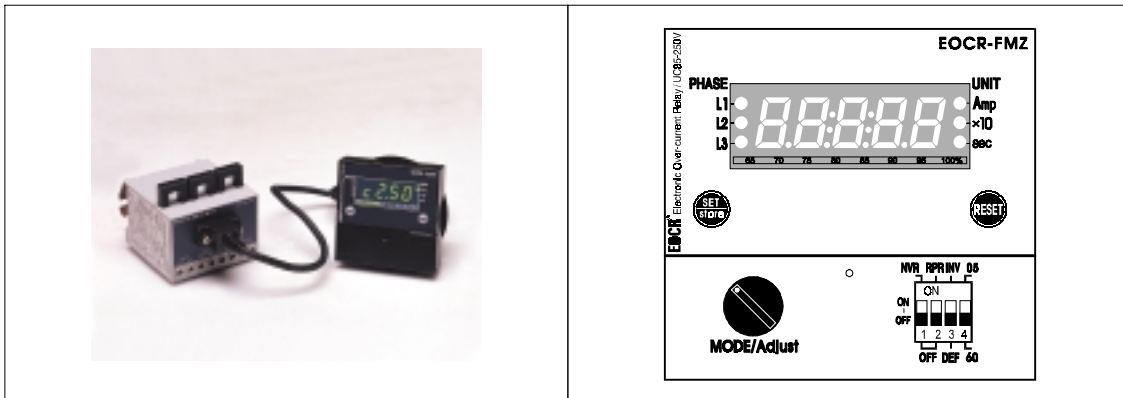


## EOCR-FMZ FLUSH MOUNTING DIGITAL MULTI-FUNCTIONAL RELAY - W/GROUND FAULT PROTECTION AND AMMETER



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# ■ EOCR-FMZ

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# 1. Application and features

## 1.1 Features and benefits

EOCR-FMZ is specially designed to completely detect over-current, phase loss, phase reversal, phase unbalance, and locked rotor with variety of functional advantages. Wide current adjustment can be added with external CT connected. Total run time or user definable run time can be measured and used to assist the maintenance of the peripheral devices. Internal EEPROM is provided to enable the user to review the last trip causes and the fault values.

When compared to conventional motor protection relays, EOCR-FMZ reflects the superior technique with the following features:

- MCU(Microprocessor Control Unit) based
- ASIC(Application Specific Integrated Circuit) inside
- Multiple protection
- Easy setting using a Pulse Rotary Switch
- Wide current protection range from 0.1A to 800A by just 1 model
- Built-in digital ammeter
- Total running time display
- Trip cause and current display
- Bar-Graph monitoring on impending overload trip
- Selectable time-current characteristics (Inverse/Definite)
- Adjustable operating features by DIP switch setting
- Test function
- Fail-safe operation / No volt Release (N type)
- Operates in wide ambient temperature range

Especially EOCR-FMZ offers the following benefits :

- Proven Technology
- Superior 3 phase motor protection
- Protect motors up to 800A by aid of external CT
- Allows high inertia starting
- Reduced spares inventory / no need for additional ammeters and selector switches
- Accurate trip cause display for easy troubleshooting
- Easy and exact setting using mode switch
- Total running time display for maintenance
- Safe remote reset
- Less space required
- Consistent accuracy
- Can replace almost any existing overload relay

## 1.2 Operation (trip) time and ancillary functions

| Protection              |       | Operating time                                  | Condition and Features  |
|-------------------------|-------|---|---|
| Over-current            |       | Preset <b>ot</b> time                           | Definite/Inverse : Selectable   |
| Under-current           |       | Preset <b>ut</b> time                           | Definite time characteristic  |
| Phase Loss              |       | within 3 sec                                    |   |
| Phase Reverse           |       | 0.1 sec   | Disable by DIP SW2  |
| Phase Current Unbalance |       | within 8 sec                                    | more than 50% difference between each phase current   |
| Ground Fault            |       | Preset <b>Et</b> time (0.05~10 sec, Adjustable) | Definite Time Characteristic,<br>A Type : 0.03~2.5A(Fault current)<br>B Type : 0.5~10A(Fault current) |
| Lock (Jam)              | Stall | 1~10sec, Off. Adjustable                        | more than 180% of <b>oc</b> setting (When using definite-time characteristic)                         |
|                         | Lock  | 0.5 sec   | Off, 2~10 times of over-current setting (When using definite-time characteristic)                     |

| Ancillary Function             | Description  |                     | Condition and Features  |
|--------------------------------|--|---------------------|---|
| Total Operation Hour Recording | Indication of accumulated operation hours from 0 hour up to 99999 hours. |                     | Hour accumulation is recorded when the load operate only. Setting is not available. |
| Setting Running hour Recording | Off, 10~9990 hour setting  |                     | Hour accumulation is recorded when the load operate only. Setting is available.     |
| Reset type                     | H-r  | Hand(Manual) Reset  | Depress Reset button on relay facia once.   |
|                                | E-r  | Electrical reset    | Control power interruption  |
|                                | A-r  | Auto-reset(0.2 sec) | 0.3 sec~20 min selectable   |
| Store trip cause               | Last trip checking function (Including "TEST" trip)                      |                     | Possible checking under operation   |
| Fail Safe                      | Energized output by control power applied                                |                     | Selectable by NVR DIP switch  |

## 1.3 Specification

|                                       |                                      |  |                     |
|---------------------------------------|--------------------------------------|--|---------------------|
| Current Setting Range                 | Over-current                         | Refer to table #1.4                                |                     |
|                                       | Under-current                        | Off, From 0.5Amp to less than over-current setting |                     |
|                                       | Ground Fault Current                 | A : 0.03~2.5A<br>B : 0.5~10A                       |                     |
| Time Setting                          | Starting Delay Time( <b>dt</b> )     | Off~200 sec, Adjustable                            |                     |
|                                       | Over-current Trip Delay( <b>ot</b> ) | Definite Time                                      | 0.2~30sec           |
|                                       |                                      | Inverse Time                                       | 1.0~30sec           |
| Under-current Trip Delay( <b>ut</b> ) | 0.5~30 sec (Definite time operation) |  |                     |
| Tolerance                             | Current                              | ±5%  |                     |
|                                       | Time                                 | ±5%  |                     |
| Control Power                         | 220                                  | 85~250VAC/DC 50/60Hz                               |                     |
| Output Relay                          | OL                                   | 1-SPST   | 3A/250VAC Resistive |
|                                       | GR                                   | 1-SPST   | 3A/250VAC Resistive |

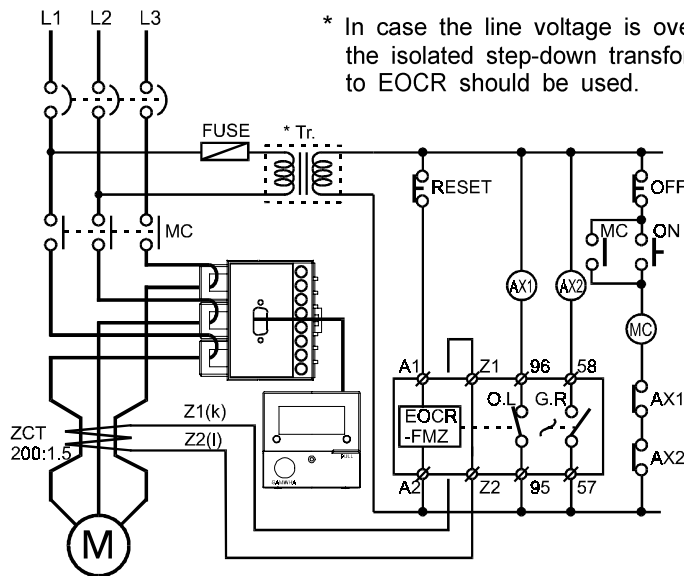
|  |  |   |         |
|--|--|---|---------|
| Environment                                | Temperature  | Store                                       | -30~80℃ |
|  |  | Operation                                   | -20~70℃ |
|  | Humidity   | 30~90% RH Non-Condensing                    |         |
| Display                                    | 7-Segment LEDs   | 3 Phase current, Trip cause, Operating hour |         |
|  | Bar-Graph  | Load factor for current setting             |         |
| Insulation                                 | Between casing and circuit : over 100MΩ, DC500V        |   |         |
| Dielectric Strength                        | Between casing and circuit                             | AC 2000V, 60Hz, 1 min                       |         |
|  | Between open contacts                                  | AC 1000V, 60Hz, 1 min                       |         |
|  | Between circuit  | AC 2000V, 60Hz, 1 min                       |         |
| Surge (IEC1000-4-5)                        | 1.2×50μs, ±4kV(0°, 90°, 180°, 270°)                    |   |         |
| Electrostatic Discharge (IEC1000-4-2)      | Air Discharge : ±8kV, Contact Discharge : ±4kV         |   |         |
| EFT / Burst (IEC1000-4-4)                  | ±2kV, 1min   |   |         |
| Radiated Electromagnetic Field Disturbance | 150MHz & 450MHz Portable transmitter : Level 3 (10V/m) |   |         |

#### 1.4 Current setting range

| Type | Current Setting Range (Amps) | Number of Conductors thru CT windows | DIP SW4 Position | External CT Ratio | Setting of CT Ratio |
|------|------------------------------|--------------------------------------|------------------|-------------------|---------------------|
| 05   | 0.1~2.0                      | 5                                    | 05               | —                 | 5t                  |
| 05   | 0.25~5.0                     | 2                                    | 05               | —                 | 2t                  |
| 05   | 0.5~10                       | 1                                    | 05               | —                 | 05(indication)      |
| 60   | 5.0~60                       | 1                                    | 60               | —                 | 60(indication)      |
| 10   | 1.0~12                       | 1                                    | 05               | 10:5              | 10                  |
| 15   | 1.5~18                       | 1                                    | 05               | 15:5              | 15                  |
| 20   | 2.0~24                       | 1                                    | 05               | 20:5              | 20                  |
| 25   | 2.5~30                       | 1                                    | 05               | 25:5              | 25                  |
| 30   | 3.0~36                       | 1                                    | 05               | 30:5              | 30                  |
| 40   | 4.0~48                       | 1                                    | 05               | 40:5              | 40                  |
| 50   | 5.0~60                       | 1                                    | 05               | 50:5              | 50                  |
| 60   | 6.0~72                       | 1                                    | 05               | 60:5              | 60                  |
| 75   | 7.5~90                       | 1                                    | 05               | 75:5              | 75                  |
| 100  | 10~120                       | 1                                    | 05               | 100:5             | 100                 |
| 120  | 12~144                       | 1                                    | 05               | 120:5             | 120                 |
| 150  | 15~180                       | 1                                    | 05               | 150:5             | 150                 |
| 200  | 20~240                       | 1                                    | 05               | 200:5             | 200                 |
| 250  | 25~300                       | 1                                    | 05               | 250:5             | 250                 |
| 300  | 30~360                       | 1                                    | 05               | 300:5             | 300                 |
| 400  | 40~480                       | 1                                    | 05               | 400:5             | 400                 |
| 500  | 50~600                       | 1                                    | 05               | 500:5             | 500                 |
| 600  | 60~720                       | 1                                    | 05               | 600:5             | 600                 |
| 750  | 75~900                       | 1                                    | 05               | 750:5             | 750                 |
| 800  | 80~960                       | 1                                    | 05               | 800:5             | 800                 |

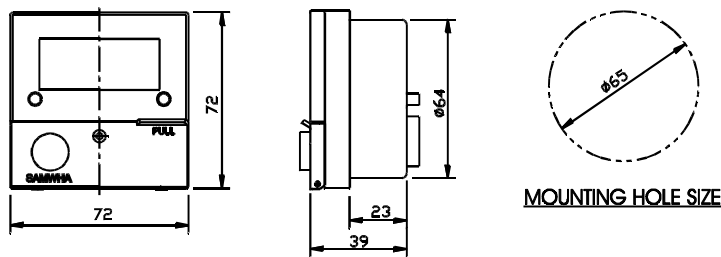
## 2. Design

### 2.1 Wiring

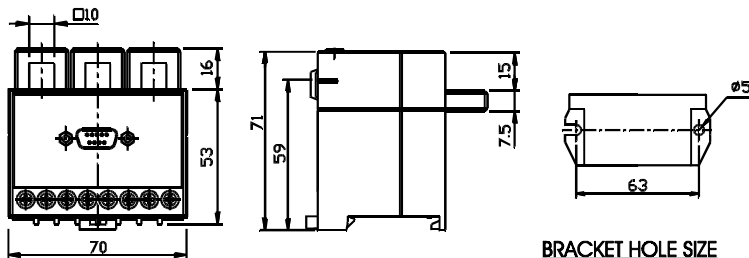


### 2.2 Dimension

#### DISPLAY & CONTROL UNIT (DCU)

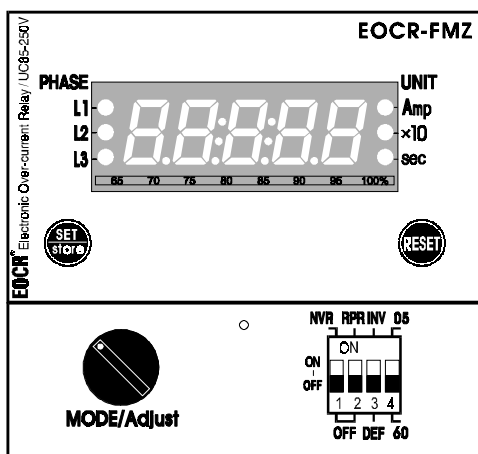


#### POWER CONTROL UNIT (PCU)



#### DIN RAIL TYPE

### 2.3 Front face

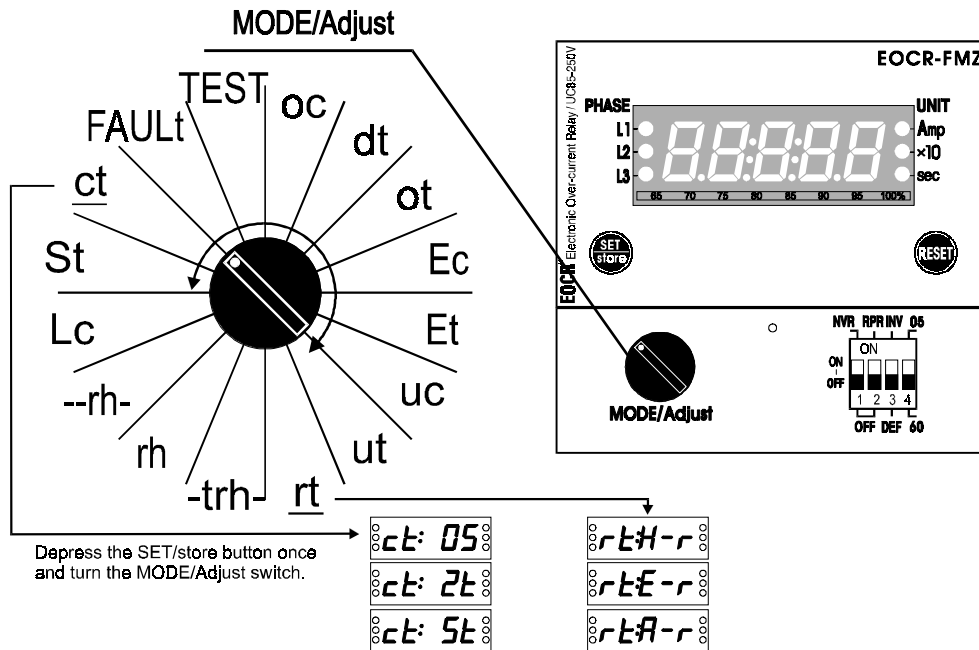


|      |  |
|------|--|
| L1   | Line 1 current (phase R or A)              |
| L2   | Line 2 current (phase S or B)              |
| L3   | Line 3 current (phase T or C)              |
| Amp  | Value in ampere                            |
| × 10 | 10 times of indicating Value               |
| sec  | Time in seconds                            |
| NVR  | No voltage release                         |
| RPR  | Reverse phase relay                        |
| INV  | Inverse time characteristic                |
| DEF  | Definite time characteristic               |
| 05   | 05 type (current setting range: 0.5 ~ 10A) |
| 60   | 60 type (current setting range: 5 ~ 70A)   |

### 3. Operation and setting

#### 3.1 <MODE/Adjust> switch

Selection of the parameter or mode is started by turning <MODE/Adjust> switch clockwise or counterclockwise as shown in following diagram. Once the selection of the parameter is completed by depressing <SET/store> pushbutton, the setting values for the parameter can be now selected turning <MODE/Adjust> switch again. At this time, turning the switch clockwise will increase the set value and decrease it in the other way.



#### 3.2 Setting steps

- Select the mode to adjust with turning the <MODE/Adjust> switch clockwise or counter clockwise.
- Depress the <SET/store> button once to start the setting.
- Adjust the required amount or output with the <MODE/Adjust> switch.
- Depress the <SET/store> button once to complete the setting.

#### 3.3 Trip display

| Cause of Trip  | Indication | Description   |
|----------------|------------|---|
| Over-current   |            | Operated by max. current 10.7A on L3(T) phase           |
| Under-current  |            | Operated by min. current 1.14A on L2(S) phase           |
| Earth Fault    |            | Operated by 0.6 Amp as Earth Fault current.             |
| Locked Rotor   |            | Operated by max. current 26.9A on L3(R) phase           |
| Stall Trip     |            | Stall Trip  |
| Phase Reversal |            | Phase Reversal Trip                                     |
| Unbalance      |            | Operated by min. unbalance current 2.78A on L1(R) phase |
| Phase Loss     |            | Operated by L1(R) phase loss                            |
|                |            | Operated by L2(S) phase loss                            |
|                |            | Operated by L3(T) phase loss                            |

### 3.4 Display mode

| MODE | Function                         | Description  | Range & Others   |
|------|----------------------------------|--|--|
|      | Over-current                     | Set the required over-current amount   | Refer to table No.1.4  |
|      | Starting Delay Time              | Adjust trip delay time to prevent unnecessary trip due to inrush current during start-up of the motor except phase loss and phase reverse.   | Off ~ 200 sec<br>Off : disable   |
|      | Over-current Trip Delay Time     | Adjust trip delay time when the load current is more than the preset oc amount according to the selection of DIP SW#3 (Inverse/Definite)   | Definite : 0.2 ~ 30 sec<br>Inverse : 1 ~ 30 sec<br>※ Refer to table #3.7   |
|      | Earth Fault Current              | Set the desired Earth(Ground) Fault trip current.  | A Type : 0.03 ~ 2.5A<br>B Type : 0.5 ~ 10A                                 |
|      | Earth Fault Operating Delay Time | Adjust trip delay time when the earth fault current exceeds the preset Ec setting current ※ Definite time characteristic only.   | 0.05 ~ 10 sec,<br>Adjustable   |
|      | Under Current                    | Set the required under-current amount.<br>Off : Disable function   | Off/0.5 ~ lower than preset over-current amount.                           |
|      | Under Current Trip Delay Time    | Adjust trip delay time when the load current is less than preset <b>uc</b> amount.   | 0.5 ~ 30 sec<br>※ Definite time characteristic only                        |
|      | Reset Type                       | Selection of reset type  |  |
|      |                                  | <b>rt:H-r</b> : Hand(Manual) reset - Reset by depressing reset button on the relay facia only.   |  |
|      |                                  | <b>rt:E-r</b> ; Electrical(Remote) reset - Reset by interruption of supply power on A1, A2, otherwise depress reset button on the relay facia.   |  |
|      |                                  | <b>rt:A-r</b> : Automatic reset - If this mode is stored, relay will be reset after 0.2 sec. If <b>A-r</b> mode has not been stored and MODE/Adjust switch is continuously turned round, display window shows 0.3 ~ 0.9, 1 ~ 10, 20 ~ 50, 1n ~ 20n in sequence. Select required time and store it by depressing SET/store button once.   | 0.3 sec to 20 min. adjustable<br>※ "n" : minute                            |
|      | Total Running Hour               | This is running hour accumulation counter. The counter starts to accumulate under condition in which load is more than 0.2Amp. <b>-trh-</b> and 0303.3(accumulated run hour) are shown 15 times in turn when this mode is selected. ※ 0303.3 = 303 hour & 18 minutes(0.3 × 60min)  | Maximum accumulation time : 99999 hours<br>※ This time cannot be reset.    |
|      | Operation hour setting           | This is same as <b>-trh-</b> except that setting is available.<br>※ 10 hours step setting<br>※ In case the setting hour elapse, current of L1, L2, L3 and the elapsed setting hour are displayed in every 5 sec and 1 sec respectively. ※ It can be reset by stored "Off"  | Off/10 ~ 9990 hours.<br>※ Enable setting                                   |
|      | Operation hour                   | This is indication Mode of elapse time for preset running hours. If the <b>--rh-</b> is selected by turning of "MODE/Adjust", relay are shown <b>--rh-</b> and <b>30.6</b> 15 times every second in turn. The counter starts to accumulate under condition in which load is more than 0.2 Amp. 30.6 means accumulated operation time of load from the preset time point.<br>※ 30.6 = 30 hour & 36 minutes(0.6 × 60min) |  |
|      | Locked Current                   | Trip delay : 0.5 sec<br>This function is to protect a motor from rapid increasing of the load or current.  | 2 ~ 10 times of oc set point adjustable<br>※ "Definite time" setting only. |
|      | Stall Trip Delay Time            | Adjust the trip delay time when the current is more than 180% of current setting amount.   | Off/1 ~ 10sec<br>※ Off : disable function<br>Definite time setting only.   |
|      | CT Ratio                         | Select the primary current of CT in case using external CT.<br>Example : If external CT ratio is 200.5, then select 200.   | Refer to table #1.4  |
|      | Cause of Trip Confirmation       | It is possible to confirm the last trip cause. The cause of trip is identified together with current and others by depressing SET/store button and turning MODE/Adjust switch.   | ※ Regardless function of power failure.                                    |
|      | Test                             | This is the self test of the relay, checking function of sequence after the installation. If the relay enters this mode, it will become trip status after 3 sec, and preset <b>ot</b> begins its countdown. After the countdown, it shows "End" message in the display window to indicate the completion of the test.  | ※ This mode block up under operation to prevent unnecessary trip.          |

### 3.5 Dip-switch setting

#### 1. NVR : No Volt Release

|  |  |
|--|--|
|  | <p><b>Disable of Fail safe</b></p> <p>The output relay of "oL" is de-energize regardless of the control power applied.</p>                                 |
|  | <p><b>Enable of Fail safe</b></p> <p>The output relay of "oL" is energized by control power applied. The output relay will be de-energized after trip.</p> |

#### 2. RPR : Reverse Phase Relay

|  |   |
|--|---|
|  | <p><b>Disable of phase reversal protection.</b></p> |
|  | <p><b>Enable of phase reversal protection.</b></p>  |

#### 3. Selection of Time-Current Characteristics : Inverse / Definite

|                     |   |                |       |       |       |       |                     |     |    |    |    |
|---------------------|---|----------------|-------|-------|-------|-------|---------------------|-----|----|----|----|
|                     | <p><b>Definite :</b></p> <p>Definite time-current characteristic for over-current operation. Refer to table no.1</p>  |                |       |       |       |       |                     |     |    |    |    |
|                     | <p><b>Inverse :</b></p> <p>Inverse time-current characteristic for over-current operation.<br/>(Refer to table #2,3 of 3.6)<br/>IEC947-4 Trip curve based on the O-Time setting &lt;table #2 of 3.6&gt;</p> <table border="1" data-bbox="502 1164 1197 1243"> <tr> <td>O-Time Setting</td> <td>1-5</td> <td>6-10</td> <td>11-20</td> <td>21-30</td> </tr> <tr> <td>IEC947-4 Trip Curve</td> <td>10A</td> <td>10</td> <td>20</td> <td>30</td> </tr> </table> | O-Time Setting | 1-5   | 6-10  | 11-20 | 21-30 | IEC947-4 Trip Curve | 10A | 10 | 20 | 30 |
| O-Time Setting      | 1-5   | 6-10           | 11-20 | 21-30 |       |       |                     |     |    |    |    |
| IEC947-4 Trip Curve | 10A   | 10             | 20    | 30    |       |       |                     |     |    |    |    |

#### 4. Selection of Maximum Current Setting Range

|  |   |
|--|---|
|  | <p><b>05 Type</b></p> <p>Current setting range : 0.5~10 Amp.<br/>1 looped(2 turn) conductor through CT(adjusted 2t on CT MODE)<br/>- 0.25~5Amp<br/>4 looped(5 turn) conductor through CT(adjusted 2t on CT MODE)<br/>- 0.1~2Amp</p> |
|  | <p><b>60 Type</b></p> <p>Current Setting Range : 5.0~70 Amp.</p>  |

### 3.6 Characteristic curve

Table 1

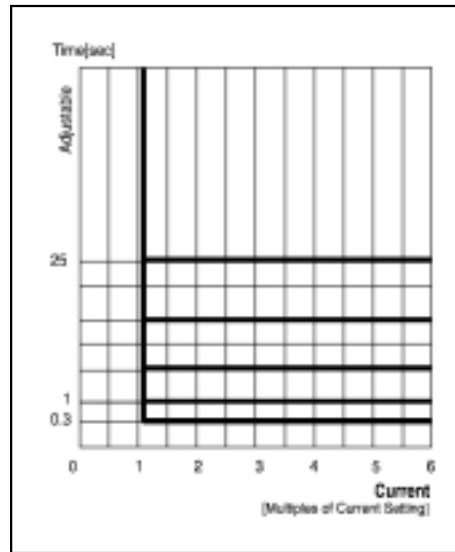


Table 2

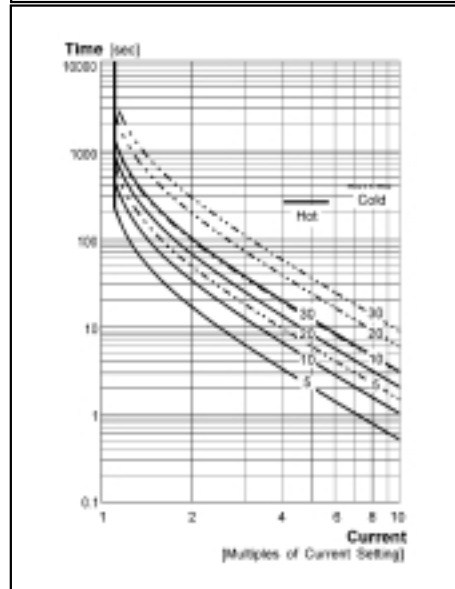
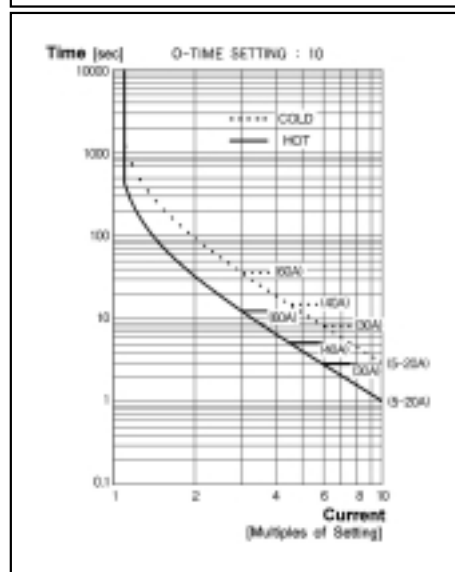


Table 3



## 4. Ordering

**EOCR-FMZ - 220 - 2**  
①                      ②                      ③

|                          |   |              |
|--------------------------|---|--------------|
| ① Model Name             | FLUSH MOUNTING MULTI-FUNCTIONAL RELAY - W/GROUND FAULT PROTECTION AND AMMETER |              |
| ② Control Power Voltage  | 24  | 24VAC/DC     |
|                          | 220   | 85~250VAC/DC |
| ③ Interface Cable Length | 0.5:0.5M, 1:1.0M, 2:2.0M, 3:3.0M, Other Length : Option.                      |              |