

PM-311x

Smart Power Meter

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User's Manual



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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 ($<1\%$, $PF=1$), 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 1% ($PF=1$)
- Supports RS-485 Interface
- Supports Modbus RTU
- Supports 2-Power Relay Output (Form A)

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.

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.

Chapter 2 Specifications

2.1 Specifications

AC Power Measurement	PM-311x:10-300 VAC Connector: 7.62mm patch	
Input Current	CTΦ10 mm (60A) , CTΦ16mm (100A) , CTΦ24mm (200A)	
Aux Power	DC +10V~+30 VDC; Connector: 5.08mm patch	
Frequency	60/50 Hz	
Starting Current	>0.03A (60A) , >0.05A (100A) , >0.09A (200A) Connector: 3.81mm patch	
Wiring diagram	PM-3112 : 2 loops single-phase; M-3114 : 4 loops single-phase	
Power Parameters Measures	PM-3112: V1, V2 I 1, I 2 kW1, kW2 kVA1, kVA2 kVar1, kVar2 PF1, PF2 kWh1, kWh2 kVAh1, kVAh2 kVarh1, kVarh2	PM-3114: V1, V1, V2, V2 I 1, I 2, I 3, I 4 kW1, kW2, kW3, kW4 kVA1, kVA2, kVA3, kVA4 kVar1, kVar2, kVar3, kVar4 PF1, PF2, PF3, PF4 kWh1, kWh2, kWh3, kWh4 kVAh1, kVAh2, kVAh3, kVAh4 kVarh1, kVarh2, kVarh3, kVarh4
Communication	2500 VDC Isolated RS-485, Half-duplex; Protocol: Modbus-RTU Baud Rate: 9600, 19200 (Default), 38400, 115200 bps Connector: 3.81mm patch	
W Accuracy	<1% (@V=220Vac ,I=5A ,PF=1)	
Dimensions (W x L x H)	127 mm x 105 mm x 33 mm	
Operating Temperature	-10°C ~ +70 °C	
Module Installation	DIN-Rail Mounting	

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.

2.2 Naming Rules

PM-311



Channel
2: 2 Loops
4: 4 Loops



CT size (measurement)
100: CTΦ10 mm (0 ~ 60 A)
160: CTΦ16 mm (0 ~ 100 A)
240: CTΦ24 mm (0 ~ 200 A)

-



Communication
□: RS-485
CAN: CAN Bus
CPS: CANopen
MTCP: Modbus TCP

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.

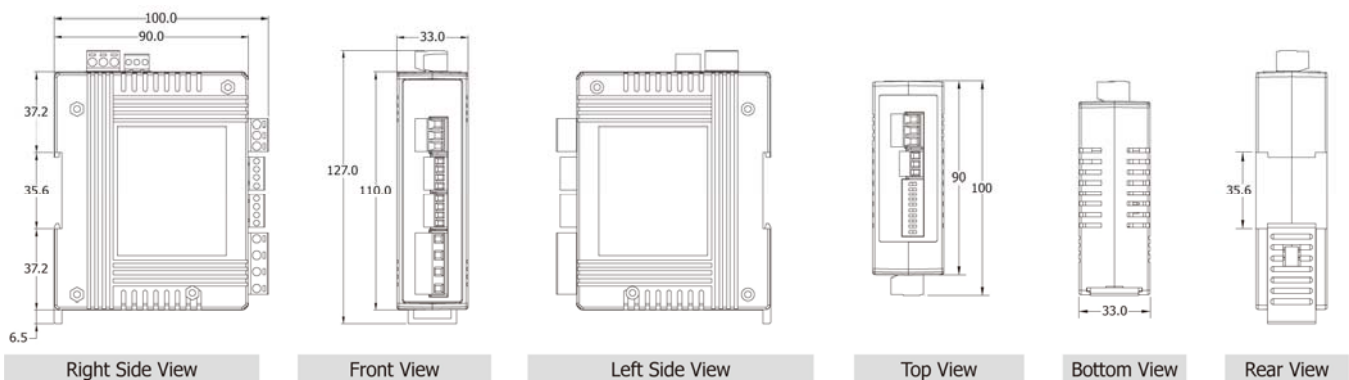
3.2 Safety



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



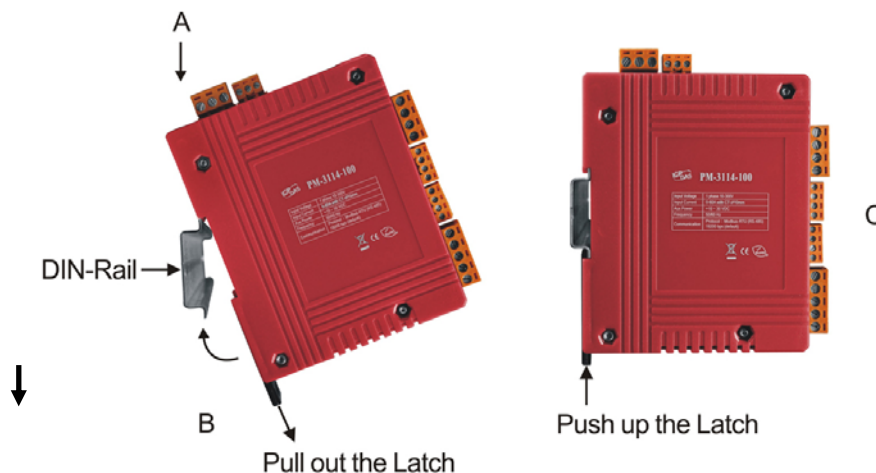
- Products come with external split type clip-on CT's. Disconnect the CT's or use other CT's is highly prohibited.
- Please read this operation manual carefully before using.
- Please re-confirm the measure position.
- PM-311x series can be installed as rail mounting mode or embedded, no need to drill 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 +10V ~+30V.

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.



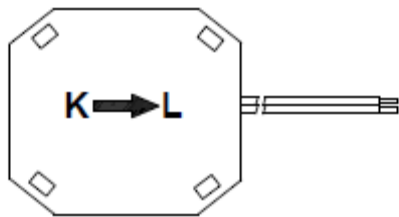
- Wire Disconnection

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.

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.

Chapter 4 Wiring Diagrams

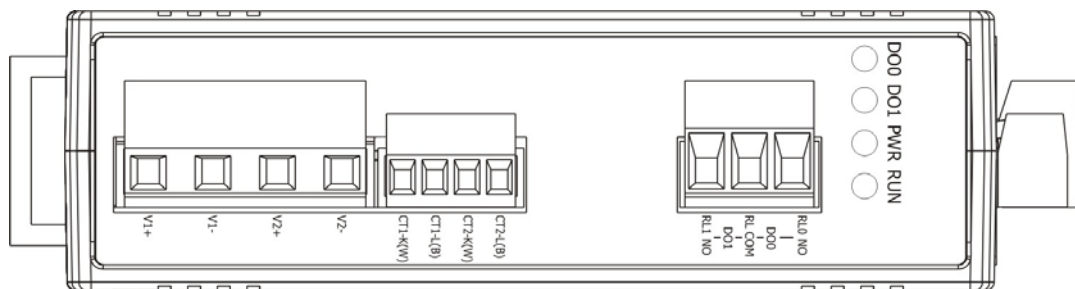
4.1 Connection

● 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+ ◦

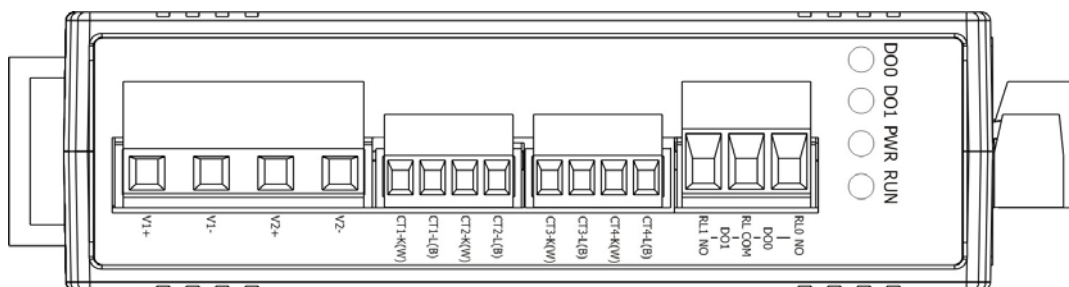


● PM-3114 series

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,CT3-K,CT3-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+ ◦



● AC Voltage Input:

PM-3112 series: AC Input Voltage up to 300V,

PM-3114 series: AC Input Voltage up to 300V.

When input voltage larger than 300V, please add the PT (power transformer), and Change PT RATIO setup.

● 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 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 $\Phi 10$ use 60A CT , $\Phi 10\sim\Phi 16</math> use 100A CT , $\Phi 16\sim\Phi 24</math> use 200A CT .$$
9. The maximum current value can not exceed the CT rating.

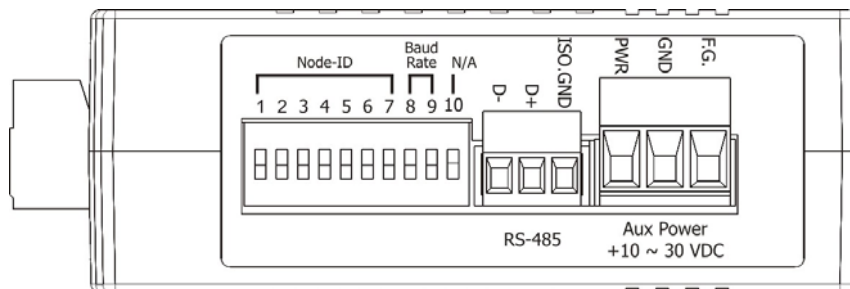
4.2 Communication Interface

- PM-311x (RS-485, Modbus-RTU)

Connect RS-485 D+, D-

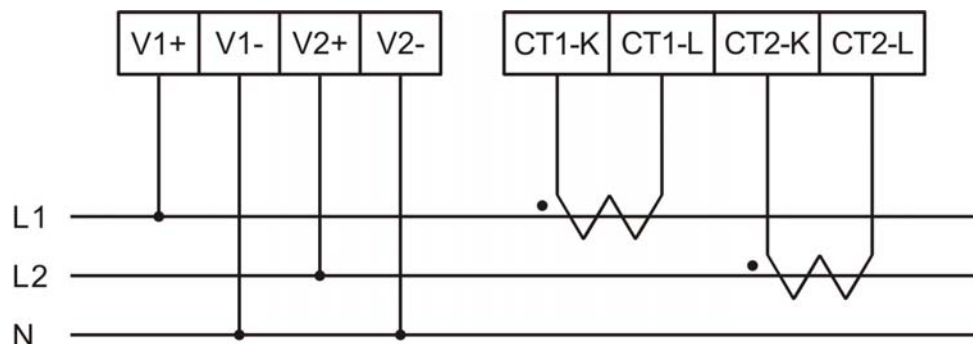
("PWR", "GND" sequence base on the top cover mark showed)

And then, add the auxiliary power ◦ DC+10~+30V (PWR, GND, F.G.)

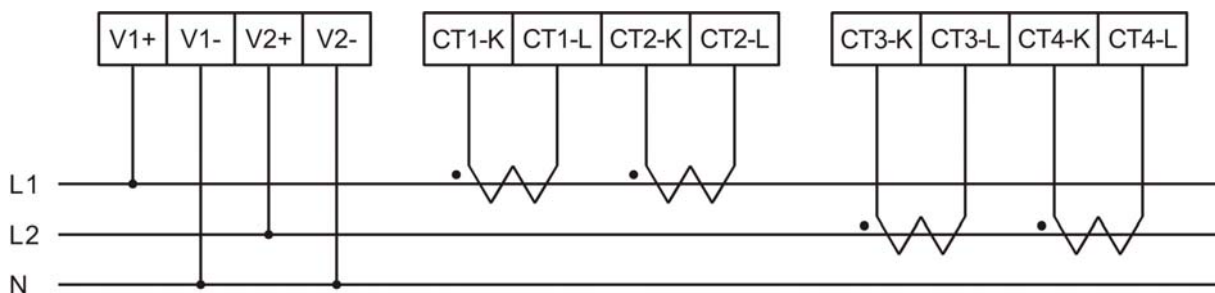


Wiring:

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



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

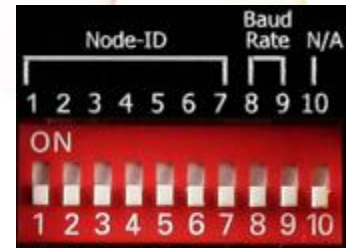


Chapter 5 Modbus-RTU communication

5.1 Connection

5.1 Dip Switch:

Dip Switch is used for Modbus RTU address and Baud Rate setting.



- **SW 1-7:** Node-ID.

Dip switch 1-7 is used for Modbus RTU address setting, rang form 1 to 128. 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

Modbus Address	1	2	3	4	5	6	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
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
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	ON	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
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
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

- **SW 8-9:** For Baud Rate select

PM-311x : Select Baud Rate (Default 19200 bps)

Baud Rate	8	9
9600	OFF	OFF
19200	ON	OFF
38400	OFF	ON
115200	ON	ON

- **SW 10:** Only OFF.

If this pin is "on", dip it to "off" and re-power PM-311x after setting.

Chapter 6 Relay output & LED Indicator

6.1 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

6.2 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".

Chapter 7 communication Formats

7.1 Specifications

- **Communication protocol: Modbus-RTU**
- **Transport specification**
 - 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, 38400, 115200
- **Modbus slave address** : 1-128
- 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 Function 04 is 125 registers

- **Format of data :**

Integer : 16 bits with sign, each with 1 register
 Unsigned Integer : 16 bits without sign, each with 1 register
 Unsigned Integer32 : 32 bits without sign, each with 2 registers
 Float : IEEE 754 Format , each with 2 registers, Low Word is first priority while transmit

IEEE 754 Format

Definition of the floating format of the Bits

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

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

Where:

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.

- **transport sequence (Float)**

1	2	3	4
Data Lo Word , Hi Byte	Data Lo Word , Lo Byte	Data Hi Word , Hi Byte	Data Hi Word , Lo Byte

- **transport sequence (Inverse Integer)**

1	2	3	4
Data Hi Word , Hi Byte	Data Hi Word , Lo Byte	Data Lo Word , Hi Byte	Data Lo Word , Lo Byte

- **transport sequence (Integer)**

1	2	3	4
Data Lo Word , Hi Byte	Data Lo Word , Lo Byte	Data Hi Word , Hi Byte	Data Hi Word , Lo Byte

7.2 Modbus Register

Modbus Address #1 - Coil: Relay Value

Parameter name	Modbus Coil		Len	Data Type	Range	Default value	Comment
	Modicom	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 Address #2 - Holding Register: System Parameter Setting

Parameter name	Modbus Register		Len	Data Type	Range	Default value	Units	Comment
	Modicom	Hex						
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
Default Frequency	44110	0x100D	Word	UInt	0x0055: Auto 0x0064: 50Hz 0x0078: 60Hz	0x0055		Re-power the module after setting

Modbus Address #3 - Input Register: System Information

Parameter name	Modbus Register		Len	Data Type	Range	Default value	Units	Comment
	Modicom	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

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

Parameter name	Modbus Register		Len	Data Type	Range	Units	Comment
	Modicom	Hex					
V_1	34353-34354	0x1100-0x1101	DWord	Float		Volt	Primary
I_1	34355-34356	0x1102-0x1103	DWord	Float		Amp	Primary
kW_1	34357-34358	0x1104-0x1105	DWord	Float		kW	Primary
kvar_1	34359-34360	0x1106-0x1107	DWord	Float		kvar	Primary
kVA_1	34361-34362	0x1108-0x1109	DWord	Float		kVA	Primary
PF_1	34363-34364	0x110A-0x110B	DWord	Float			Primary
kWh_1	34365-34366	0x110C-0x110D	DWord	Float			Primary
kvarh_1	34367-34368	0x110E-0x110F	DWord	Float			Primary
kVAh_1	34369-34370	0x1110-0x1111	DWord	Float			Primary
V_2	34371-34372	0x1112-0x1113	DWord	Float		Volt	Primary
I_2	34373-34374	0x1114-0x1115	DWord	Float		Amp	Primary
kW_2	34375-34376	0x1116-0x1117	DWord	Float		kW	Primary
kvar_2	34377-34378	0x1118-0x1119	DWord	Float		kvar	Primary
kVA_2	34379-34380	0x111A-0x111B	DWord	Float		kVA	Primary
PF_2	34381-34382	0x111C-0x111D	DWord	Float			Primary
kWh_2	34383-34384	0x111E-0x111F	DWord	Float			Primary

kvarh_2	34385-34386	0x1120-0x1121	DWord	Float			Primary
kVAh_2	34387-34388	0x1122-0x1123	DWord	Float			Primary
V_3	34389-34390	0x1124-0x1125	DWord	Float		Volt	Primary
I_3	34391-34392	0x1126-0x1127	DWord	Float		Amp	Primary
kW_3	34393-34394	0x1128-0x1129	DWord	Float		kW	Primary
kvar_3	34395-34396	0x112A-0x112B	DWord	Float		kvar	Primary
kVA_3	34397-34398	0x112C-0x112D	DWord	Float		kVA	Primary
PF_3	34399-34400	0x112E-0x112F	DWord	Float			Primary
kWh_3	34401-34402	0x1130-0x1131	DWord	Float			Primary
kvarh_3	34403-34404	0x1132-0x1133	DWord	Float			Primary
kVAh_3	34405-34406	0x1134-0x1135	DWord	Float			Primary
V_4	34407-34408	0x1136-0x1137	DWord	Float		Volt	Primary
I_4	34409-34410	0x1138-0x1139	DWord	Float		Amp	Primary
kW_4	34411-34412	0x113A-0x113B	DWord	Float		kW	Primary
kvar_4	34413-34414	0x113C-0x113D	DWord	Float		kvar	Primary
kVA_4	34415-34416	0x113E-0x113F	DWord	Float		kVA	Primary
PF_4	34417-34418	0x1140-0x1141	DWord	Float			Primary
kWh_4	34419-34420	0x1142-0x1143	DWord	Float			Primary
kvarh_4	34421-34422	0x1144-0x1145	DWord	Float			Primary
kVAh_4	34423-34424	0x1146-0x1147	DWord	Float			Primary

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

Parameter name	Modbus Register		Len	Data Type	Range	Units	Comment
	Modicom	Hex					
V_1	34609-34610	0x1200-0x1201	DWord	UInt32		0.1 Volt	Primary
I_1	34611-34612	0x1202-0x1203	DWord	UInt32		0.1A	Primary
kW_1	34613-34614	0x1204-0x1205	DWord	Int32		0.1kW	Primary
kvar_1	34615-34616	0x1206-0x1207	DWord	Int32		0.1kvar	Primary
kVA_1	34617-34618	0x1208-0x1209	DWord	Int32		0.1kVA	Primary
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	Primary
I_2	34628-34629	0x1213-0x1214	DWord	UInt32		0.1A	Primary
kW_2	34630-34631	0x1215-0x1216	DWord	Int32		0.1kW	Primary
kvar_2	34632-34633	0x1217-0x1218	DWord	Int32		0.1kvar	Primary
kVA_2	34634-34635	0x1219-0x121A	DWord	Int32		0.1kVA	Primary
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	Primary
I_3	34645-34646	0x1224-0x1225	DWord	UInt32		0.1A	Primary
kW_3	34647-34648	0x1226-0x1227	DWord	Int32		0.1kW	Primary
kvar_3	34649-34650	0x1228-0x1229	DWord	Int32		0.1kvar	Primary
kVA_3	34651-34652	0x122A-0x122B	DWord	Int32		0.1kVA	Primary
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	0x1233-0x1234	DWord	UInt32		0.1 Volt	Primary
I_4	34662-34663	0x1235-0x1236	DWord	UInt32		0.1A	Primary
kW_4	34664-34665	0x1237-0x1238	DWord	Int32		0.1kW	Primary
kvar_4	34666-34667	0x1239-0x123A	DWord	Int32		0.1kvar	Primary
kVA_4	34668-34669	0x123B-0x123C	DWord	Int32		0.1kVA	Primary
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

Modbus Module #6 Input Register: Power Value (Integer)

Parameter name	Modbus Register		Len	Data Type	Range	Units	Comment
	Modicom	Hex					
V_1	34847-34848	0x1300-0x1301	DWord	UInt32		0.1 Volt	Primary
I_1	34849-34850	0x1302-0x1303	DWord	UInt32		0.1A	Primary
kW_1	34851-34852	0x1304-0x1305	DWord	Int32		0.1kW	Primary
kvar_1	34853-34854	0x1306-0x1307	DWord	Int32		0.1kvar	Primary
kVA_1	34855-34856	0x1308-0x1309	DWord	Int32		0.1kVA	Primary
PF_1	34857	0x130A	Word	Int	0~1000	0.001PF	0~1.000
kWh_1	34858-34859	0x130B-0x130C	DWord	Int32	±0~99999999	0.1kWh	±0~9999999.9
kvarh_1	34860-34861	0x130D-0x130E	DWord	Int32	0~99999999	0.1kvarh	0~9999999.9
kVAh_1	34862-34863	0x130F-0x1310	DWord	Int32	±0~99999999	0.1kVAh	±0~9999999.9
V_2	34864-34865	0x1311-0x1312	DWord	UInt32		0.1 Volt	Primary
I_2	34866-34867	0x1313-0x1314	DWord	UInt32		0.1A	Primary
kW_2	34868-34869	0x1315-0x1316	DWord	Int32		0.1kW	Primary
kvar_2	34870-34871	0x1317-0x1318	DWord	Int32		0.1kvar	Primary
kVA_2	34872-34873	0x1319-0x131A	DWord	Int32		0.1kVA	Primary
PF_2	34874	0x131B	Word	Int	0~1000	0.001PF	0~1.000
kWh_2	34875-34876	0x131C-0x131D	DWord	Int32	±0~99999999	0.1kWh	±0~9999999.9
kvarh_2	34877-34878	0x131E-0x131F	DWord	Int32	0~99999999	0.1kvarh	0~9999999.9
kVAh_2	34879-34880	0x1320-0x1321	DWord	Int32	±0~99999999	0.1kVAh	±0~9999999.9
V_3	34881-34882	0x1322-0x1323	DWord	UInt32		0.1 Volt	Primary
I_3	34883-34884	0x1324-0x1325	DWord	UInt32		0.1A	Primary
kW_3	34885-34886	0x1326-0x1327	DWord	Int32		0.1kW	Primary
kvar_3	34887-34888	0x1328-0x1329	DWord	Int32		0.1kvar	Primary
kVA_3	34889-34890	0x132A-0x132B	DWord	Int32		0.1kVA	Primary
PF_3	34891	0x132C	Word	Int	0~1000	0.001PF	0~1.000
kWh_3	34892-34893	0x132D-0x132E	DWord	Int32	±0~99999999	0.1kWh	±0~9999999.9
kvarh_3	34894-34895	0x132F-0x1330	DWord	Int32	0~99999999	0.1kvarh	0~9999999.9
kVAh_3	34896-34897	0x1331-0x1332	DWord	Int32	±0~99999999	0.1kVAh	±0~9999999.9
V_4	34898-34899	0x1333-0x1334	DWord	UInt32		0.1 Volt	Primary
I_4	34900-34901	0x1335-0x1336	DWord	UInt32		0.1A	Primary

kW_4	34902-34903	0x1337-0x1338	DWord	Int32		0.1kW	Primary
kvar_4	34904-34905	0x1339-0x133A	DWord	Int32		0.1kvar	Primary
kVA_4	34906-34907	0x133B-0x133C	DWord	Int32		0.1kVA	Primary
PF_4	34908	0x133D	Word	Int	0~1000	0.001PF	0~1.000
kWh_4	34909-34910	0x133E-0x1340	DWord	Int32	±0~99999999	0.1kWh	±0~9999999.9
kvarh_4	34911-34912	0x1341-0x1342	DWord	Int32	0~99999999	0.1kvarh	0~9999999.9
kVAh_4	34913-34914	0x1343-0x1344	DWord	Int32	±0~99999999	0.1kVAh	±0~9999999.9

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 (like 100/5...) , It could causes the fatal 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?

(1) 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 follow the sequence order.

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

Q6. PC and meter cannot make the connection ?

- (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.

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

Power cable diameter < Φ 10 use 60A CT , Φ 10~ Φ 16 use 100A CT , Φ 16~ Φ 24 use 200A CT.

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

Φ 10, Φ 16 and Φ 24 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.

Appendix 2: PVC wire and model

Item	copper wire		Wire external diameter (mm)	Reference current (A)	CT size and product model	CT spec. (internal diameter/Max . current)		
	AWG SIZE (mm ²)	Quantity /Diameter (mm)						
Flat cable		1.6	3.2	15	Ø10 (PM-3112-100) or (PM-3114-100)	10mm/60A		
		2.0	3.6	20				
Twisted pair	2.0	7/0.6	3.4	17				
	3.5	7/0.8	4.0	20				
	5.5	7/1.0	5.0	30				
	8.0	7/1.2	6.0	40				
	14	7/1.6	7.6	55				
	22	7/2.0	9.2	70				
	30	7/2.3	10.5	90			Ø16 (PM-3112-160) or (PM-3114-160)	16mm/100A
	38	7/2.6	11.5	100				
		50	19/1.8	13.0	120	Ø24 (PM-3112-240) or (PM-3114-240)	24mm/200A	
		60	19/2.0	14.0	140			
		80	19/2.3	15.5	165			
		100	19/2.6	17.0	190			
	125	19/2.9	19.0	220				
	150	37/2.3	21.0	250				
	200	37/2.6	23.0	300				

*Wire and current will have discrepancy because of the temperature, material and brand