sMPR-3000F

SMART MOTOR PROTECTION RELAY

Intelligent Smart Energy Monitoring and Protection Relay

- The best products for implementing Smart MCC (Microcontroller unit control)
- Power Meter, saving maintenance costs and integrating the Motor Protection Relay to single device products
- Current real-time control system in unmanned, voltage, energy saving of about 10% over the amount of power measurement
- Improve the maintenance and safety of a more efficient motor of the industry through the fault waveform record
- The special functions are included as Insulation Resistance Measurement, Temperature inside the motor, Temperature and Humidity inside the MCC and 4-20mA Input

Power, Voltage and Current Meter

18 Functions for Motor Protection with Short Circuit

Motor Insulation Measurement
(25 VDC for safety)

Temperature Protection with PT100

Temperature and Humidity measurement inside the panel

4 - 20mA Input for Vibration, Gas Pressure, Flux or etc.

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Protection Function

Protection items		Operating Condition / Set-up Range	Operating time
Current	Over Current	Load current (In) exceeds threshold (oc), In ≥ oc Setting Range: 0.5 ~ 100A (Def), 0.5 ~ 60A (Inv & th)	Definite(Def): 0.2 ~ 120 sec, adjustable Inverse(Inv) & Thermal(th): 1 ~ 30 Class
	Under Current	Load current (In) less than threshold (uc), In ≤ uc 0.5 ~ oc setting value or disable: Selectable	oFF, 1 ~ 120 sec, adjustable
	Current Phase Loss	Max unbalance is more than 85% among 3 phase current, Enable or disable: Selectable	oFF, 0.5 ~ 5 sec, adjustable
	Current Unbalance	Current unbalance ≥ threshold 1 ~ 10s Adjustable. Setting Range: 10 - 50% or disable: Selectable $\text{Unbalance } [\%] = \frac{100 \text{ x (Max phase current} - \text{Min phase current)}}{\text{Max phase curent}}$	oFF, 1 ~ 10 sec, adjustable
	Stall	Active only in motor starting, In ≥ Stall threshold (Sc x OC ≤ 500A). Setting Range: Adjustable or disable: Selectable 2 ~ 8 times of oc setting if Sc x OC doesn't exceed 500A	Within 0.5 sec after D-Time elapsed If D-Time is "0", it is inactive, oFF, 2 ~ 8 sec
	Jam / Shock	Active only in motor running, In ≥ Jam threshold (JA x OC ≤ 500A). Setting Range: Adjustable or disable: Selectable 1.5 ~ 8 times of oc setting if JA x OC doesn't exceed 500A	oFF, 0.2 ~ 10 sec, adjustable
	Reverse Phase	Reverse phase sequence input on MTECH Enable or disable: Selectable	oFF, Within 0.15 sec
	Earth Fault Current	EF current (Ie) exceeds threshold (EF) Setting Range: 0.03 ~ 2.5A (EF: 2.5) or 1.0 ~ 10A (EF: 10) or disable: Selectable	0.05 ~ 10 sec, adjustable (External) 0.1 ~ 10 sec, adjustable (Internal) oFF
	Short Circuit Current	When high short circuit current exceeds threshold (OC x SH ≤ 500A) Setting Range: Adjustable or disable: Selectable 2 ~ 50 times of oc setting if SH x OC doesn't exceed 500A	oFF, Within 0.05 sec
Voltage	Over Voltage	Nominal Voltage higher than threshold (ou). Setting Range: 101 ~ 115% of Nominal voltage (110 ~ 690V) or disable: Selectable	oFF, 0.2 ~ 30 sec, adjustable
	Under Voltage	Nominal Voltage less than threshold (uu). Setting Range: 70 ~ 99% of Nominal voltage (110 ~ 690V) or disable: Selectable	oFF, 0.2 ~ 30 sec, adjustable
	Voltage Phase Loss	Max unbalance is more than 38% among 3 phase voltage, Enable of disable: Selectable	oFF, 0.1 ~ 30 sec, adjustable
	Unbalance Voltage	Voltage unbalance ≥ threshold. Setting Range: 3 -15% or disable: Selectable $\text{Unbalance } [\%] = \frac{100 \text{ x (Max diff ph to ph} - \text{average ph to ph voltage)}}{\text{average phase to phase voltage}}$	oFF, 0.2 ~ 20 sec, adjustable
	Reverse Phase	Reverse phase sequence input on MTECH Enable or disable: Selectable	oFF, Within 0.15 sec
Power	Over Power	Nominal Power exceeds threshold (oP) Setting Range: 20 ~ 800% of nominal power (0.1 ~ 999 kW) or disable: Selectable (Do not operate at the same time a group of motors)	oFF, 1 ~ 100 sec, adjustable
	Under Power	Nominal Power less than threshold (uP) Setting Range: 20 ~ 800% of nominal power (0.1 ~ 999 kW) or disable: Selectable (Do not operate at the same time a group of motors)	oFF, 1 ~ 30 sec, adjustable
	Over Power Factor	Power Factor exceeds threshold (oF) Setting Range: 0 ~ 100% of nominal power factor or disable: Selectable (Do not operate at the same time a group of motors)	oFF, 2 ~ 30 sec, adjustable
	Under Power Factor	Power Factor less than threshold (uF) Setting Range: 0 ~ 100% of nominal power factor or disable: Selectable (Do not operate at the same time a group of motors)	oFF, 1 ~ 30 sec, adjustable

Auxiliary Function

Function	Description
Password	Password Secure configuration
3-Phase/Single Phase selection	The selection enables application to 3-phase or single phase motor without further setting
TCC selection	Available three time-current-characteristics (Definite, Inverse. Thermal inverse)
Ground fault delay time setting	Ground fault delay time can be set when start-up operation
Short circuit delay time setting	Ground fault delay time can be set when start-up operation
Analog output setting	Analog output: 4~20mA loop current or Metering pulse for energy
Analog input setting	Analog input: 4~20mA loop current or Metering pulse (1%, Two decimal places) for vibration, gas pressure, flux/wind, leakage/dust or etc.)
Start cycle setting	To determine the state of the motor by the user compares the current value of the set delay time, when the motor is set to a Star-Delta start, the current during switching ignored.
Fail safe setting	Fail safe operation for OL trip output
Alarm setting	Pre alarm signaling by the 07-08 output contact
Bar graph display	Easy indicator for load ratio
Reset type	Available setting: Manual, Remote, Auto
Operating time setting	Accumulated operating hours alarm output reference time. When the cumulative operating time exceeds more than the set time for your maintenance produces the alarm output. The time setting can be set from 1 to 9990 times by one hour.
Total Running-Hour	Total Running-Hour Record of total running from installation which cannot be modified or cleared. The maximum time is 99999.
Date/Time Information Setting	Save date/time of failure to provide exact time of motor failure
Limitation of auto reset attempt	Limitation of auto reset attempt Block auto-reset if the reset count exceeds the pre-set count within 30 minutes
Fault waveform record (Available through communication)	Fault with Date, time (Year/Month/Day/Hour/Minute/Second) Fault wave form recording (200ms): 3 phase current & voltage data. Sampling is 1ms units in the fault waveform records. The first part is 70% of pre-trigger data sample value, the second half of 30% shows a sample value after the trigger.
Self-test function	To test the operating time while the motor did not run
Communication status checking	To diagnostic the communication
Fault History	Fault History Records for recent 3 faults each phase current which stored in a non-volatile memory
Power metering	Active, reactive power & Energy metering
MC on/off count & alarm	1,000 ~ 990,000 setting
Run with VSD	Low frequency (5 ~ 60Hz) setting
Insulation Resistance setting	Motor insulation resistance testing: 1MΩ, 5MΩ, 10MΩ (25 Vdc for safety)
Temperature protection for motor	To measure the temperature increase to protect the motor from damage due to heat build-up in the windings and / or bearings. The sensor is PT100 (-100ºC ~ 300ºC). Distance is within 600 m.
Ambient Temperature monitoring in cabinet	To measure the ambient temperature in the cabinet, range: -40ºC ~ 120ºC ±1ºC
Humidity monitoring in cabinet	To measure the humidity in air, range: 0 ~ 100% ±5%

Communication Function

Item	Specification	Remark
Communication Protocol	Modbus RTU	
Communication Method	RS - 485	
Baud Rate	1.2, 2.4, 4.8, 9.6, 19.2, 38.4 AUTO kbps	
Range	1.2km max.	Depend on the environment
Communication Line	Universal RS - 485 Shielded Twist 2 - Pair Cable	

Rated Specification

Over current (A) setting range		Definite: 0.5 ~ 6A, 5 ~ 100A(Internal CT)	
		Inverse/Inverse Thermal: 0.5 ~ 6A, 5 ~ 32A	
Under current (A) setting range		0.5 ~ oc	
Overload Characteristics Curve		Definite (Def) / Inverse (Inv) / Inverse Thermal	
Leakage ground current (A) setting range		oFF 0.03 ~ 2.5A, or 1.0 ~ 10A	
Operating Time Characteristics	Start-up delay	0 ~ 600s	
	Definite time over current operating time	0.2 ~ 120s	
	Inverse over current characteristics curve	1 ~ 30 Class	
	Leakage ground current operating time	0.05 ~ 10s	
	Leakage ground fault detection delay time at start-up	0 ~ 30s	
	Auto reset time	0.5s ~ 20min.	
	Reset type	Manual (H-r) / Remote (E-r) / Auto (A-r)	
Control Power	Rated Voltage	AC/DC 100 ~ 240V (-15%, +10%)	
	Allowable input voltage	85% ~ 110%(of rated voltage)	
	Frequency	50/60Hz	
	Power consumption	Less than 7VA	
Output Contact	FR	2-SPST	3A/250VAC, Resistive
	AL/GR/SC	3-SPST	3A/250VAC, Resistive
Display	7 Segment LED	Displays current measurement, failure information, and setting values	
	Bar graph	Load ratio display (50 ~ 120%)	
Communication		Modbus - RTU/RS - 485	
Over current (A) setting range		Embedded in panel (flush mounting)	
		Inverse/Inverse Thermal: 0.5 ~ 6A. 5 ~ 32A	
Under current (A) setting range		5 ~ oc	
Overload Characteristics Curve		Definite (Def)/Inverse (Inv)/Inverse Thermal	
Leakage Characteristics Curve		oFF 0.03 ~ 2.5A or 1.0 ~ 10A	
Insulation Resistance	Between circuit and EndoSure	DC 500V 10MΩ over	
	Between dielectric strength circuits and enclosure	2KV. 50/60Hz.1 minute	
	Between contacts	1KV. 50/60Hz.1 minute	
	Between circuits	2KV. 50/60Hz.1 minute	
ESD	: IEC61000-4-2/IEC60255-22-2	Level 3 : Air Discharge : ±8KV, Contact Discharge : ±6KV	
Radiated Disturbance	: IEC61000-4-3/IEC60255-22-3	Level 3 : 10V/m, 80 ~ 1000MHz	
Conducted Disturbance	: IEC61000-4-6/IEC60255-22-6	Level 3 : 10V, 0.15 ~ 80MHz	
EFT/Burst	: IEC61000-4-4/IEC60255-22-4	Level 3 : ±2KV, 1 Min	
Surge	: IEC61000-4-5/IEC60255-22-5	Level 3 : 1.2 x 50µs, ±4KV(0°, 90°, 180°, 270°)	
Emission	: CISPR11/IEC60255-22-26	Class A (Conducted and Radiated)	
Operating Environment	Temperature	Storage : -40°C ~ +85°C / Operation: -20°C ~ +60°C	
	Humidity	30 ~ 85% RH (no condensate)	
Dimensions	Main Body EU	70W x 56.3H x 108.1D	
	Display Device OCU	108W x 74H x 38.6D	
Weight		sMPR 3000F: 454g; cable : 2M	

The table shows the current setting.

Range setting current (A)	Internal CT (round)	External CT	CT mode setting	Note
0.5 ~ 60A	1	-	OFF	Operating range wide
0.25 ~ 3A	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	
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	

Time -Current Characteristic Curve.

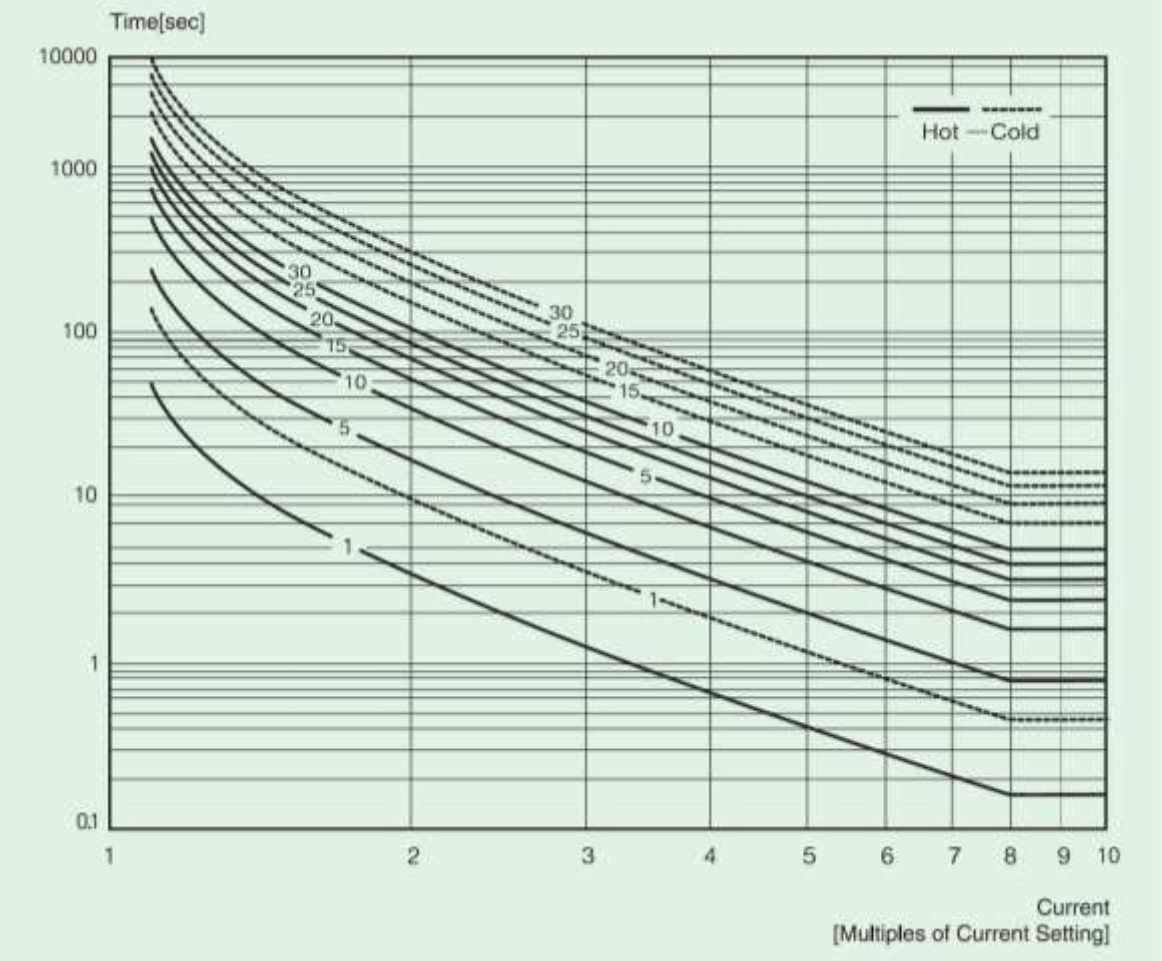


Figure 1. Inverse characteristic (0.5 ~ 60A)

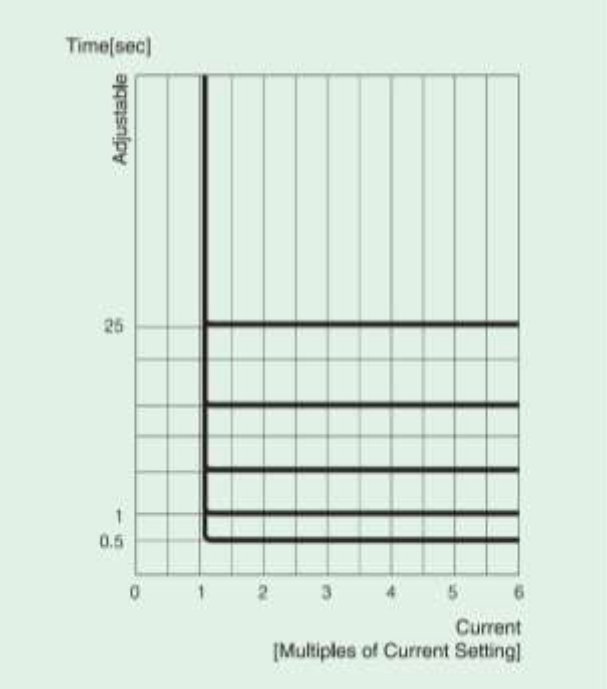


Figure 2. Definite time characteristics

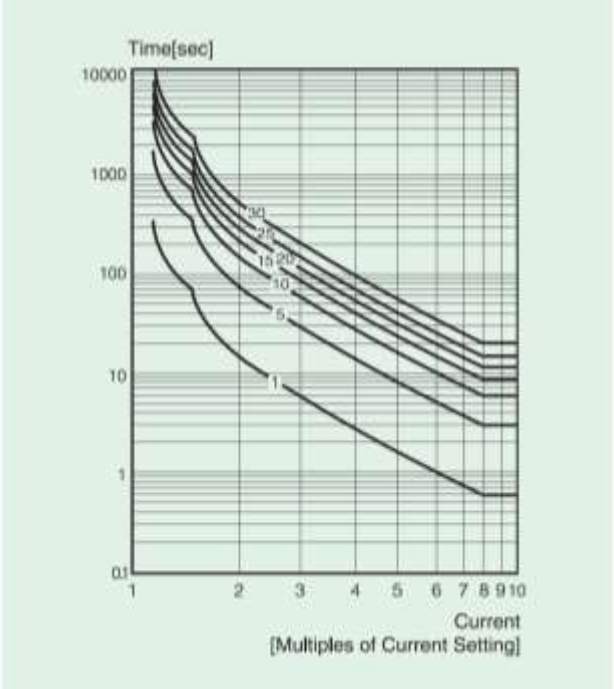


Figure 3. Inverse thermal time characteristics (0.5 ~ 32A)

Over current and time setting trips

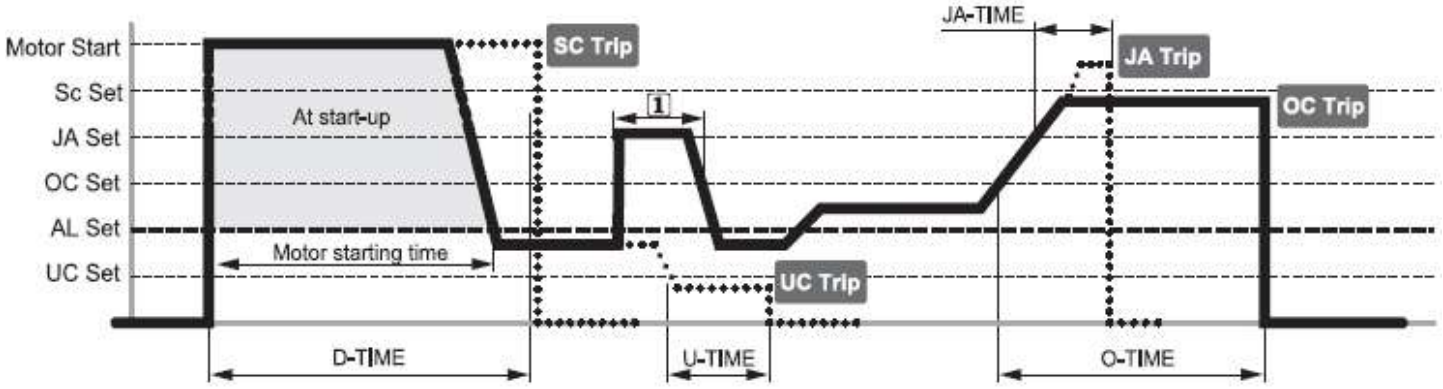
- **Over-current**

Setting tips in definite TCC mode

1. Over current threshold (OC):
   - Set the OC at the rating current of a motor. To protect machine together, it is recommended to set at 110 ~ 120% of the actual normal operating current.
2. Starting delay time (D-time)
   - Set an expected start-up time to reach the normal current of load. If you do not know it, set to 15sec at first and start-up the motor to measure the time to reach the normal operation current by monitoring the displayed current and then set the time at 2 secs longer than the time measured. For a Y-D start, it's better to set time 2 sec longer than the present time of the Y-D change timer.
3. Operation time (O-time): Set the trip delay time which activates and counts down under a fault condition.

Configuration tips when Inverse or Thermal Inverse characteristic is necessary

1. Overcurrent threshold (oc):
   - This value is the basic current and from the point of 105% of oc, the inverse curve starts. Usually oc is set to the rated current of the motor.
2. Starting delay time (D-time)
   - Usually this value is set to zero. With zero D-time and Inverse is selected, first the cold curve is applied until the load current drops down the oc value, and then the hot curve is applied.
   - But if the user wants fast trip with very high current during starting, set D-time other than zero. With non-zero D-time, the enabled STALL function detects very high current immediately after the D-time elapsed.
   - If the Inverse is selected, and D-time is non-zero, the Inverse function is blocked during starting, and the hot curve is applied after D-time elapsed.
   - If Thermal Inverse is selected, it detects overcurrent regardless of D-time. That is, thermal inverse is activated during motor starting as well as motor running.
3. Operation time (O-time):
   - When Inverse or Thermal Inverse is selected, O-time setting determines the trip class. sMPR supports trip class from 1 to 30. Refer to the graphical representation of Inverse or Thermal Inverse to check trip time.



♦ The trip is deactivated until the over-current run time is longer than O-time.

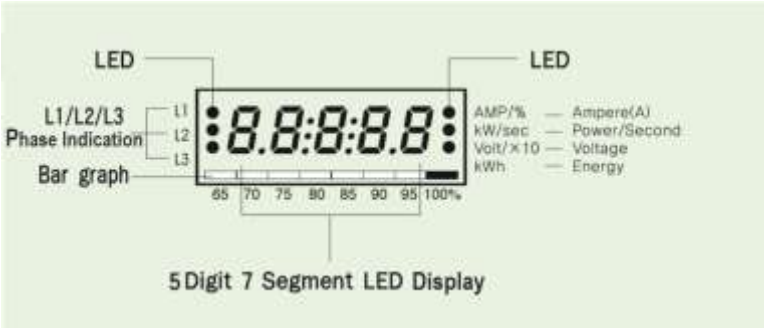
Alert Operation Pattern

Do use this function by OL/GR common output.

Running Stage / ALo Setting	Starting	Normal Operation	Higher than the preset Alert value	Trip
Aux "A"				
Flicker "F"				
Hold "H"				
Time Out "to"				
Under Current "uc"				
Insulation Resistance "In"				
MC Count "mc"				
Voltage "Vo"				
Power "Po"				

Display Layout

3 phase currents (In) and the leakage current are displayed every 2 seconds in sequence.



7 Segment LED (7 segment LED Display)

Bar graph

- OC (Over current threshold) It shows the setting current.
- if the setting value is the rated motor current, it shows the load factor of the motor.
- % value = (running current/setting current) × 100%
- Less than 65% is not displayed in case of current.
- it shows the load factor to OC setting value by %
- % value = (running current/setting current) × 100%

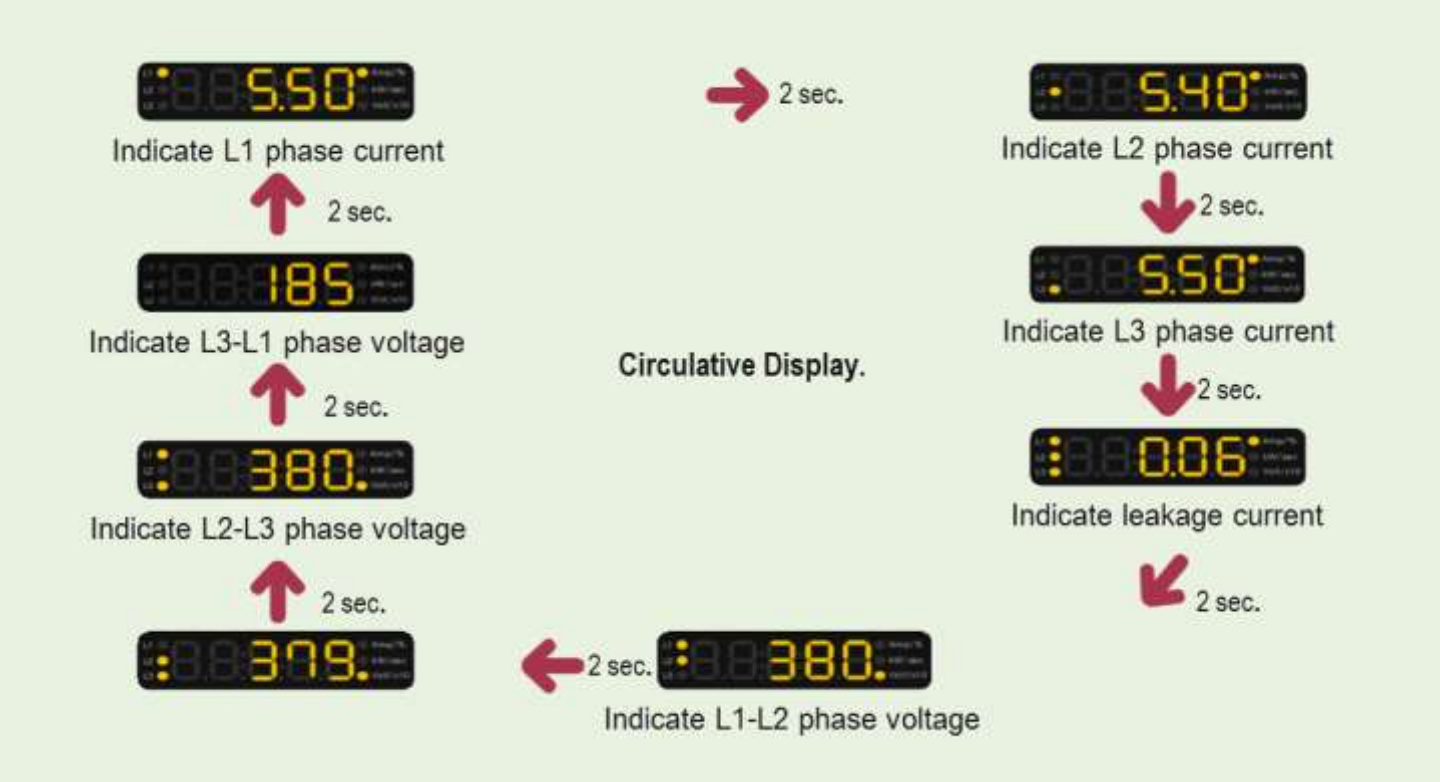
Current display

- Shows the highest current among three phases for oc, Stall, Jam trips.
- Shows the lowest current among three phases for uc, Ub trips.
- Shows the lost phase for PL.
- Shows the phase and the current during running.

Unit Display

Amp/%: Ampere. LED is on when a current display.
kWh/Sec: Second. LED is on when a time display.
Volt/x10: Shows the unit changed to 10 times.
kWh: display kWh LED ON changed.

3-Phase Digital Ammeter Function



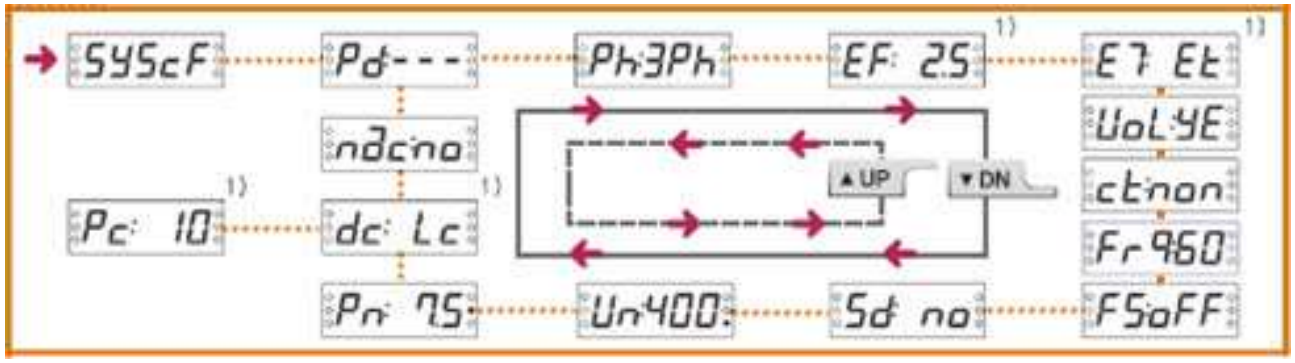
Button and Setting Sequence

Button	Description of Function
▲UP ▼DN	Press UP or DN to find a menu item. Refer to the User's guide for detailed menu description.
SET	In the menu mode. Press SET makes blinking. A parameter and allows modifying parameter.
▲UP ▼DN	Press "UP" or "DN" key to set the parameter while blinking.
SET	Press "SET" again then blinking is stopped and it will be stored the parameter in the non-volatile memory while blinking.
ESC	To rectum normal display mode, either press "ESC" or wait for 50secs of the time elapsed from set menu.

- Once the SET/STORE button is pressed during a product operation, the auto-scrolling is de-activated so that the display does NOT change. Another SET press will turn the current on display to the next phase one. (e.g. If you press the SET button with L1 current displayed, the display will show L2 current.) To re-activate the auto-scrolling, press the ESC button. In manually-scrolling display, you can access each setting in a circular manner as pressing UP or DOWN.
  Fault history check: Pressing the ESC button more than 5 sec, it displays the latest fault cause and the fault current or fault phase. Continuing to press DN button, you can see the current of L1(R), L2(S), L3(T), (GR) in turn, press the DN button again to check the previous fault continually. In the latest fault display, the 100%LED of bar graph lights on and two LEDs of 95%,100% lights on for the second fault display, three LEDs of 90%,95%,100% lights on for the oldest fault display. When you press the ESC button in this mode, it returns to the normal current display mode. The oldest fault record is over written when the number of fault to record exceeds three.

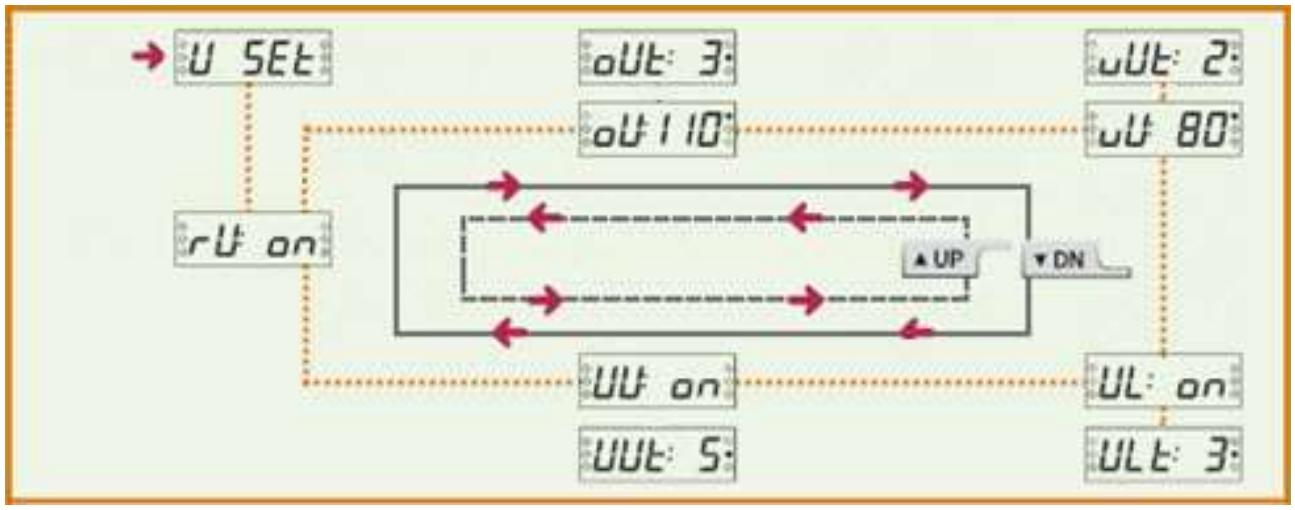
Mode Setting order

1. System settings mode.



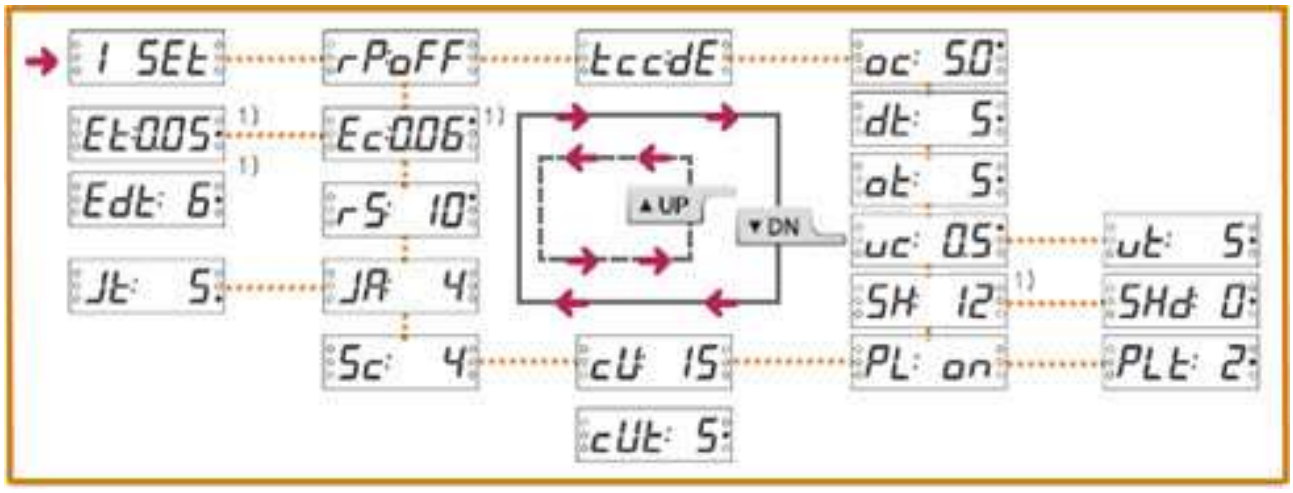
♦ System preferences are enable to be set only in ready mode and displayed in other mode.

2. Voltage settings mode.

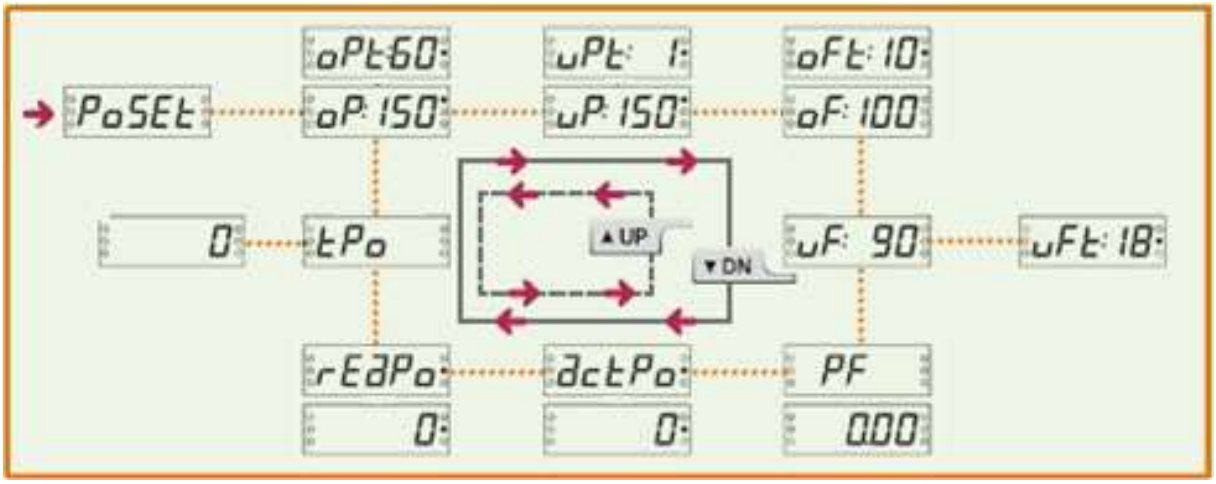


♦ Voltage preferences are disable if "no" is set on voltage protection menu.

3. Current settings mode.

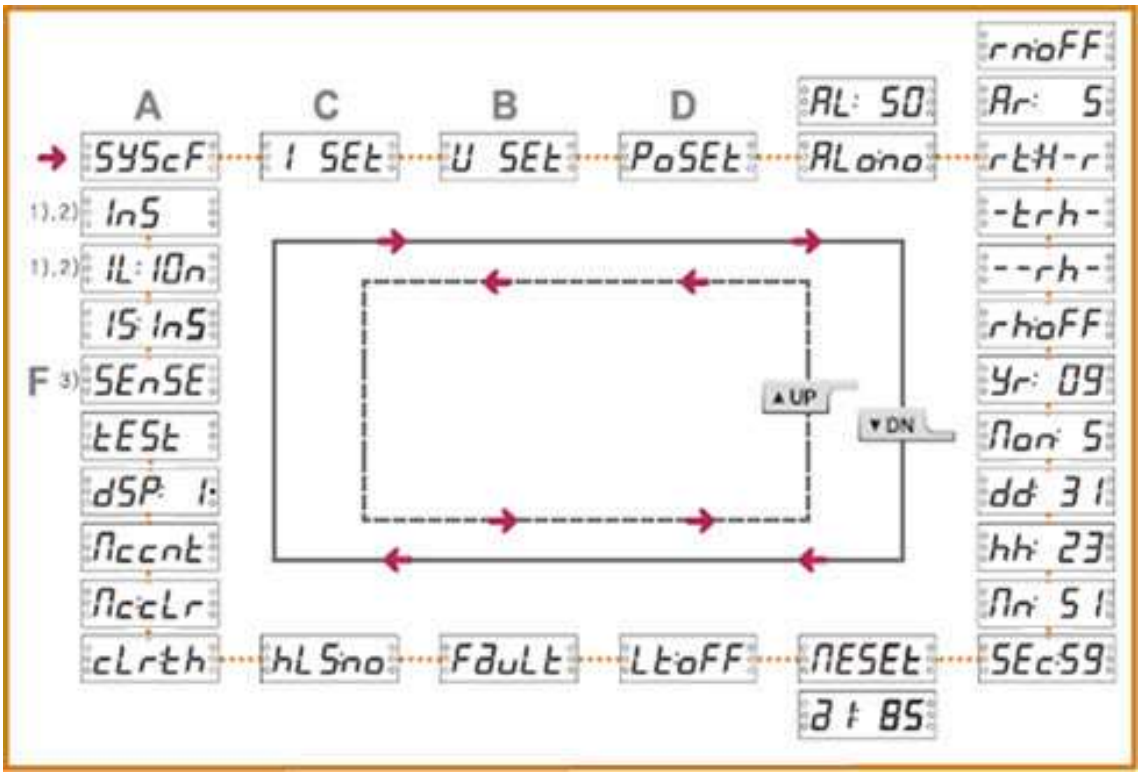


4. Power settings mode.

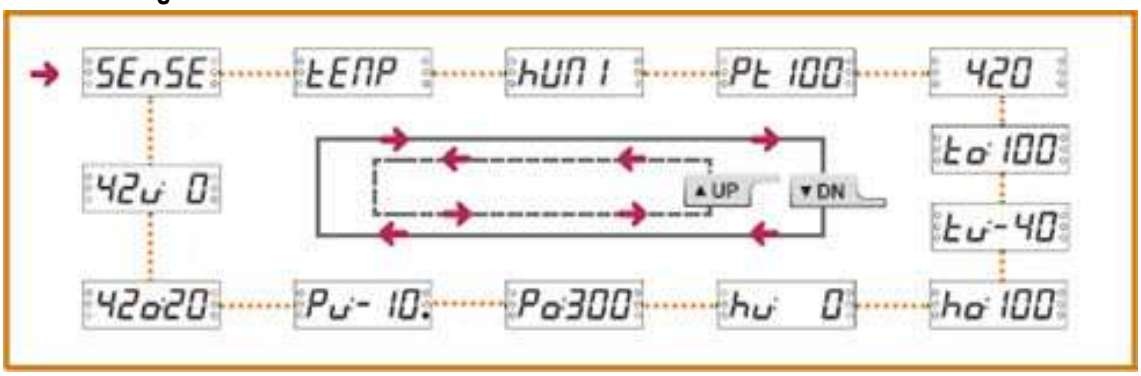


♦ Power preferences are disable it "no" is selected on voltage wiring menu.

5. Mode Accessary functions and network preferences.

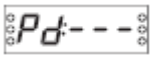
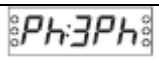
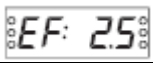
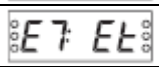
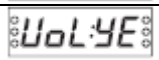
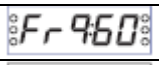
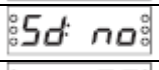
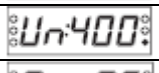
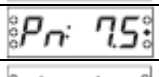
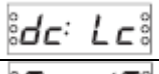
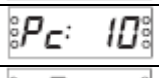


6. Sensor settings mode.

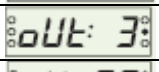
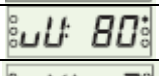
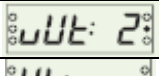
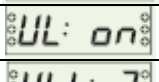
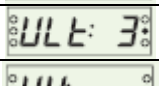
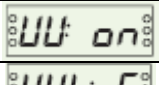
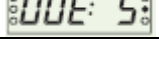


Sequence and Menu for Setting Functions

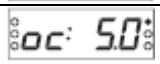
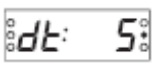
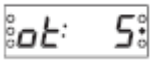
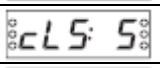
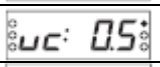
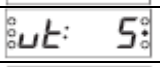
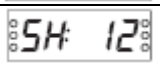
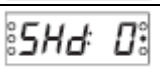
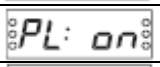
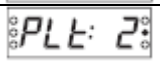
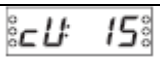
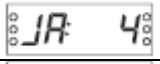
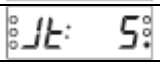
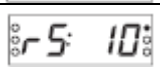
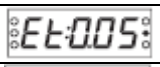
System setting mode (SYScF)

Item	Mode	Description	Range	Default	Unit
1.		Password	000 - 999 (000 for no password setting)	000	
2.		Select 3 phase or single phase	1Ph, 3Ph	3Ph	
3.		Select Base ground fault current range	2.5, 10 (2.5: 0.03 - 2.5A, 10: 1.0 -10.0A)	2.5	
4.		Select ground fault protection	In (Internal ZCT); Et (External ZCT)	In	
5.		Select voltage protection	YE, no	YE	
6.		External CT ratio, select cuS for separate configuration of primary, secondary and multiple passes	non, 2t, 3t, 4t, 5t, Cus (ct:10 ~ 3600)	non	
7.		System fundamental frequency	50, 60	60	
8.		Set/Reset Fail safe mode	oFF, on	oFF	
9.		Select Star or Delta operating motors	YE, no	no	
10.		Set the rated voltage of the motor	110 ~ 690	440	Volt
11.		Set the rated power of the motor	0.01 ~ 655	7.5	sec
12.		Select DC output	Lc, PS	Lc	
13.		Set the value of metering pulse	100, 200, 500, 1000, 5000, 9000	100	
14.		Set the authority to write On the network	YE, no	YE	

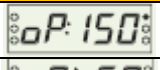
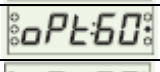
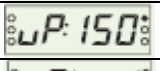
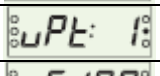
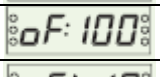
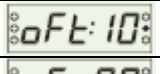
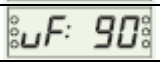
Protection and Control Function Setting, Voltage setting mode (U SET)

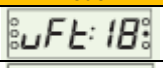
Item	Mode	Description	Range	Default	Unit
1.		Reversed phase detection	on, oFF	oFF	
2.		Over voltage threshold	oFF, 101 ~ 115	oFF	%
3.		Over voltage duration,	0.2 ~ 30	3	sec
4.		Under voltage threshold	oFF, 70 ~ 99	oFF	%
5.		Under voltage duration	0.2 ~ 30	2	sec
6.		Phase loss	on, oFF	oFF	
7.		Phase loss duration	0.1 ~ 30	2	sec
8.		Unbalance threshold	oFF, 3 ~15	oFF	
9.		Unbalance fault duration	0.2 ~ 20	5	sec

Protection and Control Function Setting, Current setting mode (I SET)

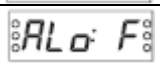
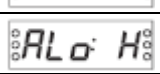
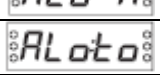
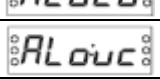
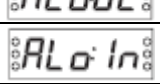
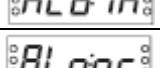
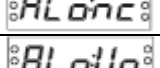
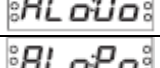
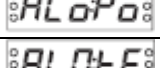
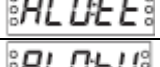
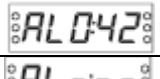
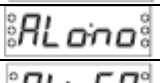
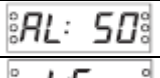
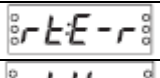
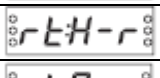
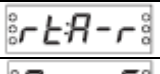
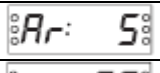
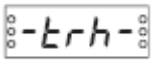
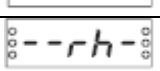
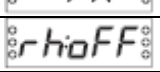
Item	Mode	Description	Range	Default	Unit
1.		Reversed phase detection	on, oFF	oFF	
2.		Time-current characteristic	NO, dE, th, In	dE	
3.		Over current threshold	dE: 0.5 ~ 100 ; In/th: 0.5 ~ 60	5	Amp
4.		Starting delay time	0 ~ 600	5	sec
5.		Over current duration	0.2 ~ 120	5	sec
6.		TCC class for inverse or thermal inverse	1 ~ 30	5	
7.		Under current threshold	oFF, 0.5 ~ oc	oFF	Amp
8.		Under current duration	0.5 ~ 120	5	sec
9.		Short circuit current threshold	oFF, 2 ~ 50	oFF	
10.		SH starting delay	0 ~ 20	0	sec
11.		Phase loss	on, oFF	oFF	
12.		Phase loss duration	0.5 ~ 5	2	sec
13.		Unbalance threshold	oFF, 10 ~50	oFF	
14.		Unbalance duration	1 ~ 10	5	sec
15.		Stall threshold (multiples of oc)	oFF, 2 ~ 8	oFF	
16.		Jam threshold (multiples of oc)	oFF, 1.5 ~ 8	oFF	
17.		Jam fault duration,	0.2 ~ 10	5	sec
18.		4-20 Output range threshold	0.5 ~ 100	oFF	%
19.		Ground fault threshold	2.5, 10 2.5: 0.03 ~ 2.5A, 10: 1.0 ~ 10.0A	oFF	Amp
20.		Ground fault duration	In: 0.05 ~ 10s, Et: 0.1 ~ 10s	1	sec
21.		Ground fault starting delay	0 ~ 30	0	sec

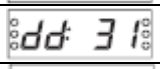
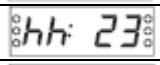
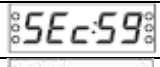
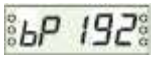
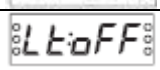
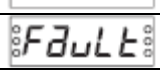
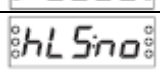
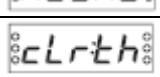
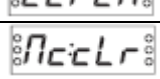
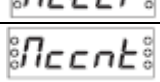
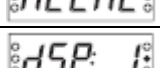
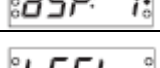
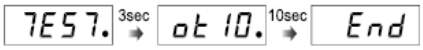
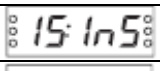
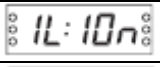
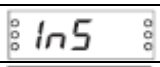
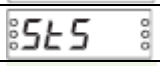
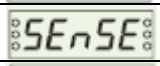
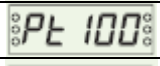
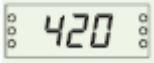
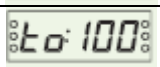
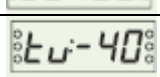
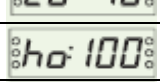
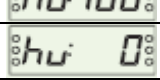
Power setting mode (PoSET)

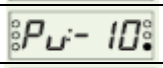
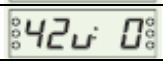
Item	Mode	Description	Range	Default	Unit
1.		Over-power threshold	oFF, 20 ~ 800	oFF	%
2.		Over-power duration	1 ~ 100	60	sec
3.		Under-power threshold	oFF, 20 ~ 100	oFF	%
4.		Under-power duration	1 ~ 30	1	sec
5.		Over-power factor threshold	oFF, 0 - 100	oFF	
6.		Over-power factor duration	2.0 ~ 30	10	sec
7.		Under-power factor threshold	oFF, 0 ~ 100	oFF	

Item	Mode	Description	Range	Default	Unit
8.		Under-power factor duration	1 ~ 30	10	sec
9.		Power factor is displayed (Unable to be set)	0.00 ~ 1.00	0.00	
10.		Effective power is displayed (Unable to be set)	-	0	kW
11.		Reactive power is displayed (Unable to be set)	-	0	kW
12.		Effective power consumption is displayed (Unable to be set)	-	0	

Protection and Control Function Setting

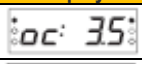
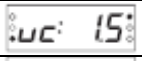
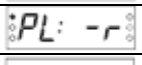
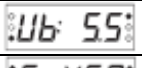
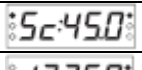
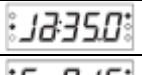
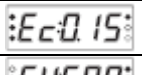
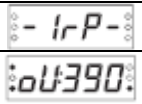
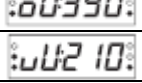
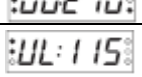
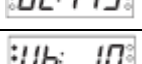
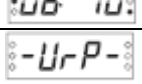
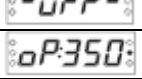
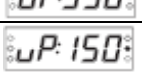
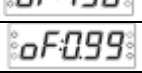
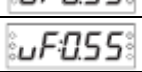
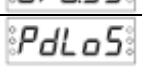
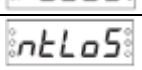
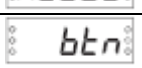
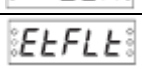
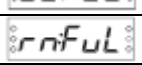
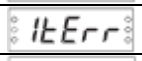
Item	Mode	Description	Range	Default
1.		The contact 07-08 will be closed when the EOCR detects current.	A, F, H, to, uc, In, Vo, Po, no, nc	no
		The contact will be open and closed repeatedly when the detected current exceeds the alarm setting.		
		If the detected current exceeds the Alarm setting, the contact will be closed or the contact is open.		
		The contact will be open and closed continuously every 2 minutes after the set time passed.		
		It is closed when a low current is detected.		
		The contact will be closed with the resistance less than the setting.		
		A contact to restrict a start of a motor, if the motor is detected to start, the contact will be closed.		
		A contact to use a voltage-out, if the function is working on, the contact will be closed.		
		A contact to use a power-out, if the function is working on, the contact will be closed.		
		The alarm contact is closed while the temperature is out of the setting.		
		The alarm contact is closed while the humidity is out of the setting.		
		The alarm contact is closed while the temperature from PT100 is out of the setting.		
		The alarm contact is closed while the 4-20mA current loop is out of the setting.		
		With this mode set, Alarm output is disable.		
2.		Alert threshold (%of oc)	50 ~ 100	50
3.		A trip-recovery by disconnecting the power.	E-r, H-r, A-r	H-r
4.		A trip-recovery way by pressing the Reset button.		
5.		A trip-recovery after the time A-r passes.		
6.		Auto reset timer	0.5 ~ 20min	5
7.		Limit of auto reset in 30 minutes	oFF, 1 ~ 5	oFF
8.		Total running hour	0 ~ 99999	0
9.		Running hour	0 ~ 99999	0
10.		Timeout alarm threshold	oFF,1~9990	oFF
11.		Year,2009 -2099	09 ~ 99	12

Item	Mode	Description	Range	Default
12.		Month	1 ~ 12	7
13.		Date	1 ~ 31	31
14.		Hour	00 ~ 23	17
15.		Minute	00 ~ 59	40
16.		Second	00 ~ 59	39
17.		Modbus slave address	1 - 247	97
18.		Baud rate (bps)	1.2, 2.4, 4.8, 9.6, 19.2, 38.4, auto	19.2
19.		Parity, none, even, odd	Eun, non, even, odd	Eun
20.		Communication loss time	oFF,1 ~ 999	oFF
21.		Fault records	3 records	
22.		Enable disconnection detection of sPDM	YE, no	no
23.		Initiate accumulated load power SET Button → clr:th → SET Button	th	th
24.		Set alarm threshold number of motor-starting	1t ~ 99t	cLr
25.		Display how many times a motor has started		
26.		Display setting mode	1,2	1
27.		Press RESET to recover it from a trip after the test is complete.  Test is Not applicable under normal operation		
28.		Select either motor insulation status or contact status.	InS, StS	InS
29.		Set insulation resistance	1n, 5n, 10n	10n
30.		Insulation resistance test	60sec	
31.		Contact status test	OP	
32.		Sensor settings		
33.		Temperature is displayed (unable to be set)		
34.		Humidity is displayed (unable to be set)		
35.		PT100 Temperature is displayed (unable to be set)		
36.		4-20 Analog input data is displayed (unable to be set)		
37.		Temperature over level for Alarm	-40 ~ 100	100
38.		Temperature under level for Alarm	-40 ~ 100	-40
39.		Humidity over level for Alarm	0 ~ 100	100
40.		Humidity under level for Alarm	0 ~ 100	0

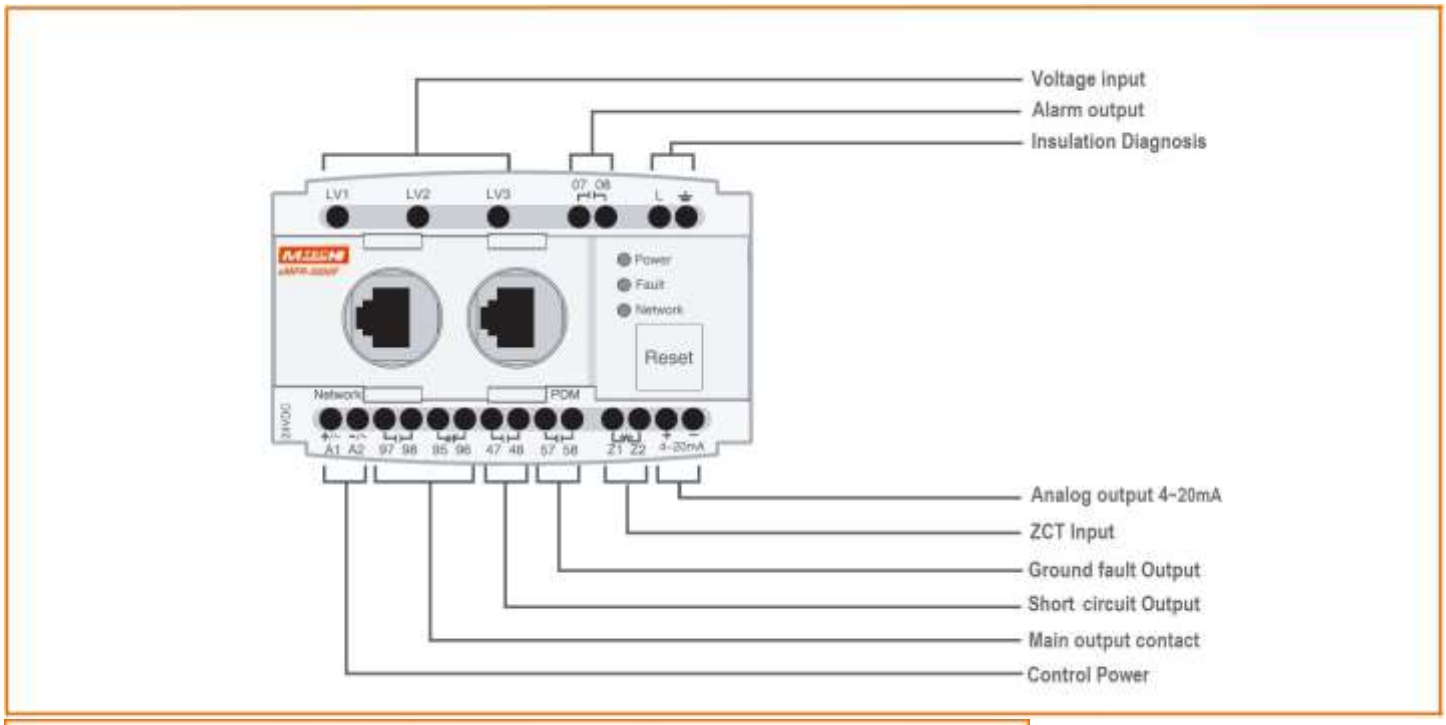
Item	Mode	Description	Range	Default
41.		PT100 Temperature over level for Alarm	-100 ~ 300	300
42.		PT100 Temperature under level for Alarm	-100 ~ 300	-100
43.		4-20 Current input over level for Alarm	0 ~ 20	20
44.		4-20 Current input under level for Alarm	0 ~ 20	0

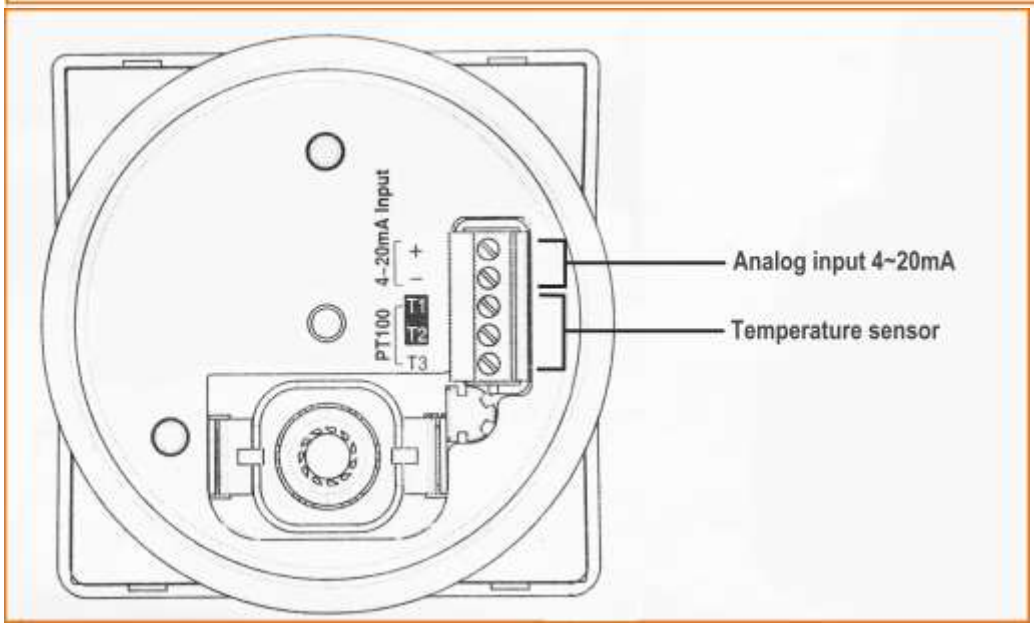
Fault Indication

When the relay is tripped, the cause and current of the trip is displayed. The cause and current values of the phases for the latest 3 trip are stored and available for search. Search is available during stop or operation.

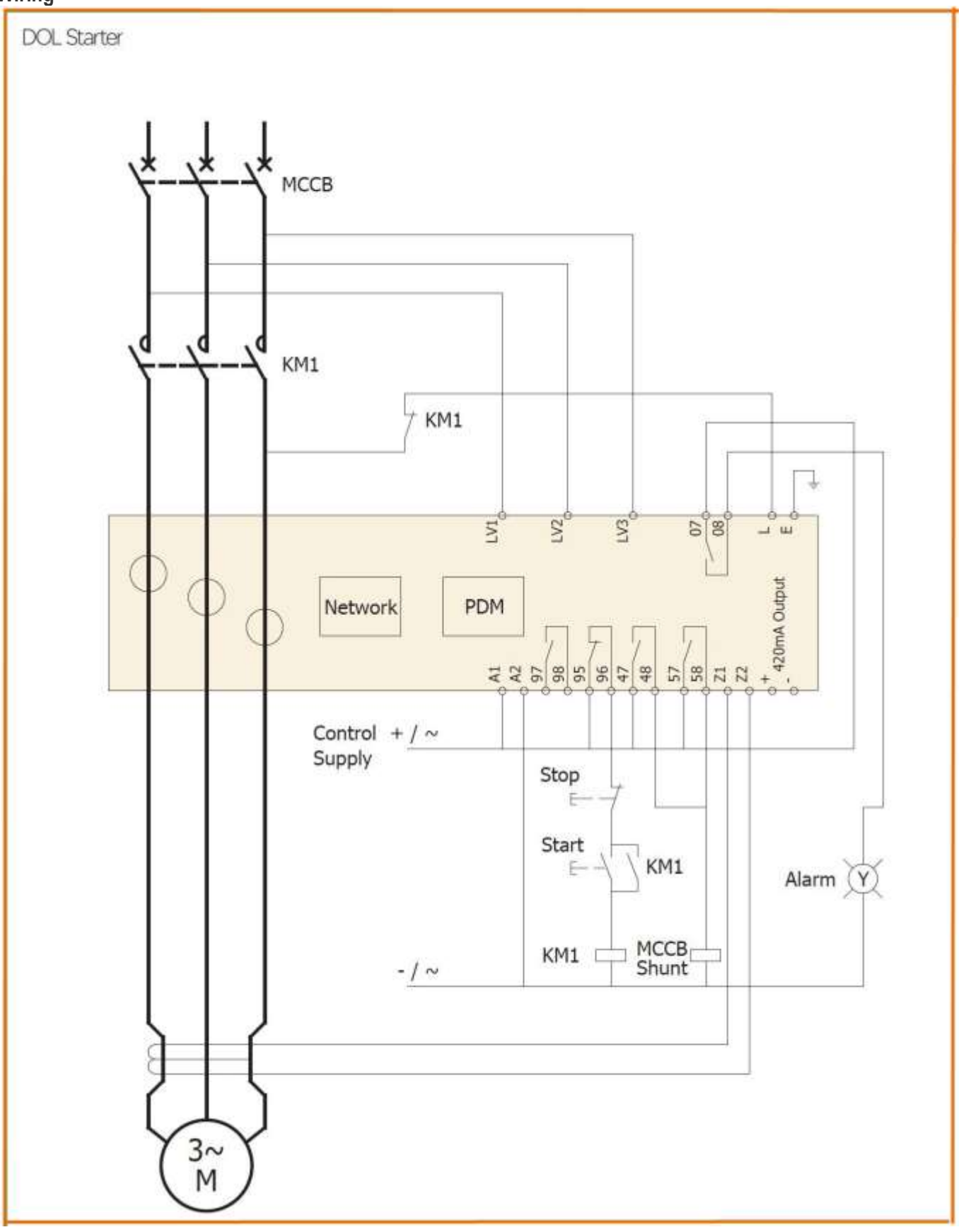
Item	Trip Cause	Display	Description
1	Over current (oc)		With over-current 3.5A on L1 in 'RUN' mode
2	Under current (uc)		With under-current 1.5A on L3 in 'RUN' mode
3	Current Phase Loss (PL)		With the phase-loss on L1
4	Current Unbalance (IM)		With the unbalanced current on L3
5	Stall at starting (Stall)		With stall-current 45A on L1 in 'Start' mode
6	Stall at running (Jam)		With stall-current 35A on L2 in 'RUN' mode
7	Ground fault (EF)		With an earth-fault current 0.15A
8	Short Circuit		With short-current 60A on L3
9	Reverse Phase (RP)		With reverse-phase in 'Start' mode
10	Over Voltage		With over-voltage 390V between L1 and L2 phases in 'RUN' mode
11	Under Voltage		With under-voltage 210V between L1 and L2 phases in 'RUN' mode
12	Current phase Loss (PL)		With an phase-loss analyses with the differential between L1 and L2 phases
13	Current Unbalance (IM)		With an unbalance analyses with the differential between L1 and L2 phases
14	Reverse Phase (RP)		With reverse-phase voltage
15	Over Power		With over-power 350kW in 'RUN' mode
16	Under Power		With under-power 150kW in 'RUN' mode
17	Over-power factor		With over-power factor 0.99 in 'RUN' mode
18	Under-power factor		With under-power factor 0.55 in 'RUN' mode
19	PDM Communication disconnected		With no communication on PDM
20	Network communication loss		With no network communication on Modbus
21	Stuck button (btn)		When a button hold pressed for a long period
22	External fault initiated		When the failure signal is received through the network communication
23	Auto-recovery restriction		When the number of auto-reset is over the setting in half an hour
24	Internal failure		Due to an internal problem
25	Test completed		When test is finished

Input / output terminal block diagram





Wiring


DOL Starter
MCCB
KM1
KM1
LV1
LV2
LV3
07
08
L
E
Network
PDM
A1
A2
97
98
95
96
47
48
57
58
Z1
Z2
+
-
420mA Output
Control Supply + / ~
Stop
Start
KM1
Alarm
Y
KM1
MCCB Shunt
- / ~
3~
M

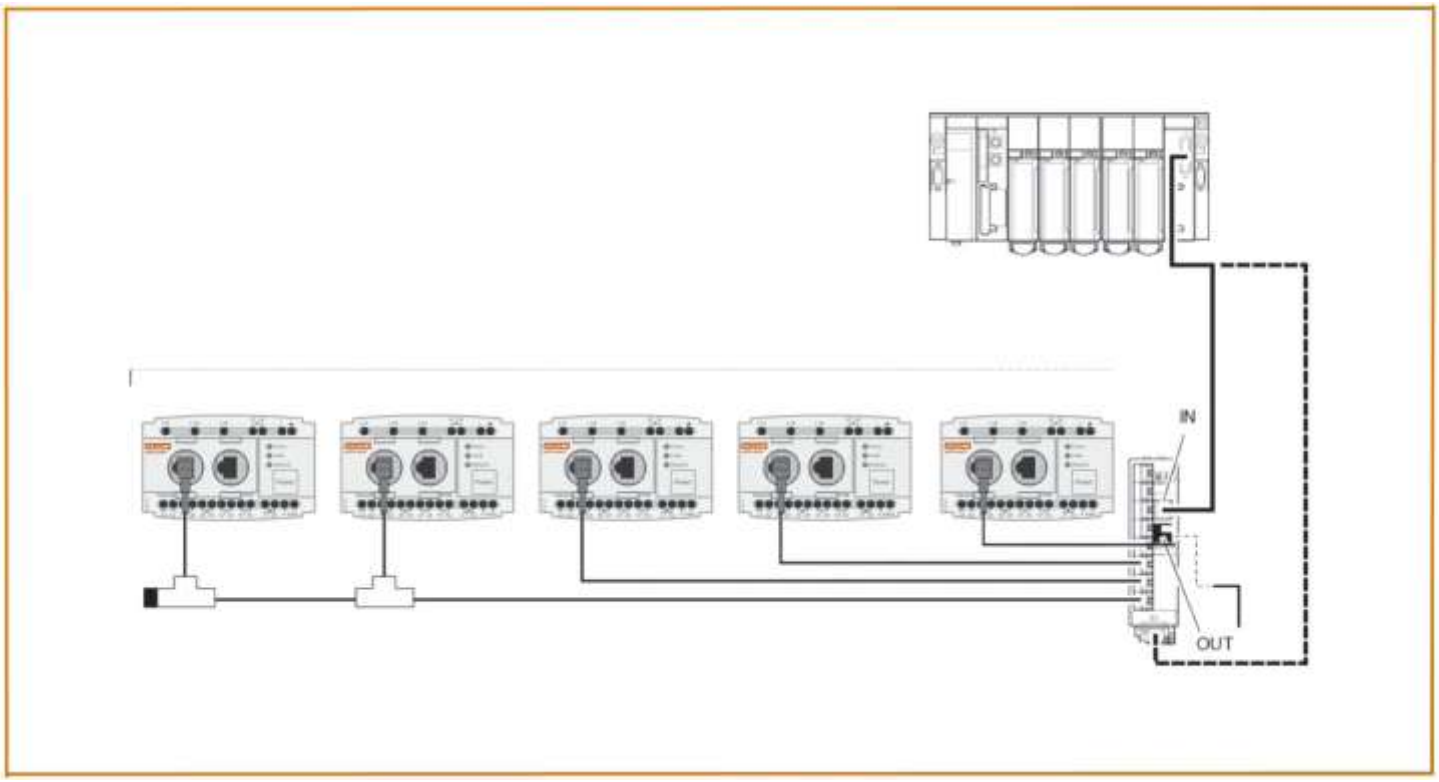
Dimensions


90.3
121.5
PANEL & DIN RAIL TYPE
R2.2
99.3
108.2
MOUNTING HOLE SIZE


72
72
64
13.4
28.1

Outline

Modbus communication is between master and slave.



Only one device at a time can send data via a communication line. The master initializes and controls data communication. Data communication is implemented by the manner that the master sends signals sequentially to the slaves, one after another, the slave responds to the signal. Unless requested by the master, a slave cannot send data to the master. If the data is incorrect, the master requests re-transmission of the data to the slave. If no response is received from a slave for a preset time, after retrial for preset time, the slave is judged to have accessibility problem. If the data received from the master is not valid, the slave sends an error response (Exception Response) to the master, which will re-send the data, or ignore the response.

Modbus Conversation Format

The conversation between master and slave can be made in one of two types.

- The master requests a specific slave for sata and wait for response.
- The master sends slavs with broadcast data and does not wait for response. In this casem the slaves do not respond.

Direct communication between slaves is not possible. There must be a master for controlling and driving data communication

Modbus Network Set-up

Communication Setting Value

Please set the Modbus communication parameters
by PCON™ or HMI for the communication

- Slave Address
- Baud rate
- Parity bit
- Communication loss timeout

Slave Address

The sMPR has slave address from 1 to 247.
The factory default setting is 1.

Baud rate

The communication speed provided is like below

- 1.2kbps
- 2.4kbps
- 4.8kbps
- 9.6kbps
- 19.2kbps
- 38.4kbps

Factory setting is 19.2kbps.

Parity Bit setting

- Even
- Odd
- None

Factory setting is Even. Parity and stop bit have following relationship.

Parity	Stop Bit
Even or Odd	1
None	2

Communication loss timeout

It is the criteria to confirm the communication disconnection with a master like as PLC. sMPR judges it as a communication disconnection error, if there is no call from the master during a certain preset time. The time setting range is 1~999sec the factory default setting is OFF. The OFF means no communication error check. It is advised to set it at OFF, if there is no concern of communication disconnection or no needs of communication error check at ordinary times.

RS485 Bus Connection

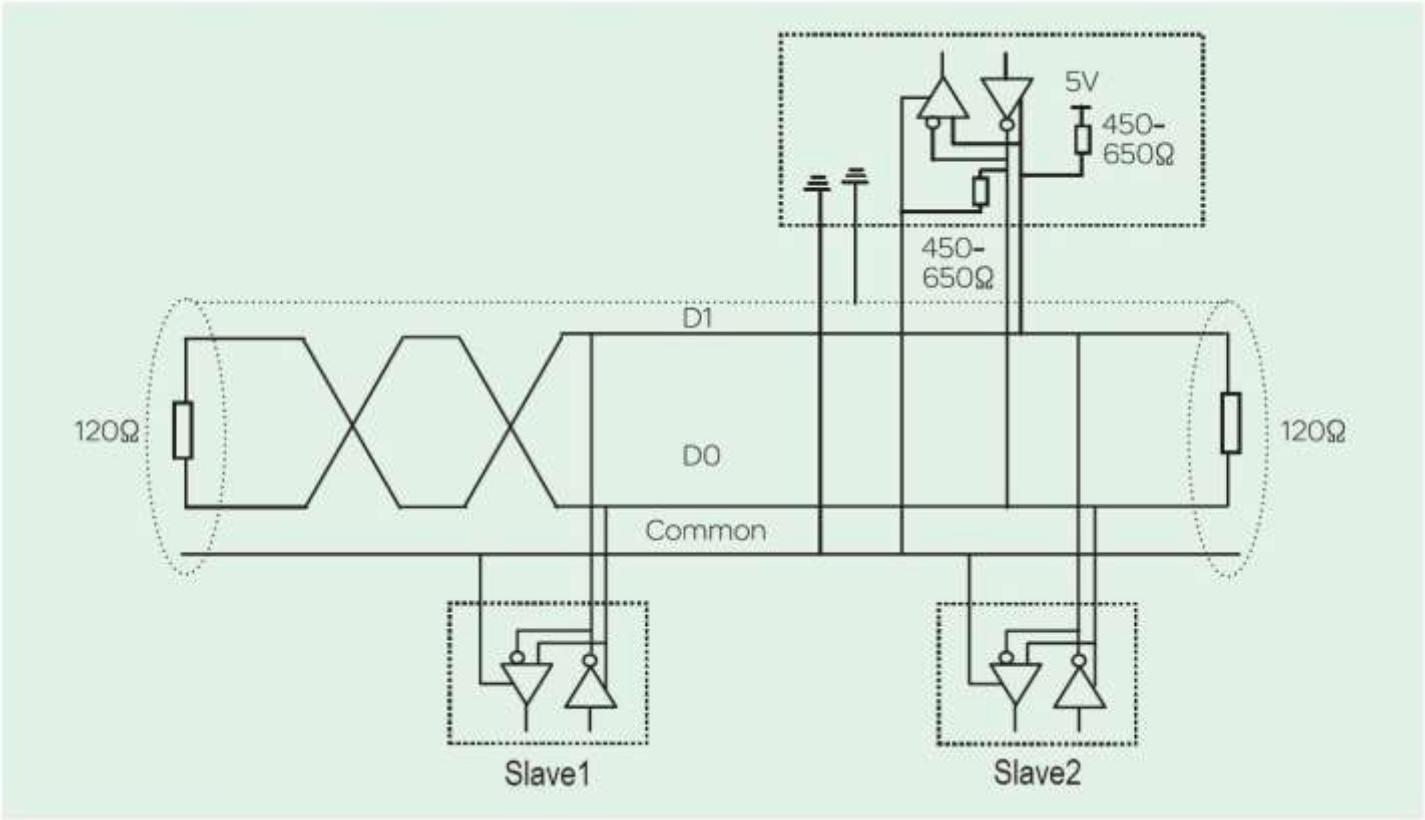
RS485 standard allows several different characteristics.

- Polarization
- Line Terminator
- Number of Slaves
- Length of the bus

There is a definition of Modbus presented in detail at the website of Modbus.org in 2002.
Standard connection.

Standard Connection

The standard connection conforms to the Modbus specifications, sepecially 2 wire multidrop serial bus diagram, presented at the website of Modbus.org in 2002 (Modbus_over_serial_line_V1.pdf, Nov.2002). Simple wiring diagram is like below.

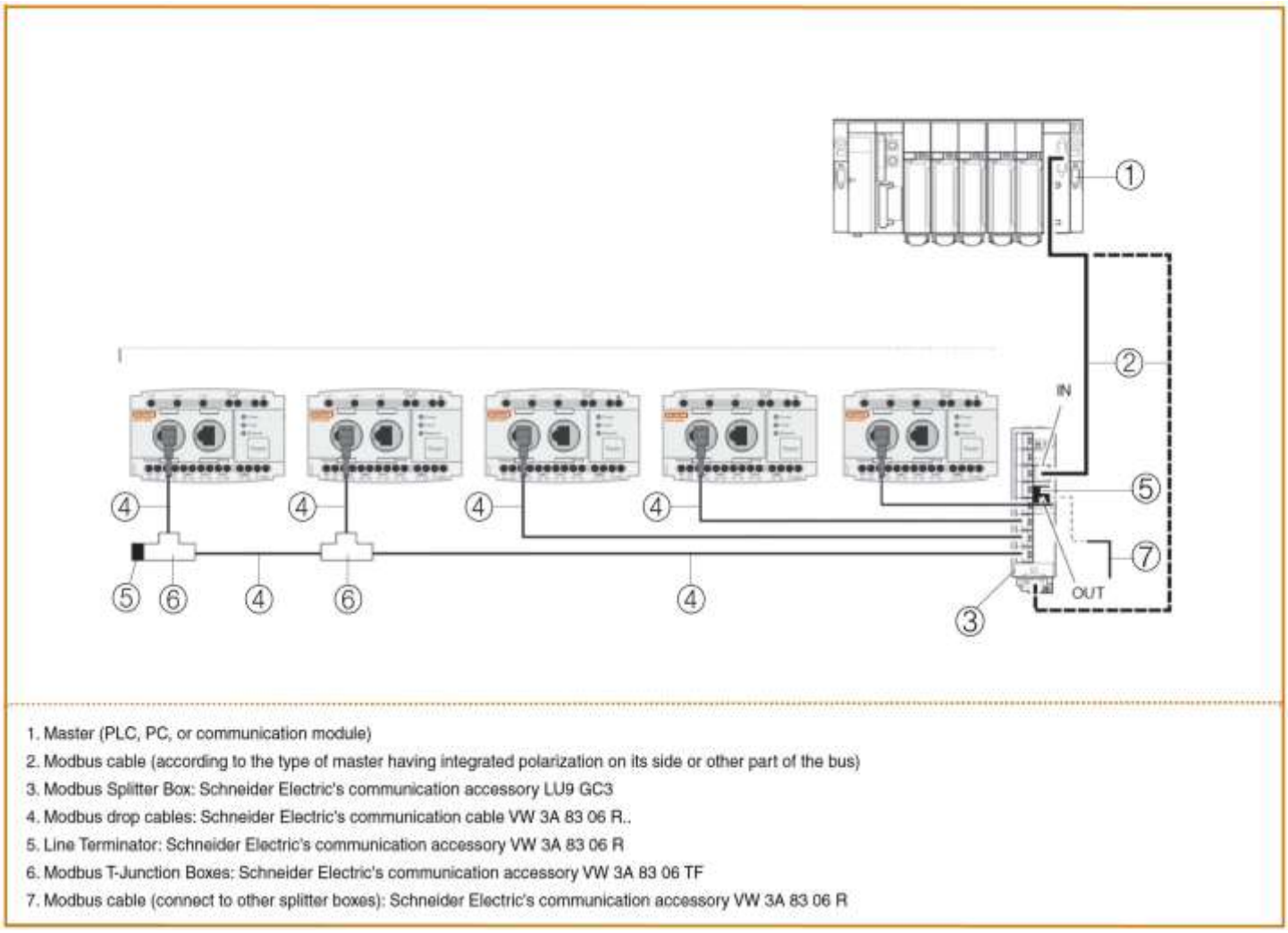


The characteristics is like below in case of a direct connection to the bus.

Item	Description
Type of trunk cable	Single, Shielded, Twisted pair cable. Min 3rd cable
Maximum length of the bus	1000m(3,2181 ft) (at 19.2kbps)
Maximum number of stations without repeater	32 stations (31 slaves)
Maximum length of Tap-Offs	• 20m (66ft, 1 tapoff) • 40m (131ft, divided by tapoff no. in Multi-Junction Box)
Bus Polarization	• 450-650Ω pullup resistor, 5V basis • 450-650Ω pulldown resistor, Recommend the polarization to Master at Common. There is no polarization at RS485 of sMPR.
Line Terminator	120Ω resistor, +/- 5%
Common Polarity	YES (connect 1 protection ground minimum to the bus)

Bus ConnectiAon using SCA Type Junction Box

The diagram below shows the connection to bus using SCA type junction box.



1. Master (PLC, PC, or communication module)
2. Modbus cable (according to the type of master having integrated polarization on its side or other part of the bus)
3. Modbus Splitter Box: Schneider Electric's communication accessory LU9 GC3
4. Modbus drop cables: Schneider Electric's communication cable VW 3A 83 06 R..
5. Line Terminator: Schneider Electric's communication accessory VW 3A 83 06 R
6. Modbus T-Junction Boxes: Schneider Electric's communication accessory VW 3A 83 06 TF
7. Modbus cable (connect to other splitter boxes): Schneider Electric's communication accessory VW 3A 83 06 R

- Install the Line Terminators at both ends of the bus to prevent communication interference. All the ports of the T-Junction Box must be connected. If not connected to a slave or the master, install Line Terminator.
- Connect bus with the IN port (or bottom terminal) of the Splitter Box. Use OUT port connection to other Splitter Boxes.

- Please use a cable with 2pair shielded Twisted Conductors for Interface protection.
- It is advised to isolate the Modbus cable 30m(11.3in) at least from a power cable.
- If necessary, intersect the Modbus cable to a power cable perpendicularly.