

# EOCR-3EZ/FEZ

## Digital Over Current Relay

### EOCR-3EZ Built-in Panel

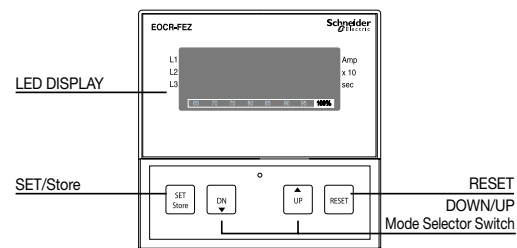
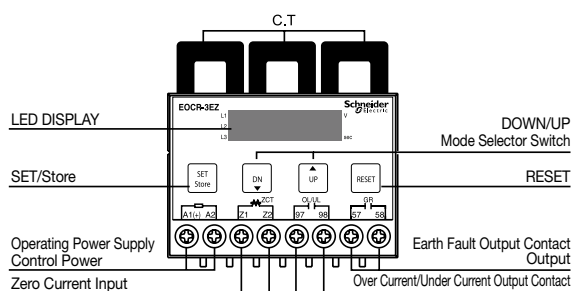


■ Hole Type

### EOCR-FEZ Embedded Panel



■ Terminal Type



## Main Features

- Built-in MCU (Micro Controller Unit)
- Real time processing/higher precision
- Over current protection range: 0.5~60A, wide range protection (1~960A with an external CT)
- Under current protection range : The set over current or less
- Earth fault current protection range: Earth fault protection via zero current detection / 0.02~3A (Definite operation)
- Over current protection operation time characteristic: Definite - 0.5~60A (external CT combination for over 60A)  
Inverse - 0.5~10A (external CT combination for over 10A)
- Earth fault protection operation time characteristics : Definite : 0.05~10 sec
- Digital Display
  - Auto circulation display on 3-phase current and earth fault current : Digital Ammeter (every 5 sec for each phase)
  - Allows fixed management on single-phase or earth fault current via manual circulation
  - Trip cause digital display : Easy Troubleshooting
- Last trip cause check function: Can check the last 3 trip causes and current at the occurrence of each trip. Available even during the recovery of electricity after a power outage.
- The actual current % on current change and current set value can be easily identified via a Bar Graph (FEZ type)
- Manual (instant)/electrical (remote) reset
- Also works well on frequency converter systems (e.g., inverter): Frequency response range 20~400Hz
- Fail Safe function (FS:ON): Self-diagnosis function - when power is supplied to the relay, the relay is normally energized
- Applicable in various installation environments, with both terminal and hole types

## Protection Functions and Characteristics

Protection Function	Operation Time	
Over Current	Operates based on the set ot	
Under Current	Operates based on the set ut	
Phase Loss	Within 3 sec	
Reverse Phase	0.1~0.3 sec	
Earth Fault Current	0.05~10 sec (Definite operation)	
Unbalance	Within 8 sec	
Locked Rotor	Lock	Operates within 0.5 sec after dt (Definite operation)
	Stall	0.5, 1~10 sec (Definite operation)

\* Over Current Protection Activation Characteristics - 0.5A~10A : Definite / Inverse - 11A or higher: Definite (except when using an external CT)

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### Specifications

Functions and Characteristics		Specifications		
Current Setting	Over Current	Refer to current setting range table		
	Under Current	0.5~59A / oFF (with an external CT : 800A or less)		
	Earth Fault Current	0.02~3A (Definite)		
	Unbalance	5%~50% / oFF		
	Start Delay Time (dt)	1~200 sec (Definite)		
	Over Current Operation Time (ot)	0.5~30 sec (Definite), 1~30 sec (Inverse)		
	Under Current Operation Time (ut)	0.5~30 sec (Definite)		
	Earth Fault Current Operation Time (Et)	0.05~10 sec (Definite)		
	Earth Fault Operation Delay Time (ED) at Start-up	Off/1~10 sec (Definite)		
Reset		Manual (Instant) Reset/Electrical Reset		
Error Tolerance	Current	$I < 1A : \pm 0.05A, I \geq 1A : \pm 5\%$		
	Time	$t \leq 3s : \pm 0.2s, t > 3s : \pm 5\%$		
Usage Environment	Temperature	Operation	-20°C~60°C	
		Save	-30°C~80°C	
	Humidity	30~85% RH (with no dew condensation)		
Operating Power Supply	Terminal type		AC220/110V	
			- DC/AC85~250V, 50/60Hz	
	Hole type		- AC220V : $\pm 15\%$ , 50/60Hz	
			- AC110V : $\pm 15\%$ , 50/60Hz	
Output contact	OL/UL	1-SPST	AC250V/3A resistive load	
		GR	1-SPST	AC250V/3A resistive load
	Insulation Resistance	Between circuit and case		10M $\Omega$ or higher at DC500V
		Between contacts		1.0kV 60Hz for 1 min
Insulation Withstanding Voltage	Between circuit and case		2.0kV 60Hz for 1 min	
	Between contacts		1.0kV 60Hz for 1 min	
	Between circuits		2.0kV 60Hz for 1 min	
Installation Method	35mm DIN Rail or Panel			

### Over Current Operation Time Characteristic Curve

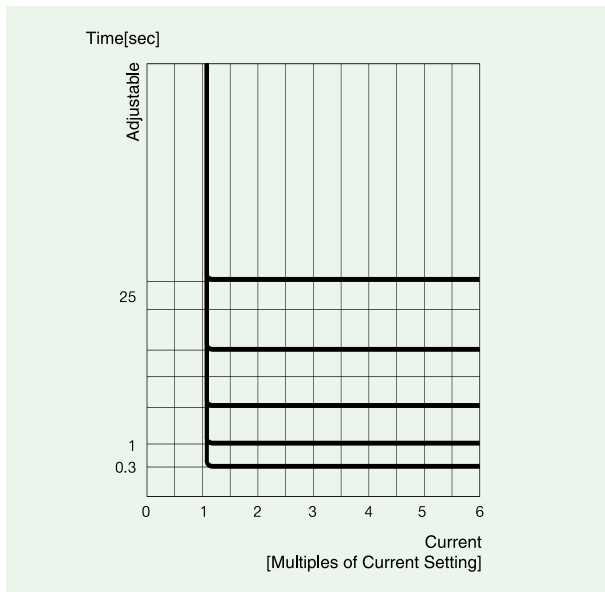


Table 1. Over Current Protection Definite Operation Characteristic Curve

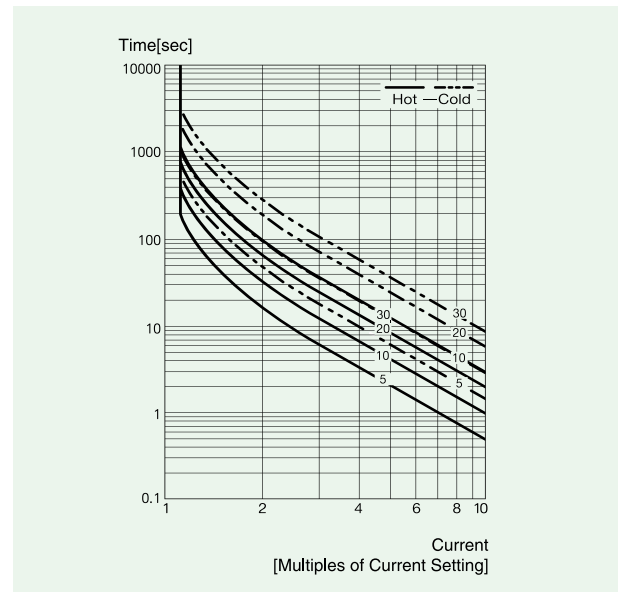


Table 2. Over Current Protection Inverse Operation Characteristic Curve (0.5~10A, external CT combination)

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### Current Setting Range Table

Setting Range	Number of CT Holes	External CT Current Transformer Ratio	CT Setting	Notes
0.5~60A	1	No CT combination	oFF	Wide Range
0.25~5.0A	2 Holes	No CT combination	2t	
0.1~2.0A	5 Holes	No CT combination	5t	
1~12A	1	10:05	10	
1.5~18A	1	15:05	15	
2.0~24A	1	20:05	20	
2.5~30A	1	25:05:00	25	
3.0~36A	1	30:05:00	30	
4.0~48A	1	40:05:00	40	
5~60A	1	50:05:00	50	
6~72A	1	60:05:00	60	
7.5~90A	1	75:05:00	75	
10~120A	1	100:05:00	100	
12~144A	1	120:05:00	120	
15~180A	1	150:05:00	150	
20~240A	1	200:05:00	200	
25~300A	1	250:05:00	250	
30~360A	1	300:05:00	300	
40~480A	1	400:05:00	400	
50~600A	1	500:05:00	500	
60~720A	1	600:05:00	600	
75~900A	1	750:05:00	750	
80~960A	1	800:05:00	800	

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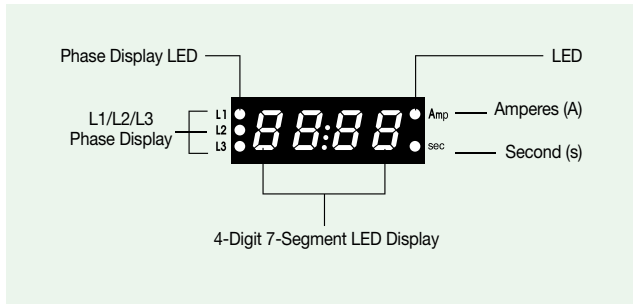
## Digital Over Current Relay

### Display Front View

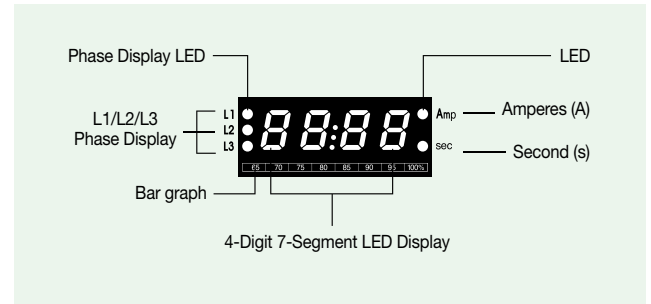
Automatically displays the operating current of 3 phases with the phase display every 5 sec in circulation, without additional button input.

#### • LED Display

EOCR-3EZ Type



EOCR-FEZ Type



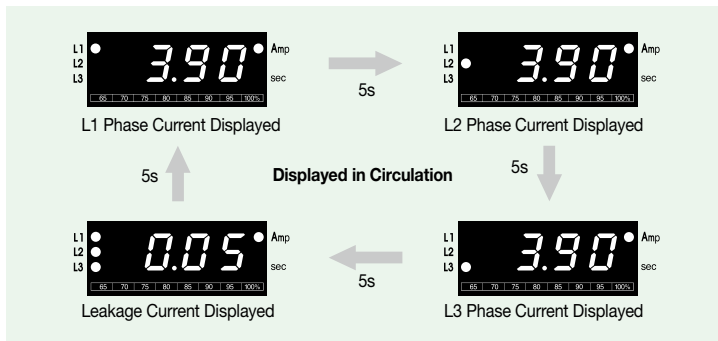
#### 7-segment LED

- A large font and a comfortable background color are used to prevent visual interference caused by reflections from the control panel in any direction.

#### Bar graph (limited to FEZ)

- Allows you to view the load status of the motor by showing the ratio of the present operating current to the set OC (Over Current).
- If you set the OC set value to the rated current of the motor, the percentage (%) shown on the bar graph will indicate the load factor of the motor.

### 3-phase Digital Current System Function



※ Press the SET (Store) button once during operation to view the manual circulation display instead of the auto circulation display. Every time you press the SET (Store) button while in manual circulation mode, the display changes in the order specified above, allowing you to lock on the current of a certain phase for focused management.

※ Press the Reset button once to switch back to the auto circulation display.

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## Digital Over Current Relay

### Button Switch Functions and Setting Sequence

Mode		Press the Up/Down buttons to find the function to set.
Set		This mode indicates the start of the setting. When this button is pressed once, the corresponding value or characters flicker 5 times, during which you should continue the setting process. If it is left untouched for 30 seconds, it will be reset and you will have to press this button again to make the setting.
Adjust		Press the Up/Down buttons to select the desired value or characters.
Store		When the SET (store) button is pressed once, the selected value or characters will be stored and the flickering will stop at the same time.
Reset		Reset button is used to return to the initial state. Once the setting is made, press the Reset button or leave it for 30 seconds to complete the setting.

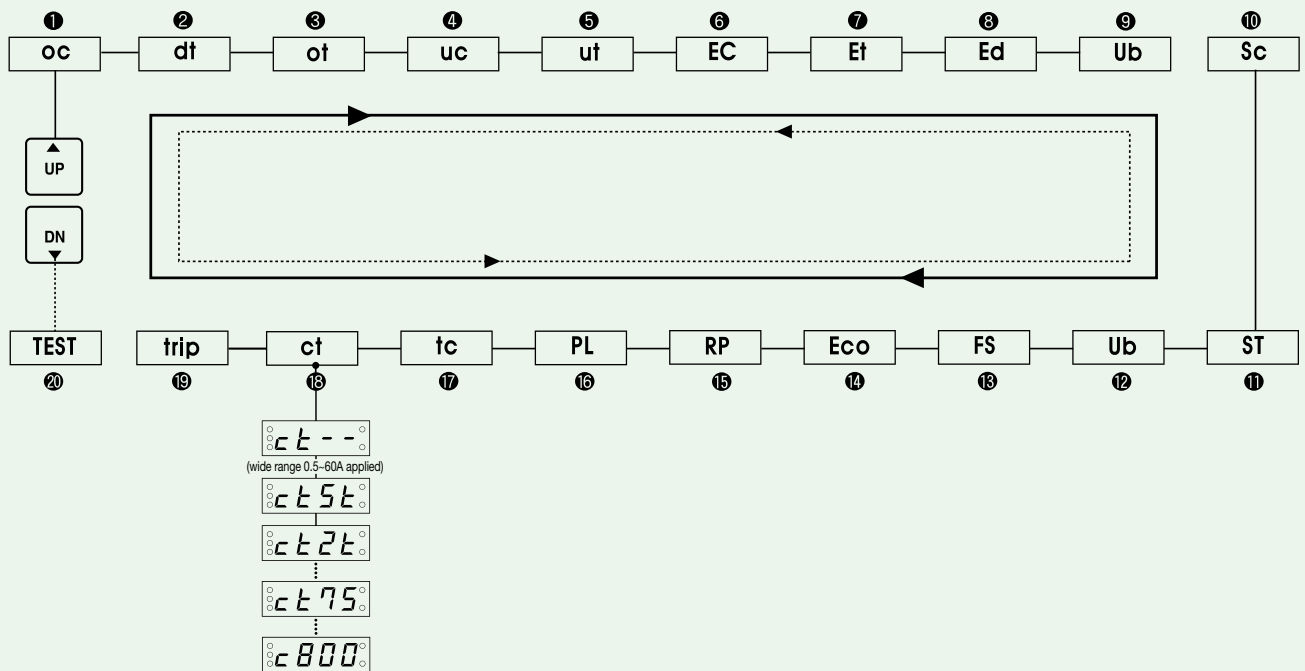
※ Manual Circulation Display

- If you press the Set (Store) button during operation, the display of 3-phase current is switched from auto circulation display to manual circulation display.
- Once the original L1 phase is displayed, every time you press it, the phase display will change in the order of L2→L3→L1 phase. Press Reset to return to the auto circulation display state.

※ Trip Cause Check

- After pressing the Up/Down buttons to enter "Trip" Mode, press the Set/Store button once to display the last trip cause. Every time the Up button is pressed, the current at each phase (L1, L2, L3) at the time of the trip will be displayed. Press it once more to check the second-last trip cause. The method for checking subsequent fault causes and current during operation is the same as the one used for checking the last trip cause.

#### • Setting sequence



- Press the UP/Down buttons to find the Mode to set.
- To find ot in this figure, press the UP SW button 3 times if you are rotating the sequence of modes in a clock-wise direction, then ot will appear in the display window.

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### Function Setting Sequence and Setting Menu

Sequence	Setting	Display	Description	Setting Range	Default
1	Over Current Setting	OC 0.5	<ul style="list-style-type: none"> <li>Set the desired over current value.</li> <li>Set it higher (100%~125%) than the active load current (operating current).</li> <li>Current of 0.4A or higher can be displayed, but setting and operation are only available at the current of 0.5A or higher.</li> <li>0.5 ~ 10A : Changes in increments of 0.1A</li> <li>10 ~ 60A : Changes in increments of 1A</li> <li>For Inverse, the setting cannot exceed 10A.</li> <li>When setting the CT Ratio, the protection set value converted from the secondary CT (=primary active current/CT Ratio) must be set in "OC" Mode before setting the Ratio in "CT" Mode.</li> <li>Check the current value in "OC" Mode after setting the CT Ratio, and you will recognize that it is automatically converted to the active current value based on the primary CT.</li> <li>Afterwards, the active current value can be changed to any value in the "OC" Mode for the identical CT ratio.</li> </ul>	Current Setting Range Table (see p.165)	10
2	Start Delay Time Setting	dt 1.0	<ul style="list-style-type: none"> <li>Function to stop the operation of start-up over current, under current, lock, and stall functions. Must be set accurately. Phase loss and reverse phase function normally during the set time period.</li> <li>1~100 sec: Changes in increments of 1 sec.</li> <li>100~200 sec: Changes in increments of 10 sec.</li> </ul>	<ul style="list-style-type: none"> <li>Can be set from oFF(-) 1~200 sec</li> </ul>	10
3	Over Current Operation Time Setting	ot 1.0	<ul style="list-style-type: none"> <li>Definite/Inverse can be selected and set in the tc mode.</li> <li>0.2~1 sec: Changes in increments of 0.1 sec.</li> <li>1~30 sec: Changes in increments of 1 sec.</li> </ul>	<ul style="list-style-type: none"> <li>Can be set from 0.5~0.9-1...sec (definite time)</li> <li>Can be set from 1~30 (Inverse)</li> </ul>	5
4	Under Current Setting	uc 0.5	<ul style="list-style-type: none"> <li>Sets the under current (light load) value you want.</li> <li>Cannot be the same as OC set value or higher.</li> <li>0.5~10A: Changes in increments of 0.1A.</li> <li>10~59A: Changes in increments of 1A.</li> </ul>	<ul style="list-style-type: none"> <li>Can be set from 0.5~59A oFF (Mode display: -)</li> </ul>	--
5	Under Current Operation Time Setting	ut 1.0	<ul style="list-style-type: none"> <li>Sets the operation time of the relay for the set under current (light load).</li> <li>Definite Operation</li> <li>0.5~1 sec: Changes in increments of 0.1 sec.</li> <li>1~30 sec: Changes in increments of 1 sec.</li> </ul>	Can be set from 0.5~30 sec	--
6	Earth Fault Over Current Setting	Ec 0.03	<ul style="list-style-type: none"> <li>Earth Fault Protection via Zero Phase Current Detection</li> <li>Displayed as Ec.02 if set to 0.02A.</li> </ul>	<ul style="list-style-type: none"> <li>0.02~3A</li> <li>0.02~0.1: Increases in increments of 0.01A</li> <li>0.1~3: Increases in increments of 0.1A</li> </ul>	3
7	Earth Fault Protection Operation Time Setting	Et 0.1	<ul style="list-style-type: none"> <li>0.05, 0.1~1~10 sec / Displayed as Et.02 if set to 0.02 sec. (0.1~1 sec: Changes in increments of 0.1 sec, 1~10 sec: Changes in increments of 1 sec)</li> </ul>	<ul style="list-style-type: none"> <li>0.05~10 sec (Definite operation)</li> </ul>	1
8	Earth Fault Delay Time Setting	Ed --	<ul style="list-style-type: none"> <li>-- : Ignores earth fault operation delay during startup. Operates at the set current or higher during startup</li> <li>Operation stops for the specified duration of time (at startup)</li> </ul>	<ul style="list-style-type: none"> <li>oFF/1~10 sec</li> </ul>	1
9	Lock (Stall) Current Setting: A multiple of OC set value.	Lc 7	<ul style="list-style-type: none"> <li>Definite Operation</li> <li>Operates within 0.5 sec after dt</li> <li>Does not operate during operation.</li> </ul>	<ul style="list-style-type: none"> <li>0.5~10A: 2~10 times the over current setting</li> <li>11A or higher: Automatically reduced to an appropriate multiple value. The upper value set for "Lc" is "[ Lc" upper value=100÷ "OC" set value], during which "Lc" can be changed to the range of upper value or below.</li> <li>oFF (Mode display: -)</li> </ul>	10
10	Stall (heavy load during operation) or Shock (mechanical shock) Setting: A multiple of the over current set Value	Sc 2.0	<ul style="list-style-type: none"> <li>Set to 1.5 times the over current set value.</li> <li>Definite Operation</li> <li>If the current flow exceeds the multiple of the OC set value due to heavy load during normal operation after startup, it will trip after the set St time.</li> </ul>	<ul style="list-style-type: none"> <li>5~50% oFF (Mode display: -)</li> </ul>	5
11	Stall Operation Time Setting	St 5.0	<ul style="list-style-type: none"> <li>When Sc is set to oFF(-), St is also automatically displayed as oFF(-).</li> <li>Operates with the setting of 0.5 sec for shock protection</li> </ul>	<ul style="list-style-type: none"> <li>0.5, 1~10 sec oFF (Mode display: -)</li> </ul>	5

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Sequence	Setting	Display	Description	Setting Range	Default
12	Current Unbalance Setting	Ub 10	<ul style="list-style-type: none"> <li>Indicates that it is set to detect 10% of the imbalance current against the max. phase current.</li> <li><math>[(\text{max. phase current} - \text{min. phase current}) / \text{max. phase current}] \times 100 &gt; \text{set } \%</math></li> </ul>	<ul style="list-style-type: none"> <li>5~50% oFF (Mode display: - -)</li> </ul>	50
13	Fail Safe (NVR) Function	F5 on	<ul style="list-style-type: none"> <li>Cannot be set while operating. (over current output contact)</li> </ul>	ON, oFF (- -)	ON
14	Eco (select earth fault output contact)	Eco.d	57- 158 GR <ul style="list-style-type: none"> <li>정상시 소자상태로 open접점을 표시합니다.</li> </ul>	<ul style="list-style-type: none"> <li>Can select contact a or b</li> <li>Cannot be set while operating.</li> <li>Eco.b setting: Becomes 57- 158 closed contact after the operating power is supplied.</li> </ul>	a
15	RPR (Reverse Phase Relay) Function	RP on	<ul style="list-style-type: none"> <li>Off(-) ignores reverse phase function.</li> </ul>	ON, oFF (Mode display: - -)	ON
16	Phase Loss Function Select	PL on	<ul style="list-style-type: none"> <li>Can be set to oFF(-). (Set to OFF for single-phase)</li> </ul>	ON, oFF (Mode display: - -)	ON
17	Over Current Protection Operation Time Characteristics (Select Definite/Inverse)	tcdE	<ul style="list-style-type: none"> <li>tc (Time-Current Characteristic) : dE, In</li> <li>- Definite (dE): Operates based on operation characteristics in Table 1.</li> <li>- Inverse (In): Operates based on characteristics curve in Table 2.</li> <li>- When set to 11A or higher, dE is automatically applied.</li> <li>※ Once Inverse (tdIn) is selected and operation delay time (dt) is set, a hot curve will be applied after dt. When using inverse time for a longer startup time, it is possible to set a faster operation time on overload during operation.</li> </ul>	<ul style="list-style-type: none"> <li>dE(definite), In(Inverse)</li> <li>0.5~10A: Can select dE/In</li> <li>11A or higher: dE</li> </ul>	dE
18	CT Current Transformer Ratio Setting	ct 75	<ul style="list-style-type: none"> <li>Automatically set to wide range (0.5~60A) mode if set to oFF (-).</li> <li>Cannot set the CT scale while operating.</li> <li>5t: Protectable at 0.12A or higher</li> <li>2t: Protectable at 0.3A or higher</li> <li>To set the CT Ratio, the target active current value for protection should be converted to the secondary value (=active current value/CT ratio), and the resulting value must be set first in the "OC" Mode. (see the "OC" Mode setting guide for details)</li> </ul>	OFF-5t, 2t, 10-15-25-30-40-50-60-75-100-120-150-200-250-300-400-500-600-750-800	--
19	Trip Cause Check	tr 1P	<ul style="list-style-type: none"> <li>Displayed in the order of Last-2nd Last. Trip causes and the current at each phase can be checked.</li> </ul>	Can check from the 1st to the 3rd	--
20	TEST Function	7E57	<div style="text-align: center;"> <div style="border: 1px solid black; padding: 2px; display: inline-block;">7E57.</div>            ↓ 3 sec  <div style="border: 1px solid black; padding: 2px; display: inline-block;">ot 10.</div>            ↓ 10 sec  <div style="border: 1px solid black; padding: 2px; display: inline-block;">End</div> </div>	Does not convert to Test while operating.	

Inspection after installing EOCR should be performed as follows:

- Ensure that the wiring has been performed properly.
- Press the Down button once before starting the motor to show the Test display. 3 seconds after its display, a countdown of the set Ot value will start. If End is displayed after the countdown, it is normal.
- EOCR is designed to block the test function while operating in order to prevent unnecessary trip accidents.

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### How to Set Current/Time

Protects the motor by setting the current and time appropriately, as follows:

**• Notes on Current Setting**

- Wide Range: If CT is set to --(oFF), it turns to the wide range. The range of working current can go up to 0.5A~60A for Definite (set to tcdE), and up to 0.5A~10A for Inverse (set to tcln). (not including the case of using an external CT)
  - ※ You can select either Definite or Inverse if the OC set value is 10A or lower. However, if the OC set value is 10A or higher, Inverse setting is not allowed. Similarly, OC set value cannot be 10A or higher when it is set to Inverse (tcln).

**2. External CT Combination**

- CT ratio cannot be adjusted if OC (Over Current) set value is 6A or higher.
- CT setting sets the primary current value of an external CT. Once set, it is displayed as CT75 if the CT primary current is 75:5 or lower during the setting, and displayed as c100 if it is 100:5 or higher.
- The current range available when using an external CT is calculated as follows: CT ratio (i.e., 100:5=100/5=20)×0.5-6A=10-120A
  - ※ Once the current transformer ratio of CT is set, OC setting will not display the letter "c" in "OC"; instead, it will be displayed as o10.8 without "c".
  - Similarly, the under current setting will not display the "c" in "UC" and will be displayed as u9.80, for example.

**- Over Current Setting Sequence**

- Set the OC (Over Current) value to 6A or lower.
- Set the CT ratio. The OC (Over Current) that is already set will be automatically converted to a value multiplied by the current transformer ratio of the CT (20 times if 100:5). For example, if OC is set at 4A and CT at 200, the over current setting is automatically set to 4×40=160A and saved.
- Simply check the over current setting and set it appropriately for the load.

**3. Operation Time**

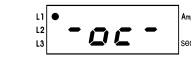
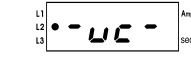
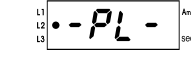
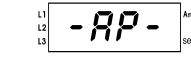
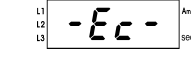
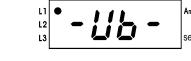
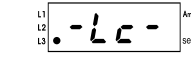
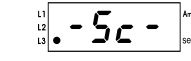
- Definite: Set the time it takes for the current exceeding the set point to start to flow and trip the relay to ot.
- Inverse: Decide when the relay will be tripped in terms of after how much time has elapsed and after what multiple value of the set current begins to flow by referring to the current-time characteristic curve, and complete the setting. Consider the figure below as an example. If ot is set to 5 and the current flow is 5 times the regular current, the relay will be tripped at 2 sec; if set to 10, at 4 sec.

**• Under Current Protection**

- It is more convenient to set UC--(oFF) to prevent malfunction during startup for a test operation. Even during the test operation, it operates with no-load because the current flow is only one-third the rated current during no-load.
- During normal operation, check the current in no-load state, and set the current to be slightly higher than the current in no-load state (to prevent no-load operation).
- If under current function is unnecessary, the function is removed if set to UC--(oFF), and the over current operation time ut is removed as well.

### Trip Cause Display and Check Method

Displays all kinds of trip causes and fault current values on the digital display window, allowing for easy maintenance and a faster response to accidents

Trip Cause	Trip Cause Display	Description	Notes
Over Current		Detects over current at L1 (R) phase during operation and indicates operation.	Capable of checking the current for each phase by pressing the switch after trip
Under Current		Detects under current at L2 (S) phase during operation and indicates operation.	
Phase Loss		Indicates operation due to a phase loss at L2 (S) phase.	
Reverse Phase		Displays reverse phase trip.	
Earth Fault		Detects earth fault current and operates.	
Unbalance		Indicates that it operates due to a phase unbalance calculated by [(max. phase current-min. phase current) / max. phase current]×100>set %, and that min. current at the time is at L1 (R) phase.	
Locked Rotor		Detects stall and indicates operation.	
Jam Trip During Operation		Displays trip due to a stall or mechanical shock caused by heavy load at L3 (T) phase during operation.	

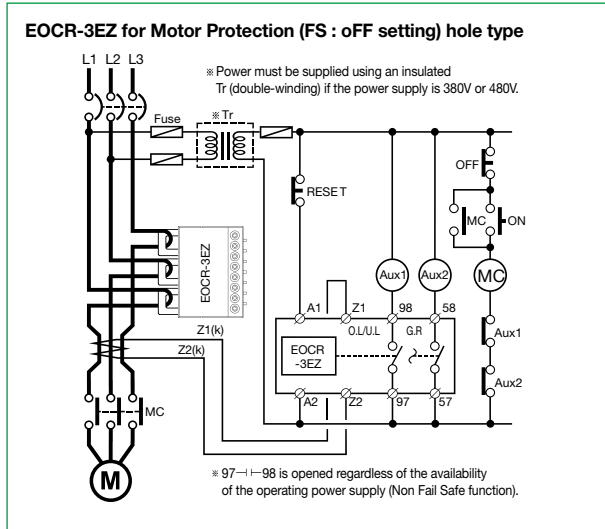
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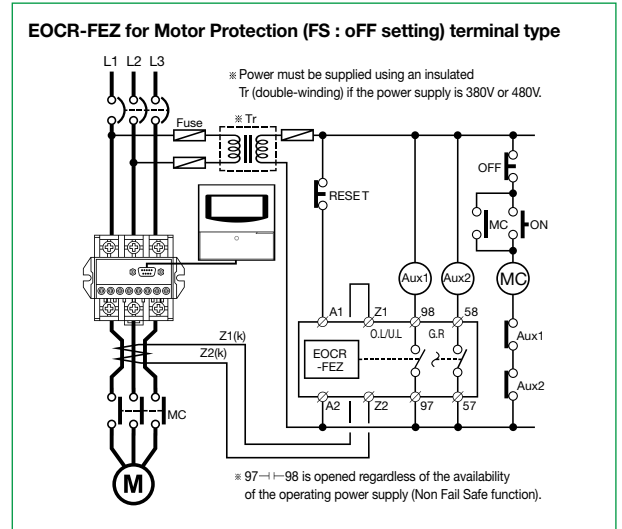
### Example Wiring Diagram

EOCR installation must be wired as shown below.

-Installation on either the frontal or the rear part of the MC is allowed.

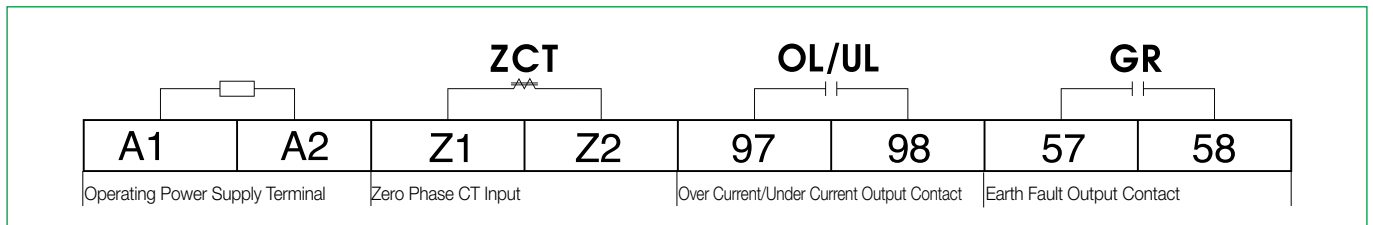


- ※ The OL output 97-98 is converted to close if FS is set to ON and operating power is supplied to A1 and A2.
- ※ ZCT terminal should be used without a ground connection.



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### I/O Terminal Configuration



- ※ The operating power supply must be connected to operating power supply terminals (A1, A2) and the specified operational voltage should be applied.
- ※ When using Star-Delta Starter (Y-Δstarter), ZCT must be installed on the upper part of the main MC upper body, below the Main CB.