



Numerical Protection Relay

MELPRO™-D Series

VOLTAGE RELAY

MODEL

CBV4-A01D1

INSTRUCTION MANUAL

Request

Ensure that this Instruction Manual is delivered to the end users and the maintenance manager.

— Safety section —

This Safety section should be read before starting any work on the relay. Be sure to read the instruction manuals and other related documents prior to commencing any work on the relay in order to maintain them in a safe condition. Be sure to be familiar with the knowledge, safety information and all caution items of the product prior to use.



CAUTION

Caution means that failure to un-observe safety information, incorrect use, or improper use may endanger personnel and equipment and cause personnel injury or physical damage.

Items as classified to the caution may become to occur more severe results according to the circumstance. Therefore, all items described in the safety section are important and to be respected without fail.



CAUTION

1. Items concerning transportation
 - (1) Be sure the equipment to be kept in normal direction
 - (2) Avoid the bumps, shock, and vibration, otherwise the product performance /life might be unfavorably affected.
2. Items concerning storage
 - (1) Environment shall be as below, otherwise the product performance/life might be unfavorably affected.
 - Ambient temperature: $-20^{\circ}\text{C}\sim+60^{\circ}\text{C}$ (with no condensation nor freezing)
 - Relative humidity: 30~80% average of a day
 - Altitude: Less than 2000m
 - Avoid applying unusual shock, vibration or leaning or magnetic field
 - Not expose to harmful smoke, gas, salty air, water, vapor, dust, powder, explosive material or wind, rain.
3. Items concerning mounting/wiring work
 - (1) Mounting and wiring work should be done correctly.
Otherwise, damage, burning or erroneous operation might occur.
 - (2) Screw terminal should be tightened securely.
Otherwise, damage and burning might occur.
 - (3) Grounding should be done correctly in case it is required.
Otherwise, electric shock, damage, burning or erroneous operation might occur.
 - (4) Wiring should be done without mistake especially observing the correct polarity.
Otherwise, damage, burning or erroneous operation might occur.
 - (5) Wiring should be done without mistake especially observing the phase ordering.
Otherwise, damage, or erroneous operation might occur.
 - (6) Auxiliary power source, measuring transformer and power source which have enough capacity for correct operation of product should be used.
Otherwise, an erroneous operation might occur.
 - (7) Be sure to restore the front cover, terminal cover, protection cover, etc to the original position, which have been removed during the mounting/ wiring work.
Otherwise, electrical shock might occur at the time of checking.
 - (8) Connection should be done correctly using designated and right connectors.
Otherwise, damage or burning might occur.
 - (9) Fully insert the sub unit into the case until you can hear a click while pressing the handles located on both sides of the sub unit front face.
Otherwise, incomplete inserting the sub unit might only establish a poor contact with the terminals located on the back side of unit, which might cause erroneous operation or heating.
4. Concerning equipment operation and settings
 - (1) Operational condition should be as below.
Otherwise, the product performance/life might be unfavorably affected.
 - Deviation of auxiliary power: within $+10\%\sim-15\%$ of rated voltage
 - Deviation of frequency: within $\pm 5\%$ of rated frequency
 - Ambient temperature: $0^{\circ}\text{C}\sim+40^{\circ}\text{C}$ ($-10^{\circ}\text{C}\sim+50^{\circ}\text{C}$ is permissible during couples of hour per day, with no condensation nor freezing)
 - Relative humidity: 30~80% average of a day
 - Altitude: Less than 2000m
 - Avoid to be exposed to unusual shock, vibration, leaning or magnetic field

-Not expose to harmful smoke, gas, salty air, water, vapor, dust, powder, explosive material, wind or rain.

- (2) Qualified personnel may work on or operate this product, otherwise, the product performance/life might be unfavorably affected and/or burning or erroneous operation might occur.
- (3) Be sure to read and understand the instruction manuals and other related documents prior to commencing operation and maintenance work on the product. Otherwise, electrical shock, injury, damage, or erroneous operation might occur.
- (4) While energizing product, be sure not to remove any unit or parts without permissible one. Otherwise, damage, or erroneous operation might occur.
- (5) While energizing product, be sure to make short circuit of current transformer secondary circuits before setting change or drawing out the sub unit. Otherwise, secondary circuit of live current transformer might be opened and damage or burning might occur due to the high level voltage.
- (6) While energizing product, be sure to open trip lock terminal before setting change or drawing out the internal unit of product. Otherwise, erroneous operation might occur.
- (7) Be sure to use the product within rated voltage and current.
Otherwise, damage or mal-operation might be occurred.
- (8) While energizing product, be sure not to clean up the product.
Only wiping a stain on the front cover of product with a damp waste might be allowable. (Be sure to wring hardly the water out of the waste.)

5. Items concerning maintenance and checking

- (1) Be sure that only qualified personnel might work on or operate this product.
Otherwise, electrical shock, injury, damage, or erroneous operation might occur.
- (2) Be sure to read and understand the instruction manuals and other related documents prior to commencing operation and maintenance work on the product. Otherwise, electrical shock, injury, damage, or erroneous operation might occur.
- (3) In case of replacing the parts, be sure to use the ones of same type, rating and specifications, etc. If impossible to use above parts, be sure to contact the sales office or distributor nearest you. Otherwise, damage or burning might occur.
- (4) Testing shall be done with the following conditions.
 - Ambient temperature: $20^{\circ}\text{C}\pm 10^{\circ}\text{C}$
 - Relative humidity: Less than 90%
 - Magnetic field: Less than 80A/m
 - Atmospheric pressure: $86\sim 106\times 10^3\text{ Pa}$
 - Installation angle: Normal direction $\pm 2^{\circ}$
 - Deviation of frequency: within $\pm 1\%$ of nominal frequency
 - Wave form(in case of AC): Distortion factor less than 2%
(Distortion factor= $100\%\times\text{effective value of harmonics}/\text{effective value of fundamental}$)
 - Ripple (in case of DC): Ripple factor less than 3%
(Ripple factor= $100\%\times(\text{max}-\text{min})/\text{average of DC}$)
 - Deviation of auxiliary power: within $\pm 2\%$ of nominal voltage
 - Be sure not to inject the voltage or current beyond the overload immunity.
Otherwise, damage or burning might occur.
 - Be careful not to touch the energized parts.
Otherwise, the electric shock might occur.

6. Items concerning modification and/or repair work

Be sure to ask any modification and/ or repair work for product to the sales office or distributor nearest you.

Unless otherwise, any incidents occurred with modification or repair works (including software) done by any other entity than MITSUBIHI ELECTRIC CORPORATION shall be out of scope on warranty covered by MITSUBISHI ELECTRIC CORPORATION.

7. Items concerning disposal

Particular regulations within the country of operation shall be applied to the disposal.

- Introduction -

Thank for your purchasing MITSUBISHI ELECTRIC **MELPRO**™ – D Series Digital Protection Relay.

Please read this manual carefully to be familiar with the functions and performances enough to use the product properly.

Please be sure to send this instruction manual to end users.

For operation of the product, this manual should be used in conjunction with the following materials:

Title of document	Document No.
MELPRO – D Series Protection Relay General Operation Manual	JEP0-IL9416

When the protection relay is used together with a communication card, use the following documents too:

(For CC-Link)

Title of document	Document No.
MELPRO – D Series Protection Relay CC-COM Communication Card (CC-Link) Operation Manual (General information)	JEP0-IL9417
MELPRO – D Series Protection Relay CC-COM Communication Card (CC-Link) Operation Manual (Model-specific information)	JEP0-IL9418

– CONTENTS –

1. Features.....	6
1.1 General description	6
1.2 Features.....	6
2 Rating and specifications.....	8
2.1 General information	8
2.2 Protective elements	9
2.3 Measurement elements.....	9
3 Characteristics	11
3.1 Protective elements	11
3.2 Measurement elements.....	11
3.3 Common technical data.....	12
4 Functions.....	13
4.1 Protection.....	13
4.2 Measurement.....	16
4.3 Self-diagnosis	17
4.4 Communication.....	18
5 Configuration.....	20
5.1 Internal configuration	20
5.2 External connection	23
6 Handling.....	28
6.1 Unpacking.....	28
6.2 Transportation and storage	28
6.3 Appearance and how to pull sub unit out	28
6.4 How to use front control panel.....	31
7 Mounting	38
7.1 Mounting dimension	38
7.2 Standard operating environment.....	38
8 Test.....	39
8.1 Appearance inspection	39
8.2 Characteristic test.....	40
9 Maintenance	42
9.1 Daily inspection	42
9.2 Periodical inspection.....	42
10 Ordering.....	43
11 Guarantee	43
11.1 Guarantee period.....	43
11.2 Scope of guarantee	43
11.3 Exclusion of loss in opportunity and secondary loss from warranty liability.....	44
11.4 Applications of products	44
11.5 Onerous repair term after discontinuation of product.....	45
11.6 Changes in product specification	45
11.7 Scope of service	45
12 Improvement on the reliability of protection function	45

1. Features

1.1 General description

Mitsubishi Electric MELPRO-D Series is a digital protection relay product with a microprocessor for protecting high/extra-high-voltage electric power system.

With its improved functions, including operation support using the advanced communication networks, data saving at the power system faults and power system voltage/current measurement, this series of protection relay will allow stable and effective control and monitoring of electric power systems as well as provide high-reliable protection.

1.2 Features

(1) High-reliable protection

The product includes a three-phase undervoltage and a duplicated earth fault overvoltage element.

It is used for backup protection to protect an extra-high/high voltage system from phase and earth faults.

(2) Communication Network

- With an open field bus system, the relays can be used to build a high-speed, high-performance network system. In addition, the relay's multi-drop serial wiring reduces the amount of labor required for communication wiring.
- Control of measurement values, operation status, as well as setting changes, etc., can be performed from a remote location.
- In consideration of future network system variations and compatibility with communication networks, communication features are mounted in the relay using a replaceable card.

(3) Measurement & Recording Functions

- Real time monitor of relay input data
The relay can measure steady state relay input values, supporting energy management.
- Fault Data Monitor
When a fault occurs, the relay saves the past 5 effective input values and waveform data to assist with fault analysis.

(4) Programmable Output Configuration

The operating output contacts (DO) can be set by combining the outputs of the protection relay element using 'OR' logic, thereby simplifying sequence design.

(5) High Accurate Digital Computation

The digital computation using high-speed sampling minimizes the effect of harmonics, etc., and results in highly accurate protection.

(6) Self-diagnosis

The relay continuously monitors electronic circuits from input to output so that it can detect internal failure before that failure causes damage on the power system, thereby improving reliability.

(7) Easy Replacement

The dimensions of the panel cutout are the same as the prior MULTICAP series. Changing from an existing relay type to this new type is easy.

(8) Easy Maintenance

The relays are adopted as draw-out unit mechanisms with automatic CT shorting at drawing, thereby making maintenance easy.

(9) Easy wiring check

It is possible to carry out forced operation of the output contacts individually. This will allow an easy wiring check.

2 Rating and specifications

2.1 General information

Type name		CBV4-A01D1		
Style	Relay without RS232C I/F	366PMB	367PMB	
	Relay with RS232C I/F	547PMB	548PMB	
Element	Protection	Undervoltage element × 3		
	Measurement	Earth fault overvoltage element × 2		
		Voltage, zero-phase voltage		
Rating	Frequency	50 Hz	60 Hz	
	Voltage	57 ~ 120 V		
	Zero-phase voltage	100 ~ 208 V		
	Auxiliary power supply *21	Voltage	Common use for 100 ~ 220VDC / 100 ~ 220VAC	
	Operative range	DC : 85 ~ 242 V (Range of 80 ~ 286VDC is allowable temporarily.) AC : 85 ~ 242 V (Range of 80 ~ 253VAC is allowable temporarily.)		
Display	RUN	Indicate the result of self-diagnosis. The lamp is lit for normal conditions and off for abnormal.		
	Unit	Indicate the unit symbol for measurements.		
	Item No., Item data	Display measurement, status, setting and option data selected with an item number.		
	Communication	With a communication card installed: the lamp is lit for normal conditions, blinking during communication and off for abnormal. With a communication card not installed: the lamp is off.		
Self-diagnosis		Monitor the electronic circuit and internal power supply to output signal to the RUN LED and self-diagnosis output (ALARM).		
Output contacts	Configurations	For trip	2 make contacts: X ₄ and X ₅ (programmable output)	
		For signaling	4 make contacts: X ₀ to X ₃ (programmable output)	
		For self-diagnosis output	1 break contact: Y (open for normal result of self-diagnosis with power on)	
	Capacity	For trip	Make	110VDC, 15A, 0.5 s (L/R = 0 s) 220VDC, 10A, 0.5 s (L/R = 0 s)
			Break	110VDC, 0.3A (L/R ≤ 40 ms) 220VDC, 0.15A (L/R ≤ 40 ms)
			Carry	1.5 A, continuously
		For signaling and self-diagnosis output	Make and Break	500 VA (cosφ = 0.4), 60W (L/R = 0.007 s)
			Max. current	5 A
Max. voltage	380VAC, 125VDC			
Burden	Voltage circuit	1 VA or less (with rated voltage)		
	Zero-phase voltage circuit	0.15 VA or less (with rated voltage)		
	Auxiliary power supply circuit	For 100VDC: approx. 5 W (approx. 7W including communication card) For 100VAC: approx. 7 VA (approx. 9VA including communication card) For 220VDC: approx. 6 W (approx. 8W including communication card) For 220VAC: approx. 12 VA (approx. 14VA including communication card)		
Mass		Net weight of relay unit :	approx. 2.3 kg	
		Including case :	approx. 3.0 kg	
Case/cover		Size :	D1 type	
		Color :	N1.5	

*21 When an uninterruptible AC power source is not provided in your system for the auxiliary supply voltage, use the type B-T1 backup power supply or commercially available uninterruptible power supply (UPS).

Type B-T1 back up power supply unit can be applied for DASH series protection relay with 100V~200V auxiliary power supply voltage rating only.

In addition, the power supply duration of the type B-T1 back up power supply is confirmed about 2 seconds in combination with one MELPRO-D series relay. Therefore, in the case that the required power supply duration after power source loss exceeds 2 seconds, please use a suitable commercial uninterruptible power supply.

When the power supply back up for the control power supply of a circuit breaker is required, it is necessary to prepare the backup power supply different from the type B-T1 back up power supply.

2.2 Protective elements

Style	Relay without RS232C I/F		366PMB	367PMB
	Relay with RS232C I/F		547PMB	548PMB
Setting *24	Undervoltage	Operation voltage	LOCK - 10 ~ 110V (1V step)	
		Operation time	INST - 0.1 ~ 10 s (0.1 s step)	
		UV test	OFF – AB phase test – BC phase test – CA phase test When execute the relay test, enable to use the selected input phase only. "UV test" LED turn on during selecting "UV TEST".	
	Earth fault overvoltage	Operation voltage	LOCK - 5 ~ 60V (1V step)	
Operation time		INST - 0.1 ~ 10 s (0.1 s step)		
Forced operation			Forced operation is available for any trip or signaling contact individually.	
Operation indication			Operation indicator LED (red) comes on when the relay operates.	

2.3 Measurement elements

Style	Relay without RS232C I/F		366PMB	367PMB
	Relay with RS232C I/F		547PMB	548PMB
Option *24	VT primary voltage		100 ~ 999V (1V step) 1000 ~ 9990V (10V step) 10.0k ~ 99.9kV (0.1kV step) 100k ~ 300kV (1kV step)	
	VT secondary voltage		100/√3 -110/√3 -115/√3 -120/√3 -100-110-115-120[V] (57.7) (63.5) (66.4) (69.3)	
	EVT primary voltage		100 ~ 999V (1V step) 1000 ~ 9990V (10V step) 10.0k ~ 99.9kV (0.1kV step) 100k ~ 300kV (1kV step)	
	EVT tertiary voltage		100-110-115-120-100√3 -110√3 -115√3 -120√3[V] (173) (190) (200) (208)	
Display	Voltage	Real time	Conversion	Indication value = Relay input value ×VT primary setting / VT secondary setting
			Range *22	0.00 ~ VT primary setting / VT secondary setting ×165 [V]
			Update	Approx. 200 ms
		Max. record	Conversion	Indication value = Relay input value ×VT primary setting / VT secondary setting
			Range *22	0.00 ~ VT primary setting / VT secondary setting ×165 [V]
			Fault record *23	Conversion
	Range *22	0.00 ~ VT primary setting / VT secondary setting ×165 [V]		
	Zero-phase voltage	Real time	Conversion	Indication value = Relay input value ×(EVT primary setting / EVT tertiary setting) ×(1/ √3)
			Range *22	0.00 ~ (EVT primary setting / EVT tertiary setting)×(1/ √3) ×210 [V]
			Update	Approx. 200 ms
		Max. record	Conversion	Indication value = Relay input value ×(EVT primary setting / EVT tertiary setting) ×(1/ √3)
			Range *22	0.00 ~ (EVT primary setting / EVT tertiary setting)×(1/ √3) ×210 [V]
Fault record *23			Conversion	Indication value = Relay input value ×(EVT primary setting / EVT tertiary setting) ×(1/ √3)
	Range *22	0.00 ~ (EVT primary setting / EVT tertiary setting)×(1/ √3) ×210 [V]		

- *22 The form of display depends on value range as shown in the tables below:
 VT/EVT primary setting value determines the minimum number of digits to be displayed on each measurement display.
 When a value to be displayed exceeds the max. value of the display range, the max. value will blink.

VT/EVT primary setting	100 ~ 500[V]	501 ~ 10000[V]	11 ~ 300[kV]
Form of display	0 ~ 999[V]	□□□[V]	□.□□[kV]
	1.00 ~ 9.99[kV]	□.□□[kV]	□.□[kV]
	10.0 ~ 99.9[kV]	□□.□[kV]	□□.□[kV]
	100 ~ 999[kV]	□□□[kV]	□□□[kV]

- *23 When a communication card is connected, waveform data in the event of system fault can be read.
 (See the section 4 "Function").
- *24 When the product is shipped from the factory, each setting value is "Lock" (With lock setting element) or "minimum setting value" (Without lock setting element).

3 Characteristics

Common conditions	(1) Rated frequency: $\pm 1\%$ (2) Ambient temperature: $20^{\circ}\text{C} \pm 10^{\circ}\text{C}$ (3) Aux. supply voltage: Rated voltage $\pm 2\%$	The conditions shown on the left should be applied unless otherwise specified.
-------------------	--	--

3.1 Protective elements

Items		Conditions	Guaranteed performance
Operation value	Undervoltage element	(Common conditions)	Setting value $\pm 5\%$
	Earth fault overvoltage element		
Reset value	Undervoltage element	(Common conditions)	Operation value $\times 105\%$ or less
	Earth fault overvoltage element		Operation value $\times 95\%$ or more
Operation time	Undervoltage element	Rated voltage \rightarrow Setting $\times 70\%$	<ul style="list-style-type: none"> - For setting of INST 40ms or less - For setting of 0.4s or less Setting value $\pm 25\text{ms}$ - For setting of 0.5s or more Setting value $\pm 5\%$
	Earth fault overvoltage element	0 \rightarrow Setting $\times 150\%$	
Reset time	Undervoltage element	Setting $\times 70\% \rightarrow$ Rated voltage	60ms or less
	Earth fault overvoltage element	Setting $\times 150\% \rightarrow 0$	

3.2 Measurement elements

Items		Condition	Guaranteed performance
Real time and max. records	Voltage	VT primary setting / VT secondary setting $\times 165$	$\pm 1\%$
	Zero-phase voltage	(EVT primary setting / EVT tertiary setting) $\times (1 / \sqrt{3}) \times 210$	$\pm 5\%$

3.3 Common technical data

ITEM		DESCRIPTION	CONDITION	STANDARD
Environment	Ambient operating temperature	-10°C to +55°C		IEC60255-6
	Ambient storage and transport temperature	-25°C to +70°C		IEC60255-6
	Damp heat	+40°C, 95%RH, 4 days		IEC60068-2-3
Thermal withstand	VT	1.15Vn, 3hrs once		
	Aux. power	Permissible max. voltage 3hrs once		
Dielectric test	Circuit of 60V or below	500VAC, 1min.	1) Between each circuit and the exposed conductive parts, the terminals of each independent circuit being connected together 2) Between independent circuits, the terminals of each independent circuit being connected together	IEC60255-5
	Circuit of more than 60V and 500v or below	2000VAC 1min.		
	Open contact	1000VAC, 1min.		
Impulse voltage test		5kV, 1.2µs/50µs	1) Between each circuit and the exposed conductive parts, the terminals of each independent circuit being connected together 2) Between independent circuits, the terminals of each independent circuit being connected together	IEC60255-5
High-frequency disturbance test	Common mode	2.5kV peak, 1MHz with 200 ohm source impedance for 2s	Between independent circuits, and between independent circuit and earth Across terminals of the same circuit	IEC60255-22-1 class 3
	Differential mode	1.0kV peak, 1MHz with 200 ohm source impedance for 2s		
Electrostatic discharge test		8kV	Contact discharge	IEC60255-22-2 Class 4
		15kV	Air discharge	
Radiated electromagnetic field disturbance test		68 to 87Mhz 146 to 174MHz 420 to 470MHz		IEC60255-22-3 class 3
Fast transient disturbance test		2.0kV, 5ns/50ns, 1min		IEC60255-22-4
Vibration test		Refer to class 1		IEC60255-21-1 Class 1
Shock response		Refer to class 2		IEC60255-21-2 Class 2
Shock withstand		Refer to class 1		IEC60255-21-2 Class 1
Bump		Refer to class 1		IEC60255-21-2 Class 1
Enclosure protection		IP51		IEC60529

Vn: Rated voltage

4 Functions

4.1 Protection

4.1.1. Undervoltage elements

Fig. 4.1 “Undervoltage element internal function block diagram” shows operation of the undervoltage elements.

Undervoltage element compares input voltages of voltage circuit with the operation setting. If an input voltage is less than the specified operation level, the element outputs an operation signal when the timer expires.

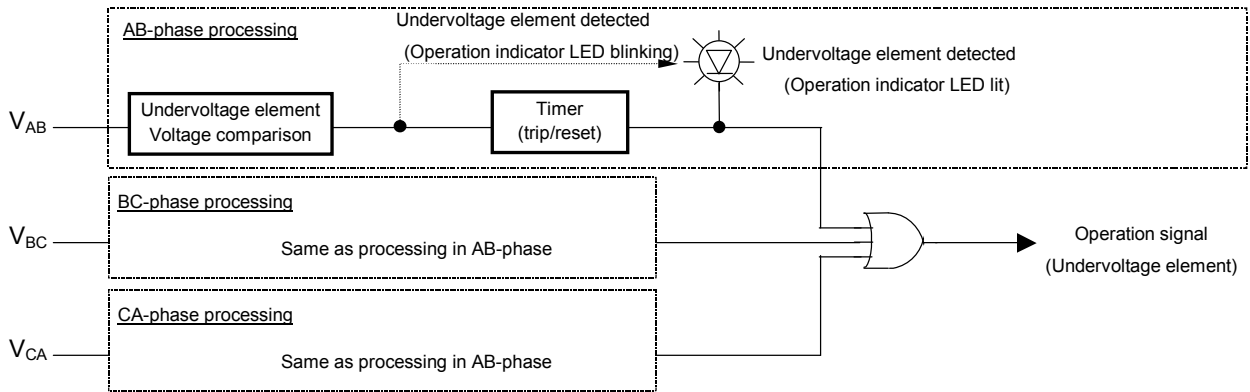


Figure 4.1 Undervoltage element internal function diagram

4.1.2 Earth fault overvoltage elements

Fig. 4.2 “Earth fault overvoltage element internal function block diagram” shows operation of the earth fault overvoltage elements.

Earth fault overvoltage element compares input voltages of zero-phase voltage circuit with the operation setting. If an input voltage is larger than the specified operation level, the element outputs an operation signal when the timer expires.

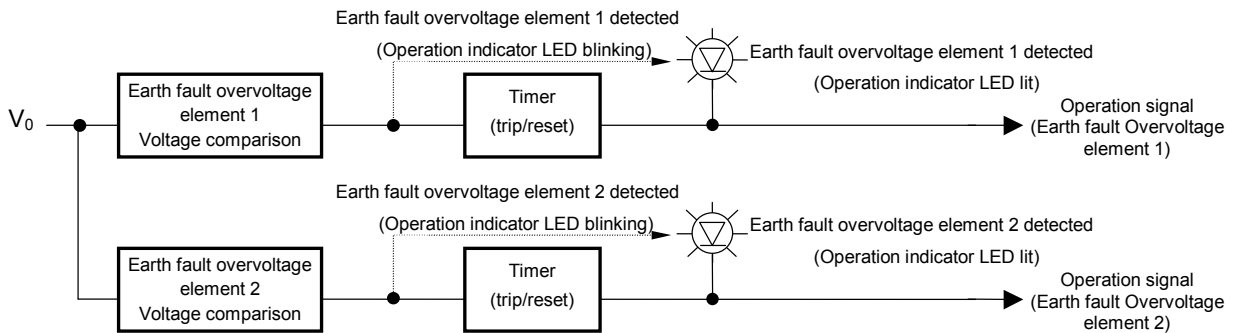


Figure 4.2 Earth fault overvoltage element internal function diagram

4.1.3 General functions

(1) Setting of operation voltage

The operation voltage settings for undervoltage and earth fault overvoltage elements are indicated with voltage values [V].

When the setting “Lock”, the elements selected are locked for operation.

(2) Setting of operation timer

The operation time settings for undervoltage and earth fault overvoltage elements are indicated with second [s].

(3) UV test

Regarding UV test of under voltage element, only selected phase is available for testing and remaining phase are locked. (For example, in case of selecting AB phase, BC phase and CA phase of under voltage element are locked.)

The LED lamp of UV test will stay on after selecting operation of any phase for UV test.

After the UV test, phase selection of UV test should be off position to go back to the running condition.

(4) Operation display

For undervoltage element, when the input voltage becomes less than the operation setting, the corresponding operation indicator LED will blink to allow you check the starting value.

For earth fault overvoltage elements, when the input voltage becomes larger than the operation setting, the corresponding operation indicator LED will blink to allow you check the starting value.

The LED lamp will come on as soon as an operation output is made when a period of operation time has elapsed.

The operation indicator LED has been set to “self-hold” in the factory. This setting can be freely changed to “auto reset”.

With the “self-hold” setting, data of the latest operation indication will be stored in the internal memory even if the auxiliary power supply runs down.

The data stored will be cleared when the “indicator reset” switch is pressed.

Up to latest five phenomena can be stored and displayed as a history record. (Older data than the latest five phenomena will automatically be cleared).

Item No.	History	Sequence of recording
311	1 st phenomena	Latest fault record data
312	2 nd phenomena	↓
313	3 rd phenomena	↓
314	4 th phenomena	↓
315	5 th phenomena	Oldest fault record data

(5) Output contacts

The signaling outputs X_0 to X_3 and trip outputs X_4 and X_5 are all programmable type.

The factory default setting of the arrangement of these outputs is as shown in the internal function block diagram of Figure 5.2. This setting can be freely changed by specifying outputs of the internal elements based on the OR logic.

All the outputs have been set to “auto reset” in the factory. Any of them can be changed to “self hold”.

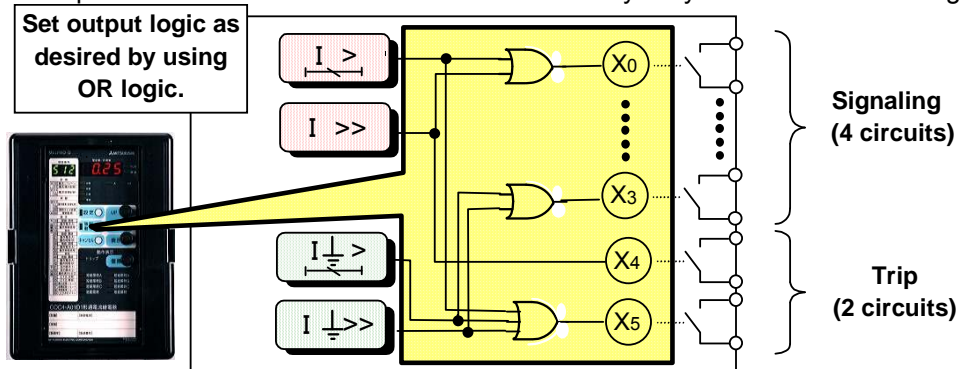


Figure 4.3 Schematic image of Programmable Outputs (example: COC4-A01)

(6) Forced operation

It is possible to carry out forced operation of any of the signaling outputs X_0 to X_3 and trip outputs X_4 and X_5 independently. Forced operation is useful for checking the wiring.

When forced operation is carried out, the corresponding LED lamps will come on to show the current status of the programmable outputs. Checking the lamp status will be useful not only for wiring check but also to check the programmable outputs arrangement.

4.2 Measurement

Voltages input to the relay are measured and converted into freely set VT/EVT primary voltages, then indicated in the display.

(1) Real time measurement

The effective voltage input to the relay under steady state is displayed.

(2) Max. record

The maximum effective voltage is recorded and stored.

The max. record will be all cleared when “aux. power supply OFF” or “max. record reset” operation is made.

(3) Fault record

In the event of system fault, the effective voltage and waveform data that have been measured at the time when one of the protection elements operates to issue an output signal are stored. Data of up to five phenomena can be stored and displayed for each phase.

With “aux. power supply OFF”, only the waveform data will be cleared and the effective voltage data will remain. With “fault record reset” operation, however, both of the data items will be all cleared.

(Records older than the 5th phenomenon will automatically be cleared.)

Item No.	History	Sequence of recording
211	1 st phenomena	Latest fault record data ↓ ↓ ↓ Oldest fault record data
212	2 nd phenomena	
213	3 rd phenomena	
214	4 th phenomena	
215	5 th phenomena	

The following fault waveform data can be collected if a communication card is installed:

Item	Specification
Data sampling cycle	Fixed to the electric angle of 30° of rated frequency
Data storing capacity (for a phenomenon)	224 cycles of rated frequency (Data point: $224 \times 360^\circ / 30^\circ = 2688$ points)
Permissible setting range	224 cycles before trip ~ 224 cycles after trip
Collected data	The range for data collection can be set by cycle within the “data storing capacity” in the “permissible set range”.

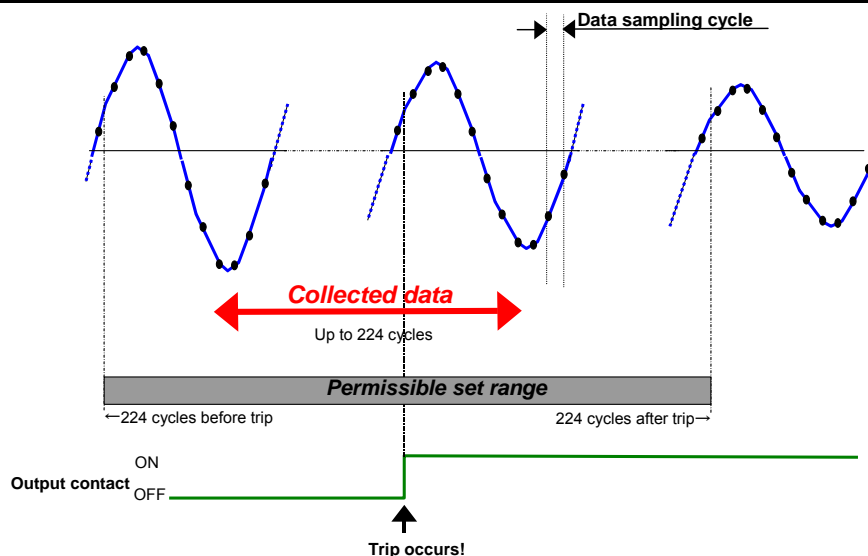


Figure 4.4 Concept of recording fault waveform

4.3 Self-diagnosis

The self-diagnosis function monitors the electronic circuit and built-in power source continuously. If an abnormal condition occurs, the protection elements will be locked for operation. Also, the RUN LED lamp will go off and the self-diagnosis output contact (break contact) will be closed.

(1) Checking defect code at failure detection

When a failure is detected, the defect code will be recorded. This defect code can be checked through the self-diagnosis (ALARM) status indication.

(2) Resetting self-diagnosis output

If a failure is detected, **the failure status may be reset by turning off/on the power.**

In this case, **be sure to lock the trip circuit on the external wiring of the relay** before resetting. (If the failure persists, an erroneous output may be caused).

(3) Clearing the defect code

The defect code data stored at failure detection can not be cleared only by carrying out the power on/off procedure in the item (2) above. All the defect code numbers that have been detected since the previous “self-diagnosis reset” (RESET ALARM) operation was made are accumulated in the memory. **To clear the record data, carry out “self-diagnosis reset” (RESET ALARM) operation.**

Table 4.1 Output for protection relay failures

Status	Detected items	Output				
		Display		ALARM (break contact)	Operation output lock	
		RUN	Defect code			
Normal	—	On		Open	Not locked	
Power circuit failure	—	Off	No display	Closed	Locked	
CPU stop	—				*45	
Monitor error	ROM check				0001	Locked
	RAM check				0002	
	A/D accuracy check				0003	
	A/I check				0004	
	A/D check				0005	
	SRAM check				0006	
	D/O status check				0008	
	D/O operation check				0009	
	Analog filter check				0010	
	A/I double check				0011	
	D/I check *41				0012	
	E ² PROM check				0013	
	Computing function check				0014	
	WDT check				0015	
	Data transfer check *42				0016	
Differential current check *43	0017					
Communication card check *44	0028				On	Open
Communication card channel No. switch setting error *44	0029					
Communication card baud rate switch setting error *44	0030					
Communication card channel No. switch change error *44	0031					
Communication card baud rate switch change error *44	0032					

*41 Monitored only in the models with built-in D/I function.

*42 Monitored only in the models with D2 unit.

*43 Monitored only the biased differential relay.

*44 Monitored only when the relay is installed with communication card.

*45 No necessary to lock the operation output as any signals can't be output in case of CPU stop.

4.4 Communication

Figure 4.5 shows an example of network system configuration.

For more information on the communication facilities, see the materials shown in the introduction (page 2).

Central Control System

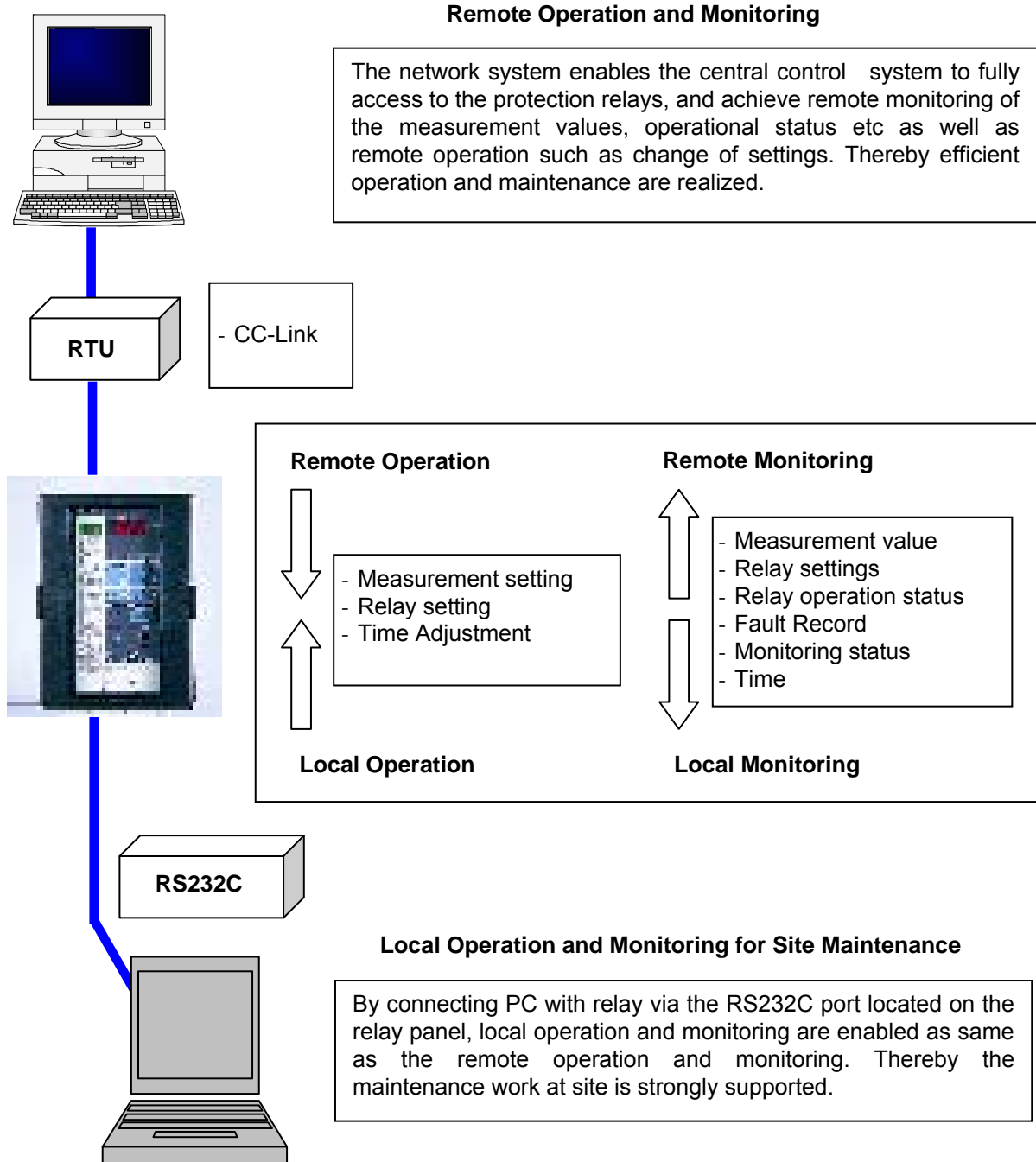


Figure 4.5 Example of communication network system configuration

Using the communication facilities, it is possible to perform Remote Monitoring and Remote Operation with the various useful functions shown in Table 4.2.

Table 4.2 Outline of functions enabled by communication network

Direction of communication	Item	Description
Remote Monitoring RTU ← Protection relay	Setting	Read the settings stored in the protection relay.
	Measurement	Read the measurements stored in the protection relay.
	Max. value	Read the max. values stored in the protection relay.
	Fault record	Read the measurements at the time of trip.
	Self-diagnosis (ALARM)	Read the result of self-diagnosis.
	Operation element	Read the elements that operated at the time of trip.
	Operation time	Read the time at the time of trip.
	Current time	Read the internal time of the communication card.
	Waveform record	Read the wave form at the time of trip.
Remote Operation RTU → Protection relay	Setting	Change the setting of the protection relay.
	Indicator reset	Reset the LED lamp that came on at the time of trip.
	Self-diagnosis (ALARM) reset	Clear the result of self-diagnosis.
	Fault record reset	Clear the fault record, operation elements and operation time data.
	Max. record reset	Clear the max. record.
	Forced operation	Carry out forced operation of output contact.
	Time	Set time of communicate card.

5 Configuration

5.1 Internal configuration

(1) I/O and CPU circuits

Fig. 5.1 shows the internal block diagram of the model CBV4-A01D1.

Voltage input is converted into AC signals at the electronic circuit level via the auxiliary transformer and filter circuits. These signals are retained as a form of DC signal in the sample hold circuit on each channel sharing a same time. The multiplexer selects a channel to take the signal and sends it to an A/D converter. The signals are converted to digital signals sequentially in the converter to be sent to the CPU.

The setting circuit is used to input setting data into the CPU.

These inputs will be used to carry out the functions shown in Fig. 5.2 “Internal function block diagram”, and then issue output signals to the display and output relay.

(2) Self-diagnosis circuit

When the self-diagnosis function detects that the electronic and power circuits are normal, the output relay will be energized to open the self-diagnosis output contact (break contact).

The self-diagnosis output contact (break contact) will be closed when a failure occurs in the circuits above or when the built-in power fuse burns.

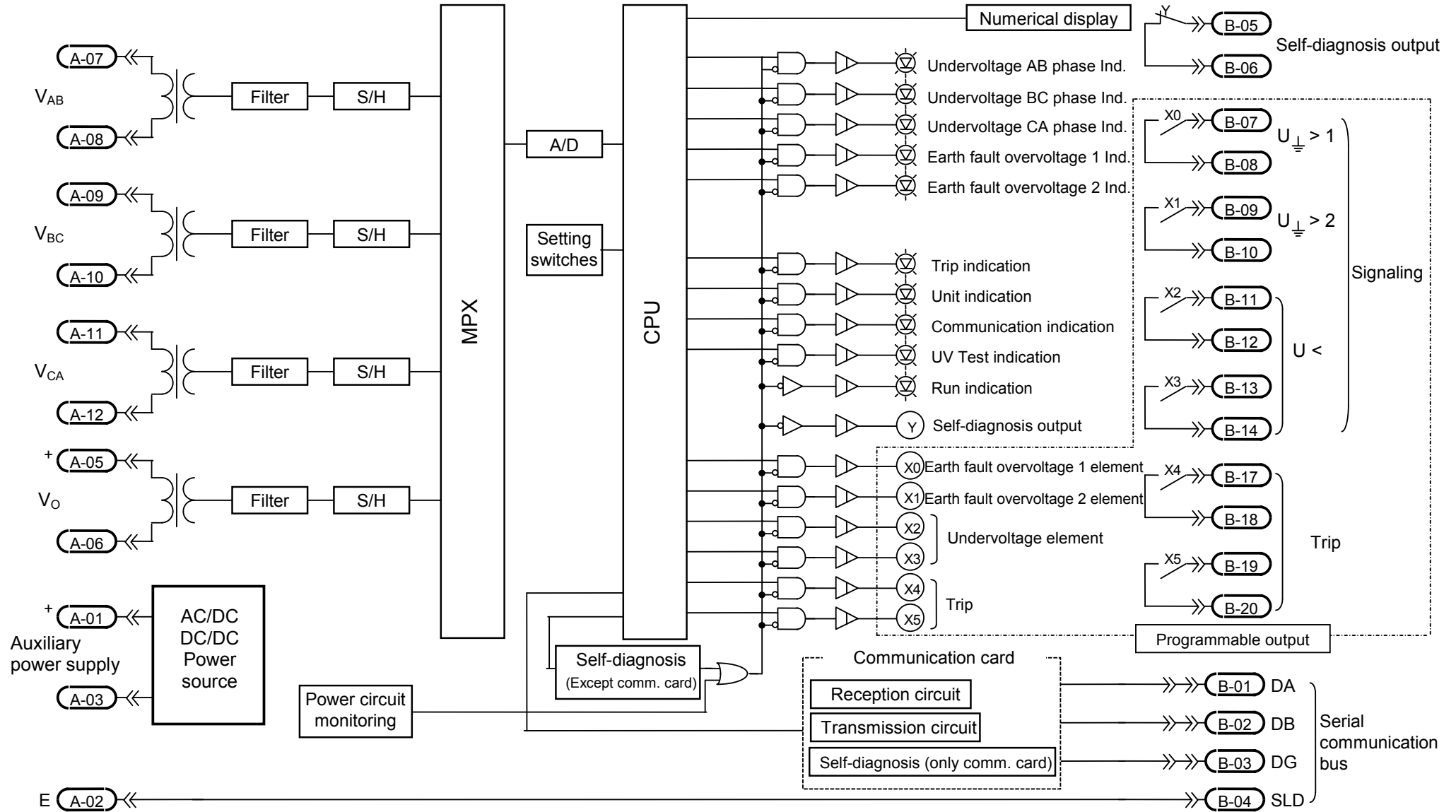


Figure 5.1 Internal block diagram of Type CBV4-A01D1 relay

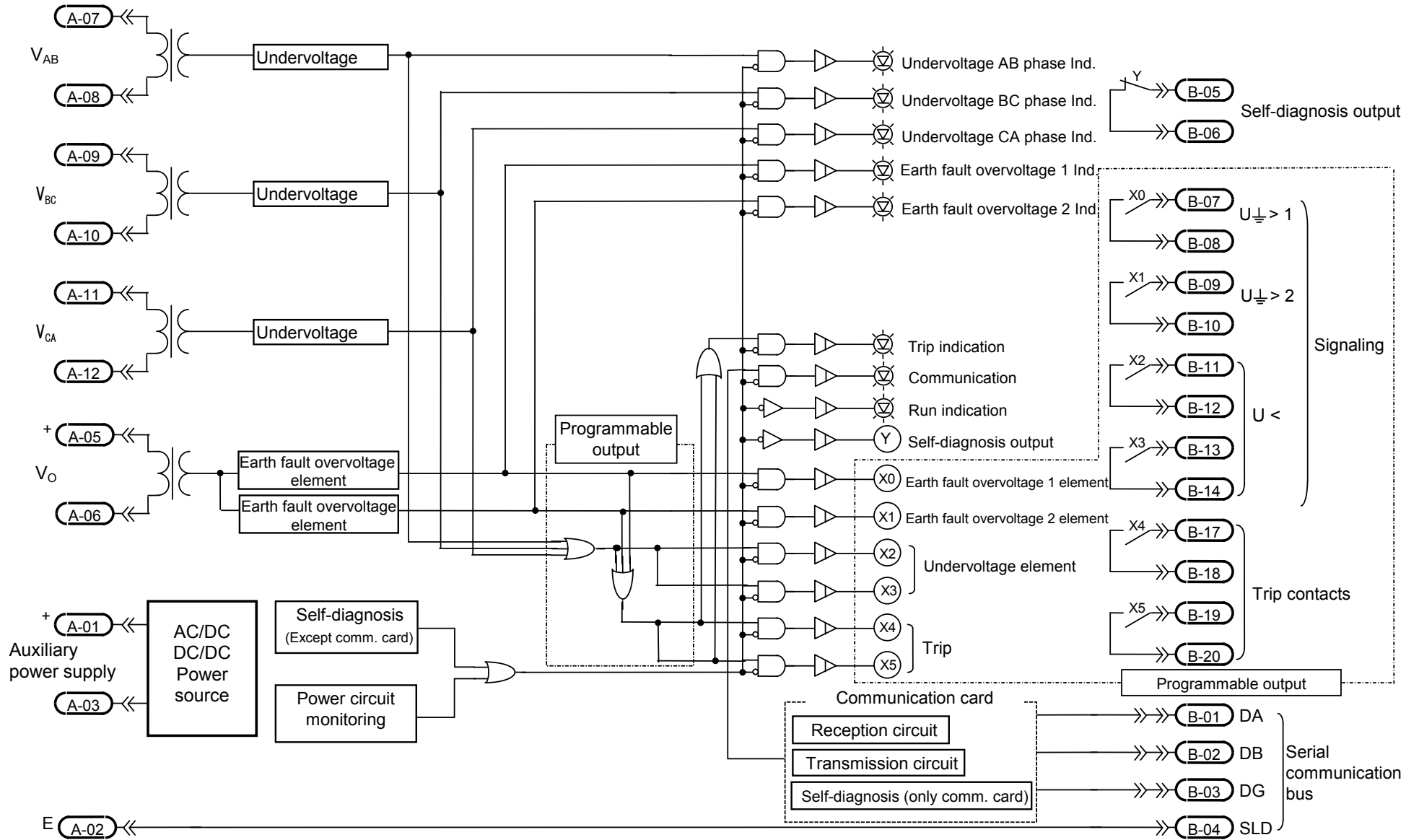


Figure 5.2 Internal function block diagram of Type CBV4-A01D1 relay

5.2 External connection

(1) Connection diagram

Figures 5.4 show examples of input circuit (AC circuit) connection, Figure 5.5 an example of control circuit (DC circuit) connection and Figure 5.6 a terminal arrangement.

In the terminals, M3.5 screws should be used and wires of 2 mm² or less are recommended to be used.

(2) Precautions for wiring work

a. Important facilities should be provided with fail safe measures such as dual system to improve reliability of the facilities.

b. Effects of external surge

Some type of surge with a certain condition may inversely affect the relay. If so, take it into account to install **MF type surge absorbers made by Mitsubishi Electric**.

c. Guarantee of AC auxiliary power supply against power interruption

The AC auxiliary power supply of the relay is not **guaranteed against power interruption**. When you do not have an uninterruptible AC power source, use the **type B-T1 back up power supply manufactured by Mitsubishi Electric** or uninterruptible power source (UPS) that is commercially available.

d. Inrush current of auxiliary supply

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

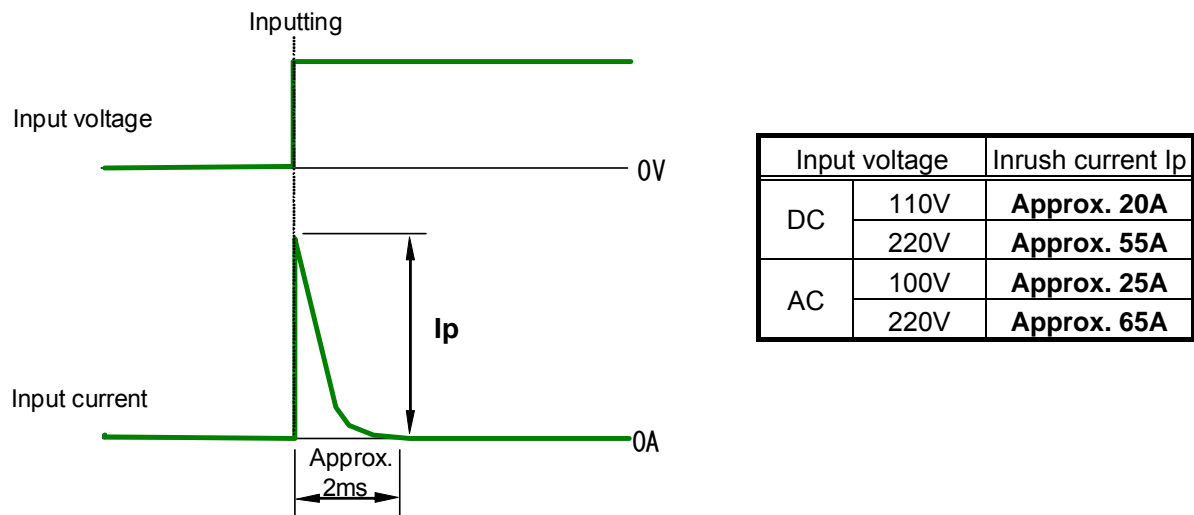


Figure 5.3 Inrush current of auxiliary power supply

e. Trip circuit

Only the contacts X₄ and X₅ can be used for the trip circuit. Please keep in mind that the contacts X₀ to X₃ can not 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.

f. Self-diagnosis output circuit

The self-diagnosis output contact is so configured that the auxiliary relay can be energized (break

contact) with normal result of monitoring, in order to be able to continue monitoring even if the built-in power fuse burns. Therefore, connect the timer to the external wiring. (See Fig. 5.5 “DC circuit connection diagram”)

g. Earth circuit

Be sure to earth the earth terminal located on the back of the relay according to the Class D earth wiring method.

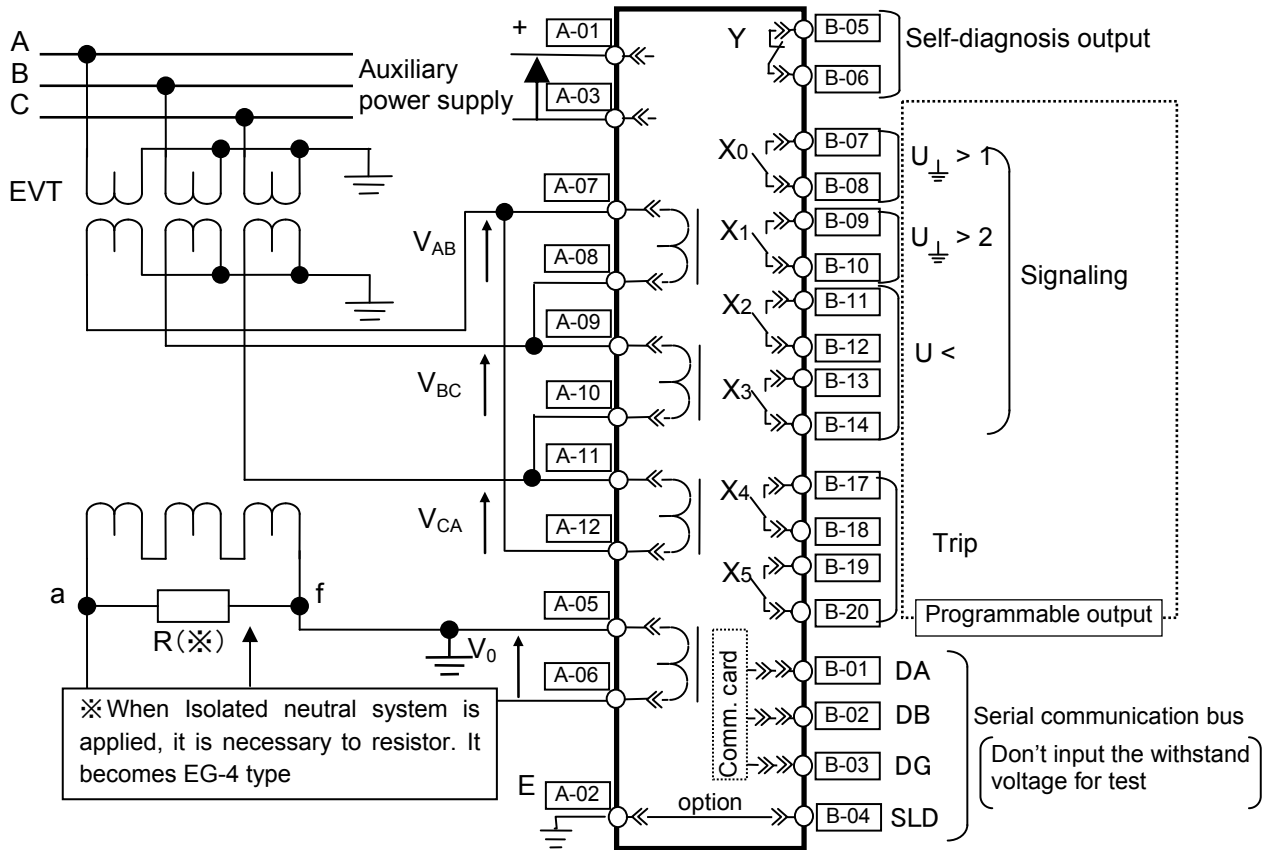
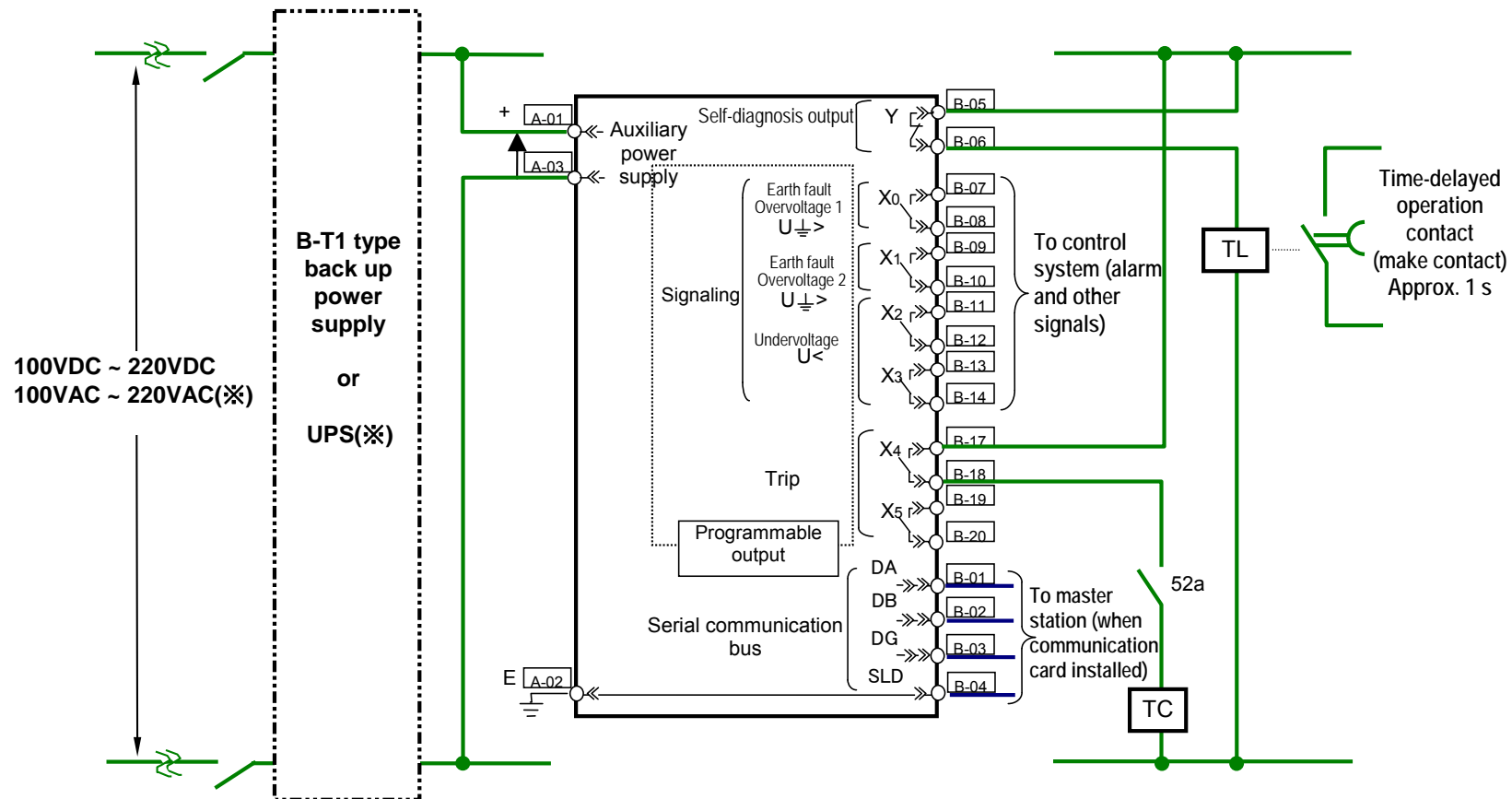


Figure 5.4 External connection diagram for CBV4-A01D1 relay



Note 1) The self-diagnosis output contact is so configured as below mentioned that alarm can be issued even after the built-in power fuse burns. This type of auxiliary relay circuit configured such that relay will be energized ("break contact" opened) when normal result of self-diagnosis is received. Therefore, the "break contact" is closed when the power is applied and will be opened after about 50ms. If the auxiliary power supply of the relay and the self-diagnosis output contact shares a same power source, the "break contact" will be closed temporarily after the auxiliary power supply is turned on. In the case where the phenomenon stated in the above would conflict with your system requirement, it is recommended that the self-diagnosis output contact should be connected via the time-delayed timer as shown in the left of the figure.

Note 2) Regarding to the type CPS1 AC/DC converter or commercially available uninterruptible power supply (UPS), refer to the note *21 in the section 2.1 General information.

(*) Refer to the page 23, 5.2 External connection (2) Precautions for wiring work C. Guarantee of AC auxiliary power supply against power interruption.

Figure 5.5 Auxiliary power supply circuit connection example of type CBV4-A01D1 relay

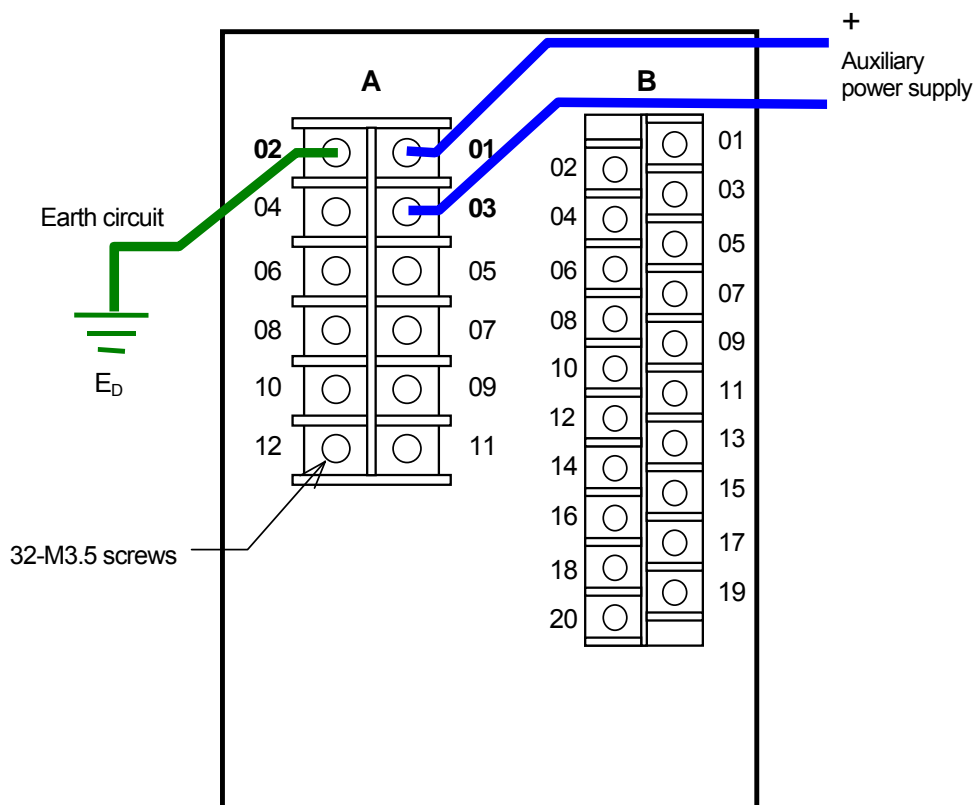


Figure 5.6 Rear view of type CBV4-A01D1 relay

6 Handling

6.1 Unpacking

Usually this relay is packed in a D1 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.

6.2 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.

6.3 Appearance and how to pull sub unit out

The relay is so constructed that the sub unit can be drawn out, in order to facilitate inspection or test. It is possible to pull the sub unit out without disconnecting the external wiring.

Note that the sub unit should not be drawn out with the line hot. Before drawing out, be sure to take the following actions.

- Lock the tripping circuit including breakers.
- Stop the main circuit.
- Open the auxiliary power supply circuit.

Bear in mind that careless opening of circuits may result in opening the other control circuits too to impair the protective function. Be sure to only shut off the concerned circuit.

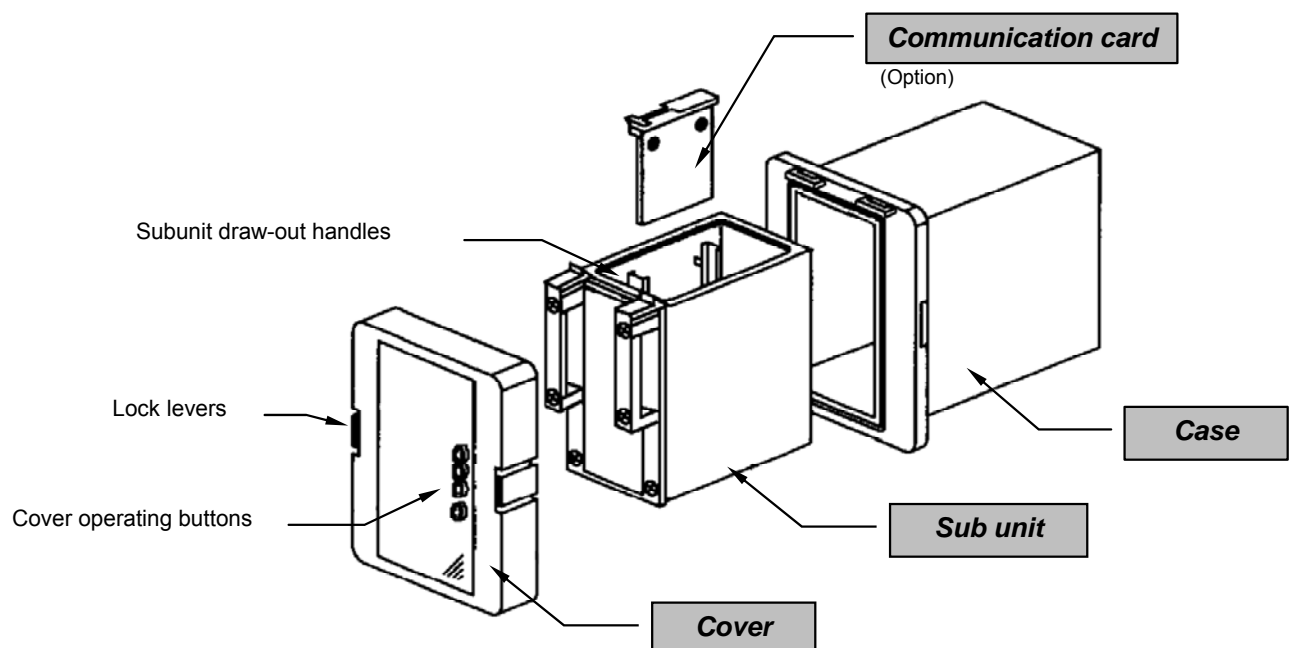
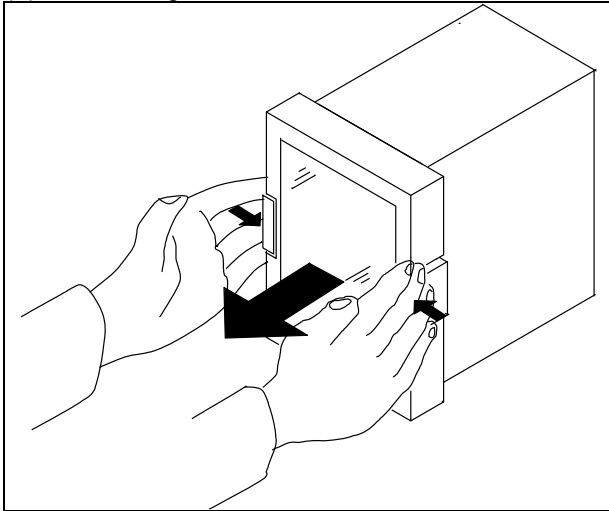


Figure 6.1 Outside view of type CBV4-A01D1 relay

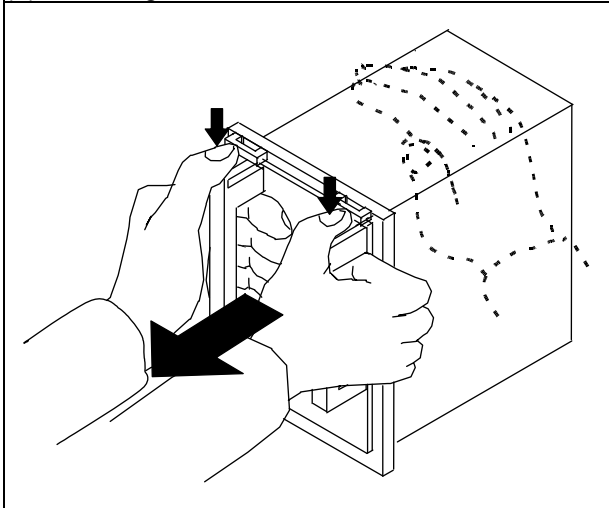
6.3.1 How to draw sub unit out

(1) Removing the cover



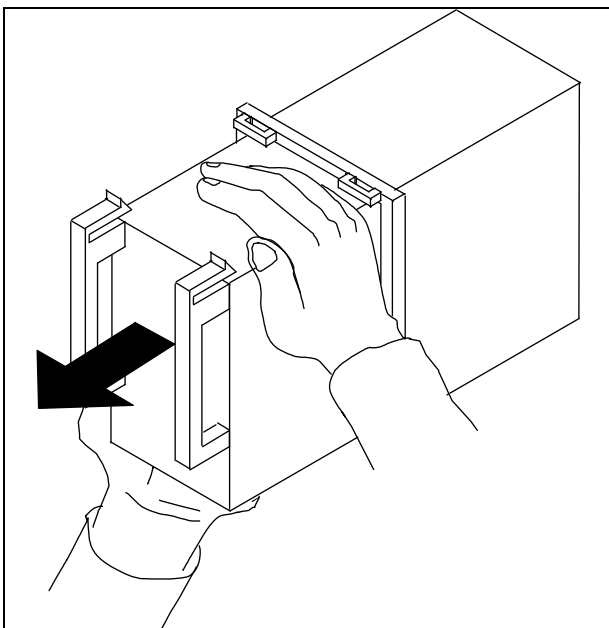
Hold the **lock levers**, which are located at both sides of the cover, on their front sections. Take off the cover **straight toward you** while pushing the levers **inwards**.

(2) Drawing the sub unit



Grip the draw-out handles (located at both sides of the front of the sub unit). **Press the locking pieces installed in the upper portion of the draw-out handles with your thumbs to pull the sub unit towards you.**

Note) The sub unit is so designed that it can not be removed unless it is pulled out with a relatively strong force, in consideration of quake-proof measures. When the relay unit is to be removed independently, it is recommended to draw it out with the case held by other operator.

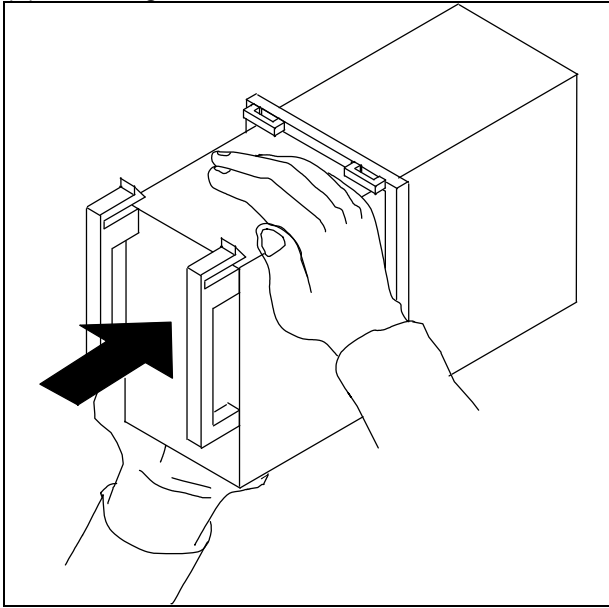


When about a half portion of the sub unit is pulled out of the case, just stop the drawing motion. Then, **hold the top and bottom of the sub unit to pull it out completely**, in order to prevent the unit from falling.

Note) Be careful not to touch the printed circuit board and parts inside the sub unit.

6.3.2 Housing the sub unit

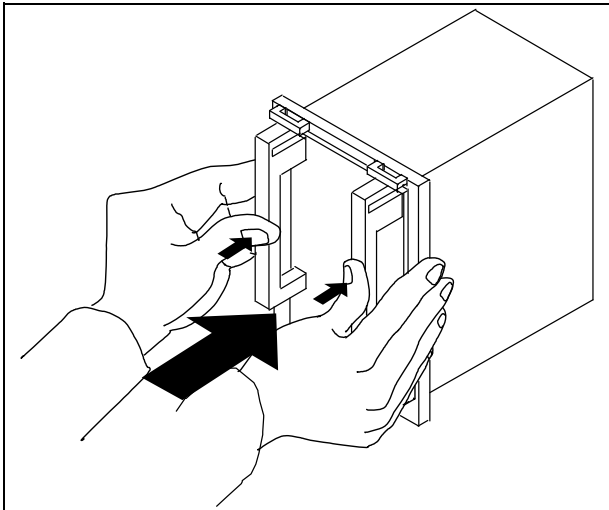
(1) Housing the sub unit



Hold the sub unit on the top and bottom to push the unit into the case approx. a half of the unit.

Note)

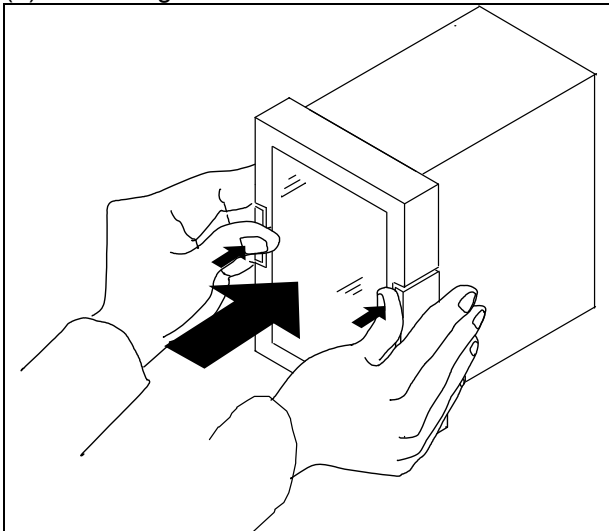
- Be careful not to touch the PCB and parts inside the sub unit.
- The sub unit is so constructed that it can not be housed in the case upside down.



Fully insert the sub unit into the case until you hear a click while pressing the handles located on both sides of the front of the sub unit, and also the front face of subunit (ie, 4 corners of front face) is becoming flush with the vertical surface of the case.

Note) Please note that inserting the sub-unit incompletely may only establish a poor contact of the terminals located on the back of the unit, which may cause operational failure or heating.

(2) Attaching the cover



Fit the cover straight to the case. Hold the cover frame to **fully push the lock levers, located both side of the cover, to case side until it is clicked and locked.**

Note) After setting the cover, check if the buttons can be smoothly pressed from over the cover.

6.4 How to use front control panel

6.4.1 Front control panel layout

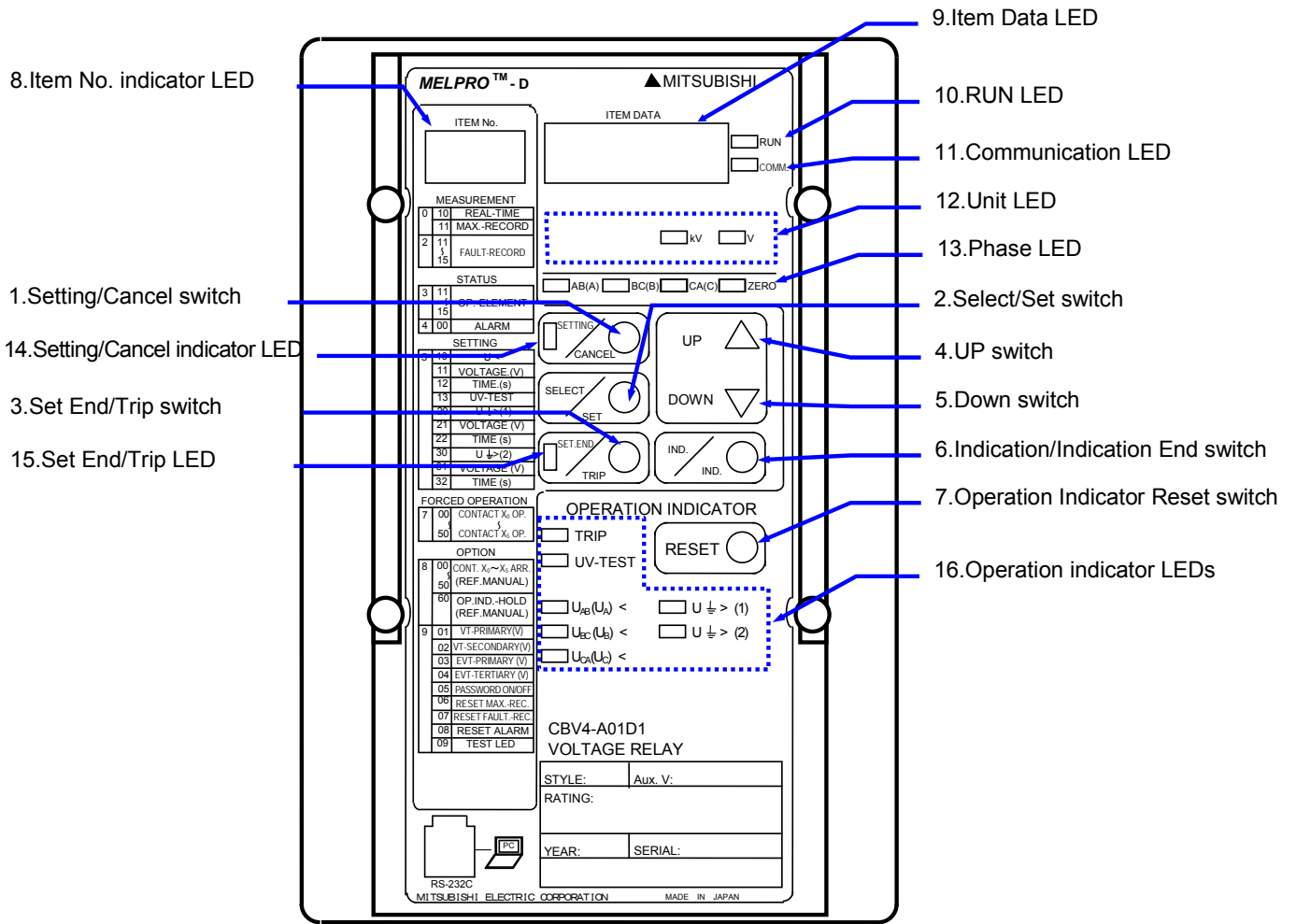


Figure 6.2 Front view of type CBV4-A01D1 relay

Table 6.1 Front control panel guide

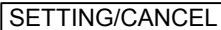







No.	Designation		Symbol	Description
1	Setting / Cancel			Pressing this switch will start the procedure for setting, forced operation or option. When this switch is pressed again instead of the  switch, data that has been programmed will be all cleared to terminate the selected procedure. The SETTING/CANCEL indicator LED is lit during the procedure.
2	Select / Set			This switch is used to select an item number and to program item data during setting, forced operation or option procedure. When data is programmed to be ready for replacing the currently used setting, the SET.END/TRIP LED will blink.
3	Set End / Trip			When the SET.END/TRIP switch is pressed with its LED blinking during setting, forced operation or option procedure, the currently enabled setting will be replaced by data given by programming. The new setting will be thus enabled.
4	UP select			These switches are used for selecting data elements. Pressing these switches for a while will allow fast forwarding. With the cover operating buttons, you can use the switches without removing the cover.
5	DOWN select			
6	Indication / Indication End			Pressing this switch will start or end the display of settings and measurements. With the cover operating button, you can use the switch without removing the cover.
7	Reset			Pressing this switch will reset output contacts after the relay operated and extinguish the operation indicator LEDs. With the cover operating button, you can use the switch without removing the cover.
8	Item No.	Green	-	A number allocated to the selected setting, forced operation or option item is indicated here.
9	Item Data	Red	-	Data that corresponds to the item number selected is displayed here. For the indication of individual letters, see Table 6.2.
10	RUN	Green	-	Indicate the result of the automatic self-check. The lamp will be lit for normal results while off for abnormal.
11	Communication	Green	-	Indicate the operational status of the communication card. - With a communication card installed: the lamp will be lit for normal conditions, blinking during communication and off for abnormal conditions. - With a communication card not installed: the lamp will be off.
12	Unit	Yellow	-	Indicate the unit used for the item data.
13	Phase	Yellow	-	Indicate the phase that corresponds to the item data.
14	Setting / Cancel	Yellow	-	This lamp will be lit during setting, forced operation or option procedure.
15	Set End / Trip	Yellow	-	This lamp will blink when new data is programmed to be ready for replacing the currently enabled setting.
16	Operation	Red	-	Indicate the corresponding operation elements and phases of the relay, and UV test condition.

Table 6.2 Letter representation of item data indicator LEDs

Item		Display in item data box
Designation	Letters	
On	ON	
Off	OFF	
Yes	YES	
No	NO	
Operation lock	LOCK	
Instantaneous	INST	

6.4.2 Operational procedure

For more information about the operational procedure shown below, see the MELPRO-D Series General Operation Manual (JEP0-IL9416).

6.4.2.1 Relay without RS232C communication I/F

Table 6.3 Operational procedure

Item			Corresponding section of general operation manual		
No.	Designation	Description	Indication mode	Setting / forced operation / option mode	
010	Measurement	Real time	A-1		
011		Max. record			A-2
211		Fault record	1 st phenomena		A-3
212			2 nd phenomena		
213			3 rd phenomena		
214			4 th phenomena		
215	5 th phenomena				
311	Status	Operation elements	1 st phenomena	A-4	
312			2 nd phenomena		
313			3 rd phenomena		
314			4 th phenomena		
315			5 th phenomena		
400	Self-diagnosis (ALARM)		A-6		
511	Setting	Undervoltage	Operation voltage [V]	A-7	B-1
512			Operation time [s]		
513			UV-test		
521		Earth fault Overvoltage(1)	Operation voltage [V]		
522			Operation time [s]		
531		Earth fault Overvoltage(2)	Operation voltage [V]		
532	Operation time [s]				
700	Forced operation	Contact X ₀ operation		A-7	C-1
710		Contact X ₁ operation			
720		Contact X ₂ operation			
730		Contact X ₃ operation			
740		Contact X ₄ operation			
750		Contact X ₅ operation			
800	Option	Contact arrangement	Contact X ₀	A-7	D-1
810			Contact X ₁		
820			Contact X ₂		
830			Contact X ₃		
840			Contact X ₄		
850			Contact X ₅		
860	Operation indicator LED hold			D-2	
901	Option	VT primary side [V]		A-7	D-3
902		VT secondary side [V]			
903		EVT primary side [V]			
904		EVT tertiary side [V]			
905		Max. record reset			D-4
906		Fault record reset			
907		Self-diagnosis (ALARM) reset			
908		LED lamp test			

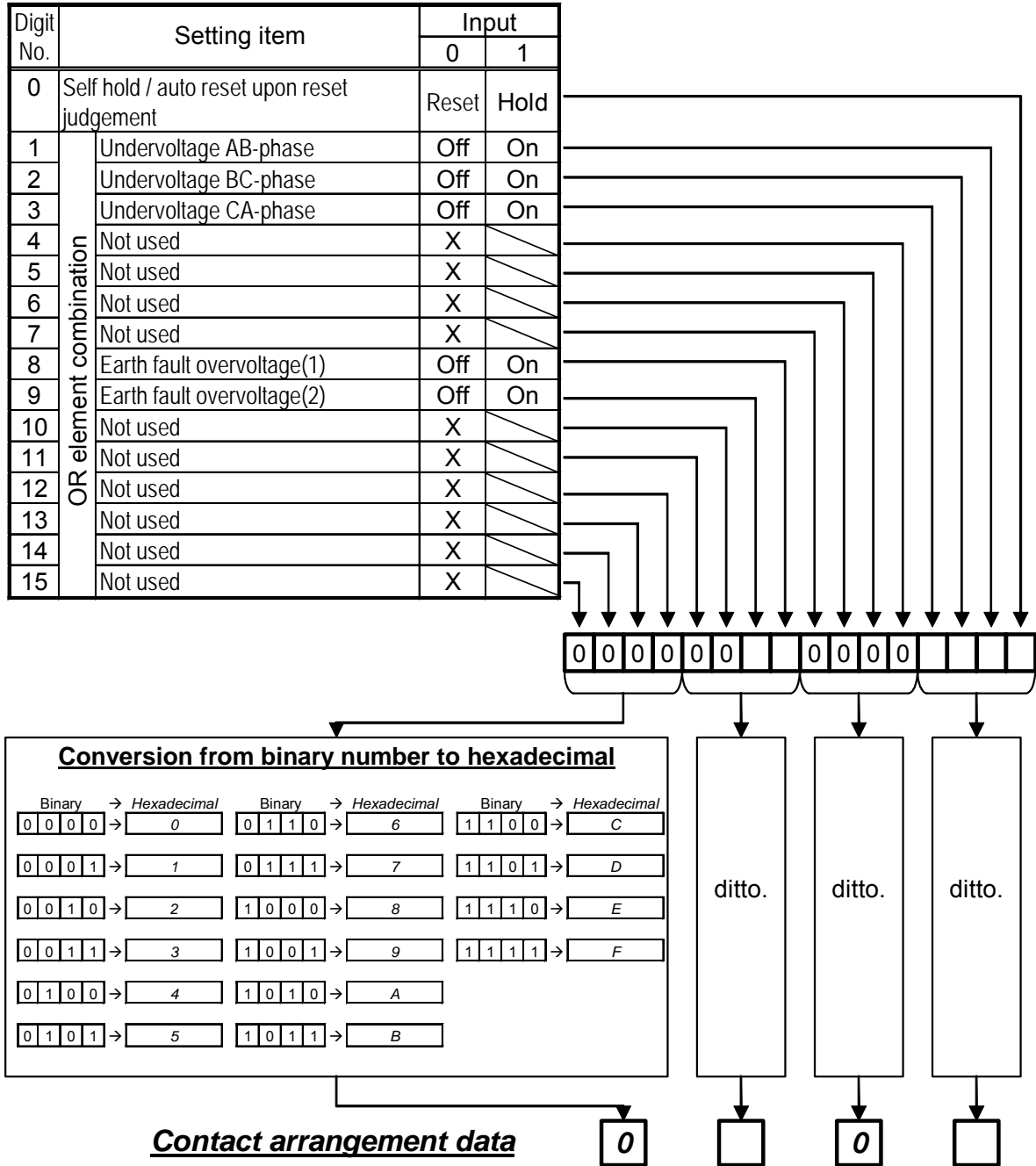
6.4.2.2 Relay with RS232C communication I/F

Item			Corresponding section of general operation manual	
No.	Designation	Description	Indication mode	Setting / forced operation / option mode
As the same as Table 6.3 described in item 6.4.2.1 about the No. 010~860.				
901	VT primary side [V]	Set the VT primary voltage of the voltage circuit connected to the relay.	A-7	D-3
902	VT secondary side [V]	Set the VT secondary voltage of the voltage circuit connected to the relay.		
903	EVT primary side [V]	Set the EVT primary voltage of zero-phase voltage circuit connected to the relay.		
904	EVT tertiary side [V]	Set the EVT tertiary voltage of zero-phase voltage circuit connected to the relay.		
905	Relay password enable/disable option	Set relay password enable or disable for setting.		D-9
906	Max. record reset	Clear data of the max. record.	/	D-4
907	Fault record reset	Clear data of the fault record.		
908	Self-diagnosis (ALARM) reset	Clear data of the self-diagnosis record.		
909	LED lamp test	Carry out forced illumination of all the LED lamps on the front of the relay unit.		D-5

6.4.2.3 Guide for option function

(1) Specifying contact arrangement data of output contacts

The table below shows the setting guide table. See the section D-1 of the general operation manual for the detailed procedure.



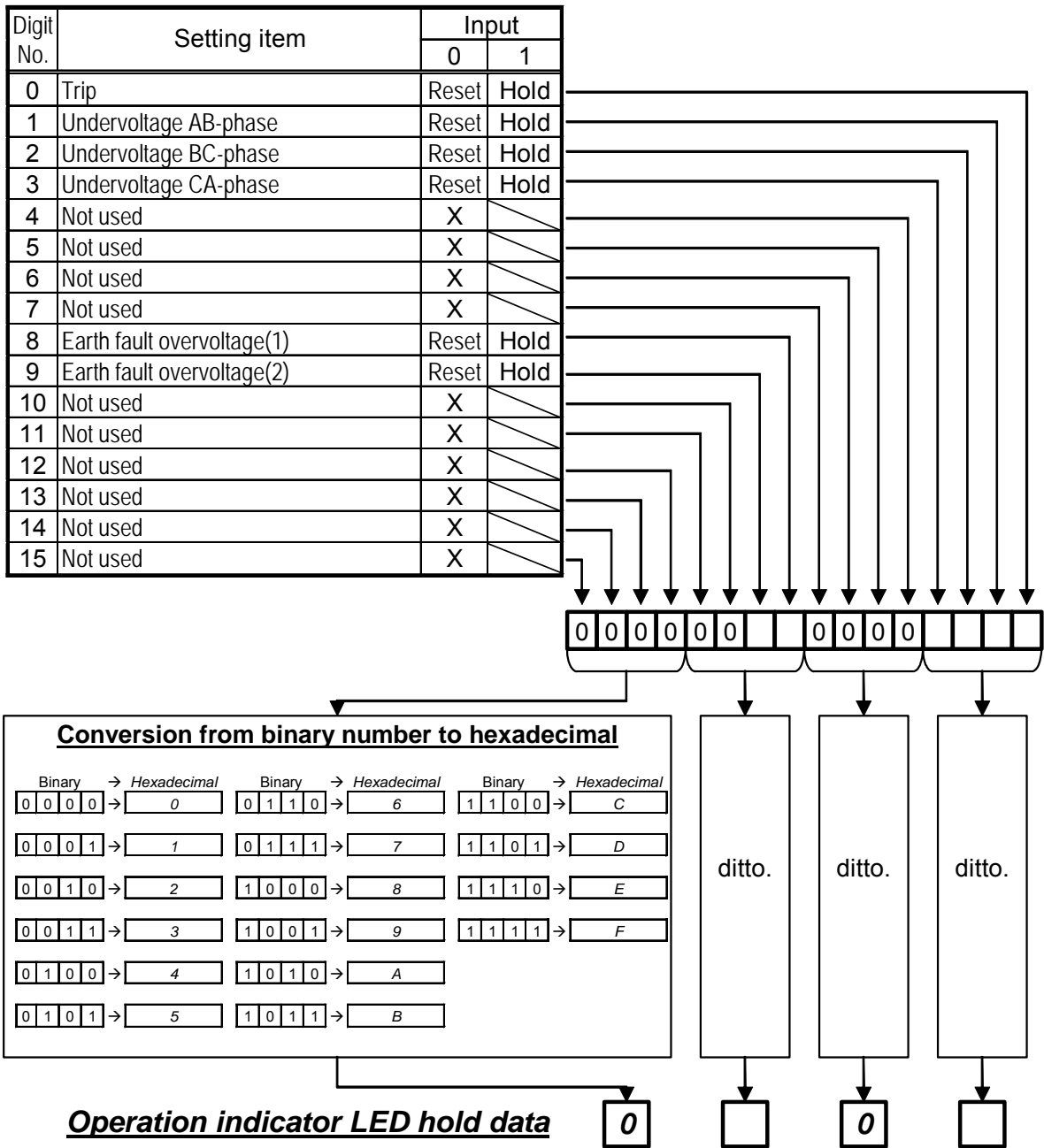
When the product is shipped from the factory, contact arrangement data are set as follows..

Contact	Item number	Contact arrangement data	Setting of the element	Contact	Item number	Contact arrangement data	Setting of the element
X0	800	0100	Earth fault overvoltage 1	X3	830	000E	Undervoltage
X1	810	0200	Earth fault overvoltage 2	X4	840	030E	OR of all the elements
X2	820	000E	Undervoltage	X5	850	030E	OR of all the elements

*The "Self hold/auto reset" setting are "Reset" (auto reset) for all contacts.

(2) Specifying operation indicator LED hold data

The table below shows the setting guide table. See the section **D-2** in the general operation manual for the detailed procedure.



When the product is shipped from the factory, all LEDs are set to self-hold.

Item number	Operation indicator LED hold data
860	030F

7 Mounting

7.1 Mounting dimension

Mount the case to the panel according to Fig. 7.1 "Mounting dimension".

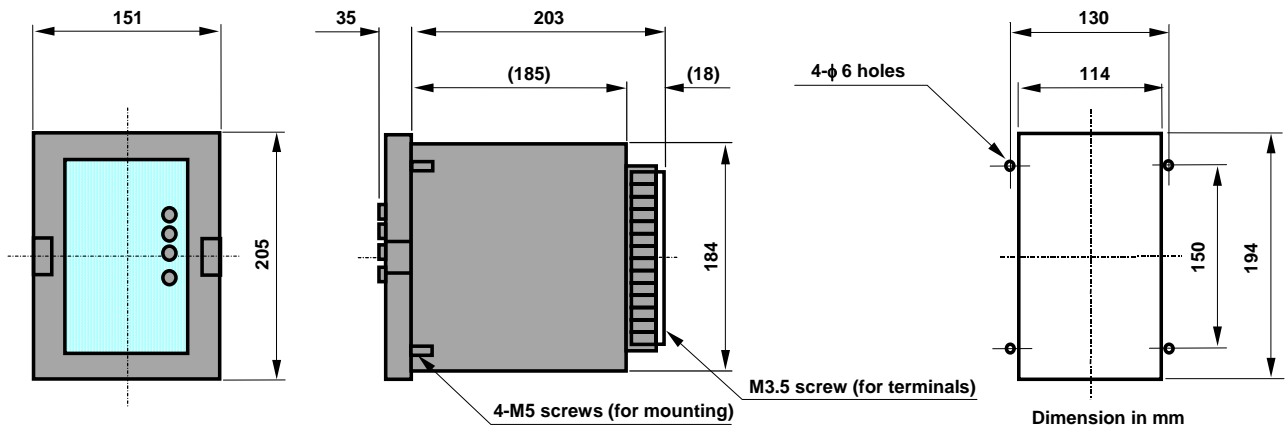


Figure 7.1 Outside dimension /drilling drawing

7.2 Standard operating environment

Install the relay in the environment described in section 3.3 Common technical data. In addition, the following conditions should be kept:

- Abnormal vibration, shock, inclination or magnetic field should be avoided.
- Harmful smoke or gas, salt gas, excessive humidity, water drop or vapor, excessive dust or fine powder, rain and wind should be avoided.

8 Test

The relay has been fully tested prior to shipment. However, it is recommended to carry out a test again by referring to the following test guide before use.

8.1 Appearance inspection

Check the relay for appearance according to the following procedure:

Objects		Check points
Unit	Coil/conductor	(1) Discoloring and burning due to overheat. (2) Abnormal conditions including loosened screws.
	Printed card	(1) Discoloring of the printed card due to overheated parts. (2) Contact between the printed card and connector
	Mechanism	(1) Deformation (2) Operation of the operating key switches. (3) Damage of the draw-out lever of the sub unit. (4) Discoloring and deformation of the name plate on the front panel. (5) Damage of the terminal section.
Case/cover		(1) Damage of the cover. (2) Stain of the cover. (3) Clouding of the cover. (4) Damage of the lock lever of the cover. (5) Damage of the operating buttons of the cover. (6) Operation of the operating buttons of the cover. (7) Damage of the terminal section.
Others		Invasion of foreign matters including dust and iron chips.

8.2 Characteristic test

8.2.1 Precautions in testing

(1) Standard test conditions

Ensure the following test conditions whenever possible:

Note that carrying out a test under an environment that significantly differs from the following conditions may produce an incorrect result.

- Ambient temperature : $20^{\circ}\text{C}\pm 10^{\circ}\text{C}$
- Rated frequency : $\pm 5\%$
- Waveform (AC) : 2% (distortion ratio)
- Auxiliary power supply voltage : rated voltage $\pm 2\%$

(2) Characteristic control point

See the section 3 “Characteristics”.

The characteristic control point refers to the characteristic of a relay unit only. Note that, when a characteristic test is carried out on a relay system connected with external equipment such as EVT, the result obtained would be a combined characteristic added with the fluctuation of the external equipment.

For special control in terms of a specific control point (for instance, using the operation setting), first carry out a test at “Characteristic control point” at the time when the relay is received or put in service to determine the acceptance/rejection. Thereafter, perform another test at each control point, so that the data obtained can be used for future reference.

(3) Changing setting

Change the setting according to the section 6 “Handling”.

(4) Operation judgment

Determine the operation currents and time and other values of the relay unit basically by turning on and off the corresponding output relay contact of each element.

To determine the starting value of the time-delayed elements of overcurrent relay, which cannot be checked through the output contact, read the display of “elapsed time of time-delayed timer”.

(5) Communication card

Whatever the communication card is inside or not, for the test of withstand voltage and lightning impulse withstand voltage, please avoid inputting test voltage to the serial communication network circuit (DA, DB, DG, SLD terminals).

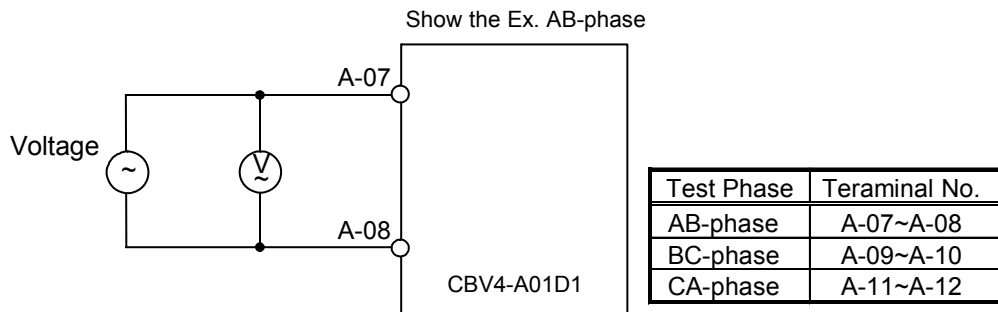
Note: it is not necessary to take the communication card out when test if the communication card was inside unit.

8.2.2 Characteristic test

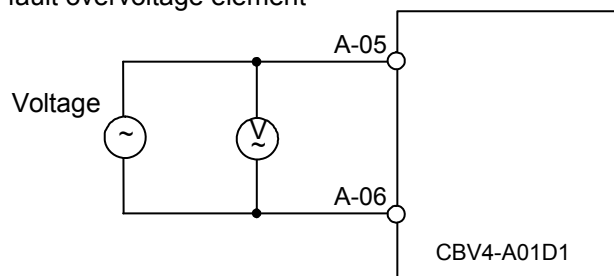
(1) Test circuit

Connect the external wiring referring to the AC input circuit diagram shown below:

a. Undervoltage elements



b. Earth fault overvoltage element



(2) Test items and characteristic control point

a. Forced operation test

See "Front control panel operational procedure" in the section 6 "Handling".

b. Operation value test

See "Operation and reset values" in the "3 Characteristic".

c. Operation time test

See "Operation time" in the "3 Characteristic".

d. Reset time test

See "Reset time" in the "3 Characteristic".

9 Maintenance

9.1 Daily inspection

Take every opportunity to carry out the following inspection:

- Check that the cover is not damaged and is attached properly.
- Check that no dust or iron chips have invaded into the unit.
- Check that the cover is not clouded notably.
- Check that abnormal noise is not generated.
- Check that the RUN LED lamp is lit.

9.2 Periodical inspection

It is recommended to carry out periodic inspections to check the relay for proper function.

For periodical inspections, perform the appearance inspection and characteristic test in accordance with the section 8 "Test".

10 Ordering

The product and specification shown in this manual may subject to changes (including specification change and production suspend) without notice. It is advisory to inquire the nearest Mitsubishi Electric's branch or sales office, if required, to confirm that the latest information is given in the manual, prior to placing an order.

Notify the following items when placing an order.

Item	Example of order	Remarks
Model	CBV4-A01D1	For more information, see the section 2 "Rating and specification".
Frequency	50 Hz	Select 50Hz or 60Hz.
Rating	Voltage : 57 ~ 120V Zero-phase voltage: 100 ~ 208V	For more information, see the section 2 "Rating and specification".
Setting range	Undervoltage element (27): 10 ~ 110V Earth fault overvoltage element (64) : 5 ~ 60V	For more information, see the section 2 "Rating and specification".
Communication card	One of the followings can be selected: a. CC-Link communication card (Manual No.: JEP0-IL9417, JEP0-IL9418) b. No communication card	Only purchasing a communication card separately will allow customer to add the communication facilities. If customer does not need the communication facilities at the time of introducing the system, just purchase the relay unit without communication card. Customer can add the communication facilities whenever he/she needs to introduce them. This will help decrease the initial cost and upgrade the system in stages.

11 Guarantee

11.1 Guarantee period

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

11.2 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.

- ①When 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.
- ②When the faults or defects are resulted from the reason concerning without our products.
- ③When the faults or defects are resulted from the modification or repair carried out by any other entity

than MITSUBISHI ELECTRIC CORPORATION.

- ④When the faults or defects are resulted from a phenomenon which can not be predicted with the science and technology put into practical use at the time of purchase or contract
- ⑤In 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.
- ⑥In case of that the faults or defects are resulted from un-proper application being out of instruction of MITSUBISHI ELECTRIC CORPORATION.
- ⑦In 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.

11.3 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

11.4 Applications of products

- ①The 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.

- ②This 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.

- ③In 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.

- ④The 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
- ⑤The 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.

11.5 Onerous repair term after discontinuation of product

- ①MITSUBISHI 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.)
- ②Product supply (including repair parts) is not available after production is discontinued.

11.6 Changes in product specification

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

11.7 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.

12 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 them 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.

mitsubishi **MITSUBISHI ELECTRIC CORPORATION**

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

Revised in Nov. 2011