PM-3033

Smart Power Meter

User's Manual



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Revision History

The table below shows the revision history:

Revision	Date	Description
1.24	2024/04/25	● Fix the Integer type value rage of kVAh,kVARh ● Fix the Bi_xxx_kWh modbus address number ● Change the Display Voltage definition “automatic” to “default”

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PM-3033 User's Manual

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Chapter 1 Introduction

1.1. PM-3033 introduction

ICP DAS brings the most powerful, cost-effective, advanced Smart Power Meters PM-3033 series that gives you access to real-time electric usage for three-phase power measurement. With its high accuracy (<0.5%, PF=1), the PM-3033 series can be applied to both low voltage primary side and/or medium/high voltage secondary side and enables the users to obtain reliable and accurate energy consumption readings from the monitored equipments in real time under operation.
Direct input from “secondary side 1A/5A” type CTs. Dedicated CTs are no longer needed, which lowers the cost of implementation.
It operates over a wide input voltages range 10 ~ 500 VAC which allows worldwide compatibility. It also supports Modbus RTU, Modbus TCP or CANopen protocols for easy integration.

Features：

- True RMS Power Measurements
- Energy Analysis for 3P4W-3CT, 3P3W-2CT, 3P3W-3CT, 1P2W-1CT, 1P3W-2CT
- Direct input of secondary side 1A/5A CT
- Voltage Measurements Up to 500 V
- W Accuracy Better than 0.5% (PF=1)
- Supports RS-485, Ethernet Interface (PoE)
- Supports Modbus RTU, Modbus TCP protocols.
- Total Harmonic Distortion (THD)

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1.2. Caution



1.2.1. Danger

The meter contains hazardous voltages, and should never be disassembled. Failing to follow this practice will result in serious injury or death. Any work on or near energized meters, meter sockets, or other metering equipment could induce a danger of electrical shock. It is strongly recommended that all work should be performed only by qualified industrial electricians and metering specialist. ICP DAS assumes no responsibility if your electrical installer does not follow the appropriate national and local electrical codes.

1.3. Warning

ICP DAS assumes no liability for any damage resulting from the use of this product. ICP DAS reserves the right to change this manual at any time without notice. The information furnished by ICP DAS is believed to be accurate and reliable. However, no responsibility is assumed by ICP DAS for its use, not for any infringements of patents or other rights of third parties resulting from its use.

1.4. Product Warranty & Customer Support

ICP DAS warrants all products free from defects in material and workmanship for a period of one year from the date of shipping. During the warranty period, we will, at our position, either repair or replace any product that proves to be defective. To report any defect, please contact ：**+886-3- 597-3366** or **service@icpdas.com**.

Please have the model, serial number and a detailed problem description available when you call. If the problem concerns a particular reading, please have all meter readings available. When returning any merchandise to ICP DAS, a return SN. is required.

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1.4.1. Limitation of Warranty

This warranty does not apply to defects resulting from unauthorized modification, misuse, or use for reason other than electrical power monitoring. The supplied meter is not a user-serviceable product.

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Chapter 2 Specifications

2.1. Specifications

Model		PM-3033	PM-3033-MTCP
AC Power Measurement			
Wiring		1P2W-1CT, 1P3W-2CT, 3P3W-2CT, 3P3W-3CT and 3P4W-3CT	
Measurement Voltage		10 ~ 500 V (CAT III)	
Measurement Current		Secondary current: 1A or 5A	
Measurement Frequency		50-60 Hz	
W Accuracy		Better than 0.5% (PF:1)	
Power Parameter Measurement		True RMS voltage (Vrms), True RMS current (Irms), Active Power (kW), Active Energy (kWh), Apparent Power (kVA), Apparent Energy (kVAh), Reactive Power (kVAR), Reactive Energy (kVARh), Power Factor (PF), Frequency(Hz)	
Data Update Rate		1 Second	
Communication			
RS-485	Protocol	Modbus-RTU	-
	Baud rate	9600,19200 (default), 38400, 115200; DIP Switch Selectable	-
	Data format	N,8,1 (default); N,8,2; E,8,1; E,8,2; O,8,1; O,8,2	
	Isolation	3000 VDC	-
	Bias Resistor	No (**Usually supplied by the RS-485 Master. Alternatively, add a tM-SG4 or SG-785**)	
Ethernet	Protocol	-	Modbus TCP
	PoE	-	Yes, IEEE 802.3af

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Aux Power		
Input Range	+12 ~ 48 VDC	+12 ~ 48 VDC or PoE
		PoE Pin Assignments: + (Pin 1, 2), V- (Pin 3, 6)
Power Consumption	2 W	
Dimensions (W x L x H)	127 mm x 100 mm x 33 mm	
Environment		
Operating Temperature	-20 ~ +70 °C	
Storage Temperature	-25 ~ +80 °C	

Field Wiring Terminal Markings:

3.81mm (For Measurement Current and Communication): Use Copper Conductors Only, wires range 16-26 AWG, torque value 3.0 lb-in.

5.08mm (For Measurement Voltage, Aux Power and Alarm Output): Use Copper Conductors Only, wires range 12-24 AWG, torque value 7.0 lb-in.

7.62mm: Use Copper Conductors Only, wires range 12-24 AWG, torque value 4.5 lb-in.

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2.2. Naming Rules



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Chapter 3 Installation

3.1. Inspection

The instrument is no longer safe when,

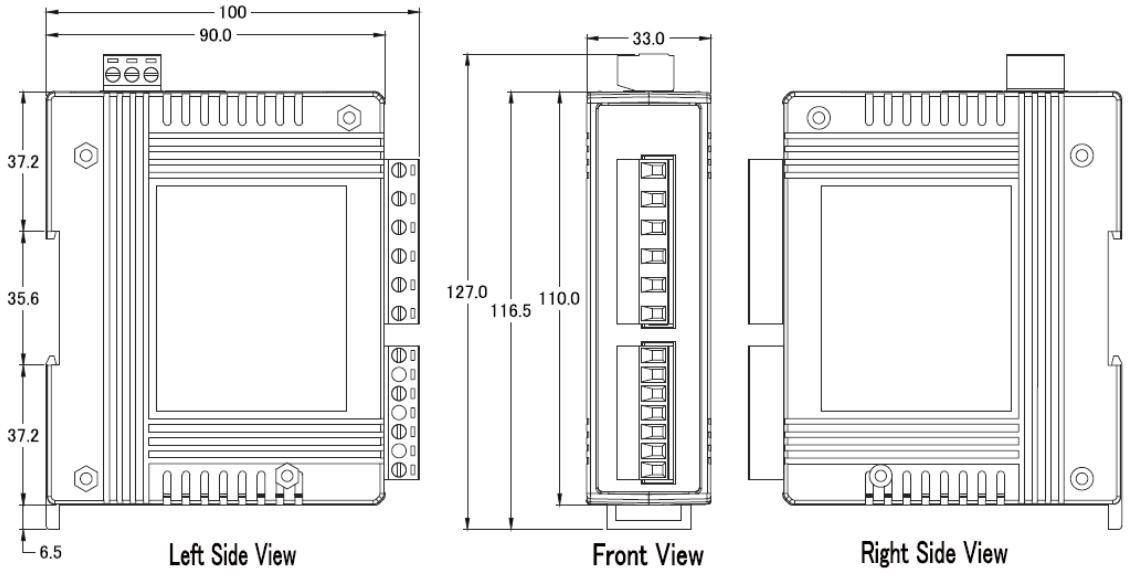
a) Shows clear signs of damage
b) Does not work
c) Long storage under extreme conditions
d) Damage during shipment

3.2. Safety



Please use the soft dry clothes to clean the instrument.
Please do not use any chemical or detergent or volatile solvents to clean the instrument, in order to avoid any possibility of the cover damage.

3.3. Dimension and Latch



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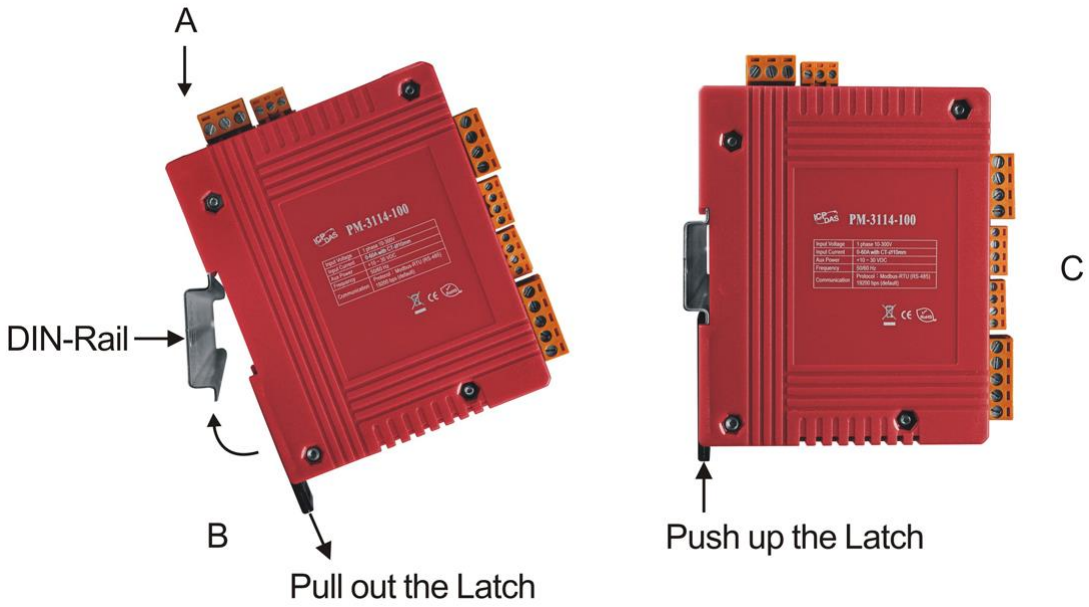
- Please read this operation manual carefully before using.
- Please re-confirm the measure position.
- PM-3033 series can be installed as rail mounting mode or embedded, no need to drill a hole or screw to fix it (rail mounting width can up to the length of 35 mm).
- Meter auxiliary power is DC +12V ~+48V.

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3.3.1. Mounting and Dismounting

- Mounting
  Assembly: Place the PM-3033 on the DIN-Rail. Push the front of the PM-3033 toward the mounting surface until it audibly snaps into place.
  Dismantling: Pull out the latch and then remove the PM-3033 from the DIN-Rail.

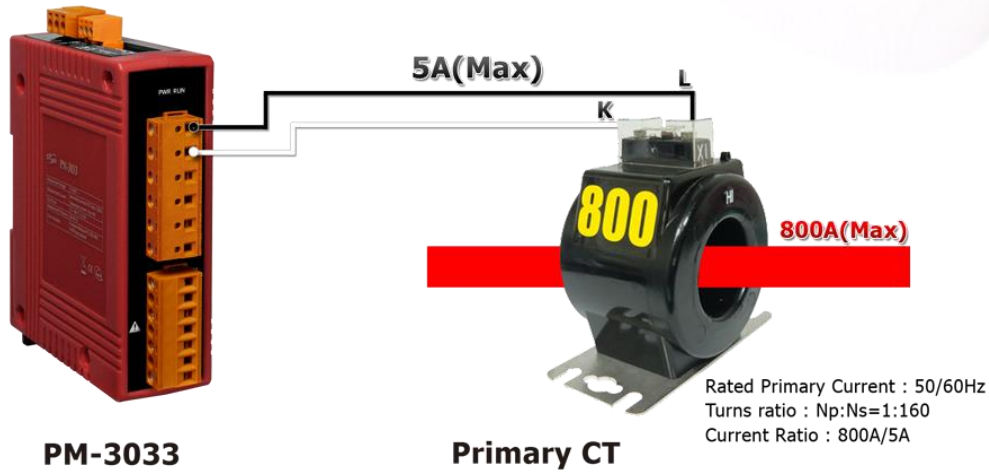


- Wire Disconnection
  1. Disconnect the voltage input wires from terminals and wrap the wire tips with plastic tape.
  2. Disconnect the communication wires from terminal.
  3. Disconnect the auxiliary power from terminal and wrap the wire tip with plastic tape.

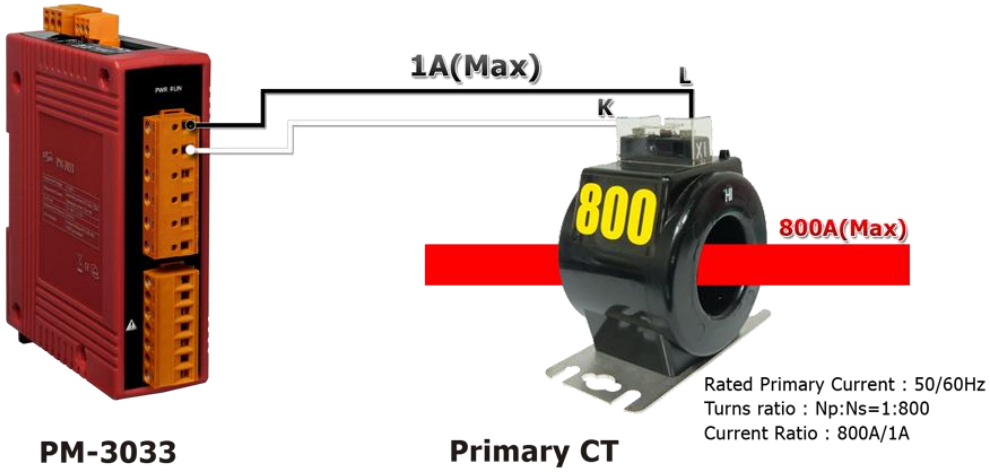
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3.3.2. 800A/5A Primary CT Installation and Wiring



3.3.3. 800A/1A Primary CT Installation and Wiring

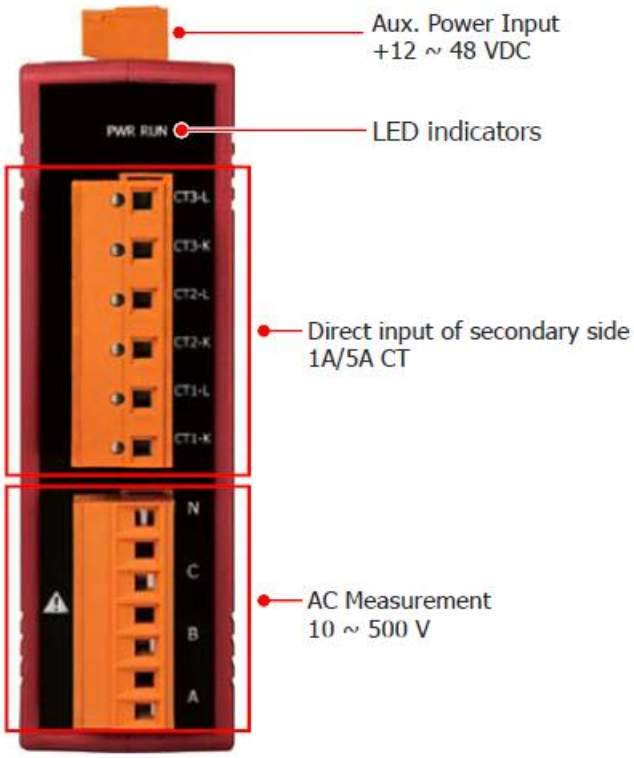


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Chapter 4 Wiring Diagrams

4.1. Connection



Please firstly check the current input terminal.
Make sure the arrow direction sign on Primary CT's follows current flow direction （K→L）.

Note: it must be in the same direction.
Connect the voltage input terminal N C B A. for PM-3033, in the three phase order as follows on N C B A.
Attention please!! For 3P3W-2CT, connect in N C A phase sequence, do not connect phase B (Check the diagram).

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Voltage Input

1. PM-3033 series: Input Voltage up to 500V.
   For any higher Input Voltage large than 500V, please add the PT (power transformer), and Change PT RATIO setup.
2. Confirm the RST (ABC) phase sequence.

Current Input

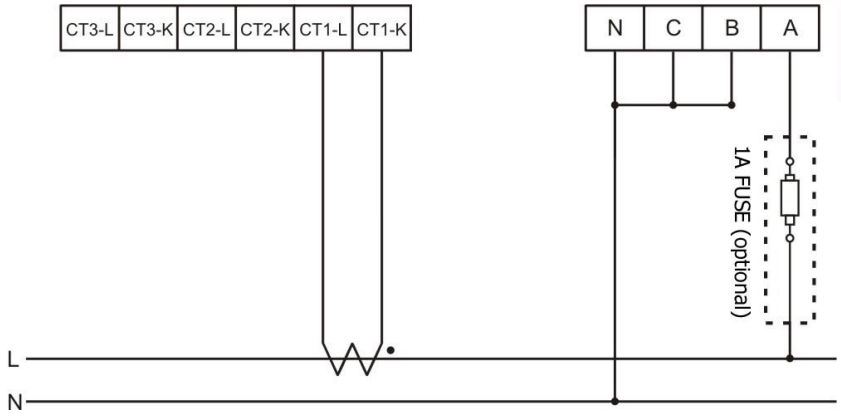
1. CT with secondary side output 1A/5A can be connected directly.
2. The current direction must follow K-L marked on CT's.

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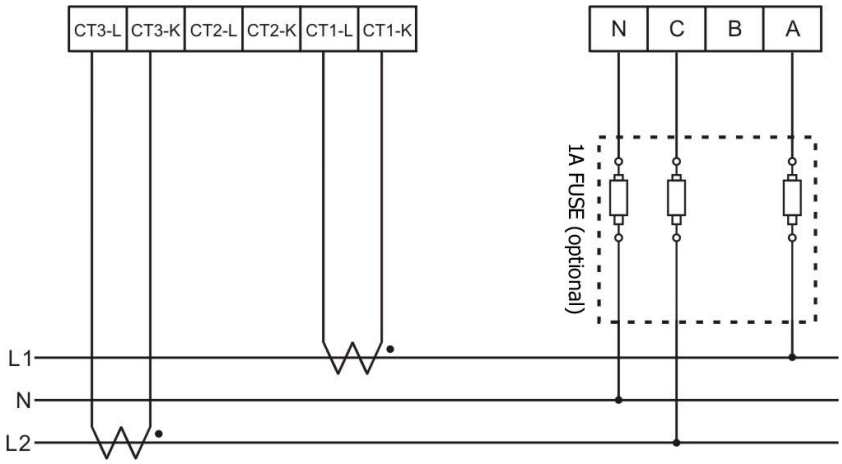
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4.2. Wiring

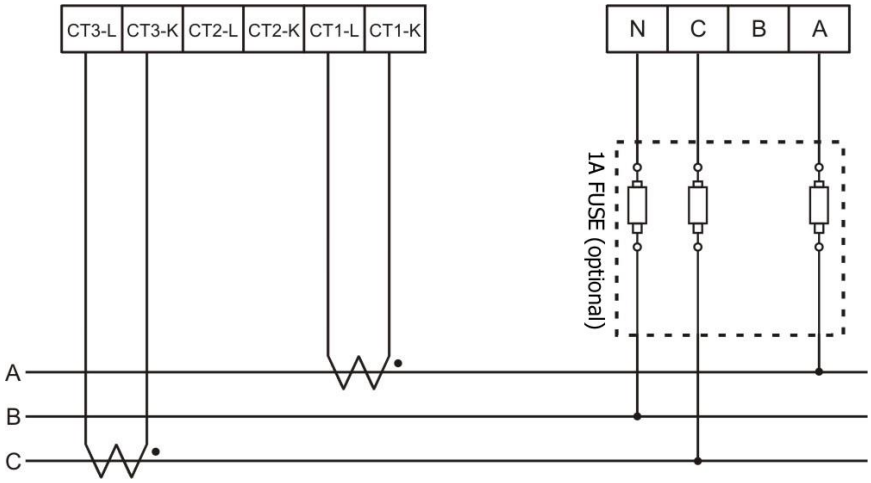
- 1P2W-1CT (PM-3033)



- 1P3W-2CT (PM-3033)



- 3P3W-2CT (PM-3033)

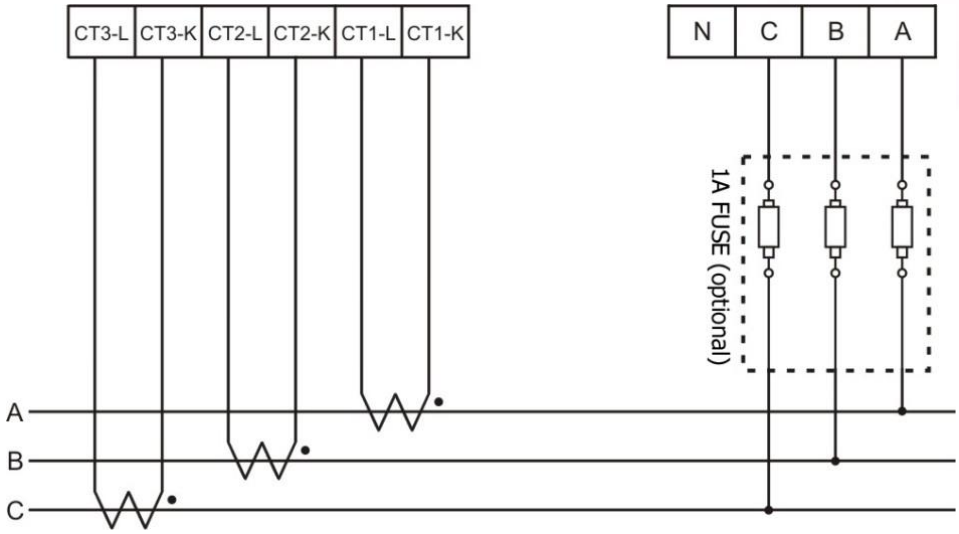


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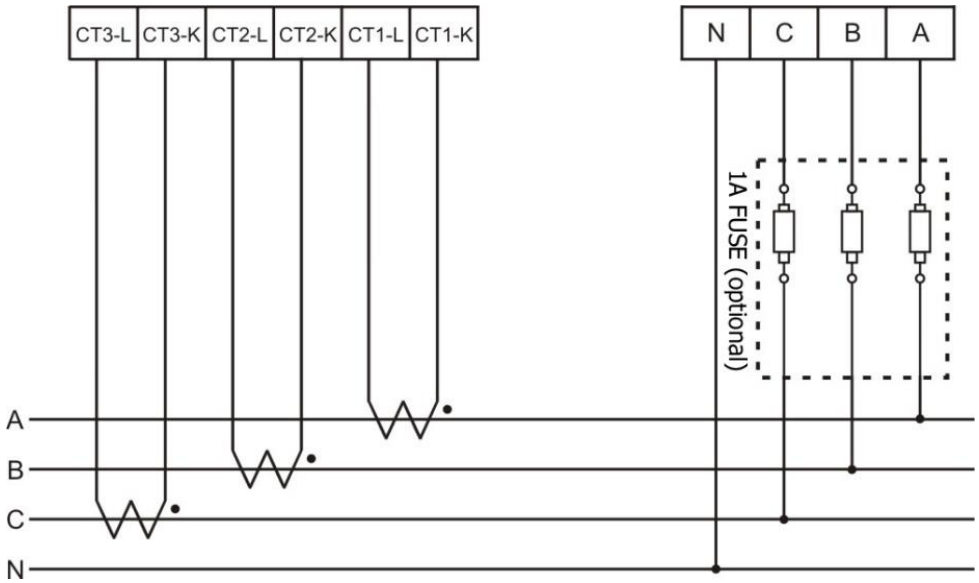
- 3P3W-3CT (PM-3033)

DIP switch: Wiring mode	SW 9	SW 10
3P3W-3CT	OFF	**ON**



- 3P4W-3CT (PM-3033)

DIP switch: Wiring mode	SW 9	SW 10
3P4W-3CT	**ON**	**ON**



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Chapter 5 LED Indicator

5.1. LED Indicator

The PM-3033 has 2 LED to indicate the unit power status, RS-485 communication, and power data calculation.

- **RUN:** Green, light up after RS-485 ready. LED will flash when the unit is processing RS-485 communication.
- **PWR:** Red, Power on LED always on.

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Chapter 6 Modbus-RTU Communication

6.1. RS-485 setting

- Default setting for RS-485: **19200, n, 8, 1**
- DIP switch (SW1-SW6) is used for Modbus address setting, default is 1, i.e. all OFF

  For example: Modbus address is 10，find the table of DIP switch 1-6 is

  ON, OFF, OFF, ON, OFF, OFF

6.1.1 SW1－SW6 setting

Setting Modbus-RTU address for communication (1-64)

Modbus Address	SW 1	SW 2	SW 3	SW 4	SW 5	SW 6
1	OFF	OFF	OFF	OFF	OFF	OFF
2	**ON**	OFF	OFF	OFF	OFF	OFF
3	OFF	**ON**	OFF	OFF	OFF	OFF
4	**ON**	**ON**	OFF	OFF	OFF	OFF
5	OFF	OFF	**ON**	OFF	OFF	OFF
6	**ON**	OFF	**ON**	OFF	OFF	OFF
7	OFF	**ON**	**ON**	OFF	OFF	OFF
8	**ON**	**ON**	**ON**	OFF	OFF	OFF
9	OFF	OFF	OFF	**ON**	OFF	OFF
10	**ON**	OFF	OFF	**ON**	OFF	OFF
11	OFF	**ON**	OFF	**ON**	OFF	OFF
12	**ON**	**ON**	OFF	**ON**	OFF	OFF
13	OFF	OFF	**ON**	**ON**	OFF	OFF
14	**ON**	OFF	**ON**	**ON**	OFF	OFF
15	OFF	**ON**	**ON**	**ON**	OFF	OFF
16	**ON**	**ON**	**ON**	**ON**	OFF	OFF
17	OFF	OFF	OFF	OFF	**ON**	OFF
18	**ON**	OFF	OFF	OFF	**ON**	OFF
19	OFF	**ON**	OFF	OFF	**ON**	OFF
20	**ON**	**ON**	OFF	OFF	**ON**	OFF
21	OFF	OFF	**ON**	OFF	**ON**	OFF
22	**ON**	OFF	**ON**	OFF	**ON**	OFF
23	OFF	**ON**	**ON**	OFF	**ON**	OFF
24	**ON**	**ON**	**ON**	OFF	**ON**	OFF

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25	**OFF**	OFF	OFF	**ON**	**ON**	OFF
26	**ON**	OFF	OFF	**ON**	**ON**	OFF
27	**OFF**	ON	OFF	**ON**	**ON**	OFF
28	**ON**	ON	OFF	**ON**	**ON**	OFF
29	**OFF**	OFF	ON	**ON**	**ON**	OFF
30	**ON**	OFF	ON	**ON**	**ON**	OFF
31	**OFF**	ON	ON	**ON**	**ON**	OFF
32	**ON**	ON	ON	**ON**	**ON**	OFF
33	**OFF**	OFF	OFF	**OFF**	**OFF**	ON
34	**ON**	OFF	OFF	**OFF**	**OFF**	ON
35	**OFF**	ON	OFF	**OFF**	**OFF**	ON
36	**ON**	ON	OFF	**OFF**	**OFF**	ON
37	**OFF**	OFF	ON	**OFF**	**OFF**	ON
38	**ON**	OFF	ON	**OFF**	**OFF**	ON
39	**OFF**	ON	ON	**OFF**	**OFF**	ON
40	**ON**	ON	ON	**OFF**	**OFF**	ON
41	**OFF**	OFF	OFF	**ON**	**OFF**	ON
42	**ON**	OFF	OFF	**ON**	**OFF**	ON
43	**OFF**	ON	OFF	**ON**	**OFF**	ON
44	**ON**	ON	OFF	**ON**	**OFF**	ON
45	**OFF**	OFF	ON	**ON**	**OFF**	ON
46	**ON**	OFF	ON	**ON**	**OFF**	ON
47	**OFF**	ON	ON	**ON**	**OFF**	ON
48	**ON**	ON	ON	**ON**	**OFF**	ON
49	**OFF**	OFF	OFF	**OFF**	**ON**	ON
50	**ON**	OFF	OFF	**OFF**	**ON**	ON
51	**OFF**	ON	OFF	**OFF**	**ON**	ON
52	**ON**	ON	OFF	**OFF**	**ON**	ON
53	**OFF**	OFF	ON	**OFF**	**ON**	ON
54	**ON**	OFF	ON	**OFF**	**ON**	ON
55	**OFF**	ON	ON	**OFF**	**ON**	ON
56	**ON**	ON	ON	**OFF**	**ON**	ON
57	**OFF**	OFF	OFF	**ON**	**ON**	ON
58	**ON**	OFF	OFF	**ON**	**ON**	ON
59	**OFF**	ON	OFF	**ON**	**ON**	ON
60	**ON**	ON	OFF	**ON**	**ON**	ON
61	**OFF**	OFF	ON	**ON**	**ON**	ON
62	**ON**	OFF	ON	**ON**	**ON**	ON
63	**OFF**	ON	ON	**ON**	**ON**	ON
64	**ON**	ON	ON	**ON**	**ON**	ON

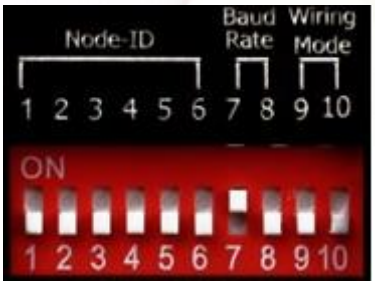
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● SW7－SW8 setting

PM-3033：For Baud Rate Setting

Baud Rate	SW 7	SW8
9600 bps	OFF	OFF
19200 bps (Default)	**ON**	OFF
38400 bps	OFF	**ON**
115200 bps	**ON**	**ON**



Add the Bias Resistor on RS-485 Network for stable signal

The RS-485 master is required to provide the bias for PM-3033 series. Otherwise, the tM-SG4 or SG-785 should be added to provide the bias. All ICP DAS controllers and converters provide the bias.

● SW9－SW10 setting

PM-3033：Select the different wiring mode

(Please select the Software setting, if 1P2W-1CT or 1P3W-2CT is used)

Wiring	SW 9	SW 10
Software setting	OFF	OFF
3P3W-2CT	**ON**	OFF
3P3W-3CT	OFF	**ON**
3P4W-3CT	**ON**	**ON**

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6.2 Modbus-RTU setting

6.2.1 Specifications

Protocol	Modbus-RTU
Transmission Specifications	Bits per Byte： 1 start bit 8 data bits, least significant bit sent first None Parity 1 stop bits Error Check： Cyclical Redundancy Check (CRC)
Baud Rate	9600, 19200 (Default), 38400, 115200
Modbus slave address	1-64 (Default = 1)

- Modbus Function Code：01h, 03h, 04h, 05h, 06h, 0Fh, 10h

Code	MODBUS_ name	Description
01h	Read Coils	Read boolean values of read/write location
05h	Write Single Coil	Set one boolean value of read/write location
0Fh	Write Multiple Coil	Set boolean values of read/write location
03h	Read Holding Registers	Read the contents of read/write location
06h	Write Single Register	Set the content of one read/write location
10h	Write Multiple Registers	Set the contents of read/write location
04h	Read Input Registers	Read the contents of read only location

Note: the max. data reading of Function 03 and Function04 is 125 registers

- **Data format**

  Integer：16 bits with sign, each with 1 register

  Unsigned Integer：16 bits without sign, each with 1 register

  Float：IEEE 754 Format, each with 2 registers

  Low word is first priority while transmit

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IEEE 754 Format

Definition of the floating format of the Bits

Data Hi Word， Hi Byte	Data Hi Word， Lo Byte	Data Lo Word， Hi Byte	Data Lo Word， Lo Byte
SEEE EEEE	EMMM MMMM	MMMM MMMM	MMMM MMMM

Value = $(-1)^{S} \times (1.M) \times 2^{E-127}$ $0 < E < 255$

S represents the sign bit where 1 is negative and 0 is positive

E is the two's complement exponent with an offset of 127.

i.e. an exponent of zero is represented by 127, an exponent of 1 by 128 etc.

M is the 23-bit normal mantissa. The highest bit is always 1 and, therefore, is not stored.

Transfer sequence (Float)

1	2	3	4
Data Low Word， High Byte	Data Low Word， Low Byte	Data High Word， High Byte	Data High Word， Low Byte

Transfer sequence (Inverse Integer)

1	2	3	4
Data High Word， High Byte	Data High Word， Low Byte	Data Low Word， High Byte	Data Low Word， Low Byte

Transfer sequence (Integer)

1	2	3	4
Data Low Word， High Byte	Data Low Word， Low Byte	Data High Word， High Byte	Data High Word， Low Byte

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6.2.2 Modbus Register

- Modbus Module #1 – Coil: Relay Value: N/A

- Modbus Module #2 – Holding Register : System Parameter Setting

Parameter name	Modbus Register		Len	Data Type	Range	Default value	Units	Comment
	Modicom Format	Hex						
Parity	44098	0x1001	Word	UInt	0: None 1: Odd Parity 2: Even Parity	0		Only work for RS-485 Interface
Stop Bit	44099	0x1002	Word	UInt	1: 1 stop bit 2: 2 stop bits	1		Only work for RS-485 Interface
PT_Ratio	44100	0x1003	Word	UInt	1-65535	100	0.01	
CT_Ratio	44101	0x1004	Word	UInt	1-65535	1		
Wiring Mode	44107	0x100A	Word	UInt	1: 1P2W 2: 1P3W 3: 3P3W2CT 4: 3P3W3CT 5: 3P4W3CT	5		Only work when SW9-SW10 is all off
Set Energy to Zero	44108	0x100B	Word	UInt	0x0055			Only Write
Reset to Factory Settings	44109	0x100C	Word	UInt	0x0055			Only Write, Re-power the module after setting
Default Frequency	44110	0x100D	Word	UInt	0x0055: Auto 0x0064: 50Hz 0x0078: 60Hz	0x0055		Re-power the module after setting or changing the frequency
Energy Absolute Accumulated Mode	44113	0x1010	Word	UInt	0: Enable 1: Disable	0		

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Harmonic Phase Select	44114	0x1011	Word	UInt	0: Disable 1: Phase A 2: Phase B 3: Phase C	0		
Display Voltage	44115	0x1012	Word	UInt	0: Default 1: Show as Vln 2: Show as Vll	0		Refer to Q5

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- Modbus Module #3 – Input Register : System Information

Parameter name	Modbus Register		Len	Data Type	Range	Default value	Units	Comment
	Modicom Format	Hex						
Wiring Type	30513	0x0200	Word	UInt	9: 1P2W 10: 1P3W 11: 3P3W2CT 12: 3P3W3CT 13: 3P4W 14: 3P3W2CT (HW) 15: 3P3W3CT (HW) 16: 3P4W (HW)	13		(HW)： set wiring by hardware Dip Switch
Phase Sequence	30514	0x0201	Word	UInt	0: Negative (ACB) 1: Positive (ABC)			Only work when 3P4W
Model Name	30515	0x0202	Word	UInt	3033: PM-3033	3033		
Model Type	30516	0x0203	Word	UInt	0x0001: 50Hz 0x0002: 60Hz	0x0002		
Firmware Version	30517	0x0204	Word	BCD		0x0100		Ver. 1.0

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- Modbus Module #4 – Input Register :Power value (Float)

Parameter name	Modbus Register		Len	Data Type	Range	Units	Comment
	Modicom Format	Hex					
V_a	34353-34354	0x1100-0x1101	DWord	Float		Volt	Refer to Q5
I_a	34355-34356	0x1102-0x1103	DWord	Float		Amp	
kW_a	34357-34358	0x1104-0x1105	DWord	Float		kW	
kvar_a	34359-34360	0x1106-0x1107	DWord	Float		kvar	
kVA_a	34361-34362	0x1108-0x1109	DWord	Float		kVA	
PF_a	34363-34364	0x110A-0x110B	DWord	Float			
kWh_a	34365-34366	0x110C-0x110D	DWord	Float			
kvarh_a	34367-34368	0x110E-0x110F	DWord	Float			
kVAh_a	34369-34370	0x1110-0x1111	DWord	Float			
V_b	34371-34372	0x1112-0x1113	DWord	Float		Volt	Refer to Q5
I_b	34373-34374	0x1114-0x1115	DWord	Float		Amp	
kW_b	34375-34376	0x1116-0x1117	DWord	Float		kW	
kvar_b	34377-34378	0x1118-0x1119	DWord	Float		kvar	
kVA_b	34379-34380	0x111A-0x111B	DWord	Float		kVA	
PF_b	34381-34382	0x111C-0x111D	DWord	Float			
kWh_b	34383-34384	0x111E-0x111F	DWord	Float			
kvarh_b	34385-34386	0x1120-0x1121	DWord	Float			
kVAh_b	34387-34388	0x1122-0x1123	DWord	Float			
V_c	34389-34390	0x1124-0x1125	DWord	Float		Volt	Refer to Q5
I_c	34391-34392	0x1126-0x1127	DWord	Float		Amp	
kW_c	34393-34394	0x1128-0x1129	DWord	Float		kW	
kvar_c	34395-34396	0x112A-0x112B	DWord	Float		kvar	
kVA_c	34397-34398	0x112C-0x112D	DWord	Float		kVA	
PF_c	34399-34400	0x112E-0x112F	DWord	Float			
kWh_c	34401-34402	0x1130-0x1131	DWord	Float			
kvarh_c	34403-34404	0x1132-0x1133	DWord	Float			
kVAh_c	34405-34406	0x1134-0x1135	DWord	Float			
V_avg	34407-34408	0x1136-0x1137	DWord	Float		Volt	
I_avg	34409-34410	0x1138-0x1139	DWord	Float		Amp	
kW_tot	34411-34412	0x113A-0x113B	DWord	Float		kW	
kvar_tot	34413-34414	0x113C-0x113D	DWord	Float		kvar	
kVA_tot	34415-34416	0x113E-0x113F	DWord	Float		kVA	

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PF_tot	34417-34418	0x1140-0x1141	DWord	Float			
kWh_tot	34419-34420	0x1142-0x1143	DWord	Float			
kvarh_tot	34421-34422	0x1144-0x1145	DWord	Float			
kVAh_tot	34423-34424	0x1146-0x1147	DWord	Float			
Freq_a	34425-34426	0x1148-0x1149	DWord	Float	45~65	Hz	
Freq_b	34427-34428	0x114A-0x114B	DWord	Float	45~65	Hz	
Freq_c	34429-34430	0x114C-0x114D	DWord	Float	45~65	Hz	
Freq_max	34431-34432	0x114E-0x114F	DWord	Float	45~65	Hz	
VTHD	34459-34460	0x116A-0x116B	DWord	Float	0~4		Phase set by **Harmonic Phase Select** Register
ITHD	34461-34462	0x116C-0x116D	DWord	Float	0~4		
Bi_Positive _kWh	34463-34464	0x116E-0x116F	DWord	Float			
Bi_Negative _kWh	34465-34466	0x1170-0x1171	DWord	Float			
Bi_Net _kWh	34467-34468	0x1172-0x1173	DWord	Float			
Bi_Total _kWh	34469-34470	0x1174-0x1175	DWord	Float			

Note:

The definition of bi-direction energy registers :

- Bi_Positive_kWh: = Sum(absolute(all channel's positive kWh in every sec.))
- Bi_Negative_kWh: = Sum(absolute(all channel's negative kWh in every sec.))
- Bi_Net_kWh: = Sum(all channel's kWh in every sec.)
- Bi_Total_kWh: = Sum(absolute(all channels kWh in every sec.))

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- Modbus Module #5 – Input Register :Power value (Inverse Integer)

Parameter name	Modbus Register		Len	Data Type	Range	Units	Comment
	Modicom Format	Hex					
V_a	34609- 34610	0x1200-0x1201	DWord	UInt32		0.1 Volt	
I_a	34611- 34612	0x1202-0x1203	DWord	UInt32		0.1A	
kW_a	34613- 34614	0x1204-0x1205	DWord	Int32		0.1kW	
kvar_a	34615- 34616	0x1206-0x1207	DWord	Int32		0.1kvar	
kVA_a	34617- 34618	0x1208-0x1209	DWord	Int32		0.1kVA	
PF_a	34619	0x120A	Word	Int	0~1000	0.001PF	0~1.000
kWh_a	34620- 34621	0x120B-0x120C	DWord	Int32	±0~99999999	0.1kWh	±0~9999999.9
kvarh_a	34622- 34623	0x120D-0x120E	DWord	Int32	±0~99999999	0.1kvarh	±0~9999999.9
kVAh_a	34624- 34625	0x120F-0x1210	DWord	Int32	0~99999999	0.1kVAh	0~9999999.9
V_b	34626- 34627	0x1211-0x1212	DWord	UInt32		0.1 Volt	
I_b	34628- 34629	0x1213-0x1214	DWord	UInt32		0.1A	
kW_b	34630- 34631	0x1215-0x1216	DWord	Int32		0.1kW	
kvar_b	34632- 34633	0x1217-0x1218	DWord	Int32		0.1kvar	
kVA_b	34634- 34635	0x1219-0x121A	DWord	Int32		0.1kVA	
PF_b	34636	0x121B	Word	Int	0~1000	0.001PF	0~1.000
kWh_b	34637- 34638	0x121C-0x121D	DWord	Int32	±0~99999999	0.1kWh	±0~9999999.9
kvarh_b	34639- 34640	0x121E-0x121F	DWord	Int32	±0~99999999	0.1kvarh	±0~9999999.9
kVAh_b	34641- 34642	0x1220-0x1221	DWord	Int32	0~99999999	0.1kVAh	0~9999999.9
V_c	34643- 34644	0x1222-0x1223	DWord	UInt32		0.1 Volt	
I_c	34645- 34646	0x1224-0x1225	DWord	UInt32		0.1A	
kW_c	34647- 34648	0x1226-0x1227	DWord	Int32		0.1kW	
kvar_c	34649- 34650	0x1228-0x1229	DWord	Int32		0.1kvar	
kVA_c	34651- 34652	0x122A-0x122B	DWord	Int32		0.1kVA	
PF_c	34653	0x122C	Word	Int	0~1000	0.001PF	0~1.000
kWh_c	34654- 34655	0x122D-0x122E	DWord	Int32	±0~99999999	0.1kWh	±0~9999999.9
kvarh_c	34656-34657	0x122F-0x1230	DWord	Int32	±0~99999999	0.1kvarh	±0~9999999.9
kVAh_c	34658-34659	0x1231-0x1232	DWord	Int32	0~99999999	0.1kVAh	0~9999999.9
V_avg	34660-34661	0x1233-x1234	DWord	UInt32		0.1 Volt	
I_avg	34662-34663	0x1235-0x1236	DWord	UInt32		0.1A	
kW_tot	34664-34665	0x1237-0x1238	DWord	Int32		0.1kW	
kvar_tot	34666-34667	0x1239-0x123A	DWord	Int32		0.1kvar	

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kVA_tot	34668-34669	0x123B-0x123C	DWord	Int32		0.1kVA	
PF_tot	34670	0x123D	Word	Int	0~1000	0.001PF	0~1.000
kWh_tot	34671-34672	0x123E-0x123F	DWord	Int32	±0~99999999	0.1kWh	±0~9999999.9
kvarh_tot	34673-34674	0x1240-0x1241	DWord	Int32	±0~99999999	0.1kvarh	±0~9999999.9
kVAh_tot	34675-34676	0x1242-0x1243	DWord	Int32	0~99999999	0.1kVAh	0~9999999.9
Freq_a	34677	0x1244	Word	Int	45~65	1Hz	45~65
Freq_b	34678	0x1245	Word	Int	45~65	1Hz	45~65
Freq_c	34679	0x1246	Word	Int	45~65	1Hz	45~65
Freq_max	34680	0x1247	Word	Int	45~65	1Hz	45~65

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- Modbus Module #6 – Input Register :Power value (Integer)

Parameter name	Modbus Register		Len	Data Type	Range	Units	Comment
	Modicom Format	Hex					
V_a	34865-34866	0x1300-0x1301	DWord	UInt32		0.1 Volt	
I_a	34867-34868	0x1302-0x1303	DWord	UInt32		0.1A	
kW_a	34869-34870	0x1304-0x1305	DWord	Int32		0.1kW	
kvar_a	34871-34872	0x1306-0x1307	DWord	Int32		0.1kvar	
kVA_a	34873-34874	0x1308-0x1309	DWord	Int32		0.1kVA	
PF_a	34875	0x130A	Word	Int	0~1000	0.001PF	0~1.000
kWh_a	34876-34877	0x130B-0x130C	DWord	Int32	±0~99999999	0.1kWh	±0~9999999.9
kvarh_a	34878-34879	0x130D-0x130E	DWord	Int32	±0~99999999	0.1kvarh	±0~9999999.9
kVAh_a	34880-34881	0x130F-0x1310	DWord	Int32	0~99999999	0.1kVAh	0~9999999.9
V_b	34882-34883	0x1311-0x1312	DWord	UInt32		0.1 Volt	
I_b	34884-34885	0x1313-0x1314	DWord	UInt32		0.1A	
kW_b	34886-34887	0x1315-0x1316	DWord	Int32		0.1kW	
kvar_b	34888-34889	0x1317-0x1318	DWord	Int32		0.1kvar	
kVA_b	34890-34891	0x1319-0x131A	DWord	Int32		0.1kVA	
PF_b	34892	0x131B	Word	Int	0~1000	0.001PF	0~1.000
kWh_b	34893-34894	0x131C-0x131D	DWord	Int32	±0~99999999	0.1kWh	±0~9999999.9
kvarh_b	34895-34896	0x131E-0x131F	DWord	Int32	±0~99999999	0.1kvarh	±0~9999999.9
kVAh_b	34897-34898	0x1320-0x1321	DWord	Int32	0~99999999	0.1kVAh	0~9999999.9
V_c	34899-34900	0x1322-0x1323	DWord	UInt32		0.1 Volt	
I_c	34901-34902	0x1324-0x1325	DWord	UInt32		0.1A	
kW_c	34903-34904	0x1326-0x1327	DWord	Int32		0.1kW	
kvar_c	34905-34906	0x1328-0x1329	DWord	Int32		0.1kvar	
kVA_c	34907-34908	0x132A-0x132B	DWord	Int32		0.1kVA	
PF_c	34909	0x132C	Word	Int	0~1000	0.001PF	0~1.000
kWh_c	34910-34911	0x132D-0x132E	DWord	Int32	±0~99999999	0.1kWh	±0~9999999.9
kvarh_c	34912-34913	0x132F-0x1330	DWord	Int32	±0~99999999	0.1kvarh	±0~9999999.9
kVAh_c	34914-34915	0x1331-0x1332	DWord	Int32	0~99999999	0.1kVAh	0~9999999.9
V_avg	34916-34917	0x1333-0x1334	DWord	UInt32		0.1 Volt	
I_avg	34918-34919	0x1335-0x1336	DWord	UInt32		0.1A	
kW_tot	34920-34921	0x1337-0x1338	DWord	Int32		0.1kW	
kvar_tot	34922-34923	0x1339-0x133A	DWord	Int32		0.1kvar	
kVA_tot	34924-34925	0x133B-0x133C	DWord	Int32		0.1kVA	

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PF_tot	34926	0x133D	Word	Int	0~1000	0.001PF	0~1.000
kWh_tot	34927-34928	0x133E-0x133F	DWord	Int32	±0~99999999	0.1kWh	±0~9999999.9
kvarh_tot	34929-34930	0x1340-0x1341	DWord	Int32	±0~99999999	0.1kvarh	±0~9999999.9
kVAh_tot	34931-34932	0x1342-0x1343	DWord	Int32	0~99999999	0.1kVAh	0~9999999.9
Freq_a	34933	0x1344	Word	Int	45~65	1Hz	45~65
Freq_b	34934	0x1345	Word	Int	45~65	1Hz	45~65
Freq_c	34935	0x1346	Word	Int	45~65	1Hz	45~65
Freq_max	34936	0x1347	Word	Int	45~65	1Hz	45~65

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Chapter 7 Modbus-TCP Communication

7.1 Default settings

Ethernet default settings：

IP Address	**192.168.255.1**
Subnet mask	**255.255.0.0**
Gateway	**192.168.0.1**
Port	**502**

For recovering to default settings, dip Init/Run Switch (SW 4) to Init position for 10 seconds after power on, the settings will be changed as default values. Must dip back to Run position and repower on after settings changed. User also can recover settings to default value by Modbus command.



SW1－SW2 setting

PM-3033：Select the different wiring mode

(Please select the Software setting, if 1P2W-1CT or 1P3W-2CT is used)

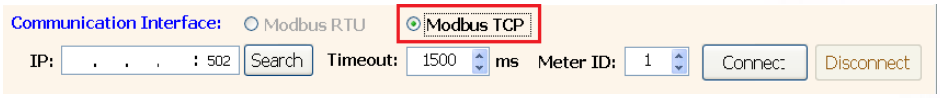
Wiring	SW 1	SW 2
Software setting	OFF	OFF
3P3W-2CT	**ON**	OFF
3P3W-3CT	OFF	**ON**
3P4W-3CT	**ON**	**ON**

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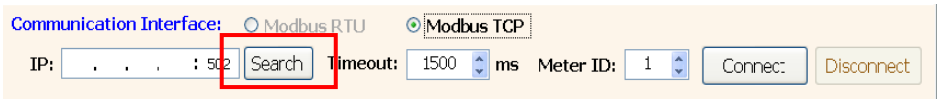
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7.1.1 Ethernet configurations

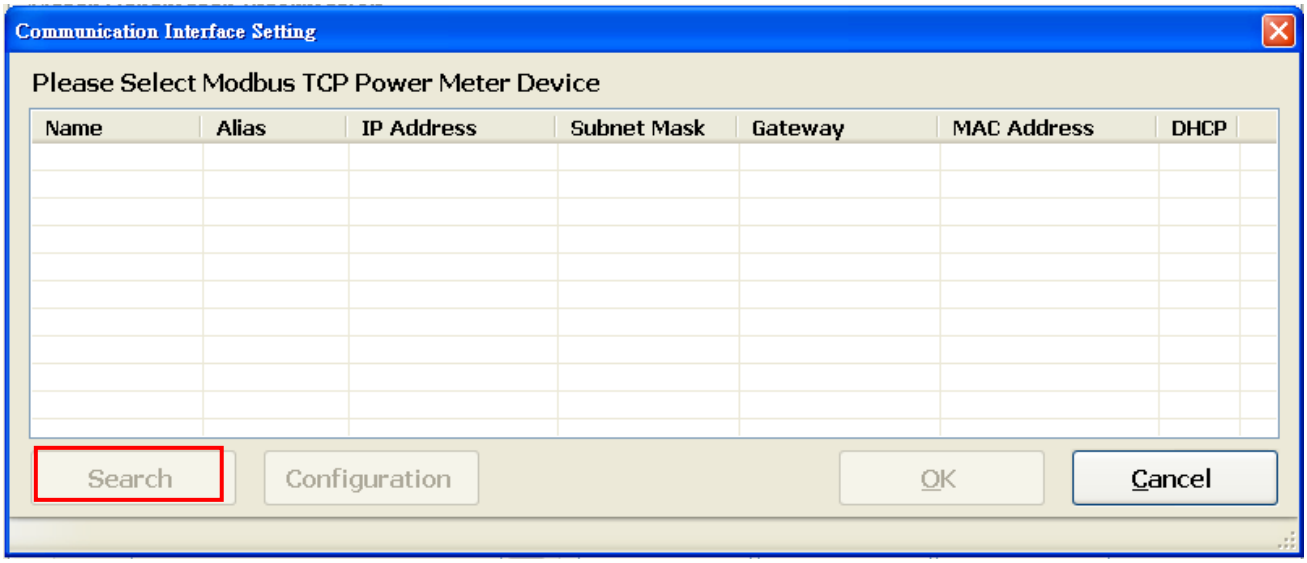
In the Power Meter Utility, please select “Modbus TCP” in the Communication Interface.



Click “Search” to enter the “Communication Interface Setting” window.



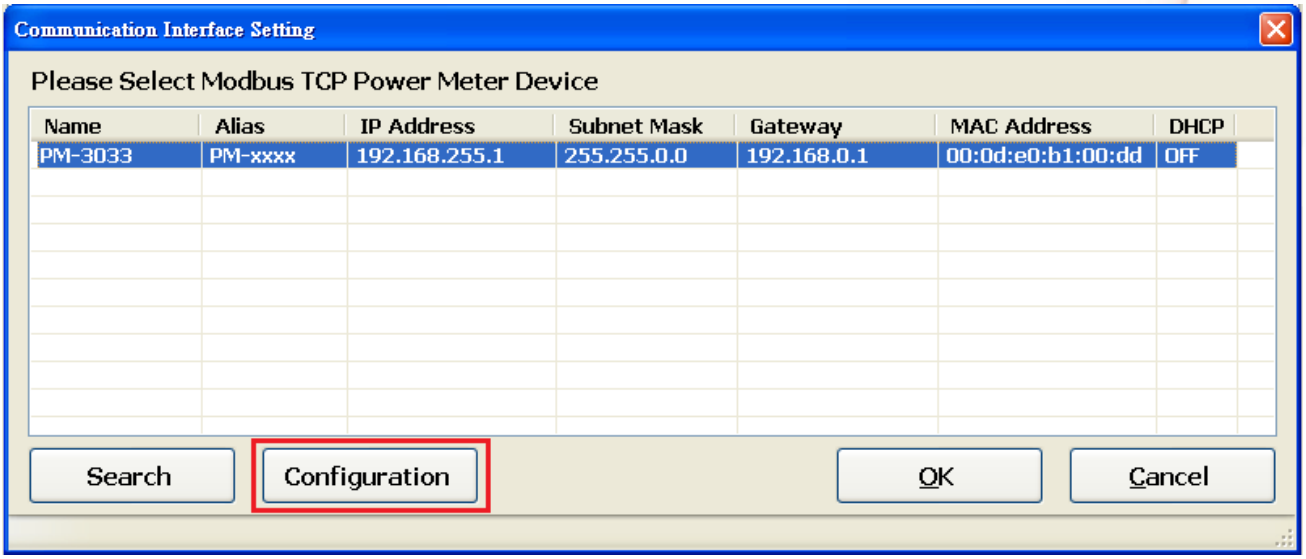
Click ”Search” button to search the available power meter.

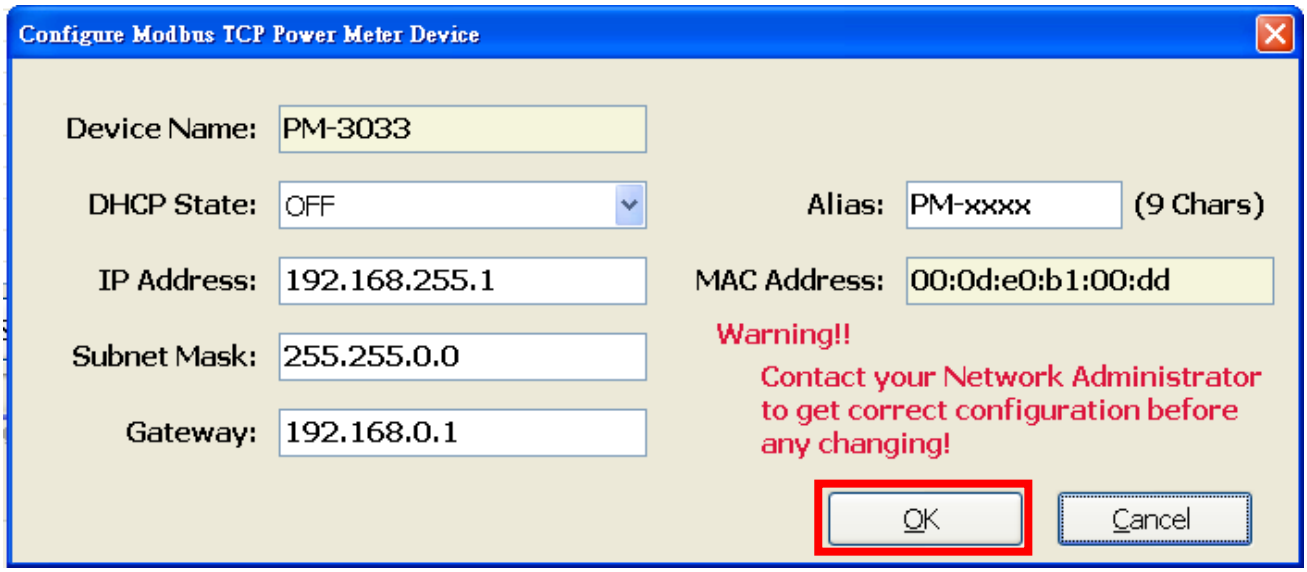


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Select the power meter which you want to modify parameters from the meter list, then click ”Configuration” button to setup the meter parameters. After complete all setting, click “OK”, and return to the meter list windows.





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7.2 Specifications

Modbus-TCP structure

Byte 00~05	Byte 06~11
6-byte header	RTU Data

Modbus-TCP(Byte 00~05)

Byte 00	Byte 01	Byte 02	Byte 03	Byte 04	Byte 05
Transaction identifier		Protocol identifier		Data length upper byte	Data length lower byte

Transaction identifier = Assign by Modbus/TCP Master (Client)
Protocol identifier = 0
Data length (upper byte) = 0
Data length (lower byte) = Depend on the number of the RTU Data bytes

RTU Data structure

Byte 06	Byte 07	Byte 08-09	Byte 10-11
Net ID (Station number)	Function Code	Data as needed	
		Address Mapping	data

Net ID (Station number)： Assign the device (Modbus/TCP slave)。

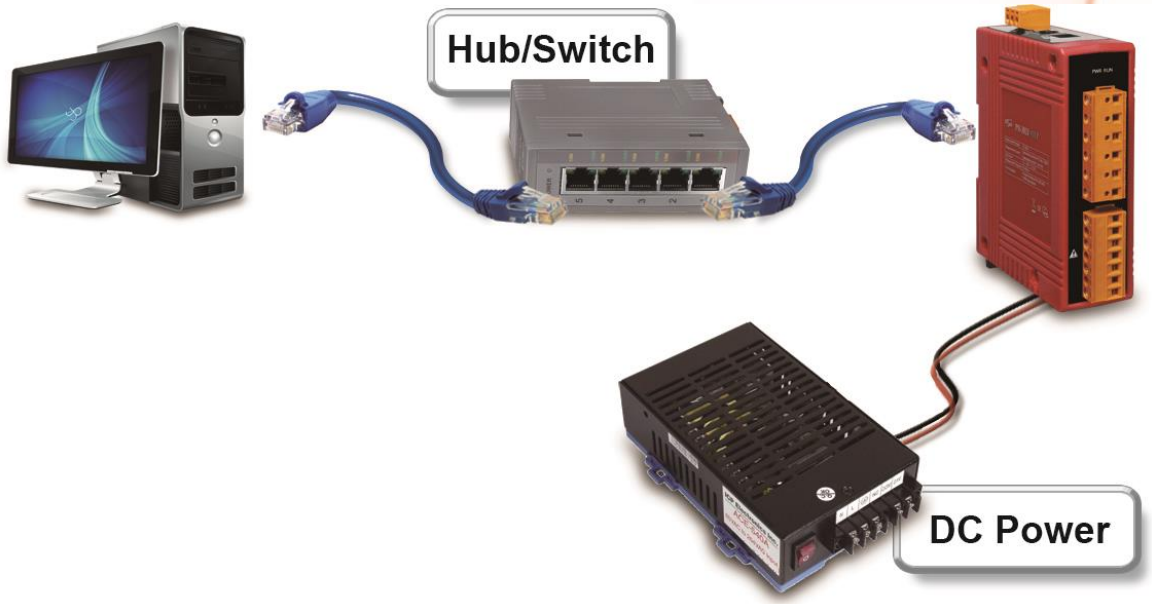
7.2.1 Modbus Register

Please refer the 6.2.2 Modbus Register。

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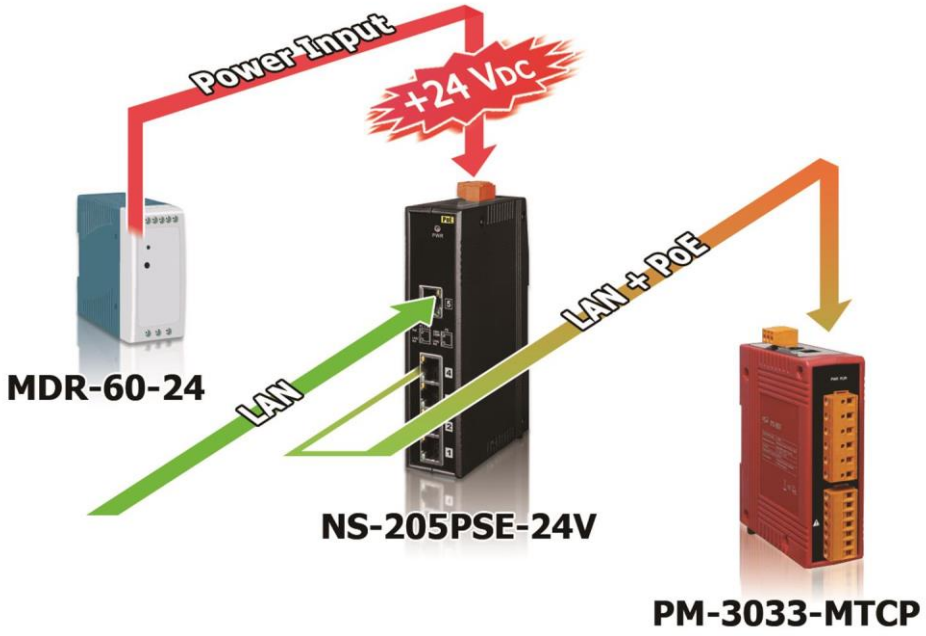
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7.3 Connecting the Power and Host PC (without PoE)



Power over Ethernet (PoE):

The PM-3033-MTCP module can be powered by an IEEE802.3af compliant PoE switch. Both Ethernet and power can be carried by an Ethernet cable eliminating the need for additional wiring and power supply.

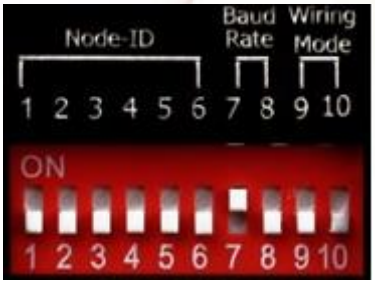


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Chapter 8 CANopen communication

8.1 CANopen setting



- Default setting for CANopen: **Baud rate:125 K b.p.s. , Node ID:1**
- DIP switch (SW1-SW6) is used for Node ID setting, default is 1, i.e. all OFF

  For example: Node ID is 10，find the table of DIP switch 1-6 is

  ON, OFF, OFF, ON, OFF, OFF

- SW1－SW6 setting

Setting CANopen Node ID for communication (1-64)

Modbus Address	SW 1	SW 2	SW 3	SW 4	SW 5	SW 6
1	OFF	OFF	OFF	OFF	OFF	OFF
2	**ON**	OFF	OFF	OFF	OFF	OFF
3	OFF	**ON**	OFF	OFF	OFF	OFF
4	**ON**	**ON**	OFF	OFF	OFF	OFF
5	OFF	OFF	**ON**	OFF	OFF	OFF
6	**ON**	OFF	**ON**	OFF	OFF	OFF
7	OFF	**ON**	**ON**	OFF	OFF	OFF
8	**ON**	**ON**	**ON**	OFF	OFF	OFF
9	OFF	OFF	OFF	**ON**	OFF	OFF
10	**ON**	OFF	OFF	**ON**	OFF	OFF
11	OFF	**ON**	OFF	**ON**	OFF	OFF
12	**ON**	**ON**	OFF	**ON**	OFF	OFF
13	OFF	OFF	**ON**	**ON**	OFF	OFF
14	**ON**	OFF	**ON**	**ON**	OFF	OFF
15	OFF	**ON**	**ON**	**ON**	OFF	OFF
16	**ON**	**ON**	**ON**	**ON**	OFF	OFF
17	OFF	OFF	OFF	OFF	**ON**	OFF
18	**ON**	OFF	OFF	OFF	**ON**	OFF
19	OFF	**ON**	OFF	OFF	**ON**	OFF
20	**ON**	**ON**	OFF	OFF	**ON**	OFF
21	OFF	OFF	**ON**	OFF	**ON**	OFF
22	**ON**	OFF	**ON**	OFF	**ON**	OFF
23	OFF	**ON**	**ON**	OFF	**ON**	OFF
24	**ON**	**ON**	**ON**	OFF	**ON**	OFF
25	OFF	OFF	OFF	**ON**	**ON**	OFF
26	**ON**	OFF	OFF	**ON**	**ON**	OFF
27	OFF	**ON**	OFF	**ON**	**ON**	OFF
28	**ON**	**ON**	OFF	**ON**	**ON**	OFF
29	OFF	OFF	**ON**	**ON**	**ON**	OFF

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30	**ON**	OFF	**ON**	**ON**	**ON**	OFF
31	OFF	**ON**	**ON**	**ON**	**ON**	OFF
32	**ON**	**ON**	**ON**	**ON**	**ON**	OFF
33	OFF	OFF	OFF	OFF	OFF	**ON**
34	**ON**	OFF	OFF	OFF	OFF	**ON**
35	OFF	**ON**	OFF	OFF	OFF	**ON**
36	**ON**	**ON**	OFF	OFF	OFF	**ON**
37	OFF	OFF	**ON**	OFF	OFF	**ON**
38	**ON**	OFF	**ON**	OFF	OFF	**ON**
39	OFF	**ON**	**ON**	OFF	OFF	**ON**
40	**ON**	**ON**	**ON**	OFF	OFF	**ON**
41	OFF	OFF	OFF	**ON**	OFF	**ON**
42	**ON**	OFF	OFF	**ON**	OFF	**ON**
43	OFF	**ON**	OFF	**ON**	OFF	**ON**
44	**ON**	**ON**	OFF	**ON**	OFF	**ON**
45	OFF	OFF	**ON**	**ON**	OFF	**ON**
46	**ON**	OFF	**ON**	**ON**	OFF	**ON**
47	OFF	**ON**	**ON**	**ON**	OFF	**ON**
48	**ON**	**ON**	**ON**	**ON**	OFF	**ON**
49	OFF	OFF	OFF	OFF	**ON**	**ON**
50	**ON**	OFF	OFF	OFF	**ON**	**ON**
51	OFF	**ON**	OFF	OFF	**ON**	**ON**
52	**ON**	**ON**	OFF	OFF	**ON**	**ON**
53	OFF	OFF	**ON**	OFF	**ON**	**ON**
54	**ON**	OFF	**ON**	OFF	**ON**	**ON**
55	OFF	**ON**	**ON**	OFF	**ON**	**ON**
56	**ON**	**ON**	**ON**	OFF	**ON**	**ON**
57	OFF	OFF	OFF	**ON**	**ON**	**ON**
58	**ON**	OFF	OFF	**ON**	**ON**	**ON**
59	OFF	**ON**	OFF	**ON**	**ON**	**ON**
60	**ON**	**ON**	OFF	**ON**	**ON**	**ON**
61	OFF	OFF	**ON**	**ON**	**ON**	**ON**
62	**ON**	OFF	**ON**	**ON**	**ON**	**ON**
63	OFF	**ON**	**ON**	**ON**	**ON**	**ON**
64	**ON**	**ON**	**ON**	**ON**	**ON**	**ON**

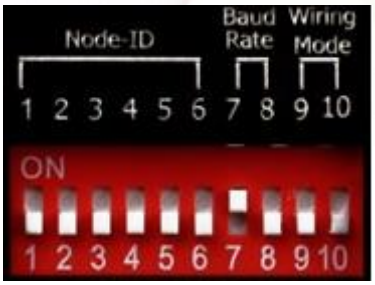
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● SW7－SW8 setting

PM-3033：For CANopen Baud Rate Setting

Baud Rate	SW 7	SW8
125 K bps(Default)	OFF	OFF
250 K bps	**ON**	OFF
500 K bps	OFF	**ON**
1M bps	**ON**	**ON**



● SW9－SW10 setting

PM-3033-CPS：Select the different wiring mode

(Please select the Software setting, if 1P2W-1CT or 1P3W-2CT is used)

Wiring	SW 9	SW 10
Software setting	OFF	OFF
3P3W-2CT	**ON**	OFF
3P3W-3CT	OFF	**ON**
3P4W-3CT	**ON**	**ON**

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8.2 CANopen Protocol

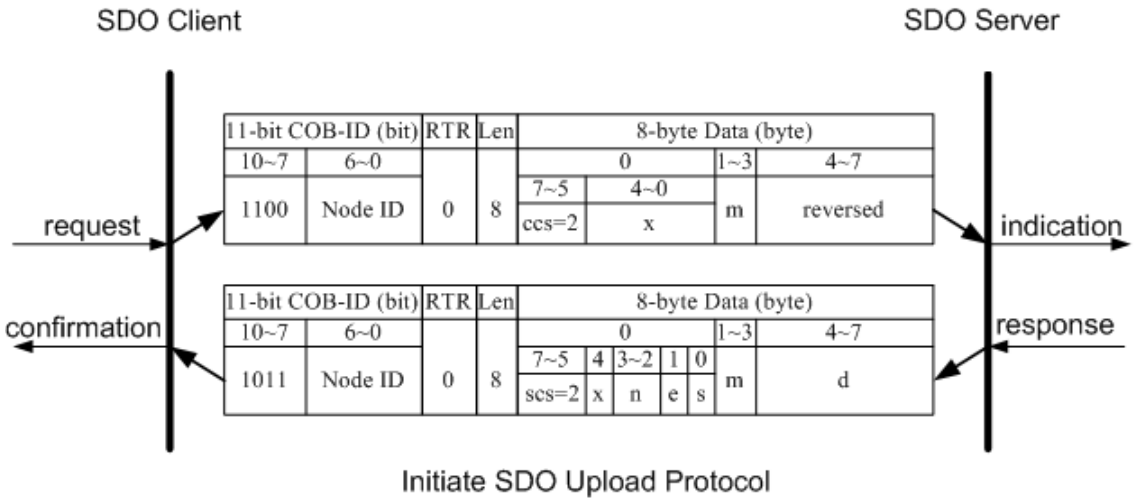
The CANopen is a kind of network protocols evolving from the CAN bus, used on car control system in early days, and has been greatly used in various applications, such as vehicles, industrial machines, building automation, medical devices, maritime applications, restaurant appliances, laboratory equipment & research.

8.2.1 SDO Introduction

8.2.1.1 Upload SDO Protocol

Initiate SDO Upload Protocol

Before transferring the SDO segments, the client and server need to communicate with each other by using the initiate SDO upload protocol. Via the initiate SDO upload protocol, the SDO client will inform the SDO server what object the SDO client wants to request. As well, the initiate SDO upload protocol is permitted to transmit up to four bytes of data. Therefore, if the data length of the object, which the SDO client can read, is equal to or less than the permitted data amount, the SDO communication will be finished only by using the initial SDO upload protocol, i.e. if the data upload is less enough to be transmitted in the initiate SDO upload protocol, then the upload SDO segment protocol will not be used. The communication process of this protocol is shown as follows.



Initiate SDO Upload Protocol

ccs: client command specified

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2: initiate upload request

scs: server command specified

2: initiate upload response

n : Only valid if **e** = 1 and **s** = 1, otherwise 0.

If valid, it indicates the number of bytes in **d** that do not contain data. Bytes [8-**n**, 7] do not contain segment data.

e: transfer type

0: normal transfer

1: expedited transfer

If the **e**=1, it means that the data of the object are equal or less than 4 bytes, and only initiate SDO upload protocol is needed. If **e**=0, the upload SDO segment protocol is necessary.

s: size indicator

0: Data set size is not indicated.

1: Data set size is indicated.

m: multiplexer

It represents the index/sub-index of the data to be transfer by the SDO. The first two bytes are the index value and the last byte is the sub-index value.

d: data

e=0, **s**=0: **d** is reserved for further use.

e=0, **s**=1: **d** contains the number of bytes to be uploaded, and byte 4 contains the least significant bit, and byte 7 contains the most significant bit.

e=1, **s**=1: **d** contains the data of length 4-**n** to be uploaded, the encoding depends on the type of the data referenced by index and sub-index.

e=1, **s**=0: **d** contains unspecified number of bytes to be uploaded.

x: not used, always 0

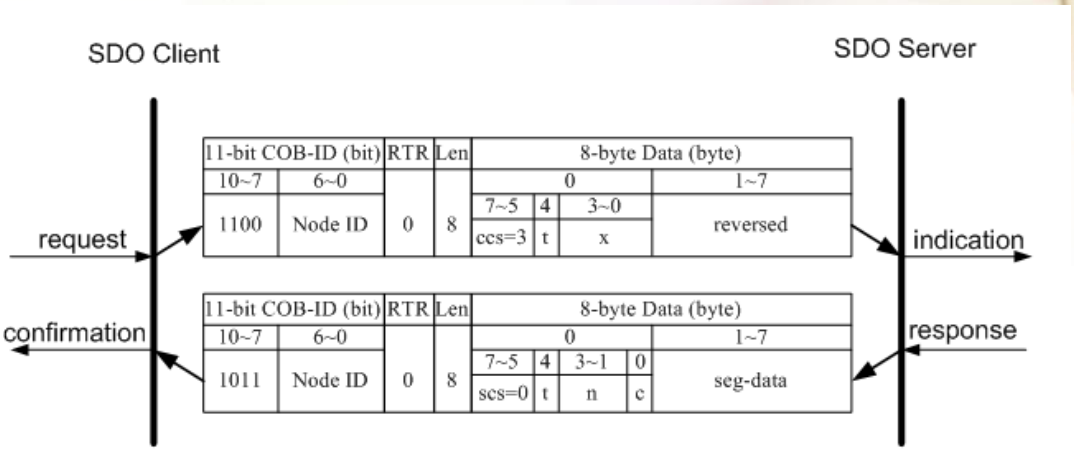
reserved: reserved for further use , always 0

Upload SDO Segment Protocol

When the upload data length is over 4 bytes, the upload SDO segment protocol will be needed. After finishing the transmission of the initiate SDO upload protocol, the SDO client will start to upload the data. The upload SDO segment protocol will comply with the process shown below.

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Upload SDO Segment Protocol

ccs: client command specified

3: upload segment request

scs: server command specified

0: upload segment response

t: toggle bit.

This bit must alternate for each subsequence segment that is uploaded. The first segment will have the toggle bit set to 0. The toggle bit will be equal for the request and response message.

c : indicates whether where are still more segments to be uploaded

0: more segments to be uploaded.

1: no more segment to be uploaded.

seg-data: It is at most 7 bytes of segment data to be uploaded.

The encoding depends on the type of the data referenced by index and sub-index.

n: It indicates the number of bytes in **seg-data** that do not contain segment data.

Bytes [8-**n**, 7] do not contain segment data. **n** = 0 if no segment size is indicated.

x: not used, always 0

reserved: reserved for further use , always 0

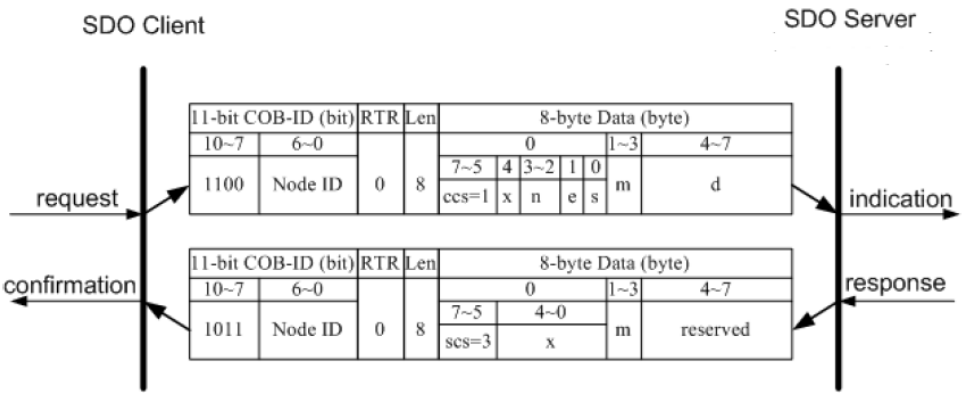
8.2.1.2 Download SDO Protocol

Initiate SDO Download Protocol

The download modes are similar to the upload modes, but different in some parameters of the SDO messages. They are also separated into two steps. If the download data length is less than 4 bytes, the download action will finish in the download initialization protocol. Otherwise, the download segment protocol will be needed. These two protocols are shown below.

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Initiate SDO Download Protocol

ccs: client command specified

1: initiate download request

scs: server command specified

3: initiate download response

n: Only valid if e = 1 and s = 1, otherwise 0.

If valid, it indicates the number of bytes in d that do not contain data. Bytes [8-n, 7] do not contain segment data.

e: transfer type

0: normal transfer

1: expedited transfer

If the e=1, it means that the data of the object are equal or less than 4 bytes, and only initiate SDO download protocol is needed. If e=0, the download SDO segment protocol is necessary.

s: size indicator

0: Data set size is not indicated.

1: Data set size is indicated.

m: multiplexer

It represents the index/sub-index of the data to be transfer by the SDO. The first two bytes are the index value and the last byte is the sub-index value.

d: data

e=0, s=0: d is reserved for further use.

e=0, s=1: d contains the number of bytes to be downloaded, and byte 4 contains the least significant bit, and byte 7 contains the most significant bit.

e=1, s=1: d contains the data of length 4-n to be downloaded, the encoding depends on the type of the data referenced by index and sub-index.

e=1, s=0: d contains unspecified number of bytes to be downloaded.

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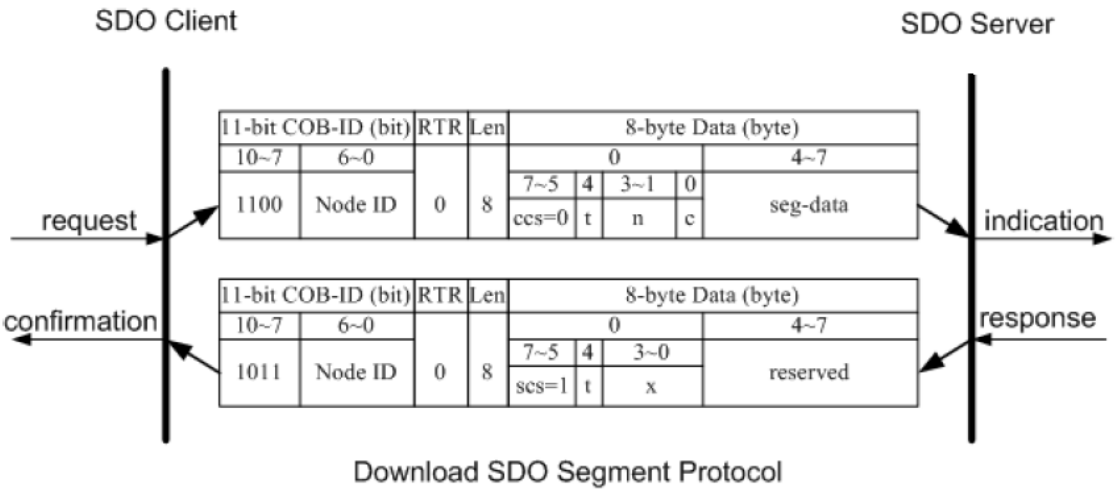
x: not used, always 0

reserved: reserved for further use , always 0

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Download Segment Protocol



Download SDO Segment Protocol

ccs: client command specified

0: download segment request

scs: server command specified

1: download segment response

seg-data: It is at most 7 bytes of segment data to be downloaded.

The encoding depends on the type of the data referenced by index and sub-index.

n: It indicates the number of bytes in seg-data that do not contain segment data.

Bytes [8-n, 7] do not contain segment data. n = 0 if no segment size is indicated.

c: It indicates whether there are still more segments to be downloaded.

0:more segments to be downloaded.

1:no more segments to be downloaded.

t: toggle bit

This bit must alternate for each subsequent segment that is downloaded. The first segment will have the toggle-bit set to 0.The toggle bit will be equal for the request and the response message.

x: not used, always 0

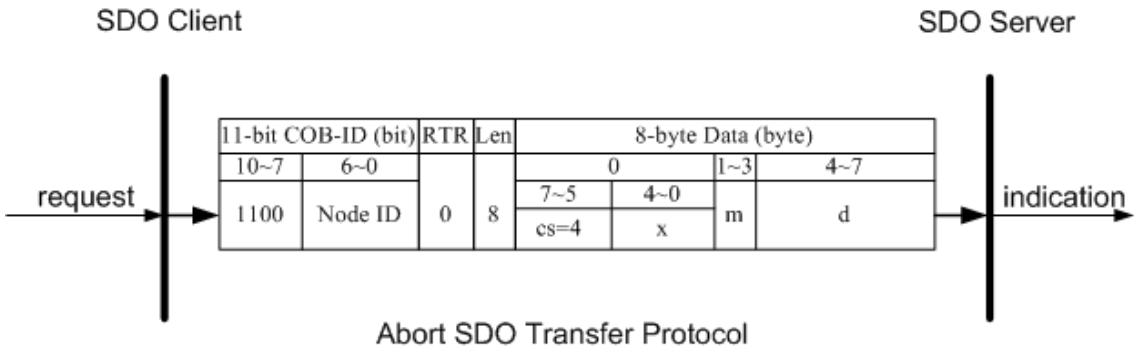
reserved: reserved for further use , always 0

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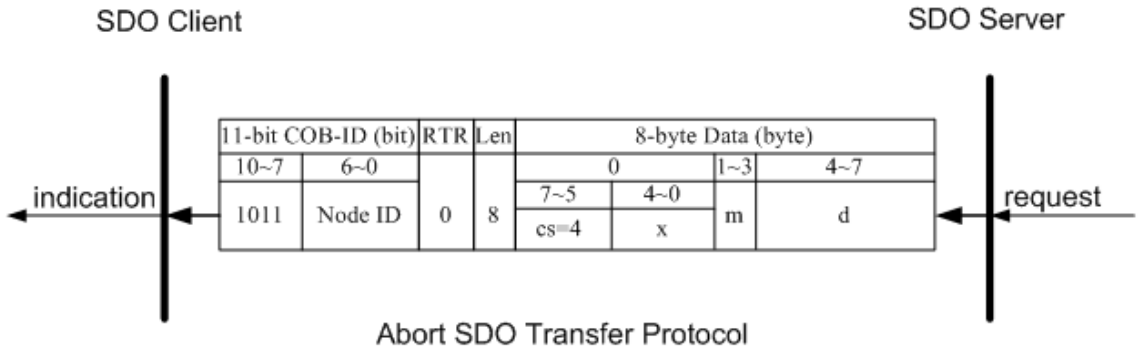
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8.2.1.3 Abort SDO Transfer Protocol

In some conditions, the SDO client or SDO server will terminate the SDO transmission. For example, the value of entries that users want to modify does not exist or is read-only, even users wouldn't continue the uncompleted SDO protocol under some special situations. When these conditions occur, both the client and the server can be activated to send the Abort SDO Transfer message. The Abort SDO Transfer protocol is shown below.



Abort SDO Transfer Protocol



Abort SDO Transfer Protocol

cs: command specified
4: abort transfer request

x: not used, always 0

m: multiplexer
It represents index and sub-index of the SDO

d: contains a 4-byte "Abort Code" about the reason for the abort.

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Abort Code	Description
0503 0000h	Toggle bit not alternated.
0504 0000h	SDO protocol timed out.
0504 0001h	Client/server command specified not valid or unknown.
0504 0002h	Invalid block size (block mode only).
0504 0003h	Invalid sequence number (block mode only).
0504 0004h	CRC error (block mode only).
0504 0005h	Out of memory.
0601 0000h	Unsupported access to an object.
0601 0001h	Attempt to read a write only object.
0601 0002h	Attempt to write a read only object.
0602 0000h	Object does not exist in the object dictionary.
0604 0041h	Object cannot be mapped to the PDO.
0604 0042h	The number and length of the objects to be mapped would exceed PDO length.
0604 0043h	General parameter incompatibility reason.
0604 0047h	General internal incompatibility in the device.
0606 0000h	Access failed due to a hardware error.
0607 0010h	Data type does not match, length of service parameter does not match
0607 0012h	Data type does not match, length of service parameter too high
0607 0013h	Data type does not match, length of service parameter too low
0609 0011h	Sub-index does not exist.
0609 0030h	Value range of parameter exceeded (only for write access).
0609 0031h	Value of parameter written too high.
0609 0032h	Value of parameter written too low.
0609 0036h	Maximum value is less than minimum value.
0800 0000h	General error.
0800 0020h	Data cannot be transferred or stored to the application.
0800 0021h	Data cannot be transferred or stored to the application because of local control.
0800 0022h	Data cannot be transferred or stored to the application because of the present device state.
0800 0023h	Object dictionary dynamic generation fails or no object dictionary is present (e.g. object dictionary is generated from file and generation fails because of a file error).

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8.2.2 PDO Introduction

8.2.2.1 PDO COB-ID Parameters

Before the real-time data are transmitted by the PDO, it is necessary to check the COB-ID parameter of this PDO in the PDO communication objects. This parameter setting controls the COB-ID of the PDO communication, which is in 32 bits, and each bit with its meaning is given in the table follow.

Bit Number	Value	Meaning
31(MSB)	0	PDO exits (PDO is valid)
	1	PDO does not exist (PDO is not valid)
30	0	RTR allowed on this PDO
	1	No RTR allowed on this PDO
29	0	11-bit ID (CAN 2.0A)
	1	29-bit ID (CAN 2.0B)
28-11	0	If bit 29=0
	X	If bit 29=1: 28-11 bits of 29-bit COB-ID
10-0(LSB)	X	10-0 bits of COB-ID

Note: PM-3033-CPS supports CAN 2.0A only.

In the following table, it's regarding the default PDO COB-ID parameters.

Number of PDO	Default COB-ID	
	Bit10~Bit7 (Function Code)	Bit6~Bit0
TxPDO1	0011	Node-ID
TxPDO2	0101	Node-ID
TxPDO3	0111	Node-ID
TxPDO4	1001	Node-ID
RxPDO1	0100	Node-ID
RxPDO2	0110	Node-ID
RxPDO3	1000	Node-ID
RxPDO4	1010	Node-ID

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Note:

1. Users can also define the PDO COB-ID by themselves. Actually, all COB-ID can be defined by users except the reserved COB-ID described in the table of the section 3.1. It is important to avoid the conflict with the defined COB-ID used in the same node.
2. The PDO COB-ID parameters cannot be changed if the PDO is valid (bit 31 =0).

8.2.2.2 Transmission Type

The transmission type is one of the several parameters defined in PDO communication objects with sub-index 02. Each PDO has its own transmission type. The transmission type can indicate the transmission or reception character for its corresponding PDO. The following table describes the relationship between the value of the transmission type and the PDO character. For example, if users used transmission type 0 for the first TxPDO, the CANopen device will follow the rule of the acyclic and synchronous PDO transmission.

Transmission Type	PDO Transmission Method				
	cyclic	acyclic	synchronous	Asynchronous	RTR only
0		**O**	**O**		
1-240	**O**		**O**		
241-251	----------Reserved----------				
252			**O**		**O**
253				**O**	**O**
254				**O**	
255				**O**	

Note:

- The transmission type 1-240 indicates how many SYNC objects the TxPDO will be triggered. The RxPDO is always triggered by the following SYNC upon reception of data independent of the transmission types 0-240.
- The transmission type 252 and 253 are only used for TxPDO. The transmission type 252 means that the data is updated (but not sent) immediately after reception of the SYNC object. For these two transmission types, the PDO is only transmitted on remote transmission requests.
- For the transmission types 254 and 255, the event timer will be used in the TxPDO.

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The PDO, including the DI value, will be sent when the DI value is changed. And both transmission types will directly trigger an update of the mapped data when receiving the RxPDO.

- The PM-3033-CPS doesn't support RxPDO.

8.2.2.3 PDO Communication Rule

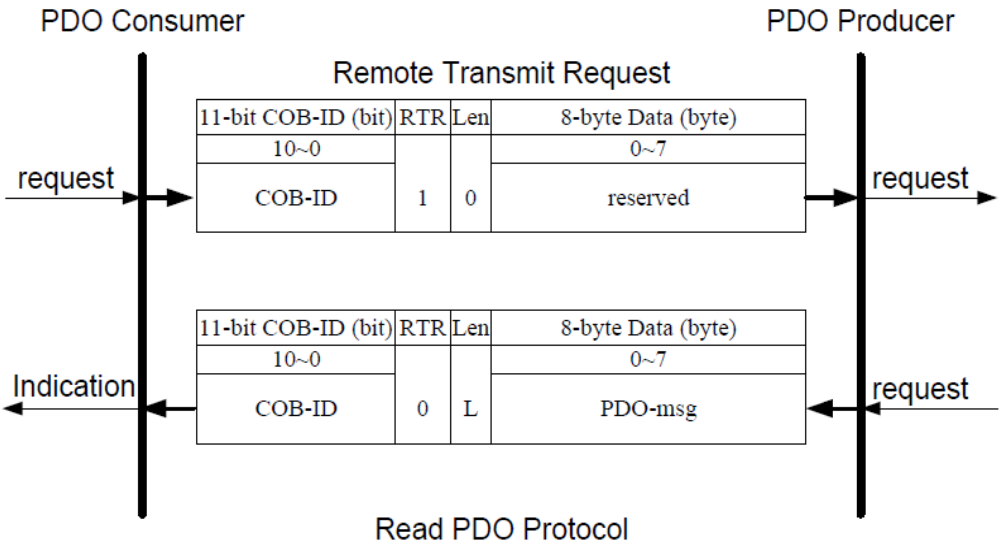
The PDO related objects are indicated from index 0x1400 to 0x1BFF. For the PM-3033-CPS, RxPDO communication objects are not used. The ranges of the TxPDO communication objects and the mapping objects are from index 0x1800 to index 0x1813 and from index 0x1A00 to index 0x1A13 respectively. Moreover, each PDO communication object has its own PDO mapping object.

For example, the first TxPDO communication object is stored in the entry with index 0x1800, and the corresponding mapping object is stored in an entry with index 0x1A00. The object with index 0x1801 and the object with index 0x1A01 are a group, and so on. Therefore, before users access the practical data via PDO communication, each parameter for the PDO communications and mapping objects must be controlled.

Besides, only PDO communications can be used in the NMT operational state. Users can use the NMT module control protocol to change the NMT state of the PM-3033-CPS. It is described in the section 8.3.3. Besides, during communication via the PDO messages, the data length of the PDO message must match with the PDO mapping object. If the data length 'L' of the PDO message exceeds the total bytes 'n' of the PDO mapping object entries, only the first 'n' bytes of the PDO message are used by the PDO consumer. If 'L' is less than 'n', the PDO message will not be disposed by the PDO consumer, and an Emergency message with error code 8210h will be transmitted to the PDO producer. The PDO communication set is shown as follows.

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COB-ID: the default PDO COB-ID, or the PDO COB-ID defined by users

L: the data length about how many bytes the PDO message has

PDO-msg: the real-time data or the data which can be mapped into the PDO mapping objects

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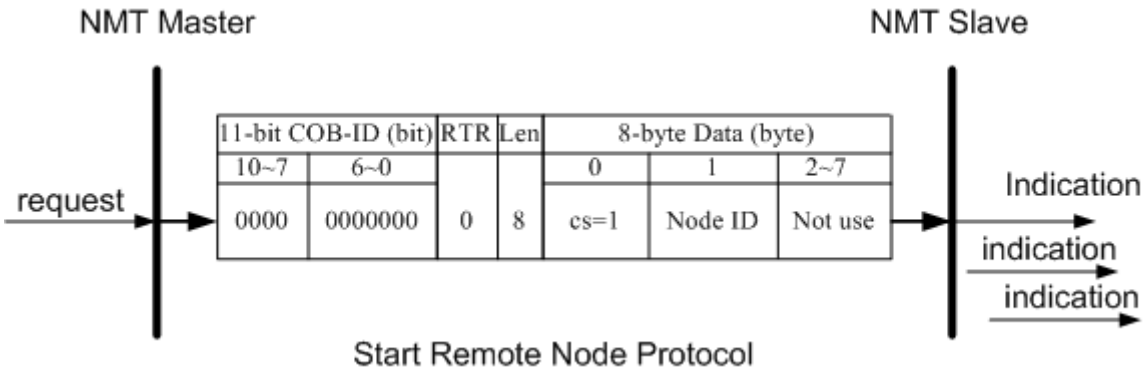
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8.2.3 NMT Introduction

8.2.3.1 Module Control Protocol

The NMT communication set can be applied for changing the NMT slave status. The following figure shows how to change the different NMT statuses for the PM-3033-CPS.

Start Remote Node Protocol



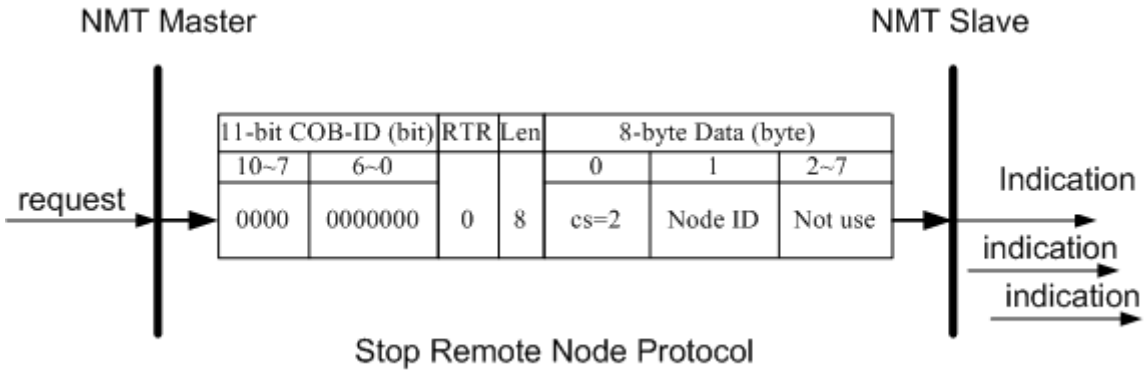
Start Remote Node Protocol

cs: NMT command specified

1: start

Node ID: the node ID of the NMT slave device

Stop Remote Node Protocol



Stop Remote Node Protocol

cs: NMT command specified

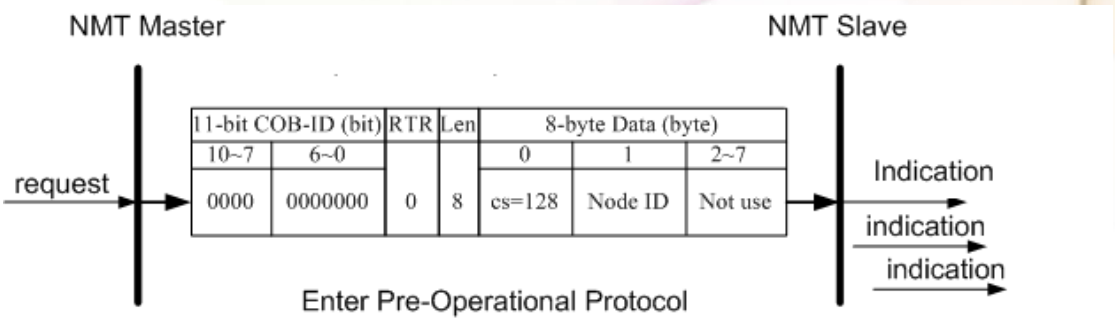
2: stop

Node ID: the node ID of the NMT slave device

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Enter Pre-Operational Protocol

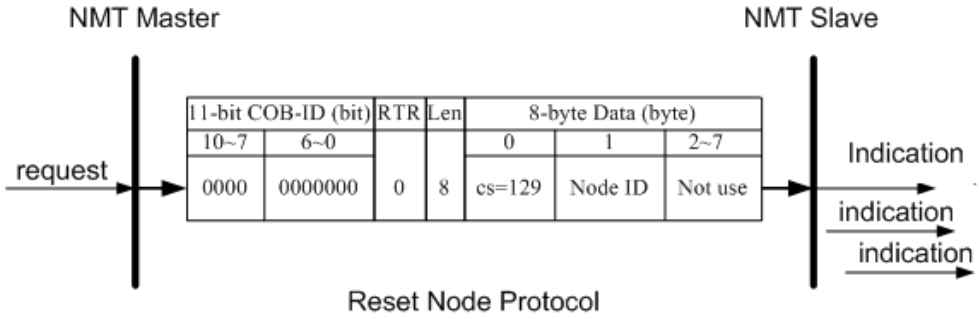


cs: NMT command specified

128: enter PRE-OPERATIONAL

Node ID: the node ID of the NMT slave device

Reset Node Protocol



cs : NMT command specified

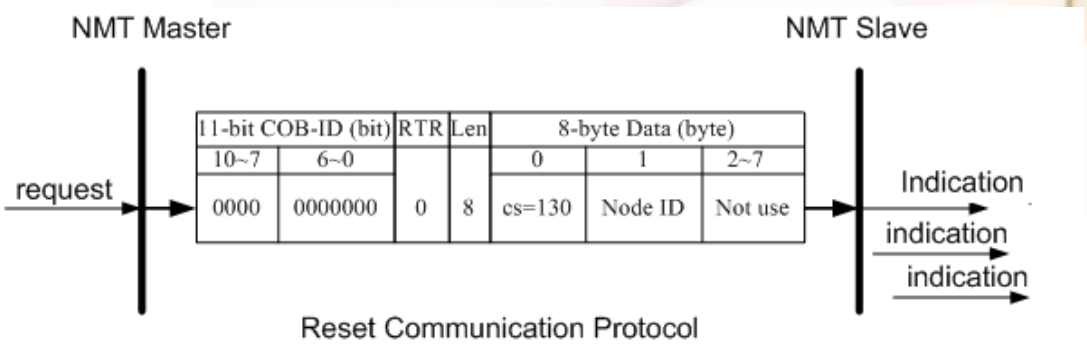
129: Reset_Node

Node ID : the node ID of the NMT slave device

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Reset Communication Protocol



Reset Communication Protocol

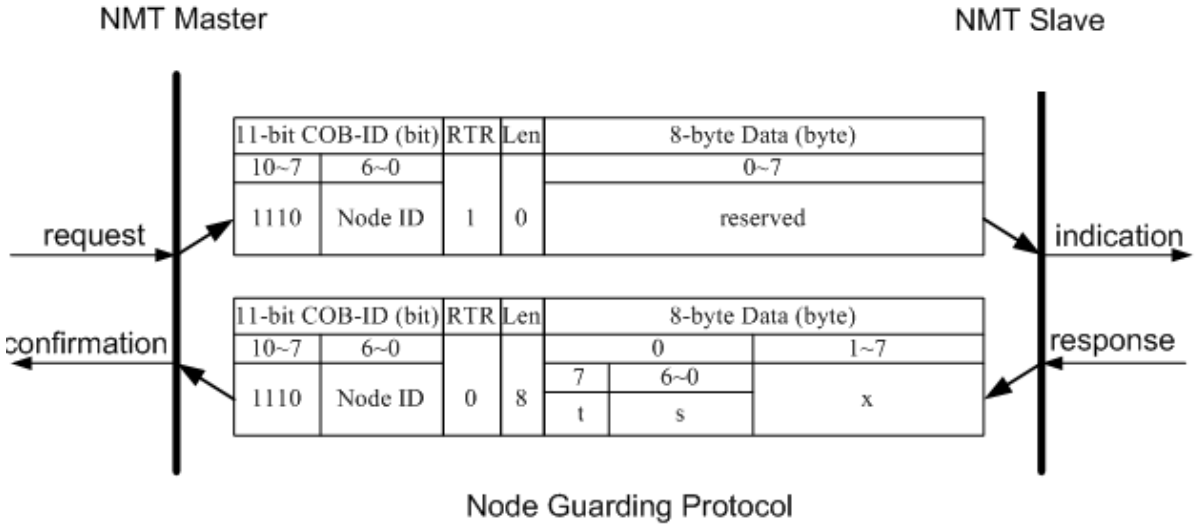
cs: NMT command specified

130: Reset_Communication

Node ID: the node ID of the NMT slave device

8.2.3.2 Error Control Protocol

Error Control Protocol is a kind of the solution to check whether the CANopen device is still alive or not. And its related objects include 0x100C and 0x100D. The 0x100C is the guard time, and the 0x100D is the life time factor. The node life time is the guard time multiplied by the life time factor. The Node Guarding timer of the PM-3033-CPS will start to count after receiving the first RTR message for the guarding identifier. The communication set of the Error Control protocol is displayed below.



Node Guarding Protocol

t: toggle bit

The value of this bit will be alternatively changed between two consecutive responses from the NMT slave. After the Node Guarding protocol becomes active, the value of the toggle-bit of the first response will be 0.

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s: the state of the NMT Slave

4: STOPPED

5: OPERATIONAL

127: PRE_OPERATIONAL

8.2.4 Special Functions for PM-3033-CPS

8.2.4.1 Power Meter Data Table

The PM-3033-CPS Manufacturer in the Specific Profile Area defines some entries, which are used for the power meter data. The objects with index 0x3200~0x3209 will map to the PDOs as below table. The D0 to D7 represent the CANopen message from Data0 to Data7.

No.(PDO)	COB-ID	Data Length	D0~D3	D4~D7
1	0x180+Node-ID	8	kW(Kw_a)	kWh_a
2	0x280+Node-ID	8	kW(Kw_b)	kWh_b
3	0x380+Node-ID	8	kW(Kw_c)	kWh_c
4	0x480+Node-ID	8	kW(Kw_tot)	kWh_tot
5	---	8	Volt(V_a)	Amp(I_a)
6	---	8	Volt(V_b)	Amp(I_b)
7	---	8	Volt(V_c)	Amp(I_c)
8	---	8	Volt(V_avg)	Amp(I_avg)
9	---	8	kvar(kvar_a)	kVA(Kva_a)
10	---	8	kvar(kvar_b)	kVA(Kva_b)
11	---	8	kvar(kvar_c)	kVA(Kva_c)
12	---	8	kvar(kvar_tot)	kVA(Kva_tot)
13	---	8	PF_a	kVAh_a
14	---	8	PF_b	kVAh_b
15	---	8	PF_c	kVAh_c
16	---	8	PF_tot	kVAh_tot
17	---	8	kvarh_a	Freq_a
18	---	8	kvarh_b	Freq_b
19	---	8	kvarh_c	Freq_c
20	---	8	kvarh_tot	Freq_avg

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8.3 Object Dictionary of PM-3033-CPS

8.3.1 Communication Profile Area

The following tables are regarding each entry of the communication profile area is defined in PM-3033-CPS. For the convenient purpose, all communication entries are divided into several tables. They are “General Communication Entries”, “TxPDO Communication Entries”, and “TxPDO Mapping Communication Entries”.

Please note that in the table header with “Idx”, “Sidx” and “Attr” represent “index”, “sub-index”, and “attribute” respectively. The sign “---” in the default field means that the default is not defined or can be defined conditionally by the firmware built in PM-3033-CPS. In the table, the number accompanying letter “h” indicates that this value is in the hex format.

General Communication Entries

Idx	Sidx	Description	Type	Attr	Default
1000h	0h	device type	UNSIGNED 32	RO	---
1001h	0h	error register	UNSIGNED 8	RO	---
1003h	0h	largest sub-index supported for “predefine error field”	UNSIGNED 8	RO	0h
	1h	actual error (the newest one)	UNSIGNED 32	RO	---
	…	…	…	…	---
	5h	actual error (the oldest one)	UNSIGNED 32	RO	---
1005h	0h	COB-ID of Sync message	UNSIGNED 32	RW	80h
1008h	0h	manufacturer device name	VISIBLE_STRING	RO	“PM-3033-CPS”
1009h	0h	manufacturer hardware version	VISIBLE_STRING	RO	"1.21"
100Ah	0h	manufacturer software version	VISIBLE_STRING	RO	"3.10-20180717"
100Ch	0h	guard time	UNSIGNED 16	RW	0
100Dh	0h	life time factor	UNSIGNED 8	RW	0
1010h	0h	largest sub-index supported for “store parameters”	UNSIGNED 8	RO	1
	1h	save all communication parameters	UNSIGNED 32	RW	--
1011h	0h	largest sub-index supported for	UNSIGNED 8	RO	1

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		“restore default parameters”			
	1h	restore all default parameters	UNSIGNED 32	RW	--
1014h	0h	COB-ID of EMCY	UNSIGNED 32	RW	80h+Node-ID
1015h	0h	Inhibit time of EMCY	UNSIGNED 16	RW	0
1018h	0h	largest sub-index supported for “identity object”	UNSIGNED 8	RO	1
	1h	vendor ID	UNSIGNED 32	RO	0000013Ch
	2h	product code	UNSIGNED 32	RO	00003133h
	3h	revision number	UNSIGNED 32	RO	00000003h
	4h	serial number	UNSIGNED 32	RO	6CD3683Ch

SDO Communication Entries

Idx	Sidx	Description	Type	Attr	Default
1200h	0h	largest sub-index supported for “server SDO parameter”	UNSIGNED 8	RO	2
	1h	COB-ID form client to server (RxSDO)	UNSIGNED 32	RO	600h+Node-ID
	2h	COB-ID form server to clien t(TxSDO)	UNSIGNED 32	RO	580h+Node-ID

TxPDO Communication Entries

Idx	Sidx	Description	Type	Attr	Default
1800h	0	largest sub-index supported for “receive PDO parameter”	UNSIGNED 8	RO	5
	1	COB-ID used by PDO (Tx)	UNSIGNED 32	RW	180h+Node-ID
	2	transmission type	UNSIGNED 8	RW	FFh
	3	inhibit time	UNSIGNED 16	RW	0
	4	Reversed	…	…	…
	5	event timer	UNSIGNED 16	RW	0
1801h	0	largest sub-index supported for “receive PDO parameter”	UNSIGNED 8	RO	5
	1	COB-ID used by PDO (Tx)	UNSIGNED 32	RW	280h+Node-ID
	2	transmission type	UNSIGNED 8	RW	FFh
	3	inhibit time	UNSIGNED 16	RW	0
	4	Reversed	…	…	…
	5	event timer	UNSIGNED 16	RW	0

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1802h	0	largest sub-index supported for “receive PDO parameter”	UNSIGNED 8	RO	5
	1	COB-ID used by PDO (Tx)	UNSIGNED 32	RW	380h+Node-ID
	2	transmission type	UNSIGNED 8	RW	FFh
	3	inhibit time	UNSIGNED 16	RW	0
	4	Reversed	…	…	…
	5	event timer	UNSIGNED 16	RW	0
1803h	0	largest sub-index supported for “receive PDO parameter”	UNSIGNED 8	RO	5
	1	COB-ID used by PDO (Tx)	UNSIGNED 32	RW	480h+Node-ID
	2	transmission type	UNSIGNED 8	RW	FFh
	3	inhibit time	UNSIGNED 16	RW	0
	4	Reversed	…	…	…
	5	event timer	UNSIGNED 16	RW	0
1804h	0	largest sub-index supported for “receive PDO parameter”	UNSIGNED 8	RO	5
	1	COB-ID used by PDO (Tx)	UNSIGNED 32	RW	80000000h
	2	transmission type	UNSIGNED 8	RW	FFh
	3	inhibit time	UNSIGNED 16	RW	0
	4	Reversed	…	…	…
	5	event timer	UNSIGNED 16	RW	0
…	…	…	…	…	…
1813h	0	largest sub-index supported for “receive PDO parameter”	UNSIGNED 8	RO	5
	1	COB-ID used by PDO (Tx)	UNSIGNED 32	RW	80000000h
	2	transmission type	UNSIGNED 8	RW	FFh
	3	inhibit time	UNSIGNED 16	RW	0
	4	Reversed	…	…	…
	5	event timer	UNSIGNED 16	RW	0

TxPDO Mapping Communication Entries

Idx	Sidx	Description	Type	Attr	Default
1A00h	0	largest sub-index supported for “transmit PDO mapping”	UNSIGNED 8	RO	2
	1	read Kw_a data	UNSIGNED 32	RW	3200 0120h
	2	read kWh_a data	UNSIGNED 32	RW	3201 0120h

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1A01h	0	largest sub-index supported for “transmit PDO mapping”	UNSIGNED 8	RO	2
	1	read Kw_b data	UNSIGNED 32	RW	3200 0220h
	2	read kWh_b data	UNSIGNED 32	RW	3201 0220h
1A02h	0	largest sub-index supported for “transmit PDO mapping”	UNSIGNED 8	RO	2
	1	read Kw_c data	UNSIGNED 32	RW	3200 0320h
	2	read kWh_c data	UNSIGNED 32	RW	3201 0320h
1A03h	0	largest sub-index supported for “transmit PDO mapping”	UNSIGNED 8	RO	2
	1	read Kw_tot data	UNSIGNED 32	RW	3200 0420h
	2	read kWh_tot data	UNSIGNED 32	RW	3201 0420h
1A04h	0	largest sub-index supported for “transmit PDO mapping”	UNSIGNED 8	RO	2
	1	read V_a data	UNSIGNED 32	RW	3202 0120h
	2	read I_a data	UNSIGNED 32	RW	3203 0120h
1A05h	0	largest sub-index supported for “transmit PDO mapping”	UNSIGNED 8	RO	2
	1	read V_b data	UNSIGNED 32	RW	3202 0220h
	2	read I_b data	UNSIGNED 32	RW	3203 0220h
1A06h	0	largest sub-index supported for “transmit PDO mapping”	UNSIGNED 8	RO	2
	1	read V_c data	UNSIGNED 32	RW	3202 0320h
	2	read I_c data	UNSIGNED 32	RW	3203 0320h
1A07h	0	largest sub-index supported for “transmit PDO mapping”	UNSIGNED 8	RO	2
	1	read V_avg data	UNSIGNED 32	RW	3202 0420h
	2	read I_avg data	UNSIGNED 32	RW	3203 0420h
1A08h	0	largest sub-index supported for “transmit PDO mapping”	UNSIGNED 8	RO	2
	1	read kvar(kvar_a) data	UNSIGNED 32	RW	3204 0120h
	2	read kVA(Kva_a) data	UNSIGNED 32	RW	3205 0120h
1A09h	0	largest sub-index supported for “transmit PDO mapping”	UNSIGNED 8	RO	2
	1	read kvar(kvar_b) data	UNSIGNED 32	RW	3204 0220h
	2	read kVA(Kva_b) data	UNSIGNED 32	RW	3205 0220h

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1A0Ah	0	largest sub-index supported for “transmit PDO mapping”	UNSIGNED 8	RO	2
	1	read kvar(kvar_c) data	UNSIGNED 32	RW	3204 0320h
	2	read kVA(Kva_c) data	UNSIGNED 32	RW	3205 0320h
1A0Bh	0	largest sub-index supported for “transmit PDO mapping”	UNSIGNED 8	RO	2
	1	read kvar_tot data	UNSIGNED 32	RW	3204 0420h
	2	read Kva_tot data	UNSIGNED 32	RW	3205 0420h
1A0Ch	0	largest sub-index supported for “transmit PDO mapping”	UNSIGNED 8	RO	2
	1	read PF_a data	UNSIGNED 32	RW	3206 0120h
	2	read kVAh_a data	UNSIGNED 32	RW	3207 0120h
1A0Dh	0	largest sub-index supported for “transmit PDO mapping”	UNSIGNED 8	RO	2
	1	read PF_b data	UNSIGNED 32	RW	3206 0220h
	2	read kVAh_b data	UNSIGNED 32	RW	3207 0220h
1A0Eh	0	largest sub-index supported for “transmit PDO mapping”	UNSIGNED 8	RO	2
	1	read PF_c data	UNSIGNED 32	RW	3206 0320h
	2	read kVAh_c data	UNSIGNED 32	RW	3207 0320h
1A0Fh	0	largest sub-index supported for “transmit PDO mapping”	UNSIGNED 8	RO	2
	1	read PF_tot data	UNSIGNED 32	RW	3206 0420h
	2	read kVAh_tot data	UNSIGNED 32	RW	3207 0420h
1A10h	0	largest sub-index supported for “transmit PDO mapping”	UNSIGNED 8	RO	2
	1	read kvarh_a data	UNSIGNED 32	RW	3208 0120h
	2	read Freq_a data	UNSIGNED 32	RW	3209 0120h
1A11h	0	largest sub-index supported for “transmit PDO mapping”	UNSIGNED 8	RO	2
	1	read kvarh_b data	UNSIGNED 32	RW	3208 0220h
	2	read Freq_b data	UNSIGNED 32	RW	3209 0220h
1A12h	0	largest sub-index supported for “transmit PDO mapping”	UNSIGNED 8	RO	2
	1	read kvarh_c data	UNSIGNED 32	RW	3208 0320h
	2	read Freq_c data	UNSIGNED 32	RW	3209 0320h

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1A13h	0	largest sub-index supported for “transmit PDO mapping”	UNSIGNED 8	RO	2
	1	read kvarh_tot data	UNSIGNED 32	RW	3208 0420h
	2	read Freq_avg data	UNSIGNED 32	RW	3209 0420h

Power On Value Function

Idx	Sidx	Description	Type	Attr	Default
2010h	0	Number of Output 8-Bit	UNSIGNED 8	RO	1
	1	Set DO power on value of ch0 and ch1	UNSIGNED 8	RW	00h

Digital Output Function

Idx	Sidx	Description	Type	Attr	Default
6200h	0	Number of Output 8-Bit	UNSIGNED 8	RO	1
	1	DO value of ch0 and ch1	UNSIGNED 8	RW	00h

8.3.2 Manufacturer Specific Profile Area

In the following table, there is information about some special functions for the PM-3033-CPS. The index from 0x3200 to 0x3209 records the power meter measurement parameters. The number of these entries will be automatically updated when the PM-3033-CPS boot up. 0x320A is total harmonic distortion of voltage and current. 0x320B and 0x320C are system parameter setting objects (refer to p24: Modbus Module #2 – Holding Register: System Parameter Setting). 0x320D is system information object (refer to p25: Modbus Module #3 – Input Register : System Information) include wiring type, model type and phase sequence.

Idx	Sidx	Description	Type	Attr	Default
3200h	0	Number of entries for “kW”	UNSIGNED 8	RO	4
	1	kW(Kw_a)	REAL 32	RO	0
	2	kW(Kw_b)	REAL 32	RO	0
	3	kW(Kw_c)	REAL 32	RO	0
	4	kW(Kw_tot)	REAL 32	RO	0
3201h	0	Number of entries for “kWh”	UNSIGNED 8	RO	4
	1	kWh_a	REAL 32	RO	0

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	2	kWh_b	REAL 32	RO	0
	3	kWh_c	REAL 32	RO	0
	4	kWh_tot	REAL 32	RO	0
3202h	0	Number of entries for “Volt”	UNSIGNED 8	RO	4
	1	Volt(V_a)	REAL 32	RO	0
	2	Volt(V_b)	REAL 32	RO	0
	3	Volt(V_c)	REAL 32	RO	0
	4	Volt(V_avg)	REAL 32	RO	0
3203h	0	Number of entries for “Amp”	UNSIGNED 8	RO	4
	1	Amp(I_a)	REAL 32	RO	0
	2	Amp(I_b)	REAL 32	RO	0
	3	Amp(I_c)	REAL 32	RO	0
	4	Amp(I_avg)	REAL 32	RO	0
3204h	0	Number of entries for “kvar”	UNSIGNED 8	RO	4
	1	kvar(kvar_a)	REAL 32	RO	0
	2	kvar(kvar_b)	REAL 32	RO	0
	3	kvar(kvar_c)	REAL 32	RO	0
	4	kvar(kvar_tot)	REAL 32	RO	0
3205h	0	Number of entries for “kVA”	UNSIGNED 8	RO	4
	1	kVA(Kva_a)	REAL 32	RO	0
	2	kVA(Kva_b)	REAL 32	RO	0
	3	kVA(Kva_c)	REAL 32	RO	0
	4	kVA(Kva_tot)	REAL 32	RO	0
3206h	0	Number of entries for “PF”	UNSIGNED 8	RO	4
	1	PF_a	REAL 32	RO	0
	2	PF_b	REAL 32	RO	0
	3	PF_c	REAL 32	RO	0
	4	PF_tot	REAL 32	RO	0
3207h	0	Number of entries for “kVAh”	UNSIGNED 8	RO	4
	1	kVAh_a	REAL 32	RO	0
	2	kVAh_b	REAL 32	RO	0
	3	kVAh_c	REAL 32	RO	0
	4	kVAh_tot	REAL 32	RO	0
3208h	0	Number of entries for “kvarh”	UNSIGNED 8	RO	4
	1	kvarh_a	REAL 32	RO	0
	2	kvarh_b	REAL 32	RO	0

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	3	kvarh_c	REAL 32	RO	0
	4	kvarh_tot	REAL 32	RO	0
3209h	0	Number of entries for “Frequency”	UNSIGNED 8	RO	4
	1	Freq_a	REAL 32	RO	0
	2	Freq _b	REAL 32	RO	0
	3	Freq _c	REAL 32	RO	0
	4	Freq _avg	REAL 32	RO	0
320Ah	0	Number of entries for “Total Harmonic Distortion”	UNSIGNED 8	RO	2
	1	VTHD	REAL 32	RO	0
	2	ITHD	REAL 32	RO	0
320Bh	0	Number of entries for “System Parameter Setting”	UNSIGNED 8	RO	6
	1	PT Ratio	UNSIGNED 16	RW	100
	2	CT Ratio	UNSIGNED 16	RW	1
	3	Wiring Mode	UNSIGNED 8	RW	5
	4	Energy Absolute Accumulated Mode	UNSIGNED 8	RW	0
	5	Harmonic Phase Select	UNSIGNED 8	RW	0
	6	Display Voltage	UNSIGNED 8	RW	0
320Ch	0	Number of entries for “System Parameter Setting”	UNSIGNED 8	RO	3
	1	Set Energy to Zero	UNSIGNED 8	WO	55h
	2	Reset to Factory Settings	UNSIGNED 8	WO	55h
	3	Default Frequency	UNSIGNED 8	RW	55h
320Dh	0	Number of entries for “System Information”	UNSIGNED 8	RO	3
	1	Wiring Type	UNSIGNED 16	RO	0Dh
	2	Phase Sequence	UNSIGNED 16	RO	--
	3	Model Type	UNSIGNED 16	RO	02h

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8.3.3 Store and Restore Object

The users can write the object the value 65766173h to object with index 1010h and subindex 1 to save the application setting, or write the value 64616F6Ch to object with index 1011h and subindex 1 and reboot the module to load the factory default. The following table lists the relative objects which will be stored or restored after writing these two objects:

Index	Subindex	Description
2010h	1	DO power on value
1800h	1~5	TxPDO1 parameter
……	……	……
1813h	1~5	TxPDO1 parameter

Note:

For power meter system parameters setting, such as object 320Bh, users need write object index 320Ch subindex 02h to 55h to load the factory default setting.

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Appendix: Questions & Answers

Q1. What problem is while the measured reading of the kW is negative?

(1) Check the field current direction（K→L）.

(2) Confirm the RST (ABC) phase sequence.

Q2. What does negative kW on a motor/pump mean?

Confirm the pump running at full load. Or are the readings taken at "**idle**" (negative kW, low power factor)?

Q3. PC and meter cannot make the connection with RS-485？

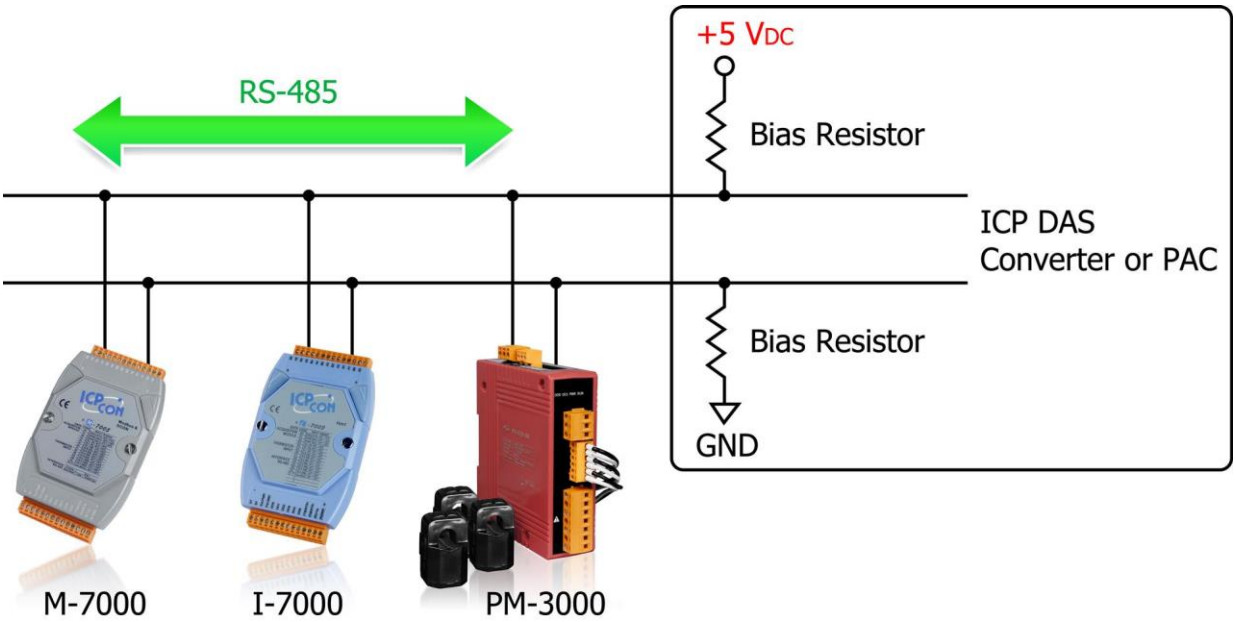
(1) Confirm the Modbus Address, default is 1.

(2) Confirm the Band Rate, default is 19200.

(3) Confirm the stop bit, default is 1.

(4) Confirm the RS-485 connection, make sure the D+/D- is right.

(5) Confirm the RS-485 master have to provide the bias for PM-3033 series. Otherwise, the tM-SG4 or SG-785 should be added to provide the bias. All ICP DAS controllers and converters provide the bias.

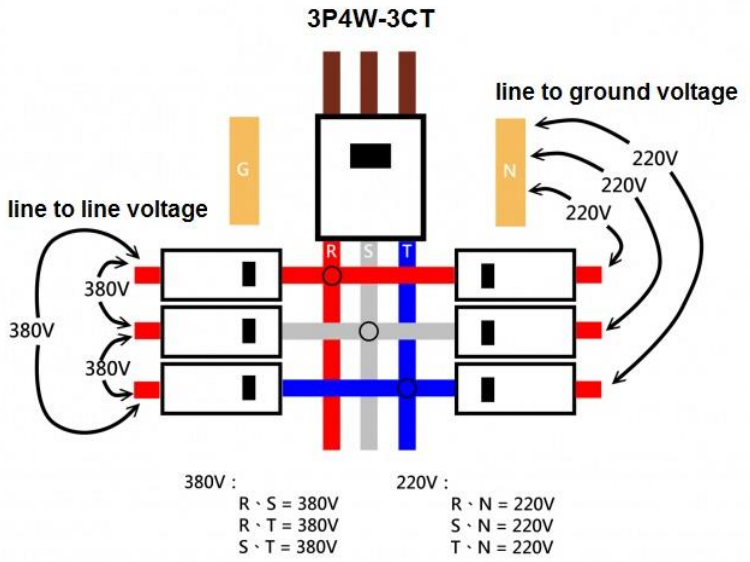


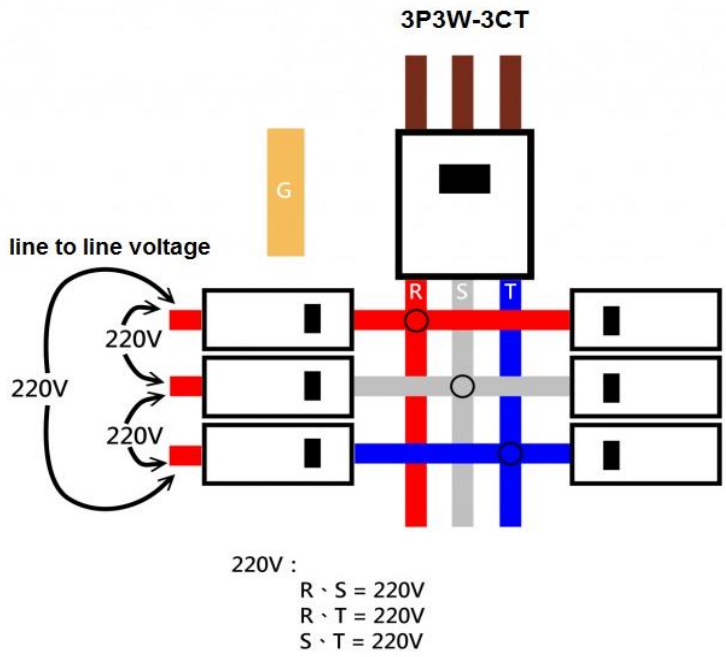
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Q4. What is the difference between line to line voltages to line to ground voltage?

On a three phase wye connected system line to line voltages will be the voltages between the terminals A - B, B - C, A - C. On a three phase wye connected system line to ground voltages will be the voltages between the terminals A - N, B - N, C - N. To calculate the line to ground voltages divide the line voltage by the square root of three which equals 1.73. An example, on a 380 volt wye system, line to line voltage is 380 volts and line to ground voltage is 380/1.73 = 220 volts





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Q5. How to set up [Display Voltage] register value to correctly display line to ground voltage or line to line voltage?

The voltage [V_x] register in Modbus register table can be used to show line-to-ground voltage or line-to-line voltage value by setting [Display Voltage] register value. According to different wiring types, it is required to set different [Display Voltage] value. If the voltage is not displayed as expected value, please refer to the table below and check if the setting value is set accurately.

	Line to Ground Voltage	Line to Line Voltage
3P3W-2CT	[Display Voltage] = 1 (Show as Vln)	[Display Voltage] = 0 (Default)
3P3W-3CT	[Display Voltage] = 0 (Default)	[Display Voltage] = 2 (Show as Vll)
3P4W-3CT	[Display Voltage] = 0 (Default)	[Display Voltage] = 2 (Show as Vll)

Q6. How about the harmonic (THD) analysis capability?

The number of harmonics N that can be analyzed within the 2.8 kHz pass band is the whole number of 2800/f. The absolute maximum number of harmonics accepted by the Energy Metering IC is 63. **N = [2800/f], N ≤ 63**

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Q7. How to measure the Voltage large than 500V?

For service voltage above 600 Vac, voltage transformers (PTs) are used to step down the voltage to a lower range that will work with a PM-3033 meter.



Selecting a Transformer:

Selecting the right voltage transformer is simple. Review the following considerations to determine the best fit for your application.

Input Voltage:

Select a transformer that will operate on the supply voltage available at your facility (Example: PRI. Voltage 720V; SEC. Voltage 120V). Check the connection diagram (three-phase Y and delta; phase sequence) to ensure compatibility.

Adding potential transformers has the effect of reducing the measured line voltage by the PT ratio (let's say 6:1 for this example). So a voltage of 720 Vac becomes 120 Vac. Since the meter sees 120 Vac, many of the measurements it reports will be low by a factor of 6 unless they are scaled up by 6.

Frequency:

If you are operating in the United States, you will most likely be operating on 60 Hz. However should you need a 50 Hz rated transformer.

Accuracy: Transformer (PT) accuracy (Example: 1% or 3%) will influence the measurement.

Rated Output (VA): Example: 150 VA (50VA per phase).

Q8. How to use 5A output CT's with PM-3033 Power Meter?

The CT inputs of the PM-3033 can handle a maximum of 5A current.

PM-3033's current ratio is always full scale to 5A.

Adding current transformer (5A Output CTs) has the effect of reducing the measured current by the CT ratio (let's say 40:1 for 200A CT as example). So a current of 200A becomes 5A. Since the meter sees 5A, many of the measurements it reports will be low by a factor of 40 unless they are scaled up by 40.

Current transformer	CT Ratio (PM-3033)		Current transformer	CT Ratio (PM-3033)
50A CT	10:1		400A CT	80:1
100A CT	20:1		800A CT	160:1
200A CT	40:1		1000A CT	200:1

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