PM-311x

Smart Power Meter



User's Manual

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Revision History

The table below shows the revision history:

Revision	Date	Description
1.07	2024/04/25	● Fix the Integer type value rage of kVAh,kVARh

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Chapter 1 Introduction

1.1. PM-311x introduction

ICP DAS brings the most powerful, cost-effective, advanced Smart Power Meters PM-3000 series that gives you access to real-time electric usage for single-phase power measurement. With its high accuracy (<0.5%, PF=1), the PM-3000 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. These compact size and cost-effective power meters are equipped with revolutionary wired clip-on CT (various types, support input current up to 200 A). It operates over a wide input voltages range 10 ~ 300 VAC which allows worldwide compatibility. And with 2 channels relay output, it can be linked with sirens or lightings for alarm messages. It also supports Modbus RTU, Modbus TCP or CAN bus protocols for easy integration.

Features：

- True RMS Power Measurements
- Energy Analysis for 1P2W, 1P4W
- Current Measurements Up to 200 A with Different CT Ratio
- Voltage Measurements Up to 300 V
- Clip-on CT for Easy Installation
- W Accuracy Better than 0.5% (PF=1)
- Supports RS-485, Ethernet, CAN bus Interface
- Supports Modbus RTU, Modbus TCP, CANopen protocols.
- Supports 2-Power Relay Output (Form A)

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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-3112 PM-3114	PM-3112-MTCP PM-3114-MTCP	PM-3112-CPS PM-3114-CPS
AC Power Measurement				
Wiring		1P2W-2CT 1P4W-4CT	1P2W-2CT 1P4W-4CT	1P2W-2CT 1P4W-4CT
Measurement Voltage		10 ~ 300 V (CAT II)		
Measurement Current		CT Φ10 mm (60 A); CTΦ16 mm (100 A); CTΦ24 mm (200 A)		
Measurement Frequency		50-60 Hz		
W Accuracy		Better than 0.5% (PF=1)		
Starting Current		>0.03A (60A), >0.05A (100A), >0.09A(200A)		
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	2500 VDC	-	-
Ethernet	Protocol	-	Modbus TCP	-
CAN Bus	Protocol	-	-	CANopen
	Baud rate	-	-	125 k (default), 250 k, 500 k, 1 M; DIP Switch Selectable

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Alarm Output			
Power Relay	Form A (Normal Open) x 2; Relay Contact Voltage Range: 5 A @ 250 VAC (47 ~ 63Hz), 5 A @ 30 VDC		
Aux Power			
Input Range	+12 ~ 48 VDC	+12 ~ 48 VDC	+12 ~ 48 VDC
Power Consumption	2 W		
Mechanical			
Casing	Plastic		
Dimensions (W x L x H)	127 mm x 105 mm x 33 mm		
Module Installation	DIN-Rail Mounting		
CT Installation	Clip-On		
Environment			
Operating Temperature	-10 ~ +70 °C		
Storage Temperature	-25 ~ +80 °C		
Ambient Relative Humidity	10% ~ 90% RH, Non-condensing		

Field Wiring Terminal Markings:

3.81mm: Use Copper Conductors Only, wires range 16-26 AWG, torque value 3.0 lb-in.

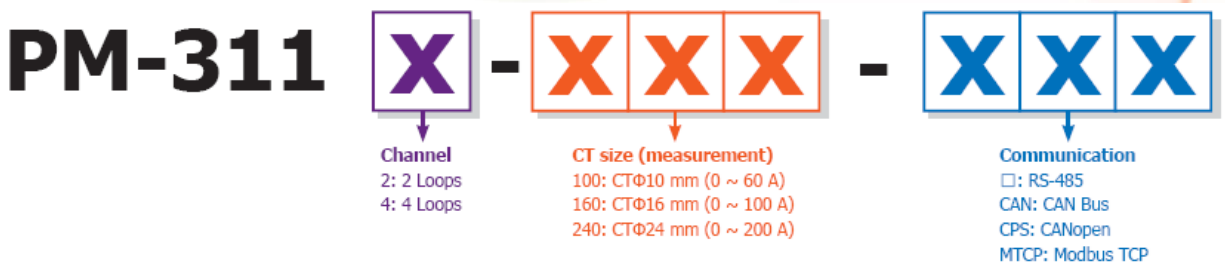
5.08mm: Use Copper Conductors Only, wires range 12-24 AWG, torque value 7.0 lb-in.

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

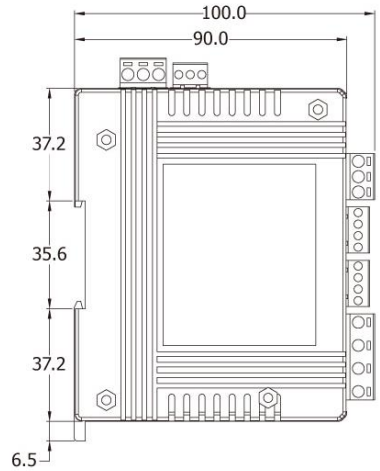
The instrument is no longer safe when,
a) Shows clear signs of damage
b) Does not work
c) Long storage under extreme conditions
d) Damage during shipment

3.2. Safety

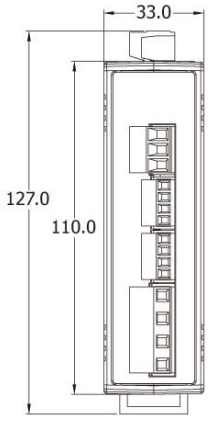


Please use the soft dry clothes to clean the instrument.
Please do not use any chemical or detergent or volatile solvents to clean the instrument, in order to avoid any possibility of the cover damage.

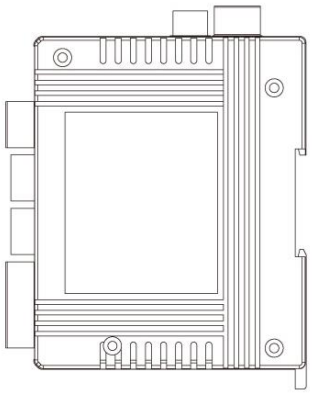
3.2.1. Dimension and Latch



Right Side View



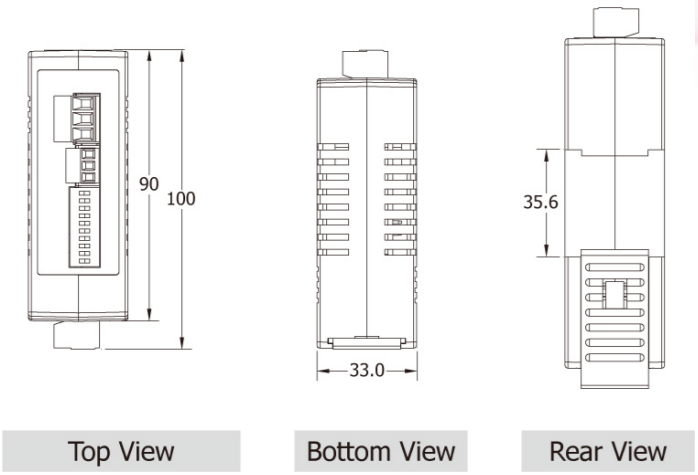
Front View



Left Side View

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- Products come with external split type clip-on CT's. Disconnect the CT's or use other CT's is highly prohibited.
- Please read this operation manual carefully before using.
- Please re-confirm the measure position.
- PM-311x 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 for PM-311x series is DC +12V ~+48V or DC +10V ~+30V (For PM-311x-xxxC version).

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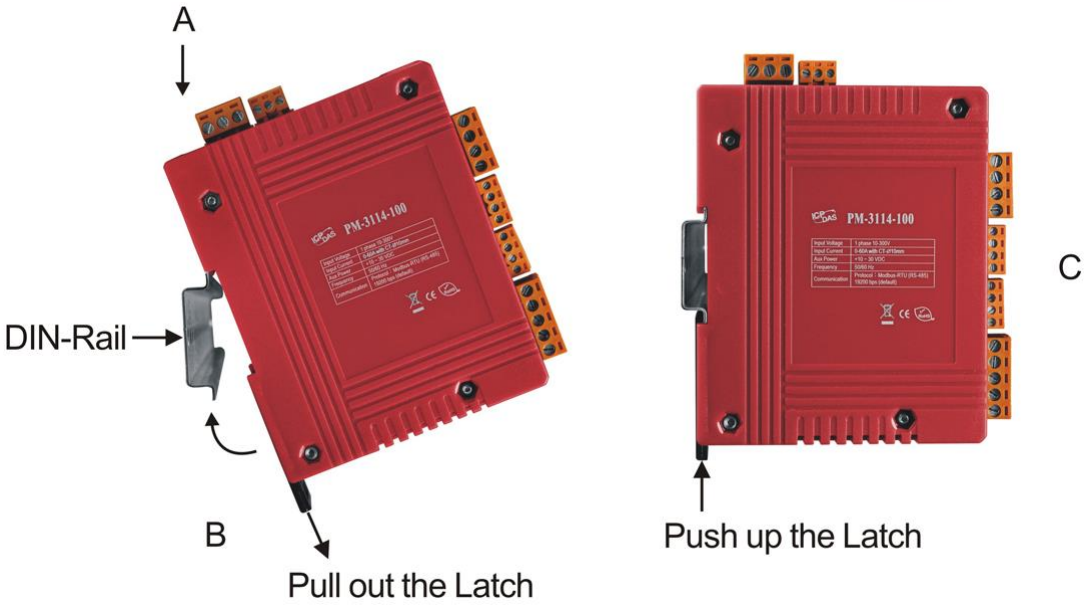
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3.2.2. Mounting and Dismounting

- Mounting

  Assembly: Place the PM-311x on the DIN-Rail. Push the front of the PM-311x toward the mounting surface until it audibly snaps into place.

  Dismantling: Pull out the latch and then remove the PM-311x from the DIN-rail.



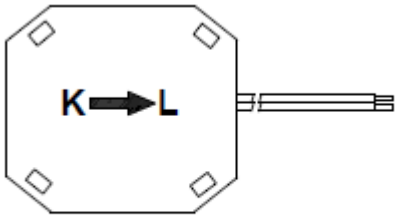
- Wire Disconnection
  1. Open the CT clip to detach the CT, do not remove the CT terminal lines if possible

     Note: if you need to remove the terminal lines, always detach the CT before removing the CT terminal lines. Otherwise the CT may develop open-circuit secondary voltages which may be hazardous to personnel or damaging to the CT or equipment connected in the secondary circuit.
  2. Disconnect the voltage input wires from terminals and wrap the wire tips with plastic tape.
  3. Disconnect the communication wires from terminal.
  4. Disconnect the auxiliary power from terminal and wrap the wire tip with plastic tape.

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3.2.3. CT's installation steps



Bottom view

- At the bottom of the CT, there is a "K →L" mark.



- Open the CT clip.



- Make sure the power current direction follow the "K→L" mark on the CT and then close the CT clip.



- Installation steps finished.

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Chapter 4 Wiring Diagrams

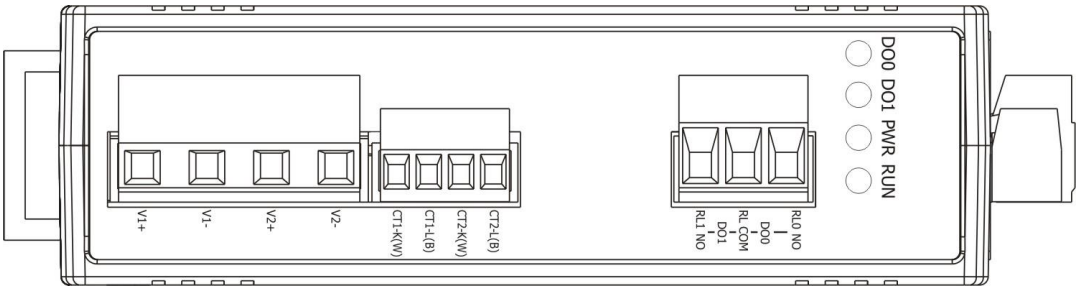
4.1. Connection

- **PM-3112 series**

  Please firstly check the current input terminal, and then in the white black, white black wired sequences（CT1-K,CT1-L,CT2-K,CT2-L）. After connect the CT's, clip on CT's. Make sure the arrow direction sign on CT's follows current flow direction（K→L）.

  Note: it must be in the same direction.

  Connect the AC voltage input terminal. For PM-3112, connect V1- V1+ and V2- V2+.

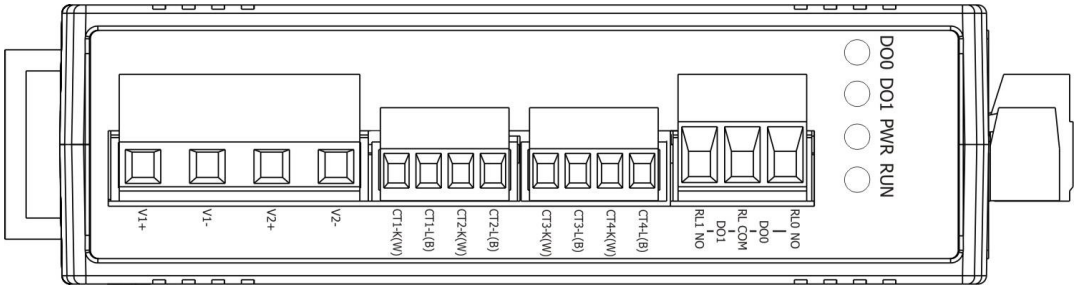


- **PM-3114 series**

  Please firstly check the current input terminal, and then in the white black, white black wired sequences （CT1-K,CT1-L,CT2-K,CT2-L,CT3-K,CT3-L,CT4-K,CT4-L）. After connect the CT's, clip on CT's. Make sure the arrow direction sign on CT's follows current flow direction（K→L）.

  Note: it must be in the same direction.

  Connect the AC voltage input terminal. For PM-3114, connect V1- V1+ and V2- V2+.



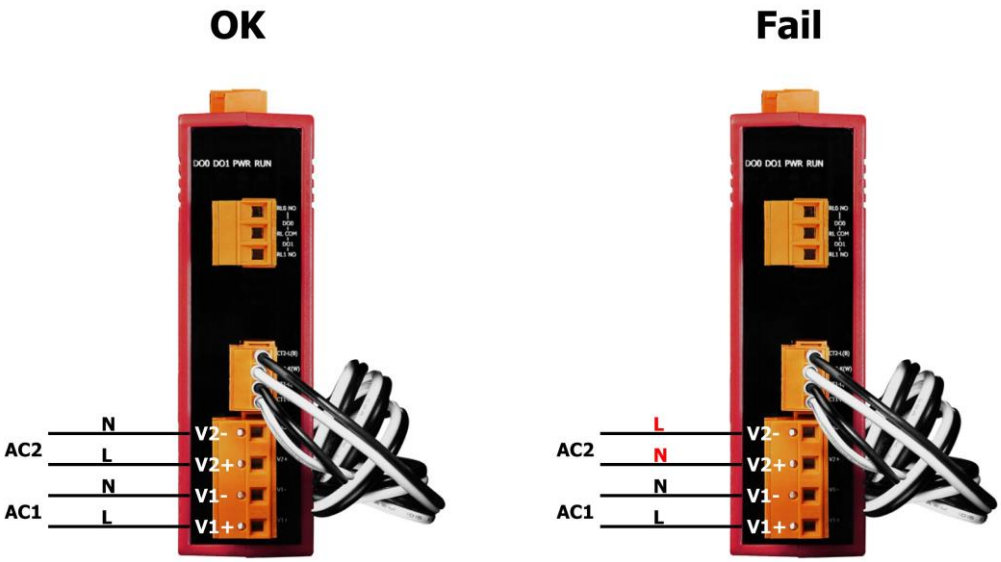
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- **AC Voltage Input**

  PM-311x series: Input Voltage up to 300V,
  When input voltage larger than 300V, please add the PT (power transformer), and Change PT Ratio setup.

  Notice: Please check the L-N connection of PM-311x-xxxC series or it will cause the damage. Please refer the following diagram.



- **Current Input**

  1. The external CT's are fragile, please handle with care.
  2. The current input of PM-311x series is in mA range. **Only the ex-factory attached CT's can be used.** The other CT's, for example, from panel will damage the instrument due to its large current (around 5A)
  3. When more than one smart meters (PM-311x series) are installed, please do not disconnect the CT with its original meter and mix use with each other. Since each set of smart meter (PM-311x series) and its attached split type clip-on CT are calibrated set by set. The mix use may cause wrong measurements.
  4. To install CT's correctly, please ensure the CT lines sequences is right before clip the CT's onto the power cable of the monitoring equipment. (Detail will be found in next section)
  5. **When measuring the current, the secondary circuit of a CT should never**

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be opened when a load is passing through its primary. Make sure you always open the CT clip to detach the CT before removing the terminal lines. Otherwise, it will cause severe injury.

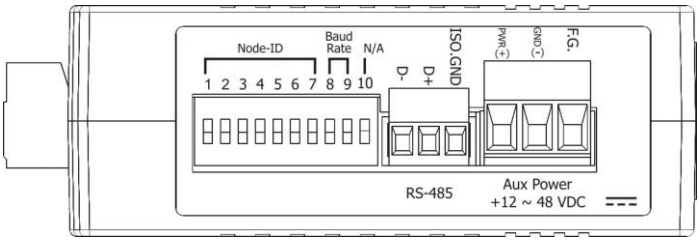
6. Please handle with extra care, especially when the operation space of CT's is limited.
7. The current direction must follow K-L marked on CT's.
8. Please select the right size CT's for different size of monitoring equipment cables:
   power cable diameter ＜Φ10 use 60A CT，Φ10～Φ16 use 100A CT，Φ16～Φ24 use 200A CT。
9. The maximum current value cannot exceed the CT rating.

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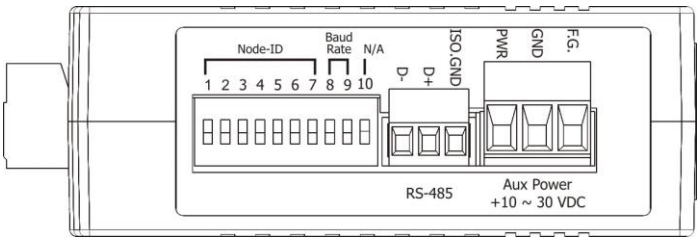
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4.2. Communication Interface

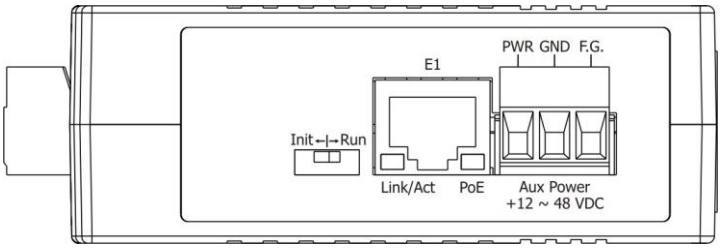
- PM-311x (RS-485, Modbus-RTU)
  Connect RS-485 D+, D- (”D+”,”D-” sequence base on the top cover mark showed)
  And then, add the auxiliary power。DC+12~+48V (PWR, GND, F.G.)



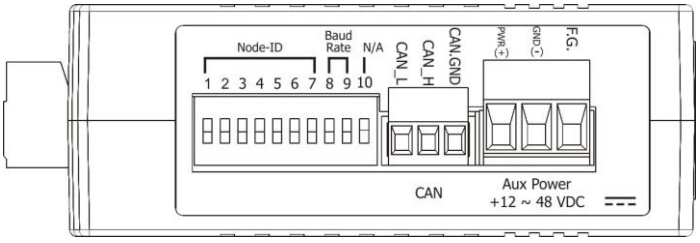
DC+10~+30V (PWR, GND, FG) for PM-311x-xxxC



- PM-311x –MTCP (Ethernet, Modbus-TCP)
  Connect Ethernet (RJ-45)
  And then, add the auxiliary power。DC+12~+48V (PWR, GND, F.G.)



- PM-311x-CPS (CANopen)
  Connect CAN_H, CAN_L (”H”, ”L” sequence base on the top cover mark showed)
  And then, add the auxiliary power。DC+12~+48V (PWR, GND, FG)

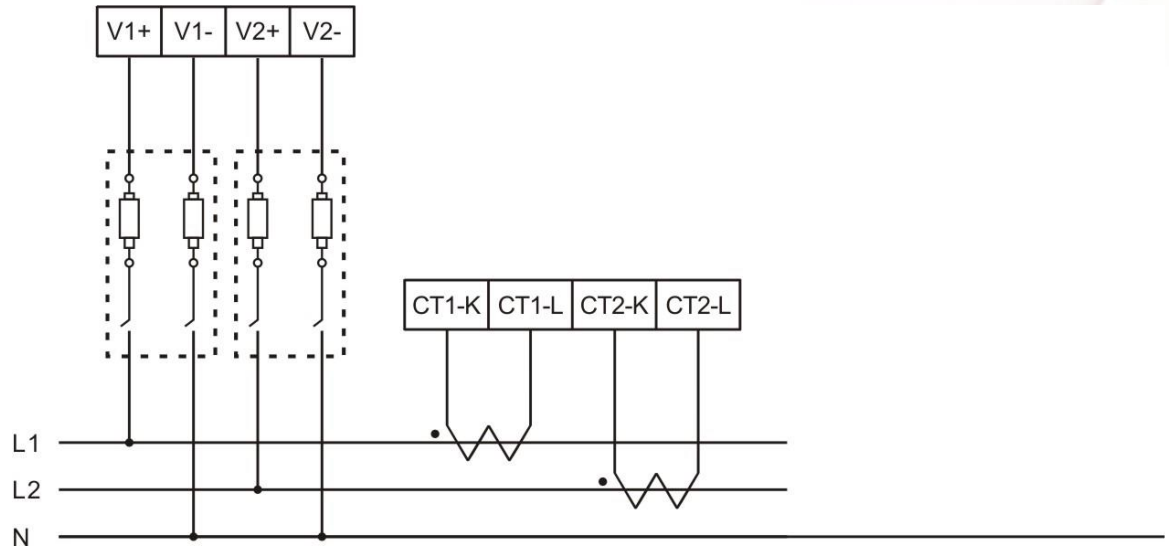


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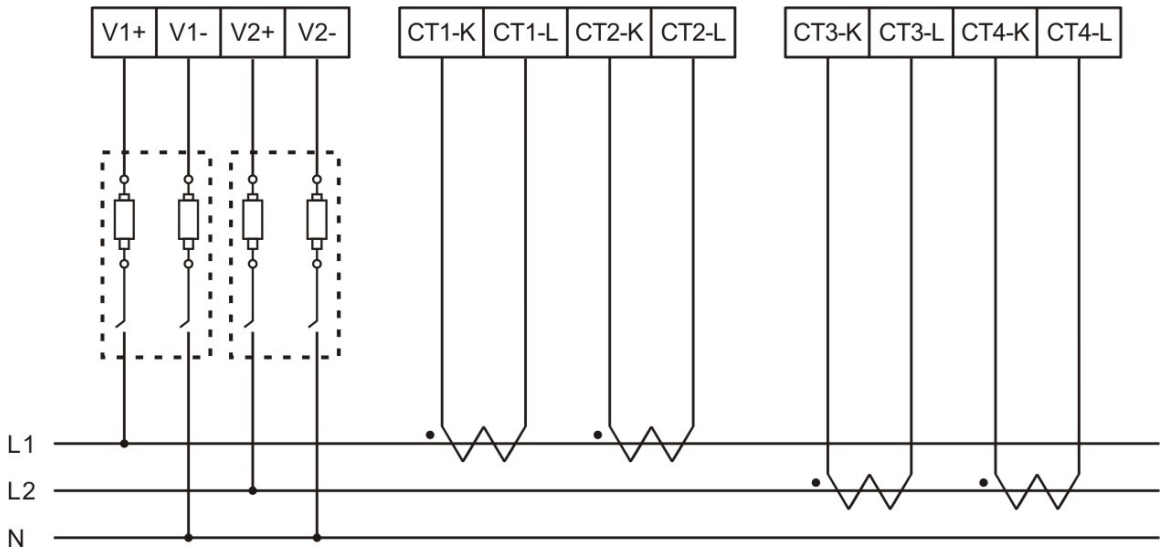
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4.3. Wiring

- 1P2W-2CT (PM-3112 Series)



- 1P4W-4CT(PM-3114 Series)



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Chapter 5 Relay output & LED Indicator

5.1. Relay

Relay type	Power Relay, Form A (SPST N.O.)
Operating Voltage Range	250 VAC/30 VDC
Max. Load Current	5 A at 25 °C
Operate Time	6 ms
Release Time	3 ms

5.2. LED Indicator

The PM-311x has 4 LED to indicate the unit power status, RS-485 communication, and power data calculation.

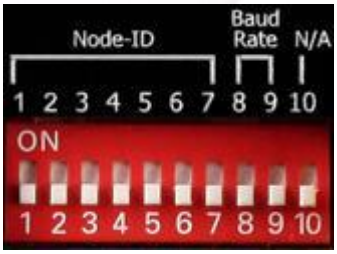
- **RUN:** Green, light up after RS-485 ready. LED will flash when the unit is processing RS-485 communication.
- **PWR:** Red, Power on LED always on.
- **DO0:** Green. LED DO0 will light up, when DO0 is “ON”.
- **DO1:** Green. LED DO1 will light up, when DO1 is “ON”.

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Chapter 6 Modbus-RTU communication

6.1. DIP Switch



DIP switch 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 1-7 is **ON, OFF, OFF, ON, OFF, OFF, OFF**

6.1.1. SW1－SW7 setting

Setting Modbus-RTU address for communication (1-128)

Modbus Address	SW 1	SW 2	SW 3	SW 4	SW 5	SW 6	SW7
1	OFF	OFF	OFF	OFF	OFF	OFF	OFF
2	**ON**	OFF	OFF	OFF	OFF	OFF	OFF
3	OFF	**ON**	OFF	OFF	OFF	OFF	OFF
4	**ON**	**ON**	OFF	OFF	OFF	OFF	OFF
5	OFF	OFF	**ON**	OFF	OFF	OFF	OFF
6	**ON**	OFF	**ON**	OFF	OFF	OFF	OFF
7	OFF	**ON**	**ON**	OFF	OFF	OFF	OFF
8	**ON**	**ON**	**ON**	OFF	OFF	OFF	OFF
9	OFF	OFF	OFF	**ON**	OFF	OFF	OFF
10	**ON**	OFF	OFF	**ON**	OFF	OFF	OFF
11	OFF	**ON**	OFF	**ON**	OFF	OFF	OFF
12	**ON**	**ON**	OFF	**ON**	OFF	OFF	OFF
13	OFF	OFF	**ON**	**ON**	OFF	OFF	OFF
14	**ON**	OFF	**ON**	**ON**	OFF	OFF	OFF
15	OFF	**ON**	**ON**	**ON**	OFF	OFF	OFF
16	**ON**	**ON**	**ON**	**ON**	OFF	OFF	OFF
17	OFF	OFF	OFF	OFF	**ON**	OFF	OFF
18	**ON**	OFF	OFF	OFF	**ON**	OFF	OFF
19	OFF	**ON**	OFF	OFF	**ON**	OFF	OFF
20	**ON**	**ON**	OFF	OFF	**ON**	OFF	OFF
21	OFF	OFF	**ON**	OFF	**ON**	OFF	OFF
22	**ON**	OFF	**ON**	OFF	**ON**	OFF	OFF
23	OFF	**ON**	**ON**	OFF	**ON**	OFF	OFF
24	**ON**	**ON**	**ON**	OFF	**ON**	OFF	OFF
25	OFF	OFF	OFF	**ON**	**ON**	OFF	OFF

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

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71	OFF	**ON**	**ON**	OFF	OFF	OFF	**ON**
72	**ON**	**ON**	**ON**	OFF	OFF	OFF	**ON**
73	OFF	OFF	OFF	**ON**	OFF	OFF	**ON**
74	**ON**	OFF	OFF	**ON**	OFF	OFF	**ON**
75	OFF	**ON**	OFF	**ON**	OFF	OFF	**ON**
76	**ON**	**ON**	OFF	**ON**	OFF	OFF	**ON**
77	OFF	OFF	**ON**	**ON**	OFF	OFF	**ON**
78	**ON**	OFF	**ON**	**ON**	OFF	OFF	**ON**
79	OFF	**ON**	**ON**	**ON**	OFF	OFF	**ON**
80	**ON**	**ON**	**ON**	**ON**	OFF	OFF	**ON**
81	OFF	OFF	OFF	OFF	**ON**	OFF	**ON**
82	**ON**	OFF	OFF	OFF	**ON**	OFF	**ON**
83	OFF	**ON**	OFF	OFF	**ON**	OFF	**ON**
84	**ON**	**ON**	OFF	OFF	**ON**	OFF	**ON**
85	OFF	OFF	**ON**	OFF	**ON**	OFF	**ON**
86	**ON**	OFF	**ON**	OFF	**ON**	OFF	**ON**
87	OFF	**ON**	**ON**	OFF	**ON**	OFF	**ON**
88	**ON**	**ON**	**ON**	OFF	**ON**	OFF	**ON**
89	OFF	OFF	OFF	**ON**	**ON**	OFF	**ON**
90	**ON**	OFF	OFF	**ON**	**ON**	OFF	**ON**
91	OFF	**ON**	OFF	**ON**	**ON**	OFF	**ON**
92	**ON**	**ON**	OFF	**ON**	**ON**	OFF	**ON**
93	OFF	OFF	**ON**	**ON**	**ON**	OFF	**ON**
94	**ON**	OFF	**ON**	**ON**	**ON**	OFF	**ON**
95	OFF	**ON**	**ON**	**ON**	**ON**	OFF	**ON**
96	**ON**	**ON**	**ON**	**ON**	**ON**	OFF	**ON**
97	OFF	OFF	OFF	OFF	OFF	**ON**	**ON**
98	**ON**	OFF	OFF	OFF	OFF	**ON**	**ON**
99	OFF	**ON**	OFF	OFF	OFF	**ON**	**ON**
100	**ON**	**ON**	OFF	OFF	OFF	**ON**	**ON**
101	OFF	OFF	**ON**	OFF	OFF	**ON**	**ON**
102	**ON**	OFF	**ON**	OFF	OFF	**ON**	**ON**
103	OFF	**ON**	**ON**	OFF	OFF	**ON**	**ON**
104	**ON**	**ON**	**ON**	OFF	OFF	**ON**	**ON**
105	OFF	OFF	OFF	**ON**	OFF	**ON**	**ON**
106	**ON**	OFF	OFF	**ON**	OFF	**ON**	**ON**
107	OFF	**ON**	OFF	**ON**	OFF	**ON**	**ON**
108	**ON**	**ON**	OFF	**ON**	OFF	**ON**	**ON**
109	OFF	OFF	**ON**	**ON**	OFF	**ON**	**ON**
110	**ON**	OFF	**ON**	**ON**	OFF	**ON**	**ON**
111	OFF	**ON**	**ON**	**ON**	OFF	**ON**	**ON**
112	**ON**	**ON**	**ON**	**ON**	OFF	**ON**	**ON**
113	OFF	OFF	OFF	OFF	**ON**	**ON**	**ON**
114	**ON**	OFF	OFF	OFF	**ON**	**ON**	**ON**
115	OFF	**ON**	OFF	OFF	**ON**	**ON**	**ON**

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116	**ON**	**ON**	OFF	OFF	**ON**	**ON**	**ON**
117	OFF	OFF	**ON**	OFF	**ON**	**ON**	**ON**
118	**ON**	OFF	**ON**	OFF	**ON**	**ON**	**ON**
119	OFF	**ON**	**ON**	OFF	**ON**	**ON**	**ON**
120	**ON**	**ON**	**ON**	OFF	**ON**	**ON**	**ON**
121	OFF	OFF	OFF	**ON**	**ON**	**ON**	**ON**
122	**ON**	OFF	OFF	**ON**	**ON**	**ON**	**ON**
123	OFF	**ON**	OFF	**ON**	**ON**	**ON**	**ON**
124	**ON**	**ON**	OFF	**ON**	**ON**	**ON**	**ON**
125	OFF	OFF	**ON**	**ON**	**ON**	**ON**	**ON**
126	**ON**	OFF	**ON**	**ON**	**ON**	**ON**	**ON**
127	OFF	**ON**	**ON**	**ON**	**ON**	**ON**	**ON**
128	**ON**	**ON**	**ON**	**ON**	**ON**	**ON**	**ON**

6.1.2. SW8－SW9 setting

PM-311x：For Baud Rate Setting

Baud Rate	SW 8	SW9
9600	OFF	OFF
19200 (Default)	**ON**	OFF
38400	OFF	**ON**
115200	**ON**	**ON**

6.1.3. SW10 setting

SW10: Only OFF

If this pin is “ON”, DIP it to “OFF” and re-power PM-311x after setting.

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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	1-128 (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

Parameter name	Modbus Register		Len	Data Type	Range	Default value	Comment
	Modicom Format	Hex					
DO 0	04097	0x1000	Word	Byte	0 = OFF 1 = ON	0	
DO 1	04098	0x1001	Word	Byte	0 = OFF 1 = ON	0	
DO 0 Power On Value	04113	0x1010	Word	Byte	0 = OFF 1 = ON	0	
DO 1 Power On Value	04114	0x1011	Word	Byte	0 = OFF 1 = ON	0	

- 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		
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

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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	7: PM311x	7		
Model Name	30515	0x0202	Word	UInt	3112: PM3112 3114: PM3114	311x		
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_1	34353-34354	0x1100-0x1101	DWord	Float		Volt	
I_1	34355-34356	0x1102-0x1103	DWord	Float		Amp	
kW_1	34357-34358	0x1104-0x1105	DWord	Float		kW	
kvar_1	34359-34360	0x1106-0x1107	DWord	Float		kvar	
kVA_1	34361-34362	0x1108-0x1109	DWord	Float		kVA	
PF_1	34363-34364	0x110A-0x110B	DWord	Float			
kWh_1	34365-34366	0x110C-0x110D	DWord	Float			
kvarh_1	34367-34368	0x110E-0x110F	DWord	Float			
kVAh_1	34369-34370	0x1110-0x1111	DWord	Float			
V_2	34371-34372	0x1112-0x1113	DWord	Float		Volt	
I_2	34373-34374	0x1114-0x1115	DWord	Float		Amp	
kW_2	34375-34376	0x1116-0x1117	DWord	Float		kW	
kvar_2	34377-34378	0x1118-0x1119	DWord	Float		kvar	
kVA_2	34379-34380	0x111A-0x111B	DWord	Float		kVA	
PF_2	34381-34382	0x111C-0x111D	DWord	Float			
kWh_2	34383-34384	0x111E-0x111F	DWord	Float			
kvarh_2	34385-34386	0x1120-0x1121	DWord	Float			
kVAh_2	34387-34388	0x1122-0x1123	DWord	Float			
V_3	34389-34390	0x1124-0x1125	DWord	Float		Volt	
I_3	34391-34392	0x1126-0x1127	DWord	Float		Amp	
kW_3	34393-34394	0x1128-0x1129	DWord	Float		kW	
kvar_3	34395-34396	0x112A-0x112B	DWord	Float		kvar	
kVA_3	34397-34398	0x112C-0x112D	DWord	Float		kVA	
PF_3	34399-34400	0x112E-0x112F	DWord	Float			
kWh_3	34401-34402	0x1130-0x1131	DWord	Float			
kvarh_3	34403-34404	0x1132-0x1133	DWord	Float			
kVAh_3	34405-34406	0x1134-0x1135	DWord	Float			
V_4	34407-34408	0x1136-0x1137	DWord	Float		Volt	
I_4	34409-34410	0x1138-0x1139	DWord	Float		Amp	
kW_4	34411-34412	0x113A-0x113B	DWord	Float		kW	
kvar_4	34413-34414	0x113C-0x113D	DWord	Float		kvar	
kVA_4	34415-34416	0x113E-0x113F	DWord	Float		kVA	

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PF_4	34417-34418	0x1140-0x1141	DWord	Float			
kWh_4	34419-34420	0x1142-0x1143	DWord	Float			
kvarh_4	34421-34422	0x1144-0x1145	DWord	Float			
kVAh_4	34423-34424	0x1146-0x1147	DWord	Float			
Freq_1	34425-34426	0x1148-0x1149	DWord	Float	45 - 65	Hz	
Freq_2	34427-34428	0x114A-0x114B	DWord	Float	45 - 65	Hz	
Freq_3	34429-34430	0x114C-0x114D	DWord	Float	45 - 65	Hz	
Freq_4	34431-34432	0x114E-0x114F	DWord	Float	45 - 65	Hz	

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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_1	34609- 34610	0x1200-0x1201	DWord	UInt32		0.1 Volt	
I_1	34611- 34612	0x1202-0x1203	DWord	UInt32		0.1A	
kW_1	34613- 34614	0x1204-0x1205	DWord	Int32		0.1kW	
kvar_1	34615- 34616	0x1206-0x1207	DWord	Int32		0.1kvar	
kVA_1	34617- 34618	0x1208-0x1209	DWord	Int32		0.1kVA	
PF_1	34619	0x120A	Word	Int	0~1000	0.001PF	0~1.000
kWh_1	34620- 34621	0x120B-0x120C	DWord	Int32	±0~99999999	0.1kWh	±0~9999999.9
kvarh_1	34622- 34623	0x120D-0x120E	DWord	Int32	±0~99999999	0.1kvarh	±0~9999999.9
kVAh_1	34624- 34625	0x120F-0x1210	DWord	Int32	0~99999999	0.1kVAh	0~9999999.9
V_2	34626- 34627	0x1211-0x1212	DWord	UInt32		0.1 Volt	
I_2	34628- 34629	0x1213-0x1214	DWord	UInt32		0.1A	
kW_2	34630- 34631	0x1215-0x1216	DWord	Int32		0.1kW	
kvar_2	34632- 34633	0x1217-0x1218	DWord	Int32		0.1kvar	
kVA_2	34634- 34635	0x1219-0x121A	DWord	Int32		0.1kVA	
PF_2	34636	0x121B	Word	Int	0~1000	0.001PF	0~1.000
kWh_2	34637- 34638	0x121C-0x121D	DWord	Int32	±0~99999999	0.1kWh	±0~9999999.9
kvarh_2	34639- 34640	0x121E-0x121F	DWord	Int32	±0~99999999	0.1kvarh	±0~9999999.9
kVAh_2	34641- 34642	0x1220-0x1221	DWord	Int32	0~99999999	0.1kVAh	0~9999999.9
V_3	34643- 34644	0x1222-0x1223	DWord	UInt32		0.1 Volt	
I_3	34645- 34646	0x1224-0x1225	DWord	UInt32		0.1A	
kW_3	34647- 34648	0x1226-0x1227	DWord	Int32		0.1kW	
kvar_3	34649- 34650	0x1228-0x1229	DWord	Int32		0.1kvar	
kVA_3	34651- 34652	0x122A-0x122B	DWord	Int32		0.1kVA	
PF_3	34653	0x122C	Word	Int	0~1000	0.001PF	0~1.000
kWh_3	34654- 34655	0x122D-0x122E	DWord	Int32	±0~99999999	0.1kWh	±0~9999999.9
kvarh_3	34656-34657	0x122F-0x1230	DWord	Int32	±0~99999999	0.1kvarh	±0~9999999.9
kVAh_3	34658-34659	0x1231-0x1232	DWord	Int32	0~99999999	0.1kVAh	0~9999999.9
V_4	34660-34661	0x1233-x1234	DWord	UInt32		0.1 Volt	
I_4	34662-34663	0x1235-0x1236	DWord	UInt32		0.1A	
kW_4	34664-34665	0x1237-0x1238	DWord	Int32		0.1kW	
kvar_4	34666-34667	0x1239-0x123A	DWord	Int32		0.1kvar	

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kVA_4	34668-34669	0x123B-0x123C	DWord	Int32		0.1kVA	
PF_4	34670	0x123D	Word	Int	0~1000	0.001PF	0~1.000
kWh_4	34671-34672	0x123E-0x123F	DWord	Int32	±0~99999999	0.1kWh	±0~9999999.9
kvarh_4	34673-34674	0x1240-0x1241	DWord	Int32	±0~99999999	0.1kvarh	±0~9999999.9
kVAh_4	34675-34676	0x1242-0x1243	DWord	Int32	0~99999999	0.1kVAh	0~9999999.9
Freq_1	34677	0x1244	Word	Int	45~65	1Hz	45~65
Freq_2	34678	0x1245	Word	Int	45~65	1Hz	45~65
Freq_3	34679	0x1246	Word	Int	45~65	1Hz	45~65
Freq_4	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_1	34865-34866	0x1300-0x1301	DWord	UInt32		0.1 Volt	
I_1	34867-34868	0x1302-0x1303	DWord	UInt32		0.1A	
kW_1	34869-34870	0x1304-0x1305	DWord	Int32		0.1kW	
kvar_1	34871-34872	0x1306-0x1307	DWord	Int32		0.1kvar	
kVA_1	34873-34874	0x1308-0x1309	DWord	Int32		0.1kVA	
PF_1	34875	0x130A	Word	Int	0~1000	0.001PF	0~1.000
kWh_1	34876-34877	0x130B-0x130C	DWord	Int32	±0~99999999	0.1kWh	±0~9999999.9
kvarh_1	34878-34879	0x130D-0x130E	DWord	Int32	±0~99999999	0.1kvarh	±0~9999999.9
kVAh_1	34880-34881	0x130F-0x1310	DWord	Int32	0~99999999	0.1kVAh	0~9999999.9
V_2	34882-34883	0x1311-0x1312	DWord	UInt32		0.1 Volt	
I_2	34884-34885	0x1313-0x1314	DWord	UInt32		0.1A	
kW_2	34886-34887	0x1315-0x1316	DWord	Int32		0.1kW	
kvar_2	34888-34889	0x1317-0x1318	DWord	Int32		0.1kvar	
kVA_2	34890-34891	0x1319-0x131A	DWord	Int32		0.1kVA	
PF_2	34892	0x131B	Word	Int	0~1000	0.001PF	0~1.000
kWh_2	34893-34894	0x131C-0x131D	DWord	Int32	±0~99999999	0.1kWh	±0~9999999.9
kvarh_2	34895-34896	0x131E-0x131F	DWord	Int32	±0~99999999	0.1kvarh	±0~9999999.9
kVAh_2	34897-34898	0x1320-0x1321	DWord	Int32	0~99999999	0.1kVAh	0~9999999.9
V_3	34899-34900	0x1322-0x1323	DWord	UInt32		0.1 Volt	
I_3	34901-34902	0x1324-0x1325	DWord	UInt32		0.1A	
kW_3	34903-34904	0x1326-0x1327	DWord	Int32		0.1kW	
kvar_3	34905-34906	0x1328-0x1329	DWord	Int32		0.1kvar	
kVA_3	34907-34908	0x132A-0x132B	DWord	Int32		0.1kVA	
PF_3	34909	0x132C	Word	Int	0~1000	0.001PF	0~1.000
kWh_3	34910-34911	0x132D-0x132E	DWord	Int32	±0~99999999	0.1kWh	±0~9999999.9
kvarh_3	34912-34913	0x132F-0x1330	DWord	Int32	±0~99999999	0.1kvarh	±0~9999999.9
kVAh_3	34914-34915	0x1331-0x1332	DWord	Int32	0~99999999	0.1kVAh	0~9999999.9
V_4	34916-34917	0x1333-0x1334	DWord	UInt32		0.1 Volt	
I_4	34918-34919	0x1335-0x1336	DWord	UInt32		0.1A	
kW_4	34920-34921	0x1337-0x1338	DWord	Int32		0.1kW	
kvar_4	34922-34923	0x1339-0x133A	DWord	Int32		0.1kvar	
kVA_4	34924-34925	0x133B-0x133C	DWord	Int32		0.1kVA	

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PF_4	34926	0x133D	Word	Int	0~1000	0.001PF	0~1.000
kWh_4	34927-34928	0x133E-0x133F	DWord	Int32	±0~99999999	0.1kWh	±0~9999999.9
kvarh_4	34929-34930	0x1340-0x1341	DWord	Int32	±0~99999999	0.1kvarh	±0~9999999.9
kVAh_4	34931-34932	0x1342-0x1343	DWord	Int32	0~99999999	0.1kVAh	0~9999999.9
Freq_1	34933	0x1344	Word	Int	45~65	1Hz	45~65
Freq_2	34934	0x1345	Word	Int	45~65	1Hz	45~65
Freq_3	34935	0x1346	Word	Int	45~65	1Hz	45~65
Freq_4	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：

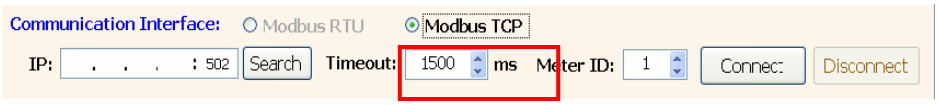
IP Address	192.168.255.1
Subnet mask	255.255.0.0
Gateway	192.168.0.1
Port	502



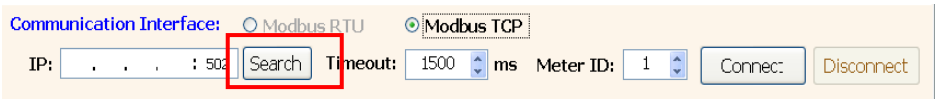
For recovering to default settings, dip Init/Run Switch to Init position for 10 seconds after power on, the settings will be changed as default values. Must dip back to Run position and repower on after settings changed. User also can recover settings to default value by Modbus command.

7.1.1. Ethernet configurations

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



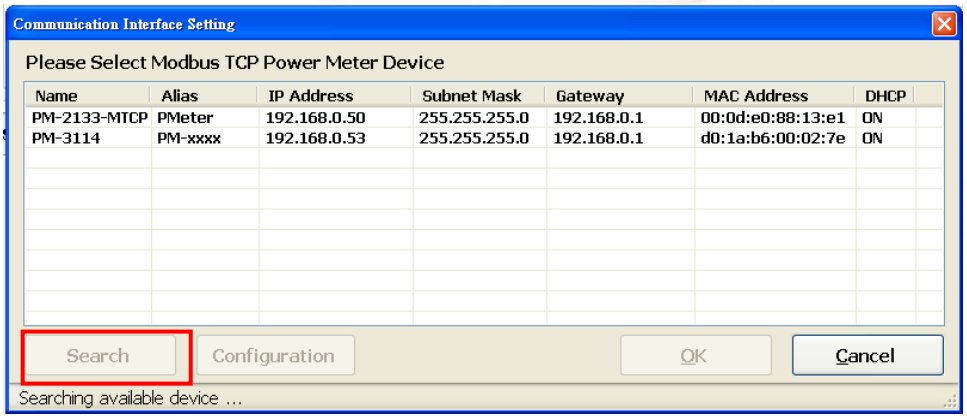
Click “Search” to enter the “Communication Interface Setting” window.



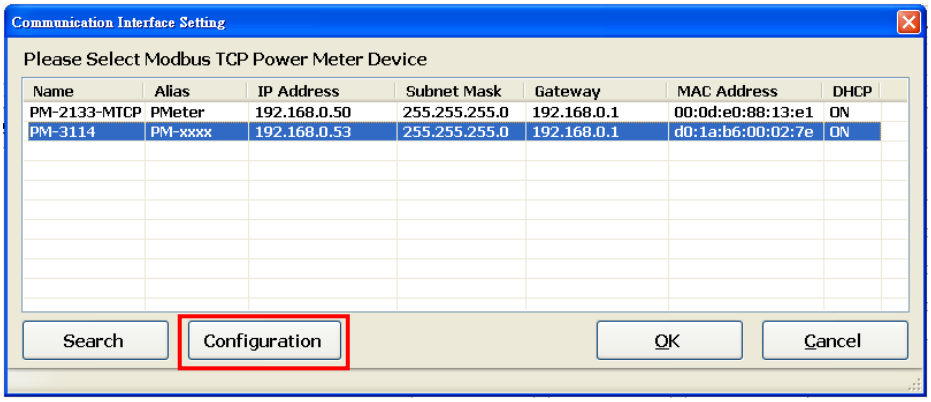
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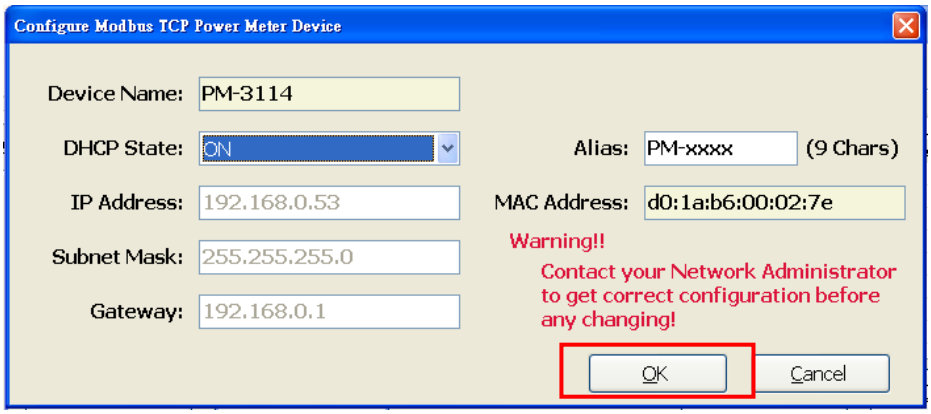
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Click ”Search” button to search the available power meter.



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)。

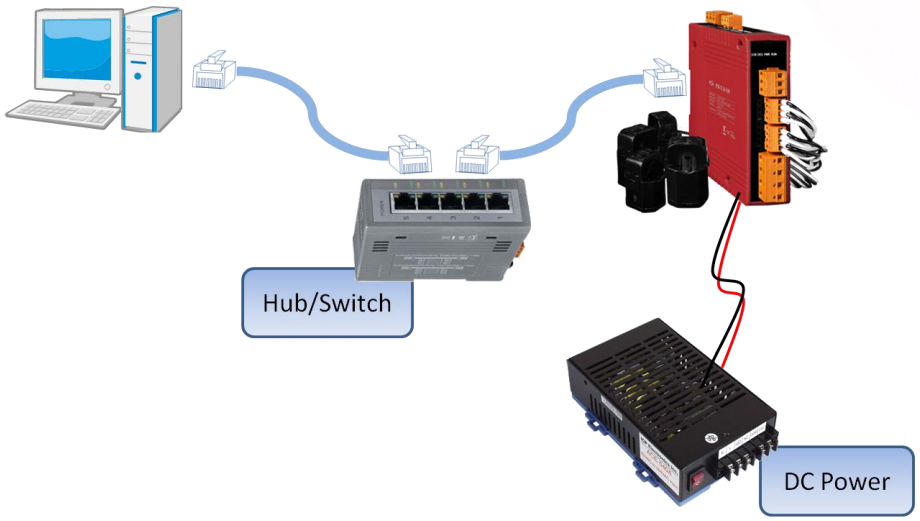
7.2.1. Modbus Register

Please refer the 6.2.2 Modbus Register。

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7.3. Connecting the Power and Host PC



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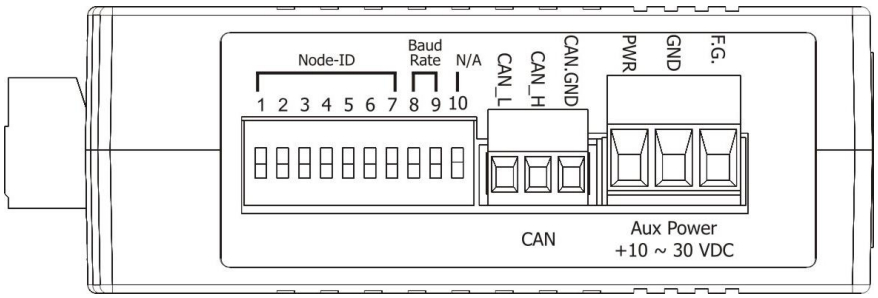
Chapter 8 CANopen communication

8.1. Overview

CANopen, a kind of communication protocols, is an intelligent field bus (CAN bus). It has been developed as a standard embedded network with a high flexible configuration. It provides a standard communication protocol transmitting real-time data in PDO (**P**rocess **D**ata **O**bjects), configuration data in SDO (**S**ervice **D**ata **O**bjects), and network management data (NMT message, and Error Control), even supports the special functions (Time Stamp, Sync message, and Emergency message).These features can improve the network reliability and transmission efficiency. Nowadays, CANopen is used on many applications and in specific fields, such as medical equipment, off-road vehicles, maritime electronics, public transportation, automation and so on. The PM-311x-CPS power meter is built-in the CANopen interface. Therefore, users can easily apply in any CANopen applications via the power meter.

8.2. DIP Switch of PM-311x-CPS

8.2.1. The Node-ID of CANopen



PM-311x-CPS provides hardware Node-ID setting by DIP-Switch. The relationship between the Node-ID and the DIP-Switch status is shown below.

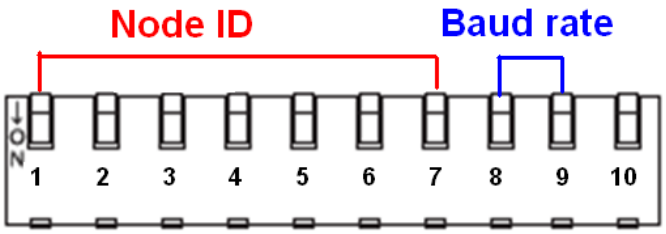
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Node-ID and Dip-Switch 1 ~ 7 digital.

Node ID	Pin 1	Pin2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7
1	OFF	OFF	OFF	OFF	OFF	OFF	OFF
2	ON	OFF	OFF	OFF	OFF	OFF	OFF
3	OFF	ON	OFF	OFF	OFF	OFF	OFF
4	ON	ON	OFF	OFF	OFF	OFF	OFF
…							
126	ON	OFF	ON	ON	ON	ON	ON
127	OFF	ON	ON	ON	ON	ON	ON
128	ON	ON	ON	ON	ON	ON	ON

8.2.2. The Baud Rate of CANopen



The DIP-Switch from pin 8 to pin 9 represents the CAN bus baud rate of the PM-311x-CPS. The mapping table is shown as below. The default baud rate value is 125K, and the corresponding DIP-Switch value from pin 8 to pin 9 is (OFF) (OFF).

CAN baud rate and Dip-Switch 8~ 9.

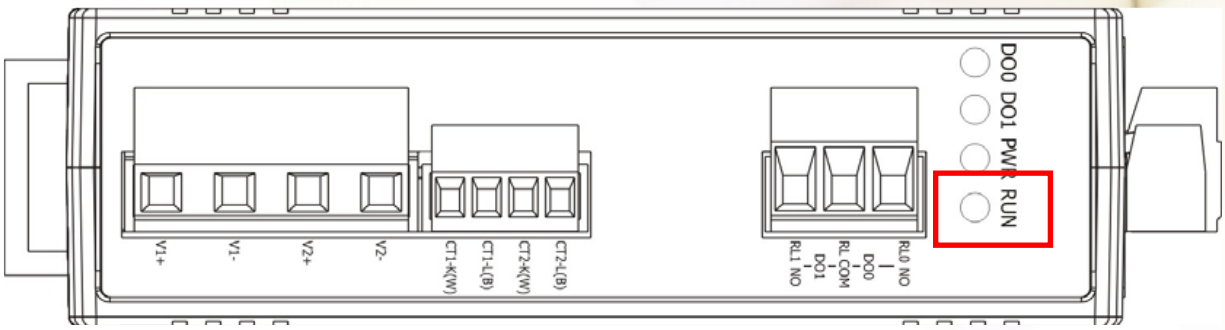
CAN baud-rate	Pin 8	Pin9
125kbps	OFF	OFF
250kbps	ON	OFF
500kbps	OFF	ON
1000kbps	ON	ON

8.2.3. The LED State

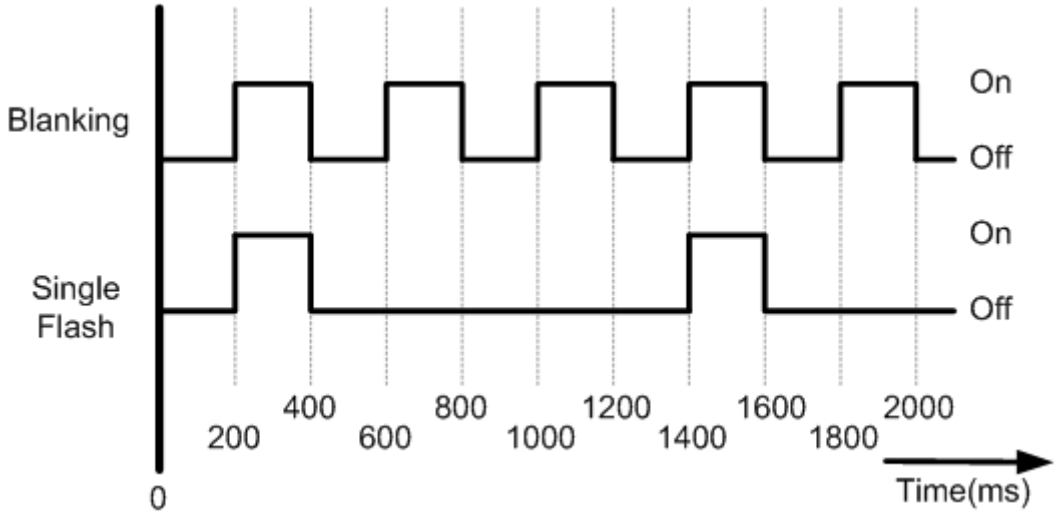
RUN LED of CANopen" is an indicator LED of CAN bus in the PM-311x-CPS. It shows whether the CAN communication is normal or incorrect. The following figure shows the LED.

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No.	Signal	State	Description
1	No Light	Non-operation	Malfunction or Power Supply/Connection not ready
2	Single Flash	Stopped	The device is in Stopped state
3	Blinking	Pre-operation	The device is in the pre-operation state
4	Continuing Light	Operation	The device is in the operational state



8.3. 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.

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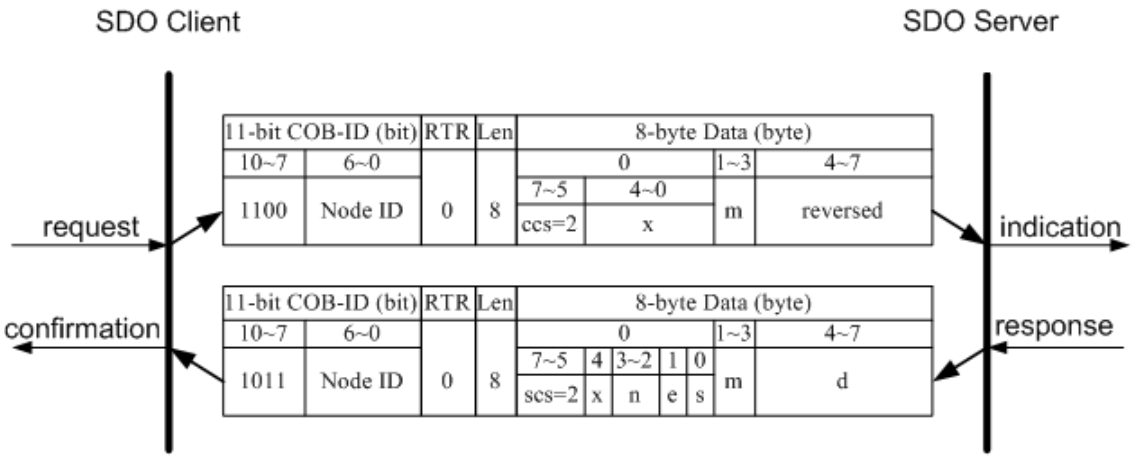
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8.3.1. SDO Introduction

8.3.1.1. 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

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

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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.

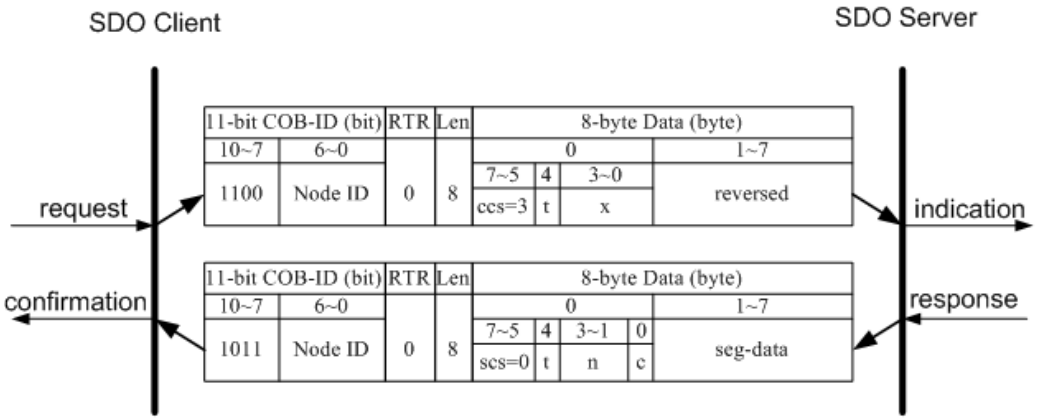
e=1, **s**=0: **d** contains unspecified number of bytes to be uploaded.

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.



Upload SDO Segment Protocol

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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.

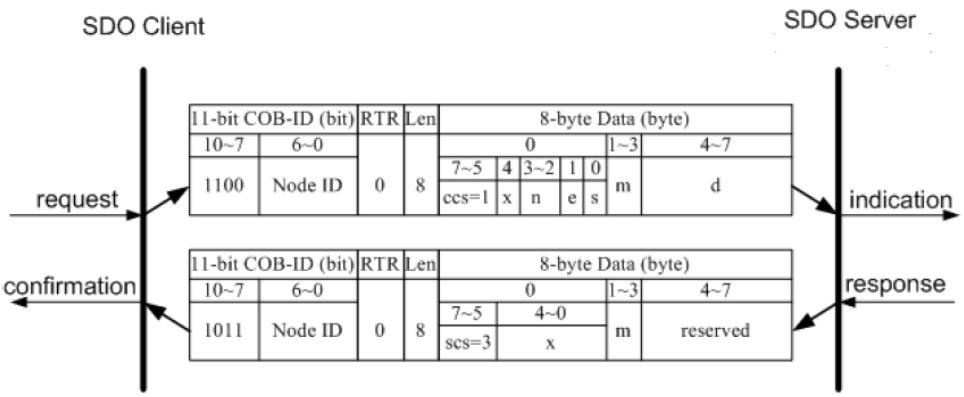
x: not used, always 0

reserved: reserved for further use , always 0

8.3.1.2. 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.



Initiate SDO Download Protocol

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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.

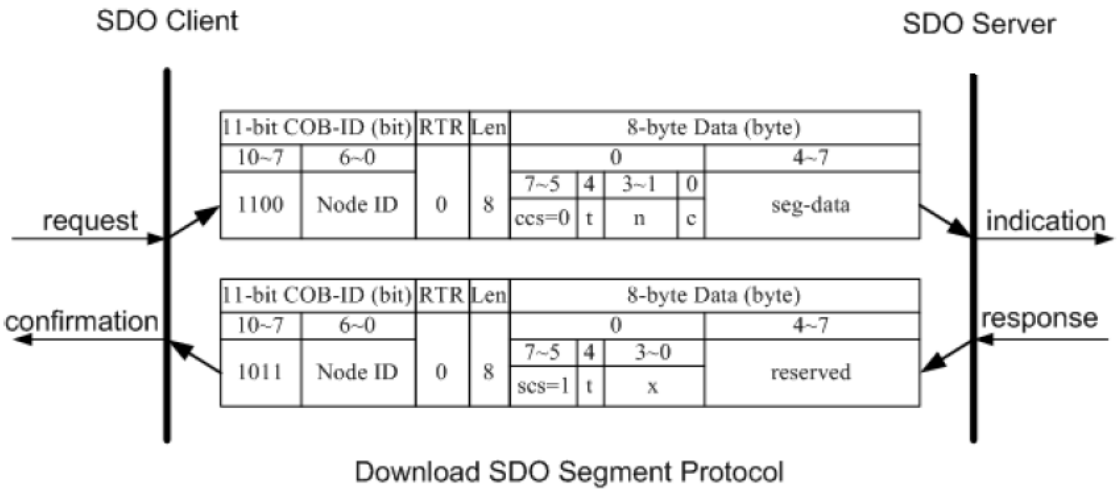
x: not used, always 0

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

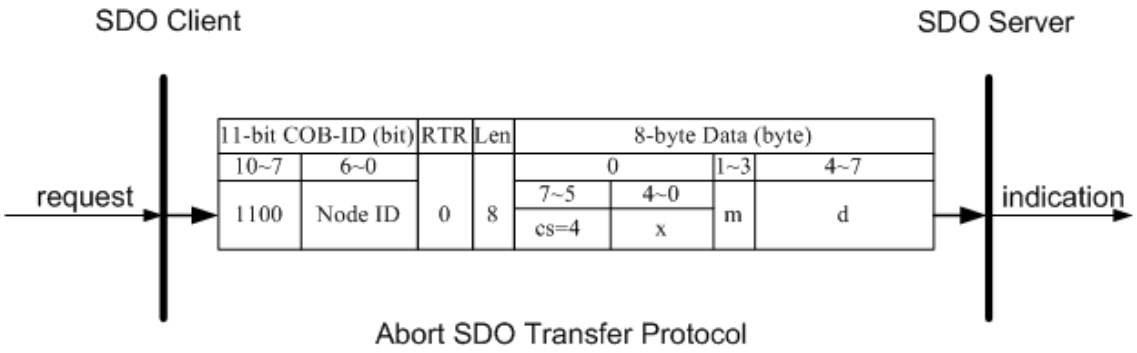
reserved: reserved for further use , always 0

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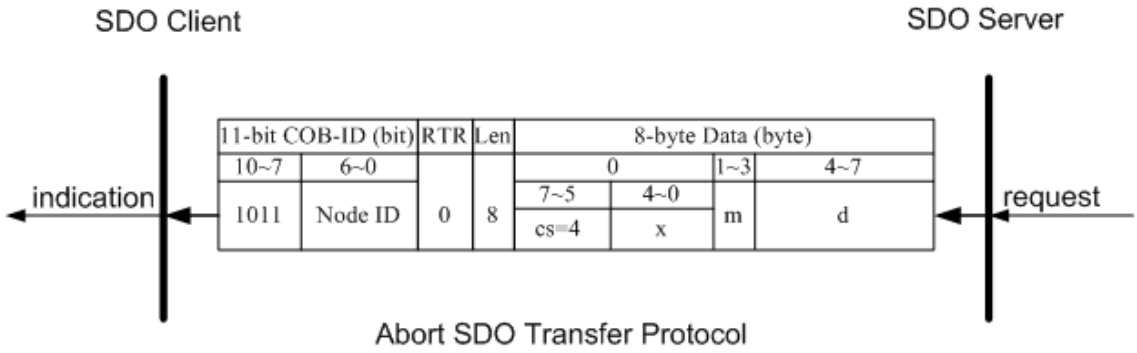
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8.3.1.3. Abort SDO Transfer Protocol

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.

Abort Code	Description
0503 0000h	Toggle bit not alternated.
0504 0000h	SDO protocol timed out.

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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 an 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 an file error).

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8.3.2. PDO Introduction

8.3.2.1. 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-311x-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).

8.3.2.2. 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-311x-CPS doesn't support RxPDO.

8.3.2.3. PDO Communication Rule

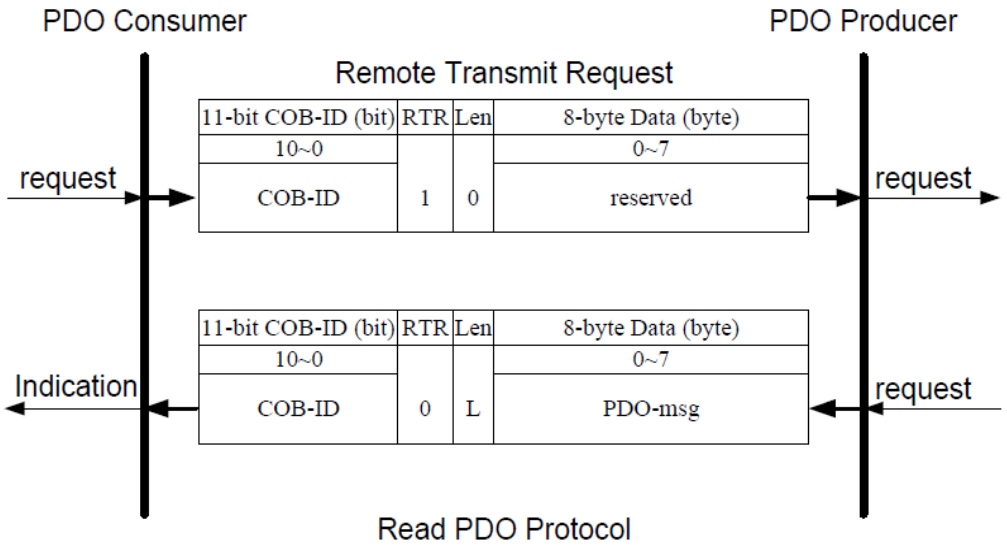
The PDO related objects are indicated from index 0x1400 to 0x1BFF. For the PM-311x-CPS, RxPDO communication objects are not used. The ranges of the TxPDO communication objects and the mapping objects are from index 0x1800 to index 0x1813 and from index 0x1A00 to index 0x1A13 respectively. Moreover, each 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-311x-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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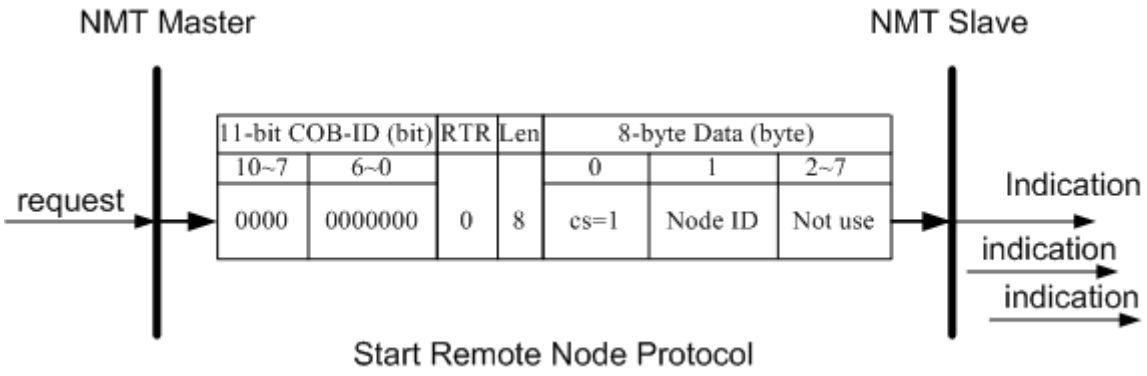
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8.3.3. NMT Introduction

8.3.3.1. 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-311x-CPS.

Start Remote Node Protocol



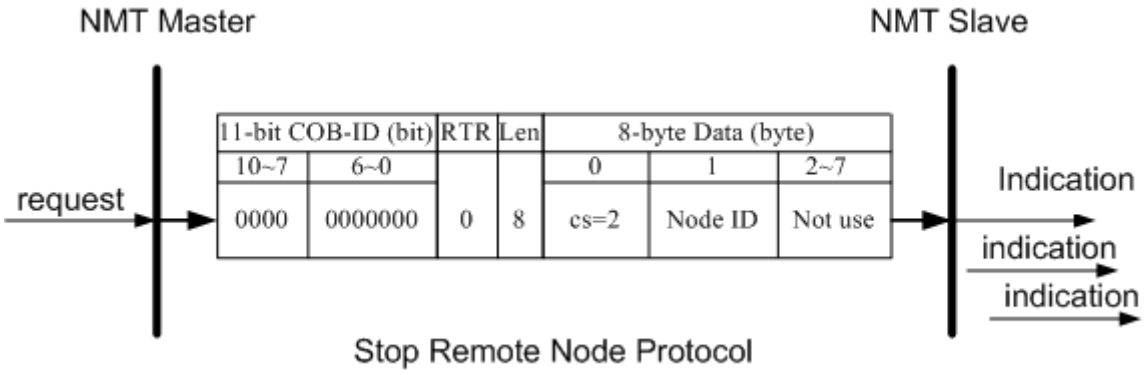
Start Remote Node Protocol

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

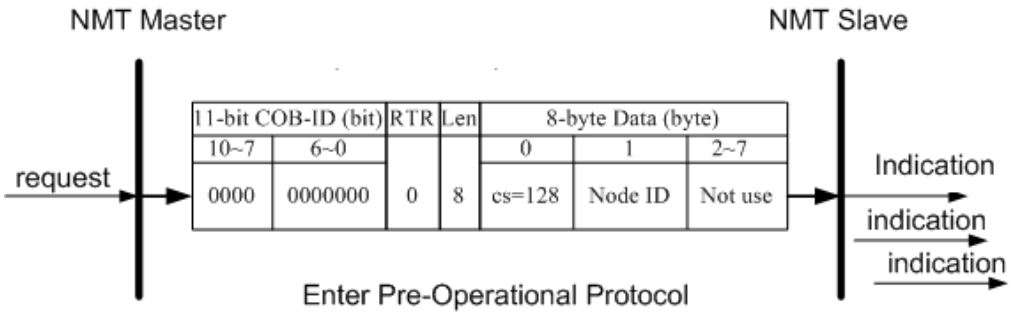
2: stop

Node ID: the node ID of the NMT slave device

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Enter Pre-Operational Protocol

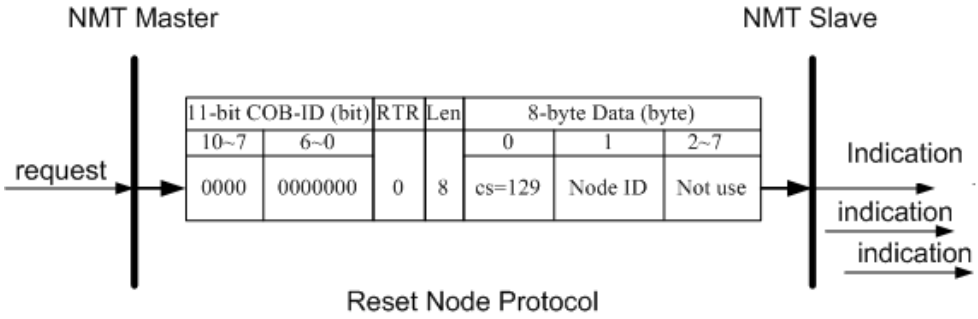


cs: NMT command specified

128: enter PRE-OPERATIONAL

Node ID: the node ID of the NMT slave device

Reset Node Protocol



cs : NMT command specified

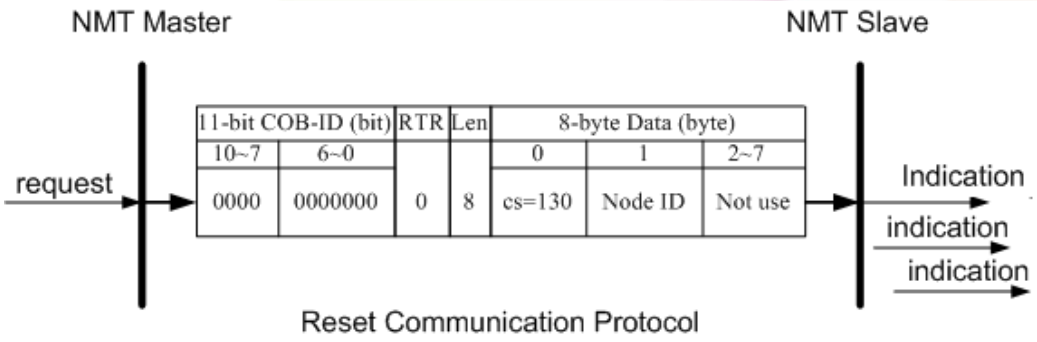
129: Reset_Node

Node ID : the node ID of the NMT slave device

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Reset Communication Protocol



Reset Communication Protocol

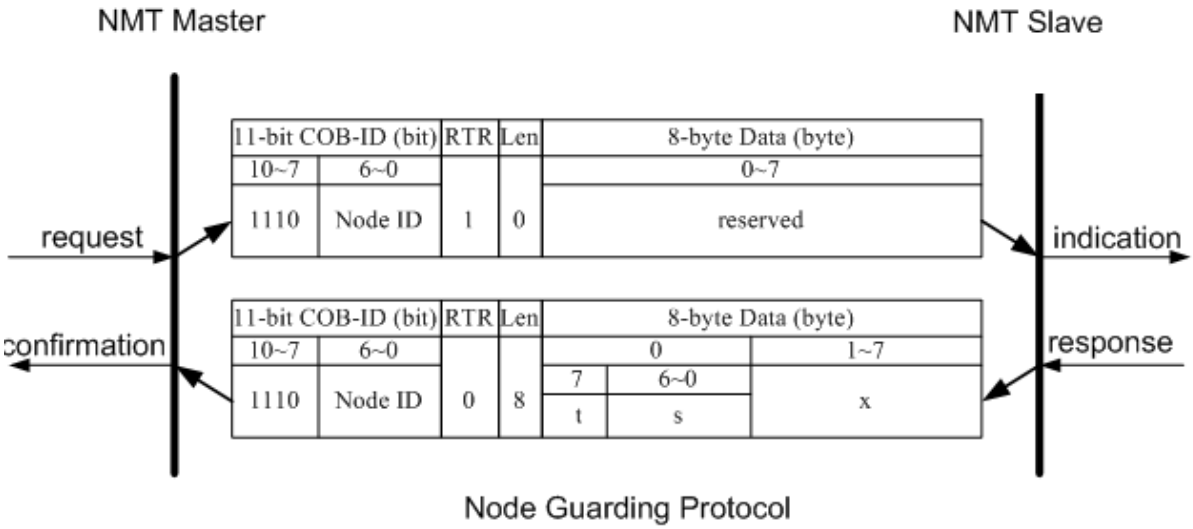
cs: NMT command specified

130: Reset_Communication

Node ID: the node ID of the NMT slave device

8.3.3.2. 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-311x-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

8.3.4. Special Functions for PM-311x-CPS

8.3.4.1. Power Meter Data Table

The PM-311x-CPS Manufacturer in the Specific Profile Area defines some entries, which are used for the power meter data. The objects with index 0x3200~0x3208 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_d)	kWh_d
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_d)	Amp(I_d)
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_d)	kVA(Kva_d)
13	---	8	PF_a	kVAh_a
14	---	8	PF_b	kVAh_d
15	---	8	PF_c	kVAh_c
16	---	8	PF_d	kVAh_d
17	---	4	kvarh_a	---
18	---	4	kvarh_b	---
19	---	4	kvarh_c	---
20	---	4	kvarh_d	---

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8.4. Object Dictionary of PM-311x-CPS

8.4.1. Communication Profile Area

The following tables are regarding each entry of the communication profile area is defined in PM-311x-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-311-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	
1009h	0h	manufacturer hardware version	VISIBLE_STRING	RO	---
100Ah	0h	manufacturer software version	VISIBLE_STRING	RO	---
100Ch	0h	guard time	UNSIGNED 16	RW	0
100Dh	0h	life time factor	UNSIGNED 8	RW	0
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	vender ID	UNSIGNED 32	RO	---

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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
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

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	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(Kw_a) data	INTEGER 32	RO	3200 0120h
	2	read kWh_a data	INTEGER 32	RO	3201 0120h
1A01h	0	largest sub-index supported for “transmit PDO mapping”	UNSIGNED 8	RO	2
	1	read kW(Kw_b) data	INTEGER 32	RO	3200 0220h
	2	read kWh_b data	INTEGER 32	RO	3201 0220h
1A02h	0	largest sub-index supported for “transmit PDO	UNSIGNED 8	RO	2

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		mapping”			
	1	read kW(Kw_c) data	INTEGER 32	RO	3200 0320h
	2	read kWh_c data	INTEGER 32	RO	3201 0320h
1A03h	0	largest sub-index supported for “transmit PDO mapping”	UNSIGNED 8	RO	2
	1	read kW(Kw_d) data	INTEGER 32	RO	3200 0420h
	2	read kWh_d data	INTEGER 32	RO	3201 0420h
1A04h	0	largest sub-index supported for “transmit PDO mapping”	UNSIGNED 8	RO	2
	1	read Volt(V_a) data	INTEGER 32	RO	3202 0120h
	2	read Amp(I_a) data	INTEGER 32	RO	3203 0120h
1A05h	0	largest sub-index supported for “transmit PDO mapping”	UNSIGNED 8	RO	2
	1	read Volt(V_b) data	INTEGER 32	RO	3202 0220h
	2	read Amp(I_b) data	INTEGER 32	RO	3203 0220h
1A06h	0	largest sub-index supported for “transmit PDO mapping”	UNSIGNED 8	RO	2
	1	read Volt(V_c) data	INTEGER 32	RO	3202 0320h
	2	read Amp(I_c) data	INTEGER 32	RO	3203 0320h
1A07h	0	largest sub-index supported for “transmit PDO	UNSIGNED 8	RO	2

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		mapping”			
	1	read Volt(V_d) data	INTEGER 32	RO	3202 0420h
	2	read Amp(I_d) data	INTEGER 32	RO	3203 0420h
1A08h	0	largest sub-index supported for “transmit PDO mapping”	UNSIGNED 8	RO	2
	1	read kvar(kvar_a) data	INTEGER 32	RO	3204 0120h
	2	read kVA(Kva_a) data	INTEGER 32	RO	3205 0120h
1A09h	0	largest sub-index supported for “transmit PDO mapping”	UNSIGNED 8	RO	2
	1	read kvar(kvar_b) data	INTEGER 32	RO	3204 0220h
	2	read kVA(Kva_b) data	INTEGER 32	RO	3205 0220h
1A0Ah	0	largest sub-index supported for “transmit PDO mapping”	UNSIGNED 8	RO	2
	1	read kvar(kvar_c) data	INTEGER 32	RO	3204 0320h
	2	read kVA(Kva_c) data	INTEGER 32	RO	3205 0320h
1A0Bh	0	largest sub-index supported for “transmit PDO mapping”	UNSIGNED 8	RO	2
	1	read kvar(kvar_d) data	INTEGER 32	RO	3204 0420h
	2	read kVA(Kva_d)	INTEGER 32	RO	3205 0420h

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		data			
1A0Ch	0	largest sub-index supported for “transmit PDO mapping”	UNSIGNED 8	RO	2
	1	read PF_a data	INTEGER 32	RO	3206 0120h
	2	read kVAh_a data	INTEGER 32	RO	3207 0120h
1A0Dh	0	inhibit time	UNSIGNED 8	RO	2
	1	read PF_b data	INTEGER 32	RO	3206 0220h
	2	read kVAh_b data	INTEGER 32	RO	3207 0220h
1A0Eh	0	largest sub-index supported for “transmit PDO mapping”	UNSIGNED 8	RO	2
	1	read PF_c data	INTEGER 32	RO	3206 0320h
	2	read kVAh_c data	INTEGER 32	RO	3207 0320h
1A0Fh	0	largest sub-index supported for “transmit PDO mapping”	UNSIGNED 8	RO	2
	1	read PF_d data	INTEGER 32	RO	3206 0420h
	2	read kVAh_d data	INTEGER 32	RO	3207 0420h
1A10h	0	largest sub-index supported for “transmit PDO mapping”	UNSIGNED 8	RO	1
	1	read kvarh_a data	INTEGER 32	RO	3208 0120h
1A11h	0	largest sub-index supported for “transmit PDO mapping”	UNSIGNED 8	RO	1
	1	read kvarh_b data	INTEGER 32	RO	3208 0220h
1A12h	0	largest sub-index supported for “transmit PDO mapping”	UNSIGNED 8	RO	1

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	1	read kvarh_c data	INTEGER 32	RO	3208 0320h
1A13h	0	largest sub-index supported for “transmit PDO mapping”	UNSIGNED 8	RO	1
	1	read kvarh_d data	INTEGER 32	RO	32080h

8.4.2. Manufacturer Specific Profile Area

In the following table, there is information about some special functions for the PM-311x-CPS. The index from 0x3200 to 0x3208 records the power meter measurement parameters. The number of these entries will be automatically updated when the PM-311x-CPS boot up. 0x2500 and 0x3209 are meter parameters information. 0x2500 records the software CANopen Node-ID. 0x3209 stores three meter parameters including Meter Ratio, PT Ratio and RT Ratio. PT Ratio means potential transformer ratio, the default value is 100 and the unit is 0.1. RT Ratio means current transformer ratio, the default value is 1 and the unit is 1.

Idx	Sidx	Description	Type	Attr	Default
3200h	0	largest sub-index supported for “kW”	UNSIGNED 8	RO	4
	1	kW(Kw_a)	INTEGER32	RO	0
	2	kW(Kw_b)	INTEGER32	RO	0
	3	kW(Kw_c)	INTEGER32	RO	0
	4	kW(Kw_d)	INTEGER32	RO	0
3201h	0	largest sub-index supported for “kWh”	UNSIGNED 8	RO	4
	1	kWh_a	INTEGER32	RO	0
	2	kWh_b	INTEGER32	RO	0
	3	kWh_c	INTEGER32	RO	0
	4	kWh_d	INTEGER32	RO	0
3202h	0	largest sub-index supported for “Volt”	UNSIGNED 8	RO	4
	1	Volt(V_a)	INTEGER32	RO	0
	2	Volt(V_b)	INTEGER32	RO	0

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	3	Volt(V_c)	INTEGER32	RO	0
	4	Volt(V_b)	INTEGER32	RO	0
3203h	0	largest sub-index supported for “Amp”	UNSIGNED 8	RO	4
	1	Amp(I_a)	INTEGER32	RO	0
	2	Amp(I_b)	INTEGER32	RO	0
	3	Amp(I_c)	INTEGER32	RO	0
	4	Amp(I_d)	INTEGER32	RO	0
3204h	0	largest sub-index supported for “kvar”	UNSIGNED 8	RO	4
	1	kvar(kvar_a)	INTEGER32	RO	0
	2	kvar(kvar_b)	INTEGER32	RO	0
	3	kvar(kvar_c)	INTEGER32	RO	0
	4	kvar(kvar_d)	INTEGER32	RO	0
3205h	0	largest sub-index supported for “kVA”	UNSIGNED 8	RO	4
	1	kVA(Kva_a)	INTEGER32	RO	0
	2	kVA(Kva_b)	INTEGER32	RO	0
	3	kVA(Kva_c)	INTEGER32	RO	0
	4	kVA(Kva_d)	INTEGER32	RO	0
3206h	0	largest sub-index supported for “PF”	UNSIGNED 8	RO	4
	1	PF_a	INTEGER32	RO	0
	2	PF_b	INTEGER32	RO	0
	3	PF_c	INTEGER32	RO	0
	4	PF_d	INTEGER32	RO	0
3207h	0	largest sub-index supported for “kVAh”	UNSIGNED 8	RO	4
	1	kVAh_a	INTEGER32	RO	0
	2	kVAh_b	INTEGER32	RO	0
	3	kVAh_c	INTEGER32	RO	0
	4	kVAh_d	INTEGER32	RO	0
3208h	0	largest sub-index supported for “kvarh”	UNSIGNED 8	RO	4
	1	kvarh_a	INTEGER32	RO	0
	2	kvarh_b	INTEGER32	RO	0

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	3	kvarh_c	INTEGER32	RO	0
	4	kvarh_d	INTEGER32	RO	0
3209h	0	largest sub-index supported for object	UNSIGNED 8	RO	2
	1	PT Ratio	UNSIGNED 16	RW	100
	2	CT Ratio	UNSIGNED 16	RW	1
320Ah	0	largest sub-index supported for object	UNSIGNED 8	RO	3
	1	Set Energy to Zero	UNSIGNED 16	RW	0x0055
	2	Reset to Factory Settings	UNSIGNED 16	RW	0x0055
	3	Default Frequency	UNSIGNED 16	RW	0x0055

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Appendix 1: Questions & Answers

Q1. Can we use the other 5A CT's(like 300/5..) to directly connect to the input current terminals of PM-311x series ?

No, because the input current is only mA size on PM-311x series，definitely not to directly use other 5A CT's to connect and apply（like100/5…），It could causes the fetal damages.

Users can use the PM-311x series attached split type clip-on CT to connect the other CT's secondary test 5A current.

Q2. If I want to replace the failed split type clip-on CT, can I just detach it? Anything I should pay more attention to?

In any circumstance, please make sure the CT had been disconnected with the power cable of monitoring equipments before the CT lines detach from the terminals of the smart meter. Otherwise, it will cause the severe injury.

Q3. If the turn point of the split type clip-on CT has broken, or inner Ferrite-core has broken, how to settle this condition?

The measure data will be not accuracy as before, please do not use any more.

You need the new CT.

Q4. If multiple set of meters being installed，Can I detach the CT's and mix use with each other?

Please do not mix use，because each set of smart meter(PM-311x series) and its attached split type clip-on CT are calibrated set by set. The mix use may cause the wrong measurements.

Q5. What problem is while the measured readings of the power consumption（kw）is negative?

(2) First check the current input end – line terminal, （check the connection should be **CT1-K, CT1-L, CT2-K, CT2-L**），base on white black, white black, white black follow the sequence order

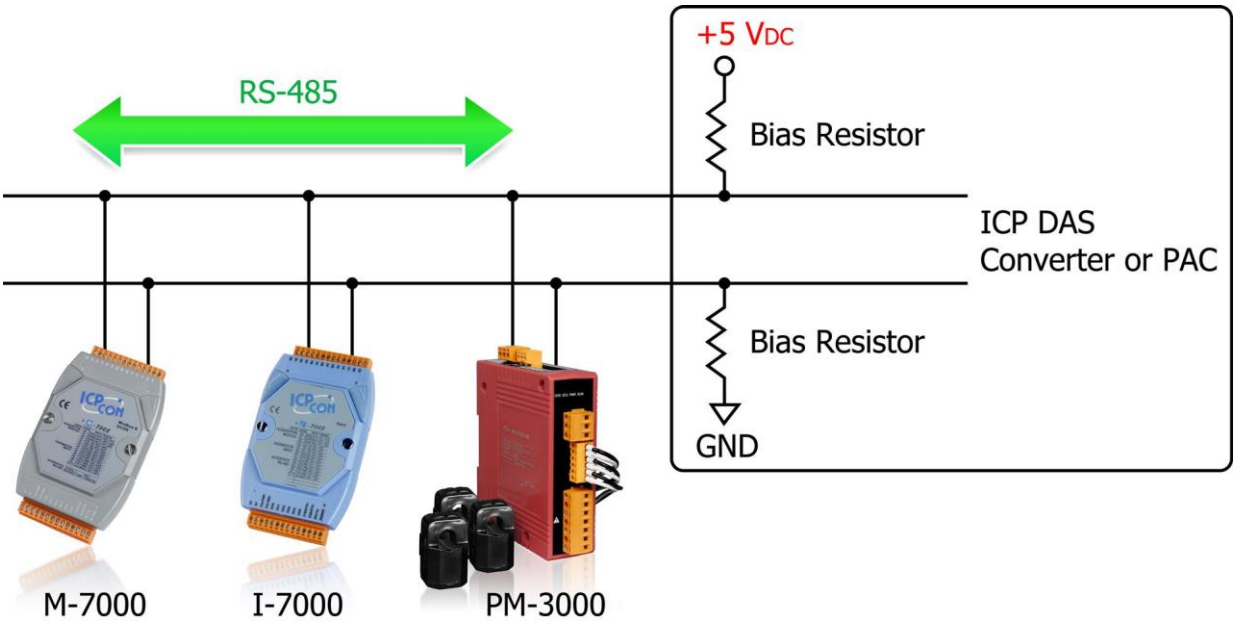
(3) Check the field current direction（K→L）is same as the inner arrow direction of the split type clip-on CT.

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Q6. 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-3133 series. Otherwise, the tM-SG4 or SG-785 should be added to provide the bias. All ICP DAS controllers and converters provide the bias.



Q7. What the power cable diameter (mm) of the monitoring equipments should be for the various CT's?

Power cable diameter ＜Φ10 use 60A CT，Φ10～Φ16 use 100A CT，Φ16～Φ24 use 200A CT.

Q8. Regarding to the split type clip-on CT's, if the wire is not long enough?

Φ10, Φ16, Φ24 split type CT，the standard length is 1.8M. For special length, please contact ICP DAS.

Q9. How to measure the current large than 200A?

For larger current measurement requirement, please contact ICP DAS.

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