

MOTOR PROTECTOR WITH AMPEREMETER, GROUND FAULT
AND OUTPUT 4-20mA

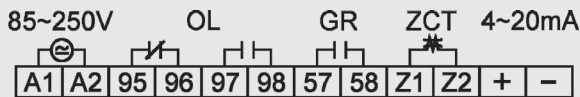
TPM-PMZ

Description

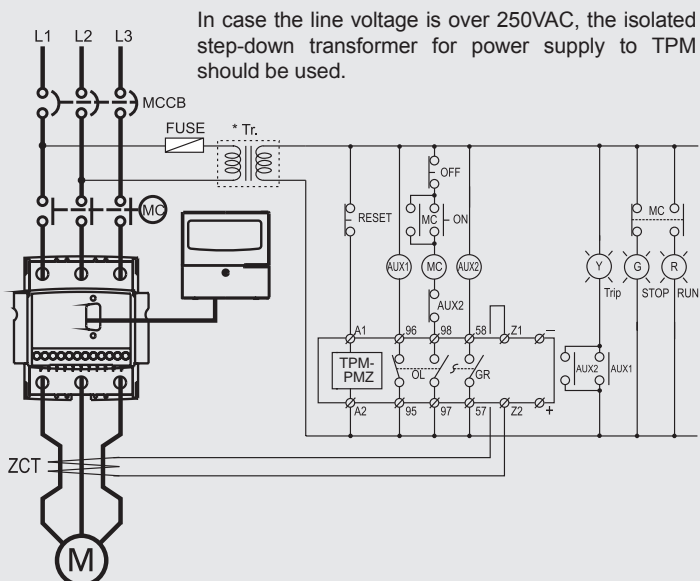
- MCU(Micro Controller Unit) based.
- Easy installation: surface mounting.
- Wide functions range, easy to program.
- Three integral current transformers.
- Multiple protection functions.
- Wide current range protection from 0.1A to 3600A only a model.
- Current display:
 - Order display: L1→L2→L3→GF→L1→
 - Display time of each current is 5 sec., user can select the phase to read manually.
- Time-Current trip characteristics selectable (see tables 2 and 3):
 - Overcurrent protection / Ground fault protection.
 - Thermal memory protection (see table 3).
 - Non-thermal memory protection (see table 2).
- Digital amperemeter integrated.
- Total running time display.
- Overload trip bar graph control.
- 4-20mA current loop communications.
- Test function.
- Fail safe selection / Version without voltage (FS : ON)
- Wide room temperature range working.



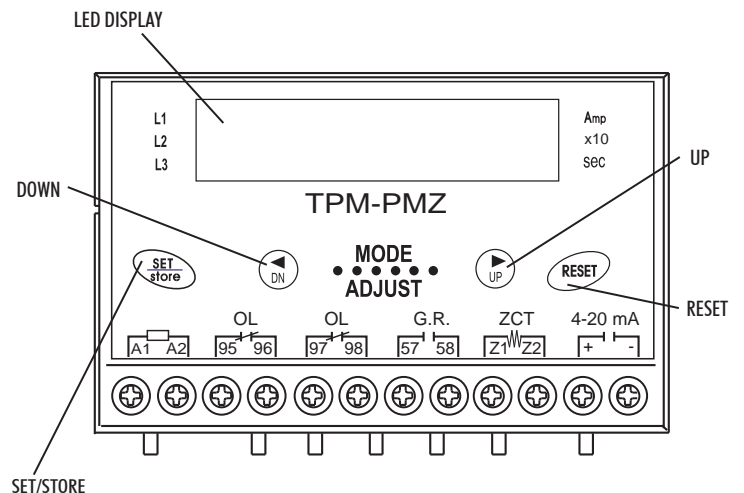
I/O Terminals Configuration



Typical Application Diagram



Frontal configuration



Function feature

Protected Item	Operation Delay
Overcurrent	1...30 seC (adjustable time)
	Type 1...30 (inverse time)
Undercurrent	1...30 sec (adjustable time)
Phase Loss	3 sec.
Phase Reversal	0,1 sec.
Unbalance	8 sec.
Locked rotor/running	Trip after "dt" time (see "how to set")
Locked rotor/work	1...10 sec. (see "how to set")
Ground fault	0,05...10 sec. (adjustable time)

How to setup

1) Current:






- **Definite time** – Set the rated motor current in "OC" mode. For protection of connected machinery with motor, it is recommended to set the 10~115% of running current after motor current is stabilized.
- **Inverse time** – 100% of rated motor current or 110~125% actual motor current is recommended.

2) D-Time: Set the expected run-up time of motor in "dt" mode.

3) O-Time :

- **Definite Time** – Set the desired trip delay time in "ot" mode.
- **Inverse Time** – Set the trip delay time according to Time-Current characteristics.

How to set

Mode		Search a mode to be adjusted by depressing UP/DN mode switch.
Set		Selected mode and setting value start flickering which means to be ready to accept setting as depressing once a Set/store button.
Adjust		Select a required setting value and/or characters by depressing continuously UP/DN mode switch until reaching what want to do.
Store		Store a selected value and/or characters by depressing once Set/store button. Instantaneously the flickering is stopped.
Reset		After completing above procedure, make a reset to be ready to operate. If not made reset, it will be reset automatically after an elapse of 30 sec.
Current rotation by Manual		Instead of automatic rotation, manual display rotation is possible as depressing once SET/ Store button during an operation. If manual is selected, the information of phase current L1 is displayed firstly and next information is displayed continuously like a manner of: L1→L2→L3→GF→L1→....

Size

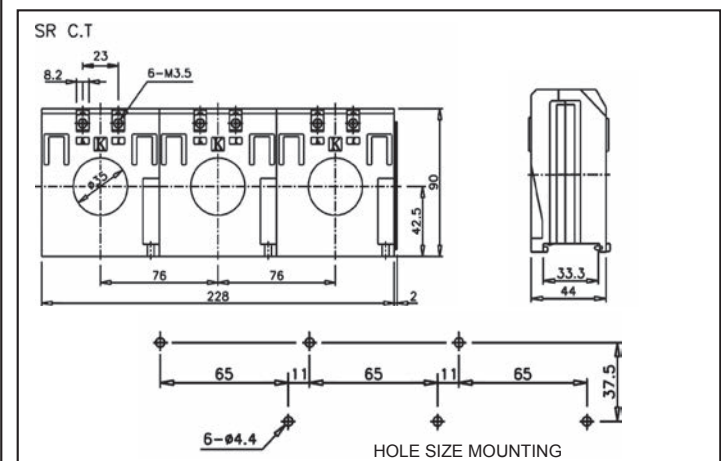
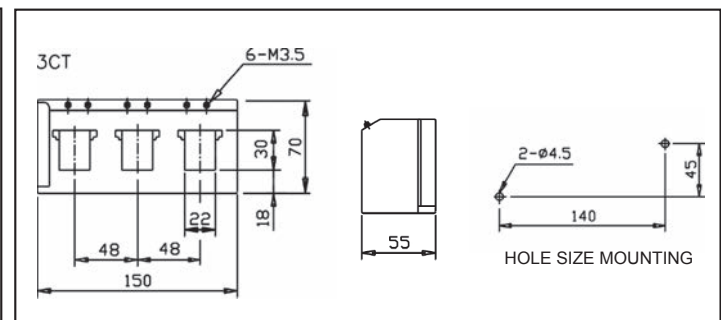
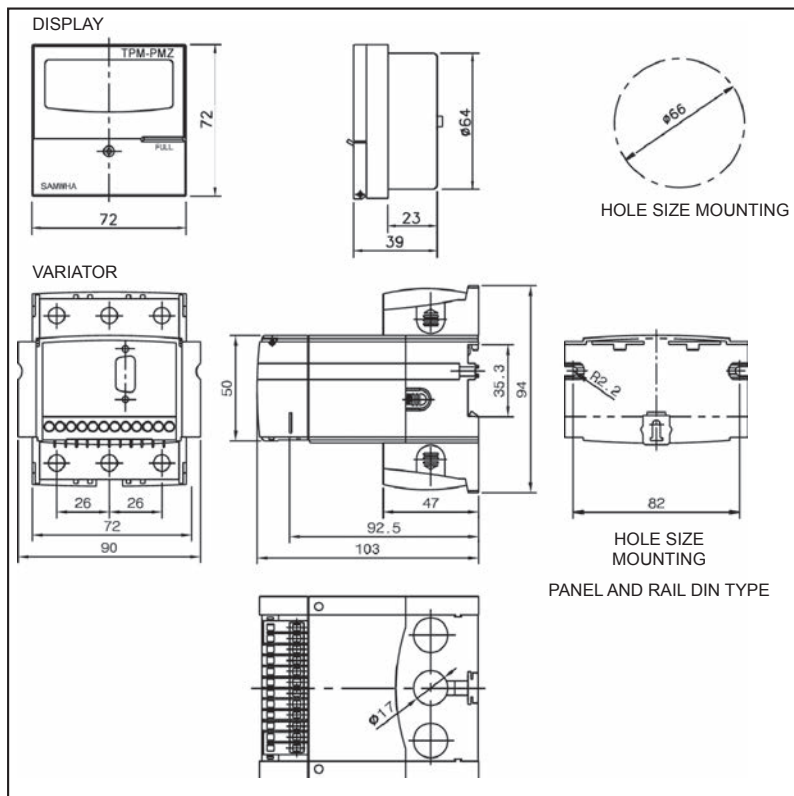


Table 1

Current setting range (A.)	Number of conductors through CT	External CT Ratio	Setting of CT Ratio	Remark
0.5...60A	1	-	OFF	Wide Range
0.25...3.0A	2	-	2t	
0.1...1.2A	5	-	5t	
1...12A	1	10:5	10	
1.5...18A	1	15:5	15	
2.0...24A	1	20:5	20	
2.5...30A	1	25:5	25	
3.0...36A	1	30:5	30	
4.0...48A	1	40:5	40	
5...60A	1	50:5	50	
6...72A	1	60:5	60	
7.5...90A	1	75:5	75	
10...120A	1	100:5	100	
12...144A	1	120:5	120	
15...180A	1	150:5	150	

Current setting range (A.)	Number of conductors through CT	External CT Ratio	Setting of CT Ratio	Remark
20...240A	1	200:5	200	
25...300A	1	250:5	250	
30...360A	1	300:5	300	
40...480A	1	400:5	400	
50...600A	1	500:5	500	
60...720A	1	600:5	600	
75...900A	1	750:5	750	
80...960A	1	800:5	800	
100...1200A	1	1000:5	1000	
120...1440A	1	1200:5	1200	
150...1800A	1	1500:5	1500	
200...2400A	1	2000:5	2000	
250...3000A	1	2500:5	2500	
300...3600A	1	3000:5	3000	

Table 2

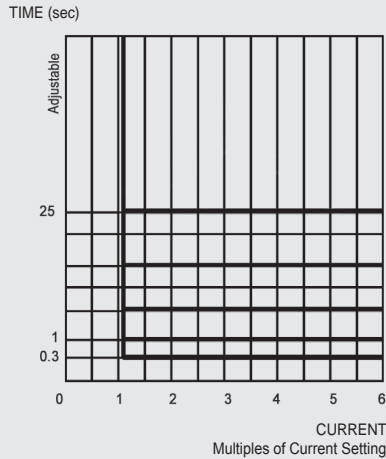


Table 2. OC adjustable time features

Table 3

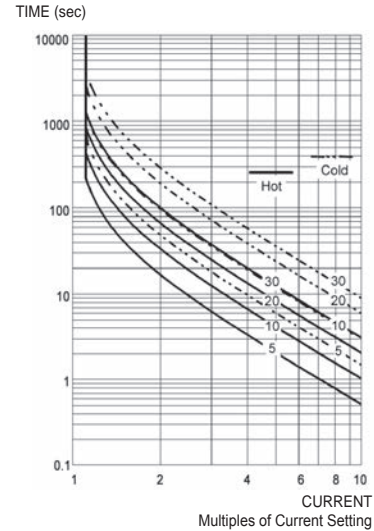


Table 3. OC inverse time features
0.5...10A / combined with external transformer

Trip Display

Function	LED Display	Description
Overload		Tripped by over current
Ucerload		Tripped by under current
Locked rotor running		Tripped by Locked Rotor
Locked rotor work		Locked Rotor in running
Phase reversal		Tripped by Phase reversal
Phase unbalance		Tripped by unbalance phase
Phase loss		Tripped by phase loss
Ground fault		Tripped by fround fault current

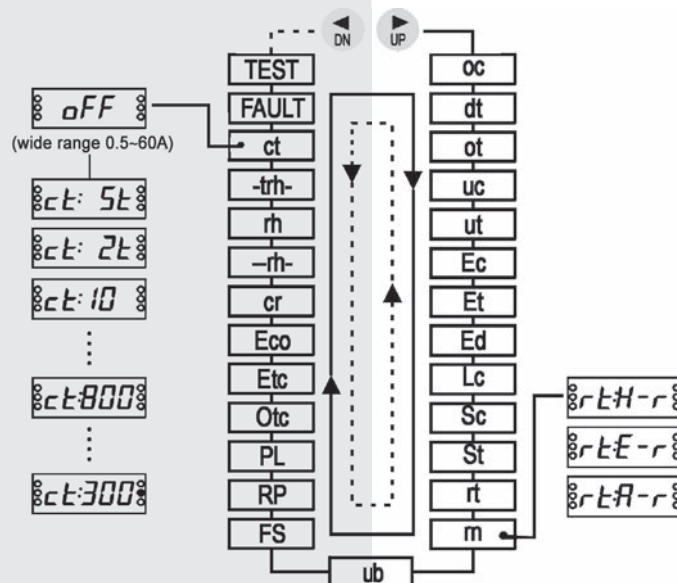
Display Setting

Function	Setting Range	Display	Description
Over-current	0.5 A...60 A		<ul style="list-style-type: none"> Display any current over 0.1A, and protect from 0.5 A. Current setting range. To set at first a preset protected value(<6A) based on CT secondary output before setting a CT ratio if needed to adopt external CT instead of wide range ("CT": OFF). After that, operator can change value based in practice load current in "oc" mode under the same CT ratio.
Starting delay time	1...200 sec. / OFF (dt--)		<ul style="list-style-type: none"> Set delay to prevent unnecessary trips caused overload during motor start-up, except phase failure trip and phase reversal trip. OFF: deactivated.
Over-current trip delay time	<ul style="list-style-type: none"> Adjustable: 0.2...30 sec. Inverse: 1...30 sec. 		<ul style="list-style-type: none"> Time-Current operation features selected in "Otc" mode.
Under-current	Adjustable until 0.5~less than "oc" setting value /OFF(uc--)		<ul style="list-style-type: none"> Set an underload value. OFF: deactivated.
Under-current trip delay time	<ul style="list-style-type: none"> Adjustable-current time feature. 1...30 sec. 		<ul style="list-style-type: none"> In case of "UC:OFF", mode "UT" becomes OFF automatically.
Ground fault	<ul style="list-style-type: none"> OFF Adjustable: 0.03...10A Inverse : 0.03...1A 		<ul style="list-style-type: none"> Activated by zero sequence current. Time-Current features set automatically over 1 A from value set. Only can restart output tripped by Hr.
Ground fault trip delay time	Adjustable / Inverse: 0.05,0.1...1...10 sec		<ul style="list-style-type: none"> 0.1...1 sec.→ intervals of 0.1 sec., 1...10 sec. → intervals of 1 sec. Time-Current operatives are selected in "Etc" mode.
Ground fault starting delay time	OFF/1...10 sec.		<ul style="list-style-type: none"> Available only for time adjustable-current features. OFF: deactivated.
Locked rotor running	<ul style="list-style-type: none"> OFF/2...10 times oc Adjustable 		<ul style="list-style-type: none"> Locked rotor running. Trip in 0.5 sec, after elapse of "dt".
Locked rotor work	<ul style="list-style-type: none"> OFF/1.5...5 times oc Adjustable 		<ul style="list-style-type: none"> Locked rotor while motor is running. Trip after elapse of preset time("St").
Operating Time of Stall	0.1...10 sec		<ul style="list-style-type: none"> In case of "Sc:OFF", "St" mode becomes OFF automatically. Recommended set 0.05 seconds to shock protection.
Reset type	<ul style="list-style-type: none"> Hr: manual reset Er: remote reset Ar : automatic reset (1...59sec.-1n (min) -20n(min) 		<ul style="list-style-type: none"> Hr : press RESET button once. Er : Voltage interruption. Ar : Restart after time set. Not operated in phase loss, phase reversal, short-circuit, ground fault, locked rotor running, locked rotor work.
Reset number allowed	OFF/3...10 times		<ul style="list-style-type: none"> Only applicable in automatic reset. Set value indicates number of motor resets in 30 minutes. After last scheduled reset, motor can't start again without delete set number. Reset conditions (number of resets) delete by "Hr".
Phase current Imbalance	OFF/5...50%		More than setting % in terms of maximum phase current.
Fail Safe	ON, OFF		Impossible to set during operation.
Phase Reversal	ON, OFF		Impossible automatic reset if tripped.
Phase Loss	ON, OFF		Impossible automatic reset if tripped.
Time characteristics for overcurrent	<ul style="list-style-type: none"> dE : adjustable In : inverse th : thermal reverse 		<ul style="list-style-type: none"> Inverse Table 2 displays time-current. Thermal reverse: Reverse-current time features based in thermal memory accumulated. "dE" and "In" aren't applicable to thermal memory.

Display Setting

Function	Setting Range	Display	Description
Time-Current characteristics for ground fault protection	<ul style="list-style-type: none"> dE : adjustable In : inverse 	<code>Etc</code>	Inverse: table 3 displays time-current features.
Output state ground fault	a,b	<code>Eco</code>	<ul style="list-style-type: none"> a: output ground relay activates by voltage supply. b: output ground relay desactivates with or without voltage supply.
Wide current range for Current loop communications	4-20mA	<code>cr 20</code>	<ul style="list-style-type: none"> Current less to 0.5 A converts in 4mA. Scheduled current value in "cr" mode converts in 20mA. Operator can check if current signal is coming or not, only while motor is working.
Operation hour	Only display	<code>--rh-</code>	<ul style="list-style-type: none"> 30.6h=30h + 0.6 s x 60min = 30 h 36 min
Setting operation hour recording	OFF...9990h(1hr)	<code>rh1.0</code>	<ul style="list-style-type: none"> Like "--rh-", but schedule is available. Able to set time necessary to alarm.
Total operation hour recording	0.1h...65500h	<code>-trh-5</code>	<ul style="list-style-type: none"> Is not a programming mode, but display total operation hours accumulated. Not possible to restart after.
CT Ratio	OFF/5t-2t-10-3000	<code>ct10</code>	<ul style="list-style-type: none"> OFF: use to wide current range, 0.5...60A Can't adjust during operation.
Trip Cause Memory	Last 3 trips	<code>FAULT</code>	<ul style="list-style-type: none"> Saved information is displayed from last trip and can check each phase current.
Test	Test function	<code>tEst</code>	<ul style="list-style-type: none"> If relay is in test mode, countdown "ot" value set will begin after 3 seconds, and will start trip state until display "END" message, it indicates than relay is OK to work. Result "END" message is saved in "Fault" mode too like last trip.

Setting order



Technical features

Model	TPM-PMZ		
Current range	Overload (oc)	Table 1	
	Underload (uc)	OFF / Adjustable until 0.5 A less than "oc" set value	
	Ground fault (Ec)	<ul style="list-style-type: none"> • OFF. • 0.03...10 A: adjustable time features • 0.03...1 A: adjustable time features / inverse, selectable 	
Delay	Start (D-TIME)	1...200 seconds (adjustable time) / OFF	
	Overload trip (O-TIME)	<ul style="list-style-type: none"> • Adjustable (dE) → 0.2...30 sec. • Reverse (In) → 1...30 class • Thermal reverse (th) 	
	Underload trip (U-TIME)	1...30 seconds (adjustable time). If "uc" mode is OFF, will display automatic "off" in "ut" mode.	
	Phase failure trip	3 sec. mode PL disabled	
	Phase reversal trip	0.1...0.3 sec. RP mode disabled	
	Phase imbalance trip	<ul style="list-style-type: none"> • 8 sec. • Greater than difference % set in maximum intensity terms phase. • $(\text{Max} - \text{Min} / \text{Max}) \times 100$ [%] 	
	Ground fault trip (Et)	Adjustable/Reversal: 0.05, 0.1...1...10 sec. (0.1...1 sec. → each 0.1 sec., 1...10 sec. → each 1 sec.)	
	Ground fault trip start (Ed)	OFF / 1...10 sec. (adjustable time)	
	Locked rotor running	OFF / 0.1...10 sec., adjustable (1.5...5 times "oc" value).	
	Locked rotor work	0.5 sec. after delay (OFF / 2...10 times "oc" value)	
Reset	Manual (Hr)	Press RESET button	
	Remote (Er)	Supply interrupted	
	Automatic (Ar)	<ul style="list-style-type: none"> • 1 sec....59sec.-1n(min.)-20n(min.), selectable. • No operative with phase loss, phase reversal, ground fault, locked rotor running or locked rotor work. 	
Current loop communications	4-20mA	<ul style="list-style-type: none"> • Una intensidad inferior a 0.5A se transforma a 4mA. • Intensity programming value set in "cr" mode, converts in 20 mA. 	
Total operation time recording	Operation hours cumulative number display from 0 to 65500.	<ul style="list-style-type: none"> • Only record total operating hours when motor is running. • Not possible setting. 	
Time operation setting	OFF, 1...9900 hours	<ul style="list-style-type: none"> • Able to program time to alarm user. • Setting available. 	
Trip cause memory	Check last trip function (including "TEST" trip)	<ul style="list-style-type: none"> • Trip cause in each operation phase check. • Automatic reset mode, display order intensity L1→L2→L3→ last trip cause → GF →L1...→, display time in each intensity is 5 sec, 1 sec. for last trip 	
Fail Safe	Activated output by supply	FS mode selectable.	
Tolerance	Current	$I < 1 \text{ A}: \pm 0.05 \text{ A}, I \geq 1 \text{ A}: \pm 5\%$	
	Time	$t \leq 3 \text{ seg.}: \pm 0.2 \text{ seg.}, t > 3 \text{ seg.} \pm 5\%$	
Ambient temperature	Operation	-20° +60° C	
	Storage	-30° +80° C	
Ambient humidity	30...85% relative humidity, without condensation		
Control voltage	220	85...250 VDC / AC, 50/60 Hz	
Output contacts	OL	2-SPST	3 A / 250 VAC resistive
	GR	1-SPST	3 A / 250 VAC resistive
Display	LED 7 segments	3 Phases intensity, trip cause, operation hour	
	Bar graph	Load factor for intensity value (50...100%)	
Insulation	Between casing & circuits	Over 10 MOhms (500 VDC megger)	
Dielectric Strength	Between casing & circuits	2 kV, 50/60 Hz, 1 min.	
	Between contacts	1 kV, 50/60 Hz, 1 min.	
	Between circuits	2 kV, 50/60 Hz, 1 min.	
Mounting	35mm Din Rail or Panel		
Electrostatic Discharge	IEC61000-4-2	Level 3: <ul style="list-style-type: none"> • Air Discharge: ±8kV • Contact Discharge: ±6kV 	
Radiated Electromagnetic Field Disturbance	IEC61000-4-3	Level 3: 10V/m, 150 MHz y 450 MHz portable transceiver	
EFT / Start	IEC61000-4-4	Level 3: ±2 kV, 1min	
Aumento	IEC61000-4-5	Level 3: 1.2×50µs, ±2kV(0°, 90°, 180°, 270°)	
1 MHz burst disturbance	IEC61000-4-12	Level 3: 2.5kV, 1MHz	
Conducted emission	EN55011	Class B	
Approximate average weight	500 g.		