

Intelligent Motor Protection Relay

iEOCR-MME

Next Generation Relay with Communication Functionality
for Motor Monitoring, Protection and Control



SEOCR
is becoming

Schneider
Electric

EOCR Samwha EOCR

by **Schneider** Electric

Reliable, simple and efficient solutions



Optimised investment and operating costs



Greater energy efficiency



Connectivity everywhere



Reliable, ultra-pure power



Lifecycle services



Next Generation Relay with Communication Functionality for Motor Monitoring, Protection and Control

iEOCR-MME

- Easy installation and maintenance for improved work efficiency
- Save time and maintenance cost
- Improve the efficiency and safety of production process
- In unmanned management system, save energy through operation statistics
- Greatly reduced space compared with the traditional panel of the same capacity

For more than 30 years since its establishment, Samwha EOCR has developed more than 10,000 EOCR related products including applications. Samwha is opening the global market with its sole expertise in EOCR that differentiates Samwha from other companies.

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iEOCR-MME

Intelligent Motor Management Economic Version



> Application



Buildings

- Office, commercial, and residential buildings, schools, hospitals



Industrial Facilities

- Petrochemical, electronic, glass, steel, semiconductor, chemical, pharmaceutical, cement, paint, etc.



Protection, monitoring and control of motors can be performed through communication



CAM Switch



Timer



EOCR-FMZ

- > Control Voltage
 - 100 ~ 240VAC, 50/60Hz
 - 24VDC
 - 100 ~ 125VDC
- > Motor Protection
 - Over/Under Current
 - Thermal Overload
 - Phase Reversal/Phase Loss/Phase Unbalance
 - Locked Rotor (Stall & Jam)
 - EF Current
- > Control Function
 - Operating Mode
 - ; DOL, Y-D Starting, Inverter Starting
 - Control Mode
 - ; LOP, MCC, AUTO(PLC, DCS), Network
- > Network Communication Protocol
 - MODBUS-RTU
- > Rated Current
 - Over-current: 0.5 ~ 100A
 - Ground Current: 0.03 ~ 10A (Lo or Hi selected)
 - Load-Ratio Display: 50 ~ 120%
- > Diagnosis Function
 - Limit number of auto reset
 - Detect network communication loss
 - Detect stuck button
 - Run command error
 - Stop command error
 - Run checkback error
 - Stop checkback error



Utilities

- Gas, water supply & drainage, airport, railway, port

iEOCR-MME

Intelligent Motor Protection Relay (Basic Model)

Features



- On/off function for local and remote
- Operating Mode: DOL, star-delta, inverter
- Built-in MODBUS RS-485 communication
- Control Mode: LOP, MCC, AUTO, COMM
- Suitable for inverter environment: Available for low frequency (5~200Hz)
- Enhanced monitoring function: Real-time monitoring at far distance (150m)
- Perfect protection by selecting inverse thermal time / definite time / inverse time
- Bar graph function: operating current to set current
- Record 3 latest fault: fault type fault time fault current of R.S.T phase
- Date & Time setting: YYYY/MM/DD/HH/MM/SS
- Limit restarting, operating hour saving functions
- 3-phase current and leakage current display (alternatively)
- 3-phase / single phase setting
- Security set-up: password function
- Setting and monitoring with PC: free PCON software
- Selectable by General/Ground Current with External ZCT
Ground Current with built-in ZCT
- Real Time Processing / Higher Precision

Protection Function

Item	Operating Condition / Set-up Range	Operating Time
Over Current (oc)	Load current(In) exceeds threshold(Is) Setting Range : 0.5~100A(Def), 0.5~32A(Inv & th) 100	Definite(Def) : 0.2~120s Adjustable Inverse(Inv) & Thermal(th) : 1~30 Class
Under Current (uc)	Load current(In) less than threshold(uc) In <= uc uc should be less than oc Setting	oFF, 1~120s Adjustable
Phase Loss (PL)	max imbalance is more than 85% among 3 phase current, Enable or disable : Selectable	oFF, 0.5~5s Adjustable
Reverse Phase(rP)	Reversed phase sequence input on EOCR. Enable or disable : Selectable	Within 0.15s
Stall (Sc)	Active only in motor starting, In ≥ Stall threshold (Sc×OC). Setting Range : Adjustable 2~8 times of oc setting if Sc×OC doesn't exceed 250A	Immediately after D-Time elapsed
Jam	Active only in motor running, In ≥ Jam threshold (JA×OC). Setting Range : 1.5~8 times of oc setting if JA×OC doesn't exceed 250A	0.2~10s Adjustable
Unbalance (ub)	Current unbalance ≥ threshold 1~10s Adjustable. Setting Range : 10~50% Unbalance[%] = 100 × (Max phase current - Min phase current)/ Max phase current	1~10s Adjustable
Earth Fault (EF) ^{*1)}	EF current(Ie) exceeds threshold(Ies) Setting Range : oFF, 0.03~10A	0.05~10s Adjustable (0.1~10s for MMED model)

*1) This function is not available for MMED model.

Auxiliary Functions

Password	Password Secure configuration
3-phase / single phase setting	The selection enables application to 3-phase or single phase motor without further setting
Communication	Communication Serial network communication for monitoring of metering, status, and fault history
Phase selection	Phase selection Select a Single-phase motor or 3-Phase motor
Total Running-Hour	Total Running-Hour Record of total running from installation which cannot be modified or cleared
Running-Hour	Running-Hour Running-Hour Accumulated running hour from preset point which can be cleared to zero, when motor stops
Fault History	Fault History Records for recent 3 faults each phase current which stored in a non-volatile memory
Limitation of autoreset attempt	Limitation of autoreset attempt Block auto-reset if the reset count exceeds the pre-set count within 30 minutes
Date/Time Information Setting	Save date/time of failure to provide exact time of motor failure

Control Function

Control Function	Description	Operating Conditions
Operating Mode	DOL	Direct on Line
	Y-D start	Y start time: 0.1~999 sec, Y-D switching time: 0.0~3 sec.
Control Mode	LOP	Local Operation Panel
	MCC (HMI)	Motor Control Center, Operation by OCU
	AUTO (PLC)	PLC, DCS automatic operation
	Network	Operation by RS-485 MODBUS communication

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 (05 selected), 5~100A (80 selected)
			Inverse/Inverse Thermal: 0.5~6A (05 selected), 5~32A (80 selected)
Under current (A) setting range			0.5 ~ oc (05 selected), 5 ~ oc (80 selected)
Overload Characteristics Curve			Definite (Def) / Inverse (Inv) / Inverse Thermal
Leakage ground current (A) setting range			oFF 0.03~2.5A (Lo selected), or 1.0~10A (Hi selected)
Operating Time Characteristics	Start-up delay		0~200s
	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 (0.1~10s for MMEB model)
	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		100~240VAC, 24VDC, 100~125VDC
	Allowable input voltage		85%~110% (of rated voltage)
	Frequency		50/60Hz
	Power consumption		Less than 7VA
Output Contact	Capacity		3A/250VAC Resistive.
	composition		NO output: O1,O2,O3
Display	7 Segment LED		Displays current measurement, failure information, and setting values
	Bar graph		Load ratio display (50 ~ 120%)
Communication			Modbus-RTU/ RS-485
Mounting			Embedded in panel (flush mounting)
Insulation Resistance	Between circuit and enclosure		DC500V 10MΩ over
	Between dielectric strength circuit and enclosure		2KV, 50/60Hz, 1 minute
	Between contacts		1KV, 50/60Hz, 1 minute
	Between circuits		2KV, 50/60Hz, 1 minute
Electrostatic Discharge(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			MMED : 295g , MMEB : 330g, MMEZ: 295g OCU : 180g, 1M cable : 55g

● Control Channel

With LOP (AUTO is available for 2-Wires only)	Input	Function	Selected Control Channel				
			LOP	AUTO	MCC	COMM	
	I1	RUN	OFF → ON	ON	Ignore		
		STOP	N/A	OFF			
	I4	STOP	OFF less than 2 sec	N/A	N/A		
		LOCAL S/W	ON	ON			
		REMOTE S/W	OFF above 2 sec	OFF			OFF
Without LOP AUTO-3 Wire	I1	RUN	N/A	OFF → ON	Ignore		
	I4	STOP	N/A	OFF			
AUTO-2 Wire	I1	RUN	N/A	ON	Ignore		
		STOP	N/A	OFF			
	I4		N/A		Neglected		

Time -current characteristic curve.

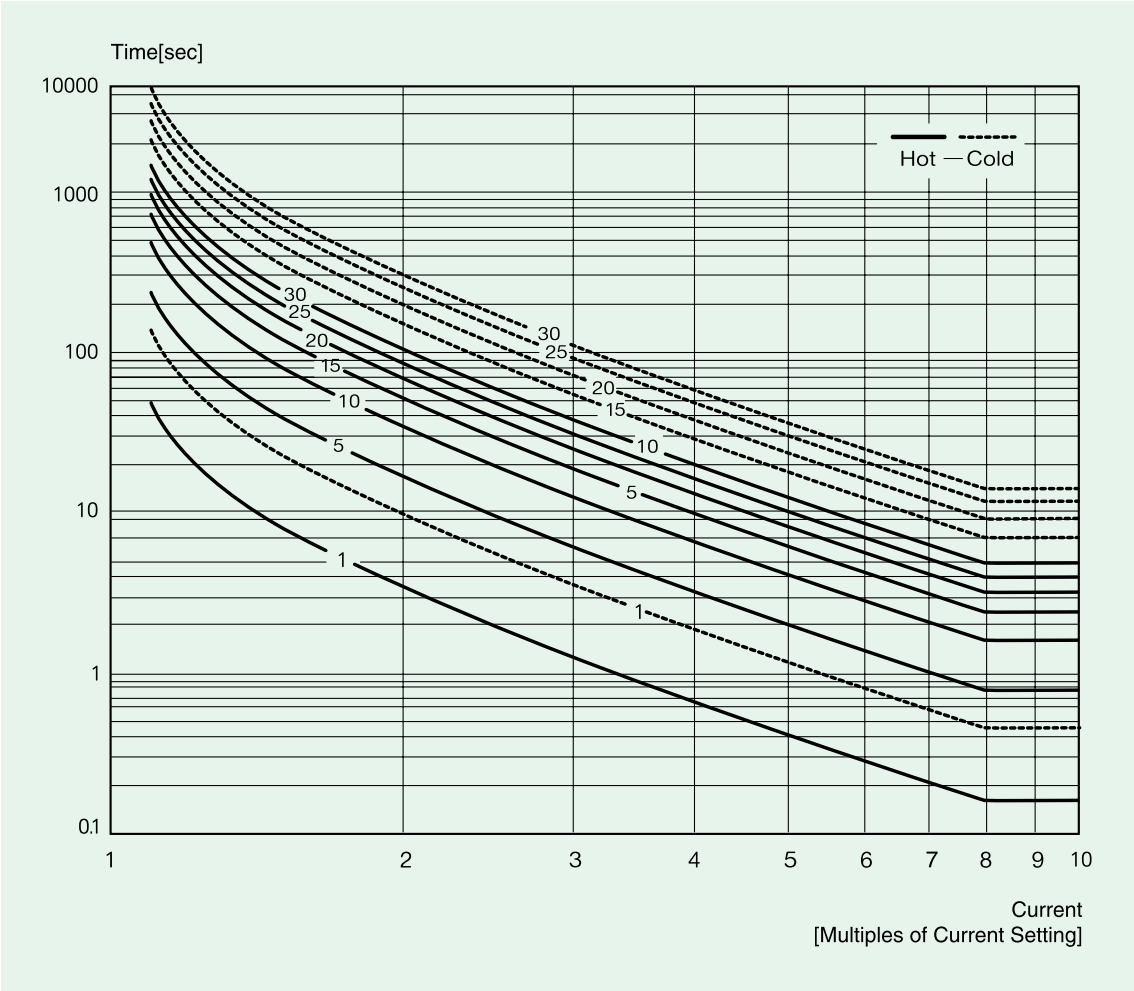


Table 1. Inverse characteristic (0.5~32A)

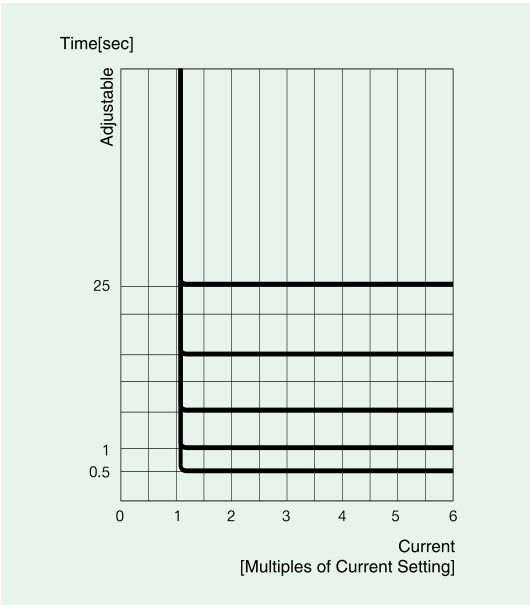


Table 2. Definite time characteristics

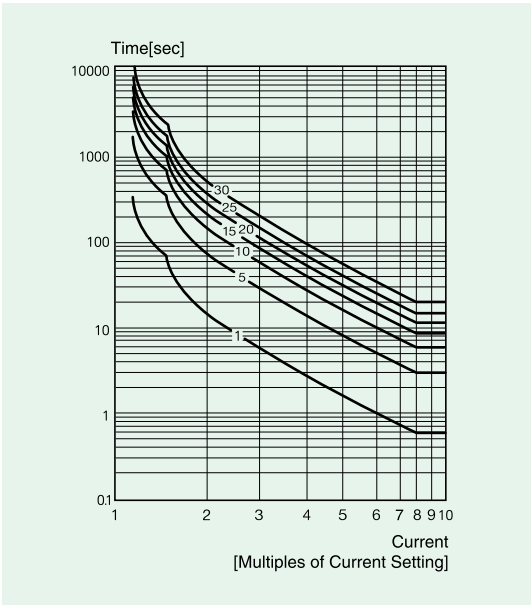


Table 3. Inverse thermal time characteristics (0.5~32A)

Over current and time setting tips

● 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 sec longer than the time measured. For a Y-D start, it's better to set time 2 sec longer than the preset time of the Y- 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. nEOCR supports trip class from 1 to 30. Refer to the graphical representation of Inverse or Thermal Inverse to check trip time.

Alert Operation Pattern

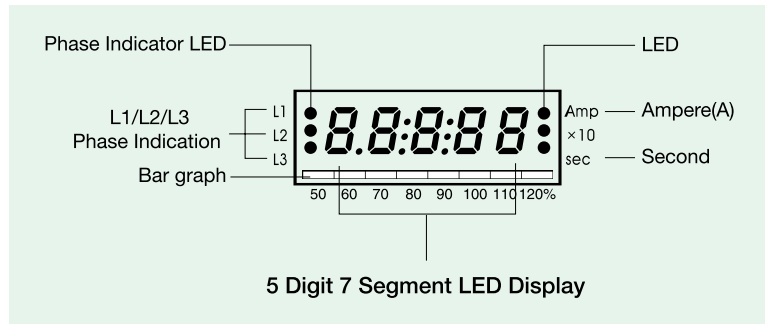
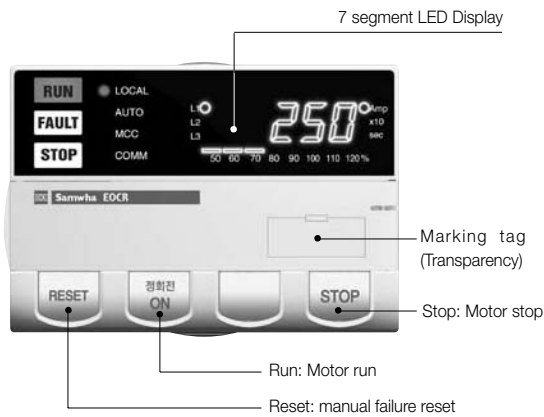
Do use this function by OL/GR common output.

Running Stage ALo Setting	Starting	Normal Operation	Higher than the preset Alert value	Trip
Aux 				
Flicker				
Hold				

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Intelligent Motor Protection Relay (Basic Model)

Display Layout



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

Bar graph

- it shows the load factor to OC setting value by %
- % value = (running current/setting current) × 100%
- Min scale is 50%
- if the setting value is the rated motor current, it shows the load factor of the motor.

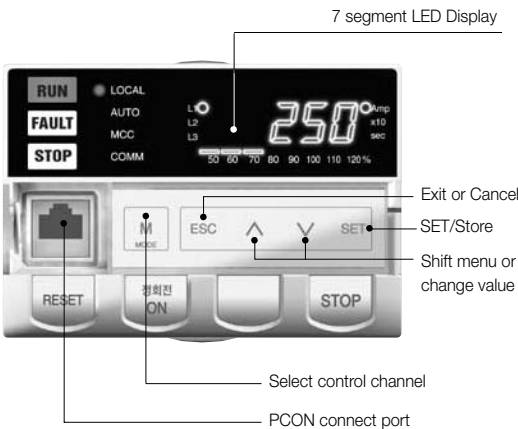
Current display

- 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.

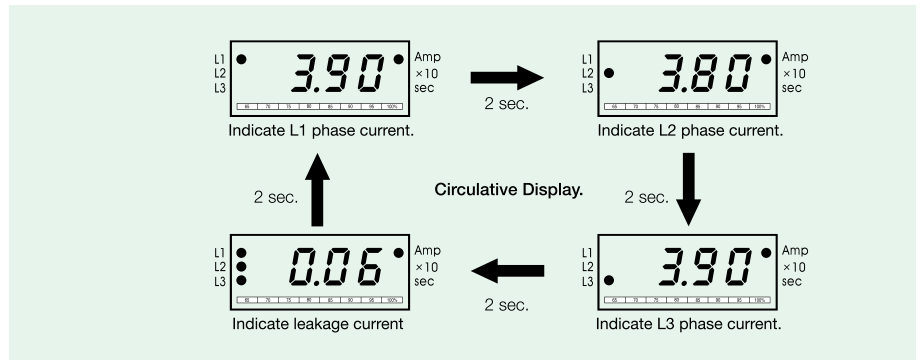
Amp: Ampere. LED is on when a current display.

X10: Shows the unit changed to 10 times.

Sec: Second. LED is on when a time display.



3-Phase Digital Ammeter Function



※Indicate leakage current is not available for MMED model.

Button and Setting Sequence

Button	Description of Function
^ v	Shift menu or change setting value
SET	Select, save or open submenu
ESC	Return to previous or parent menu
M MODE	Select motor control channel
RESET	Manual rest of failure
정회전 ON	Motor run in normal direction
STOP	Motor stop

※FAULT menu shows from the latest to oldest failures. Use ^ v buttons to search failure data. While the latest failure data is displayed, 120% of the load ratio LED is lit. 110%, 120% LED will be lit while the earlier failure data are displayed. For the oldest failure data, 100%, 110%, 120% LED are lit. Pressing ESC during failure data display will return to the menu mode.

Sequence and Menu for Setting Functions

● System Configuration

Display	Description	Setting Range
	Secure configuration	000 999 (000 for no password setting)
	3 phase or single phase	3ph, 1ph
	Base load current range	05, 80 (05-> oc:0.5 -6A, 80-> oc:5-100A)
	Base earth leakage fault current range	Lo, Hi (Lo : 0.03-2.5, Hi : 1.0 - 10.0A)
	External CT ratio, select cuS for separate configuration of primary, secondary and multiple passes	Non, 2t, 3t, 4t, 5t, cuS (ctse:1, ctse:5, ct:10~3000, PaS:1~5)
	LOP exist or not	yE, no
	AUTO(PLC or DCS) exist or not	yE, no
	Enable control by communication	yE, no
	Enable control by OCU	yE, no
	Enable global stop from OCU	yE, no
	operation mode, select DOL, YD, Inverter or By pass	doL, y-d, Inv, b-P
	Select Auto-2wire for maintained contact or Auto-3wire for momentary contact	2, 3
	Output type of OL and GR, select common or separate	SE, Co
	System fundamental frequency	50, 60
	Enable bump(stop) between control channel transfer	yE, no
	If yes, measurement starts from 5Hz	yE, no
	Enable write access to network for configuration	yE, no

* During the change of system related item settings, protection and control functions are disabled. Press SET to save the new setting and ESC to return to normal mode.

● Protection and Control Function Setting

Display	Description	Setting Range
	Reversed phase detection	On, oFF
	Time-current characteristic (none, definite, inverse, thermal inverse)	no, dE, In, th
	Over current threshold	dE: 0.5 – 6.0 or 5.0 – 100 In/th: 0.5 – 6.0 or 5.0 – 32
	Starting delay	0 – 200s
	Over current duration	0.2 – 120s
	TCC class for inverse	1 – 30
	or thermal inverse	oFF 0.5 – oc or 5.0 – oc
	Under current threshold	0.5 – 120s

Sequence and Menu for Setting Functions

● Configuration of control and protection

Display	Description	Setting Range
	Earth leakage threshold	oFF, 0.03 – 2.5A or 1.0 – 10.0A
	Earth leakage duration	0.05 – 10s
	Starting delay of earth leakage	1~10s for MMED model
	Enable phase loss	on, oFF
	Phase loss duration	0.5 – 5s
	Unbalance threshold	oFF, 10 – 50%
	Unbalance duration	1 – 10
	Stall threshold (multiples of oc)	oc x Sc < 45 (05 selected) oc x Sc < 240 (80 selected)
	Jam threshold (multiples of oc)	oc x JA < 45 (05 selected) oc x JA < 2400 (80 selected)
	Jam duration	0.2 - 10s
	1 step time in YD starter	0.1 - 999s
	Transition time in YD starter	0 - 3s
	Alarm output type	no, A, F, H, to, uc
	Alarm threshold (% of oc)	50-100%
	Reset type (manual, remote, auto)	H - r, E - r, A - r
	Auto reset timer	0.5 - 20n
	Limit of auto reset in 30 minutes	oFF, 1 - 5
	Total running hour from installation	0 - 99999
	Running hour	0 - 99999
	Accumulated operating hours alarm output reference time	0 - 9990
	Year, 2009 - 2099	09 - 99
	Month	1 - 12
	Day	1 - 31
	Hour	00 - 23
	Minute	00 - 59
	Second	00 - 59
	Modbus slave address	1 - 247

Sequence and Menu for Setting Functions

● Configuration of control and protection

Display	Description	Setting Range
	Baud rate (bps)	1.2, 2.4, 4.8, 9.6, 19.2, 38.4, auto
	Parity, none, even, odd	non, even, odd
	Communication Loss operating time	1 - 999
	Open PCON pore	yE, no
	Run/Stop command diagnosys	yE, no
	Fault records	3 records
	Check OCU connection	yE, no
	Rapid cycle time	0 - 999
	Clear thermal capacity	Sequence: SET → Blink → SET
	Output test	SET to run, press RESET to return.
	End of output test	

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 lastest 3trip are stored and available for search. search is available during stop or operation.

Trip Cause	Display	Description
Over current		Overcurrent with 3.6A at R-phase
Phase Loss		Phase loss at R-phase
Reversed Phase		Phase reveral
Stall at starting		Stall with 35.0A at S-phase immediately after at expires
Jam at running		Jam with 5.8A at T-phase
Unbalance		Unbalance detected
Under current		Under current with 1.6 at T-phase
Eorth leakage		Earth leakage with 0.06A detected
Network communication loss		Network communication loss
Stuck button		Button stuck in OUC or EU
Run command		NO current flowing after is from a run command
Run checkback error		Aveage load current for 0.5s is zero after a run command with following a stop command

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Intelligent Motor Protection Relay (Basic Model)

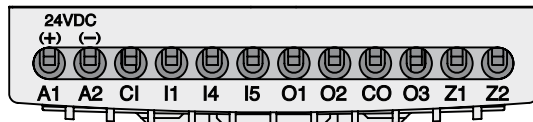
Cause of Trigger Indication and Check Method

Trip Cause	Display	Description
Stop command error	StPEr	Current flowing after is from a stop command
Stop checkback error	cbStP	Average load current is not zero for 0.5s after a stop command with no following a run command
External fault intiagted	ELFLt	Fault initiated by network communication
Limit of auto-reset reached	rn:FUL	Number of auto-reset in 30minutes exceeds the limit

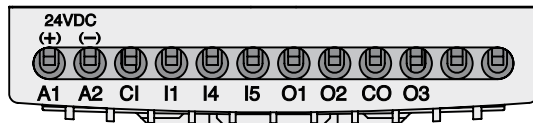
I/O Terminal layout

DC Type

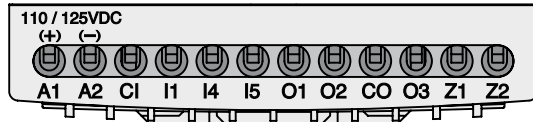
MMEZ-WRBx



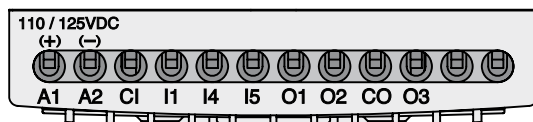
MMEB-WRBx / MMED-WRBx



MMEZ-WRGx

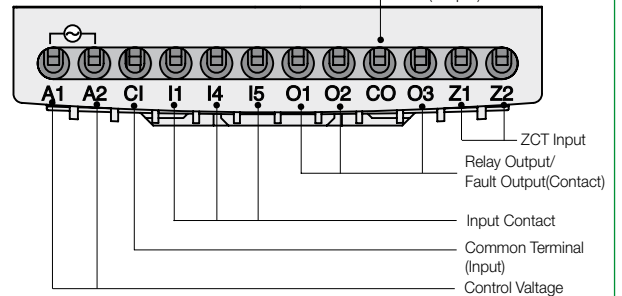


MMED-WRGx / MMEB-WRGx

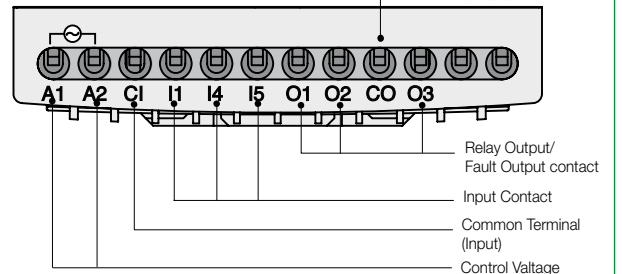


AC Type

MMEZ-WRUx



MMED-WRUx / MMEB-WRUx



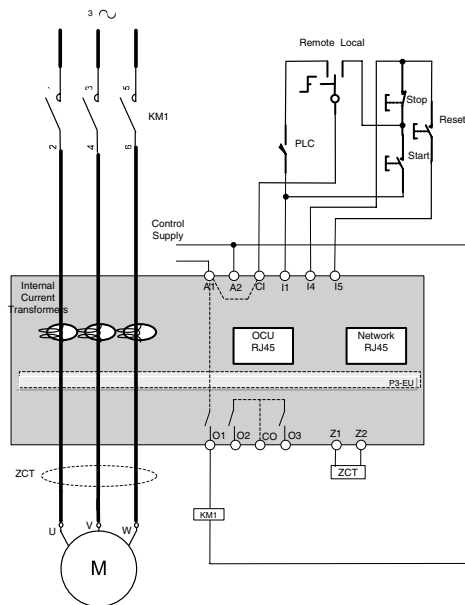
*DC type description is the same AC type.

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Intelligent Motor Protection Relay (Basic Model)

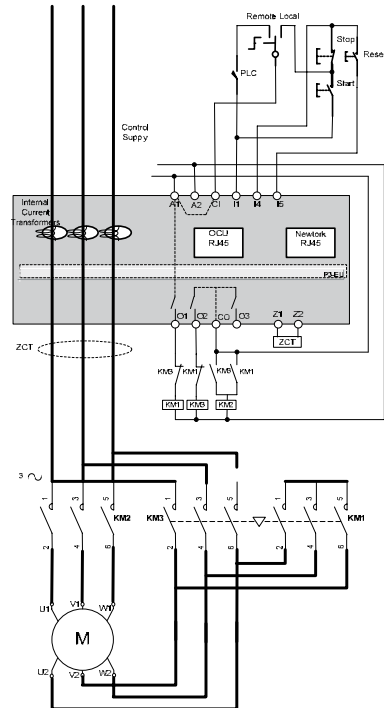
Wiring Diagram (Exemplary)

DOL starter



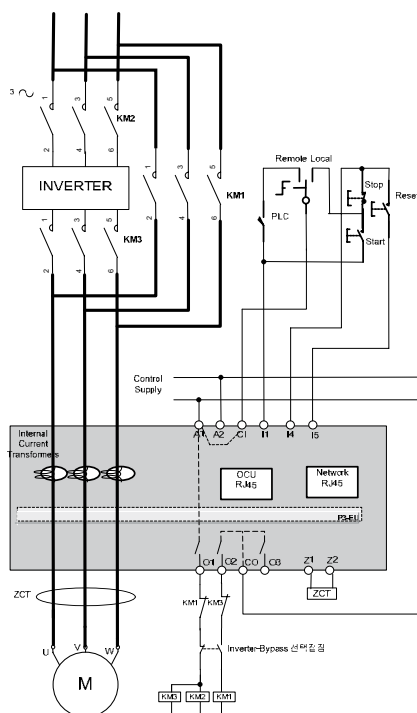
- ※The control power must be insulated.
- ※Wiring of a logic input should be done through CI like above example.

Y-D starter



- ※The control power must be insulated.
- ※Wiring of a logic input should be done through CI like above example.

Inverter

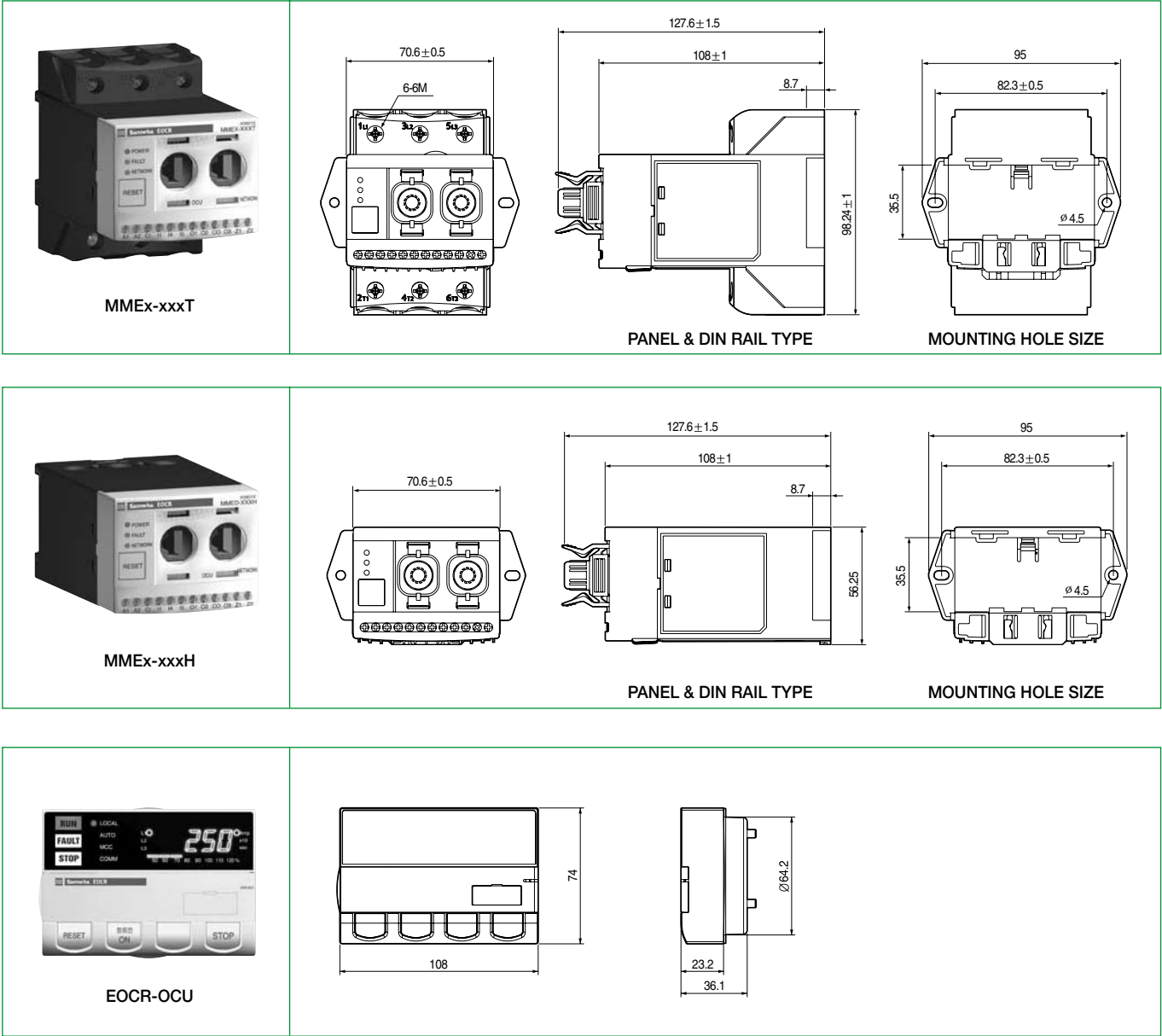


- ※The control power must be insulated.
- ※Wiring of a logic input should be done through CI like above example.

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Intelligent Motor Protection Relay (Basic Model)

Dimensions



Intelligent Motor Protection Relay (Basic Model)

M M E D - W R U H

① ② ③ ④

C A B L E - R J 4 5 - 0 0

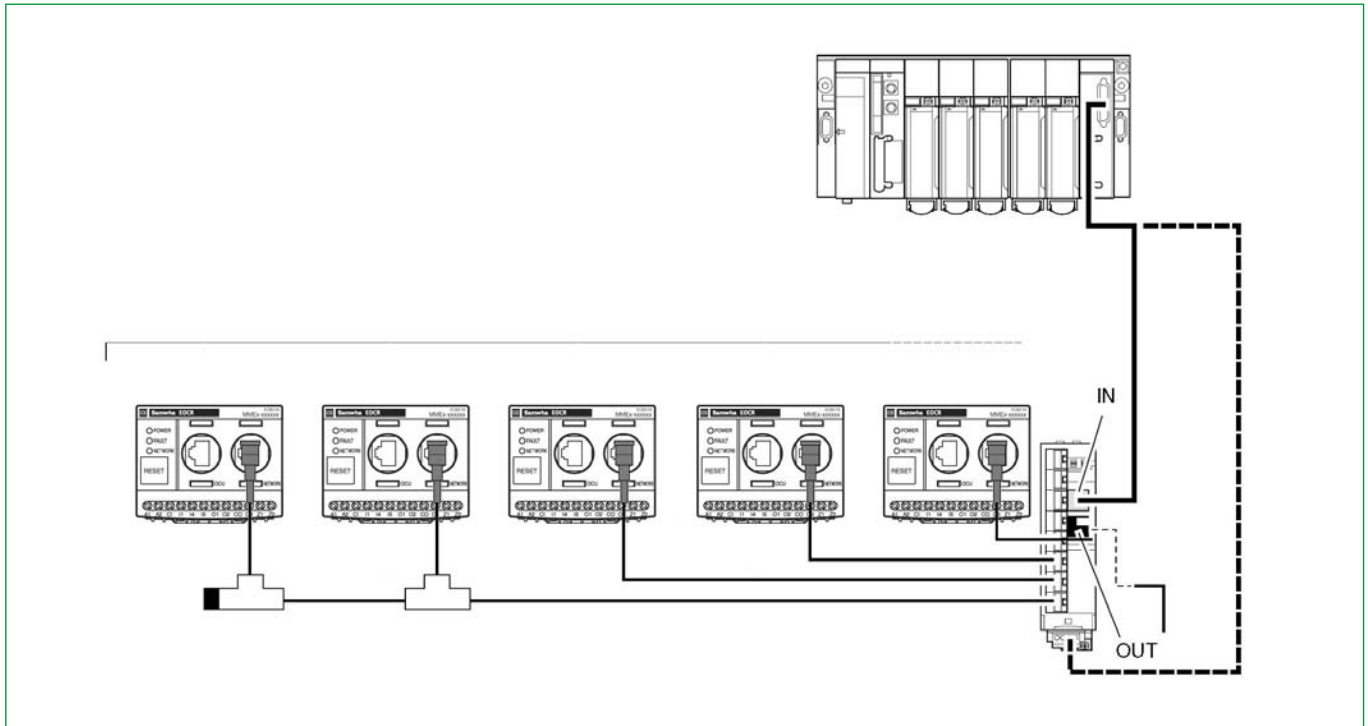
①	Cable conection	RJ45	
②	Cable length	00H	0.5M
		001	1M
		01H	1.5M
		002	2M
		003	3M
		Others	Order specification (max. 150m)

Communication Manual

Intelligent Motor Protection Relay (Basic Model)

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, then 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 retrieval 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 data and wait for response.
- The master sends slaves with broadcast data and does not wait for response.

In this case 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 EOCR 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. EOCR 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.

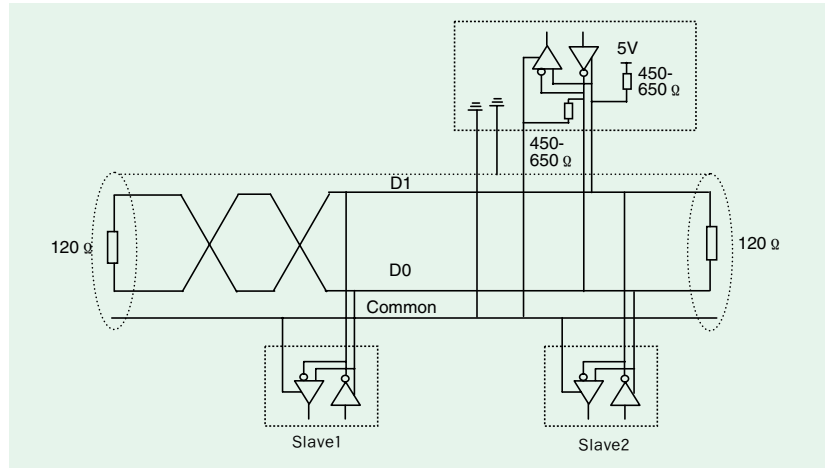
- Polarization
- Line Terminator
- Number of Slaves
- Length of the bus

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.



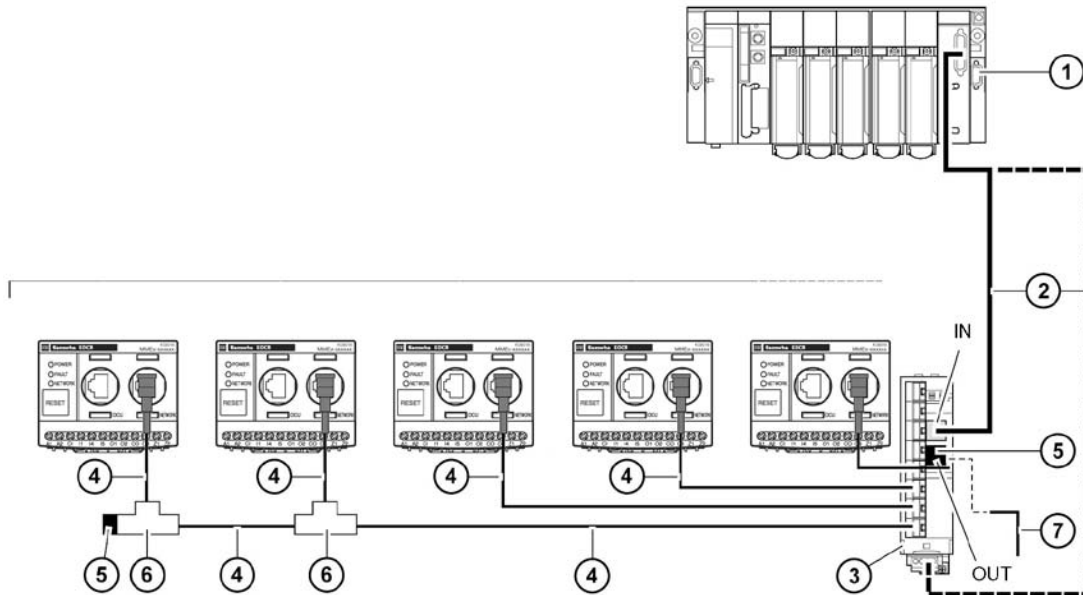
The characteristics is like below in case of a direct connection to the bus.

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 tapoffs	● 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 EOCR.
Line Terminator	120Ω resistor, +/- 5%
Common Polarity	YES (connect 1 protection ground minimum to the bus)

Communication Manual

Bus Connection 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 prepemdicularly.



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