

PM-4324

Smart Power Meter User's Manual



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Revision History

The table below shows the revision history:

Revision	Date	Description
1.05	2024/04/25	<ul style="list-style-type: none">● Fix the Integer type value range of kVAh,kVARh● Fix the Bi_xxx_kWh modbus address number● Change the Display Voltage definition "automatic" to "default"

Table of Contents

Chapter 1 Introduction	5	Chapter 4 Wiring Diagrams	15
1.1. PM-4324 introduction.....	5	4.1. Connection.....	15
1.2. Caution	6	4.2. Wiring.....	17
1.2.1. Danger.....	6	Chapter 5 Relay output & LED Indicator.....	19
1.3. Warning	6	5.1. Relay.....	19
1.4. Product Warranty & Customer Support.....	6	5.2. LED Indicator	19
1.4.1. Limitation of Warranty.....	7	Chapter 6 Modbus-RTU communication.....	20
Chapter 2 Specifications	8	6.1. RS-485 setting	20
2.1. Specifications.....	8	6.1.1 SW1 – SW6 setting.....	20
2.2. Naming Rules	10	6.2. Modbus-RTU setting	23
Chapter 3 Installation.....	11	6.2.1 Specifications	23
3.1. Inspection	11	6.2.2 Modbus Register	25
3.2. Safety	11	Chapter 7 Modbus-TCP Communication.....	45
3.2.1. Dimension and Latch	11	7.1. Default settings	45
3.2.2. Mounting and Dismounting	13	7.1.1 Ethernet configurations....	46
3.2.3. CT's installation steps.....	14	7.2. Specifications	48
		7.2.1 Modbus Register	48

Chapter 8 CANopen communication.....	49	8.2.3	NMT Introduction.....	64	
8.1	CANopen setting.....	49	8.2.3.1	Module Control Protocol..	64
8.2	CANopen Protocol.....	51	8.2.3.2	Error Control Protocol.....	66
8.2.1	SDO Introduction	52	8.2.4	Special Functions for PM-4324-CPS	67
8.2.1.1	Upload SDO Protocol.....	52	8.2.4.1	Power Meter Data Table..	67
8.2.1.2	Download SDO Protocol.	54	8.2.5	Object Dictionary of PM-4324-CPS	69
8.2.1.3	Abort SDO Transfer Protocol	57	8.2.5.1	Communication Profile Area	69
8.2.2	PDO Introduction	60	8.2.5.2	Manufacturer Specific Profile Area	76
8.2.2.1	PDO COB-ID Parameters	60			
8.2.2.2	Transmission Type.....	61			
8.2.2.3	PDO Communication Rule	62			
			Appendix: Questions & Answers.....	82	

Chapter 1 Introduction

1.1. PM-4324 introduction

ICP DAS offers PM-4324 family in a full range of Single-phase and Three-phase smart power meters for power monitoring. The products offer a rich feature set combined with easy-to-integrate communications.

With its high accuracy ($<0.5\%$, $PF=1$), the PM-4324 series products can be applied both on low voltage primary side and/or medium/high voltage secondary side and enable the users to obtain in real time the reliable and accurate energy consumption readings from the monitored equipments while in operation. These compact size and cost effective Power Meters are equipped with revolutionary wired clip-on CT (various types support input current up to 400A) and standard Modbus communication RS-485 protocol for easy deployment. It works with input voltages ranging 10V ~ 500V, supporting a wide range of applications.

Features :

- True RMS Power Measurements
- Energy Analysis for 3P4W-3CT, 3P3W-2CT, 3P3W-3CT, 1P2W-1CT, 1P3W-2CT
- Current Measurements Up to 400 A with Different CT Ratio
- Voltage Measurements Up to 500 V
- Clip-on CT for Easy Installation
- W Accuracy Better than 0.5% ($PF=1$)
- Supports RS-485, Ethernet Interface
- Supports Modbus RTU, Modbus TCP protocols.
- Supports 2-Power Relay Output (Form A)
- Total Harmonic Distortion (THD)

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

Model	PM-4324		PM-4324-MTCP	PM-4324-CPS
AC Power Measurement				
Wiring	1P2W-1CT, 1P3W-2CT, 3P3W-2CT, 3P3W-3CT and 3P4W-3CT			
Measurement Voltage	10 ~ 500 V (CAT III)			
Measurement Current	CTØ10 mm (0.05 A~60 A); CTØ16 mm (0.1 A~100 A); CTØ24 mm (0.15 A~200 A); CTØ36 mm (0.3 A~300 A); CTØ36 mm (0.3 A~400 A).			
Measurement Frequency	50-60 Hz			
W Accuracy	Better than 0.5% (PF:1)			
Power Parameter Measurement	True RMS voltage (Vrms), True RMS current (Irms), Active Power (kW), Active Energy (kWh), Apparent Power (kVA), Apparent Energy (kVAh), Reactive Power (kVAR), Reactive Energy (kVARh), Power Factor (PF), Frequency(Hz)			
Data Update Rate	1 Second			
Communication				
RS-485	Protocol	Modbus-RTU	-	
	Baud rate	9600,19200 (default), 38400, 115200; DIP Switch Selectable	-	
	Data format	N,8,1 (default); N,8,2; E,8,1; E,8,2; O,8,1; O,8,2	-	
	Isolation	3000 VDC	-	
	Bias Resistor	No (Usually supplied by the RS-485 Master. Alternatively, add a tM-SG4 or SG-785)		
Ethernet	Protocol	-	Modbus TCP	
CANopen	Protocol			CANopen
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	+100 ~ +240 VAC	+100 ~ +240 VAC	+100 ~ +240 VAC
Power Consumption	6 W		
Dimensions (W x L x H)	237 mm x 52 mm x 134 mm		
Environment			
Operating Temperature	-20 ~ +70 °C		
Storage Temperature	-25 ~ +80 °C		

Field Wiring Terminal Markings:

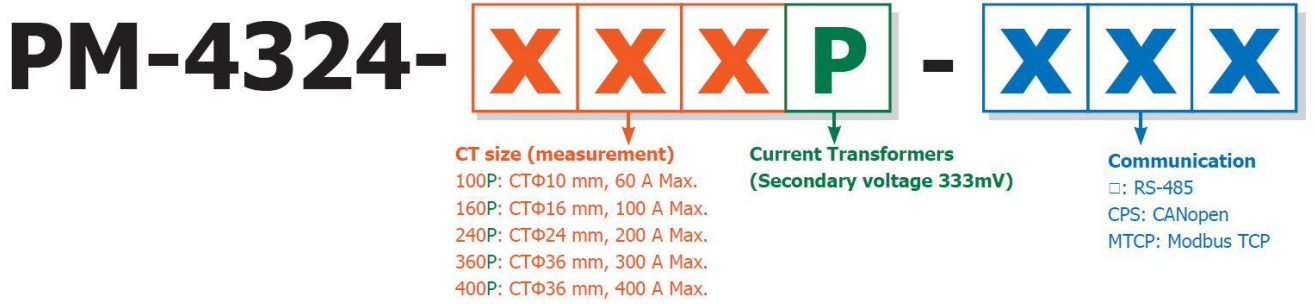
3.81mm (For Measurement Current and Communication): Use Copper Conductors Only, wires range 16-26 AWG, torque value 3.0 lb-in.

5.08mm (For Measurement Voltage, Aux Power and Alarm Output):

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

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

2.2. Naming Rules



Chapter 3 Installation

3.1. Inspection

The instrument is no longer safe when,

- Shows clear signs of damage
- Does not work
- Long storage under extreme conditions
- Damage during shipment

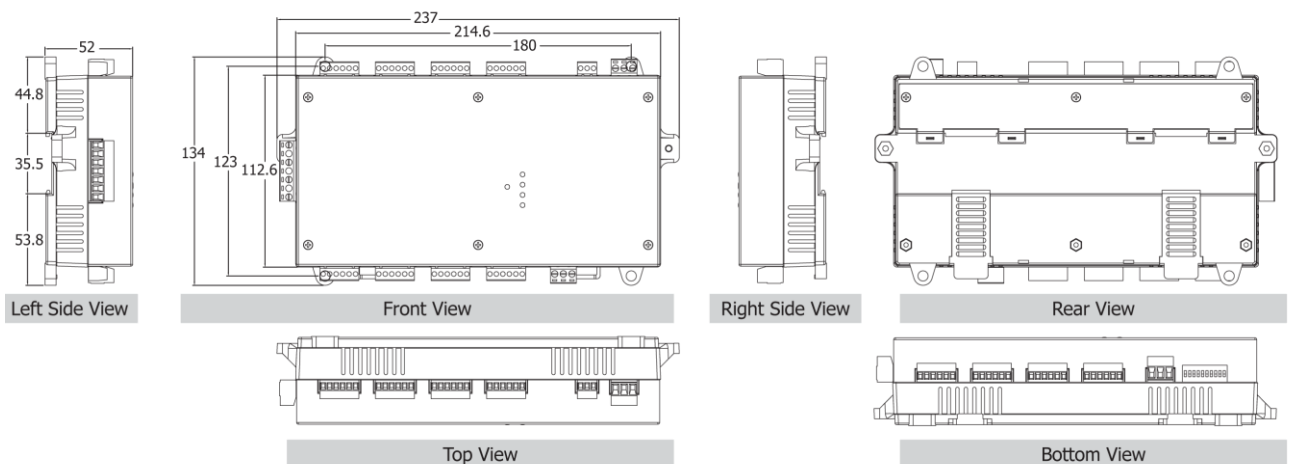
3.2. Safety



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



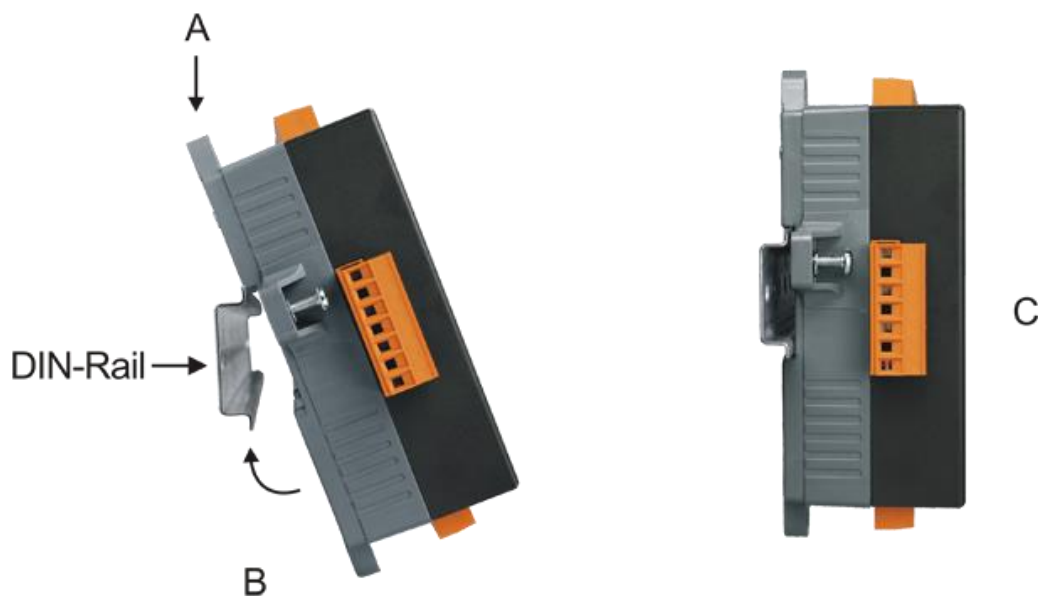
- Products come with external split type clip-on CT's. Disconnect the CT's or use other CT's is highly prohibited.
- Please read this operation manual carefully before using.
- Please re-confirm the measure position.
- PM-4324 series can be installed as rail mounting mode or embedded, no need to drill a hole or screw to fix it (rail mounting width can up to the length of 35 mm).
- Meter auxiliary power is +100 ~ +240 VAC.

3.2.2. Mounting and Dismounting

- Mounting

Assembly: Place the PM-4324 on the DIN-Rail. Push the front of the PM-4324 toward the mounting surface until it audibly snaps into place.

Dismantling: Pull out the latch and then remove the PM-4324 from the DIN-Rail.



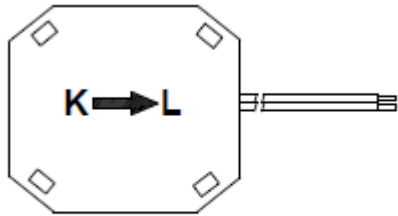
- Wire Disconnection

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.



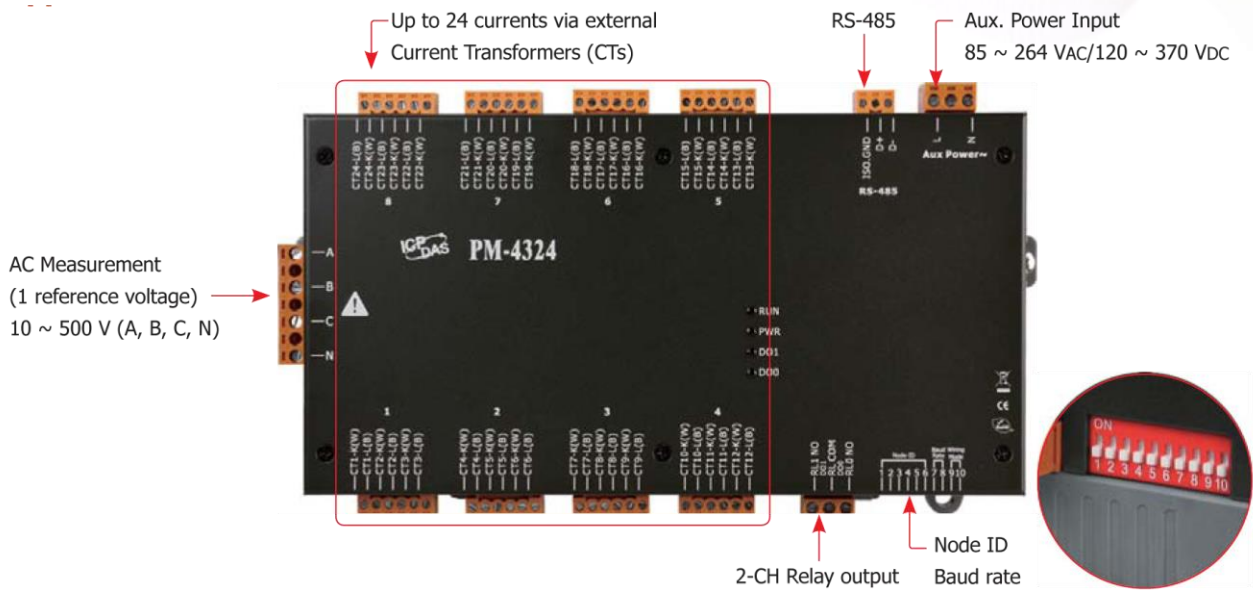
- Make sure the power current direction follow the "K→L" mark on the CT and then close the CT clip.



- Installation steps finished.

Chapter 4 Wiring Diagrams

4.1. Connection



Please firstly check the current input terminal, and then in white black, white black, white black wire sequences (CT1-K, CT1-L, CT2-K, CT2-L, CT3-K, CT3-L). Then connect the CT's, and close the CT clip. 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 voltage input terminal N C B A. for PM-4324, in the three phase order as follows on N C B A.

Attention please!! For 3P3W-2CT, connect in N C A phase sequence, do not connect phase B (Check the diagram).

Voltage Input

1. PM-4324 series: Input Voltage up to 500V.
For any higher Input Voltage large than 500V, please add the PT (power transformer), and Change PT RATIO setup.
2. Confirm the RST (ABC) phase sequence.

Current Input

1. The external CT's are fragile, please handle with care.
2. The current input of PM-4324 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 meter (PM-4324 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-4324 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)

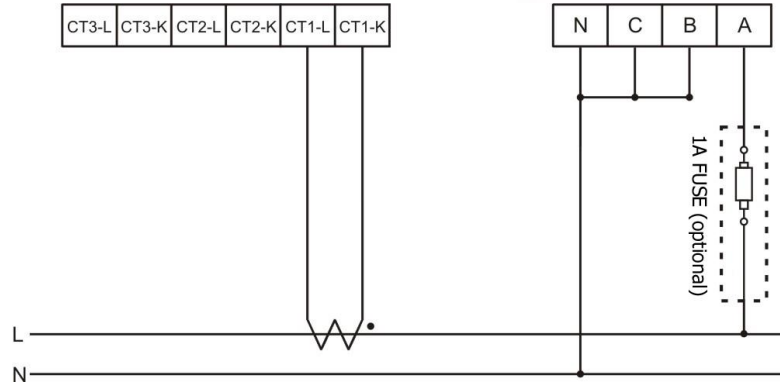


5. When measuring the current, the secondary circuit of a CT should never be opened when a load is passing through its primary. Make sure you always open the CT clip to detach the CT before removing the terminal lines. Otherwise, it will cause severe injury.

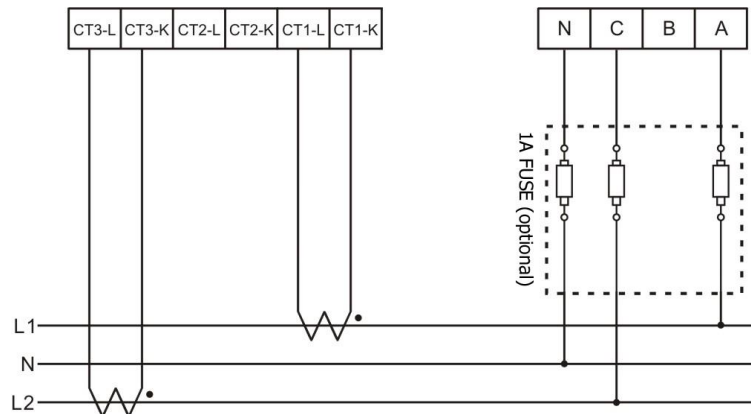
6. Please handle with extra care, especially when the operation space of CT's is limited.
7. The current direction must follow K-L marked on CT's.
8. Please select the right size CT's for different size of monitoring equipment cables:
power cable diameter $\Phi 10$ use 60A CT , $\Phi 10 \sim \Phi 16$ use 100A CT , $\Phi 16 \sim \Phi 24$ use 200A CT , $\Phi 36$ use 300A CT , $\Phi 36$ use 400A CT
9. The maximum current value cannot exceed the CT rating

4.2. Wiring

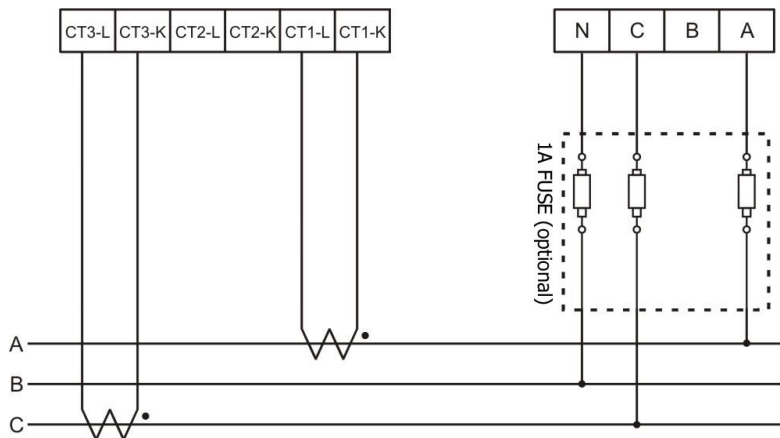
- 1P2W-1CT (PM-4324)



- 1P3W-2CT (PM-4324)

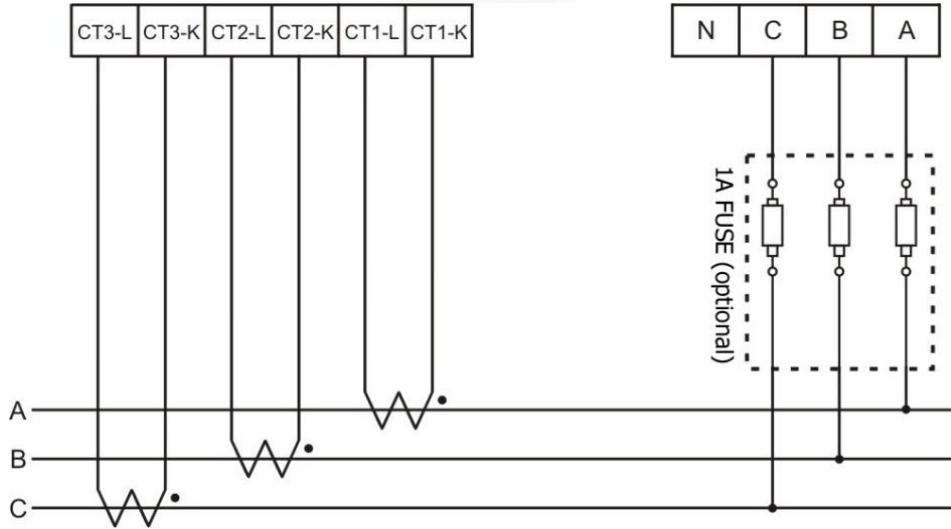


- 3P3W-2CT (PM-4324)



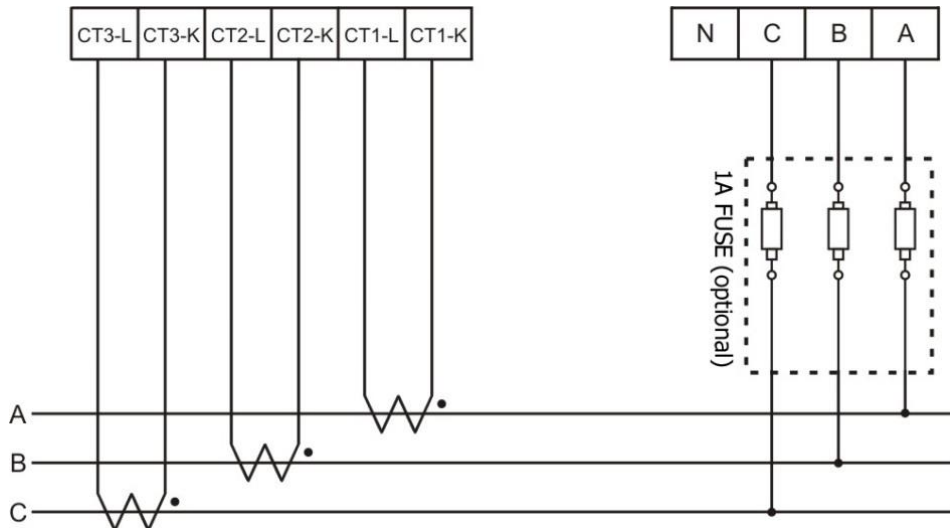
● 3P3W-3CT (PM-4324)

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



● 3P4W-3CT (PM-4324)

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



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-4324 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 6 Modbus-RTU communication

6.1. RS-485 setting

- Default setting for RS-485: **19200, n, 8, 1**
- DIP switch (SW1-SW6) is used for Modbus address setting, default is 1, i.e. all OFF
For example: Modbus address is 10 , find the table of DIP switch 1-6 is **ON, OFF, OFF, ON, OFF, OFF**

6.1.1 SW1 – SW6 setting

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

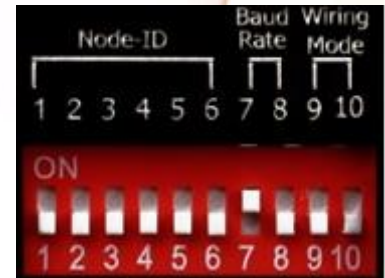
Modbus Address	SW 1	SW 2	SW 3	SW 4	SW 5	SW 6
1	OFF	OFF	OFF	OFF	OFF	OFF
2	ON	OFF	OFF	OFF	OFF	OFF
3	OFF	ON	OFF	OFF	OFF	OFF
4	ON	ON	OFF	OFF	OFF	OFF
5	OFF	OFF	ON	OFF	OFF	OFF
6	ON	OFF	ON	OFF	OFF	OFF
7	OFF	ON	ON	OFF	OFF	OFF
8	ON	ON	ON	OFF	OFF	OFF
9	OFF	OFF	OFF	ON	OFF	OFF
10	ON	OFF	OFF	ON	OFF	OFF
11	OFF	ON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

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

● SW7 – SW8 setting

PM-4324 : For Baud Rate Setting

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



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

The RS-485 master is required to provide the bias for PM-4324 series. Otherwise, the tM-SG4 or SG-785 should be added to provide the bias. All ICP DAS controllers and converters provide the bias.

● SW9 – SW10 setting

PM-4324 : Select the different wiring mode

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

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

6.2 Modbus-RTU setting

6.2.1 Specifications

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

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

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

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

- **Data format**

Integer : 16 bits with sign, each with 1 register

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

Float : IEEE 754 Format , each with 2 registers

Low word is first priority while transmit

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

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

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

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						
PT_Ratio	44097	0x1000	Word	UInt	1-65535	100	0.01	
CT_Ratio_1	44098	0x1001	Word	UInt	1-65535	1		For Submeter1
CT_Ratio_2	44099	0x1002	Word	UInt	1-65535	1		For Submeter2
CT_Ratio_3	44100	0x1003	Word	UInt	1-65535	1		For Submeter3
CT_Ratio_4	44101	0x1004	Word	UInt	1-65535	1		For Submeter4
CT_Ratio_5	44102	0x1005	Word	UInt	1-65535	1		For Submeter5
CT_Ratio_6	44103	0x1006	Word	UInt	1-65535	1		For Submeter6
CT_Ratio_7	44104	0x1007	Word	UInt	1-65535	1		For Submeter7
CT_Ratio_8	44105	0x1008	Word	UInt	1-65535	1		For Submeter8
Default Frequency	44106	0x1009	Word	UInt	0x0055: Auto 0x0064: 50Hz 0x0078: 60Hz	0x0055		Re-power the module after setting or changing the frequency

Wiring Mode	44107	0x100A	Word	UInt	1: 1P2W 2: 1P3W 3: 3P3W2CT 4: 3P3W3CT 5: 3P4W3CT	5		Only work when SW9-SW10 is all off
Set Energy to Zero	44108	0x100B	Word	UInt	1: submeter1 2: submeter2 3: submeter3 4: submeter4 5: submeter5 6: submeter6 7: submeter7 8: submeter8 0x0055: ALL			Only Write
Reset to Factory Settings	44109	0x100C	Word	UInt	0x0055			Only Write, Re-power the module after setting
Parity	44110	0x100D	Word	UInt	0: None 1: Odd Parity 2: Even Parity	0		Only work for RS-485 Interface
Stop Bit	44111	0x100E	Word	UInt	1: 1 stop bit 2: 2 stop bits	1		Only work for RS-485 Interface
Energy Absolute Accumulated Mode	44113	0x1010	Word	UInt	0: Enable 1: Disable	0		
Harmonic Phase Select 1	44114	0x1011	Word	UInt	0: Disable 1: Phase A 2: Phase B 3: Phase C	0		For Submeter1
Harmonic Phase Select 2	44115	0x1012	Word	UInt	0: Disable 1: Phase A 2: Phase B 3: Phase C	0		For Submeter2

Harmonic Phase Select 3	44116	0x1013	Word	UInt	0: Disable 1: Phase A 2: Phase B 3: Phase C	0		For Submeter3
Harmonic Phase Select 4	44117	0x1014	Word	UInt	0: Disable 1: Phase A 2: Phase B 3: Phase C	0		For Submeter4
Harmonic Phase Select 5	44118	0x1015	Word	UInt	0: Disable 1: Phase A 2: Phase B 3: Phase C	0		For Submeter5
Harmonic Phase Select 6	44119	0x1016	Word	UInt	0: Disable 1: Phase A 2: Phase B 3: Phase C	0		For Submeter6
Harmonic Phase Select 7	44120	0x1017	Word	UInt	0: Disable 1: Phase A 2: Phase B 3: Phase C	0		For Submeter7
Harmonic Phase Select 8	44121	0x1018	Word	UInt	0: Disable 1: Phase A 2: Phase B 3: Phase C	0		For Submeter8
Display Voltage	44122	0x1019	Word	UInt	0: Default 1: Show as VIn 2: Show as VII	0		Refer to Q13

● Modbus Module #3 – Input Register : System Information

Parameter name	Modbus Register		Len	Data Type	Range	Default value	Units	Comment
	Modicom Format	Hex						
Wiring Type	30513	0x0200	Word	UInt	9: 1P2W 10: 1P3W 11: 3P3W2CT 12: 3P3W3CT 13: 3P4W3CT 14: 3P3W2CT (HW) 15: 3P3W3CT (HW) 16: 3P4W3CT (HW)	13		(HW) : set wiring by hardware Dip Switch
Phase Sequence	30514	0x0201	Word	UInt	0: Negative (ACB) 1: Positive (ABC)			Only work when 3P4W3CT
Model Name	30515	0x0202	Word	UInt	4324: PM-4324	4324		
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) for Submeter1

Parameter name	Modbus Register		Len	Data Type	Range	Units	Comment
	Modicom Format	Hex					
V_a	34353-34354	0x1100-0x1101	DWord	Float		Volt	For CT_1
I_a	34355-34356	0x1102-0x1103	DWord	Float		Amp	
kW_a	34357-34358	0x1104-0x1105	DWord	Float		kW	
kvar_a	34359-34360	0x1106-0x1107	DWord	Float		kvar	
kVA_a	34361-34362	0x1108-0x1109	DWord	Float		kVA	
PF_a	34363-34364	0x110A-0x110B	DWord	Float			
kWh_a	34365-34366	0x110C-0x110D	DWord	Float			
kvarh_a	34367-34368	0x110E-0x110F	DWord	Float			
kVAh_a	34369-34370	0x1110-0x1111	DWord	Float			
V_b	34371-34372	0x1112-0x1113	DWord	Float		Volt	For CT_2
I_b	34373-34374	0x1114-0x1115	DWord	Float		Amp	
kW_b	34375-34376	0x1116-0x1117	DWord	Float		kW	
kvar_b	34377-34378	0x1118-0x1119	DWord	Float		kvar	
kVA_b	34379-34380	0x111A-0x111B	DWord	Float		kVA	
PF_b	34381-34382	0x111C-0x111D	DWord	Float			
kWh_b	34383-34384	0x111E-0x111F	DWord	Float			
kvarh_b	34385-34386	0x1120-0x1121	DWord	Float			
kVAh_b	34387-34388	0x1122-0x1123	DWord	Float			
V_c	34389-34390	0x1124-0x1125	DWord	Float		Volt	For CT_3
I_c	34391-34392	0x1126-0x1127	DWord	Float		Amp	
kW_c	34393-34394	0x1128-0x1129	DWord	Float		kW	
kvar_c	34395-34396	0x112A-0x112B	DWord	Float		kvar	
kVA_c	34397-34398	0x112C-0x112D	DWord	Float		kVA	
PF_c	34399-34400	0x112E-0x112F	DWord	Float			
kWh_c	34401-34402	0x1130-0x1131	DWord	Float			
kvarh_c	34403-34404	0x1132-0x1133	DWord	Float			
kVAh_c	34405-34406	0x1134-0x1135	DWord	Float			
V_avg	34407-34408	0x1136-0x1137	DWord	Float		Volt	
I_avg	34409-34410	0x1138-0x1139	DWord	Float		Amp	
kW_tot	34411-34412	0x113A-0x113B	DWord	Float		kW	
kvar_tot	34413-34414	0x113C-0x113D	DWord	Float		kvar	
kVA_tot	34415-34416	0x113E-0x113F	DWord	Float		kVA	

PF_tot	34417-34418	0x1140-0x1141	DWord	Float			
kWh_tot	34419-34420	0x1142-0x1143	DWord	Float			
kvarh_tot	34421-34422	0x1144-0x1145	DWord	Float			
kVAh_tot	34423-34424	0x1146-0x1147	DWord	Float			
Freq_a	34425-34426	0x1148-0x1149	DWord	Float	45~65	Hz	For CT_1
Freq_b	34427-34428	0x114A-0x114B	DWord	Float	45~65	Hz	For CT_2
Freq_c	34429-34430	0x114C-0x114D	DWord	Float	45~65	Hz	For CT_3
Freq_max	34431-34432	0x114E-0x114F	DWord	Float	45~65	Hz	
VTHD	34459-34460	0x116A-0x116B	DWord	Float	0~4		Phase set by Harmonic Phase Select 1 Register
ITHD	34461-34462	0x116C-0x116D	DWord	Float	0~4		
Bi_Positive_kWh	34463-34464	0x116E-0x116F	DWord	Float			
Bi_Negative_kWh	34465-34466	0x1170-0x1171	DWord	Float			
Bi_Net_kWh	34467-34468	0x1172-0x1173	DWord	Float			
Bi_Total_kWh	34469-34470	0x1174-0x1175	DWord	Float			

Note:

The definition of bi-direction energy registers :

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

● Modbus Module #5 – Input Register :Power value (Float) for Submeter2

Parameter name	Modbus Register		Len	Data Type	Range	Units	Comment
	Modicom Format	Hex					
V_a	34609-34610	0x1200-0x1201	DWord	Float		Volt	For CT_4
I_a	34611-34612	0x1202-0x1203	DWord	Float		Amp	
kW_a	34613-34614	0x1204-0x1205	DWord	Float		kW	
kvar_a	34615-34616	0x1206-0x1207	DWord	Float		kvar	
kVA_a	34617-34618	0x1208-0x1209	DWord	Float		kVA	
PF_a	34619-34620	0x120A-0x120B	DWord	Float			
kWh_a	34621-34622	0x120C-0x120D	DWord	Float			
kvarh_a	34623-34624	0x120E-0x120F	DWord	Float			
kVAh_a	34625-34626	0x1210-0x1211	DWord	Float			
V_b	34627-34628	0x1212-0x1213	DWord	Float		Volt	For CT_5
I_b	34629-34630	0x1214-0x1215	DWord	Float		Amp	
kW_b	34631-34632	0x1216-0x1217	DWord	Float		kW	
kvar_b	34633-34634	0x1218-0x1219	DWord	Float		kvar	
kVA_b	34635-34636	0x121A-0x121B	DWord	Float		kVA	
PF_b	34637-34638	0x121C-0x121D	DWord	Float			
kWh_b	34639-34640	0x121E-0x121F	DWord	Float			
kvarh_b	34641-34642	0x1220-0x1221	DWord	Float			
kVAh_b	34643-34644	0x1222-0x1223	DWord	Float			
V_c	34645-34646	0x1224-0x1225	DWord	Float		Volt	For CT_6
I_c	34647-34648	0x1226-0x1227	DWord	Float		Amp	
kW_c	34649-34650	0x1228-0x1229	DWord	Float		kW	
kvar_c	34651-34652	0x122A-0x122B	DWord	Float		kvar	
kVA_c	34653-34654	0x122C-0x122D	DWord	Float		kVA	
PF_c	34655-34656	0x122E-0x122F	DWord	Float			
kWh_c	34657-34658	0x1230-0x1231	DWord	Float			
kvarh_c	34659-34660	0x1232-0x1233	DWord	Float			
kVAh_c	34661-34662	0x1234-0x1235	DWord	Float			
V_avg	34663-34664	0x1236-0x1237	DWord	Float		Volt	
I_avg	34665-34666	0x1238-0x1239	DWord	Float		Amp	
kW_tot	34667-34668	0x123A-0x123B	DWord	Float		kW	
kvar_tot	34669-34670	0x123C-0x123D	DWord	Float		kvar	
kVA_tot	34671-34672	0x123E-0x123F	DWord	Float		kVA	

PF_tot	34673-34674	0x1240-0x1241	DWord	Float			
kWh_tot	34675-34676	0x1242-0x1243	DWord	Float			
kvarh_tot	34677-34678	0x1244-0x1245	DWord	Float			
kVAh_tot	34679-34680	0x1246-0x1247	DWord	Float			
Freq_a	34681-34682	0x1248-0x1249	DWord	Float	45~65	Hz	For CT_4
Freq_b	34683-34684	0x124A-0x124B	DWord	Float	45~65	Hz	For CT_5
Freq_c	34685-34686	0x124C-0x124D	DWord	Float	45~65	Hz	For CT_6
Freq_max	34687-34688	0x124E-0x124F	DWord	Float	45~65	Hz	
VTHD	34715-34716	0x126A-0x126B	DWord	Float	0~4		Phase set by Harmonic Phase Select 2 Register
ITHD	34717-34718	0x126C-0x126D	DWord	Float	0~4		
Bi_Positive_kWh	34719-34720	0x126E-0x126F	DWord	Float			
Bi_Negative_kWh	34721-34722	0x1270-0x1271	DWord	Float			
Bi_Net_kWh	34723-34724	0x1272-0x1273	DWord	Float			
Bi_Total_kWh	34725-34726	0x1274-0x1275	DWord	Float			

Note:

The definition of bi-direction energy registers :

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

● Modbus Module #6 – Input Register :Power value (Float) for Submeter3

Parameter name	Modbus Register		Len	Data Type	Range	Units	Comment
	Modicom Format	Hex					
V_a	34865-34866	0x1300-0x1301	DWord	Float		Volt	For CT_7
I_a	34867-34868	0x1302-0x1303	DWord	Float		Amp	
kW_a	34869-34870	0x1304-0x1305	DWord	Float		kW	
kvar_a	34871-34872	0x1306-0x1307	DWord	Float		kvar	
kVA_a	34873-34874	0x1308-0x1309	DWord	Float		kVA	
PF_a	34875-34876	0x130A-0x130B	DWord	Float			
kWh_a	34877-34878	0x130C-0x130D	DWord	Float			
kvarh_a	34879-34880	0x130E-0x130F	DWord	Float			
kVAh_a	34881-34882	0x1310-0x1311	DWord	Float			
V_b	34883-34884	0x1312-0x1313	DWord	Float		Volt	For CT_8
I_b	34885-34886	0x1314-0x1315	DWord	Float		Amp	
kW_b	34887-34888	0x1316-0x1317	DWord	Float		kW	
kvar_b	34889-34890	0x1318-0x1319	DWord	Float		kvar	
kVA_b	34891-34892	0x131A-0x131B	DWord	Float		kVA	
PF_b	34893-34894	0x131C-0x131D	DWord	Float			
kWh_b	34895-34896	0x131E-0x131F	DWord	Float			
kvarh_b	34897-34898	0x1320-0x1321	DWord	Float			
kVAh_b	34899-34900	0x1322-0x1323	DWord	Float			
V_c	34901-34902	0x1324-0x1325	DWord	Float		Volt	For CT_9
I_c	34903-34904	0x1326-0x1327	DWord	Float		Amp	
kW_c	34905-34906	0x1328-0x1329	DWord	Float		kW	
kvar_c	34907-34908	0x132A-0x132B	DWord	Float		kvar	
kVA_c	34909-34910	0x132C-0x132D	DWord	Float		kVA	
PF_c	34911-34912	0x132E-0x132F	DWord	Float			
kWh_c	34913-34914	0x1330-0x1331	DWord	Float			
kvarh_c	34915-34916	0x1332-0x1333	DWord	Float			
kVAh_c	34917-34918	0x1334-0x1335	DWord	Float			
V_avg	34919-34920	0x1336-0x1337	DWord	Float		Volt	
I_avg	34921-34922	0x1338-0x1339	DWord	Float		Amp	
kW_tot	34923-34924	0x133A-0x133B	DWord	Float		kW	
kvar_tot	34925-34926	0x133C-0x133D	DWord	Float		kvar	
kVA_tot	34927-34928	0x133E-0x133F	DWord	Float		kVA	

PF_tot	34929-34930	0x1340-0x1341	DWord	Float			
kWh_tot	34931-34932	0x1342-0x1343	DWord	Float			
kvarh_tot	34933-34934	0x1344-0x1345	DWord	Float			
kVAh_tot	34935-34936	0x1346-0x1347	DWord	Float			
Freq_a	34937-34938	0x1348-0x1349	DWord	Float	45~65	Hz	For CT_7
Freq_b	34939-34940	0x134A-0x134B	DWord	Float	45~65	Hz	For CT_8
Freq_c	34941-34942	0x134C-0x134D	DWord	Float	45~65	Hz	For CT_9
Freq_max	34943-34944	0x134E-0x134F	DWord	Float	45~65	Hz	
VTHD	34971-34972	0x136A-0x136B	DWord	Float	0~4		Phase set by Harmonic Phase Select 3 Register
ITHD	34973-34974	0x136C-0x136D	DWord	Float	0~4		
Bi_Positive_kWh	34975-34976	0x136E-0x136F	DWord	Float			
Bi_Negative_kWh	34977-34978	0x1370-0x1371	DWord	Float			
Bi_Net_kWh	34979-34980	0x1372-0x1373	DWord	Float			
Bi_Total_kWh	34981-34982	0x1374-0x1375	DWord	Float			

Note:

The definition of bi-direction energy registers :

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

● Modbus Module #7 – Input Register :Power value (Float) for Submeter4

Parameter name	Modbus Register		Len	Data Type	Range	Units	Comment
	Modicom Format	Hex					
V_a	35121-35122	0x1400-0x1401	DWord	Float		Volt	For CT_10
I_a	35123-35124	0x1402-0x1403	DWord	Float		Amp	
kW_a	35125-35126	0x1404-0x1405	DWord	Float		kW	
kvar_a	35127-35128	0x1406-0x1407	DWord	Float		kvar	
kVA_a	35129-35130	0x1408-0x1409	DWord	Float		kVA	
PF_a	35131-35132	0x140A-0x140B	DWord	Float			
kWh_a	35133-35134	0x140C-0x140D	DWord	Float			
kvarh_a	35135-35136	0x140E-0x140F	DWord	Float			
kVAh_a	35137-35138	0x1410-0x1411	DWord	Float			
V_b	35139-35140	0x1412-0x1413	DWord	Float		Volt	For CT_11
I_b	35141-35142	0x1414-0x1415	DWord	Float		Amp	
kW_b	35143-35144	0x1416-0x1417	DWord	Float		kW	
kvar_b	35145-35146	0x1418-0x1419	DWord	Float		kvar	
kVA_b	35147-35148	0x141A-0x141B	DWord	Float		kVA	
PF_b	35149-35150	0x141C-0x141D	DWord	Float			
kWh_b	35151-35152	0x141E-0x141F	DWord	Float			
kvarh_b	35153-35154	0x1420-0x1421	DWord	Float			
kVAh_b	35155-35156	0x1422-0x1423	DWord	Float			
V_c	35157-35158	0x1424-0x1425	DWord	Float		Volt	For CT_12
I_c	35159-35160	0x1426-0x1427	DWord	Float		Amp	
kW_c	35161-35162	0x1428-0x1429	DWord	Float		kW	
kvar_c	35163-35164	0x142A-0x142B	DWord	Float		kvar	
kVA_c	35165-35166	0x142C-0x142D	DWord	Float		kVA	
PF_c	35167-35168	0x142E-0x142F	DWord	Float			
kWh_c	35169-35170	0x1430-0x1431	DWord	Float			
kvarh_c	35171-35172	0x1432-0x1433	DWord	Float			
kVAh_c	35173-35174	0x1434-0x1435	DWord	Float			
V_avg	35175-35176	0x1436-0x1437	DWord	Float		Volt	
I_avg	35177-35178	0x1438-0x1439	DWord	Float		Amp	
kW_tot	35179-35180	0x143A-0x143B	DWord	Float		kW	
kvar_tot	35181-35182	0x143C-0x143D	DWord	Float		kvar	
kVA_tot	35183-35184	0x143E-0x143F	DWord	Float		kVA	

PF_tot	35185-35186	0x1440-0x1441	DWord	Float			
kWh_tot	35187-35188	0x1442-0x1443	DWord	Float			
kvarh_tot	35189-35190	0x1444-0x1445	DWord	Float			
kVAh_tot	35191-35192	0x1446-0x1447	DWord	Float			
Freq_a	35193-35194	0x1448-0x1449	DWord	Float	45~65	Hz	For CT_10
Freq_b	35195-35196	0x144A-0x144B	DWord	Float	45~65	Hz	For CT_11
Freq_c	35197-35198	0x144C-0x144D	DWord	Float	45~65	Hz	For CT_12
Freq_max	35199-35200	0x144E-0x144F	DWord	Float	45~65	Hz	
VTHD	35227-35228	0x146A-0x146B	DWord	Float	0~4		Phase set by Harmonic Phase Select 4 Register
ITHD	35229-35230	0x146C-0x146D	DWord	Float	0~4		
Bi_Positive_kWh	35231-35232	0x146E-0x146F	DWord	Float			
Bi_Negative_kWh	35233-35234	0x1470-0x1471	DWord	Float			
Bi_Net_kWh	35235-35236	0x1472-0x1473	DWord	Float			
Bi_Total_kWh	35237-35238	0x1474-0x1475	DWord	Float			

Note:

The definition of bi-direction energy registers :

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

● Modbus Module #8 – Input Register :Power value (Float) for Submeter5

Parameter name	Modbus Register		Len	Data Type	Range	Units	Comment
	Modicom Format	Hex					
V_a	35377-35378	0x1500-0x1501	DWord	Float		Volt	For CT_13
I_a	35379-35380	0x1502-0x1503	DWord	Float		Amp	
kW_a	35381-35382	0x1504-0x1505	DWord	Float		kW	
kvar_a	35383-35384	0x1506-0x1507	DWord	Float		kvar	
kVA_a	35385-35386	0x1508-0x1509	DWord	Float		kVA	
PF_a	35387-35388	0x150A-0x150B	DWord	Float			
kWh_a	35389-35390	0x150C-0x150D	DWord	Float			
kvarh_a	35391-35392	0x150E-0x150F	DWord	Float			
kVAh_a	35393-35394	0x1510-0x1511	DWord	Float			
V_b	35395-35396	0x1512-0x1513	DWord	Float		Volt	For CT_14
I_b	35397-35398	0x1514-0x1515	DWord	Float		Amp	
kW_b	35399-35400	0x1516-0x1517	DWord	Float		kW	
kvar_b	35401-35402	0x1518-0x1519	DWord	Float		kvar	
kVA_b	35403-35404	0x151A-0x151B	DWord	Float		kVA	
PF_b	35405-35406	0x151C-0x151D	DWord	Float			
kWh_b	35407-35408	0x151E-0x151F	DWord	Float			
kvarh_b	35409-35410	0x1520-0x1521	DWord	Float			
kVAh_b	35411-35412	0x1522-0x1523	DWord	Float			
V_c	35413-35414	0x1524-0x1525	DWord	Float		Volt	For CT_15
I_c	35415-35416	0x1526-0x1527	DWord	Float		Amp	
kW_c	35417-35418	0x1528-0x1529	DWord	Float		kW	
kvar_c	35419-35420	0x152A-0x152B	DWord	Float		kvar	
kVA_c	35421-35422	0x152C-0x152D	DWord	Float		kVA	
PF_c	35423-35424	0x152E-0x152F	DWord	Float			
kWh_c	35425-35426	0x1530-0x1531	DWord	Float			
kvarh_c	35427-35428	0x1532-0x1533	DWord	Float			
kVAh_c	35429-35430	0x1534-0x1535	DWord	Float			
V_avg	35431-35432	0x1536-0x1537	DWord	Float		Volt	
I_avg	35433-35434	0x1538-0x1539	DWord	Float		Amp	
kW_tot	35435-35436	0x153A-0x153B	DWord	Float		kW	
kvar_tot	35437-35438	0x153C-0x153D	DWord	Float		kvar	
kVA_tot	35439-35440	0x153E-0x153F	DWord	Float		kVA	

PF_tot	35441-35442	0x1540-0x1541	DWord	Float			
kWh_tot	35443-35444	0x1542-0x1543	DWord	Float			
kvarh_tot	35445-35446	0x1544-0x1545	DWord	Float			
kVAh_tot	35447-35448	0x1546-0x1547	DWord	Float			
Freq_a	35449-35450	0x1548-0x1549	DWord	Float	45~65	Hz	For CT_13
Freq_b	35451-35452	0x154A-0x154B	DWord	Float	45~65	Hz	For CT_14
Freq_c	35453-35454	0x154C-0x154D	DWord	Float	45~65	Hz	For CT_15
Freq_max	35455-35456	0x154E-0x154F	DWord	Float	45~65	Hz	
VTHD	35483-35484	0x156A-0x156B	DWord	Float	0~4		Phase set by Harmonic Phase Select 5 Register
ITHD	35485-35486	0x156C-0x156D	DWord	Float	0~4		
Bi_Positive_kWh	35487-35488	0x156E-0x156F	DWord	Float			
Bi_Negative_kWh	35489-35490	0x1570-0x1571	DWord	Float			
Bi_Net_kWh	35491-35492	0x1572-0x1573	DWord	Float			
Bi_Total_kWh	35493-35494	0x1574-0x1575	DWord	Float			

Note:

The definition of bi-direction energy registers :

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

● Modbus Module #9 – Input Register :Power value (Float) for Submeter6

Parameter name	Modbus Register		Len	Data Type	Range	Units	Comment
	Modicom Format	Hex					
V_a	35633-35634	0x1600-0x1601	DWord	Float		Volt	For CT_16
I_a	35635-35636	0x1602-0x1603	DWord	Float		Amp	
kW_a	35637-35638	0x1604-0x1605	DWord	Float		kW	
kvar_a	35639-35640	0x1606-0x1607	DWord	Float		kvar	
kVA_a	35641-35642	0x1608-0x1609	DWord	Float		kVA	
PF_a	35643-35644	0x160A-0x160B	DWord	Float			
kWh_a	35645-35646	0x160C-0x160D	DWord	Float			
kvarh_a	35647-35648	0x160E-0x160F	DWord	Float			
kVAh_a	35649-35650	0x1610-0x1611	DWord	Float			
V_b	35651-35652	0x1612-0x1613	DWord	Float		Volt	For CT_17
I_b	35653-35654	0x1614-0x1615	DWord	Float		Amp	
kW_b	35655-35656	0x1616-0x1617	DWord	Float		kW	
kvar_b	35657-35658	0x1618-0x1619	DWord	Float		kvar	
kVA_b	35659-35660	0x161A-0x161B	DWord	Float		kVA	
PF_b	35661-35662	0x161C-0x161D	DWord	Float			
kWh_b	35663-35664	0x161E-0x161F	DWord	Float			
kvarh_b	35665-35666	0x1620-0x1621	DWord	Float			
kVAh_b	35667-35668	0x1622-0x1623	DWord	Float			
V_c	35669-35670	0x1624-0x1625	DWord	Float		Volt	For CT_18
I_c	35671-35672	0x1626-0x1627	DWord	Float		Amp	
kW_c	35673-35674	0x1628-0x1629	DWord	Float		kW	
kvar_c	35675-35676	0x162A-0x162B	DWord	Float		kvar	
kVA_c	35677-35678	0x162C-0x162D	DWord	Float		kVA	
PF_c	35679-35680	0x162E-0x162F	DWord	Float			
kWh_c	35681-35682	0x1630-0x1631	DWord	Float			
kvarh_c	35683-35684	0x1632-0x1633	DWord	Float			
kVAh_c	35685-35686	0x1634-0x1635	DWord	Float			
V_avg	35687-35688	0x1636-0x1637	DWord	Float		Volt	
I_avg	35689-35690	0x1638-0x1639	DWord	Float		Amp	
kW_tot	35691-35692	0x163A-0x163B	DWord	Float		kW	
kvar_tot	35693-35694	0x163C-0x163D	DWord	Float		kvar	
kVA_tot	35695-35696	0x163E-0x163F	DWord	Float		kVA	

PF_tot	35697-35698	0x1640-0x1641	DWord	Float			
kWh_tot	35699-35700	0x1642-0x1643	DWord	Float			
kvarh_tot	35701-35702	0x1644-0x1645	DWord	Float			
kVAh_tot	35703-35704	0x1646-0x1647	DWord	Float			
Freq_a	35705-35706	0x1648-0x1649	DWord	Float	45~65	Hz	For CT_16
Freq_b	35707-35708	0x164A-0x164B	DWord	Float	45~65	Hz	For CT_17
Freq_c	35709-35710	0x164C-0x164D	DWord	Float	45~65	Hz	For CT_18
Freq_max	35711-35712	0x164E-0x164F	DWord	Float	45~65	Hz	
VTHD	35739-35740	0x166A-0x166B	DWord	Float	0~4		Phase set by Harmonic Phase Select 6 Register
ITHD	35741-35742	0x166C-0x166D	DWord	Float	0~4		
Bi_Positive_kWh	35743-35744	0x166E-0x166F	DWord	Float			
Bi_Negative_kWh	35745-35746	0x1670-0x1671	DWord	Float			
Bi_Net_kWh	35747-35748	0x1672-0x1673	DWord	Float			
Bi_Total_kWh	35749-35750	0x1674-0x1675	DWord	Float			

Note:

The definition of bi-direction energy registers :

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

● Modbus Module #10 – Input Register :Power value (Float) for Submeter7

Parameter name	Modbus Register		Len	Data Type	Range	Units	Comment
	Modicom Format	Hex					
V_a	35889-35890	0x1700-0x1701	DWord	Float		Volt	For CT_19
I_a	35891-35892	0x1702-0x1703	DWord	Float		Amp	
kW_a	35893-35894	0x1704-0x1705	DWord	Float		kW	
kvar_a	35895-35896	0x1706-0x1707	DWord	Float		kvar	
kVA_a	35897-35898	0x1708-0x1709	DWord	Float		kVA	
PF_a	35899-35900	0x170A-0x170B	DWord	Float			
kWh_a	35901-35902	0x170C-0x170D	DWord	Float			
kvarh_a	35903-35904	0x170E-0x170F	DWord	Float			
kVAh_a	35905-35906	0x1710-0x1711	DWord	Float			
V_b	35907-35908	0x1712-0x1713	DWord	Float		Volt	For CT_20
I_b	35909-35910	0x1714-0x1715	DWord	Float		Amp	
kW_b	35911-35912	0x1716-0x1717	DWord	Float		kW	
kvar_b	35913-35914	0x1718-0x1719	DWord	Float		kvar	
kVA_b	35915-35916	0x171A-0x171B	DWord	Float		kVA	
PF_b	35917-35918	0x171C-0x171D	DWord	Float			
kWh_b	35919-35920	0x171E-0x171F	DWord	Float			
kvarh_b	35921-35922	0x1720-0x1721	DWord	Float			
kVAh_b	35923-35924	0x1722-0x1723	DWord	Float			
V_c	35925-35926	0x1724-0x1725	DWord	Float		Volt	For CT_21
I_c	35927-35928	0x1726-0x1727	DWord	Float		Amp	
kW_c	35929-35930	0x1728-0x1729	DWord	Float		kW	
kvar_c	35931-35932	0x172A-0x172B	DWord	Float		kvar	
kVA_c	35933-35934	0x172C-0x172D	DWord	Float		kVA	
PF_c	35935-35936	0x172E-0x172F	DWord	Float			
kWh_c	35937-35938	0x1730-0x1731	DWord	Float			
kvarh_c	35939-35940	0x1732-0x1733	DWord	Float			
kVAh_c	35941-35942	0x1734-0x1735	DWord	Float			
V_avg	35943-35944	0x1736-0x1737	DWord	Float		Volt	
I_avg	35945-35946	0x1738-0x1739	DWord	Float		Amp	
kW_tot	35947-35948	0x173A-0x173B	DWord	Float		kW	
kvar_tot	35949-35950	0x173C-0x173D	DWord	Float		kvar	
kVA_tot	35951-35952	0x173E-0x173F	DWord	Float		kVA	

PF_tot	35953-35954	0x1740-0x1741	DWord	Float			
kWh_tot	35955-35956	0x1742-0x1743	DWord	Float			
kvarh_tot	35957-35958	0x1744-0x1745	DWord	Float			
kVAh_tot	35959-35960	0x1746-0x1747	DWord	Float			
Freq_a	35961-35962	0x1748-0x1749	DWord	Float	45~65	Hz	For CT_19
Freq_b	35963-35964	0x174A-0x174B	DWord	Float	45~65	Hz	For CT_20
Freq_c	35965-35966	0x174C-0x174D	DWord	Float	45~65	Hz	For CT_21
Freq_max	35967-35968	0x174E-0x174F	DWord	Float	45~65	Hz	
VTHD	35995-35996	0x176A-0x176B	DWord	Float	0~4		Phase set by Harmonic Phase Select 7 Register
ITHD	35997-35998	0x176C-0x176D	DWord	Float	0~4		
Bi_Positive_kWh	35999-36000	0x176E-0x176F	DWord	Float			
Bi_Negative_kWh	36001-36002	0x1770-0x1771	DWord	Float			
Bi_Net_kWh	36003-36004	0x1772-0x1773	DWord	Float			
Bi_Total_kWh	36005-36006	0x1774-0x1775	DWord	Float			

Note:

The definition of bi-direction energy registers :

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

● Modbus Module #11 – Input Register :Power value (Float) for Submeter8

Parameter name	Modbus Register		Len	Data Type	Range	Units	Comment
	Modicom Format	Hex					
V_a	36145-36146	0x1800-0x1801	DWord	Float		Volt	For CT_22
I_a	36147-36148	0x1802-0x1803	DWord	Float		Amp	
kW_a	36149-36150	0x1804-0x1805	DWord	Float		kW	
kvar_a	36151-36152	0x1806-0x1807	DWord	Float		kvar	
kVA_a	36153-36154	0x1808-0x1809	DWord	Float		kVA	
PF_a	36155-36156	0x180A-0x180B	DWord	Float			
kWh_a	36157-36158	0x180C-0x180D	DWord	Float			
kvarh_a	36159-36160	0x180E-0x180F	DWord	Float			
kVAh_a	36161-36162	0x1810-0x1811	DWord	Float			
V_b	36163-36164	0x1812-0x1813	DWord	Float		Volt	For CT_23
I_b	36165-36166	0x1814-0x1815	DWord	Float		Amp	
kW_b	36167-36168	0x1816-0x1817	DWord	Float		kW	
kvar_b	36169-36170	0x1818-0x1819	DWord	Float		kvar	
kVA_b	36171-36172	0x181A-0x181B	DWord	Float		kVA	
PF_b	36173-36174	0x181C-0x181D	DWord	Float			
kWh_b	36175-36176	0x181E-0x181F	DWord	Float			
kvarh_b	36177-36178	0x1820-0x1821	DWord	Float			
kVAh_b	36179-36180	0x1822-0x1823	DWord	Float			
V_c	36181-36182	0x1824-0x1825	DWord	Float		Volt	For CT_24
I_c	36183-36184	0x1826-0x1827	DWord	Float		Amp	
kW_c	36185-36186	0x1828-0x1829	DWord	Float		kW	
kvar_c	36187-36188	0x182A-0x182B	DWord	Float		kvar	
kVA_c	36189-36190	0x182C-0x182D	DWord	Float		kVA	
PF_c	36191-36192	0x182E-0x182F	DWord	Float			
kWh_c	36193-36194	0x1830-0x1831	DWord	Float			
kvarh_c	36195-36196	0x1832-0x1833	DWord	Float			
kVAh_c	36197-36198	0x1834-0x1835	DWord	Float			
V_avg	36199-36200	0x1836-0x1837	DWord	Float		Volt	
I_avg	36201-36202	0x1838-0x1839	DWord	Float		Amp	
kW_tot	36203-36204	0x183A-0x183B	DWord	Float		kW	
kvar_tot	36205-36206	0x183C-0x183D	DWord	Float		kvar	
kVA_tot	36207-36208	0x183E-0x183F	DWord	Float		kVA	

PF_tot	36209-36210	0x1840-0x1841	DWord	Float			
kWh_tot	36211-36212	0x1842-0x1843	DWord	Float			
kvarh_tot	36213-36214	0x1844-0x1845	DWord	Float			
kVAh_tot	36215-36216	0x1846-0x1847	DWord	Float			
Freq_a	36217-36218	0x1848-0x1849	DWord	Float	45~65	Hz	For CT_22
Freq_b	36219-36220	0x184A-0x184B	DWord	Float	45~65	Hz	For CT_23
Freq_c	36221-36222	0x184C-0x184D	DWord	Float	45~65	Hz	For CT_24
Freq_max	36223-36224	0x184E-0x184F	DWord	Float	45~65	Hz	
VTHD	36251-36252	0x186A-0x186B	DWord	Float	0~4		Phase set by Harmonic Phase Select 8 Register
ITHD	36253-36254	0x186C-0x186D	DWord	Float	0~4		
Bi_Positive_kWh	36255-36256	0x186E-0x186F	DWord	Float			
Bi_Negative_kWh	36257-36258	0x1870-0x1871	DWord	Float			
Bi_Net_kWh	36259-36260	0x1872-0x1873	DWord	Float			
Bi_Total_kWh	36261-36262	0x1874-0x1875	DWord	Float			

Note:

The definition of bi-direction energy registers :

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

Chapter 7 Modbus-TCP Communication

7.1 Default settings

Ethernet default settings :

IP Address	192.168.255.1
Subnet mask	255.255.0.0
Gateway	192.168.0.1
Port	502



For recovering to default settings, dip Init/Run Switch (SW 7) to ON position for 10 seconds after power on, the settings will be changed as default values. Must dip back to OFF position and repower on after settings changed. User also can recover settings to default value by Modbus command.

● SW9 – SW10 setting

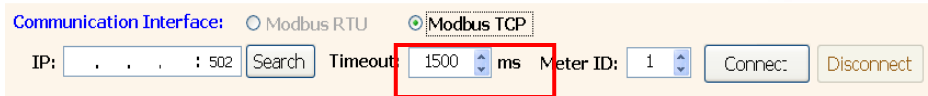
PM-4324 : Select the different wiring mode

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

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

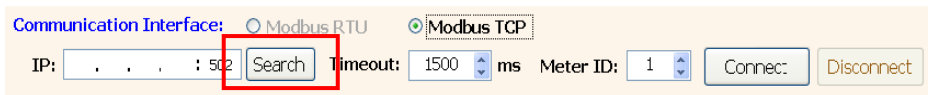
7.1.1 Ethernet configurations

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



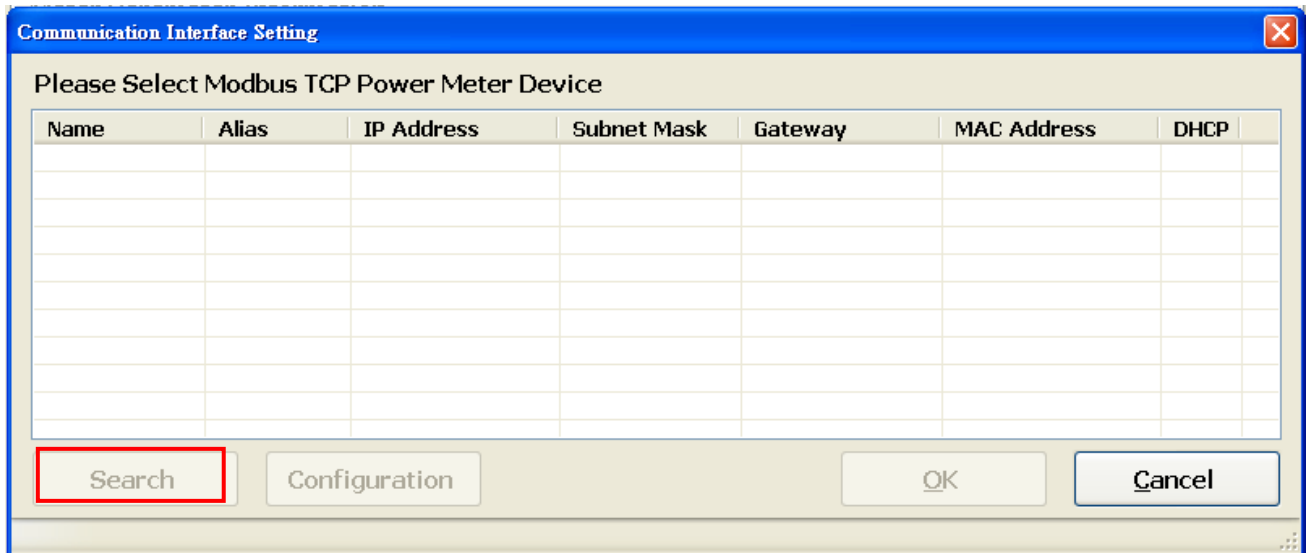
Communication Interface: Modbus RTU Modbus TCP
IP: . . . : 502 Search Timeout: 1500 ms Meter ID: 1 Connect Disconnect

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



Communication Interface: Modbus RTU Modbus TCP
IP: . . . : 502 Search Timeout: 1500 ms Meter ID: 1 Connect Disconnect

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



Communication Interface Setting

Please Select Modbus TCP Power Meter Device

Name	Alias	IP Address	Subnet Mask	Gateway	MAC Address	DHCP

Search Configuration OK Cancel

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.

Name	Alias	IP Address	Subnet Mask	Gateway	MAC Address	DHCP
PM-4324	PM-xxxx	192.168.255.1	255.255.0.0	192.168.0.1	00:0d:e0:b1:00:01	OFF

Device Name: PM-4324

DHCP State: OFF

Alias: PM-xxxx (9 Chars)

IP Address: 192.168.255.1

Subnet Mask: 255.255.0.0

Gateway: 192.168.0.1

MAC Address: 00:0d:e0:b1:00:01

Warning!!
Contact your Network Administrator to get correct configuration before any changing!

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 ◦

Chapter 8 CANopen communication

8.1 CANopen setting

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

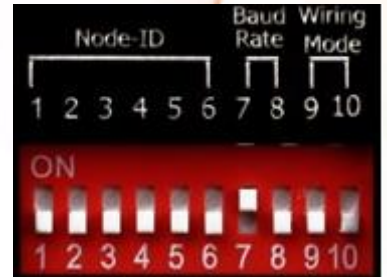
For example: Node ID is 10 · find the table of DIP switch 1-6 is

ON, OFF, OFF, ON, OFF, OFF

- **SW1 – SW6 setting**

Setting CANopen Node ID for communication (1-64)

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

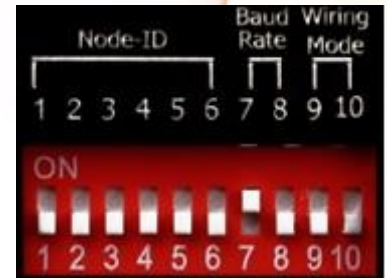


30	ON	OFF	ON	ON	ON	OFF
31	OFF	ON	ON	ON	ON	OFF
32	ON	ON	ON	ON	ON	OFF
33	OFF	OFF	OFF	OFF	OFF	ON
34	ON	OFF	OFF	OFF	OFF	ON
35	OFF	ON	OFF	OFF	OFF	ON
36	ON	ON	OFF	OFF	OFF	ON
37	OFF	OFF	ON	OFF	OFF	ON
38	ON	OFF	ON	OFF	OFF	ON
39	OFF	ON	ON	OFF	OFF	ON
40	ON	ON	ON	OFF	OFF	ON
41	OFF	OFF	OFF	ON	OFF	ON
42	ON	OFF	OFF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

● SW7 – SW8 setting

PM-4324-CPS : For CANopen Baud Rate Setting

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



● SW9 – SW10 setting

PM-4324-CPS : Select the different wiring mode

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

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

8.2 CANopen Protocol

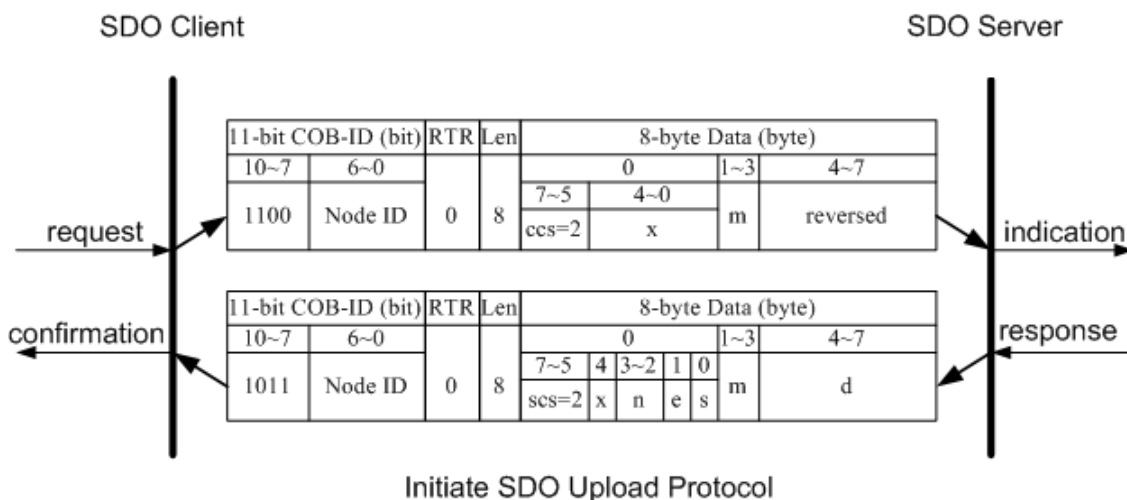
The CANopen is a kind of network protocols evolving from the CAN bus, used on car control system in early days, and has been greatly used in various applications, such as vehicles, industrial machines, building automation, medical devices, maritime applications, restaurant appliances, laboratory equipment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

8.2.1 SDO Introduction

8.2.1.1 Upload SDO Protocol

Initiate SDO Upload Protocol

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



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

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.

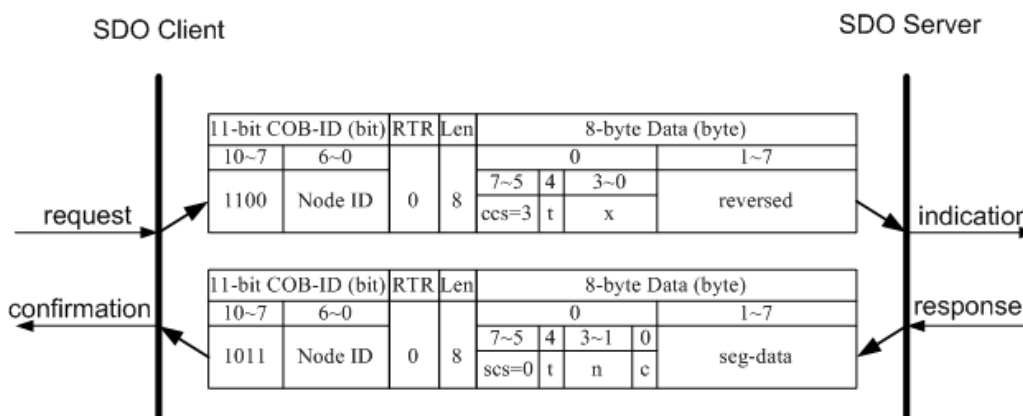
e=1, s=0: d contains unspecified number of bytes to be uploaded.

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

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 there are still more segments to be uploaded

0: more segments to be uploaded.

1: no more segment to be uploaded.

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

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

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

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

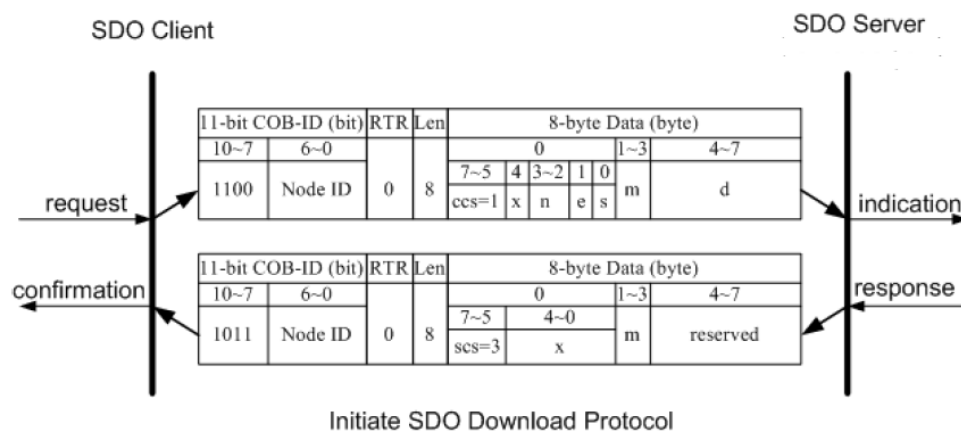
x: not used, always 0

reserved: reserved for further use , always 0

8.2.1.2 Download SDO Protocol

Initiate SDO Download Protocol

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



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.

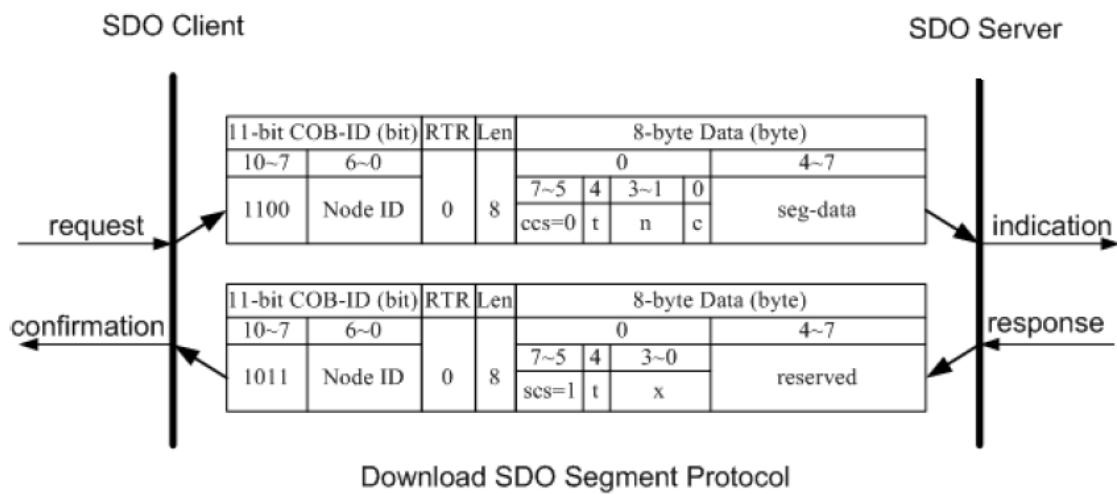
$e=0, s=1$: d contains the number of bytes to be downloaded, and byte 4 contains the least significant bit, and byte 7 contains the most significant bit.

$e=1, s=1$: 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

Download 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

Abort Code	Description
0503 0000h	Toggle bit not alternated.
0504 0000h	SDO protocol timed out.
0504 0001h	Client/server command specified not valid or unknown.
0504 0002h	Invalid block size (block mode only).
0504 0003h	Invalid sequence number (block mode only).
0504 0004h	CRC error (block mode only).
0504 0005h	Out of memory.
0601 0000h	Unsupported access to an object.
0601 0001h	Attempt to read a write only object.
0601 0002h	Attempt to write a read only object.
0602 0000h	Object does not exist in the object dictionary.
0604 0041h	Object cannot be mapped to the PDO.
0604 0042h	The number and length of the objects to be mapped would exceed PDO length.
0604 0043h	General parameter incompatibility reason.
0604 0047h	General internal incompatibility in the device.
0606 0000h	Access failed due to 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).
--	---

8.2.2 PDO Introduction

8.2.2.1 PDO COB-ID Parameters

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

Bit Number	Value	Meaning
31(MSB)	0	PDO exists (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-4324-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

Note:

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

8.2.2.2 Transmission Type

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

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

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.

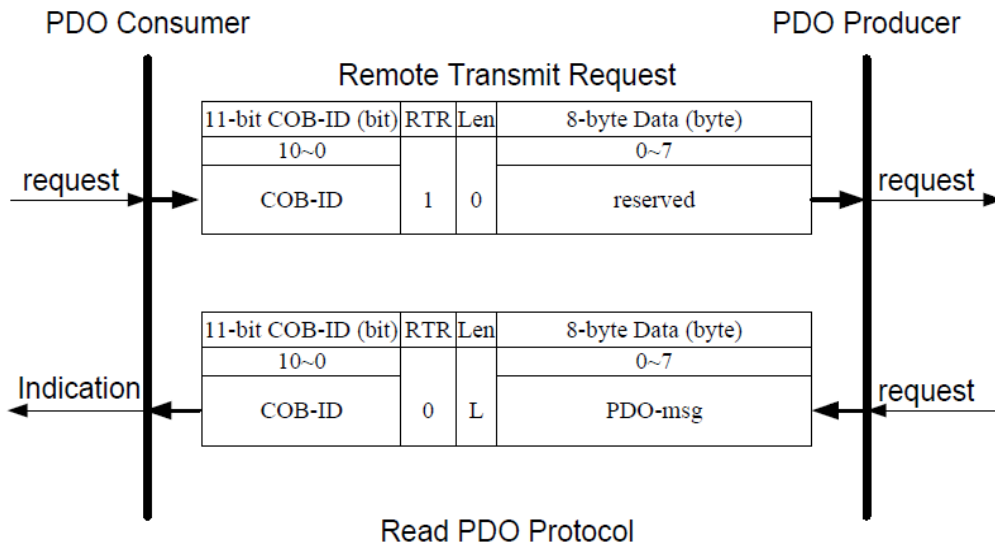
The PDO, including the DI value, will be sent when the DI value is changed. And both transmission types will directly trigger an update of the mapped data when receiving the RxPDO.

8.2.2.3 PDO Communication Rule

The PDO related objects are indicated from index 0x1400 to 0x1BFF. For the PM-4324-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 0x1A27 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-4324-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.



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

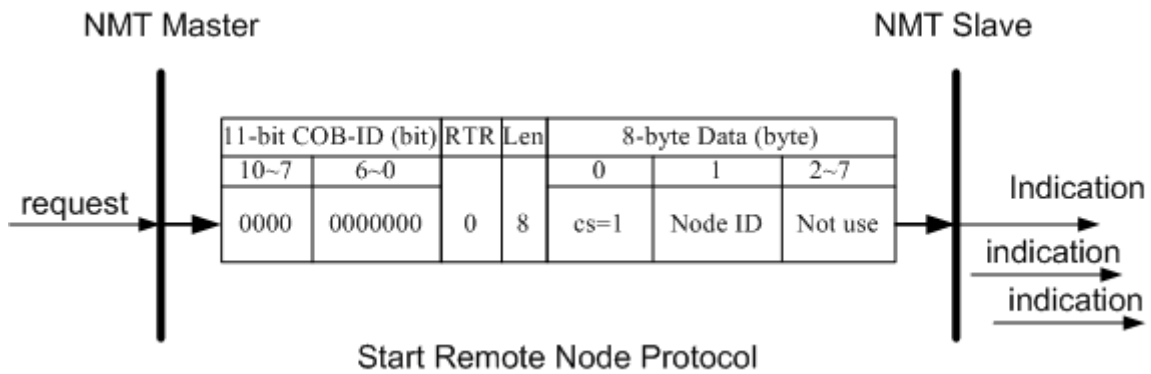
PDO-msg: the real-time data or the data which can be mapped into the PDO mapping objects

8.2.3 NMT Introduction

8.2.3.1 Module Control Protocol

The NMT communication set can be applied for changing the NMT slave status. The following figure shows how to change the different NMT statuses for the PM-4324-CPS.

Start Remote Node Protocol

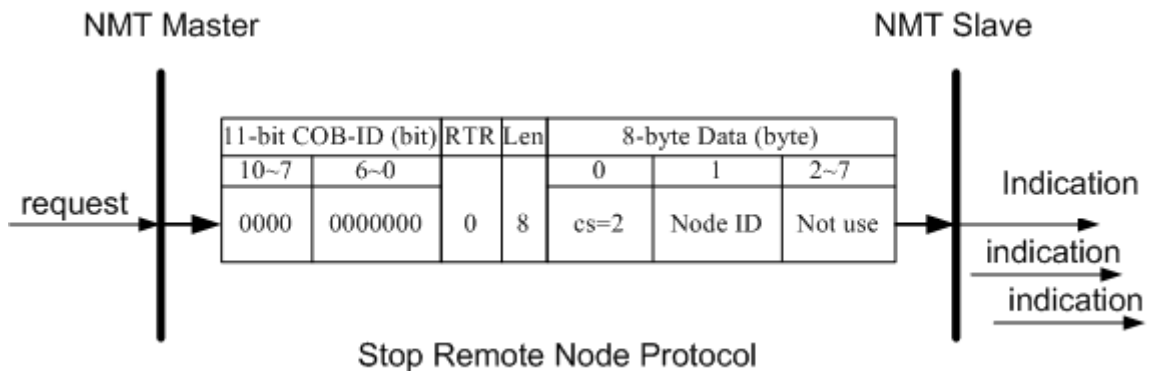


cs: NMT command specified

1: start

Node ID: the node ID of the NMT slave device

Stop Remote Node Protocol

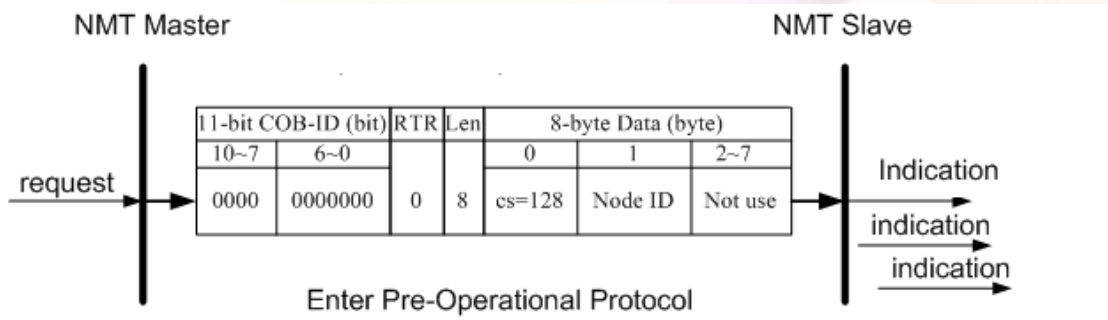


cs: NMT command specified

2: stop

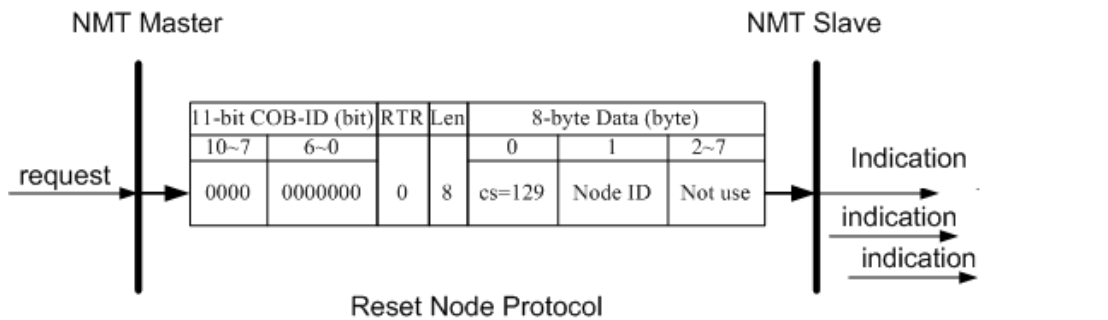
Node ID: the node ID of the NMT slave device

Enter Pre-Operational Protocol



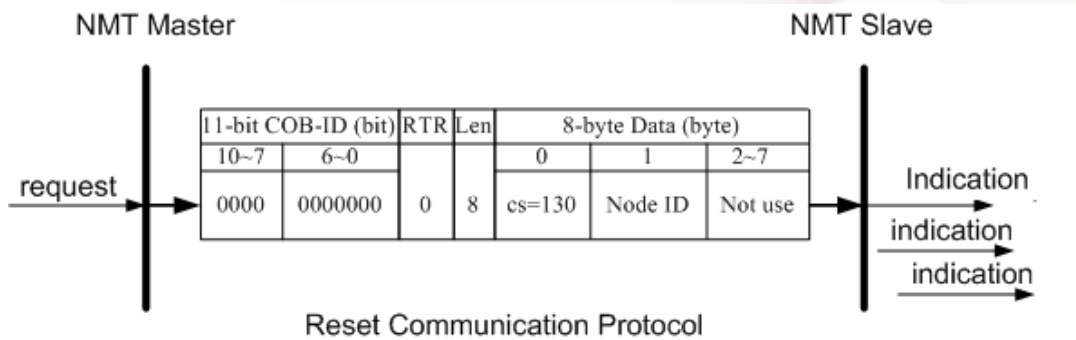
cs: NMT command specified
 128: enter PRE-OPERATIONAL
Node ID: the node ID of the NMT slave device

Reset Node Protocol



cs : NMT command specified
 129: Reset_Node
Node ID : the node ID of the NMT slave device

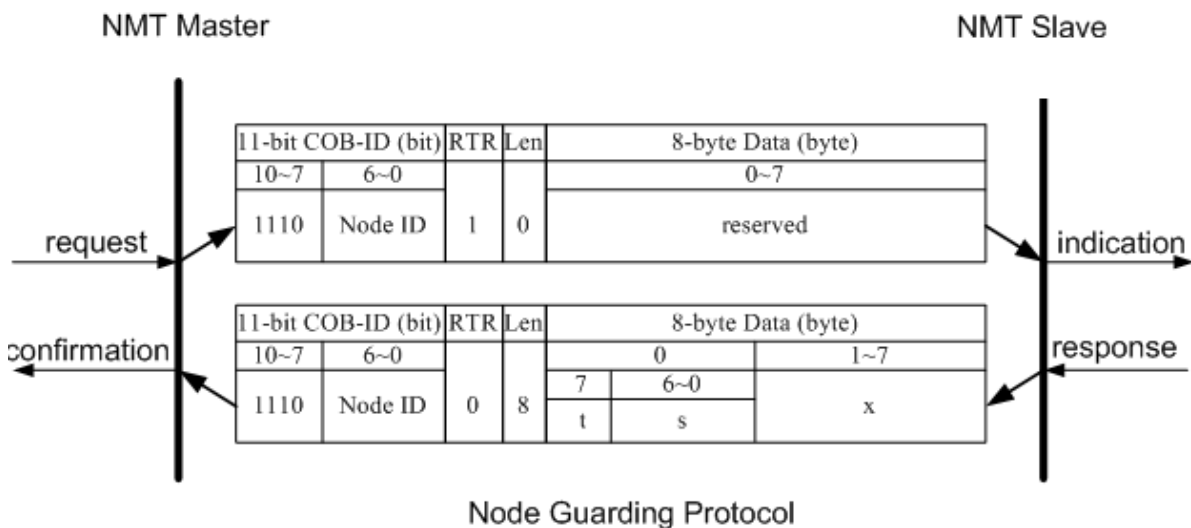
Reset Communication Protocol



cs: NMT command specified
 130: Reset_Communication
Node ID: the node ID of the NMT slave device

8.2.3.2 Error Control Protocol

Error Control Protocol is a kind of the solution to check whether the CANopen device is still alive or not. And its related objects include 0x100C and 0x100D. The 0x100C is the guard time, and the 0x100D is the life time factor. The node life time is the guard time multiplied by the life time factor. The Node Guarding timer of the PM-4324-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.



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.

s: the state of the NMT Slave

4: STOPPED

5: OPERATIONAL

127: PRE_OPERATIONAL

8.2.4 Special Functions for PM-4324-CPS

8.2.4.1 Power Meter Data Table

The PM-4324-CPS Manufacturer in the Specific Profile Area defines some entries, which are used for the power meter data. The objects with index 0x3200~0x3203 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)_CT1	kWh_a_CT1
2	0x280+Node-ID	8	kW(Kw_b)_CT2	kWh_b_CT2
3	0x380+Node-ID	8	kW(Kw_c)_CT3	kWh_c_CT3
4	0x480+Node-ID	8	kW(Kw_tot)_M1	kWh_tot_M1
5	---	8	kW(Kw_a)_CT4	kWh_a_CT4
6	---	8	kW(Kw_b)_CT5	kWh_b_CT5
7	---	8	kW(Kw_c)_CT6	kWh_c_CT6
8	---	8	kW(Kw_tot)_M2	kWh_tot_M2
9	---	8	kW(Kw_a)_CT7	kWh_a_CT7
10	---	8	kW(Kw_b)_CT8	kWh_b_CT8
11	---	8	kW(Kw_c)_CT9	kWh_c_CT9
12	---	8	kW(Kw_tot)_M3	kWh_tot_M3
13	---	8	kW(Kw_a)_CT10	kWh_a_CT10
14	---	8	kW(Kw_b)_CT11	kWh_b_CT11
15	---	8	kW(Kw_c)_CT12	kWh_c_CT12
16	---	8	kW(Kw_tot)_M4	kWh_tot_M4
17	---	8	kW(Kw_a)_CT13	kWh_a_CT13
18	---	8	kW(Kw_b)_CT14	kWh_b_CT14
19	---	8	kW(Kw_c)_CT15	kWh_c_CT15
20	---	8	kW(Kw_tot)_M5	kWh_tot_M5

No.(PDO)	COB-ID	Data Length	D0~D3	D4~D7
21	---	8	kW(Kw_a)_CT16	kWh_a_CT16
22	---	8	kW(Kw_b)_CT17	kWh_b_CT17
23	---	8	kW(Kw_c)_CT18	kWh_c_CT18
24	---	8	kW(Kw_tot)_M6	kWh_tot_M6
25	---	8	kW(Kw_a)_CT19	kWh_a_CT19
26	---	8	kW(Kw_b)_CT20	kWh_b_CT20
27	---	8	kW(Kw_c)_CT21	kWh_c_CT21
28	---	8	kW(Kw_tot)_M7	kWh_tot_M7
29	---	8	kW(Kw_a)_CT22	kWh_a_CT22
30	---	8	kW(Kw_b)_CT23	kWh_b_CT23
31	---	8	kW(Kw_c)_CT24	kWh_c_CT24
32	---	8	kW(Kw_tot)_M8	kWh_tot_M8
33	---	8	Volt(V_a)_CT1	Amp(I_a)_CT1
34	---	8	Volt(V_b)_CT2	Amp(I_b)_CT2
35	---	8	Volt(V_c)_CT3	Amp(I_c)_CT3
36	---	8	Volt(V_avg)_M1	Amp(I_avg)_M2
37	---	8	Volt(V_a)_CT4	Amp(I_a)_CT4
38	---	8	Volt(V_b)_CT5	Amp(I_b)_CT5
39	---	8	Volt(V_c)_CT6	Amp(I_c)_CT6
40	---	8	Volt(V_avg)_M2	Amp(I_avg)_M2

8.2.5 Object Dictionary of PM-4324-CPS

8.2.5.1 Communication Profile Area

The following tables are regarding each entry of the communication profile area is defined in PM-4324-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-4324-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	---

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 client (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

	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
...
1827h	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	UNSIGNED 8	RO	2
	1	read Kw_a CT1	INTEGER 32	RW	3200 0120h
	2	read kWh_a CT1	INTEGER 32	RW	3201 0120h
1A01h	0	largest sub-index	UNSIGNED 8	RO	2
	1	read Kw_b CT2	INTEGER 32	RW	3200 0220h
	2	read kWh_b CT2	INTEGER 32	RW	3201 0220h
1A02h	0	largest sub-index	UNSIGNED 8	RO	2
	1	read Kw_c CT3	INTEGER 32	RW	3200 0320h
	2	read kWh_c CT3	INTEGER 32	RW	3201 0320h
1A03h	0	largest sub-index	UNSIGNED 8	RO	2
	1	read Kw_tot Meter1	INTEGER 32	RW	3200 0420h
	2	read kWh_tot Meter1	INTEGER 32	RW	3201 0420h
1A04h	0	largest sub-index	UNSIGNED 8	RO	2
	1	read Kw_a CT4	INTEGER 32	RW	3200 0520h
	2	read kWh_a CT4	INTEGER 32	RW	3201 0520h

1A05h	0	largest sub-index	UNSIGNED 8	RO	2
	1	read Kw_b CT5	INTEGER 32	RW	3200 0620h
	2	read kWh_b CT5	INTEGER 32	RW	3201 0620h
1A06h	0	largest sub-index"	UNSIGNED 8	RO	2
	1	read Kw_c CT6	INTEGER 32	RW	3200 0720h
	2	read kWh_c CT6	INTEGER 32	RW	3201 0720h
1A07h	0	largest sub-index	UNSIGNED 8	RO	2
	1	read Kw_tot Meter2	INTEGER 32	RW	3200 0820h
	2	read kWh_tot Meter2	INTEGER 32	RW	3201 0820h
1A08h	0	largest sub-index	UNSIGNED 8	RO	2
	1	read Kw_a CT7	INTEGER 32	RW	3200 0920h
	2	read kWh_a CT7	INTEGER 32	RW	3201 0920h
1A09h	0	largest sub-index	UNSIGNED 8	RO	2
	1	read Kw_b CT8	INTEGER 32	RW	3200 0A20h
	2	read kWh_b CT8	INTEGER 32	RW	3201 0A20h
1A0Ah	0	largest sub-index	UNSIGNED 8	RO	2
	1	read Kw_c CT9	INTEGER 32	RW	3200 0B20h
	2	read kWh_c CT9	INTEGER 32	RW	3201 0B20h
1A0Bh	0	largest sub-index	UNSIGNED 8	RO	2
	1	read Kw_tot Meter3	INTEGER 32	RW	3200 0C20h
	2	read kWh_tot Meter3	INTEGER 32	RW	3201 0C20h
1A0Ch	0	largest sub-index	UNSIGNED 8	RO	2
	1	read Kw_a CT10	INTEGER 32	RW	3200 0D20h
	2	read kWh_a CT10	INTEGER 32	RW	3201 0D20h
1A0Dh	0	largest sub-index	UNSIGNED 8	RO	2
	1	read Kw_b CT11	INTEGER 32	RW	3200 0E20h
	2	read kWh_b CT11	INTEGER 32	RW	3201 0E20h
1A0Eh	0	largest sub-index	UNSIGNED 8	RO	2
	1	read Kw_c CT12	INTEGER 32	RW	3200 0F20h
	2	read kWh_c CT12	INTEGER 32	RW	3201 0F20h
1A0Fh	0	largest sub-index	UNSIGNED 8	RO	2
	1	read Kw_tot Meter4	INTEGER 32	RW	3200 1020h
	2	read kWh_tot Meter4	INTEGER 32	RW	3201 1020h
1A10h	0	largest sub-index	UNSIGNED 8	RO	2
	1	read Kw_a CT13	INTEGER 32	RW	3200 1120h
	2	read kWh_a CT13	INTEGER 32	RW	3201 1120h

1A11h	0	largest sub-index	UNSIGNED 8	RO	2
	1	read Kw_b CT14	INTEGER 32	RW	3200 1220h
	2	read kWh_b CT14	INTEGER 32	RW	3201 1220h
1A12h	0	largest sub-index	UNSIGNED 8	RO	2
	1	read Kw_c CT15	INTEGER 32	RW	3200 1320h
	2	read kWh_c CT15	INTEGER 32	RW	3201 1320h
1A13h	0	largest sub-index	UNSIGNED 8	RO	2
	1	read Kw_tot Meter5	INTEGER 32	RW	3200 1420h
	2	read kWh_tot Meter5	INTEGER 32	RW	3201 1420h
1A14h	0	largest sub-index	UNSIGNED 8	RO	2
	1	read Kw_a CT16	INTEGER 32	RW	3200 1520h
	2	read kWh_a CT16	INTEGER 32	RW	3201 1520h
1A15h	0	largest sub-index	UNSIGNED 8	RO	2
	1	read Kw_b CT17	INTEGER 32	RW	3200 1620h
	2	read kWh_b CT17	INTEGER 32	RW	3201 1620h
1A16h	0	largest sub-index	UNSIGNED 8	RO	2
	1	read Kw_c CT18	INTEGER 32	RW	3200 1720h
	2	read kWh_c CT18	INTEGER 32	RW	3201 1720h
1A17h	0	largest sub-index	UNSIGNED 8	RO	2
	1	read Kw_tot Meter6	INTEGER 32	RW	3200 1820h
	2	read kWh_tot Meter6	INTEGER 32	RW	3201 1820h
1A18h	0	largest sub-index	UNSIGNED 8	RO	2
	1	read Kw_a CT19	INTEGER 32	RW	3200 1920h
	2	read kWh_a CT19	INTEGER 32	RW	3201 1920h
1A19h	0	largest sub-index	UNSIGNED 8	RO	2
	1	read Kw_b CT20	INTEGER 32	RW	3200 1A20h
	2	read kWh_b CT20	INTEGER 32	RW	3201 1A20h
1A1Ah	0	largest sub-index	UNSIGNED 8	RO	2
	1	read Kw_c CT21	INTEGER 32	RW	3200 1B20h
	2	read kWh_c CT21	INTEGER 32	RW	3201 1B20h
1A1Bh	0	largest sub-index	UNSIGNED 8	RO	2
	1	read Kw_tot Meter7	INTEGER 32	RW	3200 1C20h
	2	read kWh_tot Meter7	INTEGER 32	RW	3201 1C20h

1A1Ch	0	largest sub-index	UNSIGNED 8	RO	2
	1	read Kw_a CT22	INTEGER 32	RW	3200 1D20h
	2	read kWh_a CT22	INTEGER 32	RW	3201 1D20h
1A1Dh	0	largest sub-index	UNSIGNED 8	RO	2
	1	read Kw_b CT23	INTEGER 32	RW	3200 1E20h
	2	read kWh_b CT23	INTEGER 32	RW	3201 1E20h
1A1Eh	0	largest sub-index	UNSIGNED 8	RO	2
	1	read Kw_c CT24	INTEGER 32	RW	3200 1F20h
	2	read kWh_c CT24	INTEGER 32	RW	3201 1F20h
1A1Fh	0	largest sub-index	UNSIGNED 8	RO	2
	1	read Kw_tot Meter8	INTEGER 32	RW	3200 2020h
	2	read kWh_tot Meter8	INTEGER 32	RW	3201 2020h
1A20h	0	largest sub-index	UNSIGNED 8	RO	2
	1	read V_a CT1	INTEGER 32	RW	3202 0120h
	2	read I_a CT1	INTEGER 32	RW	3203 0120h
1A21h	0	largest sub-index	UNSIGNED 8	RO	2
	1	read V_b CT2	INTEGER 32	RW	3202 0220h
	2	read I_b CT2	INTEGER 32	RW	3203 0220h
1A22h	0	largest sub-index	UNSIGNED 8	RO	2
	1	read V_c CT3	INTEGER 32	RW	3202 0320h
	2	read I_c CT3	INTEGER 32	RW	3203 0320h
1A23h	0	largest sub-index	UNSIGNED 8	RO	2
	1	read V_avg Meter1	INTEGER 32	RW	3202 0420h
	2	read I_avg Meter1	INTEGER 32	RW	3203 0420h
1A24h	0	largest sub-index	UNSIGNED 8	RO	2
	1	read V_a CT4	INTEGER 32	RW	3202 0520h
	2	read I_a CT4	INTEGER 32	RW	3203 0520h
1A25h	0	largest sub-index	UNSIGNED 8	RO	2
	1	read V_b CT5	INTEGER 32	RW	3202 0620h
	2	read I_b CT5	INTEGER 32	RW	3203 0620h
1A26h	0	largest sub-index	UNSIGNED 8	RO	2
	1	read V_c CT6	INTEGER 32	RW	3202 0720h
	2	read I_c CT6	INTEGER 32	RW	3203 0720h

1A27h	0	largest sub-index	UNSIGNED 8	RO	2
	1	read V_avg Meter2	INTEGER 32	RW	3202 0820h
	2	read I_avg Meter2	INTEGER 32	RW	3203 0820h

8.2.5.2 Manufacturer Specific Profile Area

In the following table, there is information about some special functions for the PM-4324-CPS. The index from 0x3200 to 0x3209 records the power meter measurement parameters. The number of these entries will be automatically updated when the PM-4324-CPS boot up. 0x320A is meter parameters information. 0x320B 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	32
	1	kW(Kw_a) (Meter 1)	INTEGER32	RO	0
	2	kW(Kw_b) (Meter 1)	INTEGER32	RO	0
	3	kW(Kw_c) (Meter 1)	INTEGER32	RO	0
	4	kW(Kw_tot) (Meter 1)	INTEGER32	RO	0
	---
	29	kW(Kw_a) (Meter 8)	INTEGER32	RO	0
	30	kW(Kw_b) (Meter 8)	INTEGER32	RO	0
	31	kW(Kw_c) (Meter 8)	INTEGER32	RO	0
	32	kW(Kw_tot) (Meter 8)	INTEGER32	RO	0
3201h	0	largest sub-index supported for "kWh"	UNSIGNED 8	RO	32
	1	kWh_a (Meter 1)	INTEGER32	RO	0
	2	kWh_b (Meter 1)	INTEGER32	RO	0
	3	kWh_c (Meter 1)	INTEGER32	RO	0
	4	kWh_tot (Meter 1)	INTEGER32	RO	0
	---
	29	kWh_a (Meter 8)	INTEGER32	RO	0
	30	kWh_b (Meter 8)	INTEGER32	RO	0
	31	kWh_c (Meter 8)	INTEGER32	RO	0
	32	kWh_tot (Meter 8)	INTEGER32	RO	0
3202h	0	largest sub-index supported for	UNSIGNED 8	RO	32

		"Volt"			
	1	Volt(V_a) (Meter 1)	INTEGER32	RO	0
	2	Volt(V_b) (Meter 1)	INTEGER32	RO	0
	3	Volt(V_c) (Meter 1)	INTEGER32	RO	0
	4	Volt(V_avg) (Meter 1)	INTEGER32	RO	0
	---
	29	Volt(V_a) (Meter 8)	INTEGER32	RO	0
	30	Volt(V_b) (Meter 8)	INTEGER32	RO	0
	31	Volt(V_c) (Meter 8)	INTEGER32	RO	0
	32	Volt(V_avg) (Meter 8)	INTEGER32	RO	0
3203h	0	largest sub-index supported for "Amp"	UNSIGNED 8	RO	32
	1	Amp(I_a) (Meter 1)	INTEGER32	RO	0
	2	Amp(I_b) (Meter 1)	INTEGER32	RO	0
	3	Amp(I_c) (Meter 1)	INTEGER32	RO	0
	4	Amp(I_avg) (Meter 1)	INTEGER32	RO	0
	---
	29	Amp(I_a) (Meter 8)	INTEGER32	RO	0
	30	Amp(I_b) (Meter 8)	INTEGER32	RO	0
	31	Amp(I_c) (Meter 8)	INTEGER32	RO	0
	32	Amp(I_avg) (Meter 8)	INTEGER32	RO	0
3204h	0	largest sub-index supported for "kvar"	UNSIGNED 8	RO	32
	1	kvar(kvar_a) (Meter 1)	INTEGER32	RO	0
	2	kvar(kvar_b) (Meter 1)	INTEGER32	RO	0
	3	kvar(kvar_c) (Meter 1)	INTEGER32	RO	0
	4	kvar(kvar_tot) (Meter 1)	INTEGER32	RO	0
	---
	29	kvar(kvar_a) (Meter 8)	INTEGER32	RO	0
	30	kvar(kvar_b) (Meter 8)	INTEGER32	RO	0
	31	kvar(kvar_c) (Meter 8)	INTEGER32	RO	0
	32	kvar(kvar_tot) (Meter 8)	INTEGER32	RO	0
3205h	0	largest sub-index supported for "kVA"	UNSIGNED 8	RO	32
	1	kVA(Kva_a) (Meter 1)	INTEGER32	RO	0
	2	kVA(Kva_b) (Meter 1)	INTEGER32	RO	0

	3	kVA(Kva_c) (Meter 1)	INTEGER32	RO	0
	4	kVA(Kva_tot) (Meter 1)	INTEGER32	RO	0
	---
	29	kVA(Kva_a) (Meter 8)	INTEGER32	RO	0
	30	kVA(Kva_b) (Meter 8)	INTEGER32	RO	0
	31	kVA(Kva_c) (Meter 8)	INTEGER32	RO	0
	32	kVA(Kva_tot) (Meter 8)	INTEGER32	RO	0
3206h	0	largest sub-index supported for “PF”	UNSIGNED 8	RO	32
	1	PF_a (Meter 1)	INTEGER32	RO	0
	2	PF_b (Meter 1)	INTEGER32	RO	0
	3	PF_c (Meter 1)	INTEGER32	RO	0
	4	PF_tot (Meter 1)	INTEGER32	RO	0
	---
	29	PF_a (Meter 8)	INTEGER32	RO	0
	30	PF_b (Meter 8)	INTEGER32	RO	0
	31	PF_c (Meter 8)	INTEGER32	RO	0
	32	PF_tot (Meter 8)	INTEGER32	RO	0
3207h	0	largest sub-index supported for “kVAh”	UNSIGNED 8	RO	32
	1	kVAh_a (Meter 1)	INTEGER32	RO	0
	2	kVAh_b (Meter 1)	INTEGER32	RO	0
	3	kVAh_c (Meter 1)	INTEGER32	RO	0
	4	kVAh_tot (Meter 1)	INTEGER32	RO	0
	---
	29	kVAh_a (Meter 8)	INTEGER32	RO	0
	30	kVAh_b (Meter 8)	INTEGER32	RO	0
	31	kVAh_c (Meter 8)	INTEGER32	RO	0
	32	kVAh_tot (Meter 8)	INTEGER32	RO	0
3208h	0	largest sub-index supported for “kvarh”	UNSIGNED 8	RO	32
	1	kvarh_a (Meter 1)	INTEGER32	RO	0
	2	kvarh_b (Meter 1)	INTEGER32	RO	0
	3	kvarh_c (Meter 1)	INTEGER32	RO	0
	4	kvarh_tot (Meter 1)	INTEGER32	RO	0
	---

	29	kvarh_a (Meter 8)	INTEGER32	RO	0
	30	kvarh_b (Meter 8)	INTEGER32	RO	0
	31	kvarh_c (Meter 8)	INTEGER32	RO	0
	32	kvarh_tot (Meter 8)	INTEGER32	RO	0
3209h	0	largest sub-index supported for "Frequency"	UNSIGNED 8	RO	32
	1	Freq_a (Meter 1)	INTEGER32	RO	0
	2	Freq_b (Meter 1)	INTEGER32	RO	0
	3	Freq_c (Meter 1)	INTEGER32	RO	0
	4	Freq_avg (Meter 1)	INTEGER32	RO	0
	---
	29	Freq_a (Meter 8)	INTEGER32	RO	0
	30	Freq_b (Meter 8)	INTEGER32	RO	0
	31	Freq_c (Meter 8)	INTEGER32	RO	0
	32	Freq_avg (Meter 8)	INTEGER32	RO	0
320Ah	0	largest sub-index supported for object	UNSIGNED 8	RO	2
	1	VTHD (Phase set by Harmonic Phase Select Register)	INTEGER32	RO	
	2	ITHD (Phase set by Harmonic Phase Select Register)	INTEGER32	RO	
320Bh	0	largest sub-index supported for object	UNSIGNED 8	RO	12
	1	PT Ratio	UNSIGNED 16	RW	100
	2	CT1 Ratio	UNSIGNED 16	RW	1
	3	CT2 Ratio	UNSIGNED 16	RW	1
	---
	9	CT8 Ratio	UNSIGNED 16	RW	1
	10	Software Wiring (Only work when SW9-SW10 is all off) 1: 1P2W 2: 1P3W	UNSIGNED 16	RW	5

		3: 3P3W2CT 4: 3P3W3CT 5: 3P4W3CT			
	11	Energy Absolute Accumulated Mode 0: Enable 1: Disable	UNSIGNED 16	RW	0
	12	Display Voltage 0: Automatic 1: Show as VIn 2: Show as VII	UNSIGNED 16	RW	0
320Ch	0	largest sub-index supported for object	UNSIGNED 8	RO	8
	1	H Phase Select1 0: Disable 1: Phase A 2: Phase B 3: Phase C	UNSIGNED 16	RW	0
	---
	8	H Phase Select8 0: Disable 1: Phase A 2: Phase B 3: Phase C	UNSIGNED 16	RW	0
320Dh	0	largest sub-index supported for object	UNSIGNED 8	RO	10
	1	Set Meter1 Energy Zero	UNSIGNED 16	RW	0x0055
	---
	8	Set Meter8 Energy Zero	UNSIGNED 16	RW	0x0055
	9	Set All Meter Energy Zero	UNSIGNED 16	RW	0x0055
	10	Default Frequency 0x0055: Auto 0x0064: 50Hz 0x0078: 60Hz	UNSIGNED 16	RW	0x0055

Application Object

The users can write the object the value 65766173h to object with index 1010h and subindex 1 to save the application setting, or write the value 64616F6Ch to object with index 1011h and subindex 1 and reboot the module to load the factory default.

Appendix: Questions & Answers

Q1. Can we use the other 5A CT's (like 600/5) to directly connect to the input current terminals of PM-4324 series?

No, because the input current is only mA size on PM-4324 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-4324 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-4324 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?

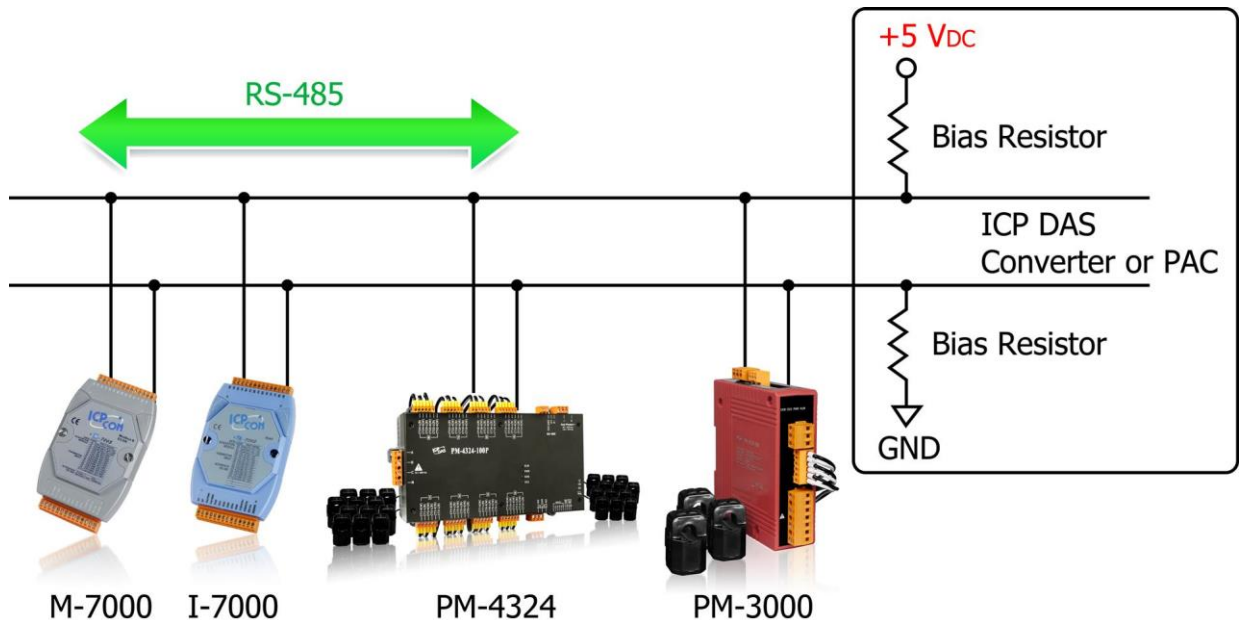
- (1) First check the current input end – line terminal, (check the connection should be **CT1-K, CT1-L, CT2-K, CT2-L, CT3-K, CT3-L**) , base on white black, white black, white black follow the sequence order
- (2) Check the field current direction (K→L) is same as the inner arrow direction of the split type clip-on CT.
- (3) Confirm the RST (ABC) phase sequence.

Q6. What does negative kW on a motor/pump mean?

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

Q7. 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-4324 series. Otherwise, the tM-SG4 or SG-785 should be added to provide the bias. All ICP DAS controllers and converters provide the bias.

**Q8. What the power cable diameter (mm) of the monitoring equipments should be for the various CT's?**

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 , $\Phi 36</math> use 300A CT , $\Phi 36</math> use 400A CT$$$$

Q9. Regarding to the split type clip-on CT's, if the wire is not long enough?

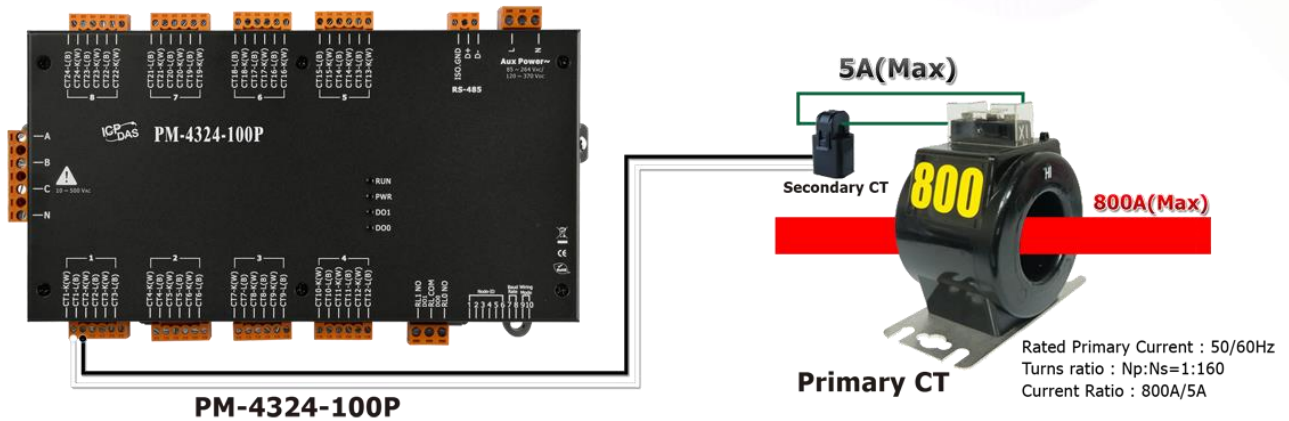
$\Phi 10, \Phi 16, \Phi 24, \Phi 36</math> split type CT , the standard length is 4M.$

For special length, please contact ICP DAS.

Q10. How to measure the current large than 400A?

The CT of PM-4324 maximum range is 400A. If the target is more than 400A, we suggest the solution as follow.

For example the target is to measure maximum 800A current. We can measure big CT output and set a CT Ratio.

**Note:**

- Primary CT accuracy will influence the measurement.
- Even primary CT output current max is 5A, please don't wire to PM-4324 and PM-4324P directly.

Q11. Can I use CT's that I currently own with PM-4324 Power Meter?

You can use CT's that you currently own with PM-4324P (without CTs) Power Meter.

The CT inputs of the PM-4324P can handle a maximum of 333mV (**Rogowski coils are not supported**) of AC current.

PM-4324P's current ratio is always full scale to 5A. CT ratio can be set internally to work with up to 1200 amp CTs.

Adding current transformer (333mV Output CTs) has the effect of reducing the measured current by the CT ratio (let's say 40:1 for 200A CT as example). So a current of 200A becomes 5A. Since the meter sees 5A, many of the measurements it reports will be low by a factor of 4 unless they are scaled up by 4.

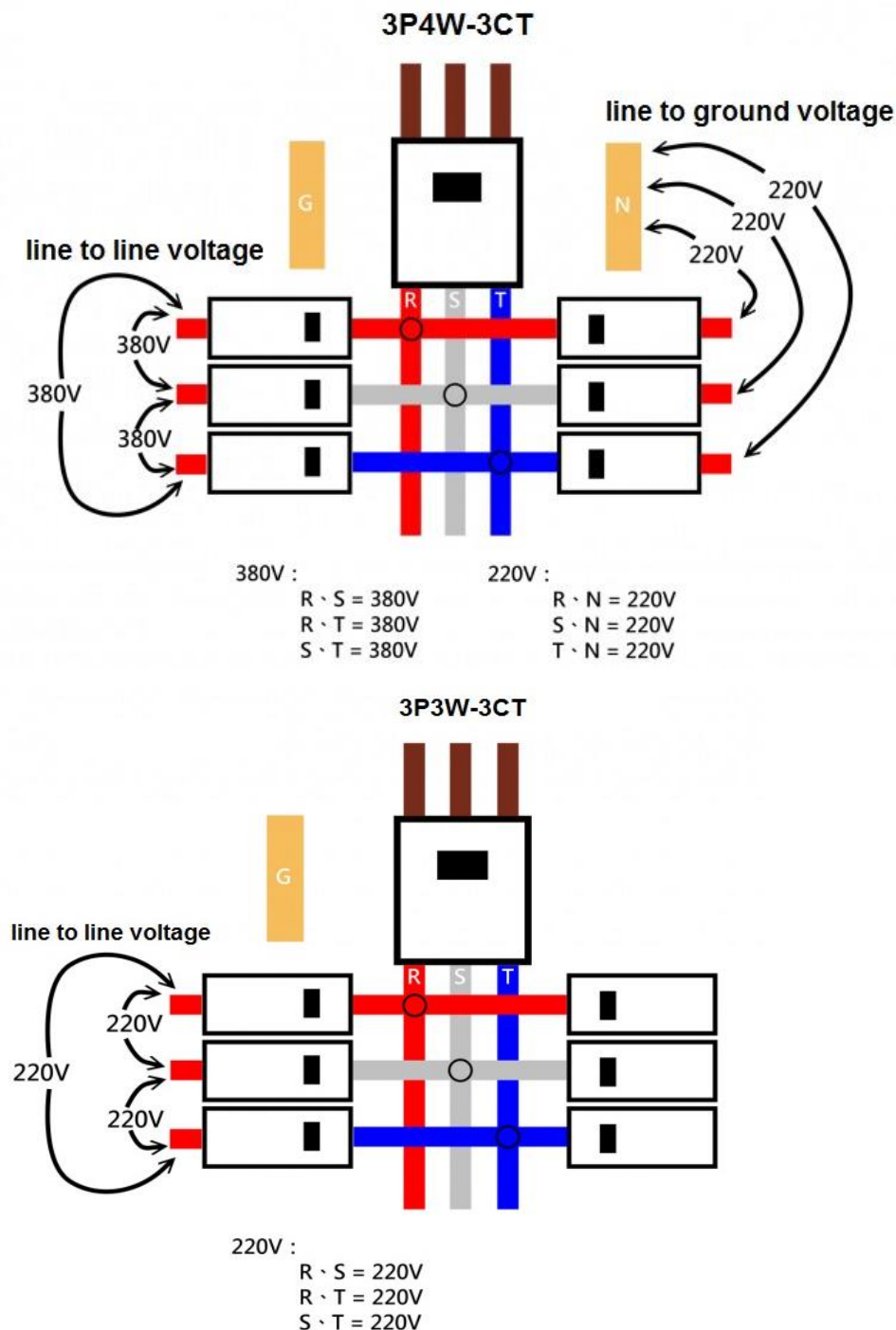
Current transformer	CT Ratio (PM-4324P)	Current transformer	CT Ratio (PM-4324P)
50A CT	10:1	400A CT	80:1
60A CT	12:1	800A CT	160:1
100A CT	20:1	1000A CT	200:1
200A CT	40:1	1200A CT	240:1

Note:

- A. Please use low phase angle error CTs: essential for accurate power and energy measurements. (Example: phase error $<2^\circ$)
- B. Accuracy may be 5% or greater without calibration with power Meter.
- C. Primary CT accuracy will influence the measurement.
- D. PM-4324P only for external 333mV Output CTs (**Rogowski coils are not supported**).
Safe: burden resistor built-in, 333 mVac voltage output at rated full scale current, no shorting blocks needed.
- E. This meter requires external CT(s) to operate:
1P2W-1CT requires 1 CT per meter.
3P3W-2CT/1P3W-2CT requires 2 CTs per meter.
3P4W-3CT/3P3W-3CT requires 3 CTs per meter.

Q12. What is the difference between line to line voltages to line to ground voltage?

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



Q13. How to set up [Display Voltage] register value to correctly display line to ground voltage or line to line voltage?

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

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

Q14. How about the harmonic (THD) analysis capability?

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

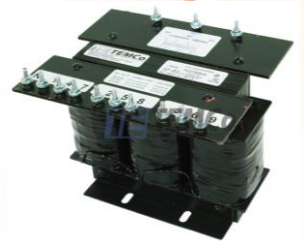
$$N = [2800/f], N \leq 63$$

Q15. How to measure the Voltage large than 500V?

For service voltage above 600 Vac, voltage transformers (PTs) are used to step down the voltage to a lower range that will work with a PM-4324 meter.

Selecting a Transformer:

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

**Input Voltage:**

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

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

Frequency:

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

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

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