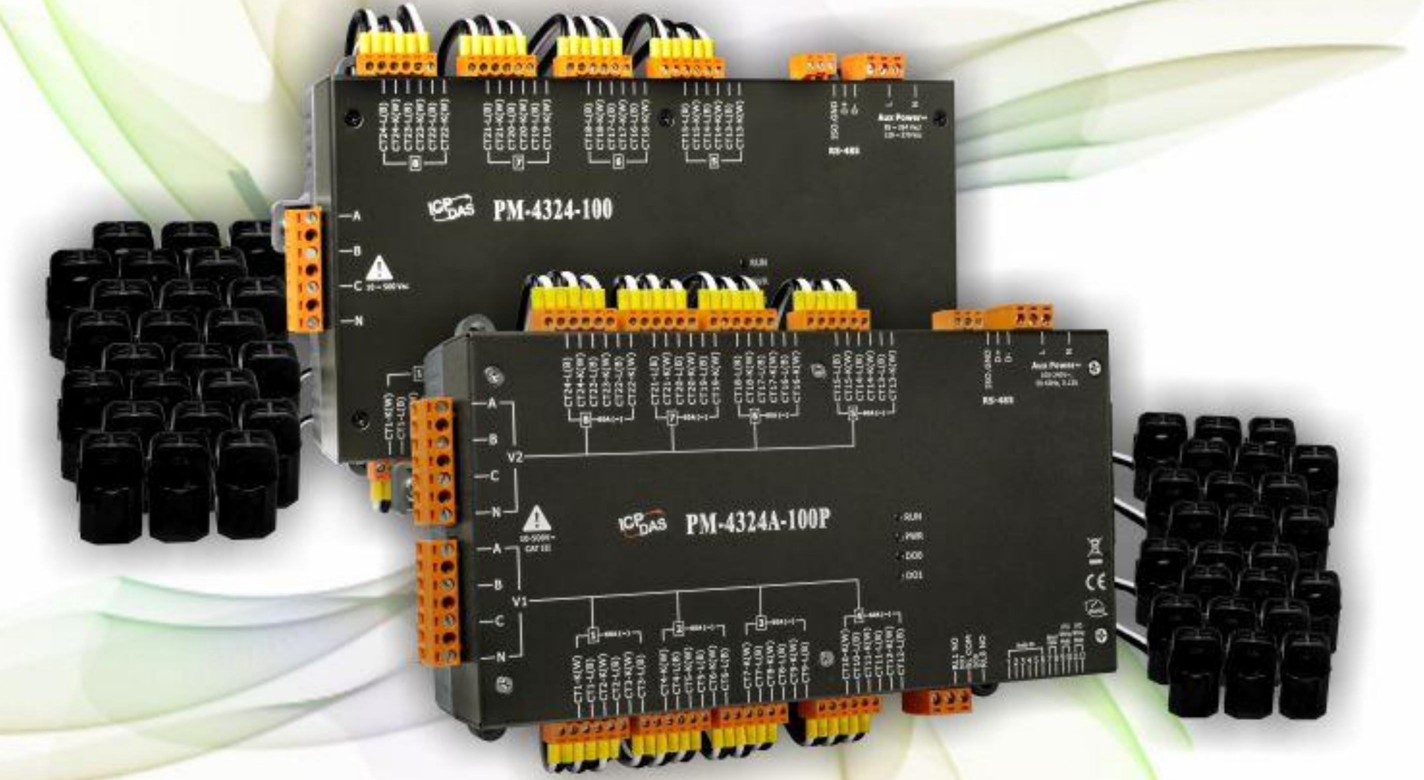
PM-4324/P/A/AP

Smart Power Meter

User's Manual



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Revision History

The table below shows the revision history:

Revision	Date	Description
1.03	2024/04/25	● Fix the Integer type value rage of kVAh,kVARh ● Fix the Bi_xxx_kWh modbus address number ● Change the Display Voltage definition “automatic” to “default”
1.04	2026/04/14	● Integrated PM-4324P, PM-4324AP, PM-4324-xxxP, and PM-4324A-xxxP into a single manual. ● Section 2.1 Add PM-4324A-EIP/ PM-4324AP-EIP module ● Add Chapter 8 EtherNet/IP Communication

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ICP DAS Co., Ltd.

PM-4324/P/A/AP

User's Manual

Table Of Contents

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1.Introduction

1.1. PM-4324/PM-4324P/PM-4324A/PM-4324AP Introduction

ICP DAS presents the PM-4324 family — a full range of single-phase and three-phase smart power meters designed for power monitoring. These products combine a rich set of features with easy-to-integrate communication interfaces.

With high accuracy (<0.5%, PF = 1), the PM-4324 series can be applied to both low-voltage (primary side) and medium/high-voltage (secondary side) power systems. They provide reliable and precise real-time energy consumption data from monitored equipment in operation.

Compact and cost-effective, the PM-4324 series is equipped with innovative wired clip-on CTs (supporting input currents up to 400 A, depending on the type) and supports Modbus RTU communication over RS-485 for easy deployment. The meters operate with input voltages ranging from 10 to 500 VAC, making them suitable for a wide range of applications.

The PM-4324A is functionally similar to the PM-4324, with the exception of AC measurement. The PM-4324A provides two independent main circuit inputs, which can be used in different power supply systems.

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)
- 2 Independent main circuit inputs

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1.2. Safety Guidelines

The meter contains hazardous voltages and requires careful handling during installation and operation. Adhere to the following safety guidelines to prevent injury or damage:

- The meter contains hazardous voltages and must never be disassembled. Failure to follow this practice may result in serious injury or death.
- Any work on or near energized meters, meter sockets, or other metering equipment poses a risk of electrical shock.
- Only qualified industrial electricians or metering specialists should perform installation and maintenance.
- ICP DAS assumes no responsibility for improper installation or failure to comply with national and local electrical codes.

1.3. Disclaimer

ICP DAS assumes no liability for any damage resulting from the use of this product. The company reserves the right to revise or modify this document at any time without prior notice.

- The information provided in this manual is believed to be accurate and reliable. However, ICP DAS assumes no responsibility for its use or for any infringements of patents or third-party rights resulting from its use.
- ICP DAS is not liable for any technical or editorial errors, omissions, or inaccuracies contained in this document.

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1.4. Product Warranty and Customer Support

ICP DAS warrants that all products, under normal use conditions, will be free from defects in materials and workmanship for a period of one (1) year from the date of shipping. During the warranty period, ICP DAS will, at its discretion, repair or replace any defective product. This warranty applies only under normal use conditions and does not cover damages caused by misuse, improper installation, or failure to comply with relevant regulations.

To report a defect:

1. Contact ICP DAS:
   - Phone: **+886-3-597-3366**
   - Email: **service@icpdas.com**
2. Provide the following information:
   - Product model number and serial number
   - A detailed description of the issue
   - If the issue pertains to specific readings, include all relevant meter readings for reference.

Returning merchandise:

- A product serial number (SN) is required before sending any product back to ICP DAS.

1.4.1. Warranty Limitations

The warranty does not apply to defects resulting from:

- Unauthorized modifications.
- Misuse or operation outside the specified conditions.
- Use for purposes other than electrical power monitoring.

Important Note:

The PM-4324 series is not a user-serviceable product. Any attempt to disassemble or repair the device will void the warranty.

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2. Specifications

2.1. Specifications

<table>
<tr><th colspan="2">Model</th><th>PM-4324A/PM-4324AP
PM-4324/PM-4324P</th><th>PM-4324A-MTCP/
PM-4324AP-MTCP
PM-4324-MTCP/
PM-4324P-MTCP</th><th>PM-4324A-EIP
PM-4324AP-EIP</th><th>PM-4324A-CPS
PM-4324AP-CPS</th></tr>
<tr><td colspan="6">AC Power Measurement</td></tr>
<tr><td colspan="2">Wiring</td><td colspan="4">1P2W-1CT, 1P3W-2CT, 3P3W-2CT, 3P3W-3CT and 3P4W-3CT</td></tr>
<tr><td colspan="2">Measurement Voltage</td><td colspan="4">10 ~ 500 V (CAT III)</td></tr>
<tr><td colspan="2">Measurement Current</td><td colspan="4">-100P: CTØ10 mm (0.05 A - 60 A), -160P: CTØ16 mm (0.1 A - 100 A), -240P: CTØ24 mm (0.15 A - 200 A), -360P: CTØ36 mm (0.3 A - 300 A), -400P: CTØ36 mm (0.3 A - 400 A)</td></tr>
<tr><td colspan="2">Measurement Frequency</td><td colspan="4">50-60 Hz</td></tr>
<tr><td colspan="2">W Accuracy</td><td colspan="4">Better than 0.5% (PF:1)</td></tr>
<tr><td colspan="2">Power Parameter Measurement</td><td colspan="4">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)</td></tr>
<tr><td colspan="2">Data Update Rate</td><td colspan="4">1 Second</td></tr>
<tr><td colspan="6">Communication</td></tr>
<tr><td rowspan="5">RS-485</td><td>Protocol</td><td>Modbus-RTU</td><td colspan="3">-</td></tr>
<tr><td>Baud rate</td><td>9600,19200 (default), 38400, 115200; DIP Switch Selectable</td><td colspan="3" rowspan="2">-</td></tr>
<tr><td>Data format</td><td>N,8,1 (default); N,8,2; E,8,1; E,8,2; O,8,1; O,8,2</td></tr>
<tr><td>Isolation</td><td>3000 VDC</td><td colspan="3">-</td></tr>
<tr><td>Bias Resistor</td><td>No (Usually supplied by the RS-485 Master. Alternatively, add a tM-SG4 or SG-785)</td><td colspan="3"></td></tr>
</table>

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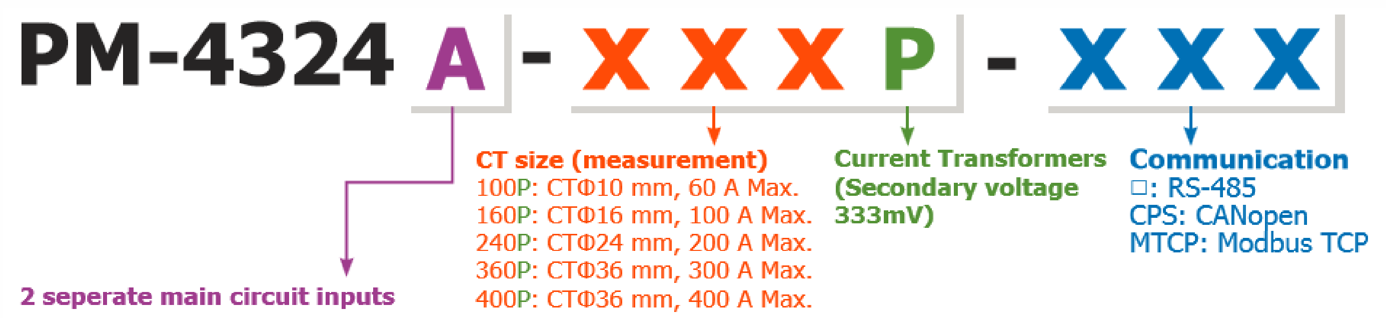
Ethernet	Protocol	-	Modbus TCP		
CANopen	Protocol				CANopen
Alarm Output					
Power Relay		Form A (Normal Open) x 2; Relay Contact Voltage Range: 5 A @ 250 VAC (47 - 63Hz), 5 A @ 30 VDC			
Aux Power					
Input Range		+100 to +240 VAC			
Power Consumption		6 W			
Dimensions (W x L x H)		237 mm x 52 mm x 134 mm			
Environment					
Operating Temperature		-20 to +70 °C			
Storage Temperature		-25 to +80 °C			

2.2. Naming Rules



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3. Installation

3.1. Inspection

The instrument may not function properly under the following conditions:
a) The exterior is visibly damaged.
b) It does not display properly after powering on.
c) It has been stored for an extended period under harsh conditions.
d) It has been damaged during transportation.

3.2. ⚠ Safety

- Please clean the instrument using a soft, dry cloth.
- Do not use chemicals, detergents, or volatile solvents to clean the instrument, as they may cause damage to the cover.
- The product includes external split type clip-on CTs. Do not disconnect or replace them with other CTs, as this is strictly prohibited.
- Carefully read this operation manual before use.
- Re-confirm the measurement position before installation.
- PM-4324 series can be installed using rail mounting or embedded mounting, without the need for drilling holes or using screws. The rail width should not exceed 35 mm.
- The meter's auxiliary power supply range is +100 to +240 VAC.

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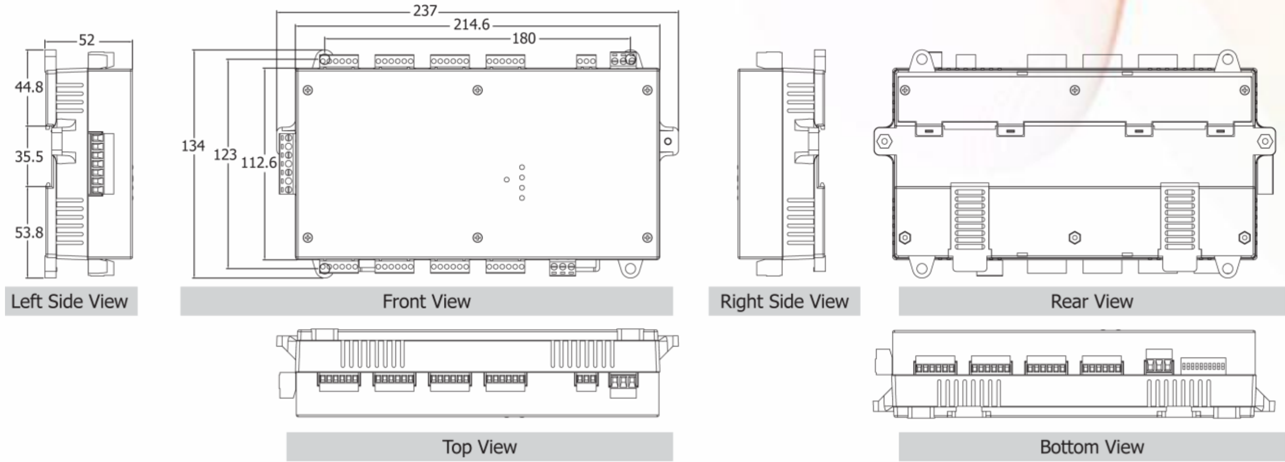
3.3. Dimension and Latch



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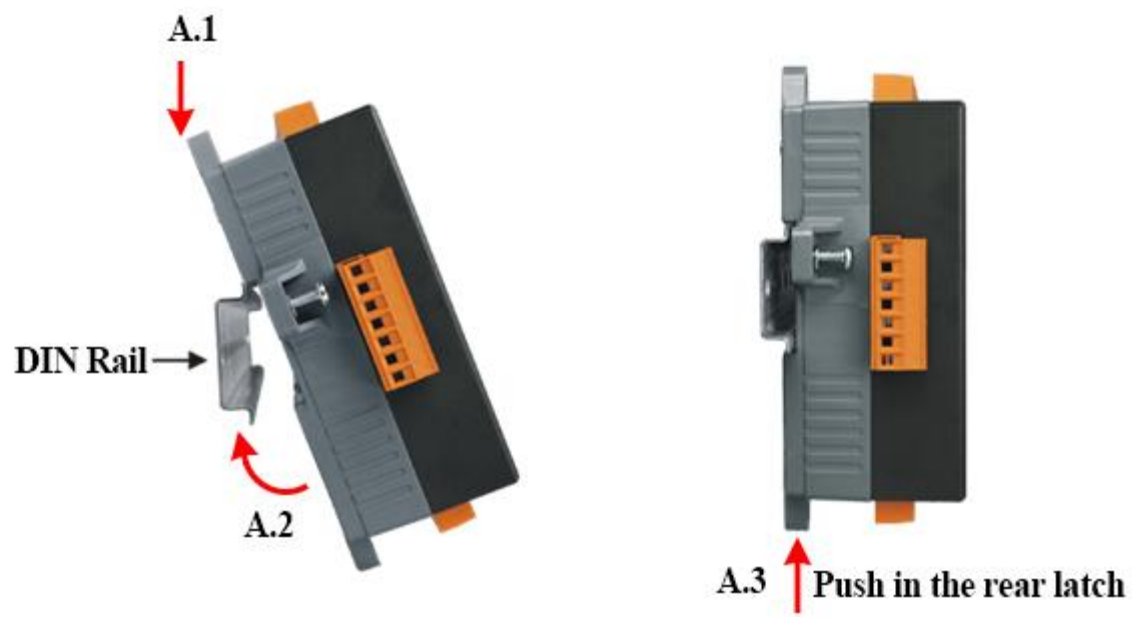
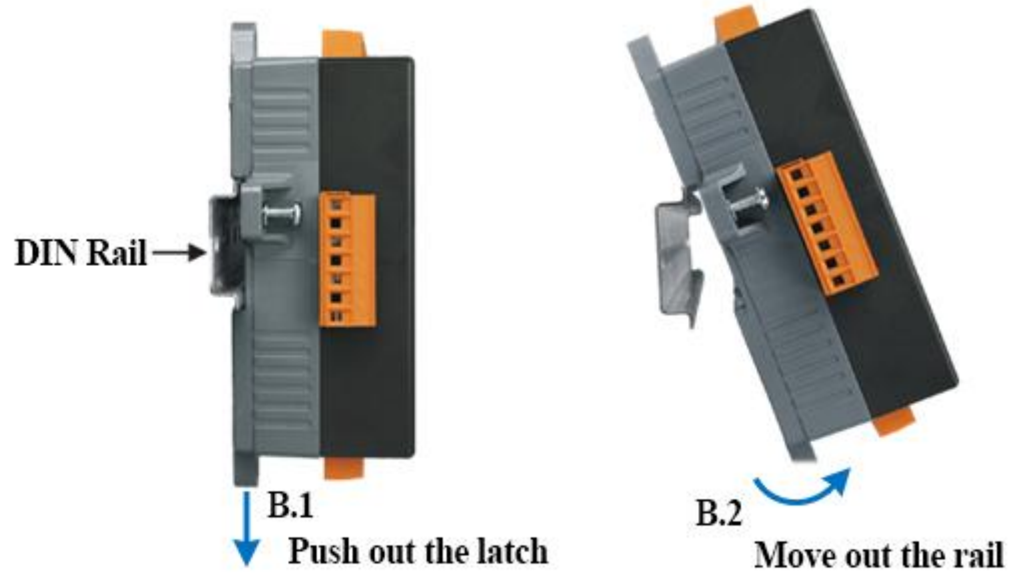
3.3.1. Mounting and Dismounting

A. **Mounting:** Place the PM-4324 series onto the rail. Then press the front of the PM-4324 series toward the mounting surface until you hear it click into place.



B. **Dismounting:** Pull out the rear latch and remove the PM-4324 series from the rail.



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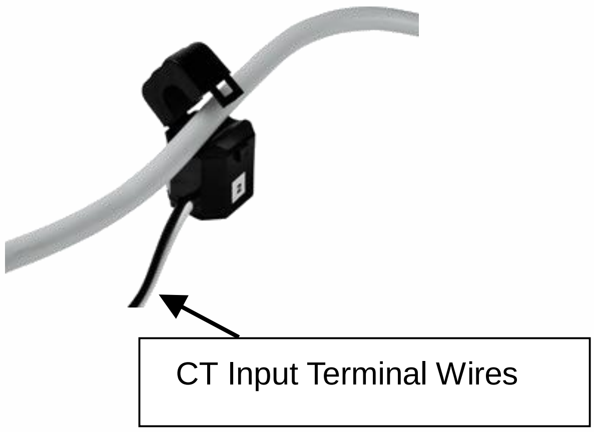
C. Wire Disconnection:

1. Unlock the CT clip and remove the CT from the power cable, avoiding disconnecting the CT terminal wires if possible (do not disconnect the terminal wirers first).
   Warning! If you need to remove the CT terminal wires, make sure to first detach the CT before removing the CT terminal wires. This is to prevent high open-circuit secondary voltage being generated on the secondary side of the CT, which could cause electric shock or damage to the CT and connected equipment in the secondary circuit.
2. Disconnect the voltage input wires from the terminals and wrap the wire ends with insulating tape.
3. Disconnect the communication wires from the terminal.
4. Disconnect the auxiliary power from the terminal, then wrap the wire ends with insulating tape.



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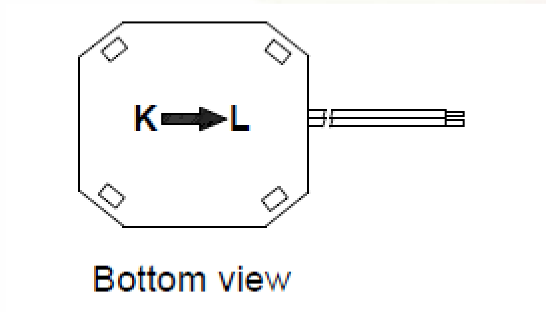
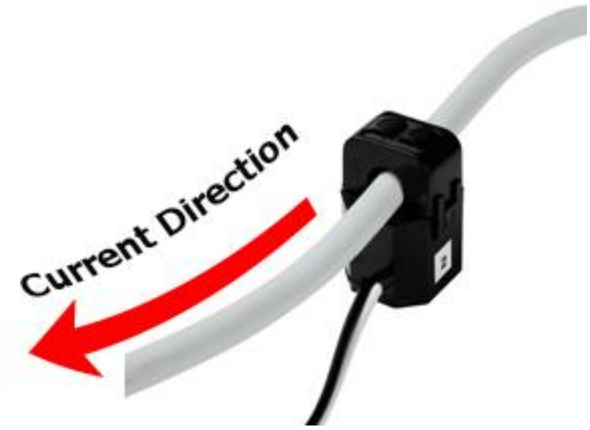
3.3.2. PM-4324-xxxP/PM-4324A-xxxP CT's Installation Steps



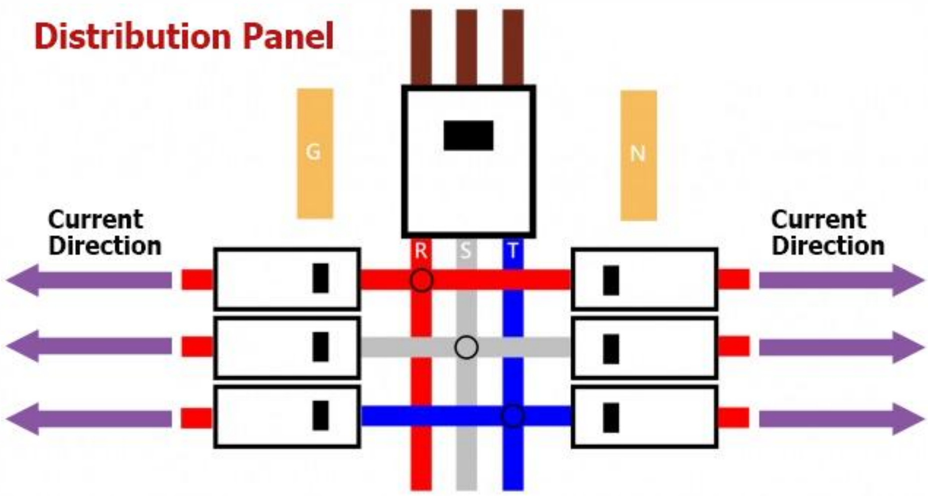
- At the bottom of the CT, there is a "K→L" mark.

- Open the CT clip.

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



- Complete the Installation.



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3.3.4. PM-4324P/PM-4324AP Current Input Scaling

1. The external CT's are fragile, please handle with care.
2. **The current input of PM-4324P/AP series is in mV range.** The other CT's, for example, from panel will damage the instrument due to its large current (around 5A)
3. CT-to-Reference Voltage Mapping:
   PM-4324P: CT1–CT24 use reference voltage V1.
   PM-4324AP: CT1–CT12 use reference voltage V1; CT13–CT24 use reference voltage V2.
4. **CT Selection Considerations:**
   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 40 unless they are scaled up by 40.

Current transformer	CT Ratio		Current transformer	CT Ratio
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°)
B. Accuracy is approximately 2–5% (PF = 1), depending on the CT used. The CT ratio must be set correctly
C. **PM-4324P/PM-4324AP 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.
D. 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

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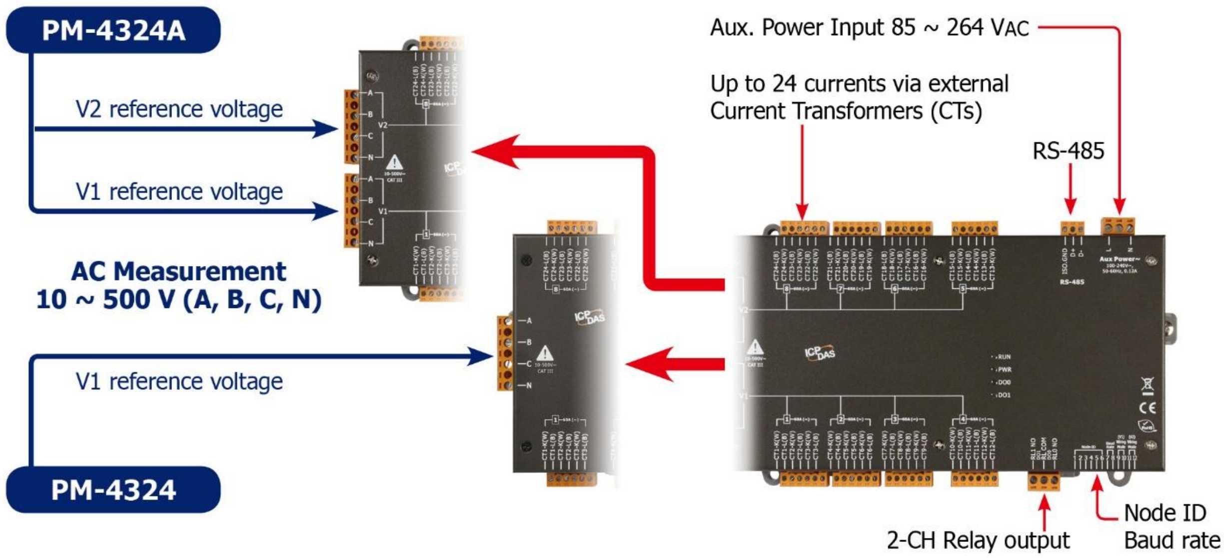
4. Wiring Diagrams

4.1. Connection



Wiring Specifications:

- **CT (Current Transformer) Wires:** AWG 16 to 28, Screw Torque Value: 1.7 lb-in
- **Reference Voltage Wires:** AWG 12 to 24, Screw Torque Value: 7.0 lb-in
- **Auxiliary Power:** AWG 12 to 24, Screw Torque Value: 7.0 lb-in
- **Relay Output:** AWG 12 to 24, Screw Torque Value: 7.0 lb-in

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Voltage Input

1. PM-4324 series supports input voltage up to 500VAC.
   For input voltage exceeding 500VAC, use a PT (power transformer), and adjust the PT RATIO settings.
2. Confirm the RST (ABC) phase sequence.

Current Input

1. Handle external CTs with care, as they are fragile.
2. Only use the CTs provided with the device. Using other CTs (e.g., from a panel), could damage the instrument due to their high current (around 5A)
3. When multiple smart meters (PM-4324 series) are installed, do not interchange CTs between devices. Each set of meters and their split-type clip-on CTs are calibrated individually. Mixing them may result in inaccurate measurements.
4. To ensure correct installation, verify the CT wiring sequences before clipping the CTs onto the power cable of the monitoring equipment.
5. ⚠**When measuring current, never open the secondary circuit of a CT while the primary has a load. Always detach the CT before removing the terminal wires to prevent injury.**
6. Exercise extra caution when working in confined space with CTs.
7. The current flow direction must follow K-L marking on the CT.
8. Select the appropriate CT size based on the diameter of the monitored equipment’s power cable:
   - For power cable diameter < Φ10, suitable for a 60A CT.
   - For power cable diameter Φ10 to Φ16, suitable for a 100A CT.
   - For power cable diameter Φ16 to Φ24, suitable for a 200A CT.
   - For power cable diameter Φ36, suitable for either a 300A CT or a 400A CT.
9. Do not exceed the rated current value of the CT.
10. CT1–CT12 use reference voltage V1 as the voltage input, while CT13–CT24 use reference voltage V2 as the voltage input.

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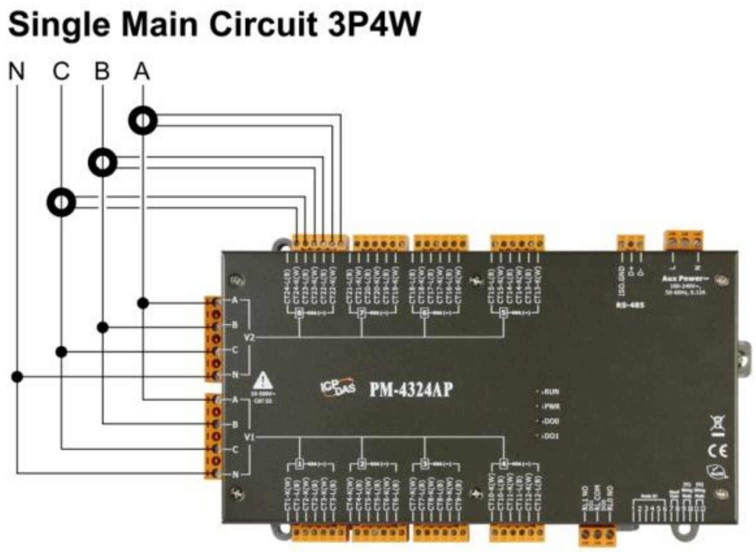
4.2. Wiring

PM-4324A/PM-4324A-xxxP Single Main Circuit Wiring

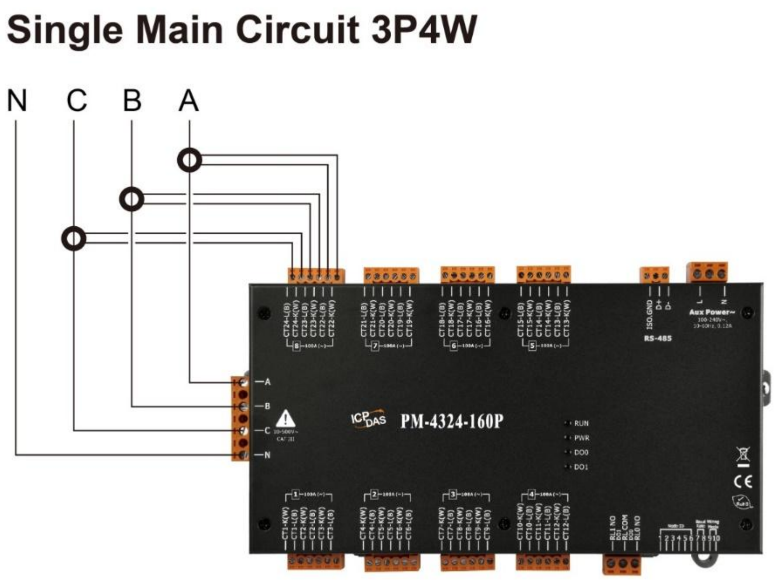
Example:



The voltage ratio, display settings, and wiring configuration for V1 and V2 must be identical.

PM-4324P/PM-4324-xxxP Single Main Circuit Wiring

Example:



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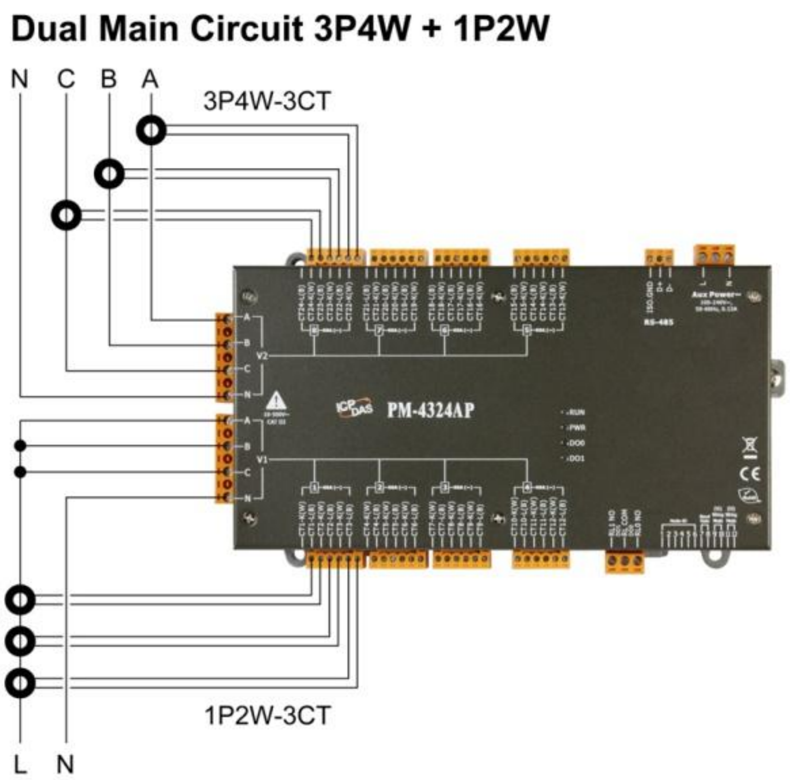
PM-4324A/PM-4324A-xxxP Dual Main Circuit Wiring

Example:



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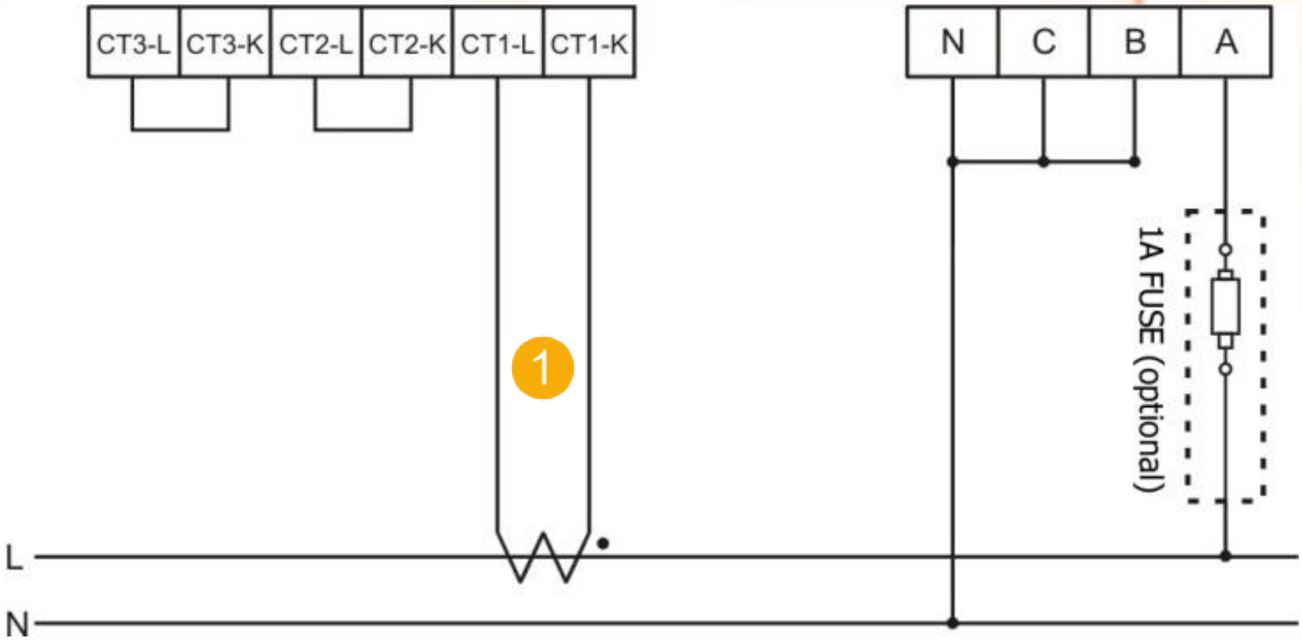
Wiring

- 1P2W-1CT(Single-phase, Single-circuit) (Configuration required via software)



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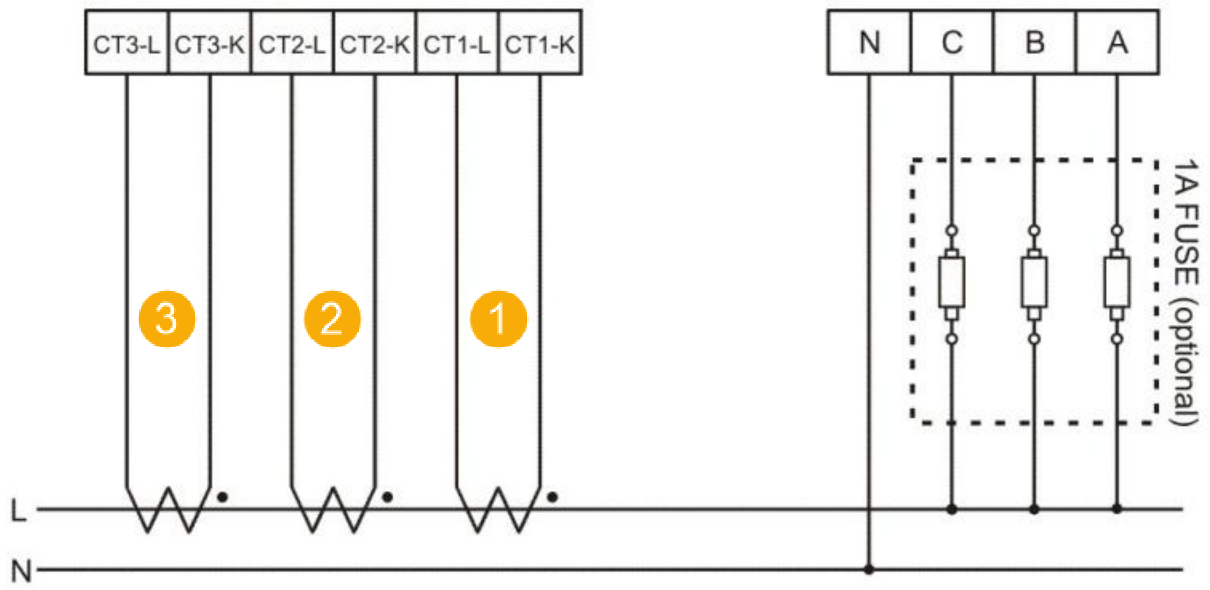
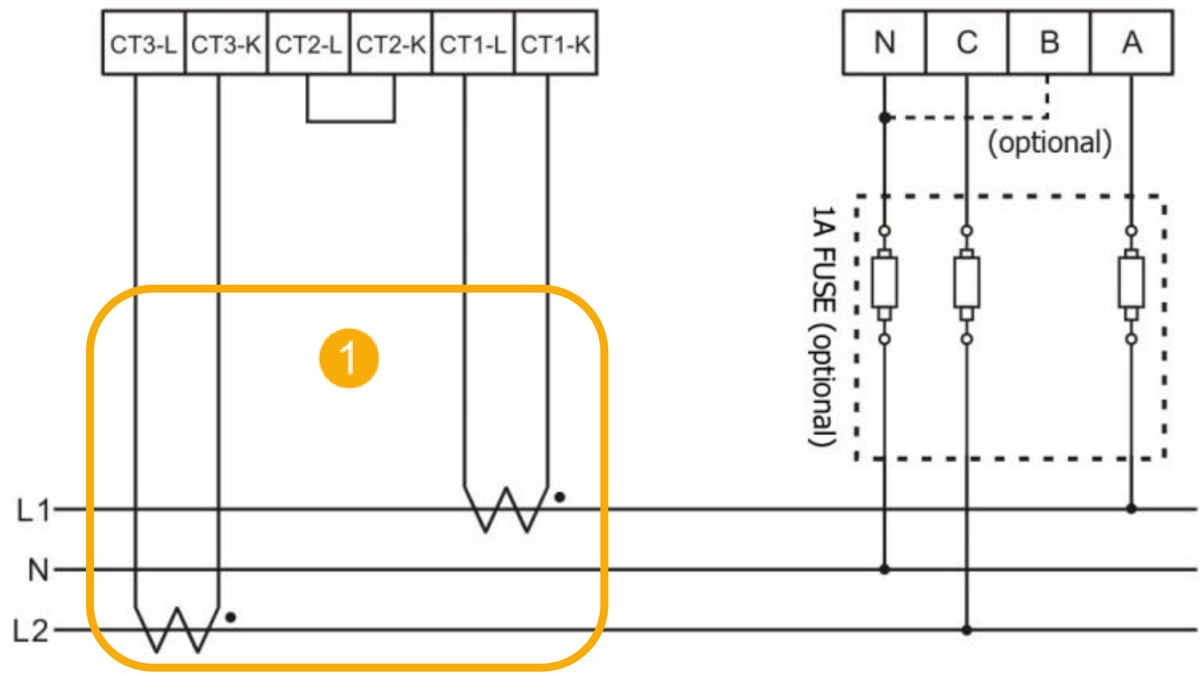
- 1P2W-3CT
  (Single-phase, 3-circuit) (Configuration required via software. Select "1P2W-1CT" as the wiring configuration.)



- 1P3W-2CT
  (Single-phase, Single-circuit) (Configuration required via software)



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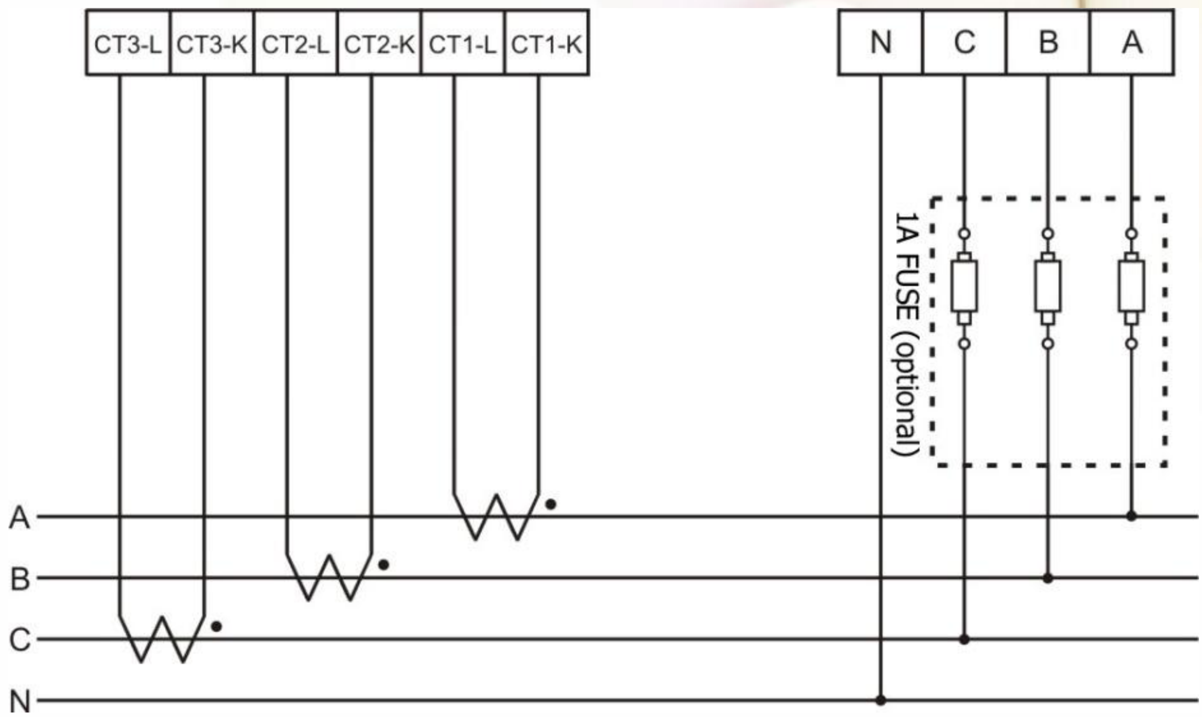
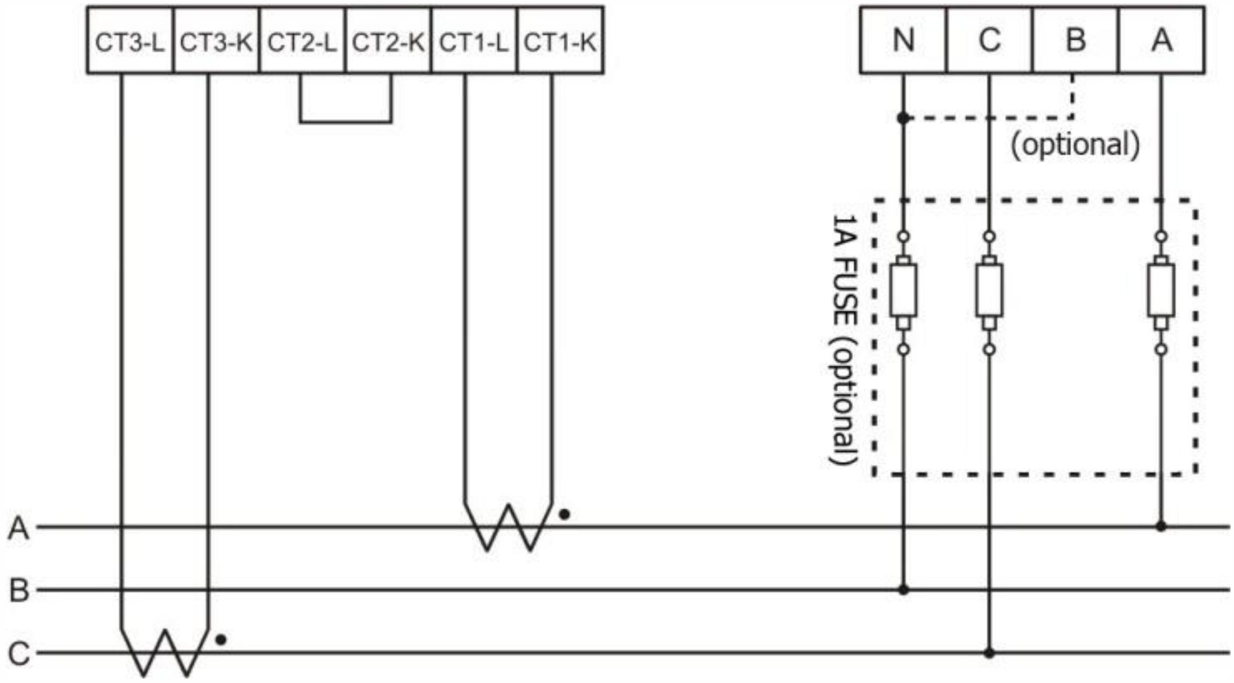
- 3P4W-3CT (Can be configured via software or DIP switch)



- 3P3W-2CT:

  (If phase B is in a floating state, it may pick up induced voltage signals. To avoid this, phase B can be connected to the neutral (N) line.)



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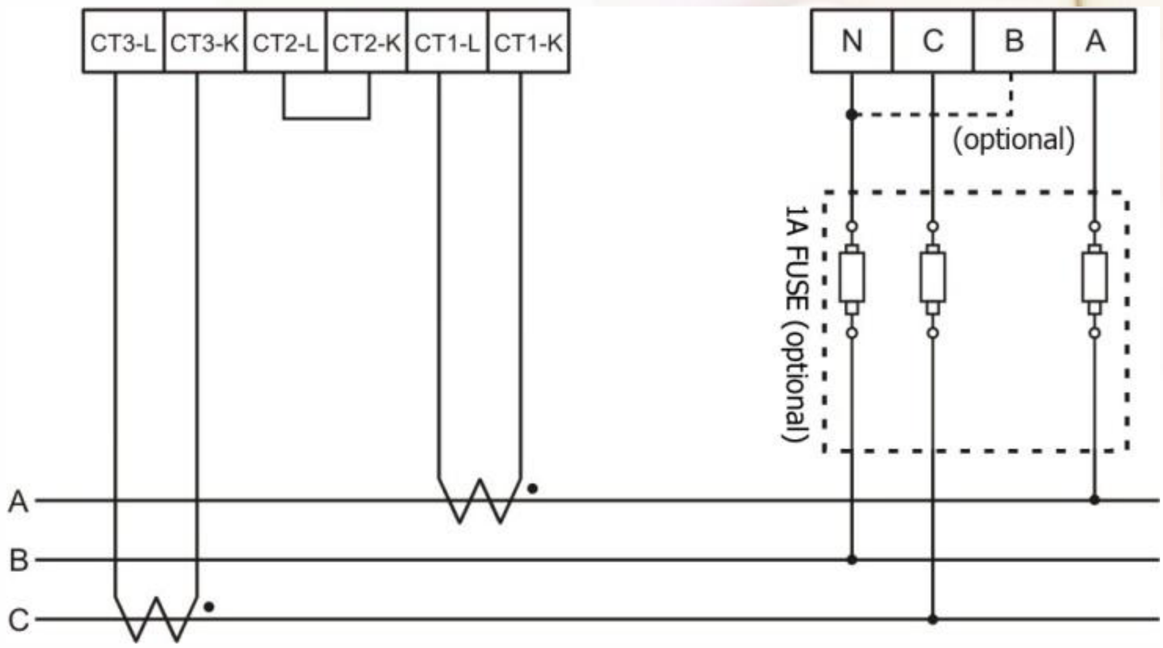
- 3P3W-2CT (Can be configured via software or DIP switch)



Notes:

1. If phase B is in a floating state, it may pick up induced voltage signals. To avoid this, phase B can be connected to the neutral (N) line.

2. The 3P3W-2CT method is only suitable for **balanced three-phase systems with low harmonic distortion**. For unbalanced loads or systems with significant harmonics, the **3P3W-3CT method** is recommended for accurate measurement. For detailed information, please refer to the Appendix “Questions and Answers” section of the manual.

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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 series has 4 LED to indicate the unit power status, RS-485 communication, and power data calculation.

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

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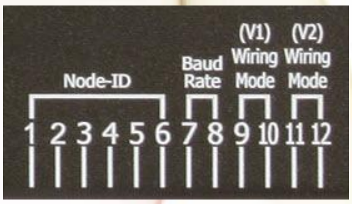
6. Modbus-RTU communication



6.1. RS-485 setting

- Default setting for RS-485: **19200**, **n, 8, 1**
- DIP switch (SW1-SW6): Used for setting the Modbus address, with the default set to 1(all switches OFF)
  For example, to set the Modbus address to 10，configure the DIP switches as follows:
  SW1 = ON, SW2 = OFF, SW3 = OFF, SW4 = ON, SW5 = OFF, SW6 = OFF.

- SW1–SW6 Settings

  Configure Modbus-RTU communication addresses ranging from 1 to 64. Use the table provided below for specific settings.

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

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

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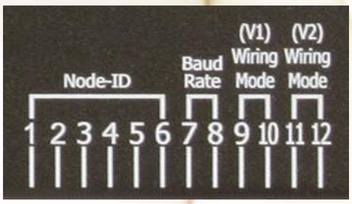
- SW7–SW8 Settings

PM-4324 series: For Baud Rate Setting



RS-485	CAN	SW 7	SW8
9600 bps	**125k (Default)**	OFF	OFF
19200 (Default)	**250k bps**	**ON**	OFF
38400 bps	**500k bps**	OFF	**ON**
115200 bps	**1M bps**	**ON**	**ON**

Note: For a stable signal on the RS-485 Network, it is recommended to add a bias resistor. The RS-485 master must provide the bias for PM-4324 series or you can add a tM-SG4 or SG-785 to provide the bias. All ICP DAS controllers and converters are equipped with a built-in bias resistor.

- SW9–SW12 Settings

For the PM-4324 series, select the appropriate wiring mode
(use the Software setting for 1P2W-1CT or 1P2W-3CT or 1P3W-2CT)

Reference voltage	**V1**		**V2**	
Wiring	SW 9	SW 10	SW 11	SW 12
Software setting	OFF	OFF	OFF	OFF
3P3W-2CT	**ON**	OFF	**ON**	OFF
3P3W-3CT	OFF	**ON**	OFF	**ON**
3P4W-3CT	**ON**	**ON**	**ON**	**ON**

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6.2. Modbus-RTU setting

6.2.1. Specifications

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

- **Data format**
  Integer: 16 bits with sign, occupying 1 register per integer.
  Unsigned Integer: 16 bits without sign, occupying 1 register per integer.
  Float: IEEE 754 Format, occupying 2 registers, with the low word transmitted first.

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IEEE 754 Format

Definition of the floating format of the Bits

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

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

S: Sign bit, where 1 is negative and 0 is positive

E: Exponent with an offset of 127, representing the power of two.
For example, an exponent of zero is represented by the value 127, and an exponent of 1 is represented by the value128, and so on.

M: Mantissa(23-bit), which represents the fractional part of the number. The highest bit, also known as the implicit leading bit, is always assumed to be1 and is therefore not stored.

Transfer sequence（Float）

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

Transfer sequence（Inverse Integer）

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

Transfer sequence（Integer）

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

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6.2.2. Modbus Register

- Modbus Module #1 – Coil: Relay Value

Parameter name	Modbus Register		Len	Data Type	Range	Default value	Comment
	Modicon 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	

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

Parameter name	Modbus Register		Len	Data Type	Range	Default value	Units	Comment
	Modicon Format	Hex						
PT_Ratio V1	44097	0x1000	Word	UInt	1-65535	100	0.01	For V1
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* (See Note) 0x0064: 50Hz 0x0078: 60Hz	0x0055		Re-power the module after setting or changing the frequency
Wiring Mode V1	44107	0x100A	Word	UInt	1: 1P2W 2: 1P3W 3: 3P3W2CT 4: 3P3W3CT 5: 3P4W3CT	5		For V1, Only work when SW9-SW10 is all off

***Note** (Auto mode only):**

Frequency detection is performed at power-up.

To ensure correct detection of **50 / 60 Hz**, **apply the measurement voltage before powering on the meter**.

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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

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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 V1	44122	0x1019	Word	UInt	0: Default 1: Show as Vln 2: Show as Vll	0		For V1, Refer to Q13
PT_RatioV2	44123	0x101A	Word	UInt	1-65535	100	0.01	For V2,
Wiring Mode V2	44124	0x101B	Word	UInt	1: 1P2W 2: 1P3W 3: 3P3W2CT 4: 3P3W3CT 5: 3P4W3CT	5		For V2, Only work when SW11-SW12 is all off
Display Voltage V2	44125	0x101C	Word	UInt	0: Default 1: Show as Vln 2: Show as Vll	0		For V2, Refer to Q13

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- Modbus Module #3 — Input Register : System Information

Parameter name	Modbus Register		Len	Data Type	Range	Default value	Units	Comment
	Modicon Format	Hex						
Wiring Type V1	30513	0x0200	Word	UInt	9: 1P2W 10: 1P3W 11: 3P3W2CT 12: 3P3W3CT 13: 3P4W3CT 14: 3P3W2CT (HW) 15: 3P3W3CT (HW) 16: 3P4W3CT (HW)	13		For V1, (HW) : set wiring by hardware Dip Switch SW9-SW10
Phase Sequence V1	30514	0x0201	Word	UInt	0: Negative (ACB) 1: Positive (ABC)			For V1, Only work when 3P4W3CT
Model Name	30515	0x0202	Word	UInt	43240: PM-4324A	43240		
Model Type	30516	0x0203	Word	UInt	0x0001: 50Hz 0x0002: 60Hz	0x0002		
Firmware Version	30517	0x0204	Word	BCD		0x0100		Ver. 1.0
Wiring Type V2	30525	0x020C	Word	UInt	9: 1P2W 10: 1P3W 11: 3P3W2CT 12: 3P3W3CT 13: 3P4W3CT 14: 3P3W2CT (HW) 15: 3P3W3CT (HW) 16: 3P4W3CT (HW)	13		For V2, (HW) : set wiring by hardware Dip Switch SW11-SW12

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Phase Sequence V2	30526	0x020D	Word	UInt	0: Negative (ACB) 1: Positive (ABC)			For V2, Only work when 3P4W3CT

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- Modbus Module #4 — Input Register :Power value (Float) for Submeter1

Parameter name	Modbus Register		Len	Data Type	Range	Units	Comment
	Modicon 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	

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PF_tot	34417-34418	0x1140-0x1141	DWord	Float			
kWh_tot	34419-34420	0x1142-0x1143	DWord	Float			
kvarh_tot	34421-34422	0x1144-0x1145	DWord	Float			
kVAh_tot	34423-34424	0x1146-0x1147	DWord	Float			
Freq_a	34425-34426	0x1148-0x1149	DWord	Float	45~65	Hz	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.))

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- Modbus Module #5 — Input Register :Power value (Float) for Submeter2

Parameter name	Modbus Register		Len	Data Type	Range	Units	Comment
	Modicon 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	

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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.))

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- Modbus Module #6 — Input Register :Power value (Float) for Submeter3

Parameter name	Modbus Register		Len	Data Type	Range	Units	Comment
	Modicon 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	

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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.))

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- Modbus Module #7 — Input Register :Power value (Float) for Submeter4

Parameter name	Modbus Register		Len	Data Type	Range	Units	Comment
	Modicon 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	

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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.))

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- Modbus Module #8 — Input Register :Power value (Float) for Submeter5

Para meter name	Modbus Register		Len	Data Type	Range	Units	Comment
	Modicon 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	

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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.))

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- Modbus Module #9 — Input Register :Power value (Float) for Submeter6

Parameter name	Modbus Register		Len	Data Type	Range	Units	Comment
	Modicon 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	

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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.))

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- Modbus Module #10 — Input Register :Power value (Float) for Submeter7

Parameter name	Modbus Register		Len	Data Type	Range	Units	Comment
	Modicon 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	

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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.))

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- Modbus Module #11 — Input Register :Power value (Float) for Submeter8

Parameter name	Modbus Register		Len	Data Type	Range	Units	Comment
	Modicon 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	

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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.))

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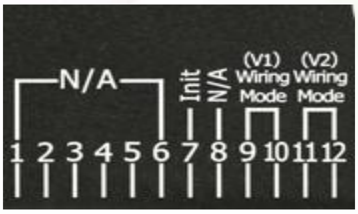
7.Modbus-TCP Communication

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**



To restore the default settings, set the **Init/Run Switch (SW7)** to the **ON** position for 10 seconds after powering on. The settings will be reset to their default values. After the reset, set the switch back to the **OFF** position and power on again. Alternatively, users can restore the default settings using a **Modbus command**.

- SW9- SW12 Settings

  For the PM-4324 series, select the appropriate wiring mode:
  (use the Software setting for 1P2W-1CT, 1P2W-3CT or 1P3W-2CT)

Reference voltage	**V1**		**V2**	
Wiring	SW 9	SW 10	SW 11	SW 12
Software setting	OFF	OFF	OFF	OFF
3P3W-2CT	**ON**	OFF	**ON**	OFF
3P3W-3CT	OFF	**ON**	OFF	**ON**
3P4W-3CT	**ON**	**ON**	**ON**	**ON**

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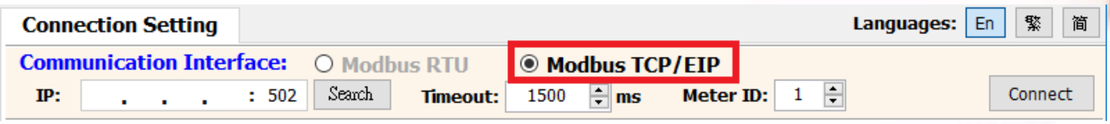
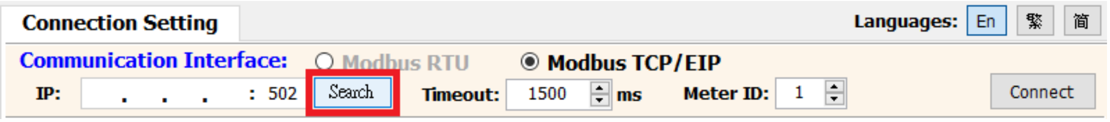
7.1.1. Ethernet configurations

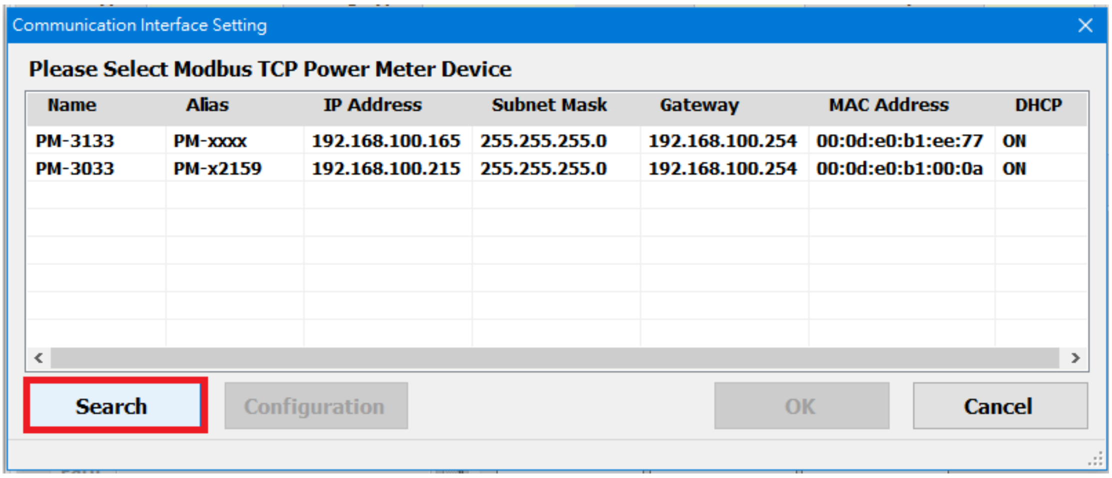
In the **Power Meter Utility**, select **"Modbus TCP"** under the **Communication Interface**.



Click "**Search**" to access the "**Communication Interface Setting**" window.



Click **"Search"** button to locate available power meter.



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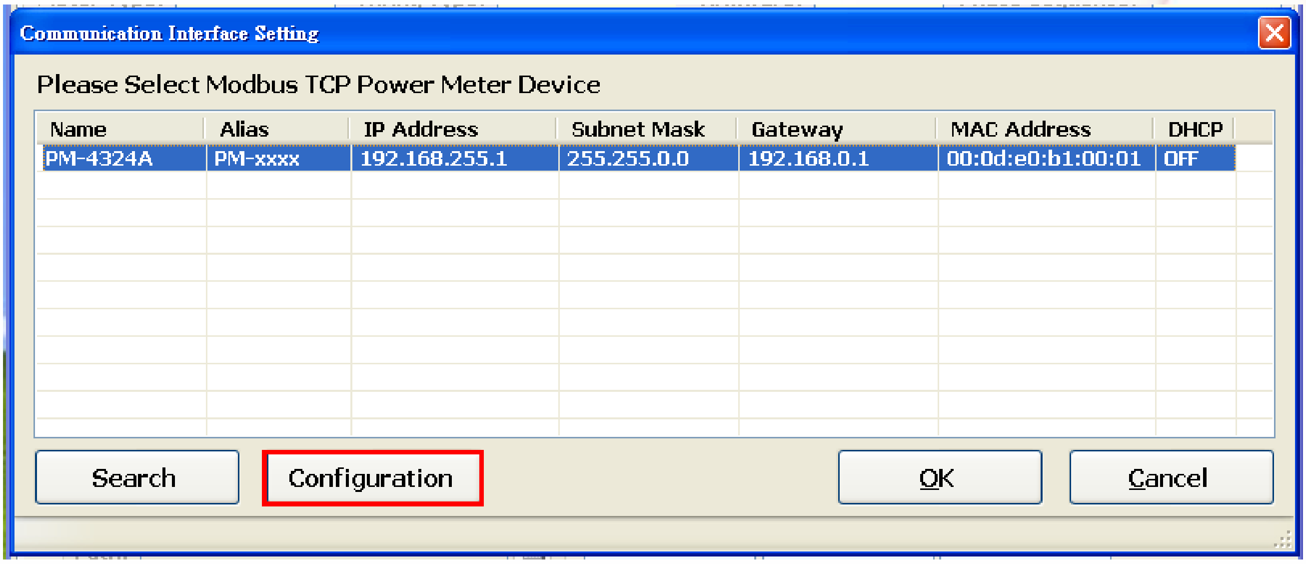
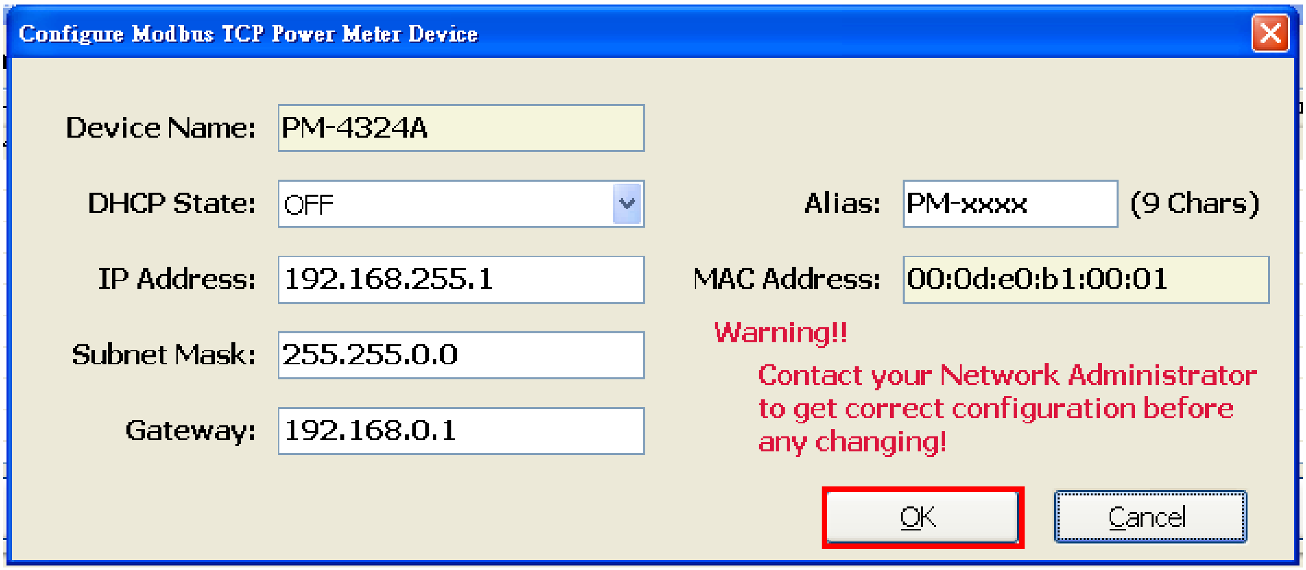
Select the power meter you want to configure from the list, then click the "**Configuration**" button to adjust the meter parameters. After completing all settings, click "**OK**" to return to the meter list window.





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7.2. Specifications

Modbus-TCP structure

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

Modbus-TCP(Byte 00~05)

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

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

RTU Data structure

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

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

7.2.1. Modbus Register

Please refer the 6.2.2 Modbus Register。

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8. EtherNet/IP Communication

8.1. Default Settings

For detailed instructions on how to use the utility, please refer to section 7.1

8.1.1. Utility configurations

For detailed instructions on how to use the utility, please refer to section 7.1.1.

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8.2. EtherNet/IP Protocol

The power meter provides an EtherNet/IP adapter function. This section introduces the power meter's EtherNet/IP Object Model and explains how to read from and write to the power meter by using the Explicit and Implicit Messages through the EtherNet/IP protocol.

8.2.1. Object Model

The EtherNet/IP adapter of the power meter provides six different objects, each serving specific functions with defined characteristics, services and instances:

- **Connection Manager Object:**
  Manages the establishment and maintenance of connections, handling the transmission of Explicit Messages and Implicit Messages.
- **Message Router Object:**
  Routes incoming messages to the correct object within the EtherNet/IP adapter for processing based on the target object ID and instance ID.
- **Assembly Object:**
  Organizes and manages I/O data by packaging multiple I/O data points into a structured data collection, facilitating efficient data transmission and exchange.
- **Identity Object:**
  Stores basic device information such as device identification, model, serial number, and status, aiding in device recognition and management.
- **TCP/IP Object:**
  Handles TCP/IP settings, including network parameters like IP address, subnet mask, and gateway configuration.
- **Ethernet Link Object:**
  Monitors and manages the status of the Ethernet connection, including link speed, connection status, and error statistics.

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When the power meter receives an EtherNet/IP message, it determines whether it is an Explicit or Implicit Message:

- **Explicit Messages** can either access the Assembly Object directly or reach other objects via the Message Router Object.
- **Implicit Messages** are limited to accessing I/O data from the Assembly Object.

Unconnected Message Manager(UCMM)

- UCMM messages allow communication with any object without establishing a connection.
- When a UCMM message is received, it is routed via the Message Router Object.
- During communication between an EtherNet/IP scanner and the power meter's EtherNet/IP adapter, the power meter responds with the appropriate data based on the request.

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8.2.2. Explicit Message

Explicit Messages are used to access all objects within the object model. Before sending Explicit Messages, a connection must be established. The process is as follows:

1. Connection Establishment:
   - Use the **Forward Open** service of the **Connection Manager Object** to establish the connection.
   - This service ensures a stable communication link between the scanner and the power meter.

2. Data Transmission:
   - Once the connection is established, the scanner can use Explicit Messages to perform read or write operations on the power meter's objects.
   - For example, it can read voltage values from the power meter or configure certain parameters.

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8.2.3. Implicit Message

Implicit Messages are used specifically for high real-time data exchange requirements. The main features are as follows:

1. Purpose:
   - Implicit Messages are specifically used to access the Input Instance (65hex) and Output Instance (66hex) of the Assembly Object, enabling real-time I/O data exchange.

2. Connection Establishment:
   - Similar to Explicit Messages, Implicit Messages also require a connection to be established before use.
   - The Forward Open service of the Connection Manager Object must be used to establish the connection between the EtherNet/IP scanner and the power meter. Once the connection is established, the scanner can start transmitting Implicit Messages.

3. Data Format:
   - All data in the Input and Output Instances is structured in BYTE format.
   - Regardless of whether the original data format is 1-bit, WORD, or another type, all register data is allocated to the Assembly Object's Instances in BYTE format.

4. Instance IDs and Data Sizes:
   - The instance ID and their corresponding data sizes are as follows:

Implicit Message Information		
Name	**Instance ID**	**Data Length**
Input(T->O)	65_{hex} (101)	1224
Output(O->T)	66_{hex} (102)	8
Configuration	64_{hex} (100)	0

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8.2.4. Power Meter Data Frame

The power meter measurements are represented as floating-point values. Each float value is encoded using a 4-byte hexadecimal format(Hex value).
For example, if the float value is 1.234, the corresponding hexadecimal value would be 0x3F9DF3B6. This 4-byte Hex value is transmitted as a byte array in the following format:

Float value		1.234
Hex value		0x3F9DF3B6
Byte Array	Byte 1	0xB6
	Byte 2	0xF3
	Byte 3	0x9D
	Byte 4	0x3F

The EherNet/IP input data frame:

Submeter 1		
Float format		
Item	Description	Byte index
V_a	Phase A VRMS	1
		2
		3
		4
I_a	Phase A IRMS	5
		6
		7
		8
kW_a	Phase A kWatt	9
		10
		11
		12
kvar_a	Phase A kvar	13
		14
		15
		16
kVA_a	Phase A kVA	17
		18

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		19
		20
PF_a	Phase A PF	21
		22
		23
		24
kWh_a	Phase A kWh	25
		26
		27
		28
kvarh_a	Phase A kvarh	29
		30
		31
		32
kVAh_a	Phase A kVAh	33
		34
		35
		36
V_b	Phase B VRMS	37
		38
		39
		40
I_b	Phase B IRMS	41
		42
		43
		44
kW_b	Phase B kWatt	45
		46
		47
		48
kvar_b	Phase B kvar	49
		50
		51
		52
kVA_b	Phase B kVA	53

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		54
		55
		56
PF_b	Phase B PF	57
		58
		59
		60
kWh_b	Phase B kWh	61
		62
		63
		64
kvarh_b	Phase B kvarh	65
		66
		67
		68
kVAh_b	Phase B kVAh	69
		70
		71
		72
V_c	Phase C VRMS	73
		74
		75
		76
I_c	Phase C IRMS	77
		78
		79
		80
kW_c	Phase C kWatt	81
		82
		83
		84
kvar_c	Phase C kvar	85
		86
		87
		88

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kVA_c	Phase C kVA	89
		90
		91
		92
PF_c	Phase C PF	93
		94
		95
		96
kWh_c	Phase C kWh	97
		98
		99
		100
kvarh_c	Phase C kvarh	101
		102
		103
		104
kVAh_c	Phase C kVAh	105
		106
		107
		108
V_avg	Average Voltage	109
		110
		111
		112
I_avg	Average Current	113
		114
		115
		116
kW_tot	Total kW	117
		118
		119
		120
kvar_tot	Total kvar	121
		122
		123

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		124
kVA_tot	Total kVA	125
		126
		127
		128
PF_tot	Total PF	129
		130
		131
		132
Freq_a	Phase A Frequency	133
		134
		135
		136
Freq_b	Phase B Frequency	137
		138
		139
		140
Freq_c	Phase C Frequency	141
		142
		134
		144
VTHD	Voltage total harmonic distortion	145
		146
		147
		148
ITHD	Current total harmonic distortion	149
		150
		151
		152

Submeter 2		
Float format		
Item	Description	Byte index
V_a	Phase A VRMS	153
		154

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		155
		156
I_a	Phase A IRMS	157
		158
		159
		160
kW_a	Phase A kWatt	161
		162
		163
		164
kvar_a	Phase A kvar	165
		166
		167
		168
kVA_a	Phase A kVA	169
		170
		171
		172
PF_a	Phase A PF	173
		174
		175
		176
kWh_a	Phase A kWh	177
		178
		179
		180
kvarh_a	Phase A kvarh	181
		182
		183
		184
kVAh_a	Phase A kVAh	185
		186
		187
		188
V_b	Phase B VRMS	189

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		190
		191
		192
I_b	Phase B IRMS	193
		194
		195
		196
kW_b	Phase B kWatt	197
		198
		199
		200
kvar_b	Phase B kvar	201
		202
		203
		204
kVA_b	Phase B kVA	205
		206
		207
		208
PF_b	Phase B PF	209
		210
		211
		212
kWh_b	Phase B kWh	213
		214
		215
		216
kvarh_b	Phase B kvarh	217
		218
		219
		220
kVAh_b	Phase B kVAh	221
		222
		223
		224

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V_c	Phase C VRMS	225
		226
		227
		228
I_c	Phase C IRMS	229
		230
		231
		232
kW_c	Phase C kWatt	233
		234
		235
		236
kvar_c	Phase C kvar	237
		238
		239
		240
kVA_c	Phase C kVA	241
		242
		243
		244
PF_c	Phase C PF	245
		246
		247
		248
kWh_c	Phase C kWh	249
		250
		251
		252
kvarh_c	Phase C kvarh	253
		254
		255
		256
kVAh_c	Phase C kVAh	257
		258
		259

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		260
V_avg	Average Voltage	261
		262
		263
		264
I_avg	Average Current	265
		266
		267
		268
kW_tot	Total kW	269
		270
		271
		272
kvar_tot	Total kvar	273
		274
		275
		276
kVA_tot	Total kVA	277
		278
		279
		280
PF_tot	Total PF	281
		282
		283
		284
Freq_a	Phase A Frequency	285
		286
		287
		288
Freq_b	Phase B Frequency	289
		290
		291
		292
Freq_c	Phase C Frequency	293
		294

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		295
		296
VTHD	Voltage total harmonic distortion	297
		298
		299
		300
ITHD	Current total harmonic distortion	301
		302
		303
		304

Submeter 3		
Float format		
Item	Description	Byte index
V_a	Phase A VRMS	305
		306
		307
		308
I_a	Phase A IRMS	309
		310
		311
		312
kW_a	Phase A kWatt	313
		314
		315
		316
kvar_a	Phase A kvar	317
		318
		319
		320
kVA_a	Phase A kVA	321
		322
		323
		324
PF_a	Phase A PF	325

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		326
		327
		328
kWh_a	Phase A kWh	329
		330
		331
		332
kvarh_a	Phase A kvarh	333
		334
		335
		336
kVAh_a	Phase A kVAh	337
		338
		339
		340
V_b	Phase B VRMS	341
		342
		343
		344
I_b	Phase B IRMS	345
		346
		347
		348
kW_b	Phase B kWatt	349
		350
		351
		352
kvar_b	Phase B kvar	353
		354
		355
		356
kVA_b	Phase B kVA	357
		358
		359
		360

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PF_b	Phase B PF	361
		362
		363
		364
kWh_b	Phase B kWh	365
		366
		367
		368
kvarh_b	Phase B kvarh	369
		370
		371
		372
kVAh_b	Phase B kVAh	373
		374
		375
		376
V_c	Phase C VRMS	377
		378
		379
		380
I_c	Phase C IRMS	381
		382
		383
		384
kW_c	Phase C kWatt	385
		386
		387
		388
kvar_c	Phase C kvar	389
		390
		391
		392
kVA_c	Phase C kVA	393
		394
		395

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		396
PF_c	Phase C PF	397
		398
		399
		400
kWh_c	Phase C kWh	401
		402
		403
		404
kvarh_c	Phase C kvarh	405
		406
		407
		408
kVAh_c	Phase C kVAh	409
		410
		411
		412
V_avg	Average Voltage	413
		414
		415
		416
I_avg	Average Current	417
		418
		419
		420
kW_tot	Total kW	421
		422
		423
		424
kvar_tot	Total kvar	425
		426
		427
		428
kVA_tot	Total kVA	429
		430

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		431
		432
PF_tot	Total PF	433
		434
		435
		436
Freq_a	Phase A Frequency	437
		438
		439
		440
Freq_b	Phase B Frequency	441
		442
		443
		444
Freq_c	Phase C Frequency	445
		446
		447
		448
VTHD	Voltage total harmonic distortion	449
		450
		451
		452
ITHD	Current total harmonic distortion	453
		454
		455
		456

Submeter 4		
Float format		
Item	Description	Byte index
V_a	Phase A VRMS	457
		458
		459
		460
I_a	Phase A IRMS	461

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		462
		463
		464
kW_a	Phase A kWatt	465
		466
		467
		468
kvar_a	Phase A kvar	469
		470
		471
		472
kVA_a	Phase A kVA	473
		474
		475
		476
PF_a	Phase A PF	477
		478
		479
		480
kWh_a	Phase A kWh	481
		482
		483
		484
kvarh_a	Phase A kvarh	485
		486
		487
		488
kVAh_a	Phase A kVAh	489
		490
		491
		492
V_b	Phase B VRMS	493
		494
		495
		496

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I_b	Phase B IRMS	497
		498
		499
		500
kW_b	Phase B kWatt	501
		502
		503
		504
kvar_b	Phase B kvar	505
		506
		507
		508
kVA_b	Phase B kVA	509
		510
		511
		512
PF_b	Phase B PF	513
		514
		515
		516
kWh_b	Phase B kWh	517
		518
		519
		520
kvarh_b	Phase B kvarh	521
		522
		523
		524
kVAh_b	Phase B kVAh	525
		526
		527
		528
V_c	Phase C VRMS	529
		530
		531

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		532
I_c	Phase C IRMS	533
		534
		535
		536
kW_c	Phase C kWatt	537
		538
		539
		540
kvar_c	Phase C kvar	541
		542
		543
		544
kVA_c	Phase C kVA	545
		546
		547
		548
PF_c	Phase C PF	549
		550
		551
		552
kWh_c	Phase C kWh	553
		554
		555
		556
kvarh_c	Phase C kvarh	557
		558
		559
		560
kVAh_c	Phase C kVAh	561
		562
		563
		564
V_avg	Average Voltage	565
		566

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		567
		568
I_avg	Average Current	569
		570
		571
		572
kW_tot	Total kW	573
		574
		575
		576
kvar_tot	Total kvar	577
		578
		579
		580
kVA_tot	Total kVA	581
		582
		583
		584
PF_tot	Total PF	585
		586
		587
		588
Freq_a	Phase A Frequency	589
		590
		591
		592
Freq_b	Phase B Frequency	593
		594
		595
		596
Freq_c	Phase C Frequency	597
		598
		599
		600
VTHD	Voltage total harmonic	601

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	distortion	602
		603
		604
ITHD	Current total harmonic distortion	605
		606
		607
		608

Submeter 5		
Float format		
Item	Description	Byte index
V_a	Phase A VRMS	609
		610
		611
		612
I_a	Phase A IRMS	613
		614
		615
		616
kW_a	Phase A kWatt	617
		618
		619
		620
kvar_a	Phase A kvar	621
		622
		623
		624
kVA_a	Phase A kVA	625
		626
		627
		628
PF_a	Phase A PF	629
		630
		631
		632

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kWh_a	Phase A kWh	633
		634
		635
		636
kvarh_a	Phase A kvarh	637
		638
		639
		640
kVAh_a	Phase A kVAh	641
		642
		643
		644
V_b	Phase B VRMS	645
		646
		647
		648
I_b	Phase B IRMS	649
		650
		651
		652
kW_b	Phase B kWatt	653
		654
		655
		656
kvar_b	Phase B kvar	657
		658
		659
		660
kVA_b	Phase B kVA	661
		662
		663
		664
PF_b	Phase B PF	665
		666
		667

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		668
kWh_b	Phase B kWh	669
		670
		671
		672
kvarh_b	Phase B kvarh	673
		674
		675
		676
kVAh_b	Phase B kVAh	677
		678
		679
		680
V_c	Phase C VRMS	681
		682
		683
		684
I_c	Phase C IRMS	685
		686
		687
		688
kW_c	Phase C kWatt	689
		690
		691
		692
kvar_c	Phase C kvar	693
		694
		695
		696
kVA_c	Phase C kVA	697
		698
		699
		700
PF_c	Phase C PF	701
		702

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		703
		704
kWh_c	Phase C kWh	705
		706
		707
		708
kvarh_c	Phase C kvarh	709
		710
		711
		712
kVAh_c	Phase C kVAh	713
		714
		715
		716
V_avg	Average Voltage	717
		718
		719
		720
I_avg	Average Current	721
		722
		723
		724
kW_tot	Total kW	725
		726
		727
		728
kvar_tot	Total kvar	729
		730
		731
		732
kVA_tot	Total kVA	733
		734
		735
		736
PF_tot	Total PF	737

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		738
		739
		740
Freq_a	Phase A Frequency	741
		742
		743
		744
Freq_b	Phase B Frequency	745
		746
		747
		748
Freq_c	Phase C Frequency	749
		750
		751
		752
VTHD	Voltage total harmonic distortion	753
		754
		755
		756
ITHD	Current total harmonic distortion	757
		758
		759
		760

Submeter 6		
Float format		
Item	Description	Byte index
V_a	Phase A VRMS	761
		762
		763
		764
I_a	Phase A IRMS	765
		766
		767
		768

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kW_a	Phase A kWatt	769
		770
		771
		772
kvar_a	Phase A kvar	773
		774
		775
		776
kVA_a	Phase A kVA	777
		778
		779
		780
PF_a	Phase A PF	781
		782
		783
		784
kWh_a	Phase A kWh	785
		786
		787
		788
kvarh_a	Phase A kvarh	789
		790
		791
		792
kVAh_a	Phase A kVAh	793
		794
		795
		796
V_b	Phase B VRMS	797
		798
		799
		800
I_b	Phase B IRMS	801
		802
		803

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		804
kW_b	Phase B kWatt	805
		806
		807
		808
kvar_b	Phase B kvar	809
		810
		811
		812
kVA_b	Phase B kVA	813
		814
		815
		816
PF_b	Phase B PF	817
		818
		819
		820
kWh_b	Phase B kWh	821
		822
		823
		824
kvarh_b	Phase B kvarh	825
		826
		827
		828
kVAh_b	Phase B kVAh	829
		830
		831
		832
V_c	Phase C VRMS	833
		834
		835
		836
I_c	Phase C IRMS	837
		838

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		839
		840
kW_c	Phase C kWatt	841
		842
		843
		844
kvar_c	Phase C kvar	845
		846
		847
		848
kVA_c	Phase C kVA	849
		850
		851
		852
PF_c	Phase C PF	853
		854
		855
		856
kWh_c	Phase C kWh	857
		858
		859
		860
kvarh_c	Phase C kvarh	861
		862
		863
		864
kVAh_c	Phase C kVAh	865
		866
		867
		868
V_avg	Average Voltage	869
		870
		871
		872
I_avg	Average Current	873

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		874
		875
		876
kW_tot	Total kW	877
		878
		879
		880
kvar_tot	Total kvar	881
		882
		883
		884
kVA_tot	Total kVA	885
		886
		887
		888
PF_tot	Total PF	889
		890
		891
		892
Freq_a	Phase A Frequency	893
		894
		895
		896
Freq_b	Phase B Frequency	897
		898
		899
		900
Freq_c	Phase C Frequency	901
		902
		903
		904
VTHD	Voltage total harmonic distortion	905
		906
		907
		908

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ITHD	Current total harmonic distortion	909
		910
		911
		912

Submeter 7		
Float format		
Item	Description	Byte index
V_a	Phase A VRMS	913
		914
		915
		916
I_a	Phase A IRMS	917
		918
		919
		920
kW_a	Phase A kWatt	921
		922
		923
		924
kvar_a	Phase A kvar	925
		926
		927
		928
kVA_a	Phase A kVA	929
		930
		931
		932
PF_a	Phase A PF	933
		934
		935
		936
kWh_a	Phase A kWh	937
		938
		939

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		940
kvarh_a	Phase A kvarh	941
		942
		943
		944
kVAh_a	Phase A kVAh	945
		946
		947
		948
V_b	Phase B VRMS	949
		950
		951
		952
I_b	Phase B IRMS	953
		954
		955
		956
kW_b	Phase B kWatt	957
		958
		959
		960
kvar_b	Phase B kvar	961
		962
		963
		964
kVA_b	Phase B kVA	965
		966
		967
		968
PF_b	Phase B PF	969
		970
		971
		972
kWh_b	Phase B kWh	973
		974

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		975
		976
kvarh_b	Phase B kvarh	977
		978
		979
		980
kVAh_b	Phase B kVAh	981
		982
		983
		984
V_c	Phase C VRMS	985
		986
		987
		988
I_c	Phase C IRMS	989
		990
		991
		992
kW_c	Phase C kWatt	993
		994
		995
		996
kvar_c	Phase C kvar	997
		998
		999
		1000
kVA_c	Phase C kVA	1001
		1002
		1003
		1004
PF_c	Phase C PF	1005
		1006
		1007
		1008
kWh_c	Phase C kWh	1009

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		1010
		1011
		1012
kvarh_c	Phase C kvarh	1013
		1014
		1015
		1016
kVAh_c	Phase C kVAh	1017
		1018
		1019
		1020
V_avg	Average Voltage	1021
		1022
		1023
		1024
I_avg	Average Current	1025
		1026
		1027
		1028
kW_tot	Total kW	1029
		1030
		1031
		1032
kvar_tot	Total kvar	1033
		1034
		1035
		1036
kVA_tot	Total kVA	1037
		1038
		1039
		1040
PF_tot	Total PF	1041
		1042
		1043
		1044

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Freq_a	Phase A Frequency	1045
		1046
		1047
		1048
Freq_b	Phase B Frequency	1049
		1050
		1051
		1052
Freq_c	Phase C Frequency	1053
		1054
		1055
		1056
VTHD	Voltage total harmonic distortion	1057
		1058
		1059
		1060
ITHD	Current total harmonic distortion	1061
		1062
		1063
		1064

Submeter 8		
Float format		
Item	Description	Byte index
V_a	Phase A VRMS	1065
		1066
		1067
		1068
I_a	Phase A IRMS	1069
		1070
		1071
		1072
kW_a	Phase A kWatt	1073
		1074
		1075

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		1076
kvar_a	Phase A kvar	1077
		1078
		1079
		1080
kVA_a	Phase A kVA	1081
		1082
		1083
		1084
PF_a	Phase A PF	1085
		1086
		1087
		1088
kWh_a	Phase A kWh	1089
		1090
		1091
		1092
kvarh_a	Phase A kvarh	1093
		1094
		1095
		1096
kVAh_a	Phase A kVAh	1097
		1098
		1099
		1100
V_b	Phase B VRMS	1101
		1102
		1103
		1104
I_b	Phase B IRMS	1105
		1106
		1107
		1108
kW_b	Phase B kWatt	1109
		1110

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		1111
		1112
kvar_b	Phase B kvar	1113
		1114
		1115
		1116
kVA_b	Phase B kVA	1117
		1118
		1119
		1120
PF_b	Phase B PF	1121
		1122
		1123
		1124
kWh_b	Phase B kWh	1125
		1126
		1127
		1128
kvarh_b	Phase B kvarh	1129
		1130
		1131
		1132
kVAh_b	Phase B kVAh	1133
		1134
		1135
		1136
V_c	Phase C VRMS	1137
		1138
		1139
		1140
I_c	Phase C IRMS	1141
		1142
		1143
		1144
kW_c	Phase C kWatt	1145

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		1146
		1147
		1148
kvar_c	Phase C kvar	1149
		1150
		1151
		1152
kVA_c	Phase C kVA	1153
		1154
		1155
		1156
PF_c	Phase C PF	1157
		1158
		1159
		1160
kWh_c	Phase C kWh	1161
		1162
		1163
		1164
kvarh_c	Phase C kvarh	1165
		1166
		1167
		1168
kVAh_c	Phase C kVAh	1169
		1170
		1171
		1172
V_avg	Average Voltage	1173
		1174
		1175
		1176
I_avg	Average Current	1177
		1178
		1179
		1180

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kW_tot	Total kW	1181
		1182
		1183
		1184
kvar_tot	Total kvar	1185
		1186
		1187
		1188
kVA_tot	Total kVA	1189
		1190
		1191
		1192
PF_tot	Total PF	1193
		1194
		1195
		1196
Freq_a	Phase A Frequency	1197
		1198
		1199
		1200
Freq_b	Phase B Frequency	1201
		1202
		1203
		1204
Freq_c	Phase C Frequency	1205
		1206
		1207
		1208
VTHD	Voltage total harmonic distortion	1209
		1210
		1211
		1212
ITHD	Current total harmonic distortion	1213
		1214
		1215

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		1216

Reserved		
Float format		
Item	Description	Byte index
Reserved #1	Reserved	1217
	Reserved	1218
	Reserved	1219
	Reserved	1220
Reserved #2	Reserved	1221
	Reserved	1222
	Reserved	1223
	Reserved	1224

The EherNet/IP output data frame:

Float format		
Item	Description	Byte index
DO0	Relay 0 [Note] 0 = OFF 1 = ON	1
DO1	Relay 1 [Note] 0 = OFF 1 = ON	2
ENRG_ZERO	Set Energy Zero 0 = OFF 1 = ON	3
Reserved	Reserved	4
Reserved	Reserved	5
Reserved	Reserved	6
Reserved	Reserved	7
Reserved	Reserved	8

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9.CANopen Communication

9.1. CANopen Settings

- Default setting for CANopen: **Baud rate:125 K b.p.s.**, **Node ID:1**
- DIP switch (SW1-SW6): Used for setting the Node ID, with the default set to 1(all switches OFF)
  For example: to set the Node ID to 10，configure the DIP switches as follows:
  SW1 = ON, SW2 = OFF, SW3 = OFF, SW4 = ON, SW5 = OFF, SW6 = OFF.

- SW1—SW6 Settings
  The DIP switches **SW1–SW6** are used to configure the **CANopen Node ID** for communication. The Node ID can be set to any value between **1 and 64**. The table below shows how to configure the DIP switches for each Node ID:

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

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

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- SW7－SW8 Settings

PM-4324-CPS/PM-4324A-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 Settings

For the PM-4324-CPS/PM-4324A-CPS, select the appropriate wiring mode (use the Software setting for 1P2W-1CT, 1P2W-3CT or 1P3W-2CT)

Reference voltage	**V1**		**V2**	
Wiring	SW 9	SW 10	SW 11	SW 12
Software setting	OFF	OFF	OFF	OFF
3P3W-2CT	**ON**	OFF	**ON**	OFF
3P3W-3CT	OFF	**ON**	OFF	**ON**
3P4W-3CT	**ON**	**ON**	**ON**	**ON**

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9.2. CANopen Protocol

CANopen is a network protocol derived from the CAN bus, initially used in automotive control systems. Today, it has been widely adopted in various applications, such as vehicles, industrial machinery, building automation, medical devices, maritime systems, restaurant appliances, laboratory equipment and research applications.

9.2.1. SDO Introduction

As one of the core protocols in CANopen, the Service Data Object (SDO) protocol facilitates access to a device's Object Dictionary, allowing for the reading and writing of configuration parameters as well as the exchange of non-real-time data. This protocol plays a critical role in device configuration and diagnostics, serving as the foundation for the detailed communication methods outlined in the subsequent sections. The following sections will provide an in-depth explanation of the specific communication mechanisms of the SDO protocol, including its upload and download processes, as well as the handling of exceptional scenarios such as interrupted transmissions.

9.2.1.1. Upload SDO Protocol

Initiate SDO Upload Protocol

Before performing SDO segment transfers, the client and server must establish communication through the **Initiate SDO Upload Protocol**. This protocol allows the SDO client to specify the object to be uploaded to the server and simultaneously transfer up to 4 bytes of data.

- If the data length is less than or equal to 4 bytes:
  The upload is completed using only the Initiate SDO Upload Protocol.
- If the data length is greater than 4 bytes:
  The Upload SDO Segment Protocol is required to transfer the data in smaller parts.

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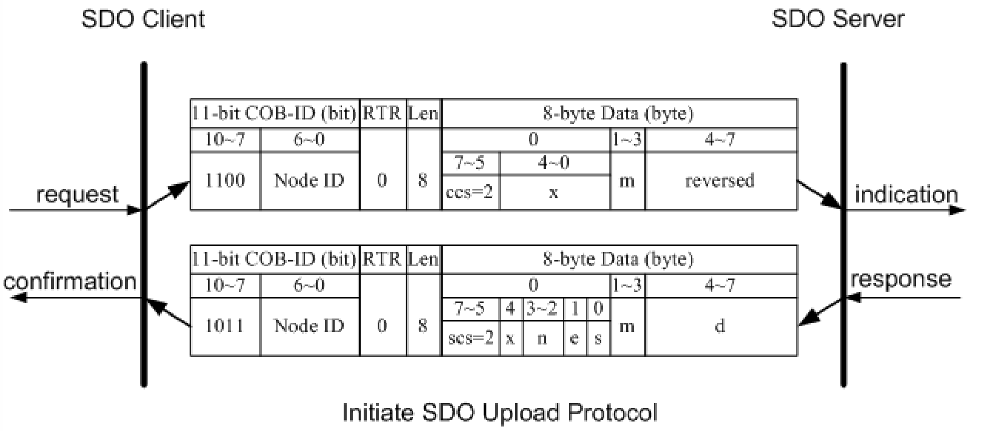
The communication process of this protocol is shown as follows.



Initiate SDO Upload Protocol

ccs: client command specifier

2: initiate upload request

scs: server command specifier

2: initiate upload response

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

If this field is valid, **n** represents the number of Bytes in the **d** field that are not used to store segment data. Specifically, the Bytes in the range [8-n, 7] of the d field are unused and do not contain any valid data.

e: transfer type

0: normal transfer

1: expedited transfer

If **e=1**, it indicates that the data size is less than or equal to 4 bytes. In this case, the transmission can be completed using only the Initiate SDO Upload Protocol.

If **e=0**, the Upload SDO Segment Protocol is required to complete the transmission.

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 transferred by the SDO. The first two bytes are the index value and the last byte is the sub-index value.

d: data

- When **e**=0, **s**=0: **d** is reserved for further use.
- When **e**=0, **s**=1: **d** contains the number of bytes to be uploaded. Byte 4

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contains the Least Significant Bit(LSB), and byte 7 contains the Most Significant Bit(MSB).

- When **e**=1, **s**=1: **d** contains the data to be uploaded, with a length of 4-**n** bytes. The encoding depends on the type of the data referenced by the index and sub-index.
- When **e**=1, **s**=0: **d** contains an unspecified number of bytes to be uploaded.

x: Not used, always 0

reserved: Reserved for further use, always 0

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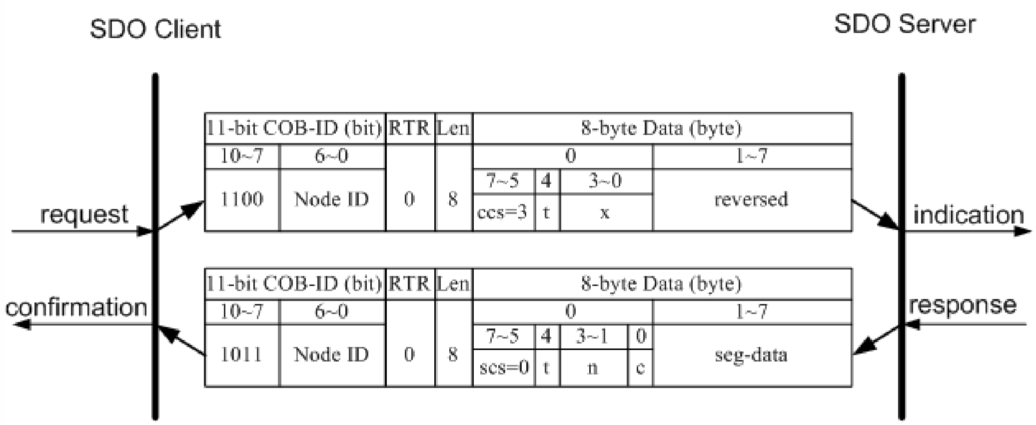
Upload SDO Segment Protocol

After completing the **Initiate SDO Upload Protocol**, if the length of the data to be uploaded exceeds 4 bytes, the client will begin transmitting the data in segments and proceed to the **Upload SDO Segment Protocol** stage. The process follows these steps:

1. The client first sends an **Initiate Upload Request**, specifying the data object to be uploaded.
2. The server responds with an **Initiate Upload Response**, confirming that segment transfer will proceed and providing the relevant parameters.
3. The client starts transmitting data in segments based on the parameters provided by the server.
4. During each transfer, the client must check the **Toggle Bit** and the **Segment Completion Indicator (c)** to ensure correctness.



Upload SDO Segment Protocol

ccs: client command specifier

3: upload segment request

scs: server command specifier

0: upload segment response

t: toggle bit.

- The initial value is 0 and alternates between 0 and 1 with each new segment transfer.
- The toggle bit in the client's request and the server's response must match to ensure the segment sequence is correct.

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

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0: more segments to be uploaded.

1: no more segment to be uploaded.

seg-data: Contains up to 7 bytes of segment data. The encoding depends on the type data referenced by index and sub-index.

n: 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

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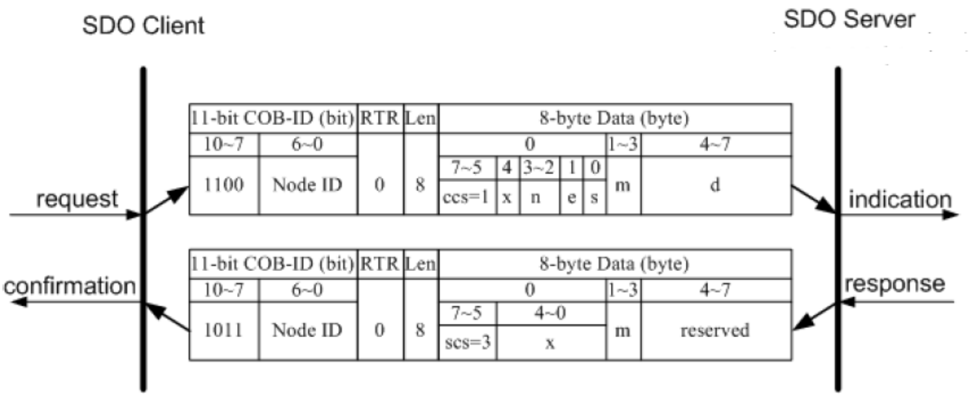
9.2.1.2. Download SDO Protocol

Initiate SDO Download Protocol

The download process is similar to the upload process, but differs slightly in the parameters used in the SDO messages. It consists of two steps.

- If the data length is less than or equal to 4 bytes:
  The download is completed using only the Initiate SDO Download Protocol.
- If the data length is greater than 4 bytes:
  The Download SDO Segment Protocol is required to transfer the data in smaller parts.

The details of the initiate SDO download protocol are as follows:



Initiate SDO Download Protocol

ccs: client command specifier
  1: initiate download request

scs: server command specifier
  3: initiate download response

n: Only valid if e = 1 and s = 1, otherwise 0.
  If this field is valid, **n** represents the number of Bytes in the **d** field that are not used to store segment data. Specifically, the Bytes in the range [8-n, 7] of the d field are unused and do not contain any valid data.

e: transfer type
  0: normal transfer

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1: expedited transfer

If **e=1**, it indicates that the data size is less than or equal to 4 bytes. In this case, the transmission can be completed using only the Initiate SDO Download Protocol. If **e=0**, the Download SDO Segment Protocol is required to complete the transmission.

s: size indicator

0: Data set size not indicated.

1: Data set size indicated.

m: multiplexer

It represents the index/sub-index of the data to be transferred by the SDO.

The first two bytes are the index value and the last byte is the sub-index value.

d: data

- When **e**=0, **s**=0: **d** is reserved for further use.
- When **e**=0, **s**=1: **d** contains the number of bytes to be downloaded. Byte 4 contains the Least Significant Bit(LSB), and byte 7 contains the Most Significant Bit(MSB).
- When **e**=1, **s**=1: **d** contains the data to be downloaded, with a length of 4-**n** bytes. The encoding depends on the type of the data referenced by the index and sub-index.
- When **e**=1, **s**=0: **d** contains an unspecified number of bytes to be downloaded.

x: Not used, always 0

reserved: Reserved for further use, always 0

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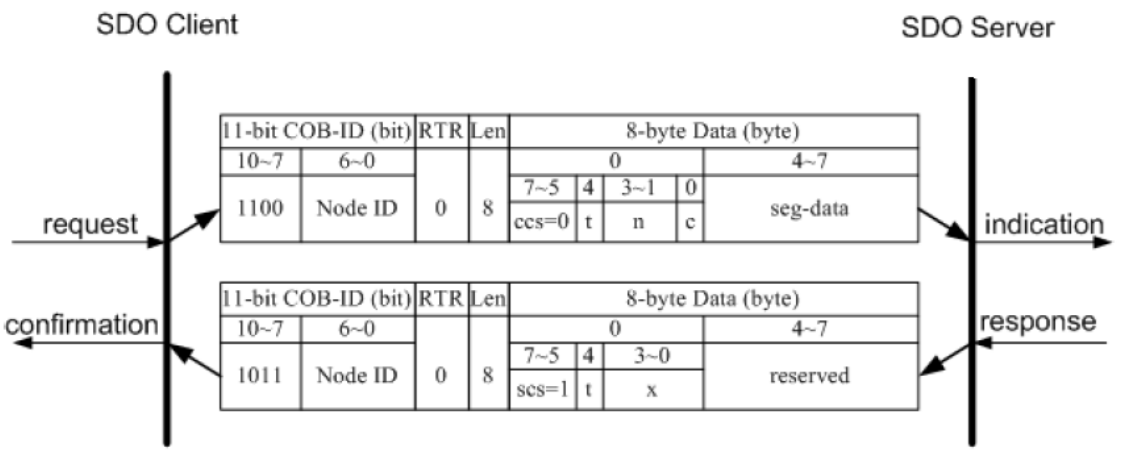
Download SDO Segment Protocol

After completing the Initiate SDO Download Protocol, if the length of the data to be downloaded exceeds 4 bytes, the client will begin receiving the data in segments and proceed to the **Download SDO Segment Protocol** stage. The process follows these steps:

1. The client first sends a **Download Segment Request**, specifying the segment of data to be downloaded.
2. The server responds with a **Download Segment Response**, providing the segment data to be downloaded.
3. The client continues receiving data in segments based on the responses from the server.
4. During each transfer, the client must check the **Toggle Bit** and the **More Segments Indicator (c)** to ensure data integrity and proper sequence.



Download SDO Segment Protocol

ccs: client command specifier

0: download segment request

scs: server command specifier

1: download segment response

seg-data: Contains up to 7 bytes of segment data to be downloaded.

The encoding of the segment depends on the type, identified by index and sub-index.

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

Bytes [8-n, 7] do not contain segment data.

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n = 0 if the segment size is not indicated.

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

0: more segments to be uploaded.

1: no more segment to be uploaded.

t: toggle bit

- The initial value is 0 and alternates between 0 and 1 with each new segment transfer.
- The toggle bit in the client's request and the server's response must match to ensure the segment sequence is correct.

x: Not used, always 0

reserved: Reserved for further use, always 0

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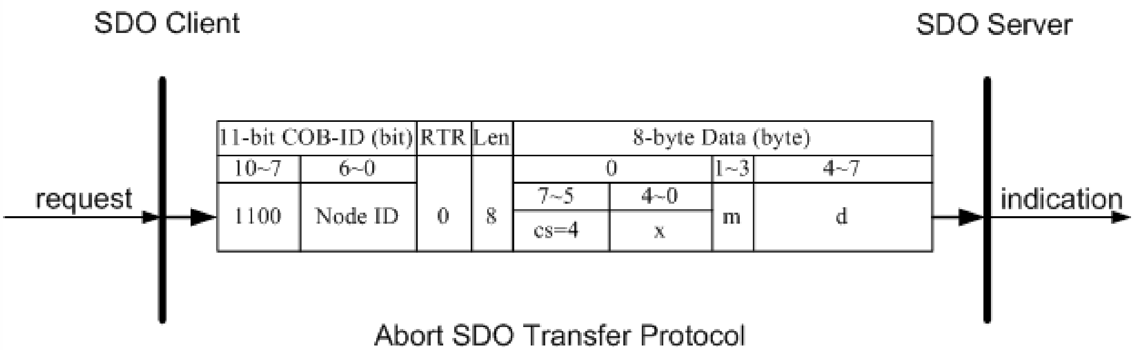
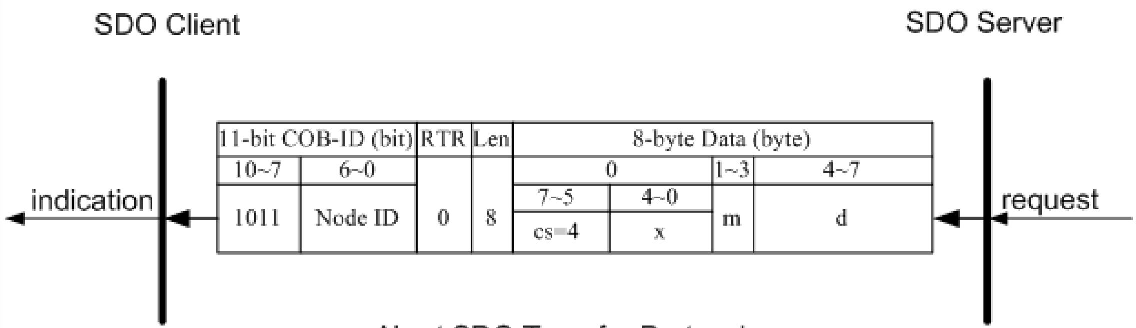
9.2.1.3. Abort SDO Transfer Protocol

In certain conditions, the SDO client or SDO server may need to terminate the SDO transmission. This can happen, for example, if the requested object entry does not exist, is read-only, or if the transmission needs to be stopped due to special circumstances. When such condition arises, either the client or the server can initiate an Abort SDO Transfer message to halt the communication.
The structure of the Abort SDO Transfer protocol is outlined below.



Abort SDO Transfer Protocol



Abort SDO Transfer Protocol

cs: command specifier
4: Indicates an Abort Transfer Request
x: Not used, always 0
m: multiplexer
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: Contains a 4-byte “Abort Code” specifying the reason for the termination.

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Abort Code	Description
0503 0000h	Toggle bit not alternated.
0504 0000h	SDO protocol timed out.
0504 0001h	Client/server command specified not valid or unknown.
0504 0002h	Invalid block size (block mode only).
0504 0003h	Invalid sequence number (block mode only).
0504 0004h	CRC error (block mode only).
0504 0005h	Out of memory.
0601 0000h	Unsupported access to an object.
0601 0001h	Attempt to read a write only object.
0601 0002h	Attempt to write a read only object.
0602 0000h	Object does not exist in the object dictionary.
0604 0041h	Object cannot be mapped to the PDO.
0604 0042h	The number and length of the objects to be mapped would exceed PDO length.
0604 0043h	General parameter incompatibility reason.
0604 0047h	General internal incompatibility in the device.
0606 0000h	Access failed due to an hardware error.
0607 0010h	Data type or service parameter length mismatch.
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

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	generation fails because of an file error).

9.2.2. PDO Introduction

In CANopen, PDOs (Process Data Objects) enable fast, real-time data exchange between devices without requiring acknowledgment. Each PDO can transmit multiple data entries, such as measurements or status updates, and uses mapping from the object dictionary to organize data transmission efficiently.

9.2.2.1. PDO COB-ID Parameters

Before transmitting real-time data through the PDO, it is essential to verify the COB-ID (Communication Object Identifier) parameter in the corresponding PDO communication object. The COB-ID is a 32 bit value that defines the priority, type, and behavior of the PDO. Each bit in the CPB-ID serves a specific function, as described in the following table:

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

Note: PM-4324A-CPS only supports CAN 2.0A (11-bit ID).

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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. Some COB-IDs are reserved for specific communication objects or other designated purposes and therefore cannot be used by users. Apart from these reserved COB-IDs, users may customize the remaining COB-IDs as PDO COB-IDs; however, they must ensure that no duplicate COB-IDs are assigned within the same node.
   The table below lists the reserved COB-IDs:

Reserved COB-ID (Hex)	Assigned Object
0	Network Management (NMT)
1	Reserved
80	Synchronization (SYNC)
81 to FF	Emergency Event (EMERGENCY)
100	Time Stamp (TIME STAMP)
101 to 180	Reserved
581 to 5FF	Default for PDO Transmission
601 to 67F	Default for PDO Reception
6E0	Reserved
701 to 77F	Network Management (NMT) Error Control
780 to 7FF	Reserved

2. The PDO COB-ID parameters cannot be changed if the PDO is valid (bit 31 =0).

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9.2.2.2. Transmission Type

The transmission type is a key parameter defined in PDO communication objects (sub-index 02). Each PDO has a specific transmission type that determines how the data is sent or received. It defines the behavior of the PDO, such as whether it is synchronous, asynchronous, or event-driven.
The table below describes the relationship between the transmission type value and the behavior of the PDO. For example, if transmission type 0 is set for the first TxPDO, the CANopen device will follow acyclic and synchronous PDO transmission rules.

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

Note:

- **Transmission type 1-240**: Indicates how many SYNC objects trigger a TxPDO. RxPDO always respond to the next SYNC, regardless of the transmission type.

- **Transmission type 252 and 253:** These are used exclusively for TxPDO.
  - Type 252 updates data immediately upon receiving a SYNC signal but does not transmit the data.
  - Type 253 does not update data based on the SYNC signal and only transmits data upon receiving a Remote Transmission Request (RTR).
  - For both types, the PDO transmits data only when an RTR request is received.

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- **Transmission types 254 and 255**:
  - The device can use an event timer to periodically trigger the transmission of TxPDO.
  - Additionally, if a DI or other variable is mapped to a PDO, any changes in the value of this DI will immediately trigger the transmission of the corresponding TxPDO.
  - For transmission type 255, in addition to the above triggering conditions, data transmission can also be initiated by a Remote Transmission Request (RTR).

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9.2.2.3. PDO Communication Rule

PDO-related objects are assigned indexes within the range 0x1400 to 0x1BFF. However, for the PM-4324-CPS/PM-4324A-CPS, RxPDO communication objects are not used. The indexes for TxPDO communication objects range from 0x1800 to 0x1813, while their corresponding mapping objects are indexed from 0x1A00 to 0x1A27. Each TxPDO communication object has a corresponding PDO mapping object.

For example:
• The first TxPDO communication object is stored at **index 0x1800**, with its corresponding mapping object at **index 0x1A00**.
• Similarly, the second TxPDO communication object is stored at **0x1801**, with its mapping object at **0x1A01**, and so on.

Before accessing data via PDO communication, users must ensure that all parameters for both the PDO communication objects and their mapping objects are correctly configured. Additionally, after modifying any parameters, the device must be set to the NMT Operational state to activate the new configuration.

Operational Requirements:
• PDO communication is only available when the device is in the NMT Operational state.
• Users can use the NMT module control protocol (see Section 8.2.3) to change the NMT state of the PM-4324-CPS/PM-4324A-CPS.

Data Length Matching:
During PDO communication, the data length (L) of the PDO message must exactly match the total size (n) of the corresponding PDO mapping object.

- If L > n: Only the first n bytes of the PDO message will be processed by the PDO consumer.
- If L < n: The PDO message will be discarded, and an Emergency message(EMCY) with error code 8210h will be sent to the PDO producer.

.

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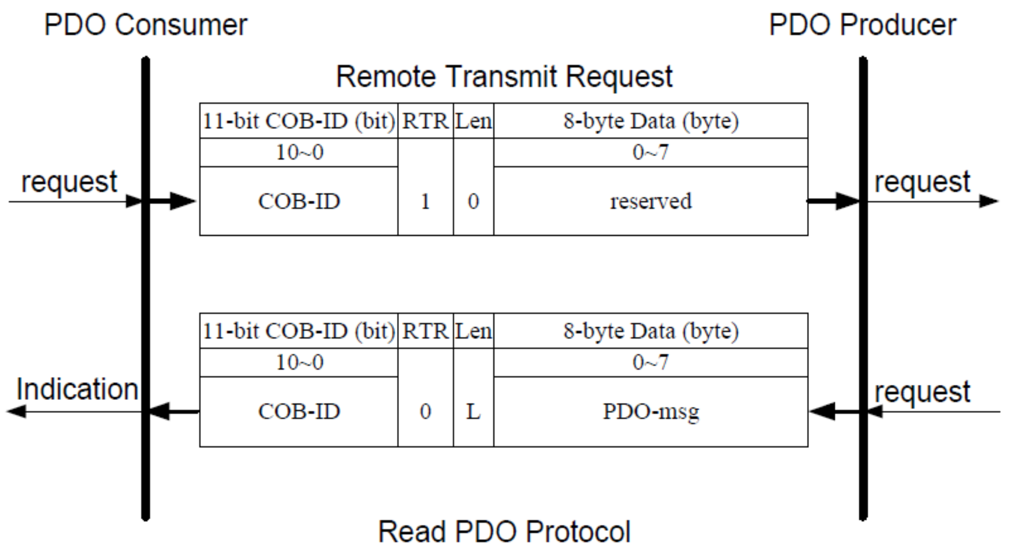
The PDO communication set is shown as follows.



COB-ID: The default PDO COB-ID, or user-defined COB-ID.
L: The length of the PDO message (in bytes)
PDO-msg: Real-time data or data that can be mapped into PDO mapping objects

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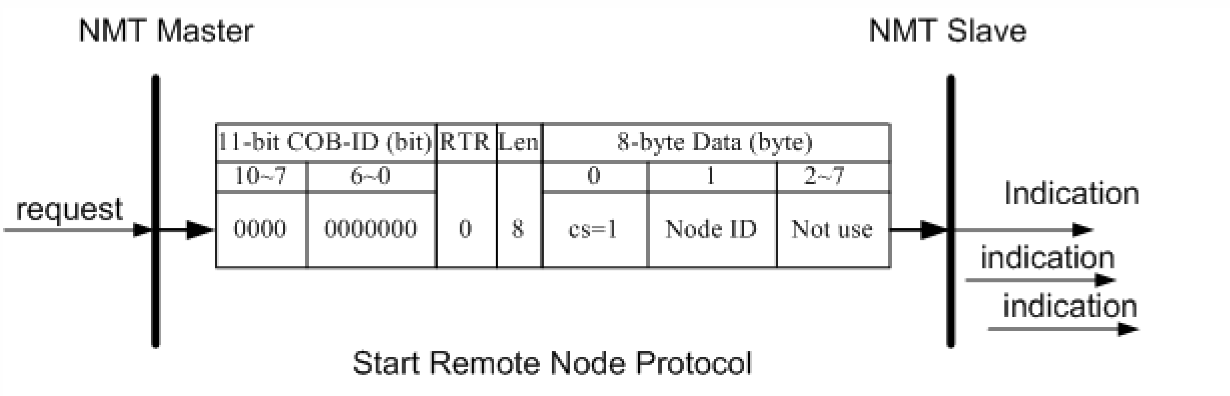
9.2.3. NMT Introduction

The NMT (Network Management) protocol is used to control the state of CANopen devices. The PM-4324-CPS/PM-4324A-CPS supports several NMT commands that allow changing the NMT slave status. Below are the protocols used for switching between different NMT states.

9.2.3.1. Module Control Protocol

The following commands are used to control the NMT slave device status:

Start Remote Node Protocol



cs: NMT command specified

1: start

Node ID: the node ID of the NMT slave device

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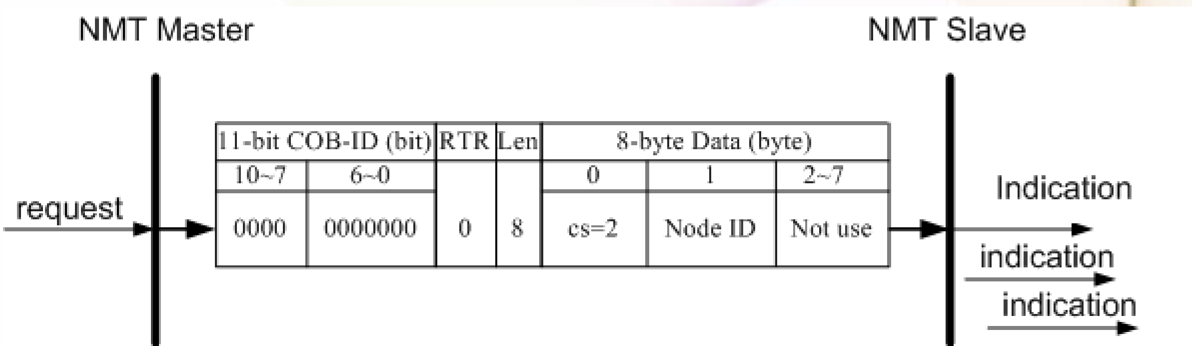
Stop Remote Node Protocol



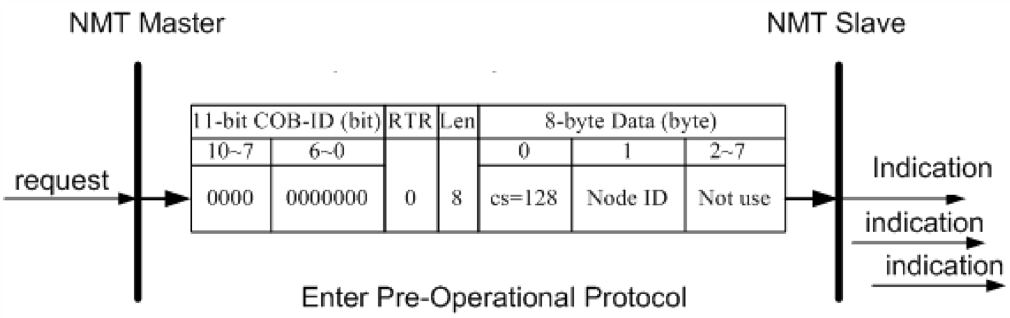
Stop Remote Node Protocol

cs: NMT command specified

2: stop

Node ID: the node ID of the NMT slave device

Enter Pre-Operational Protocol



Enter Pre-Operational Protocol

cs: NMT command specified

128: enter PRE-OPERATIONAL

Node ID: the node ID of the NMT slave device

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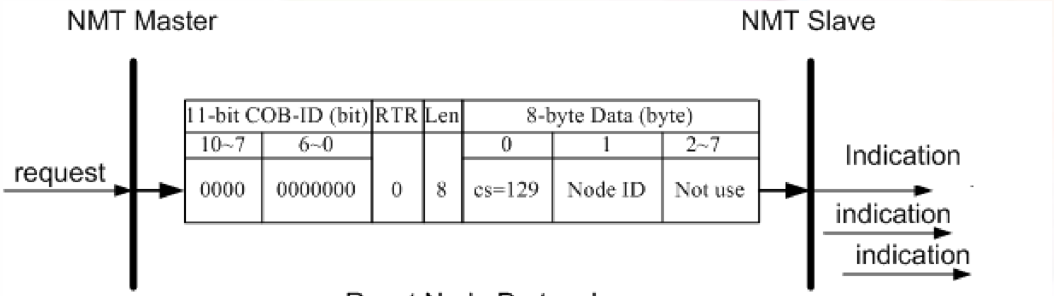
Reset Node Protocol



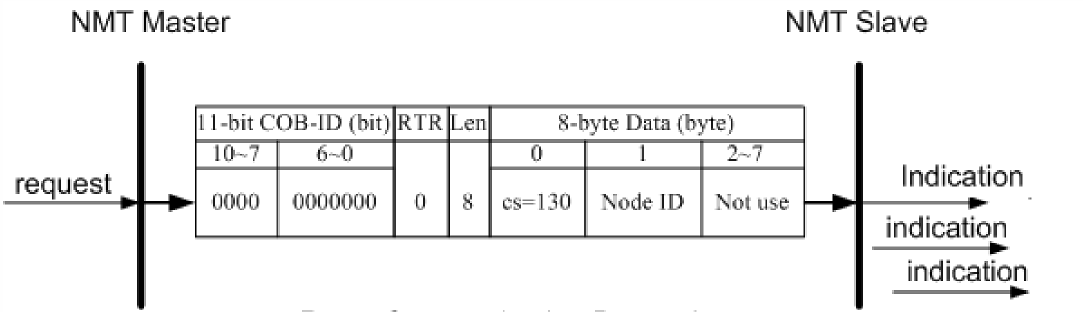
Reset Node Protocol

cs : NMT command specified

129: Reset_Node

Node ID : the node ID of the NMT slave device

Reset Communication Protocol



Reset Communication Protocol

cs: NMT command specified

130: Reset_Communication

Node ID: the node ID of the NMT slave device

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9.2.3.2. Error Control Protocol

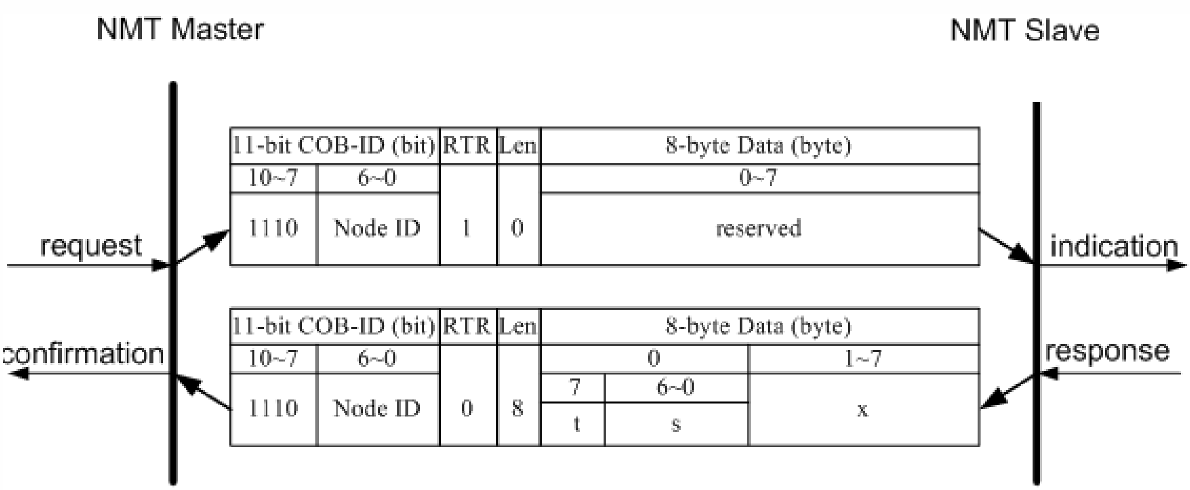
The **Error Control Protocol** ensures that the CANopen device is active and responsive. It uses two key objects:

- **0x100C**: **Guard Time** (the interval between status checks)
- **0x100D**: **Life Time Factor** (a multiplier that extends the waiting period)

The **Node Life Time** defines the maximum amount of time the system will wait for a response from the PM-4324-CPS/PM-4324A-CPS before considering it unresponsive. It is calculated by multiplying the **Guard Time** by the **Life Time Factor**.
Formula:
Node Life Time = Guard Time × Life Time Factor

When the **PM-4324-CPS/PM-4324A-CPS** receives the first **RTR (Remote Transmission Request)** —used by the master to verify if the device is active—the **Node Guarding Timer** starts. This timer tracks the time since the last response from the node:

- **If the node responds** within the Node Life Time, the timer resets.
- **If the node does not respond** before the timer expires, the system raises an **error**, indicating the device may be offline or unresponsive.



Node Guarding Protocol

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t: toggle bit

- The toggle bit alternates between 0 and 1 with each consecutive response from the NMT slave.
- When the Node Guarding protocol becomes active, the toggle bit in the first response will be set to 0.

s: the state of the NMT Slave

4: STOPPED

5: OPERATIONAL

127: PRE_OPERATIONAL

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9.2.4. Special Functions for PM-4324-CPS/PM-4324A-CPS

The PM-4324-CPS/PM-4324A-CPS module offers a range of specialized functions tailored for power monitoring applications. These include data storage entries in the Manufacturer Specific Profile Area, which provide access to key power meter data. This data is mapped to PDOs (Process Data Objects) for efficient communication within CANopen networks. The following sections outline the structure and mapping details of these entries.

9.2.4.1. Power Meter Data Table

The **PM-4324-CPS/PM-4324A-CPS** defines several entries in the Manufacturer Specific Profile Area that are used to store power meter data. These entries, indexed from **0x3200 to 0x3209**, are mapped to **PDOs** (Process Data Objects) as shown in the table below. Each PDO message consists of **8 bytes** divided between **D0 to D7**, representing fields for CANopen messages from **Data0 to Data7**.

No.(PDO)	COB-ID	Data Length	D0~D3	D4~D7
1	0x180+Node-ID	8	kW_a_CT1	kWh_a_CT1
2	0x280+Node-ID	8	kW_b_CT2	kWh_b_CT2
3	0x380+Node-ID	8	kW_c_CT3	kWh_c_CT3
4	0x480+Node-ID	8	kW_tot_M1	kWh_tot_M1
5	---	8	kW_a_CT4	kWh_a_CT4
6	---	8	kW_b_CT5	kWh_b_CT5
7	---	8	kW_c_CT6	kWh_c_CT6
8	---	8	kW_tot_M2	kWh_tot_M2
9	---	8	kW_a_CT7	kWh_a_CT7
10	---	8	kW_b_CT8	kWh_b_CT8
11	---	8	kW_c_CT9	kWh_c_CT9
12	---	8	kW_tot_M3	kWh_tot_M3
13	---	8	kW_a_CT10	kWh_a_CT10
14	---	8	kW_b_CT11	kWh_b_CT11
15	---	8	kW_c_CT12	kWh_c_CT12
16	---	8	kW_tot_M4	kWh_tot_M4
17	---	8	kW_a_CT13	kWh_a_CT13

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18	---	8	kW_b_CT14	kWh_b_CT14
19	---	8	kW_c_CT15	kWh_c_CT15
20	---	8	kW_tot_M5	kWh_tot_M5
21	---	8	kW_a_CT16	kWh_a_CT16
22	---	8	kW_b_CT17	kWh_b_CT17
23	---	8	kW_c_CT18	kWh_c_CT18
24	---	8	kW_tot_M6	kWh_tot_M6
25	---	8	kW_a_CT19	kWh_a_CT19
26	---	8	kW_b_CT20	kWh_b_CT20
27	---	8	kW_c_CT21	kWh_c_CT21
28	---	8	kW_tot_M7	kWh_tot_M7
29	---	8	kW_a_CT22	kWh_a_CT22
30	---	8	kW_b_CT23	kWh_b_CT23
31	---	8	kW_c_CT24	kWh_c_CT24
32	---	8	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)_M1
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
41	---	8	Volt(V_a)_CT7	Amp(I_a)_CT7
42	---	8	Volt(V_b)_CT8	Amp(I_b)_CT8
43	---	8	Volt(V_c)_CT9	Amp(I_c)_CT9
44	---	8	Volt(V_avg)_M3	Amp(I_avg)_M3
45	---	8	Volt(V_a)_CT10	Amp(I_a)_CT10
46	---	8	Volt(V_b)_CT11	Amp(I_b)_CT11
47	---	8	Volt(V_c)_CT12	Amp(I_c)_CT12
48	---	8	Volt(V_avg)_M4	Amp(I_avg)_M4
49	---	8	Volt(V_a)_CT13	Amp(I_a)_CT13
50	---	8	Volt(V_b)_CT14	Amp(I_b)_CT14
51	---	8	Volt(V_c)_CT15	Amp(I_c)_CT15

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52	---	8	Volt(V_avg)_M5	Amp(I_avg)_M5
53	---	8	Volt(V_a)_CT16	Amp(I_a)_CT16
54	---	8	Volt(V_b)_CT17	Amp(I_b)_CT17
55	---	8	Volt(V_c)_CT18	Amp(I_c)_CT18
56	---	8	Volt(V_avg)_M6	Amp(I_avg)_M6
57	---	8	Volt(V_a)_CT19	Amp(I_a)_CT19
58	---	8	Volt(V_b)_CT20	Amp(I_b)_CT20
59	---	8	Volt(V_c)_CT21	Amp(I_c)_CT21
60	---	8	Volt(V_avg)_M7	Amp(I_avg)_M7
61	---	8	Volt(V_a)_CT22	Amp(I_a)_CT22
62	---	8	Volt(V_b)_CT23	Amp(I_b)_CT23
63	---	8	Volt(V_c)_CT24	Amp(I_c)_CT24
64	---	8	Volt(V_avg)_M8	Amp(I_avg)_M8
65	---	8	kvar_a_CT1	kVA_a_CT1
66	---	8	kvar_b_CT2	kVA_b_CT2
67	---	8	kvar_c_CT3	kVA _c_CT3
68	---	8	kvar_tot_M1	kVA_tot_M1
69	---	8	kvar_a_CT4	kVA_a_CT4
70	---	8	kvar_b_CT5	kVA_b_CT5
71	---	8	kvar_c_CT6	kVA_c_CT6
72	---	8	kvar_tot_M2	kVA_tot_M2
73	---	8	kvar_a_CT7	kVA_a_CT7
74	---	8	kvar_b_CT8	kVA_b_CT8
75	---	8	kvar_c_CT9	kVA_c_CT9
76	---	8	kvar_tot_M3	kVA_tot_M3
77	---	8	kvar_a_CT10	kVA_a_CT10
78	---	8	kvar_b_CT11	kVA_b_CT11
79	---	8	kvar_c_CT12	kVA_c_CT12
80	---	8	kvar_tot_M4	kVA_tot_M4
81	---	8	kvar_a_CT13	kVA_a_CT13
82	---	8	kvar_b_CT14	kVA_b_CT14
83	---	8	kvar_c_CT15	kVA_c_CT15
84	---	8	kvar_tot_M5	kVA_tot_M5
85	---	8	kvar_a_CT16	kVA_a_CT16

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86	---	8	kvar_b_CT17	kVA_b_CT17
87	---	8	kvar_c_CT18	kVA_c_CT18
88	---	8	kvar_tot_M6	kVA_tot_M6
89	---	8	kvar_a_CT19	kVA_a_CT19
90	---	8	kvar_b_CT20	kVA_b_CT20
91	---	8	kvar_c_CT21	kVA_c_CT21
92	---	8	kvar_tot_M7	kVA_tot_M7
93	---	8	kvar_a_CT22	kVA_a_CT22
94	---	8	kvar_b_CT23	kVA_b_CT23
95	---	8	kvar_c_CT24	kVA_c_CT24
96	---	8	kvar_tot_M8	kVA_tot_M8
97	---	8	PF_a_CT1	kVAh_a_CT1
98	---	8	PF_b_CT2	kVAh_b_CT2
99	---	8	PF_c_CT3	kVAh_c_CT3
100	---	8	PF_tot_M1	kVAh_tot_M1
101	---	8	PF_a_CT4	kVAh_a_CT4
102	---	8	PF_b_CT5	kVAh_b_CT5
103	---	8	PF_c_CT6	kVAh_c_CT6
104	---	8	PF_tot_M2	kVAh_tot_M2
105	---	8	PF_a_CT7	kVAh_a_CT7
106	---	8	PF_b_CT8	kVAh_b_CT8
107	---	8	PF_c_CT9	kVAh_c_CT9
108	---	8	PF_tot_M3	kVAh_tot_M3
109	---	8	PF_a_CT10	kVAh_a_CT10
110	---	8	PF_b_CT11	kVAh_b_CT11
111	---	8	PF_c_CT12	kVAh_c_CT12
112	---	8	PF_tot_M4	kVAh_tot_M4
113	---	8	PF_a_CT13	kVAh_a_CT13
114	---	8	PF_b_CT14	kVAh_b_CT14
115	---	8	PF_c_CT15	kVAh_c_CT15
116	---	8	PF_tot_M5	kVAh_tot_M5
117	---	8	PF_a_CT16	kVAh_a_CT16
118	---	8	PF_b_CT17	kVAh_b_CT17
119	---	8	PF_c_CT18	kVAh_c_CT18

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120	---	8	PF_tot_M6	kVAh_tot_M6
121	---	8	PF_a_CT19	kVAh_a_CT19
122	---	8	PF_b_CT20	kVAh_b_CT20
123	---	8	PF_c_CT21	kVAh_c_CT21
124	---	8	PF_tot_M7	kVAh_tot_M7
125	---	8	PF_a_CT22	kVAh_a_CT22
126	---	8	PF_b_CT23	kVAh_b_CT23
127	---	8	PF_c_CT24	kVAh_c_CT24
128	---	8	PF_tot_M8	kVAh_tot_M8
129	---	8	kvarh_a_CT1	Freq_a_CT1
130	---	8	kvarh_b_CT2	Freq_b_CT2
131	---	8	kvarh_c_CT3	Freq_c_CT3
132	---	8	kvarh_tot_M1	Freq_avg_M1
133	---	8	kvarh_a_CT4	Freq_a_CT4
134	---	8	kvarh_b_CT5	Freq_b_CT5
135	---	8	kvarh_c_CT6	Freq_c_CT6
136	---	8	kvarh_tot_M2	Freq_avg_M2
137	---	8	kvarh_a_CT7	Freq_a_CT7
138	---	8	kvarh_b_CT8	Freq_b_CT8
139	---	8	kvarh_c_CT9	Freq_c_CT9
140	---	8	kvarh_tot_M3	Freq_avg_M3
141	---	8	kvarh_a_CT10	Freq_a_CT10
142	---	8	kvarh_b_CT11	Freq_b_CT11
143	---	8	kvarh_c_CT12	Freq_c_CT12
144	---	8	kvarh_tot_M4	Freq_avg_M4
145	---	8	kvarh_a_CT13	Freq_a_CT13
146	---	8	kvarh_b_CT14	Freq_b_CT14
147	---	8	kvarh_c_CT15	Freq_c_CT15
148	---	8	kvarh_tot_M5	Freq_avg_M5
149	---	8	kvarh_a_CT16	Freq_a_CT16
150	---	8	kvarh_b_CT17	Freq_b_CT17
151	---	8	kvarh_c_CT18	Freq_c_CT18
152	---	8	kvarh_tot_M6	Freq_avg_M6
153	---	8	kvarh_a_CT19	Freq_a_CT19

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154	---	8	kvarh_b_CT20	Freq_b_CT20
155	---	8	kvarh_c_CT21	Freq_c_CT21
156	---	8	kvarh_tot_M7	Freq_avg_M7
157	---	8	kvarh_a_CT22	Freq_a_CT22
158	---	8	kvarh_b_CT23	Freq_b_CT23
159	---	8	kvarh_c_CT24	Freq_c_CT24
160	---	8	kvarh_tot_M8	Freq_avg_M8

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9.3. Object Dictionary of PM-4324-CPS/PM-4324A-CPS

The **Object Dictionary** in PM-4324-CPS/ PM-4324A-CPS contains all the communication-related parameters and manufacturer-specific entries. The dictionary follows the CANopen protocol, enabling flexible configuration and communication of the power meter. It is divided into several key areas:

- **Communication Profile Area**: This section defines general communication objects.
- **Manufacturer-Specific Profile Area**: This section includes entries for specific features or measurement data unique to PM-4324-CPS/ PM-4324A-CPS.
- **Storage and Restoration of Objects**: This section manages parameter storage and restoration.

9.3.1. Communication Profile Area

The **Communication Profile Area** lists the communication parameters essential for CANopen operations. For easier reference, this section is divided into three tables:

1. **General Communication Entries:** Lists device-related identifiers and communication control parameters.
2. **TxPDO Communication Entries:** Contains information about the transmission PDOs.
3. **TxPDO Mapping Communication Entries:** Lists mapping rules for the PDOs.

The column headers are explained as follows:

- **Idx:** The index within the object dictionary.
- **Sidx:** Sub-index for finer control of entries.
- **Attr:** Attributes, such as **RO** (Read-Only) or **RW** (Read-Write).
- **Default**: Default value assigned to the parameter. If the default value is shown as "---", it means it is either undefined or may be assigned dynamically by the **PM-4324-CPS/PM-4324A-CPS firmware**.

Additionally, any number with the suffix "**h**" is presented in **hexadecimal format**.

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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
1010h	0h	largest sub-index supported for “store parameters”	UNSIGNED 8	RO	1
	1h	save all parameters	UNSIGNED 32	RW	0
1011h	0h	largest sub-index supported for “restore default parameters”	UNSIGNED 8	RO	1
	1h	restore all default parameters	UNSIGNED 32	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	---
1F52h	0h	largest sub-index supported for “firmware update”	UNSIGNED 8	RO	1
	1h	1: start to update firmware	UNSIGNED 8	WO	---
2010h	0h	largest sub-index supported for “DO Power On Value”	UNSIGNED 8	RO	1
	1h	2-bits DO power on value	UNSIGNED 8	RW	0

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SDO Communication Entries

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

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	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

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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

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	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

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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

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	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
1A28h	0	largest sub-index	UNSIGNED 8	RO	2
	1	read V_a CT7	INTEGER 32	RW	3202 0920h
	2	read I_a CT7	INTEGER 32	RW	3203 0920h
1A29h	0	largest sub-index	UNSIGNED 8	RO	2
	1	read V_b CT8	INTEGER 32	RW	3202 0A20h
	2	read I_b CT8	INTEGER 32	RW	3203 0A20h
1A2Ah	0	largest sub-index	UNSIGNED 8	RO	2
	1	read V_c CT9	INTEGER 32	RW	3202 0B20h
	2	read I_c CT9	INTEGER 32	RW	3203 0B20h
1A2Bh	0	largest sub-index	UNSIGNED 8	RO	2
	1	read V_avg Meter3	INTEGER 32	RW	3202 0C20h
	2	read I_avg Meter3	INTEGER 32	RW	3203 0C20h
1A2Ch	0	largest sub-index	UNSIGNED 8	RO	2
	1	read V_a CT10	INTEGER 32	RW	3202 0D20h
	2	read I_a CT10	INTEGER 32	RW	3203 0D20h
1A2Dh	0	largest sub-index	UNSIGNED 8	RO	2
	1	read V_b CT11	INTEGER 32	RW	3202 0E20h

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	2	read I_b CT11	INTEGER 32	RW	3203 0E20h
1A2Eh	0	largest sub-index	UNSIGNED 8	RO	2
	1	read V_c CT12	INTEGER 32	RW	3202 0F20h
	2	read I_c CT12	INTEGER 32	RW	3203 0F20h
1A2Fh	0	largest sub-index	UNSIGNED 8	RO	2
	1	read V_avg Meter4	INTEGER 32	RW	3202 1020h
	2	read I_avg Meter4	INTEGER 32	RW	3203 1020h
1A30h	0	largest sub-index	UNSIGNED 8	RO	2
	1	read V_a CT13	INTEGER 32	RW	3202 1120h
	2	read I_a CT13	INTEGER 32	RW	3203 1120h
1A31h	0	largest sub-index	UNSIGNED 8	RO	2
	1	read V_b CT14	INTEGER 32	RW	3202 1220h
	2	read I_b CT14	INTEGER 32	RW	3203 1220h
1A32h	0	largest sub-index	UNSIGNED 8	RO	2
	1	read V_c CT15	INTEGER 32	RW	3202 1320h
	2	read I_c CT15	INTEGER 32	RW	3203 1320h
1A33h	0	largest sub-index	UNSIGNED 8	RO	2
	1	read V_avg Meter5	INTEGER 32	RW	3202 1420h
	2	read I_avg Meter5	INTEGER 32	RW	3203 1420h
1A34h	0	largest sub-index	UNSIGNED 8	RO	2
	1	read V_a CT16	INTEGER 32	RW	3202 1520h
	2	read I_a CT16	INTEGER 32	RW	3203 1520h
1A35h	0	largest sub-index	UNSIGNED 8	RO	2
	1	read V_b CT17	INTEGER 32	RW	3202 1620h
	2	read I_b CT17	INTEGER 32	RW	3203 1620h
1A36h	0	largest sub-index	UNSIGNED 8	RO	2
	1	read V_c CT18	INTEGER 32	RW	3202 1720h
	2	read I_c CT18	INTEGER 32	RW	3203 1720h
1A37h	0	largest sub-index	UNSIGNED 8	RO	2
	1	read V_avg Meter6	INTEGER 32	RW	3202 1820h
	2	read I_avg Meter6	INTEGER 32	RW	3203 1820h

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1A38h	0	largest sub-index	UNSIGNED 8	RO	2
	1	read V_a CT19	INTEGER 32	RW	3202 1920h
	2	read I_a CT19	INTEGER 32	RW	3203 1920h
1A39h	0	largest sub-index	UNSIGNED 8	RO	2
	1	read V_b CT20	INTEGER 32	RW	3202 1A20h
	2	read I_b CT20	INTEGER 32	RW	3203 1A20h
1A3Ah	0	largest sub-index	UNSIGNED 8	RO	2
	1	read V_c CT21	INTEGER 32	RW	3202 1B20h
	2	read I_c CT21	INTEGER 32	RW	3203 1B20h
1A3Bh	0	largest sub-index	UNSIGNED 8	RO	2
	1	read V_avg Meter7	INTEGER 32	RW	3202 1C20h
	2	read I_avg Meter7	INTEGER 32	RW	3203 1C20h
1A3Ch	0	largest sub-index	UNSIGNED 8	RO	2
	1	read V_a CT22	INTEGER 32	RW	3202 1D20h
	2	read I_a CT22	INTEGER 32	RW	3203 1D20h
1A3Dh	0	largest sub-index	UNSIGNED 8	RO	2
	1	read V_b CT23	INTEGER 32	RW	3202 1E20h
	2	read I_b CT23	INTEGER 32	RW	3203 1E20h
1A3Eh	0	largest sub-index	UNSIGNED 8	RO	2
	1	read V_c CT24	INTEGER 32	RW	3202 1F20h
	2	read I_c CT24	INTEGER 32	RW	3203 1F20h
1A3Fh	0	largest sub-index	UNSIGNED 8	RO	2
	1	read V_avg Meter8	INTEGER 32	RW	3202 2020h
	2	read I_avg Meter8	INTEGER 32	RW	3203 2020h
1A40h	0	largest sub-index	UNSIGNED 8	RO	2
	1	read kvar_a CT1	INTEGER 32	RW	3204 0120h
	2	read kVA_a CT1	INTEGER 32	RW	3205 0120h
1A41h	0	largest sub-index	UNSIGNED 8	RO	2
	1	read kvar_b CT2	INTEGER 32	RW	3204 0220h
	2	read kVA_b CT2	INTEGER 32	RW	3205 0220h
1A42h	0	largest sub-index	UNSIGNED 8	RO	2

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	1	read kvar_c CT3	INTEGER 32	RW	3204 0320h
	2	read kVA_c CT3	INTEGER 32	RW	3205 0320h
1A43h	0	largest sub-index	UNSIGNED 8	RO	2
	1	read kvar_tot Meter1	INTEGER 32	RW	3204 0420h
	2	read kVA_tot Meter1	INTEGER 32	RW	3205 0420h
1A44h	0	largest sub-index	UNSIGNED 8	RO	2
	1	read kvar_a CT4	INTEGER 32	RW	3204 0520h
	2	read kVA_a CT4	INTEGER 32	RW	3205 0520h
1A45h	0	largest sub-index	UNSIGNED 8	RO	2
	1	read kvar_b CT5	INTEGER 32	RW	3204 0620h
	2	read kVA_b CT5	INTEGER 32	RW	3205 0620h
1A46h	0	largest sub-index	UNSIGNED 8	RO	2
	1	read kvar_c CT6	INTEGER 32	RW	3204 0720h
	2	read kVA_c CT6	INTEGER 32	RW	3205 0720h
1A47h	0	largest sub-index	UNSIGNED 8	RO	2
	1	read kvar_tot Meter2	INTEGER 32	RW	3204 0820h
	2	read kVA_tot Meter2	INTEGER 32	RW	3205 0820h
1A48h	0	largest sub-index	UNSIGNED 8	RO	2
	1	read kvar_a CT7	INTEGER 32	RW	3204 0920h
	2	read kVA_a CT7	INTEGER 32	RW	3205 0920h
1A49h	0	largest sub-index	UNSIGNED 8	RO	2
	1	read kvar_b CT8	INTEGER 32	RW	3204 0A20h
	2	read kVA_b CT8	INTEGER 32	RW	3205 0A20h
1A4Ah	0	largest sub-index	UNSIGNED 8	RO	2
	1	read kvar_c CT9	INTEGER 32	RW	3204 0B20h
	2	read kVA_c CT9	INTEGER 32	RW	3205 0B20h
1A4Bh	0	largest sub-index	UNSIGNED 8	RO	2
	1	read kvar_tot Meter3	INTEGER 32	RW	3204 0C20h
	2	read kVA_tot Meter3	INTEGER 32	RW	3205 0C20h
1A4Ch	0	largest sub-index	UNSIGNED 8	RO	2
	1	read kvar_a CT10	INTEGER 32	RW	3204 0D20h

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	2	read kVA_a CT10	INTEGER 32	RW	3205 0D20h
1A4Dh	0	largest sub-index	UNSIGNED 8	RO	2
	1	read kvar_b CT11	INTEGER 32	RW	3204 0E20h
	2	read kVA_b CT11	INTEGER 32	RW	3205 0E20h
1A4Eh	0	largest sub-index	UNSIGNED 8	RO	2
	1	read kvar_c CT12	INTEGER 32	RW	3204 0F20h
	2	read kVA_c CT12	INTEGER 32	RW	3205 0F20h
1A4Fh	0	largest sub-index	UNSIGNED 8	RO	2
	1	read kvar_tot Meter4	INTEGER 32	RW	3204 1020h
	2	read kVA_tot Meter4	INTEGER 32	RW	3205 1020h
1A50h	0	largest sub-index	UNSIGNED 8	RO	2
	1	read kvar_a CT13	INTEGER 32	RW	3204 1120h
	2	read kVA_a CT13	INTEGER 32	RW	3205 1120h
1A51h	0	largest sub-index	UNSIGNED 8	RO	2
	1	read kvar_b CT14	INTEGER 32	RW	3204 1220h
	2	read kVA_b CT14	INTEGER 32	RW	3205 1220h
1A52h	0	largest sub-index	UNSIGNED 8	RO	2
	1	read kvar_c CT15	INTEGER 32	RW	3204 1320h
	2	read kVA_c CT15	INTEGER 32	RW	3205 1320h
1A53h	0	largest sub-index	UNSIGNED 8	RO	2
	1	read kvar_tot Meter5	INTEGER 32	RW	3204 1420h
	2	read kVA_tot Meter5	INTEGER 32	RW	3205 1420h
1A54h	0	largest sub-index	UNSIGNED 8	RO	2
	1	read kvar_a CT16	INTEGER 32	RW	3204 1520h
	2	read kVA_a CT16	INTEGER 32	RW	3205 1520h
1A55h	0	largest sub-index	UNSIGNED 8	RO	2
	1	read kvar_b CT17	INTEGER 32	RW	3204 1620h
	2	read kVA_b CT17	INTEGER 32	RW	3205 1620h
1A56h	0	largest sub-index	UNSIGNED 8	RO	2
	1	read kvar_c CT18	INTEGER 32	RW	3204 1720h
	2	read kVA_c CT18	INTEGER 32	RW	3205 1720h

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1A57h	0	largest sub-index	UNSIGNED 8	RO	2
	1	read kvar_tot Meter6	INTEGER 32	RW	3204 1820h
	2	read kVA_tot Meter6	INTEGER 32	RW	3205 1820h
1A58h	0	largest sub-index	UNSIGNED 8	RO	2
	1	read kvar_a CT19	INTEGER 32	RW	3204 1920h
	2	read kVA_a CT19	INTEGER 32	RW	3205 1920h
1A59h	0	largest sub-index	UNSIGNED 8	RO	2
	1	read kvar_b CT20	INTEGER 32	RW	3204 1A20h
	2	read kVA_b CT20	INTEGER 32	RW	3205 1A20h
1A5Ah	0	largest sub-index	UNSIGNED 8	RO	2
	1	read kvar_c CT21	INTEGER 32	RW	3204 1B20h
	2	read kVA_c CT21	INTEGER 32	RW	3205 1B20h
1A5Bh	0	largest sub-index	UNSIGNED 8	RO	2
	1	read kvar_tot Meter7	INTEGER 32	RW	3204 1C20h
	2	read kVA_tot Meter7	INTEGER 32	RW	3205 1C20h
1A5Ch	0	largest sub-index	UNSIGNED 8	RO	2
	1	read kvar_a CT22	INTEGER 32	RW	3204 1D20h
	2	read kVA_a CT22	INTEGER 32	RW	3205 1D20h
1A5Dh	0	largest sub-index	UNSIGNED 8	RO	2
	1	read kvar_b CT23	INTEGER 32	RW	3204 1E20h
	2	read kVA_b CT23	INTEGER 32	RW	3205 1E20h
1A5Eh	0	largest sub-index	UNSIGNED 8	RO	2
	1	read kvar_c CT24	INTEGER 32	RW	3204 1F20h
	2	read kVA_c CT24	INTEGER 32	RW	3205 1F20h
1A5Fh	0	largest sub-index	UNSIGNED 8	RO	2
	1	read kvar_tot Meter8	INTEGER 32	RW	3204 2020h
	2	read kVA_tot Meter8	INTEGER 32	RW	3205 2020h
1A60h	0	largest sub-index	UNSIGNED 8	RO	2
	1	read PF_a CT1	INTEGER 32	RW	3206 0120h
	2	read kVAh_a CT1	INTEGER 32	RW	3207 0120h
1A61h	0	largest sub-index	UNSIGNED 8	RO	2

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	1	read PF_b CT2	INTEGER 32	RW	3206 0220h
	2	read kVAh_b CT2	INTEGER 32	RW	3207 0220h
1A62h	0	largest sub-index	UNSIGNED 8	RO	2
	1	read PF_c CT3	INTEGER 32	RW	3206 0320h
	2	read kVAh_c CT3	INTEGER 32	RW	3207 0320h
1A63h	0	largest sub-index	UNSIGNED 8	RO	2
	1	read PF_tot Meter1	INTEGER 32	RW	3206 0420h
	2	read kVAh_tot Meter1	INTEGER 32	RW	3207 0420h
1A64h	0	largest sub-index	UNSIGNED 8	RO	2
	1	read PF_a CT4	INTEGER 32	RW	3206 0520h
	2	read kVAh_a CT4	INTEGER 32	RW	3207 0520h
1A65h	0	largest sub-index	UNSIGNED 8	RO	2
	1	read PF_b CT5	INTEGER 32	RW	3206 0620h
	2	read kVAh_b CT5	INTEGER 32	RW	3207 0620h
1A66h	0	largest sub-index	UNSIGNED 8	RO	2
	1	read PF_c CT6	INTEGER 32	RW	3206 0720h
	2	read kVAh_c CT6	INTEGER 32	RW	3207 0720h
1A67h	0	largest sub-index	UNSIGNED 8	RO	2
	1	read PF_tot Meter2	INTEGER 32	RW	3206 0820h
	2	read kVAh_tot Meter2	INTEGER 32	RW	3207 0820h
1A68h	0	largest sub-index	UNSIGNED 8	RO	2
	1	read PF_a CT7	INTEGER 32	RW	3206 0920h
	2	read kVAh_a CT7	INTEGER 32	RW	3207 0920h
1A69h	0	largest sub-index	UNSIGNED 8	RO	2
	1	read PF_b CT8	INTEGER 32	RW	3206 0A20h
	2	read kVAh_b CT8	INTEGER 32	RW	3207 0A20h
1A6Ah	0	largest sub-index	UNSIGNED 8	RO	2
	1	read PF_c CT9	INTEGER 32	RW	3206 0B20h
	2	read kVAh_c CT9	INTEGER 32	RW	3207 0B20h
1A6Bh	0	largest sub-index	UNSIGNED 8	RO	2
	1	read PF_tot Meter3	INTEGER 32	RW	3206 0C20h

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	2	read kVAh_tot Meter3	INTEGER 32	RW	3207 0C20h
1A6Ch	0	largest sub-index	UNSIGNED 8	RO	2
	1	read PF_a CT10	INTEGER 32	RW	3206 0D20h
	2	read kVAh_a CT10	INTEGER 32	RW	3207 0D20h
1A6Dh	0	largest sub-index	UNSIGNED 8	RO	2
	1	read PF_b CT11	INTEGER 32	RW	3206 0E20h
	2	read kVAh_b CT11	INTEGER 32	RW	3207 0E20h
1A6Eh	0	largest sub-index	UNSIGNED 8	RO	2
	1	read PF_c CT12	INTEGER 32	RW	3206 0F20h
	2	read kVAh_c CT12	INTEGER 32	RW	3207 0F20h
1A6Fh	0	largest sub-index	UNSIGNED 8	RO	2
	1	read PF_tot Meter4	INTEGER 32	RW	3206 1020h
	2	read kVAh_tot Meter4	INTEGER 32	RW	3207 1020h
1A70h	0	largest sub-index	UNSIGNED 8	RO	2
	1	read PF_a CT13	INTEGER 32	RW	3206 1120h
	2	read kVAh_a CT13	INTEGER 32	RW	3207 1120h
1A71h	0	largest sub-index	UNSIGNED 8	RO	2
	1	read PF_b CT14	INTEGER 32	RW	3206 1220h
	2	read kVAh_b CT14	INTEGER 32	RW	3207 1220h
1A72h	0	largest sub-index	UNSIGNED 8	RO	2
	1	read PF_c CT15	INTEGER 32	RW	3206 1320h
	2	read kVAh_c CT15	INTEGER 32	RW	3207 1320h
1A73h	0	largest sub-index	UNSIGNED 8	RO	2
	1	read PF_tot Meter5	INTEGER 32	RW	3206 1420h
	2	read kVAh_tot Meter5	INTEGER 32	RW	3207 1420h
1A74h	0	largest sub-index	UNSIGNED 8	RO	2
	1	read PF_a CT16	INTEGER 32	RW	3206 1520h
	2	read kVAh_a CT16	INTEGER 32	RW	3207 1520h
1A75h	0	largest sub-index	UNSIGNED 8	RO	2
	1	read PF_b CT17	INTEGER 32	RW	3206 1620h
	2	read kVAh_b CT17	INTEGER 32	RW	3207 1620h

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1A76h	0	largest sub-index	UNSIGNED 8	RO	2
	1	read PF_c CT18	INTEGER 32	RW	3206 1720h
	2	read kVAh_c CT18	INTEGER 32	RW	3207 1720h
1A77h	0	largest sub-index	UNSIGNED 8	RO	2
	1	read PF_tot Meter6	INTEGER 32	RW	3206 1820h
	2	read kVAh_tot Meter6	INTEGER 32	RW	3207 1820h
1A78h	0	largest sub-index	UNSIGNED 8	RO	2
	1	read PF_a CT19	INTEGER 32	RW	3206 1920h
	2	read kVAh_a CT19	INTEGER 32	RW	3207 1920h
1A79h	0	largest sub-index	UNSIGNED 8	RO	2
	1	read PF_b CT20	INTEGER 32	RW	3206 1A20h
	2	read kVAh_b CT20	INTEGER 32	RW	3207 1A20h
1A7Ah	0	largest sub-index	UNSIGNED 8	RO	2
	1	read PF_c CT21	INTEGER 32	RW	3206 1B20h
	2	read kVAh_c CT21	INTEGER 32	RW	3207 1B20h
1A7Bh	0	largest sub-index	UNSIGNED 8	RO	2
	1	read PF_tot Meter7	INTEGER 32	RW	3206 1C20h
	2	read kVAh_tot Meter7	INTEGER 32	RW	3207 1C20h
1A7Ch	0	largest sub-index	UNSIGNED 8	RO	2
	1	read PF_a CT22	INTEGER 32	RW	3206 1D20h
	2	read kVAh_a CT22	INTEGER 32	RW	3207 1D20h
1A7Dh	0	largest sub-index	UNSIGNED 8	RO	2
	1	read PF_b CT23	INTEGER 32	RW	3206 1E20h
	2	read kVAh_b CT23	INTEGER 32	RW	3207 1E20h
1A7Eh	0	largest sub-index	UNSIGNED 8	RO	2
	1	read PF_c CT24	INTEGER 32	RW	3206 1F20h
	2	read kVAh_c CT24	INTEGER 32	RW	3207 1F20h
1A7Fh	0	largest sub-index	UNSIGNED 8	RO	2
	1	read PF_tot Meter8	INTEGER 32	RW	3206 2020h
	2	read kVAh_tot Meter8	INTEGER 32	RW	3207 2020h
1A80h	0	largest sub-index	UNSIGNED 8	RO	2

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	1	read kvarh_a CT1	INTEGER 32	RW	3208 0120h
	2	read Freq_a CT1	INTEGER 32	RW	3209 0120h
1A81h	0	largest sub-index	UNSIGNED 8	RO	2
	1	read kvarh_b CT2	INTEGER 32	RW	3208 0220h
	2	read Freq_b CT2	INTEGER 32	RW	3209 0220h
1A82h	0	largest sub-index	UNSIGNED 8	RO	2
	1	read kvarh_c CT3	INTEGER 32	RW	3208 0320h
	2	read Freq_c CT3	INTEGER 32	RW	3209 0320h
1A83h	0	largest sub-index	UNSIGNED 8	RO	2
	1	read kvarh_tot Meter1	INTEGER 32	RW	3208 0420h
	2	read Freq_avg Meter1	INTEGER 32	RW	3209 0420h
1A84h	0	largest sub-index	UNSIGNED 8	RO	2
	1	read kvarh_a CT4	INTEGER 32	RW	3208 0520h
	2	read Freq_a CT4	INTEGER 32	RW	3209 0520h
1A85h	0	largest sub-index	UNSIGNED 8	RO	2
	1	read kvarh_b CT5	INTEGER 32	RW	3208 0620h
	2	read Freq_b CT5	INTEGER 32	RW	3209 0620h
1A86h	0	largest sub-index	UNSIGNED 8	RO	2
	1	read kvarh_c CT6	INTEGER 32	RW	3208 0720h
	2	read Freq_c CT6	INTEGER 32	RW	3209 0720h
1A87h	0	largest sub-index	UNSIGNED 8	RO	2
	1	read kvarh_tot Meter2	INTEGER 32	RW	3208 0820h
	2	read Freq_avg Meter2	INTEGER 32	RW	3209 0820h
1A88h	0	largest sub-index	UNSIGNED 8	RO	2
	1	read kvarh_a CT7	INTEGER 32	RW	3208 0920h
	2	read Freq_a CT7	INTEGER 32	RW	3209 0920h
1A89h	0	largest sub-index	UNSIGNED 8	RO	2
	1	read kvarh_b CT8	INTEGER 32	RW	3208 0A20h
	2	read Freq_b CT8	INTEGER 32	RW	3209 0A20h
1A8Ah	0	largest sub-index	UNSIGNED 8	RO	2
	1	read kvarh_c CT9	INTEGER 32	RW	3208 0B20h

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	2	read Freq_c CT9	INTEGER 32	RW	3209 0B20h
1A8Bh	0	largest sub-index	UNSIGNED 8	RO	2
	1	read kvarh_tot Meter3	INTEGER 32	RW	3208 0C20h
	2	read Freq_avg Meter3	INTEGER 32	RW	3209 0C20h
1A8Ch	0	largest sub-index	UNSIGNED 8	RO	2
	1	read kvarh_a CT10	INTEGER 32	RW	3208 0D20h
	2	read Freq_a CT10	INTEGER 32	RW	3209 0D20h
1A8Dh	0	largest sub-index	UNSIGNED 8	RO	2
	1	read kvarh_b CT11	INTEGER 32	RW	3208 0E20h
	2	read Freq_b CT11	INTEGER 32	RW	3209 0E20h
1A8Eh	0	largest sub-index	UNSIGNED 8	RO	2
	1	read kvarh_c CT12	INTEGER 32	RW	3208 0F20h
	2	read Freq_c CT12	INTEGER 32	RW	3209 0F20h
1A8Fh	0	largest sub-index	UNSIGNED 8	RO	2
	1	read kvarh_tot Meter4	INTEGER 32	RW	3208 1020h
	2	read Freq_avg Meter4	INTEGER 32	RW	3209 1020h
1A90h	0	largest sub-index	UNSIGNED 8	RO	2
	1	read kvarh_a CT13	INTEGER 32	RW	3208 1120h
	2	read Freq_a CT13	INTEGER 32	RW	3209 1120h
1A91h	0	largest sub-index	UNSIGNED 8	RO	2
	1	read kvarh_b CT14	INTEGER 32	RW	3208 1220h
	2	read Freq_b CT14	INTEGER 32	RW	3209 1220h
1A92h	0	largest sub-index	UNSIGNED 8	RO	2
	1	read kvarh_c CT15	INTEGER 32	RW	3208 1320h
	2	read Freq_c CT15	INTEGER 32	RW	3209 1320h
1A93h	0	largest sub-index	UNSIGNED 8	RO	2
	1	read kvarh_tot Meter5	INTEGER 32	RW	3208 1420h
	2	read Freq_avg Meter5	INTEGER 32	RW	3209 1420h
1A94h	0	largest sub-index	UNSIGNED 8	RO	2
	1	read kvarh_a CT16	INTEGER 32	RW	3208 1520h
	2	read Freq_a CT16	INTEGER 32	RW	3209 1520h

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1A95h	0	largest sub-index	UNSIGNED 8	RO	2
	1	read kvarh_b CT17	INTEGER 32	RW	3208 1620h
	2	read Freq_b CT17	INTEGER 32	RW	3209 1620h
1A96h	0	largest sub-index	UNSIGNED 8	RO	2
	1	read kvarh_c CT18	INTEGER 32	RW	3208 1720h
	2	read Freq_c CT18	INTEGER 32	RW	3209 1720h
1A97h	0	largest sub-index	UNSIGNED 8	RO	2
	1	read kvarh_tot Meter6	INTEGER 32	RW	3208 1820h
	2	read Freq_avg Meter6	INTEGER 32	RW	3209 1820h
1A98h	0	largest sub-index	UNSIGNED 8	RO	2
	1	read kvarh_a CT19	INTEGER 32	RW	3208 1920h
	2	read Freq_a CT19	INTEGER 32	RW	3209 1920h
1A99h	0	largest sub-index	UNSIGNED 8	RO	2
	1	read kvarh_b CT20	INTEGER 32	RW	3208 1A20h
	2	read Freq_b CT20	INTEGER 32	RW	3209 1A20h
1A9Ah	0	largest sub-index	UNSIGNED 8	RO	2
	1	read kvarh_c CT21	INTEGER 32	RW	3208 1B20h
	2	read Freq_c CT21	INTEGER 32	RW	3209 1B20h
1A9Bh	0	largest sub-index	UNSIGNED 8	RO	2
	1	read kvarh_tot Meter7	INTEGER 32	RW	3208 1C20h
	2	read Freq_avg Meter7	INTEGER 32	RW	3209 1C20h
1A9Ch	0	largest sub-index	UNSIGNED 8	RO	2
	1	read kvarh_a CT22	INTEGER 32	RW	3208 1D20h
	2	read Freq_a CT22	INTEGER 32	RW	3209 1D20h
1A9Dh	0	largest sub-index	UNSIGNED 8	RO	2
	1	read kvarh_b CT23	INTEGER 32	RW	3208 1E20h
	2	read Freq_b CT23	INTEGER 32	RW	3209 1E20h
1A9Eh	0	largest sub-index	UNSIGNED 8	RO	2
	1	read kvarh_c CT24	INTEGER 32	RW	3208 1F20h
	2	read Freq_c CT24	INTEGER 32	RW	3209 1F20h
1A9Fh	0	largest sub-index	UNSIGNED 8	RO	2

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	1	read kvarh_tot Meter8	INTEGER 32	RW	3208 2020h
	2	read Freq_avg Meter8	INTEGER 32	RW	3209 2020h

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9.3.2. Manufacturer Specific Profile Area

The following table lists the special feature items for the **PM-4324-CPS/PM-4324A-CPS**. Entries indexed from **0x3200 to 0x3209** record the power meter measurement parameters. These values are automatically updated each time the PM-4324-CPS/PM-4324A-CPS boots.

- **0x320A:** Contains **meter parameter information.**
- **0x320B:** Stores three key meter parameters: **PT Ratio, CT Ratio,** and **Meter Ratio.**

✓ **PT Ratio**: Potential transformer ratio. The default value is **100**, with a unit of **0.1**.
✓ **CT Ratio**: Current transformer ratio. The default value is **1**, with a unit of **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)	REAL 32	RO	0
	2	kW(Kw_b) (Meter 1)	REAL 32	RO	0
	3	kW(Kw_c) (Meter 1)	REAL 32	RO	0
	4	kW(Kw_tot) (Meter 1)	REAL 32	RO	0
	…	…	…	…	---
	29	kW(Kw_a) (Meter 8)	REAL 32	RO	0
	30	kW(Kw_b) (Meter 8)	REAL 32	RO	0
	31	kW(Kw_c) (Meter 8)	REAL 32	RO	0
	32	kW(Kw_tot) (Meter 8)	REAL 32	RO	0
3201h	0	largest sub-index supported for “kWh”	UNSIGNED 8	RO	32
	1	kWh_a (Meter 1)	REAL 32	RO	0
	2	kWh_b (Meter 1)	REAL 32	RO	0
	3	kWh_c (Meter 1)	REAL 32	RO	0
	4	kWh_tot (Meter 1)	REAL 32	RO	0
	…	…	…	…	---
	29	kWh_a (Meter 8)	REAL 32	RO	0
	30	kWh_b (Meter 8)	REAL 32	RO	0

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	31	kWh_c (Meter 8)	REAL 32	RO	0
	32	kWh_tot (Meter 8)	REAL 32	RO	0
3202h	0	largest sub-index supported for "Volt"	UNSIGNED 8	RO	32
	1	Volt(V_a) (Meter 1)	REAL 32	RO	0
	2	Volt(V_b) (Meter 1)	REAL 32	RO	0
	3	Volt(V_c) (Meter 1)	REAL 32	RO	0
	4	Volt(V_avg) (Meter 1)	REAL 32	RO	0
	…	…	…	…	---
	29	Volt(V_a) (Meter 8)	REAL 32	RO	0
	30	Volt(V_b) (Meter 8)	REAL 32	RO	0
	31	Volt(V_c) (Meter 8)	REAL 32	RO	0
	32	Volt(V_avg) (Meter 8)	REAL 32	RO	0
3203h	0	largest sub-index supported for "Amp"	UNSIGNED 8	RO	32
	1	Amp(I_a) (Meter 1)	REAL 32	RO	0
	2	Amp(I_b) (Meter 1)	REAL 32	RO	0
	3	Amp(I_c) (Meter 1)	REAL 32	RO	0
	4	Amp(I_avg) (Meter 1)	REAL 32	RO	0
	…	…	…	…	---
	29	Amp(I_a) (Meter 8)	REAL 32	RO	0
	30	Amp(I_b) (Meter 8)	REAL 32	RO	0
	31	Amp(I_c) (Meter 8)	REAL 32	RO	0
	32	Amp(I_avg) (Meter 8)	REAL 32	RO	0
3204h	0	largest sub-index supported for "kvar"	UNSIGNED 8	RO	32
	1	kvar(kvar_a) (Meter 1)	REAL 32	RO	0
	2	kvar(kvar_b) (Meter 1)	REAL 32	RO	0
	3	kvar(kvar_c) (Meter 1)	REAL 32	RO	0
	4	kvar(kvar_tot) (Meter 1)	REAL 32	RO	0
	…	…	…	…	---
	29	kvar(kvar_a) (Meter 8)	REAL 32	RO	0
	30	kvar(kvar_b) (Meter 8)	REAL 32	RO	0
	31	kvar(kvar_c) (Meter 8)	REAL 32	RO	0

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	32	kvar(kvar_tot) (Meter 8)	REAL 32	RO	0
3205h	0	largest sub-index supported for "kVA"	UNSIGNED 8	RO	32
	1	kVA(Kva_a) (Meter 1)	REAL 32	RO	0
	2	kVA(Kva_b) (Meter 1)	REAL 32	RO	0
	3	kVA(Kva_c) (Meter 1)	REAL 32	RO	0
	4	kVA(Kva_tot) (Meter 1)	REAL 32	RO	0
	…	…	…	…	---
	29	kVA(Kva_a) (Meter 8)	REAL 32	RO	0
	30	kVA(Kva_b) (Meter 8)	REAL 32	RO	0
	31	kVA(Kva_c) (Meter 8)	REAL 32	RO	0
	32	kVA(Kva_tot) (Meter 8)	REAL 32	RO	0
3206h	0	largest sub-index supported for "PF"	UNSIGNED 8	RO	32
	1	PF_a (Meter 1)	REAL 32	RO	0
	2	PF_b (Meter 1)	REAL 32	RO	0
	3	PF_c (Meter 1)	REAL 32	RO	0
	4	PF_tot (Meter 1)	REAL 32	RO	0
	…	…	…	…	---
	29	PF_a (Meter 8)	REAL 32	RO	0
	30	PF_b (Meter 8)	REAL 32	RO	0
	31	PF_c (Meter 8)	REAL 32	RO	0
	32	PF_tot (Meter 8)	REAL 32	RO	0
3207h	0	largest sub-index supported for "kVAh"	UNSIGNED 8	RO	32
	1	kVAh_a (Meter 1)	REAL 32	RO	0
	2	kVAh_b (Meter 1)	REAL 32	RO	0
	3	kVAh_c (Meter 1)	REAL 32	RO	0
	4	kVAh_tot (Meter 1)	REAL 32	RO	0
	…	…	…	…	---
	29	kVAh_a (Meter 8)	REAL 32	RO	0
	30	kVAh_b (Meter 8)	REAL 32	RO	0
	31	kVAh_c (Meter 8)	REAL 32	RO	0
	32	kVAh_tot (Meter 8)	REAL 32	RO	0

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3208h	0	largest sub-index supported for “kvarh”	UNSIGNED 8	RO	32
	1	kvarh_a (Meter 1)	REAL 32	RO	0
	2	kvarh_b (Meter 1)	REAL 32	RO	0
	3	kvarh_c (Meter 1)	REAL 32	RO	0
	4	kvarh_tot (Meter 1)	REAL 32	RO	0
	…	…	…	…	---
	29	kvarh_a (Meter 8)	REAL 32	RO	0
	30	kvarh_b (Meter 8)	REAL 32	RO	0
	31	kvarh_c (Meter 8)	REAL 32	RO	0
	32	kvarh_tot (Meter 8)	REAL 32	RO	0
3209h	0	largest sub-index supported for “Frequency”	UNSIGNED 8	RO	32
	1	Freq_a (Meter 1)	REAL 32	RO	0
	2	Freq _b (Meter 1)	REAL 32	RO	0
	3	Freq _c (Meter 1)	REAL 32	RO	0
	4	Freq _avg (Meter 1)	REAL 32	RO	0
	…	…	…	…	---
	29	Freq_a (Meter 8)	REAL 32	RO	0
	30	Freq _b (Meter 8)	REAL 32	RO	0
	31	Freq _c (Meter 8)	REAL 32	RO	0
	32	Freq _avg (Meter 8)	REAL 32	RO	0
320Ah	0	largest sub-index supported for “Total Harmonic Distortion”	UNSIGNED 8	RO	16
	1	VTHD (Meter 1) (Voltage total harmonic distortion)	REAL 32	RO	
	2	ITHD (Meter 1) (Current total harmonic distortion)	REAL 32	RO	
	3	VTHD (Meter 2) (Voltage total harmonic distortion)	REAL 32	RO	
	4	ITHD (Meter 2) (Current total harmonic distortion)	REAL 32	RO	
	…	…	REAL 32	RO	
	15	VTHD (Meter 8) (Voltage total harmonic distortion)	REAL 32	RO	

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	16	ITHD (Meter 8) (Current total harmonic distortion)	REAL 32	RO	
320Bh	0	largest sub-index supported for objects	UNSIGNED 8	RO	15
	1	PT Ratio (V1)	UNSIGNED 16	RW	100
	2	CT Ratio Meter 1 (V1)	UNSIGNED 16	RW	1
	3	CT Ratio Meter 2 (V1)	UNSIGNED 16	RW	1
	4	CT Ratio Meter 3 (V1)	UNSIGNED 16	RW	1
	5	CT Ratio Meter 4 (V1)	UNSIGNED 16	RW	1
	6	Wiring Mode (V1) (Only work when SW9-SW10 is all off) 1: 1P2W 2: 1P3W 3: 3P3W2CT 4: 3P3W3CT 5: 3P4W3CT	UNSIGNED 8	RW	5
	7	Display Voltage (V1) 0: Automatic 1: Show as Vln 2: Show as Vll	UNSIGNED 8	RW	0
	8	PT Ratio (V2)	UNSIGNED 16	RW	100
	9	CT Ratio Meter 5 (V2)	UNSIGNED 16	RW	1
	10	CT Ratio Meter 6 (V2)	UNSIGNED 16	RW	1
	11	CT Ratio Meter 7 (V2)	UNSIGNED 16	RW	1
	12	CT Ratio Meter 8 (V2)	UNSIGNED 16	RW	1
	13	Wiring Mode (V2) (Only work when SW11-SW12 is all off) 1: 1P2W 2: 1P3W 3: 3P3W2CT 4: 3P3W3CT 5: 3P4W3CT	UNSIGNED 8	RW	5
	14	Display Voltage (V2) 0: Automatic 1: Show as Vln	UNSIGNED 8	RW	0

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		2: Show as Vll			
	15	Energy Absolute Accumulated Mode 0: Enable 1: Disable	UNSIGNED 8	RW	0
320Ch	0	largest sub-index supported for “Harmonic Phase Select”	UNSIGNED 8	RO	8
	1	Harmonic Phase Select Meter 1 0: Disable 1: Phase A 2: Phase B 3: Phase C	UNSIGNED 8	RW	0
	…	…	…	…	---
	8	Harmonic Phase Select Meter 8 0: Disable 1: Phase A 2: Phase B 3: Phase C	UNSIGNED 8	RW	0
320Dh	0	largest sub-index supported for objects	UNSIGNED 8	RO	3
	1	Set Energy to Zero 0x1 ~ 0x8: Set Meter 1 ~ 8 to Zero 0x55: Set all Meter to Zero	UNSIGNED 8	WO	0
	2	Reset to Factory Settings 0x55: Re-power the module after setting	UNSIGNED 8	WO	0
	3	Default Frequency 0x55: Auto 0x64: 50Hz 0x78: 60Hz	UNSIGNED 8	RW	0x55
320Eh	0	largest sub-index supported for objects	UNSIGNED 8	RO	5
	1	Wiring Type V1 (Set wiring by Dip Switch SW9-SW10) 9: 1P2W	UNSIGNED 16	RO	13

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		10: 1P3W 11: 3P3W2CT 12: 3P3W3CT 13: 3P4W3CT 14: 3P3W2CT (HW) 15: 3P3W3CT (HW) 16: 3P4W3CT (HW)			
	2	Wiring Type V2 (Set wiring by Dip Switch SW11-SW12) 9: 1P2W 10: 1P3W 11: 3P3W2CT 12: 3P3W3CT 13: 3P4W3CT 14: 3P3W2CT (HW) 15: 3P3W3CT (HW) 16: 3P4W3CT (HW)	UNSIGNED 16	RO	13
	3	Phase Sequence V1 (Only work when 3P4W3CT) 0: Negative (ACB) 1: Positive (ABC)	UNSIGNED 16	RO	--
	4	Phase Sequence V2 (Only work when 3P4W3CT) 0: Negative (ACB) 1: Positive (ABC)	UNSIGNED 16	RO	--
	5	Model Type 0x0001: 50Hz 0x0002: 60Hz	UNSIGNED 16	RO	0x0002
	6	Enable VLL Compensation (Only work for 3P3W3CT wiring) 0 = OFF 1 = ON	UNSIGNED 8	RW	0
	7	Disable HW Wiring Dipswitch (SW9, SW10 always in software mode) 0 = OFF	UNSIGNED 8	RW	0

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		1 = ON			
	8	Enable Phase B Zero Voltage 0 = OFF 1 = ON	UNSIGNED 8	RW	0
3220h	0	largest sub-index supported for "CT Ratio Scale"	UNSIGNED 8	RO	8
	1	CT Ratio Scale (Meter 1) Range: 6 ~ 14	UNSIGNED 8	RW	10
	…	…	…	…	…
	8	CT Ratio Scale (Meter 8) Range: 6 ~ 14	UNSIGNED 8	RW	10
3221h	0	largest sub-index supported for "PT Ratio Scale"	UNSIGNED 8	RO	8
	1	PT Ratio Scale (Meter 1) Range: 6 ~ 14	UNSIGNED 8	RW	8
	…	…	…	…	…
	8	PT Ratio Scale (Meter 8) Range: 6 ~ 14	UNSIGNED 8	RW	8
3230h	0	largest sub-index supported for "Bi-direction Energy"	UNSIGNED 8	RO	4
	1	Bi_Positive_kWh (Meter 1)	REAL 32	RO	--
	2	Bi_Negative_kWh (Meter 1)	REAL 32	RO	--
	3	Bi_Net_kWh (Meter 1)	REAL 32	RO	--
	4	Bi_Total_kWh (Meter 1)	REAL 32	RO	--
	…	…	…	…	…
	29	Bi_Positive_kWh (Meter 8)	REAL 32	RO	--
	30	Bi_Negative_kWh (Meter 8)	REAL 32	RO	--
	31	Bi_Net_kWh (Meter 8)	REAL 32	RO	--
	32	Bi_Total_kWh (Meter 8)	REAL 32	RO	--

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9.3.3. Store and Restore Object

This section describes how users can store application settings and restore the default settings on the PM-4324-CPS/PM-4324A-CPS.

- To **store application settings**, write the value 65766173h to the object at **index 1010h**, **sub-index 1.**
- To **restore the default factory settings**, write the value 64616F6Ch to the object at **index 1011h**, **sub-index 1** and reboot the module.

The following table outlines the specific objects that will be stored or restored when these actions are performed.

Table: Objects Stored or Restored During Operations

Index	Sub-index	Description
100Ch	0	Guard time
100Dh	0	Life time factor
1017h	0	Heartbeat time
1800h	1~5	TxPDO1 parameter
……	……	……
189Fh	1~5	TxPDO1 parameter
2010h	1	DO power on value

Note:

For **power meter system parameters settings** (such as object **320Bh**), users need to write the value 55h to index 320Dh, sub-index 02h to load the default factory settings.

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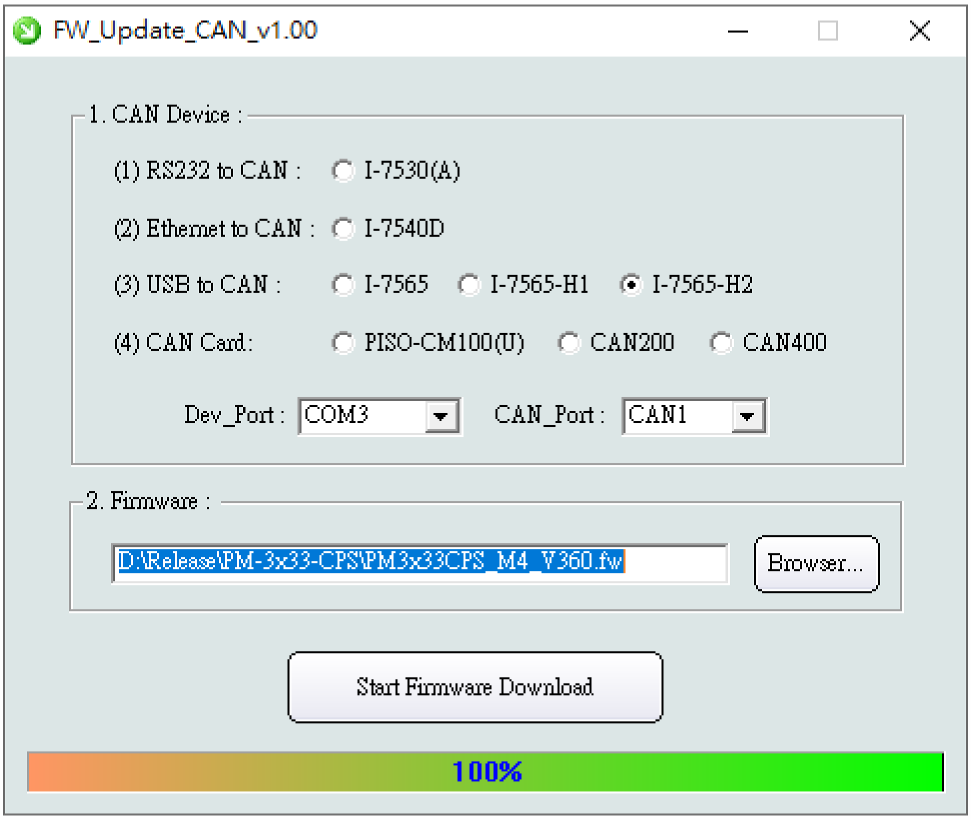
9.3.4. Firmware Update Object

This section describes how to update the firmware of the PM-4324-CPS/PM-4324A-CPS via CAN Bus.

Note: This function is supported only on firmware version **“3.05-20260122”** and later. (Check the version via **Object 0x100A**.)

Before starting the firmware update process, users must prepare the following:

- The **FW_Update_CAN_Tool** firmware update utility.
- A compatible **ICP DAS CAN module**. (see tool interface for supported modules)



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The firmware update procedure is as follows:

- **Enter Firmware Update Mode**: Write **1** to **Object 1F52h, Sub-index 1**. If successful, the **RUN LED** will turn off and the device will enter update mode.
- **Start Firmware Update:** Open the update tool, select the CAN device and port, choose the firmware file, and then click **“Start Firmware Download”**. The process takes about **1–2 minutes**, with the **RFU LED** blinking rapidly. The device will reboot automatically after completion.
- **Cancel Update Mode:** If you don’t proceed with the update, simply power cycle the device to exit update mode.

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10. Appendix: Questions & Answers

Q1. Can we use other 5A CTs (e.g., 600/5) directly with the input current terminals of the PM-4324 series?

Answer: No, you cannot directly use other 5A CTs, such as 600/5 or 100/5, with the PM-4324 series because the input current terminals are designed for milliamp (mA) inputs only. Directly connecting 5A CTs may cause fatal damage to the device. Use the included split-type clip-on CT provided with the PM-4324 series to connect to the secondary 5A output of other CTs for testing.

Q2. Can I replace the failed split-type clip-on CT by detaching it? Is there anything I should pay attention to?

Answer: Yes, you can replace a failed CT, but always ensure that the CT is disconnected from the power cable of the monitored equipment before detaching the CT wires from the meter terminals. Failure to do so may result in severe injury.

Q3. How should I handle a split-type clip-on CT if the turning point or internal Ferrite-core breaks?

Answer: A damaged CT will yield inaccurate measurements and should no longer be used. Replace it with a new CT.

Q4. Can I mix and match the CTs and meters from multiple PM-4324 series units?

Answer: No, do not mix CTs and meters between different units. Each smart meter and its attached CTs are calibrated as a set. Mixing them may result in inaccurate measurements.

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Q5. What should I do if the power consumption readings (kW) are negative?

Answer:

(1) Verify the connections on the current input terminals to ensure they follow the sequence **CT1-K, CT1-L, CT2-K, CT2-L, CT3-K,** and **CT3-L**, in the correct white-black pattern.

(2) Check the current flow direction (K → L) to confirm it matches the arrow direction on the clip-on CT.

(3) Confirm the RST (ABC) phase sequence is correct.

(4) An incorrect wiring sequence for voltage or current inputs may result in phase angle calculation errors. This can cause the power meter to misinterpret the direction of power flow, leading to negative KW readings or abnormally low Power Factor (PF) values.

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

Answer:

Negative kW readings may occur when the motor or pump is not operating under normal load conditions. Please confirm that the equipment is running under full load. If the readings are taken while the motor is idling or lightly loaded, the power factor may be very low or unstable, which can result in negative kW readings.

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Q7. Why can't the PC connect to the meter over RS-485？

Answer:

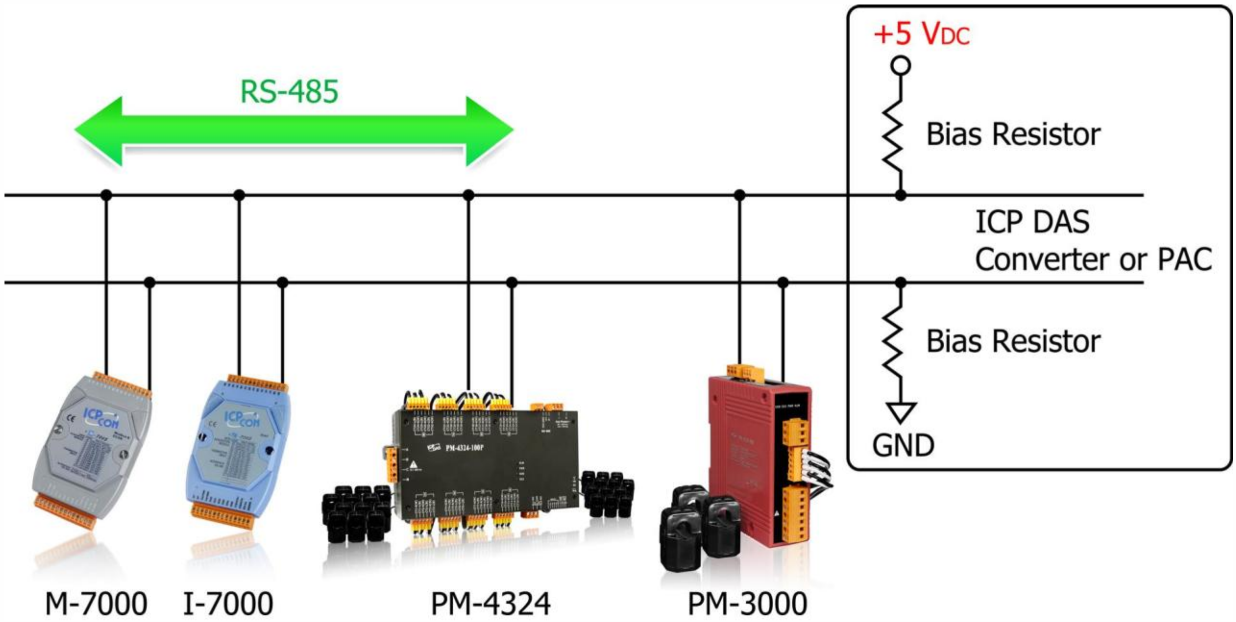
(1) **Confirm the Modbus address:** Ensure the Modbus address is set correctly. The default value is 1.

(2) **Check the baud rate:** The default baud rate is 19200.

(3) **Verify the stop bit:** Ensure the stop bit is configured to 1.

(4) **Check the RS-485 wiring:** Verify that the D+/D- connections are correctly wired.

(5) **Ensure the RS-485 master provides bias:** The RS-485 master must provide bias for the PM-4324 series. If not, use a tM-SG4 or SG-785 module to supply the required bias. All ICP DAS controllers and converters are equipped to provide this bias.



Q8. What power cable diameter (in mm) should be used with the various CTs?

Answer:

- **≤Φ10 mm:** Use a 60A CT.
- **Φ10 to Φ16 mm:** Use a 100A CT.
- **Φ16 to Φ24 mm:** Use a 200A CT.
- **Φ36 mm:** Use a 300A or 400A CT.

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Q9. What if the wire length for the split-type clip-on CT is insufficient?

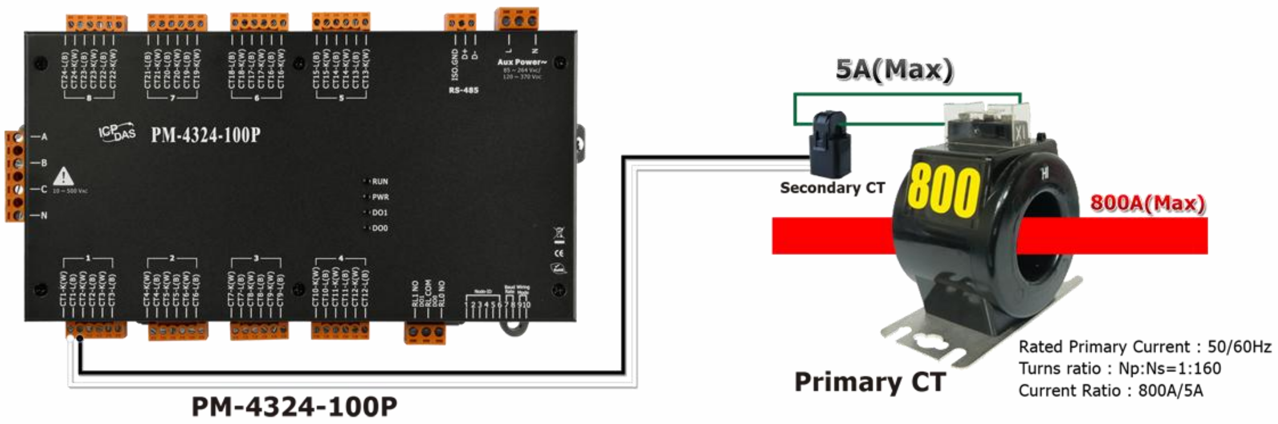
Answer:

- PM-4324-xxxP/ PM-4324A-xxxP CTs: Standard length is 4 m
- CT cable length can be extended to 8 meters (excluding Rogowski coil type CT), with no loss in accuracy. It is recommended to use twisted pair wires with AWG 18–14 (cross-sectional area 0.75–2.0 mm²) to reduce interference.
- For custom lengths, contact ICP DAS.

Q10. How can I measure currents exceeding 400A?

Answer:

The maximum current range for the CTs used with the PM-4324-xxxP/ PM-4324A-xxxP is **400A**. If the target current exceeds 400A, consider the following solution:
For example, to measure a current of up to **800A**, use a **primary CT** with the appropriate output and configure the **CT ratio** in the PM-4324 to scale the readings correctly.



Note:

A. The accuracy of the primary CT will affect the measurement accuracy.
B. Even primary CT output current max is 5A, please don’t wire to PM-4324/PM-4324A/ PM-4324P/PM-4324AP directly.
C. B. Even if the primary CT has a maximum output of 5A, do not connect it directly to the PM-4324/PM-4324A/PM-4324P /PM-4324AP.

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Q11. What is the difference between line-to-line voltage and line-to-ground voltage?

Answer:

In a three-phase wye-connected system:

Line-to-line voltage is the voltage between terminals A-B, B-C, and A-C.

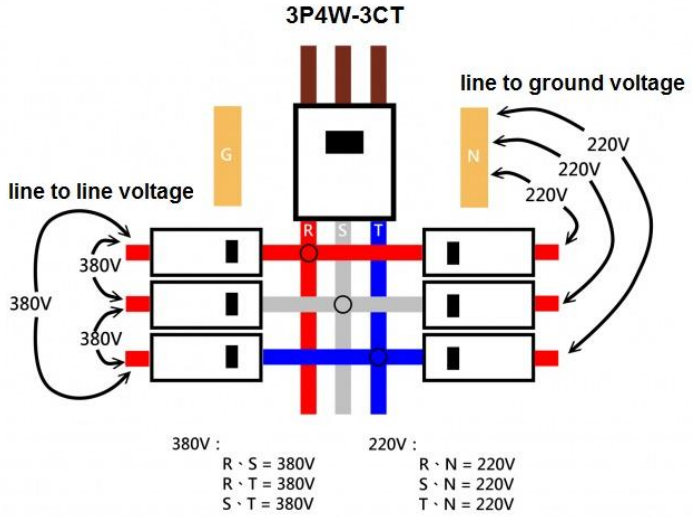
Line-to-ground voltage is the voltage between terminals A-N, B-N, and C-N.

Calculation:

Line-to-ground voltage = Line-to-line voltage ÷ √3 (approximately 1.73)

Example:

In a 380V wye system, the line-to-line voltage is 380V, so the line-to-ground voltage is 380 ÷ 1.73 = 220V.



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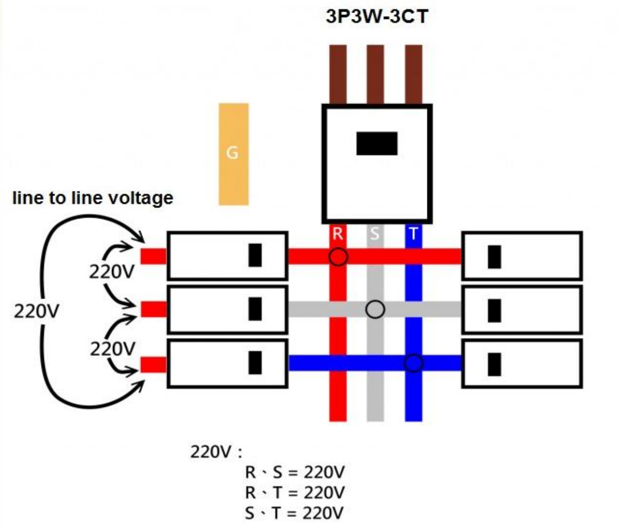

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Q12. How do I set the [Display Voltage] register to correctly display line-to-ground voltage or line-to-line voltage?

Answer:

The voltage [V_x] register in the Modbus register table can be configured to display either line-to-ground or line-to-line voltage by adjusting the [Display Voltage] register. Depending on the wiring type, different [Display Voltage] values are required. If the voltage reading is not as expected, refer to the table below and ensure the correct setting:

Wiring Type	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 Vll)
3P4W-3CT	[Display Voltage] = 0 (Automatic)	[Display Voltage] = 2 (Show as Vll)

Q13. What is the harmonic (THD) analysis capability?

Answer:

The number of harmonics **N** that can be analyzed within the 2.8 kHz pass band is determined by the formula:

N = [2800/f], N ≤ 63

Here, **N** must be a whole number. The maximum number of harmonics that the Energy Metering IC can analyze is 63.

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Q14. How do I measure Voltage above 500V?

Answer:

For service voltage above 500 Vac, voltage transformers (PTs) are used to step down the voltage to a range that compatible with the PM-4324 series meter.

Selecting a Transformer:

- **Input Voltage:**
  Ensure the transformer is designed to operate at your facility's supply voltage (e.g., **PRI. Voltage 720V; SEC. Voltage 120V**). Check the connection diagram for compatibility with the wiring configuration (e.g., three-phase Y or delta) and confirm the correct phase sequence.

- **PT Ratio:**
  The addition of potential transformers (PTs) reduces the measured voltage by the PT ratio (e.g., 6:1). In this case, a 720 Vac input would be transformed to 120 Vac. Since the meter receives 120 Vac, the readings must be scaled by the PT ratio (in this example, multiplied by 6) to reflect the correct voltage.

- **Frequency:**
  Ensure the transformer is rated for the appropriate frequency. Most systems in the United States operate at **60 Hz**, while some other regions may require **50 Hz**-rated transformers.

- **Accuracy:**
  The accuracy of the Transformer (PT) (e.g., **1%** or **3%**) will affect the precision of the measurement. Choose a transformer with an accuracy rating that meets your requirements.

- **Rated Output (VA):**
  Ensure the transformer has an adequate power rating to handle the load. For example, a **150 VA** transformer (50VA per phase) would be suitable for many applications.

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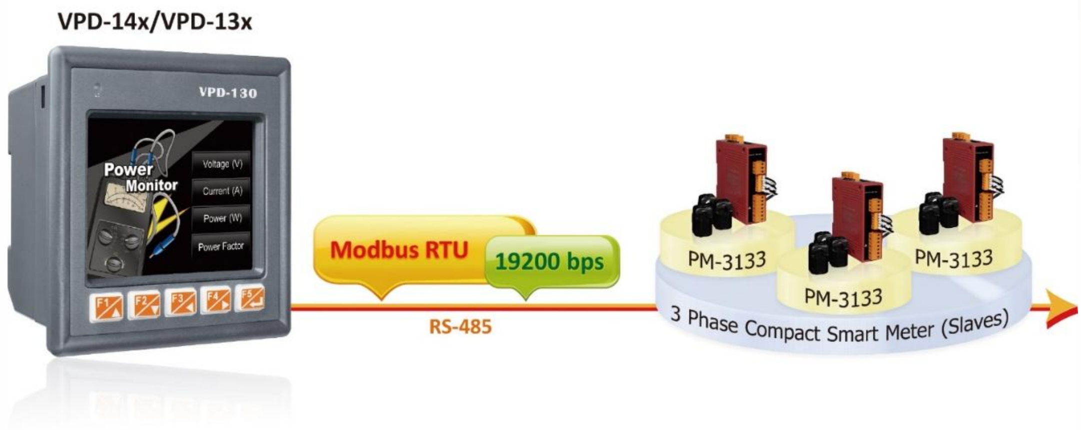
Q15. Can the Power Meter be connected to a remote display via RS-485?

Answer:

A: The Power Meter can be connected to **VPD-13x** or **VPD-14x** series displays via RS-485 for remote monitoring.



B: Two Masters Sharing One Slave (via tSH-735):

This feature allows two master devices, connected to different serial ports, to share access to the same slave device.

- **Modbus Mode:** Converts between the Modbus RTU and Modbus ASCII protocols.
- **Raw Data Mode:** Supports DCON or other query-response protocols.
- **Flexible Communication:** Different **baud rates** and **data formats** can be configured for each serial port independently.
- **Built-in Cache:** The caching mechanism reduces communication load by eliminating duplicated queries when both master devices request the same information.

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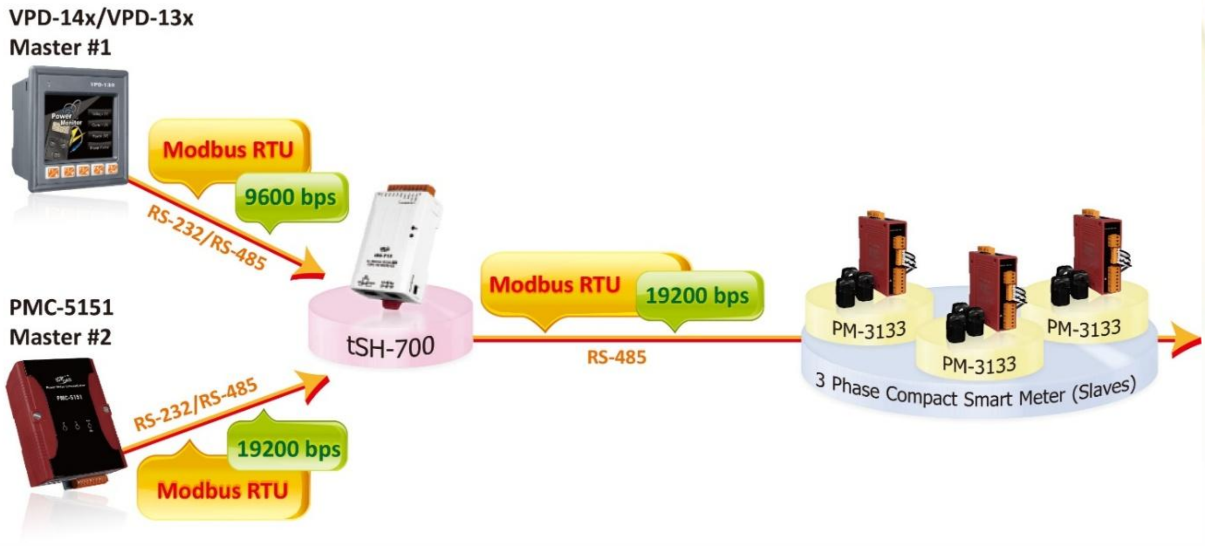

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Q16. How do I change the units of the [PT Ratio] and [CT Ratio] register vales?

Answer:

Users can change the unit of the [PT Ratio] and [CT Ratio] register values by setting the values of the [PT Ratio Scale] and [CT Ratio Scale] registers.

The actual unit of the [PT Ratio] and [CT Ratio] is calculated using the following formula, which is based on powers of 10:

Unit of Ratio Value = 10^(X-10), 6≦X≦14,

X is the register value of [PT Ratio Scale] or [CT Ratio Scale]

Examples:

- When **[PT Ratio Scale]** = 8, the unit of PT Ratio is **0.01** (i.e., 10^(8-10) =10^(-2))
- When **[CT Ratio Scale]** = 10, the unit of CT Ratio is **1** (i.e., 10^(10-10] = 10 ^0)

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Q17. What is the difference between the [PF_x] and [SignedPF_x] registers?

Answer:

The **PF_a**, **PF_b**, **PF_c**, **PF_total** registers provide **unsigned power factor** values, ranging only from **0 to +1**.

- [0x110A-0x110B]: Phase A's unsigned PF (float)
- [0x111C-0x111D]: Phase B's unsigned PF (float)
- [0x112E-0x112F]: Phase C's unsigned PF (float)
- [0x1140-0x1141]: Total unsigned PF (float)

The **SignedPF_a**, **SignedPF _b**, **SignedPF _c**, and **SignedPF _total** registers provide signed power factor values(float), which indicate the direction of power flow based on the signs of active power (P) and reactive power (Q):

- [0x11A2, 0x11A3]: Phase A's signed PF (float)
- [0x11A4, 0x11A5]: Phase B's signed PF (float)
- [0x11A6, 0x11A7]: Phase C's signed PF (float)
- [0x11A8, 0x11A9]: Total signed PF (float)

Signed PF values follow these rules based on power quadrants:

- **Quadrant 1:** P > 0, Q > 0 → PF range: **0 to +1**
- **Quadrant 2:** P < 0, Q > 0 → PF range: **-2 to -1**
- **Quadrant 3:** P < 0, Q < 0 → PF range: **-1 to 0**
- **Quadrant 4:** P > 0, Q < 0 → PF range: **+1 to +2**

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Q18. Why does using the 3P3W-2CT method to measure kWh in a 3P3W system cause larger errors??

Answer:

The 3P3W-2CT method helps reduce installation cost, but its calculation principle assumes a balanced three-phase load. Therefore, significant errors may occur under the following conditions:

1. **Three-phase imbalance**
   - If loads are unbalanced or single-phase loads dominate, measurement errors will occur.
2. **Harmonic distortion**
   - Harmonics distort voltage and current waveforms. Uneven harmonic distribution across phases increases errors.
3. **Wiring or configuration errors**
   - Incorrect CT direction, phase sequence, or meter settings directly affect kWh accuracy.
4. **Low power factor condition**
   - When the power factor drops below 0.5, one phase in the 2CT method may momentarily measure negative kWh.
   - If the meter is configured to use absolute kWh accumulation, reverse power is still accumulated as positive energy, which causes overestimation of total energy.

Conclusion:

The 3P3W-2CT method is only suitable for **balanced three-phase systems with low harmonic distortion**. For unbalanced loads or systems with significant harmonics, the **3P3W-3CT method** is recommended for accurate measurement.

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Q19. What is the function of Modbus register [Enable Phase B Zero Voltage]?

Answer:

The Modbus register [Enable Phase B Zero Voltage] is applicable only when the wiring mode is 3P3W-2CT.

- When the register is set to **Enable (Value = 1)**, the voltage value of Phase B will be forced to zero.
- When the register is set to **Disable (Value = 0)**, the actual voltage value of Phase B will be displayed.

This function prevents misinterpretation of Phase B voltage under 3P3W-2CT wiring.

Q20. I would like to read voltage and current values via PDOs, but the manual does not list the corresponding PDO COB-IDs. How can I read these values? (Applicable to PM-4324-xxxP-CPS/PM-4324A-xxxP-CPS)

Answer:

The reason and solution are as follows:

- In the standard CANopen protocol, **only PDOs 1, 2, 3, and 4 have default PDO COB-IDs**.
- The voltage and current values are mapped to **PDOs 5, 6, 7, and 8**, which do not have default COB-IDs.
- Therefore, users must manually configure the PDO COB-IDs for the following PDO Communication Parameter objects:
  - PDO 5 → Object **0x1804-01**
  - PDO 6 → Object **0x1805-01**
  - PDO 7 → Object **0x1806-01**
  - PDO 8 → Object **0x1807-01**
- After the PDO COB-IDs are configured, the voltage and current values can be received via the assigned COB-IDs.

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