PM-2133D/ PM-2133D-RCT

Smart Power Meter

User's Manual



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Revision History

The table below shows the revision history:

Revision	Date	Description
1.02	2024/04/25	● Fix the Integer type value rage of kVAh,kVARh ● Fix the Bi_xxx_xxx modbus address number ● Change the Display Voltage definition “automatic” to “default”
1.03	2025/04/12	● Modify introduction and features in 1.1 ● Add specifications and information for models PM-2133DP and PM-2133D-RCTxxxP. ● Modify content in CT positional accuracy and installation steps. ● Modify content and diagram in 4.1&4.2 regarding connection and wiring. ● Update Appendix Q5 & Q6

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PM-2133D/PM-2133D-RCT

User's Manual

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Chapter 1 Introduction

1.1. PM-2133D-RCT/PM-2133D introduction

ICP DAS presents the PM-2133D and PM-2133D-RCT series — advanced, compact, and cost-effective Smart Power Meters designed for real-time three-phase power monitoring across a wide range of applications.

With high accuracy (PM-2133D: <0.5%, PM-2133D-RCT: <2%, PF=1), both series support monitoring on low voltage (primary side) as well as medium/high voltage (secondary side) systems. They provide users with reliable and precise energy consumption data from equipment in operation, enabling better energy management and operational efficiency.

The PM-2133D series is equipped with wired clip-on CTs that support a wide range of current inputs (up to 400 A), offering flexibility and ease of installation. It also supports a broad input voltage range of 10 to 500 VAC, ensuring compatibility with global electrical systems.

The PM-2133D-RCT features Rogowski Coil technology — a flexible, rope-style current transformer (CT) that simplifies installation in tight spaces, with a large window size range from 55 to 185 mm. This makes it ideal for applications where conventional CTs cannot be easily installed.

An intuitive LED display provides real-time visual power readings for quick on-site monitoring.

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Features：

- True RMS Power Measurements
- Energy Analysis for 3P4W-3CT, 3P3W-2CT, 3P3W-3CT, 1P2W-1CT, 1P3W-2CT
- Voltage Measurements Up to 500 V
- Clip-on CT for Easy Installation
- Current Measurement Capabilities
  PM-2133D Series: Current measurements up to 400 A**.**
  PM-2133D-RCT Series: Current measurements up to 4000 A
- Power Measurement Accuracy
  PM-2133D Series: Accuracy better than ±0.5% (Power Factor = 1)
  PM-2133D-RCT Series:
  For -500P and -1000P models: Accuracy better than ±2% (PF = 1, Input Current > 50 A)
  For -2000P and -4000P models: Accuracy better than ±2% (PF = 1, Input Current > 200 A)
- 8 - Digit LED Display
- Supports RS-485, Ethernet Interface
- Supports Modbus RTU, Modbus TCP protocols.
- Bi-directional Energy
- Total Harmonic Distortion (THD)

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1.2. Safety Guidelines

The PM-2133D/PM-2133D-RCT 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.

1.5. 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-2133D/PM-2133D-RCT is not a user-serviceable product. Any attempt to disassemble or repair the device will void the warranty.

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Chapter 2 Specifications

Model	PM-2133D/PM-2133D-RCT	PM-2133D-MTCP/ PM-2133D-RCT-MTCP
AC Power Measurement		
Wiring	1P2W-1CT, 1P3W-2CT, 3P3W-2CT, 3P3W-3CT and 3P4W-3CT	
Measurement Voltage	10 ~ 500 V (CAT III)	
Measurement Current	PM-2133D-005P: CTØ10 mm (0.05 A ~ 5 A) PM-2133D-100P: CTØ10 mm (0.05 A ~ 60 A) PM-2133D-160P: CTØ16 mm (0.1 A ~ 100 A) PM-2133D-240P: CTØ24 mm (0.15 A ~ 200 A) PM-2133D-360P: CTØ36 mm (0.3 A ~ 300 A) PM-2133D-400P: CTØ36 mm (0.3 A ~ 400 A) PM-2133D-RCT500P: CTØ55 mm (5 A ~ 500 A) PM-2133D-RCT1000P: CTØ80 mm (5 A ~ 1000 A) PM-2133D-RCT2000P: CT105 mm (5 A ~ 2000 A) PM-2133D-RCT4000P: CTØ185 mm (5 A ~ 4000 A) PM-2133DP: Supports 333 mV output CTs; actual current range depends on CT's primary rating Refer to Appendix Q10 for more details.	
Measurement Frequency	50 Hz/60 Hz	
W Accuracy	PM-2133D Series: Accuracy better than ±0.5% (Power Factor = 1) PM-2133D-RCT Series: For -500P and -1000P models: Accuracy better than ±2% (PF = 1, Input Current > 50 A) For -2000P and -4000P models: Accuracy better than ±2% (PF = 1, Input Current > 200 A) PM-2133DP:Accuracy is approximately 2–5% (PF = 1), depending on the CT used. The CT ratio must be set correctly.	
Power Parameter Measurement	True RMS voltage (Vrms), True RMS current (Irms), Active Power (kW), Active Energy (kWh), Apparent Power (kVA), Apparent Energy (kVAh), Reactive Power (kVAR), Reactive Energy (kVARh), Power Factor (PF), Frequency (45 ~ 65 Hz)	
Data Update Rate	1 Second	

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Communication			
RS-485	Protocol	Modbus-RTU	-
	Baud rate	9600,19200 (default), 38400, 115200;	-
	Data format	N,8,1 (default); N,8,2; E,8,1; E,8,2; O,8,1; O,8,2	
	Isolation	3000 VDC	-
	Bias Resistor	No (**Usually supplied by the RS-485 Master. Alternatively, add a tM-SG4 or SG-785**)	
Ethernet	Protocol	-	Modbus TCP

Aux Power	
Input Range	+85 ~ +264 VAC (277 VAC available)
Power Consumption	6 W
Dimensions (W x L x H)	110 mm x 50 mm x 115 mm
Environment	
Operating Temperature	-20 ~ +70 °C
Storage Temperature	-25 ~ +80 °C

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Chapter 3 Installation

3.1 Inspection

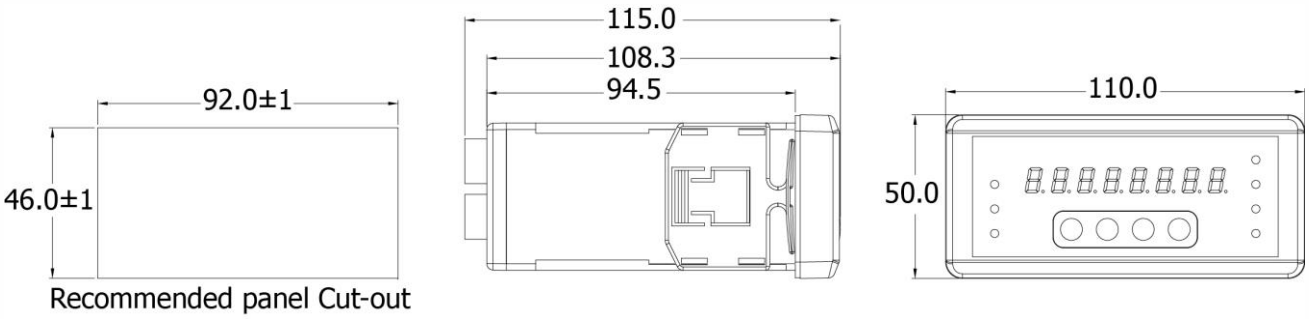
The instrument is no longer safe when,
a) Shows clear signs of damage
b) Does not work
c) Long storage under extreme conditions
d) Damage during shipment

3.2 Safety

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

3.2.1 Dimension and Latch

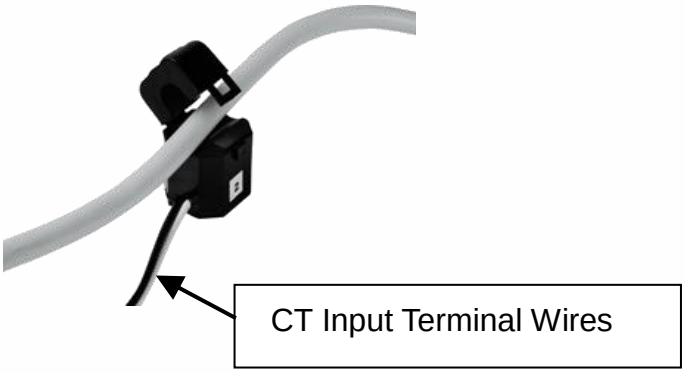
The diagrams below provide the dimensions of the PM-2133D0-RCT/PM-2133D to use in defining your enclosure specifications. Remember to leave room for potential expansion if you are using other components in your system.



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- Products come with external split type clip-on CT's. Disconnect the CT's or use other CT's is highly prohibited.
- Please read this operation manual carefully before using.
- Please re-confirm the measure position.
- Meter auxiliary power is +85 ~ +264 VAC (277 VAC available).
- Wire Disconnection:
  1. Open the CT clip to detach the CT, do not remove the CT terminal lines if possible
     Note: if you need to remove the terminal lines, always detach the CT before removing the CT terminal lines. Otherwise the CT may develop open-circuit secondary voltages which may be hazardous to personnel or damaging to the CT or equipment connected in the secondary circuit.
  2. Disconnect the voltage input wires from terminals and wrap the wire tips with plastic tape.
  3. Disconnect the communication wires from terminal.
  4. Disconnect the auxiliary power from terminal and wrap the wire tip with plastic tape.

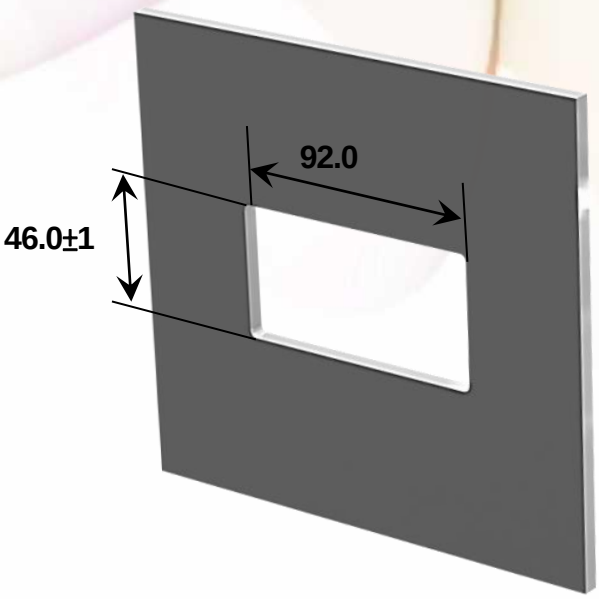


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3.2.2 Mounting

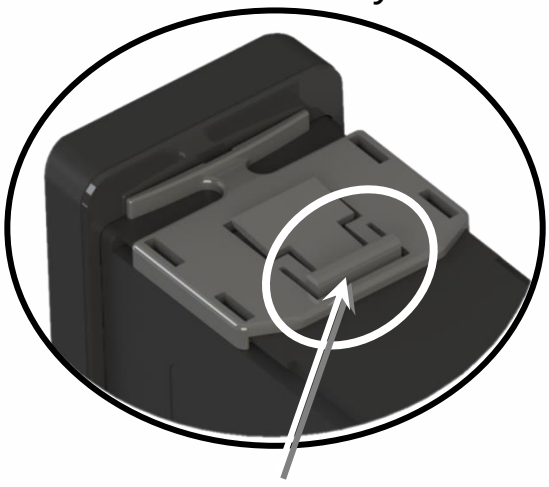
1. Prepare a panel and cut a hole to the specified size (unit: mm).



Panel thickness: 1 to 5 mm

2. Remove the latch assembly.

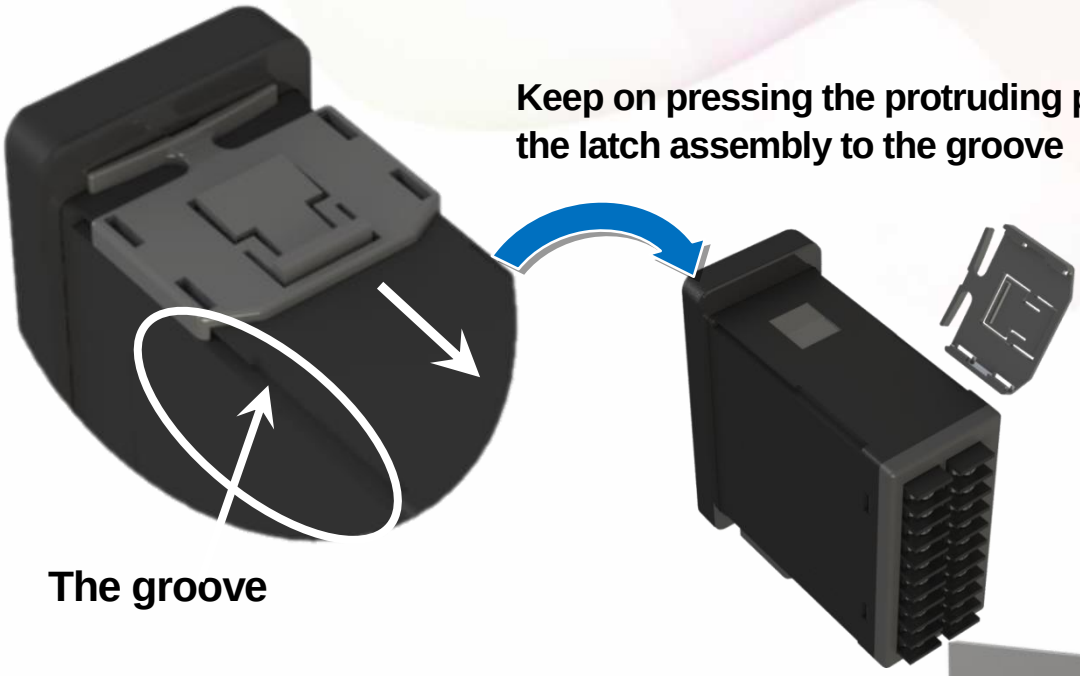
Press the protruding pin of the latch assembly.



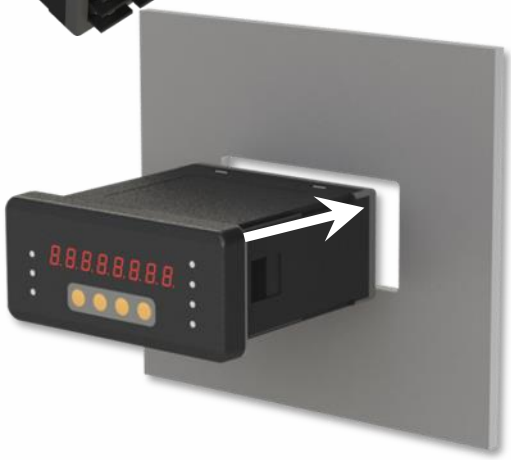
The protruding pin

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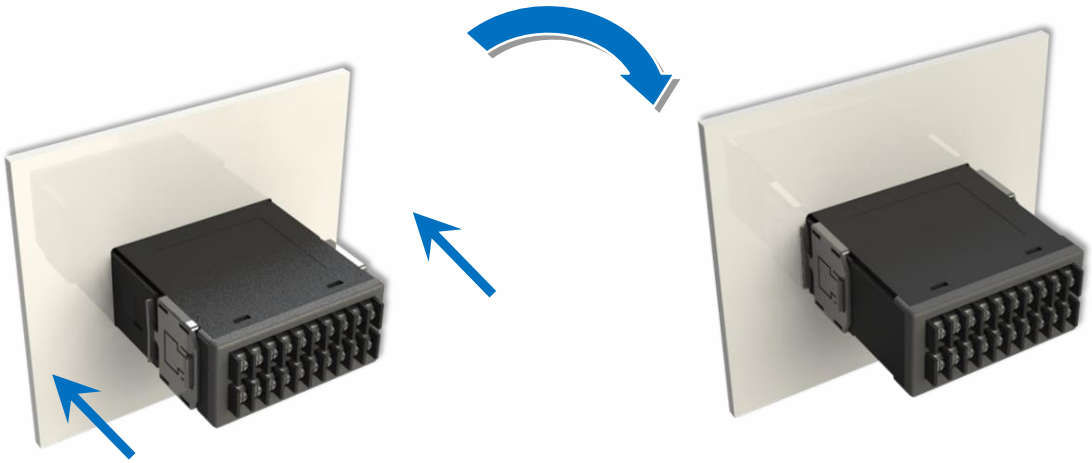


3. Attach the PM-2133D to the cut-out hole.



4. Attach the latch assembly, and then

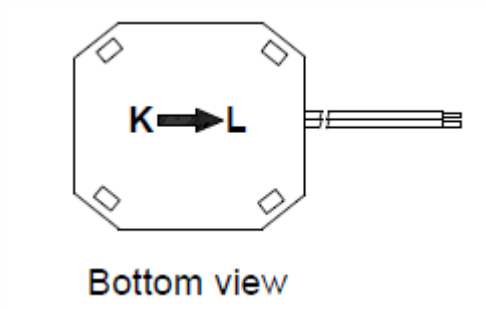
slide the latch assembly toward the panel.



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3.2.3 PM-2133D CT's installation steps



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



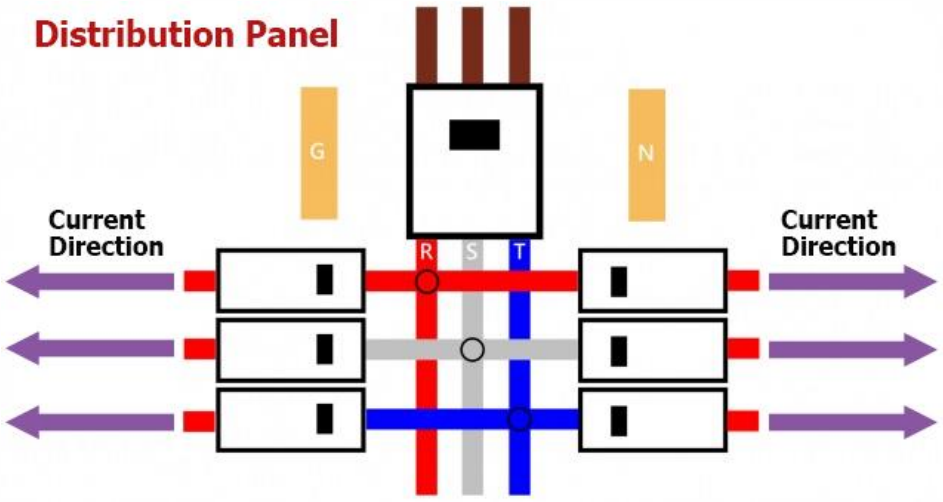
- Open the CT clip.



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



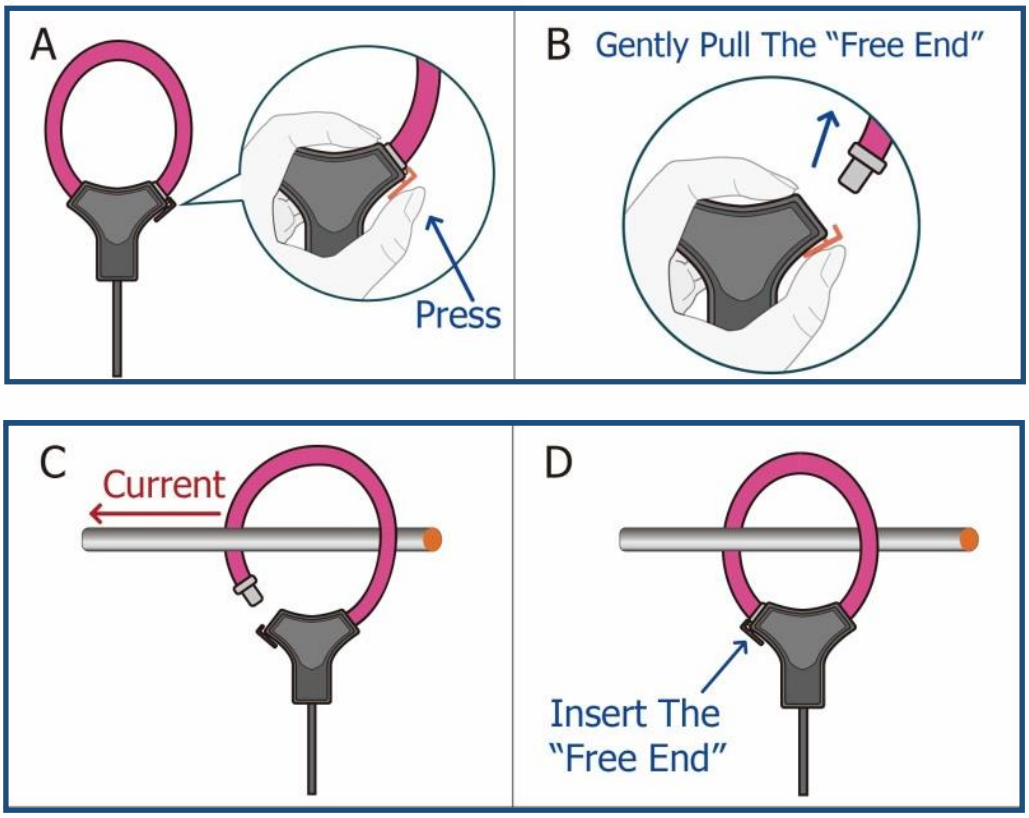
- Installation steps finished.



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3.2.4 PM-2133D-RCT CT's installation steps



Models	A (Inner Diameter)	B (Outer Diameter)
PM-2133D-RCT500P	55 mm	68 mm
PM-2133D-RCT1000P	80 mm	93 mm
PM-2133D-RCT2000P	105 mm	118 mm
PM-2133D-RCT4000P	185 mm	199 mm

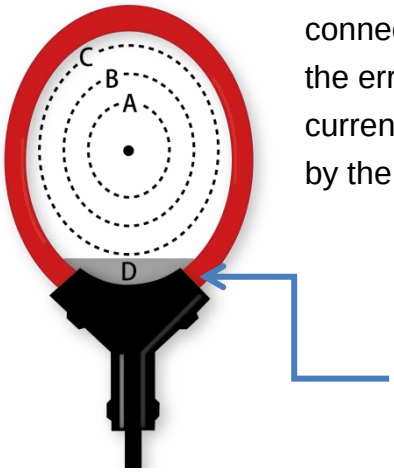
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3.2.5 Positional Accuracy

1. -500P:
   W Accuracy Better than 2% (PF=1; Input Current >50A; the “A” area).
   -1000P:
   W Accuracy Better than 2% (PF=1; Input Current >50A; the “A” area).
   -2000P:
   W Accuracy Better than 2% (PF=1; Input Current >200A; the “A” area).
   -4000P:
   W Accuracy Better than 2% (PF=1; Input Current >200A; the “A” area).

2. Due to small variations in the winding density and coil cross-sectional area the transducer output varies slightly depending on the position of the current within the coil loop.
   The diagram below shows the variation of accuracy throughout the coil. The variation is greatest when the current is positioned near the junction of the connecting cable and the coil, where there is some discontinuity, and the error here can be typically 5%. Since in most applications the current is distributed throughout a significant part of the area contained by the coil loop the reading will be very close to the calibration value.



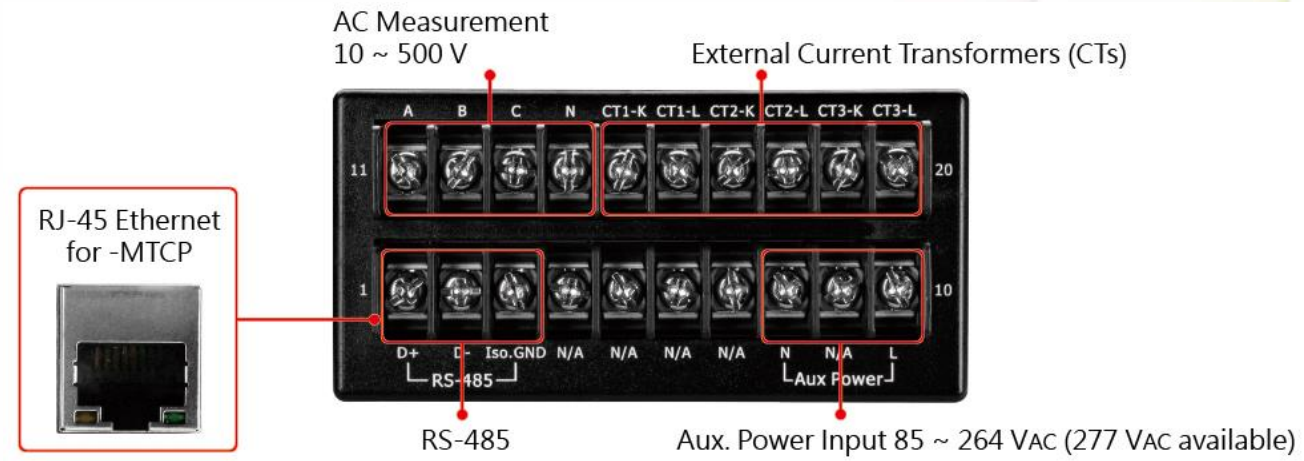
Type	A	B	C	D
Accuracy	2%	3%	5%	>5%
The current should not be positioned close to the coil-cable junction (shown by the “D” area) since the error for this region is greater.				

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Chapter 4 Wiring Diagrams

4.1 Connection



Please firstly check the current input terminal, and then in white black, white black, white black wire sequences (CT1-K, CT1-L, CT2-K, CT2-L, CT3-K, CT3-L). Then connect the CT's, and close the CT clip. Make sure the arrow direction sign on CT's follows current flow direction K **(W/R)**→L**(B)**.

Note: it must be in the same direction.
Connect the voltage input terminal N C B A. for PM-2133D/PM-2133D-RCT, in the three phase order as follows on N C B A.

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Voltage Input

1. PM-2133D/PM-2133D-RCT series: Input Voltage up to 500V.
   For any higher Input Voltage large than 500V, please add the PT (power transformer), and Change PT RATIO setup.
2. Confirm the RST (ABC) phase sequence.

Current Input

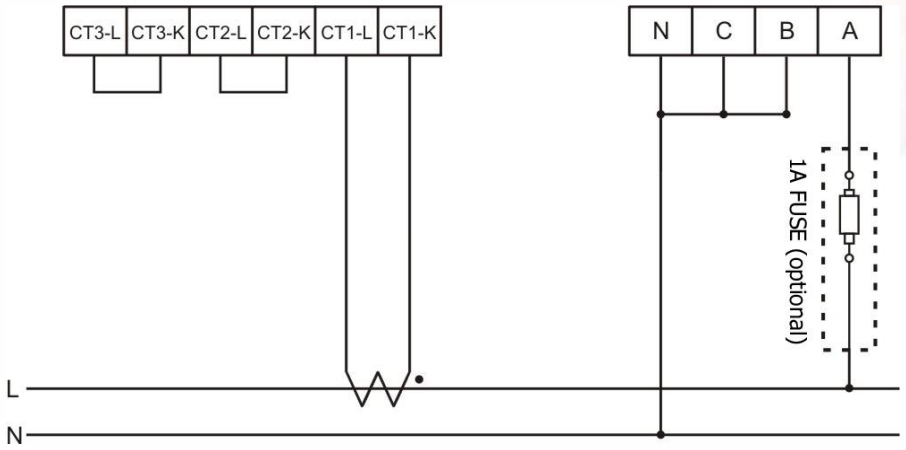
1. The external CT's are fragile, please handle with care.
2. The current input of PM-2133D/PM-2133D-RCT series is in mA range. Only the ex-factory attached CT's can be used. The other CT's, for example, from panel will damage the instrument due to its large current (around 5A)
3. When more than one smart meter (PM-2133D/PM-2133D-RCT series) are installed, please do not disconnect the CT with its original meter and mix use with each other. Since each set of smart meter (PM-2133D/PM-2133D-RCT series) and its attached split type clip-on CT are calibrated set by set. The mix use may cause wrong measurements.
4. To install CT's correctly, please ensure the CT lines sequences is right before clip the CT's onto the power cable of the monitoring equipment. (Detail will be found in next section)
5. **When measuring the current, the secondary circuit of a CT should never be opened when a load is passing through its primary. Make sure you always open the CT clip to detach the CT before removing the terminal lines. Otherwise, it will cause severe injury.**
6. Please handle with extra care, especially when the operation space of CT's is limited.
7. The current direction must follow K-L marked on CT's.
8. Please select the right size CT's for different size of monitoring equipment cables: power cable diameter ＜Φ10 use 60A CT，Φ10～Φ16 use 100A CT，Φ16～Φ24 use 200A CT，Φ36 use 300A CT，Φ36 use 400A CT, Φ55 use RCT500P CT, Φ80 use RCT1000P CT, Φ105 use RCT2000P CT, , Φ185 use RCT4000P CT.
9. The maximum current value cannot exceed the CT rating

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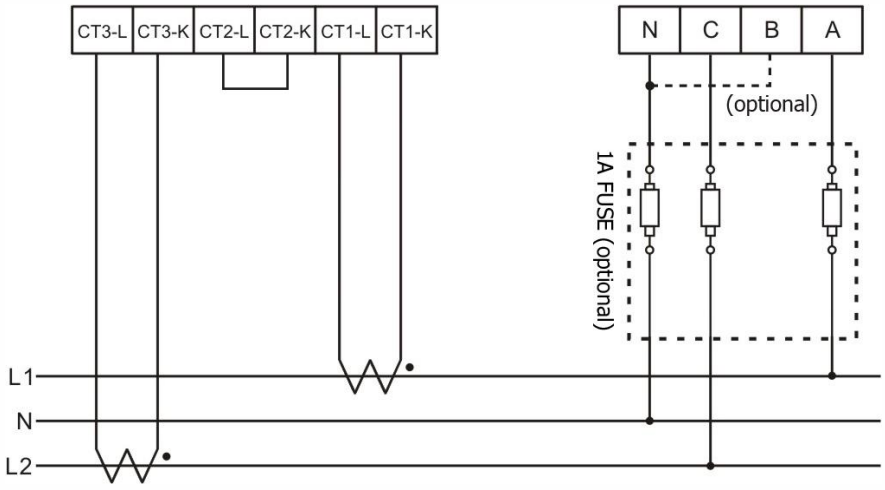
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4.2 Wiring

- 1P2W-1CT



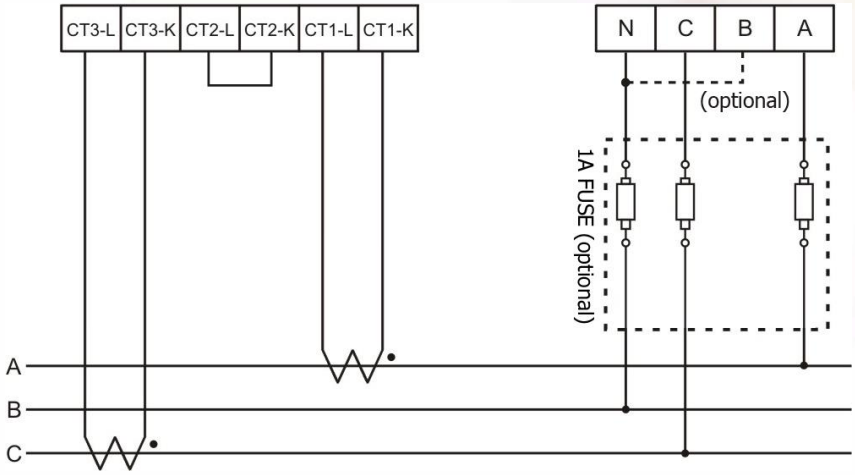
- 1P3W-2CT



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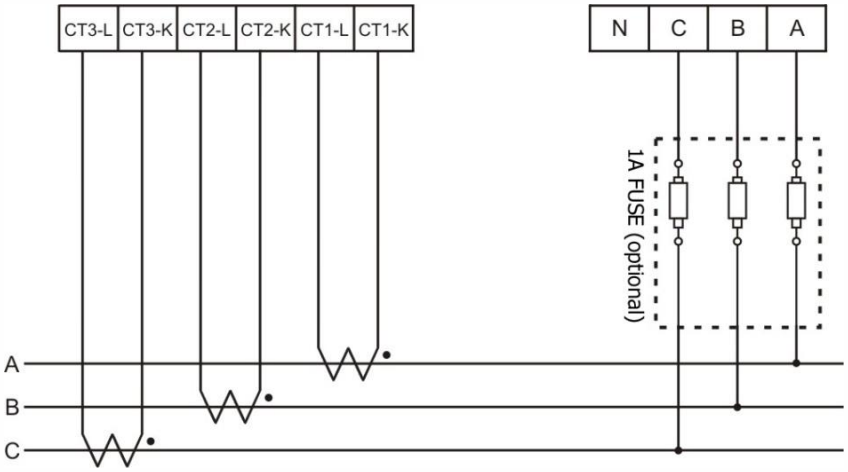
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- 3P3W-2CT

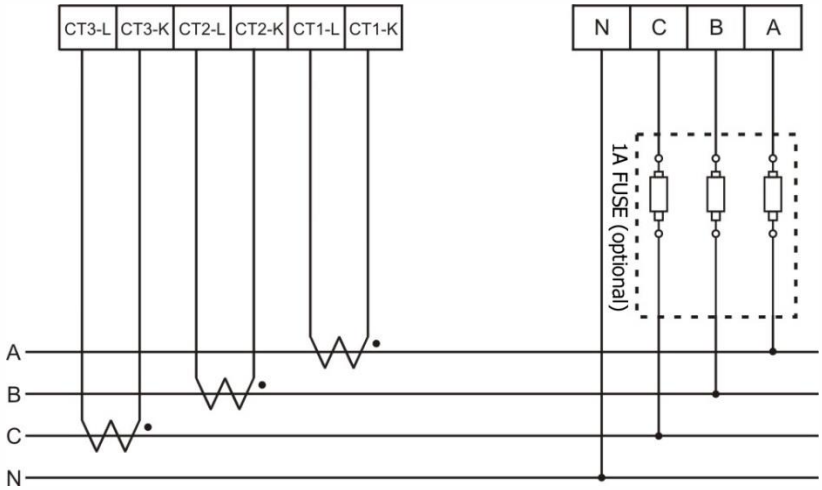


(Note: If phase B is in a floating state, it may pick up induced voltage signals.
To avoid this, phase B can be connected to the neutral (N) line.)

- 3P3W-3CT



- 3P4W-3CT



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Chapter 5 Keypad, LED Indicator & Display

5.1 Function of LED Display, Indicator and Keypad

PM-2133D has a built-in 8-Digit LED Display to display the power data measured by the meters. The 7 LED Indicators are used to indicate the type of the power data which are currently shown on the 8-Digit LED Display, and the status of RS-485 communication(Tx/Rx).



PM-21333D also has a built-in four buttons of keypad which is used to adjust the power data which is currently shown on the LED Display or the parameters setting of PM-2133D.

Keypad	Function
▲	Move to next item be shown or decrease the settings of parameters
▼	Move to previous item be shown or increase the settings of parameters
Enter	Change LED Display to "Setup Mode" or enable the modification of parameters
Exit	Change LED Display to "Normal Mode" or disable the modification of parameters

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5.2 Operation of LED Display, Indicator and Keypad

With the built-in LED Display, Indicator and Keypad, PM-2133D can display the real-time power data it measures. User can also change the setting of the power meter. The following sections describe the features provided.

5.2.1 Normal Mode

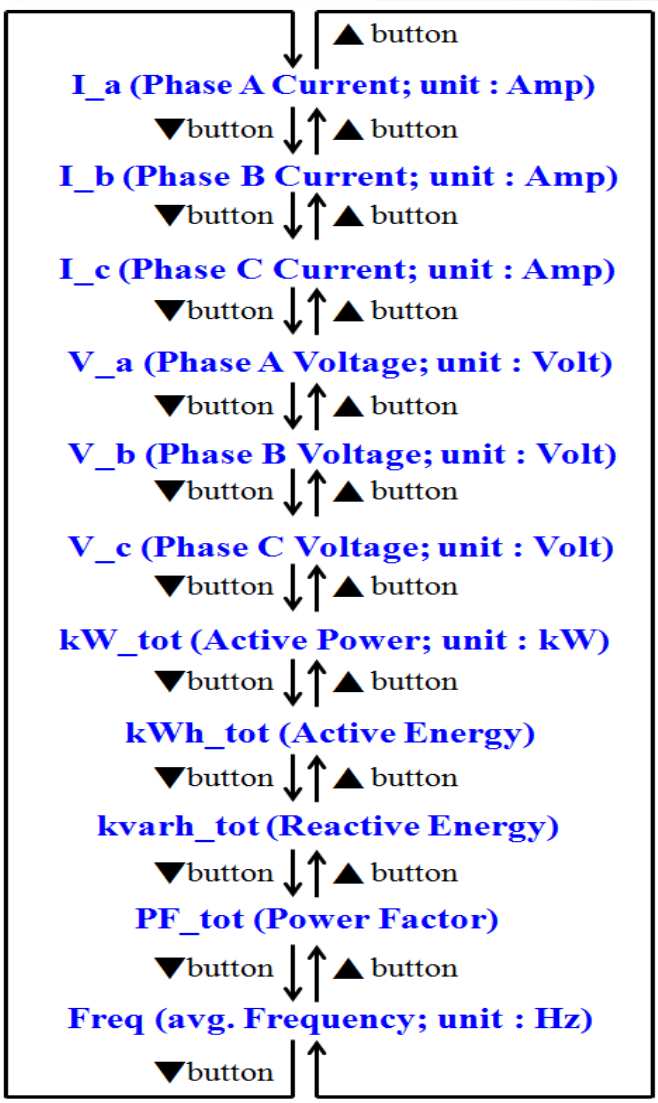
After power up PM-2133D, the default power data shown is power data of I_a (Phase A Current). User can press the "▲" button and "▼" button of the Keypad to select the desired power data to be displayed on PM-2133D. The corresponding LED Indicator of the power data selected will also be in "ON" status - lights up in red.



The power data provided by PM-2133D will be displayed circularly in the sequence as below:

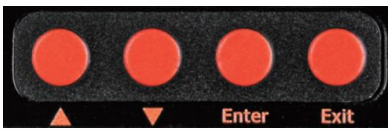
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5.2.2 Setup Mode

User can press the buttons of Keypad to enter the Setup Mode to adjust the parameters setting of PM-2133D. The steps are as below:



i. Press the "Enter" button to enter the Setup mode, all the LED Indicators of PMD-2133D will be in "ON" status, and the LED Display panel will display 8.8.8.8.8.8.8.8.

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ii. Press the "▲" button and "▼" button of the Keypad to select the parameter of PM-2133D to be modified. The settings of parameters provided by PM-2133D will be shown in sequence as below:.

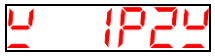
-  : LED Segment check (read only, cannot be modified)
-  : Firmware version (read only, cannot be modified).
-  : Modbus Address setting.
  - Press the "Enter" button, the current address setting will blink.
  - Press the "▲" button and "▼" button to adjust the setting of address. The range is from 1 to 64.
-  : Modbus Baudrate setting.
  - Press the "Enter" button, the current Baudrate setting will blink.
  - Press the "▲" button and "▼" button to adjust the Baudrate setting. There are 4 options : 9600(), 19200( ), 38400( ) and 115200() for selection.
-  : Modbus Data Format setting.
  - Press the "Enter" button, the current Data Format setting will blink.
  - Press the "▲" button and "▼" button to adjust the Data Format setting. There are 6 options: 8N1(; 8 data bits, None Parity, 1 stop bits), 8O1 (; 8 data bits, Odd Parity, 1 stop bits;), 8E1(; 8 data bits, Even Parity, 1 stop bits), 8N2(; 8 data bits, None Parity, 2 stop bits), 8O2 (; 8 data bits, Odd Parity, 2 stop bits;) and 8E2(; 8 data bits, Even Parity, 2 stop bits) for selection.
-  : PT ratio setting. The range is from 0.01 to 655.35.
  - Press the "Enter" button, the hundreds digit of the PT ratio will blink. Press the "▲" button and "▼" button to adjust the setting of hundreds digit.
  - After completing the setting of hundreds digit, press the "Enter" button, the tens digit of the PT ratio will blink. Press the "▲" button and "▼" button to adjust the setting of tens digit.
  - After completing the setting of tens digit, press the "Enter" button, the units digit of the PT ratio will blink. Press the "▲" button and "▼" button to adjust the setting of units digit.

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- After completing the setting of units digit, press the "Enter" button, the tenths digit of the PT ratio will blink. Press the "▲" button and "▼" button to adjust the setting of tenths digit.
- After completing the setting of tenths digit, press the "Enter" button, the hundredths digit of the PT ratio will blink. Press the "▲" button and "▼" button to adjust the setting of hundredths digit.

-  : CT ratio setting. The range is from 1 to 65535.
  - Press the "Enter" button, the ten thousands digit of the CT ratio will blink. Press the "▲" button and "▼" button to adjust the setting of ten thousands digit.
  - After completing the setting of ten thousands digit, press the "Enter" button, the thousands digit of the CT ratio will blink. Press the "▲" button and "▼" button to adjust the setting of thousands digit.
  - After completing the setting of thousands digit, press the "Enter" button, the hundreds digit of the CT ratio will blink. Press the "▲" button and "▼" button to adjust the setting of hundreds digit.
  - After completing the setting of hundreds digit, press the "Enter" button, the tens digit of the CT ratio will blink. Press the "▲" button and "▼" button to adjust the setting of tens digit.
  - After completing the setting of tens digit, press the "Enter" button, the units digit of the CT ratio will blink. Press the "▲" button and "▼" button to adjust the setting of units digit.

-  : Wiring mode setting.
  - Press the "Enter" button, the current Wiring mode setting will blink.
  - Press the "▲" button and "▼" button to adjust the Wiring mode setting. There are 5 options: 1P2W(), 1P3W(), 3P3W2CT (), 3P3W3CT() and 3P4W3CT() for selection.

-  : Display Voltage setting.
  - Press the "Enter" button, the current Display Voltage setting will blink.
  - Press the "▲" button and "▼" button to adjust the Display Voltage setting. There are 3 options: Automatic(), "Show as Vln" () and "Show as Vll" () for selection. Please refer to the Q12 of "Appendix 1: Questions & Answers" section before change the setting of Display Voltage.

iii. After completing the setting, press the "Enter" button to save the new setting.

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iv. Repeat Step ii~iii to complete all parameter settings.

v. After all parameter settings are completed, press the "Exit" button to return the Normal Mode.

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Chapter 6 Modbus-RTU communication

6.1 RS-485 setting

About the Modbus Baudrate setting, Modbus Data Format setting and Modbus Address setting, Please refer to "5.3.2 Setup Mode" section for detail.

- The default setting for RS-485: **19200, n, 8, 1**
- The default setting for Modbus Address: **1**

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, Odd Parity or Even Parity, 1 stop bits or 2 stop bits Error Check： Cyclical Redundancy Check (CRC)
Baud Rate	9600, 19200 (Default), 38400, 115200
Modbus slave address	1-64 (Default = 1)

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

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

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

- **Data format**

  Integer：16 bits with sign, each with 1 register

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

  Float：IEEE 754 Format ，each with 2 registers

  Low word is first priority while transmit

IEEE 754 Format

Definition of the floating format of the Bits

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

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

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

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

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

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

Transfer sequence (Float)

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

Transfer sequence (Inverse Integer)

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

Transfer sequence (Integer)

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

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6.2.2 Modbus Register

- Modbus Table #1 – N/A

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

Parameter name	Modbus Register		Len	Data Type	Range	Default value	Units	Comment
	Modicom Format	Hex						
PT_Ratio	44100	0x1003	Word	UInt	1-65535	100	0.01	Only work for RS-485 Interface
CT_Ratio	44101	0x1004	Word	UInt	1-65535	1		Only work for RS-485 Interface
Wiring Mode	44107	0x100A	Word	UInt	1: 1P2W 2: 1P3W 3: 3P3W2CT 4: 3P3W3CT 5: 3P4W3CT	5		
Set Energy to Zero	44108	0x100B	Word	UInt	0x0055			Only Write
Reset to Factory Settings	44109	0x100C	Word	UInt	0x0055			Only Write, Re-power the module after setting
Default Frequency	44110	0x100D	Word	UInt	0x0055: Auto 0x0064: 50Hz 0x0078: 60Hz	0x0055		Re-power the module after setting or changing the frequency
Energy Absolute Accumulated Mode	44113	0x1010	Word	UInt	0: Enable 1: Disable	0		
Harmonic Phase Select	44114	0x1011	Word	UInt	0: Disable 1: Phase A 2: Phase B 3: Phase C	0		

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Display Voltage	44115	0x1012	Word	UInt	0: Default 1: Show as Vln 2: Show as Vll	0		Refer to Q12
Baud rate	44127	0x101E	Word	UInt	0: 9600 1: 19200 2: 38400 3: 115200	19200		
Modbus ID	44128	0x101F	Word	UInt	1-64	1		

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- Modbus Table #3 — Input Register : System Information

Parameter name	Modbus Register		Len	Data Type	Range	Default value	Units	Comment
	Modicom Format	Hex						
Wiring Type	30513	0x0200	Word	UInt	9: 1P2W 10: 1P3W 11: 3P3W2CT 12: 3P3W3CT 13: 3P4W	13		
Phase Sequence	30514	0x0201	Word	UInt	0: Negative (ACB) 1: Positive (ABC)			Only work when 3P4W
Model Name	30515	0x0202	Word	UInt	21330: PM-2133D	21330		
Model Type	30516	0x0203	Word	UInt	0x0001: 50Hz 0x0002: 60Hz	0x0002		
Firmware Version	30517	0x0204	Word	BCD		0x0100		Ver. 1.0

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

Parameter name	Modbus Register		Len	Data Type	Range	Units	Comment
	Modicom Format	Hex					
V_a	34353-34354	0x1100-0x1101	DWord	Float		Volt	Refer to Q12
I_a	34355-34356	0x1102-0x1103	DWord	Float		Amp	
kW_a	34357-34358	0x1104-0x1105	DWord	Float		kW	
kvar_a	34359-34360	0x1106-0x1107	DWord	Float		kvar	
kVA_a	34361-34362	0x1108-0x1109	DWord	Float		kVA	
PF_a	34363-34364	0x110A-0x110B	DWord	Float			
kWh_a	34365-34366	0x110C-0x110D	DWord	Float			
kvarh_a	34367-34368	0x110E-0x110F	DWord	Float			
kVAh_a	34369-34370	0x1110-0x1111	DWord	Float			
V_b	34371-34372	0x1112-0x1113	DWord	Float		Volt	Refer to Q12
I_b	34373-34374	0x1114-0x1115	DWord	Float		Amp	
kW_b	34375-34376	0x1116-0x1117	DWord	Float		kW	
kvar_b	34377-34378	0x1118-0x1119	DWord	Float		kvar	
kVA_b	34379-34380	0x111A-0x111B	DWord	Float		kVA	
PF_b	34381-34382	0x111C-0x111D	DWord	Float			
kWh_b	34383-34384	0x111E-0x111F	DWord	Float			
kvarh_b	34385-34386	0x1120-0x1121	DWord	Float			
kVAh_b	34387-34388	0x1122-0x1123	DWord	Float			
V_c	34389-34390	0x1124-0x1125	DWord	Float		Volt	Refer to Q12
I_c	34391-34392	0x1126-0x1127	DWord	Float		Amp	
kW_c	34393-34394	0x1128-0x1129	DWord	Float		kW	
kvar_c	34395-34396	0x112A-0x112B	DWord	Float		kvar	
kVA_c	34397-34398	0x112C-0x112D	DWord	Float		kVA	
PF_c	34399-34400	0x112E-0x112F	DWord	Float			
kWh_c	34401-34402	0x1130-0x1131	DWord	Float			
kvarh_c	34403-34404	0x1132-0x1133	DWord	Float			
kVAh_c	34405-34406	0x1134-0x1135	DWord	Float			
V_avg	34407-34408	0x1136-0x1137	DWord	Float		Volt	
I_avg	34409-34410	0x1138-0x1139	DWord	Float		Amp	
kW_tot	34411-34412	0x113A-0x113B	DWord	Float		kW	
kvar_tot	34413-34414	0x113C-0x113D	DWord	Float		kvar	
kVA_tot	34415-34416	0x113E-0x113F	DWord	Float		kVA	

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PF_tot	34417-34418	0x1140-0x1141	DWord	Float			
kWh_tot	34419-34420	0x1142-0x1143	DWord	Float			
kvarh_tot	34421-34422	0x1144-0x1145	DWord	Float			
kVAh_tot	34423-34424	0x1146-0x1147	DWord	Float			
Freq_a	34425-34426	0x1148-0x1149	DWord	Float	45~65	Hz	
Freq_b	34427-34428	0x114A-0x114B	DWord	Float	45~65	Hz	
Freq_c	34429-34430	0x114C-0x114D	DWord	Float	45~65	Hz	
Freq_max	34431-34432	0x114E-0x114F	DWord	Float	45~65	Hz	
VTHD	34459-34460	0x116A-0x116B	DWord	Float			Phase set by **Harmonic Phase Select** Register
ITHD	34461-34462	0x116C-0x116D	DWord	Float			
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 Table #5 – Input Register :Power value (Inverse Integer)

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

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

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

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

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kVA_tot	34924-34925	0x133B-0x133C	DWord	Int32		0.1kVA	
PF_tot	34926	0x133D	Word	Int	0~1000	0.001PF	0~1.000
kWh_tot	34927-34928	0x133E-0x133F	DWord	Int32	±0~99999999	0.1kWh	±0~9999999.9
kvarh_tot	34929-34930	0x1340-0x1341	DWord	Int32	±0~99999999	0.1kvarh	±0~9999999.9
kVAh_tot	34931-34932	0x1342-0x1343	DWord	Int32	0~99999999	0.1kVAh	0~9999999.9
Freq_a	34933	0x1344	Word	Int	45~65	1Hz	45~65
Freq_b	34934	0x1345	Word	Int	45~65	1Hz	45~65
Freq_c	34935	0x1346	Word	Int	45~65	1Hz	45~65
Freq_max	34936	0x1347	Word	Int	45~65	1Hz	45~65

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Appendix 1: Questions & Answers

Q1. Can we use the other 5A CT's (like 300/5) to directly connect to the input current terminals of PM-2133D series?

No, because the input current is only mA size on PM-2133D series，definitely not to directly use other 5A CT's to connect and apply（like100/5…），It could causes the fetal damages. Users can use the PM-2133D series attached split type clip-on CT to connect the other CT's secondary test 5A current.

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

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

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

The measure data will be not accuracy as before, please do not use any more.
You need the new CT.

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

Please do not mix use，because each set of smart meter(PM-2133D series) and its attached split type clip-on CT are calibrated set by set. The mix use may cause the wrong measurements.

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

(1) First check the current input end – line terminal, （check the connection should be **CT1-K, CT1-L, CT2-K, CT2-L, CT3-K, CT3-L**），base on white black, white black, white black follow the sequence order

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

(3) Incorrect voltage or current wiring sequence may lead to phase angle calculation errors, causing the power meter to misinterpret the direction of power flow. This may also result in an abnormally low Power Factor (PF) reading.

Q6. PC and meter cannot make the connection with RS-485？

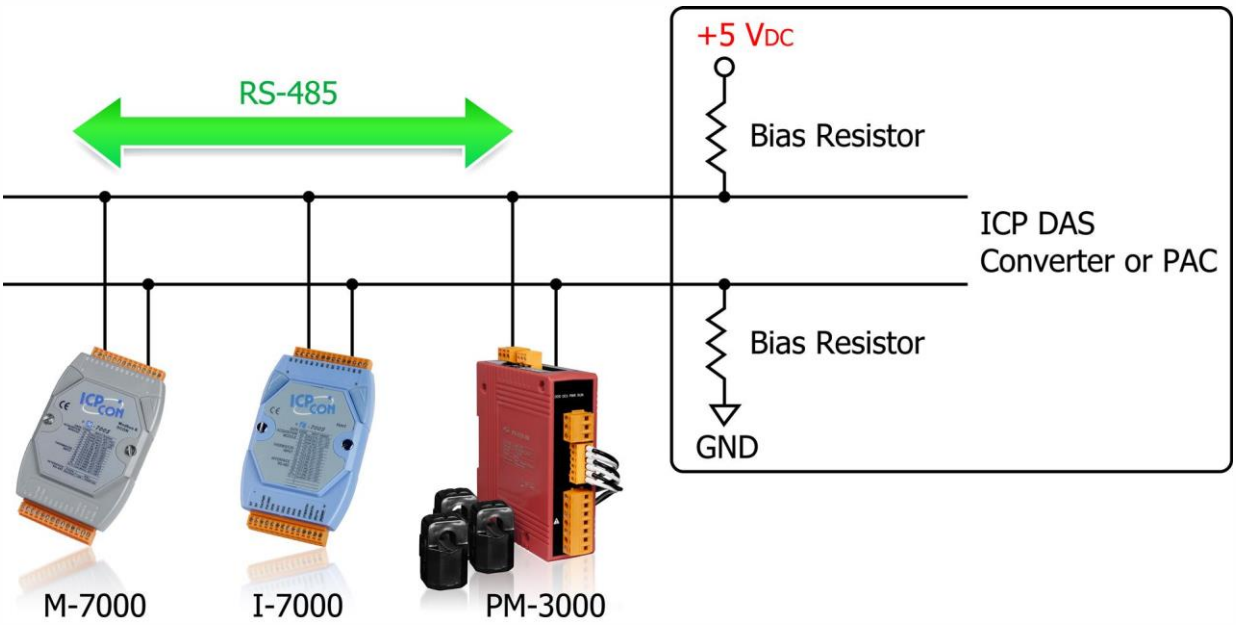
(1) Confirm the Modbus Address, default is 1.

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

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

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

(5) Confirm the RS-485 master have to provide the bias for PM-2133D-RCT/PM-2133D series. Otherwise, the tM-SG4 or SG-785 should be added to provide the bias. All ICP DAS controllers and converters provide the bias.



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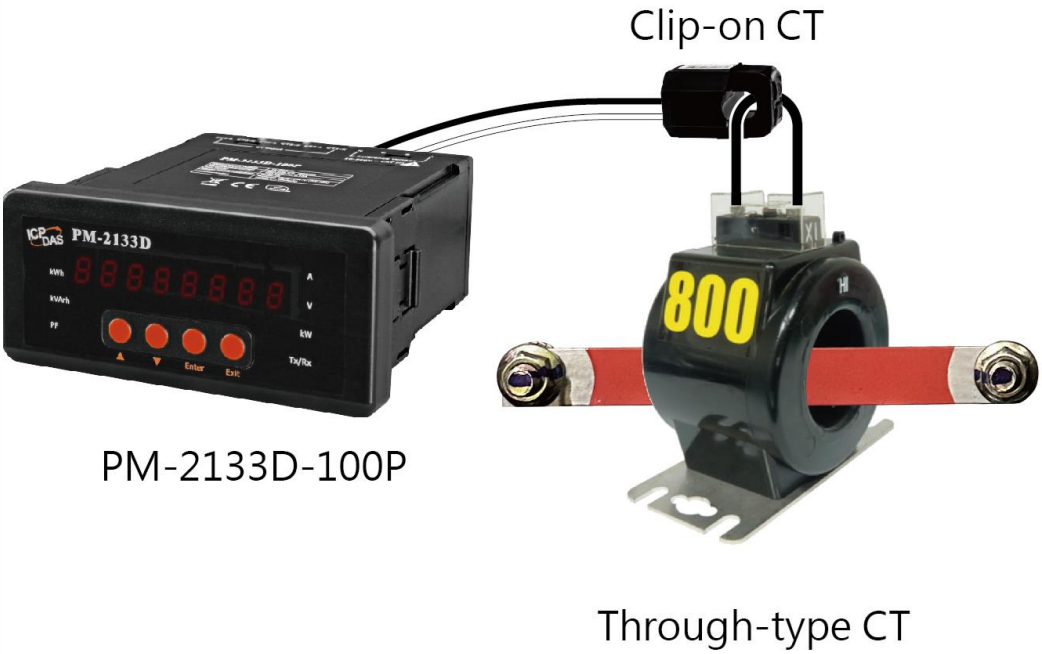
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Q7. How to measure the current larger than 400A?

The CT of PM-2133D maximum range is 400A. If the target is more than 400A, we suggest the solution as follow.

(1) Please consider selecting PM-2133D-RCT500P / PM-2133D-RCT1000P / PM-2133D-RCT2000P / PM-2133D-RCT4000P.

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



Note:

A. Primary CT accuracy will influence the measurement.

B. Even primary CT output current max is 5A, please don't wire to PM-2133D and PM-2133DP directly.

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Q10. Can I use CT's that I currently own with PM-2133D Power Meter?

You can use CT's that you currently own with PM-2133DP (without CTs) Power Meter. The CT inputs of the PM-2133DP can handle a maximum of 333mV **(Rogowski coils are not supported)** of AC current.

PM-2133DP's current ratio is always full scale to 5A.

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 (PM-2133DP)		Current transformer	CT Ratio (PM-2133DP)
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. Primary CT accuracy will influence the measurement.

C. PM-2133DP 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.

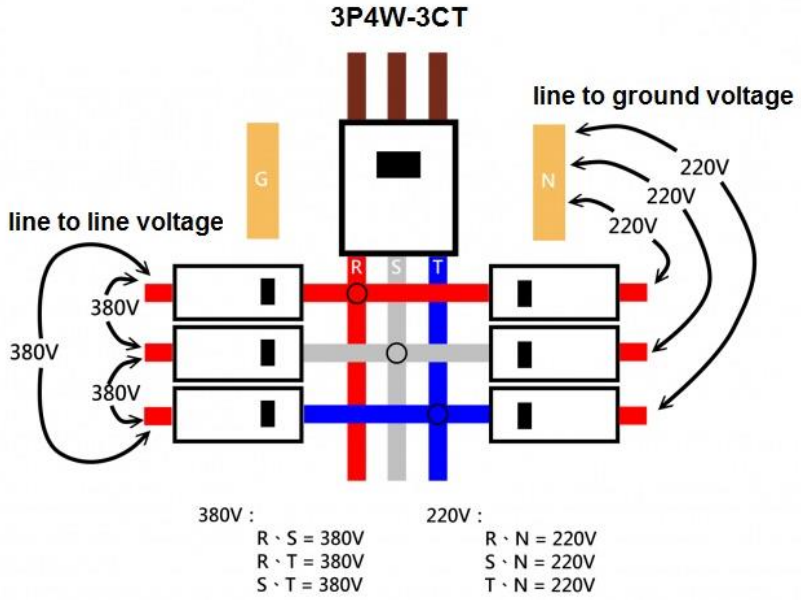
D. This meter requires external CT(s) to operate:
1P2W-1CT requires 1 CT per meter.
3P3W-2CT/1P3W-2CT requires 2 CTs per meter.
3P4W-3CT/3P3W-3CT requires 3 CTs per meter.

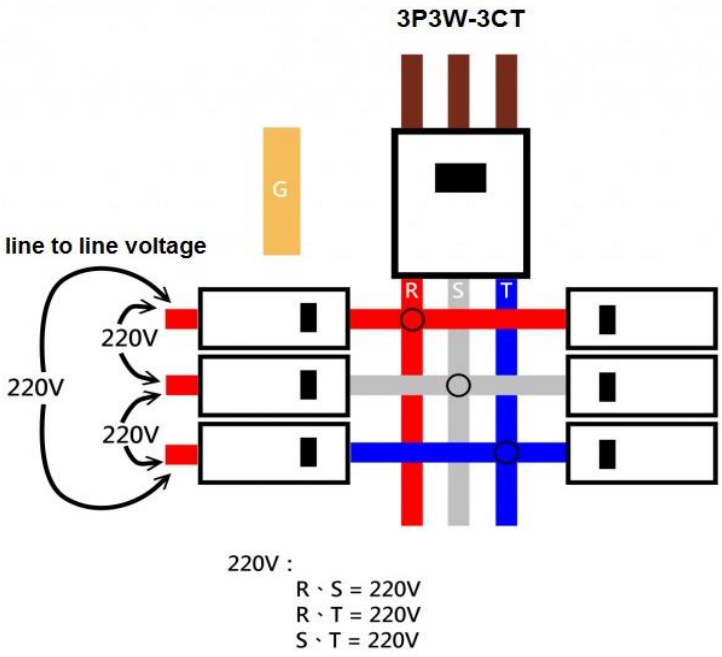
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Q11. What is the difference between line to line voltages to line to ground voltage?

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





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Q12. How to set up [Display Voltage] register value to correctly display line to ground voltage or line to line voltage?

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

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

Q13. How about the harmonic (THD) analysis capability?

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

N = [2800/f], N ≤ 63

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Q14. How to measure the Voltage large than 500V?

For service voltage above 600 Vac, voltage transformers (PTs) are used to step down the voltage to a lower range that will work with a PM-2133D/PM-2133D-RCT meter.



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

Input Voltage:
Select a transformer that will operate on the supply voltage available at your facility (Example: PRI. Voltage 720V; SEC. Voltage 120V). Check the connection diagram (three-phase Y and delta; phase sequence) to ensure compatibility.
Adding potential transformers has the effect of reducing the measured line voltage by the PT ratio (let's say 6:1 for this example). So a voltage of 720 Vac becomes 120 Vac. Since the meter sees 120 Vac, many of the measurements it reports will be low by a factor of 6 unless they are scaled up by 6.

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

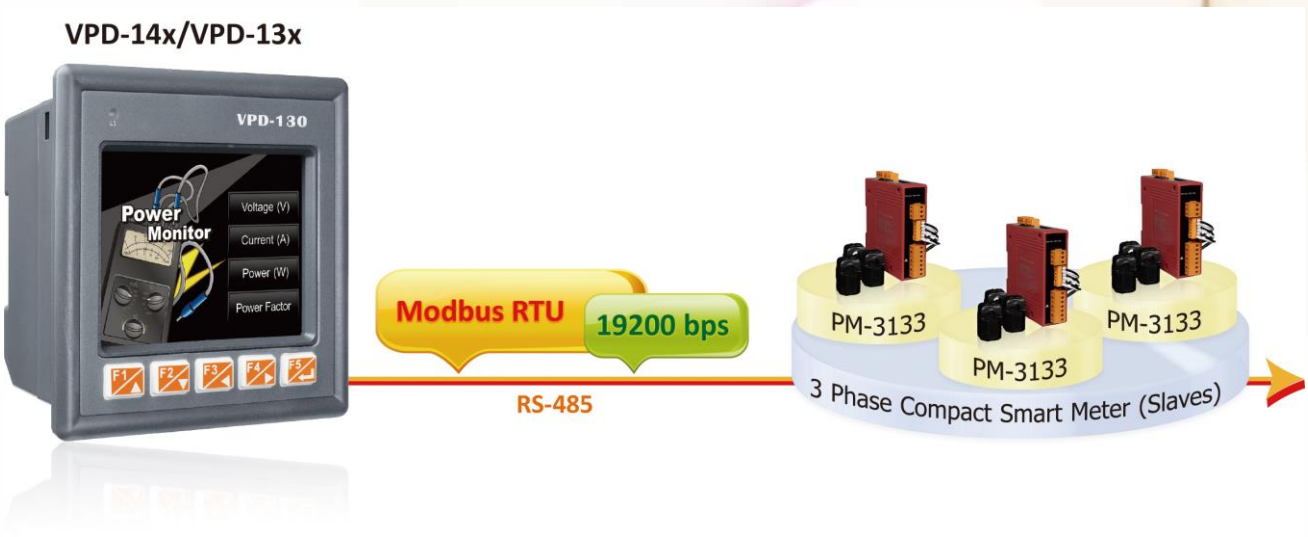
Accuracy: Transformer (PT) accuracy (Example: 1% or 3%) will influence the measurement.
Rated Output (VA): Example: 150 VA (50VA per phase).

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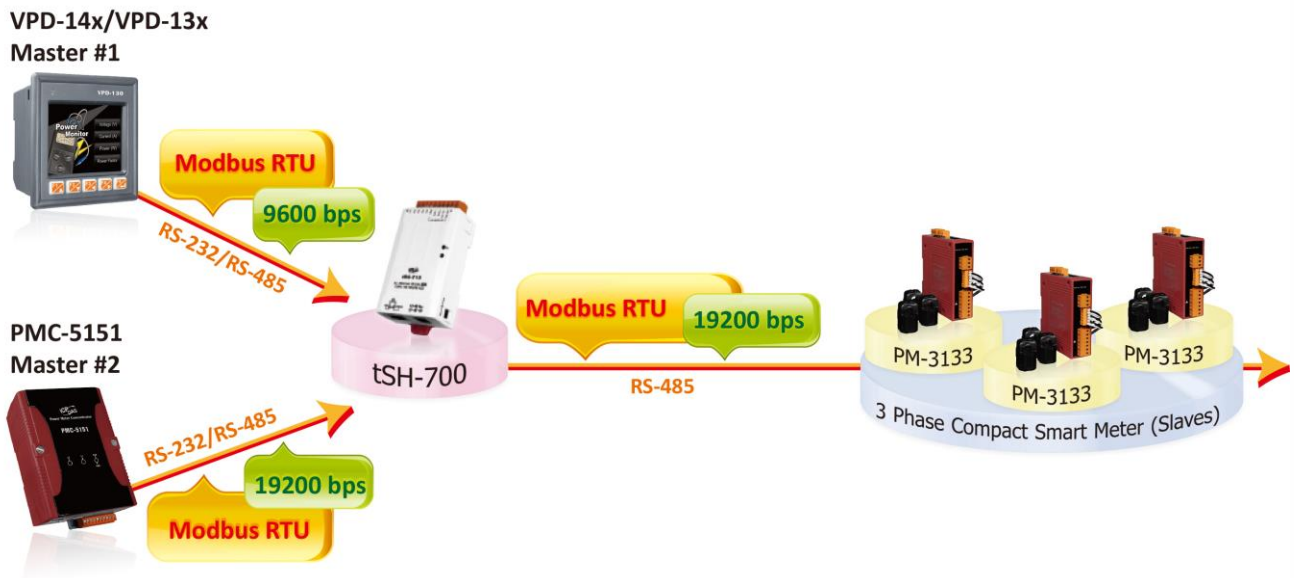
Q15. The Power Meter can be connected to a remote display (via RS-485).

A: Power Meter can be connected to VPD-13x or VPD-14x series via RS-485:



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

This function allows two master devices connected to different serial ports to share slave devices. Modbus mode can be used to convert the Modbus RTU/ASCII protocols, while raw data mode can be used for DCON or other query-response protocols. Different baud rates and data formats can also be used on the different serial ports. The built-in cache function reduces the loading of serial communication on the slave port by removing duplicated queries when the two master devices are requesting the same information.



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