MITSUBISHI ELECTRIC

Numerical Protection Relay

MELPRO™-D Series
OVERCURRENT RELAY

MODEL
COC2-A01D1

INSTRUCTION MANUAL

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

－ Safety section －

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

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

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

be unfavorably affected and/or burning or erroneous operation might occur.

(3) Be sure to read and understand the instruction manuals and other related documents prior to commencing operation and maintenance work on the product. Otherwise, electrical shock, injury, damage, or erroneous operation might occur.

(4) While energizing product, be sure not to remove any unit or parts without permissible one. Otherwise, damage, or erroneous operation might occur.

(5) While energizing product, be sure to make short circuit of current transformer secondary circuits before setting change or drawing out the sub unit. Otherwise, secondary circuit of live current transformer might be opened and damage or burning might occur due to the high level voltage.

(6) While energizing product, be sure to open trip lock terminal before setting change or drawing out the internal unit of product. Otherwise, erroneous operation might occur.

(7) Be sure to use the product within rated voltage and current.
   Otherwise, damage or mal-operation might be occurred.

(8) While energizing product, be sure not to clean up the product.
   Only wiping a stain on the front cover of product with a damp waste might be
   allowable. (Be sure to wring hardly the water out of the waste.)

5. Items concerning maintenance and checking

(1) Be sure that only qualified personnel might work on or operate this product.
   Otherwise, electrical shock, injury, damage, or erroneous operation might occur.

(2) Be sure to read and understand the instruction manuals and other related documents prior to commencing operation and maintenance work on the product. Otherwise, electrical shock, injury, damage, or erroneous operation might occur.

(3) In case of replacing the parts, be sure to use the ones of same type, rating and specifications, etc.
   If impossible to use above parts, be sure to contact the sales office or distributor nearest you.
   Otherwise, damage or burning might occur.

(4) Testing shall be done with the following conditions.
   -Ambient temperature: $20℃±10℃$
   -Relative humidity: Less than 90%
   -Magnetic field: Less than 80A/m
   -Atmospheric pressure: $86\sim106×10^3$ 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.

- Introduction -

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

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

Please note end users are required to be provided with this instruction manual.

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

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

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

(For CC-Link)

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

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1 Features

1.1 General description

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

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

1.2 Features

(1) High-reliable protection

The product includes a two-phase overcurrent protection element. Just this one relay is enough to protect a power system from phase fault.

(2) Diverse operation and reset characteristics

The product is provided with diversified operation and reset characteristics that meet the requirements of IEC 60255-3, and can be used for protecting various types of electric systems.

(3) Communication Network

- With an open field bus system, the relays can be used to build a high-speed, high-performance network system. In addition, the relay's multi-drop serial wiring reduces the amount of labor required for communication wiring.

- Control of measurement values, operation status, as well as setting changes, etc., can be performed from a remote location.

- In consideration of future network system variations and compatibility with communication networks, communication features are mounted in the relay using a replaceable card.

(4) Measurement & Recording Functions

- Real time monitoring of relay input data

The relay can measure steady state relay input values, supporting energy management.

- Fault Data Monitoring

When a fault occurs, the relay saves the past 5 effective input values and waveform data to assist with fault analysis.

(5) Programmable Output Configuration

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

(6) High Accurate Digital Computation

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

(7) Self-diagnosis

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

(8) Easy Replacement

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

(9) Easy Maintenance

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

(10) Easy wiring check

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

2 Rating and specifications
2.1 General information

			COC2-A01D1			
Type name						
Style	Relay without RS232C I/F		314PMB	315PMB	316PMB	317PMB
	Relay with RS232C I/F		511PMB	512PMB	513PMB	514PMB
Element	Protection		Time–delayed element × 2			
			Instantaneous element × 2			
	Measurement		Current			
Rating	Frequency		50 Hz	60 Hz	50 Hz	60 Hz
	Current		5 A		1 A	
	Auxiliary Power supply *21	Voltage	Common use for 100 ~ 220VDC / 100 ~ 220VAC			
		Operative range	DC : 85 ~ 242 V (Range of 80 ~ 286VDC is allowable temporarily.)			
			AC : 85 ~ 242 V (Range of 80 ~ 253VAC is allowable temporarily.)			
Display	RUN		Indicate the result of self-diagnosis. The lamp is lit for normal conditions and off for abnormal.			
	Unit		Indicate the unit symbol for measurements.			
	Item No., Item data		Display measurement, status, setting and option data selected with an item number.			
	Communication		With a communication card installed: the lamp is lit for normal conditions, blinking during communication and off for abnormal. With a communication card not installed: the lamp is off.			
Self-diagnosis			Monitor the electronic circuit and internal power supply to output signal to the RUN LED and self-diagnosis output (ALARM).			
Output contacts	Configurations	For trip	2 make contacts: X_4 and X_5 (programmable output)			
		For signaling	4 make contacts: X_0 to X_3 (programmable output)			
		For self-diagnosis output	1 break contact: Y (open for normal result of self-diagnosis with power on)			
	Capacity	For trip / Make	110VDC, 15A, 0.5 s (L/R = 0 s) 220VDC, 10A, 0.5 s (L/R = 0 s)			
		For trip / Break	110VDC, 0.3A (L/R$\leq$40 ms) 220VDC, 0.15A (L/R$\leq$40 ms)			
		For trip / Carry	1.5 A, continuously			
		For signaling and self-diagnosis output / Make and Break	500 VA (cosφ= 0.4), 60W (L/R = 0.007 s)			
		For signaling and self-diagnosis output / Max. current	5 A			
		For signaling and self-diagnosis output / Max. voltage	380VAC, 125VDC			
Burden	Phase circuit		0.5 VA or less (with rated current)			
	Zero-phase circuit		0.5 VA or less (with rated current)			
	Auxiliary power supply circuit		For 100VDC: approx. 5 W (approx. 7W including communication card) For 100VAC: approx. 7 VA (approx. 9VA including communication card) For 220VDC: approx. 6 W (approx. 8W including communication card) For 220VAC: approx. 12 VA(approx. 14VA including communication card)			
Mass			Net weight of relay unit : approx. 2.3 kg Including case : approx. 3.0 kg			
Case/cover			Size : D1 type Color : N1.5			

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

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

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

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

2.2 Protective elements

Style			314PMB	315PMB	316PMB	317PMB
	Relay without RS232C I/F		314PMB	315PMB	316PMB	317PMB
	Relay with RS232C I/F		511PMB	512PMB	513PMB	514PMB
Setting *24	Time-delayed	Operation current	LOCK - 1 ~ 12A (0.1A step)		LOCK - 0.2 ~ 2.4A (0.02A step)	
		Operation time multiplier	0.25 - 0.5 ~ 50 (0.5 step)			
		Operation time characteristics	Normal inverse time-delayed×3, Very inverse time-delayed×2, Extremely inverse time-delayed×3, Long inverse time-delayed×3, Definite time-delayed			
		Reset time characteristics	Inverse, definite time-delayed×2			
	Instantaneous	Operation current	LOCK - 2 ~ 80A (1A step)		LOCK - 0.4 ~ 16A (0.2A step)	
		Operation time	INST - 0.1 ~ 0.5 s (0.1 s step)			
Forced operation			Forced operation is available for any trip or signaling contact individually.			
Operation indication			Operation indicator LED (red) comes on when the relay operates.			

2.3 Measurement elements

Style					314PMB	315PMB	316PMB	317PMB
	Relay without RS232C I/F				314PMB	315PMB	316PMB	317PMB
	Relay with RS232C I/F				511PMB	512PMB	513PMB	514PMB
Option *24	CT primary current				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]		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]	
Display	Current	Real time	Conversion		Indication value = Relay input value ×CT primary setting / 5		Indication value = Relay input value ×CT primary setting	
			Range *22		0.00 ~ CT primary setting ×2 [A]			
			Update		Approx. 200 ms			
		Max. record	Conversion		Indication value = Relay input value ×CT primary setting / 5		Indication value = Relay input value ×CT primary setting	
			Range *22		0.00 ~ CT primary setting ×2 [A]			
		Fault record *23	Conversion		Indication value = Relay input value ×CT primary setting / 5		Indication value = Relay input value ×CT primary setting	
			Range *22		0.00 ~ CT primary setting ×40 [A]			

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

CT primary setting		1[A]	5 ~ 40[A]	50 ~ 400[A]	500 ~ 4000[A]	5000 ~ 8000[A]
Form of display	0.00 ~ 9.99[A]	□.□□[A]	□.□[A]	□[A]	-	-
	10.0 ~ 99.9[A]	□□.□[A]	□□.□[A]	□□[A]	□.□□[kA]	-
	100 ~ 999[A]	□□□[A]	□□□[A]	□□□[A]	□.□□[kA]	□.□[kA]
	1.00 ~ 9.99[kA]	□.□□[kA]	□.□□[kA]	□.□□[kA]	□.□□[kA]	□.□[kA]
	10.0 ~ 99.9[kA]	□□.□[kA]	□□.□[kA]	□□.□[kA]	□□.□[kA]	□□.□[kA]
	100 ~ 999[kA]	□□□[kA]	□□□[kA]	□□□[kA]	□□□[kA]	□□□[kA]

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

3　Characteristics

Common conditions	(1) Rated frequency: ±1% (2) Ambient temperature: 20°C±10°C (3) Aux. supply voltage: Rated voltage±2%	The conditions shown on the left should be applied unless otherwise specified.

3.1　Protective elements

| Items		Conditions	Guaranteed performance
Operation value	Time-delayed element	(Common conditions)	- For setting of 1.0 ~ 2.0A (5A rating product) For setting of 0.2 ~ 0.4A (1A rating product) Setting value ±10% - For setting of other range Setting value ±5%
	Instantaneous element		Setting value ±10%
Reset value	Time-delayed element	(Common conditions)	- For setting of 1.0 ~ 2.0A (5A rating product) For setting of 0.2 ~ 0.4A (1A rating product) Operation value× 90% or more - For setting of other range Operation value× 95% or more
	Instantaneous element		Operation value× 95% or more
Operation time	Time-delayed element	Operation setting: Minimum, Operation time multiplier: 10 Input: 0 → Operation setting×300, 500, 1000 %	See Figures 3.1 and 3.2. See Tables 3.1 to 3.12.
	Instantaneous element	Operation setting: Minimum Input: 0 → 200% of setting	Setting value ±25ms INST = 40 ms or less.
Reset time	Time-delayed element	300% of setting → 0 [A]	See Figure 3.3 and Table 3.13.
	Instantaneous element	300% of setting → 0 [A]	200msec±25msec
Overshoot characteristic	Time-delayed element	Time-delayed operation value: Minimum Operation time multiplier　: 10 Operation characteristics　: All Input current　　: 0A → Setting value×1000%	No-operation limit time / operation time = 90% or more

3.2　Measurement elements

Items	Condition	Guaranteed performance
Real time and max. records	CT primary setting×2	±1%

3.3 Common technical data

ITEM		DESCRIPTION	CONDITION	STANDARD
Environment	Ambient operating temperature	-10°C to +55°C		IEC60255-6
	Ambient storage and transport temperature	-25°C to +70°C		IEC60255-6
	Damp heat	+40°C, 95%RH, 4 days		IEC60068-2-3
Thermal withstand	VT	1.15Vn, 3h		
	CT	40In, 1s		
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, 1.2µs/50µs	1) Between each circuit and the exposed conductive parts, the terminals of each independent circuit being connected together 2) Between independent circuits, the terminals of each independent circuit being connected together	IEC60255-5
High-frequency disturbance test	Common mode	2.5kV peak, 1MHz with 200Ω source impedance for 2s	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 2s	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		68 to 87Mhz 146 to 174MHz 420 to 470MHz		IEC60255-22-3 class 3
Fast transient disturbance test		2.0kV, 5ns/50ns, 1min		IEC60255-22-4
Vibration test		Refer to class 1		IEC60255-21-1 Class 1
Shock response		Refer to class 2		IEC60255-21-2 Class 2
Shock withstand		Refer to class 1		IEC60255-21-2 Class 1
Bump		Refer to class 1		IEC60255-21-2 Class 1
Enclosure protection		IP51		IEC60529

Vn: Rated voltage, In: Rated current

12 types of operation time characteristics and 3 types of reset time characteristics as shown in Figures 3.1 to 3.3 are integrated in both of the phase fault and earth fault time-delayed elements.
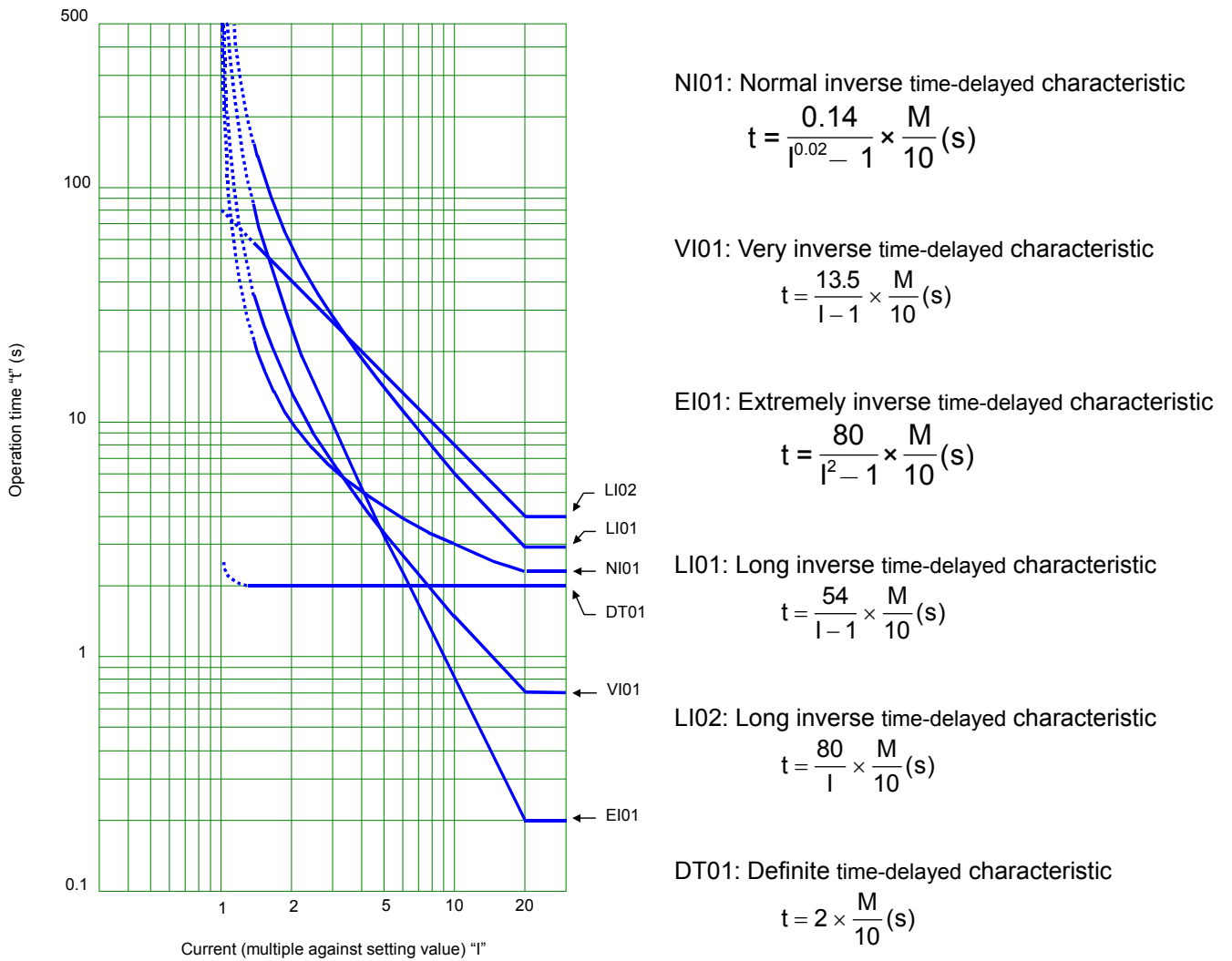
NI01: Normal inverse time-delayed characteristic
$$t = \frac{0.14}{I^{0.02} - 1} \times \frac{M}{10} \, (s)$$

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

$\Bigg\{$
t : Operation time (s)

I : Multiple of input current against setting value (times)

M : Operation time multiplier (times)

Figure 3.1　Operation time characteristic (1)
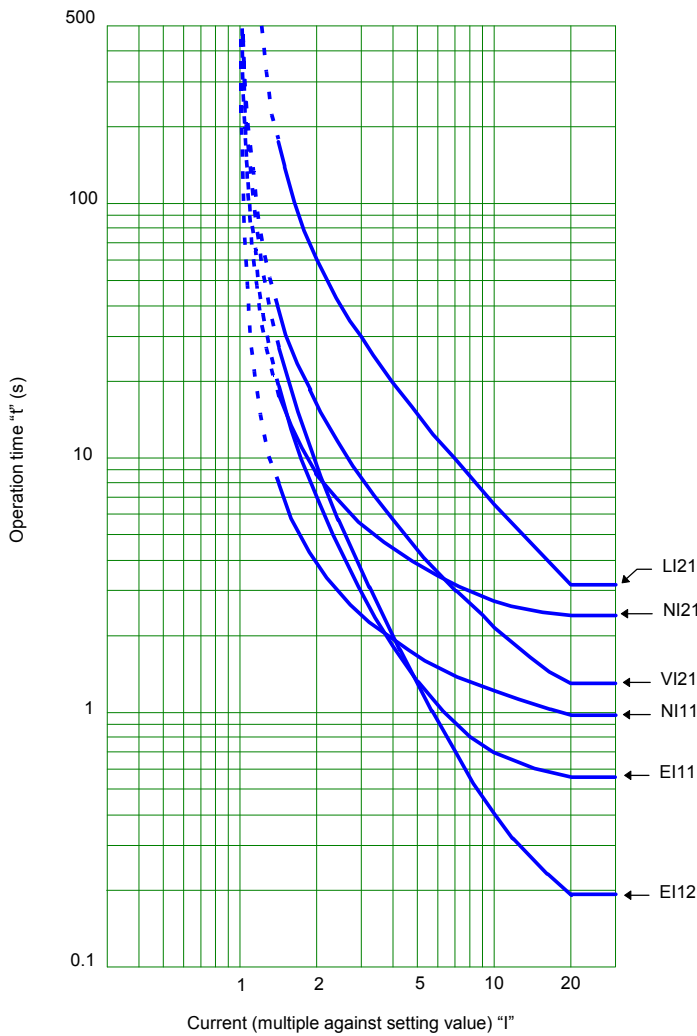
NI11: Normal inverse time-delayed characteristic

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

EI11: Extremely inverse time-delayed characteristic

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

EI12: Extremely inverse time-delayed characteristic

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

NI21: Normal inverse time-delayed characteristic

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

VI21: Very inverse time-delayed characteristic

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

LI21: Long inverse time-delayed characteristic

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

t : Operation time (s)

I : Multiple of input current against setting value (times)

M : Operation time multiplier (times)

Figure 3.2   Operation time characteristic (2)

Computed curve of operation timer 11 ＊31

01: Definite time-delayed characteristic

t = 0.2 (s)

11: Inverse time-delayed characteristic

t = 0.2 (s)

21: Definite time-delayed characteristic

t < 0.05 (s)
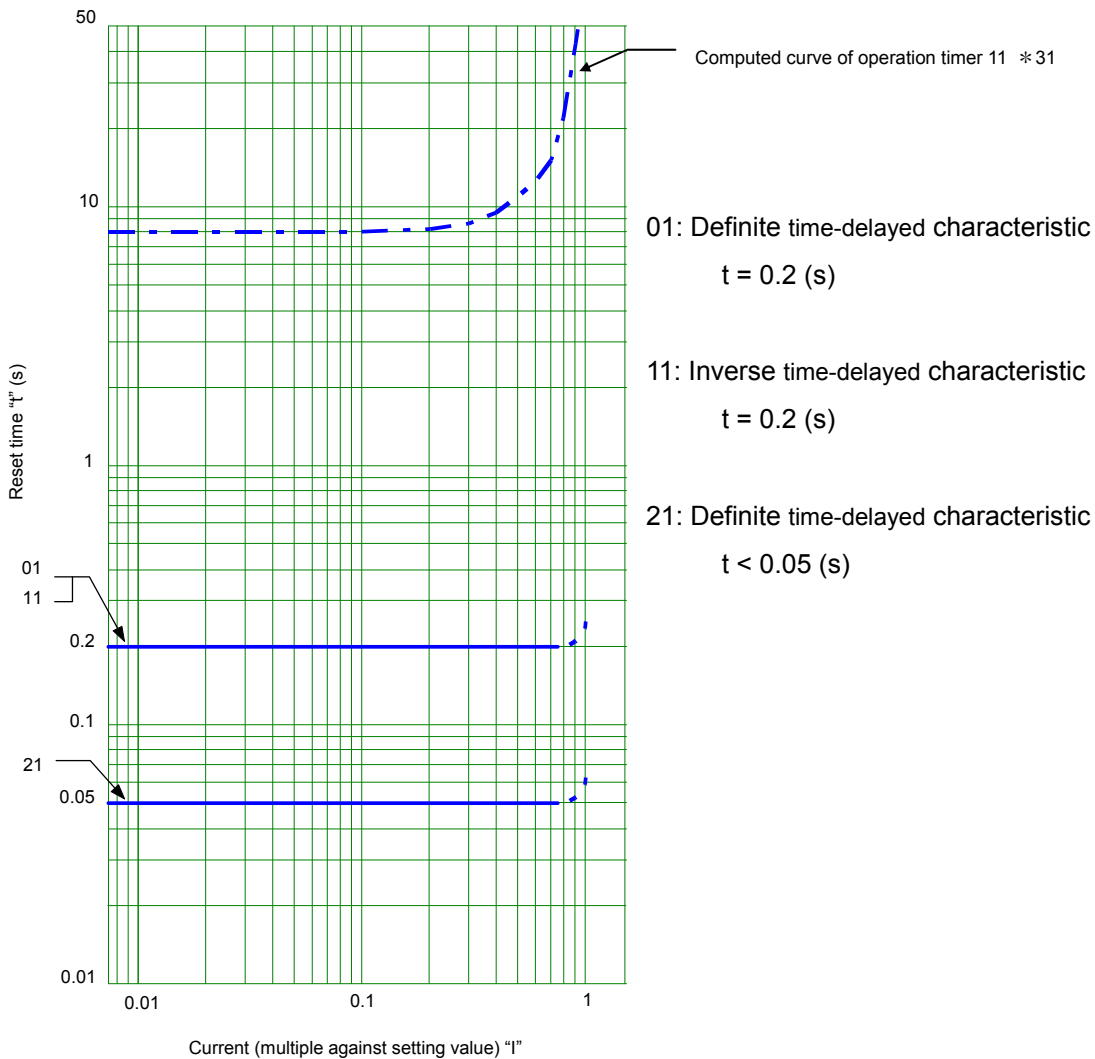
Figure 3.3　Reset time characteristic

*31　Inverse time-delayed characteristic for resetting

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 recurrent overload, which typically occurs in starting a motor. For further information, see the section 4 "Functions".

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

Table 3.1 Operation time range for Normal inverse time-delayed characteristic (NI01)

Unit: s

Operation time multiplier (M)	Input		
	300%	500%	1000%
0.25	0.158 ± 5.50%	0.107 ± 3.75%	0.074 ± 3.75%
	*0.040 ~ 0.504	*0.040 ~ 0.267	*0.040 ~ 0.186
0.5	0.315 ± 5.67%	0.214 ± 3.83%	0.149 ± 3.83%
	*0.040 ~ 0.672	*0.040 ~ 0.378	*0.040 ~ 0.262
1	0.630 ± 6.00%	0.428 ± 4.00%	0.297 ± 4.00%
	0.252 ~ 1.008	0.257 ~ 0.599	0.178 ~ 0.416
1.5	0.945 ± 6.33%	0.642 ± 4.17%	0.446 ± 4.17%
	0.546 ~ 1.344	0.464 ~ 0.820	0.322 ~ 0.569
2	1.260 ± 6.67%	0.856 ± 4.33%	0.594 ± 4.33%
	0.840 ~ 1.681	0.670 ~ 1.041	0.465 ~ 0.723
2.5	1.575 ± 7.00%	1.070 ± 4.50%	0.743 ± 4.50%
	1.134 ~ 2.017	0.877 ~ 1.263	0.609 ~ 0.876
3	1.891 ± 7.33%	1.284 ± 4.67%	0.891 ± 4.67%
	1.428 ~ 2.353	1.084 ~ 1.484	0.753 ~ 1.030
3.5	2.206 ± 7.67%	1.498 ± 4.83%	1.040 ± 4.83%
	1.723 ~ 2.689	1.291 ~ 1.705	0.896 ~ 1.183
4	2.521 ± 8.00%	1.712 ± 5.00%	1.188 ± 5.00%
	2.017 ~ 3.025	1.498 ~ 1.926	1.040 ~ 1.337
4.5	2.836 ± 8.33%	1.926 ± 5.17%	1.337 ± 5.17%
	2.311 ~ 3.361	1.705 ~ 2.147	1.183 ~ 1.490
5	3.151 ± 8.67%	2.140 ± 5.33%	1.485 ± 5.33%
	2.605 ~ 3.697	1.912 ~ 2.368	1.327 ~ 1.644
6	3.781 ± 9.33%	2.568 ± 5.67%	1.782 ± 5.67%
	3.193 ~ 4.369	2.325 ~ 2.810	1.614 ~ 1.951
7	4.411 ± 10.00%	2.996 ± 6.00%	2.079 ± 6.00%
	3.781 ~ 5.042	2.739 ~ 3.253	1.901 ~ 2.258
8	5.042 ± 10.67%	3.424 ± 6.33%	2.376 ± 6.33%
	4.369 ~ 5.714	3.153 ~ 3.695	2.188 ~ 2.565
9	5.672 ± 11.33%	3.852 ± 6.67%	2.674 ± 6.67%
	4.958 ~ 6.386	3.566 ~ 4.137	2.475 ~ 2.872
10	6.302 ± 12.00%	4.280 ± 7.00%	2.971 ± 7.00%
	5.546 ~ 7.058	3.980 ~ 4.579	2.763 ~ 3.179
15	9.453 ± 12.00%	6.420 ± 7.00%	4.456 ± 7.00%
	8.319 ~ 10.587	5.970 ~ 6.869	4.144 ~ 4.768
20	12.604 ± 12.00%	8.559 ± 7.00%	5.941 ± 7.00%
	11.091 ~ 14.116	7.960 ~ 9.159	5.525 ~ 6.357
30	18.906 ± 12.00%	12.839 ± 7.00%	8.912 ± 7.00%
	16.637 ~ 21.174	11.940 ~ 13.738	8.288 ~ 9.536
40	25.208 ± 12.00%	17.119 ± 7.00%	11.882 ± 7.00%
	22.183 ~ 28.233	15.921 ~ 18.317	11.051 ~ 12.714
50	31.510 ± 12.00%	21.399 ± 7.00%	14.853 ± 7.00%
	27.728 ~ 35.291	19.901 ~ 22.897	13.813 ~ 15.893

Note: The values shown in the upper column of each box represent the theoretical operation time and error limit, and those in the lower column represent the permissible range
Refer to the note *32 to *35.

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Table 3.2   Operation time range for Very inverse time-delayed characteristic (VI01)

Unit: s

Operation time multiplier (M)	Input		
	300%	500%	1000%
0.25	0.169 ± 5.50%	0.084 ± 3.75%	0.038 ± 3.75%
	* 0.040 ~ 0.540	* 0.040 ~ 0.211	* 0.040 ~ 0.094
0.5	0.338 ± 5.67%	0.169 ± 3.83%	0.075 ± 3.83%
	* 0.040 ~ 0.720	* 0.040 ~ 0.298	* 0.040 ~ 0.133
1	0.675 ± 6.00%	0.338 ± 4.00%	0.150 ± 4.00%
	0.270 ~ 1.080	0.203 ~ 0.473	0.090 ~ 0.210
1.5	1.013 ± 6.33%	0.506 ± 4.17%	0.225 ± 4.17%
	0.585 ~ 1.440	0.366 ~ 0.647	0.163 ~ 0.288
2	1.350 ± 6.67%	0.675 ± 4.33%	0.300 ± 4.33%
	0.900 ~ 1.800	0.529 ~ 0.821	0.235 ~ 0.365
2.5	1.688 ± 7.00%	0.844 ± 4.50%	0.375 ± 4.50%
	1.215 ~ 2.160	0.692 ~ 0.996	0.308 ~ 0.443
3	2.025 ± 7.33%	1.013 ± 4.67%	0.450 ± 4.67%
	1.530 ~ 2.520	0.855 ~ 1.170	0.380 ~ 0.520
3.5	2.363 ± 7.67%	1.181 ± 4.83%	0.525 ± 4.83%
	1.845 ~ 2.880	1.018 ~ 1.344	0.453 ~ 0.598
4	2.700 ± 8.00%	1.350 ± 5.00%	0.600 ± 5.00%
	2.160 ~ 3.240	1.181 ~ 1.519	0.525 ~ 0.675
4.5	3.038 ± 8.33%	1.519 ± 5.17%	0.675 ± 5.17%
	2.475 ~ 3.600	1.344 ~ 1.693	0.598 ~ 0.753
5	3.375 ± 8.67%	1.688 ± 5.33%	0.750 ± 5.33%
	2.790 ~ 3.960	1.508 ~ 1.868	0.670 ~ 0.830
6	4.050 ± 9.33%	2.025 ± 5.67%	0.900 ± 5.67%
	3.420 ~ 4.680	1.834 ~ 2.216	0.815 ~ 0.985
7	4.725 ± 10.00%	2.363 ± 6.00%	1.050 ± 6.00%
	4.050 ~ 5.400	2.160 ~ 2.565	0.960 ~ 1.140
8	5.400 ± 10.67%	2.700 ± 6.33%	1.200 ± 6.33%
	4.680 ~ 6.120	2.486 ~ 2.914	1.105 ~ 1.295
9	6.075 ± 11.33	3.038 ± 6.67%	1.350 ± 6.67%
	5.310 ~ 6.840	2.813 ~ 3.263	1.250 ~ 1.450
10	6.750 ± 12.00%	3.375 ± 7.00%	1.500 ± 7.00%
	5.940 ~ 7.560	3.139 ~ 3.611	1.395 ~ 1.605
15	10.125 ± 12.00%	5.063 ± 7.00%	2.250 ± 7.00%
	8.910~ 11.340	4.708 ~ 5.417	2.093 ~ 2.408
20	13.500 ± 12.00%	6.750 ± 7.00%	3.000 ± 7.00%
	11.880~ 15.120	6.278 ~ 7.223	2.790 ~ 6.357
30	20.250 ± 12.00%	10.125 ± 7.00%	4.500 ± 7.00%
	17.820 ~ 22.680	9.416 ~ 10.834	4.185 ~ 4.815
40	27.000 ± 12.00%	13.500 ± 7.00%	6.000 ± 7.00%
	23.760 ~ 30.240	12.555 ~ 14.445	5.580 ~ 6.420
50	33.750 ± 12.00%	16.875 ± 7.00%	7.500 ± 7.00%
	29.700 ~ 37.800	15.694 ~ 18.056	6.975 ~ 8.025

Note: The values shown in the upper column of each box represent the theoretical operation time and error limit, and those in the lower column represent the permissible range
Refer to the note *32 to *35.

Table 3.3 Operation time range for Extremely inverse time-delayed characteristic (EI01)

Unit: s

Operation time multiplier (M)	Input		
	300%	500%	1000%
0.25	0.250 ± 5.50%	0.083 ± 3.75%	0.020 ± 0.05
	* 0.040 ~ 0.800	* 0.040 ~ 0.208	* 0.040 ~ 0.070
0.5	0.500 ± 5.67%	0.167 ± 3.83%	0.040 ± 0.05
	* 0.040 ~ 1.067	* 0.040 ~ 0.294	* 0.040 ~ 0.090
1	1.000 ± 6.00%	0.333 ± 4.00%	0.081 ± 0.05
	0.400 ~ 1.600	0.200 ~ 0.467	* 0.040 ~ 0.131
1.5	1.500 ± 6.33%	0.500 ± 4.17%	0.121 ± 0.05
	0.867 ~ 2.133	0.361 ~ 0.639	0.071 ~ 0.171
2	2.000 ± 6.67%	0.667 ± 4.33%	0.162 ± 0.05
	1.333 ~ 2.667	0.522 ~ 0.811	0.112 ~ 0.212
2.5	2.500 ± 7.00%	0.833 ± 4.50%	0.202 ± 0.05
	1.800 ~ 3.200	0.683 ~ 0.983	0.152 ~ 0.252
3	3.000 ± 7.33%	1.000 ± 4.67%	0.242 ± 0.05
	2.267 ~ 3.733	0.844 ~ 1.156	0.192 ~ 0.292
3.5	3.500 ± 7.67%	1.167 ± 4.83%	0.283 ± 0.05
	2.733 ~ 4.267	1.006 ~ 1.328	0.233 ~ 0.333
4	4.000 ± 8.00%	1.333 ± 5.00%	0.323 ± 0.05
	3.200 ~ 4.800	1.167 ~ 1.500	0.273 ~ 0.373
4.5	4.500 ± 8.33%	1.500 ± 5.17%	0.364 ± 0.05
	3.667 ~ 5.333	1.328~ 1.672	0.314 ~ 0.414
5	5.000 ± 8.67%	1.667 ± 5.33%	0.404 ± 0.05
	4.133 ~ 5.867	1.489 ~ 1.844	0.354 ~ 0.454
6	6.000 ± 9.33%	2.000 ± 5.67%	0.485 ± 0.05
	5.067 ~ 6.933	1.811 ~ 2.189	0.435 ~ 0.535
7	7.000 ± 10.00%	2.333 ± 6.00%	0.566 ± 0.05
	6.000 ~ 8.000	2.133 ~ 2.533	0.516 ~ 0.616
8	8.000 ± 10.67%	2.667 ± 6.33%	0.646 ± 6.33%
	6.933 ~ 9.067	2.456 ~ 2.878	0.595 ~ 0.698
9	9.000 ± 11.33%	3.000 ± 6.67%	0.727 ± 6.67%
	7.867 ~ 10.133	2.778 ~ 3.222	0.673 ~ 0.781
10	10.000 ± 12.00%	3.333 ± 7.00%	0.808 ± 7.00%
	8.800 ~ 11.200	3.100 ~ 3.567	0.752 ~ 0.865
15	15.000 ± 12.00%	5.000 ± 7.00%	1.212 ± 7.00%
	13.200 ~ 16.800	4.650 ~ 5.350	1.127 ~ 1.297
20	20.000 ± 12.00%	6.667 ± 7.00%	1.616 ± 7.00%
	17.600 ~ 22.400	6.200 ~ 7.133	1.503 ~ 1.729
30	30.000 ± 12.00%	10.000 ± 7.00%	2.424 ± 7.00%
	26.400 ~ 33.600	9.300 ~ 10.700	2.255 ~ 2.594
40	40.000 ± 12.00%	13.333 ± 7.00%	3.232 ± 7.00%
	35.200 ~ 44.800	12.400 ~ 14.267	3.006 ~ 3.459
50	50.000 ± 12.00%	16.667 ± 7.00%	4.040 ± 7.00%
	44.000 ~ 56.000	15.500 ~ 17.833	3.758 ~ 4.323

Note: The values shown in the upper column of each box represent the theoretical operation time and error limit, and those in the lower column represent the permissible range
Refer to the note *32 to *35.

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Table 3.4   Operation time range for Long inverse time-delayed characteristic (LI01)

Unit: s

Operation time multiplier (M)	Input		
	300%	500%	1000%
0.25	0.675 ± 5.50%	0.338 ± 3.75%	0.150 ± 3.75%
	* 0.040 ~ 2.160	* 0.040 ~ 0.844	* 0.040 ~ 0.375
0.5	1.350 ± 5.67%	0.675 ± 3.83%	0.300 ± 3.83%
	* 0.040 ~ 2.880	0.158 ~ 1.193	0.070 ~ 0.530
1	2.700 ± 6.00%	1.350 ± 4.00%	0.600 ± 4.00%
	1.080 ~ 4.320	0.158 ~ 1.890	0.360 ~ 0.840
1.5	4.050 ± 6.33%	2.025 ± 4.17%	0.900 ± 4.17%
	2.340 ~ 5.760	1.463 ~ 2.588	0.650 ~ 1.150
2	5.400 ± 6.67%	2.700 ± 4.33%	1.200 ± 4.33%
	3.600 ~ 7.200	2.115 ~ 3.285	0.940 ~ 1.460
2.5	6.750 ± 7.00%	3.375 ± 4.50%	1.500 ± 4.50%
	4.860 ~ 8.640	2.768 ~ 3.983	1.230 ~ 1.770
3	8.100 ± 7.33%	4.050 ± 4.67%	1.800 ± 4.67%
	6.120 ~ 10.080	3.420 ~ 4.680	1.520 ~ 2.080
3.5	9.450 ± 7.67%	4.725 ± 4.83%	2.100 ± 4.83%
	7.380 ~ 11.520	4.073 ~ 5.378	1.810 ~ 2.390
4	10.800 ± 8.00%	5.400 ± 5.00%	2.400 ± 5.00%
	8.640 ~ 12.960	4.725 ~ 6.075	2.100 ~ 2.700
4.5	12.150 ± 8.33%	6.075 ± 5.17%	2.700 ± 5.17%
	9.900 ~ 14.400	5.378 ~ 6.773	2.390 ~ 3.010
5	13.500 ± 8.67%	6.750 ± 5.33%	3.000 ± 5.33%
	11.160 ~ 15.840	6.030 ~ 7.470	2.680 ~ 3.320
6	16.200 ± 9.33%	8.100 ± 5.67%	3.600 ± 5.67%
	13.680~ 18.720	7.335 ~ 8.865	3.260 ~ 3.940
7	18.900 ± 10.00%	9.450 ± 6.00%	4.200 ± 6.00%
	16.200 ~ 21.600	8.640 ~ 10.260	3.840 ~ 4.560
8	21.600 ± 10.67%	10.800 ± 6.33%	4.800 ± 6.33%
	18.720 ~ 24.480	9.945 ~ 11.655	4.420 ~ 5.180
9	24.300 ± 11.33%	12.150 ± 6.67%	5.400 ± 6.67%
	24.300 ± 11.33%	12.150 ± 6.67%	5.400 ± 6.67%
10	27.000 ± 12.00%	13.500 ± 7.00%	6.000 ± 7.00%
	23.760 ~ 30.240	12.555 ~ 14.445	5.580 ~ 6.420
15	40.500 ± 12.00%	20.250 ± 7.00%	9.000 ± 7.00%
	35.640 ~ 45.360	18.833 ~ 21.668	8.370 ~ 9.630
20	54.000 ± 12.00%	27.000 ± 7.00%	12.000 ± 7.00%
	47.520 ~ 60.480	25.110 ~ 28.890	11.160~ 12.840
30	81.000 ± 12.00%	40.500 ± 7.00%	18.000 ± 7.00%
	71.280 ~ 90.720	37.665 ~ 43.335	16.740 ~ 19.260
40	108.00 ± 12.00%	54.000 ± 7.00%	24.000 ± 7.00%
	95.040 ~ 120.96	50.220 ~ 57.780	22.320 ~ 25.680
50	135.00 ± 12.00%	67.500 ± 7.00%	30.000 ± 7.00%
	118.80 ~ 151.20	62.775 ~ 72.225	27.900 ~ 32.100

Note: The values shown in the upper column of each box represent the theoretical operation time and error limit, and those in the lower column represent the permissible range
Refer to the note *32 to *35.

Table 3.5 Operation time range for Long inverse time-delayed characteristic (LI02)

Unit: s

Operation time multiplier (M)	Input		
	300%	500%	1000%
0.25	0.667 ± 5.50%	0.400 ± 3.75%	0.200 ± 3.75%
	* 0.040 ~ 2.133	* 0.040 ~ 1.000	* 0.040 ~ 0.500
0.5	1.333 ± 5.67%	0.800 ± 3.83%	0.400 ± 3.83%
	* 0.040 ~ 2.844	0.187 ~ 1.413	0.093 ~ 0.707
1	2.667 ± 6.00%	1.600 ± 4.00%	0.800 ± 4.00%
	1.067 ~ 4.267	0.960 ~ 2.240	0.480 ~ 1.120
1.5	4.000 ± 6.33%	2.400 ± 4.17%	1.200 ± 4.17%
	2.311 ~ 5.689	1.733 ~ 3.067	0.867 ~ 1.533
2	5.333 ± 6.67%	3.200 ± 4.33%	1.600 ± 4.33%
	3.556 ~ 7.111	2.507 ~ 3.893	1.253 ~ 1.947
2.5	6.667 ± 7.00%	4.000 ± 4.50%	2.000 ± 4.50%
	4.800 ~ 8.533	3.280 ~ 4.720	1.640 ~ 2.360
3	8.000 ± 7.33%	4.800 ± 4.67%	2.400 ± 4.67%
	6.044 ~ 9.956	4.053 ~ 5.547	2.027 ~ 2.773
3.5	9.333 ± 7.67%	5.600 ± 4.83%	2.800 ± 4.83%
	7.289 ~ 11.378	4.827~ 6.373	2.413 ~ 3.187
4	10.667 ± 8.00%	6.400 ± 5.00%	3.200 ± 5.00%
	8.533 ~ 12.800	5.600 ~ 7.200	2.800 ~ 3.600
4.5	12.000 ± 8.33%	7.200 ± 5.17%	3.600 ± 5.17%
	9.778 ~ 14.222	6.373 ~ 8.027	3.187 ~ 4.013
5	13.333 ± 8.67%	8.000 ± 5.33%	4.000 ± 5.33%
	11.022 ~ 15.644	7.147 ~ 8.853	3.573 ~ 4.427
6	16.000 ± 9.33%	9.600 ± 5.67%	4.800 ± 5.67%
	13.511 ~ 18.489	8.693 ~ 10.507	4.347 ~ 5.253
7	18.667 ± 10.00%	11.200 ± 6.00%	5.600 ± 6.00%
	16.000 ~ 21.333	10.240 ~ 12.160	5.120 ~ 6.080
8	21.333 ± 10.67%	12.800 ± 6.33%	6.400 ± 6.33%
	18.489 ~ 24.178	11.787 ~ 13.813	5.893~ 6.907
9	24.000 ± 11.33%	14.400 ± 6.67%	7.200 ± 6.67%
	20.978 ~ 27.022	13.333 ~ 15.467	6.667 ~ 7.733
10	26.667 ± 12.00%	16.000 ± 7.00%	8.000 ± 7.00%
	23.467 ~ 29.867	14.880 ~ 17.120	7.440 ~ 8.560
15	40.000 ± 12.00%	24.000 ± 7.00%	12.000 ± 7.00%
	35.200 ~ 44.800	22.320 ~ 25.680	11.160 ~ 12.840
20	53.333 ± 12.00%	32.000 ± 7.00%	16.000 ± 7.00%
	46.933~ 59.733	29.760 ~ 34.240	14.880 ~ 17.120
30	80.000 ± 12.00%	48.000 ± 7.00%	24.000 ± 7.00%
	70.400 ~ 89.600	44.640 ~ 51.360	22.320 ~ 25.680
40	106.67 ± 12.00%	64.000 ± 7.00%	32.000 ± 7.00%
	93.867 ~ 119.47	59.520 ~ 68.480	29.760 ~ 34.240
50	133.33 ± 12.00%	80.000 ~ 7.00%	40.000 ± 7.00%
	117.33 ~ 149.33	74.400 ~ 85.600	37.200~ 42.800

Note: The values shown in the upper column of each box represent the theoretical operation time and error limit, and those in the lower column represent the permissible range
Refer to the note *32 to *35.

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Table 3.6　Operation time range for Definite time-delayed characteristic (DT01)

Unit: s

Operation time multiplier (M)	Input		
	300%	500%	1000%
0.25	0.050 ± 2.56%	0.050 ± 2.56%	0.050 ± 2.56%
	* 0.040 ~ 0.101	* 0.040 ~ 0.101	* 0.040 ~ 0.101
0.5	0.100 ± 2.63%	0.100 ± 2.63%	0.100 ± 2.63%
	0.048 ~ 0.153	0.048 ~ 0.153	0.048 ~ 0.153
1	0.200 ± 2.75%	0.200 ± 2.75%	0.200 ± 2.75%
	0.145 ~ 0.255	0.145 ~ 0.255	0.145 ~ 0.255
1.5	0.300 ± 2.88%	0.300 ± 2.88%	0.300 ± 2.88%
	0.243 ~ 0.358	0.243 ~ 0.358	0.243 ~ 0.358
2	0.400 ± 3.00%	0.400 ± 3.00%	0.400 ± 3.00%
	0.340 ~ 0.460	0.340 ~ 0.460	0.340 ~ 0.460
2.5	0.500 ± 3.13%	0.500 ± 3.13%	0.500 ± 3.13%
	0.438 ~ 0.563	0.438 ~ 0.563	0.438 ~ 0.563
3	0.600 ± 3.25%	0.600 ± 3.25%	0.600 ± 3.25%
	0.535 ~ 0.665	0.535 ~ 0.665	0.535 ~ 0.665
3.5	0.700 ± 3.38%	0.700 ± 3.38%	0.700 ± 3.38%
	0.633 ~ 0.768	0.633 ~ 0.768	0.633 ~ 0.768
4	0.800 ± 3.50%	0.800 ± 3.50%	0.800± 3.50%
	0.730 ~ 0.870	0.730 ~ 0.870	0.730 ~ 0.870
4.5	0.900 ± 3.63%	0.900 ± 3.63%	0.900 ± 3.63%
	0.828 ~ 0.973	0.828 ~ 0.973	0.828 ~ 0.973
5	1.000 ± 3.75%	1.000 ± 3.75%	1.000 ± 3.75%
	0.925 ~ 1.075	0.925 ~ 1.075	0.925 ~ 1.075
6	1.200 ± 4.00%	1.200 ± 4.00%	1.200 ± 4.00%
	1.120 ~ 1.280	1.120 ~ 1.280	1.120 ~ 1.280
7	1.400 ± 4.25%	1.400 ± 4.25%	1.400 ± 4.25%
	1.315 ~ 1.485	1.315 ~ 1.485	1.315 ~ 1.485
8	1.600 ± 4.50%	1.600 ± 4.50%	1.600 ± 4.50%
	1.510 ~ 1.690	1.510 ~ 1.690	1.510 ~ 1.690
9	1.800 ± 4.75%	1.800 ± 4.75%	1.800 ± 4.75%
	1.705 ~ 1.895	1.705 ~ 1.890	1.705 ~ 1.895
10	2.000 ± 5.00%	2.000 ± 5.00%	2.000 ± 5.00%
	1.900 ~ 2.100	1.900 ~ 2.100	1.900~ 2.100
15	3.000 ± 5.00%	3.000 ± 5.00%	3.000 ± 5.00%
	2.850 ~ 3.150	2.850 ~ 3.150	2.850 ~ 3.150
20	4.000 ± 5.00%	4.000 ± 5.00%	4.000 ± 5.00%
	3.800 ~ 4.200	3.800 ~ 4.200	3.800 ~ 4.200
30	6.000 ± 5.00%	6.000 ± 5.00%	6.000 ± 5.00%
	5.700 ~ 6.300	5.700 ~ 6.300	5.700 ~ 6.300
40	8.000 ± 5.00%	8.000 ± 5.00%	8.000 ± 5.00%
	7.600 ~ 8.400	7.600 ~ 8.400	7.600 ~ 8.400
50	10.000 ± 5.00%	10.000 ± 5.00%	10.000 ± 5.00%
	9.500 ~ 10.500	9.500 ~ 10.500	9.500 ~ 10.500

Note: The values shown in the upper column of each box represent the theoretical operation time and error limit, and those in the lower column represent the permissible range
　　　Refer to the note *32 to *35.

Table 3.7 Operation time range for Normal inverse time-delayed characteristic (NI11)

Unit: s

Operation time multiplier (M)	Input		
	300%	500%	1000%
0.25	0.061 ± 5.50%	0.042 ± 3.75%	0.030 ± 0.05
	* 0.040 ~ 0.195	* 0.040 ~ 0.106	* 0.040 ~ 0.080
0.5	0.122 ± 5.67%	0.084 ± 3.83%	0.060 ± 0.05
	* 0.040 ~ 0.259	* 0.040 ~ 0.149	* 0.040 ~ 0.110
1	0.243 ± 6.00%	0.169 ± 4.00%	0.121 ± 0.05
	0.097 ~ 0.389	0.101 ~ 0.236	0.071 ~ 0.171
1.5	0.365 ± 6.33%	0.253 ± 4.17%	0.181 ± 4.17%
	0.211 ~ 0.519	0.183 ~ 0.324	0.131 ~ 0.231
2	0.486 ± 6.67%	0.338 ± 4.33%	0.241 ± 4.33%
	0.324 ~ 0.649	0.265 ~ 0.411	0.189 ~ 0.294
2.5	0.608 ± 7.00%	0.422 ± 4.50%	0.302 ± 4.50%
	0.438~ 0.778	0.346 ~ 0.498	0.247 ~ 0.356
3	0.730 ± 7.33%	0.506 ± 4.67%	0.362 ± 4.67%
	0.551 ~ 0.908	0.428 ~ 0.585	0.306 ~ 0.418
3.5	0.851 ± 7.67%	0.591 ± 4.83%	0.422 ± 4.83%
	0.665 ~ 1.038	0.509 ~ 0.673	0.364 ~ 0.481
4	0.973 ± 8.00%	0.675 ± 5.00%	0.483 ± 5.00%
	0.778 ~ 1.167	0.591 ~ 0.760	0.422 ~ 0.543
4.5	1.094 ± 8.33%	0.760 ± 5.17%	0.543 ± 5.17%
	0.892 ~ 1.297	0.673 ~ 0.847	0.481 ~ 0.605
5	1.216 ± 8.67%	0.844 ± 5.33%	0.603 ± 5.33%
	1.005 ~ 1.427	0.754 ~ 0.934	0.539 ~ 0.668
6	1.459 ± 9.33%	1.013 ± 5.67%	0.724 ± 5.67%
	1.232 ~ 1.686	0.917 ~ 1.109	0.656 ~ 0.792
7	1.703 ± 10.00%	1.182 ± 6.00%	0.845 ± 6.00%
	1.459 ~ 1.946	1.081 ~ 1.283	0.772 ~ 0.917
8	1.946 ± 10.67%	1.351 ± 6.33%	0.965 ± 6.33%
	1.686 ~ 2.205	1.244 ~ 1.458	0.889 ~ 1.042
9	2.189 ± 11.33%	1.519 ± 6.67%	1.086 ± 6.67%
	1.913 ~ 2.465	1.407 ~ 1.632	1.006 ~ 1.167
10	2.432 ± 12.00%	1.688 ± 7.00%	1.207 ± 7.00%
	2.140 ~ 2.724	1.570 ~ 1.807	1.122 ~ 1.291
15	3.648 ± 12.00%	2.532 ± 7.00%	1.810 ± 7.00%
	3.211 ~ 4.086	2.355 ~ 2.710	1.683 ~ 1.937
20	4.864 ± 12.00%	3.377 ± 7.00%	2.414 ± 7.00%
	4.281 ~ 5.448	3.140 ~ 3.613	2.245 ~ 2.582
30	7.297 ± 12.00%	5.065 ± 7.00%	3.620 ± 7.00%
	6.421~ 8.172	4.710 ~ 5.420	3.367 ~ 3.874
40	9.729 ± 12.00%	6.753 ± 7.00%	4.827 ± 7.00%
	8.561 ~ 10.896	6.281 ~ 7.226	4.489 ~ 5.165
50	12.161 ± 12.00%	8.442 ± 7.00%	6.034 ± 7.00%
	10.702 ~ 13.620	7.851 ~ 9.033	5.611 ~ 6.456

Note: The values shown in the upper column of each box represent the theoretical operation time and error limit, and those in the lower column represent the permissible range
Refer to the note *32 to *35.

Table 3.8   Operation time range for Extremely inverse time-delayed characteristic (EI11)

Unit: s

Operation time multiplier (M)	Input		
	300%	500%	1000%
0.25	0.074 ± 5.50%	0.033 ± 0.05	0.017 ± 0.05
	* 0.040 ~ 0.235	* 0.040 ~ 0.082	* 0.040 ~ 0.067
0.5	0.147 ± 5.67%	0.065 ± 3.83%	0.034 ± 0.05
	* 0.040 ~ 0.314	* 0.040 ~ 0.116	* 0.040 ~ 0.084
1	0.294 ± 6.00%	0.131 ± 4.00%	0.069 ± 0.05
	0.118 ~ 0.471	0.078 ~ 0.183	* 0.040 ~ 0.119
1.5	0.441 ± 6.33%	0.196 ± 4.17%	0.103 ± 0.05
	0.255 ~ 0.628	0.142 ~ 0.251	0.053 ~ 0.153
2	0.588 ± 6.67%	0.262 ± 4.33%	0.138 ± 0.05
	0.392 ~ 0.785	0.205 ~ 0.318	0.088 ~ 0.188
2.5	0.736 ± 7.00%	0.327 ± 4.50%	0.172 ± 0.05
	0.530 ~ 0.942	0.268 ~ 0.386	0.122 ~ 0.222
3	0.883 ± 7.33%	0.392 ± 4.67%	0.207 ± 0.05
	0.667~ 1.098	0.331~ 0.453	0.157 ~ 0.257
3.5	1.030 ± 7.67%	0.458 ± 4.83%	0.241 ± 0.05
	0.804 ~ 1.255	0.395 ~ 0.521	0.191 ~ 0.291
4	1.177 ± 8.00%	0.523 ± 5.00%	0.276 ± 0.05
	0.942~ 1.412	0.458 ~ 0.589	0.226 ~ 0.326
4.5	1.324 ± 8.33%	0.589 ± 5.17%	0.310 ± 0.05
	1.079 ~ 1.569	0.521 ~ 0.656	0.260 ~ 0.360
5	1.471 ± 8.67%	0.654 ± 5.33%	0.345 ± 0.05
	1.216 ~ 1.726	0.584 ~ 0.724	0.295 ~ 0.395
6	1.765 ± 9.33%	0.785 ± 5.67%	0.413 ± 0.05
	1.491~ 2.040	0.711 ~ 0.859	0.363 ~ 0.463
7	2.060 ± 10.00%	0.916 ± 6.00%	0.482 ± 0.05
	1.765 ~ 2.354	0.837 ~ 0.994	0.432 ~ 0.532
8	2.354 ± 10.67%	1.046 ± 6.33%	0.551 ± 0.05
	2.040 ~ 2.668	0.964 ~ 1.129	0.501 ~ 0.601
9	2.648 ± 11.33%	1.177 ± 6.67%	0.620 ± 0.05
	2.315 ~ 2.981	1.090 ~ 1.264	0.570 ~ 0.670
10	2.942 ± 12.00%	1.308 ± 7.00%	0.689 ± 0.05
	2.589 ~ 3.295	1.217 ~ 1.400	0.639 ~ 0.739
15	4.413 ± 12.00%	1.962 ± 7.00%	1.034 ± 7.00%
	3.884 ~ 4.943	1.825 ~ 2.099	0.961 ~ 1.106
20	5.885 ± 12.00%	2.616 ± 7.00%	1.378 ± 7.00%
	5.178 ~ 6.591	2.433 ~ 2.799	1.282 ~ 1.475
30	8.827 ± 12.00%	3.924 ± 7.00%	2.067 ± 7.00%
	7.768 ~ 9.886	3.650 ~ 4.199	1.923 ~ 2.212
40	11.769 ± 12.00%	5.232 ± 7.00%	2.756 ± 7.00%
	10.357 ~ 13.181	4.866 ~ 5.599	2.563 ~ 2.949
50	14.711 ± 12.00%	6.540 ± 7.00%	3.445 ± 7.00%
	12.946 ~ 16.477	6.083 ~ 6.998	3.204 ~ 3.687

Note: The values shown in the upper column of each box represent the theoretical operation time and error limit, and those in the lower column represent the permissible range
Refer to the note *32 to *35.

Table 3.9　Operation time range for Extremely inverse time-delayed characteristic (EI12)

Unit: s

Operation time multiplier (M)	Input		
	300%	500%	1000%
0.25	0.091 ± 5.50%	0.032 ± 0.05	0.010 ± 0.05
	* 0.040 ~ 0.292	* 0.040 ~ 0.082	* 0.040 ~ 0.060
0.5	0.182 ± 5.67%	0.065 ± 3.83%	0.020 ± 0.05
	* 0.040 ~ 0.389	* 0.040 ~ 0.115	* 0.040 ~ 0.070
1	0.365 ± 6.00%	0.130 ± 4.00%	0.041 ± 0.05
	0.146 ~ 0.583	0.078 ~ 0.182	* 0.040 ~ 0.091
1.5	0.547 ± 6.33%	0.195 ± 4.17%	0.061 ± 0.05
	0.316 ~ 0.778	0.140 ~ 0.249	* 0.040 ~ 0.111
2	0.729 ± 6.67%	0.259 ± 4.33%	0.081 ± 0.05
	0.486 ~ 0.972	0.203 ~ 0.316	* 0.040 ~ 0.131
2.5	0.912 ± 7.00%	0.324 ± 4.50%	0.102 ± 0.05
	0.656 ~ 1.167	0.266 ~ 0.383	0.052 ~ 0.152
3	1.094 ± 7.33%	0.389 ± 4.67%	0.122 ± 0.05
	0.827 ~ 1.361	0.328 ~ 0.450	0.072 ~ 0.172
3.5	1.276 ± 7.67%	0.454 ± 4.83%	0.142 ± 0.05
	0.997 ~ 1.556	0.391 ~ 0.517	0.092 ~ 0.192
4	1.459 ± 8.00%	0.519 ± 5.00%	0.163 ± 0.05
	1.167 ~ 1.750	0.454 ~ 0.584	0.113 ~ 0.213
4.5	1.641 ± 8.33%	0.584 ± 5.17%	0.183 ± 0.05
	1.337 ~ 1.945	0.517 ~ 0.651	0.133 ~ 0.233
5	1.823 ± 8.67%	0.648 ± 5.33%	0.203 ± 0.05
	1.507 ~ 2.139	0.579 ~ 0.718	0.153 ~ 0.253
6	2.188 ± 9.33%	0.778 ± 5.67%	0.244 ± 0.05
	1.848 ~ 2.528	0.705 ~ 0.851	0.194 ~ 0.294
7	2.553 ± 10.00%	0.908 ± 6.00%	0.285 ± 0.05
	2.188 ~ 2.917	0.830 ~ 0.985	0.235 ~ 0.335
8	2.917 ± 10.67%	1.037 ± 6.33%	0.325 ± 0.05
	2.528 ~ 3.306	0.955 ~ 1.119	0.275 ~ 0.375
9	3.282 ± 11.33%	1.167 ± 6.67%	0.366 ± 0.05
	2.869 ~ 3.695	1.081 ~ 1.253	0.316 ~ 0.416
10	3.647 ± 12.00%	1.297 ± 7.00%	0.407 ± 0.05
	3.209 ~ 4.084	1.206 ~ 1.387	0.357 ~ 0.457
15	5.470 ± 12.00%	1.945 ± 7.00%	0.610 ± 0.05
	4.814 ~ 6.126	1.809 ~ 2.081	0.560 ~ 0.660
20	7.293 ± 12.00%	2.593 ± 7.00%	0.813 ± 7.00%
	6.418 ~ 8.169	2.412 ~ 2.775	0.756 ~ 0.870
30	10.940 ± 12.00%	3.890 ± 7.00%	1.220 ± 7.00%
	9.627 ~ 12.253	3.618 ~ 4.162	1.134 ~ 1.305
40	14.587 ± 12.00%	5.187 ± 7.00%	1.626 ± 7.00%
	12.836 ~ 16.337	4.824 ~ 5.550	1.512 ~ 1.740
50	18.234 ± 12.00%	6.484 ± 7.00%	2.033 ± 7.00%
	16.045 ~ 20.422	6.030 ~ 6.937	1.890 ~ 2.175

Note: The values shown in the upper column of each box represent the theoretical operation time and error
limit, and those in the lower column represent the permissible range
Refer to the note *32 to *35.

Table 3.10 Operation time range for Normal inverse time-delayed characteristic (NI21)

Unit: s

Operation time multiplier (M)	Input		
	300%	500%	1000%
0.25	0.139 ± 5.50%	0.096 ± 3.75%	0.070 ± 3.75%
	* 0.040 ~ 0.444	* 0.040 ~ 0.241	* 0.040 ~ 0.174
0.5	0.277 ± 5.67%	0.193 ± 3.83%	0.139 ± 3.83%
	* 0.040 ~ 0.592	0.045 ~ 0.341	* 0.040 ~ 0.246
1	0.555 ± 6.00%	0.386 ± 4.00%	0.279 ± 4.00%
	0.222 ~ 0.888	0.231 ~ 0.540	0.167 ~ 0.390
1.5	0.832 ± 6.33%	0.578 ± 4.17%	0.418 ± 4.17%
	0.481 ~ 1.184	0.418 ~ 0.739	0.302 ~ 0.534
2	1.110 ± 6.67%	0.771 ± 4.33%	0.557 ± 4.33%
	0.740 ~ 1.480	0.604 ~ 0.938	0.437 ~ 0.678
2.5	1.387 ± 7.00%	0.964 ± 4.50%	0.697 ± 4.50%
	0.999 ~ 1.776	0.790 ~ 1.137	0.571 ~ 0.822
3	1.665 ± 7.33%	1.157 ± 4.67%	0.836 ± 4.67%
	1.258 ~ 2.072	0.977 ~ 1.337	0.706 ~ 0.966
3.5	1.942 ± 7.67%	1.350 ± 4.83%	0.976 ± 4.83%
	1.517 ~ 2.368	1.163 ~ 1.536	0.841 ~ 1.110
4	2.220 ± 8.00%	1.542 ± 5.00%	1.115 ± 5.00%
	1.776 ~ 2.664	1.350 ~ 1.735	0.976 ~ 1.254
4.5	2.497 ± 8.33%	1.735 ± 5.17%	1.254 ± 5.17%
	2.035 ~ 2.959	1.536 ~ 1.934	1.110 ~ 1.398
5	2.775 ± 8.67%	1.928 ± 5.33%	1.394 ± 5.33%
	2.294 ~ 3.255	1.722 ~ 2.134	1.245 ~ 1.542
6	3.329 ± 9.33%	2.314 ± 5.67%	1.672 ± 5.67%
	2.812 ~ 3.847	2.095 ~ 2.532	1.514 ~ 1.830
7	3.884 ± 10.00%	2.699 ± 6.00%	1.951 ± 6.00%
	3.329 ~ 4.439	2.468 ~ 2.930	1.784 ~ 2.118
8	4.439 ± 10.67%	3.085 ± 6.33%	2.230 ± 6.33%
	3.847 ~ 5.031	2.841 ~ 3.329	2.053 ~ 2.406
9	4.994 ± 11.33%	3.470 ± 6.67%	2.509 ± 6.67%
	4.365 ~ 5.623	3.213 ~ 3.727	2.323 ~ 2.695
10	5.549 ± 12.00%	3.856 ± 7.00%	2.787 ± 7.00%
	4.883 ~ 6.215	3.586 ~ 4.126	2.592 ~ 2.983
15	8.324 ± 12.00%	5.784 ± 7.00%	4.181 ± 7.00%
	7.325 ~ 9.322	5.379 ~ 6.189	3.888 ~ 4.474
20	11.098 ± 12.00%	7.712 ± 7.00%	5.575 ± 7.00%
	9.766 ~ 12.430	7.172 ~ 8.252	5.185 ~ 5.965
30	16.647 ± 12.00%	11.568 ± 7.00%	8.362 ± 7.00%
	14.649 ~ 18.645	10.758 ~ 12.377	7.777 ~ 8.948
40	22.196 ± 12.00%	15.424 ± 7.00%	11.150 ± 7.00%
	19.533 ~ 24.860	14.344 ~ 16.503	10.369 ~ 11.930
50	27.745 ± 12.00%	19.279 ± 7.00%	13.937 ± 7.00%
	24.416 ~ 31.075	17.930 ~ 20.629	12.962 ~ 14.913

Note: The values shown in the upper column of each box represent the theoretical operation time and error limit, and those in the lower column represent the permissible range
Refer to the note *32 to *35.

Table 3.11   Operation time range e for Very inverse time-delayed characteristic (VI21)

Unit: s

Operation time multiplier (M)	Input		
	300%	500%	1000%
0.25	0.210 ± 5.50%	0.110 ± 3.75%	0.054 ± 3.75%
	* 0.040 ~ 0.672	* 0.040 ~ 0.275	* 0.040 ~ 0.136
0.5	0.420 ± 5.67%	0.220 ± 3.83%	0.109 ± 3.83%
	* 0.040 ~ 0.896	0.051 ~ 0.389	* 0.040 ~ 0.192
1	0.840 ± 6.00%	0.440 ± 4.00%	0.218 ± 4.00%
	0.336 ~ 1.344	0.264 ~ 0.616	0.131 ~ 0.305
1.5	1.260 ± 6.33%	0.660 ± 4.17%	0.327 ± 4.17%
	0.728 ~ 1.792	0.477 ~ 0.843	0.236 ~ 0.417
2	1.680 ± 6.67%	0.880 ± 4.33%	0.436 ± 4.33%
	1.120 ~ 2.240	0.689 ~ 1.071	0.341 ~ 0.530
2.5	2.100 ± 7.00%	1.100 ± 4.50%	0.544 ± 4.50%
	1.512 ~ 2.688	0.902 ~ 1.298	0.446 ~ 0.642
3	2.520 ± 7.33%	1.320 ± 4.67%	0.653 ± 4.67%
	1.904 ~ 3.136	1.115 ~ 1.525	0.552 ~ 0.755
3.5	2.940 ± 7.67%	1.540 ± 4.83%	0.762 ± 4.83%
	2.296 ~ 3.584	1.327 ~ 1.753	0.657 ~ 0.867
4	3.360 ± 8.00%	1.760 ± 5.00%	0.871 ± 5.00%
	2.688 ~ 4.032	1.540 ~ 1.980	0.762 ~ 0.980
4.5	3.780 ± 8.33%	1.980 ± 5.17%	0.980 ± 5.17%
	3.080 ~ 4.480	1.753 ~ 2.207	0.867 ~ 1.093
5	4.200 ± 8.67%	2.200 ± 5.33%	1.089 ± 5.33%
	3.472 ~ 4.928	1.965 ~ 2.435	0.973 ~ 1.205
6	5.040 ± 9.33%	2.640 ± 5.67%	1.307 ± 5.67%
	4.256 ~ 5.824	2.391 ~ 2.889	1.183 ~ 1.430
7	5.880 ± 10.00%	3.080 ± 6.00%	1.524 ± 6.00%
	5.040 ~ 6.720	2.816 ~ 3.344	1.394 ~ 1.655
8	6.720 ± 10.67%	3.520 ± 6.33%	1.742 ± 6.33%
	5.824 ~ 7.616	3.241 ~ 3.799	1.604 ~ 1.880
9	7.560 ± 11.33%	3.960 ± 6.67%	1.960 ± 6.67%
	6.608 ~ 8.512	3.667 ~ 4.253	1.815 ~ 2.105
10	8.400 ± 12.00%	4.400 ± 7.00%	2.178 ± 7.00%
	7.392 ~ 9.408	4.092 ~ 4.708	2.025 ~ 2.330
15	12.600 ± 12.00%	6.600 ± 7.00%	3.267 ± 7.00%
	11.088 ~ 14.112	6.138 ~ 7.062	3.038 ~ 3.495
20	16.800 ± 12.00%	8.800 ± 7.00%	4.356 ± 7.00%
	14.784~ 18.816	8.184 ~ 9.416	4.051 ~ 4.660
30	25.200 ± 12.00%	13.200 ± 7.00%	6.533 ± 7.00%
	22.176 ~ 28.224	12.276 ~ 14.124	6.076 ~ 6.991
40	33.600 ± 12.00%	17.600 ± 7.00%	8.711 ± 7.00%
	29.568 ~ 37.632	16.368 ~ 18.832	8.101 ~ 9.321
50	42.000 ± 12.00%	22.000 ± 7.00%	10.889 ± 7.00%
	36.960 ~ 47.040	20.460 ~ 23.540	10.127 ~ 11.651

Note: The values shown in the upper column of each box represent the theoretical operation time and error limit, and those in the lower column represent the permissible range

   Refer to the note *32 to *35.

Table 3.12   Operation time range for Long inverse time-delayed characteristic (LI21)

Unit: s

Operation time multiplier (M)	Input		
	300%	500%	1000%
0.25	0.750 ± 5.50%	0.375 ± 3.75%	0.167 ± 3.75%
	* 0.040 ~ 2.400	* 0.040 ~ 0.938	* 0.040 ~ 0.417
0.5	1.500 ± 5.67%	0.750 ± 3.83%	0.333 ± 3.83%
	* 0.040 ~ 3.200	0.175 ~ 1.325	0.078 ~ 0.589
1	3.000 ± 6.00%	1.500 ± 4.00%	0.667 ± 4.00%
	1.200 ~ 4.800	0.900 ~ 2.100	0.400 ~ 0.933
1.5	4.500 ± 6.33%	2.250 ± 4.17%	1.000 ± 4.17%
	2.600 ~ 6.400	1.625 ~ 2.875	0.722~ 1.278
2	6.000 ± 6.67%	3.000 ± 4.33%	1.333 ± 4.33%
	4.000 ~ 8.000	2.350 ~ 3.650	1.044 ~ 1.622
2.5	7.500 ± 7.00%	3.750 ± 4.50%	1.667 ± 4.50%
	5.400 ~ 9.600	3.075 ~ 4.425	1.367 ~ 1.967
3	9.000 ± 7.33%	4.500 ± 4.67%	2.000 ± 4.67%
	6.800 ~ 11.200	3.800 ~ 5.200	1.689 ~ 2.311
3.5	10.500 ± 7.67%	5.250 ± 4.83%	2.333 ± 4.83%
	8.200 ~ 12.800	4.525 ~ 5.975	2.011 ~ 2.656
4	12.000 ± 8.00%	6.000 ± 5.00%	2.667 ± 5.00%
	9.600 ~ 14.400	5.250 ~ 6.750	2.333 ~ 3.000
4.5	13.500 ± 8.33%	6.750 ± 5.17%	3.000 ± 5.17%
	11.000 ~ 16.000	5.975 ~ 7.525	2.656 ~ 3.344
5	15.000 ± 8.67%	7.500 ± 5.33%	3.333 ± 5.33%
	12.400 ~ 17.600	6.700 ~ 8.300	2.978 ~ 3.689
6	18.000 ± 9.33%	9.000 ± 5.67%	4.000 ± 5.67%
	15.200 ~ 20.800	8.150 ~ 9.850	3.622 ~ 4.378
7	21.000 ± 10.00%	10.500 ± 6.00%	4.667 ± 6.00%
	18.000 ~ 24.000	9.600 ~ 11.400	4.267~ 5.067
8	24.000 ± 10.67%	12.000 ± 6.33%	5.333 ± 6.33%
	20.800 ~ 27.200	11.050 ~ 12.950	4.911 ~ 5.756
9	27.000 ± 11.33%	13.500 ± 6.67%	6.000 ± 6.67%
	23.600 ~ 30.400	12.500 ~ 14.500	5.556 ~ 6.444
10	30.000 ± 12.00%	15.000 ± 7.00%	6.667 ± 7.00%
	26.400 ~ 33.600	13.950 ~ 16.050	6.200 ~ 7.133
15	45.000 ± 12.00%	22.500 ± 7.00%	10.000 ± 7.00%
	39.600 ~ 50.400	20.925 ~ 24.075	9.300 ~ 10.700
20	60.000 ± 12.00%	30.000 ± 7.00%	13.333 ± 7.00%
	52.800 ~ 67.200	27.900 ~ 32.100	12.400 ~ 14.267
30	90.000 ± 12.00%	45.000 ± 7.00%	20.000 ± 7.00%
	79.200 ~ 100.80	41.850 ~ 48.150	18.600 ~ 21.400
40	120.00 ± 12.00%	60.000 ± 7.00%	26.667 ± 7.00%
	105.60 ~ 134.4	55.800 ~ 64.200	24.800 ~ 28.533
50	150.00 ± 12.00%	75.000 ± 7.00%	33.333 ± 7.00%
	132.00 ~ 168.00	69.750 ~ 80.250	31.000 ~ 35.667

Note: The values shown in the upper column of each box represent the theoretical operation time and error
limit, and those in the lower column represent the permissible range
Refer to the note *32 to *35.

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Table 3.13   Reset time characteristic

Input: Setting value×300% →0

	Output contact	Reset of operation timer inside relay
01 : Definite time-delayed (200 ms)	200ms ± 25ms	Immediately
11 : Inverse time-delayed	200ms ± 25ms	Approx. 8 s (for M=10 , I=0)*36
21 : Definite time-delayed (50 ms)	50ms or less	Immediately

Note:

*32   The numbers "300%", "500%" and "1000%" represent multiples against the current setting.

*33   The values shown in the upper column of each box in the table represent the theoretical operation time and error limit, and those in the lower column represent the permissible range (see the formula below).

a. Operation time multiplier "M" $\leq$10	b. Operation time multiplier "M" > 10
$$\varepsilon = \frac{T_M - \frac{M}{10} \cdot T_{10}}{T_{10}} \cdot 100$$	$$\varepsilon = \frac{T_M - \frac{M}{10} \cdot T_{10}}{\frac{M}{10} \cdot T_{10}} \cdot 100$$

where;

T_{10} : Nominal operation time for reference operation time setting (M = 10)

T_M : Actual measurement of operation time for operation time setting "M"

ε : Error (%)

M   : Operation time multiplier

If an error range determined using the formula above is smaller the lower error limit of ± 50ms, this lower error limit should be used as the error range.

34   "40ms" given at the underlined part (marked with "") in the table indicates the time determined as minimum operation time.

*35   The table is prepared on the basis of minimum operation setting under normal temperature, and the operation time ranges change as condition varies.

*36   The elapsed time of reset of the operation timer can be checked through the "Elapse of time-delayed timer (LAPSE) indicator".

4　Functions

4.1　Protection

4.1.1　Overcurrent elements

Fig. 4.1 "Overcurrent element internal function block diagram" shows operation of the overcurrent elements.

The time-delayed element compares input currents with the operation setting in each phase. If an input current is larger than the specified operation level, the element outputs an operation signal when the time-delayed timer expires. The expiring time depends on the input current amount and the setting in the operation time characteristic.
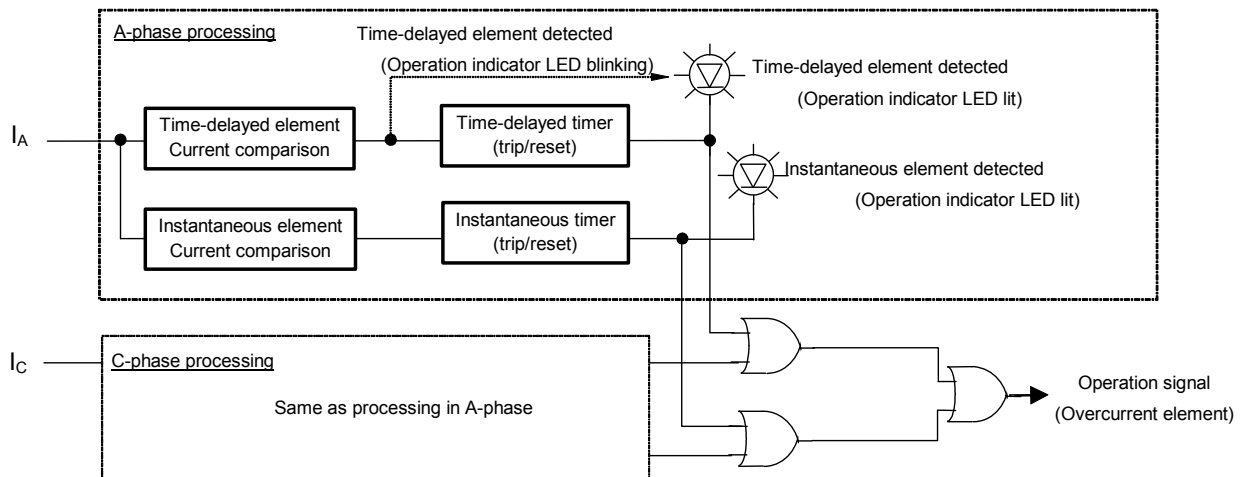
Figure 4.1　Overcurrent element internal function diagram

Like the time-delayed element, the instantaneous element also compares the input current with the operation setting to output an operation signal when a period of time set in the instantaneous timer has elapsed.

4.1.2　General functions

(1)　Setting of operation current

The operation current settings for the instantaneous and time-delayed elements are indicated with current values [A].

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

(2)　Setting of operation time multiplier

This parameter is indicated with a multiplier against the basic operation time characteristic (value for the letter "M" in the operation characteristic formula shown in Figure 3.1).

(3)　Setting of operation time characteristic

A time-delayed element includes 11 types of inverse and a type of definite time-delayed characteristics for trip action that meet the requirements specified by IEC60255-3. One of them can be selected by operation time characteristic setting.

Figures 3.1 and 3.2 show the operation time characteristic curves and operation time characteristic formulas.

(4) Setting of reset time characteristic

A time-delayed element includes a type of inverse and two types of definite time-delayed characteristics for reset action that meet the requirements specified by IEC60255-3. One of them can be selected by reset time characteristic setting.

Figure 3.3 shows the reset time characteristic curves and reset time characteristic formula.

Characteristic		Reset when relay input is less than operation setting		Response to intermittent inputs
Designation	Symbol	Reset of time-lag timer inside relay	Output contact	
Definite time-lag	01	Quick reset	Definite time-lag of 200ms	Unlikely to operate
	21	Quick reset	Definite time-lag of 50ms	
Inverse time-lag	11	Inverse time-lag reset according to the formula below: $t_r = \dfrac{8}{1-I^2} \times \dfrac{M}{10}$(s)	Definite time-lag of 200ms	Likely to operate

For the definite time-delayed reset characteristic, the internal timer will reset quickly when the input current becomes less than the operation setting. The definite time-delayed reset characteristic is not suitable for detecting intermittent overloads which are likely to occur in starting a motor or intermittent earth fault. For the inverse time-delayed reset characteristic in turn, the internal timer will reset according to an inverse time-delayed reset characteristic even when the input current becomes less than the operating setting by following the principle of resetting the electromagnetic mechanical type induction disc. Therefore, it is relatively easy for the inverse time-delayed reset characteristic to detect intermittent phenomena. Select either depending on your application.

Note that the output contact will reset after a definite period of time whichever characteristic is selected for resetting.

When definite time-delayed reset characteristic is selected:

When inverse time-delayed reset characteristic is selected:
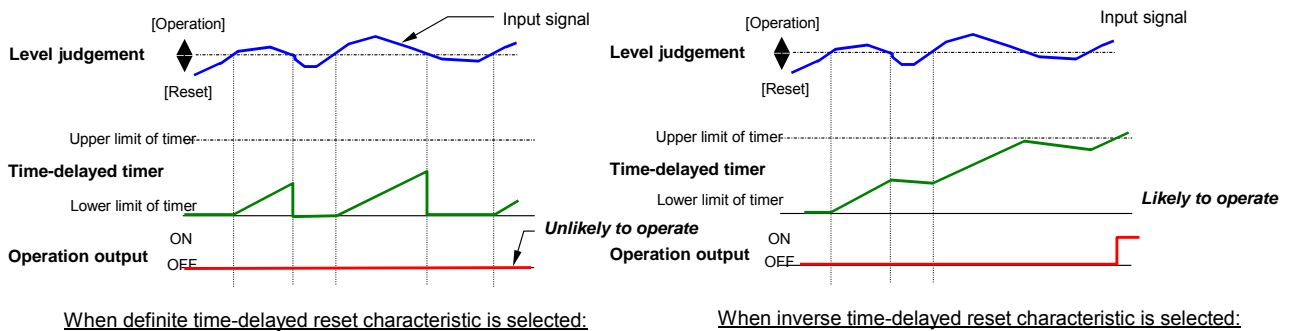
**Figure 4.2   Comparison of relay operation with intermittent overload input
between two reset characteristics**

(5) Operation display

For the time-delayed element, when the input current becomes larger than the operation setting, the corresponding operation indicator LED will blink to allow you check the starting value.

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

For the instantaneous element in turn, the LED lamp will come on at the same time when an operation

output is made.

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

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

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

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

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

(6) Display of elapsed time of time-delayed timer

For the time-delayed elements, the elapsed time of the internal operation timer is indicated in the display. As the elapsed time is counted, operators may imagine the current status of the electromagnetic mechanical induction disc, which will help detect the starting value.

When an input current is detected to have reached the operation setting or more, "0" will appear in the display. Counting will be made by dividing the operation time equally into ten parts and starting from "1", "2" to "9" and "10". An operation signal will be output as soon as the counter reaches "10".

(7) Output contacts

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

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

All the outputs have been set to "auto reset" in the factory. Any of them can be changed to "self hold".
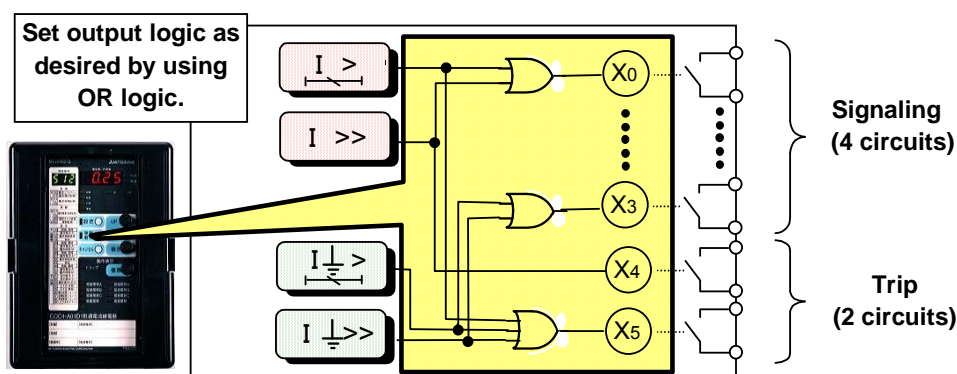
Figure 4.3   Schematic image of Programmable Outputs (example: COC4-A01)

(8) Forced operation

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

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

4.2   Measurement

Currents input to the relay are measured and converted into freely set CT primary currents, then indicated on the display.

(1) Real time measurement

The effective values of input current and 2f ratio are displayed for each phase.

(2) Max. record

The maximum effective current is recorded and stored for each phase.

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

(3) Fault record

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

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

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

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

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

| Item	Specification
Data sampling cycle	Fixed to the electric angle of 30° of rated frequency
Data storing capacity (for a phenomenon)	224 cycles of rated frequency (Data point: 224×360°/30° = 2688 points)
Permissible setting range	224 cycles before trip ~ 224 cycles after trip
Collected data	The range for data collection can be set by cycle within the "data storing capacity" in the "permissible set range".
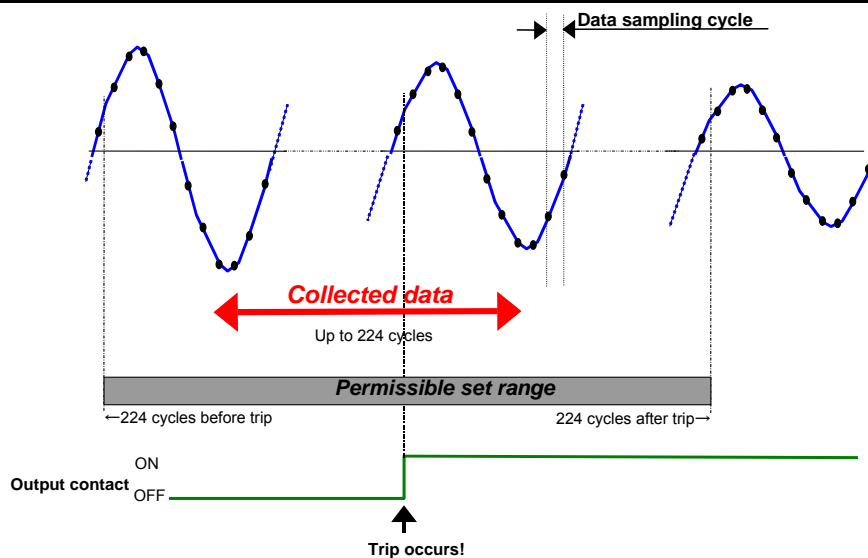
Figure 4.4   Concept of recording fault waveform

4.3 Self-diagnosis

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

(1) Checking defect code at failure detection

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

(2) Resetting self-diagnosis output

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

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

(3) Clearing the defect code

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

Table 4.1   Output for protection relay failures

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

*41   Monitored only in the models with built-in D/I function.
*42   Monitored only in the models with D2 unit.
*43   Monitored only the biased differential relay.
*44   Monitored only when the relay is installed with communication card.
*45   No necessary to lock the operation output as any signals can't be output in case of CPU stop.

4.4   Communication

Figure 4.5 shows an example of network system configuration.

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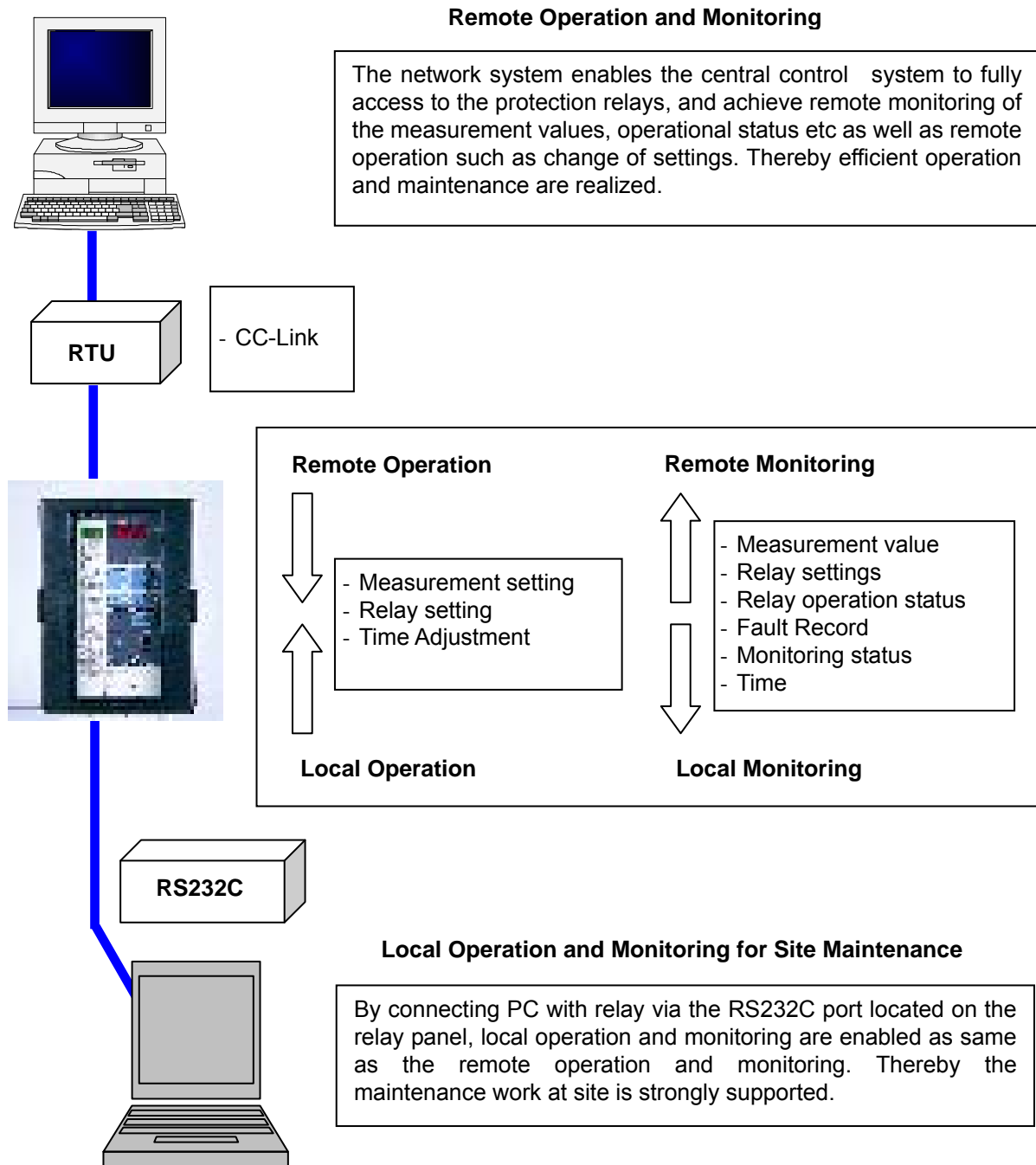
Central Control System

Remote Operation and Monitoring

The network system enables the central control   system to fully access to the protection relays, and achieve remote monitoring of the measurement values, operational status etc as well as remote operation such as change of settings. Thereby efficient operation and maintenance are realized.

RTU

- CC-Link

Remote Operation

Remote Monitoring

- Measurement setting
- Relay setting
- Time Adjustment

- Measurement value
- Relay settings
- Relay operation status
- Fault Record
- Monitoring status
- Time

Local Operation

Local Monitoring

RS232C

Local Operation and Monitoring for Site Maintenance

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.

Figure 4.5 Example of communication network system configuration

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

Table 4.2   Outline of functions enabled by communication network

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

5 Configuration

5.1 Internal configuration

(1) I/O and CPU circuits

Fig. 5.1 shows the internal block diagram of the model COC2-A01D1.

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

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

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

(2) Self-diagnosis circuit

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

The self-diagnosis output contact (break contact) will be closed when a failure occurs in the circuits above or when the built-in power fuse burns.
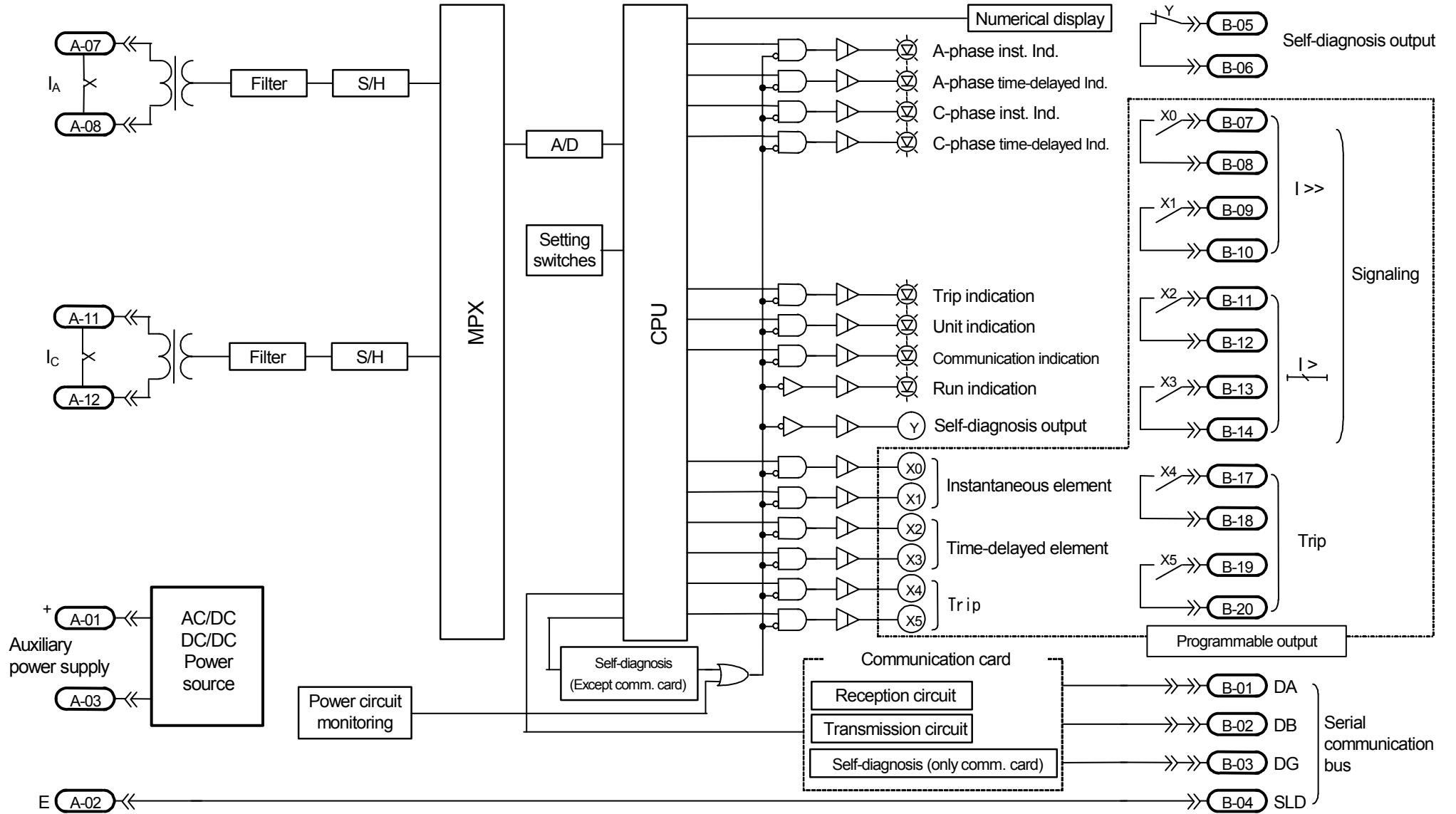
Figure 5.1   Internal block diagram of Type COC2-A01D1 relay

37
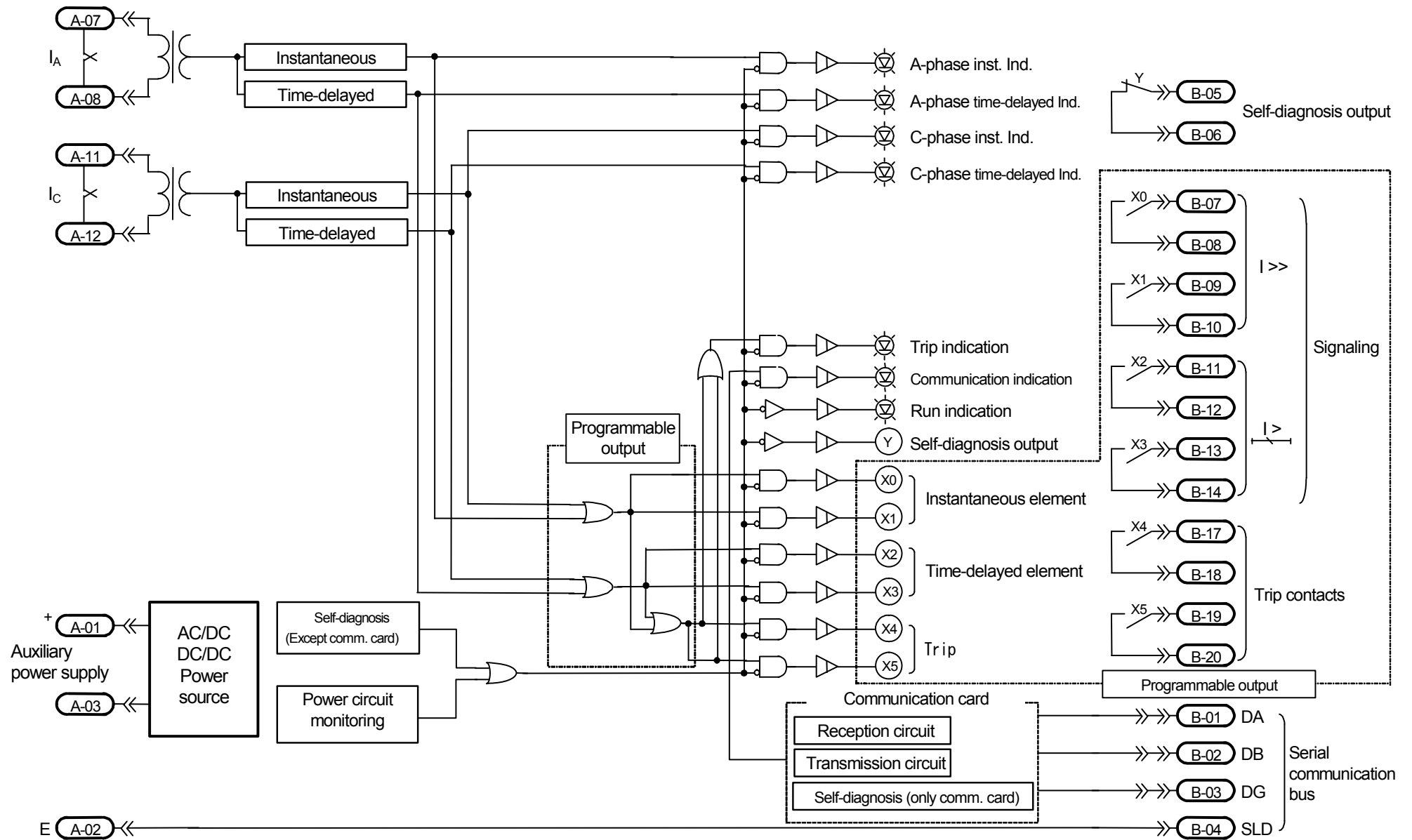
Figure 5.2 Internal function block diagram of Type COC2-A01D1 relay

5.2 External connection

(1) Connection diagram

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

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

(2) Precautions for wiring work

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

b. Effects of external surge

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

c. Guarantee of AC auxiliary power supply against power interruption

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

d. Inrush current of auxiliary supply

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

Input voltage		Inrush current Ip
DC	110V	**Approx. 20A**
	220V	**Approx. 55A**
AC	100V	**Approx. 25A**
	220V	**Approx. 65A**
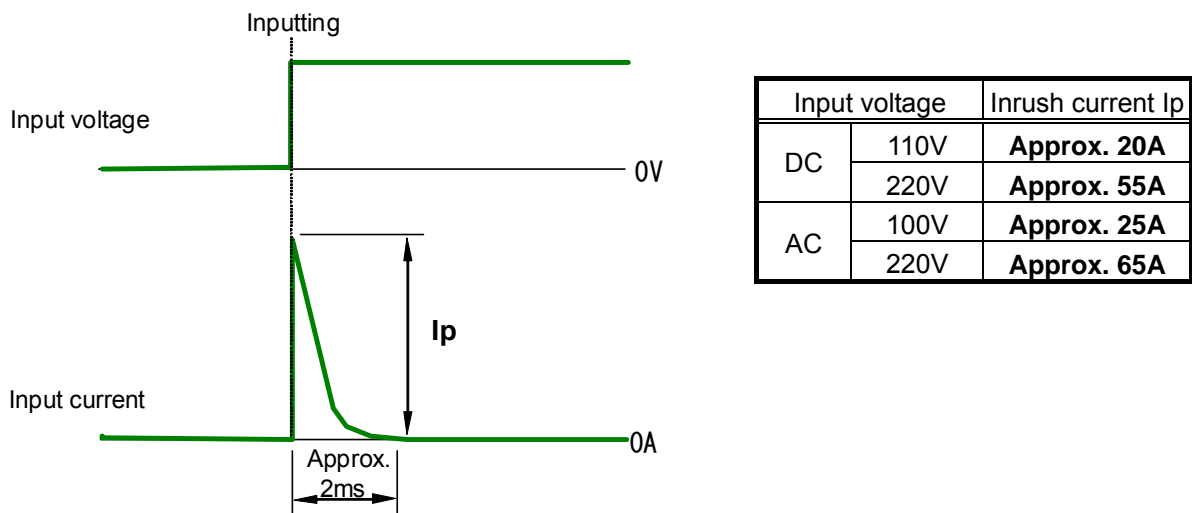
Figure 5.3   Inrush current of auxiliary power supply

e. Trip circuit

Only the contacts X_4 and X_5 can be used for the trip circuit. Please keep in mind that the contacts X_0 to X_3 can not be used for the trip circuit. (If used, the contact may burn).

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

f. Self-diagnosis output circuit

The self-diagnosis output contact is so configured that the auxiliary relay can be energized (break contact) with normal result of monitoring, in order to be able to continue monitoring even if the built-in

power fuse burns. Therefore, connect the timer to the external wiring. (See Fig. 5.5 "DC circuit connection diagram")

g. Earth circuit

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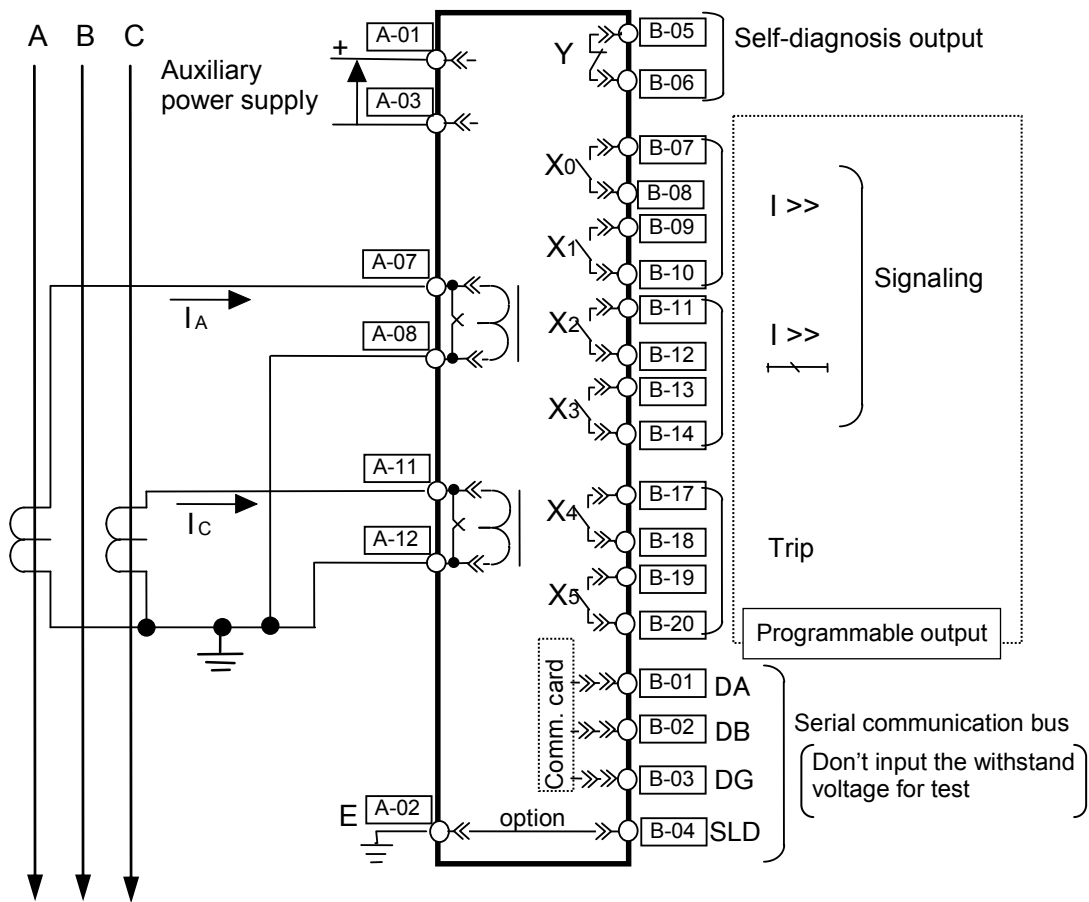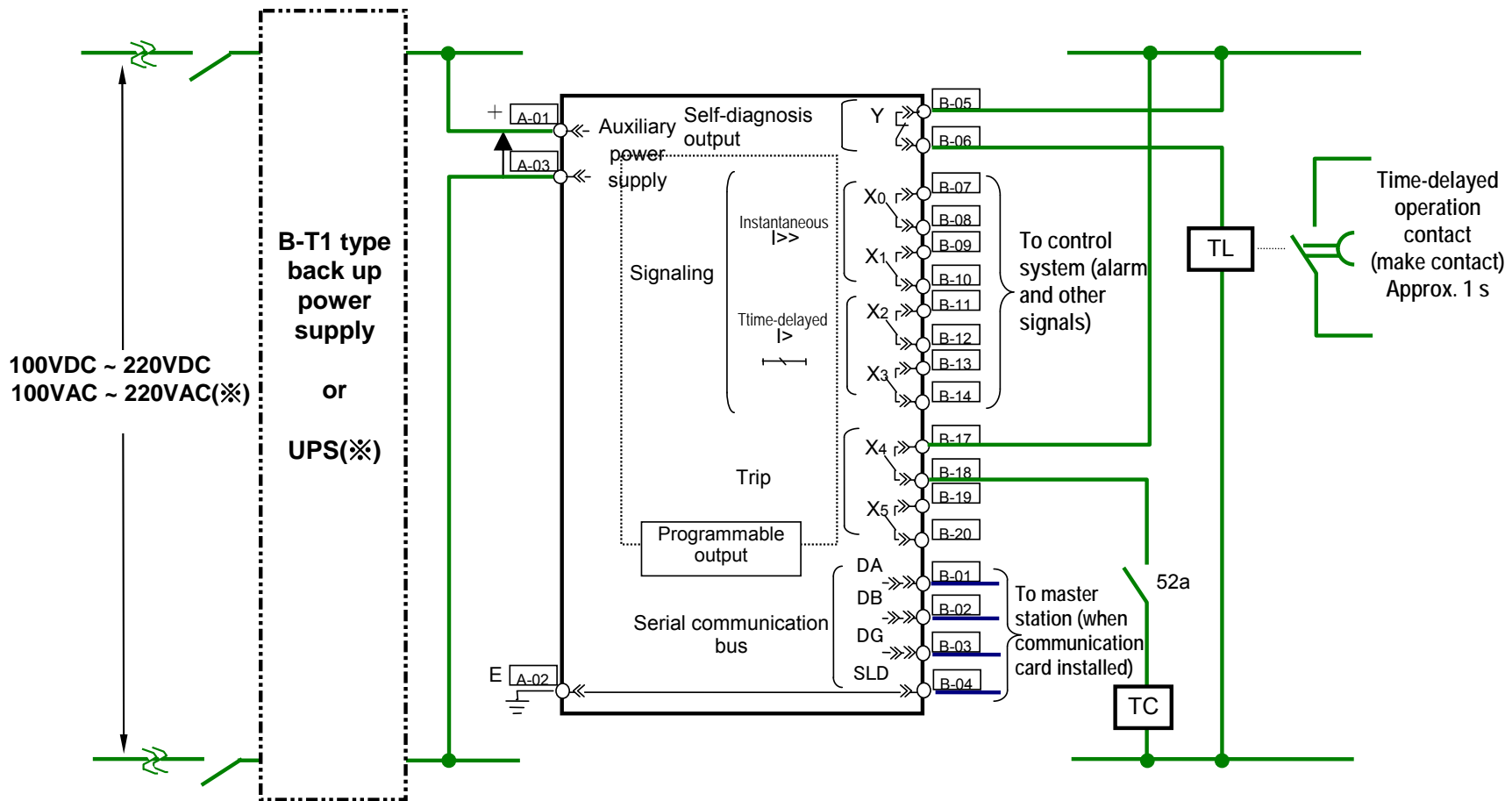

Figure 5.4   External connection diagram for COC2-A01D1 relay

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

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

(※) Refer to the page 39, 5.2 External connection (2) Precautions for wiring work   c. Guarantee of AC auxiliary power supply against power interruption.

Figure 5.5   Auxiliary power supply circuit connection example of type COC2-A01D1 relay
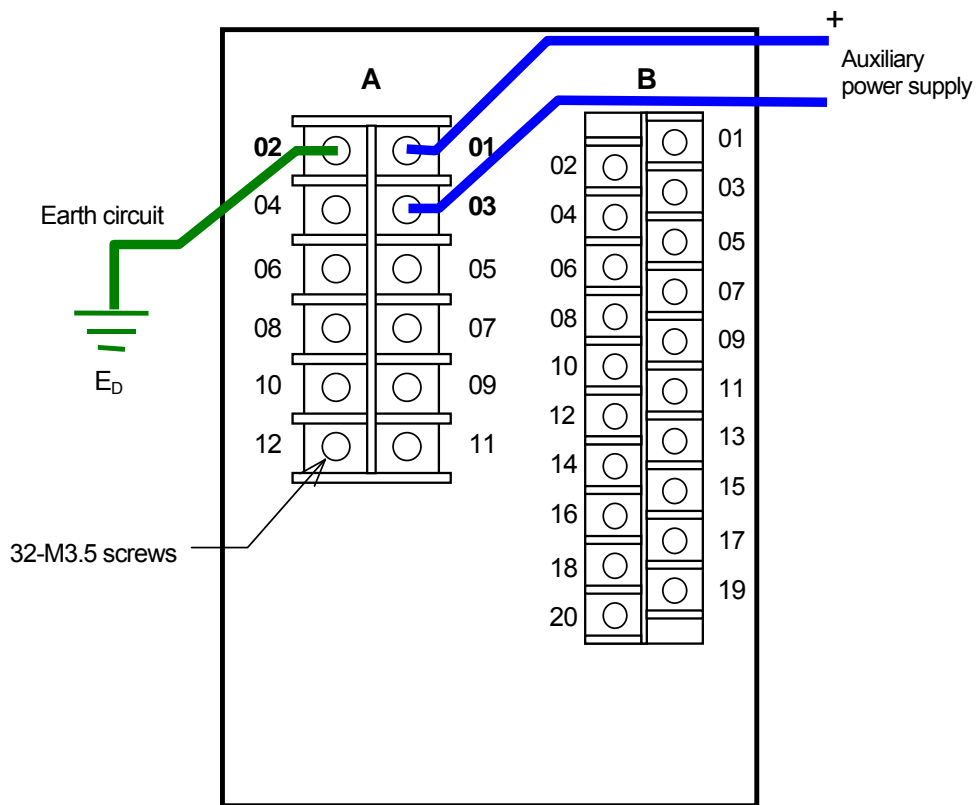
Figure 5.6   Rear view of type COC2-A01D1 relay

6　Handling

6.1　Unpacking

Usually this relay is packed in a D1 case for transportation. However, it may occur that only the sub unit is transported independently for the convenience at repair. In such a case, fully brush off the dust, dirt, etc. adhered to the sub unit after completion of unpacking, and further visually check that the parts mounted on the front panel or built in the sub unit are not damaged.

6.2　Transportation and storage

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

6.3　Appearance and how to pull sub unit out

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

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

- Lock the tripping circuit including breakers.
- Stop the main circuit.
- Shorten and isolate the CT circuit.
- Open the auxiliary power supply circuit.

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

The CT circuit is provided with an automatic short circuit mechanism. In case that you have pulled the sub unit out without isolating the CT circuit by mistake, the automatic short circuit mechanism will work to prevent the CT secondary circuit from opening.
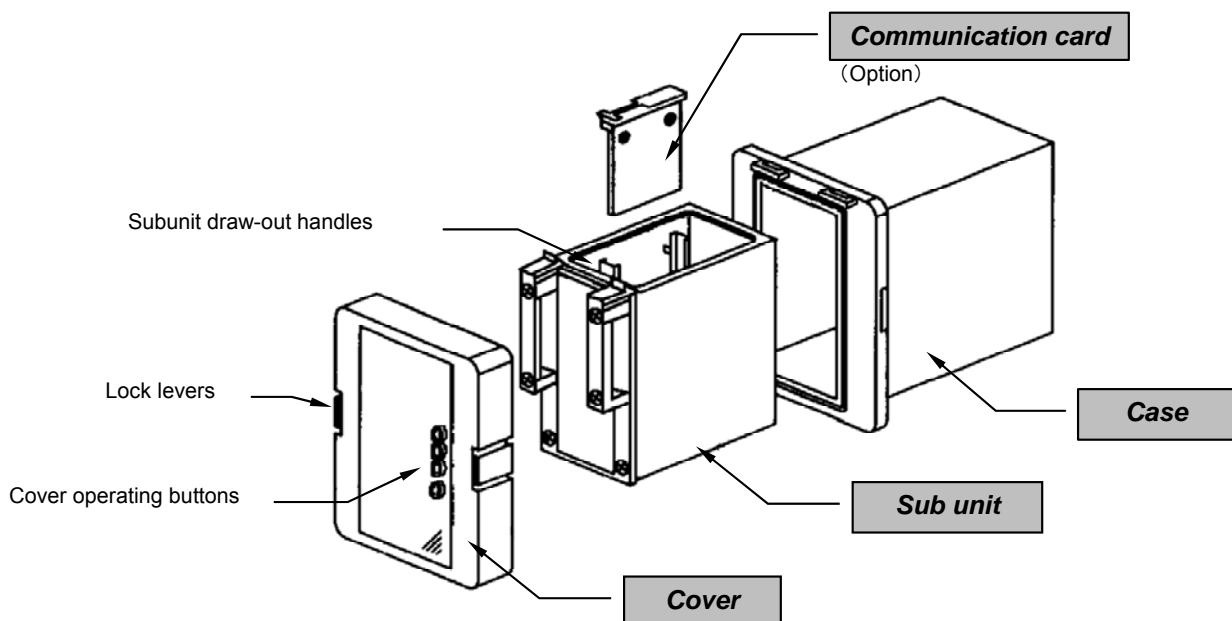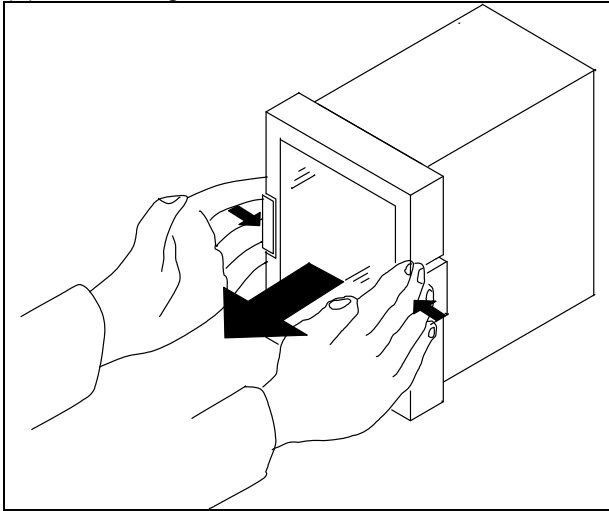

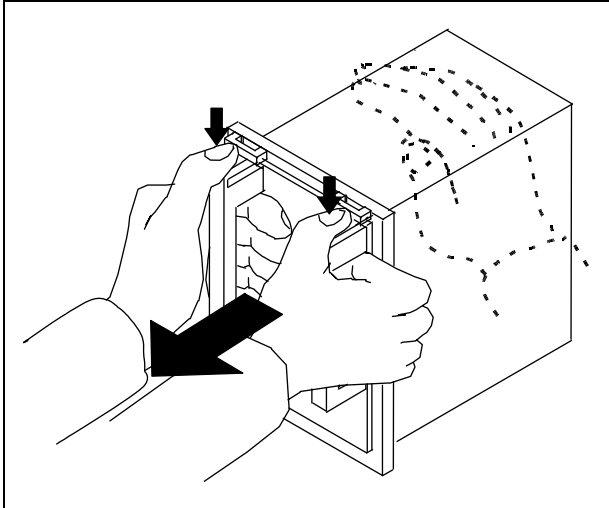**Figure 6.1　Outside view of type COC2-A01D1 relay**

### 6.3.1   How to draw sub unit out

(1)   Removing the cover

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

(2)   Drawing the sub unit

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

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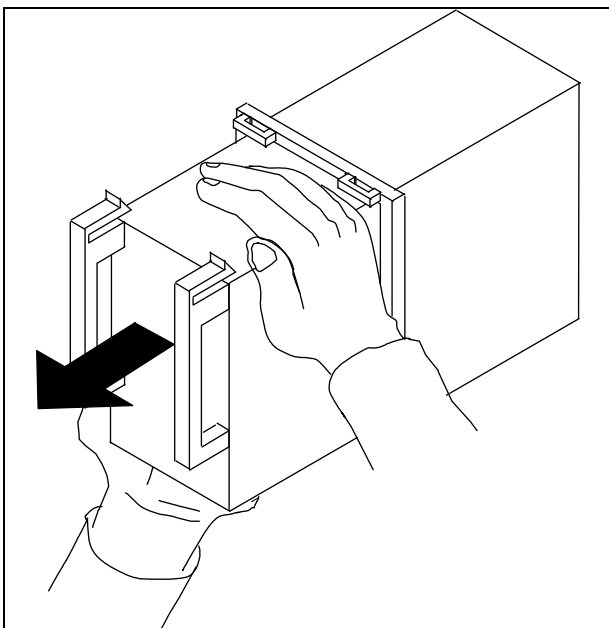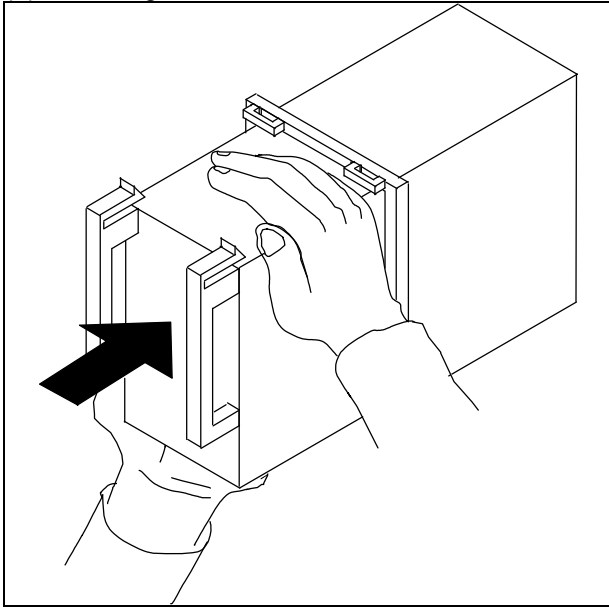

When about a half portion of the sub unit is pulled out of the case, just stop the drawing motion. Then, **hold the top and bottom of the sub unit to pull it out completely**, in order to prevent the unit from falling.

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

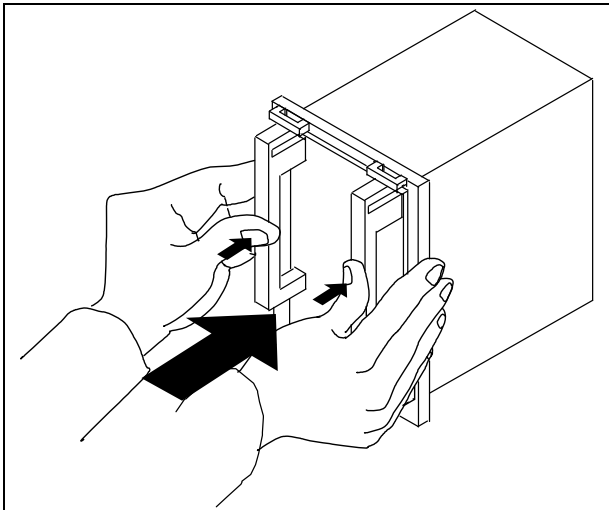### 6.3.2 Housing the sub unit

(1) Housing the sub unit

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

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

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

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

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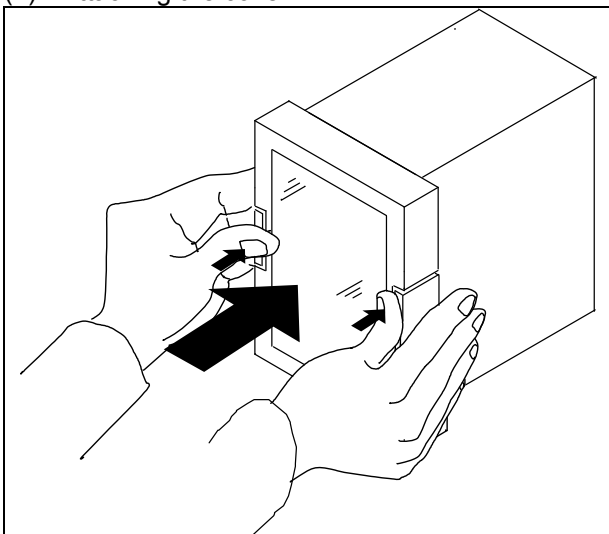
Fit the cover straight to the case. Hold the cover frame to **fully push the lock levers, located both side of the cover, to case side until it is clicked** and locked.

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

6.4   How to use front control panel
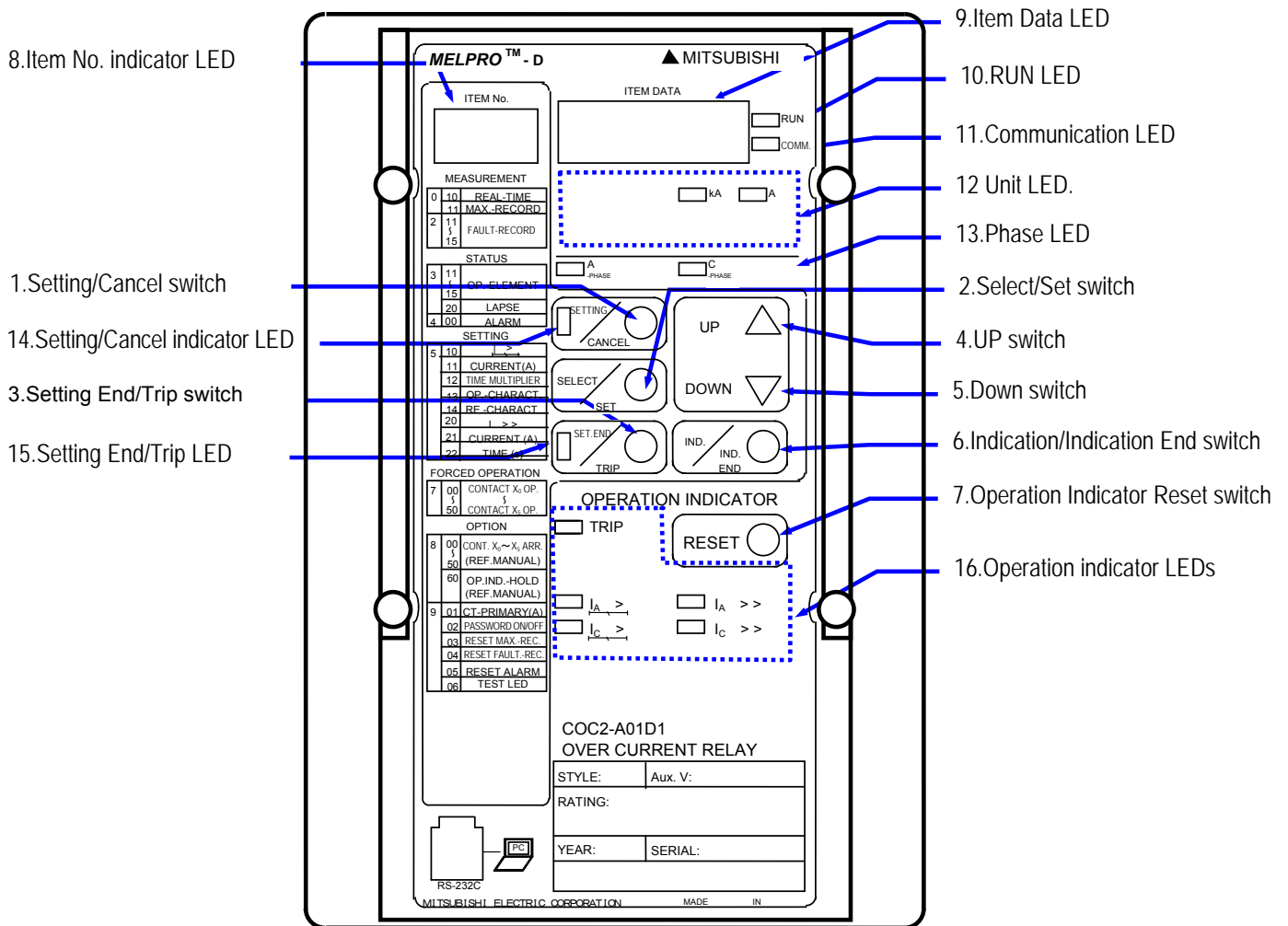
6.4.1   Front control panel layout

Figure 6.2   Front view of type COC2-A01D1 relay
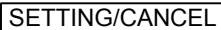
Table 6.1   Front control panel guide

No.	Designation		Symbol	Description
1	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 to program item data during setting, forced operation or option procedure. When data is programmed to be ready for replacing the currently used setting, the SET.END/TRIP LED will blink.
3	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 currently enabled 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 forwarding.
5	DOWN select		DOWN	With the cover operating buttons, you can use the switches without removing the cover.
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 switch 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 switch without removing the cover.
8	Item No.	Green	–	A number allocated to the selected setting, forced operation or option item is indicated here.
9	Item Data	Red	–	Data that corresponds to the item number selected is displayed here. For the indication of individual letters, see the Table 6.2.
10	RUN	Green	–	Indicate the result of the automatic self-check. The lamp will be lit for normal results while off for abnormal.
11	Communication	Green	–	Indicate the operational status of the communication card. - With a communication card installed: the lamp will be lit for normal conditions, blinking during communication and off for abnormal conditions. - With a communication card not installed: the lamp will be off.
12	Unit	Yellow	–	Indicate the unit used for the item data.
13	Phase	Yellow	–	Indicate the phase that corresponds to the item data.
14	Setting / Cancel	Yellow	–	This lamp will be lit during setting, forced operation or option procedure.
15	Setting End / Trip	Yellow	–	This lamp will blink when new data is programmed to be ready for replacing the currently enabled setting.
16	Operation	Red	–	Indicate the corresponding operation elements and phases of the relay.

Note: Items 1–7 are grouped under "Operational key switches"; items 8–16 are grouped under "Indicator LEDs".

Table 6.2 Letter representation of item data indicator LEDs

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

Item			Display in item data box
	Designation	Letters	
Operation characteristics	Normal inverse time-delayed	NI01	nI01
		NI11	nI11
		NI21	nI21
	Very inverse time-delayed	VI01	UI01
		VI21	UI21
	Extremely inverse time-delayed	EI01	EI01
		EI11	EI11
		EI12	EI12
	Long inverse time-delayed	LI01	LI01
		LI02	LI02
		LI21	LI21
	Definite time-delayed	DT01	d701
Reset characteristics	Definite time-delayed	01	01
	Inverse time-delayed	11	11
	Definite time-delayed	21	21

6.4.2 Operational procedure
For more information about the operational procedure shown below, see the MELPRO-D Series General Operation Manual (JEP0-IL9416).
6.4.2.1 Relay without RS232C communication I/F

Table 6.3 Operational procedure

No.		Designation			Description	Indication mode	Setting / forced operation / option mode
			Item			**Corresponding section of general operation manual**	
010	Measurement	Real time			Measure and display effective value currents input to the relay all the time.	A-1	
011		Max. record			Display the max. effective value current.	A-2	
211		Fault record	1st phenomena		Keep in record and display effective value currents for up to five latest phenomena of relay trip caused by system fault. The 1st phenomena is the latest trip and the 5th the oldest.	A-3	
212			2nd phenomena				
213			3rd phenomena				
214			4th phenomena				
215			5th phenomena				
311	Status	Operation elements	1st phenomena		Keep in record and display the status of the operation indicator LEDs for up to five latest phenomena of relay trip caused by system fault. The 1st phenomena is the latest trip and the 5th the oldest.	A-4	
312			2nd phenomena				
313			3rd phenomena				
314			4th phenomena				
315			5th phenomena				
320		Elapse of time-delayed timer (LAPSE)			Display the count of the elapsed time of operation of time-delayed elements.	A-5	
400		Self-diagnosis (ALARM)			Keep in record and display defect codes in the case where an abnormal condition is detected by the self-diagnosis.	A-6	
511	Setting	Phase fault	Time-delayed	Operation current [A]	Set and display settings.	A-7	B-1
512				Operation time multiplier			
513				Operation characteristic			
514				Reset characteristic			
521			Instantaneous	Operation current [A]			
522				Operation time [s]			
700	Forced operation	Contact X_0 operation			Carry out forced operation of output contacts individually. The setting of the programmable contacts can be checked through the operation indicator LEDs.		C-1
710		Contact X_1 operation					
720		Contact X_2 operation					
730		Contact X_3 operation					
740		Contact X_4 operation					
750		Contact X_5 operation					
800	Option	Contact arrangement	Contact X_0		Configure the programmable outputs. Also, set and display self-hold/reset setting of the programmable outputs. For the guide for setting, see the section 6.4.2.3 (1) below.	A-7	D-1
810			Contact X_1				
820			Contact X_2				
830			Contact X_3				
840			Contact X_4				
850			Contact X_5				
860		Operation indicator LED hold			Set and display self-hold/auto reset setting of the operation indicator LEDs. For the guide for setting, see the section 6.4.2.3 (2) below.		D-2
901		CT primary side [A]			Set the CT primary current of the phase current circuit connected to the relay.		D-3
902		Max. record reset			Clear data of the max. record.		D-4
903		Fault record reset			Clear data of the fault record.		
904		Self-diagnosis (ALARM) reset			Clear data of the self-diagnosis record.		
905		LED lamp test			Carry out forced illumination of all the LED lamps on the front of the relay unit.		D-5

6.4.2.2　Relay with RS232C communication I/F

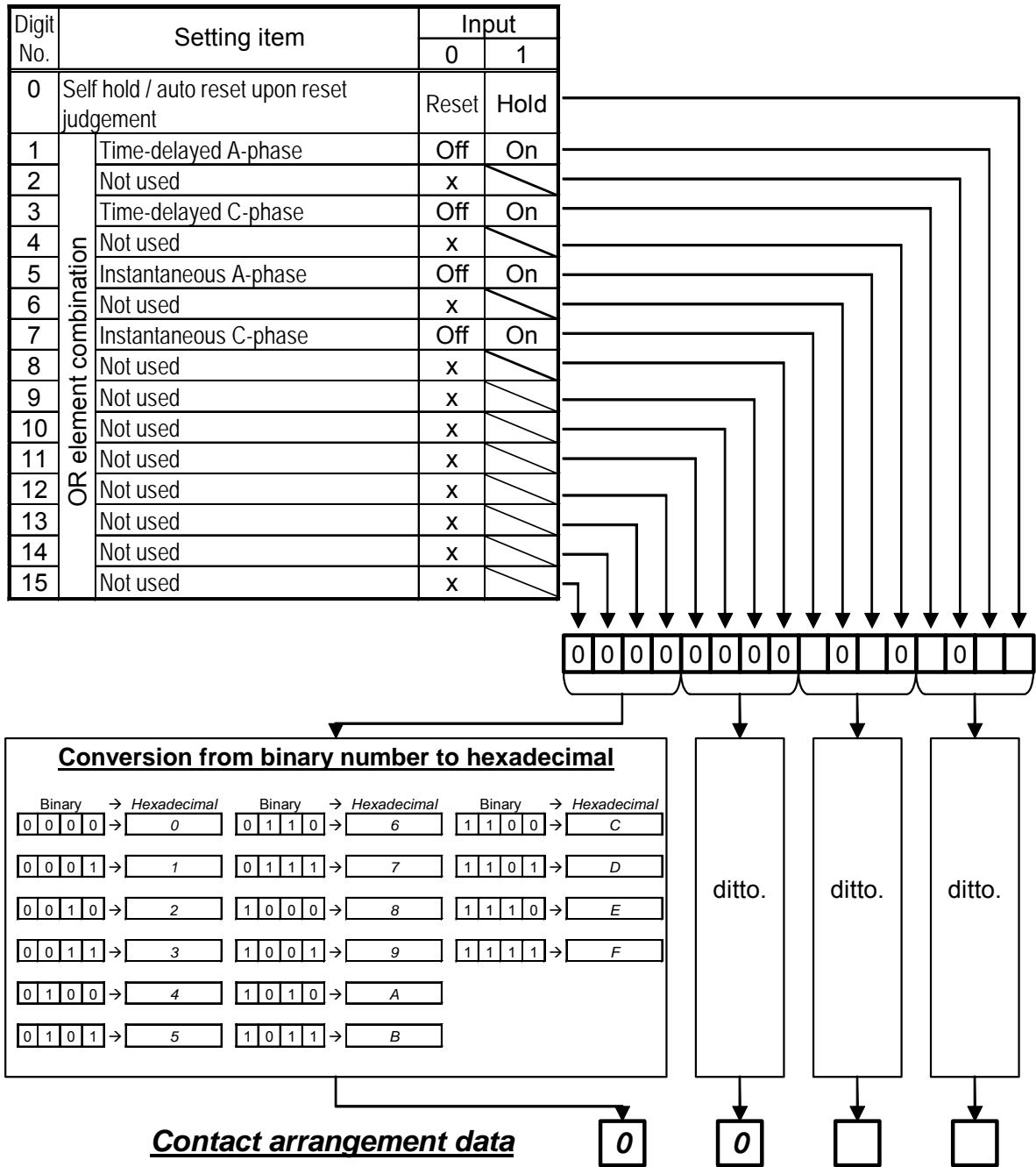| Item			Corresponding section of general operation manual	
No.	Designation	Description	Indication mode	Setting / forced operation / option mode
As the same as Table 6.3 described in item 6.4.2.1 about the No. 010～860.				
901	CT primary side [A]	Set the CT primary current of the phase current circuit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

6.4.2.3   Guide for option function

(1)   Specifying contact arrangement data of output contacts

The table below shows the setting guide table. See the section $\boxed{\text{D-1}}$ of the general operation manual for the detailed procedure.

Digit No.	Setting item		Input	
			0	1
0	Self hold / auto reset upon reset judgement		Reset	Hold
1		Time-delayed A-phase	Off	On
2		Not used	x	
3		Time-delayed C-phase	Off	On
4		Not used	x	
5		Instantaneous A-phase	Off	On
6	OR element combination	Not used	x	
7		Instantaneous C-phase	Off	On
8		Not used	x	
9		Not used	x	
10		Not used	x	
11		Not used	x	
12		Not used	x	
13		Not used	x	
14		Not used	x	
15		Not used	x	

`0 0 0 0  0 0 0 0   0   0   0`

Conversion from binary number to hexadecimal

Binary → Hexadecimal	Binary → Hexadecimal	Binary → Hexadecimal
0 0 0 0 → 0	0 1 1 0 → 6	1 1 0 0 → C
0 0 0 1 → 1	0 1 1 1 → 7	1 1 0 1 → D
0 0 1 0 → 2	1 0 0 0 → 8	1 1 1 0 → E
0 0 1 1 → 3	1 0 0 1 → 9	1 1 1 1 → F
0 1 0 0 → 4	1 0 1 0 → A	
0 1 0 1 → 5	1 0 1 1 → B	

ditto.   ditto.   ditto.

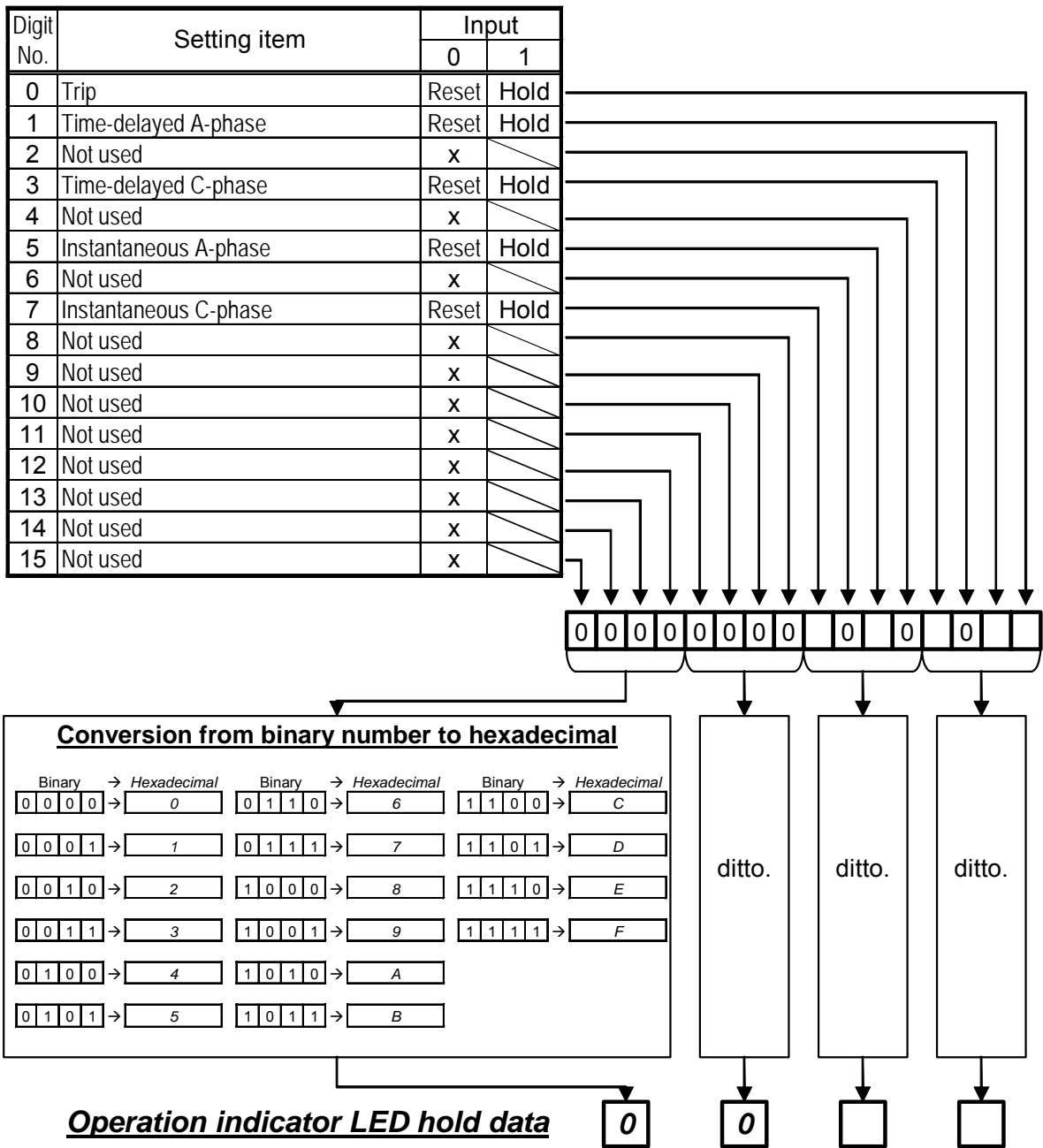### *Contact arrangement data*   0   0

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

Contact	Item number	Contact arrangement data	Setting of the element	Contact	Item number	Contact arrangement data	Setting of the element
X0	800	00A0	Instantaneous	X3	830	000A	Time-delayed
X1	810	00A0	Instantaneous	X4	840	00AA	OR of all the elements
X2	820	000A	Time-delayed	X5	850	00AA	OR of all the elements

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

(2) Specifying operation indicator LED hold data

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

Digit No.	Setting item	Input 0	Input 1
0	Trip	Reset	Hold
1	Time-delayed A-phase	Reset	Hold
2	Not used	x	
3	Time-delayed C-phase	Reset	Hold
4	Not used	x	
5	Instantaneous A-phase	Reset	Hold
6	Not used	x	
7	Instantaneous C-phase	Reset	Hold
8	Not used	x	
9	Not used	x	
10	Not used	x	
11	Not used	x	
12	Not used	x	
13	Not used	x	
14	Not used	x	
15	Not used	x	

```
0 0 0 0 | 0 0 0 0 | 0 | 0 | 0 |
```

Conversion from binary number to hexadecimal

Binary → Hexadecimal	Binary → Hexadecimal	Binary → Hexadecimal
0 0 0 0 → 0	0 1 1 0 → 6	1 1 0 0 → C
0 0 0 1 → 1	0 1 1 1 → 7	1 1 0 1 → D
0 0 1 0 → 2	1 0 0 0 → 8	1 1 1 0 → E
0 0 1 1 → 3	1 0 0 1 → 9	1 1 1 1 → F
0 1 0 0 → 4	1 0 1 0 → A	
0 1 0 1 → 5	1 0 1 1 → B	

ditto. | ditto. | ditto.

Operation indicator LED hold data |0| |0| |☐| |☐|

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

Item number	Operation indicator LED hold data
860	00AB

7   Mounting

7.1   Mounting dimension

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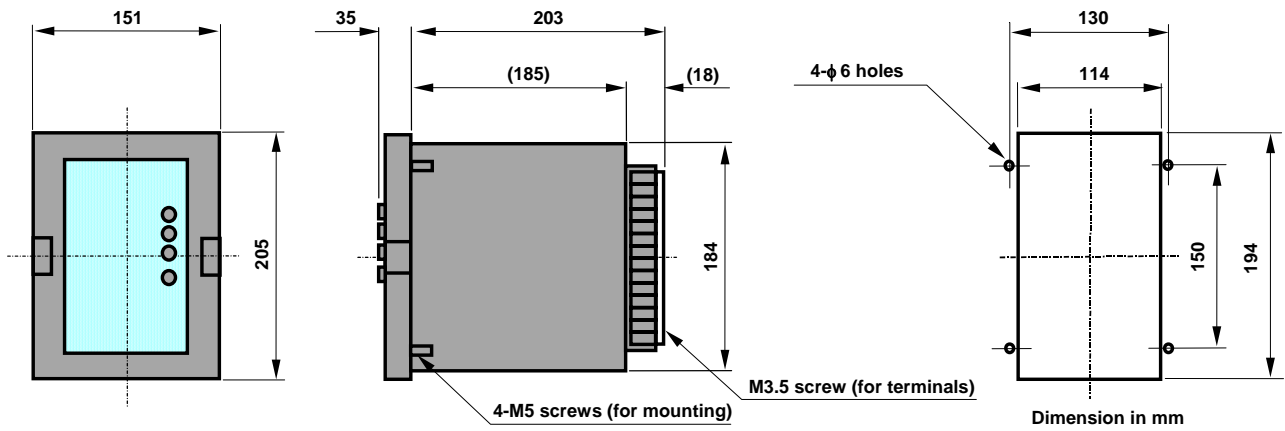

Figure 7.1   Outside dimension /drilling drawing

7.2   Standard operating environment

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

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

8 Test

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

8.1 Appearance inspection

Check the relay for appearance according to the following procedure:

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

8.2 Characteristic test

8.2.1 Precautions in testing

(1) Standard test conditions

Ensure the following test conditions whenever possible:

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

- Ambient temperature : 20°C±10°C
- Rated frequency : ± 5%
- Waveform (AC) : 2% (distortion ratio)
- Auxiliary power supply voltage : rated voltage ±2%

(2) Characteristic control point

See the section 3 "Characteristics".

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

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

(3) Changing setting

Change the setting according to the section 6 "Handling".

(4) Operation judgment

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

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

(5) Communication card

Whatever the communication card is inside or not, for the test of withstand voltage and lightning impulse withstand voltage, please avoid inputting test voltage to the serial communication network circuit (DA, DB, DG, SLD terminals).
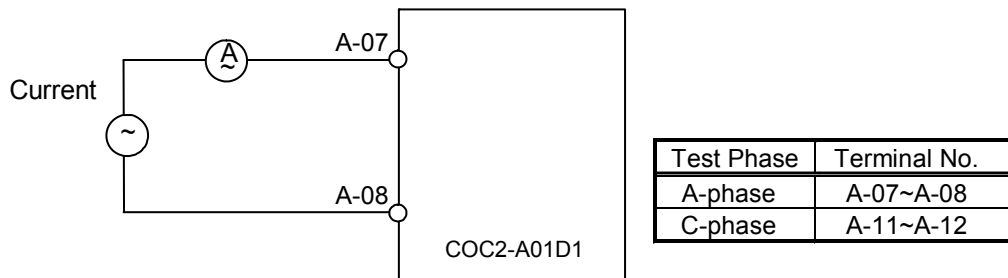
Note: it is not necessary to take the communication card out when test if the communication card was inside unit.

8.2.2   Characteristic test

(1) Test circuit

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

Show an example for A-phase

Test Phase	Terminal No.
A-phase	A-07~A-08
C-phase	A-11~A-12

(2) Test items and characteristic control point

a. Forced operation test

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

b. Operation value test

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

c. Operation time test

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

d. Reset time test

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

9 Maintenance

9.1 Daily inspection

Take every opportunity to carry out the following inspection:

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

9.2 Periodical inspection

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

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

10　Ordering

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

Notify the following items when placing an order.

Item	Example of order	Remarks
Model	COC2-A01D1	For more information, see the section 2 "Rating and specification".
Frequency	50 Hz	Select 50Hz or 60Hz.
Rating	Current: 5A	For more information, see the section 2 "Rating and specification".
Setting range	Time-delayed element (51)　　　: 1 ~ 12A Instantaneous element (50)　　　: 2 ~ 80A	For more information, see the section 2 "Rating and specification".
Communication card	One of the followings can be selected: a.　CC-Link communication card (Manual No.: JEP0-IL9417, JEP0-IL9418) b.　No communication card	Only purchasing a communication card separately will allow customer to add the communication facilities. If customer does not need the communication facilitates at the time of introducing the system, just purchase the relay unit without communication card. Customer can add the communication facilities whenever he/she needs to introduce them. This will help decrease the initial cost and upgrade the system in stages.

11　Guarantee

11.1　Guarantee period

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

11.2　Scope of guarantee

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

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

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

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

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

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

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

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

⑤In case of integrating our products into your equipment, when damages can be hedged by the proper

function or structure in the possession of your equipment which should be completed according to the concept of the de facto standard of industry.

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

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

11.3   Exclusion of loss in opportunity and secondary loss from warranty liability

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

11.4   Applications of products

①The user is requested to confirm the standards, the regulations and the restrictions which should be applied, in case of utilizing products described in this catalogue and another one in combination.
Also, the user is requested to confirm the suitability of our products to your applied system or equipment or apparatus by yourself.
MITSUBISHI ELECTRIC CORPORATION shall not be liable for any suitability of our products to your utilization.

②This MITSUBISHI ELECTRIC CORPORATION products described in the catalogue have been designed and manufactured for application in general industries, etc. Thus, application in which the life or an asset could be affected by special application such as medical system for life-sustaining, in nuclear power plants, power plants, aerospace, transportation devices(automobile, train, ship, etc)shall be excluded from the application. In addition to above, application in which the life or an asset could be affected by potentially chemical contamination or electrical interference and also in which the circumstances and condition are not mentioned in this catalogue shall be excluded from the application. Note even if the user wants to use for these applications with user's responsibility, the user to be requested to approve the specification of MITSUBISHI ELECTRIC CORPORATION products and to contact to the technical section of MITSUBISHI ELECTRIC CORPORATION prior to such applications. If the user applies MITSUBISHI ELECTRIC CORPORATION products to such applications without any contact to our technical section, MITSUBISHI ELECTRIC CORPORATION shall not be liable for any items and not be insured, independently from mentioned in this clause.

③In using MITSUBISHI ELECTRIC CORPORATION product, the working conditions shall be that the application will not lead to a major accident even if any problem or fault occur, and that backup or duplicate system built in externally which should be decided depend on the importance of facility, is recommended.

④The application examples given in this catalogue are reference only and you are requested to confirm function and precaution for equipment and apparatus and then, use our products

⑤The user is requested to understand and to respect completely all warning and caution items so that

unexpected damages of the user or the third party arising out of un-correct application of our products would not be resulted.

11.5   Onerous repair term after discontinuation of product

①MITSUBISHI ELECTRIC CORPORATION shall accept onerous product repairs for 7(seven) years after production of the product is discontinued. (However, please consider the replacement of products after 15 years have been passed from ex-work of products.)

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

11.6   Changes in product specification

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

11.7   Scope of service

The technical service fee such as engineer dispatching fee is excluded in the price of our products.

Please contact to our agents if you have such a requirement.

12   Improvement on the reliability of protection function

Any parts and materials applied to the protection relay have limited life time which will bring the degradation to the relay.

The degree of degradation will be variable and depend on the purpose, period in use, applied circumstance and unevenness on the performance of each part.

MITSUBISHI ELECTRIC CORPORATION design the relay so as to realize that the recommended replaced duration is more them 15 years.

However, there may be some possibilities to occur some defects before reaching 15 years due to above mentioned the degree of degradation of parts and materials being depended on the condition in use.

To prevent unwanted operation or no operation of relay due to above reasons, it is recommended to apply the relay with self-diagnosis function and/or multiplexing relay system such as dual or duplex scheme.

MITSUBISHI ELECTRIC CORPORATION

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