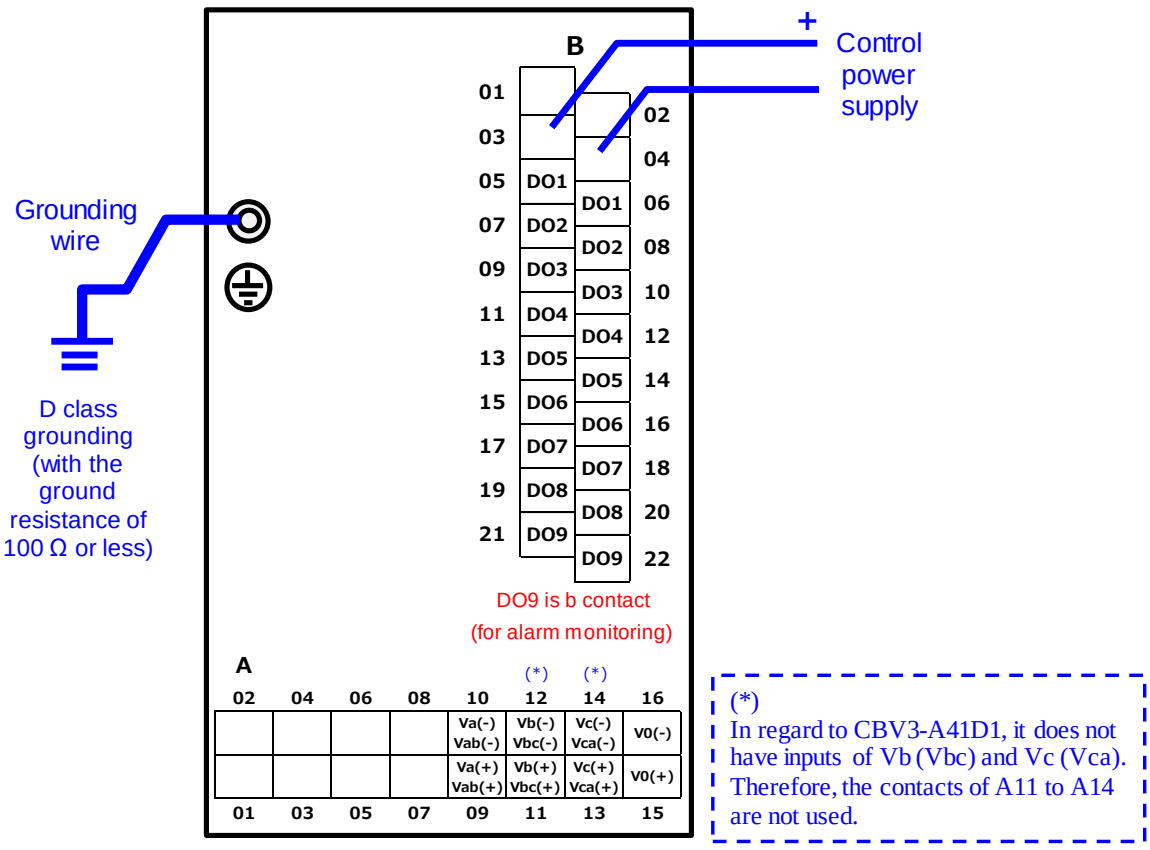


Fig. 2-3 Terminal number on the back of relay

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

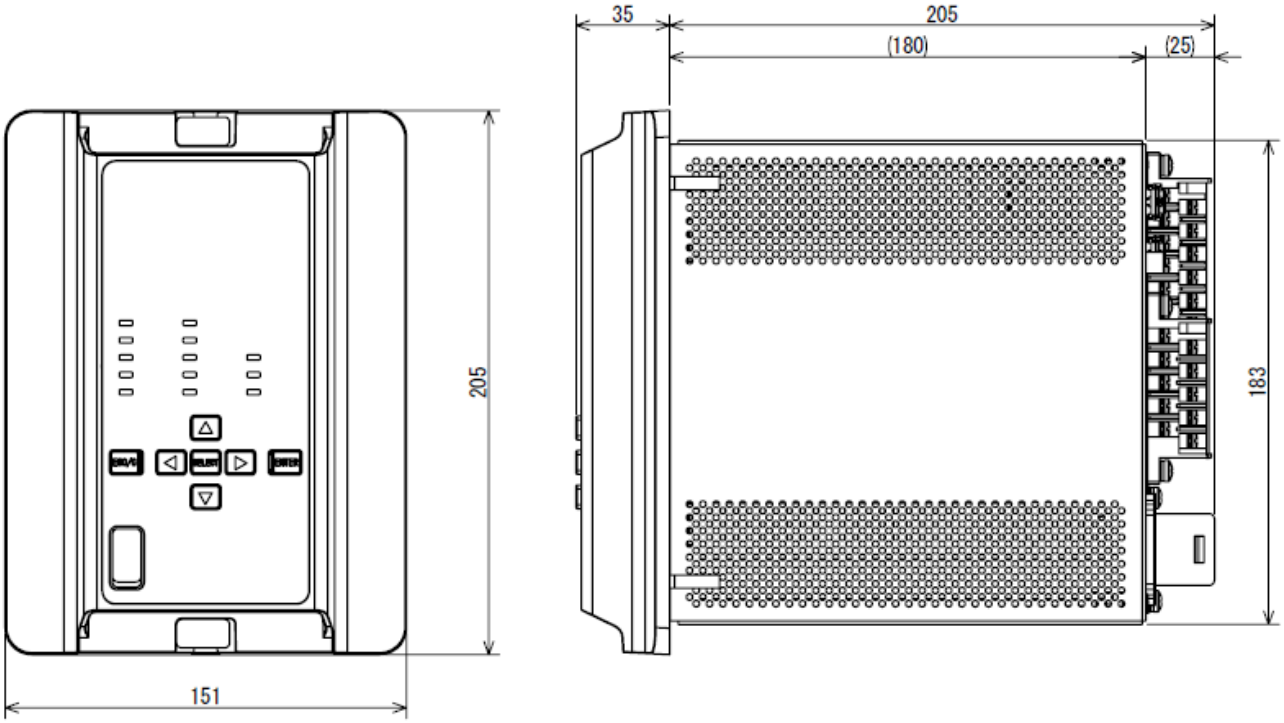


Fig. 2-4 Dimensions of relay

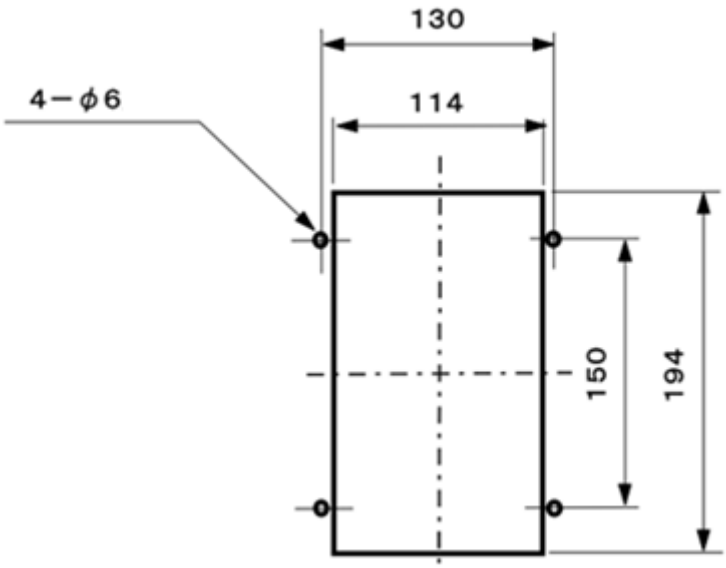


Fig. 2-5 Cut-Out dimensions of panel

2.4. External view of relay

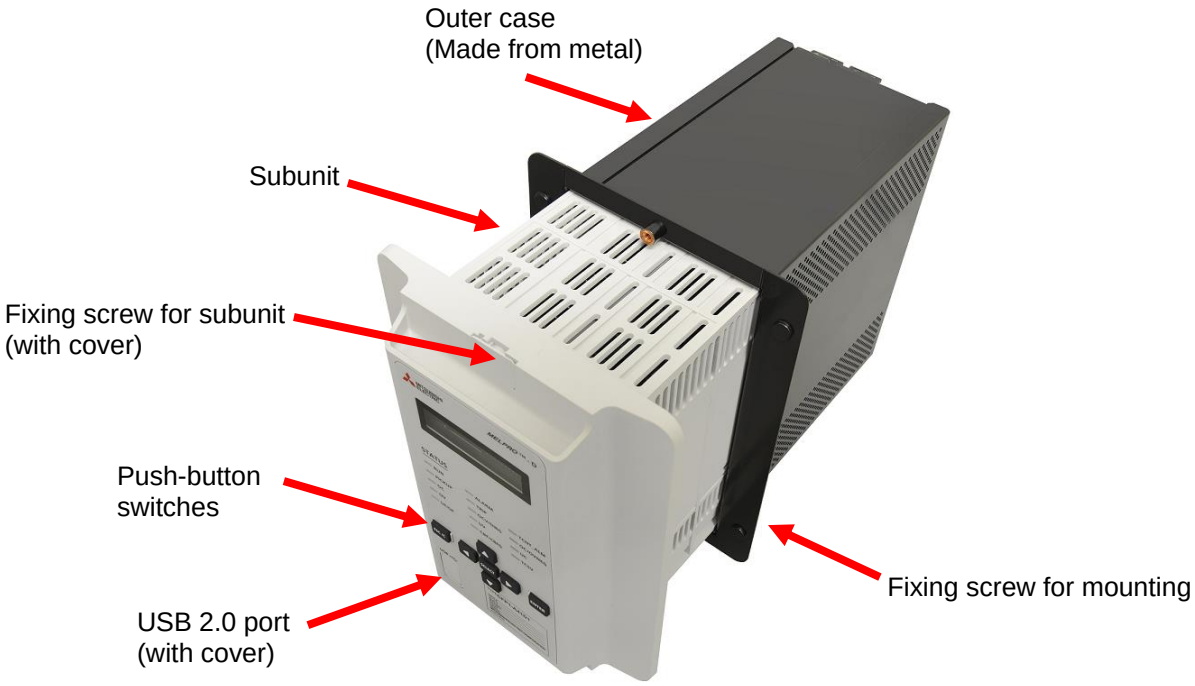


Fig. 2-6 External view of relay

3. Handling, Mounting

3.1. Unpacking

Usually this relay is packed in a case for transportation. However, it may occur that only the sub-unit is transported independently for the convenience at repair. In such a case, fully brush off the dust, dirt, etc. adhered to the sub unit after completion of unpacking, and further visually check that the parts mounted on the front panel or built in the sub unit are not damaged.

3.2. Transportation and storage

To carry the equipment within the place of use, handle it carefully so that the parts installed on the front panel of the sub-unit or built-in parts cannot be deformed or broken.

3.3. How to draw sub-unit out

The relay has 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:

- Open control power supply of the relay (Note: Take care that the appropriate circuit is opened.)
- Shunt / Isolate the CT circuit
- Lock out the tripping circuit including breakers etc.
- Disconnect the main control circuits

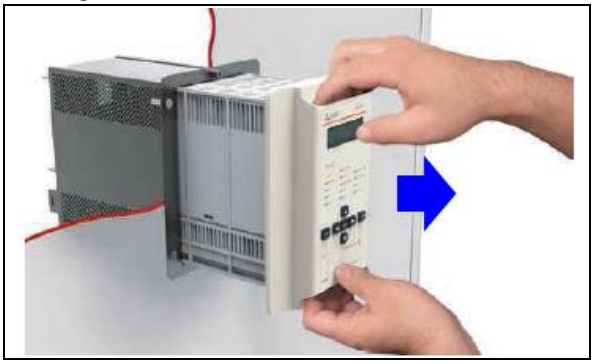
As an additional precaution, the CT circuit is provided with an automatic short-circuiting mechanism. This will ensure that the CT secondary circuit is not opened when the sub-unit is removed even if the CT circuits have not been shunted.

3.3.1. Procedures for drawing out subunit

(1) Removing screws

When drawing out the subunit from the outer case, open upper & lower screw covers at the front side of the subunit and detach both screws.

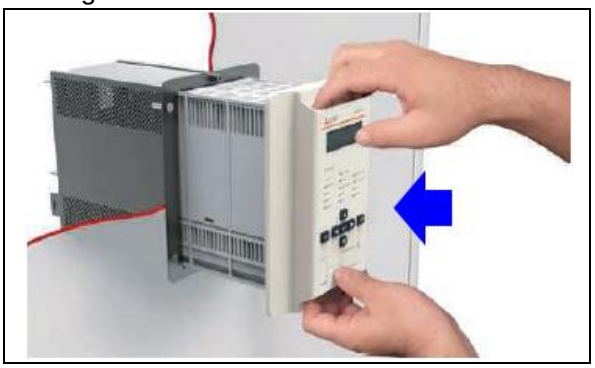
(2) Drawing out the subunit



Draw out subunit horizontally by using fingers on the upper & lower grooves of it.

3.3.2. Procedures for housing subunit

(1) Inserting the subunit

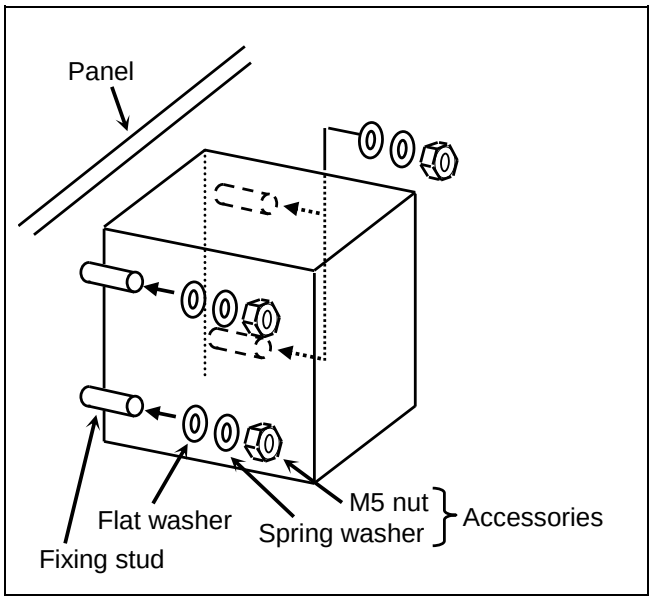


Insert subunit into the outer case horizontally by using fingers on the upper & lower grooves of it. Ensure that there is no gap between front side of the subunit and outer case.

(2) Fixing the screws

Tighten upper & lower screws and fix the subunit to the outer case.
After that, close screw covers.

3.4. Mounting

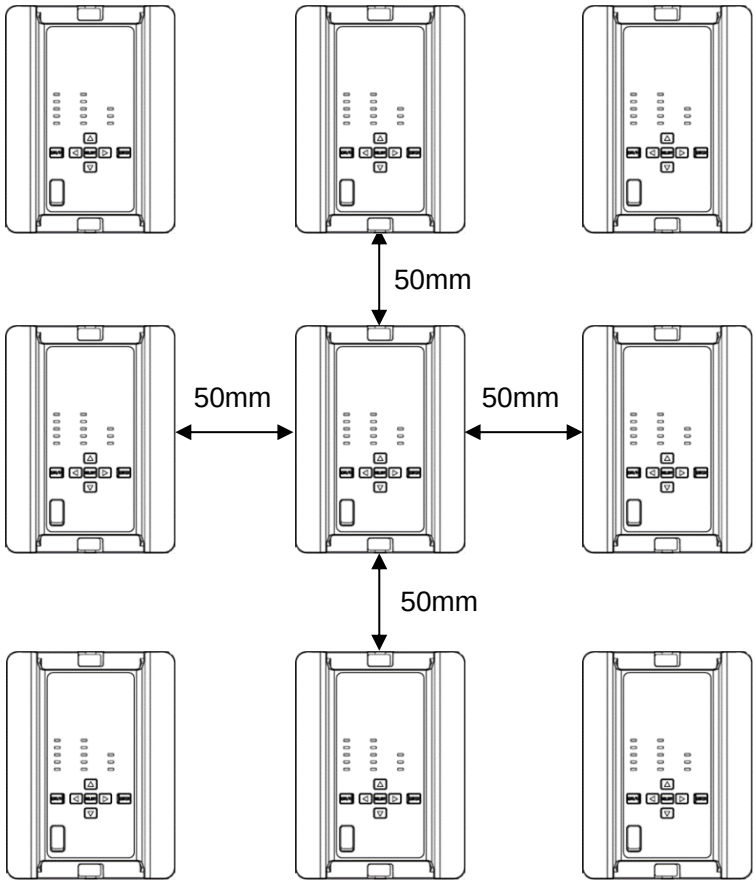


When inserting this relay into control panel, take care in order not to damage it.
After inserting, fix this relay with washers and nuts which are supplied with the product.

Section 2.3 explains Cut-Out dimensions of panel.

3.5. Distance between two devices

If you install more than one relay devices in a control panel, please leave 50 mm between one device and another.



4. Connection

4.1. Precautions for wiring work

(1) Multiplexing

Important facilities should be provided with fail-safe measures such as dual or duplex system in order to improve reliability of the facilities.

(2) Effects of external surge

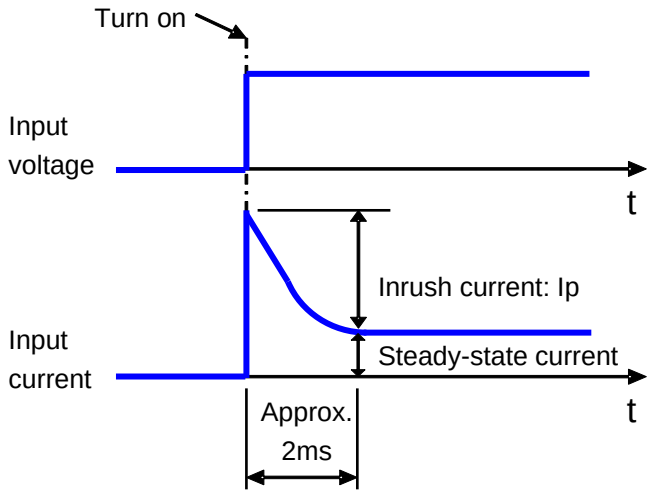
Some types of surge with a certain condition may negatively affect the relay. If so, take it into account to install surge absorbers. (MF type surge absorbers made by Mitsubishi Electric, for example.)

(3) Guarantee of control power supply against power interruption

The control power supply of the relay is not guaranteed against power interruption. When you do not have an uninterruptible power supply (UPS), please purchase it that is made by Mitsubishi Electric or commercially available. When you select UPS, please confirm rated values, ambient temperature, and other service conditions.

(4) Inrush current of control power supply

Since inrush current may flow in the relay when the control power supply is turned on as shown in the figure below, make consideration of this point when selecting the breaker for the control power supply circuit.



Input voltage	Inrush current: Ip
DC100V	Approx. 20A or less
DC220V	Approx. 55A or less
AC100V	Approx. 25A or less
AC220V	Approx. 65A or less

Fig. 4-1 Inrush current of control power supply

(5) Self-diagnosis output circuit

In order to be able to continue monitoring even if the built-in power fuse is blown, the self-diagnosis output circuit adopts normally-closed contact which is excited (opened) at the time of normal condition of monitoring. Therefore, connect the timer to the external wiring. For details, refer to Fig. 4-2.

(6) Trip circuit

There are two kinds of output contacts for the trip circuits and the control circuits. Please keep in mind that the output contacts for control circuits cannot be used for the trip circuit. (If used, the contact may burn.)

Connect the pallet contact (52a) of the circuit breaker to the trip circuit.

(7) Ground circuit

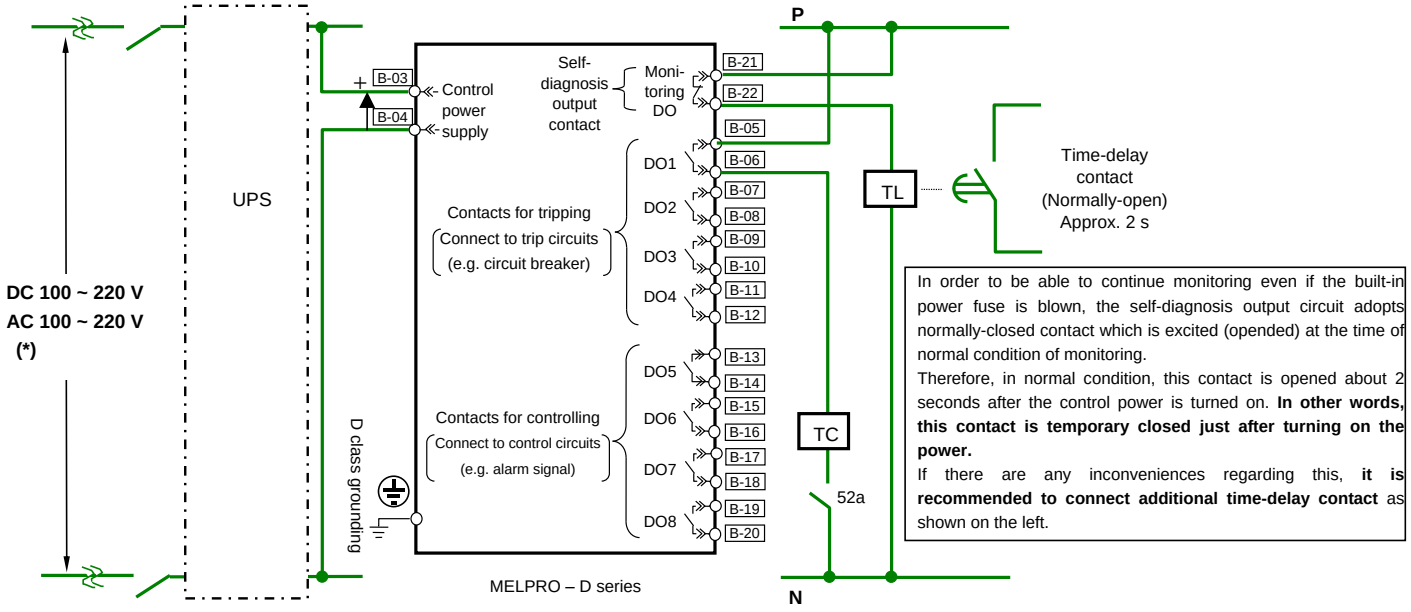
Be sure to earth the ground terminal located on the back of the relay with D class grounding method whose ground resistance is 100 Ω or less.

4.2. Terminal layout

Regarding to the terminal layout, refer to Section 2.2. The screw size of each terminal is M3.5. Recommended wire size is 2mm^2 or less.

4.3. External connection

4.3.1. Connection example of control circuit



(*) Refer to Section 4.1-(3) "Guarantee of control power supply against power interruption".

Fig. 4-2 Connection example of control power supply and self-diagnosis output circuit.

4.3.2. Connection example of input circuit

This figure shows concept of the connection to the relay. Therefore, the position or condition of CT, VT, and other devices sometimes differs from the actual state.

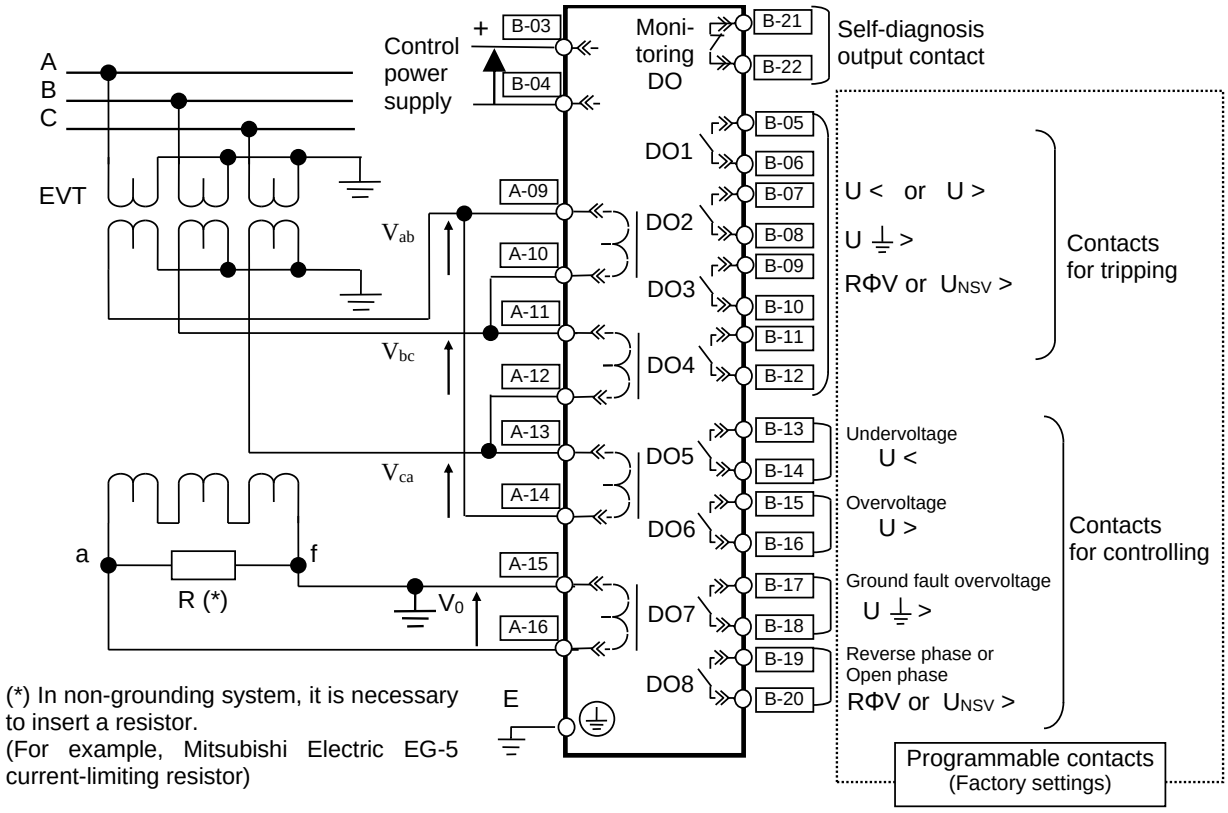


Fig. 4-3 CBV2-A41D1 Example of AC input circuit

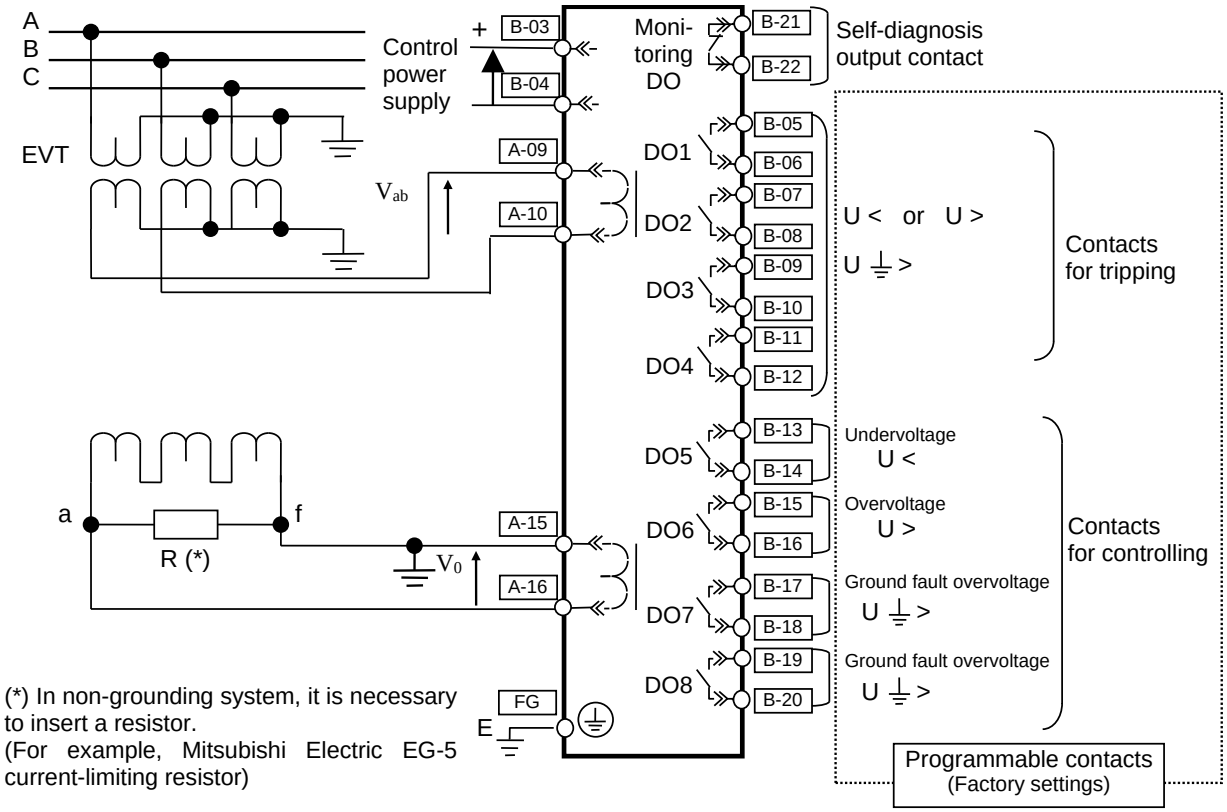


Fig. 4-4 CBV3-A41D1 Example of AC input circuit

5. Human machine interface

There are three 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) is described in a separate volume. Please refer to the following document.

Title of document	Document No.
MELPRO-D Series Protection Relay PC-HMI Instruction Manual	JEP0-IL9504

5.1. Pushbutton switches and indication display

This section describes the pushbuttons and indication display on the front panel.

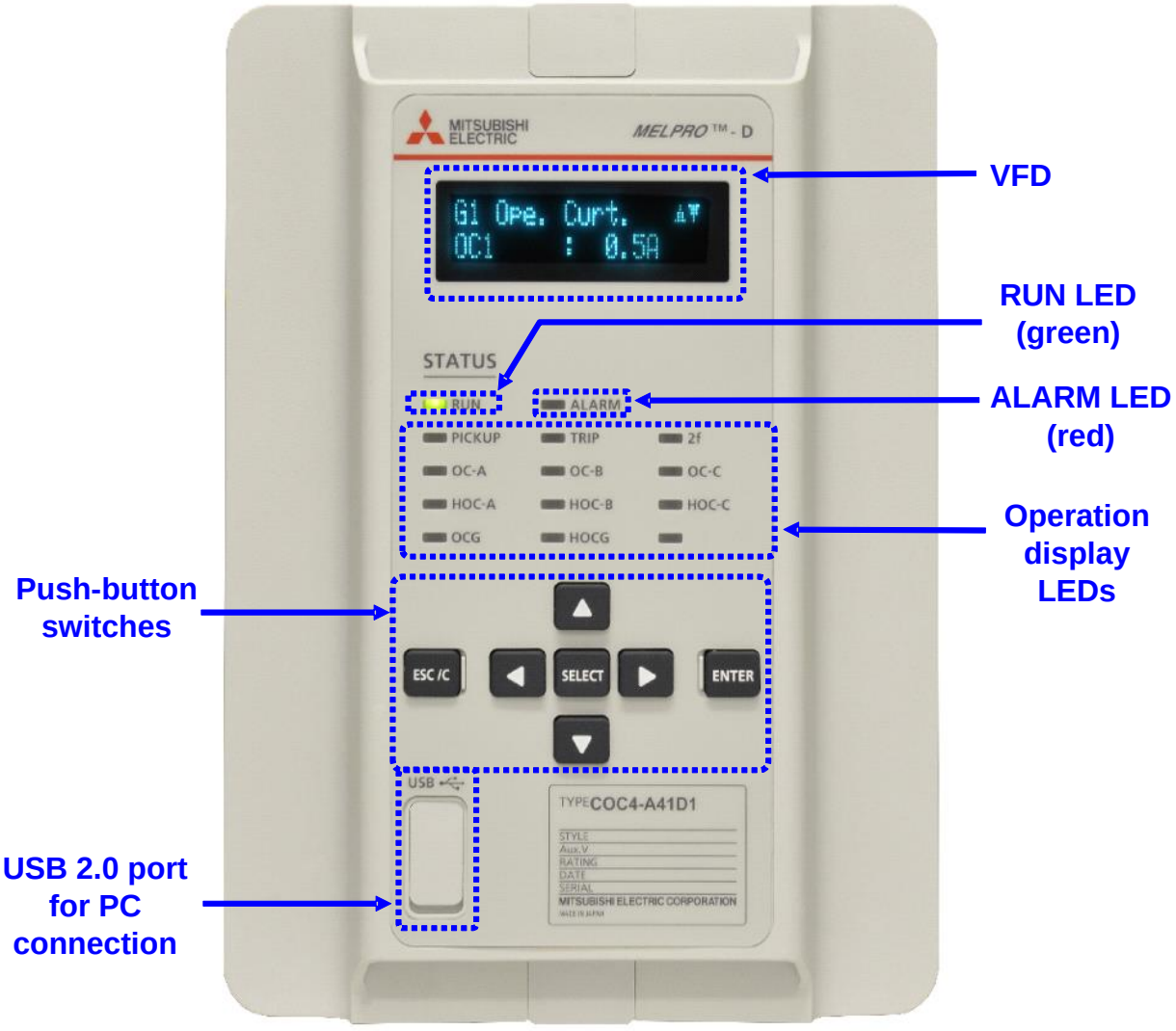


Fig. 5-1 Front view of relay

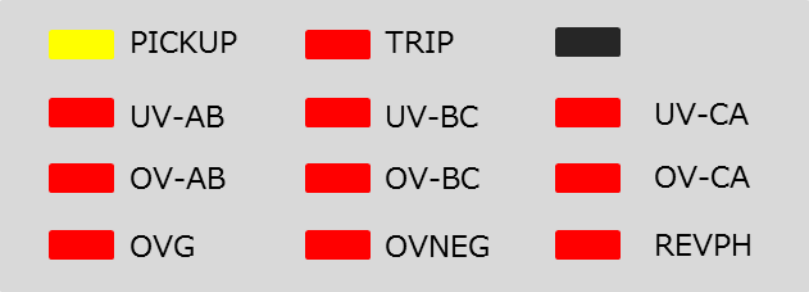


Fig. 5-2 Operation display LEDs of CBV2-A41D1

Fig. 5-3 Operation display LEDs of CBV3-A41D1

Table 5-1 Description of front panel

Name				Description
VFD (Vacuum Fluorescent Display) (18 characters x 2 lines)				Shows various menus and values of the DISPLAY/SETTING mode. If you has not operated any push buttons for more than 30 minutes, the VFD is automatically turned off. In the METERING menu, you can expand the character size.
RUN LED			Green	Shows the result of constant supervision. Illuminated for a normal condition. When this LED light is turned off, the relay functions are not working.
ALARM LED			Red	Shows the result of constant supervision. Illuminated for an abnormal condition.
Operation display LED		PICKUP	Yellow	Illuminated for detection of protection element (OR of all elements). This LED will be turned off after resetting.
		TRIP	Red	Illuminated when the definitive signal (TRIP signal) of protection element is issued (OR of all elements). (*)
	CBV2-A41D1	UV-AB	Red	Illuminated when the definitive signal of UV1-A/UV2-A is issued. (*)
		UV-BC	Red	Illuminated when the definitive signal of UV1-B/UV2-B is issued. (*)
		UV-CA	Red	Illuminated when the definitive signal of UV1-C/UV2-C is issued. (*)
		OV-AB	Red	Illuminated when the definitive signal of OV1-A/OV2-A is issued. (*)
		OV-BC	Red	Illuminated when the definitive signal of OV1-B/OV2-B is issued. (*)
		OV-CA	Red	Illuminated when the definitive signal of OV1-C/OV2-C is issued. (*)
		OVG	Red	Illuminated when the definitive signal of OVG1/OVG2 is issued. (*)
		OVNEG	Red	Illuminated when the definitive signal of NOV1/NOV2 is issued. (*)
		REVPH	Red	Illuminated when the definitive signal of REVPH is issued. (*)
	CBV3-A41D1	UV	Red	Illuminated when the definitive signal of UV1/UV2 is issued. (*)
		OV	Red	Illuminated when the definitive signal of OV1/OV2 is issued. (*)
		OVG	Red	Illuminated when the definitive signal of OVG1/OVG2 is issued. (*)
Pushbutton switch		SELECT		• Moves to the menu one level lower • Confirms selection of input item • Confirms input value • Reconfirms after pressing ENTER in SETTING mode
		ENTER		• Starts operation in SETTING mode
		ESC/C		• Turns off VFD • Turns off operation indicator LEDs by holding down (for 3s or longer)
		◀		• Moves to the menu one level higher • Moves to digit on the left in the value input screen • Discards the input value in the input screen and moves to the menu one level higher
		▶		• Moves to digit on the right in the value input screen
		▼ ▲		• Moves to the menu above/below • Increments/decrements the input value in the value input screen
USB2.0 port				For PC connection (Commercial USB cable is available)

(*) The LED continues lighting after resetting the protection element. You can turn the LED off by pushing ESC/C button if the trouble has been resolved.

5.2. List of menus

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

Table 5-2 List of menu

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

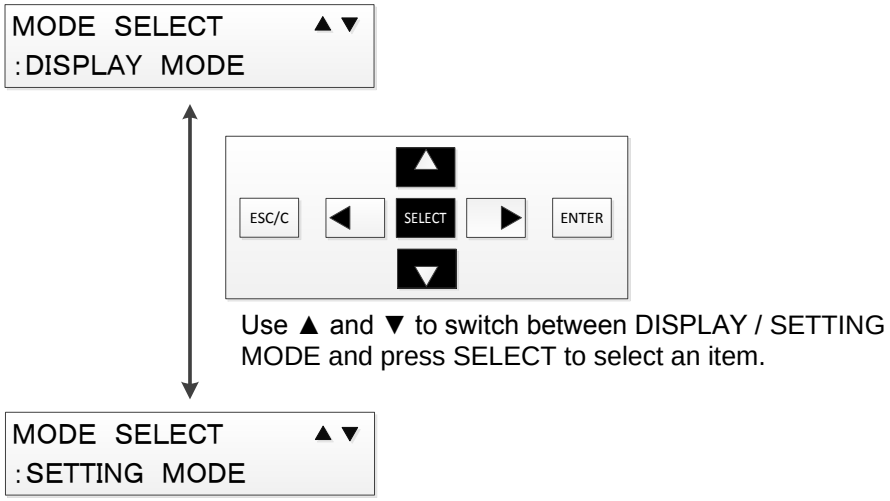
Menu		Operation mode	
		DISPLAY	SETTING
Status (STATUS)	Clock (CLOCK)	○	-
	Measured analog value (METERING)	○	-
	DI/DO status (DIGITAL I/O)	○	-
	Trip counter (TRIP COUNTER)	○	-
	Device name (DEVICE NAME)	○	-
Record (RECORD)	Fault record (FAULT RECORD)	○	-
	Event record (EVENT RECORD)	○	-
	Access record (ACCESS RECORD)	○	-
	Alarm record (ALARM RECORD)	○	-
Setting (SETTING)	Active group (ACTIVE WG)	○	Θ
	Group 1 setting (G1)	○	Θ
	Group 2 setting (G2)	○	Θ
Configuration (CONFIG)	Communication setting (COMMUNICATION)	○	Θ
	Clock adjustment (CLOCK ADJUST)	-	Θ
	Analog value display switching (METERING)	○	Θ
	Trip counter (TRIP COUNTER)	○	Θ
	Disturbance record (DISTURBANCE)	○	Θ
	Password use/unuse (PASSWORD USE)	-	Θ
	Password registration (PASSWORD REGIST)	-	Θ
Test (TEST)	DO contact test (CONTACT TEST)	-	Θ
	Test mode (MODE)	-	Θ
	LED/VFD lighting test (LED/VFD TEST)	-	Θ
Clear record (RECORD-CLR)	Clear fault record (FAULT REC CLEAR)	-	Θ
	Clear alarm record (ALARM REC CLEAR)	-	Θ
	Clear event record (EVENT REC CLEAR)	-	Θ

5.3. Operation method

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

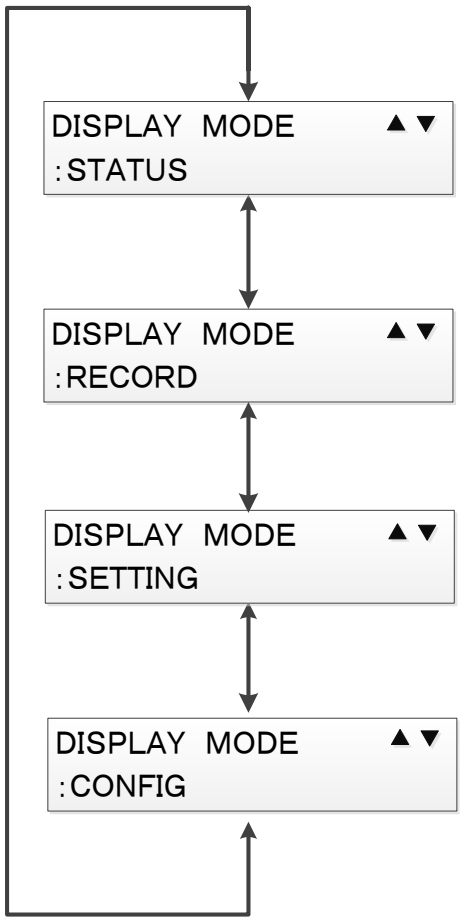
5.3.1. DISPLAY/SETTING mode selection

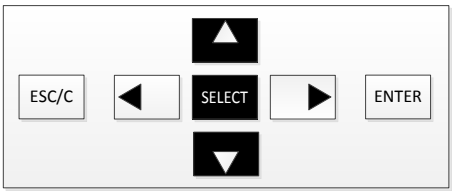
Press a key except for ESC/C when VFD is OFF to show the DISPLAY/SETTING mode selection screen. The DISPLAY and SETTING modes offer different sets of menus available.
For the details about the menus in the respective modes, see Table 5-2.



5.3.2. DISPLAY mode menu operations

This subsection describes the menu operations in the DISPLAY mode.
The menu screen has four 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 5-2.

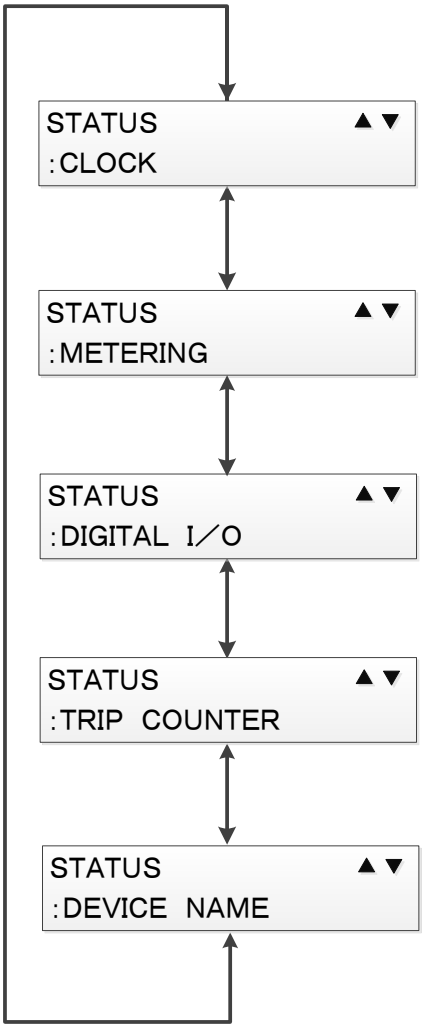


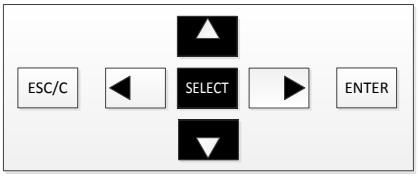


Use ▲ and ▼ to switch between items and press SELECT to select an item.

5.3.2.1. 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.

5.3.2.1.1. Clock (CLOCK) menu

[Operation path] DISPLAY MODE > STATUS > CLOCK

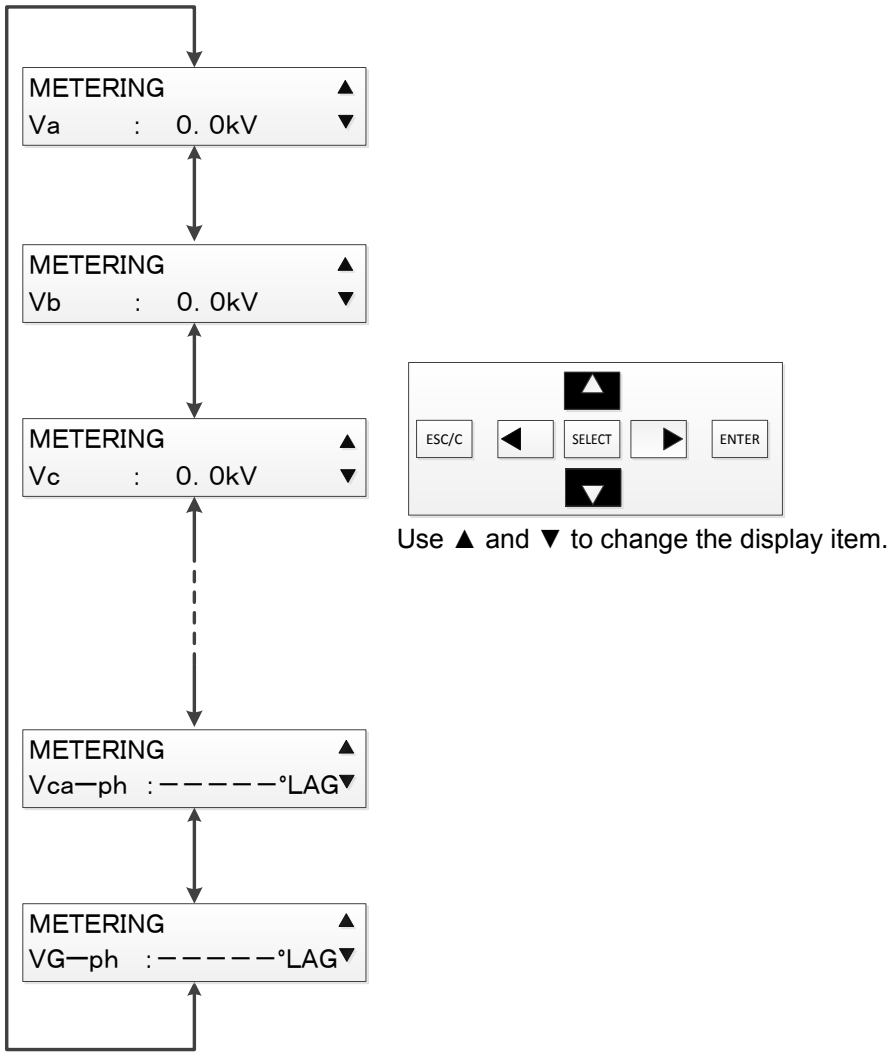
The clock (CLOCK) menu allows viewing of the current time and synchronization type.

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

5.3.2.1.2. Measured analog value (METERING) menu

[Operation path] DISPLAY MODE > STATUS > METERING

The Measured analog 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 5.3.4.2.3.



Note: This is an example.

By pressing SELECT, you can expand the character size of the measured value.
Pressing SELECT again goes back to the original state.

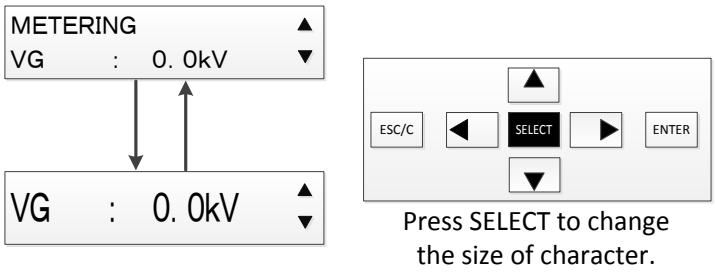


Table 5-3 Measured value display items

- CBV2-A41D1

No.	Signal name	Unit (primary/secondary)
1	Va	kV / V
2	Vb	kV / V
3	Vc	kV / V
4	Vab	kV / V
5	Vbc	kV / V
6	Vca	kV / V
7	VG	kV / V
8	3V0	kV / V
9	V1	kV / V
10	V2	kV / V
11	Va-ph	°LAG / °LAG
12	Vb-ph	°LAG / °LAG
13	Vc-ph	°LAG / °LAG
14	Vab-ph	°LAG / °LAG
15	Vbc-ph	°LAG / °LAG
16	Vca-ph	°LAG / °LAG
16	VG-ph	°LAG / °LAG

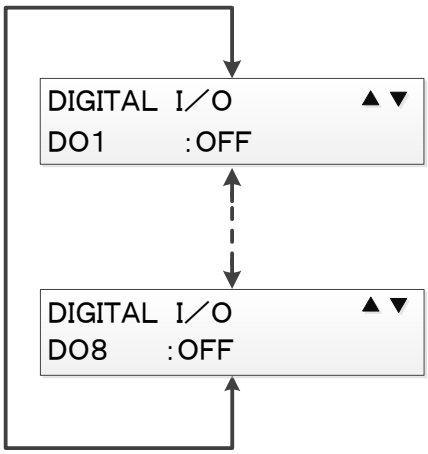
- CBV3-A41D1

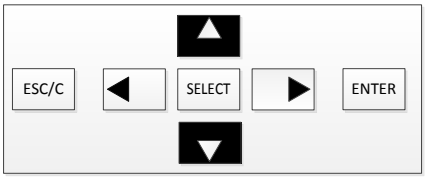
No.	Signal name	Unit (primary/secondary)
1	V	kV / V
2	VG	kV / V

5.3.2.1.3. 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.





Use ▲ and ▼ to change the display item

Table 5-4 Show DI/DO status Display items

No.	Signal name
1	DO1
2	DO2
3	DO3
4	DO4
5	DO5
6	DO6
7	DO7
8	DO8

5.3.2.1.4. 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.

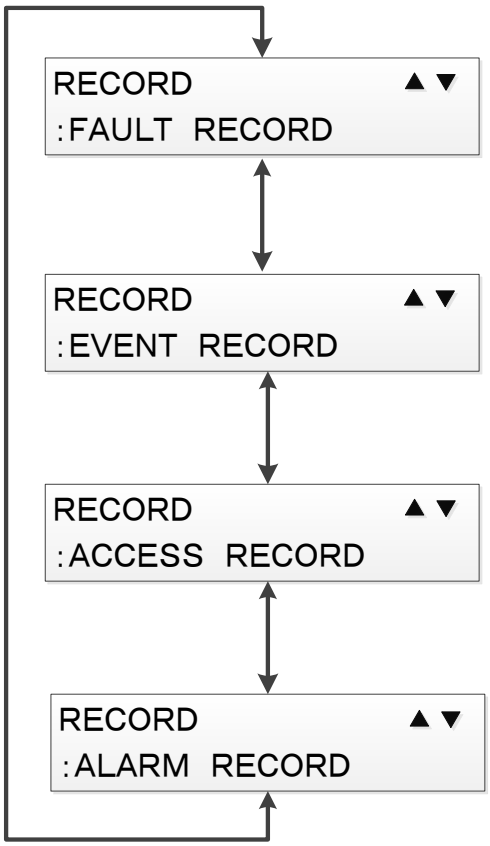
5.3.2.1.5. Device name (DEVICE NAME) menu

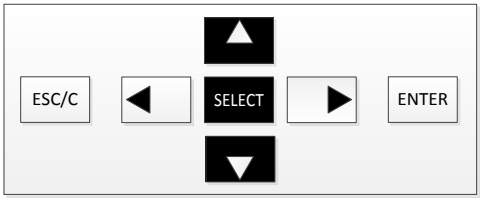
[Operation path] DISPLAY MODE > STATUS > DEVICE NAME

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

5.3.2.2. 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)



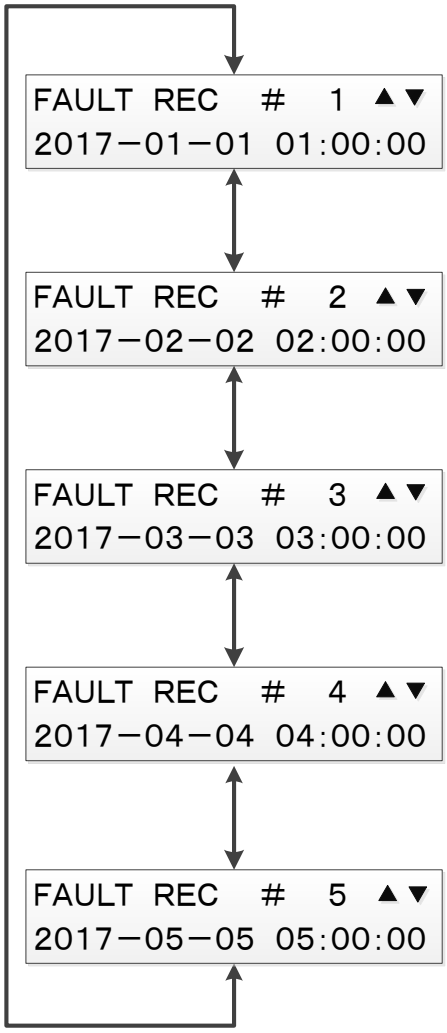


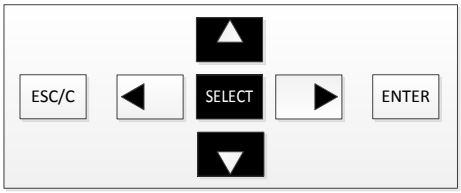
Use ▲ and ▼ to switch between items and press SELECT to select an item.

5.3.2.2.1. 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.

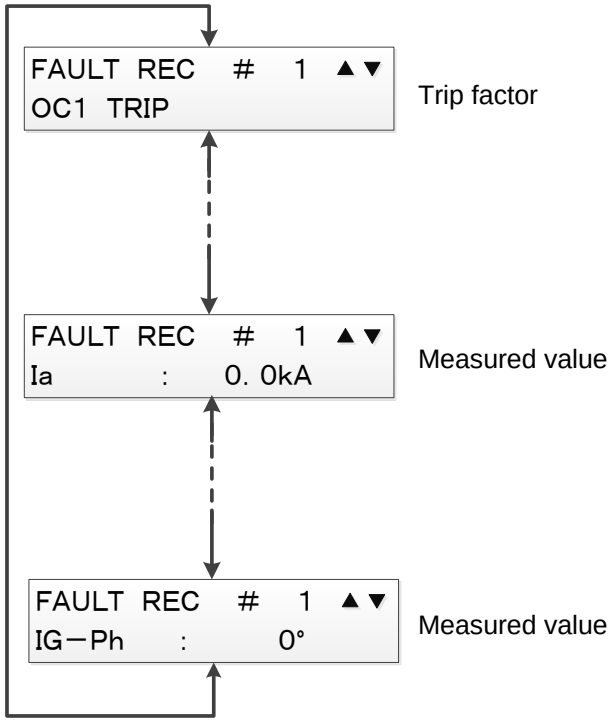




Use ▲ and ▼ to switch between items and press SELECT to select an item.

Note: This is an example.

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



Note: This is an example.

Table 5-5 Elements of fault records (CBV2-A41D1)

Element name displayed
UV1-A Trip
UV1-B Trip
UV1-C Trip
UV2-A Trip
UV2-B Trip
UV2-C Trip
OV1-A Trip
OV1-B Trip
OV1-C Trip
OV2-A Trip
OV2-B Trip
OV2-C Trip
OVG1 Trip
OVG2 Trip
OVNEG1 Trip
OVNEG2 Trip
REVPH Trip

Table 5-6 Elements of fault records (CBV3-A41D1)

Element name displayed
UV1 Trip
UV2 Trip
OV1 Trip
OV2 Trip
OVG1 Trip
OVG2 Trip

Table 5-7 Measured values of fault records (CBV2-A41D1)

No.	Signal name	Unit
1	Va	kV
2	Vb	kV
3	Vc	kV
4	Vab	kV
5	Vbc	kV
6	Vca	kV
7	VG	kV
8	3V0	kV
9	V1	kV
10	V2	kV
11	Va-ph	°LAG
12	Vb-ph	°LAG
13	Vc-ph	°LAG
14	Vab-ph	°LAG
15	Vbc-ph	°LAG
16	Vca-ph	°LAG
16	VG-ph	°LAG

Table 5-8 Measured values of fault records (CBV3-A41D1)

No.	Signal name	Unit
1	V	kV
2	VG	kV

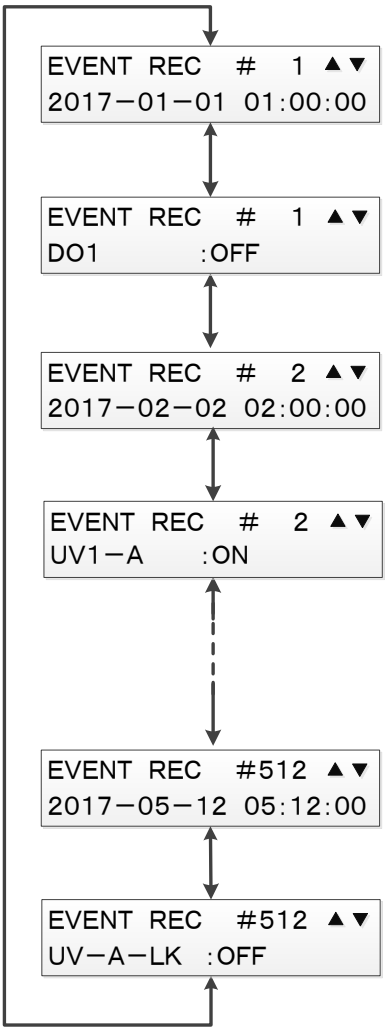
5.3.2.2.2. Event record (EVENT RECORD) menu

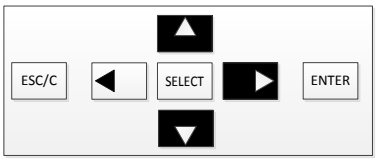
[Operation path] DISPLAY MODE > RECORD > EVENT RECORD

The Event record (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.

Note: This is an example.

Table 5-9 List of event record (CBV2-A41D1)

Event name	
UV1-A	Definitive signal of UV1 A-phase or forced operation from PC-HMI
UV1-B	Definitive signal of UV1 B-phase or forced operation from PC-HMI
UV1-C	Definitive signal of UV1 C-phase or forced operation from PC-HMI
UV2-A	Definitive signal of UV2 A-phase or forced operation from PC-HMI
UV2-B	Definitive signal of UV2 B-phase or forced operation from PC-HMI
UV2-C	Definitive signal of UV2 C-phase or forced operation from PC-HMI
OV1-A	Definitive signal of OV1 A-phase or forced operation from PC-HMI
OV1-B	Definitive signal of OV1 B-phase or forced operation from PC-HMI
OV1-C	Definitive signal of OV1 C-phase or forced operation from PC-HMI
OV2-A	Definitive signal of OV2 A-phase or forced operation from PC-HMI
OV2-B	Definitive signal of OV2 B-phase or forced operation from PC-HMI
OV2-C	Definitive signal of OV2 C-phase or forced operation from PC-HMI
OVG1	Definitive signal of OVG1 or forced operation from PC-HMI
OVG2	Definitive signal of OVG2 or forced operation from PC-HMI
NOV1	Definitive signal of OVNEG1 or forced operation from PC-HMI
NOV2	Definitive signal of OVNEG2 or forced operation from PC-HMI
REVPH	Definitive signal of REVPH or forced operation from PC-HMI
TCNT_ALM	Alarm of trip counter
DO1	Status of DO1
DO2	Status of DO2
DO3	Status of DO3
DO4	Status of DO4
DO5	Status of DO5
DO6	Status of DO6
DO7	Status of DO7
DO8	Status of DO8
ALARM	Abnormal condition of constant supervision (serious failure)
ALARM-L	Abnormal condition of constant supervision (minor failure)
RY-LOCK	Locking of relay
UV-A-LK	Locking of UV A-phase
UV-B-LK	Locking of UV B-phase
UV-C-LK	Locking of UV C-phase
OV-A-LK	Locking of OV A-phase
OV-B-LK	Locking of OV B-phase
OV-C-LK	Locking of OV C-phase
TCNT-LK	Locking of trip counter
ALLEL-O	OR of all definitive signals
DS_TRIG	Pulse signal from start-up until the end of data saving (Except for pre-fault time)
SV-LK	Locking of supervision

Table 5-10 List of event record (CBV3-A41D1)

Event name	
UV1	Definitive signal of UV1 or forced operation from PC-HMI
UV2	Definitive signal of UV2 or forced operation from PC-HMI
OV1	Definitive signal of OV1 or forced operation from PC-HMI
OV2	Definitive signal of OV2 or forced operation from PC-HMI
OVG1	Definitive signal of OVG1 or forced operation from PC-HMI
OVG2	Definitive signal of OVG2 or forced operation from PC-HMI
TCNT_ALM	Alarm of trip counter
DO1	Status of DO1
DO2	Status of DO2
DO3	Status of DO3
DO4	Status of DO4
DO5	Status of DO5
DO6	Status of DO6
DO7	Status of DO7
DO8	Status of DO8
ALARM	Abnormal condition of constant supervision (serious failure)
ALARM-L	Abnormal condition of constant supervision (minor failure)
RY-LOCK	Locking of relay
UV-LK	Locking of UV
OV-LK	Locking of OV
TCNT-LK	Locking of trip counter
ALLEL-O	OR of all definitive signals
DS_TRIG	Pulse signal from start-up until the end of data saving (Except for pre-fault time)
SV-LK	Locking of supervision

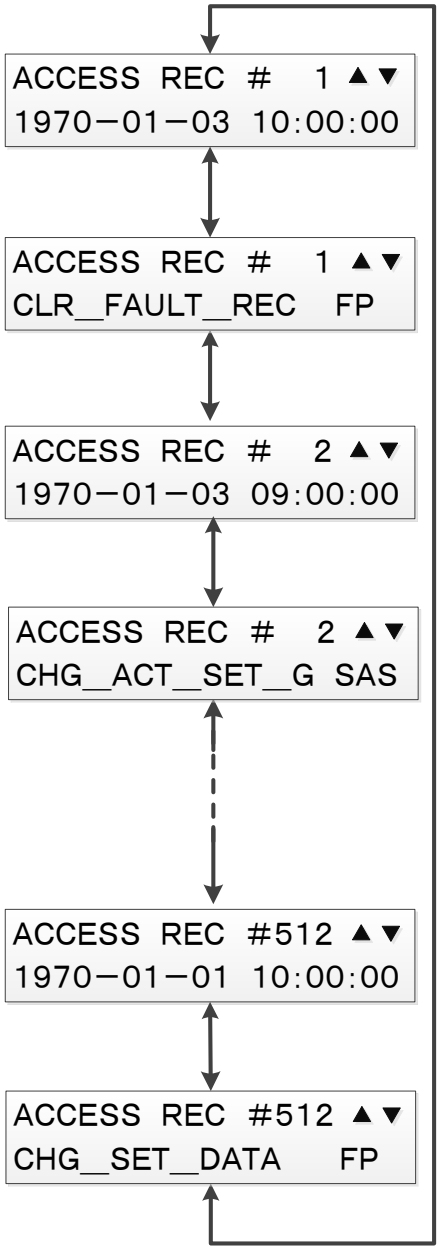
5.3.2.2.3. Access record (ACCESS RECORD) menu

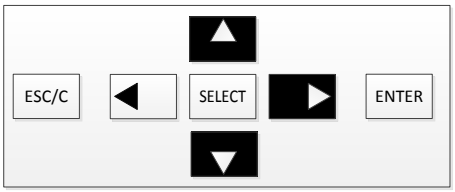
[Operation path] DISPLAY MODE > RECORD > ACCESS RECORD

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.

Note: This is an example.

Access record description registered (operator)

Display item	Operation description
RY	Front panel
PC	PC-HMI
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_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_TRIP_CNTR	Change of trip counter
CHG_DEV_NAME	Change of device name
CHG_CFG_METER	Change of configuration of analog measurement status display
CHG_TIMEMANAGE	Change of configuration of time management
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
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

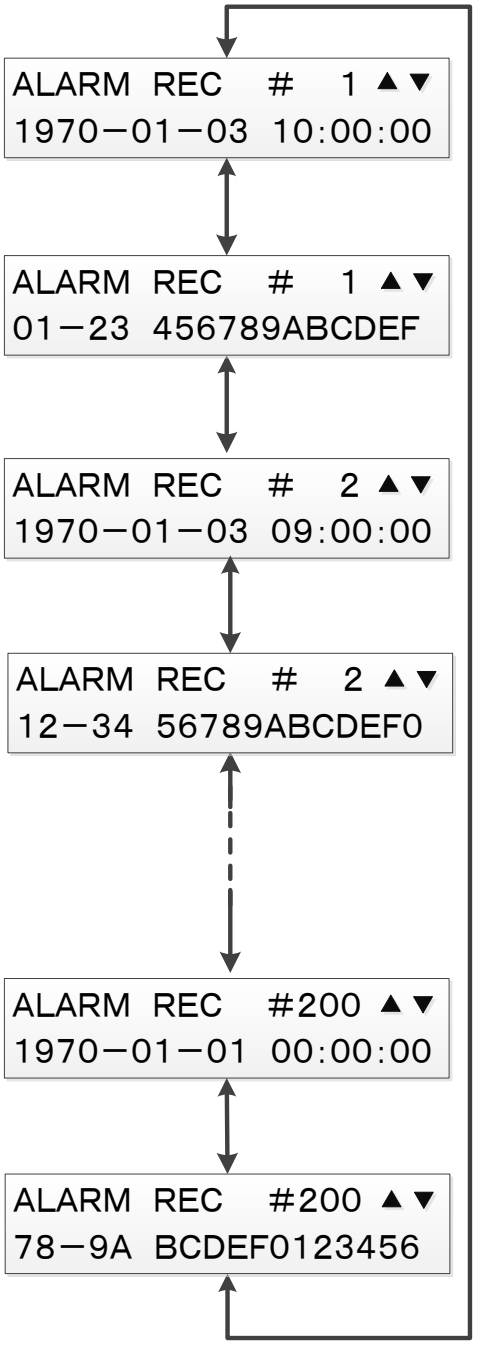
5.3.2.2.4. Alarm record (ALARM RECORD) menu

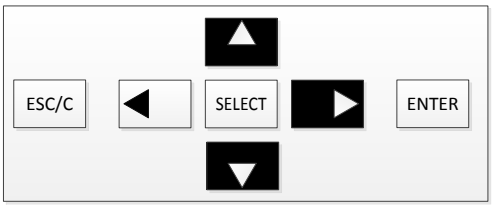
[Operation path] DISPLAY MODE > RECORD > ALARM RECORD

The Alarm record (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.

Note: This is an example.

5.3.2.3. 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 5.3.4.1.

5.3.2.4. Configuration (CONFIG) menu

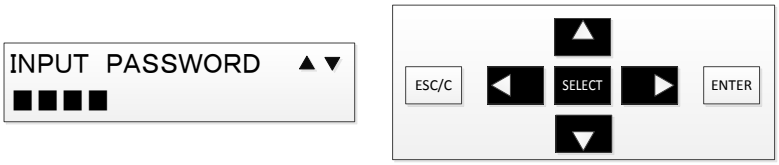
The Configuration menu can be selected in either DISPLAY or SETTING mode. Clock adjustment (CLOCK ADJUST), Password use/unuse (PASSWORD USE) and Password registration (PASSWORD REGIST) can be selected only in the SETTING mode.
For other settings, the DISPLAY mode allows only viewing of the setting values.
The setting values can be changed only in the SETTING mode.

For operations for the Configuration menu, see 5.3.4.2.

5.3.3. Password input screen

If the password use/unuse setting is “USE,” a four-digit password is requested when the SETTING mode is selected.

* For the password use/unuse setting, see 5.3.4.2.6.
For how to set the password input, see 5.3.4.2.7.



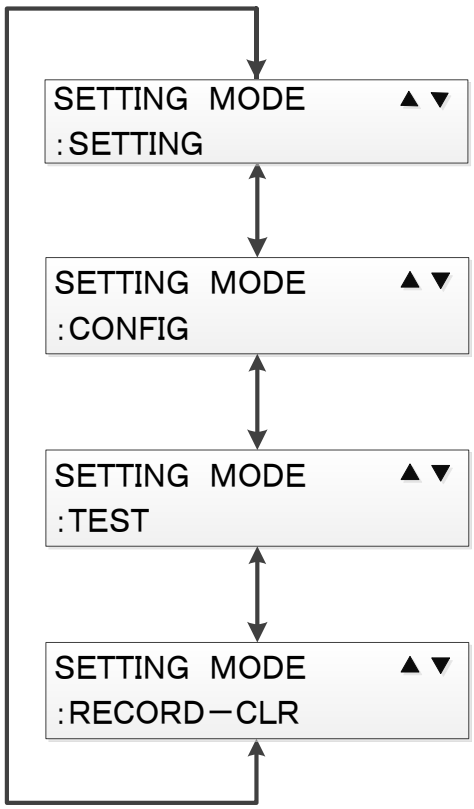
Use ▲ and ▼ to change the value of the each digit selected.
Pressing SELECT confirms the value for the digit entered and moves the cursor to the next digit on the right.

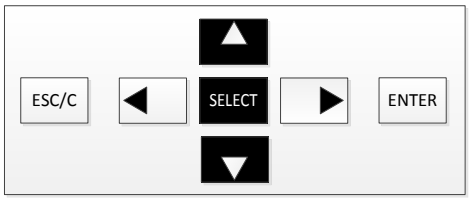
If the password input is wrong, a screen as shown below appears.

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

5.3.4. SETTING mode menu operations

This subsection describes the SETTING mode menu.
The menu screen has four 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 5-2.

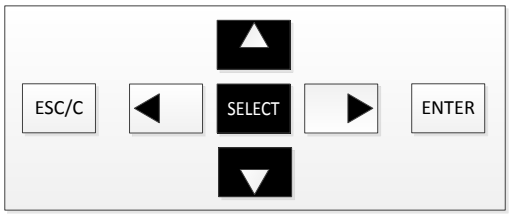




Use ▲ and ▼ to switch between items and press SELECT to select an item.

5.3.4.1. 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.

5.3.4.1.1. Active group (ACTIVE WG) menu

[Operation path] SETTING MODE > SETTING > ACTIVE WG

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

```
ACTIVE WG
          :G1
```

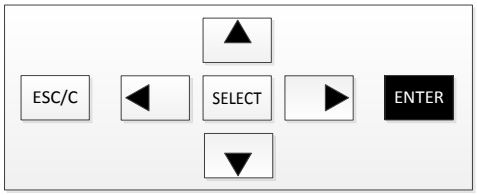
To change the active group number, in the Active group menu, press SELECT.
A cursor appears, which allows the selection of a group number with the Up and Down keys.
Select the group number to change and press SELECT to confirm the change.

```
ACTIVE WG
          :■1
```

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

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

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



Press ENTER to show the screen on the left.

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

```
SETTING
HAVE CHANGED
```

Message for a successful change of the active group

```
SETTING
FAILED TO CHANGE
```

Message for an unsuccessful change of the active group

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

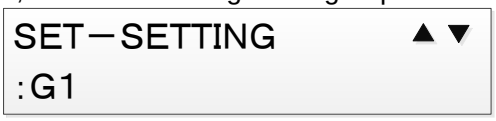
```
CANCEL ACTIVE WG?
YES=SELECT  NO=◀
```

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

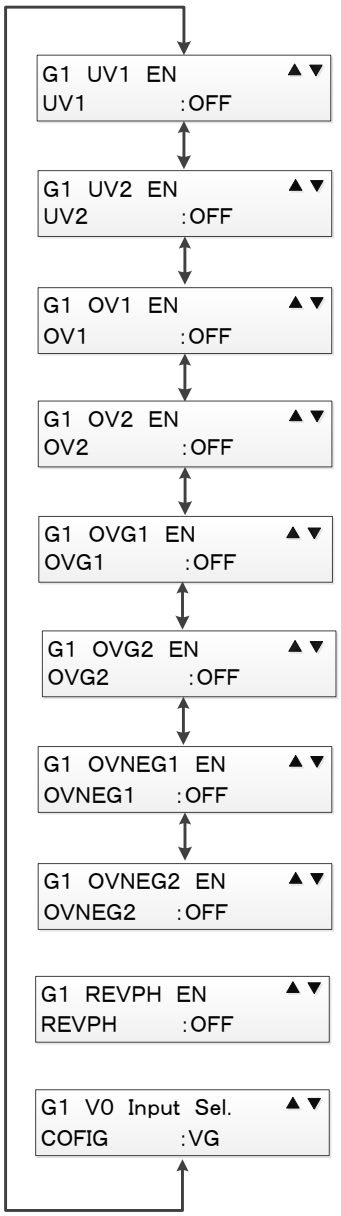
[Operation path] SETTING MODE > SETTING > G1(G2)

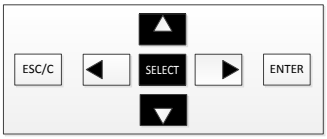
The Group 1 setting (G1) and Group 2 setting (G2) menus allow viewing and changing of the setting values for the respective group settings.
(Setting values can be changed only in the SETTING mode. The DISPLAY mode allows only viewing of the setting values)
The operation procedure for changing group settings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

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



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

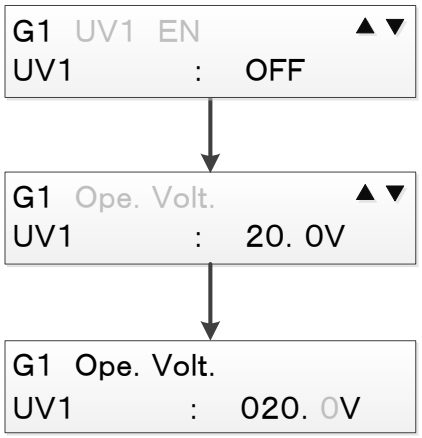




Use ▲ and ▼ to select an element and press SELECT to confirm.

Note: This is an example.

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.

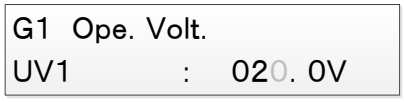


Cursor moves to the setting parameter indication.

Select the setting parameter to change and press SELECT.

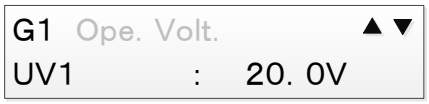
Cursor moves to the setting value indication.

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.

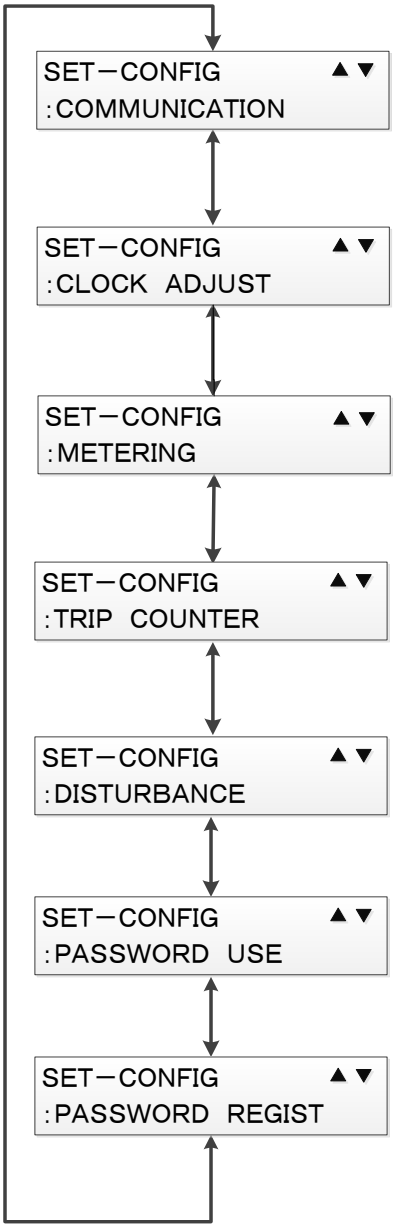
The following messages are shown respectively to check the successful or unsuccessful setting change, The display returns back to the Setting menu by pressing SELECT while either of the messages below.

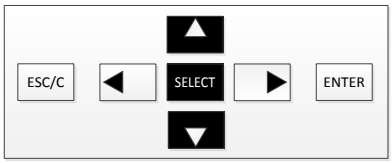
Message for successful changes of setting value

Message for unsuccessful changes of setting value

5.3.4.2. 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/unuse (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.

5.3.4.2.1. Communication setting (COMMUNICATION) menu

[Operation path] SETTING MODE > CONFIG > COMMUNICATION

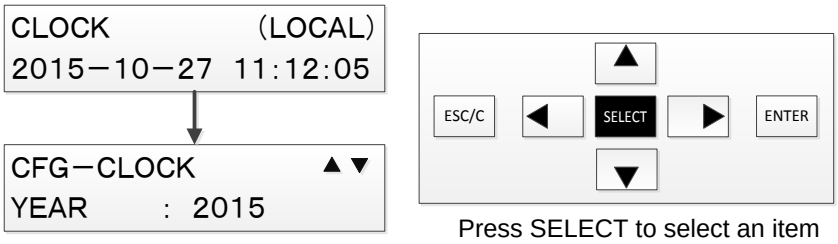
In regard to the standard products, there is no communication function.
In this menu, the message "NONE" appears on the display.

5.3.4.2.2. Clock adjustment (CLOCK ADJUST) menu

[Operation path] SETTING MODE > CONFIG > CLOCK ADJUST

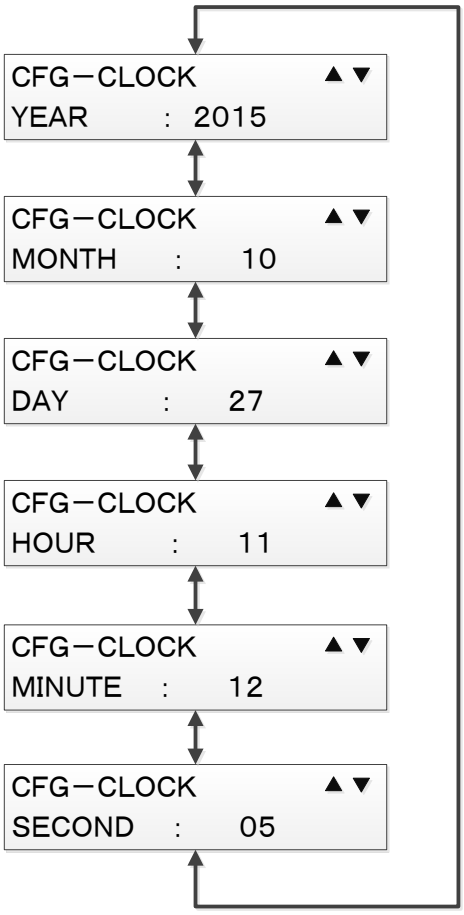
The Clock adjustment (CLOCK ADJUST) menu allows time setting.
This item can be selected only in the SETTING mode.

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.

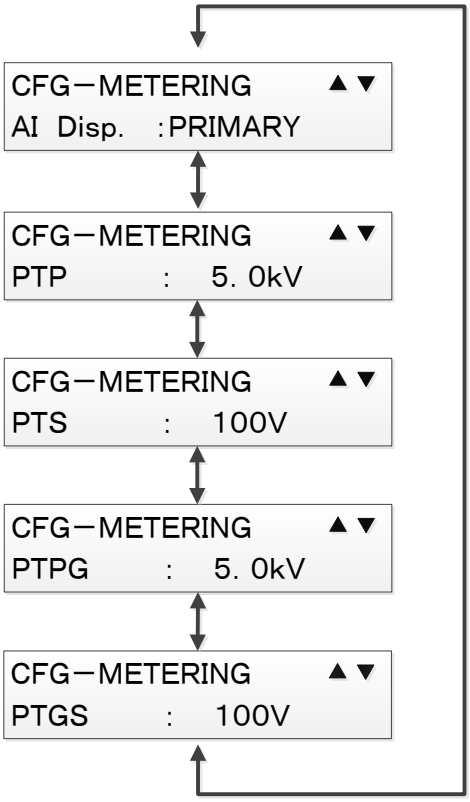
5.3.4.2.3. Analog value display switching (METERING) menu

[Operation path] SETTING MODE > CONFIG > METERING

The Analog value display switching (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 Measurement value display switching menu.



Note: This is an example.

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.

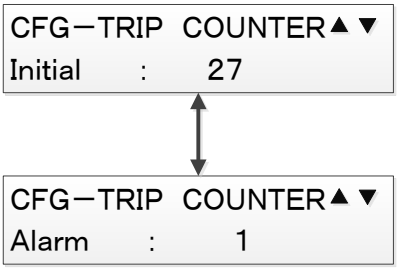
Table 5-11 Setting items of analog value display

No.	Item	Setting description	Setting range	Unit
1	AI Disp	AI display primary value / secondary value selection	PRIMARY / SECONDARY	—
2	PTP	VT primary side rating	0.10 ~ 99.00	kV
3	PTS	VT secondary side rating	100 ~ 125	V
4	PTGP	EVT primary side rating	0.10 ~ 99.00	kV
5	PTGS	EVT tertiary side rating	100 ~ 220	V

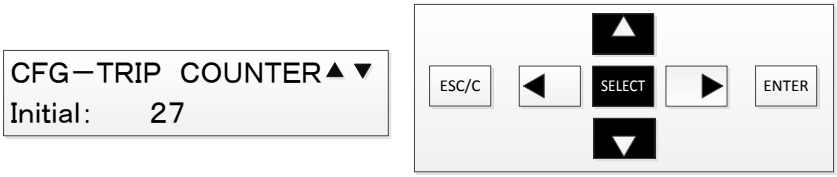
5.3.4.2.4. Trip counter (TRIP COUNTER) menu

[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)

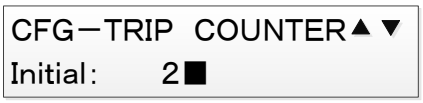


1. The trip counter setting menu appears. Use the Up and Down keys to select the item to change and press SELECT.

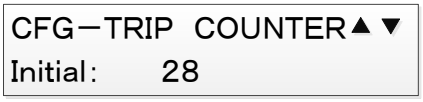


Use ▲ and ▼ to switch between items and press SELECT to select an item.

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.

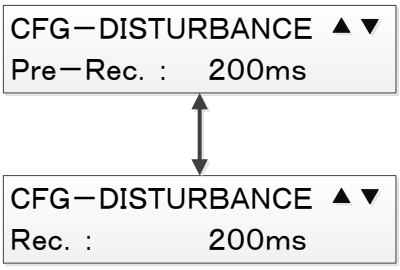
Table 5-12 Setting items of trip counter

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

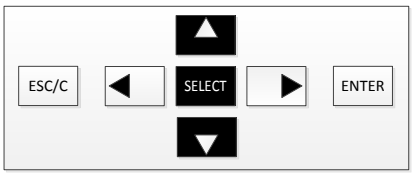
5.3.4.2.5. Disturbance record (DISTURBANCE) menu

[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 5-13 Setting items of disturbance record time

No.	Item	Setting description	Setting range	Unit
1	Pre-Rec.	Save time of pre-fault waveform data	100 ~ 4500	ms
2	Rec.	Save time of waveform data	200 ~ 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”.

5.3.4.2.6. Password use/unuse (PASSWORD USE) menu

[Operation path] SETTING MODE > CONFIG > PASSWORD USE

The Password use/unuse (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/unuse 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/unuse setting changed appears as shown in the figure below.
   Press SELECT to apply the password use/unuse 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 5-14 Setting item of Password use/unuse

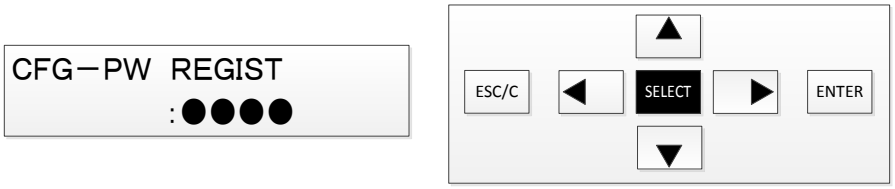
No.	Item	Setting description	Setting
1	PASSWORD	Password use/unuse setting	USE / UNUSE

5.3.4.2.7. Password registration (PASSWORD REGIST) menu

[Operation path] SETTING MODE > CONFIG > PASSWORD REGIST

The 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.

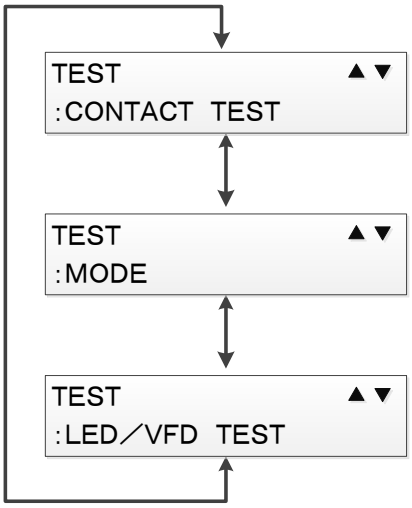
3. When the four digits have been entered, password input is requested again.
   Enter the same password as that registered in step 2 above.

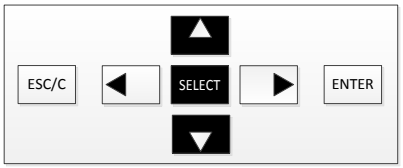
4. If the above two password-inputs in steps 2 and 3 are same, the screen shown in step 1 appears.
   Press ENTER and the confirmation message of the password registration appears.
   Press SELECT to apply the password registration and complete the setting.
   Press the Left key to go back to the setting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

5.3.4.3. 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

5.3.4.3.1. 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 DO8).

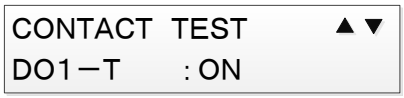
1. When the DO contact test menu has been selected, the caution message appears.

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 5-15 Setting items of DO contact test

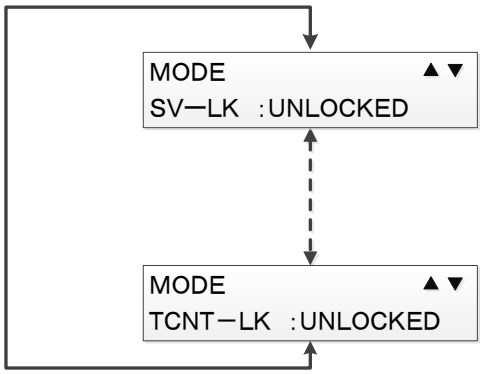
No.	Item
1	DO1-T
2	DO2-T
3	DO3-T
4	DO4-T
5	DO5-T
6	DO6-T
7	DO7-T
8	DO8-T

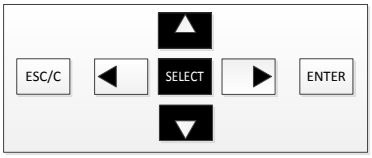
5.3.4.3.2. Test mode (MODE) menu

[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.





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

Note: This is an example.

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.

Caution

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.

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

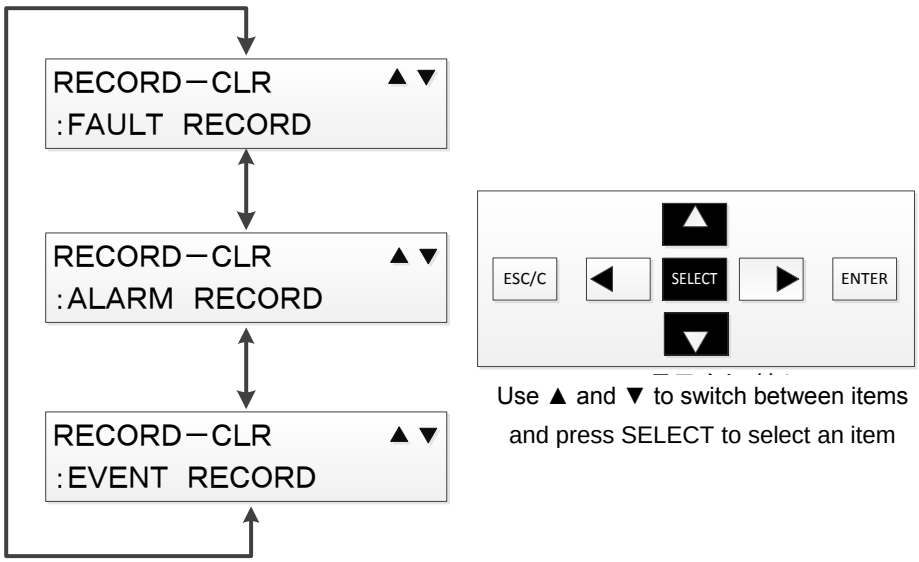
[Operation path] SETTING MODE > TEST > LED/VFD TEST

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.

5.3.4.4. 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.



5.3.4.4.1. 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.

5.3.4.4.2. 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.

5.3.4.4.3. 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.

6. PC-HMI

PC-HMI is a software for setting, configuration, and supervision of this relay.
The software can be downloaded on the web site of Mitsubishi Electric FA (Factory Automation).
The operation method is described in a separate volume. Please refer to the following document.

Title of document	Document No.
MELPRO-D Series Protection Relay PC-HMI Instruction Manual	JEP0-IL9504

In regard to PLC signals, refer to Table 6-1 and Table 6-2.

Table 6-1 PLC signals of CBV2-A41D1

Signal name	Description
UV1-A/	Definitive signal of 1st undervoltage (27) element on A (AB) phase
UV1-B/	Definitive signal of 1st undervoltage (27) element on B (BC) phase
UV1-C/	Definitive signal of 1st undervoltage (27) element on C (CA) phase
UV2-A/	Definitive signal of 2nd undervoltage (27) element on A (AB) phase
UV2-B/	Definitive signal of 2nd undervoltage (27) element on B (BC) phase
UV2-C/	Definitive signal of 2nd undervoltage (27) element on C (CA) phase
OV1-A/	Definitive signal of 1st overvoltage (59) element on A (AB) phase
OV1-B/	Definitive signal of 1st overvoltage (59) element on B (BC) phase
OV1-C/	Definitive signal of 1st overvoltage (59) element on C (CA) phase
OV2-A/	Definitive signal of 2nd overvoltage (59) element on A (AB) phase
OV2-B/	Definitive signal of 2nd overvoltage (59) element on B (BC) phase
OV2-C/	Definitive signal of 2nd overvoltage (59) element on C (CA) phase
OVG1/	Definitive signal of 1st ground fault overvoltage (64) element
OVG2/	Definitive signal of 2nd ground fault overvoltage (64) element
NOV1/	Definitive signal of 1st negative sequence overvoltage (47) element
NOV2/	Definitive signal of 2nd negative sequence overvoltage (47) element
REVPH/	Definitive signal of reverse phase element
TCNT_ALM	Alarm of trip counter
UV1-AD	Detection signal of 1st undervoltage (27) element on A (AB) phase
UV1-BD	Detection signal of 1st undervoltage (27) element on B (BC) phase
UV1-CD	Detection signal of 1st undervoltage (27) element on C (CA) phase
UV2-AD	Detection signal of 2nd undervoltage (27) element on A (AB) phase
UV2-BD	Detection signal of 2nd undervoltage (27) element on B (BC) phase
UV2-CD	Detection signal of 2nd undervoltage (27) element on C (CA) phase
OV1-AD	Detection signal of 1st overvoltage (59) element on A (AB) phase
OV1-BD	Detection signal of 1st overvoltage (59) element on B (BC) phase
OV1-CD	Detection signal of 1st overvoltage (59) element on C (CA) phase
OV2-AD	Detection signal of 2nd overvoltage (59) element on A (AB) phase
OV2-BD	Detection signal of 2nd overvoltage (59) element on B (BC) phase
OV2-CD	Detection signal of 2nd overvoltage (59) element on C (CA) phase
OVG1-D	Detection signal of 1st ground fault overvoltage (64) element
OVG2-D	Detection signal of 2nd ground fault overvoltage (64) element
NOV1-D	Detection signal of 1st negative sequence overvoltage (47) element
NOV2-D	Detection signal of 2nd negative sequence overvoltage (47) element
REVPH-D	Detection signal of reverse phase element
ALARM	Abnormal condition of constant supervision (serious failure)
ALARM-L	Abnormal condition of constant supervision (minor failure)
RY-LOCK	Locking of relay
RESET	Reset signal (activated by pushing ESC/C button for more than 3 seconds)
INTER1	1st intermediate output signal of PLC
INTER2	2nd intermediate output signal of PLC
INTER3	3rd intermediate output signal of PLC
INTER4	4th intermediate output signal of PLC
INTER5	5th intermediate output signal of PLC
INTER6	6th intermediate output signal of PLC
INTER7	7th intermediate output signal of PLC

INTER8	8th intermediate output signal of PLC
UV1-3D_O	Detection signal of any UV1 of A (AB), B (BC), and C (CA) phase
UV2-3D_O	Detection signal of any UV2 of A (AB), B (BC), and C (CA) phase
OV1-3D_O	Detection signal of any OV1 of A (AB), B (BC), and C (CA) phase
OV2-3D_O	Detection signal of any OV2 of A (AB), B (BC), and C (CA) phase
UV-3D_O	Detection signal of any of undervoltage elements on A, B, and C phase
OV-3D_O	Detection signal of any of overvoltage elements on A, B, and C phase
OVG-D_O	Detection signal of any of ground fault overvoltage (OVG) elements
NOV-D_O	Detection signal of any of negative sequence overvoltage (OVNEG) elements
ALLEL-D_O	Detection signal of any of all elements (OR of all detection signals)
UV1-3_O/	Definitive signal of any UV1 of A (AB), B (BC), and C (CA) phase
UV2-3_O/	Definitive signal of any UV2 of A (AB), B (BC), and C (CA) phase
OV1-3_O/	Definitive signal of any OV1 of A (AB), B (BC), and C (CA) phase
OV2-3_O/	Definitive signal of any OV2 of A (AB), B (BC), and C (CA) phase
UV-3_O	Definitive signal of any of undervoltage elements on A, B, and C phase
OV-3_O	Definitive signal of any of overvoltage elements on A, B, and C phase
OVG-O	Definitive signal of any of ground fault overvoltage (OVG) elements
NOV-O	Definitive signal of any of negative sequence overvoltage (OVNEG) elements
NOV/REVPH	Definitive signal of NOV-O or REVPH/
ALLEL-O	Definitive signal of any of all elements (OR of all definitive signals)
UV1-3D_A	Detection signal of all UV1 of A, B, and C phase (AND of all UV1 detection signals)
UV2-3D_A	Detection signal of all UV2 of A, B, and C phase (AND of all UV2 detection signals)
OV1-3D_A	Detection signal of all OV1 of A, B, and C phase (AND of all OV1 detection signals)
OV2-3D_A	Detection signal of all OV2 of A, B, and C phase (AND of all OV2 detection signals)
UV1-3_A	Definitive signal of all UV1 of A, B, and C phase (AND of all UV1 definitive signals)
UV2-3_A	Definitive signal of all UV2 of A, B, and C phase (AND of all UV2 definitive signals)
OV1-3_A	Definitive signal of all OV1 of A, B, and C phase (AND of all OV1 definitive signals)
OV2-3_A	Definitive signal of all OV2 of A, B, and C phase (AND of all OV2 definitive signals)
UV1-A	Definitive signal of UV1 A-phase or forced operation from PC-HMI
UV1-B	Definitive signal of UV1 B-phase or forced operation from PC-HMI
UV1-C	Definitive signal of UV1 C-phase or forced operation from PC-HMI
UV2-A	Definitive signal of UV2 A-phase or forced operation from PC-HMI
UV2-B	Definitive signal of UV2 B-phase or forced operation from PC-HMI
UV2-C	Definitive signal of UV2 C-phase or forced operation from PC-HMI
OV1-A	Definitive signal of OV1 A-phase or forced operation from PC-HMI
OV1-B	Definitive signal of OV1 B-phase or forced operation from PC-HMI
OV1-C	Definitive signal of OV1 C-phase or forced operation from PC-HMI
OV2-A	Definitive signal of OV2 A-phase or forced operation from PC-HMI
OV2-B	Definitive signal of OV2 B-phase or forced operation from PC-HMI

OV2-C	Definitive signal of OV2 C-phase or forced operation from PC-HMI
OC4-3_O	Definitive signal of any OC4 of A, B, and C phase or forced operation from PC-HMI
OVG1	Definitive signal of OVG1 or forced operation from PC-HMI
OVG2	Definitive signal of OVG2 or forced operation from PC-HMI
NOV1	Definitive signal of OVNEG1 or forced operation from PC-HMI
NOV2	Definitive signal of OVNEG2 or forced operation from PC-HMI
REVPH	Definitive signal of REVPH or forced operation from PC-HMI

Table 6-2 PLC signals of CBV3-A41D1

Signal name	Description
UV1/	Definitive signal of 1st undervoltage (27) element
UV2-A/	Definitive signal of 2nd undervoltage (27) element
OV1-A/	Definitive signal of 1st overvoltage (59) element
OV2-A/	Definitive signal of 2nd overvoltage (59) element
OVG1/	Definitive signal of 1st ground fault overvoltage (64) element
OVG2/	Definitive signal of 2nd ground fault overvoltage (64) element
TCNT_ALM	Alarm of trip counter
UV1	Detection signal of 1st undervoltage (27) element
UV2	Detection signal of 2nd undervoltage (27) element
OV1	Detection signal of 1st overvoltage (59) element
OV2	Detection signal of 2nd overvoltage (59) element
OVG1-D	Detection signal of 1st ground fault overvoltage (64) element
OVG2-D	Detection signal of 2nd ground fault overvoltage (64) element
ALARM	Abnormal condition of constant supervision (serious failure)
ALARM-L	Abnormal condition of constant supervision (minor failure)
RY-LOCK	Locking of relay
RESET	Reset signal (activated by pushing ESC/C button for more than 3 seconds)
INTER1	1st intermediate output signal of PLC
INTER2	2nd intermediate output signal of PLC
INTER3	3rd intermediate output signal of PLC
INTER4	4th intermediate output signal of PLC
INTER5	5th intermediate output signal of PLC
INTER6	6th intermediate output signal of PLC
INTER7	7th intermediate output signal of PLC
INTER8	8th intermediate output signal of PLC
UV-D_O	Detection signal of any of undervoltage elements
OV-D_O	Detection signal of any of overvoltage elements
OVG-D_O	Detection signal of any of ground fault overvoltage (OVG) elements
ALLEL-D_O	Detection signal of any of all elements (OR of all detection signals)
UV-O	Definitive signal of any of undervoltage elements
OV-O	Definitive signal of any of overvoltage elements
OVG-O	Definitive signal of any of ground fault overvoltage (OVG) elements
ALLEL-O	Definitive signal of any of all elements (OR of all definitive signals)
UV1	Definitive signal of UV1 or forced operation from PC-HMI
UV2	Definitive signal of UV2 or forced operation from PC-HMI
OV1	Definitive signal of OV1 or forced operation from PC-HMI
OV2	Definitive signal of OV2 or forced operation from PC-HMI
OVG1	Definitive signal of OVG1 or forced operation from PC-HMI
OVG2	Definitive signal of OVG2 or forced operation from PC-HMI

7. Rating, Specification

7.1. Features

(1) Multi-function

- The relay incorporates a variety of voltage protection functions.
- 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.
  Measurement values (e.g. voltage) can be viewed via the front panel display on the relay or using interface software on a PC.
  In addition, you can expand the character size of the measured values on the front panel display, which enables to check values easily.
- 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) 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.

(4) 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.

(5) 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.

7.2. Standard Ratings

Item			Contents
Rating	Voltage		57 ~ 120 V
	Zero-sequence voltage		100 ~ 208 V
	Frequency		50 Hz / 60 Hz
	Power Supply	Voltage	DC: 100 ~ 220 V AC: 100 ~ 220 V
		Variation range	DC: 85 ~ 242 V (Range of 80 ~ 286 V is allowable temporarily.) AC: 85 ~ 242 V (Range of 85 ~ 253 V is allowable temporarily.)
Communication function*	CC-LINK		Option

7.3. Protection elements

Protection element	Operating value	Operating time	Other setting
27 (Instantaneous Undervoltage)	20.0 ~ 120.0 V	0.00 ~ 10.00 s (0.01 s step) In setting 0.00 s, instantaneous operating time is less than 50 ms.	
59 (Instantaneous Overvoltage)	20.0 ~ 120.0 V	0.00 ~ 10.00 s (0.01 s step) In setting 0.00 s, instantaneous operating time is less than 50 ms.	
64 (Instantaneous Ground Fault Overvoltage)	20.0 ~ 120.0 V	0.00 ~ 10.00 s (0.01 s step) In setting 0.00 s, instantaneous operating time is less than 50 ms.	
47 (*) (Instantaneous Negative Sequence Overvoltage)	20.0 ~ 120.0 V	0.00 ~ 10.00 s (0.01 s step) In setting 0.00 s, instantaneous operating time is less than 50 ms.	
47 (*) (Reverse Phase Protection)	-	0.00 ~ 10.00 s (0.01 s step) In setting 0.00 s, instantaneous operating time is less than 50 ms.	

* In CBV3-A41D1, there are no 47 elements.
* Factory settings are set to a default of “Non-use” for the items with setting of Use/Non-use. If the Use/Non-use setting is not applicable, the setting value will be set to the minimum setting.
* For details about protective function, refer to Chapter 8.

7.4. Measuring element

- CBV2-A41D1

Contents displayed		Range	Measured value		Accident record	Waveform record
Name of signal	Item	(Secondary value / Primary value)	Primary	Secondary	Primary only	Common
Va	A-phase voltage	0.0 ~ 150.0 V (0.1 V step) / 0.0 ~ 750.0 kV (0.1 kV step)	○	○	○	○
Vb	B-phase voltage		○	○	○	○
Vc	C-phase voltage		○	○	○	○
Vab	AB-phase voltage (*)	0.0 ~ 260.0 V (0.1 V step) / 0.0 ~ 750.0 kV (0.1 kV step)	○	○	○	○
Vbc	BC-phase voltage (*)		○	○	○	○
Vca	CA-phase voltage (*)		○	○	○	○
VG	Zero-phase voltage	0.0 ~ 247.0 V (0.1 V step) / 0.0 ~ 750.0 kV (0.1 kV step)	○	○	○	○
3V0	Zero-phase voltage (Calculated by software)		○	○	○	×
V1	Positive-sequence voltage	0.0 ~ 150.0 V (0.1 V step) / 0.0 ~ 750.0 kV (0.1 kV step)	○	○	○	×
V2	Negative-sequence voltage		○	○	○	×
Va-phase	Phase angle of Va	0.0 ~ 359.9 ° (0.1 ° step) (**) (Lag angle)	○	○	○	×
Vb-phase	Phase angle of Vb		○	○	○	×
Vc-phase	Phase angle of Vc		○	○	○	×
Vab-phase	Phase angle of Vab		○	○	○	×
Vbc-phase	Phase angle of Vbc		○	○	○	×
Vca-phase	Phase angle of Vca		○	○	○	×
VG-phase	Phase angle of VG		○	○	○	×

(*) If phase voltage is input to the relay, this value is calculated by software.

(**) If phase voltage is input to the relay, this value is expressed by the standards of Va.
If line voltage is input to the relay, this value is expressed by the standards of Vab.

- CBV3-A41D1

Contents displayed		Range	Measured value		Accident record	Waveform record
Name of signal	Item	(Secondary value / Primary value)	Primary	Secondary	Primary only	Common
Va	Phase voltage or Line voltage	0.0 ~ 260.0 V (0.1 V step) / 0.0 ~ 750.0 kV (0.1 kV step)	○	○	○	○
VG	Zero-phase voltage	0.0 ~ 247.0 V (0.1 V step) / 0.0 ~ 750.0 kV (0.1 kV step)	○	○	○	○

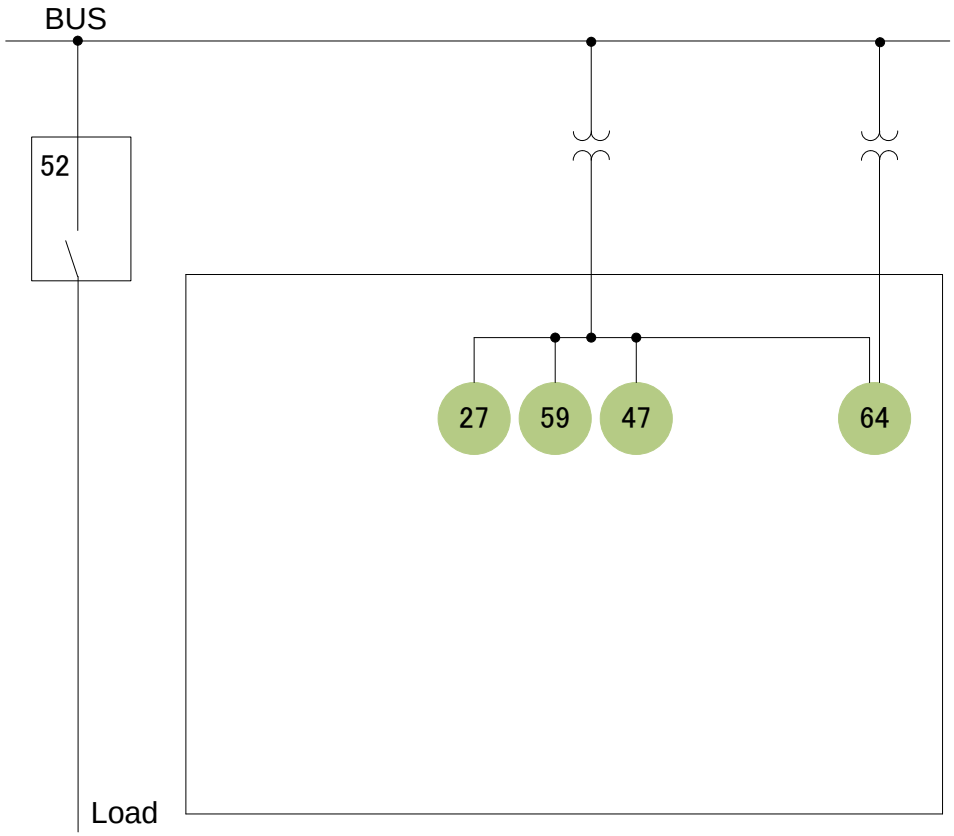
7.5. List of functions

Menu	Item	Operation system	
		PC-HMI	Front panel
Status (STATUS)	Clock (CLOCK)	○	○
	Measured analog value (METERING)	○	○
	DI/DO status (DIGITAL I/O)	○	○
	Trip counter (TRIP COUNTER)	○	○
	Device name (DEVICE NAME)	○	○
	Monitoring	○	×
	LED reset	○	×
Record (RECORD)	Waveform analysis	○	×
	Disturbance record	○	×
	Fault record (FAULT RECORD)	○ (*)	○
	Event record (EVENT RECORD)	○	○
	Access record (ACCESS RECORD)	○	○
	Alarm record (ALARM RECORD)	○	○
Setting (SETTING)	Active group (ACTIVE WG)	○	○
	Group 1 setting (G1)	○	○
	Group 2 setting (G2)	○	○
	PLC	○	×
Configuration (CONFIG)	Communication setting (COMMUNICATION)	×	○
	Clock adjustment (CLOCK ADJUST)	○	○
	Analog value display switching (METERING)	○	○
	Trip counter (TRIP COUNTER)	○	○
	Disturbance record (DISTURBANCE)	○	○
	Password use/unuse (PASSWORD USE)	×	○
	Password registration (PASSWORD REGIST)	×	○
	Device name setting	○	×
	Time management setting	○	×
	DO contact test setting	○	×
Test (TEST)	DO contact test (CONTACT TEST)	○	○
	Test mode (MODE)	○	○
	LED/VFD lighting test (LED/VFD TEST)	×	○
	Forced operation of relay	○	×
Clear record (RECORD-CLR)	Clear fault record (FAULT REC CLEAR)	○	○
	Clear alarm record (ALARM REC CLEAR)	○	○
	Clear event record (EVENT REC CLEAR)	○	○

(*) In PC-HMI, the item of Fault record is included in Disturbance analysis.

8. Protective function

In the relay, following protection elements are provided for the purposes of voltage protection.
In this chapter, the protection elements incorporated in the relay are described.



Model	Protection elements	Input	Purpose
CBV2-A41D1	27, 59, 64, 47	Va, Vb, Vc (3 phase) or Vab, Vbc, Vca (3 phase) V0 : EVT	3 phase voltage or 3 line voltage detects undervoltage, overvoltage, and negative sequence. V0 from EVT or software calculation detects ground fault overvoltage.
CBV3-A41D1	27, 59, 64	Va (1 phase) or Vab (1 phase) V0 : EVT	1 phase voltage or 1 line voltage detects undervoltage and overvoltage. V0 from EVT detects ground fault overvoltage.

8.1. Undervoltage element

Two types of undervoltage elements are provided in CBV2-A41D1 and CBV3-A41D1.

Particularly, in CBV2-A41D1, it is possible to select two kinds of undervoltage detection by means of a setting.

Apparatus No.	Display name	Protective function
27	UV1, UV2	Instantaneous undervoltage element In CBV2-A41D1, it has two types of detection methods (1) Detection by the reduction of phase voltage (UVP) (2) Detection by the reduction of line voltage (UVS)

8.1.1. UV1 element

Fig. 8-1 shows the internal function blocks of UV1 element.

UV1 outputs a definitive signal after a preset time of the operation timer (Ope. Time) has passed, when input voltage is less than or equal to the operation setting value (Ope. Volt.).
An off-delay timer of 200 ms is added in order to prevent chattering of the output contacts.

In CBV2-A41D1, setting (UVP/UVS Sel.) is used to determine whether phase voltage measurement (UVP) or line (phase to phase) voltage measurement (UVS) will take place to detect the under-voltage condition if phase voltage is input to the relay.

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-HMI.
Furthermore, this element is enabled only when the setting of Use/Non-use of UV1 element (UV1 EN) is set to 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 UV1 element.

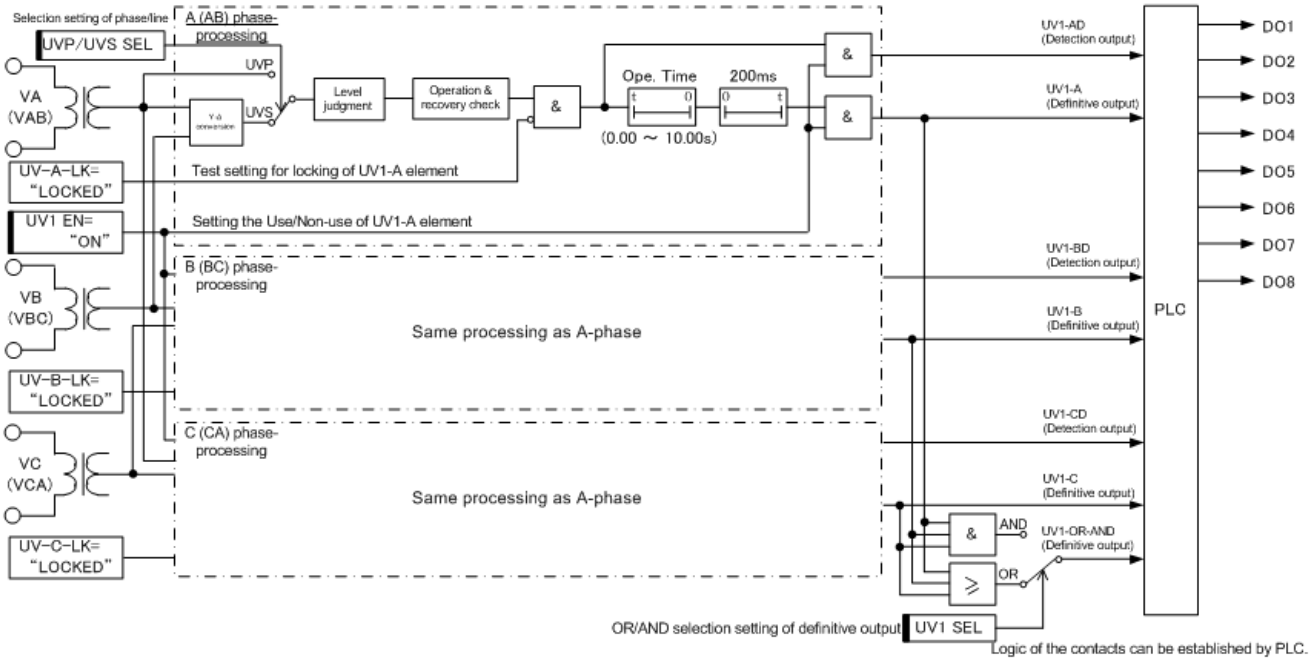


Fig. 8-1 Internal function block diagram of UV1 element

Note: This figure is the example of CBV2-A41D1. In CBV3-A41D1, it has only one phase of Va.

Table 8-1 Setting items of UV1 element

Display name	Setting parameter	Setting		Description
		Range of setting	step	
UV1	UV1 EN	OFF, ON	-	OFF: Non-use, ON: Use When this element is used, set to ON.
	UVP/UVS Sel. (CBV2-A41D1 only)	UVP, UVS	-	UVP: Detection by the reduction of phase voltage UVS: Detection by the reduction of line voltage
	Ope. Volt.	20.0 ~ 120.0V	0.1V	Operating voltage
	Ope. Time	0.00 ~ 10.00s	0.01s	Operating time INST: ≤ 50 ms

In CBV2-A41D1, the calculation method is determined with the combination of “UVP/UVS Sel”. and “V Input Sel”.
Regarding the configuration of “V Input Sel.”, refer to Section 8.6.

Table 8-2 Relationship between "V Input Sel." and "UVP/UVS Sel."

		UVP/UVS Sel.	
		UVP (Phase voltage)	UVS (Line voltage)
V Input Sel.	Y	The input voltage to the terminal block is directly used.	The input voltage to the terminal block is multiplied by √3. (This calculation is executed by the internal software.)
	D	The input voltage to the terminal block is directly used.	The input voltage to the terminal block is directly used.

To set the same setting as CBV2-A01D1, CBV4-A01D1, and CUB1-A01D1, "V Input Sel." is set to "D", and "UVP/UVS Sel." is set to "UVS".

8.1.2. UV2 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 8.1.1.

Table 8-3 Setting items of UV2 element

Display name	Setting parameter	Setting		Description
		Range of setting	step	
UV2	UV2 EN	OFF, ON	-	OFF: Non-use, ON: Use When this element is used, set to ON.
	UVP/UVS Sel. (CBV2-A41D1 only)	UVP, UVS	-	UVP: Detection by the reduction of phase voltage UVS: Detection by the reduction of line voltage
	Ope. Volt.	20.0 ~ 120.0V	0.1V	Operating voltage
	Ope. Time	0.00 ~ 10.00s	0.01s	Operating time INST: ≤ 50 ms

8.2. Overvoltage element

Two types of overvoltage elements are provided in CBV2-A41D1 and CBV3-A41D1.
Particularly, in CBV2-A41D1, it is possible to select two kinds of overvoltage detection by means of a setting.

Apparatus No.	Display name	Protective function
59	OV1, OV2	Instantaneous overvoltage element In CBV2-A41D1, it has two types of detection methods (1) Detection by the rise of phase voltage (OVP) (2) Detection by the rise of line voltage (OVS)

8.2.1. OV1 element

Fig. 8-2 shows the internal function blocks of OV1 element.

OV1 outputs a definitive signal after a preset time of the operation timer (Ope. Time) has passed, when input voltage is greater than or equal to the operation setting value (Ope. Volt.).
An off-delay timer of 200 ms is added in order to prevent chattering of the output contacts.

In CBV2-A41D1, setting (OVP/OVS Sel.) is used to determine whether phase voltage measurement (OVP) or line (phase to phase) voltage measurement (OVS) will take place to detect the over-voltage condition if phase voltage is input to the relay.

To facilitate testing of the single phase operation, a lock function is provided for the OV1 element of each phase. The lock function can be set from the front panel or PC-HMI.
Furthermore, this element is enabled only when the setting of Use/Non-use of OV1 element (OV1 EN) is set to 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 OV1 element.

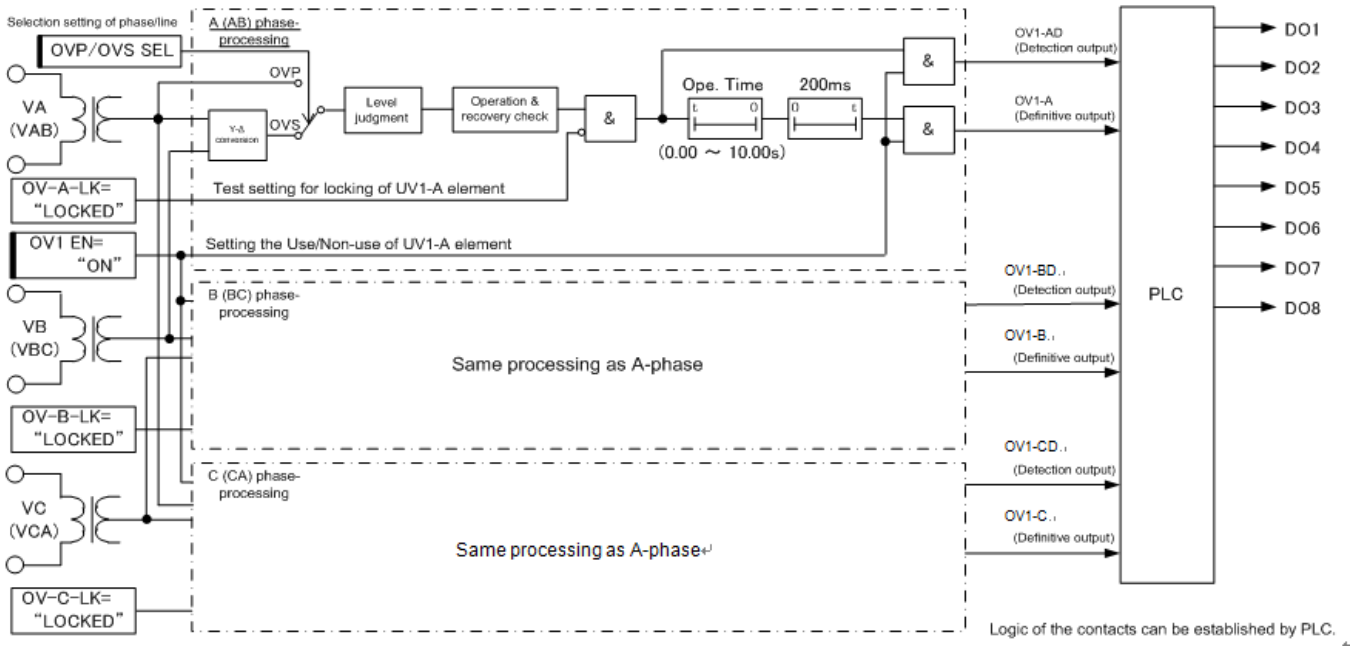


Fig. 8-2 Internal function block diagram of OV1 element

Note: This figure is the example of CBV2-A41D1. In CBV3-A41D1, it has only one phase of Va.

Table 8-4 Setting items of OV1 element

Display name	Setting parameter	Setting		Description
		Range of setting	step	
OV1	OV1 EN	OFF, ON	-	OFF: Non-use, ON: Use When this element is used, set to ON.
	OVP/OVS Sel. (CBV2-A41D1 only)	OVP, OVS	-	OVP: Detection by the rise of phase voltage OVS: Detection by the rise of line voltage
	Ope. Volt.	20.0 ~ 200.0V	0.1V	Operating voltage
	Ope. Time	0.00 ~ 10.00s	0.01s	Operating time INST: ≤ 50 ms

In CBV2-A41D1, the calculation method is determined with the combination of “OVP/OVS Sel”. and “V Input Sel”.
Regarding the configuration of “V Input Sel.”, refer to Section 8.6.

Table 8-5 Relationship between "V Input Sel." and "OVP/OVS Sel."

		OVP/UVS Sel.	
		OVP (Phase voltage)	OVS (Line voltage)
V Input Sel.	Y	The input voltage to the terminal block is directly used.	The input voltage to the terminal block is multiplied by √3. (This calculation is executed by the internal software.)
	D	The input voltage to the terminal block is directly used.	The input voltage to the terminal block is directly used.

To set the same setting as CBV2-A01D1, CBV4-A01D1, and CUB1-A01D1, "V Input Sel." is set to "D", and "OVP/OVS Sel." is set to "OVS".

8.2.2. OV2 element

The OV2 element has the same characteristics as the OV1 element.
Regarding the internal function block diagram and its operation, refer to sub-clause 8.2.1.

Table 8-6 Setting items of OV2 element

Display name	Setting parameter	Setting		Description
		Range of setting	step	
OV2	OV2 EN	OFF, ON	-	OFF: Non-use, ON: Use When this element is used, set to ON.
	OVP/OVS Sel. (CBV2-A41D1 only)	OVP, OVS	-	OVP: Detection by the rise of phase voltage OVS: Detection by the rise of line voltage
	Ope. Volt.	20.0 ~ 200.0V	0.1V	Operating voltage
	Ope. Time	0.00 ~ 10.00s	0.01s	Operating time INST: ≤ 50 ms

8.3. Ground fault overvoltage element

Two types of ground fault overvoltage elements are provided in CBV2-A41D1 and CBV3-A41D1. Particularly, in CBV2-A41D1, it is possible to select two kinds of detection methods by means of a setting.

Apparatus No.	Display name	Protective function
64	OVG1, OVG2	Instantaneous ground fault overvoltage element In CBV2-A41D1, it has two types of detection methods (1) VG: Zero-sequence voltage is directly taken from the V0 terminal. (2) 3P: Zero-sequence voltage is calculated by software which synthesizes 3-phase voltages.

8.3.1. OVG1 element

Fig. 8-3 shows the internal function blocks of OVG1 element.

OVG1 outputs a definitive signal after a preset time of the operation timer (Ope. Time) has passed, when input voltage is greater than or equal to the operation setting value (Ope. Volt.).
An off-delay timer of 200 ms is added in order to prevent chattering of the output contacts.

In CBV2-A41D1, it is possible to select by setting (V0 Input Sel.), whether the zero-sequence voltage is derived by calculation of [(Va+Vb+Vc)/3], or directly taken from the V0 terminal. Regarding the configuration of “V0 Input Sel.”, refer to Section 8.6.

Furthermore, this element is enabled only when the setting of Use/Non-use of OVG1 element (OVG1 EN) is set to 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 OVG1 element.

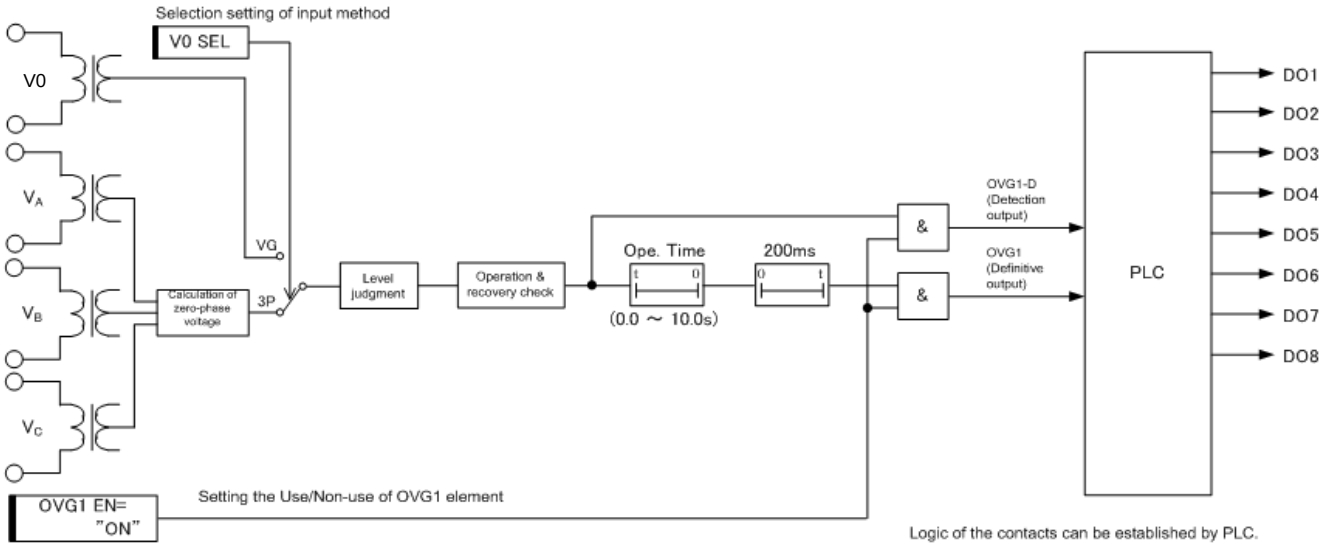


Fig. 8-3 Internal function block diagram of OVG1 element

Note: This figure is the example of CBV2-A41D1. In CBV3-A41D1, it has only one phase of V0.

Table 8-7 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

8.3.2. OVG2 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 8.3.1.

Table 8-8 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

8.4. Negative sequence overvoltage element

Two types of negative sequence overvoltage elements are provided in CBV2-A41D1.

Since the negative sequence voltage is obtained from 3-phase voltage, it is possible to detect voltage unbalance due to external wiring errors or open phase conditions, etc.

Apparatus No.	Display name	Protective function
47 (CBV2-A41D1 only)	OVNEG1, OVNEG2	Instantaneous negative sequence overvoltage element

8.4.1. OVNEG1 element

Fig. 8-4 shows the internal function blocks of OVNEG1 element.

The OVNEG1 element calculates negative 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 or equal to the setting value, a definitive signal is issued after a 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 is enabled only when the setting of Use/Non-use of OVNEG1 element (OVNEG1 EN) is set to 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 OVNEG1 element.

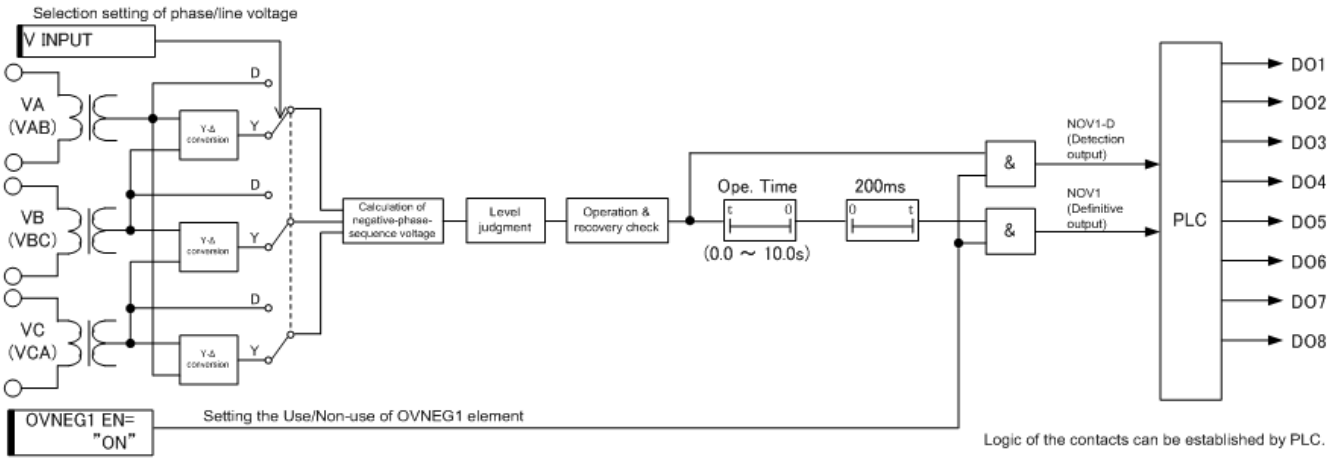


Fig. 8-4 Internal function block diagram of OVNEG1 element

Table 8-9 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	0.00 ~ 10.00 s	0.01 s	Operating time INST: ≤ 50 ms

8.4.2. OVNEG2 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 8.3.18.4.1.

Table 8-10 Setting items of OVNEG2 element

Display name	Setting parameter	Setting		Description
		Range of setting	step	
OVNEG2	OVNEG2 EN	OFF, ON	-	OFF: Non-use, ON: Use When this element is used, set to ON.
	Ope. Volt.	2.0 ~ 100.0 V	0.1 V	Operating voltage
	Ope. Time	0.00 ~ 10.00 s	0.01 s	Operating time INST: ≤ 50 ms

8.5. Reverse phase protection element

In CBV2-A41D1, a reverse phase protection element is provided.

Since the reverse phase element is obtained from 3-phase voltage, it is possible to detect reverse phase element due to external wiring errors, etc.

Apparatus No.	Display name	Protective function
47 (CBV2-A41D1 only)	REVPH	Reverse phase protection element

8.5.1. REVPH element

Fig. 8-4 shows the internal function blocks of REVPH element.

The REVPH element calculates reverse phase voltage from 3-phase line voltage or phase voltage. If the voltage is detected, a definitive signal is issued after a 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 is enabled only when the setting of Use/Non-use of REVPH element (REVPH EN) is set to 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 REVPH element.

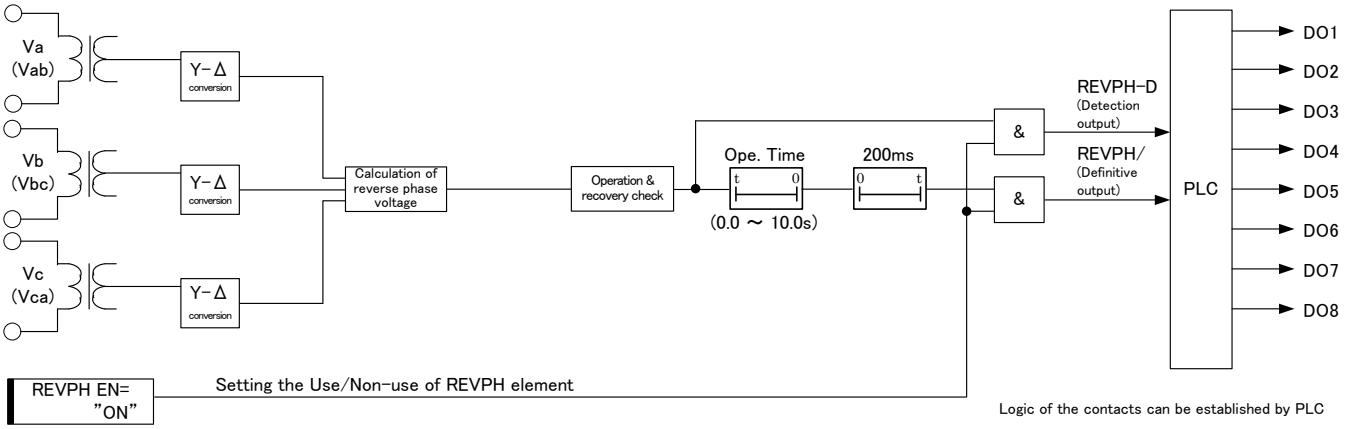


Fig. 8-5 Internal function block diagram of REVPH element

Table 8-11 Setting items of REVPH element

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

8.6. AI-Configulation setting

Table 8-12 Seting items of AI-CONFIG

Display name	Setting parameter	Setting		Description
		Range of setting	step	
CONFIG	V0 Input Sel.	VG, 3P	-	VG: Zero-sequence voltage is directly taken from the V0 terminal (A15-A16). 3P: Zero- sequence voltage is calculated by software which synthesizes 3-phase voltages.
	V Input Sel.	D, Y		D: Voltage terminals are assigned to the line (phase to phase) input. Y: Voltage terminals are assigned to 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.

9. Standard (Technical data)

Compliance standards: Standard of the Japanese Electrotechnical Committee (JEC)

JEC2500 (2010) Protection relays for electric power systems

JEC2501 (2010) Electromagnetic compatibility tests for protection relays

JEC2502 (2010) Analog to digital converter dedicated to numerical relays

JEC2511 (1995) Voltage relays

Guaranteed performance

Common conditions	Frequency: Rated frequency Control power supply voltage: Rated voltage Ambient temperature: 20°C Relative humidity: 30 to 80 % on daily average	Unless otherwise indicated, the common conditions shall be as described in the left column.

9.1. Relay characteristic data

Item	Test condition		Standard
Operating value	All elements	Voltage setting	Setting ± 5%
Resetting value	Undervoltage element (27)	Voltage setting	Voltage operating value × 105% or less
	Other elements	Voltage setting	Voltage operating value × 90% or more
Operating time	Undervoltage element (27)	Setting : Voltage setting = Minimum and Maximum Input: Voltage = Rated voltage → Voltage setting value × 70% Rated voltage → Voltage setting value × 0% (a) Ope.Time : 0.00 s (b) Ope.Time : 0.01s ≤ Ope.Time < 1.00s (c) Ope.Time : 1.00s ≤ Ope.Time ≤ 10.00s	(a) Within 50 ms (b) Ope.time setting ± 50 ms (c) Ope.time setting ± 5%
	Overvoltage element (59)	Setting : Voltage setting = Minimum and Maximum Input: Voltage = Rated voltage → Voltage setting value × 120% Rated voltage → Voltage setting value × 130% Rated voltage → Voltage setting value × 150% (a) Ope.Time : 0.00 s (b) Ope.Time : 0.01s ≤ Ope.Time < 1.00s (c) Ope.Time : 1.00s ≤ Ope.Time ≤ 10.00s	
	Ground fault overvoltage element (64)	Setting : Voltage setting = Minimum and Maximum Input: Voltage = Rated voltage → Voltage setting value × 120% Rated voltage → Voltage setting value × 150% Rated voltage → Voltage setting value × 200% (a) Ope.Time : 0.00 s (b) Ope.Time : 0.01s ≤ Ope.Time < 1.00s (c) Ope.Time : 1.00s ≤ Ope.Time ≤ 10.00s	

Item	Test condition		Standard
Operating time	Negative sequence overvoltage element (47) Reverse phase protection (47)	Setting : Voltage setting = Minimum and Maximum Input: Voltage = Rated voltage → Voltage setting value × 120% (a) Ope.Time : 0.00 s (b) Ope.Time : 0.01s ≤ Ope.Time < 1.00s (c) Ope.Time : 1.00s ≤ Ope.Time ≤ 10.00s	(a) Within 50 ms (b) Ope.time setting ± 50 ms (c) Ope.time setting ± 5%
Reset time	Undervoltage element (27)	Setting : Voltage setting = Maximum Input: Voltage = Voltage setting value × 70% → Rated voltage	200 ms ± 50 ms
	Overvoltage element (59)	Setting : Voltage setting = Minimum Input: Voltage = Voltage setting value × 120% → 0	
	Ground fault overvoltage element (64)	Setting : Voltage setting = Minimum Input: Voltage = Voltage setting value × 150% → 0	
	Negative sequence overvoltage element (47) Reverse phase protection (47)	Setting : Voltage setting = Minimum Input: Voltage = Voltage setting value × 120% → 0	
Temperature characteristics	All elements	Setting : Voltage setting = Maximum (27) Minimum (Others) Ope. Time. = 0.00s (a) 0, 40 °C (b) -10, 50 °C	The error relates to the operating value & time at ambient temperature of 20 °C. (a) Ope.value at 20°C ± 5% Within 50 ms (b) Ope.value at 20°C ± 10% Within 50 ms
Power supply voltage characteristics	All elements	Variation range of control power supply =DC 88 V, DC 300 V, AC 85 V, AC 264 V	Within ± 5% of the measured value at rated voltage
Distorted wave characteristics	All elements	Third harmonic content: 90% of distortion factor Fifth harmonic content: 90% of distortion factor Seventh harmonic content: 90% of distortion factor	Operating value at 1f ± 10% Resetting value at 1f ± 10%
Frequency characteristics	All elements	Frequency: Rated frequency ± 5% Setting : Voltage setting = Maximum (27) Minimum (Others) Ope. Time. = 0.00s	Ope.value at rated freq. ± 5% Within 50 ms

9.2. General specification data

<table>
<tr><th>Item</th><th colspan="4">Test condition</th><th>Standard</th></tr>
<tr><td rowspan="3">Contact capacity</td><td colspan="3" rowspan="2">Contact for tripping</td><td>Closed circuit capacity</td><td>DC 110 V : 15 A
DC 220 V : 10 A
0.5s L/R = 0</td></tr>
<tr><td>Open-circuit capacity</td><td>DC 110 V : 0.3 A
DC 220 V : 0.15 A
L/R = 40 ms</td></tr>
<tr><td colspan="4">Contact for annunciator</td><td>Open- / Closed circuit capacity :
500VA (cosφ = 0.4),
60W (L/R = 7ms)

Max. current : 5 A
Max. voltage : AC 380 V
DC 125 V</td></tr>
<tr><td rowspan="3">Overload capacity</td><td>Current circuit</td><td colspan="3">Rated current × 40 times,
for 2 s, twice, at intervals of 1 min</td><td rowspan="3">No malfunction,
no unnecessary operation,
no abnormal indication,
and etc.</td></tr>
<tr><td rowspan="2">Voltage circuit</td><td colspan="3">Rated voltage × 1.15 times, 3 hr</td></tr>
<tr><td colspan="3">Positive-phase-sequence voltage :
Rated voltage × 2.17 times, for 10 s, once

Zero-phase-sequence voltage :
Rated voltage × 1.5 times, for 5 s, once</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>Withstand voltage at commercial frequency</td><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><td>No malfunction,
no unnecessary operation,
no abnormal indication,
and etc.</td></tr>
<tr><td rowspan="2">Withstand voltage against lightning impulse</td><td rowspan="2">Standard shock voltage waveform (1.2/50 μs)

Application to each of positive and negative pole for 3 times</td><td>4.5 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><td rowspan="2">No malfunction,
no unnecessary operation,
no abnormal indication,
and etc.</td></tr>
<tr><td>3 kV</td><td colspan="2">・ Between mutual control circuits
・ Between terminals of transformer circuit for measuring instrument
・ Between contact circuit terminals (between poles)
・ Between terminals of control power supply circuit
(However, the serial communication circuit is excluded.)</td></tr>
</table>

Item	Test condition	Standard
Trouble of control power supply	・ Turning on/off control power supply ・ Instantaneous interruption of control power supply ・ Slow variation of control power supply	No malfunction, no unnecessary operation, no abnormal indication, and etc.
Immunity against electrostatic discharge	8 kV: Contact discharge 15 kV: Aerial discharge 10 times of each of positive and negative pole at intervals of more than 1s	No malfunction, no unnecessary operation, no abnormal indication, and etc.
Immunity against 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 malfunction, no unnecessary operation, no abnormal indication, and etc.
Immunity against damped oscillatory wave	・ 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 malfunction, no unnecessary operation, no abnormal indication, and etc.
Electric fast transient/Burst immunity	Applied voltage: ±2.0 kV Repetition frequency: 5.0 kHz Port for applied: Between collective control power supply circuit and ground Applied voltage: ±1.0 kV Repetition frequency: 5.0 kHz Port for applied: ・ Between collective transformer circuit for measuring instruments and ground ・ Between collective binary input/output (DI/DO) circuit and ground	No malfunction, no unnecessary operation, no abnormal indication, and etc.
Immunity to square wave impulse	Applied voltage: 1.0 kV ±10% Test time : 2s Each of positive and negative pole Output impedance : 50 Ω Pulse duration : 100 ns ±30% Pulse rise time : 1 ns or less Port for applied: ・ Between collective transformer circuit and ground ・ Between collective control power supply circuit and ground ・ Between collective binary input/output (DI/DO) circuit and ground ・ Between terminals of control power supply circuit	No malfunction, no unnecessary operation, no abnormal indication, and etc.

Item	Test condition	Standard
Surge immunity	Applied time : 1.2/50 μs at open circuit condition 8/20 μs at short circuit condition Effective output impedance : 2 Ω 5 times of each of positive and negative pole at intervals 1min Port for applied and applied voltage: ・ Between control power supply terminals: Applied voltage : 0.5, 1 kV (0 Ω, 18 μF, 1.5 mH) ・ Between collective control power supply and ground: Applied voltage : 0.5, 1, 2 kV (10 Ω, 9 μF, 1.5 mH) ・ Between binary input/output circuit terminals: Applied voltage : 0.5, 1 kV (40 Ω, 0.5 μF, 20 mH) ・ Between collective binary input/output circuit and ground: Applied voltage : 0.5, 1, 2 kV (40 Ω, 0.5 μF, 20 mH) ・ Between transformer circuits for measuring instruments: Applied voltage : 0.5, 1 kV (40 Ω, 0.5 μF, 20 mH) ・ Between collective transformer circuit for measuring instruments and ground: Applied voltage : 0.5, 1, 2 kV (40 Ω, 0.5 μF, 20mH)	No malfunction, no unnecessary operation, no abnormal indication, and etc.
Commercial frequency magnetic field immunity	Magnetic field intensity : 30 A/m, for 60 s (continuous), at once 300 A/m, for 2s, three times at intervals of 1 min * Setting value of the I0 circuit for ZCT input shall be 5 mA or more.	No malfunction, no unnecessary operation, no abnormal indication, and etc.
Immunity to conducted disturbances, induced by radio- frequency fields	Voltage level : 10 V Amplitude modulation : 1 kHz, ±80% Frequency range : (a) Sweep test : 150 kHz ~ 80 MHz (b) Spot test : 27, 68 MHz Test time : (a) Sweep test : 0.5 s or more at each step of frequency (b) Spot test : 10 s or more at each frequency Port for applied : ・Between collective control power supply and ground ・Between collective binary input/output circuit and ground ・Between collective transformer circuit for measuring instruments and ground	No malfunction, no unnecessary operation, no abnormal indication, and etc.
Radiated, radio-frequency, electromagnetic field immunity	Voltage level : 10 V/m Amplitude modulation : 1 kHz, ±80% Frequency range : (a) Sweep test : 80 MHz ~ 1.0 GHz, 1.4 GHz ~ 2.7 GHz (b) Spot test : 80, 160, 380, 450, 900, 1850, 2150 MHz Test time : (a) Sweep test : 0.5 s or more at each step of frequency (b) Spot test : 10 s or more at each frequency Number of test time : Twice at each frequency for each direction of back and forth, right and left (4 directions) ; In total, 8 times at each frequency	No malfunction, no unnecessary operation, no abnormal indication, and etc.

<table>
<tr><th>Item</th><th colspan="8">Test condition</th><th>Standard</th></tr>
<tr><td rowspan="4">Vibration</td><td rowspan="2">Frequency
(Hz)</td><td colspan="3">Amplitude
(mm)</td><td rowspan="2">Time
(s)</td><td colspan="3">Acceleration
(m/s^2)</td><td rowspan="4">No malfunction,
no unnecessary operation,
no abnormal indication,
and etc.</td></tr>
<tr><td>Back and forth</td><td>Right and left</td><td>Up and down</td><td>Back and forth</td><td>Right and left</td><td>Up and down</td></tr>
<tr><td>10</td><td colspan="2">5</td><td>2.5</td><td>30</td><td colspan="2">10</td><td>5</td></tr>
<tr><td>16.7</td><td colspan="3">0.4</td><td>600</td><td colspan="3">2</td></tr>
<tr><td>Shock</td><td colspan="8">・Shock acceleration : 300 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 : 3 times for 6 directions (In total : 18 times)</td><td>No malfunction,
no unnecessary operation,
no abnormal indication,
and etc.</td></tr>
<tr><td>Load</td><td colspan="8">(1) Current circuit
(2) Voltage circuit
(3) Control power supply</td><td>(1) At the rating of 5 A: 0.6 VA or less
At the rating of 1 A: 0.1 VA or less
(2) 0.1 VA or less
(3) 10 W or less</td></tr>
<tr><td>Mass</td><td colspan="8">(1) Subunit
(2) Subunit and outer case</td><td>(1) About 2.3 kg
(2) About 3.7 kg</td></tr>
</table>

10. 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.

10.1. 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.

10.2. Characteristic test

10.2.1. 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 9.

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 9.1) 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 5.3.4.1 for the setting change.

(4) Judgment of operation

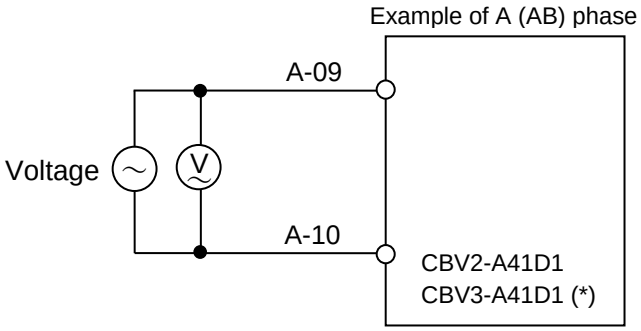
Basically, the measurement of the operating value, operating time, etc. shall be done by open/close of the output relay contact of each element.

10.2.2. Characteristic test

(1) Test circuit

The external connection of AC input circuit is as shown below as a reference.
Refer to Fig. 2-3 for the terminal arrangement.

[1] Overvoltage element / Undervoltage element

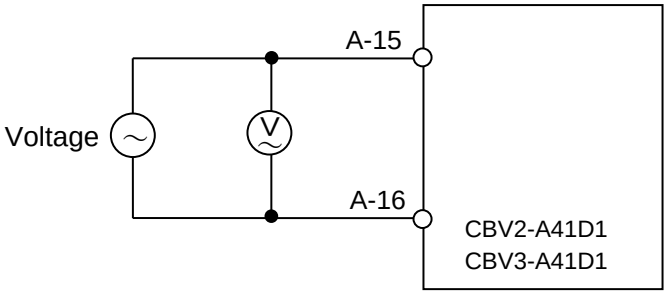


Test phase	Terminal No.
A-phase	A-09～A-10
B-phase	A-11～A-12
C-phase	A-13～A-14

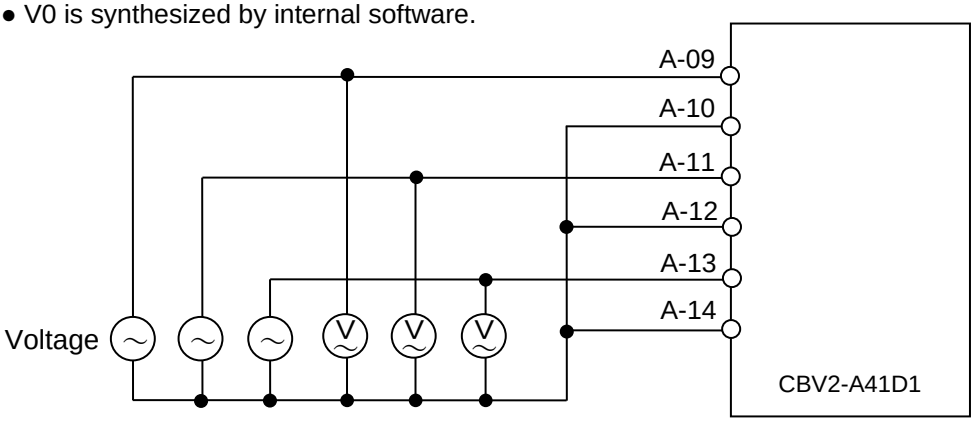
(*) In CBV3-A41D1, it has only Va (one-phase) or Vab (one-line) input.

[2] Ground fault overvoltage element

● V0 is directly taken from the terminal.

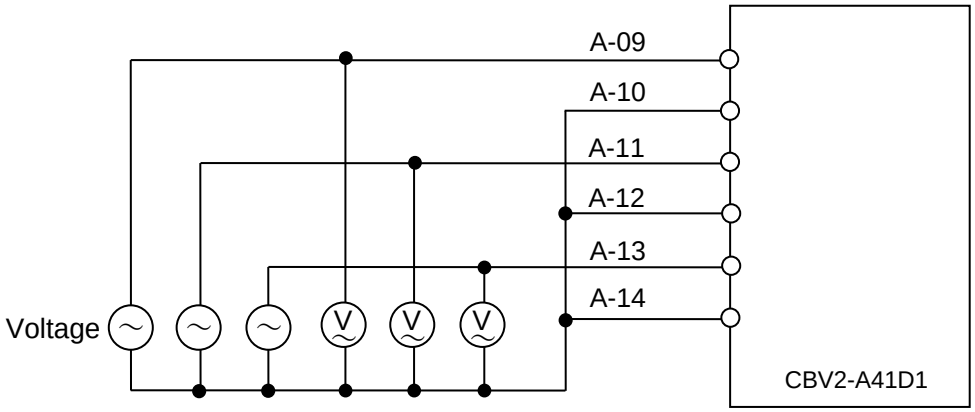


● V0 is synthesized by internal software.



In CBV2-A41D1, it is possible to select by setting (V0 Input Sel.), whether the zero-sequence voltage is derived by calculation of [(Va+Vb+Vc)/3], or directly taken from the V0 terminal. Regarding the configuration of “V0 Input Sel.”, refer to Section 8.6.

[3] Negative sequence overvoltage element / Reverse phase protection element (CBV2-A41D1 only)



(2) Test items

[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 element, lock the operaion of undervoltage B-phase and C-phase.

As for the method of test setting, refer to 5.3.4.3.2 in Chapter 5.

As for the list of test setting items, refer to the table shown below.

List of test setting items

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

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No.	Name of items	Contents of setting	Setting
1	SV-LK	Locking of alarm function	UNLOCKED / LOCKED
2	UV-LK	Locking of UV	UNLOCKED / LOCKED
3	OV-LK	Locking of OV	UNLOCKED / LOCKED
4	TCNT-LK	Locking of trip counter	UNLOCKED / LOCKED

[2] Forced operation test (DO contact test)

Refer to 5.3.4.3.1 in Chapter 5.

[3] Operating value test

Refer to the “Operating value” and “Resetting value” in Chapter 9.

[4] Operating time test

Refer to the “Operating time” in Chapter 9.

[5] Resetting time test

Refer to the “Reset time” in Chapter 9.

[6] LED/VFD full lighting test

Refer to 5.3.4.3.3 in Chapter 5.

11. Maintenance and self diagnosis

11.1. Maintenance

11.1.1. 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

11.1.2. Periodic inspection

It is recommended to test the following items periodically.

- Visual inspection, referring to Section 10.1.
- Characteristic test, referring to Section 10.2.

11.2. Self diagnosis

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

1. Alarm indication

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

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

Serious failure --- 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 11-1 LED display, Alarm DO

Status of the relay	Alarm DO	RUN LED	ALARM LED
Minor failure	OFF	ON	ON
Serious failure	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.

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. 11-1, Fig. 11-2 for LED display and alarm DO.

[2] Confirm the error code in monitoring
Refer to 5.3.2.2.4 in Chapter 5 for the confirmation method of the error code,

[3] Please contact your service provider.

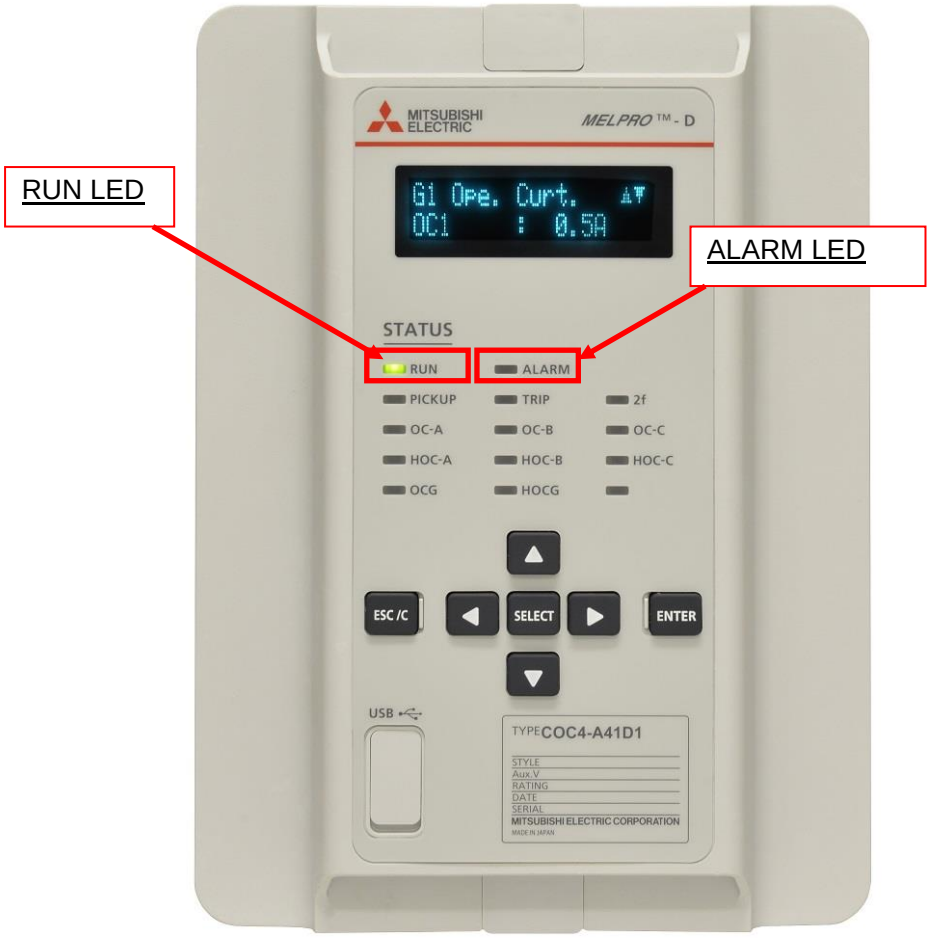

Fig. 11-1 Position of RUN LED, ALARM LED

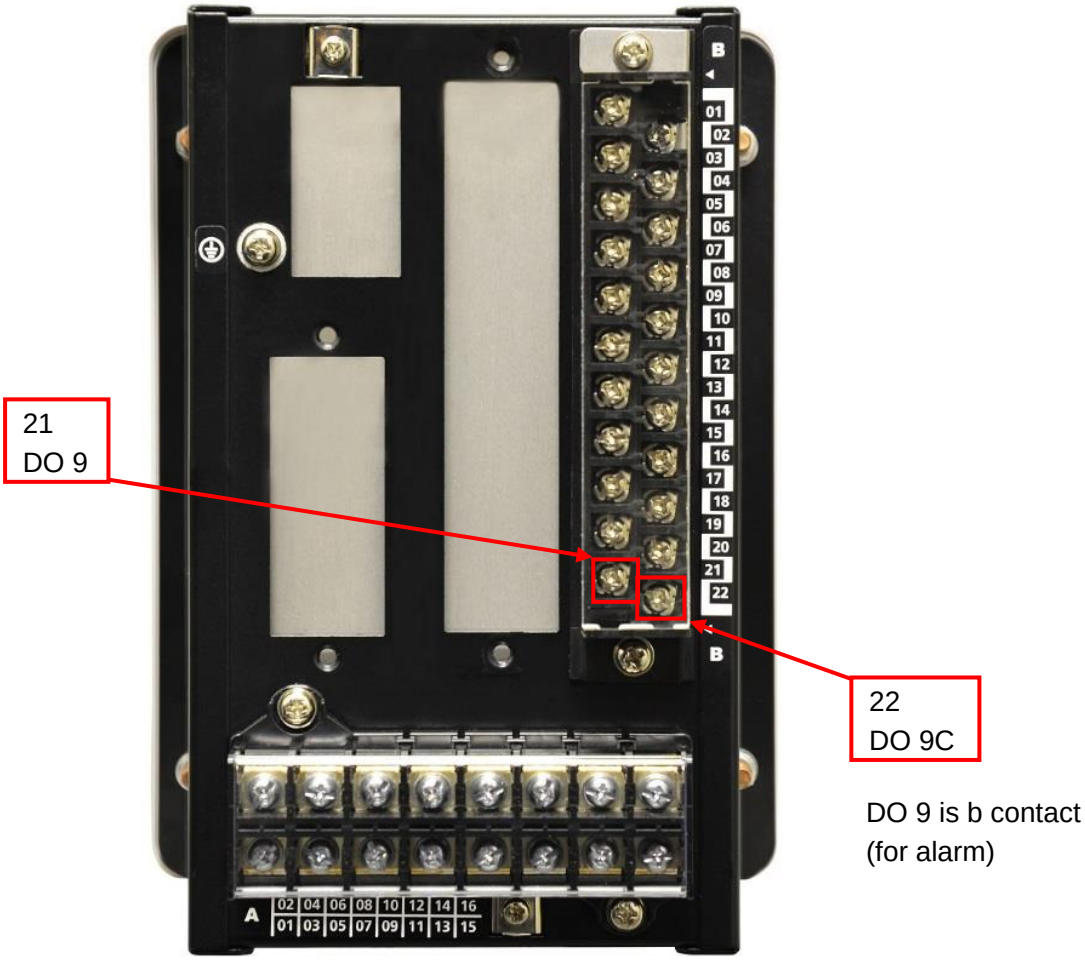

Fig. 11-2 Position of alarm DO

12. Default setting or configuration value

12.1. Setting

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Category	Element	Setting								
		Item name or Setting parameter		Range		Step	Default value		Please make a note about setting.	
		VFD	PC-HMI	VFD	PC-HMI		VFD	PC-HMI	Group 1 (G1)	Group 2 (G2)
UV/OV/OVG	UV1	UV1 EN	UV1 EN	OFF ON	Off On	–	OFF	Off		
		UVP/UVS Sel.	UV1 UVP/UVS Sel.	UVP UVS		–	UVP	UVP		
		Ope. Volt.	UV1 Ope. Volt.	20.0 ~ 120.0V		0.1V	20.0V	20.0V		
		Ope. Time	UV1 Ope. Time	0.00 ~ 10.00s		0.01s	0.00s	0.00s		
	UV2	UV2 EN	UV2 EN	OFF ON	Off On	–	OFF	Off		
		UVP/UVS Sel.	UV2 UVP/UVS Sel.	UVP UVS		–	UVP	UVP		
		Ope. Volt.	UV2 Ope. Volt.	20.0 ~ 120.0V		0.1V	20.0V	20.0V		
		Ope. Time	UV2 Ope. Time	0.00 ~ 10.00s		0.01s	0.00s	0.00s		
	OV1	OV1 EN	OV1 EN	OFF ON	Off On	–	OFF	Off		
		OVP/OVS Sel.	OV1 OVP/OVS Sel.	OVP OVS		–	OVP	OVP		
		Ope. Volt.	OV1 Ope. Volt.	20.0 ~ 200.0V		0.1V	20.0V	20.0V		
		Ope. Time	OV1 Ope. Time	0.00 ~ 10.00s		0.01s	0.00s	0.00s		
	OV2	OV2 EN	OV2 EN	OFF ON	Off On	–	OFF	Off		
		OVP/OVS Sel.	OV2 OVP/OVS Sel.	OVP OVS		–	OVP	OVP		
		Ope. Volt.	OV2 Ope. Volt.	20.0 ~ 200.0V		0.1V	20.0V	20.0V		
		Ope. Time	OV2 Ope. Time	0.00 ~ 10.00s		0.01s	0.00s	0.00s		
	OVG1	OVG1 EN	OVG1 EN	OFF ON	Off On	–	OFF	Off		
		Ope. Volt.	OVG1 Ope. Volt.	2.0 ~ 100.0V		0.1V	2.0V	2.0V		
		Ope. Time	OVG1 Ope. Time	0.00 ~ 10.00s		0.01s	0.00s	0.00s		
	OVG2	OVG2 EN	OVG2 EN	OFF ON	Off On	–	OFF	Off		
		Ope. Volt.	OVG2 Ope. Volt.	2.0 ~ 100.0V		0.1V	2.0V	2.0V		
		Ope. Time	OVG2 Ope. Time	0.00 ~ 10.00s		0.01s	0.00s	0.00s		
OVNEG/ REVPH	OVNEG1	OVNEG1 EN	OVNEG1 EN	OFF ON	Off On	–	OFF	Off		
		Ope. Volt.	OVNEG1 Ope. Volt.	2.0 ~ 100.0V		0.1V	2.0V	2.0V		
		Ope. Time	OVNEG1 Ope. Time	0.0 ~ 10.0s		0.1s	0.0s	0.0s		
	OVNEG2	OVNEG2 EN	OVNEG2 EN	OFF ON	Off On	–	OFF	Off		
		Ope. Volt.	OVNEG2 Ope. Volt.	2.0 ~ 100.0V		0.1V	2.0V	2.0V		
		Ope. Time	OVNEG2 Ope. Time	0.0 ~ 10.0s		0.1s	0.0s	0.0s		
	REVPH	REVPH EN	REVPH EN	OFF ON	Off On	–	OFF	Off		
		Ope. Time	REVPH Ope. Time	0.0 ~ 10.0s		0.1s	0.0s	0.0s		
AI-CONFIG	CONFIG	V0 Input Sel.	V0 Input Sel.	VG 3P		–	VG	VG		
		V Input Sel.	V Input Sel.	D Y		–	Y	Y		
		V 3P/2P Sel.	V 3P/2P Sel.	3P 2P		–	3P	3P		
System setting	–	Pre-Rec.	Pre-Rec. Time	100 ~ 4500ms		10ms	100ms	100ms		
	–	Rec.	Max. Rec. Time	200 ~ 5000ms		10ms	200ms	200ms		
	–	PASSWORD	–	UNUSE USE	–	–	UNUSE	–		
	–	PASS	–	0000 ~ 9999		1	0000	–		
Trip counter	–	Initial	Initial Value	0 ~ 10000		1	0	0		
	–	Alarm	Alarm Value	1 ~ 10000		1	1	1		
Analog value display	–	AI Disp.	AI Display Style	PRIMARY SECONDARY	Primary Secondary	–	PRIMARY	Primary		
	–	PTP	PTP	0.10 ~ 99.00kV		0.01kV	5.00kV	5.00kV		
	–	PTS	PTS	100 ~ 125V		1V	100V	100V		
	–	PTGP	PTGP	0.10 ~ 99.00kV		0.01kV	5.00kV	5.00kV		
	–	PTGS	PTGS	100 ~ 220V		1V	100V	100V		
DO contact test setting	–	–	One-Shot Time	–	1 ~ 20s	1s	–	1s		

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Category	Element	Setting								
		Item name or Setting parameter		Range		Step	Default value		Please make a note about setting.	
		VFD	PC-HMI	VFD	PC-HMI		VFD	PC-HMI	Group 1 (G1)	Group 2 (G2)
UV/OV/OVG	UV1	UV1 EN	UV1 EN	OFF ON	Off On	–	OFF	Off		
		Ope. Volt.	UV1 Ope. Volt.	20.0 ~ 120.0V		0.1V	20.0V	20.0V		
		Ope. Time	UV1 Ope. Time	0.00 ~ 10.00s		0.01s	0.00s	0.00s		
	UV2	UV2 EN	UV2 EN	OFF ON	Off On	–	OFF	Off		
		Ope. Volt.	UV2 Ope. Volt.	20.0 ~ 120.0V		0.1V	20.0V	20.0V		
		Ope. Time	UV2 Ope. Time	0.00 ~ 10.00s		0.01s	0.00s	0.00s		
	OV1	OV1 EN	OV1 EN	OFF ON	Off On	–	OFF	Off		
		Ope. Volt.	OV1 Ope. Volt.	20.0 ~ 200.0V		0.1V	20.0V	20.0V		
		Ope. Time	OV1 Ope. Time	0.00 ~ 10.00s		0.01s	0.00s	0.00s		
	OV2	OV2 EN	OV2 EN	OFF ON	Off On	–	OFF	Off		
		Ope. Volt.	OV2 Ope. Volt.	20.0 ~ 200.0V		0.1V	20.0V	20.0V		
		Ope. Time	OV2 Ope. Time	0.00 ~ 10.00s		0.01s	0.00s	0.00s		
	OVG1	OVG1 EN	OVG1 EN	OFF ON	Off On	–	OFF	Off		
		Ope. Volt.	OVG1 Ope. Volt.	2.0 ~ 100.0V		0.1V	2.0V	2.0V		
		Ope. Time	OVG1 Ope. Time	0.00 ~ 10.00s		0.01s	0.00s	0.00s		
	OVG2	OVG2 EN	OVG2 EN	OFF ON	Off On	–	OFF	Off		
		Ope. Volt.	OVG2 Ope. Volt.	2.0 ~ 100.0V		0.1V	2.0V	2.0V		
		Ope. Time	OVG2 Ope. Time	0.00 ~ 10.00s		0.01s	0.00s	0.00s		
System setting	–	Pre-Rec.	Pre-Rec. Time	100 ~ 4500ms		10ms	100ms	100ms		
	–	Rec.	Max. Rec. Time	200 ~ 5000ms		10ms	200ms	200ms		
	–	PASSWORD	–	UNUSE USE	–	–	UNUSE	–		
	–	PASS	–	0000 ~ 9999		1	0000	–		
Trip counter	–	Initial	Initial Value	0 ~ 10000		1	0	0		
	–	Alarm	Alarm Value	1 ~ 10000		1	1	1		
Analog value display	–	AI Disp.	AI Display Style	PRIMARY SECONDARY	Primary Secondary	–	PRIMARY	Primary		
	–	PTP	PTP	0.10 ~ 99.00kV		0.01kV	5.00kV	5.00kV		
	–	PTS	PTS	100 ~ 125V		1V	100V	100V		
	–	PTGP	PTGP	0.10 ~ 99.00kV		0.01kV	5.00kV	5.00kV		
	–	PTGS	PTGS	100 ~ 220V		1V	100V	100V		
DO contact test setting	–	–	One-Shot Time	–	1 ~ 20s	1s	–	1s		

12.2. Output contacts

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	Item name (PC-HMI)	Default value (PLC signal)	Please make a note about setting.
Contacts for tripping (DO)	DO1	ALLEL-O	
	DO2	ALLEL-O	
	DO3	ALLEL-O	
	DO4	ALLEL-O	
Contacts for annunciator (DO)	DO5	UV-3_O	
	DO6	OV-3_O	
	DO7	OVG-O	
	DO8	NOV / REVPH	

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

MITSUBISHI ELECTRIC CORPORATION

HEAD OFFICE : 7-3 MARUNOUCHI 2-CHOME, CHIYODA-KU TOKYO, 100-8310, JAPAN

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