PM-5133/
PM-5133P/
PM-5133-RCT

Smart Power Meter

User's Manual



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Revision History

The table below shows the revision history:

Revision	Date	Description
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ICP DAS Co., Ltd.

PM-5133/PM-5133P/PM-5133-RCT

User's Manual

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1.Introduction

1.1. PM-5133/PM-5133P/PM-5133-RCT Introduction

The **PM-5133 series** is a touch-type 3-phase smart meter designed for industrial automation and energy management. Equipped with a 3.5” high-resolution color TFT touch screen, it allows users to intuitively monitor power information and manage demand to meet contracted capacity requirements for carbon inventory and ISO-50001 energy management.

This product provides a comprehensive range of power measurement functions, including:

- Voltage measurement up to 500 VAC
- Clip-on CT support (various types, input current up to 4000 A depending on model)
- Bi-directional kWh measurement
- True RMS measurement
- Multi-wiring energy analysis
- Power measurement with accuracy
    - better than 0.5% (PM-5133-xxxP @ PF=1)
    - better than 2% (PM-5133-RCTxxxP @ PF=1)
- THD (Total Harmonic Distortion) measurement for high-precision energy monitoring

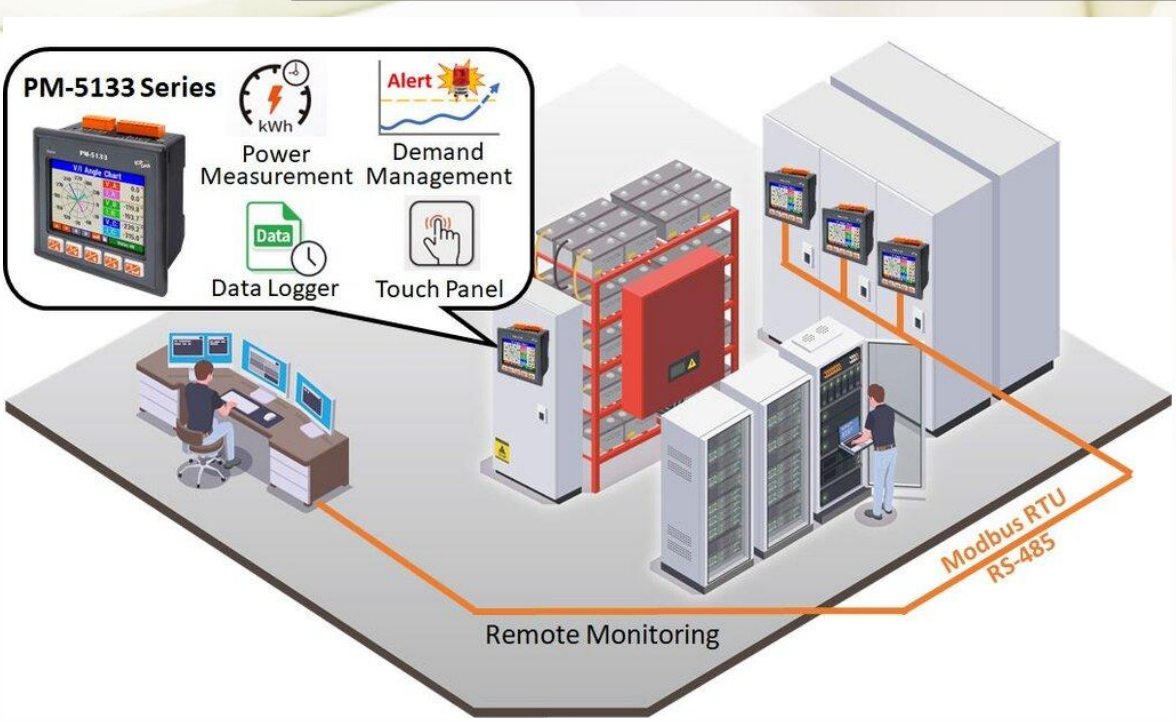
In addition, the PM-5133 series supports:

- Time-stamped power information logging
- 1-hour demand trend display and contracted capacity alarms with relay output linkage
- Display of up to 32 event and alarm messages

These features enable accurate demand forecasting and flexible integration into remote monitoring systems.

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Features：

- Bi-directional Energy
- True RMS measurements
- Energy Analysis for 3P4W, 3P3W, 1P3W, 1P2W
- Power Measurement Accuracy

  PM-5133P Series: Accuracy is approximately 2–5% (PF = 1), depending on the CT used. The CT ratio must be set correctly.

  PM-5133-xxxP Series: Accuracy better than ±0.5% (Power Factor = 1)

  PM-5133-RCTxxxP Series:

  -500P and -1000P models: Accuracy better than ±2% (PF = 1, Input Current > 50 A)

  -2000P and -4000P models: Accuracy better than ±2% (PF = 1, Input Current > 200 A)
- Total Harmonic Distortion (THD)
- 3.5” High-resolution color touch screen
- Provides time-stamped power information logging function.
- 1-hour demand trend display and contracted capacity warning
- 2 Power Relay outputs triggered by defined alarm
- Supports display of up to 32 alarms or events

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1.2.  Safety Guidelines

The PM-5133/PM-5133P/PM-5133-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 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-5133/PM-5133-RCT is not a user-serviceable product. Any attempt to disassemble or repair the device will void the warranty.

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2. Specifications

Model	PM-5133/PM-5133-RCT
AC Power Measurement	
Wiring	1P2W-1CT, 1P3W-2CT, 3P3W-2CT, 3P3W-3CT and 3P4W-3CT
Measurement Voltage	10 to 500 V (CAT III)
Measurement Current	PM-5133-005P: CTØ10 mm (0.05 A ~ 5 A) PM-5133-100P: CTØ10 mm (0.05 A ~ 60 A) PM-5133-160P: CTØ16 mm (0.1 A ~ 100 A) PM-5133-240P: CTØ24 mm (0.15 A ~ 200 A) PM-5133-360P: CTØ36 mm (0.3 A ~ 300 A) PM-5133-400P: CTØ36 mm (0.3 A ~ 400 A) PM-5133-RCT500P: CTØ55 mm (5 A ~ 500 A) PM-5133-RCT1000P: CTØ80 mm (5 A ~ 1000 A) PM-5133-RCT2000P: CT105 mm (5 A ~ 2000 A) PM-5133-RCT4000P: CTØ185 mm (5 A ~ 4000 A) PM-5133P Supports 333 mV output CTs; actual current range depends on CT's primary rating. **Please refer to Appendix for more details.**
Measurement Frequency	50 Hz/60 Hz
W Accuracy	**PM-5133 Series:** For -005P models: Accuracy better than ±0.5% (PF = 1, Input Current > 0.5 A) For -100P models: Accuracy better than ±0.5% (PF = 1, Input Current > 1.5 A) For -160P models: Accuracy better than ±0.5% (PF = 1, Input Current > 3 A) For -240P models: Accuracy better than ±0.5% (PF = 1, Input Current > 3.5 A) For -360P models: Accuracy better than ±0.5% (PF = 1, Input Current > 7 A) For -400P models: Accuracy better than ±0.5% (PF = 1, Input Current > 10 A) **PM-5133-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-5133P Series:** Accuracy is approximately 2–5% (PF = 1), depending on the CT used. The CT ratio must be set correctly.

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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 to 65 Hz)
Data Update Rate		1 Second
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**)
Power		
Input Range		+12 ~ 48 VDC
Power Consumption		3 W
Mechanical		
Casing		-20 ~ +50 °C
Dimensions (mm)		119 x 115 x 54 (W x L x H)
Panel Cut-out (mm)		90 x 90, +1/-0
Installation		DIN-Rail Mounting and Panel Mounting
Ingress Protection Rating		Front Panel: IP65
Environment		
Operating Temperature		-20 ~ +50 °C
Storage Temperature		-25 ~ +80 °C

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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

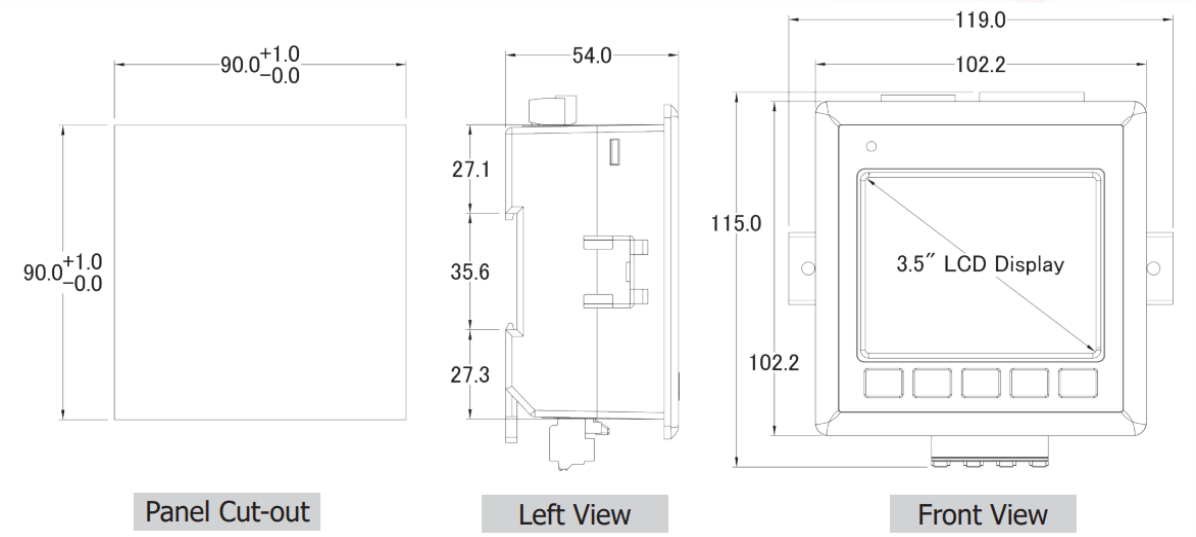
- Please clean the instrument using a soft, dry cloth.
- Do not use chemicals, detergents, or volatile solvents to clean the instrument, as they may cause damage to the cover.
- The product includes external split type clip-on CTs. Do not disconnect or replace them with other CTs, as this is strictly prohibited.
- Carefully read this operation manual before use.
- Re-confirm the measurement position before installation.
- The meter's auxiliary power supply range is DC +12V to +48V.

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3.3. Dimension and Latch

The diagrams below show the dimensions of the PM-5133/PM-5133P/PM-5133-RCT for enclosure design.
Leave sufficient space for expansion if used with other system components.

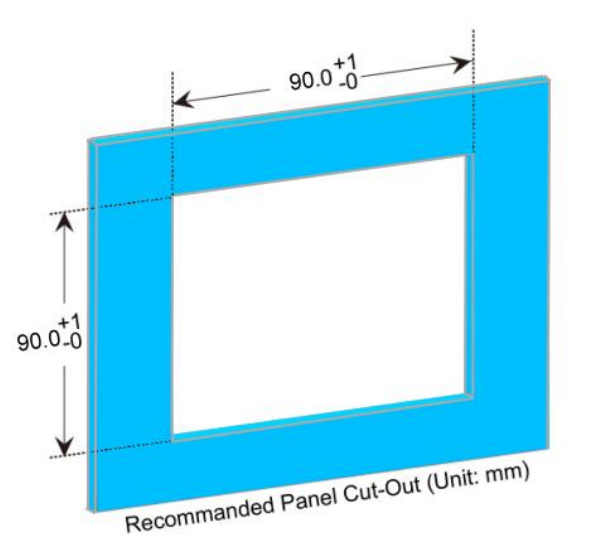


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3.3.1. Mounting and Wire Disconnection

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





Panel thickness: 1 - 5 mm

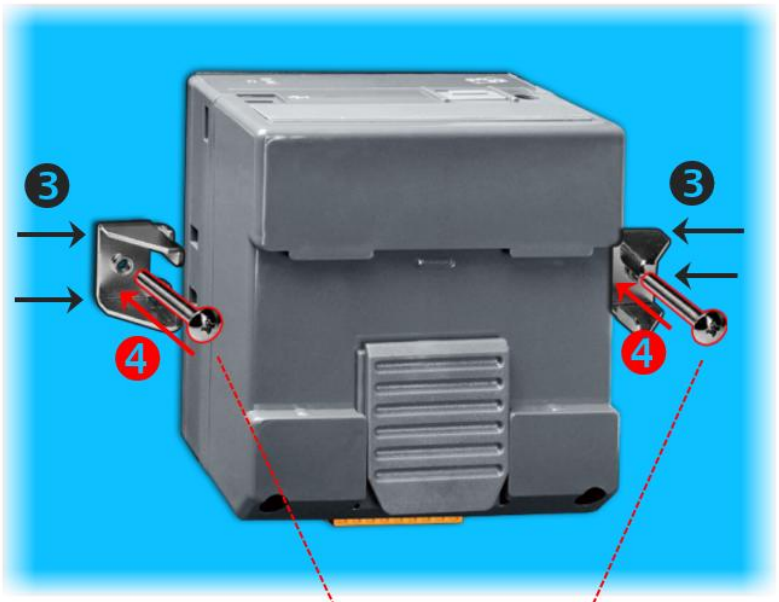
2. Attach the PM-5133 to the cut-out hole.



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3. Insert the panel mounting clips into the upper and lower ventilation holes.
4. Screw the panel mounting clips to the panel.





Mounting Screw: M4 x 30L

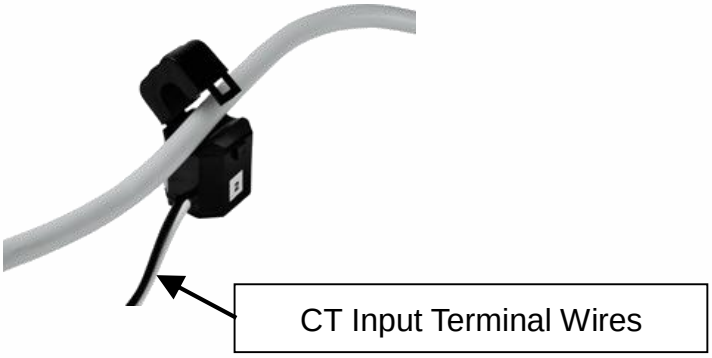
Note: Recommended Screw Torque: 3.4 ~ 4.5 kgf-cm.

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5. Wire Disconnection:

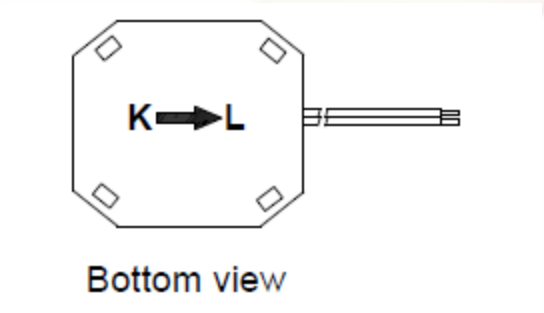
1. Unlock the CT clip and remove the CT from the power cable, avoiding disconnecting the CT terminal wires if possible (do not disconnect the terminal wirers first).
   Warning! If you need to remove the CT terminal wires, make sure to first detach the CT before removing the CT terminal wires. This is 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-5133 -xxx_xxxP CT's Installation Steps



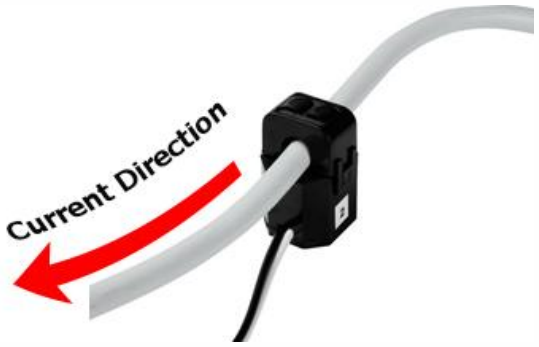
- At the bottom of the CT, there is a "K→L" mark.



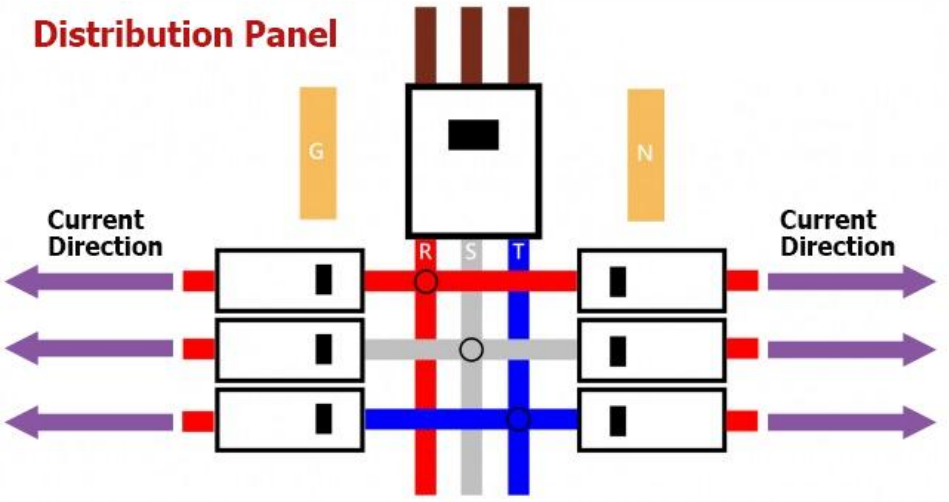
- Open the CT clip.



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



- Complete the Installation.

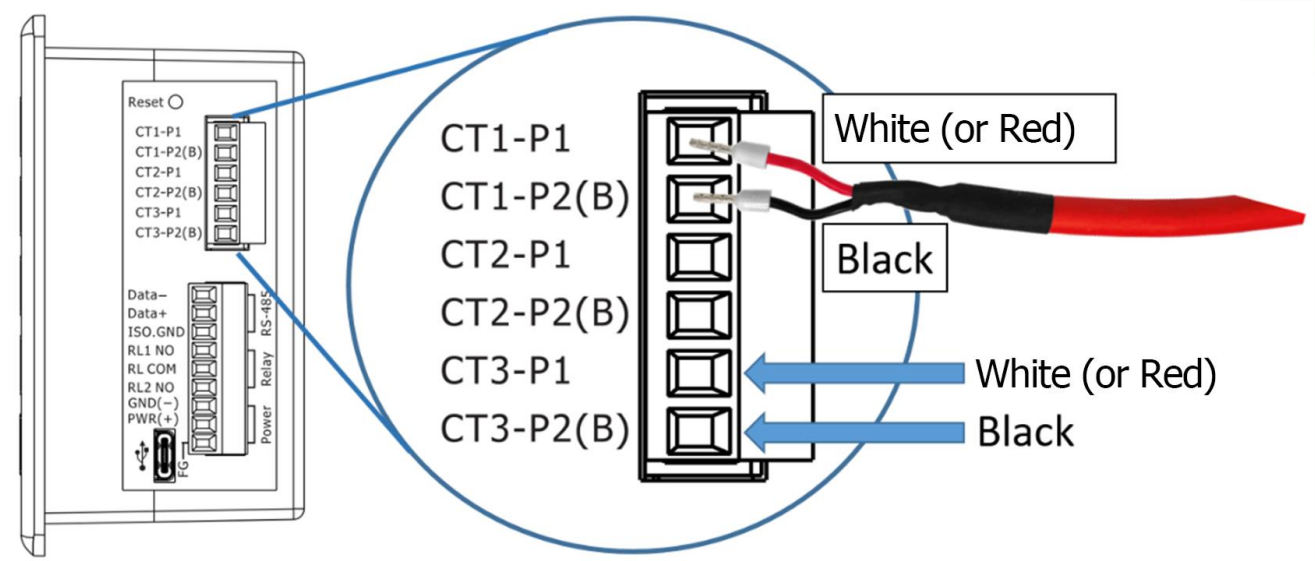


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3.3.3. PM-5133-RCTxxxP CT Connection

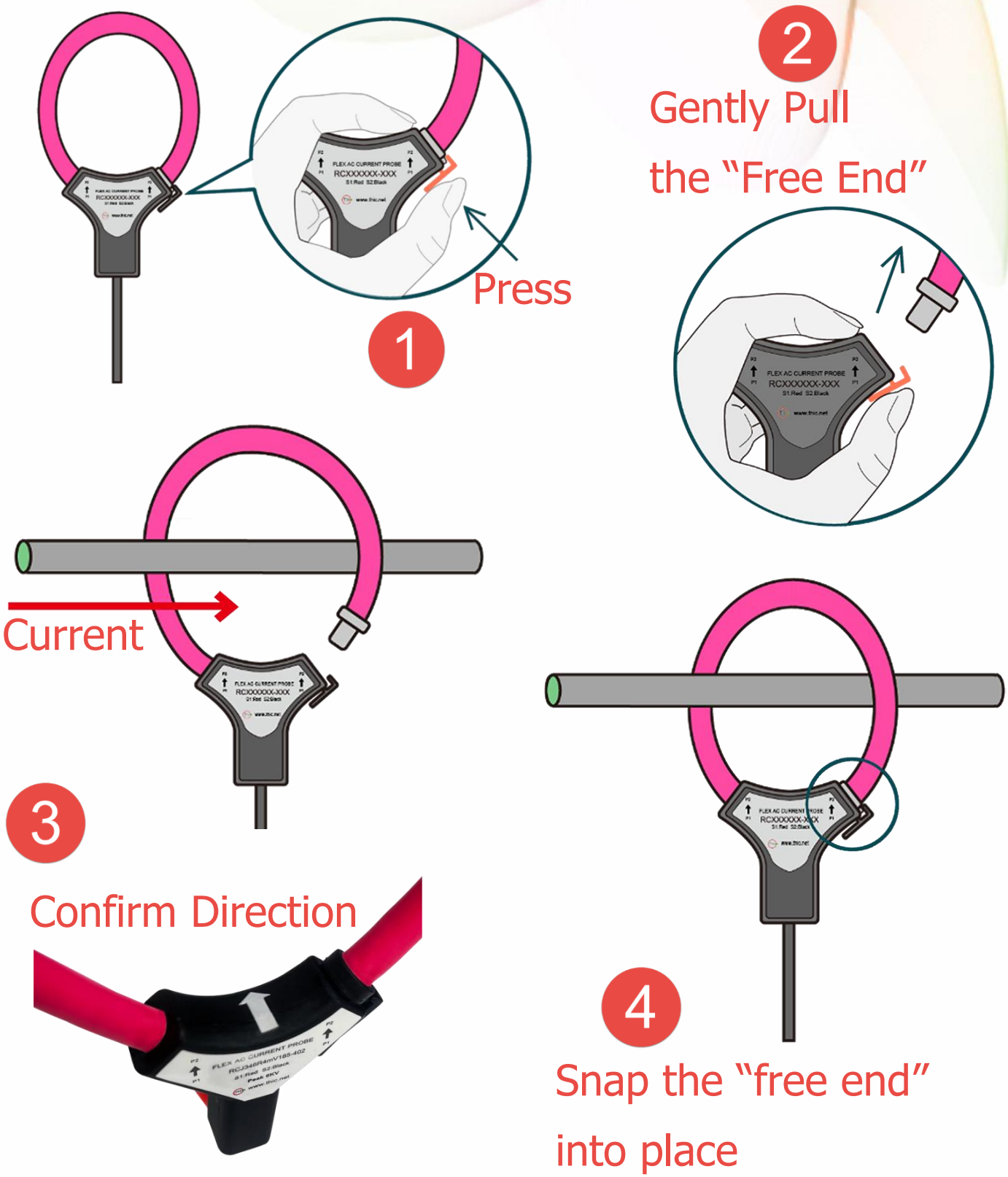
Please firstly check the current input terminal, and then and then in white (or red) - black, white (or red) - black, white (or red) - black wire sequences (CT1-P1, CT1-P2, CT2-P1, CT2-P2, CT3-P1, CT3-P2). Then connect the CT's, and close the CT clip. Make sure the arrow direction sign on CT's follows current flow direction.



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3.3.4. PM-5133-RCTxxxP CT's Installation Steps



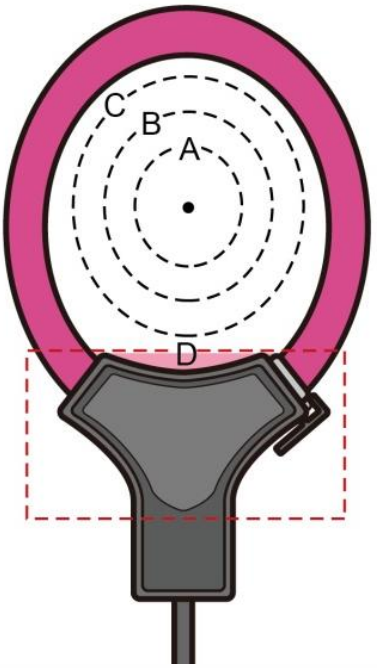
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3.3.5. PM-5133-RCTxxxP CT's Installation Precautions

1. The ICP DAS Rogowski power meter is calibrated with the conductor positioned at the center (Position A in the figure), which is the ideal location to ensure measurement accuracy.

2. The Rogowski coil is not a completely closed circular structure, as it has a connection joint. The dashed area at Position D in the figure indicates the location of this connection. It is known that when the measured conductor is placed closer to this area, the measurement error increases because magnetic flux variations in that section cannot be properly detected. Please avoid measuring current within the dashed area, as doing so may result in measurement errors exceeding −5%. Moreover, external magnetic flux can also affect the connection section, further increasing measurement errors.

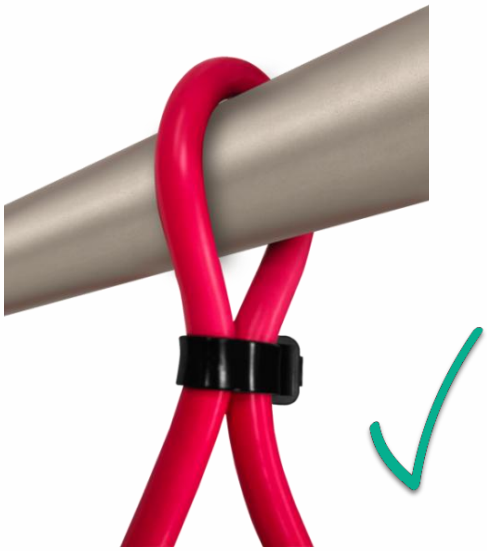


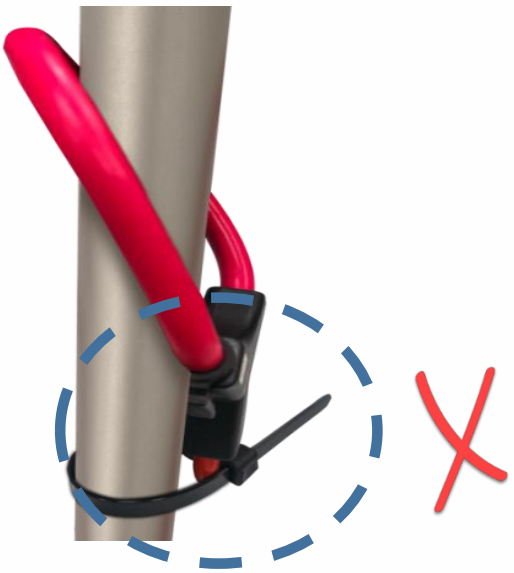
3. Before performing current measurements, ensure that all other current-carrying conductors, except the one being measured, are kept away from the Rogowski coil's connection section as much as possible.

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4. In practical applications, if the measured conductor is offset from the center of the Rogowski coil, tilted, or if the conductor size is disproportionate to the coil diameter, the measurement accuracy may be affected. When the conductor is only slightly tilted or off-center, the meter can still maintain acceptable measurement accuracy, but the error will increase accordingly. To achieve higher measurement precision, it is recommended to keep the measured conductor as perpendicular to the coil as possible and ensure it passes through the center of the coil. The left figure illustrates the recommended cable tie fixation method to minimize tilt. If the angle of inclination between the measured conductor and the plane of the Rogowski coil is large, and its position is close to the coil's connection end, as the right figure, the measurement error will reach the greatest.





Good Installation Method

1. The cable tie is fastened close to the wire to prevent the CT from slipping.
2. The tilt angle is small.
3. Avoid positioning the CT near location D.

Poor Installation Method

1. Large tilt angle.
2. Too close to connection point D

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5. At lower input currents (approximately 5%–15% of the rated current), the Rogowski coil exhibits relatively higher measurement error.

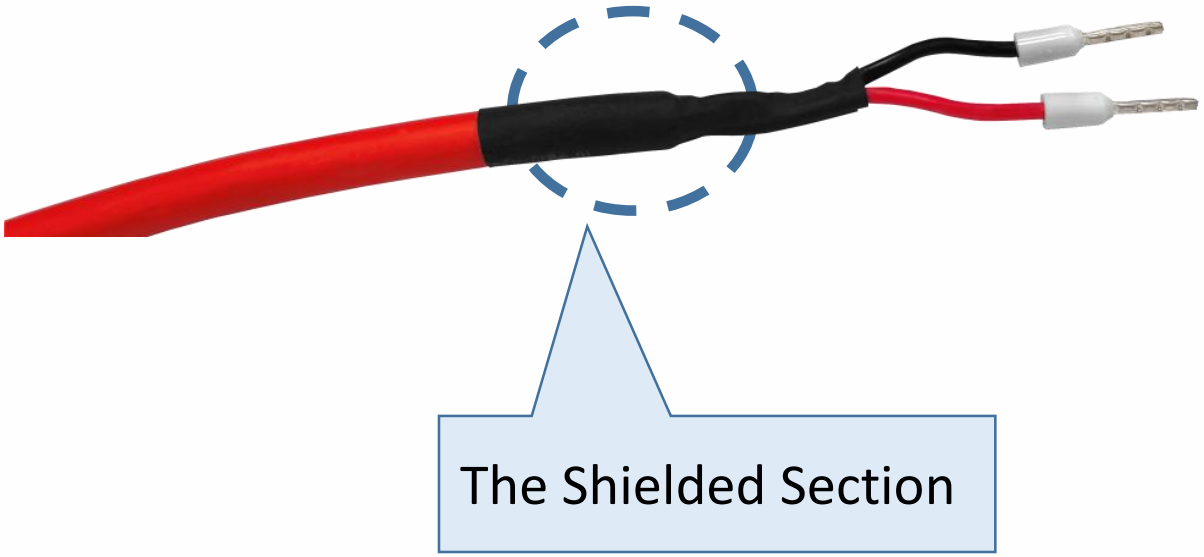
The recommended operating current range vs. measurement accuracy is shown in the table below:

Rated Current	Recommended Operating Range	Error To 5% – 15% Rated Current	Error To 15% – 100% Rated Current
500A	50A – 500A	±2% – ±4% or more	Within ±2%; if the conductor is positioned at the center of Rogowski coil, the accuracy can be further improved to within ±1%.
1000A	50A – 1000A		
2000A	200A – 2000A		
4000A	200A – 4000A		

6. Do not extend the Rogowski coil's lead wires by yourself.

Modifying the lead length will disrupt the original shielding structure, allowing external electromagnetic interference to couple into the sensing signal, which may cause waveform distortion and reduced measurement accuracy.

If a special or extended lead length is required, please contact ICP DAS to obtain a factory-designed version with proper shielding treatment.



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3.3.6. PM-5133P Current Input Scaling

1. The external CT's are fragile, please handle with care.
2. **The current input of PM-3133P series is designed for 333 mV.** Do not use any CTs that do not meet the specifications, as doing so may damage the module.
3. **CT Selection Considerations:**
   Using a 333 mV output CT reduces the measured current by its ratio. Example: A 200 A CT with a 40:1 ratio outputs 5 A. The meter sees 5 A, so the readings must be scaled by 40.

Current transformer	CT Ratio
50A CT	10:1
60A CT	12:1
100A CT	20:1
200A CT	40:1

Current transformer	CT Ratio
400A CT	80:1
800A CT	160:1
1000A CT	200:1
1200A CT	240:1

Note:

A. Please use **low phase angle error** CTs, it is essential for accurate power and energy measurements. (Example: phase error <2°)

B. Accuracy is approximately 2–5% (PF = 1) depending on the used CT specifications. The CT ratio must be set correctly

C. **PM-3133P only for external 333mV Output CTs (Rogowski coils are not supported)**. The burden resistor is built in the module, and the shorting blocks are not needed.

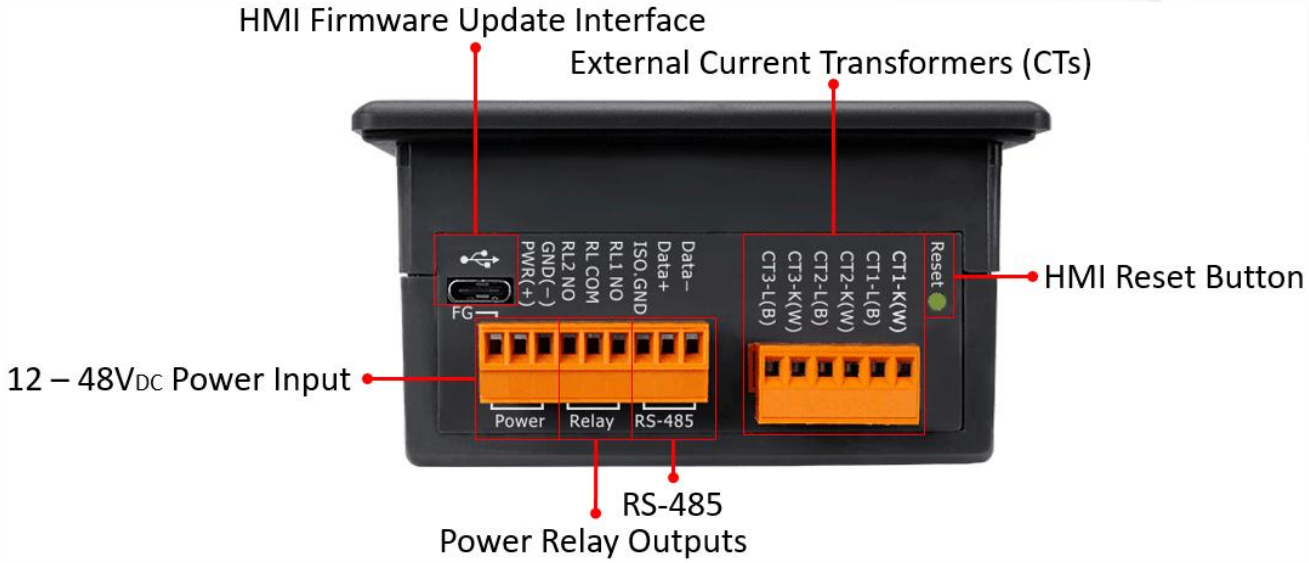
D. This meter requires external CT(s) to operate:
   1P2W-1CT requires 1 CT per meter.
   3P3W-2CT/1P3W-2CT requires 2 CTs per meter.
   3P4W-3CT/3P3W-3CT requires 3 CTs per meter

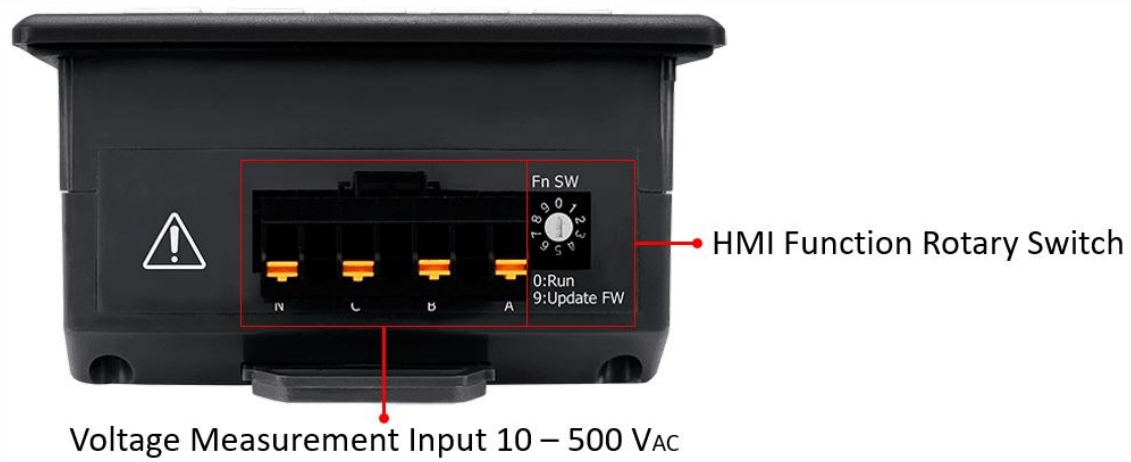
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4. Wiring Diagrams

4.1. Connection





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Voltage Input

1. PM-5133/PM-5133P/PM-5133-RCT 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 R-S-T (A-B-C) phase sequence. Make sure that terminals A, B, C, and N are connected to the corresponding phases of the actual supply (A-B-C-N or R-S-T-N).

Current Input

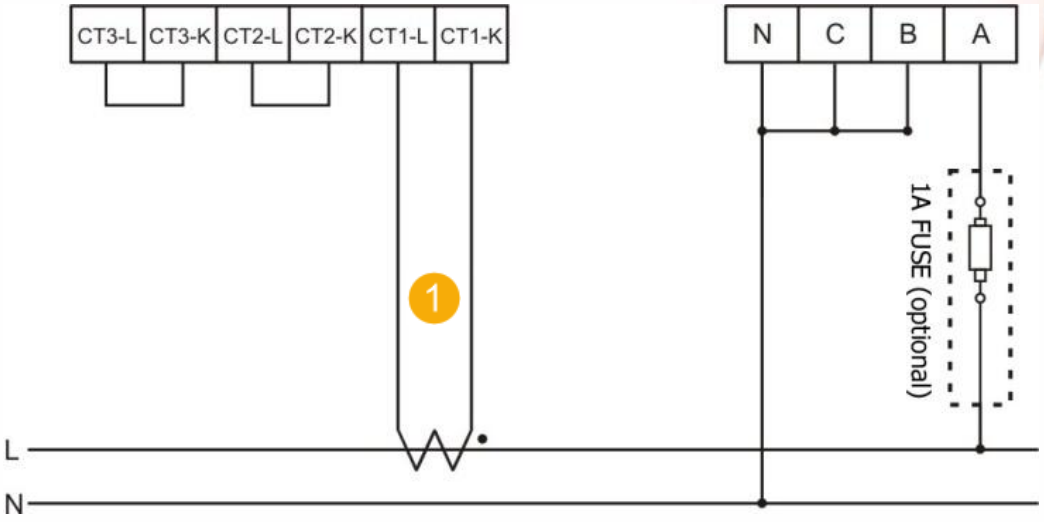
1. Handle external CTs with care, as they are fragile.
2. CT input sequence (CT1, CT2, CT3) must match the current phases (A, B, C / R, S, T). Ensure the current flow direction matches the arrow markings on the current transformers, and the wiring sequence must match the wire colors indicated on the module terminals.
3. Only use the CTs provided with the PM-5133/ PM-5133-RCT series. Using other CTs (e.g., from a panel), could damage the instrument due to their high signal input.
4. When multiple smart meters (PM-5133/PM-5133P/PM-5133-RCT 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.
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.

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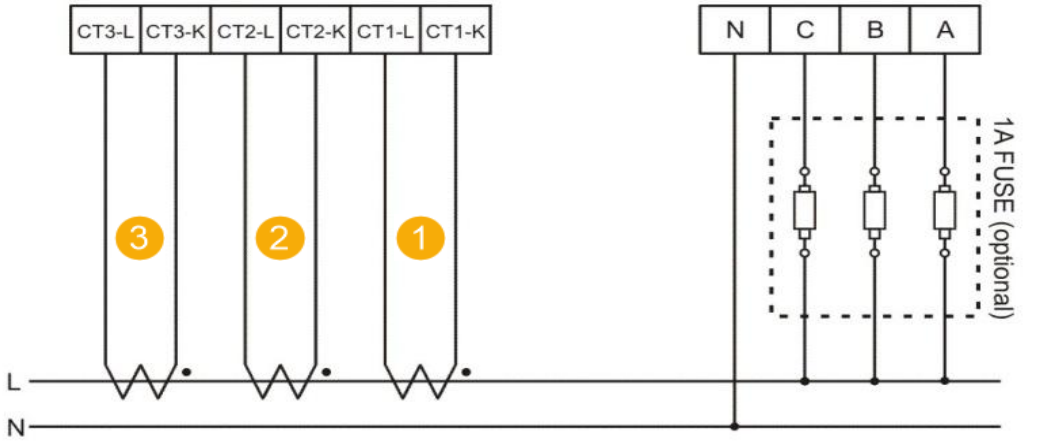
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4.2. Wiring

- 1P2W-1CT (Single-phase, Single-circuit) (Configure to 1P2W)



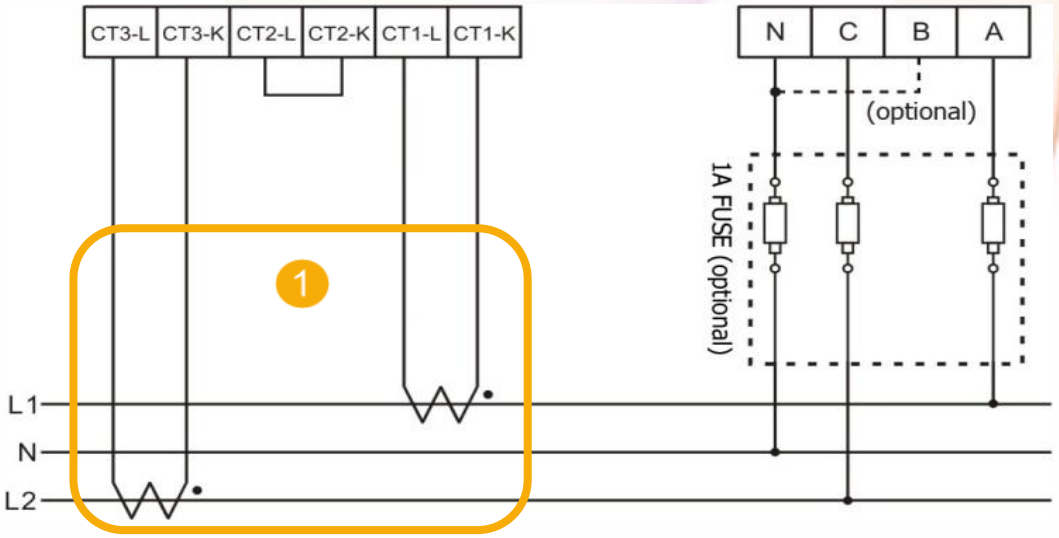
- 1P2W-3CT (Single-phase, 3-circuit) (Configure to 1P2W)



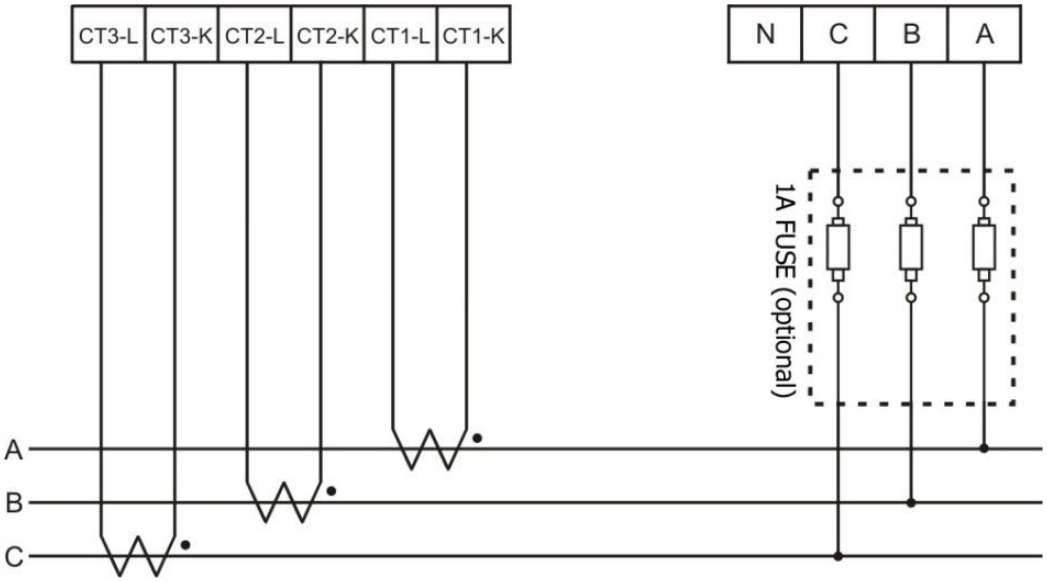
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- 1P3W-2CT (Single-phase, Single-circuit) (Configuration to 1P3W)



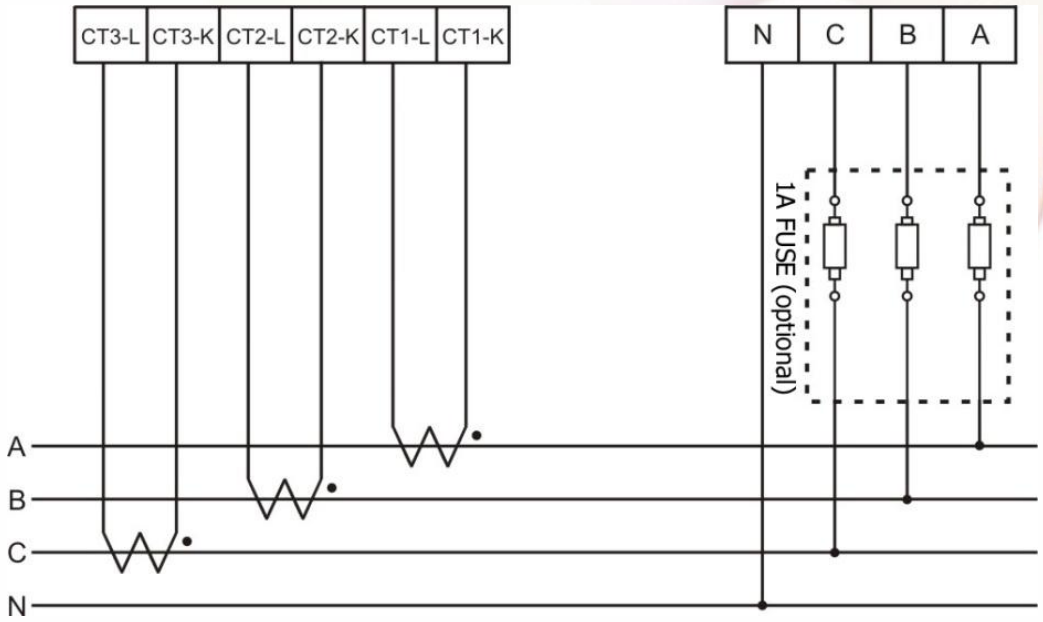
- 3P3W-3CT (Configuration to 3P3W 3CT)



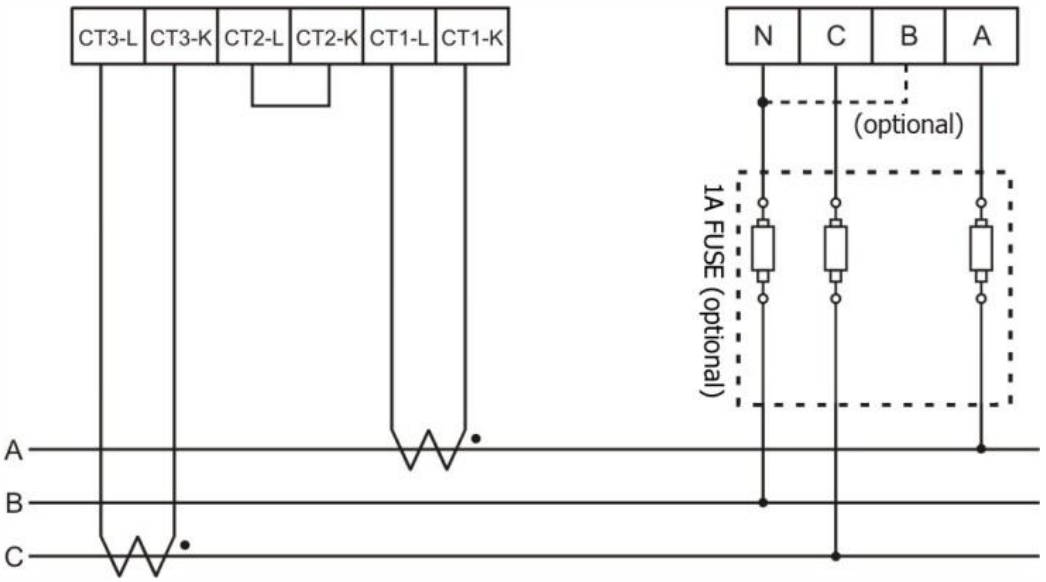
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- 3P4W-3CT (Configuration to 3P4W 3CT)



- 3P3W-2CT (Configuration to 3P3W 2CT)



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.

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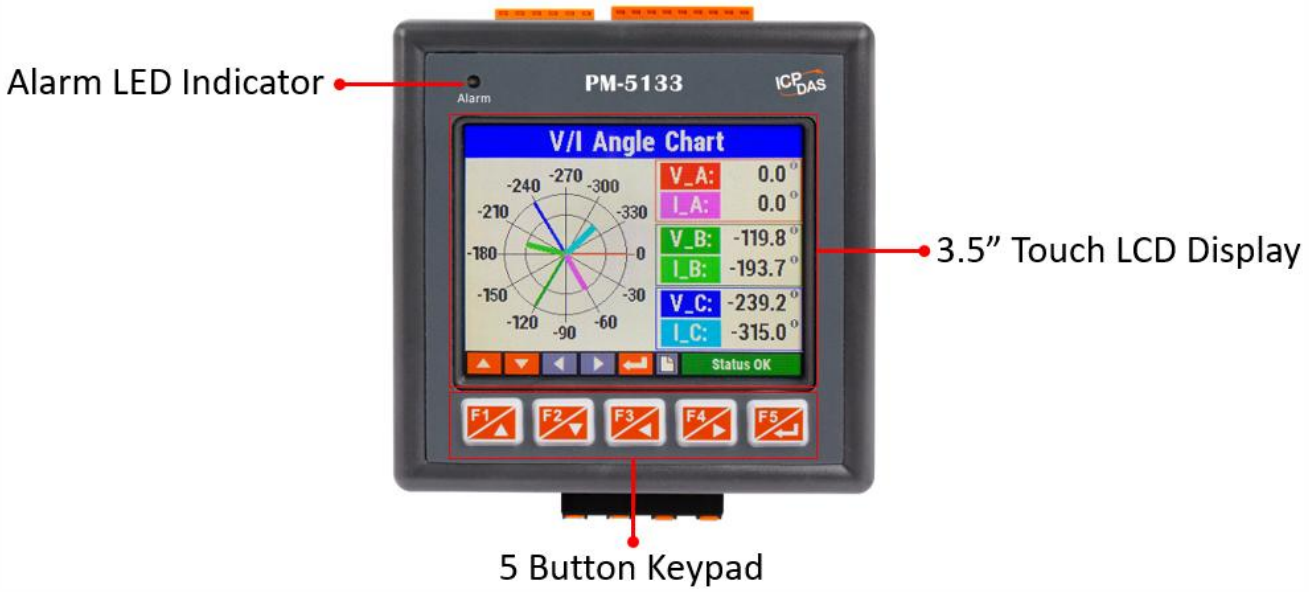
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5. Keypad, Touch LCD Display & LED Indicator

5.1. Function of Touch LCD Display, Indicator and Keypad

The PM-5133 is equipped with a 3.5” touch LCD panel for screen operation, configuration, and displaying power information.

- For applications where a touch panel is not convenient, the 5-button keypad can be used for screen navigation.
- The Alarm LED indicator warns users when a predefined alarm condition is triggered.



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Keypad Functions

Keypad	Function
	Go to previous page
	Go to next page
	Switch phase / return to main page from advanced parameter settings
	Switch phase / go to advanced parameter settings
	Go to previously viewed page / exit the Setup mode

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5.2. Operation of Touch LCD Display and Keypad

The touch LCD and keypad provide two ways to operate the PM-5133. In **Normal Mode**, users can view real-time measurement data and event records. In **Setup Mode** (also referred to as **Configuration Mode**), users can configure wiring, communication, demand, alarms, and other system parameters.

5.2.1. Normal Mode

Mode and Navigation

- The PM-5133 has two modes: **Normal Mode** and **Setup Mode**.
- Both modes use the F1 and F2 keys to switch pages.
- The F3 and F4 keys are used to switch phases or enter parameter settings on specific pages.
- Virtual buttons at the bottom of the screen can also be used for navigation.
- Grey icons indicate functions that are not available on the current page.

System Status Icons

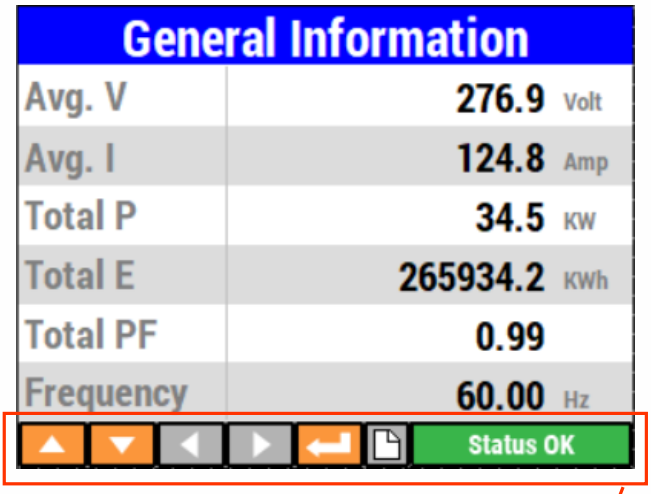
- **Log icon**: shows the status of the data logging function.
  - Idle → log icon (gray)
  - Active → log icon (green)
- **Alarm icon**: shows alarm status.
  - No unconfirmed alarms → normal icon Status OK (green / OK)
  - At least one alarm → alarm icon Alarm (red); click Alarm to open the Alarms & Events page, afterwards click the F5 to go back the previously page from the Alarms & Events page.

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General Information Page

- This is the default page displayed after power-up.
- Shows:
  - Average voltage (V)
  - Average current (I)
  - Total active power (kW)
  - Total active energy (kWh)
  - Total power factor (PF)
  - Frequency (Hz)

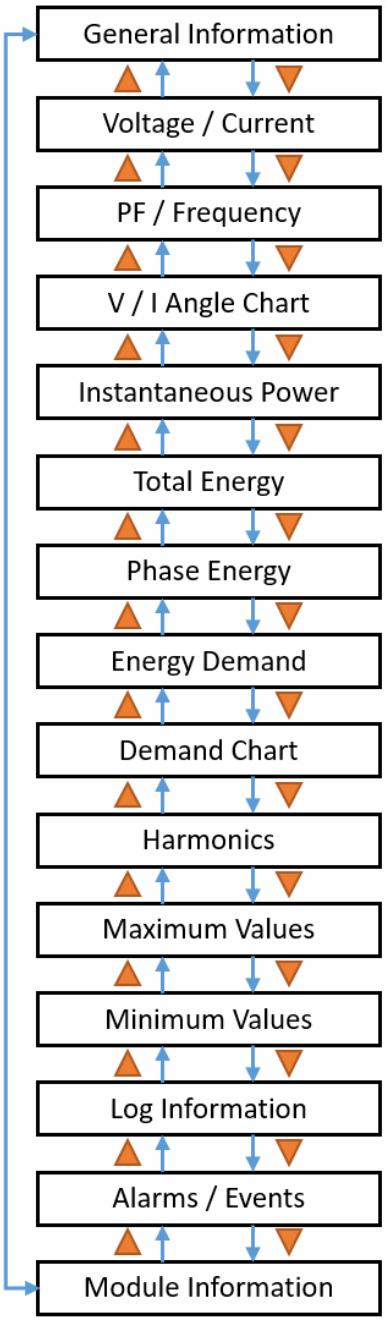


Gray icons indicate functions that are unavailable on this page.

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In addition to the default screen, a total of 15 pages are available in Normal Mode for viewing measurement data.



Average voltage, average current, total kW, total kWh, total PF, and power frequency

Voltage and current of each phase

Power factor and power frequency of each phase

The angle chart of voltage and current of each phase

The values of kW, kVar, and kVA of each phase

Total electrical power includes positive/negative/net/absolute kWh, absolute kVarh and absolute kVAh

The values of kWh, kVarh, and kVAh of each phase

The total energy demand and relative information

The trend chart of the total energy demand

Vthd, Ithd and 31-order harmonic information of each phase

The recorded maximum values of voltage, current, kW and Kvar of each phase

The recorded minimum values of voltage, current, kW and Kvar of each phase

The configuration and status of the data log functions

The log of the alarms and events

Beside the configured wiring mode and PT/CT ratio, it also provides the firmware version, system time and the way to the configuration mode.

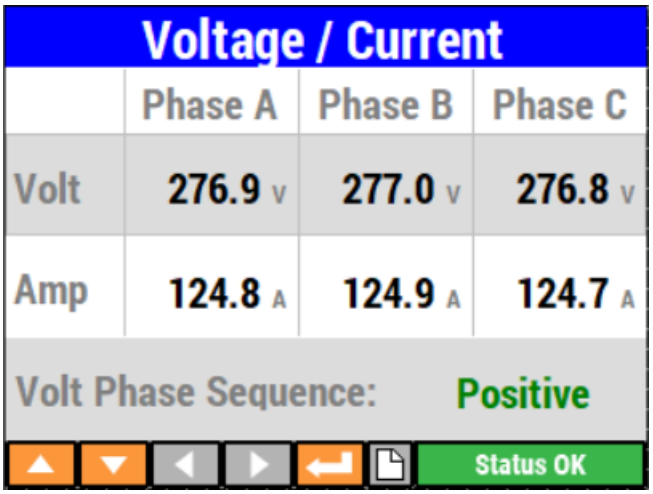
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Voltage/Current Page

- Displays phase voltage and current values.
- In 3-phase mode, the PM-5133 automatically detects the phase sequence.
- If wiring sequence is **A** → **B** → **C** (or **R** → **S** → **T**), the result is shown as **Positive**.
- If the sequence is different, the result is shown as **Negative**.
- In 3P3W-2CT wiring mode, Phase B is treated as the common reference for Phase A and Phase C.
  - The value displayed for Phase B represents the line voltage between Phase A and Phase C.

⚠ **Note:** If the wiring sequence is correct but the phase-to-phase correspondence is wrong (e.g., line A → phase B, line B → phase C, line C → phase A), the sequence may still appear as **Positive**, even though wiring is incorrect.

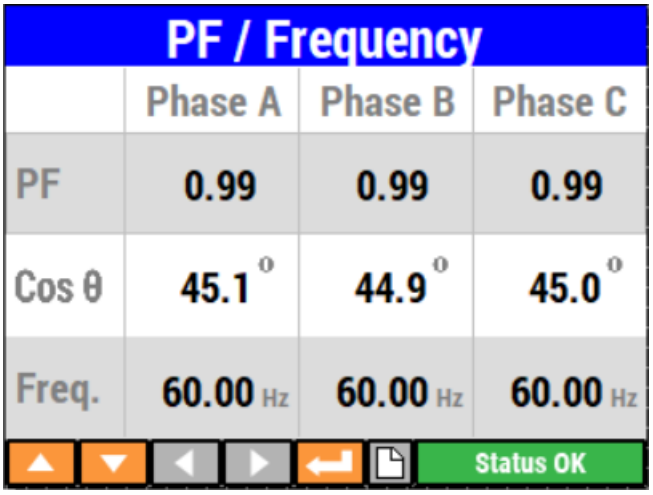


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PF/Frequency Page

- Displays:
  - Power factor (PF)
  - Voltage–current phase angle
  - Power frequency of each phase
- For 1P2W wiring mode:
  - Values in Phase A, B, C columns correspond to A-, B-, and C-wires.
- For 1P3W or 3P3W-2CT wiring modes:
  - Phase B is used as a common ground reference.
  - Therefore, all values in the Phase B column are always zero.

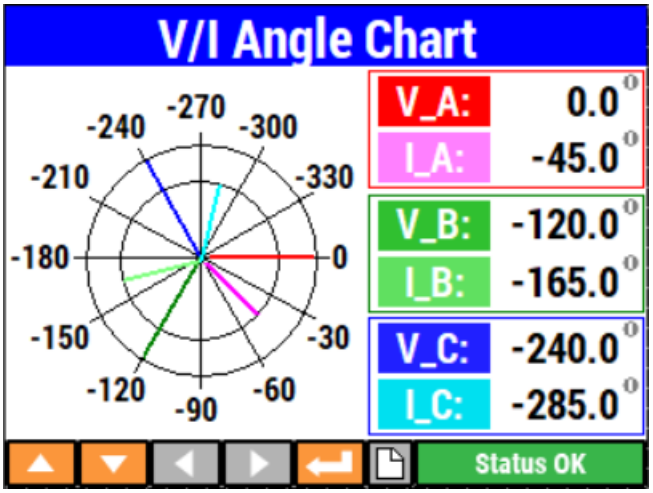


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V/I Angle Chart Page

- Provides an intuitive display of phase angle relationships.
- Shows six angle values, divided into two groups:
  - Between phase voltages
    - V_A ↔ V_B
    - V_A ↔ V_C
    - V_B ↔ V_C
  - Between voltage and current of the same phase
    - V_A ↔ I_A
    - V_B ↔ I_B
    - V_C ↔ I_C
- All angle values are referenced to Phase A voltage (V_A = 0°).
  - V_B, V_C: show the phase angle of voltage B and C relative to voltage A.
  - I_A, I_B, I_C: show the phase angle of each phase current relative to V_A.
  - Phase-to-phase and voltage-current differences can be derived from these values.
- Negative values indicate phase lag (e.g., V_B = –120° → voltage B lags A by one-third of a cycle).
- Voltages and currents of the same phase are displayed in similar colors for clarity.

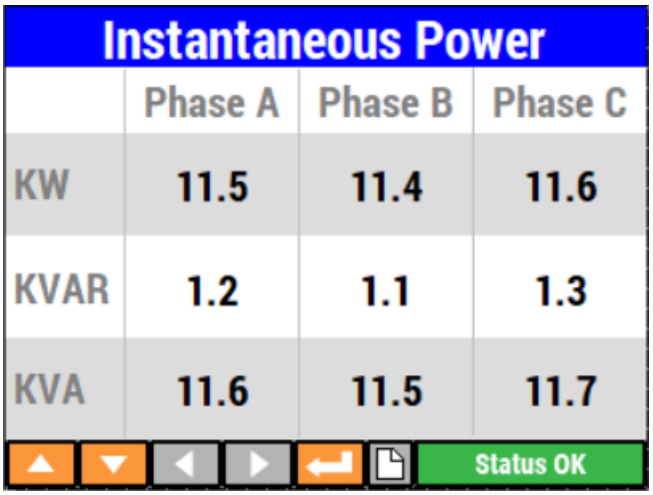


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Instantaneous Power Page

- Displays instantaneous power values for each phase:
  - Active power (**kW**)
  - Reactive power (kVAR)
  - Apparent power (kVA)
- Users can quickly confirm system power usage and efficiency from this page.

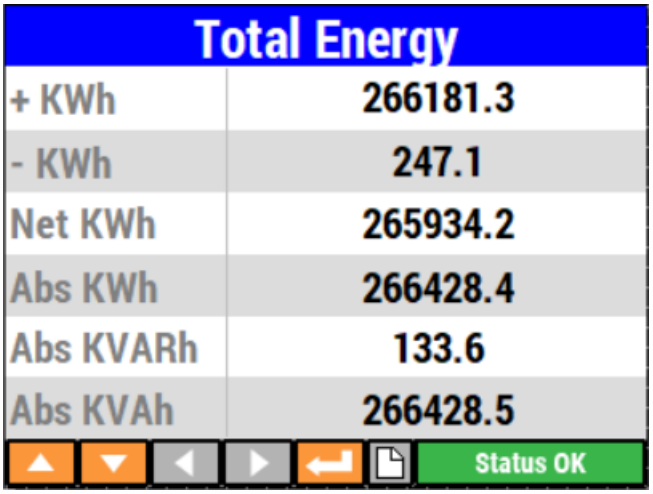


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Total Energy Page

- Displays cumulative energy values for all three phases combined:
  - Active energy (**kWh**)
  - Reactive energy (**kVARh**)
  - Apparent energy (**kVAh**)
- Supports bi-directional accumulation:
  - Positive and negative energy values are recorded separately.
  - Users can also choose to:
    - Add positive and negative values directly, or
    - Take absolute values first, then add them together.
- Provides an overview of the system's total energy consumption.
- To view per-phase accumulated energy, switch to the Phase Energy Page.

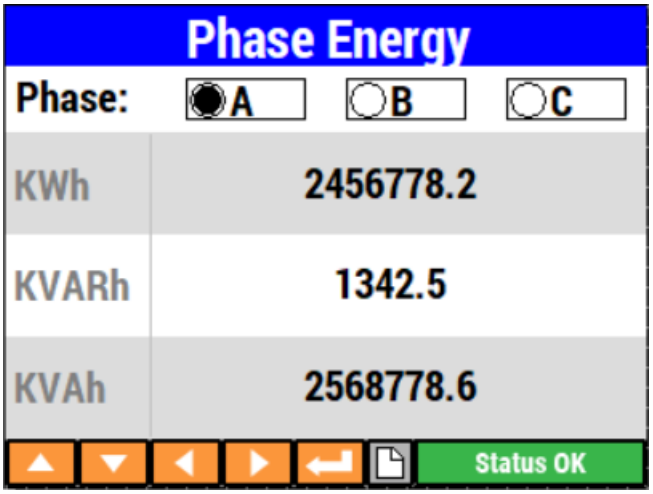


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Phase Energy Page

- Displays **cumulative energy values for each phase individually**:
  - Active energy (**kWh**)
  - Reactive energy (**kVARh**)
  - Apparent energy (**kVAh**)
- Users can use the F3 / F4 buttons to switch between phases.
- Helpful for analyzing load distribution and identifying phase imbalance.

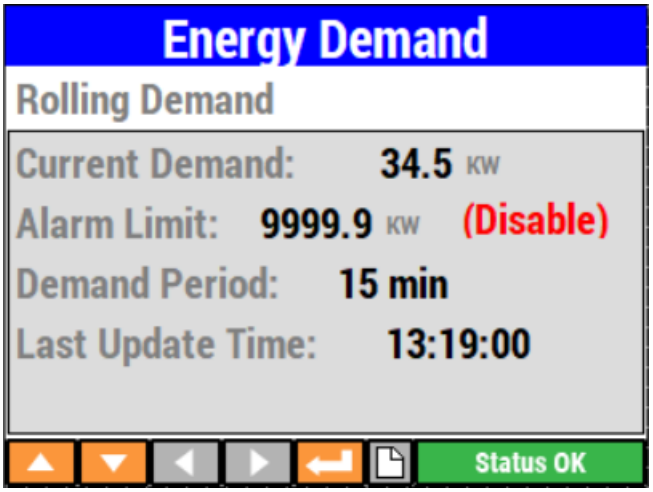


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Energy Demand Page

- Displays:
  - Real-time calculated demand
  - Configured demand alarm value
  - Demand period (15, 30, or 60 minutes)
  - Time of last update
- If Demand Alarm is disabled → “Disable” is shown in red as a reminder.
- If Demand Alarm is enabled → a red line appears in the Demand Chart (next page) to indicate the alarm limit.
- An alarm is triggered if forecast demand exceeds the configured threshold.

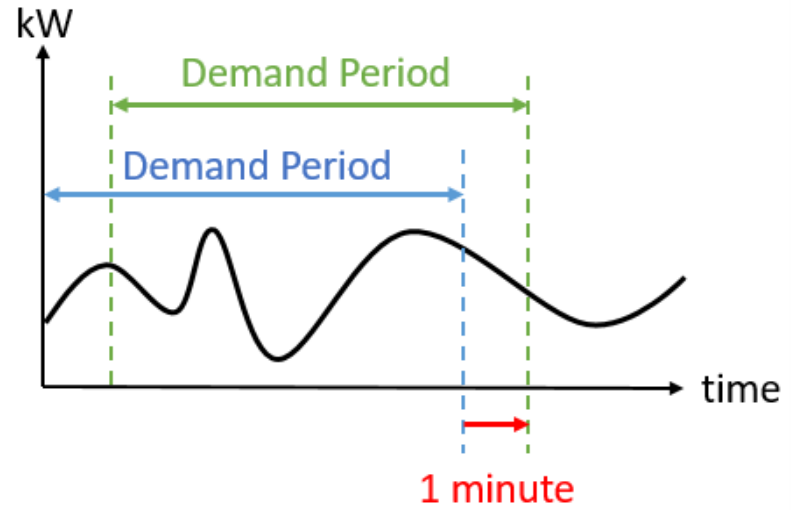


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Demand Calculation Method

- PM-5133 uses the **rolling average method**.
- Real-time demand is updated every 1 minute.
- The demand calculation period follows the configured demand setting (15, 30, or 60 minutes).
- Rolling demand concept and calculation period are illustrated in the following figure.

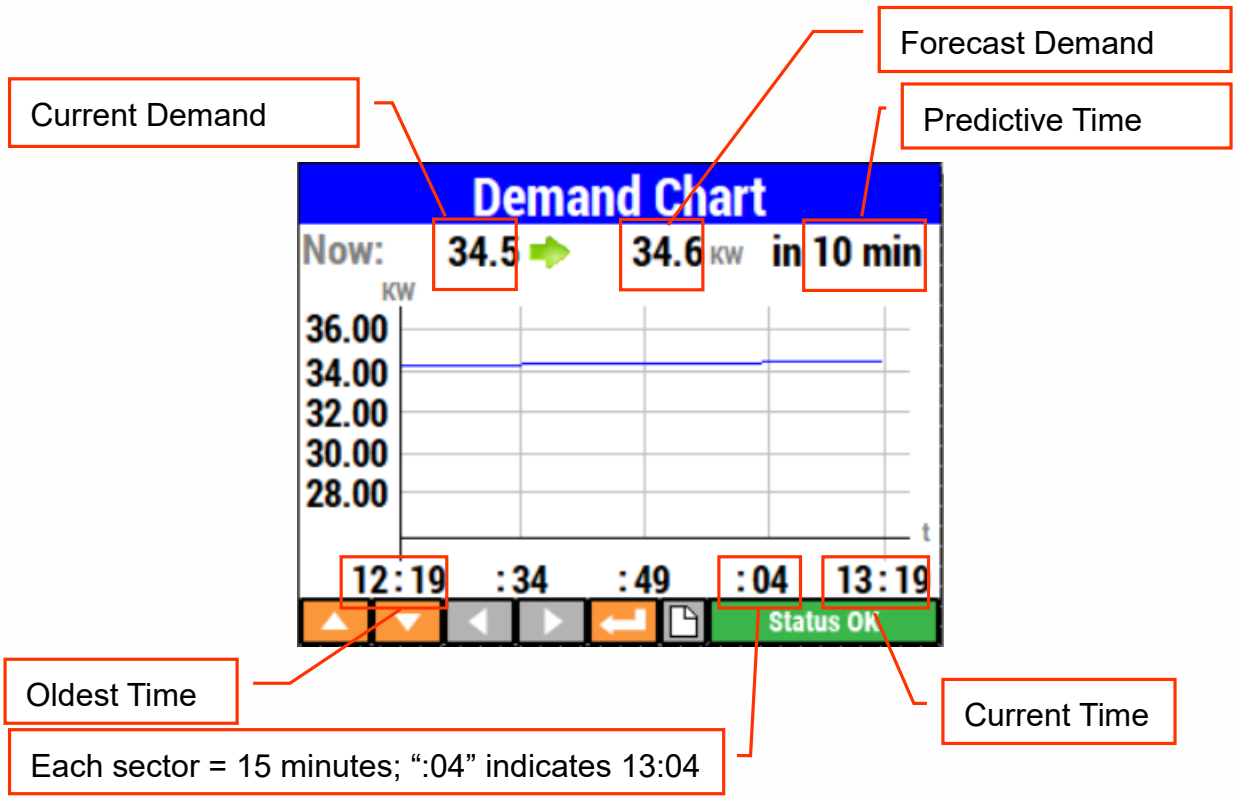


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Demand Chart Page

- Displays a **trend graph of calculated demand** for the past hour:
  - Each point = calculated demand per minute
  - X-axis = time (hh:mm), updated every minute
  - Y-axis = instantaneous power (kW)
  - Gridlines = 15-minute intervals on X-axis
- If Demand Alarm is enabled → a red line indicates the alarm threshold.
- Alarm trigger condition: when the calculated forecast demand exceeds the configured alarm value.
- Additional information on this page:
  - Current calculated demand
  - Forecast demand
  - Configured predictive time
- If wiring mode or demand period is changed → demand values and charts will be reset.

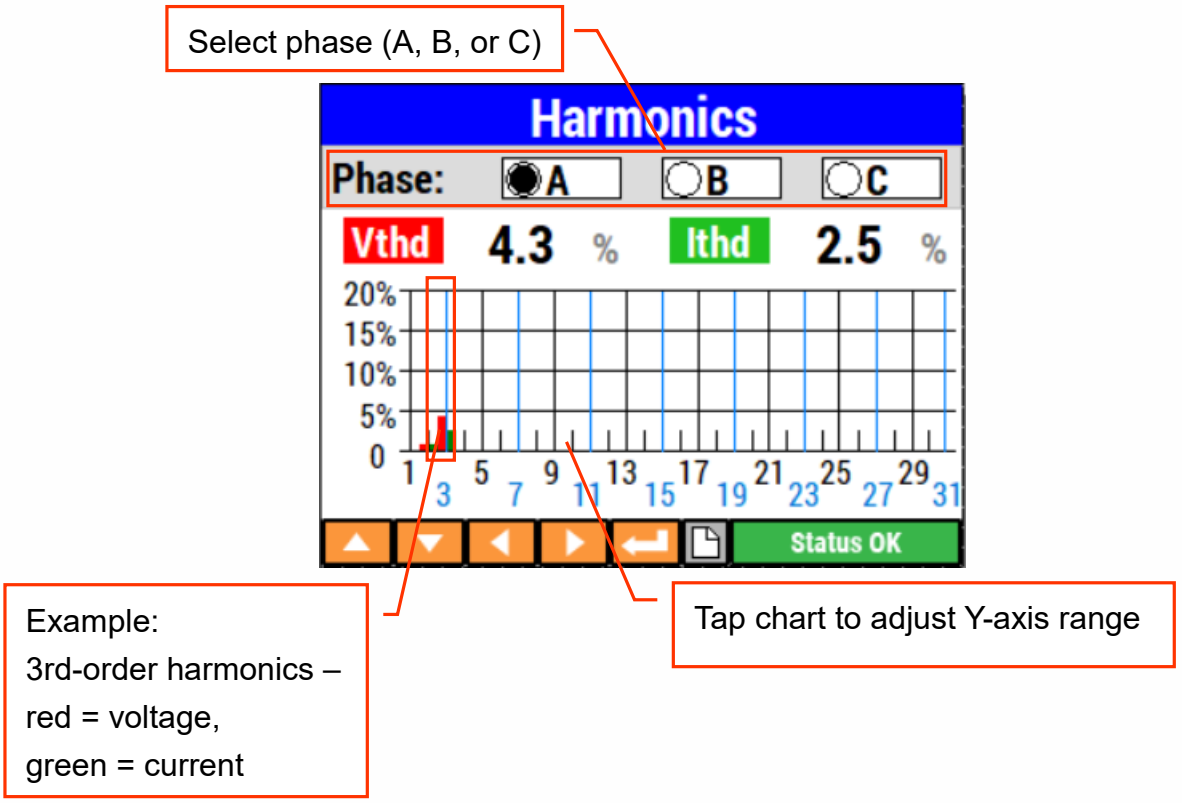


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Harmonics Page

- Provides **harmonic analysis up to the 31st order** (single-phase).
- Displays:
  - Voltage THD (Total Harmonic Distortion)
  - Current THD
- Users can select the desired phase from the option button.
- Bar chart display:
  - Voltage harmonics = red bars
  - Current harmonics = green bars
  - Centered on X-axis gridlines
  - Black gridlines = even-order harmonics
  - Blue gridlines = odd-order harmonics
- Measurement range: each order up to 399%.
- Y-axis scaling options: 0–20%, 0–40%, 0–100%, 0–200%, 0–300%, 0–400%.
- Users can tap on the chart to adjust the Y-axis range for better observation.

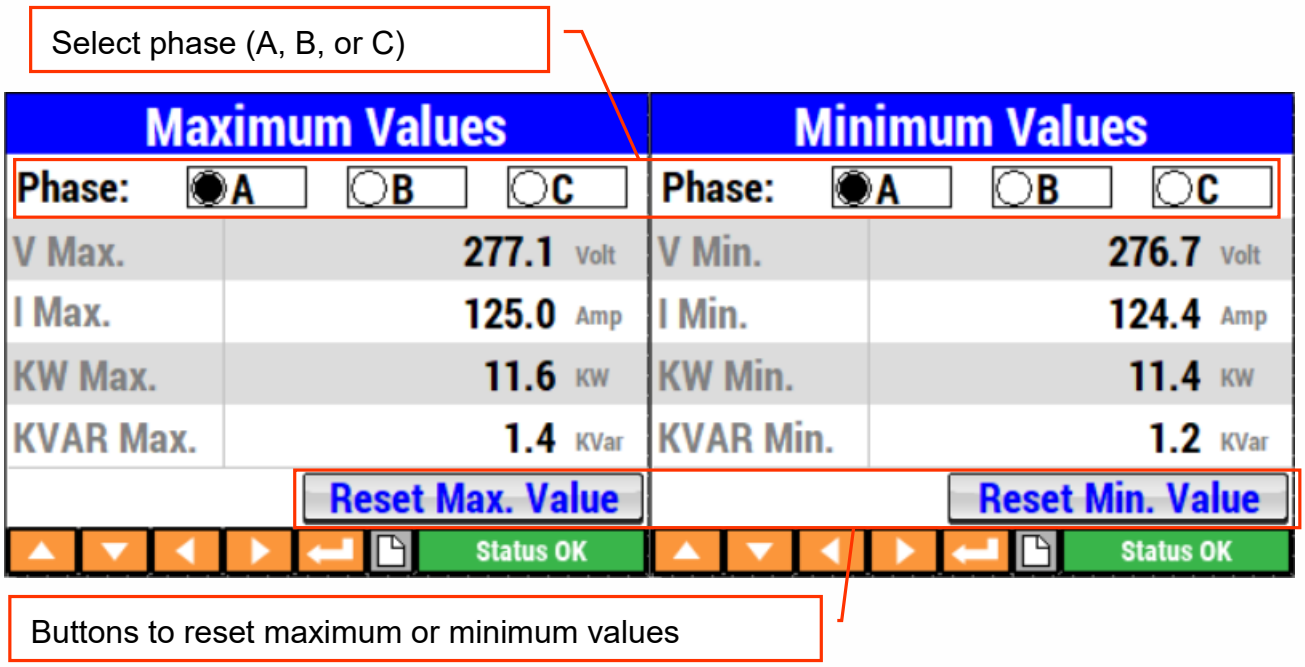


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Maximum/Minimum Values Page

- Displays the **maximum and minimum values** of monitored power parameters.
- Updates once per second.
- Provides two actions:
  - **Reset Maximum** – clears current maximum values and restarts measurement.
  - **Reset Minimum** – clears current minimum values and restarts measurement.
- Users can switch between phases using the F3 / F4 buttons or phase selection option.
- When a new value exceeds the stored maximum or drops below the stored minimum, the display updates automatically.



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Log Information Page

Data Logging Modes

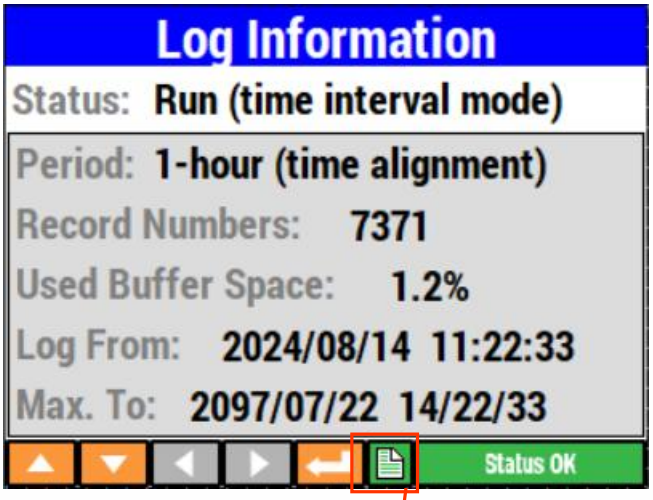
- **Normal mode**
  - Uses a ring buffer.
  - When the buffer is full, the oldest records are overwritten.
- **Time interval mode**
  - Logging starts at a user-defined time.
  - Continues until the buffer is full.

Displayed Fields

- **Status** – current logging status and mode (e.g., *Run (time interval mode)*).
- **Period**– logging interval and alignment setting (e.g., *1-hour (time alignment)*).
- **Time Alignment** – aligns record time to full seconds, minutes, or hours when enabled.
  - Example: if **Period = 10 seconds**, logs are recorded at 0, 10, 20, 30, 40, and 50 seconds of each minute.
- **Record Numbers** – total number of logged records.
- **Used Buffer Space** – buffer usage percentage.
  - Normal mode shows "----" (ring buffer).
- **Log From** – start time of logged data.
- **Max. To –** latest possible record time (time interval mode only).

Icons

- Data log icon at the bottom shows logging status:
  - Flashing – data log is running (this icon flashes when logging is active).
  - Gray – data log is stopped.



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Alarms/Events Page

Functions

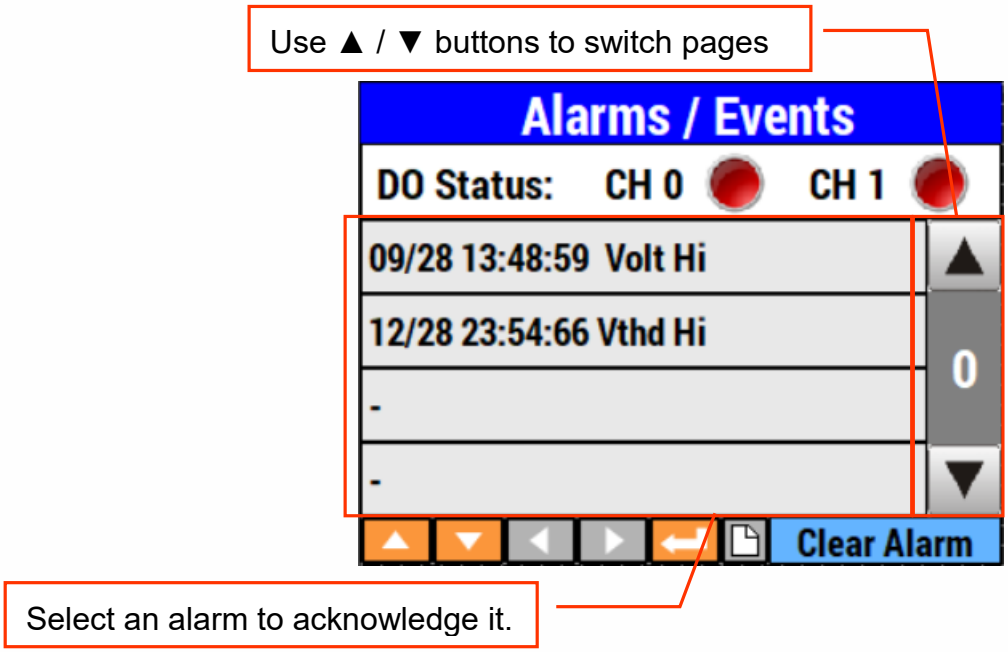
- Displays the status of alarms, digital outputs (DO), and events.
- Supports up to **32 records** (8 pages).
- Active (unconfirmed) alarms are highlighted in **red**.

User Actions

- Use ▲ / ▼ keys to switch pages.
- Select an alarm to acknowledge/confirm it.
- **Clear Alarm** button resets the Alarm LED indicator and associated DOs.

Indicators

- When at least one alarm occurs:
  - The **Alarm LED** turns on.
  - If alarm-triggered DO is enabled, the corresponding DO is also activated.

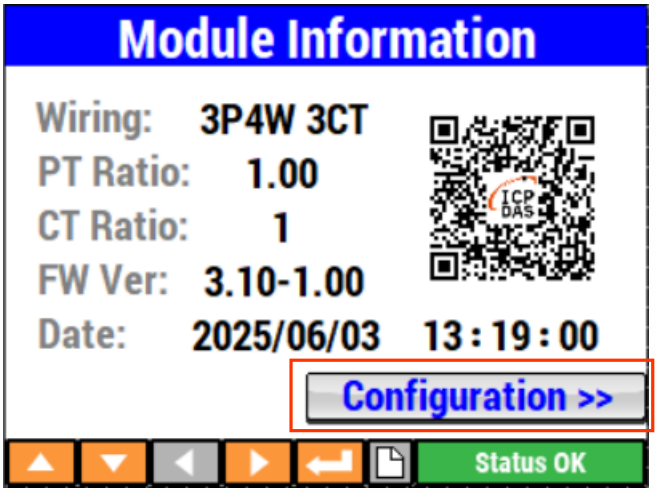


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Module Information Page

- Displayed fields:
  - Wiring mode
  - PT ratio
  - CT ratio
  - Firmware version
  - Date and time
- QR Code – provides quick access to related product information.
- **Configuration >>** button – enter **Setup Mode** for parameter settings.

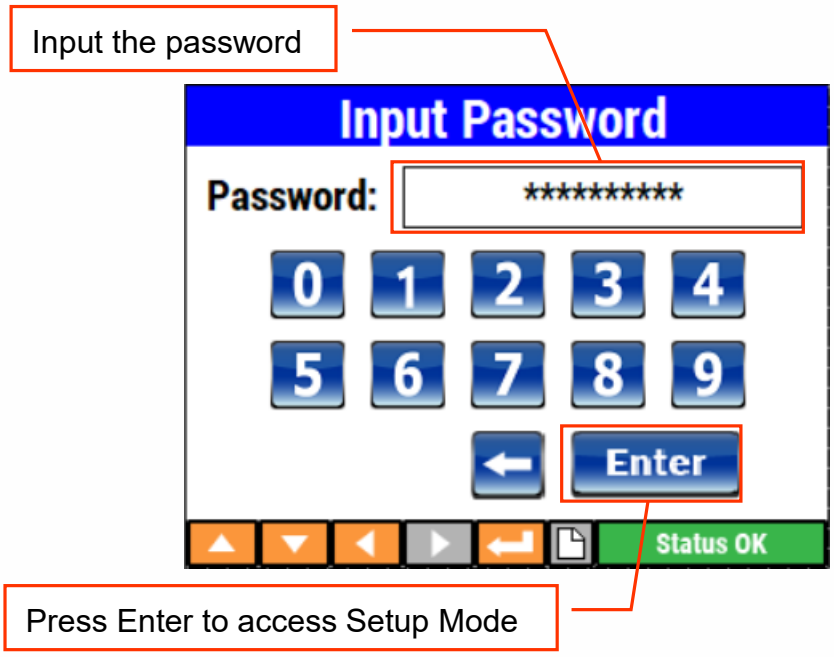


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5.2.2. Setup Mode

- Enter Setup Mode from the **Module Information Page** by pressing **Configuration >>**.
- A password (up to 16 characters) is required to access Setup Mode.
- If the password is forgotten:
  - Set the **Fn SW** (see Section 4.1) to position 3 on the Input Password page.
  - The Alarm LED will turn on for ~10 seconds.
  - During this time, users can enter Setup Mode without a password.
  - After setting a new password, return **Fn SW** to **0** for security.
- Restoring **factory defaults** (via System Settings page) resets the password to **0000**.

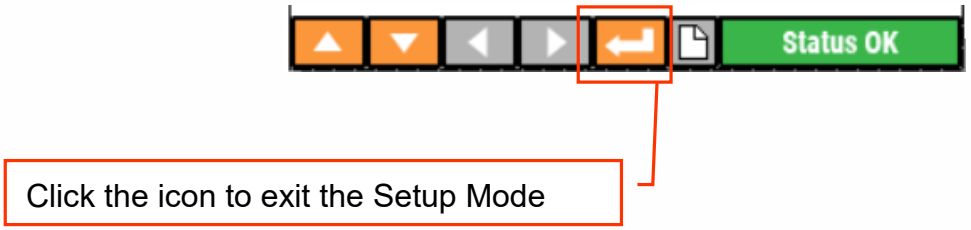


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Navigation in Setup Mode

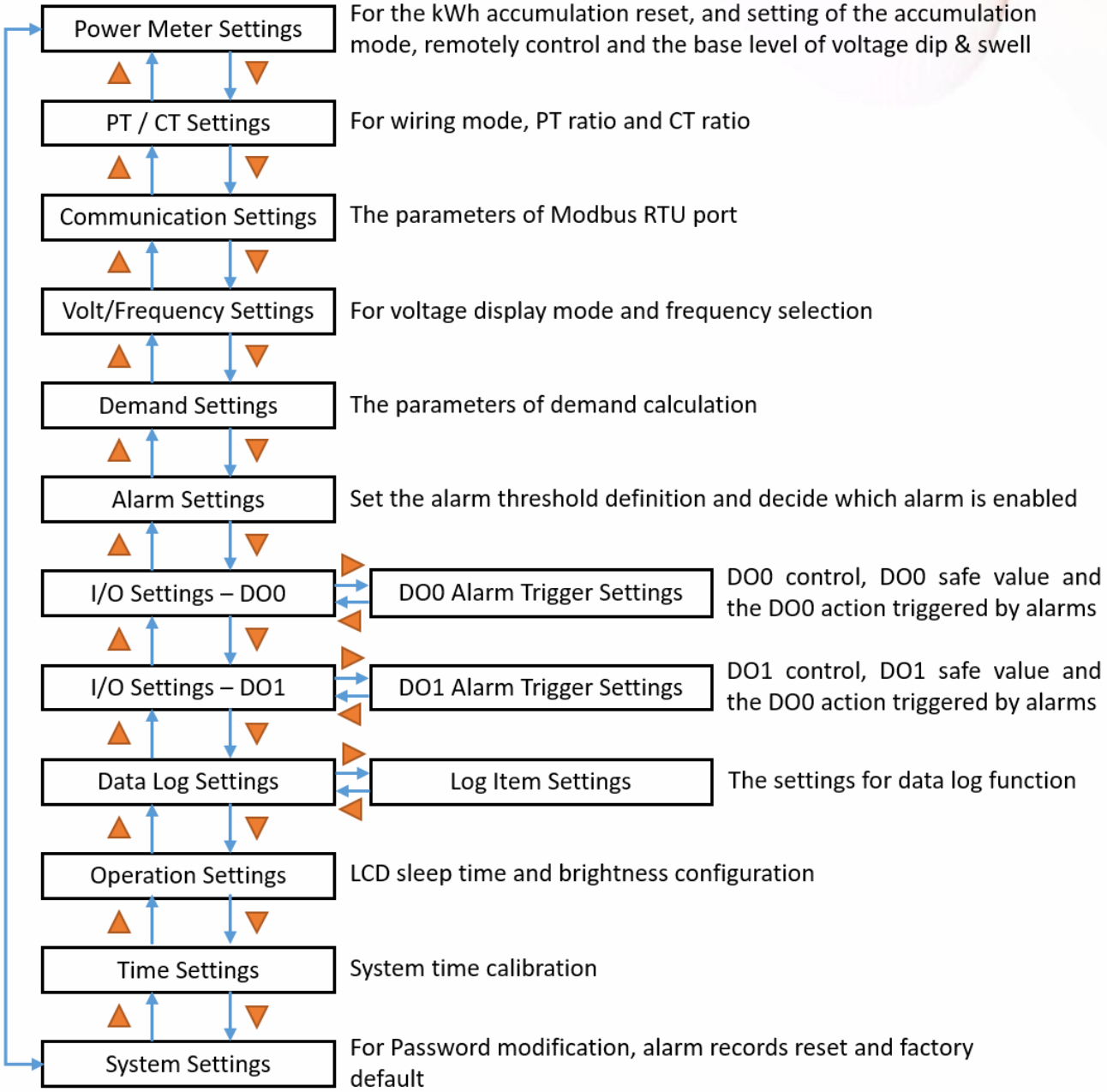
- The bottom bar layout is the same as in Normal Mode.
- **Grey icons** = unavailable functions on the current page.
- Users can:
  - Switch pages with the / **icons** or / **buttons**.
  - Exit Setup Mode with the or .



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There are 12 configuration pages in Setup Mode. These pages allow users to configure power measurement, communication parameters, alarm definitions, digital output (DO) actions, data logging, and other system functions. When switching pages in Setup Mode, the sequence and corresponding functions are shown below:



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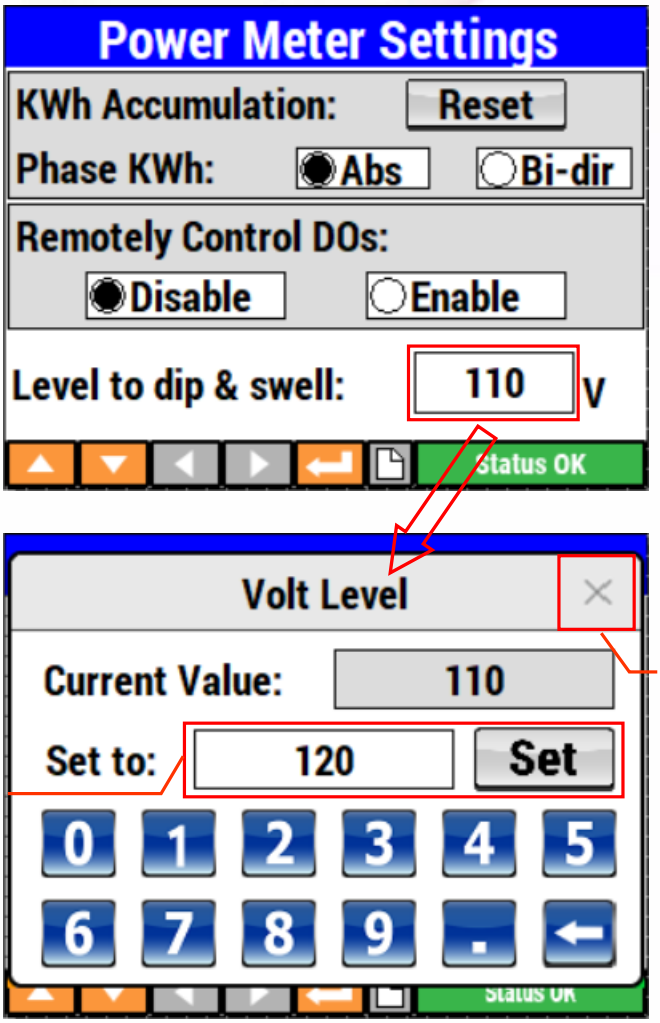
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Power Meter Settings Page

- **KWh Accumulation**
  - The PM-5133 continuously accumulates electrical energy using floating-point values.
  - Click **Reset** to clear accumulated energy.
- **Phase KWh** (accumulation mode)
  - **Abs**: takes the absolute values of positive and negative energy, then adds them together.
  - **Bi-dir**: directly adds positive and negative energy (bi-directional).
  - Select the appropriate mode according to the application.
- **Remotely Control DOs**
  - PM-5133 has two DO channels.
  - DOs can be controlled by:
    - Remote Modbus RTU master (via RS-485), or
    - Alarm-triggered DO mechanism.
  - Set Enable to allow remote Modbus control.
- **Level to Dip & Swell**
  - Detects voltage dip or swell if the deviation lasts longer than half a cycle.
  - Enter the threshold voltage level in this field.

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Enter a value and press Set

Pressing X will exit without saving changes

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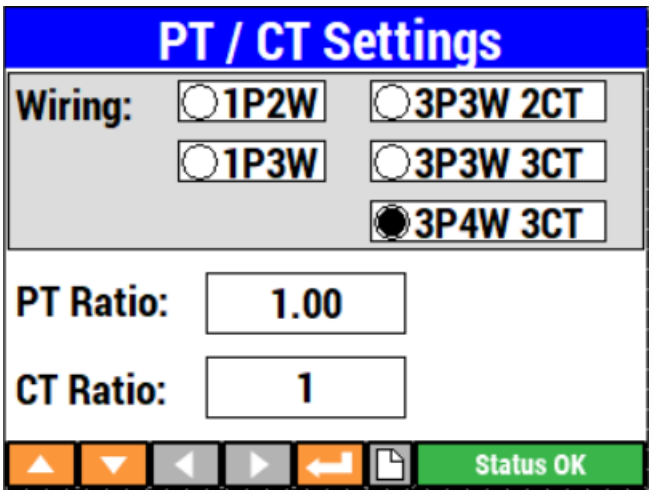
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PT/CT Settings Page

- **Wiring Mode**
  - Select the wiring configuration (e.g., 1P2W, 3P3W, 3P4W).
  - Determines how voltages and currents are measured.
  - See **Section 4.2** for detailed wiring diagrams.
- **PT Ratio**
  - Set the primary-to-secondary ratio for the potential transformer (PT).
  - Used when measuring voltages higher than 500 VAC with external PT.
  - Formula: *Primary voltage* ÷ *Secondary voltage*.
- **CT Ratio**
  - Set the primary-to-secondary ratio for the current transformer (CT).
  - Must match the CT used with the meter.
  - Formula: *Primary current* ÷ *Secondary current.*

⚠ **Note:**

- iring mode, PT ratio, and CT ratio must be configured according to the actual application.
- Incorrect settings will result in inaccurate measurements.

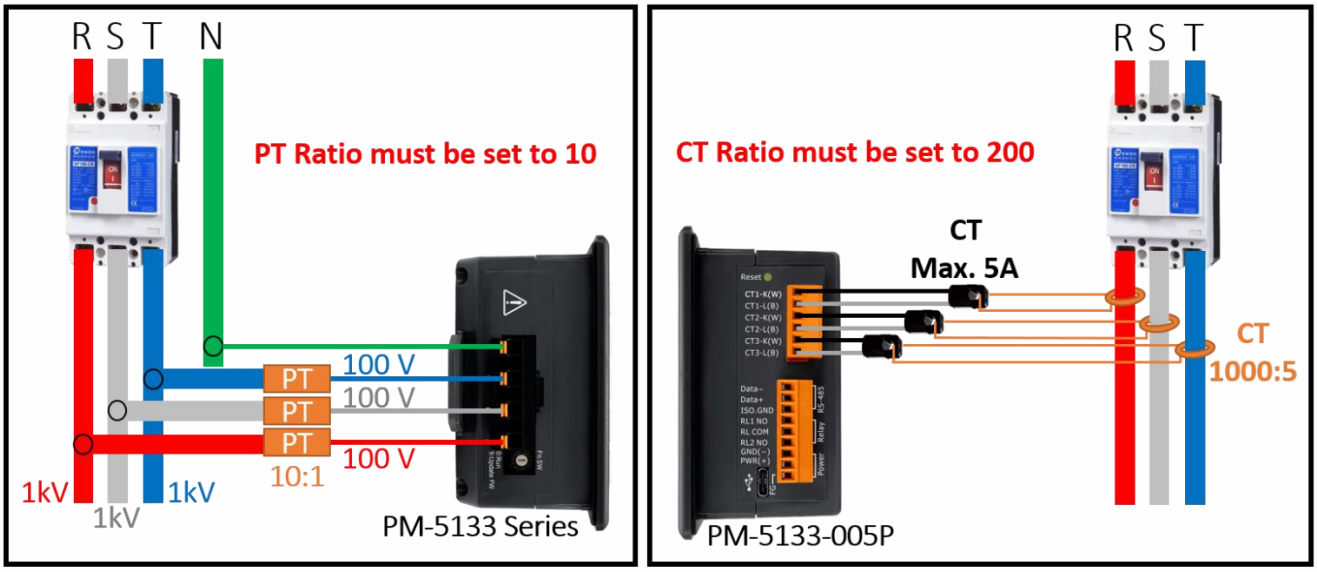


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⚠ Note:

- When using potential transformers (PT) for voltage signals, the PT ratio must be set.
- The CT ratio is required when:
  - The PM-5133 model does not include built-in CTs, or
  - The supplied CT is connected to the **secondary side** of an existing CT.
- Refer to **Case A** and **Case B** in the figure for application examples.



Case A　　Case B

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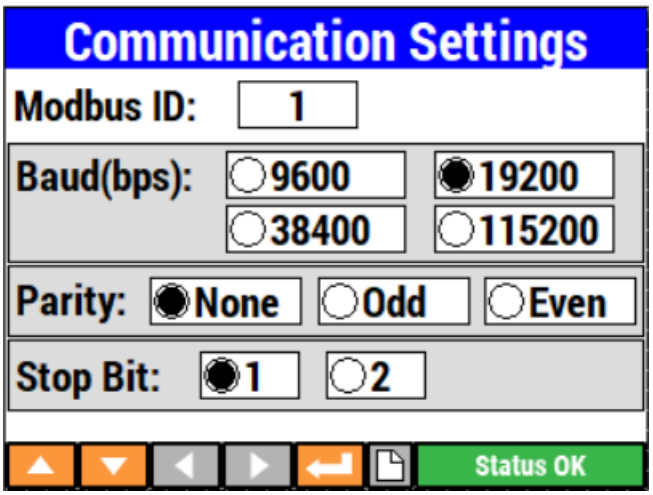
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Communication Settings Page

- The PM-5133 can act as a **Modbus RTU slave** for remote control applications.
- Users must configure the Modbus RTU parameters in this page:
  - Modbus ID: 1–64 (default = 1)
  - Baud Rate: 9600, 19200 (default), 38400, 115200 bps
  - Parity: None (default), Odd, Even
  - Stop Bit: 1 (default) or 2

⚠ **Note:**

- All communication parameters must match the Modbus master settings, otherwise communication will fail.



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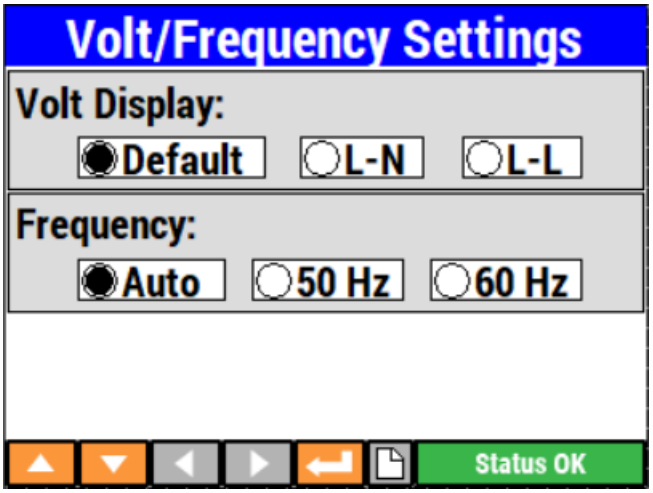
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Volt/Frequency Settings Page

- **Voltage Display Mode**
  - **Default**:
    - In **3P3W-2CT wiring mode**, displays **line voltage (L–L)**.
    - In all other wiring modes, displays **phase voltage (L–N)**.
  - **L-N**: always displays phase-to-neutral voltage.
  - **L-L**: always displays line-to-line voltage.
- **Frequency Detection**
  - **Auto**: PM-5133 automatically detects the system frequency.
  - **Manual**: user selects 50 Hz or 60 Hz.

⚠ Note:

- Correct voltage display and frequency setting are required for accurate power calculations.



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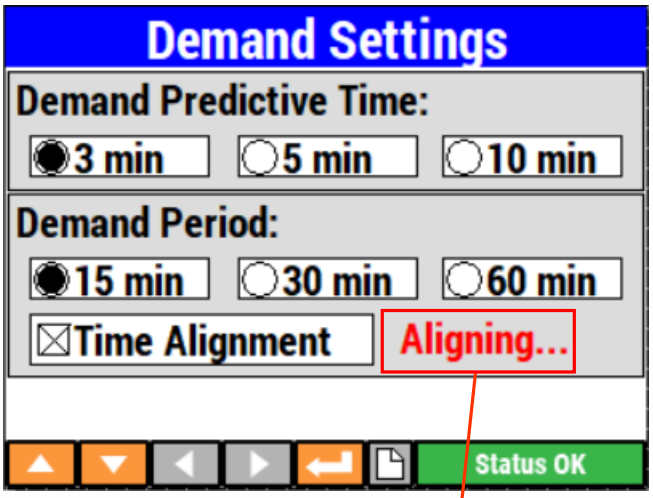
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Demand Settings Page

- **Demand Predictive Time**
  - Select predictive time: 3 min, 5 min, or 10 min.
- **Demand Period**
  - Select demand calculation period: 15 min, 30 min, or 60 min.
- **Time Alignment**
  - Aligns demand calculation with whole time units (e.g., 0 seconds, full minutes).
  - When enabled, the message **"Aligning…"** is shown until the clock reaches 0 second, then demand calculation starts.

⚠ **Note:**

- The PM-5133 calculates demand using a rolling average and predicts demand trends with linear regression for early warning.
- Demand is updated every minute and starts as soon as the PM-5133 is powered on.
- As a result, the initial demand calculation may not begin exactly at 0 seconds.
- Enabling Time Alignment forces demand calculation to start at 0 seconds.



When Time Alignment is enabled, "Aligning…" is shown until the clock reaches 0 second, then demand calculation starts.

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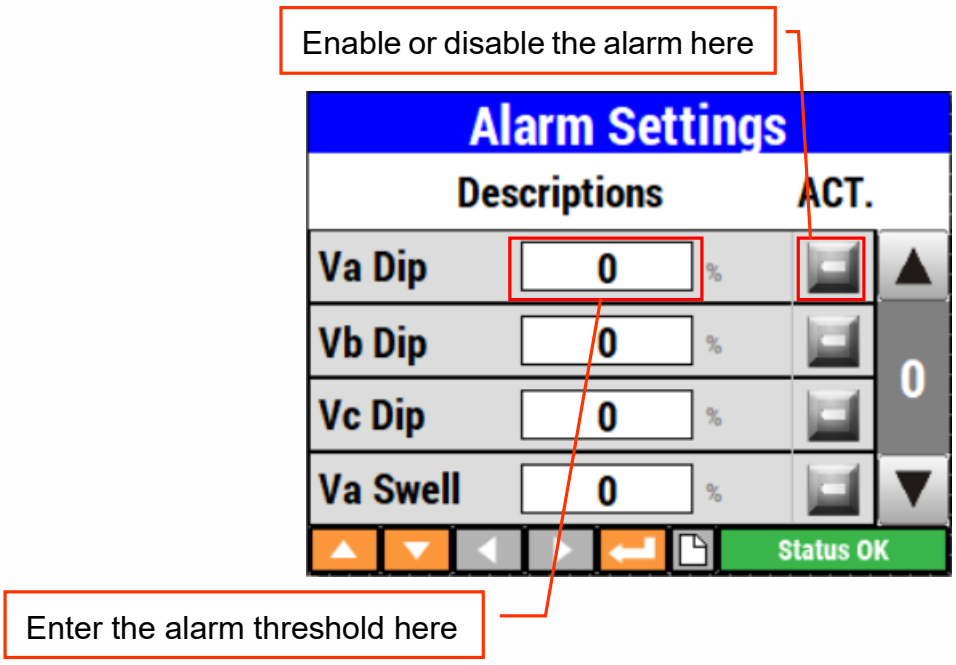
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Alarm Settings Page

- **Alarm Definition**
  - Up to **25 alarm types** are supported (e.g., Over Voltage, Under Voltage, Over Current, PF Low, Frequency Out of Range, THD, etc.).
  - Users can set threshold values for each alarm.
- **Enable/Disable**
  - Each alarm can be individually enabled or disabled.
  - Only enabled alarms will trigger events, LED indicators, and DO actions (if configured).
- **DO Linkage**
  - Alarms can be linked to digital outputs (DO0 / DO1).
  - When an alarm occurs, the assigned DO channel is activated.
- **Events and Logs**
  - Active alarms are shown in **red** on the Alarms/Events page.
  - All triggered alarms are recorded in the event log (max 32 records).

⚠ **Notes**

- Accurate alarm thresholds should be set according to the application environment.
- Misconfigured thresholds may cause frequent or missed alarms.



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I/O Settings – DO0/DO1 Page

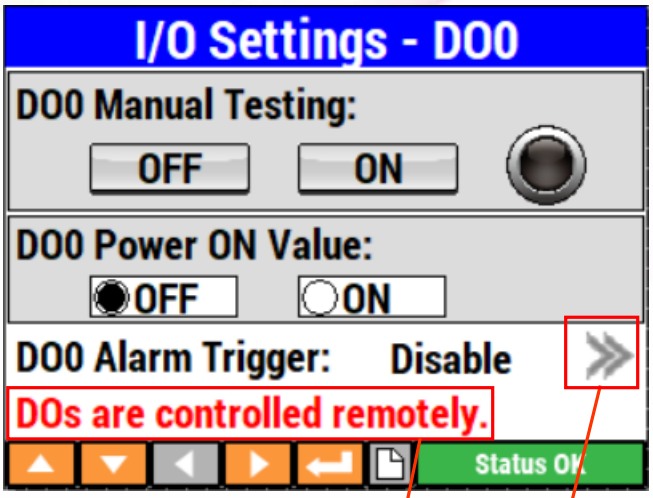
- **Manual Testing**
  - Allows manual ON/OFF control of the DO channel.
  - Useful for testing wiring and output functions.
- **Power ON Value**
  - Defines the default ON/OFF state of the DO when the device powers up.
- **Alarm Trigger**
  - Each DO channel can be linked to specific alarms.
  - When the selected alarms occur, the corresponding DO output is activated.
  - Use the **Alarm Trigger Settings** page to assign alarms to DO0/DO1.

⚠ **Note:**

- If **Remote Control DOs** is enabled, Modbus master takes priority over alarm linkage.
- Ensure the Power ON Value does not conflict with system safety requirements.
- The PM-5133 provides two DO channels, each with an independent settings page (e.g., DO0 page, DO1 page).
- Remote control via Modbus and local alarm linkage **cannot be used simultaneously**.
  - Disable **Remotely Control DOs** in the **Power Meter Settings** page before using this function.
- At least one alarm must be enabled in **Alarm Settings**; otherwise, the message “Activate the Alarms first” will be displayed.

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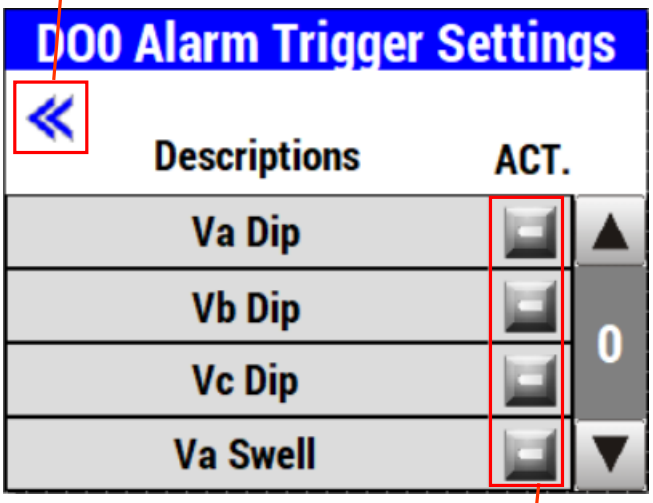
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Remotely Control DOs must be disabled

When this icon is blue, click to select alarms that trigger DO0

Click to return to the I/O Settings – DO0 page



Enable or disable the trigger here

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Data Log Settings Page

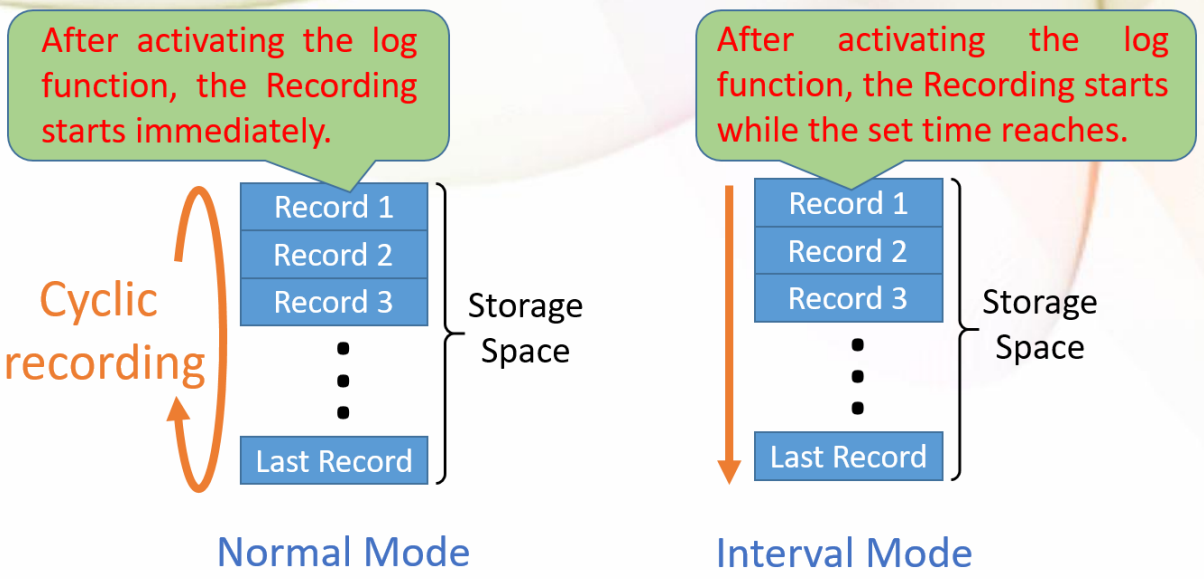
- **Modes**
  - **Normal Mode**
    - Data is recorded continuously at the set interval.
    - When storage is full, the oldest records are overwritten (cyclic recording).
    - The **From** field is not used in this mode.
  - **Interval Mode**
    - Data recording begins at the user-defined start time.
    - When storage is full, data recording stops.
    - If the configured start time is in the past, the system automatically sets it to the current time.
- **Period**
  - Defines the logging interval (seconds, minutes, or hours).
  - Example: *01 Hour* → record once per hour.
- **Time Alignment**
  - Aligns recording to specific time points.
  - Supported alignment values:

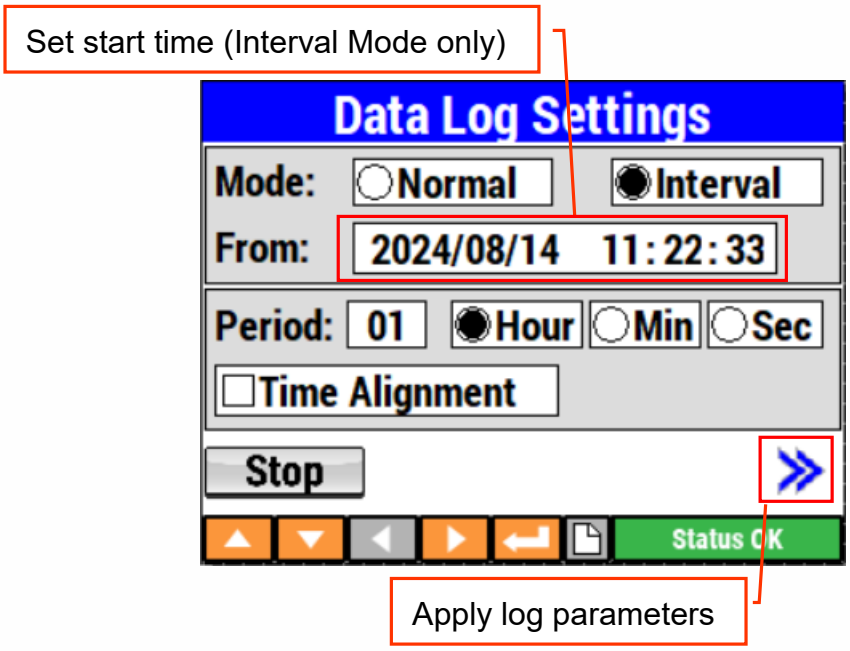
Unit	Supported Intervals
Second	1, 2, 3, 4, 5, 6, 10, 12, 15, 20, 30
Minute	1, 2, 3, 4, 5, 6, 10, 12, 15, 20, 30
Hour	1

  - Example: Period = 10 seconds with alignment enabled → records at 0, 10, 20, 30, 40, 50 seconds of every minute.
  - If the chosen period is not listed above, **Time Alignment** has no effect.

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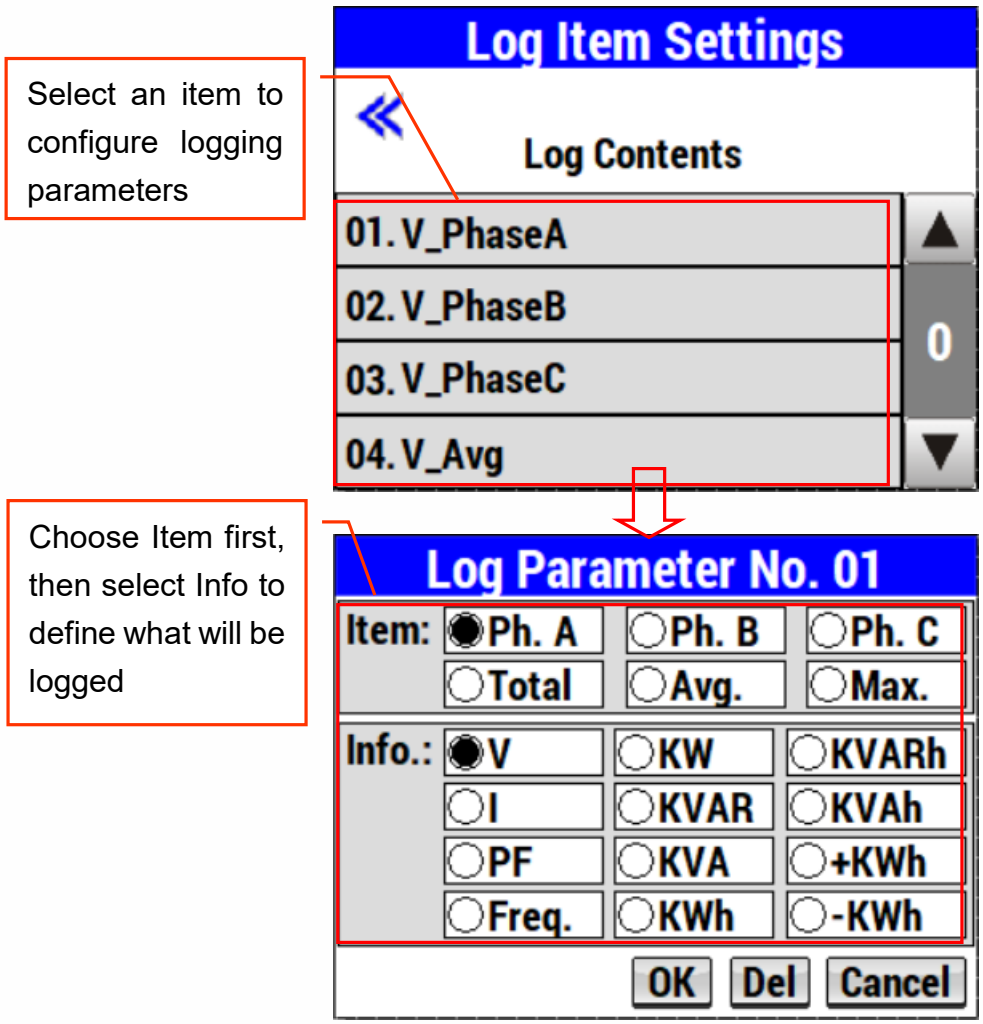


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Log Item Settings Page

- **Function**
  - Allows users to configure up to **24 parameters** for logging in a single record.
  - After finishing the configuration:
    - Click **OK** to save,
    - Click **Del** to remove the parameter,
    - Or click **Cancel** to exit without saving.
- **Operation**
  1. Select an **Item** (e.g., Phase A, Phase B, Phase C, Total, Average, Max).
  2. Select the corresponding **Info** (e.g., Voltage, Current, PF, Frequency, kWh, kVARh, kVAh, etc.).
  3. Confirm with **OK**.



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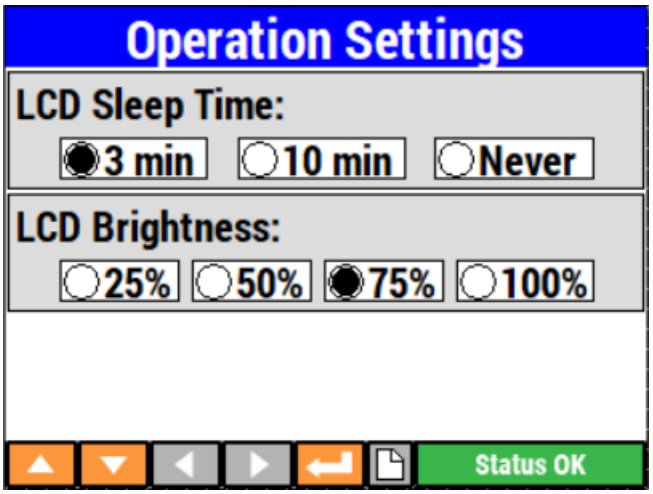
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Operation Settings Page

- **LCD Sleep Time**
  - Options: 3 min, 10 min, or Never.
  - Default: **10 min**.
  - When not set to *Never*, the LCD turns off after the set time with no user operation.
  - Tap the screen or press any key to wake the LCD.
- **LCD Brightness**
  - Options: 25%, 50%, 75%, 100%.
  - Default: **75%**.
  - Adjusts the brightness of the LCD backlight.

⚠ **Notes**

- Shorter sleep time and lower brightness help reduce power consumption and extend LCD lifetime.



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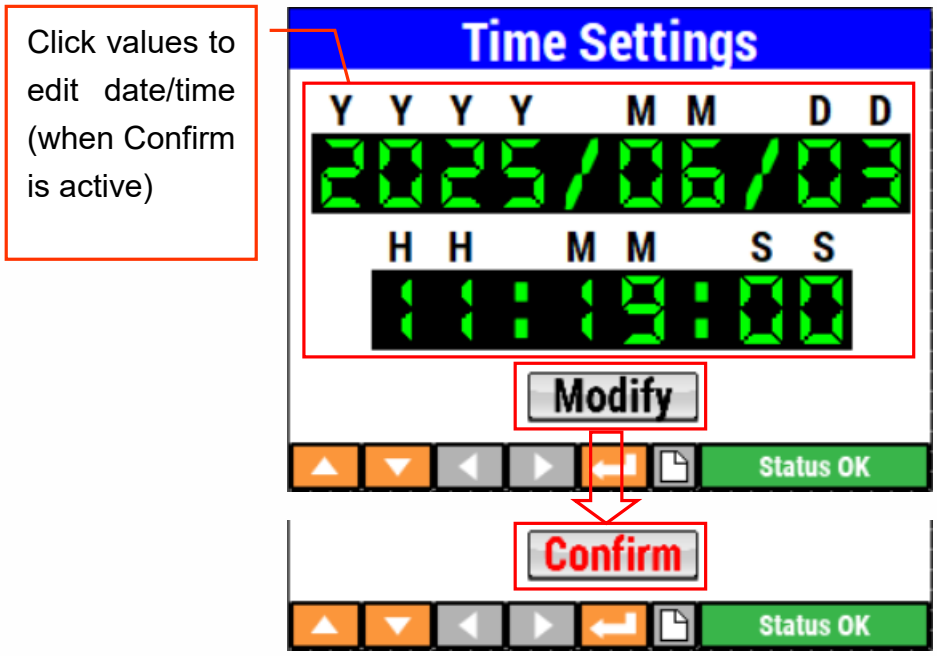
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Time Settings Page

- **Function**
  - Used to calibrate the system date and time.
  - System time is applied to data logs, alarms, and event records.
- **Operation**
  1. Press **Modify** to enter edit mode.
     - The button changes from **Modify** to **Confirm** (flashing in red).
  2. Click the value fields (Year, Month, Day, Hour, Minute, Second) to set the time.
  3. Press **Confirm** to save changes.
  4. To cancel without changes, press any other key or navigation icon.

⚠ Notes

- Ensure the system time is accurate before enabling data logging.
- Incorrect time settings may cause misaligned timestamps with external systems.



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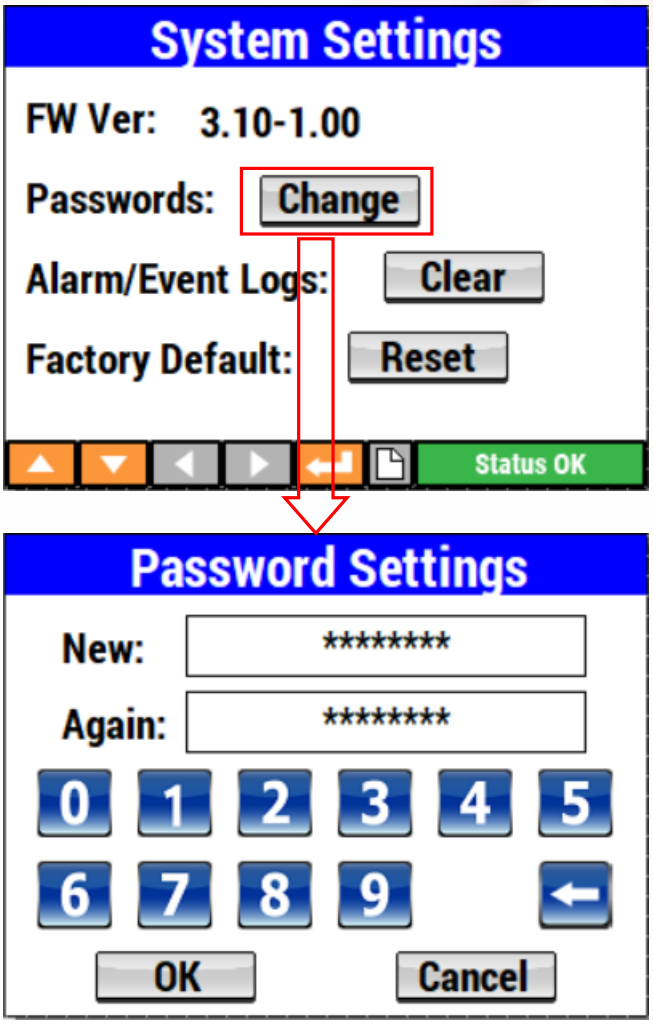
System Settings Page

- **Firmware Version (FW Ver)**
  - Displays the current firmware version of the PM-5133.
- **Password Settings**
  - Click **Change** to set a new password.
  - A new password must be entered twice, and both entries must match.
- **Alarm/Event Logs**
  - Click **Clear** to erase all alarm and event log records.
- **Factory Default**
  - Click **Reset** to restore default parameters.
  - Restores: Modbus address, LCD sleep time, LCD brightness, and clears all Alarm/Event logs.
  - After reset, the PM-5133 will automatically reboot.
- **Remote Reset via Modbus**
  - Writing Modbus address **0x100C** restores Modbus data to defaults (see Section 6.2.2).
  - LCD sleep time, brightness, and Alarm/Event logs are **not affected** by this method.

Parameters	Reset button (on device)	Modbus 0x100C Command
Modbus data	Restored to defaults (see Section 6.2.2)	
LCD Sleep Time	10 minutes(default)	Not affected
LCD Brightness	75%(default)	Not affected
Alarm/Event Logs	Cleared	Not affected

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6. Modbus-RTU communication

6.1 RS-485 setting

- The PM-5133 communicates through an **RS-485 interface** using the Modbus RTU protocol.
- Communication parameters (Baud rate, Data format, Modbus address) can be configured in **Setup Mode → Communication Settings (Section 5.2.2)**.

Default settings:

- **Baud rate**: 19200 bps
- **Data format**: N,8,1 (No parity, 8 data bits, 1 stop bit)
- **Modbus address**: 1

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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, 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

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

- **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 Table #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	

- Modbus Table #2 – Coil: System Boolean Setting Value

Parameter Name	Modbus Register		Len	Data Type	Range	Default Value	Comment
	Modicon Format	Hex					
Enable VLL Compensation	00001	0x0000	Word	Byte	0 = OFF 1 = ON	0	Only work for 3P3W3CT wiring
Remotely Control DOs	04115	0x1012	Word	Byte	0 =OFF 1 =ON	1	If set to 1, the DOs cannot be controlled from the touch screen.

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- Modbus Table #3 – Holding Register: System Parameter Setting

Parameter name	Modbus Register		Len	Data Type	Range	Default value	Units	Comment
	Modicon Format	Hex						
PT_Ratio	44100	0x1003	Word	UInt	1-65535	100	0.01	
CT_Ratio	44101	0x1004	Word	UInt	1-65535	1	1	
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		
Display Voltage	44115	0x1012	Word	UInt	0: Default 1: Show as Vln 2: Show as Vll	0		Refer to Q10
Voltage Dip Alarm Threshold	44118	0x1015	Word	UInt	0 ~ 20	0	%	The percentage of "Level to dip & swell" value. Value 0 indicates disable
Voltage Swell Alarm Threshold	44119	0x1016	Word	UInt	0 ~ 20	0	%	

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Level to dip & swell	44120	0x1017	Word	UInt	0 or 10 ~ 500	0	V	Value 0 indicates disable
CT Ratio Scale	44122	0x1019	Word	UInt	6~10~14	10		Refer to Q15
Max Value of Accumulated Energy	44131	0x1022	Word	UInt	0:9999999.9 1:99999999.9 2:999999999.9	0		
PT Ratio Scale	44132	0x1023	Word	UInt	6~10~14	8		Refer to Q15
RTC year	44145	0x1030	Word	UInt	2000 ~ 2159			Before setting the time of RTC, the data log function must be stop first
RTC month	44146	0x1031	Word	UInt	1 ~ 12			
RTC day	44147	0x1032	Word	UInt	1 ~ 31			
RTC hour	44148	0x1033	Word	UInt	0 ~ 23			
RTC minute	44149	0x1034	Word	UInt	0 ~ 59			
RTC second	44150	0x1035	Word	UInt	0 ~ 59			
Total number of logged records	44151 44152	0x1036 0x1037	DWord	UInt32	1 ~ 638586			Address 0x1036 is low Word
Starting record to read log data	44153 44154	0x1038 0x1039	DWord	UInt32	0 ~ 638587			Address 0x1038 is low Word
Status of the data logging	44155	0x103A	Word	UInt	0: stop 1: running Others: error code			
Data logger control register	44156	0x103B	Word	UInt	0: stop mode 1: normal mode 2: interval mode 0x7297: reset			
Data logger mode	44157	0x103C	Word	UInt	Bit 0: continue writing when data logger is full Bit 1: time stamp alignment, 0: disable, 1: enable			If address 0x103B is set to 1 (normal mode), the bit 0 of this register must be 1. If address 0x103B is set to 2 (interval mode), the bit 0 of this register must be 0.

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Recording period hour	44158	0x103D	Word	UInt	0 ~ 24	0		Set the value to only one of the address 0x103D, 0x103E, or 0x103F each time, while keeping all other addresses as 0. Set all the value of these three address to 0 are illegal.
Recording period minute	44159	0x103E	Word	UInt	0 ~ 59	0		
Recording period second	44160	0x103F	Word	UInt	0 ~ 59	10		
Start to record year	44161	0x1040	Word	UInt	2000 ~ 2159			
Start to record month	44162	0x1041	Word	UInt	1 ~ 12			
Start to record day	44163	0x1042	Word	UInt	1 ~ 31			
Start to record hour	44164	0x1043	Word	UInt	0 ~ 23			
Start to record minute	44165	0x1044	Word	UInt	0 ~ 59			
Start to record second	44166	0x1045	Word	UInt	0 ~ 59			
Log Parameter 01	44181	0x1054	Word	UInt	0 ~ 44			The value 0 indicates the log parameter is useless. Values 1 ~ 44 correspond to the respective electrical parameters, as detailed in the table below. All non-zero values will be recorded in the log file.
Log Parameter 02	44182	0x1055	Word	UInt	0 ~ 44			
Log Parameter 03	44183	0x1056	Word	UInt	0 ~ 44			
Log Parameter 04	44184	0x1057	Word	UInt	0 ~ 44			
Log Parameter 05	44185	0x1058	Word	UInt	0 ~ 44			
Log Parameter 06	44186	0x1059	Word	UInt	0 ~ 44			
Log Parameter 07	44187	0x105A	Word	UInt	0 ~ 44			
Log Parameter 08	44188	0x105B	Word	UInt	0 ~ 44			
Log Parameter 09	44189	0x105C	Word	UInt	0 ~ 44			
Log Parameter 10	44190	0x105D	Word	UInt	0 ~ 44			
Log Parameter 11	44191	0x105E	Word	UInt	0 ~ 44			
Log Parameter 12	44192	0x105F	Word	UInt	0 ~ 44			
Log Parameter 13	44193	0x1060	Word	UInt	0 ~ 44			
Log Parameter 14	44194	0x1061	Word	UInt	0 ~ 44			

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Log Parameter 15	44195	0x1062	Word	UInt	0 ~ 44			
Log Parameter 16	44196	0x1063	Word	UInt	0 ~ 44			
Log Parameter 17	44197	0x1064	Word	UInt	0 ~ 44			
Log Parameter 18	44198	0x1065	Word	UInt	0 ~ 44			
Log Parameter 19	44199	0x1066	Word	UInt	0 ~ 44			
Log Parameter 20	44200	0x1067	Word	UInt	0 ~ 44			
Log Parameter 21	44201	0x1068	Word	UInt	0 ~ 44			
Log Parameter 22	44202	0x1069	Word	UInt	0 ~ 44			
Log Parameter 23	44203	0x106A	Word	UInt	0 ~ 44			
Log Parameter 24	44204	0x106B	Word	UInt	0 ~ 44			
Demand Predictive time	45889	0x1700	Word	UInt	5: 5-min. 10: 10-min. Others: 3- min.			
Demand Period	45890	0x1701	Word	UInt	Bit 0~14: For Period time. 30: 30-min. 60: 60-min. Others: 15-min. Bit 15: Time alignment 0: disable 1: enable			
Demand Real Value	45905 45906	0x1710 0x1711	DWord	Float		kW		Demand Real Value
Demand Predictive Value	45907 45908	0x1712 0x1713	DWord	Float		kW		Demand Predictive Value
Va Dip Alarm Threshold	45937 45938	0x1730 0x1731	DWord	Float	0 ~ 20	0	%	The percentage of "Level to dip & swell" value. Value 0 indicates disable. Because the PM-5133 can't set the dip and swell threshold to Va, Vb, and Vc individually, these
Vb Dip Alarm Threshold	45939 45940	0x1732 0x1733	DWord	Float	0 ~ 20	0	%	
Vc Dip Alarm Threshold	45941 45942	0x1734 0x1735	DWord	Float	0 ~ 20	0	%	
Va Swell Alarm	45943	0x1736	DWord	Float	0 ~ 20	0	%	

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Threshold	45944	0x1737						values will the same as the "Voltage Dip Alarm Threshold" and "Voltage Swell Alarm Threshold".
Vb Swell Alarm Threshold	45945 45946	0x1738 0x1739	DWord	Float	0 ~ 20	0	%	
Vc Swell Alarm Threshold	45947 45948	0x173A 0x173B	DWord	Float	0 ~ 20	0	%	
Ia High Alarm Threshold	45949 45950	0x173C 0x173D	DWord	Float	0 ~ 4000	0	0.001 A	
Ib High Alarm Threshold	45951 45952	0x173E 0x173F	DWord	Float	0 ~ 4000	0	0.001 A	
Ic High Alarm Threshold	45953 45954	0x1740 0x1741	DWord	Float	0 ~ 4000	0	0.001 A	
Ia Low Alarm Threshold	45955 45956	0x1742 0x1743	DWord	Float	0 ~ 4000	0	0.001 A	
Ib Low Alarm Threshold	45957 45958	0x1744 0x1745	DWord	Float	0 ~ 4000	0	0.001 A	
Ic Low Alarm Threshold	45959 45960	0x1746 0x1747	DWord	Float	0 ~ 4000	0	0.001 A	
kWa High Alarm Threshold	45961 45962	0x1748 0x1749	DWord	Float	0 ~ 9999.9	0	0.001 kW	
kWb High Alarm Threshold	45963 45964	0x174A 0x174B	DWord	Float	0 ~ 9999.9	0	0.001 kW	
kWc High Alarm Threshold	45965 45966	0x174C 0x174D	DWord	Float	0 ~ 9999.9	0	0.001 kW	
kWa Low Alarm Threshold	45967 45968	0x174E 0x174F	DWord	Float	0 ~ 9999.9	0	0.001 kW	
kWb Low Alarm Threshold	45969 45970	0x1750 0x1751	DWord	Float	0 ~ 9999.9	0	0.001 kW	
kWc Low Alarm Threshold	45971 45972	0x1752 0x1753	DWord	Float	0 ~ 9999.9	0	0.001 kW	
kVARa High Alarm Threshold	45973 45974	0x1754 0x1755	DWord	Float	0 ~ 9999.9	0	0.001 kVAR	
kVARb High Alarm Threshold	45975 45976	0x1756 0x1757	DWord	Float	0 ~ 9999.9	0	0.001 kVAR	

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kVARc High Alarm Threshold	45977 45978	0x1758 0x1759	DWord	Float	0 ~ 9999.9	0	0.001 kVAR	
kVARa Low Alarm Threshold	45979 45980	0x175A 0x175B	DWord	Float	0 ~ 9999.9	0	0.001 kVAR	
kVARb Low Alarm Threshold	45981 45982	0x175C 0x175D	DWord	Float	0 ~ 9999.9	0	0.001 kVAR	
kVARc Low Alarm Threshold	45983 45984	0x175E 0x175F	DWord	Float	0 ~ 9999.9	0	0.001 kVAR	
Demand High Alarm Threshold	45985 45986	0x1760 0x1761	DWord	Float	0 ~ 9999.9	0	0.001 kW	
Alarm Enable	46003 46004	0x1772 0x1773	DWord	UInt32	Bit 0 ~ Bit 24 indicates different alarm. 0: Dissble 1: Enable	0		The address 0x1772, 0x1774, and 0x1776 are the low Word of the data.
Alarm trigger DO0	46005 46006	0x1774 0x1775	DWord	UInt32		0		
Alarm Trigger DO1	46007 46008	0x1776 0x1777	DWord	UInt32		0		

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The following table shows the correspondence between ID numbers and parameter names.

No.	Paras.	No.	Paras.	No.	Paras.	No.	Paras.	No.	Paras.
1	V_a	10	V_b	19	V_c	28	V_avg	37	Freq_a
2	I_a	11	I_b	20	I_c	29	I_avg	38	Freq_b
3	kW_a	12	kW_b	21	kW_c	30	kW_tot	39	Freq_c
4	kVAR_a	13	kVAR_b	22	kVAR_c	31	kVAR_tot	40	Freq_max
5	kVA_a	14	kVA_b	23	kVA_c	32	kVA_tot	41	Bi_Positive_kWh
6	PF_a	15	PF_b	24	PF_c	33	PF_tot	42	Bi_ Negitive_kWh
7	kWh_a	16	kWh_b	25	kWh_c	34	kWh_tot	43	Bi_ Net_kWh
8	kVARh_a	17	kVARh_b	26	kVARh_c	35	kVARh_tot	44	Bi_ Total_kWh
9	kVAh_a	18	kVAh_b	27	kVAh_c	36	kVAh_tot		

The four registers, Alarm Status, Alarm Enable, Alarm trigger DO0, and Alarm trigger DO0 are operated by bit. Each bit indicates one kind of alarm. The bit position and the corresponding alarm are shown as follow table.

Bit No.	Alarm Name	Bit No.	Alarm Name	Bit No.	Alarm Name
0	Va Dip	9	Ia Low	18	kVARa High
1	Vb Dip	10	Ib Low	19	kVARb High
2	Vc Dip	11	Ic Low	20	kVARc High
3	Va Swell	12	kWa High	21	kVARa Low
4	Vb Swell	13	kWb High	22	kVARb Low
5	Vc Swell	14	kWc High	23	kVARc Low
6	Ia High	15	kWa Low	24	Demand High
7	Ib High	16	kWb Low		
8	Ic High	17	kWc Low		

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- Modbus Table #4 – Input Register: System Information

Parameter name	Modbus Register		Len	Data Type	Range	Default value	Units	Comment
	Modicon 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	5133: PM-5133	5133		
Model Type	30516	0x0203	Word	UInt	0x0001: 50Hz 0x0002: 60Hz	0x0002		
Firmware Version	30517	0x0204	Word	BCD		0x0100		Ver. 1.0
Display Firmware Version	35909	0x1714 0x1715	DWord	Uint32		0x0100		Address 0x1714 is reserved
Alarm Status	35911	0x1716 0x1717	DWord	Uint32		Bit 0 ~ Bit 24 indicates different alarm status		Refer to above table for details.

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- Modbus Table #5 – Input Register: Power value (Float)

Parameter name	Modbus Register		Len	Data Type	Range	Units	Comment
	Modicon Format	Hex					
V_a	34353-34354	0x1100-0x1101	DWord	Float		Volt	Refer to Q10
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	0~1		
kWh_a	34365-34366	0x110C-0x110D	DWord	Float			±0~9999999.9
kvarh_a	34367-34368	0x110E-0x110F	DWord	Float			±0~9999999.9
kVAh_a	34369-34370	0x1110-0x1111	DWord	Float			±0~9999999.9
V_b	34371-34372	0x1112-0x1113	DWord	Float		Volt	Refer to Q10
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	0~1		
kWh_b	34383-34384	0x111E-0x111F	DWord	Float			±0~9999999.9
kvarh_b	34385-34386	0x1120-0x1121	DWord	Float			±0~9999999.9
kVAh_b	34387-34388	0x1122-0x1123	DWord	Float			±0~9999999.9
V_c	34389-34390	0x1124-0x1125	DWord	Float		Volt	Refer to Q10
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	0~1		
kWh_c	34401-34402	0x1130-0x1131	DWord	Float			±0~9999999.9
kvarh_c	34403-34404	0x1132-0x1133	DWord	Float			±0~9999999.9
kVAh_c	34405-34406	0x1134-0x1135	DWord	Float			±0~9999999.9
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	0~1		
kWh_tot	34419-34420	0x1142-0x1143	DWord	Float			±0~9999999.9
kvarh_tot	34421-34422	0x1144-0x1145	DWord	Float			±0~9999999.9
kVAh_tot	34423-34424	0x1146-0x1147	DWord	Float			±0~9999999.9
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		kWh	
Bi_Negative _kWh	34465-34466	0x1170-0x1171	DWord	Float		kWh	
Bi_Net _kWh	34467-34468	0x1172-0x1173	DWord	Float		kWh	
Bi_Total _kWh	34469-34470	0x1174-0x1175	DWord	Float		kWh	
Signed PF _A	34515-34516	0x11A2-0x11A3	DWord	Float	-2~+2		Refer to Q16
Signed PF _B	34517-34518	0x11A4-0x11A5	DWord	Float	-2~+2		Refer to Q16
Signed PF _C	34519-34520	0x11A6-0x11A7	DWord	Float	-2~+2		Refer to Q16
Signed PF _Total	34521-34522	0x11A8-0x11A9	DWord	Float	-2~+2		Refer to Q16

⚠ Notes

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 #6 – Input Register :Power value (Inverse Integer)

Parameter name	Modbus Register		Len	Data Type	Range	Units	Comment
	Modicon 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	
kVA_tot	34668-34669	0x123B-0x123C	DWord	Int32		0.1kVA	

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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 #7 – Input Register: Power value (Integer)

Parameter name	Modbus Register		Len	Data Type	Range	Units	Comment
	Modicon 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	
kVA_tot	34924-34925	0x133B-0x133C	DWord	Int32		0.1kVA	

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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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7. Appendix: Questions & Answers

Q1. Can we use other 5A CTs (e.g., 300/5) directly with the input current terminals of the PM-5133 series?

Answer: No, you cannot directly use other 5A CTs, such as 300/5 or 100/5, with the PM-5133 series because the input current terminals are designed for milliamp (mA) inputs only. Directly connecting 5A CTs could cause fatal damage. Use the included split-type clip-on CT provided with the PM-5133 series to connect with 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-5133 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) 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. Why can't the PC connect to the meter over RS-485？

Answer:

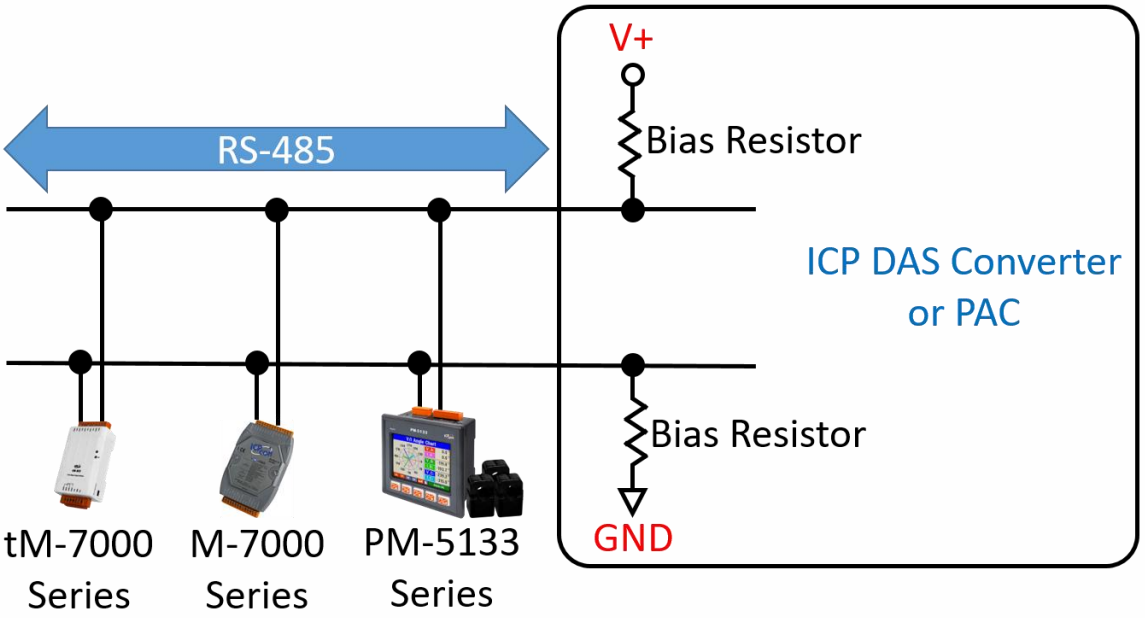
(1) **Confirm the Modbus address:** Ensure the Modbus address is set correctly. The default value is 1.

(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-5133 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.



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Q7. 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.

Q8. What if the wire length for the split-type clip-on CT is insufficient?

Answer:

- PM-5133-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.

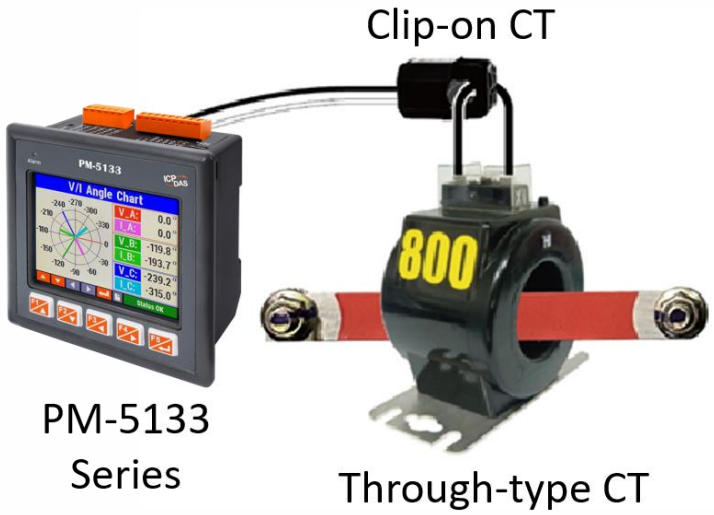
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Q9. How can I measure currents exceeding 400A?

Answer: The maximum current range for the CTs used with the PM-5133 is **400A**. If the target current exceeds 400A, consider the following solution:

(1) Use Rogowski coil models – Consider the PM-5133 with Rogowski coils, such as PM-5133-RCT500P, PM-5133-RCT1000P, PM-5133-RCT2000P, or PM-5133-RCT4000P.
(2) Use an external CT – For example, to measure 800 A, use an external CT designed for 800 A. Connect the PM-5133's clip-on CTs to the secondary side of the external CT (see figure). Then, configure the appropriate CT ratio in the PM-5133 settings.



Note:

A. Primary CT accuracy will influence the measurement.
B. Even the maximum output current of the primary CT is 5A, don't wire to the PM-5133 and PM-5133P directly.

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Q10. 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.

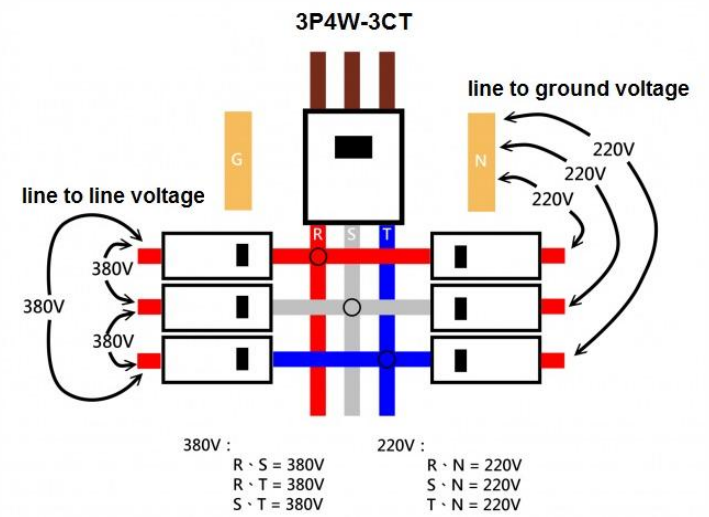
Line-to-ground voltage is the voltage between terminals A-N, B-N, and C-N.

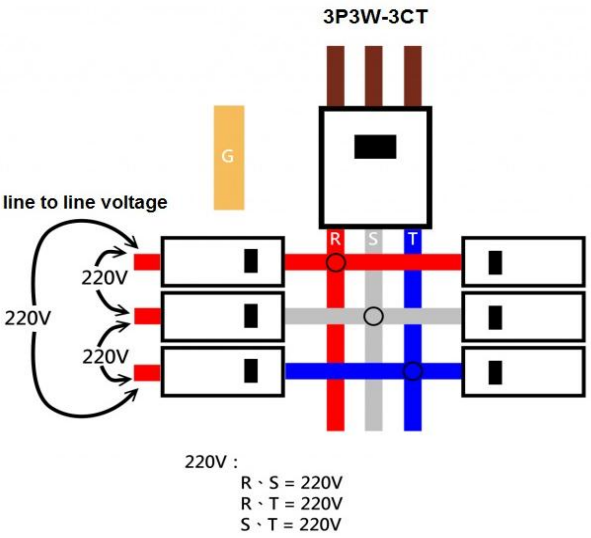
Calculation:

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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Q11. 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 (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)

Q12. 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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Q13. 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-3133 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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Q14. How can I save the recorded data of the PM-5133 series to a file?

Answer:

You can use the **Power Meter Utility** to export recorded data to a file.

The utility can be downloaded from the following website:

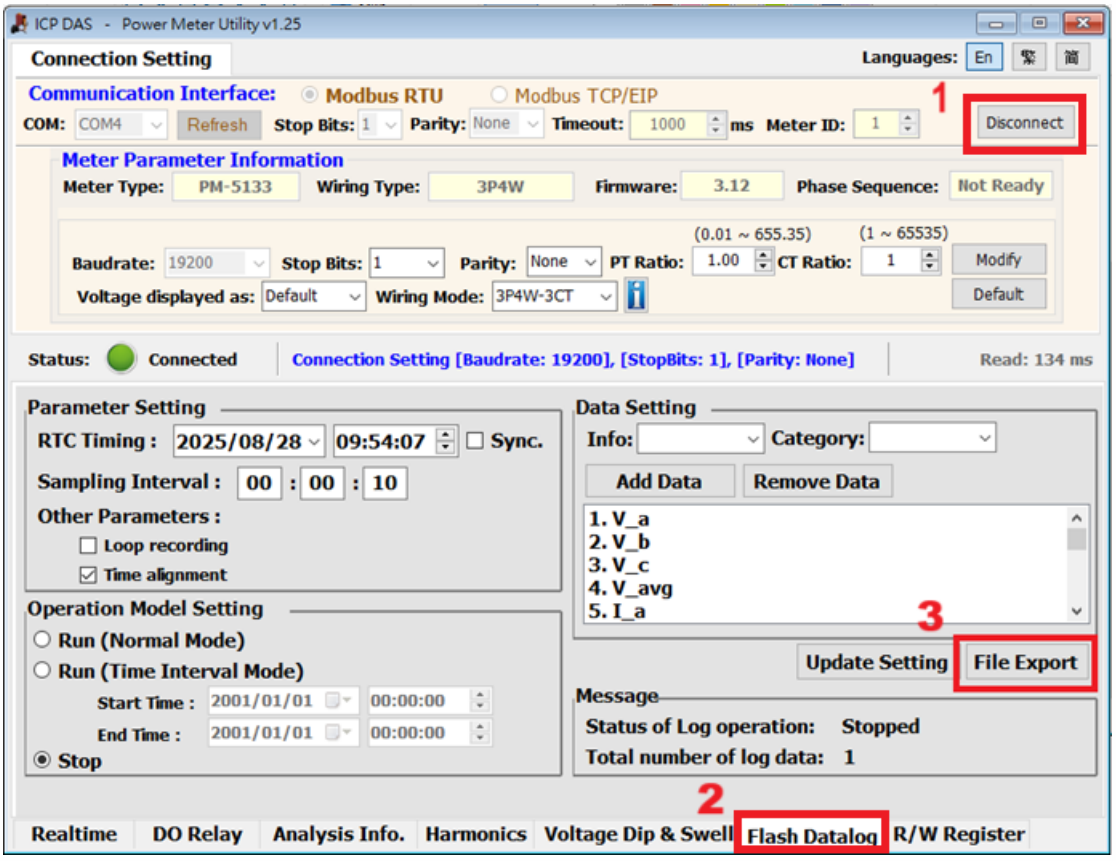
☞ https://www.icpdas.com/tw/download/index.php?model=PM-5133%20series

Steps:

1. Install the Power Meter Utility and complete the RS-485 wiring between the PC and the PM-5133.
2. Click **Connect** to establish communication.
3. Switch to the **Flash Datalog** page.
4. Click **File Export** to save the recorded data to a file.

⚠ Note:

- Before exporting, make sure the data logger function has been stopped or disabled.



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Q15. 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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Q16. 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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Q17. 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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Q18. 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.

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