



Static Protection Relay

MELPRO™ -A Series

EARTH FAULT OVERCURRENT RELAY

MODEL

MGR-A1V-R, MGR-A1V-RD

MGR-A1T-R, MGR-A1V-F

MGR-A1VB-F

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 observe safety information, incorrect use, or improper use may endanger personnel and equipment and cause personnel injury or physical damage.
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Items as classified to the caution may become to occur more sever 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 below, otherwise the product performance/life might be unfavorably affected.
 - Ambient temperature: -20°C~+60°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.

Tightened torque of screw shall be as below table

Material	Size	Standard torque	Permissible range	Application
Steel	M3.5	1.10N · m (11.2kgf · cm)	0.932~1.27N · m (9.5~12.9kgf · cm)	Terminals of back side

- (3) Grounding should be as 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.
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%~-15% of rated voltage
 - Deviation of frequency: within ±5% of rated frequency
 - Ambient temperature: 0°C~+40°C (-20°C~+50°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 erroneous might occur.
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: $86\sim 106\times 10^3$ 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= $100\%\times$ effective value of harmonics/effective value of fundamental)
 - Ripple (in case of DC): Ripple factor less than 3%
(Ripple factor= $100\%\times(\text{max}-\text{min})/\text{average of DC}$)
 - (5) Deviation of auxiliary power: within $\pm 2\%$ of nominal voltage
 - (6) Be sure not to inject the voltage or current beyond the overload immunity.
Otherwise, damage or burning might occur.
 - (7) Be careful not to touch the energized parts.
Otherwise, the electric shock might occur.
 - (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.)
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.

— 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 by a 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 can not 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

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, such as medical system for life-sustaining, in nuclear power plants, power plants, aerospace, and 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. 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, are 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.

5. Onerous repair term after discontinuation of product

①MITSUBISHI ELECTRIC CORPORATION shall accept onerous product repairs for 7(seven) years after production is terminated. (However, please consider the replacement of products being in operation during 15 years from ex-work.)

②Product 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.

MGR-A1 Series Ground Over Current Relay [Standard: JIS C 4601]

Features

- Ensures stable characteristics with high Sensitivity and high accuracy.
- An active filter is incorporated in the input circuit, so the response to higher harmonics is improve.
- Operating time is easily coordinated owing to the Adoption of instantaneous tap.
- Fitted with a power source lamp, this relay enables you to check the on/off condition of the control power source.
- Forced operation is available by a test button.
- Not need outside auxiliary power supply
The auxiliary power supply can be supplied by inside circuit of relay.
- High reliability based on dual output circuit.
- Output contacts are automatic resetting type.

1. Rating and Specifications

Type name		MGR-A1V-F	MGR-A1VB-F	MGR-A1V-R	MGR-A1V-RD	MGR-A1T-R
Style		003PPA	004PPA	098PGA	517PGA	099PGA
Tripping method		Voltage tripping				Current tripping
Element	Protection	Ground over current element (MZT correspondence ^{*1}) × 1				
Rating	Frequency	50/60Hz				
	Zero-phase Current	0.2A (ZCT primary)				
	Auxiliary Power Supply Voltage	AC100/110V (90~120V)				
Setting	Operating Value	0.1-0.2-0.4-0.6A (ZCT primary conversion value)				
	Operating Time	Instantaneous-0.2S				
Display	Power Source Display	LED : Lights up when the control power is on.				
	Operation Display	Changes from black to orange when the relay operates. (Manual resetting system)				
Output Contact	Configuration	1a, 1c No voltage	1a, 1c No voltage	1a, 1c No voltage	1a, 1c No voltage	—
	Contact Capacity	Closed circuit : AC110V 10A (Power factor=0.5) DC220V 10A (L/R=0s) AC220V 1A (Power factor0.5) Opened circuit : AC110V 5A (Power factor00.5) DC110V 15A (L/R=0s) DC110V 0.2A (L/R=40ms)				
Forced operation		Executed by pressing the switch located panel.				
Power consumption		Normal : Approx 2VA、operating : Approx 4VA				
Mass		Approx 0.6 kg		Approx 1.3kg	Approx 1.5kg	Approx 1.8kg

Case	Surface-mount fixed type (F type) color : N1.5	Compact cylindrical fixed type (R type) color : N1.5	Compact cylindrical draw-out type (RD type) color : N1.5	Compact cylindrical fixed type (R type) color : N1.5
Cover	Open-close type Color : transparent			
Applicable standard	Ground Relay Set for 6.6kV Consumer, JIS C 4601—1993			

*1) It is necessary to use the ZCT(MZT type) with the relay of MGR-A1 type

Characteristics (Combined with MGR-A1+MZT)

Item	Performance																		
Standard Operating condition	Ambient temperature: -20 to 50°C in the non-icing condition (Maximum temperature: 60°C) Relative humidity: 30 to 80% RH Altitude : 2000m Max. Others : Condition not subject to abnormal vibration, impulse or inclination, and a place not exposed to explosive or flammable dust, flammable or corrosive gas, flammable steam, etc.																		
Operating value characteristics	Within $\pm 10\%$ of each preset current at operating time $T = 0.2s$ setting.																		
Resetting value characteristics	90% or more of operating value.																		
Operating time	All the setting values: $I_0 = 130\%$ or 400% of setting value is quickly applied. <table border="1" style="width: 100%; border-collapse: collapse; text-align: center;"> <tr> <td style="width: 33%;">Test current</td> <td style="width: 33%;">130% of setting value</td> <td style="width: 33%;">400% of setting value</td> </tr> <tr> <td style="border-top: 1px solid black;">Time setting</td> <td></td> <td></td> </tr> <tr> <td style="border-top: 1px solid black;">Instantaneous</td> <td style="border-top: 1px solid black;"></td> <td style="border-top: 1px solid black;">75ms less</td> </tr> <tr> <td style="border-top: 1px solid black;">0.2 s</td> <td style="border-top: 1px solid black;">0.1~0.3 s</td> <td style="border-top: 1px solid black;">0.1~0.2 s</td> </tr> </table>	Test current	130% of setting value	400% of setting value	Time setting			Instantaneous		75ms less	0.2 s	0.1~0.3 s	0.1~0.2 s						
Test current	130% of setting value	400% of setting value																	
Time setting																			
Instantaneous		75ms less																	
0.2 s	0.1~0.3 s	0.1~0.2 s																	
Resetting value	All the setting values: Setting value X 130% or 400%, and sudden change to 0A. 500ms or less																		
Inertia characteristics	The relay does not operate when suddenly apply 400% current of setting value at setting of $T = 0.2s$ and $I_0 = 0.2A$.																		
Influence of control voltage	To the values at the rated control voltage, under 90V to 120V AC fluctuation: Operating current: $\pm 10\%$, operating time: $\pm 10\%$																		
Influence of temperature	<table border="1" style="width: 100%; border-collapse: collapse; text-align: center;"> <tr> <td style="width: 50%;">Ambient temperature</td> <td style="width: 50%;">Error against the operating current value at 20°C</td> </tr> <tr> <td style="border-top: 1px solid black;">-10°C or more but below 50°C</td> <td style="border-top: 1px solid black;">$\pm 15\%$</td> </tr> <tr> <td style="border-top: 1px solid black;">-20°C or more but below -10°C over 50°C to 60°C max.</td> <td style="border-top: 1px solid black;">$\pm 20\%$</td> </tr> </table>	Ambient temperature	Error against the operating current value at 20°C	-10°C or more but below 50°C	$\pm 15\%$	-20°C or more but below -10°C over 50°C to 60°C max.	$\pm 20\%$												
Ambient temperature	Error against the operating current value at 20°C																		
-10°C or more but below 50°C	$\pm 15\%$																		
-20°C or more but below -10°C over 50°C to 60°C max.	$\pm 20\%$																		
Resistance to vibration	<table border="1" style="width: 100%; border-collapse: collapse; text-align: center;"> <tr> <th rowspan="2">Frequency (Hz)</th> <th colspan="3">Peak-to-peak amplitude (Acceleration m/s^2)</th> <th rowspan="2">Vibration time (s)</th> </tr> <tr> <th>Forward/backward</th> <th>Right/Left</th> <th>Up/Down</th> </tr> <tr> <td style="border-top: 1px solid black;">10</td> <td style="border-top: 1px solid black;">5 (9.8)</td> <td style="border-top: 1px solid black;"></td> <td style="border-top: 1px solid black;">2.5 (4.9)</td> <td style="border-top: 1px solid black;">30</td> </tr> <tr> <td style="border-top: 1px solid black;">16.7</td> <td style="border-top: 1px solid black;">0.4 (1.96)</td> <td style="border-top: 1px solid black;"></td> <td style="border-top: 1px solid black;"></td> <td style="border-top: 1px solid black;">600</td> </tr> </table> <p style="margin-left: 20px;">No malfunction or wrong display is found when the above vibration is given with no electricity turned on and each setting value set to the minimum.</p>	Frequency (Hz)	Peak-to-peak amplitude (Acceleration m/s^2)			Vibration time (s)	Forward/backward	Right/Left	Up/Down	10	5 (9.8)		2.5 (4.9)	30	16.7	0.4 (1.96)			600
Frequency (Hz)	Peak-to-peak amplitude (Acceleration m/s^2)			Vibration time (s)															
	Forward/backward	Right/Left	Up/Down																
10	5 (9.8)		2.5 (4.9)	30															
16.7	0.4 (1.96)			600															
Resistance to shock	No abnormality is found in all parts when a shock of max. $300m/s^2$ acceleration is given in the three directions of forward/backward, right/left and up/down. 2 times each.																		
Insulation resistance	<table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 70%;"> 10MΩ or more between all electric circuit and case (E terminal) 10MΩ or more between electric circuits 10MΩ or more between contact circuit terminals (between poles) </td> <td style="width: 30%; vertical-align: middle; font-size: 2em;">}</td> <td style="width: 10%; vertical-align: middle;">with DC500V megger</td> </tr> </table>	10M Ω or more between all electric circuit and case (E terminal) 10M Ω or more between electric circuits 10M Ω or more between contact circuit terminals (between poles)	}	with DC500V megger															
10M Ω or more between all electric circuit and case (E terminal) 10M Ω or more between electric circuits 10M Ω or more between contact circuit terminals (between poles)	}	with DC500V megger																	
Withstand voltage	AC2000V AC for one min. between all electric circuits and case (E terminal) AC2000V AC for one minute between electric circuits AC1000V for one minute between contact circuit terminals (between poles)																		
Lightning impulse withstand voltage	No abnormality is found when an impose of standard waveform (1.2/50 μs) is given to positive and negative polarities separately. <ul style="list-style-type: none"> • 60KV between all ZCT primary terminals and earth (E) • 4.5KV between all electric circuits of relay and earth (E) • 4.5KV between all ZCT secondary terminals and all control circuits • 3KV between contact terminals/other terminals and control power terminals • 3KV between control power terminals 																		
Resistance to noise	No malfunction is found when a repetitive damping oscillation voltage of IEC waveform (JIS C 4609 waveform 2) is applied for two seconds with each setting value set to the minimum and zero input. <ul style="list-style-type: none"> • Between ZCT secondary terminals and earth (E) • Between control power terminals and earth (E) • Between control power terminals • Between contact terminals/other terminals and earth (E) 																		

Ratio disturbance	With the minimum settings for each setting and 0A input current, at the same time to put a transceiver antenna (5W output) with 150MHz or 400MHz band closing the relay panel about 0.5m. It is not abnormal operation.			
Output contact	Closed circuit	AC110V : 10A (Power factor=0.5) DC220V : 10A DC110V : 15A (L/R=0 s)	Opened circuit	AC110V : 5A (Power factor=0.5) AC220V : 1A (Power factor=0.5) DC110V : 0.2A (L/R=40ms)

Note) This table describes only the main performance. For more details, refer to JIS C 4601-1993

Construction

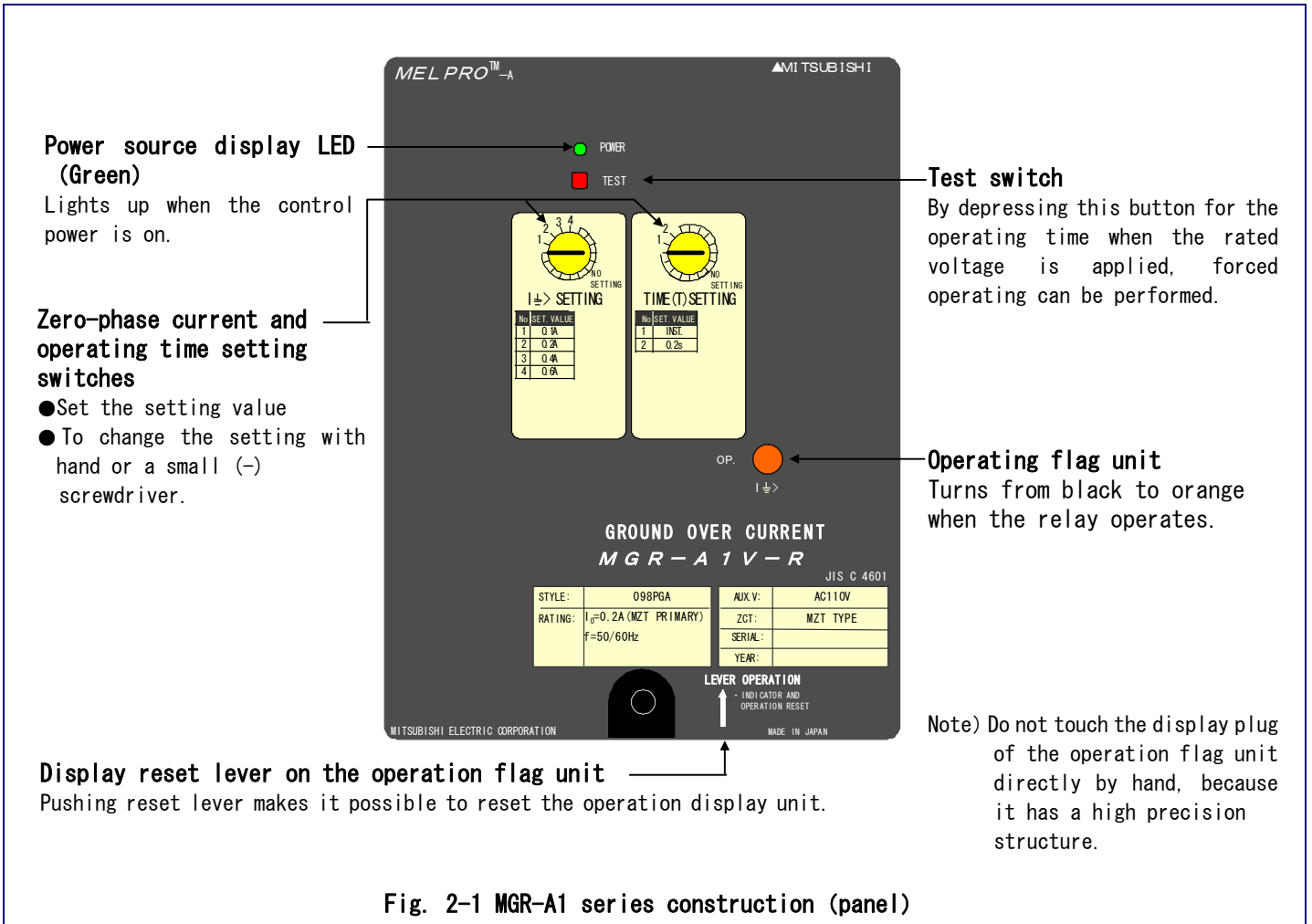


Fig. 2-1 MGR-A1 series construction (panel)

Operation Description

1. Relay Function

- ① This relay has a built-in regulated voltage circuit which derives control voltage from the voltage (VT secondary voltage) input, therefore, particular control power supply is not required.
- ② In case of a ground fault has occurred in a high voltage user site, the fault current (zero-phase current and charge current) runs through the earth and flows through the grounding capacitance of the distribution cables and the system equipment, which is then detected by the Type MZT zero-phase current transformer (ZCT), and from the secondary output it is supplied to the relay.
- ③ This zero-phase current input passes through the filter and the amplification circuit. After that, the signal is subjected to the conversion of its size in the operating value changeover circuit and then input the level detection circuit. When the input signal exceeds the operating level, the operation timer is started, and if the signal continues to exist for more than the preset operating time, the output relay and the operating flag unit come into action.
- ④ By the output relay contact, a trip signal is sent to the circuit-breaker to disconnect the fault point, and so the fault current disappears. Therefore, when the signal to be input to the level detection circuit of the relay falls below the operating level, the reset timer is started, and if there is no signal continuously for the reset time or more, the output relay will

be reset.

As the operating flag unit holds itself in the operating displaying status, for resetting, it is necessary push up the display reset lever provide at the front bottom of the relay.

2. Power source display

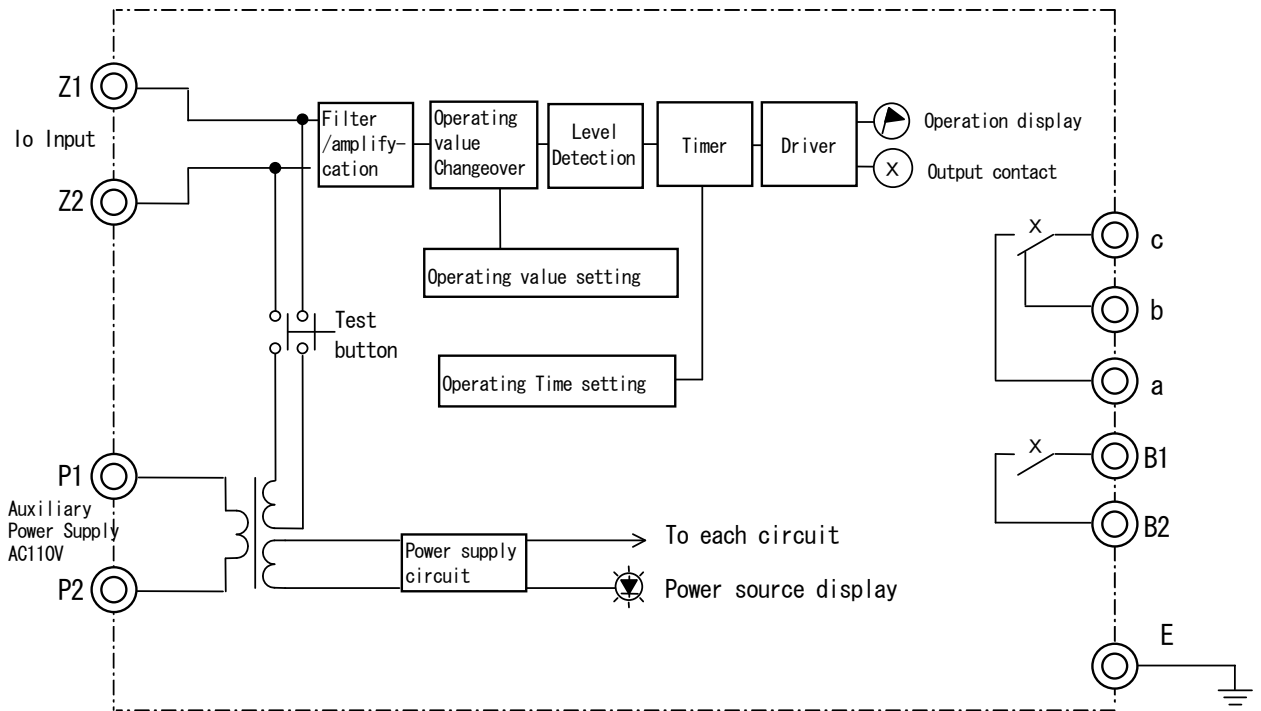
The green LED lights up when the rated control voltage is applied. This display is intended for confirming the existence of control power source. The light comes on even with a voltage (approx. 50V min.) outside a range of 90 to 120V which guarantees the relay operation in the circuit, but such lighting with a voltage outside the operating guaranteed range does not assure the operation of the relay.

3. Set point Setting Function

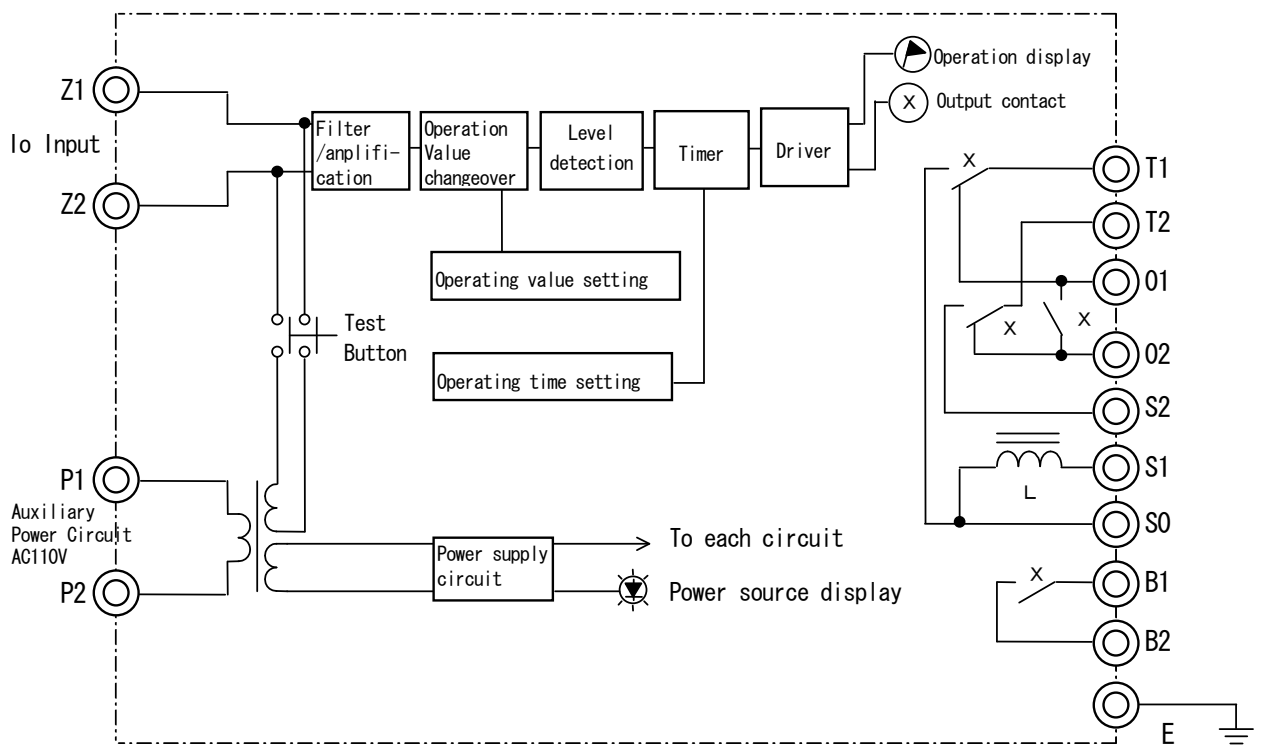
each of the figures on the nameplate, which are shown at the notched groove of the setting switch, is the setting of the zero-phase voltage V_0 , the zero-phase current I_0 , or the operation time T .

Note) Don't take a setting in range of "NO SETTING". Otherwise, unwanted operation may occur.

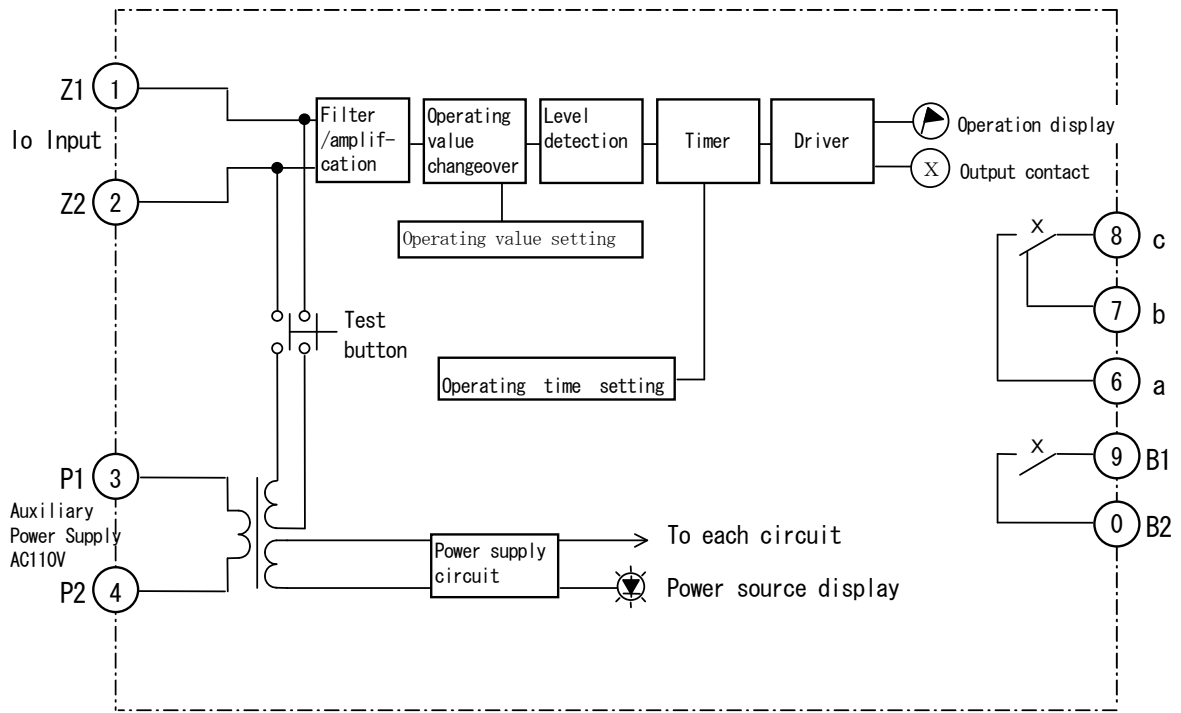
Internal Connection diagram



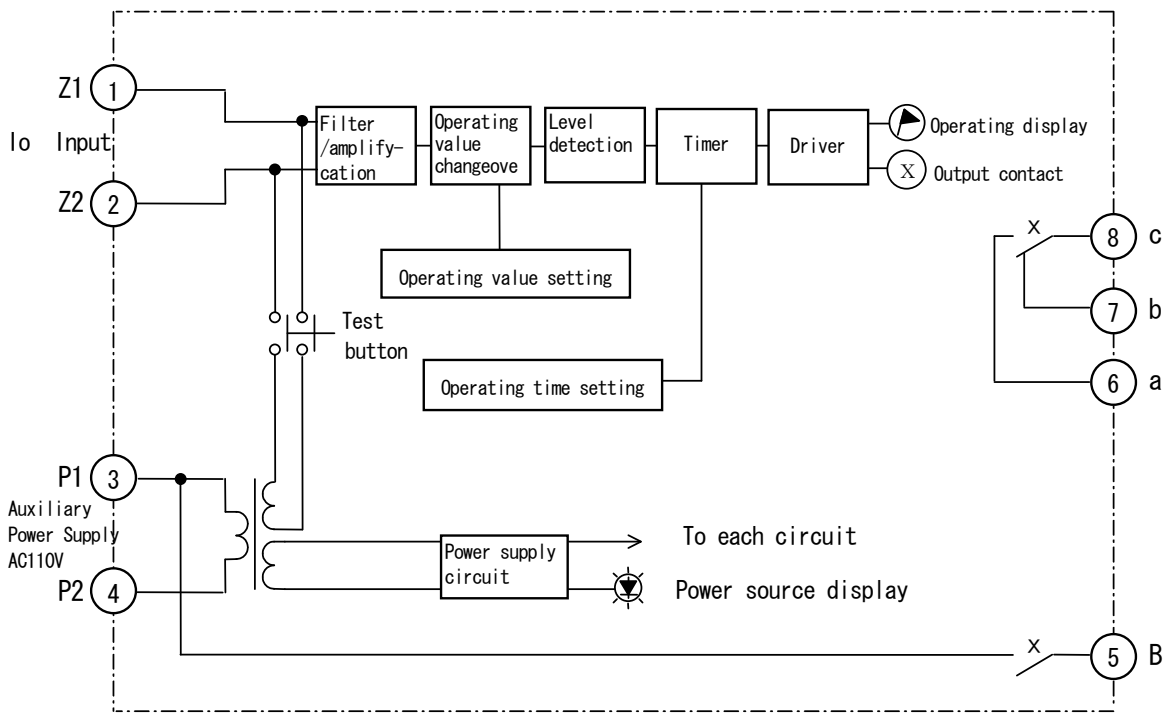
a) MGR-A 1 V-R



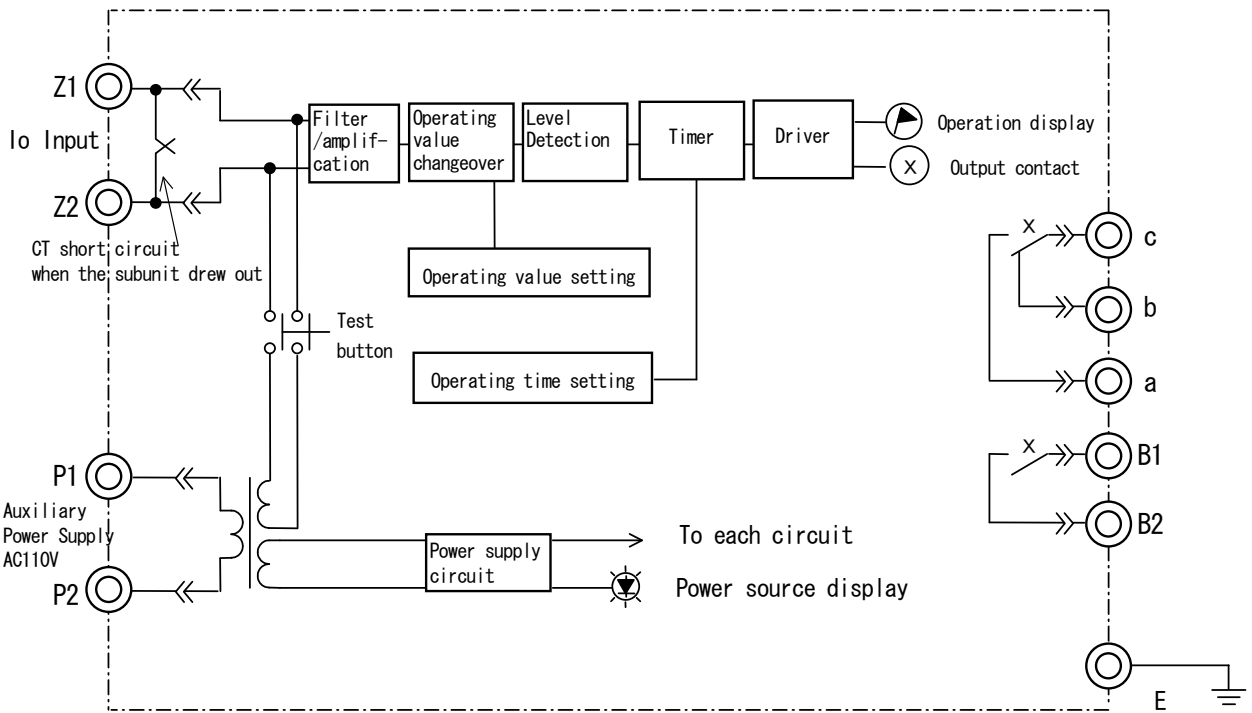
b) MGR-A 1 T-R



c) MGR-A 1 V-F



d) MGR-A 1 VB-F



e) MGR-A1V-RD
Fig. 2-2 Internal Connection diagram

External Connection Diagram

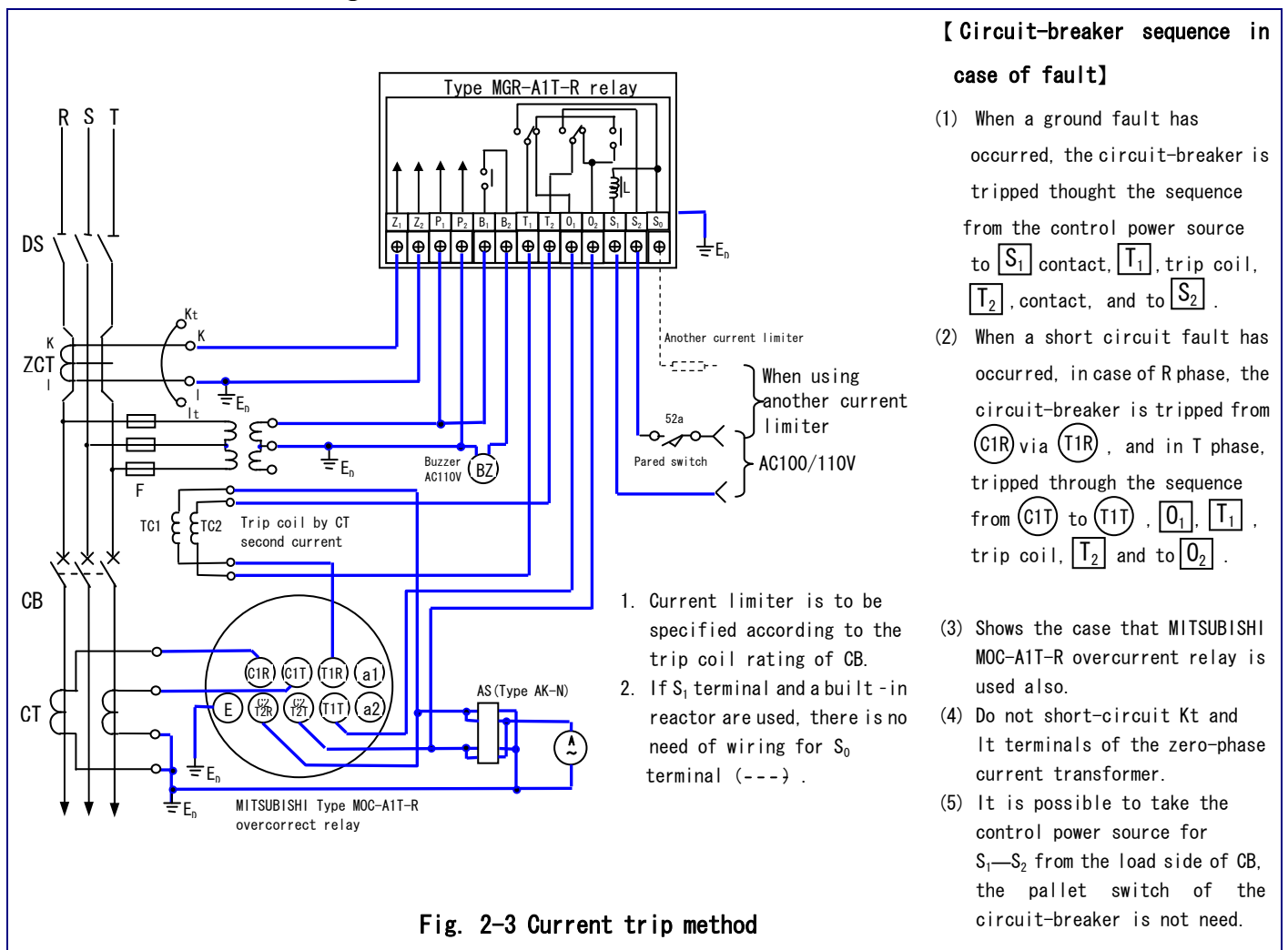


Fig. 2-3 Current trip method

【Circuit-breaker sequence in case of fault】

- (1) When a ground fault has occurred, the circuit-breaker is tripped through the sequence from the control power source to S_1 contact, T_1 , trip coil, T_2 , contact, and to S_2 .
- (2) When a short circuit fault has occurred, in case of R phase, the circuit-breaker is tripped from $C1R$ via $T1R$, and in T phase, tripped through the sequence from $C1T$ to $T1T$, O_1 , T_1 , trip coil, T_2 and to O_2 .
- (3) Shows the case that MITSUBISHI MOC-A1T-R overcurrent relay is used also.
- (4) Do not short-circuit K_t and I_t terminals of the zero-phase current transformer.
- (5) It is possible to take the control power source for S_1-S_2 from the load side of CB, the pallet switch of the circuit-breaker is not need.

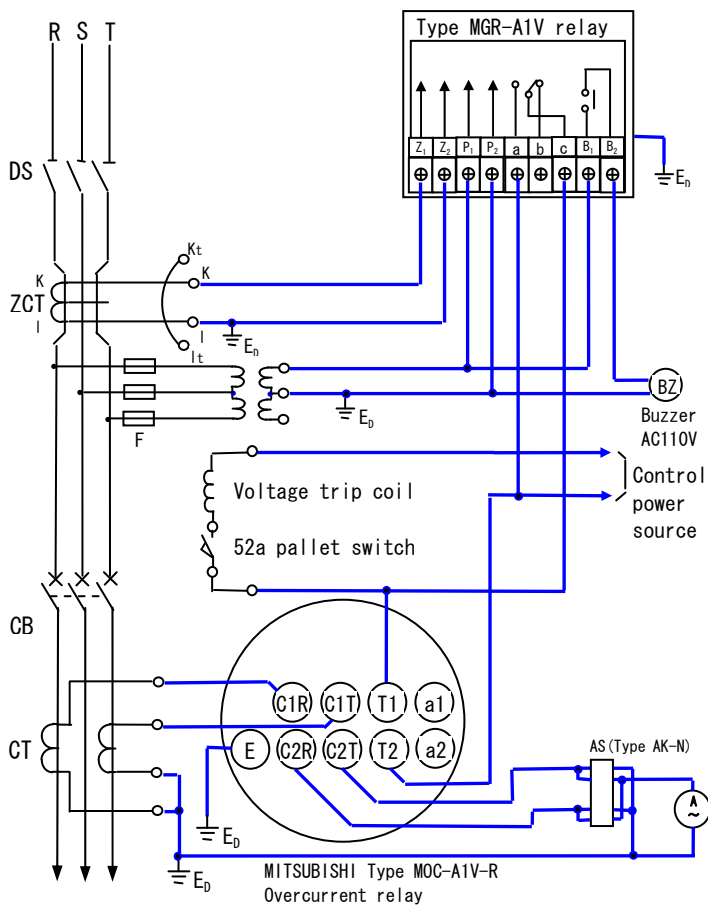


Fig. 2-4 voltage trip method

[Circuit-breaker sequence in case of fault]

- (1) When a ground fault has occurred, the circuit-breaker is tripping through the sequence from the control power source to trip coil, 52a, **C**, and to **a**.
- (2) When a short circuit has occurred, the circuit-breaker is tripped from the control power to trip coil, 52a, **T1**, and to **T2**.

1. Show the case of that the MITSUBISHI MOC-A1V-R overcurrent relay is used.
2. Do not short-circuit Kt and It terminals of the zero-phase current transformer.

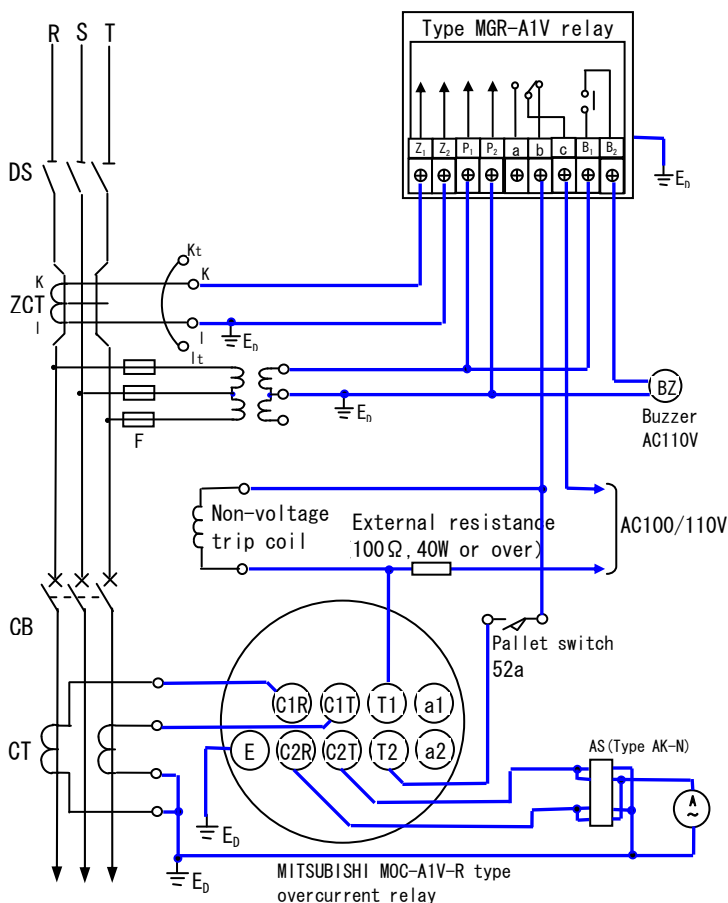


Fig. 2-5 Non-voltage trip method

[Circuit-breaker sequence in case of fault]

- (1) When a ground fault has occurred, the circuit-breaker is tripped by operating the circuit between **C** and **b**.
- (2) When a short circuit has occurred, the circuit-breaker is tripped by closing the circuit between **T1** and **T2**, thus demagnetizing the trip coil.

1. Show the case of that the MITSUBISHI MOC-A1V-R overcurrent relay is used.
2. Do not short-circuit Kt and It terminals of the zero-phase current transformer.

Setting

Operating values are generally set as follows.

However, for setting, system conditions(residual current, etc.) and protective coordination should be also taken into consideration.

<An example of setting for MGR relay>

Receiving point : $I_0=0.2-0.4A$ (※) $T=0.2s$ (※)

Branch feeder : I_0 =Equivalent to or smaller than the power receiving point. T =Instantaneous (Approx. 75ms)

For the values marked with an asterisk (※), please consult your electric power company.

Precautions for Design and Installation

<Connection>

(1) ZCT test terminal

Use the test terminals K_t and L_t of the zero phase current transformer only when letting dummy fault current flow during the test, and keep them open after the test. (If short circuit, relay does not operate.)

(2) Wiring material

Since MGR-A1 type is a static relay which has a high sensitivity, it is necessary to suppress surge and noise from the main circuit and other contact lines where applicable.

Consequently, use a 2-core shielding wire (black/white) of 0.75 to 1mm² for wiring from ZCT to the relay, and connect this shield wire to E terminal (E3) of the panel.

In this case, the load should be 5 Ω or less in both ways.

(Approx. 100m maximum in one way for a 0.75mm²wire)

(3) Power cable shield earth

When an electric power cable is used at the primary side of ZCT, note the shield earth as specified is the “shield Earth” section is “Guideline for High-voltage Power Receiving & Distribution Facilities” .

(4) Power cable handling

Take care in handling not to damage the outer sheath of ZCT primary conductor. The bending radius should be more than 10 times the conductor outside diameter. Locate the cable symmetrically in 3-phase in the ZCT thru-section.

(5) Alarm circuit

This relay is a type of auto-reset. If you want to use it as self-holding method, finish the connection refer to Fig. 2-7 please.

<Withstand voltage test>

- (1) When the relay is tested as a single unit, do not apply voltage to Z_1 and Z_2 circuit.
- (2) After the relay is assembled into the panel, when the test is performed between the high-voltage circuit and the earth, and between the high-voltage circuit and the low-voltage circuit. Be sure to check that the secondary side of ZCT and the secondary side of PT are ground.
- (3) For testing the line between the low-voltage circuit and the earth, disconnect the secondary side of PT and ZCT from the earth, without fail.

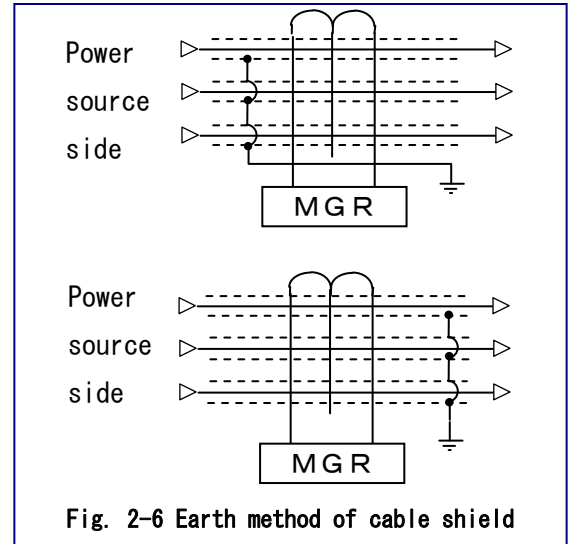


Fig. 2-6 Earth method of cable shield

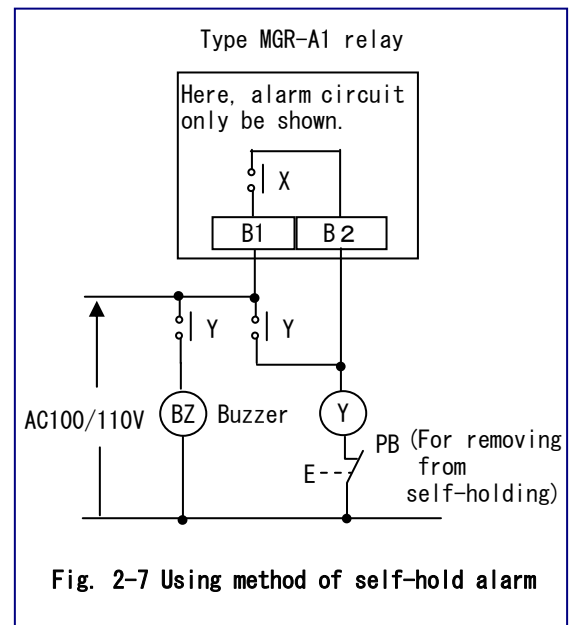


Fig. 2-7 Using method of self-hold alarm

<Precaution on use>

- (1) This ground relay uses solely the current of the zero-phase current transformer, and has no Directionality on its operation principle. In other words, the relay operates only by the side of current. So, if the ground capacitance on the load side large (the cable is laid over a long distance), please take the use of a MDG-A1 directional ground relay into consideration.
 - (2) Do not push the test switch unless for testing purpose.
 - (3) Avoid using Kt and It terminal of the zero-phase current transformer for purpose other than testing. Keep them open in normal use.
 - (4) When using a MGR-A1T-R relay, check the matching of Impedance characteristics the building reactor and that of the trip coil of the circuit-breaker to be Com-binned with the reactor, and determine combination that can ensure a flow of 3A or more current. (See Fig. 2-8)
- For VCB of our company, this matching has been completed.

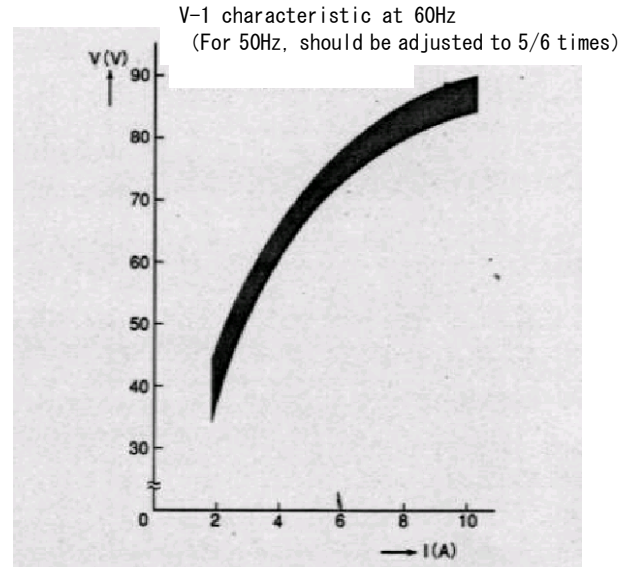


Fig. 2-8 MGR-A1T reactor

(The reactor inside MGX-1 type auxiliary box has the same characteristic.)

Shield earth of ground relay and cable

For the point to be noted for the installation of the Ground relay, as stated in the "Guideline on High voltage Power Receiving and Distribution Facility" (revised version), due attention should be paid to the shield earthing points of the cable.

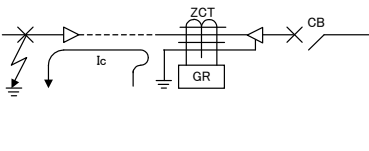
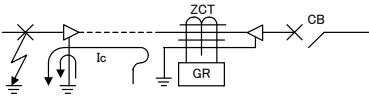
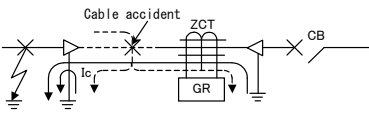
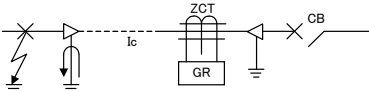
In depends on the shield earth method whether the function

of the grounding protection for the cable itself is provide or not, and whether the ground relay malfunctions or not due the charge current at the time of external accident.

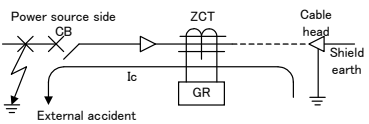
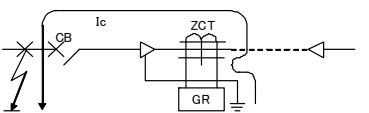
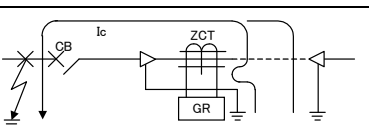
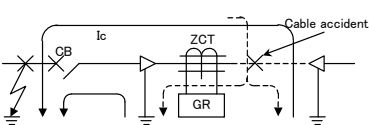
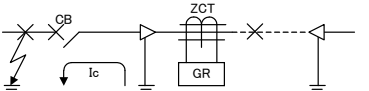
The following table shows various responses of the ground relay by the shield earth method.

[Lead-in cable]

No.	Shield earth method	Grounding protection of cable itself	Effect of cable I_c in case of external grounding fault.	Discussion	General evaluation
1		<p>○ Within the protection range, the GR relay Operates. But cancellation of fault point is impossible.</p> <p>(DGR on the distribution substation side also operates, and quick restoration is realize by keeping contact with the electric power company.)</p>	<p>△ Change current I_c runs through ZCT. So, if the change current is large), GR may commit a wrong operation.</p>	<p>This is the method Recommended in the Guideline on High-voltage Power Receiving and Distribution Facility (revised version). If there is a large charger current including the in-plant portion, use a DGR.</p>	○

2		<p>× Within the protection range, but DGR does not operate. As only the DGR on the distribution substation side operates, restoration takes a longer time.</p>	○ Charge current I_c goes to and from ZCT, so there is no malfunction of GR.	If the in-plant charge current is large, use a DGR.	△
3		<p>× Same as above (Some as above)</p>	○ Same as above	Same as above	△
4		<p>△ Within the protection range, but as the grounding current is divided and separately flows to two contact points, the detection sensitivity is lowered. Cancellation of faulty point is impossible.</p>	<p>× Same as for No. 1 Moreover, depending on Potential difference between contact points, there is a fear that a circulating current runs though when the low-voltage circuit has a ground fault. thus causing a malfunction of GR.</p>	Shall not apply.	×
5		× Same as for No. 2	○ As charge current I_c does not run through ZCT, GR makes no wrong operation.	Same as for No. 2	×

[Lead-out cable]

No.	Shield earth method	Grounding protection of cable itself	Effect of cable I_c in case of external grounding fault.	Discussion	General evaluation
1		○ Within the protection range, and GR Operates.	△ Change current I_c runs through ZCT. So, if the change current is large, GR may commit a wrong operation.	If there is a large charge current including the in-plant portion, use a DGR.	○
2		○ Same as above	△ Same as above	Same as above	○
3		○ Same as above	△ Same as above	Same as above	△
4		△ Within the protection range, but as the grounding current is divided and separately flows to two contact points, the detection sensitivity is lowered.	<p>× Shall as for No. 1 Moreover, depending on Potential difference between contact points, there is a fear that a circulating current runs though when the low-voltage circuit has a ground fault. Thus causing a malfunction of GR.</p>	Shall not apply	×
5		× Within the protection range, but GR does not operate.	○ As charge current I_c does not run through ZCT, GR makes no wrong operation.	Same as above	×

Handling Method

1. Panel assemble

- ① Do connect the relay terminal “E” to earth at Class D please
- ② Type MGR-A1V-RD is a draw-out type that the sub-unit can be drawn out from case.
For detail, refer to section of “Drawing out and Housing operation of Sub-unit” please.

2. Use and operation

- ① Avoid changing the settings during operation, since it is possible to occur unwanted operation. However, if setting change is unavoidable, please push up the display reset lever in order to lock relay operating.
- ② To change the setting may be realized manually by the

setting switch. It is also possible by using a small minus (-) screwdriver. If a large minus (-) screwdriver is used, it may damage the groove of the switch knob.

- ③ The switch for setting is a rotary one utilizing snap action. When the setting is changed, turn the switch smoothly so as not to stop it in mid-position.
- ④ Since the RUN indicator LED is lighting during the normal operation, check it in routine checking please. When it is OFF, check VT secondary input voltage value, and if it is still OFF even OFF at apporox. 85v or more, contact our local agent and branch office since the relay may fail.

Test

This relay is tested sufficiently before shipment. In the following cases, however, it is recommended that the test be carried out.

- a. After the products are unpacked when received
- b. When the equipment starts operation
(Power receiving starts)
- c. When periodical checkup is carried out
(Normally once per year)

1. Testing

- ① For voltage and current input waveforms, use a sine wave without distortion please.
- ② To select the switch for each setting with hand or use a small regular screwdriver
- ③ If the operation characteristics are tested specially in individual control points (for example, when tested in the in-service setting conditions), the test should be performed with the operation characteristic points when the products are received or the operation is started, and the test should be carried out with individual control point after the relay acceptance or rejection is judged also, use this data as a later standard.

2. Withstand Voltage Test

Perform the unit test as follows.

- a. Apply 2000V AC (commercial frequency) between all electric circuits and case (E terminal) for one

minute, and make sure that no problem.

①Type MGR-A1V-R, Type MGR-A1V-RD

Voltage Applied Terminals	
(P1) (Z1) (B1) (a) (c) (P2) (Z2) (B2) (b)	(E)

②Type MGR-A1T-R

Voltage Applied Terminals	
(P1) (Z1) (T1) (O1) (B1) (S0) (S2) (P2) (Z2) (T2) (O2) (B2) (S1)	(E)

- b. Apply 2000V AC (commercial frequency) between all electric circuits and case (E terminal) for one minute, and make sure that no problem.

①Type MGR-A1V-F, Type MGR-A1V-R, Type MGR-A1V-RD

Voltage Applied Terminals	
(P1) (P2)	(a) (b) (c) (B1) (B2)
(Z1) (Z2)	(a) (b) (c) (B1) (B2)
(Z1) (Z2)	(P1) (P2)

②Type MGR-A1T-R

Voltage Applied Terminals	
(P1) (P2)	(T1) (O1) (B1) (S0) (S2) (T2) (O2) (B2) (S1)
(Z1) (Z2)	(T1) (O1) (B1) (S0) (S2) (T2) (O2) (B2) (S1)
(Z1) (Z2)	(P1) (P2)

3. Operation Characteristic Test [Combined with ZCT]

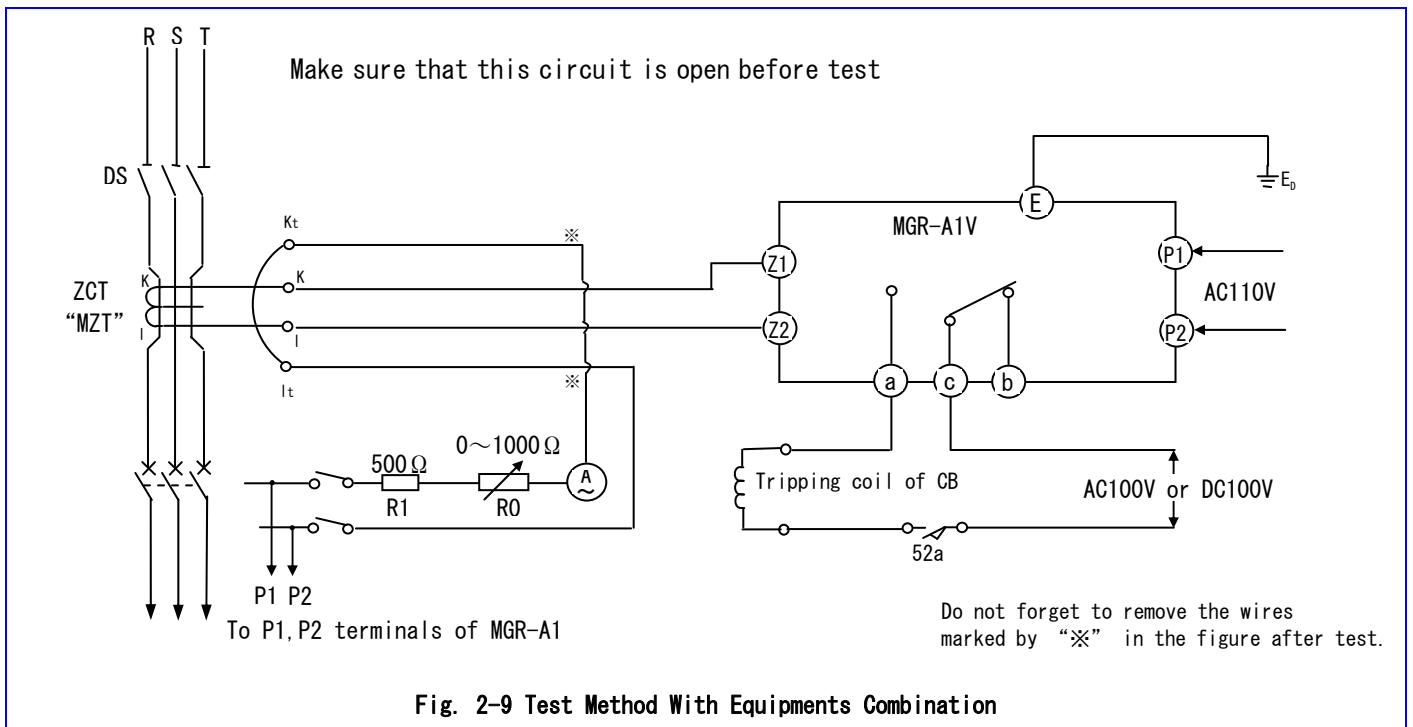
① For job-site test, refer to the test circuit Fig.2-9 and Fig.2-10.

② When this test is carried out, be sure that the main circuit be turned OFF.

4. Operation Characteristic Control Point

Perform the test periodically according to the following test conditions and criterion.

Test Item	Test conditions			Criteria for judgment
	Input	Operating Value	Operating Time	
Operating Value	—	Each setting	0.2s	±10% of the setting value
Operating time	0 to 130% of the setting value		Instantaneous	—
			0.2s	0.1~0.3s
	0 to 400% of the setting value		Instantaneous	75ms or less
			0.2s	0.1~0.2s
Reset Time	130% or 400% of the setting value to 0		Each setting	500ms or less



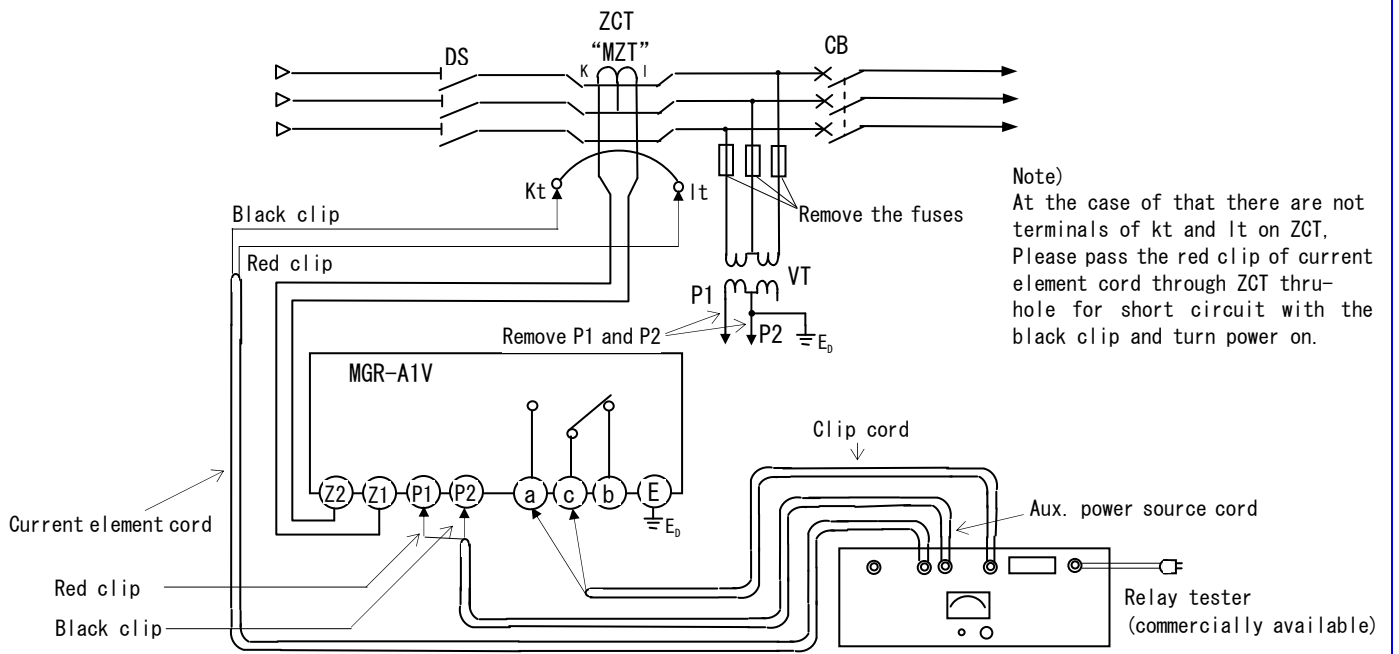
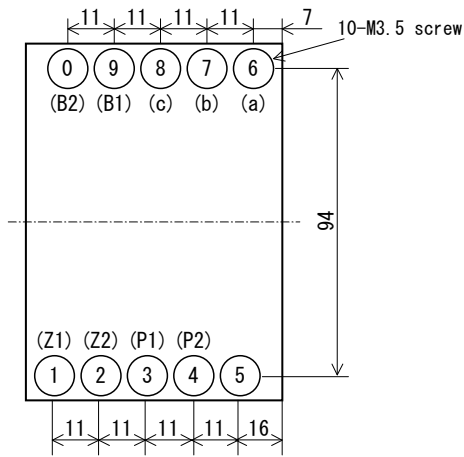
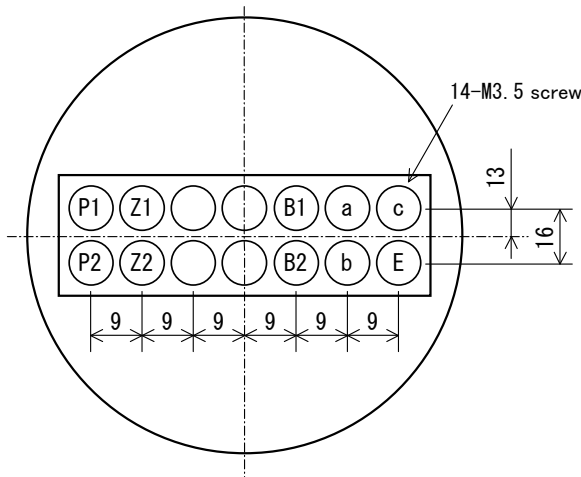


Fig. 2-10 Test Method Using Relay Tester

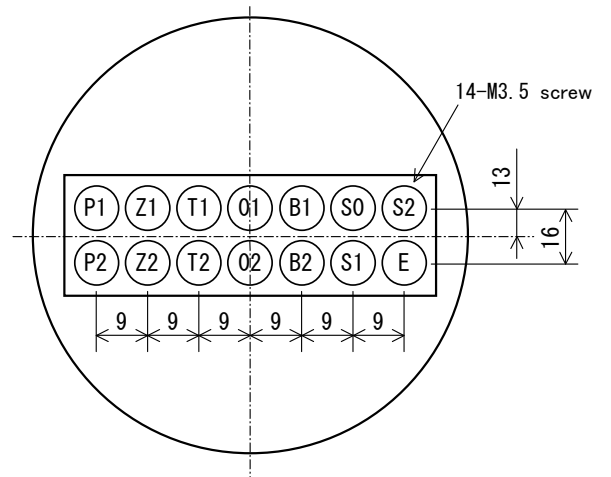
Terminal Layout



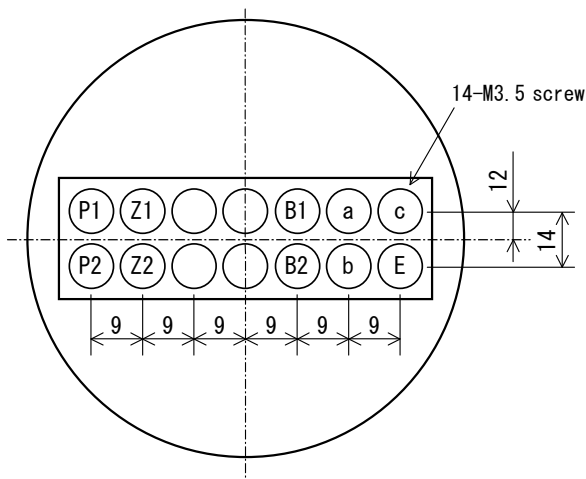
MGR-A1V-F
(Front view)



MGR-A1V-R



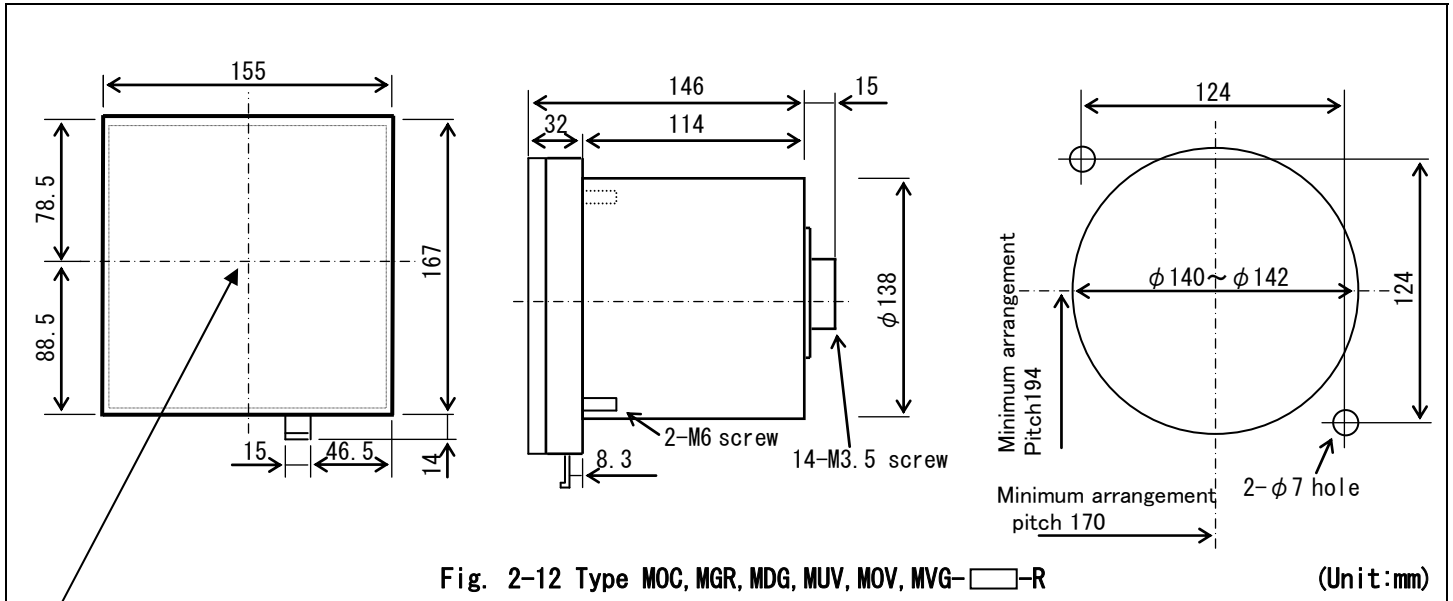
MGR-A1T-R



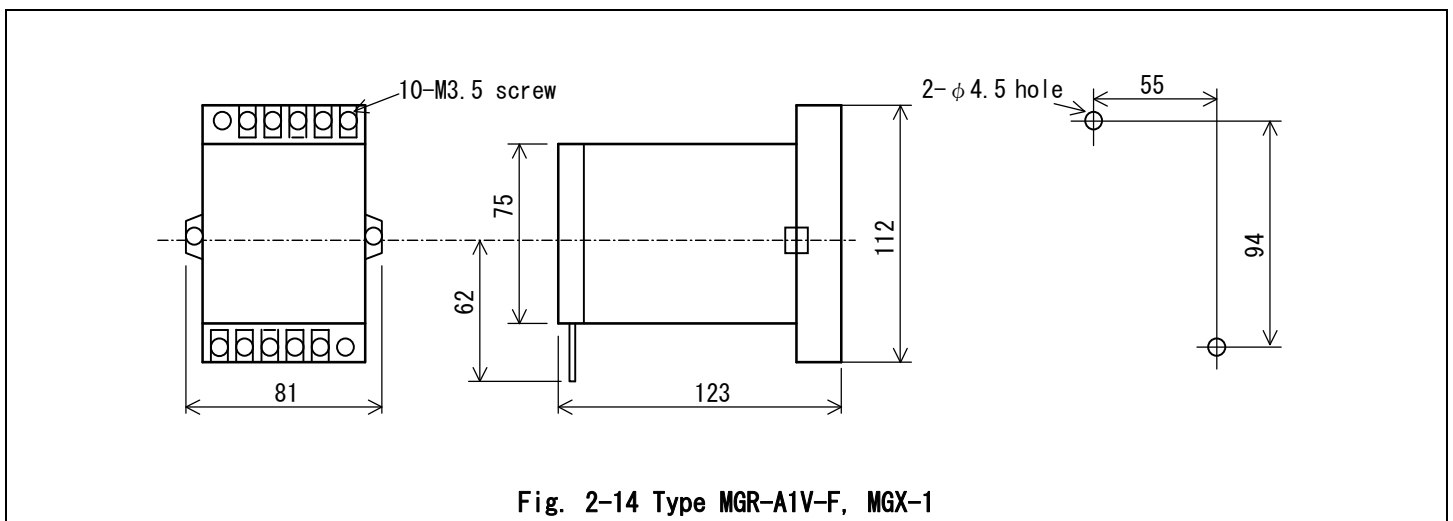
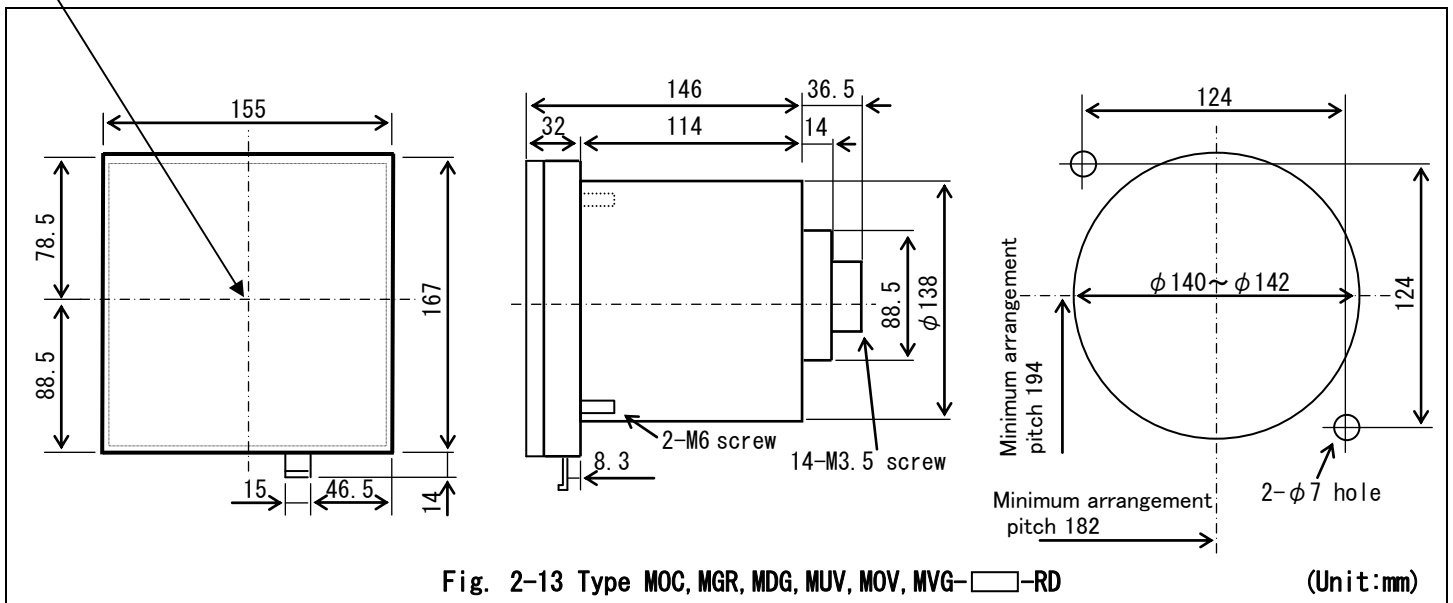
MGR-A1V-RD

Fig. 2-11 Terminal Layout

Mounting and Dimensions



Same as the center lines of $\phi 140\sim 142$ hole



Drawing out and Housing operation of Sub-unit

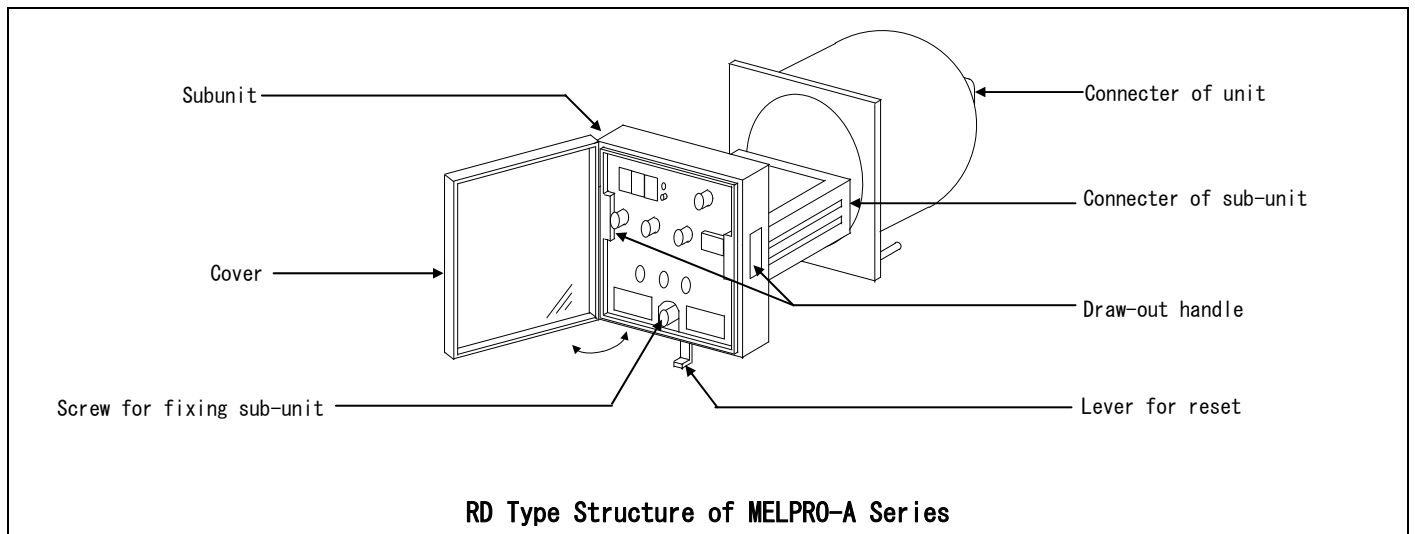
— For compact cylindrical draw-out type (RD type)

It is available to draw out the sub-unit from the relay case instead of removing the external wires. So that easier to carry out checking and testing.

When drawing out and housing, please pay attention to not to touch the electric circuit and move the sub-unit by handing the lever or from. Otherwise, it is possible to get an electric shock or make internal electric parts damage. The following operation should be checked when sub-unit be drawn out from relay case.

- Lock the tripping circuit
- Turn off the power supply into relay
- Disconnect CT circuit
- Disconnect VT circuit
- Open the auxiliary power supply (only the drawn out relay)

Note) This relay has the function that make the CT secondary automatically short-circuit when draw out the sub-unit from case.



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.

mitsubishi electric corporation

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