MITSUBISHI ELECTRIC

Changes for the Better

for a greener tomorrow

MITSUBISHI Numerical Protection Relay

MELPRO™-D Series

MELPRO™-D

Mitsubishi ELectric corporation's PROtection relay for Distribution.

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 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 as below, otherwise the product performance/life might be unfavorably affected.
   -Ambient temperature: -20℃～+60℃ (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) Please refer to the following about the screw tightening torgue.

Applications	Screw size	Guideline value of torque	Specified tolerance
Screw terminal	M3.5	1.10N･m(11.2kgf･cm)	0.932～1.27N･m(9.5～12.9kgf･cm)
Screw for relay unit fixing	M5.0	3.24N･m(33kgf･cm)	2.75～3.63N･m(28～37kgf･cm)

   (4) Grounding should be done correctly in case it is required. Otherwise, electric shock, damage, burning or erroneous operation might occur.
   (5) Wiring should be done without mistake especially observing the correct polarity. Otherwise, damage, burning or erroneous operation might occur.
   (6) Wiring should be done without mistake especially observing the phase ordering. Otherwise, damage, or erroneous operation might occur.
   (7) 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.
   (8) 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.
   (9) Connection should be done correctly using designated and right connectors. Otherwise, damage or burning might occur.
   (10) 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%～-15% of rated voltage
   -Deviation of frequency: within ±5% of rated frequency
   -Ambient temperature: -10℃～+55℃ (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 operation 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.)
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℃±10℃
   -Relative humidity: Less than 90%
   -Magnetic field: Less than 80A/m
   -Atmospheric pressure: 86～106×10^3 Pa
   -Installation angle: Normal direction±2°
   -Deviation of frequency: within ±1% of nominal frequency
   -Wave form (in case of AC): Distortion factor less than 2% (Distortion factor=100%×effective value of harmonics/effective value of fundamental)
   -Ripple (in case of DC): Ripple factor less than 3% (Ripple factor=100%×(max-min)/average of DC)
   -Deviation of auxiliary power: within ±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.

Request when placing order

Thank you very much for your usual selecting the MITSUBISHI ELECTRIC CORPORATION products.
When ordering our products described in this catalogue, please read and agree the followings before ordering as long as any special condition are not nominated in the offer document, contract document, catalogue other than this.

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 defact standard of industry.
(6) In case of that the faults or defects are resulted from un-proper application being out of instruction of MITSUBISHI ELECTRIC CORPORATION.
(7) In case that the faults or defects are resulted from force majeure such a fire or abnormal voltage and as an act of God such as natural calamity or disaster.

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

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

4. Applications of products

(1) The user is requested to confirm the standards, the regulations and the restrictions which should be applied, in case of utilizing products described in this catalogue and another one in combination. Also, the user is requested to confirm the suitability of our products to your applied system or equipment or apparatus by yourself. MITSUBISHI ELECTRIC CORPORATION shall not be liable for any suitability of our products to your utilization.
(2) This MITSUBISHI ELECTRIC CORPORATION products described in the catalogue have been designed and manufactured for application in general industries, etc. Thus, application in which the life or an asset could be affected, such as medical system for life-sustaining, in nuclear power plants, power plants (Power generation, transmission and distribution), aerospace, and transportation devices (automobile, train, ship, etc) shall be excluded. 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.
(3) In using MITSUBISHI ELECTRIC CORPORATION product, the working conditions shall be that the application will not lead to a major accident even if any problem or fault occur, and that backup or duplicate system built in externally which should be decided depend on the importance of facility, are recommended.
(4) The application examples given in this catalogue are reference only and you are requested to confirm function and precaution for equipment and apparatus and then, use our products.
(5) The user is requested to understand and to respect completely all warning and caution items so that unexpected damages of the user or the third party arising out of un-correct application of our products would not be resulted.

5. Onerous repair term after discontinuation of product

(1) MITSUBISHI ELECTRIC CORPORATION shall accept onerous product repairs for 7(seven) years after production is terminated. (However, please consider the replacement for the products being in operation during 15 years from ex-work.)
(2) Product supply (including repair parts) is not available after production is discontinued.

6. Changes in product specification

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

7. Scope of service

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

How to order

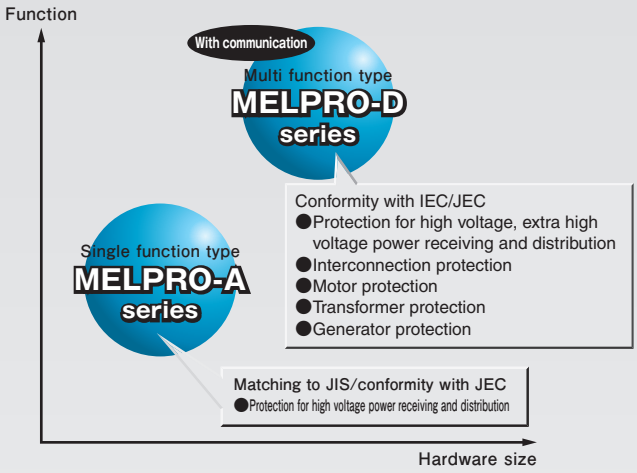
Please check the specifications and be ready with the following information when placing order.

	Items to be informed	Sample of ordering In case of COC4-A01D1	Remarks
Fundamental specification	Type name	COC4-A01D1	Refer to the specifications for detail.
	Frequency	50Hz	Specify 50Hz or 60Hz.
	Ratings	Phase current 5A, Zero phase current 1A	Refer to the specifications for detail.
	Auxiliary power supply voltage	AC/DC100～220V	Refer to the Common Technical data for detail.
	Languages	English language	Specify English or Japanese.
Optional specification	Communication function	Communication card for CC-Link	The communication feature may be installed later through subsequent purchase of the communication card. When communication feature is ordered at the same time with relay itself, type CC-COM2 communication card will be supplied. However, in case of subsequent purchase of the communication card, please include the information in your ordering which are the type of relay and presence or absence of connector for connecting PC located at the lower left corner of the relay front panel. In case of presence of connector, type of communication card is CC-COM2. In case of absence of connector, type of communication card is CC-COM.
	Parts	Case	When ordering, please specify the type of case D1 or D2 and uses of case (for testing purpose or not). Please note that CT circuits shorten mechanism is not equipped in the dedicated case of testing purpose.
		Cover	Please specify the type of case D1 or D2.
		Terminal block (with cover)	Please specify the type of relay and terminal block arrangement(from the left side of the back A,B,C,E). Please note ordering only cover is not accepted.

Please note that other specification than described in this catalogue is not applicable for manufacturing.

Relays suitable for advanced communication network systems contribute to build the automated power distribution.

To improve the reliability of distribution system is quite essential for the stable operation of all facilities installed in the factories and buildings. In order to realize high reliable distribution system, more functional protection relay as the core for the protection and control systems is essentially required. Through passing the age of the electric mechanical type relay and the transistor type relay, today, the main stream of protection relay has been moved to the numerical type. The numerical type protection relay MELPRO-D series have been developed based on the combination of the plenty know how gained through numerical relay history in several ten years and the latest electronics technology, and make possible to respond to the recent age needs for more functionality protection relay system.

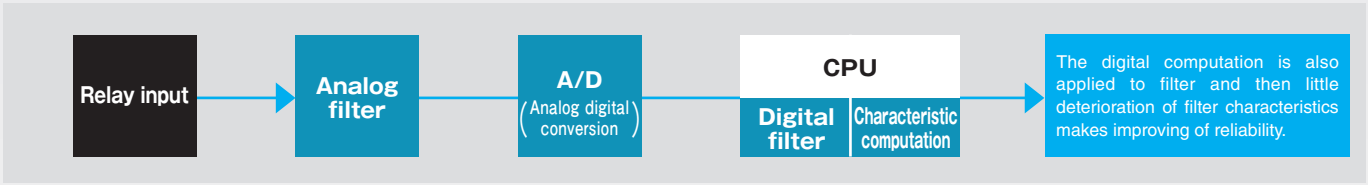


High accuracy & High speed processing

Adopt the highest performance CPU placed front end of the digital age

The high speed digital computation realizes the high accuracy operating characteristics never before possible. The operating characteristics are configured by the software, so that little deterioration and the stabilized operation can be realized.

■Digital computation



High degree of reliability

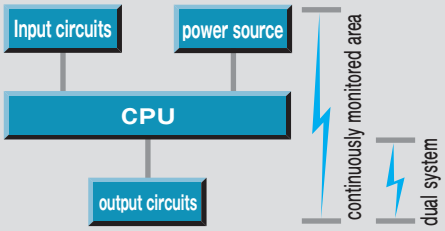
Adopting self-diagnosis function for countermeasures against problem may arise.

The self-diagnosis function which monitors continuously the input, built-in power source and CPU is equipped. In the failures occurring of the relay, they can be detected immediately by the self-diagnosis function. Furthermore, dual output circuit makes possible to prevent the occurrence of misoperation due to the hardware failures.

Superior resistance to attack by tough environment

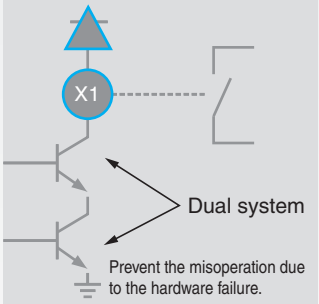
Adopt the structure to be resistant to the disturbances such as the electric surge and noise, the harmonics, the radio noise from the cellular phone, the temperature and the humidity.

■Self-diagnosis function



Always protect the electrical network and at the same time, detect the defects of relay and indicated them on the LED.

■Dual output circuits



Prevent the misoperation due to the hardware failure.

Suitable for advanced communication network system

Fully possible to access from the central control system

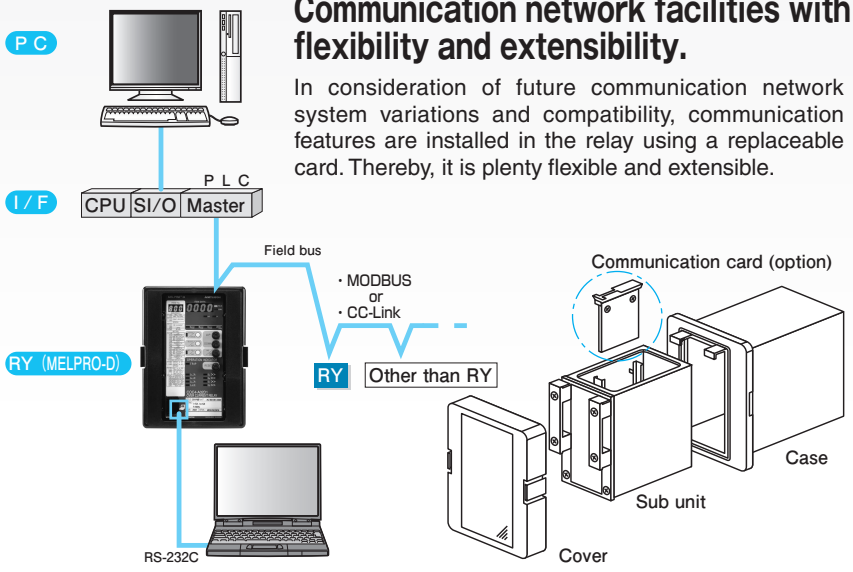
The communication network system enables the data acquisition such as measurement value, operation status and setting value as well as the remote operation such as the setting changes from the central control system. Thereby, efficient operation and maintenance can be realized.

Local operation and monitoring for Site maintenance (Direct PC)

By connecting PC with relay via the RS232C port located on the relay panel, local operation and monitoring are enabled as same as the remote operation and monitoring. Thereby, the maintenance work at site is strongly supported.

※Special HMI software (option) is needed for local operation and monitoring.

※Please refer to the specification table for each type of relay to confirm the capable of communication port and cards.

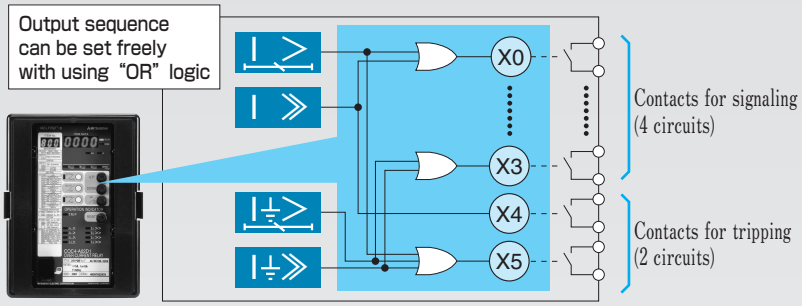


Communication network facilities with flexibility and extensibility.

In consideration of future communication network system variations and compatibility, communication features are installed in the relay using a replaceable card. Thereby, it is plenty flexible and extensible.

Programmable output contacts complying with requirements on the flexibility

The operating output contacts can be set by combing the outputs of the protection relay element using "OR" logic, thereby simplifying sequence design.
Also, it is possible to reduce the cost of switchboard as reducing wiring works.



【Schematic image of programmable output (Example: type COC4-A01)】

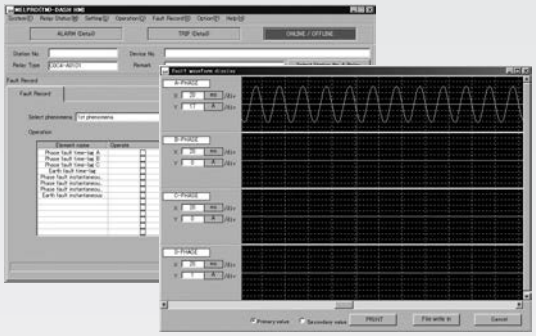
Substantial measuring function

Substantial metering function

Possible to measure the steady state of the relay input values (Current, Voltage, Power, Frequency, Power factor, Zero phase current and Zero phase voltage), thereby possible to support the energy management.
Remark: Please note that measuring item is depended on the type of relay.
Refer to the specification table of each relay type for the detail on this regards.

Data save in the event of system fault

In the event of system fault, input effective value and wave form data have been measured and stored at the time when one of the protection elements operates to issue an output signal. Data for up to five phenomena can be stored and displayed. Therefore, analyze of phenomena becomes easy.



Upper Fig. : Image of waveform down loaded by the Direct PC HMI software

Replacement of existing relay

The dimension of the panel cutting is the same as the prior existing one. Replacing from the existing one to this new type is quite easy.

The dimension of the panel cutting is the same as the prior MULTICAP series. Replacing from the existing one to this new type is possible easily without using adaptor. Also, as this relay has a high degree of compatibility with the existing relay, the design change of the existing system is minimized.(Except for some types of relay)

Easy maintenance

Adopting draw-out unit mechanism enables easy maintenance and checking works

The draw-out unit mechanisms with automatic CT shorting is adopted, so that relay unit can be draw out without removing any parts or wirings. Thereby, it is possible to improve maintenance ease.

contents

Type of MELPRO-D series (listing of implemented elements)

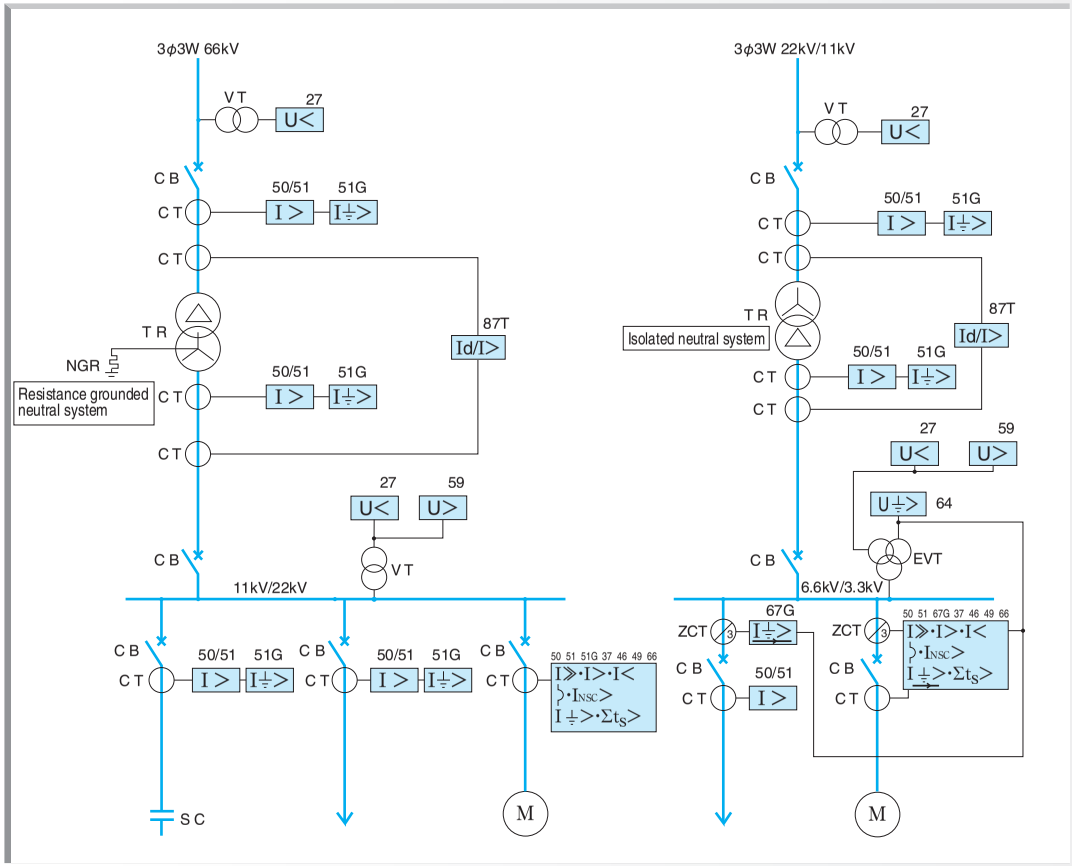
Type of MELPRO-D series and implemented elements for each type are shown as below Table.

Series	Type	50/51	50G/51G	67G	27	59	64	87T	49	37	46	47	66	67S	67P	95L	95H	91L	df/dt	84	87G	40		Remarks	
MELPRO-D	COC1-A01D1	①																						Overcurrent relay (P.9)	CT× 1 phase current
	COC1-A02D1		①																						CT× 1 phase current
	COC2-A01D1	②																							CT×2 phases current
	COC3-A01D1	③																							CT×3 phases current
	COC3-A03D1	③																							CT×3 phases current
	COC4-A01D1	③	○																						CT×3 phases current
	COC4-A02D1	③	○																						CT×3 phases current
	COC4-A03D1	③	○																						CT×3 phases current・With 2nd harmonic current detection
	CBV2-A01D1				③	③																		Voltage relay (P.20)	VT×3 line voltage
	CBV3-A01D1				①	①	○																		VT×1 line voltage
	CBV4-A01D1				③		②																		VT×3 line voltage
	CUB1-A01D1				③	③						○													VT×3 line voltage
	CFP1-A01D1	②		○																				Feeder protection relay (P.24)	CT×2 phases current（For EVT）
	CFP1-A02D1	②		○																					CT×2 phases current（For EVT）
	CDG1-A01D1			○																				Earth fault directional relay（P.24）	
	CAC1-A01D2							③																Biased differential relay for (2 windings) transformer protection（P.28）	
	CMP1-A01D1/2	②		○					○	②	○		○											Motor protection relay (P.35)	CT×2 phases current（For EVT）
	CMP1-A02D1	③	○						○	③	○		○												CT×3 phases current
	CMP2-A02D2	③	○						○	③	○		○												CT×3 phases current
	CPP1-A01D2				③	①	○							③	③	○	○	③						Interconnection protection relay for the dispersed generation system (P.42)	For extra high voltage interconnection（For EVT）
	CPP1-A11D2				③	①	○							③	③	○	○	③	○						For extra high voltage interconnection（For EVT）
	CGP1-A01D2	②		○	③	①	○				○				③	○	○			①				Generator protection relay (P.47)	CT×2 phases current（For EVT）
	CGP1-A03D2	③	○		③	①					○				③	○	○			①					CT×3 phases current
	CGP2-A01D2																				③	○		Biased differential relay for Generator protection（P.53）	
	CGP2-A02D2																				③				
※1	CAC2-A31D2							③																Biased differential relay for(3 windings) transformer protection	MELPRO-D30

※1 This type of relay belong to CD30 series. The operation method and appearance of D30 series are different from D series.
Please refer to the instruction manual for their details.

※2 ○The number written in the circle indicates detecting phase number.

Selection of relay type (example)



Abbreviation

CB : Circuit Breaker
CT : Current Transformer
EVT : Earthed type voltage Transformer
M : Motor
NGR : Neutral Grounded Resister
SC : Static Condenser
TR : Transformer
VT : Voltage Transformer

Network	Device number	MELPRO™-D	
Incoming of extra high voltage	27	1φ CBV3-A01D1 3φ CBV2-A01D1	
	50/51	3φ COC3-A01D1/COC3-A03D1	COC4-A01D1 COC4-A02D1 COC4-A03D1
	51G	1φ COC1-A02D1	
	50/51	3φ COC3-A01D1/COC3-A03D1	
	51G	1φ COC1-A02D1	
Extra high voltage (secondary of transformer)	27	1φ CBV2-A01D1	
	59	2φ CBV3-A01D1	
	87T	CAC1-A01D2	
	50/51	3φ COC3-A01D1/COC3-A03D1	COC4-A01D1
	51G	1φ COC1-A02D1	
	50/51	3φ COC3-A01D1/COC3-A03D1	COC4-A01D1
	51G	1φ COC1-A02D1	
	50/51	COC3-A01D1/COC3-A03D1	
	27	CBV3-A01D1	
	59		
	64		
High voltage (secondary of transformer)	50/51	COC2-A01D1	
	67G	CFP1-A01D1	
	27	CBV3-A01D1	
	59		
	64		
	50 51 51G 37 46 49 66	CMP1-A02D1/CMP2-A02D2	
	50 51 67G 37 46 49 66	CMP1-A01D1/CMP1-A01D2	

Remark 1: It is advisable to adopt the dual system or 2 out of 3 systems in order to improve the reliability of the important facilities.
Remark 2: In case of not available an uninterruptible power source, please use AC/DC converter type B-T1 manufactured by MITSUBISHI ELECTRIC CORPORATION or commercially available uninterruptible power source (UPS) instead of using AC auxiliary power source such as derived from VT secondary circuit because of no guarantee against power interruption during system faults.

Common Technical Data

ITEM		DESCRIPTION		CONDITION	STANDARD
Environment	Ambient operating temperature	−10℃ to +55℃			IEC60255-6
	Ambient storage and transport temperature	−25℃ to +70℃			IEC60255-6
	Damp heat	+40℃, 95%RH, 4days			IEC60068-2-78
Ratings	Auxiliary power supply	100, 110, 125, 220VDC 100,110,120,220VAC (Applicable to any voltage above)			IEC60255-6
	Operative range of auxiliary power supply	DC: −15% to +10% (Temporarily −20% to +30%) AC: −15% to +10% (Temporarily −15% to +15%)			IEC60255-6
	Frequency	50 or 60Hz			IEC60255-6
	VT	Specified per relay type			
	CT				
Burden	Auxiliary power supply	Specified per relay type			
	VT				
	CT				
Thermal withstand	VT	1.15VN, 3hours			IEC60255-6
	CT	40IN, 1second			
Contact capacity	For trip	Make	110V DC: 15A, 0.5s 220V DC: 10A, 0.5s	(L/R = 0)	IEC60255-0-20
		Break	110V DC: 0.3A 220V DC: 0.15A	(L/R≦40ms)	IEC60255-0-20
	For signalling and alarm	Break	500VA 60W	(cos φ = 0.4) (L/R = 0.007s)	IEC60255-0-20
		Max. current	5A		IEC60255-0-20
		Max. voltage	380VAC/125VDC		IEC60255-0-20
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.		Between open contact poles	
Impulse voltage test		5kV, 1.2 μs/50 μs		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 200Ω source impedance for 2second		Between independent circuits, and between independent circuit and earth	IEC60255-22-1 class 3
	Differential mode	1.0kV peak, 1MHz with 200Ω source impedance for 2second		Across terminals of the same circuit	
Electrostatic discharge test		8kV		Contact discharge	IEC60255-22-2 class 4
		15kV		Air discharge	
Radiated electromagnetic field disturbance test		38 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 IN: Rated current

COC Series OVER-CURRENT RELAY

Type, rating and specification

Type name			COC1-A02D1	COC1-A01D1	COC2-A01D1	COC3-A01D1
Rating	Phase current		1A	5A	5A	5A
	Zero-phase current		-	-	-	-
	Frequency		50Hz or 60Hz			
Protective element			51/50(1 phase)		51/50(2 phases)	51/50(3 phases)
Setting	Time-delayed	Operation current	LOCK-0.1～0.8A(0.05A step)	LOCK-1～12A(0.1A step)		
		Operation time multiplier	0.25-0.5～50(0.5 step)			
		Operation time characteristics	Normal inverse time-delayed(3 kinds), Very inverse time-delayed(2 kinds), Extremely inverse time-delayed(3 kinds), Long inverse time-delayed(3 kinds), Definite time-delayed(1 kind)			
		Reset time characteristics	Normal inverse time-delayed(1 kind), Definite time-delayed(2 kinds)			
	Instantaneous	Operation current	LOCK-1～8A(0.1A step)	LOCK-2～80A(1A step)		
		Operation time	INST-0.1～0.5s(0.1s step)			
	Output contact configuration		Refer to the external connection diagram/Auto reset for all contacts(Default setting at ex-works)			
	Operation indicator LED hold		All LED self-hold(Default setting at ex-works)			
	CT primary		1※-5-10-12-12.5-15-20-25-30-40-50-60-75-80-100-120-125-150-200-250-300-400-500-600-750-800-1000-1200-1250-1500-2000-2500-3000-4000-5000-6000-7500-8000[A] ※Positive phase rating : Applicable 1 A rating product only			
Display	Real time measurement		Phase current × 1 phase		Phase current × 2 phases	Phase current × 3 phases
	Max.record		Phase current × 1 phase		Phase current × 2 phases	Phase current × 3 phases
	Fault record(operation value)		Phase current × 1 phase		Phase current × 2 phases	Phase current × 3 phases
	Fault record(operation item)		Record and indicate the operated elements			
	Elapse of time-delayed timer		0～10 (The value 0 indicates the status of input current reaching the setting value or more and the value 1～10 indicate the elapse time up to operating of the time delayed element.			
	Self-diagnosis		Normal result: On the RUN LED(green)・Status indication item No.400=No display. Abnormal result: Off the RUN LED・Status indication item No.400=Display defects code			
Forced operation			Each output contact			
Communication	Direct communication port		Standard equipment(PC software for Direct communication: option)			
	Remote communication port		Option(For CC-LINK or MODBUS)			
Burden (at rating)			Phase current circuit: Less than 0.5VA/phase Auxiliary power supply circuit: at DC100V=Approx. 5W, at AC100V=Approx. 7VA, at DC220V=Approx. 6W, at AC220V=Approx. 12VA(In case of installing communication card, add 2 VA.)			
Mass			Net weight of relay unit: Approx. 2.3kg, Including case: Approx. 3.0kg			
Sample of external connection diagram			Fig.1-5～7	Fig.1-3～5	Fig.1-8	Fig.1-9
Remarks			The rated current 0.2A product can be made based on the 1A rating product.Also, the rated current 1A product can be made based on the 5A rating product. The setting value of time delayed element and instantaneous element of 0.2A product and 1A product are calculated by performing a multiplication 1/5 of above mentioned value.			

※Please refer to the instruction manual regarding the details on this specification.

Type name			COC3-A03D1	COC4-A01D1	COC4-A02D1	COC4-A03D1
Rating	Phase current		5A	5A	5A	5A
	Zero-phase current		-	1A	5A	1A
	Frequency		50Hz or 60Hz			
Protective element			51/50(3 phases)	51/50(3 phases), 51G/50G(Zero-phase)		
Setting	Phase fault time-delayed	Operation current	LOCK-0.5～8A(0.1A step)	LOCK-1～12A(0.1A step)		
		Operation time multiplier	0.25-0.5～50(0.5 step)			
		Operation time characteristics	Normal inverse time-delayed(3 kinds), Very inverse time-delayed(2 kinds), Extremely inverse time-delayed(3 kinds), Long inverse time-delayed(3 kinds), Definite time-delayed(1 kind)			
		Reset time characteristics	Normal inverse time-delayed (1 kind), Definite time-delayed(2 kinds)			
	Phase fault instantaneous	Operation current	LOCK-2～80A(1A step)			
		Operation time	INST-0.1～0.5s(0.1s step)			
	Earth fault time-delayed	Operation current	-	LOCK-0.1～0.8A(0.05A step)	LOCK-0.5～8A(0.1A step)	LOCK-0.1～0.8A(0.05A step)
		Operation time multiplier	-	0.25-0.5～50(0.5 step)		
		Operation time characteristics	-	Normal inverse time-delayed (3 kinds) , Very inverse time-delayed (2 kinds), Extremely inverse time-delayed (3 kinds) , Long inverse time-delayed (3 kinds), Definite time-delayed (1 kind)		
		Reset time characteristics	-	Normal inverse time-delayed(1 kind), Definite time-delayed(2 kinds)		
	Earth fault instantaneous	Operation current	-	LOCK-1～8A(0.1A step)	LOCK-2～80A(1A step)	LOCK-1～8A(0.1A step)
		Operation time	-	INST-0.1～0.5s(0.1s step)		
	2nd harmonic blocking		-			10～25%(5% step)
	Operation indicator LED hold		Refer to the external connection diagram/Auto reset for all contacts(Default setting at ex-works)			
	Output contact configuration		All LED self-hold(Default setting at ex-works)			
	CT primary(Phase current)		1※-5-10-12-12.5-15-20-25-30-40-50-60-75-80-100-120-125-150-200-250-300-400-500-600-750-800-1000-1200-1250-			
	CT primary(Zero-phase current)		1500-2000-2500-3000-4000-5000-6000-7500-8000[A] ※Positive phase rating : Applicable 1 A rating product only			
Display	Real time measurement		Phase current × 3 phases	Phase current × 3 phases, Zero-phase current		Phase current × 3 phases, Zero-phase current Percentage of 2nd harmonic current content
	Max.record		Phase current × 3 phases	Phase current × 3 phases, Zero-phase current		
	Fault record(operation value)		Phase current × 3 phases	Phase current × 3 phases, Zero-phase current		
	Fault record(operation item)		Record and indicate the operated elements			
	Elapse of time-delayed timer		0～10 (The value 0 indicates the status of input current reaching the setting value or more and the value 1～10 indicate the elapse time up to operating of the time delayed element.			
	Self-diagnosis		Normal result: On the RUN LED(green)・Status indication item No.400=No display. Abnormal result: Off the RUN LED・Status indication item No.400=Display defects code			
Forced operation			Each output contact			
Communication		Direct communication port	Not applicable	Standard equipment(PC software for Direct communication: option)		
		Remote communication port	Not applicable	Option(For CC-LINK)		
Burden (at rating)			Phase current circuit: Less than 0.5VA/phase, Zero phase circuit: Less than 0.5VA Auxiliary power supply circuit: at DC100V=Approx. 5W, at AC100V=Approx. 7VA, at DC220V=Approx. 6W, at AC220V=Approx. 12VA(In case of installing communication card, add 2 VA.)			
Mass			Net weight of relay unit: Approx. 2.3kg, Including case: Approx. 3.0kg			
Sample of external connection diagram			Fig.1-9	Fig.1-10～13	Fig.1-10～12, 14	Fig.1-10～13
Remarks			The rated current 1A product can be made based on the 5A rating product. The setting value of time delayed element and instantaneous element of 1A product is calculated by performing a multiplication 1/5 of above mentioned value. The operation current setting range "LOCK-2～130A (1A step)" for phase fault instantaneous element of type COC4-A02D1 is also available.			

※Please refer to the instruction manual regarding the details on this specification.

Characteristics

Items		Condition		Guaranteed performance
Operation current	Phase fault time-delayed element	(Common condition) ※1		·Setting 1.0～2.0A for 5A rating product Setting 0.2～0.4A for 1A rating product Setting value ±10% ·For setting of other range Setting value ±5%
	Phase fault instantaneous element			Setting value ±10%
	Earth fault time-delayed element			·Setting 0.1～0.2A for 5A rating product Setting 0.02～0.04A for 1A rating product Setting value ±10% ·For setting of other range Setting value ±5%
	Earth fault instantaneous element			Setting value ±10%
	2f/1f blocking (COC4-A03D1)	In case of half-wave rectified current superposing I_{DC}=Setting tap value×80[%] $\frac{I_{f2}}{I_{f1}} = \frac{\frac{2}{3} I_{DC}}{\sqrt{2}\ I_{AC} + \frac{\pi}{2} I_{DC}} \times 100$		·I_{AC}=254～330[%] (Setting value:10%)
		In case of harmonic current superposing method		·10% Setting value Setting value ±15% ·15～25% Setting value Setting value ±10%
Reset value	Phase fault time-delayed element	(Common condition) ※1		·Setting 1.0～2.0A for 5A rating product Setting 0.2～0.4A for 1A rating product Operation value×90% or more ·For setting of other range Operation value×95% or more
	Phase fault instantaneous element			Operation value×95% or more
	Earth fault time-delayed element			·Setting 0.1～0.2A for 5A rating product Setting 0.02～0.04A for 1A rating product Operation value×90% or more ·For setting of other range Operation value×95% or more
	Earth fault instantaneous element			Operation value×95% or more
	2f/1f blocking (COC4-A03D1)			Operation value×85% or more
Operation time	Phase fault time-delayed element	Operation setting value:Minimum, Operation time multiplier:10 Input :0→Operation setting value×300% or more		Refer to fig.1-1.2 Timing accuracy for I≧3×Current setting value, ±3.5% of reference at actual pick up
	Phase fault instantaneous element	Operation setting value:Minimum Input :0→200% of setting value		Setting value ±25ms In case of INST setting 40ms or less (except COC4-A03D1) 50ms or less (COC4-A03D1)
	Earth fault time delayed element	Operation setting value:Minimum, Operation time multiplier:10 Input :0→Operation setting value×300% or more		Refer to fig.1-1.2 Timing accuracy for I≧3×Current setting valve, ±3.5% of reference at actual pick up
	Earth fault instantaneous element	Operation setting value:Minimum Input :0→200% of setting value		Setting value ±25ms In case of INST setting 40ms or less (except COC4-A03D1) 50ms or less (COC4-A03D1)
Reset time	All elements	300% of setting value→0A		Refer to table 1-1
Overshoot characteristic	Phase fault time delayed element	Time-delayed operation value: Minimum Operation time multiplier:10 Operation characteristic:All characteristics Input current :0A→Setting value×1000%		No-operation limit time/Operation time=90% or more
	Earth fault time-delayed element	Same as the above		Same as the above

※1 Common condition:(1) Rating Frequency (2) Ambient temperature:20℃ (3) Auxiliary power supply: Rating voltage

Precaution for application

1. Guarantee against interruption of AC power supply
   When an uninterruptible AC power source is not available in your system for the auxiliary power supply, use the type B-T1 AC/DC converter or commercially available uninterruptible power supply (UPS: MITSUBISHI ELECTRIC CORPORATION FW-A series or FW-V series). In addition, possible duration of the power supply type B-T1 AC/DC converter is confirmed as about 2 seconds in combination with one MELPRO-D series relay. Therefore, in the case that the required duration of power supply after power source loss exceeds 2 seconds, please use a suitable commercial uninterruptible power supply. When power supply back up for the circuit breaker is required, it is necessary to prepare the power supply independent from the type B-T1 AC/DC converter.
2. Inrush current of power supply
   Since inrush current (about 2ms duration) as below may flow into the relay when the power supply is turned on, please make a consideration on this regard for selection of power circuit breaker.

Input voltage	Inrush current Ip
DC110V	Approx. 20A
DC220V	Approx. 55A
AC100V	Approx. 25A
AC220V	Approx. 65A

3. Trip circuit
   Only the dedicated contacts can be used for the circuit breaker trip circuit. Please keep in mind that the contacts for signaling can not be used for the trip circuit. (If used, the contact may burn). Also, connect the pallet contact (52a) of the circuit breaker to the trip coil circuit in series.
4. Self-diagnosis output circuit
   The self-diagnosis output contact is so configured that the auxiliary relay is energized ("break contact"opened) when normal result of self-diagnosis is received. This type of contact will allow the relay to output abnormal result even after the built-in power failures. Therefore, the "break contact" is still closed in the aftermath of the power applying and will be opened after 50ms. If the auxiliary power of the relay and the self-diagnosis output contact feed from a same power source, the "break contact" will be closed temporarily after auxiliary power supply is turned on. In this 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-delay timer.
5. Grounding circuit
   Be sure to make a wiring to the earth terminal located on the back of the relay according to the Class D earth wiring method (Grounding resistance should be less than 100 ohm).
6. CC-Link communication circuit
   Please include the communication card into your purchasing order in case of the application of the communication facility as the card necessary for communication (CC-Link) is option. In case of retrofit existing relay with communication card, please inform the followings of existing relay. a:Type, b:Style number, c:Manufacturing year, d:Serial number, e:Date of stamp on the checking seal (The above mentioned items a.~d. are indicated on the bottom right of front face of the relay and item e. is indicated on the upper of back side of the relay.) The version number of CC-Link is 1.00.
7. Improvement of reliability of protection system
   For the important facilities, multiplex system such as dual should be provided to improve reliability.
8. 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 surge absorbers.
9. The residual connection of 3 phases CT is needed for the earth fault current elements of COC4-A01, A02, A03D1 types.
10. It is possible to use the COC3 and COC4 as the phase over current protection provided with two phases. However, residual connection of 2 phases can not be applied to the earth fault over current element of COC3 and COC4 types. The residual connection of 3 phases only can be applied to the earth fault over current element. In case of only two phase CTs being available for phase over current protection, ZCT or one more CT is needed for earth fault over current element.

Precaution for using

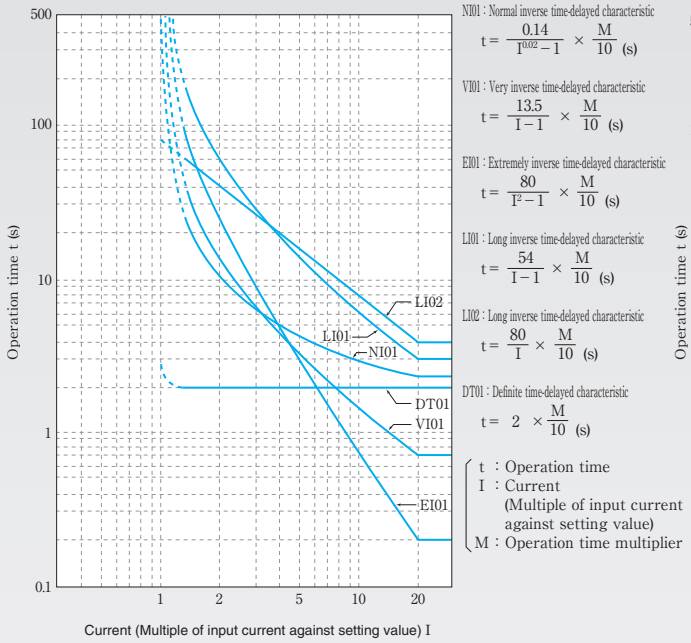
1. When the product is shipped from the factory, each setting value is "LOCK" (for element with LOCK position) or "minimum setting value" (for element without LOCK position)
2. To set as [LOCK] position means to set the element out of use.
3. The setting of measuring transformer ratio is applied only for the measuring indication converted to the primary side, and is not applied for protection element.

Precaution for safety

Please refer to page2 and 3 regarding the safty information and request when placing order.

Operation time and Reset time characteristics

The time-delayed element have 12 kinds of operation characteristics as shown on Fig.1-1 and Fig.1-2, and 3 kinds of reset time characteristics as shown on table 1-1.



NI01 : Normal inverse time-delayed characteristic

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

VI01 : Very inverse time-delayed characteristic

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

EI01 : Extremely inverse time-delayed characteristic

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

LI01 : Long inverse time-delayed characteristic

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

LI02 : Long inverse time-delayed characteristic

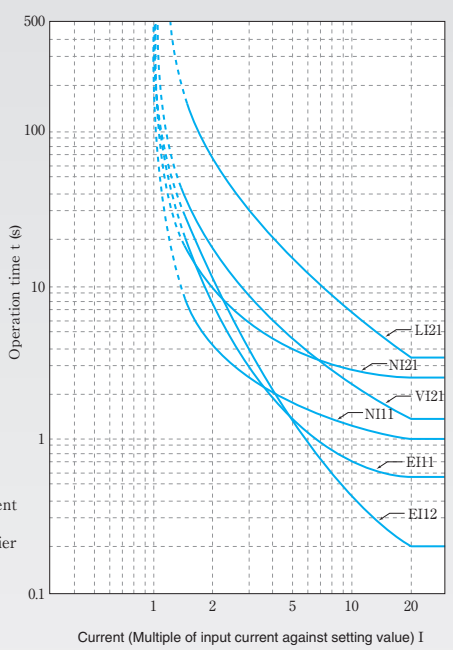
$$t = \frac{80}{I} \times \frac{M}{10}\ (s)$$

DT01 : Definite time-delayed characteristic

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

t : Operation time
I : Current
(Multiple of input current against setting value)
M : Operation time multiplier

Fig.1-1 Operation time characteristics (1)



NI11 : Normal inverse time-delayed characteristic

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

EI11 : Extremely inverse time-delayed characteristic

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

EI12 : Extremely inverse time-delayed characteristic

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

NI21 : Normal inverse time-delayed characteristic

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

VI21 : Very inverse time-delayed characteristic

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

LI21 : Long inverse time-delayed characteristic

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

t : Operation time
I : Current
(Multiple of input current against setting value)
M : Operation time multiplier

※These curves show the operation time characteristic for each type in case of the time multiplier M=10.

Fig.1-2 Operation time characteristics (2)

Table 1-1 Reset time characteristic

Input : Setting value × 300% → 0

	Output contact	Reset of operation timer inside relay
0 1 : Definite time delayed. (200ms)	2 0 0 m s ± 2 5 m s	immediately
1 1 : Inverse time delayed.	2 0 0 m s ± 2 5 m s	Approx. 8 s (M = 10)
2 1 : Definite time delayed. (50ms)	5 0 m s or less	immediately

■Inverse time-delayed characteristic for reset

Following the principle of resetting an electromagnetic mechanical type induction disc, the inverse time-delayed characteristic given by the equation below is used for computing the reset time of the internal operation timer, although the output contact will be reset after a definite period of time (0.2 s). The inverse time-delayed characteristic may be useful for detecting an intermittent overload, which typically occurs in starting a motor.

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

Sample of external connection diagram

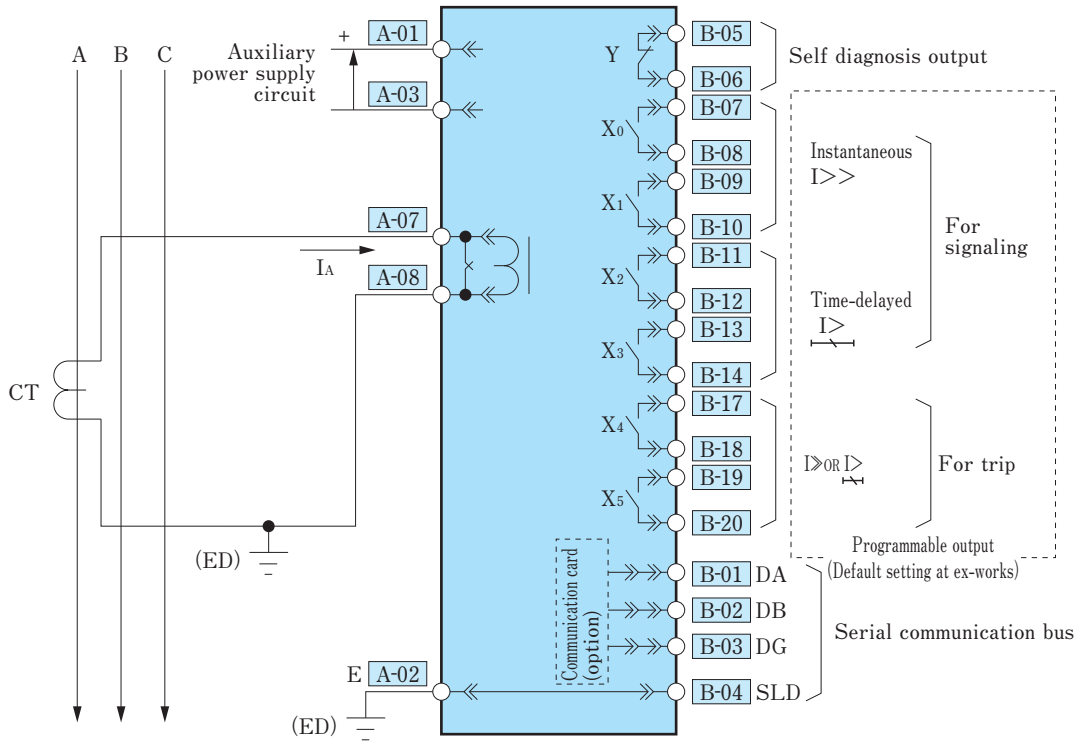


Fig.1-3 COC1-A01D1 (Phase fault protection)

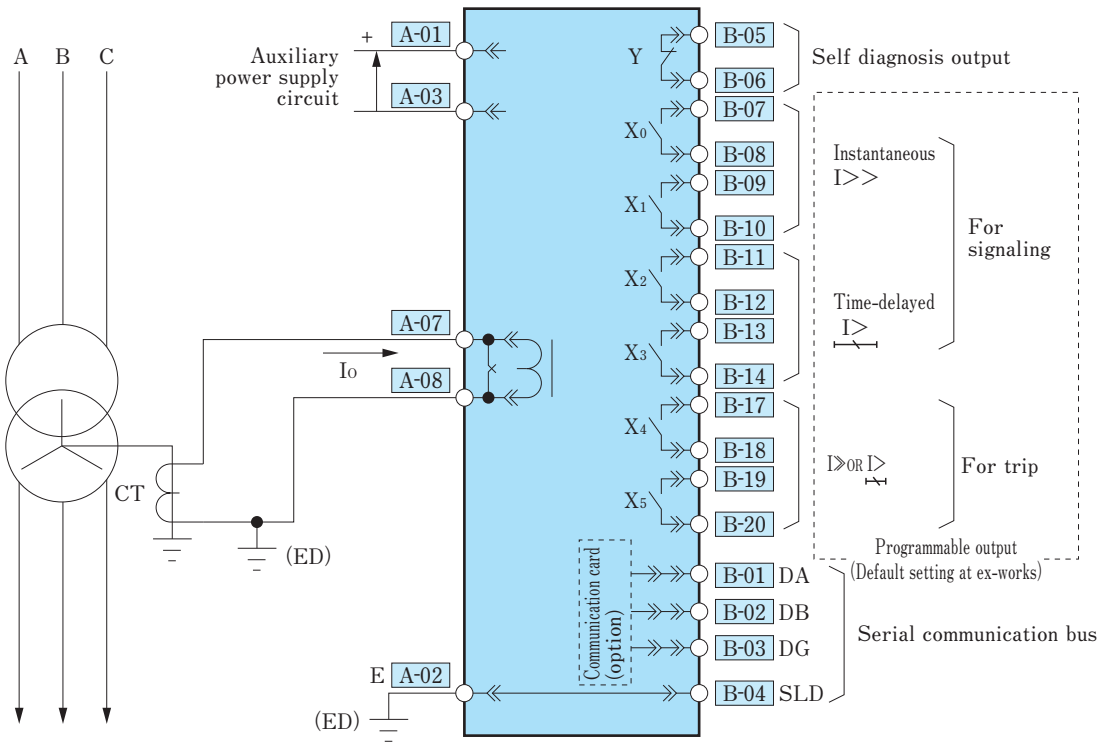
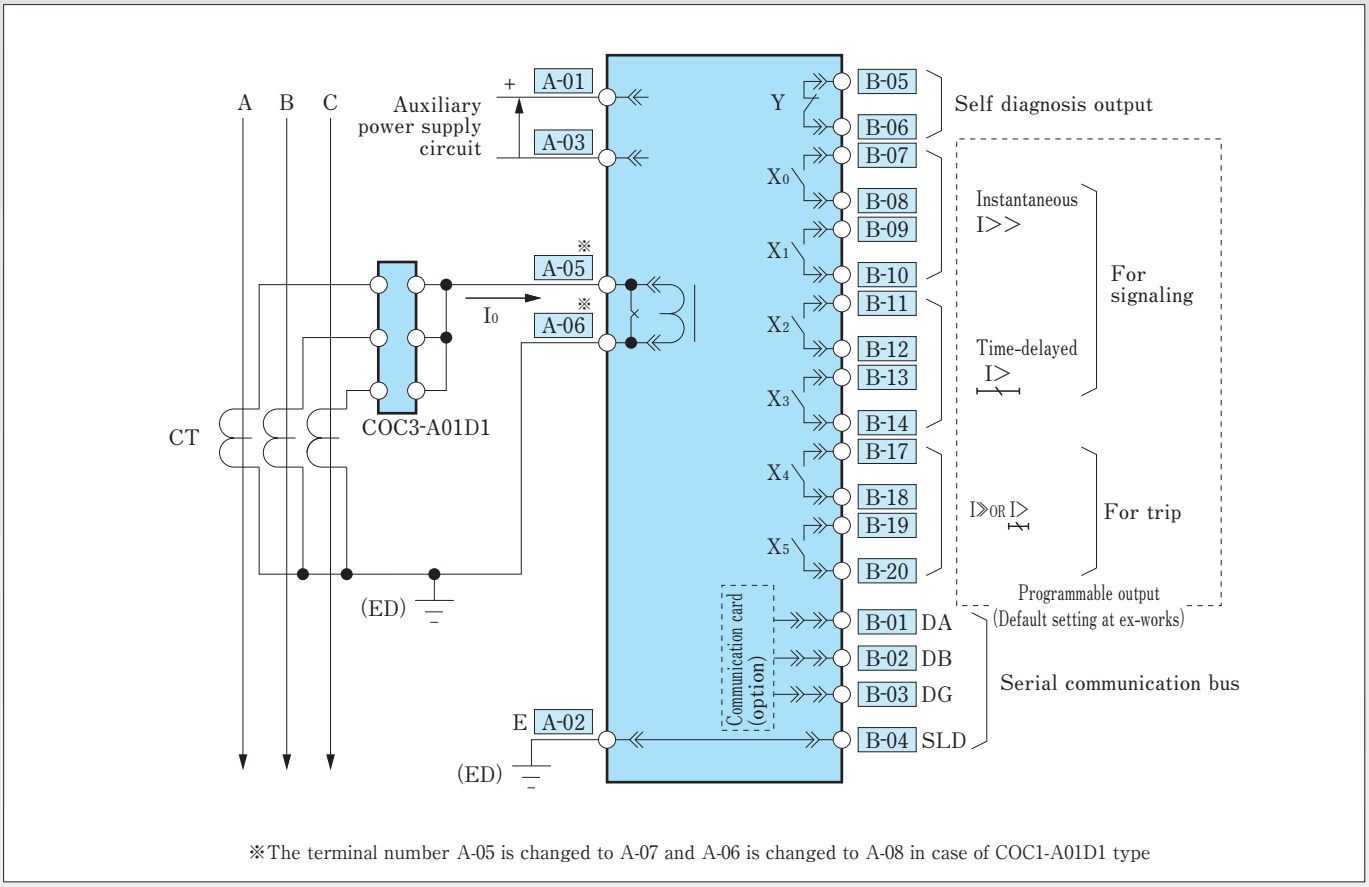


Fig.1-4 COC1-A01D1 (Solidly grounded neutral system, Earth fault protection)

The connection diagram shows concepts of the wiring only. Therefore, please note that there will have some difference between the connection diagram and actual installation status of CT,VT and safety devices such as fuse, etc.



※The terminal number A-05 is changed to A-07 and A-06 is changed to A-08 in case of COC1-A01D1 type

Fig.1-5 COC1-A01D1、COC1-A02D1 (Earth fault protection)

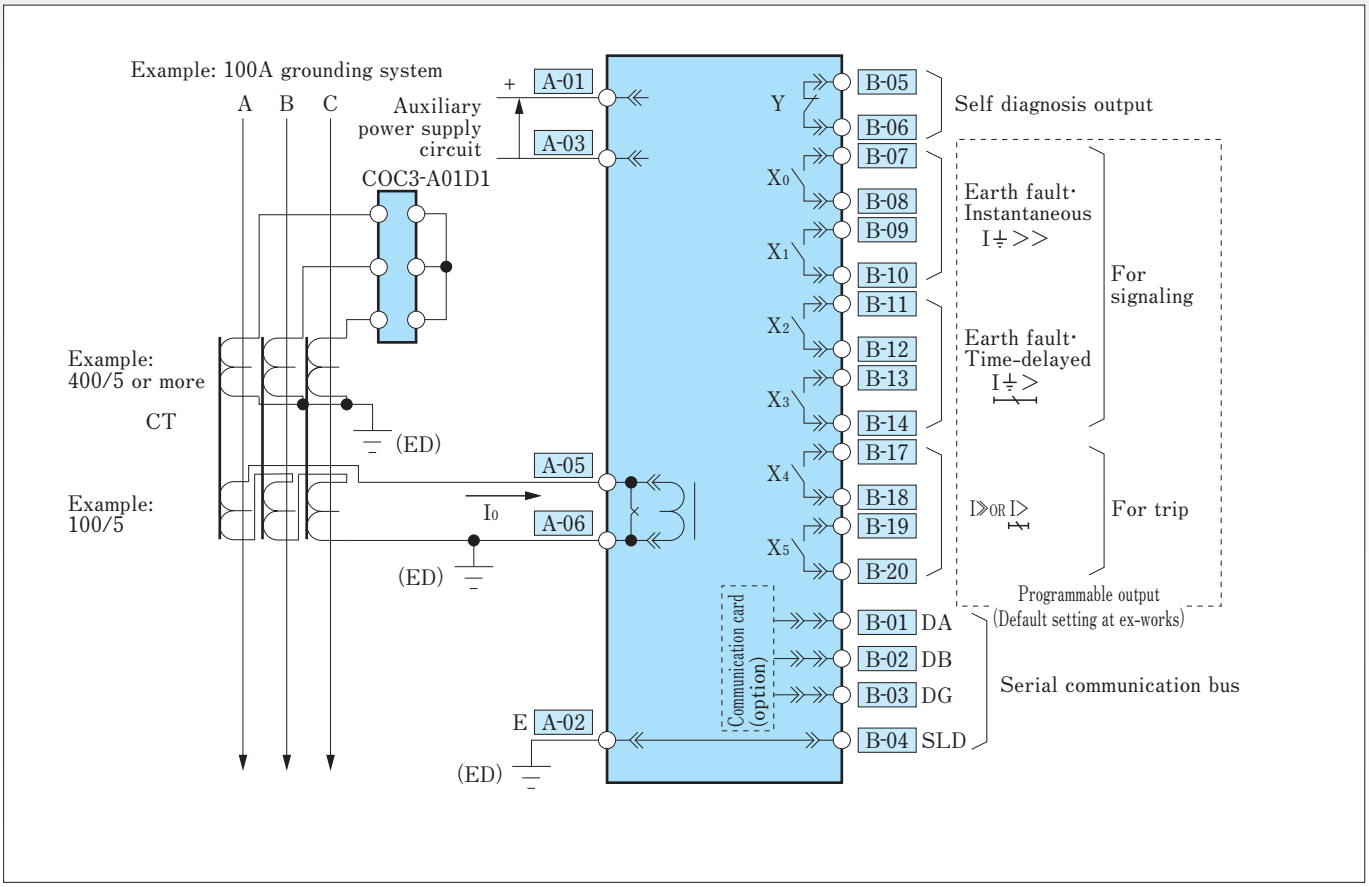


Fig.1-6 COC1-A02D1 (Earth fault protection)

The connection diagram shows concepts of the wiring only. Therefore, please note that there will have some difference between the connection diagram and actual installation status of CT,VT and safety devices such as fuse, etc.

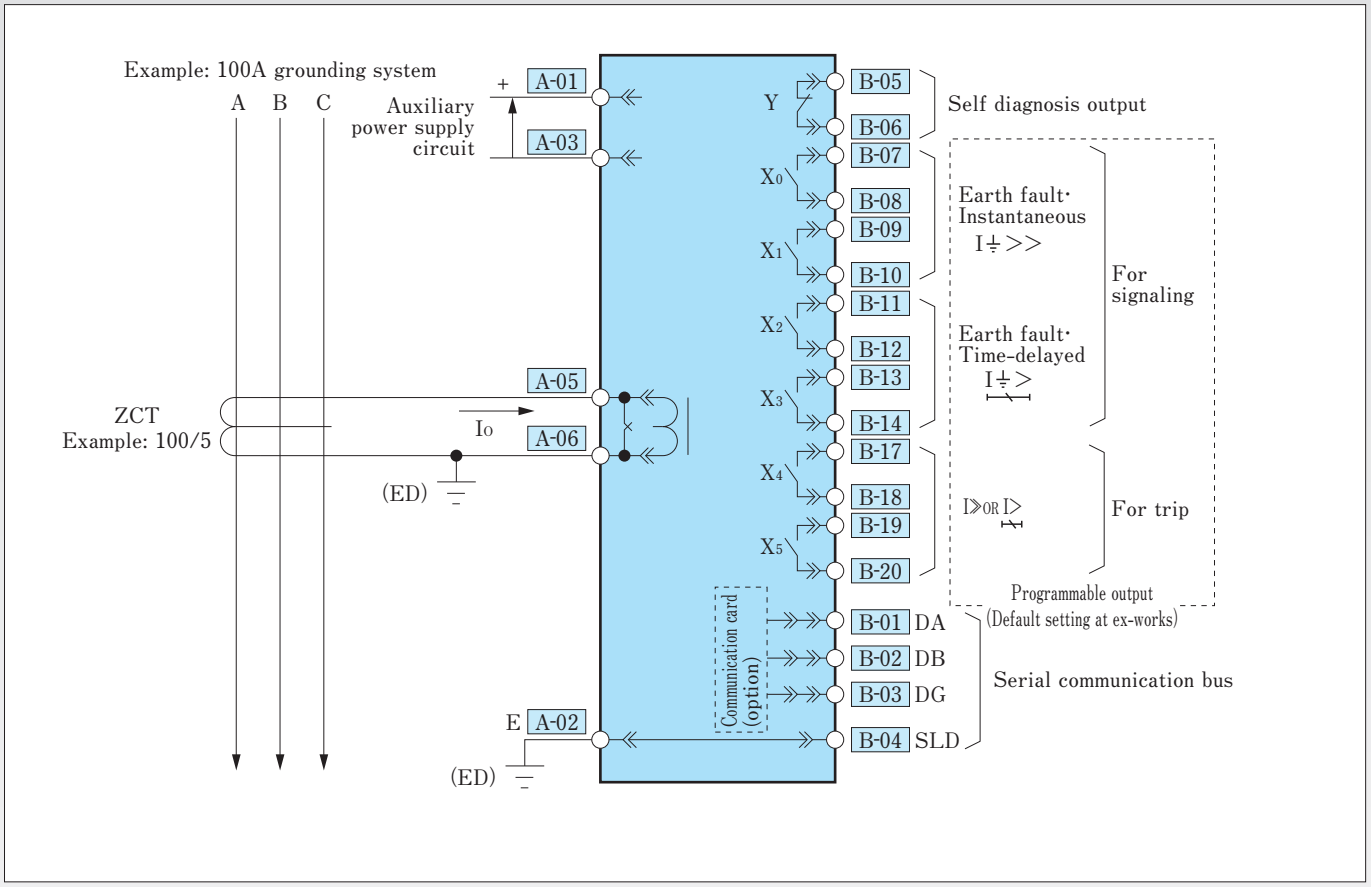


Fig.1-7 COC1-A02D1 (Earth fault protection)

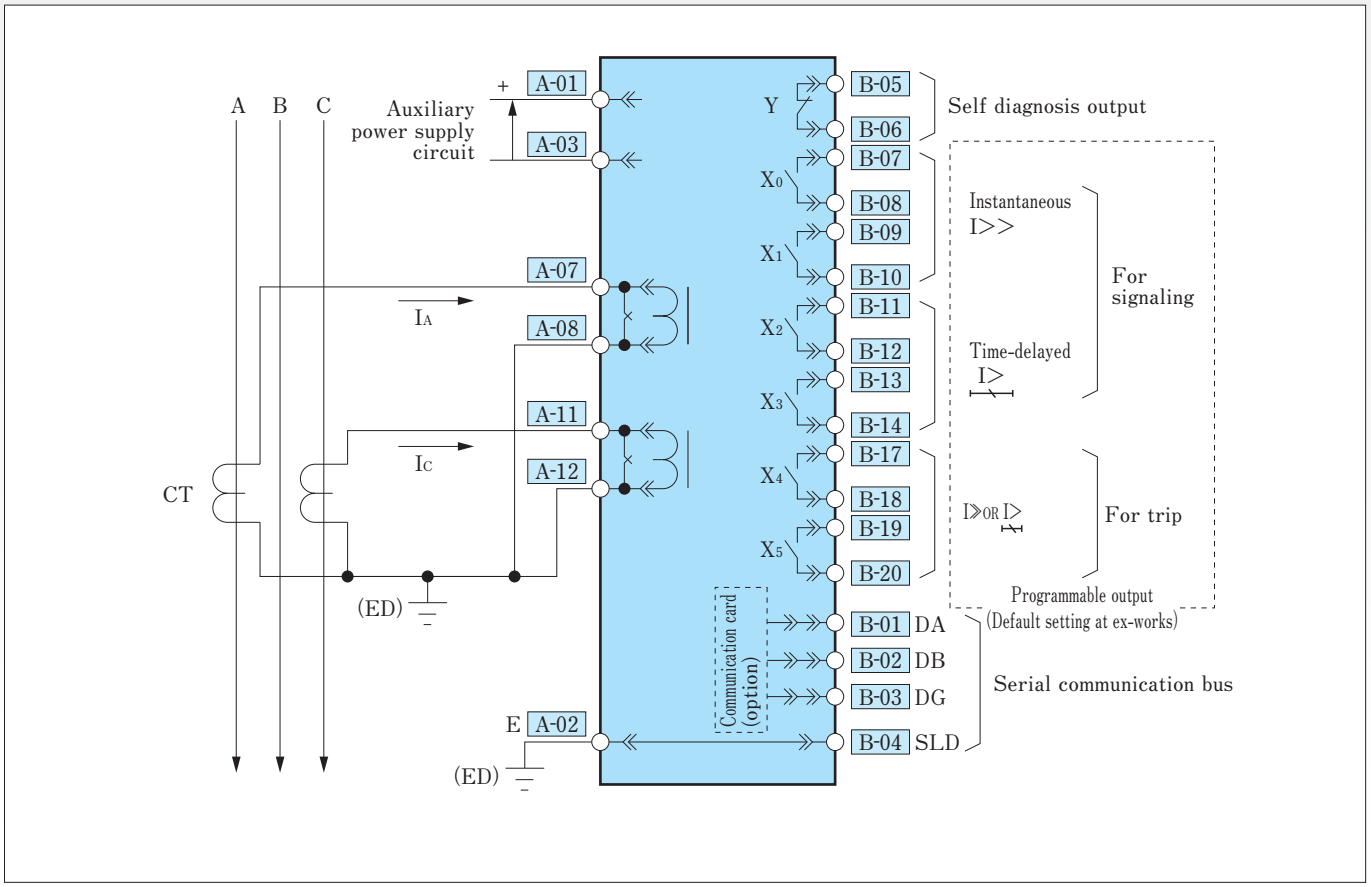
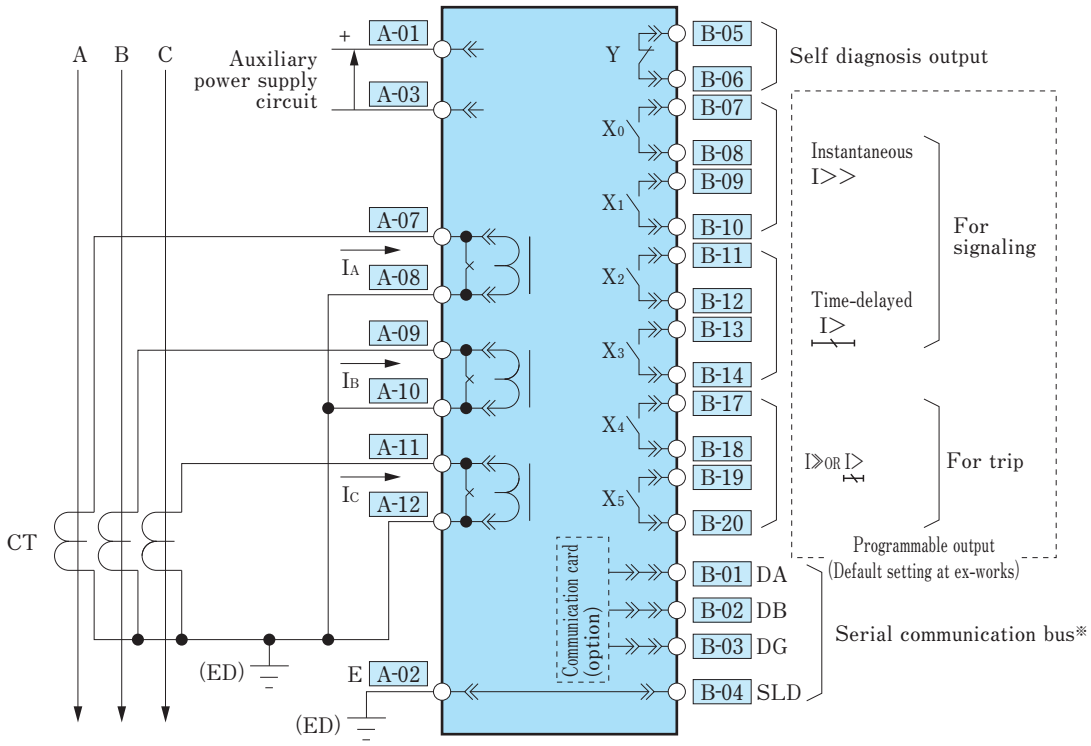


Fig.1-8 COC2-A01D1 (Phase fault protection)

The connection diagram shows concepts of the wiring only. Therefore, please note that there will have some difference between the connection diagram and actual installation status of CT,VT and safety devices such as fuse, etc.



※The serial communication facility is not available for type COC3-A03D1.

Fig.1-9　COC3-A01D1、COC3-A03D1 (Phase fault protection)

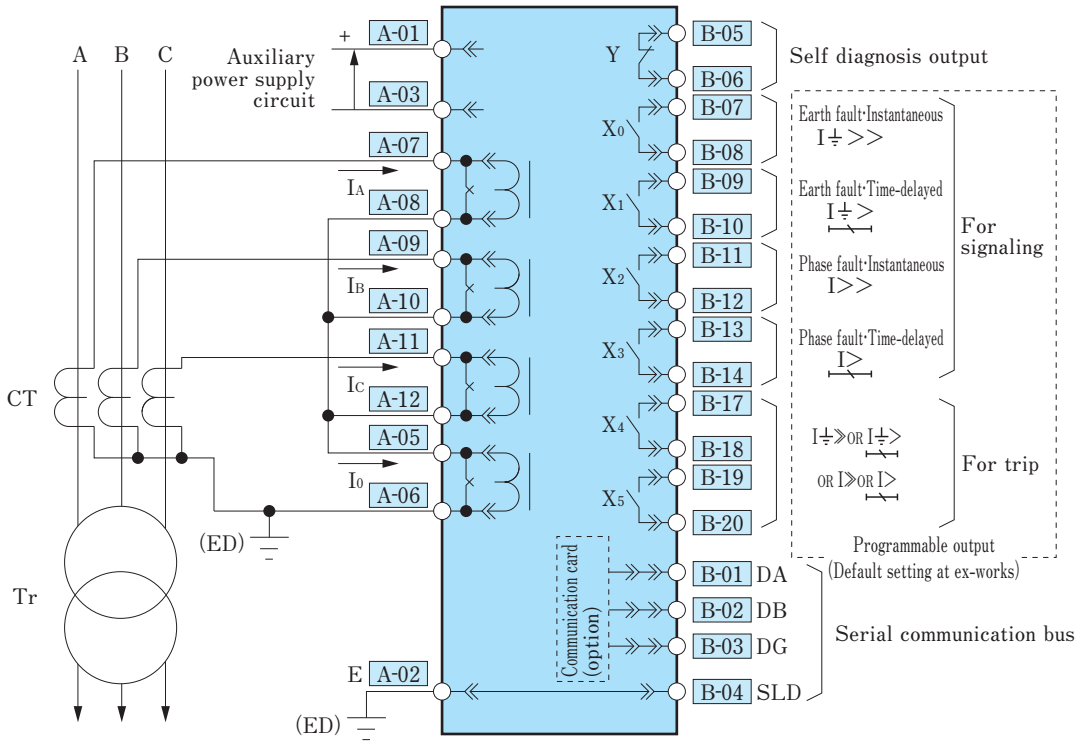


Fig.1-10　COC4-A01D1、COC4-A02D1、COC4-A03D1

The connection diagram shows concepts of the wiring only. Therefore, please note that there will have some difference between the connection diagram and actual installation status of CT,VT and safety devices such as fuse, etc.

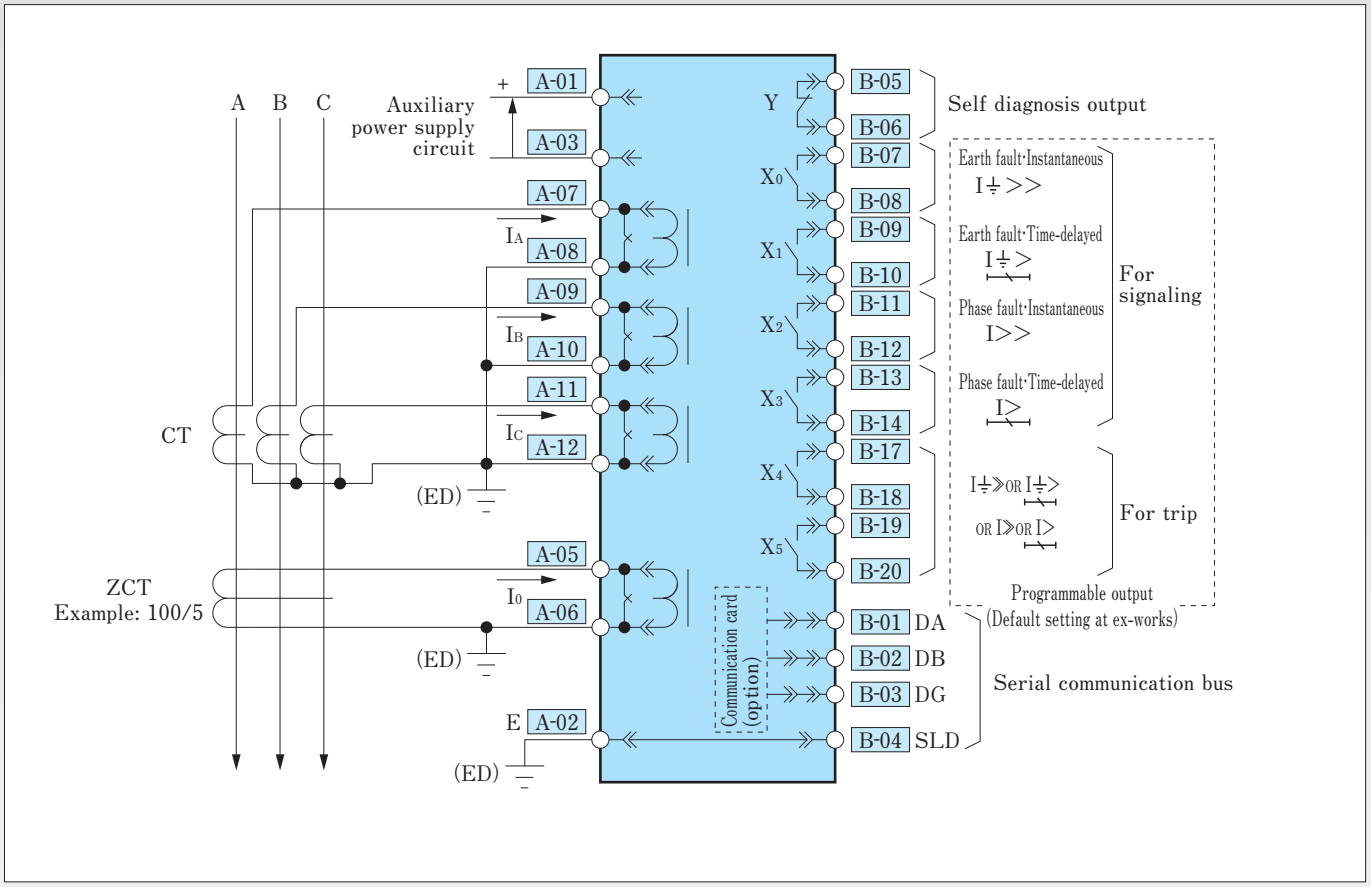


Fig.1-11　COC4-A01D1、COC4-A02D1、COC4-A03D1

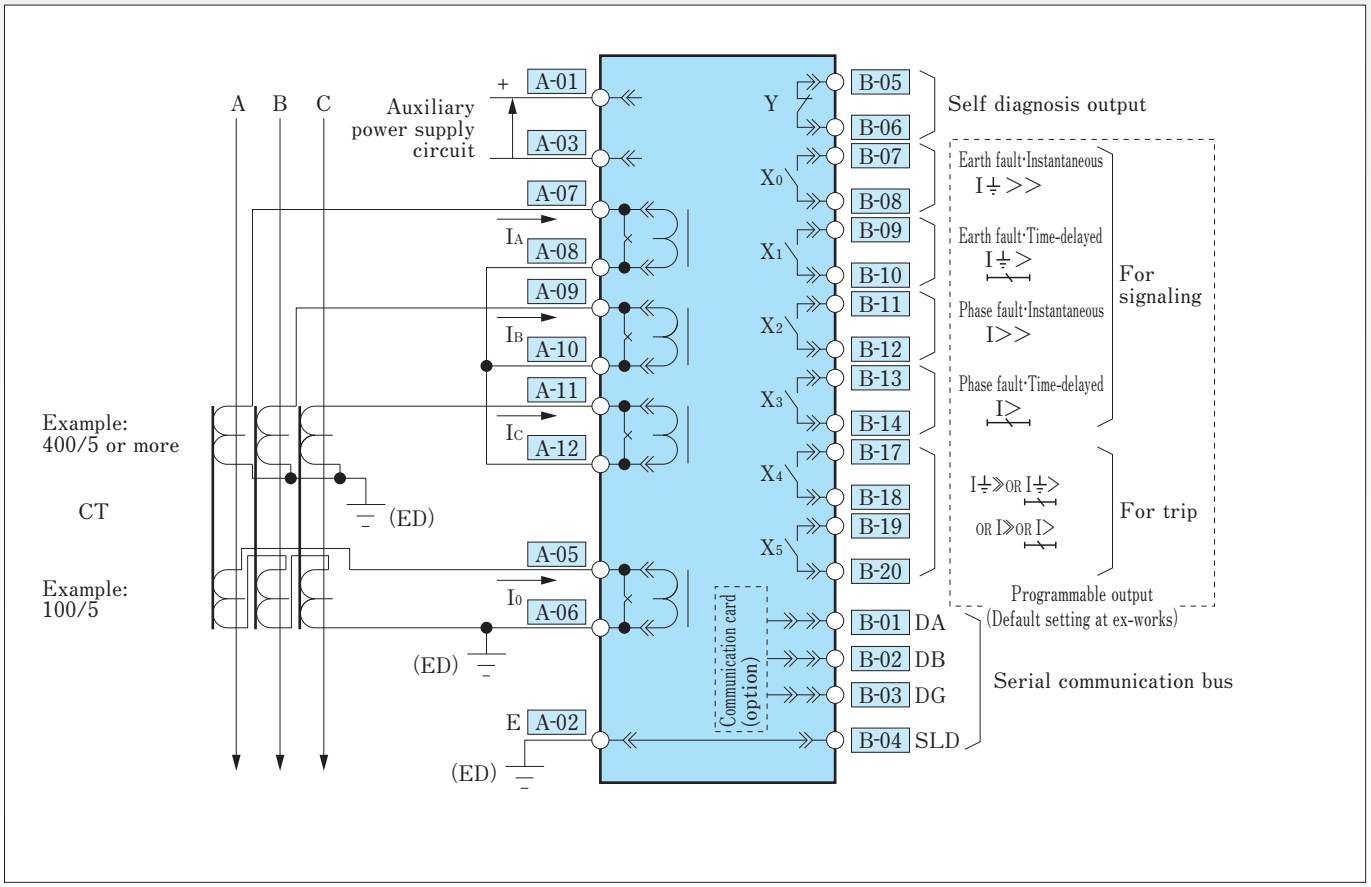


Fig.1-12　COC4-A01D1、COC4-A02D1、COC4-A03D1

The connection diagram shows concepts of the wiring only. Therefore, please note that there will have some difference between the connection diagram and actual installation status of CT,VT and safety devices such as fuse, etc.

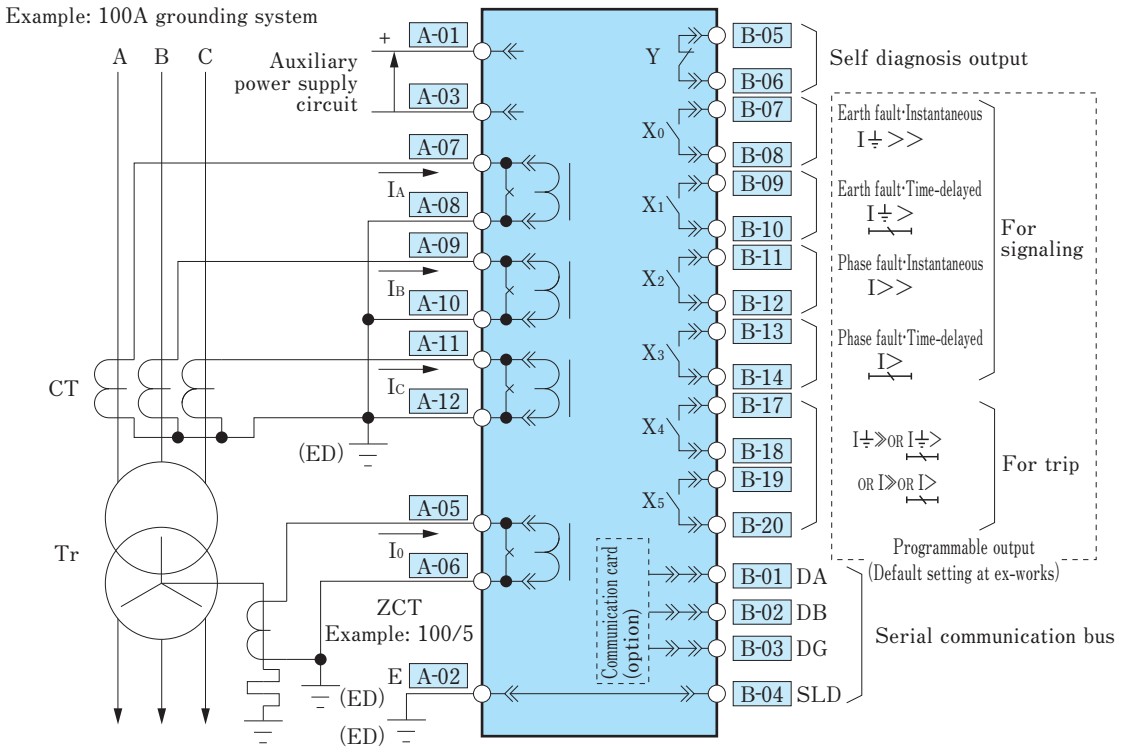


Fig.1-13 COC4-A01D1、COC4-A03D1

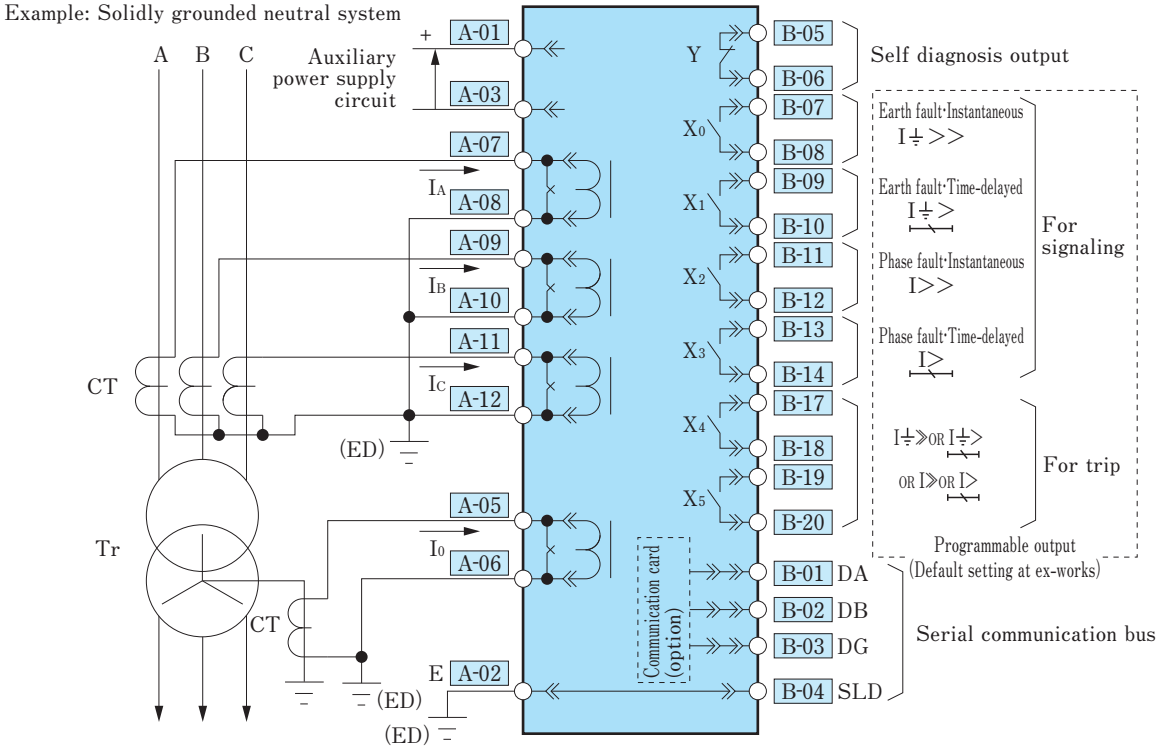


Fig.1-14 COC4-A02D1

The connection diagram shows concepts of the wiring only. Therefore, please note that there will have some difference between the connection diagram and actual installation status of CT,VT and safety devices such as fuse, etc.

Type, rating and specification

Type name			CBV2-A01D1	CBV3-A01D1	CBV4-A01D1	CUB1-A01D1
Rating	Voltage		57～120V	57～120V	57～120V	57～120V
	Zero-phase voltage		-	110V/190V	110V/190V	-
	Frequency		50Hz or 60Hz			
Protective element			27(3 phases), 59(3 phases)	27(1 phase), 59(1 phase), 64(Zero-phase)	27(3 phases), 64(Zero-phase)×2	27(3 phases), 59(3 phases), 47
Setting	Under voltage	Operation voltage	LOCK-10～110V(1V step)			
		Operation time	INST-0.1～10s(0.1s step)			
	Over voltage	Operation voltage	LOCK-60～155V(1V step)		-	LOCK-60～155V(1V step)
		Operation time	INST-0.1～10s(0.1s step)		-	INST-0.1～10s(0.1s step)
	Earth fault over voltage	Operation voltage	-	LOCK-5～60V(1V step)		-
		Operation time	-	INST-0.1～10s(0.1s step)		-
	Reverse phase	Changeover Lock/Use	-			LOCK - USE
		Operation time	-			0.1～10s(0.1s step)
	Open phase	Operation voltage	-			LOCK - 10～50V(1V step)
		Operation time	-			0.1～10s(0.1s step)
	Output contact configuration		Refer to the external connection diagram/Auto reset for all contacts(Default setting at ex-works)			
	Operation indicator LED hold		All LED self-hold(Default setting at ex-works)			
	VT primary		100～999V(1V step)、1000～9990V(10V step)、10.0k～99.9kV(0.1kV step)、100k～300kV(1kV step)			
	VT secondary		100/√3-110/√3-115/√3-120/√3-100-110-115-120V			
	EVT primary		-	100～999V(1V step),1000～9990V(10V step), 10.0k～99.9kV(0.1kV step),100k～300kV(1kV step)		-
	EVT tertiary		-	100-110-115-120-100√3-110√3-115√3-120√3V		-
Display	Real time measurement		Line voltage×3	Line voltage, Zero-phase voltage	Line voltage×3, Zero-phase voltage	Line voltage×3
	Max.record		Line voltage×3	Line voltage, Zero-phase voltage	Line voltage×3, Zero-phase voltage	Line voltage×3
	Fault record (operation value)		Line voltage×3	Line voltage, Zero-phase voltage	Line voltage×3, Zero-phase voltage	Line voltage×3, Negative sequence voltage
	Fault record (operation item)		Record and indicate the operated elements.			
	Self-diagnosis		Normal result:On the RUN LED (green) ·Status indication item No.400=No display. Abnormal result:Off the RUN LED·Status indication item No.400=Display defects code			
Forced operation			Each output contact			
Communication	Direct communication port		Standard equipment(PC software for Direct communication: Option)			Not applicable
	Remote communication port		Option(For CC-LINK or MODBUS)			Not applicable
Burden (at rating)			Voltage circuit:Less than 1 VA, Zero-phase voltage circuit:Less than 0.15 VA Auxiliary power supply circuit:at DC100V=Approx. 5W, at AC100V=Approx. 7VA, at DC220V=Approx. 6W, at AC220V=Approx. 12VA (In case of installing communication card, add 2 VA.)			
Mass			Net weight of relay unit:Approx. 2.3kg, Including case:Approx. 3.0kg			
Sample of external connection diagram			Fig.2-1	Fig.2-2	Fig.2-3	Fig.2-4

※ Please refer to the instruction manual regarding the details on this specification.

Characteristics

Items		Condition	Guaranteed performance
Operation value	Under voltage element	(Common condition) ※1	Setting value±5%
	Over voltage element		
	Earth fault over voltage element		
	Reverse phase element	Impress 3 phases negative sequence voltage	Operates from about 1V or more
	Open phase element	Impress 3 phases negative sequence voltage However, in case of applying single phase power source, impress the voltage of setting value×√3	Setting value±5% However, minimum permissible error is 1V
Reset value	Under voltage element	(Common condition) ※1	Operation value×105% or less
	Over voltage element		Operation value×95% or more
	Earth fault over voltage element		
	Reverse phase element		Reset from about 1V or more
	Open phase element		Operation value×95% or more
Operation time	Under voltage element	Rated voltage→setting value×70%	·Setting INST 40ms or less (50ms only for Over voltage element) ·Setting 0.4s or less:setting value±25ms ·Setting 0.5s or more:setting value±5%
	Over voltage element	0V→setting value×120%	
	Earth fault over voltage element	0V→setting value×150%	
	Reverse phase element	0V→3 phases negative sequence voltage	·Setting 0.4s or less:setting value±25ms ·Setting 0.5s or more:setting value±5%
	Open phase element	Do it by single phase power source 0V → setting value×√3×120%	·Setting 0.4s or less:setting value±25ms ·Setting 0.5s or more:setting value±5%
Reset time	Under voltage element	Setting value×70%→Rated voltage	·60ms or less (CBV2, 3, 4-A01D1) ·200ms±25ms (CUB1-A01D1)
	Over voltage element	Setting value×120%→0V	
	Earth fault over voltage element	Setting value×150%→0V	
	Reverse phase element	3 phases negative sequence voltage→ 0V	200ms±25ms
	Open phase element	Do it by single phase power source. Setting value×√3×120% → 0V	

※1 Common condition:(1)Rating Frequency (2)Ambient temperature:20℃ (3)Auxiliary power supply: Rating voltage
※2 Please refer to the instruction manual regarding the details on this specification.

Precaution for application

1. Guarantee against interruption of AC power supply
When an uninterruptible AC power source is not available in your system for the auxiliary power supply, use the type B-T1 AC/DC converter or commercially available uninterruptible power supply (UPS: MITSUBISHI ELECTRIC CORPORATION FW-A series or FW-V series). In addition, possible duration of the power supply type B-T1 AC/DC converter is confirmed as about 2 seconds in combination with one MELPRO-D series relay. Therefore, in the case that the required duration of power supply after power source loss exceeds 2 seconds, please use a suitable commercial uninterruptible power supply. When power supply back up for the circuit breaker is required, it is necessary to prepare the power supply independent from the type B-T1 AC/DC converter.
2. Inrush current of power supply
Since inrush current (about 2ms duration) as below may flow into the relay when the power supply is turned on, please make a consideration on this regard for selection of power circuit breaker.

Input voltage	Inrush current Ip
DC110V	Approx. 20A
DC220V	Approx. 55A
AC100V	Approx. 25A
AC220V	Approx. 65A

3. Trip circuit
Only the dedicated contacts can be used for the circuit breaker trip circuit. Please keep in mind that the contacts for signaling can not be used for the trip circuit. (If used, the contact may burn). Also, connect the pallet contact (52a) of the circuit breaker to the trip coil circuit in series.
4. Self-diagnosis output circuit
The self-diagnosis output contact is so configured that the auxiliary relay is energized (" break contact" opened) when normal result of self-diagnosis is received. This type of contact will allow the relay to output abnormal result even after the built-in power failures. Therefore, the "break contact" is still closed in the aftermath of the power applying and will be opened after 50ms. If the auxiliary power of the relay and the self-diagnosis output contact feed from a same power source, the "break contact" will be closed temporarily after auxiliary power supply is turned on. In this 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-delay timer.
5. Grounding circuit
Be sure to make a wiring to the earth terminal located on the back of the relay according to the Class D earth wiring method (Grounding resistance should be less than 100 ohm).
6. CC-Link communication circuit
Please include the communication card into your purchasing order in case of the application of the communication facility as the card necessary for communication (CC-Link) is option. In case of retrofit existing relay with communication card, please inform the followings of existing relay. a:Type, b:Style number, c:Manufacturing year, d:Serial number, e:Date of stamp on the checking seal (The above mentioned items a.~d. are indicated on the bottom right of front face of the relay and item e. is indicated on the upper of back side of the relay.) The version number of CC-Link is 1.00.
7. Improvement of reliability of protection system
For the important facilities, multiplex system such as dual should be provided to improve reliability.
8. 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 surge absorbers.
9. Make a wiring between EVT "a" terminal and "A-06" terminal of relay and EVT "f" terminal and "A-05" terminal of relay. Also, the grounding of EVT tertiary circuit has to be configured by the connection between "f" terminal of EVT and earth terminal.

Precaution for using

1. When the product is shipped from the factory, each setting value is "LOCK" (for element with LOCK position) or "minimum setting value" (for element without LOCK position)
2. To set as [LOCK] position means to set the element out of use.
3. The setting of measuring transformer ratio is applied only for the measuring indication converted to the primary side, and is not applied for protection element.
4. The EVT tertiary voltage ratio should be set as output nominal voltage between terminal "a" and "f" of EVT.
Example: 190/3⇒190V, 110/3⇒110V
5. The UV test function will be used for single phase test for under voltage element. (UV test LED (yellow color) will turn on during selecting UV TEST). UV TEST should be set as OFF in the operational condition.

Precaution for safety

Please refer to page2 and 3 regarding the safty information and request when placing order.

Sample of external connection diagram

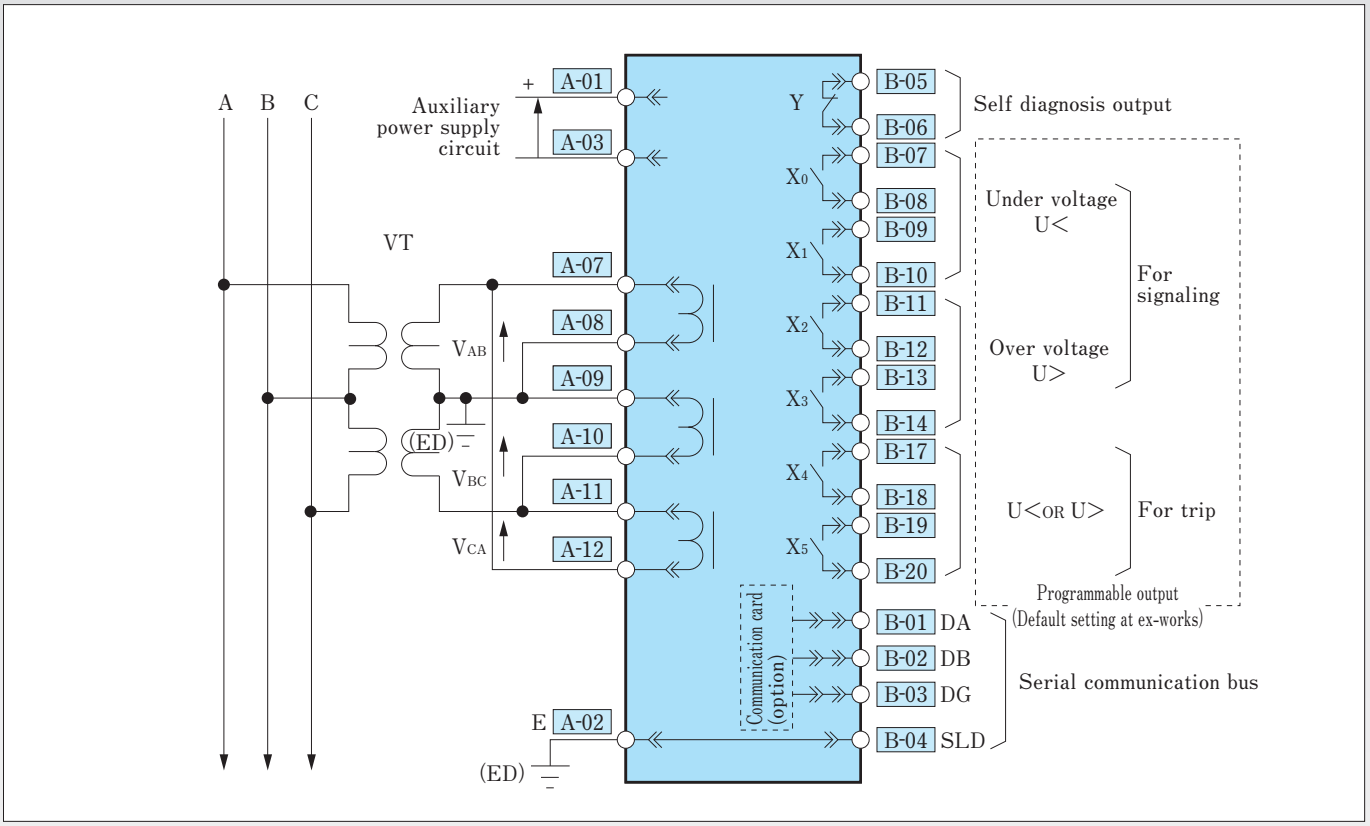
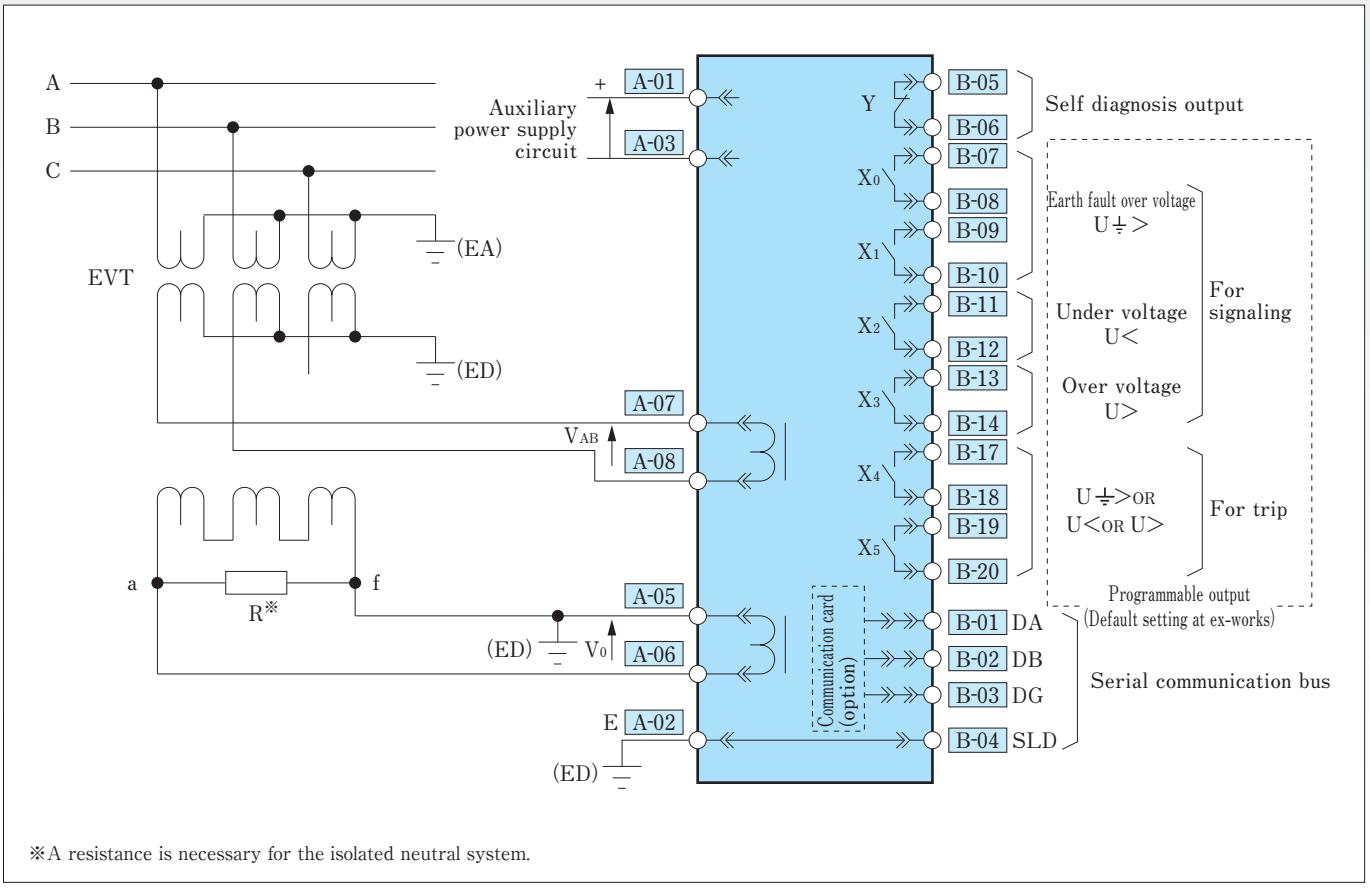


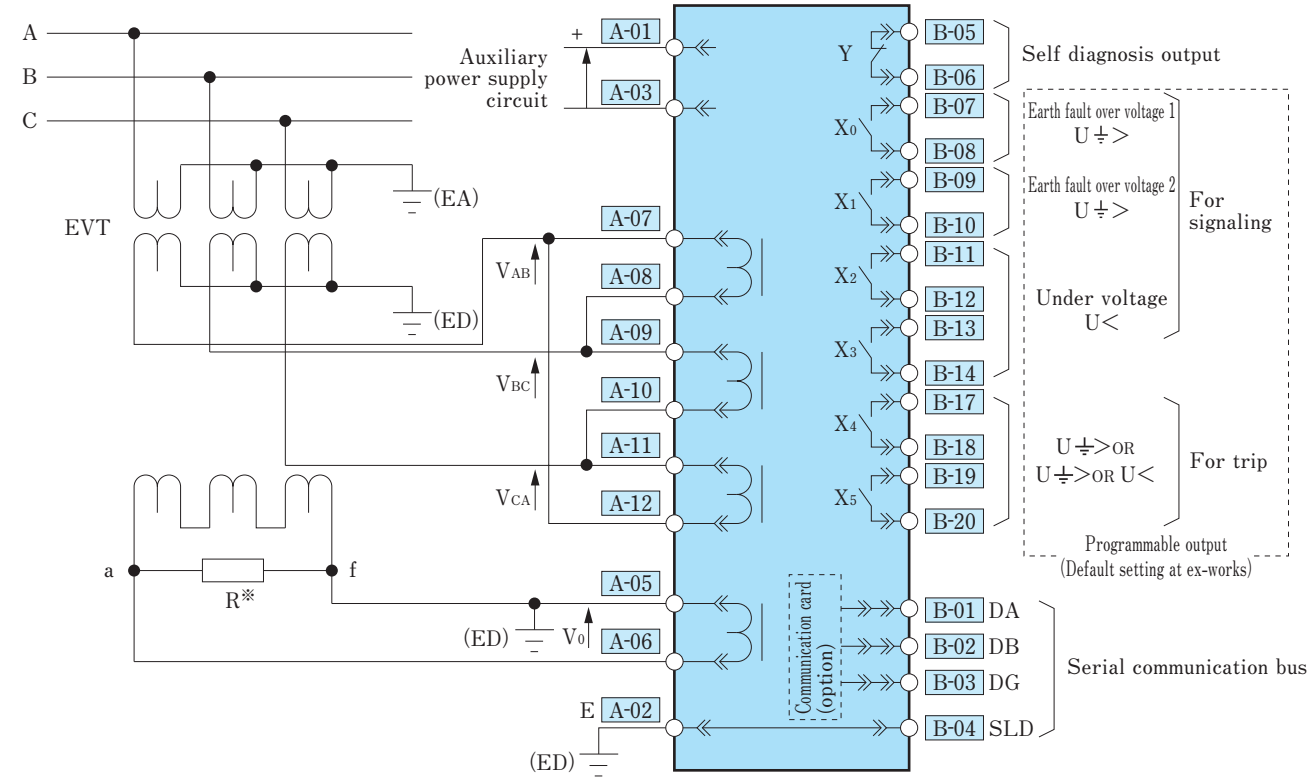
Fig.2-1 CBV2-A01D1 (Input line voltage)



※A resistance is necessary for the isolated neutral system.

Fig.2-2 CBV3-A01D1

The connection diagram shows concepts of the wiring only. Therefore, please note that there will have some difference between the connection diagram and actual installation status of CT,VT and safety devices such as fuse, etc.



※A resistance is necessary for the isolated neutral system.

Fig.2-3 CBV4-A01D1

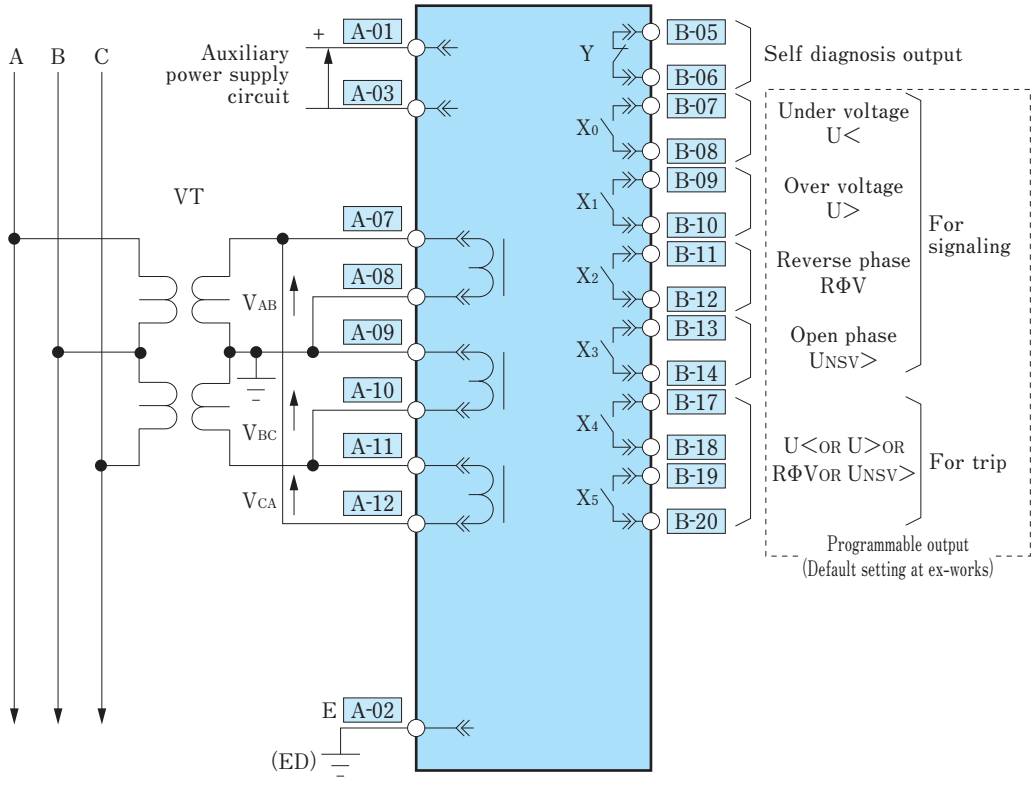
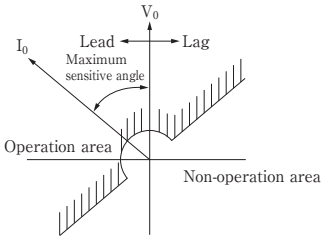
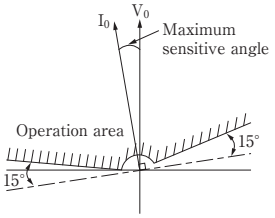


Fig.2-4 CUB1-A01D1

The connection diagram shows concepts of the wiring only. Therefore, please note that there will have some difference between the connection diagram and actual installation status of CT,VT and safety devices such as fuse, etc.

Type, rating and specification

Type name			CFP1-A01D1	CFP1-A02D1	CDG1-A01D1
Rating		Phase current	5A	5A	-
		Zero-phase current	2A	2A	1A
		Zero-phase voltage	110/190V	110/190V	100～208V
		Frequency	50Hz or 60Hz		
Protective element			51/50(2 phases), 67G	51/50(2 phases), 67G	67G
Combined instrument transformer		Zero-phase current	Commercially available ZCT(Conformity with JEC-1201 200/1.5mA)		-
		Zero-phase voltage	Commercially available EVT(Conformity with JEC-1201)		Commercially available EVT(Conformity with JEC1201)
Setting	Time-delayed	Operation current	LOCK-1～12A(0.1A step)		-
		Operation time multiplier	0.25-0.5～50(0.5 step)		-
		Operation time characteristics	Normal inverse time-delayed(3 kinds), Very inverse time-delayed(2 kinds), Extremely inverse time-delayed(3 kinds), Long inverse time-delayed(3 kinds), Definite time-delayed(1 kind)		-
		Reset time characteristics	Normal inverse time-delayed(1 kind), Definite time-delayed(2 kind)		-
	Instantaneous	Operation current	LOCK-2～80A(1A step)		-
		Operation time	INST-0.1～0.5s(0.1s step)		-
	Earth fault directional	I0 operation current	1～10mA(ZCT secondary current)(0.5mA step)	10～100mA(ZCT secondary current)(5mA step)	0.05～1.0A(0.05A step)
		V0 operation voltage	LOCK-5～60V(EVT tertiary) (1V step)		LOCK-5～60V(1S step)
		Operation time	INST-0.1～10s (0.1s step)		0.1～10s (0.1s step)
		Maximum sensitive angle	Lead 0～90°(5°step) 		Lead 0～30°(5°step) 
	Output contact configuration		Refer to the external connection diagram/Auto reset for all contacts(Default setting at ex-works)		
	Operation indicator LED hold		All LED self-hold(Default setting at ex-works)		
	CT primary(Phase current)		1※-5-10-12-12.5-15-20-25-30-40-50-60-75-80-100-120-125-150-200-250-300-400-500-600-750-800-1000-1200-1250-1500-2000-2500-3000-4000-5000-6000-7500-8000[A] ※Applicable 1 A rating product only.		
	EVT primary		100～999V(1V step),1000～9990V(10V step), 10.0k～99.9kV(0.1kV step), 100k～300kV(1kV step)		100～999V(1V step), 1000～9990V(10V step), 10.0k～99.9kV(0.1kV step), 100k～300kV(1kV step)
	EVT tertiary		100-110-115-120-100√3-110√3-115√3-120√3V		100-110-115-120-100√3 -100√3-115√3-120√3V
	ZCT error correction on/off		OFF-ON		-
	ZCT error adjustment		When the actual measured transforming ratio is within range of 200/1.5～4.1mA, the deviation from the ZCT nominal transforming ratio 200/1.5mA can be corrected.		-
Display	Real time measurement		Phase current×2, Zero-phase current, Zero-phase voltage, Characteristic angle		Zero phase current, Zero phase voltage, Phase
	Max.record		Phase current×2, Zero-phase current, Zero-phase voltage		Zero phase current, Zero phase voltage
	Fault record (operation value)		Phase current×2, Zero-phase current, Zero-phase voltage, Characteristic angle		Zero phase current, Zero phase voltage, Phase
	Fault record (operation item)		Record and indicate the operated elements		
	Elapse of time-delayed timer		0～10(The value 0 indicates the status of input current reaching the setting value or more and the value 1～10 indicate the elapse time up to operating of the time delayed element.)		-
	Self-diagnosis		Normal result:On the RUN LED (green) ･Status indication item No.400=No display. Abnormal result:Off the RUN LED･Status indication item No.400=Display defects code		
Forced operation			Each output contact		
Communication	Direct communication port		Standard equipment(PC software for Direct communication:Option)		Not applicable
	Remote communication port		Option(For CC-LINK or MODBUS)		Not applicable
Burden (at rating)			Phase current circuit:Less than 0.5VA, Zero-phase current circuit:Less than 10Ω, Zero-phase voltage circuit:Less than 0.15VA, Auxiliary power supply circuit:at DC100V=Approx. 5W, at AC100V=Approx. 7VA, at DC220V=Approx. 6W, at AC220V=Approx. 12VA(In case of installing communication card, add 2 VA.)		
Mass			Net weight of relay unit:Approx. 2.3kg, Including case:Approx. 3.0kg		
Sample of external connection diagram			Fig.3-1		Fig.3-2,3-3
Remarks			The rated current 1 A product can be made based on the 5A rating product. The setting value of time delayed element and instantaneous element of 1A product is calculated by performing a multiplication 1/5 of above mentioned value.		-

※Please refer to the instruction manual regarding the details on this specification.

Characteristics

Items			Condition	Guaranteed performance
Operation value	Phase fault time-delayed element		(Common condition)※	·Setting 1.0～2.0A for 5A rating product:Setting value ±10% Setting 0.2～0.4A for 1A rating product:Setting value ±10% ·For setting of other range:Setting value ±5%
	Phase fault instantaneous element			Setting value ±10%
	Earth fault directional element	Zero-phase current (CFP1-A01/A02D1)	Setting: Zero phase voltage=minimum Input: Zero phase voltage=Rating voltage×30%, Phase=Maximum sensitive angle	·Setting 1.0 or 1.5mA: Setting value±10% ·For setting of other range:Setting value ±5%
		Zero-phase current (CDG1-A01D1)	Input: Zero phase voltage=rating voltage Phase: Maximum sensitive angle	Setting 0.05A: Setting value ±10% For setting other range: Setting value ±5%
		Zero-phase voltage (CFP1-A01/A02D1)	Setting: Zero phase current=minimum Input: Zero phase voltage=Setting valve×1000%, Phase=Maximum sensitive angle	Setting value ±5%
		Zero-phase voltage (CDG1-A01D1)	Input: Setting value×200% Phase: Maximum sensitive angle	Setting value ±5%
Reset value	Phase fault time-delayed element		(Common condition)※	·Setting 1.0～2.0A for 5A rating product: Operation value×90% or more Setting 0.2～0.4A for 1A rating product: Operation value×90% or more ·For setting of other range: Operation value×95% or more
	Phase fault instantaneous element			Operation value×95% or more
	Earth fault directional element	Zero-phase current (CFP1-A01/A02D1)	Setting: Zero phase voltage=minimum Input: Zero phase voltage=Rating voltage×30%, Phase=Maximum sensitive angle	Operation value×90% or more
		Zero-phase current (CDG1-A01D1)	Input: Zero phase voltage=rating voltage Phase: Maximum sensitive angle	Setting 0.05A: Operation value×90% or more For setting other range: Operation value×95% or more
		Zero-phase voltage (CFP1-A01/A02D1)	Setting: Zero phase current=minimum Input: Zero phase voltage=Setting valve×1000%, Phase=Maximum sensitive angle	Operation value×90% or more
		Zero-phase voltage (CDG1-A01D1)	Input: Setting value×200% Phase: Maximum sensitive angle	Operation value×95% or more
Operation time	Phase fault time-delayed element		Operation setting value: Minimum Operation time multiplier: 10 Input:0→Operation setting value×300,500,1000%	Refer to fig.1-1.2 Timing accuracy for I≧3×Current setting value, ±3.5% of reference at actual pick up
	Phase fault instantaneous element		Operation setting value:Minimum value Input:0→200% of setting value	Setting value±25ms In case of INST setting 40ms or less
	Earth fault directional element (CFP1-A01/A02D1)		Setting: Zero phase current, voltage=minimum Input: Zero phase current=0→Setting value×1000%, Zero phase voltage=0→Rating voltage×30% Phase=Maximum sensitive angle	·INST Setting 80ms or less ·0.1～0.4s Setting: Setting value±25ms ·0.5～1.0s Setting: Setting value±5%
	Earth fault Directional element (CDG1-A01D1)		Input: Zero phase current and voltage to be changed quickly at the same time. Zero phase current: 0A→Setting value×300% Zero phase voltage: 0V→Rating voltage Phase: Maximum sensitive angle	0.1～0.4s setting: Setting value±25ms 0.5s or more setting: Setting value±5%
Reset time	Phase fault time-delayed element		300% of setting value→0A	Refer to COC series table 1-1
	Phase fault instantaneous element			
	Earth fault directional element (CFP1-A01/A02D1)		Setting: Zero phase current, voltage=minimum Input: Zero phase current=Setting value×1000%→0, Zero phase voltage=Rating voltage×30%→0 Phase=Maximum sensitive angle	200ms±25ms
	Earth fault Directional element (CDG1-A01D1)		Input: Zero phase current and voltage to be changed quickly at the same time. Zero phase current: Setting value×300%→0A Zero phase voltage: Rating voltage→0V Phase: Maximum sensitive angle	200ms±25ms

17. Type CDG1 is applicable for earth fault directional relay in the resistance grounded neutral system.
Refer to the Fig 3-2 and Fig. 3-3 on the combination with the Overcurrent relay.

※Common condition:(1) Rating Frequency (2) Ambient temperature:20℃ (3) Auxiliary power supply:Rating voltage

Characteristics

Items		Condition	Guaranteed performance
Overshoot characteristic	Phase fault time-delayed element	Time-delayed operation value: Minimum Operation time multiplier: 10 Operation characteristic: All characteristics Input current:0A→Setting value×1000%	No-operation limit time/Operation time=90% or more
Phase characteristic	Earth fault directional element (CFP1-A01/A02D1)	Setting: Zero phase current, voltage=minimum Input: Zero phase current=Setting value×1000%, Zero phase voltage=Rating voltage×30%	Maximum sensitive angle±5°
	Earth fault Directional element (CDG1-A01D1)	Operation time: Minimum Input: Zero phase current=Setting value×1000% Zero phase voltage=30V	Setting value±5°

17. Type CDG1 is applicable for earth fault directional relay in the resistance grounded neutral system.
Refer to the Fig 3-2 and Fig. 3-3 on the combination with the Overcurrent relay.

※Common condition:(1)Rating Frequency (2)Ambient temperature:20℃ (3)Auxiliary power supply:Rating voltage

Precaution for application

1. Guarantee against interruption of AC power supply
   When an uninterruptible AC power source is not available in your system for the auxiliary power supply, use the type B-T1 AC/DC converter or commercially available uninterruptible power supply (UPS: MITSUBISHI ELECTRIC CORPORATION FW-A series or FW-V series). In addition, possible duration of the power supply type B-T1 AC/DC converter is confirmed as about 2 seconds in combination with one MELPRO-D series relay. Therefore, in the case that the required duration of power supply after power source loss exceeds 2 seconds, please use a suitable commercial uninterruptible power supply. When power supply back up for the circuit breaker is required, it is necessary to prepare the power supply independent from the type B-T1 AC/DC converter.
2. Inrush current of power supply
   Since inrush current (about 2ms duration) as below may flow into the relay when the power supply is turned on, please make a consideration on this regard for selection of power circuit breaker.

Input voltage	Inrush current Ip
DC110V	Approx. 20A
DC220V	Approx. 55A
AC100V	Approx. 25A
AC220V	Approx. 65A

3. Trip circuit
   Only the dedicated contacts can be used for the circuit breaker trip circuit. Please keep in mind that the contacts for signaling can not be used for the trip circuit. (If used, the contact may burn). Also, connect the pallet contact (52a) of the circuit breaker to the trip coil circuit in series.
4. Self-diagnosis output circuit
   The self-diagnosis output contact is so configured that the auxiliary relay is energized (" break contact" opened) when normal result of self-diagnosis is received. This type of contact will allow the relay to output abnormal result even after the built-in power failures. Therefore, the "break contact" is still closed in the aftermath of the power applying and will be opened after 50ms. If the auxiliary power of the relay and the self-diagnosis output contact feed from a same power source, the "break contact" will be closed temporarily after auxiliary power supply is turned on. In this 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-delay timer.
5. Grounding circuit
   Be sure to make a wiring to the earth terminal located on the back of the relay according to the Class D earth wiring method (Grounding resistance should be less than 100 ohm).
6. CC-Link communication circuit
   Please include the communication card into your purchasing order in case of the application of the communication facility as the card necessary for communication (CC-Link) is option. In case of retrofit existing relay with communication card, please inform the followings of existing relay. a:Type, b:Style number, c:Manufacturing year, d: Serial number, e:Date of stamp on the checking seal (The above mentioned items a.～d. are indicated on the bottom right of front face of the relay and item e. is indicated on the upper of back side of the relay.) The version number of CC-Link is 1.00.
7. Improvement of reliability of protection system
   For the important facilities, multiplex system such as dual should be provided to improve reliability.
8. 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 surge absorbers.
9. Make a wiring between EVT "a" terminal and "A-06" terminal of relay and EVT "f" terminal and "A-05" terminal of relay. Also, the grounding of EVT tertiary circuit has to be configured by the connection between "f" terminal of EVT and earth terminal.
10. The test terminal "kt" and "lt" of ZCT should be no wiring in the operational condition of relay as the test terminal may be allowed to use only for the artificial fault current injection test. (Relay will not operate with these terminals short-circuited.)
11. To prevent the influence from noise or surge, a shielded 2 cores (size is 0.75～1mm^2) cable should be used for the connection between ZCT or EVT and relay, and shield wire should be connected to the earth terminal of the relay or the earth terminal located inside of the switchboard. (Grounding resistance should be less than 100 ohm). Further more, the go and return burden of the cable should be less than 5 ohms which is almost equal to 100m distance in case of core size 0.75mm^2.
12. The power cable should be applied for the primary conductor of ZCT. The earth of shield wire of cables should be done according to the regulation.
13. The wiring between ZCT, EVT and relay should be according to the connection diagram of each relay with a precaution on the polarity.
14. A commercially available ZCT conformity with JEC1201 (type BZ in case of MITSUBISHI ELECTRIC CORPORATION) may be applicable for the type CFP1-A01D1 and CFP1-A02D1.
15. No wiring to the terminal concerning to the elements without use for protection is acceptable. Also, regarding the setting of protection elements without use, to set the LOCK position is recommended. Please note that the setting LOCK of 67G element means the loss of all function of 67G which includes the 51G element, 64 element and fault direction element.
16. Only one number of ZCT can be connected to one number of the type CFP1. Correct operation of the relay can not be guaranteed against two or more numbers of ZCT to connect to one number of the type CFP1.

Precaution for using

1. When the product is shipped from the factory, each setting value is "LOCK" (for element with LOCK position) or "minimum setting value" (for element without LOCK position)
2. To set as [LOCK] position means to set the element out of use.
3. The setting of measuring transformer ratio is applied only for the measuring indication converted to the primary side, and is not applied for protection element.
4. The EVT tertiary voltage ratio should be set as output nominal voltage between terminal "a" and "f" of EVT. Example: 190/3⇒190V, 110/3⇒110V
5. The UV test function will be used for single phase test for under voltage element. (UV test LED (yellow color) will turn on during selecting UV TEST). UV TEST should be set as OFF in the operational condition.
6. The function of the ZCT error correction installed in the relay is applied for the purpose of correcting ZCT transformation error, so that improving the composite characteristics is achieved. The ZCT error correction range is 200mA/1.5mA～4.1mA(±0～+2.6mA) for the nominal transformation ratio 200mA/1.5mA specified with JEC-1201.

Precaution for safety

Please refer to page2 and 3 regarding the safty information and request when placing order.

Sample of external connection diagram

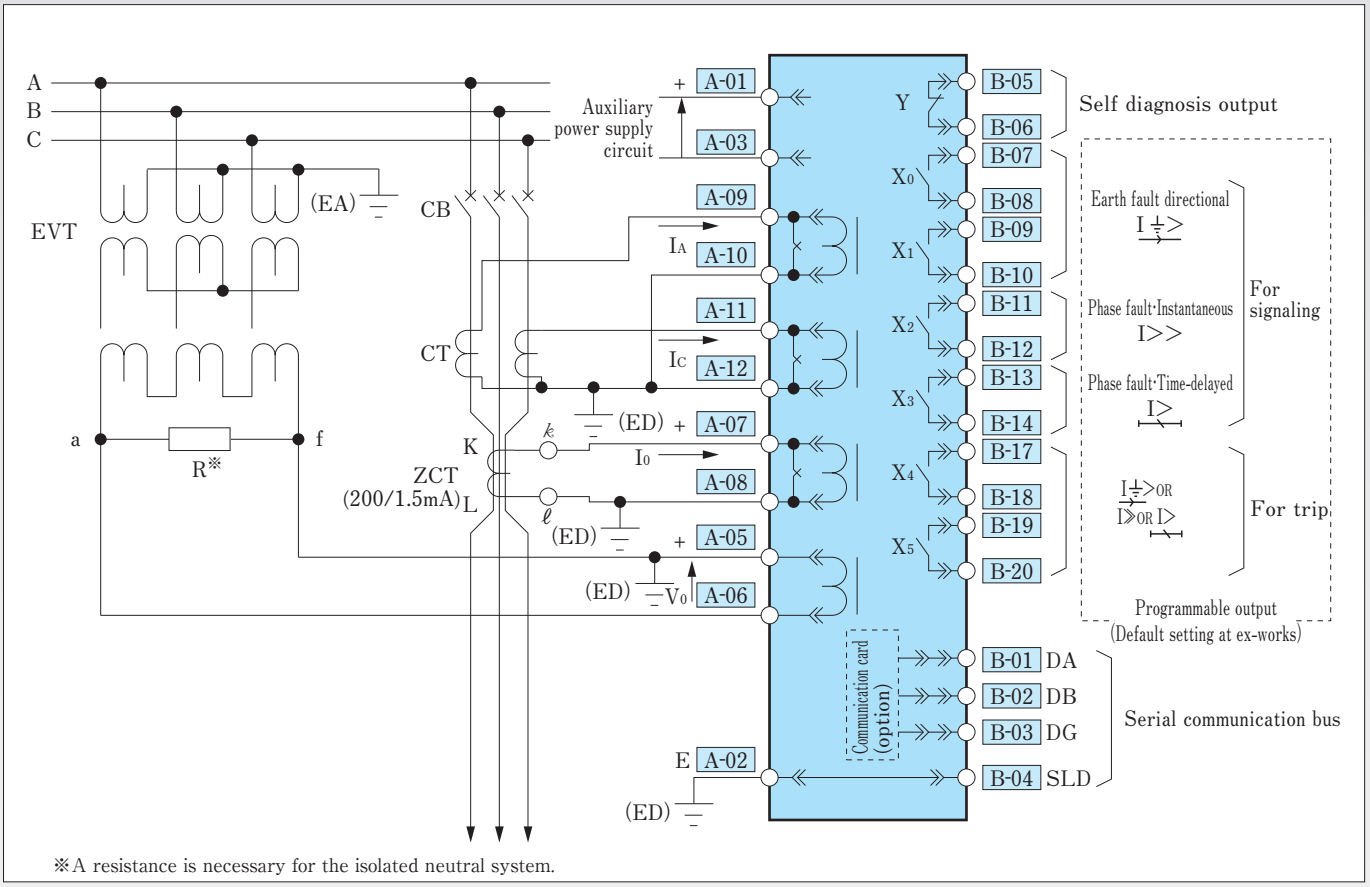


Fig.3-1　CFP1-A01D1、CFP1-A02D1

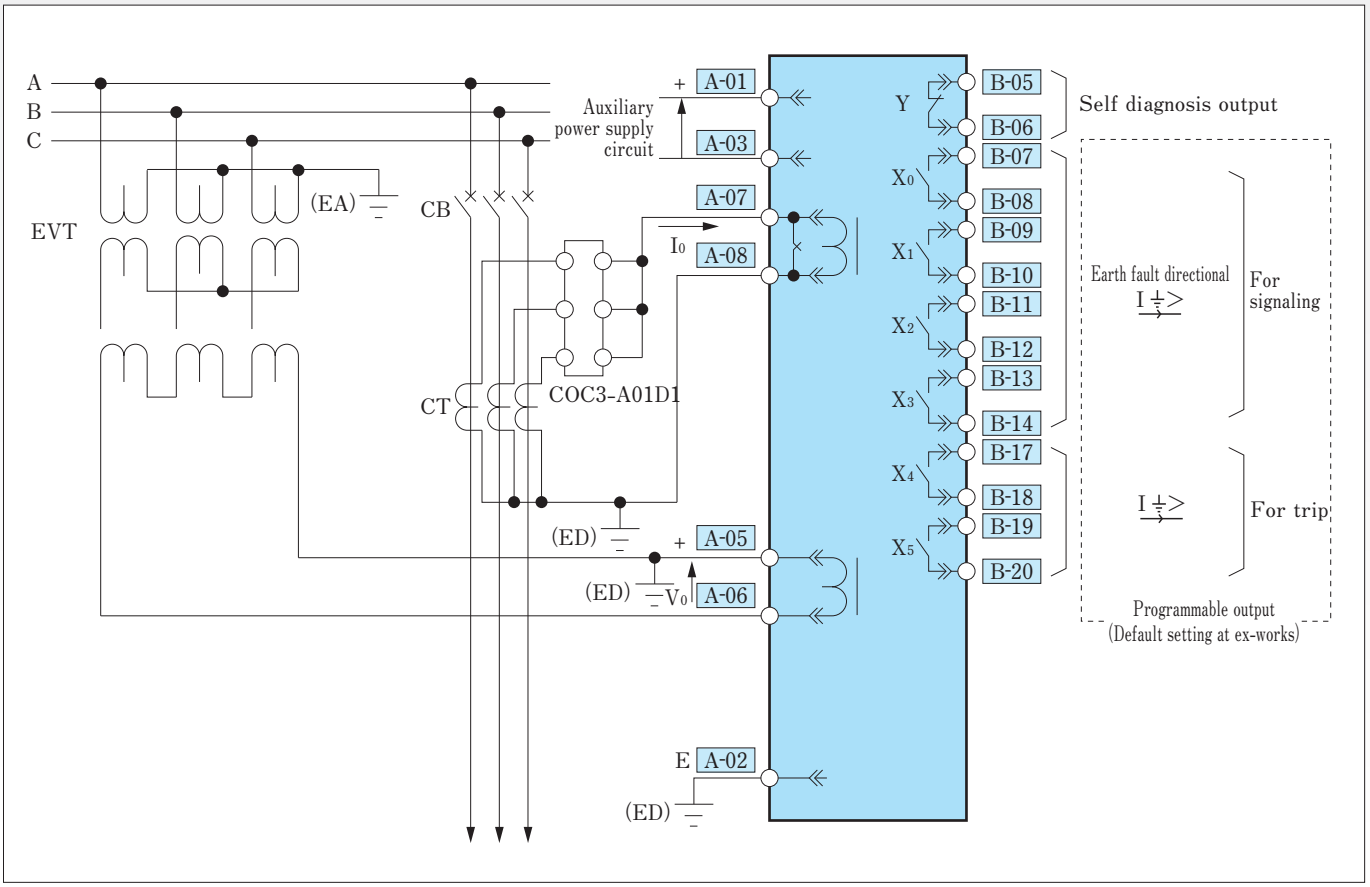


Fig.3-2　CDG1-A01D1

The connection diagram shows concepts of the wiring only. Therefore, please note that there will have some difference between the connection diagram and actual installation status of CT,VT and safety devices such as fuse, etc.

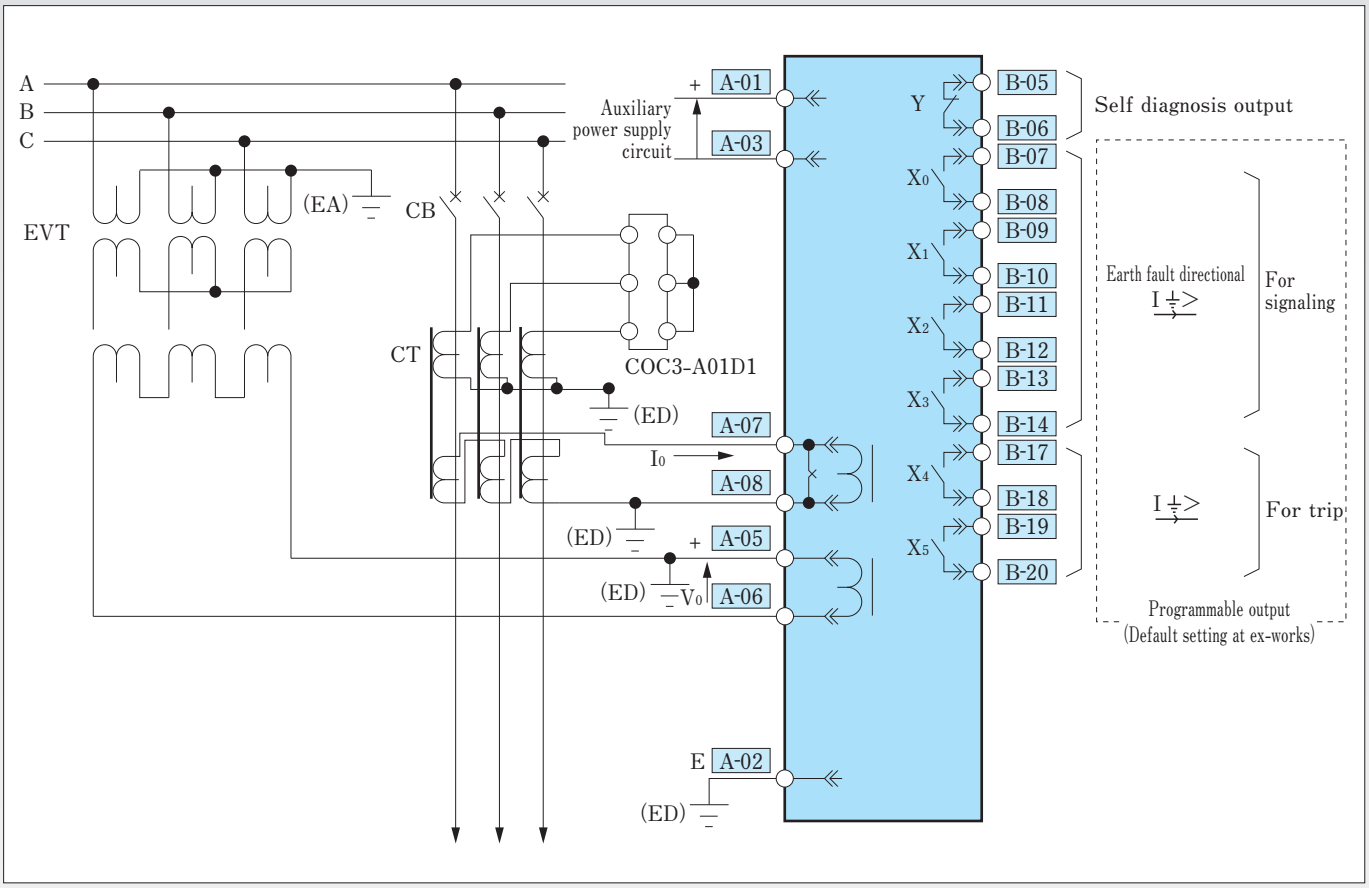


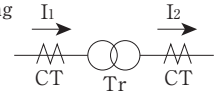
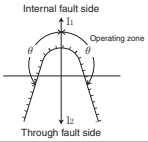
Fig.3-3 CDG1-A01D1

The connection diagram shows concepts of the wiring only. Therefore, please note that there will have some difference between the connection diagram and actual installation status of CT,VT and safety devices such as fuse, etc.

Type, rating and specification

Type name		CAC1-A01D2
Rating	Phase current	5A (Allowable continuous current: 8.7A)
	Frequency	50Hz or 60Hz
Protective element		87T for 2 windings transformer (3 phases)
Setting	Tr primary side CT matching tap I_{T1}	2.2～12.5A (0.1A step)
	Tr secondary side CT matching tap I_{T2}	2.2～12.5A (0.1A step)
	Operation Current	I_T×(LOCK-20-30-40%)
	Bias	20-30-40%
	2nd harmonic blocking	10～25% (5% step)
	Differential overcurrent multiplier	I_T×5～12 times (1time step)
	Output contact configuration	Refer to the external connection diagram/Auto reset for all contacts (Default setting at ex-works)
	Operation indicator LED hold	All LED self-hold (Default setting at ex-works)
Display	Real time measurement	Restraining current, Differential current, Percentage of 2nd harmonic current content
	Max.record	Restraining current, Differential current
	Fault record (operation value)	Restraining current, Differential current, Percentage of 2nd harmonic current content
	Fault record (operation item)	Record and indicate the operated elements.
	Self-diagnosis	Normal result:On the RUN LED (green)・Status indication item No.400=No display. Abnormal result:Off the RUN LED・Status indication item No.400=Display defects code
Forced operation		Each output contact
Communication	Direct communication port	Standard equipment (PC software for Direct communication:Option)
	Remote communication port	Option (For CC-LINK or MODBUS)
Burden (at rating)		Phase current circuit:Less than 0.5VA/phase Auxiliary power supply circuit:at DC100V=Approx. 7W, at AC100V=Approx. 25VA, at DC220V=Approx. 9W, at AC220V=Approx. 30VA (In case of installing communication card, add 2 VA.)
Mass		Net weight of relay unit:Approx. 3.8kg, Including case:Approx. 5.0kg
Sample of external connection diagram		Fig.4-1～5
Remarks		Possible to make 1A rating. The value of matching tap of tronsformer primary side and secondary side for 1A rating product is calculated by performing a multiplications 1/5 of above mentioned value.

Characteristics

Items		Condition	Guaranteed performance
Operation current	Biased differential element	Iop=I_T×Operation current (%)	Within Iop±5%
	Differential overcurrent element	Iop=I_T×Differential overcurrent	
Reset value	Biased differential element	Iop=I_T×Operation current (%)	95% or more of operations current
	Differential overcurrent element	Iop=I_T×Differential overcurrent	
Operation time	Biased differential element	0[A]→Iop×300%	50ms or less
	Differential overcurrent element	0[A]→Iop×300%	40ms or less
Reset time	Biased differential element	Iop×300%→0[A]	within 200±25ms
	Differential overcurrent element	Iop×300%→0[A]	
Biased differential characteristic		Matching tap $I_{T1} = I_{T2} = I_T$ At minimum matching tap setting $I_2 = I_T \times 200\%$ $\text{Bias} = \frac{\lvert I_1 - I_2 \rvert}{\text{Whichever is greater}}$ 	τ=20% setting: 15～25% τ=30% setting: 25～35% τ=40% setting: 35～45%
Phase characteristic		Matching tap $I_{T1} = I_{T2} = I_T$ At minimum matching tap setting $\lvert I_1 \rvert = \lvert I_2 \rvert = I_T \times 200\%$ 	Both lead and lag operation phase angle between I_1 and I_2 are shown below table. Nominal bias ratio / θ 20[%] / 168.5±5° 30[%] / 162.7±5° 40[%] / 156.9±5°
2nd harmonic blocking characteristic		Matching tap $I_{T1} = I_{T2} = I_T$ At minimum matching tap setting I_{DC}=80% of setting value (I_{DC}=Half wave rectifier current, I_{AC}=Sine wave current) $\frac{I_f^2}{I_f^1} = \frac{\frac{2}{3} I_{DC}}{\sqrt{2}\, I_{AC} + \frac{\pi}{2} I_{DC}} \times 100$ Percentage of 2nd harmonic current content	I_{AC}=254～330[%] (setting:10%) I_{AC}=137～188[%] (setting:15%) I_{AC}=81～119[%] (setting:20%) I_{AC}=47～77[%] (setting:25%)
		In case of the method of harmonic superposing, If1 is equal to 300% of the matching tap value.	2nd harmonic blocking ratio: Setting value ±10%

※Please refer to the instruction manual regarding the details on this specification.

Precaution for application

1. Guarantee against interruption of AC power supply
   When an uninterruptible AC power source is not available in your system for the auxiliary power supply, use the type B-T1 AC/DC converter or commercially available uninterruptible power supply (UPS: MITSUBISHI ELECTRIC CORPORATION FW-A series or FW-V series). In addition, possible duration of the power supply type B-T1 AC/DC converter is confirmed as about 2 seconds in combination with one MELPRO-D series relay. Therefore, in the case that the required duration of power supply after power source loss exceeds 2 seconds, please use a suitable commercial uninterruptible power supply. When power supply back up for the circuit breaker is required, it is necessary to prepare the power supply independent from the type B-T1 AC/DC converter.
2. Inrush current of power supply
   Since inrush current (about 2ms duration) as below may flow into the relay when the power supply is turned on, please make a consideration on this regard for selection of power circuit breaker.

Input voltage	Inrush current Ip
DC110V	Approx. 20A
DC220V	Approx. 55A
AC100V	Approx. 25A
AC220V	Approx. 65A

3. Trip circuit
   Only the dedicated contacts can be used for the circuit breaker trip circuit. Please keep in mind that the contacts for signaling can not be used for the trip circuit. (If used, the contact may burn). Also, connect the pallet contact (52a) of the circuit breaker to the trip coil circuit in series.
4. Self-diagnosis output circuit
   The self-diagnosis output contact is so configured that the auxiliary relay is energized ("break contact" opened) when normal result of self-diagnosis is received. This type of contact will allow the relay to output abnormal result even after the built-in power failures. Therefore, the "break contact" is still closed in the aftermath of the power applying and will be opened after 50ms. If the auxiliary power of the relay and the self-diagnosis output contact feed from a same power source, the "break contact" will be closed temporarily after auxiliary power supply is turned on. In this 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-delay timer.
5. Grounding circuit
   Be sure to make a wiring to the earth terminal located on the back of the relay according to the Class D earth wiring method (Grounding resistance should be less than 100 ohm).
6. CC-Link communication circuit
   Please include the communication card into your purchasing order in case of the application of the communication facility as the card necessary for communication (CC-Link) is option. In case of retrofit existing relay with communication card, please inform the followings of existing relay. a:Type, b:Style number, c:Manufacturing year, d:Serial number, e:Date of stamp on the checking seal (The above mentioned items a.~d. are indicated on the bottom right of front face of the relay and item e. is indicated on the upper of back side of the relay.) The version number of CC-Link is 1.00.
7. Improvement of reliability of protection system
   For the important facilities, multiplex system such as dual should be provided to improve reliability.
8. 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 surge absorbers.
9. The external wiring should be done according to Connection diagram. There is some possibility to detect differential current in case of wrong wiring.
10. The wiring of CT circuit is depended on the connection of the transformer winding (yd1, yd11, dy1, dy11, etc). Therefore, special attention on this regard is requested.
11. Regarding the CT sircuits on the transformer primary side, the incoming wiring should be connected to lower number of terminals and the outgoing wiring of them should be connected to higher number of terminals. Also, regarding the CT circuits on the transformer secondary side, the incoming wiring should be connected to higher number of terminals and outgoing wiring of them should be connected to lower number of terminals.
12. When the differential current check (defect code 0017) is detected, careful checking of wiring connection and setting value are requested as there are some possibilities to have some mistake of the wiring or improper setting of matching tap.
13. At the time of site testing or commissioning, please confirm if external wiring of CT circuits is correct or not by using the CT polarity check function(item number 906) of relay.
14. If the 2nd harmonic blocking elements (the digit number 7 to 9) are set to "ON" for a contact arrangement, the contact will make when the 2nd harmonic blocking element operate. Therefore, set them to "OFF" for the trip contact arrangement to prevent from incorrect operation. (Example of ON setting: The CB of primary side of transformer is closed and then, trip contact will make by the operation of the 2nd harmonic blocking element. Finally, CB will be tripped.) Please note that in the default setting at the time of ex-work, the 2nd harmonic blocking elements are not set to "ON" for contact arrangement on the trip circuit.
15. Another relays and load such as OCR or Aux-CT should not be connected in the same CT secondary circuits of differential relay for the primary and secondary of transformer because differential current will be caused due to the unbalance of the burden between both circuits.

Precaution for using

1. When the product is shipped from the factory, each setting value is "LOCK" (for element with LOCK position) or "minimum setting value" (for element without LOCK position)
2. To set as [LOCK] position means to set the element out of use.
3. The setting item of "DIF test (515)" should be set "ON" when carry out characteristic test. Because this relay has continuously monitoring function of differential current, so that the monitoring abnormality (0017) will occur when current applied on. The DIF test LED (yellow) will become on when setting. And do not forget to set the DIF test (515) "OFF" after finishing the characteristic test.

Precaution for safety

Please refer to page2 and 3 regarding the safty information and request when placing order.

Sample of external connection diagram

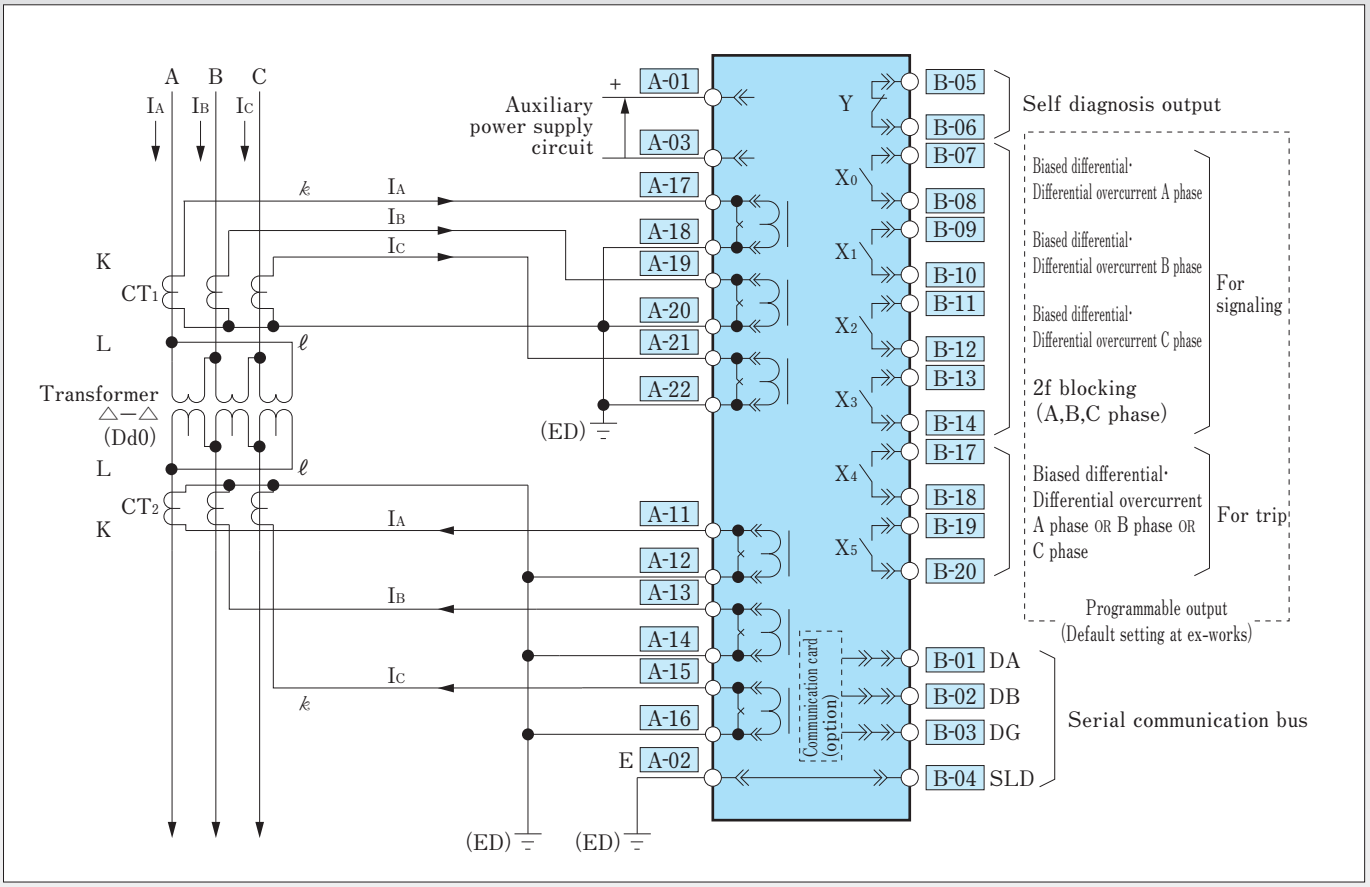


Fig.4-1 CAC1-A01D2〔Transformer△-△(Dd0)〕

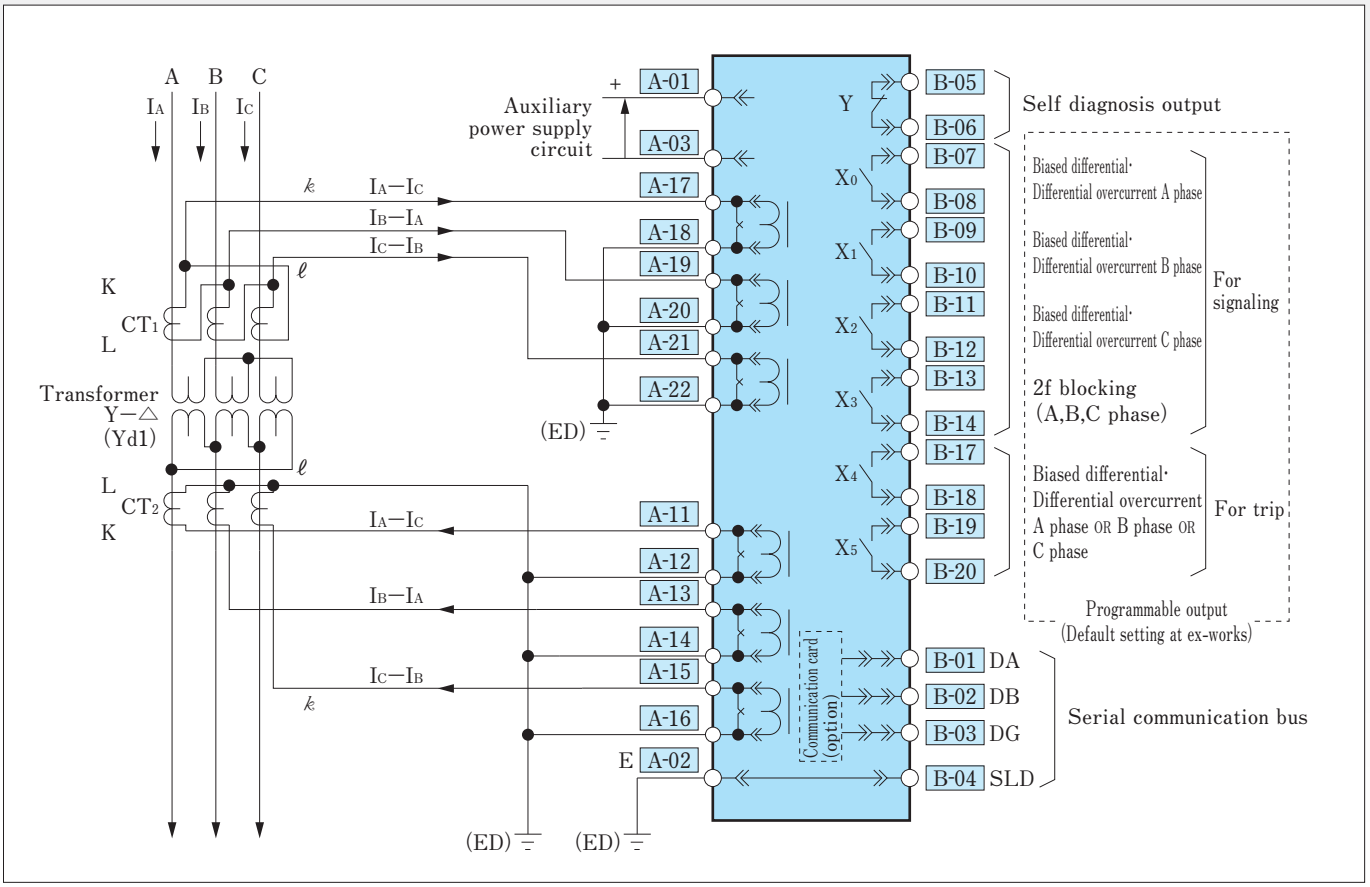


Fig.4-2 CAC1-A01D2〔Transformer Y-△(Yd1)〕

The connection diagram shows concepts of the wiring only. Therefore, please note that there will have some difference between the connection diagram and actual installation status of CT,VT and safety devices such as fuse, etc.

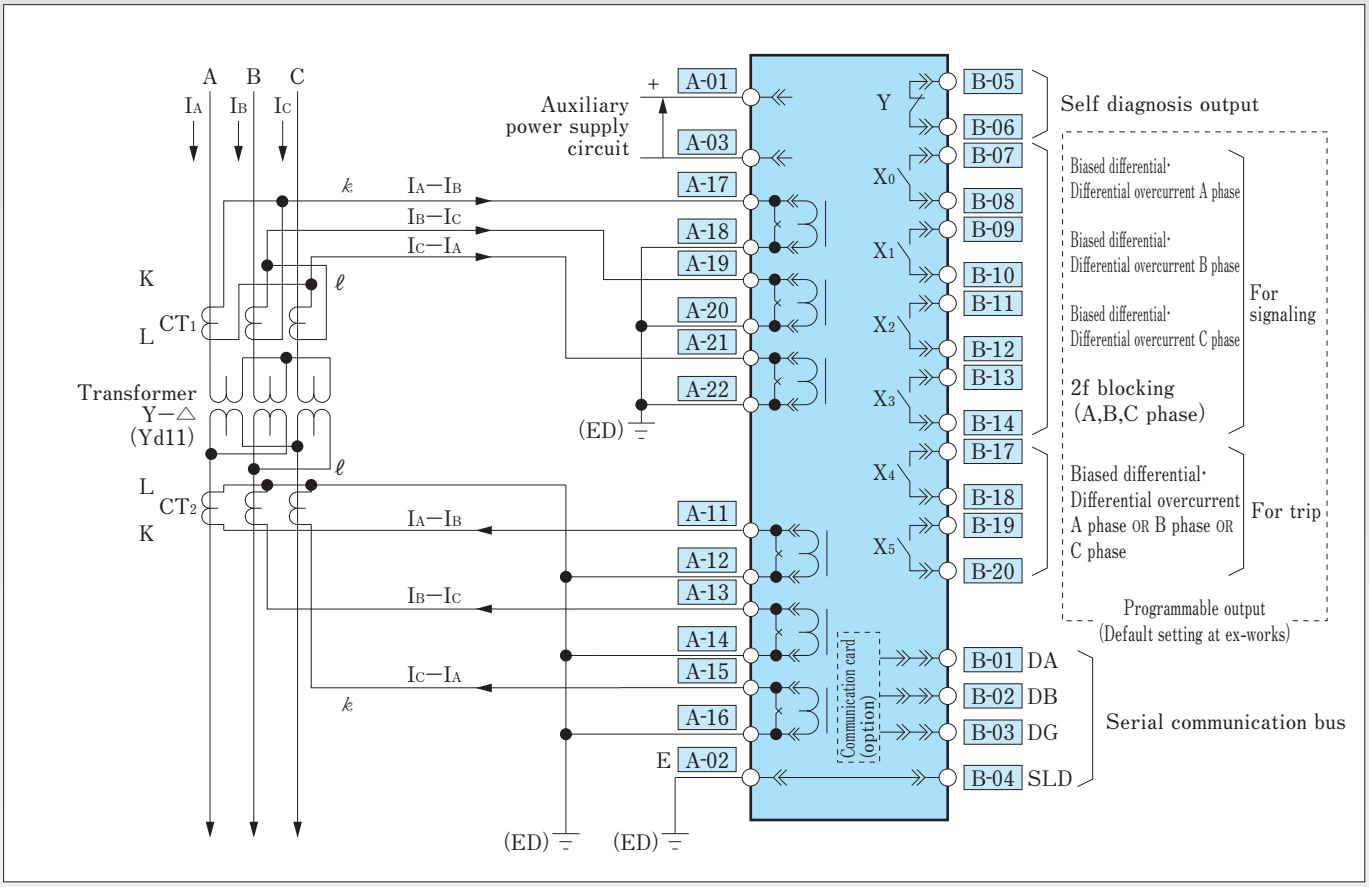


Fig.4-3 CAC1-A01D2〔Transformer Y-△(Yd11)〕

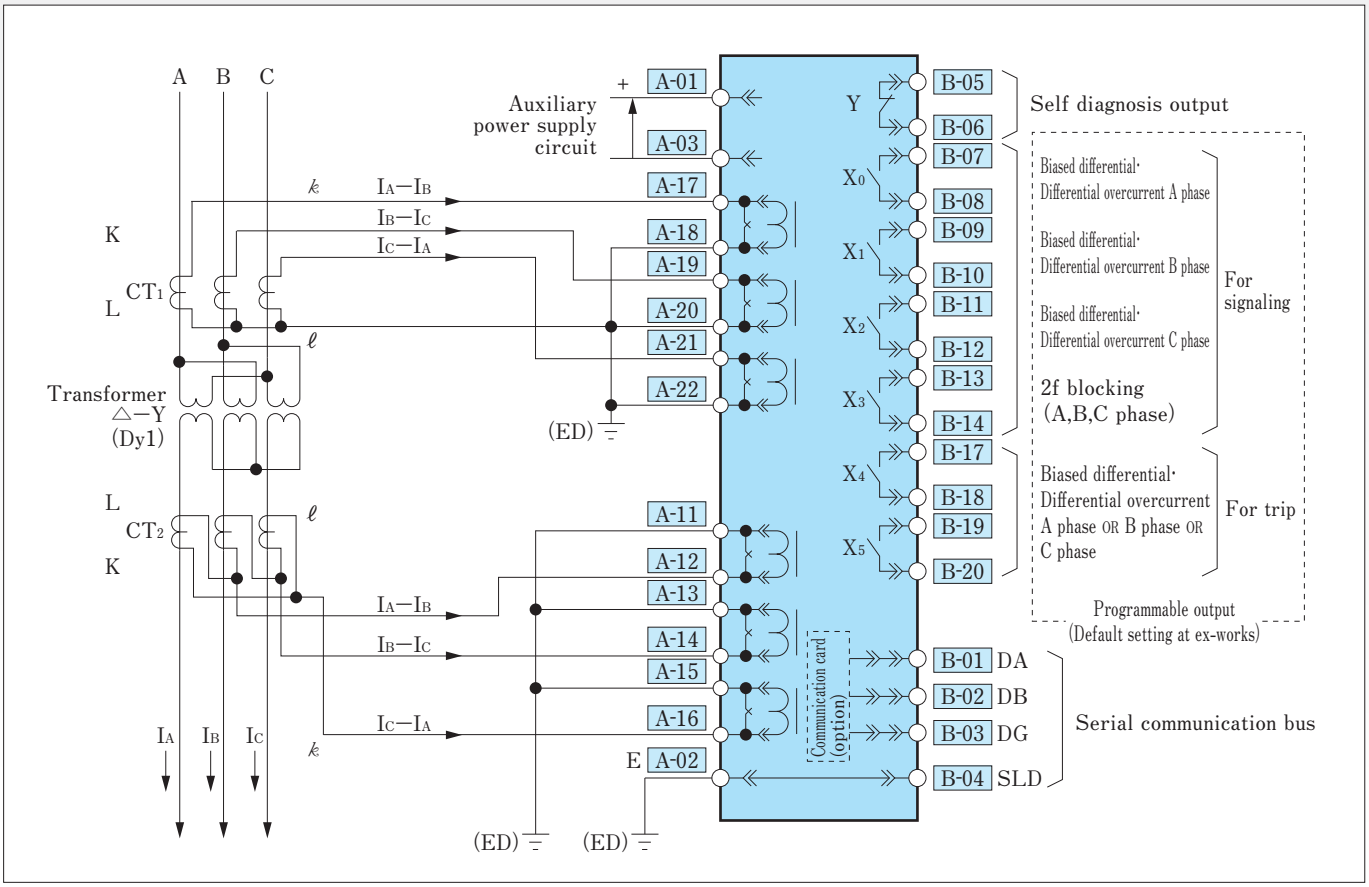


Fig.4-4 CAC1-A01D2〔Transformer△-Y(Dy1)〕

The connection diagram shows concepts of the wiring only. Therefore, please note that there will have some difference between the connection diagram and actual installation status of CT,VT and safety devices such as fuse, etc.

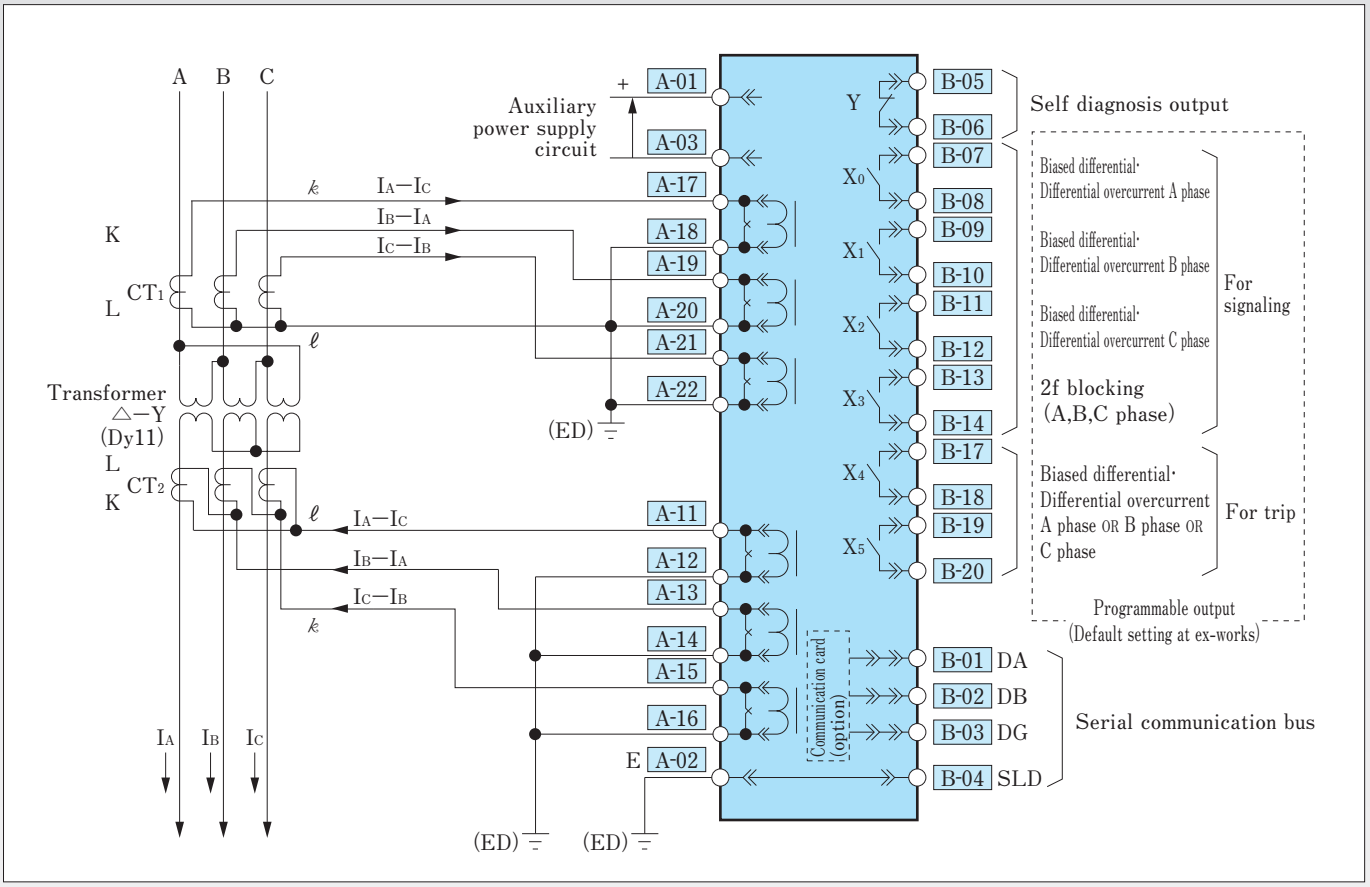


Fig.4-5 CAC1-A01D2〔Transformer△-Y(Dy11)〕

The connection diagram shows concepts of the wiring only. Therefore, please note that there will have some difference between the connection diagram and actual installation status of CT,VT and safety devices such as fuse, etc.

Type, rating and specification

Type name			CMP1-A01D1	CMP1-A01D2
Rating	Phase current		5A	
	Zero-phase current		2A	
	Zero-phase voltage		100～208V	
	Photo coupler input voltage (D2 type only)		-	DC110V (Permissible variable range 77～143V) or DC24V(Permissible variable range DC19.2V～31.2V) Input voltage 24V is applicable only for the case that auxiliary power supply voltage is 24V. In any other cases, only DC110V is applicable as for photo coupler input voltage.
	Frequency		50Hz or 60Hz	
Protective element			50/51(2 phases), 49, 46, 37(2 phases), 66, 67G	
Combined instrument transformer	Zero-phase current		Commercially available ZCT(Conformity with JEC-1201　200/1.5mA)	
	Zero-phase voltage		Commercially available EVT(Conformity with JEC-1201)	
Setting	Motor rated current(IM)		2～5A(0.1A step)	
	Overcurrent instantaneous	Operation current	LOCK-10～100A(1A step)	
		Operation time	INST-0.1～1.0s(0.1s step)	
	Overcurrent time-delayed	Operation current	LOCK-IM×130～300%(10% step)	
		Operation time(Koct)	4-5-6-8-10-12-16-20-24-32-40-48-64-80-96-112-128-160-200-240	
		Operation time characteristics equation	$T_{oct}=3\times\frac{K_{oct}}{I}$ s　(K_{oct}:Operation time setting, I:Phase current(unit: multiple to IM)) The selected K_{oct} valve is equal to the operating time of time-delayed element in case of I=3.	
	Negative sequence overcurrent	Operation current	LOCK-IM×0.5～8 times(0.5 times step)	
		Operation time	0.1～10s(0.1s step)	
	Overload	Operation current	LOCK-IM×105～125%(5% step)	
		Operation time(K_{TH})	8-12-16-20-24-32-40-48-64-80-96-112-128-160-200-240	
		Operation time characteristics equation	Operation time characteristics for HOT $T_{TH}=8.49\times K_{TH}\times\log_e\frac{(I_1^2+K\cdot I_2^2)-(I_{P1}^2+K\cdot I_{P2}^2)}{(I_1^2+K\cdot I_2^2)-1}$ s　(K_{TH}:Operation time setting　K:Negative-sequence heat multiplying factor, I_1:Positive sequence current of present input(unit: multiple to IM), I_2:Negative sequence current of present input(unit: multiple to IM), I_{P1}:Positive sequence current before overload(unit: multiple to IM), I_{P2}:Negative sequence current before overload(unit: multiple to IM)) ·Operation time for COLD characteristics, in the above equation, becomes equal to case conditioned as follows : $(I_{P1}^2+K\cdot I_{P2}^2)=0$ ·Selected value of K_{TH}, when input is provided so as to meet the conditions of $I_1^2+K\cdot I_2^2=3^2$ and $I_{P1}^2+K\cdot I_{P2}^2=0$, becomes equal to the time (sec) that will be taken until operation.	
		Negative-sequence heat multiplying factor(K)	1～10(1 step)	
		Changeover characteristic	0(COLD)　1(HOT)	
	Undercurrent	Operation current	LOCK-1.0～4.0A(0.1A step)	
		Operation time	1～600s(1s step)	
	Limit the number of start-up times	Number of start-up	LOCK-1～5(1 step)	
		Start-up time	2～120s(1s step)	
		Countdown rate	2～250s/h(0.5s/h step)	
	Earth fault directional	Io Operation current	1～10mA(ZCT secondary current)(0.5mA step)	
		Vo Operation voltage	LOCK-5～60V(1V step)	
		Operation time	INST-0.1～10s(0.1s step)	
		Maximum sensitive angle	Lead 0°～90°(5°step)	
	Output contact configuration		Refer to the external connection diagram/Auto reset for all contacts(Default setting at ex-works)	
	Operation indicator LED hold		All LED self-hold(Default setting at ex-works)	
	CT primary(Phase current)		1※-5-10-12-12.5-15-20-25-30-40-50-60-75-80-100-120-125-150-200-250-300-400-500-600-750-800-1000-1200-1250-1500-2000-2500-3000-4000-5000-6000-7500-8000[A]　※Applicable only 1 A	
	EVT primary		100～999V(1V step),1000～9990V(10V step), 10.0k～99.9kV(0.1kV step),100k～300kV(1kV step)	
	EVT tertiary		100-110-115-120-100√3-110√3-115√3-120√3V	
	ZCT error correction on/off		OFF-ON	
	ZCT error adjustment		When the actual measured transforming ratio is within range of 200/1.5～4.1mA, the deviation from the ZCT nominal transforming ratio 200/1.5mA can be corrected.	
Display	Real time measurement		Phase current×2, Zero-phase current, Zero-phase voltage, Characteristic angle, Negative sequence current	
	Max.record		Phase current×2, Zero-phase current, Zero-phase voltage	
	Fault record(operation value)		Phase current×2, Zero-phase current, Zero-phase voltage, Characteristic angle, Negative sequence current	
	Fault record(operation item)		Record and indicate the operated elements.	
	Self-diagnosis		Normal result:On the RUN LED(green)·Status indication item No.400=No display. Abnormal result:Off the RUN LED·Status indication item No.400=Display defects code	
Forced operation			Each output contact	
Communication	Direct communication port		Standard equipment(PC software for Direct communication:Option)	
	Remote communication port		Option(For CC-LINK or MODBUS)	
Burden (at rating)			Phase current circuit:Less than 0.5VA, Zero-phase current circuit:Less than 10Ω, Zero-phase voltage circuit:Less than 0.15VA Auxiliary power supply circuit:at DC100V=Approx. 4W, at AC100V=Approx. 8VA, at DC220V=Approx. 5W, at AC220V=Approx. 15VA(In case of installing communication card, add 2 VA.)	
Mass			Net weight of relay unit:Approx. 2.1kg(D1 type), Including case:Approx. 2.8kg(D1 type), Net weight of relay unit:Approx. 3.1kg(D2 type), Including case:Approx. 4.3kg(D2 type)	
Sample of external connection diagram			Fig.5-1,2	
Remarks			The rated current 1A product can be made based on the 5A rating product. The setting value of current elements on 1A product is calculated by performing a multiplication 1/5 of above mentioned value. The DI input facility is available for CMP1-A01D2, CMP1-A02D2 and not available for type CMP1-A01D1 and CMP2-A01D1.	

※Please refer to the instruction manual regarding the details on this specification.

Type name			CMP1-A02D1	CMP2-A02D2
Rating	Phase current		5A	
	Zero-phase current		5A	
	Photo coupler input voltage (D2 type only)		-	DC110V (Permissible variable range 77～143V) or DC24V(Permissible variable range DC19.2V～31.2V)
				Input voltage 24V is applicable only for the case that auxiliary power supply voltage is 24V. In any other cases, only DC110V is applicable as for photo coupler input voltage.
	Frequency		50Hz or 60Hz	
Protective element			50/51(3 phases), 49, 46, 37(3 phases), 66, 51G	
Setting	Motor rated current(IM)		2～5A(0.1A step)	
	Overcurrent instantaneous	Operation current	LOCK-10～100A(1A step)	
		Operation time	INST-0.1～1.0s(0.1s step)	
	Overcurrent time-delayed (1)	Operation current	LOCK-IM×130～300%(10% step)	
		Operation time(Koct)	4-5-6-8-10-12-16-20-24-32-40-48-64-80-96-112-128-160-200-240	
		Operation time characteristics equation	$T_{oct}=3\times\frac{K_{oct}}{I}$s ($K_{oct}$:Operation time setting, I:Phase current(unit: multiple to IM)) The selected K_{oct} valve is equal to the operating time of time-delayed element in case of I=3.	
	Overcurrent time-delayed (2)	Operation current	-	LOCK-IM×115～450%(5% step)
		Operation time	-	0.5～5.0s(0.5s step)
	Negative sequence overcurrent	Operation current	LOCK-IM×0.5～8 times(0.5 times step)	
		Operation time	0.1～10s(0.1s step)	
	Overload	Operation current	LOCK-IM×105～125%(5% step)	
		Operation time(K_{TH})	8-12-16-20-24-32-40-48-64-80-96-112-128-160-200-240	
		Operation time characteristics equation	Operation time characteristics for HOT $T_{TH}=8.49\times K_{TH}\times\log_e\frac{(I_1^2+K\cdot I_2^2)-(I_{P1}^2+K\cdot I_{P2}^2)}{(I_1^2+K\cdot I_2^2)-1}$ s (K_{TH}:Operation time setting K:Negative-sequence heat multiplying factor, I_1:Positive sequence current of present input(unit: multiple to IM), I_2:Negative sequence current of present input(unit: multiple to IM), I_{P1}:Positive sequence current before overload(unit: multiple to IM), I_{P2}:Negative sequence current before overload(unit: multiple to IM)) ・Operation time for COLD characteristics, in the above equation, becomes equal to case conditioned as $(I_{P1}^2+K\cdot I_{P2}^2)=0$ ・Selected value of K_{TH}, when input is provided so as to meet the conditions of $I_1^2+K\cdot I_2^2=3^2$ and $I_{P1}^2+K\cdot I_{P2}^2=0$, becomes equal to the time (sec) that will be taken until operation.	
		Negative-sequence heat multiplying factor(K)	1～10(1 step)	
		Changeover characteristic	0(COLD)　1(HOT)	
	Undercurrent	Operation current	LOCK-1.0～4.0A(0.1A step)	
		Operation time	1～600s(1s step)	
	Limit the number of start-up times	Number of start-up	LOCK-1～5(1 step)	
		Start-up time	2～120s(1s step)	
		Countdown rate	2～250s/h(0.5s/h step)	
	Earth fault overcurrent	Operation current	LOCK-0.05～2.50A(0.05A step)	
		Operation time	INST-0.1～10s (0.1s step)	
	Output contact configuration		Refer to the external connection diagram/Auto reset for all contacts(Default setting at ex-works)	
	Operation indicator LED hold		All LED self-hold(Default setting at ex-works)	
	CT primary(Phase current)		1#-5-10-12-12.5-15-20-25-30-40-50-60-75-80-100-120-125-150-200-250-300-400-500-600-750-800-1000-1200-1250-1500-2000-2500-3000-4000-5000-6000-7500-8000[A]　#Applicable only 1 A product	
	CT primary(Zero-phase current)		Same as phase current	
Display	Real time measurement		Phase current×3, Zero-phase current, Negative sequence current	
	Max.record		Phase current×3, Zero-phase current	
	Fault record(operation value)		Phase current×3, Zero-phase current, Negative sequence current	
	Fault record(operation item)		Record and indicate the operated elements.	
	Self-diagnosis		Normal result:On the RUN LED(green)・Status indication item No.400=No display. Abnormal result:Off the RUN LED・Status indication item No.400=Display defects code	
Forced operation			Each output contact	
Communication	Direct communication port		Standard equipment(PC software for Direct communication:Option)	
	Remote communication port		Option(For CC-LINK or MODBUS)	
Burden (at rating)			Phase current circuit:Less than 0.5VA, Zero-phase current circuit:Less than 10Ω, Zero-phase voltage circuit:Less than 0.15VA Auxiliary power supply circuit:at DC100V=Approx. 4W, at AC100V=Approx. 8VA, at DC220V=Approx. 5W, at AC220V=Approx. 15VA(In case of installing communication card, add 2 VA.)	
Mass			Net weight of relay unit:Approx. 2.1kg(D1 type), Including case:Approx. 2.8kg(D1 type), Net weight of relay unit:Approx. 3.1kg(D2 type), Including case:Approx. 4.3kg(D2 type)	
Sample of external connection diagram			Fig.5-3	Fig.5-4
Remarks			The rated current 1A product can be made based on the 5A rating product. The setting value of current elements on 1A product is calculated by performing a multiplication 1/5 of above mentioned value. The DI input facility is available for CMP1-A01D2, CMP2-A02D2 and not available for type CMP1-A01D1 and CMP1-A02D1.	

※Please refer to the instruction manual regarding the details on this specification.

Characteristics

Items			Condition	Guaranteed performance
Operation value	Overload element		Positive sequence current	Setting value ±5%
	Overcurrent time-delayed element (1)		(Common condition) ※1	
	Overcurrent time-delayed element (2)			
	Overcurrent instantaneous element			
	Under current element			
	Negative sequence overcurrent element		Negative sequence current	
	Earth fault directional element (CMP1-A01)	Zero-phase current	Setting: Zero phase voltage=minimum Input: Zero phase voltage=Rating voltage×30%, Phase=Maximum sensitive angle	
		Zero-phase voltage	Setting: Zero phase current=minimum Input: Zero phase current=Setting value×1000%, Phase=Maximum sensitive angle	
	Earth fault overcurrent element (CMP1-A02)		(Common condition) ※1	
Reset value	Overload element		(Common condition) ※1	Operation value×95% or more
	Overcurrent time-delayed element (1)			
	Overcurrent time-delayed element (2)			
	Overcurrent instantaneous element			
	Negative sequence overcurrent element			
	Earth fault directional element (CMP1-A01)	Zero-phase current	Setting: Zero phase voltage=minimum Input: Zero phase voltage=Rating voltage×30%, Phase=Maximum sensitive angle	Operation value×90% or more
		Zero-phase voltage	Setting: Zero phase current=minimum Input: Zero phase current=Setting value×1000%, Phase=Maximum sensitive angle	
	Earth fault overcurrent element (CMP1-A02)		(Common condition) ※1	Operation value×95% or more
	Under current element			Operation value×105% or less
Phase	Earth fault directional element (CMP1-A01)		Setting: Zero phase current=minimum Input: Zero phase current=Setting value×1000%, Zero phase voltage=Rating voltage×30%	Setting value ±5°
Operation time	Overload element		Setting:Operation time setting(K_{TH})=8 Input: Positive sequence current=0A→ 150% and 300% of motor rated current	Input 150%:Error against normal ±17% or less Input 300%:Error against normal ±12% or less
	Overcurrent time-delayed element (1)		Setting:Operation time setting(Koct)=4 Input: Phase current=0A→ 300%,500% and 1000% of motor rated current (IM)	Input 300%:Error against normal ±12% or less Input 500%:Error against normal ±7% or less Input 1000%:Error against normal ±7% or less
	Overcurrent time-delayed element (2)		Setting: minimum Input: Phase current=0A→300%	Setting value ±5°
	Overcurrent instantaneous element		Setting: minimum Input:0→setting value×200%	・In case of INST setting:40ms or less ・0.1～0.4s setting:Setting value ±25ms ・0.5～1.0s setting:Setting value ±5%
	Under current element		Setting: maximum Input:Setting value×300%→IM×12%	Setting value ±5%
	Negative sequence overcurrent element		Setting: minimum Input:Negative sequence current=0→Setting value×200%	・0.1～0.4s setting:Setting value ±25ms ・0.5～1.0s setting:Setting value ±5%
	Earth fault directional element (CMP1-A01)		Setting: Zero phase current=minimum Input: Zero phase current=0→Setting value×1000% Zero phase voltage=0→Rating voltage×30% Phase=Maximum sensitive angle	Setting / Input: Inst / 0.1～0.4s / 0.5～10s 130%: 80ms or less / Setting value±40ms / Setting value±10% 400%: 80ms or less / Setting value±20ms / Setting value±5%
	Earth fault overcurrent element (CMP1-A02)		Setting: minimum Input: Zero phase current=0⇒Setting value×200%	・In case of INST setting:40ms or less ・0.1～0.4s setting:Setting value ±25ms ・0.5～10s setting:Setting value ±5%

※1 Common condition:(1)Rating Frequency (2)Ambient temperature:20℃ (3)Auxiliary power supply: Rating voltage

Items		Condition	Guaranteed performance
Reset time	Overload element	Setting:Operation time setting(KTH)=8 Input: Positive sequence current=Setting value×300%→0A	HOT characteristic (300% input is applied for 5 minutes or more and then input is turned to zero.) 149.2s±15% COLD characteristic: 200±25ms
	Overcurrent time-delayed element (1)	Setting: minimum Input: Setting value×300%→0A	200±25ms
	Overcurrent time-delayed element (2)		
	Overcurrent instantaneous element		
	Under current element	Setting: maximum Input: IM×12%→Setting value×200%	
	Negative sequence overcurrent element	Setting: minimum Input: Negative sequence current=Setting value×300%→0A	
	Earth fault directional element (CMP1-A01)	Setting: Zero-phase current, voltage=minimum Input: Zero-phase current=Setting value×1000%→0A Zero-phase voltage=Rating voltage×30%→0V Phase=Maximum sensitive angle	
	Earth fault overcurrent element (CMP1-A02)	Setting: minimum Input: Zero-phase current Setting value×300 %→0A	
Restriction start time	Limit of the number of start-up times element	Setting: Number of start-up times=1, Start-up time=2s Countdown rate of start-up time counter=2s/h Input: A-phase current=0A→IM×300%	1s±5%
Restriction end time	Limit of the number of start-up times element	Setting: Number of start-up times=1, Start-up time=2s Countdown rate of start-up time counter=250s/h Input: A-phase current=0A→IM×300%(for 2s)→0A	$14.4s^{+10\%}_{0\%}$

Precaution for application

1. Guarantee against interruption of AC power supply
   When an uninterruptible AC power source is not available in your system for the auxiliary power supply, use the type B-T1 AC/DC converter or commercially available uninterruptible power supply (UPS: MITSUBISHI ELECTRIC CORPORATION FW-A series or FW-V series). In addition, possible duration of the power supply type B-T1 AC/DC converter is confirmed as about 2 seconds in combination with one MELPRO-D series relay. Therefore, in the case that the required duration of power supply after power source loss exceeds 2 seconds, please use a suitable commercial uninterruptible power supply. When power supply back up for the circuit breaker is required, it is necessary to prepare the power supply independent from the type B-T1 AC/DC converter.
2. Inrush current of power supply
   Since inrush current (about 2ms duration) as below may flow into the relay when the power supply is turned on, please make a consideration on this regard for selection of power circuit breaker.

Input voltage	Inrush current Ip
DC110V	Approx. 20A
DC220V	Approx. 55A
AC100V	Approx. 25A
AC220V	Approx. 65A

3. Trip circuit
   Only the dedicated contacts can be used for the circuit breaker trip circuit. Please keep in mind that the contacts for signaling can not be used for the trip circuit. (If used, the contact may burn). Also, connect the pallet contact (52a) of the circuit breaker to the trip coil circuit in series.
4. Self-diagnosis output circuit
   The self-diagnosis output contact is so configured that the auxiliary relay is energized ("break contact" opened) when normal result of self-diagnosis is received. This type of contact will allow the relay to output abnormal result even after the built-in power failures. Therefore, the "break contact" is still closed in the aftermath of the power applying and will be opened after 50ms. If the auxiliary power of the relay and the self-diagnosis output contact feed from a same power source, the "break contact" will be closed temporarily after auxiliary power supply is turned on. In this 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-delay timer.
5. Grounding circuit
   Be sure to make a wiring to the earth terminal located on the back of the relay according to the Class D earth wiring method (Grounding resistance should be less than 100 ohm).
6. CC-Link communication circuit
   Please include the communication card into your purchasing order in case of the application of the communication facility as the card necessary for communication (CC-Link) is option. In case of retrofit existing relay with communication card, please inform the followings of existing relay. a:Type, b:Style number, c:Manufacturing year, d: Serial number, e:Date of stamp on the checking seal (The above mentioned items a.~d. are indicated on the bottom right of front face of the relay and item e. is indicated on the upper of back side of the relay.) The version number of CC-Link is 1.00.
7. Improvement of reliability of protection system
   For the important facilities, multiplex system such as dual should be provided to improve reliability.
8. 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 surge absorbers.
9. It is possible to input the equipment fault signal and the operation signal (under voltage, etc.) of external protection relay etc to the DI(1) and DI(2). These input signals can initiate the related operation output signals.
10. Make a wiring between EVT "a" terminal and "A-06"("A-16" for CMP1-A01D2) terminal of relay and EVT "f" terminal and "A-05" ("A-15" for CMP1-A01D2) terminal of relay. Also, the grounding of EVT tertiary circuit has to be configured by the wiring between "f terminal of EVT and earth terminal. Any other wiring than above will not realize the correct detection on the earth fault directional.
11. A commercially available ZCT conformity with JEC1201 (type BZ in case of MITSUBISHI ELECTRIC CORPORATION) may be applicable for the type CMP1-A01D1/2.
12. Only one number of ZCT can be connected to one number of the type CMP1-A01D1/D2. Correct operation of the relay can not be guaranteed against two or more numbers of ZCT to connect to one number of the type CMP1-A01D1/2.
13. It is possible to use the CMP1-A02 type as the phase over current protection provided with two phases. However, residual connection of 2 phases can not be applied to the earth fault over current element. The residual connection of 3 phases only can be applied to the earth fault over current element. In case of only two phase CTs being available for phase over current protection, ZCT or one more CT is needed for earth fault over current element. Also. the negative sequence over current element is not operated properly by the CT circuits provided with two phases. Therefore, in this case, please make a setting of negative sequence of over current element to LOCK position.
14. The DI input of CMP1-A01D2 and CMP2-A02D2 has a polarity. Therefore, please pay attention to polarity as DI input can not be detected properly due to the wrong connection of DI circuit.

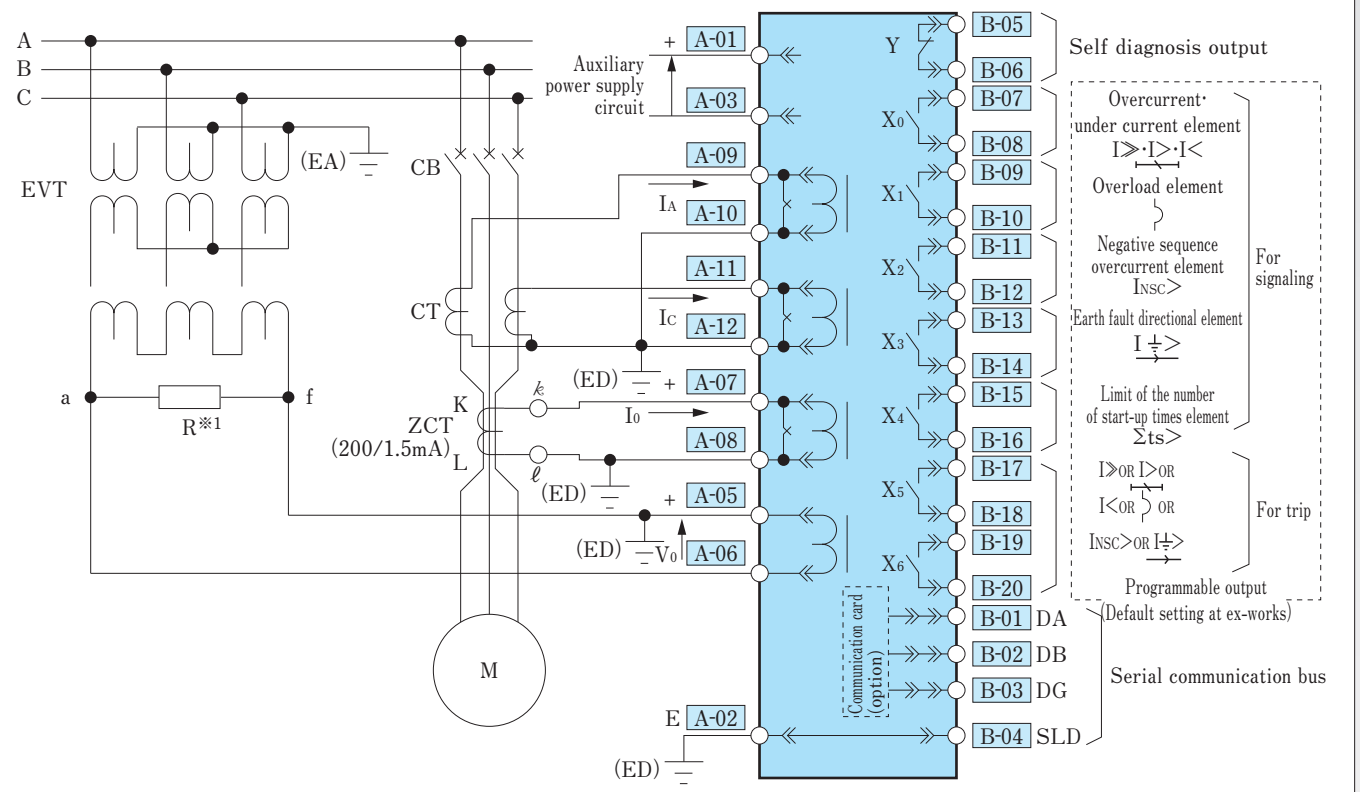
Precaution for using

1. When the product is shipped from the factory, each setting value is "LOCK" (for element with LOCK position) or "minimum setting value" (for element without LOCK position)
2. To set as [LOCK] position means to set the element out of use.
3. The setting of measuring transformer ratio is applied only for the measuring indication converted to the primary side, and is not applied for protection element.
4. The EVT tertiary voltage ratio should be set as output nominal voltage between terminal "a" and "f" of EVT. Example: 190/3⇒190V, 110/3⇒110V
5. The function of the ZCT error correction installed in the relay(CMP1-A01D1/D2 type only, item No. 904,905) is applied for the purpose of correcting ZCT transformation error, so that improving the composite characteristics is achieved. The ZCT error correction range is 200mA/1.5mA~4.1mA(±0~+2.6mA) for the nominal transformation ratio 200mA/1.5mA specified with JEC-1201.

Precaution for safety

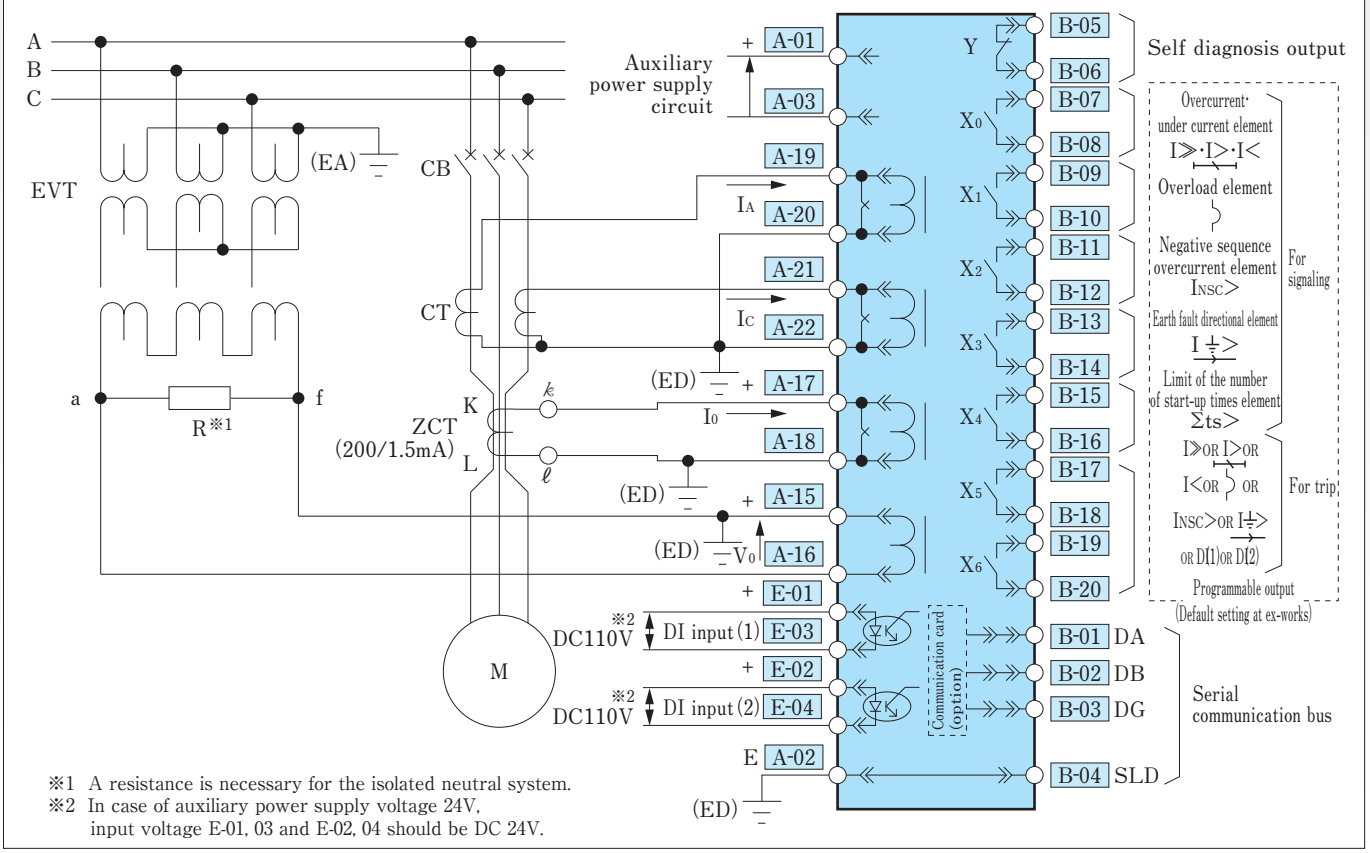
Please refer to page2 and 3 regarding the safty information and request when placing order.

Sample of external connection diagram



※1 A resistance is necessary for the isolated neutral system.

Fig.5-1 CMP1-A01D1



※1 A resistance is necessary for the isolated neutral system.
※2 In case of auxiliary power supply voltage 24V,
input voltage E-01, 03 and E-02, 04 should be DC 24V.

Fig.5-2 CMP1-A01D2

The connection diagram shows concepts of the wiring only. Therefore, please note that there will have some difference between the connection diagram and actual installation status of CT,VT and safety devices such as fuse, etc.

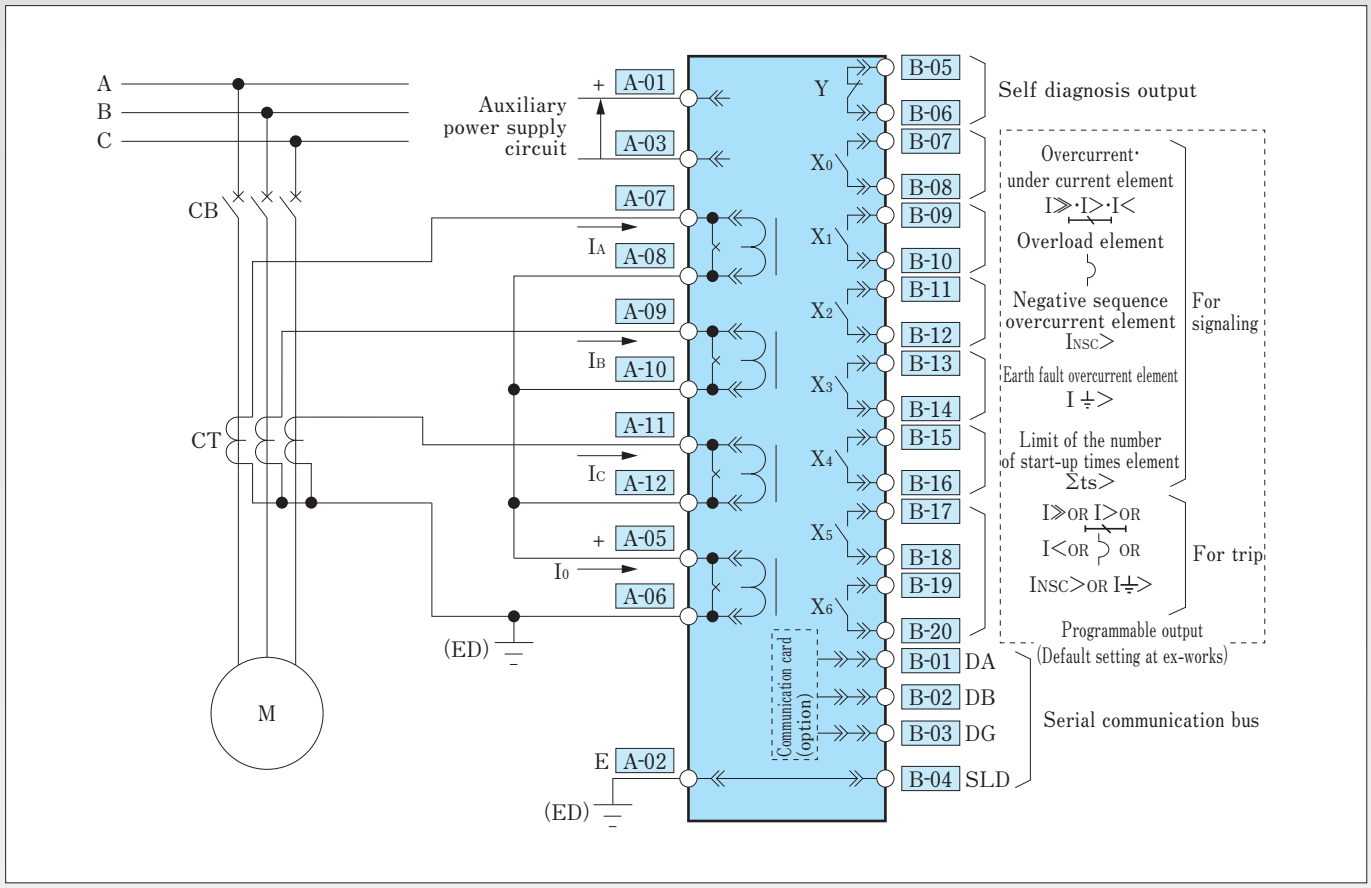


Fig.5-3 CMP1-A02D1

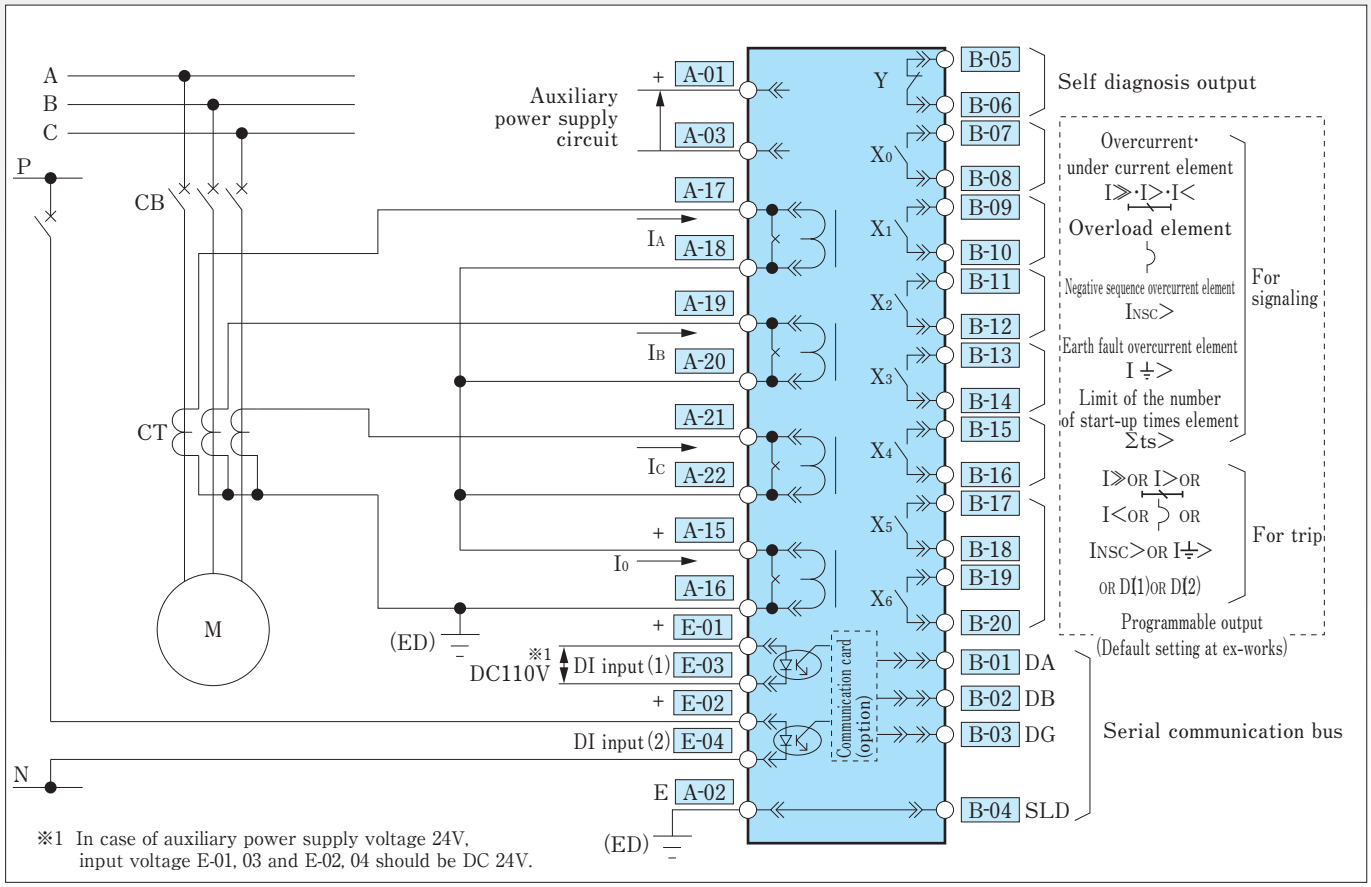


Fig.5-4 CMP2-A02D2

The connection diagram shows concepts of the wiring only. Therefore, please note that there will have some difference between the connection diagram and actual installation status of CT,VT and safety devices such as fuse, etc.

Type, rating and specification

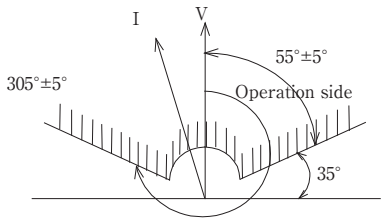
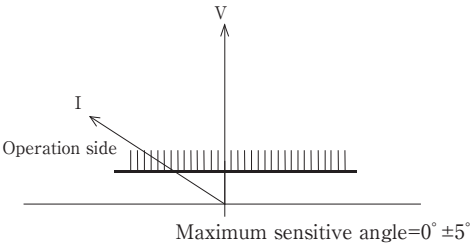
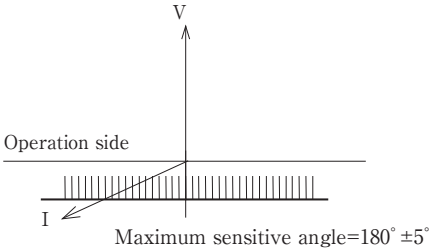
Type name			CPP1-A01D2	CPP1-A11D2
Rating	Phase current		5A	
	Voltage		57～120V	
	Zero-phase voltage		100～208V	
	Photo coupler input voltage (D2 type only)		DC110V (Permissible variable range 77～143V) or DC24V (Permissible variable range DC19.2V～31.2V)	
			Input voltage 24V is applicable only for the case that auxiliary power supply voltage is 24V. In any other cases, only DC110V is applicable as for photo coupler input voltage.	
	Frequency		50Hz or 60Hz	
Protective element			64,59,27 (3phases),67S (3phases),95L,95H,67P (3phases),91L (3phases),(df/dt* Applicable only for A11)	
Combined instrument transformer		Zero-phase voltage	Commercially available EVT (Conformity with JEC-1201)	
Setting	Earth fault over voltage	Operation voltage	LOCK-5～60V (1V step)	
		Operation time	0.05-0.1～15s (0.1s step)	
	Over voltage	Operation voltage	LOCK-110～150V (1V step)	
		Operation time	0.05-0.1～15s (0.1s step)	
	Under voltage	Operation voltage	LOCK-20～110V (1V step)	
		Operation time	0.05-0.1～15s (0.1s step)	
	Phase fault directional	L element operation value	LOCK-Rated current (5A)×1～20% (1% step)	
		L element operation time	0.05-0.1～15s (0.1s step)	
		H element operation value	LOCK-Rated current (5A)×20～100% (1% step)	
		H element operation time	0.05-0.1～15s (0.1s step)	
		UV element for DS operation value	NO USE-20～100V (1V step)	
	Under frequency	Operation value	[Rated frequency:50Hz] LOCK-49.5～45Hz (0.1Hz step), [Rated frequency:60Hz] LOCK-59.5～55Hz (0.1Hz step)	
		Operation time	0.05-0.1～15s (0.1s step)	
	Reverse power	Operation value	LOCK-Rated current (5A)×0.2～30% (0.2～1%:0.1% step,1～30%:1% step)	
		Operation time	0.05-0.1～15s (0.1s step)	
	Over frequency	Operation value	[Rated frequency:50Hz] LOCK-50.5～55Hz (0.1Hz step), [Rated frequency:60Hz] LOCK-60.5～65Hz (0.1Hz step)	
		Operation time	0.05-0.1～15s (0.1s step)	
	Under power	Operation value	LOCK-Rated current (5A)×1～30% (1% step)	
		Operation time	0.05-0.1～15s (0.1s step)	
		Open circuit detecting function lock	OFF-ON (Set ON in case of open circuit detecting function lock)	
	Lock at uninterconnected condition		0～10s (0.1s step)	
	Islanding detection (df/dt)	Operation value	-	LOCK-0.025～2Hz/s (0.025Hz/s step)
		Operation time	-	0.2～1s (0.1s step)
	Output contact configuration		Refer to the external connection diagram/Auto reset for all contacts (Default setting at ex-works)	
	Operation indicator LED hold		All LED self-hold (Default setting at ex-works)	
	CT primary		5-10-12-12.5-15-20-25-30-40-50-60-75-80-100-120-125-150-200-250-300-400-500-600-750-800-1000-1200-1250-1500-2000-2500-3000-4000-5000-6000-7500-8000[A]	
	VT primary		100～999V (1V step)、1000～9990V (10V step)、10.0k～99.9kV (0.1kV step)、100k～300kV (1kV step)	
	VT secondary		100/√3-110/√3-115/√3-120/√3-100-110-115-120V	
	EVT primary		100～999V (1V step),1000～9990V (10V step), 10.0k～99.9kV (0.1kV step),100k～300kV (1kV step)	
	EVT tertiary		100-110-115-120-100√3-110√3-115√3-120√3V	
Display	Real time measurement		Phase current×3, voltage, Zero-phase voltage, Active power, Reverse power, Power factor, Frequency	
	Max.record		Phase current×3, voltage, Zero-phase voltage, Active power, Reverse power	
	Fault record (operation value)		Phase current×3, voltage, Zero-phase voltage, Active power, Reverse power, Power factor, Frequency	
	Fault record (operation item)		Record and indicate the operated elements.	
	Self-diagnosis		Normal result:On the RUN LED (green)・Status indication item No.400=No display. Abnormal result:Off the RUN LED・Status indication item No.400=Display defects code	
Forced operation			Each output contact	
Communication	Direct communication port		Standard equipment (PC software for Direct communication:Option)	
	Remote communication port		Option (For CC-LINK or MODBUS)	
Burden (at rating)			Phase current circuit:Less than 0.5VA, voltage circuit:Less than 1.0VA, Zero-phase voltage circuit:Less than 1.5VA Auxiliary power supply circuit:at DC100V=Approx. 6W, at AC100V=Approx. 12VA, at DC220V=Approx. 6W, at AC220V=Approx. 14VA (In case of installing communication card, add 2 VA.)	
Mass			Net weight of relay unit:Approx.3.5kg, Including case:Approx.4.5kg	
Sample of external connection diagram			Fig.6-1	
Remarks			The island detection facility is available for CPP1-A11D2 and not available for type CPP1-A01D2	

※Please refer to the instruction manual regarding the details on this specification.

Characteristics

Items		Condition	Guaranteed performance
Operation value	Earth fault over voltage element	(Common condition) ※1	Setting value ±5%
	Over voltage element		
	Under voltage element		
	Phase fault directional element (L,H element)	Input voltage: Rated voltage Phase of current: Maximum sensitive angle (Set UV element for the NO USE position)	
	Phase fault directional element (U,V element)	(Common condition) ※1	
	Under frequency element	Input voltage: Rated voltage	Setting value ±0.05Hz
	Reverse power element	Input voltage: Rated voltage Phase of current: Maximum sensitive angle	·For 0.2～0.5% setting: Setting value±1.5mA ·For 0.6～0.9% setting: Setting value±7% ·For another setting: Setting value±5%
	Over frequency element	Input voltage: Rated voltage	Setting value ±0.05Hz
	Under power element	Input voltage: Rated voltage Phase of current: Maximum sensitive angle	Setting value ±5%
	Islanding detection element (CPP1-A11D2)	Input voltage: Rated voltage Change frequency quickly from rated frequency In case of operation time setting is 1s, frequency should be swept.	[Value for full operation] Setting value: ±0.0125Hz/s
Reset value	Earth fault over voltage element	(Common condition) ※1	operation value×95% or more
	Over voltage element		operation value×95% or more
	Under voltage element		operation value×105% or less
	Phase fault directional element (L,H element)	Input voltage: Rated voltage Phase of current: Maximum sensitive angle (Set UV element for the NO USE position)	operation value×95% or more
	Phase fault directional element (U,V element)	(Common condition) ※1	operation value×105% or less
	Under frequency element	Input voltage: Rated voltage	Difference between operation value and reset value is ±0.05Hz or less
	Reverse power element	Input voltage: Rated voltage Phase of current: Maximum sensitive angle	·For 0.2～0.5% setting: Operation value×80% or more ·For 0.6～0.9% setting: Operation value×93% or more ·For another setting: Operation value×95% or more
	Over frequency element	Input voltage: Rated voltage	Difference between operation value and reset value is ±0.05Hz or less
	Under power element	Input voltage: Rated voltage Phase of current: Maximum sensitive angle	operation value×105% or less
Operation time	Earth fault over voltage element	Operation setting value: Minimum Input: 0→Operation setting value×150%	Setting value ±20ms or ±5% whichever is greater
	Over voltage element	Operation setting value: Minimum Input: 0→Operation setting value×120%	
	Under voltage element	Operation setting value: 100V Input: rated voltage→operation setting value×70%	
	Phase fault directional element (L,H element)	Operation setting value: minimum, UV setting for DS: NO USE Input voltage: Rated voltage Input current: 0→setting value×200% Phase of current: Maximum sensitive angle	
	Under frequency element	Operation setting value: Minimum Input voltage: Rated voltage Frequency: Rated frequency→ setting value−1Hz with moving down rate df/dt=5Hz/s	
	Reverse power element	Operation setting value: Minimum Input voltage: Rated voltage Input current: 0→setting value×200% Phase of current: Maximum sensitive angle	
	Over frequency element	Operation setting value: Minimum Input voltage: Rated voltage Frequency: Rated frequency→ setting value+1Hz with moving up rate df/dt=5Hz/s	
	Under power element	Operation setting value: Maximum Input voltage: Rated voltage Input current: setting value×200%→0 Phase of current: Maximum sensitive angle	

※1 Common condition:(1)Rating Frequency (2)Ambient temperature:20℃ (3)Auxiliary power supply: Rating voltage

Items		Condition	Guaranteed performance
Operation time	Islanding detection element (CPP1-A11D2)	Operation setting value: Minimum Input voltage: Rated voltage Frequency:Rated frequency→ Rated frequency+setting value×(±500%) Change abruptly at the same phase.	Setting value: ±40ms
Lock reset time of lock function at un-interconnected condition		DI input voltage: Rated voltage→0 Measuring the time between contact open status→close status.	Setting value ±50ms or ±5% whichever is greater
Reset time	Earth fault over voltage element	Operation setting value: Minimum Input: Operation setting value×150%→0	200ms±20ms
	Over voltage element	Operation setting value: Minimum Input: Operation setting value×120%→0	
	Under voltage element	Operation setting value: 100V Input: operation setting value×70%→rated voltage	
	Phase fault directional element (L,H element)	Operation setting value: minimum, UV setting for DS: NO USE Input voltage: Rated voltage Input current: setting value×200%→0 Phase of current: Maximum sensitive angle	
	Under frequency element	Operation setting value: Minimum Input voltage: Rated voltage Frequency: setting value+1Hz→ Rated frequency with moving up rate df/dt=5Hz/s	
	Reverse power element	Operation setting value: Minimum Input voltage: Rated voltage Input current: setting value×200%→0 Phase of current: Maximum sensitive angle	
	Over frequency element	Operation setting value: Minimum Input voltage: Rated voltage Frequency: setting value−1Hz→ Rated frequency with moving down rate df/dt=5Hz/s	
	Under-power element	Operation setting value: Maximum Input voltage: Rated voltage Input current: 0→setting value×300% Phase of current: Maximum sensitive angle	
Output contact latching time	Islanding detection element (CPP1-A11D2)	(Common condition)※1	
Phase characteristic	Phase fault directional element (L,H element)	Input voltage: Rated voltage Input current: setting value×200% USE UV setting for DS: NO USE	
	Reverse power element	Input voltage: Rated voltage Input current: setting value×200%	
	Under power element	Input voltage: Rated voltage Input current: setting value×200%	

※1 Common condition:(1)Rating Frequency (2)Ambient temperature:20℃ (3)Auxiliary power supply: Rating voltage

Precaution for application

1. Guarantee against interruption of AC power supply
   When an uninterruptible AC power source is not available in your system for the auxiliary power supply, use the type B-T1 AC/DC converter or commercially available uninterruptible power supply (UPS: MITSUBISHI ELECTRIC CORPORATION FW-A series or FW-V series). In addition, possible duration of the power supply type B-T1 AC/DC converter is confirmed as about 2 seconds in combination with one MELPRO-D series relay. Therefore, in the case that the required duration of power supply after power source loss exceeds 2 seconds, please use a suitable commercial uninterruptible power supply. When power supply back up for the circuit breaker is required, it is necessary to prepare the power supply independent from the type B-T1 AC/DC converter.
2. Inrush current of power supply
   Since inrush current (about 2ms duration) as below may flow into the relay when the power supply is turned on, please make a consideration on this regard for selection of power circuit breaker.

Input voltage	Inrush current Ip
DC110V	Approx. 20A
DC220V	Approx. 55A
AC100V	Approx. 25A
AC220V	Approx. 65A

3. Trip circuit
   Only the dedicated contacts can be used for the circuit breaker trip circuit. Please keep in mind that the contacts for signaling can not be used for the trip circuit. (If used, the contact may burn). Also, connect the pallet contact (52a) of the circuit breaker to the trip coil circuit in series.
4. Self-diagnosis output circuit
   The self-diagnosis output contact is so configured that the auxiliary relay is energized (" break contact" opened) when normal result of self-diagnosis is received. This type of contact will allow the relay to output abnormal result even after the built-in power failures. Therefore, the "break contact" is still closed in the aftermath of the power applying and will be opened after 50ms. If the auxiliary power of the relay and the self-diagnosis output contact feed from a same power source, the "break contact" will be closed temporarily after auxiliary power supply is turned on. In this 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-delay timer.
5. Grounding circuit
   Be sure to make a wiring to the earth terminal located on the back of the relay according to the Class D earth wiring method (Grounding resistance should be less than 100 ohm).
6. CC-Link communication circuit
   Please include the communication card into your purchasing order in case of the application of the communication facility as the card necessary for communication (CC-Link) is option. In case of retrofit existing relay with communication card, please inform the followings of existing relay. a:Type, b:Style number, c:Manufacturing year, d:Serial number, e:Date of stamp on the checking seal (The above mentioned items a.~d. are indicated on the bottom right of front face of the relay and item e. is indicated on the upper of back side of the relay.) The version number of CC-Link is 1.00.
7. Improvement of reliability of protection system
   For the important facilities, multiplex system such as dual should be provided to improve reliability.
8. 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 surge absorbers.
9. Lock at un-interconnected condition (Terminal number "E-01", "E-03")
   Operation of each element (DS, RP, UF, OF, UP and df/dt) are locked for the determined time after interconnection (set by the timer element of un-interconnected condition) in order to prevent unnecessary operations due to the power fluctuation. The lock condition will be released in the determined time.
10. The DI input of un-interconnected condition (Terminal number "E-01", "E-03") has a polarity. Therefore, please pay attention to polarity as the DI input can not be detected properly due to the wrong connection of DI circuit.
11. Make a wiring between EVT "a" terminal and "A-12" terminal of relay and EVT "f" terminal and "A-11" terminal of relay. Also, the grounding of EVT tertiary circuit has to be configured by the wiring between "f" terminal of EVT and earth terminal.

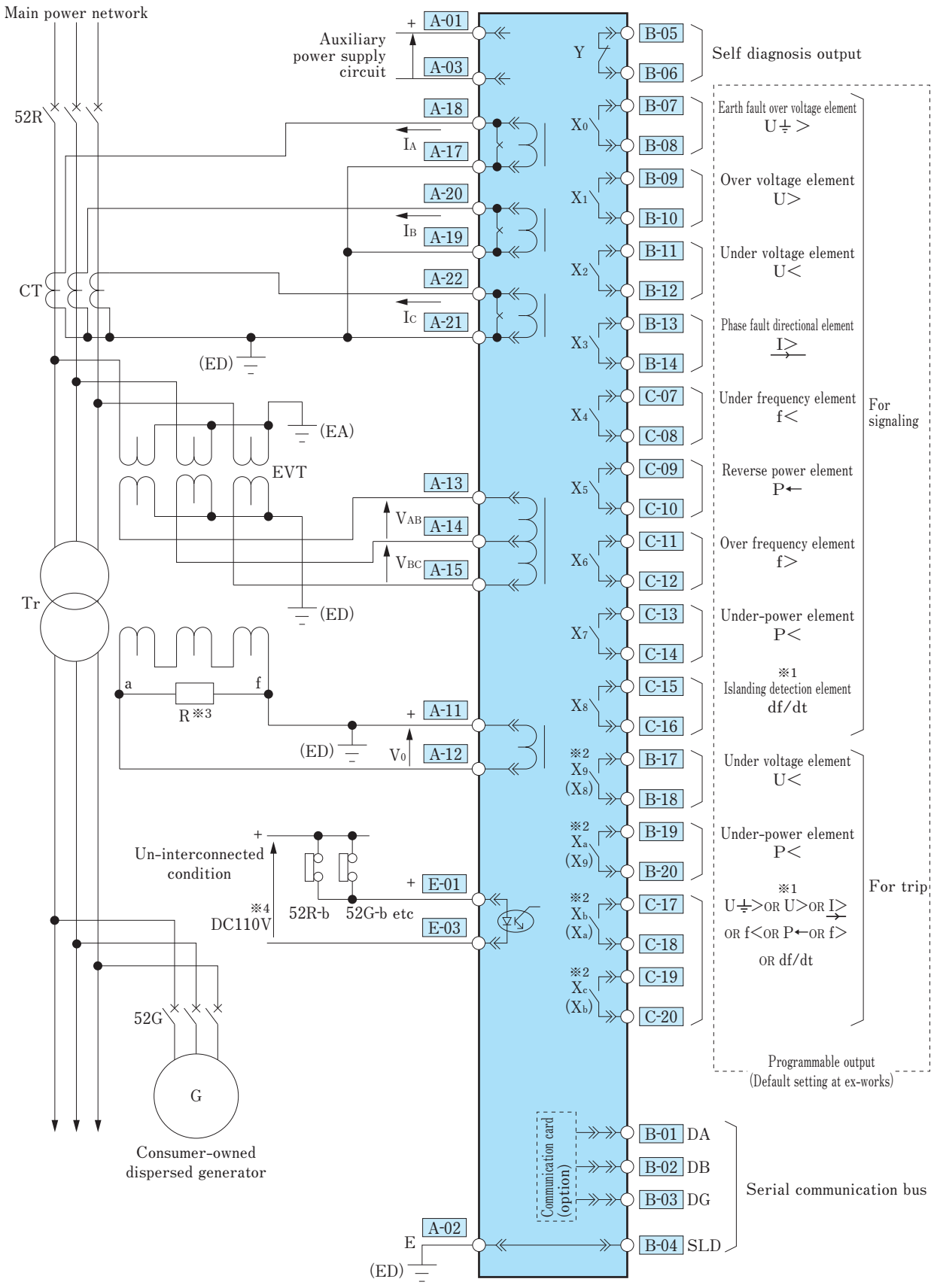
Precaution for using

1. When the product is shipped from the factory, each setting value is "LOCK" (for element with LOCK position) or "minimum setting value" (for element without LOCK position)
2. To set as [LOCK] position means to set the element out of use.
3. The setting of measuring transformer ratio is applied only for the measuring indication converted to the primary side, and is not applied for protection element.
4. The EVT tertiary voltage ratio should be set as output nominal voltage between terminal "a" and "f" of EVT. Example: 190/3⇒190V, 110/3⇒110V
5. The UV test function (item No. 533) will be used for single phase test for under voltage element. (UV test LED will turn on during selecting UV TEST). UV TEST should be set as OFF in the operational condition.
6. The DS test function (item No. 546) will be used for single phase test for the phase fault directional element. (DS test LED will turn on during selecting DS TEST). DS TEST should be set as OFF in the operational condition.
7. The 67P and 91L elements detect 3 phases active power($\sqrt{3}EI\cos\theta$). 100% of 3 phases power equal to that when nominal voltage (110V) and nominal current (5A) are impressed.
8. The 95L and 95H elements are locked in case of input voltage being less than 35V for failsafe purpose.

Precaution for safety

Please refer to page2 and 3 regarding the safty information and request when placing order.

Sample of external connection diagram



※1 The island detection facility is not available for CPP1-A01D2.
※2 The output contact device number for CPP1-A01D2 is the number inside the parentheses.
※3 A resistance is necessary for the isolated neutral system.
※4 The application voltage for terminal E-01, E-03 in case that the supplied auxiliary power voltage is 24V.

Fig.6-1 CPP1-A01D2, CPP1-A11D2

The connection diagram shows concepts of the wiring only. Therefore, please note that there will have some difference between the connection diagram and actual installation status of CT,VT and safety devices such as fuse, etc.

Type, rating and specification

Type name			CGP1-A01D2	CGP1-A03D2
Rating	Phase current		5A	
	Line voltage		57～120V	
	Zero-phase voltage		100～208V	-
	Photo coupler input voltage		DC110V (Permissible variable range 77～143V) or DC24V (Permissible variable range DC19.2V～31.2V)	
			Input voltage 24V is applicable only for the case that auxiliary power supply voltage is 24V. In any other cases, only DC110V is applicable as for photo coupler input voltage.	
	Frequency		50Hz or 60Hz	
Protective element			50/51 (2phases),46,84,59,27 (3phases),95L,95H,67P (3phases),67G,64	50/51 (3phases),46,84,59,27 (3phases),95L,95H,67P (3phases),51G
Combined instrument transformer	Zero phase current		Commercially available ZCT (Conformity with JEC-1201 200/1.5mA)	-
	Zero-phase voltage		Commercially available EVT (Conformity with JEC-1201)	
Setting	IG Generator rating current		2.5～5A (0.1A step)	
	Overcurrent time-delayed	Operation current	LOCK-IG×100～120% (1% step)	
		Operation time multiplier	0.25-0.5～10 (0.5 step)	
		Operation time characteristics	NI (Normal inverse time-delayed): $t=\frac{0.14}{I^{0.02}-1}\times\frac{M}{10}(s)$ EI (Extremely inverse time-delayed): $t=\frac{150}{I^{2}-1}\times\frac{M}{10}(s)$ DT (Definite time-delayed): $t=2\times\frac{M}{10}(s)$ t:Operation time (s) I:Multiple of input current against setting value (IG×100%～120%) M:Operation time multiplier (times)	
	Overcurrent instantaneous	Operation current	LOCK-IG×100%～1200% (50% step)	
		Operation time	INST-0.1～0.5s (0.1s step)	
	Unbalance current 1	Operation current	LOCK-IG×5%～30% (1% step)	
		Operation time multiplier	5～50 (1 step)	
		Operation time characteristics	$t=\frac{M}{I_2^2}(s)$ t:Operation time (s) I2:Multiple of input negative sequence current against IG M:Operation time multiplier (times)	
	Unbalance current 2	Operation current	LOCK-IG×5%～30% (1% step)	
		Operation time	1-10s (0.1s step)	
	Voltage detecting	Operation	LOCK-80～110V (1V step)	
		Operation time	0.5～10s (0.1s step)	
	Over voltage	Operation	LOCK-110～155V (1V step)	
		Operation time	0.1～10s (0.1s step)	
	Under voltage	Operation	LOCK-20～110V (1V step)	
		Operation time	0.1～10s (0.1s step)	
	Under frequency	Operation	[Rating:50Hz] LOCK-49.5Hz～45Hz (0.1Hz step), [Rating:60Hz] LOCK-59.5～55Hz (0.1Hz)	
		Operation time	0.1～10s (0.1s step)	
	Over frequency	Operation	[Rating:50Hz] LOCK-50.5Hz～55Hz (0.1Hz step), [Rating:60Hz] LOCK-60.5～65Hz (0.1Hz)	
		Operation time	0.1～10s (0.1s step)	
	Reverse power	Operation	LOCK-IG×0.5-1～30% (1% step)	
		Operation time	0.1～20s (0.1s step)	
	Earth fault directional	Operation current (I0)	1～10mA (ZCT secondary) (0.5mA step)	-
		Operation (V0)	LOCK-5～60V (1V step)	-
		Operation time	INST-0.1～10s (0.1s step)	-
		Maximum sensitive angle	Lead 0°～90° (5° step)	-
	Earth fault over voltage	Operation	LOCK-5～60V (1V step)	-
		Operation time	0.1～20s (0.1s step)	-
	Earth fault overcurrent	Operation	-	LOCK-0.1～2.0A (0.1A step)
		Operation time	-	INST-0.1～0.5s (0.1s step)
	Output contact configuration		Refer to the external connection diagram/Auto reset for all contacts (Default setting at ex-works)	
	Operation indicator LED hold		All LED self-hold (Default setting at ex-works)	
	CT primary		5-10-12-12.5-15-20-25-30-40-50-60-75-80-100-120-125-150-200-250-300-400-500-600-750-800-1000-1200-1250-1500-2000-2500-3000-4000-5000-6000-7500-8000[A]	
	VT primary		100～999V (1V step)、1000～9990V (10V step)、10.0k～99.9kV (0.1kV step)、100k～300kV (1kV step)	
	VT secondary		100/√3-110/√3-115/√3-120/√3-100-110-115-120V	
	EVT primary		100～999V (1V step),1000～9990V (10V step), 10.0k～99.9kV (1kV step),100k～300kV (1kV step)	-
	EVT tertiary		100-110-115-120-100√3-110√3-115√3-120√3V	-
	ZCT error correction on/off		OFF-ON	-
	ZCT error adjustment		When the actual measured transforming ratio is within range of 200/1.5～4.1mA, the deviation from the ZCT nominal transforming ratio 200/1.5mA can be corrected.	-
Display	Real time measurement		Phase current×3, voltage, Zero-phase voltage#, Active power, Reverse power, Power factor, Frequency	
	Max.record		Phase current×3, voltage, Zero-phase voltage#, Active power, Reverse power	
	Fault record (operation value)		Phase current×3, voltage, Zero-phase voltage#, Active power, Reverse power, Power factor, Frequency	
	Fault record (operation item)		Record and indicate the operated elements.	
	Self-diagnosis		Normal result:On the RUN LED (green)・Status indication item No.400=No display. Abnormal result:Off the RUN LED・Status indication item No.400=Display defects code	
Forced operation			Each output contact	
Communication	Direct communication port		Standard equipment (PC software for Direct communication:Option)	
	Remote communication port		Option (For CC-LINK or MODBUS)	
Burden (at rating)			Phase current circuit:Less than 0.5VA, Voltage circuit:Less than 1.0VA, Zero-phase voltage circuit:Less than 0.15VA (A01 type) Zero-phase current circuit: Less than 10Ω (A01 type) Auxiliary power supply circuit:at DC100V=Approx. 6W, at AC100V=Approx. 12VA, at DC220V=Approx. 6W, at AC220V=Approx. 14VA (In case of installing communication card, add 2 VA.)	
Mass			Net weight of relay unit:Approx. 3.5kg, Including case:Approx. 4.5kg	
Sample of external connection diagram			Fig.7-1	Fig.7-2

※Please refer to the instruction manual regarding the details on this specification.
Not applicable for CGP1-A03D2

Characteristics

Items		Condition		Guaranteed performance
Operation value	Overcurrent time-delayed element	(Common condition) ※1		Setting value ±5%
	Overcurrent instantaneous element			Setting value ±10%
	Unbalance current element 1	Negative sequence current		Setting value ±5%
	Unbalance current element 2			
	Voltage detecting element	(Common condition) ※1		
	Over voltage element			
	Under voltage element			
	Under frequency element	Input voltage: Rated voltage		Setting value ±0.05Hz
	Over frequency element	Input voltage: Rated voltage		
	Reverse power element	Input voltage: Rated voltage Phase of current: Maximum sensitive angle		·0.5, 1～3% setting: Setting value±5mA ·For another setting: setting value ±5%
	Earth fault directional element (CGP1-A01D2)	Zero phase current	Setting: Zero phase voltage: minimum Input: Zero phase voltage=rated voltage×30% Phase: maximum sensitive angle	·1.0 and 1.5mA setting: setting value±10% ·For another setting: setting value ±5%
		Zero phase voltage	Setting: Zero phase current: minimum Input: Zero phase current=setting value×1000% Phase: maximum sensitive angle	Setting value ±5%
	Earth fault overcurrent (CGP1-A03D2)	(Common condition) ※1		Setting value ±5%
	Earth fault over voltage element (CGP1-A01D2)	(Common condition) ※1		Setting value ±5%
Reset value	Overcurrent time-delayed element	(Common condition) ※1		Setting value×95% or more
	Overcurrent instantaneous element			
	Unbalance current element 1	Negative sequence current		
	Unbalance current element 2			
	Voltage detecting element	(Common condition) ※1		
	Over voltage element			
	Under voltage element			Setting value×105% or less
	Under frequency element	Input voltage: Rated voltage		Difference between operation value and reset value is ±0.05Hz or less
	Over frequency element	Input voltage: Rated voltage		
	Reverse power element	Input voltage: Rated voltage Phase of current: Maximum sensitive angle		·0.5, 1～3% setting: operation value×80% or more ·For another setting: setting value×95% or more
	Earth fault directional element (CGP1-A01D2)	Zero phase current	Setting: Zero phase voltage: minimum Input: Zero phase voltage=rated voltage×30% Phase: maximum sensitive angle	Operation value×90% or more
		Zero phase voltage	Setting: Zero phase current: minimum Input: Zero phase current=setting value×1000% Phase: maximum sensitive angle	
	Earth fault overcurrent (CGP1-A03D2)	(Common condition) ※1		Setting value×95% or more
	Earth fault over voltage element (CGP1-A01D2)	(Common condition) ※1		Setting value×95% or more
Operation time	Overcurrent time-delayed element	Operation setting value: minimum Operation time multiplier: 10 Input: 0→setting value×300.500.1000%		·NI,EI Input: 300%: nominal value±12% or less Input: 500%: nominal value±12% or less Input: 1000%: nominal value±7% or less ·DT Nominal value±5% or less
		NI (Normal inverse time delayed characteristics)	$t=\frac{0.14}{I^{0.02}-1}\times\frac{M}{10}(s)$	
		EI (Extremely inverse time-delayed characteristic)	$t=\frac{150}{I^{2}-1}\times\frac{M}{10}(s)$	
		DT (Definite time-delayed characteristic)	$t=2\times\frac{M}{10}(s)$	
		t: operation time(s) I: Multiple of input current against operation value (Ig×100～120%) M: Operation time multiplier (times)		
	Overcurrent instantaneous element	Operation setting value: minimum Input: 0→200% of setting value		Setting value±25ms or less and at the time of INST setting: 40ms or less
	Unbalance current element 1	Operation setting value: minimum Operation time multiplier: 10 Input: 0→30,50,100% of Generator rated current Ig		Input: 300%: nominal value±20% or less Input: 500%: nominal value±15% or less Input: 1000%: nominal value±10% or less
		$t=\frac{M}{I_2^2}(s)$	t: operation time(s) I2: Multiple of input negative sequence current against Ig M: Operation time multiplier (times)	
	Unbalance current element 2	Setting: minimum Input: negative sequence current=0→setting value×200%		Setting value ±5% or less
	Voltage detecting element	Operation setting value: minimum Input: 0→operation setting value×120%		0.1～0.5s setting: setting value±25ms or less For 0.6～10s setting: Within setting value±5%
	Over voltage element			
	Under voltage element	Operation setting value: 100V Input: rated voltage→operation setting value×70%		

※1 Common condition:(1) Rating Frequency (2) Ambient temperature:20℃ (3) Auxiliary power supply: Rating voltage

<table>
<tr><th colspan="2">Items</th><th>Condition</th><th>Guaranteed performance</th></tr>
<tr><td rowspan="6">Operation time</td><td>Under frequency element</td><td>Operation setting value: minimum
Input voltage: Rated voltage
Frequency: Rated frequency→setting value−1Hz with moving down rate df/dt=5Hz/s</td><td rowspan="3">0.1～0.5s setting: setting value±25ms or less
For 0.6～10s setting: Within setting value±5%</td></tr>
<tr><td>Over frequency element</td><td>Operation setting value: maximum
Input voltage: Rated voltage
Frequency: Rated frequency→setting value+1Hz with moving up rate df/dt=5Hz/s</td></tr>
<tr><td>Reverse power element</td><td>Operation setting value: minimum
Input voltage: Rated voltage
Input current: 0→setting value×200%
Phase of current: Maximum sensitive angle</td></tr>
<tr><td>Earth fault directional element (CGP1-A01D2)</td><td>Setting: Zero phase current, voltage=minimum
Input: Zero phase current=0→setting value×1000%
Zero phase voltage=0→rated voltage×30%
Phase: maximum sensitive angle</td><td><table><tr><th>Setting / Input</th><th>Inst</th><th>0.1～0.4s</th><th>0.5～10s</th></tr><tr><td>130%</td><td>80ms or less</td><td>Setting value±40ms</td><td>Setting value±10%</td></tr><tr><td>400%</td><td>80ms or less</td><td>Setting value±20ms</td><td>Setting value±5%</td></tr></table></td></tr>
<tr><td>Earth fault overcurrent element (CGP1-A03D2)</td><td>Operation setting value: minimum
Input: Zero phase current=0→setting value×1000%</td><td>Within setting value ±25ms</td></tr>
<tr><td>Earth fault over voltage element (CGP1-A01D2)</td><td>Operation setting value: minimum
Input: Operation setting value×150%</td><td>0.1～0.5s setting: setting value±25ms or less
For 0.6～10s setting: Within setting value±5%</td></tr>
<tr><td rowspan="11">Reset time</td><td>Overcurrent time-delayed element</td><td rowspan="2">Operation setting value: minimum
Input: Operation setting value×300%→0</td><td rowspan="11">200ms±25ms</td></tr>
<tr><td>Overcurrent instantaneous element</td></tr>
<tr><td>Unbalance current element 1</td><td>Setting: minimum</td></tr>
<tr><td>Unbalance current element 2</td><td>Input: negative sequence current=setting value×300%→0A</td></tr>
<tr><td>Voltage detecting element</td><td>Operation setting value: minimum</td></tr>
<tr><td>Over voltage element</td><td>Input: Operation setting value×120%→0</td></tr>
<tr><td>Under voltage element</td><td>Operation setting value: 100V
Input: Operation setting value×70%→rated voltage</td></tr>
<tr><td>Under frequency element</td><td>Operation setting value: minimum
Input voltage: Rated voltage
Frequency: Setting value−1Hz→rated frequency with moving up rate ,df/dt=5Hz/s</td></tr>
<tr><td>Over frequency element</td><td>Operation setting value: maximum
Input voltage: Rated voltage
Frequency: Setting value+1Hz→rated frequency with moving down rate ,df/dt=5Hz/s</td></tr>
<tr><td>Reverse power element</td><td>Operation setting value: minimum
Input voltage: Rated voltage
Input current: setting value×200%→0
Phase of current: Maximum sensitive angle</td></tr>
<tr><td>Earth fault directional element (CGP1-A01D2)</td><td>Setting: Zero phase current, voltage=minimum
Input: Zero phase current=setting value×1000%→0
Zero phase voltage=rated voltage×30%→0
Phase: maximum sensitive angle</td></tr>
<tr><td>Earth fault overcurrent element (CGP1-A03D2)</td><td>Operation setting value: minimum
Input: Zero phase current=setting value×1000%→0</td></tr>
<tr><td>Earth fault over voltage element (CGP1-A01D2)</td><td>Operation setting value: minimum
Input: operation setting value×150%→0</td></tr>
<tr><td rowspan="2">Phase characteristic</td><td>Reverse power element</td><td>Input voltage: Rated voltage
Current input: setting value×200%</td><td>Maximum sensitive angle=0°±5°</td></tr>
<tr><td>Earth fault directional element (CGP1-A01D2)</td><td>Setting: Zero phase current, voltage=minimum
Input: Zero phase current=setting value×1000%
Zero phase voltage=rated voltage×30%</td><td>Maximum sensitive angle±5°</td></tr>
<tr><td rowspan="2">Overshoot characteristic</td><td>Overcurrent time-delayed element</td><td>Settings: Time-delayed operation value=minimum,
operation time multiplier=10,
operation characteristic=all characteristics
Current input: 0A →setting value×1000%</td><td rowspan="2">No-operation limit time/operation time=90% or more</td></tr>
<tr><td>Unbalance current element 1</td><td>Settings: Time-delayed operation value=minimum,
operation time multiplier=10
Current input: 0A →setting value×1000%</td></tr>
</table>

Precaution for application

1. Guarantee against interruption of AC power supply
   When an uninterruptible AC power source is not available in your system for the auxiliary power supply, use the type B-T1 AC/DC converter or commercially available uninterruptible power supply (UPS: MITSUBISHI ELECTRIC CORPORATION FW-A series or FW-V series). In addition, possible duration of the power supply type B-T1 AC/DC converter is confirmed as about 2 seconds in combination with one MELPRO-D series relay. Therefore, in the case that the required duration of power supply after power source loss exceeds 2 seconds, please use a suitable commercial uninterruptible power supply. When power supply back up for the circuit breaker is required, it is necessary to prepare the power supply independent from the type B-T1 AC/DC converter.
2. Inrush current of power supply
   Since inrush current (about 2ms duration) as below may flow into the relay when the power supply is turned on, please make a consideration on this regard for selection of power circuit breaker.

Input voltage	Inrush current Ip
DC110V	Approx. 20A
DC220V	Approx. 55A
AC100V	Approx. 25A
AC220V	Approx. 65A

3. Trip circuit
   Only the dedicated contacts can be used for the circuit breaker trip circuit. Please keep in mind that the contacts for signaling can not be used for the trip circuit. (If used, the contact may burn). Also, connect the pallet contact (52a) of the circuit breaker to the trip coil circuit in series.
4. Self-diagnosis output circuit
   The self-diagnosis output contact is so configured that the auxiliary relay is energized ("break contact" opened) when normal result of self-diagnosis is received. This type of contact will allow the relay to output abnormal result even after the built-in power failures. Therefore, the "break contact" is still closed in the aftermath of the power applying and will be opened after 50ms. If the auxiliary power of the relay and the self-diagnosis output contact feed from a same power source, the "break contact" will be closed temporarily after auxiliary power supply is turned on. In this 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-delay timer.
5. Grounding circuit
   Be sure to make a wiring to the earth terminal located on the back of the relay according to the Class D earth wiring method (Grounding resistance should be less than 100 ohm).
6. CC-Link communication circuit
   Please include the communication card into your purchasing order in case of the application of the communication facility as the card necessary for communication (CC-Link) is option. In case of retrofit existing relay with communication card, please inform the followings of existing relay. a:Type, b:Style number, c:Manufacturing year, d:Serial number, e:Date of stamp on the checking seal (The above mentioned items a.~d. are indicated on the bottom right of front face of the relay and item e. is indicated on the upper of back side of the relay.) The version number of CC-Link is 1.00.
7. Improvement of reliability of protection system
   For the important facilities, multiplex system such as dual should be provided to improve reliability.
8. 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 surge absorbers.
9. Make a wiring between EVT "a" terminal and "A-10" terminal of relay and EVT "f" terminal and "A-09" terminal of relay. Also, the grounding of EVT tertiary circuit has to be configured by the wiring between "f" terminal of EVT and earth terminal. Any other wiring than above will not realize the correct detection on the earth fault directional.
10. Lock function by external control input
    Two DI circuits are installed for the interlock by external control signals, and a relay element can be locked by DI input. Moreover, the relay element locked at the time of DI input arising can be set up to each DI circuit.
11. A commercially available ZCT conformity with JEC1201 (type BZ in case of MITSUBISHI ELECTRIC CORPORATION) may be applicable for the type CGP1-A01D2.
12. Only one number of ZCT can be connected to one number of the type CGP1-A01D2. Correct operation of the relay can not be guaranteed against two or more numbers of ZCT to connect to one number of the type CGP1-A01D2.
13. It is possible to use the type CGP1-A03 as the phase over current protection provided with two phases. However, residual connection of 2 phases can not be applied to the earth fault over current element. The residual connection of 3 phases only can be applied to the earth fault over current element. In case of only two phase CTs being available for phase over current protection, ZCT or one more CT is needed for earth fault over current element. Also. The unbalance current elements are not operated properly by the CT circuits provide with two phases. Therefore, please make a setting of unbalance current elements as LOCK position.
14. The DI input for interlock (Terminal number "E-01", "E-03" and "E-02","E-04") has a polarity. Therefore, please pay attention to polarity as the input signals can not be detected properly due to the wrong connection of DI circuit.
15. According to the connection diagram, ZCT terminal "K" is assigned as utility side and terminal "L" is assigned as load (generator) side.
    However, it is possible to assign the ZCT terminal "K" as load (generator) side and the ZCT terminal "L" as utility side. In this case, make a wiring between ZCT secondary terminal "k" and relay terminal "A-16" and between ZCT terminal "l" and relay terminal "A-15". Regarding a CT connection, make wiring as R phase current flows into the terminal "A-18" of relay and T phase current flows into the terminal "A-22" of relay in case of normal operation. Please note allow marks indicated in the connection diagram shows the direction of current in case of faults occurrence in the generator.
16. To prevent the influence from noise or surge, a shielded 2 cores (size is 0.75~1mm2) cable should be used for the connection between ZCT or ZVT and relay and shield wire should be connected to the earth terminal of the relay or the earth terminal located inside of the switchboard. Further more, the go and return burden of the cable should be less than 5 ohms which is almost equal to 100m distance in case of 0.75mm2 .

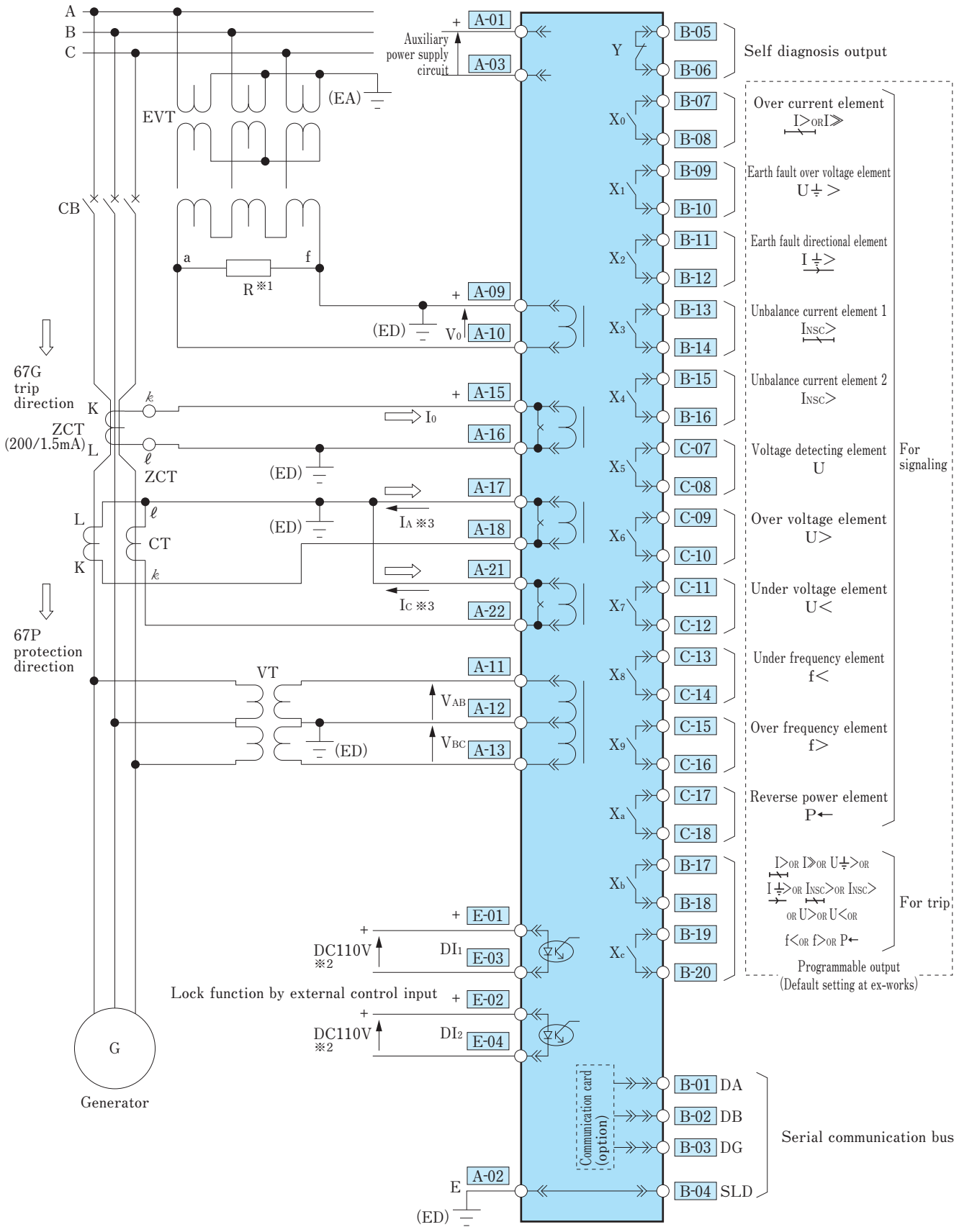
Precaution for using

1. When the product is shipped from the factory, each setting value is "LOCK" (for element with LOCK position) or "minimum setting value" (for element without LOCK position)
2. To set as [LOCK] position means to set the element out of use.
3. The setting of measuring transformer ratio is applied only for the measuring indication converted to the primary side, and is not applied for protection element.
4. The EVT tertiary voltage ratio should be set as output nominal voltage between terminal "a" and "f" of EVT. Example: 190/3⇒190V, 110/3⇒110V
5. The function of the ZCT error correction installed in the relay (CGP1-A01D2 type only, item No. 906,907) is applied for the purpose of correcting ZCT transformation error, so that improving the composite characteristics is achieved. The ZCT error correction range is 200mA/1.5mA~4.1mA(±0~+2.6mA) for the nominal transformation ratio 200mA/1.5mA specified with JEC-1201.
6. The UV test function (item No. 533) will be used for single phase test for under voltage element. (UV test LED will turn on during selecting UV TEST). UV TEST should be set as OFF in the operational condition.
7. The 67P element detect 3 phases active power($\sqrt{3}EI\cos\theta$). 100% of 3 phases power equal to that when nominal voltage (110V) and nominal current (5A) are impressed.
8. The 95L and 95H elements are locked in case of input voltage being less than 35V for failsafe purpose.

Precaution for safety

Please refer to page2 and 3 regarding the safty information and request when placing order.

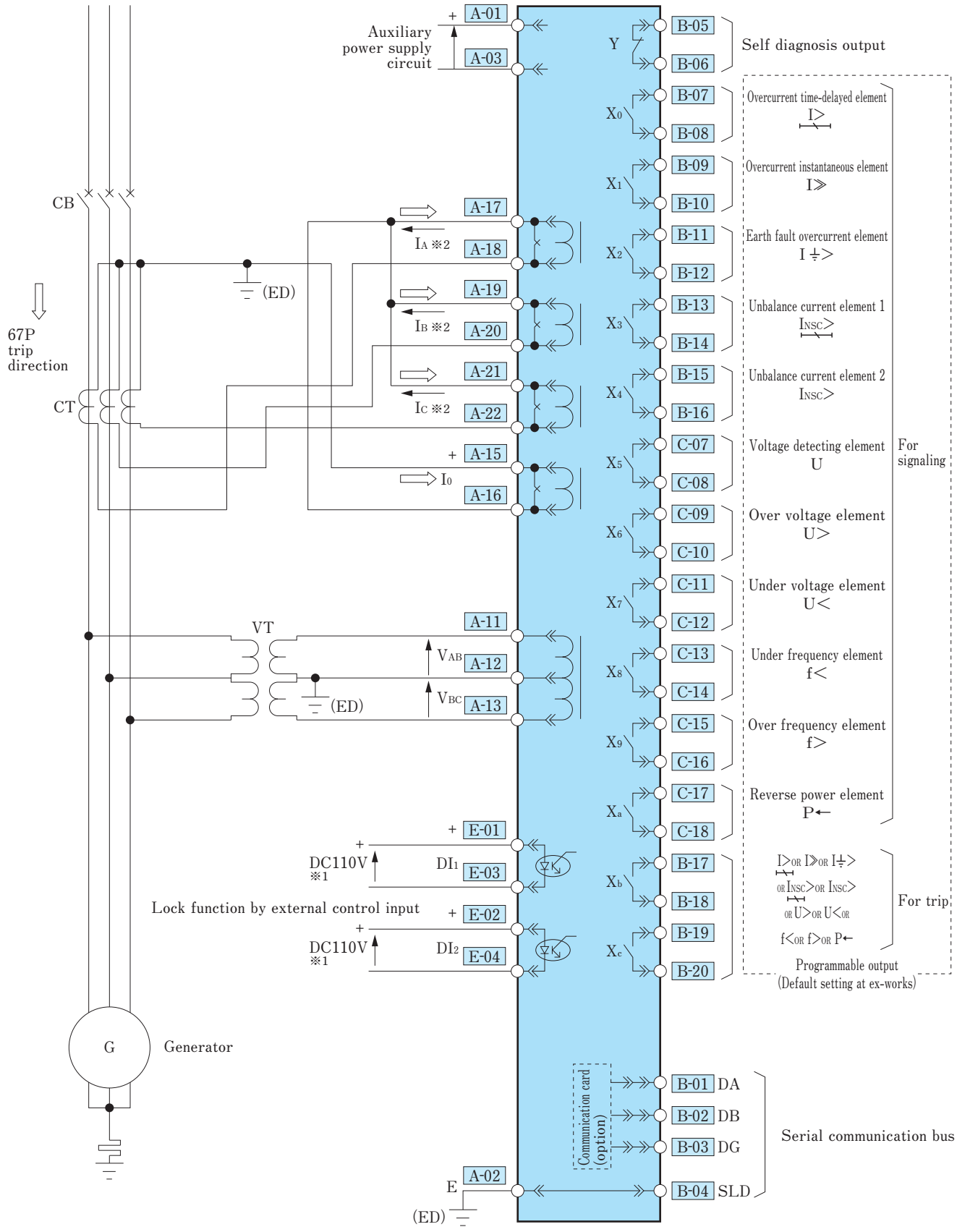
Sample of external connection diagram



※1 A resistance is necessary for the isolated neutral system.
※2 The application voltage for terminal E-01, E-03 and terminal E-02, E-04 is 24V in case that the supplied auxiliary power voltage is 24V.
※3 ⇨ Indicates the direction of current flowing into the generator side during generator failure occurrence.
→ Indicates the direction of current being output from the generator side when the system is healthy.

Fig.7-1 CGP1-A01D2

The connection diagram shows concepts of the wiring only. Therefore, please note that there will have some difference between the connection diagram and actual installation status of CT,VT and safety devices such as fuse, etc.



※1 The application voltage for terminal E-01, E-03 and terminal E-02, E-04 is 24V in case that the supplied auxiliary power voltage is 24V.
※2 ⇨ Indicates the direction of current flowing into the generator side during generator failure occurrence.
→ Indicates the direction of current being output from the generator side when the system is healthy.

Fig.7-2 CGP1-A03D2

The connection diagram shows concepts of the wiring only. Therefore, please note that there will have some difference between the connection diagram and actual installation status of CT,VT and safety devices such as fuse, etc.

Type, rating and specification

Type name			CGP2-A01D2	CGP2-A02D2
Rating	Phase current		5A	
	Line voltage		100～120V	
	Photo coupler input voltage		DC110V (Permissible variable range 77～143V) or DC24V (Permissible variable range DC19.2V～31.2V)	
			Input voltage 24V is applicable only for the case that auxiliary power supply voltage is 24V. In any other cases, only DC110V is applicable as for photo coupler input voltage.	
	Frequency		50Hz or 60Hz	
Protective element			87G (3phases),40	87G (3phases)
Setting	Biased differential	Minimum operation current	LOCK-0.4～1.0A (0.2A step)	
		Bias	10-20% (5% step)	
		Operation time	INST (60ms or less)-0.1～0.5s (0.1s step)	
	Loss of excitation	Impedance ZF	LOCK-5.0～50.0Ω (0.5Ω step)	-
		Impedance ZB	0.4～4.0Ω (0.04Ω step)	-
		Operation time	0.2～10s (0.1s step)	-
	DI lock time		0.1～5.0s (0.1s step)	
	Output contact configuration		Refer to the external connection diagram/Auto reset for all contacts (Default setting at ex-works)	
	Operation indicator LED hold		All LED self-hold (Default setting at ex-works)	
	CT primary		5-10-12-12.5-15-20-25-30-40-50-60-75-80-100-120-125-150-200-250-300-400-500-600-750-800-1000-1200-1250-1500-2000-2500-3000-4000-5000-6000-7500-8000[A]	
	VT primary		100～999V (1V step)、1000～9990V (10V step)、10.0k～99.9kV (0.1kV step)、100k～300kV (1kV step)	-
	VT secondary		100/√3-110/√3-115/√3-120/√3-100-110-115-120V	-
Display	Real time measurement		Phase current×3, Differential current, Line voltage, Phase, Frequency	
	Max.record		Phase current×3, Differential current, Line voltage	
	Fault record (operation value)		Phase current×3, Differential current, Line voltage, Phase	
	Fault record (operation item)		Record and indicate the operated elements.	
	Self-diagnosis		Normal result:On the RUN LED (green) ･Status indication item No.400=No display. Abnormal result:Off the RUN LED･Status indication item No.400=Display defects code	
Forced operation			Each output contact	
Communication	Direct communication port		Standard equipment (PC software for Direct communication:Option)	
	Remote communication port		Option (For CC-LINK or MODBUS)	
Burden (at rating)			Phase current circuit:Less than 0.5VA, Voltage circuit:Less than 1.0VA, Auxiliary power supply circuit: at DC100V=Approx. 6W, at AC100V=Approx. 12VA, at DC220V=Approx. 6W, at AC220V=Approx. 14VA (In case of installing communication card, add 2 VA.)	Phase current circuit:Less than 0.5VA, Auxiliary power supply circuit: at DC100V=Approx. 6W, at AC100V=Approx. 12VA, at DC220V=Approx. 6W, at AC220V=Approx. 14VA (In case of installing communication card, add 2 VA.)
Mass			Net weight of relay unit:Approx. 3.5kg, Including case:Approx. 4.5kg	
Sample of external connection diagram			Fig.8-1	Fig.8-2, 3

※Please refer to the instruction manual regarding the details on this specification.

Characteristics

Items		Condition	Guaranteed performance
Operation value	Biased differential characteristic Minimum operation current	Setting: Minimum operation value, Bias and operation time for all elements = minimum Input: One terminal feeding for neutral side or load side (called "one terminal feeding" in afterward)	Setting value ±5%
	Loss of excitation element ZF operation value	Setting: All settings operation time = minimum Input: Current=rated current1×2 constantly(10A) (Ia=5A, Ib=5A, Ia-Ib=10A) Current phase: lag 270°against voltage ※When measuring operation values, if voltage reaches 110V or more with the 2×rated current being constant, measurement is realized by reducing the current with voltage being constant at 110V.	Setting value ±5%
	Loss of excitation element ZB operation value		Setting value ±5%
Reset value	Loss of excitation element ZF reset value		105% or less of operation value
	Loss of excitation element ZB reset value		95% or more of operation value
	Biased differential characteristic Reset value	Setting: Minimum operation value, Bias and operation time for all elements = minimum Input: One terminal feeding	95% or more of operation value
Operation time	Biased differential characteristic	Setting: Minimum operation current=minimum, Bias=minimum, all operation time settings Input: One terminal feeding condition 0(A) →minimum operation current×300%.	At INST setting: 60ms or less At 0.1～0.5s setting: setting value ±20ms
	Loss of excitation element	Setting: ZF,ZB=minimum, all operation time settings Input: Current=0(A)→rated current1×2 constantly(10A), Voltage=110V→40(V) Current phase: lag 270°against voltage	In case of setting value 0.2s～0.4s, setting value±20ms In case of setting value 0.5s or more, setting value±5%
Reset time	Biased differential characteristic	Setting: Minimum operation current=minimum, Bias=minimum, all operation time settings Input: One terminal feeding condition, minimum operation current×300%→0(A).	200ms±20ms
	Loss of excitation element	Setting: ZF,ZB=minimum, all operation time settings Input: Current=rated current1×2 constantly(10A)→0(A), Voltage=40V→110(V) Current phase: lag 270°against voltage	200ms±20ms
Biased differential characteristic Bias characteristic		Setting: Minimum operation value, Bias and operation time for all elements Input: Fixed I1 according to right side table and vary I2	Bias setting / I1 / Bias 10% / 11A / I2=10(A)±5% 15% / 11.5A 20% / 12A
		Input: Fixed I1 to 30A and vary I2	I2:15A±10%
Phase characteristic	Biased differential characteristic	Setting: Minimum operation current = minimum, Bias and operation time for all elements = minimum Input: Fixed I1 and I2 to 10A and vary the phase between I1 and I2, measure operating angle.	Bias10%:174.3±5° Bias15%:171.4±5° Bias20%:168.5±5°
	Loss of excitation element	Setting: ZF, ZB=minimum, operation time=minimum Input current=rated current×2 constantly(10A) (IA=5A,IB=5A, IA-IB=10A) The characteristics control points: 2 points(lag 240°and 300°against voltage.) ※For the method of seeking the operation theoretic value, refer to the instruction manual.	In the inputting theoretic operation value, theoretic phase angle value±5% and theoretic operation value±5% at the characteristic control point.
Loss of excitation element ZF V-I characteristic		Setting: Minimum operation time for all elements Input current=0.8A～40A(No operation below 0.8A) Current=lag 270°against voltage	Setting value ±5%
Loss of excitation element ZB V-I characteristic			Setting value ±5%
Loss of excitation element, 51 stopper operation value		Common condition	0.8A±5%

※Please refer to the instruction manual regarding the details on this specification.

Precaution for application

1. Guarantee against interruption of AC power supply
   When an uninterruptible AC power source is not available in your system for the auxiliary power supply, use the type B-T1 AC/DC converter or commercially available uninterruptible power supply (UPS: MITSUBISHI ELECTRIC CORPORATION FW-A series or FW-V series). In addition, possible duration of the power supply type B-T1 AC/DC converter is confirmed as about 2 seconds in combination with one MELPRO-D series relay. Therefore, in the case that the required duration of power supply after power source loss exceeds 2 seconds, please use a suitable commercial uninterruptible power supply. When power supply back up for the circuit breaker is required, it is necessary to prepare the power supply independent from the type B-T1 AC/DC converter.
2. Inrush current of power supply
   Since inrush current (about 2ms duration) as below may flow into the relay when the power supply is turned on, please make a consideration on this regard for selection of power circuit breaker.

Input voltage	Inrush current Ip
DC110V	Approx. 20A
DC220V	Approx. 55A
AC100V	Approx. 25A
AC220V	Approx. 65A

3. Trip circuit
   Only the dedicated contacts can be used for the circuit breaker trip circuit. Please keep in mind that the contacts for signaling can not be used for the trip circuit. (If used, the contact may burn). Also, connect the pallet contact (52a) of the circuit breaker to the trip coil circuit in series.
4. Self-diagnosis output circuit
   The self-diagnosis output contact is so configured that the auxiliary relay is energized ("break contact" opened) when normal result of self-diagnosis is received. This type of contact will allow the relay to output abnormal result even after the built-in power failures. Therefore, the "break contact" is still closed in the aftermath of the power applying and will be opened after 50ms. If the auxiliary power of the relay and the self-diagnosis output contact feed from a same power source, the "break contact" will be closed temporarily after auxiliary power supply is turned on. In this 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-delay timer.
5. Grounding circuit
   Be sure to make a wiring to the earth terminal located on the back of the relay according to the Class D earth wiring method (Grounding resistance should be less than 100 ohm).
6. CC-Link communication circuit
   Please include the communication card into your purchasing order in case of the application of the communication facility as the card necessary for communication (CC-Link) is option. In case of retrofit existing relay with communication card, please inform the followings of existing relay. a:Type, b:Style number, c:Manufacturing year, d:Serial number, e:Date of stamp on the checking seal (The above mentioned items a.~d. are indicated on the bottom right of front face of the relay and item e. is indicated on the upper of back side of the relay.) The version number of CC-Link is 1.00.
7. Improvement of reliability of protection system
   For the important facilities, multiplex system such as dual should be provided to improve reliability.
8. 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 surge absorbers.
9. The external wiring should be done according to the connection diagram of each relay. If a wrong wiring would be made, there are some possibilities that causing of the differential current and improper operation of loss of excitation element.
10. Lock function by external control input
    Two DI circuits are installed for the interlock by external control signals, and a relay element can be locked by DI input. Moreover, the relay element locked at the time of DI input arising can be set up to each DI circuit.
11. In case of application of the loss of excitation element only, wiring should be made for the VT circuit Vab, CT circuits Ia (terminal number "A17"- "A18"), Ib (terminal number "A19"-"A20") and not necessary to make a wiring for other terminals.
12. The DI input for interlock (Terminal number "E-01", "E-03" and "E-02","E-04") has a polarity. Therefore, please pay attention to polarity as the input signals can not be detected properly due to the wrong connection of DI circuit.
13. The differential current, caused by the flow-through current (due to inrush current of transformer or faults current) of CT which has different saturated characteristics for each other and are located in the neural point and load side of generator, will become cause of miss-operation of the relay. To prevent from such an incorrect operation, it is recommended to apply the CT in which accuracy limit factor is more than 20 and accuracy is 1P class or 1PS class.
14. Despite of no faults in the excitation circuit, the calculated impedance in the relay will be closed to the operation area and the loss of excitation element will operate due to unbalance of 3 phases PT circuit voltage (caused by a broken wire for example) or unbalance of burden for each phase. To prevent from such incorrect operation, it is recommended to apply the voltage balance relay.
15. When the differential current check is detected (contact X4 is in operation and differential check LED is in lit condition), careful checking of external wiring is requested as there are a possibility to have some mistake of the wiring.

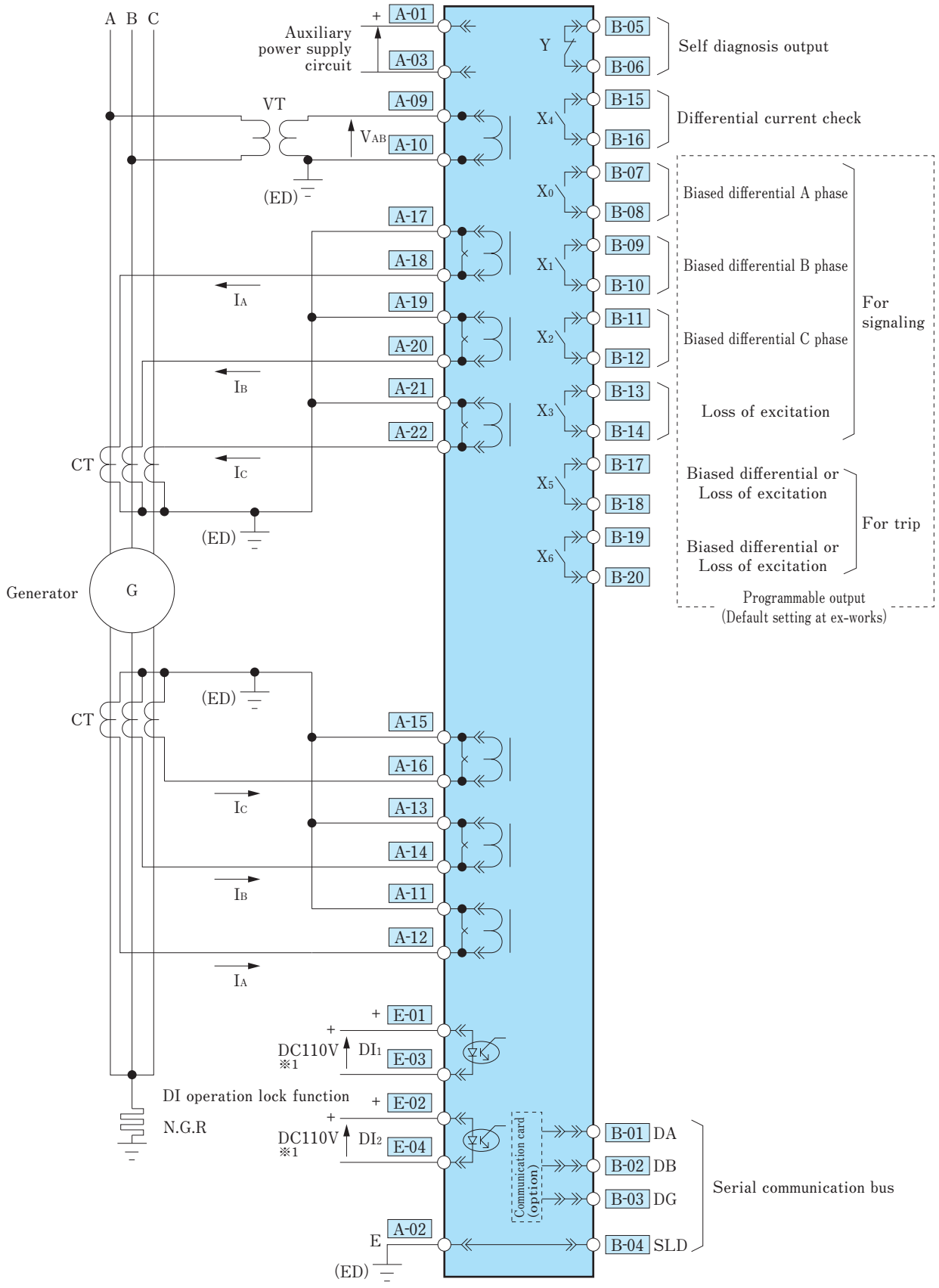
Precaution for using

1. When the product is shipped from the factory, each setting value is "LOCK" (for element with LOCK position) or "minimum setting value" (for element without LOCK position)
2. To set as [LOCK] position means to set the element out of use.
3. When current input for the loss of excitation element is derived from the generator neutral point side, the phase current measuring does not indicate outgoing current but incoming current.

Precaution for safety

Please refer to page2 and 3 regarding the safty information and request when placing order.

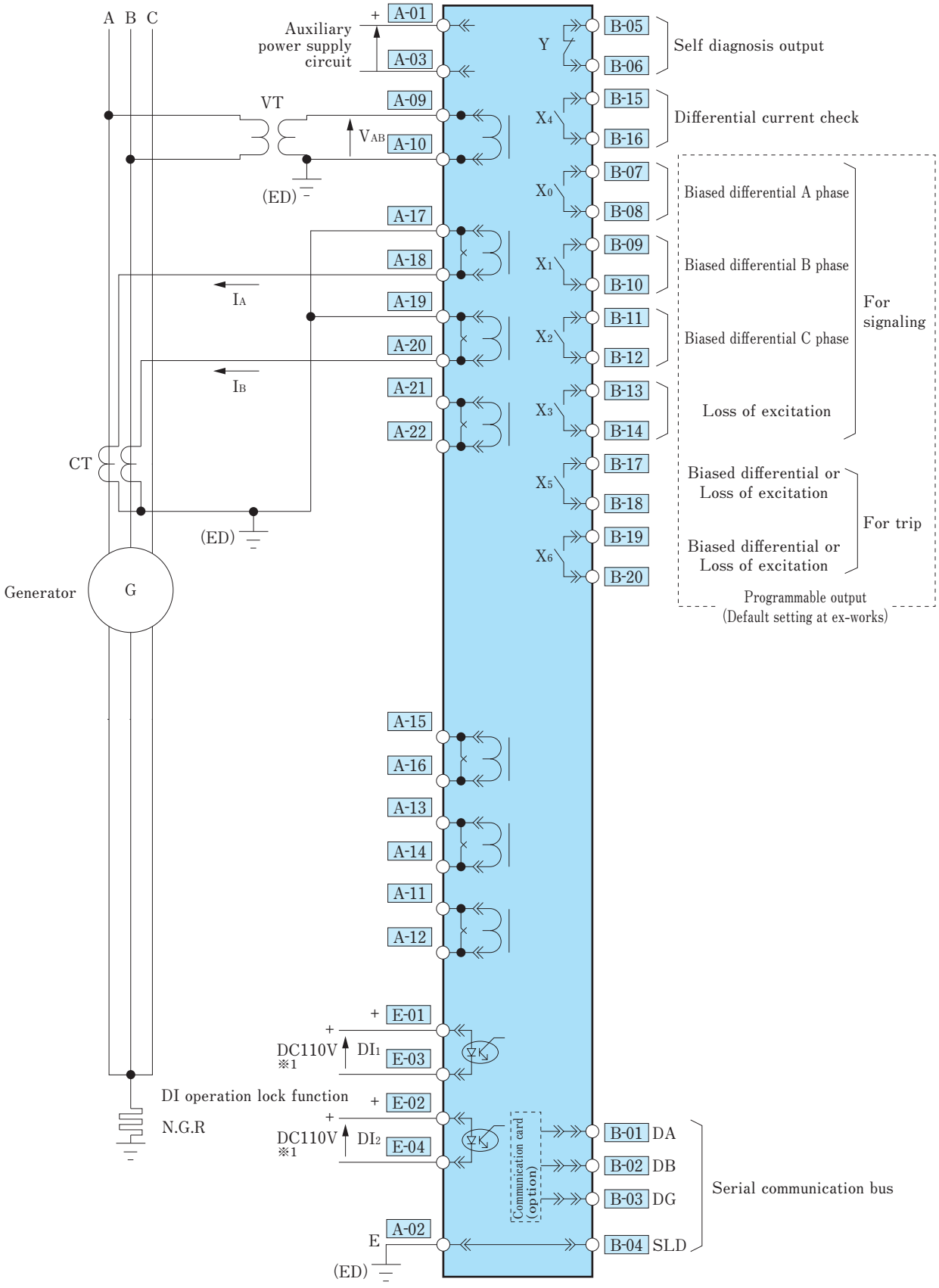
Sample of external connection diagram



※1 The application voltage for terminal E-01, E-03 and terminal E-02, E-04 is 24V in case that the supplied auxiliary power voltage is 24V.

Fig.8-1 CGP2-A01D2

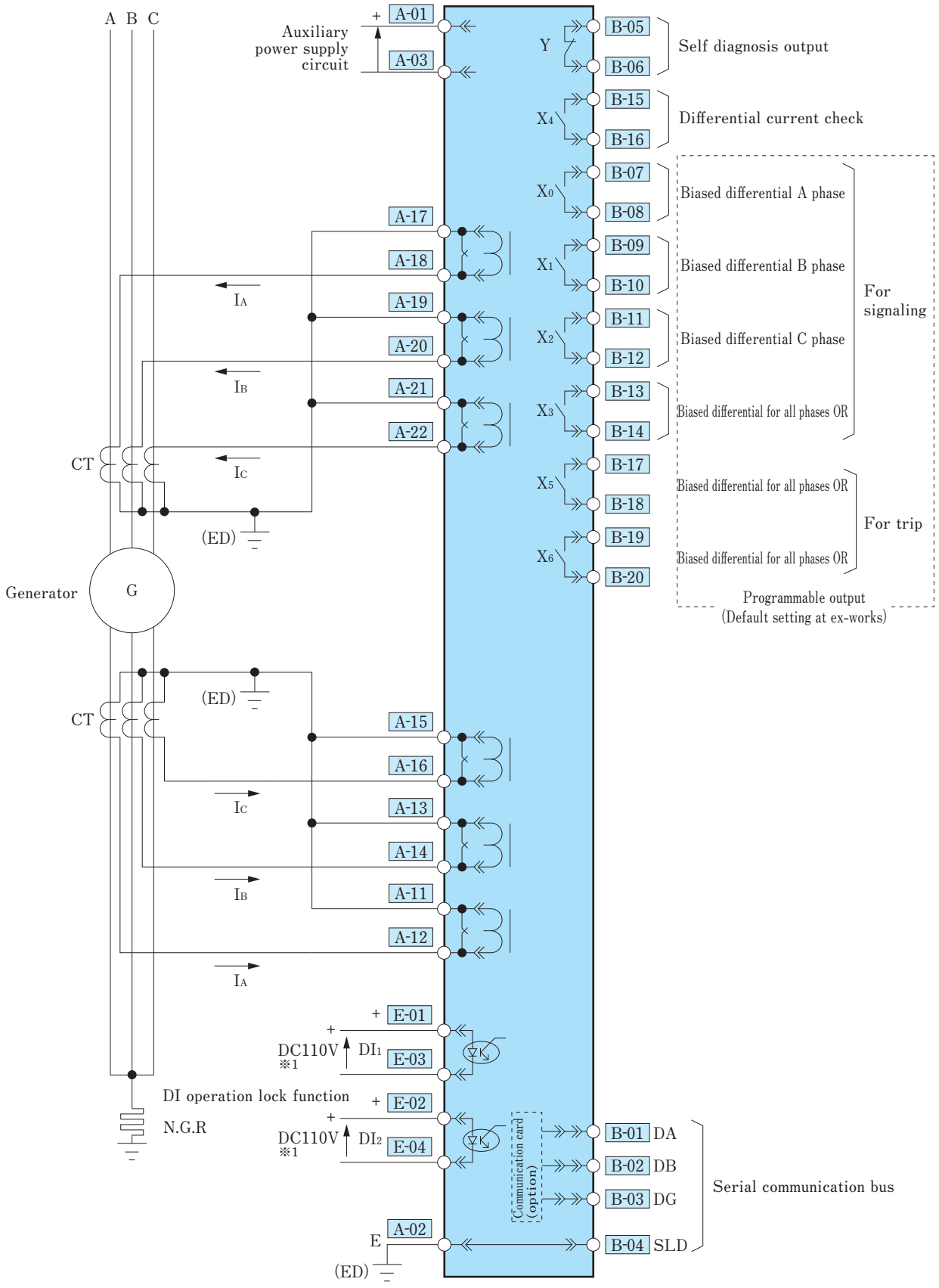
The connection diagram shows concepts of the wiring only. Therefore, please note that there will have some difference between the connection diagram and actual installation status of CT,VT and safety devices such as fuse, etc.



※1 The application voltage for terminal E-01, E-03 and terminal E-02, E-04 is 24V in case that the supplied auxiliary power voltage is 24V.

Fig.8-2 CGP2-A01D2(Apply only 40 element)

The connection diagram shows concepts of the wiring only. Therefore, please note that there will have some difference between the connection diagram and actual installation status of CT,VT and safety devices such as fuse, etc.

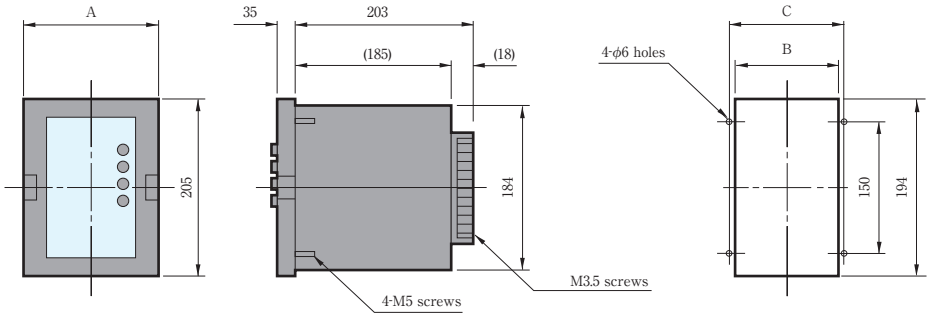


※1 The application voltage for terminal E-01, E-03 and terminal E-02, E-04 is 24V in case that the supplied auxiliary power voltage is 24V.

Fig.8-3 CGP2-A02D2

The connection diagram shows concepts of the wiring only. Therefore, please note that there will have some difference between the connection diagram and actual installation status of CT,VT and safety devices such as fuse, etc.

MELPRO-D Series Dimensions



Case type	A	B	C
D 1	151	114	130
D 2	251	214	230
2 out of 3 relay case	351	314	330

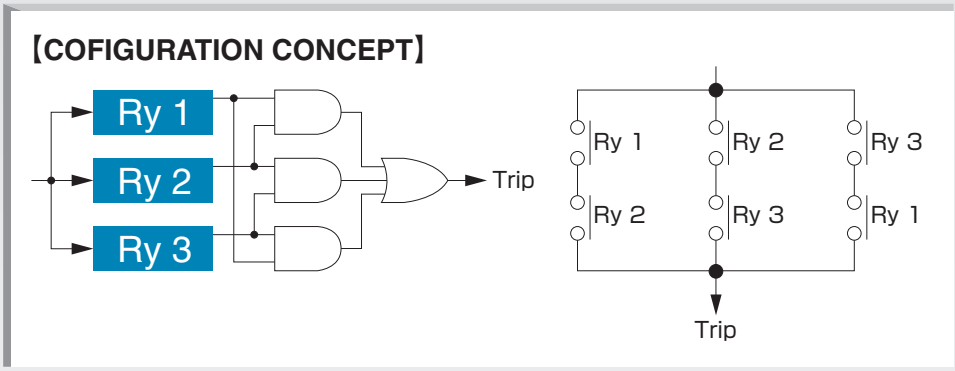
Dimension in mm

Suggestion From Mitsubishi Electric
(for improving reliability of system)

As a way to improve the realiability of Protection system, MITSUBISHI ELECTRIC also provides customers the following products.

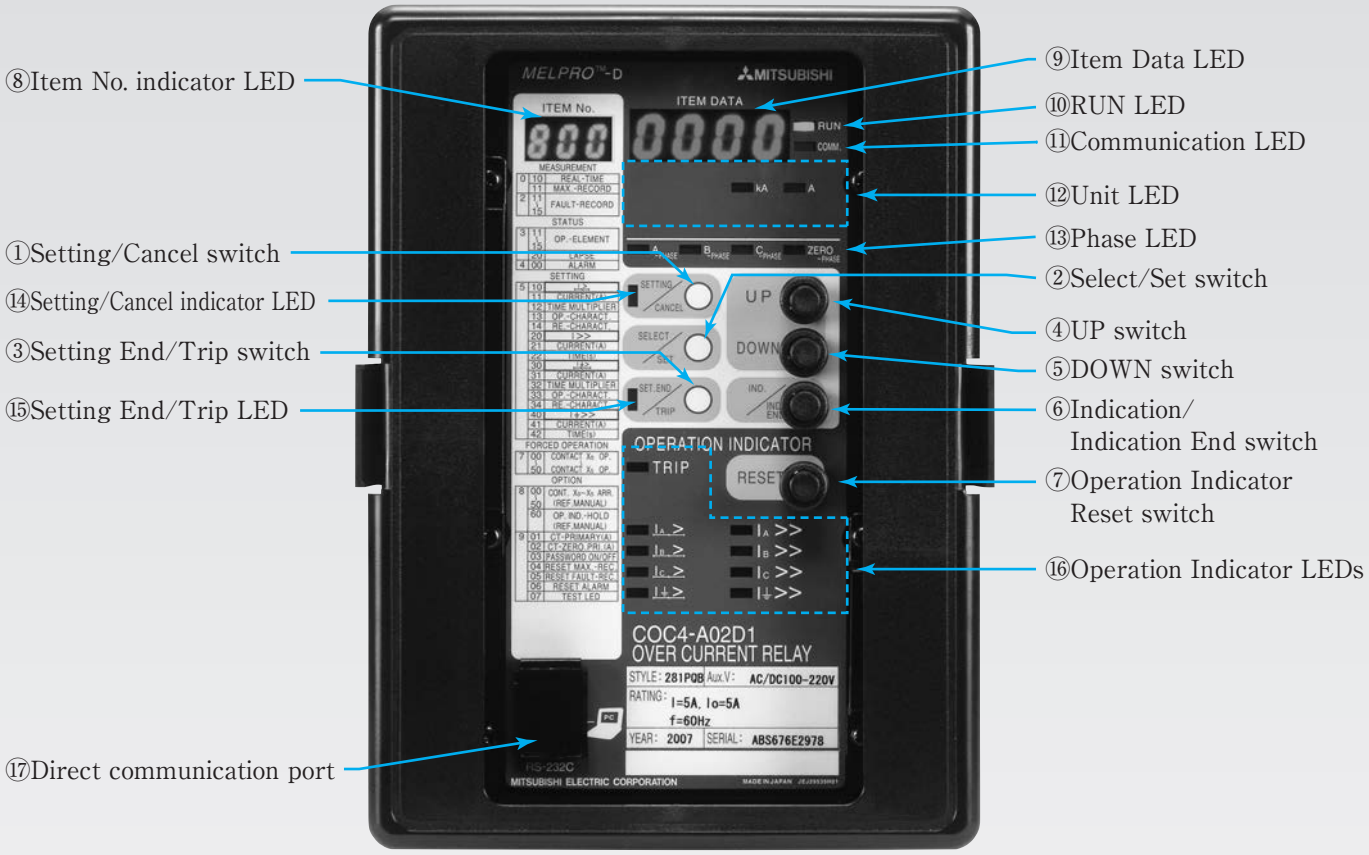
◆Reduntant fault detection system

2 out of 3 method…The method that the power system faults are detected by at least 2 relays among 3-relay set.
In this way, the power system faults can be detected when 2 relays operate, even if the other relay is in failure. (refer to the following concept diagram)



We provide a compact unit integrating 3 relays in one case.

Control and Operation



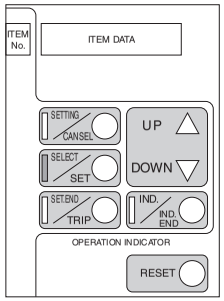
■Explanation of Front panel

No.	Designation			Symbol	Description
①	Operational key switches	Setting/Cancel		SETTING/CANCEL	Pressing this switch will start the procedure for setting, forced operation or option. When this switch is pressed again instead of the SET.END/TRIP 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		SELECT/SET	This switch is used to select an item number and 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		Setting End/Trip		SET.END/TRIP	When the SET.END/TRIP switch is pressed with its LED blinking during setting, forced operation or option procedure, the current setting will be replaced by data given by programming. The new setting will be thus enabled.
④		UP select		UP	These switches are used for selecting data elements. Pressing these switches for a while will allow fast forward. With the cover operating button, you can use the switches without removing the cover.
⑤		DOWN select		DOWN	
⑥		Indication/Indication End		IND./IND.END	Pressing this switch will start or end the display of settings and measurements. With the cover operating button, you can use the switches without removing the cover.
⑦		Reset		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 switches without removing the cover.
⑧	Indicator LEDs	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 the instruction manual specifically prepared for each model.
⑩		RUN	Green	–	Indicate the result of the auto self-check. The lamp will be lit for normal conditions while off for abnormal conditions.
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		Setting End/Trip	Yellow	–	This lamp will blink when new data is programmed to be ready for replacing the current setting.
⑯		Operation	Red	–	Indicate the applicable operation elements and phases of the relay.
⑰	Direct communication port			–	This port is used for connecting PC and relay with the dedicated cable (option). The measuring values, operating conditions and setting changes can be done by PC with the dedicated software (option).

Display/Setting Operation

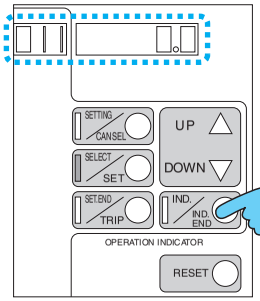
DISPLAY

Initial status



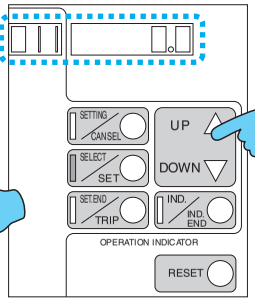
Nothing displayed at windows of ITEM No. and ITEM DATA

Start display



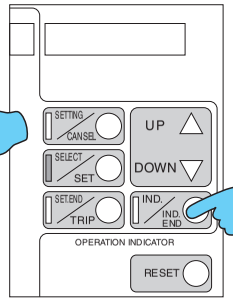
Start to display the ITEM No. and ITEM DATA by pushing IND/IND END

Select ITEM No.



Select ITEM No. by UP or DOWN, ITEM DATA displayed.

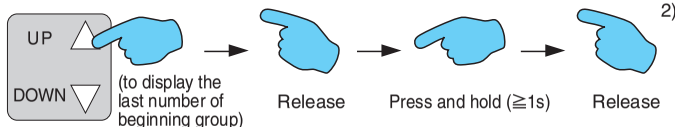
Exit display status



Exit the display status by pushing IND/IND END

Note:

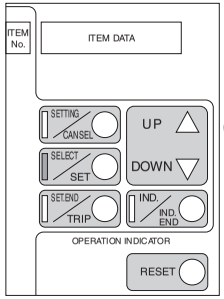
1) In setting status, to change the group of ITEM No. (500→700→800)



2) Plural items can be set at one time. (same setting group only)

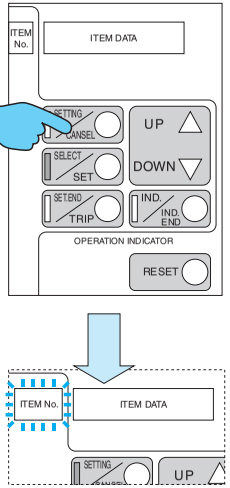
SETTING

Initial status

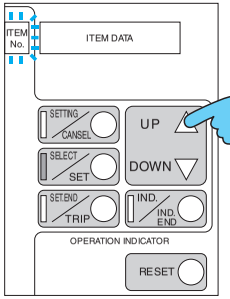


Nothing displayed at windows of ITEM No. and ITEM DATA

Start setting

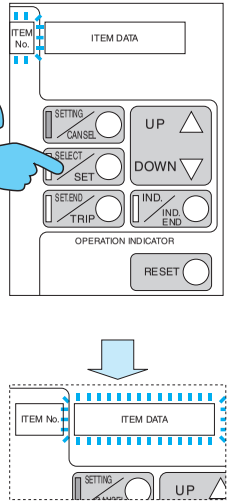


Select ITEM No.

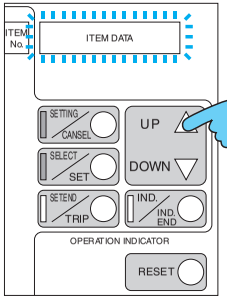


Select ITEM No. by UP or DOWN. (ITEM No. LED blinking)

Set ITEM No.

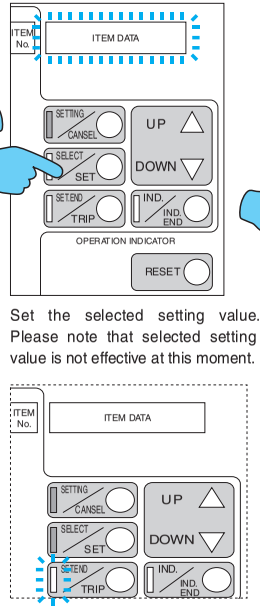


Select setting value



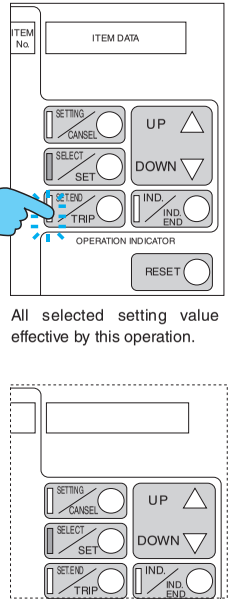
Select setting value by UP or DOWN.
(ITEM DATA LED blinking)

Admit setting value



Set the selected setting value. Please note that selected setting value is not effective at this moment.

Make setting value effect



All selected setting value are effective by this operation.

All indications are changed to turning off condition.

Please repeat the same operation in case of two or more items setting
(The above is applicable only for the same group classified with the same number of top digit.)

When the product is shipped from the factory, each setting value is "LOCK" (for element with LOCK position) or "minimum setting value" (for element without LOCK position), therefore, please make new setting as you wish according to the above mentioned procedure for each element.

MITSUBISHI Numerical Protection Relay

MELPRO™-D Series

⚠ CAUTION

TO PREVENT IT FROM THE RISK OF DAMAGE AND MAL FUNCTION, BE SURE TO READ OPERATING AND MAINTENANCE (SERVICING) INSTRUCTIONS BEFORE USING.

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

We are waiting your technical contacts by FAX.
ATTN. Protective relay technical service
FAX NO. JAPAN +81-78-682-8051

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