SATEC

Smart Multifunction Meter with Color Graphic Display

PM126

Installation and Operation Manual

BG0674 REV.A1

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Chapter 1 Main Characteristics of PM126

1.1 Model Selection Guide

Article	Description
PM126E.1	PM126E-400V-5-50HZ-ACDC-DIOR
PM126EH.2	PM126EH-400V-5-50HZ-ACDC-DIOR
PM126EH.3	PM126EH-400V-5-50HZ-ACDC-DIOR-ETH
PM126EH.4	PM126EH-400V-5-60HZ-ACDC-DIOR
PM126EH.5	PM126EH-400V-5-60HZ-ACDC-DIOR-ETH
PM126E.6	PM126E-400V-5-60HZ-ACDC-DIOR

1.2 Measurement

- Access signals directly from current and voltage transformers
- High-accuracy
- Configurable PT/CT transformation ratio
- Time-sharing electrical degree function
- Measuring bi-directional power

1.3 Communication Interface

- Serial RS485 port, supporting MODBUS-RTU
- Ethernet (RJ45) port for LAN communication

1.4 Digital Inputs/Outputs

- Up to a maximum of 8 DI or 6 DO

1.5 Power Quality Analysis

- Harmonic analysis
- Measurement of sequence components and three-phase voltage unbalance analysis
- Transient capture (80μs)
- Real-time signal waveform display, recording five cycles before trigger point, and configurable length of post-event waveform recording
- Fault waveform recording function, capable of storing 10 sets of voltage and current waveforms.

1.6 General

- 3.2'' TFT full-color display
- Monitoring and recording triggers: PT break, CT break, PT phase inversion, CT phase inversion, reset of peak demand register, powering on/off of unit, etc.
- PIR infrared body sensor: automatically turns on backlight; convenient for field data reading, saving on facility consumption. Can be used as security signal of intrusion activating an alarm.
- Configurable upper and low limit alarm for various parameters.
- Panel LED interface of electric energy pulse output, used for calibrating electrical energy.

1.7 Safety Guidelines

- Only authorized personnel / certified engineers may install and operate the unit.
- Do not open the unit under any circumstances
- Don's use the unit for any other purpose besides its intended metering application

Chapter 2 Introduction

The PM126 is a multi-functional instrument, also called a net power meter, multi-functional power meter or Intelligent Electronic Device.

The unit is designed for the requirements of the electric systems in mines and factories, public facilities, intelligent buildings, measuring all common electric parameters, such as three-phase current, voltage, frequency, etc., and is suitable for real-time power management systems.

Highly cost-effective, PM126 can replace a variety of outdated instruments. It is widely used in varieties of control systems and energy management system.

2.1 Applications

The PM126 is widely used in many fields and is appropriate for system integration. It is extremely suitable for advanced requirement of power quality and safety.

- Energy control system
- Substation automation
- Distribution automation
- Power supervisory in residential area
- Industrial automation
- Intelligent facilities
- Intelligent substation and switchgear

Chapter 3 Brief Introduction to the PM126

The PM126 is used as a front-end of remote monitoring systems (SCADA). It can be used through networking or as stand-alone.

The PM126 communicates via RS485 and MODBUS-RTU communication protocol. Shielded twisted pair (STP) wiring can be used to create a reliable communication network. A large color-screen provides clear data display.

The unit may be operated via its front panel using the 4-button interface. The unit provides automatic display, and lets users read many parameters without pushing any keys.

Central measured parameters:

- Three-phase voltage
- Three-phase current
- Power (three—phase active power, three—phase reactive power, three—phase apparent power)
- power factor
- Frequency
- Electric energy (Four-quadrant components and cumulative energy)
- Demand
- Harmonics, up to the 63rd harmonic
- Upper and lower limit alarms, and alarm event log
- 8 DI
- 6 DO
- 2 PO
- 2 AO (output is freely configurable)
- Optional single-channel leakage current measurement function
- Optional latitude and longitude-based time control switch function
- MODBUS-RTU communication protocol

Notes: "The total number of DO, AO, and PO channels must not exceed 6. Each channel can be set as any one of these module type

Chapter 4 Specifications

4.1 Inputs

4.1.1 Voltage

Rating: 100V AC / 400VAC + 25% tolerance

Overload: 2 times rated value (constant); 2500VAC/sec (voltage withstand)

Measurement: True-RMS

burden: < 0.2VA

4.1.2 Current

Rating: 5A + 20% overcurrent

Starting current (min.): 3mA

Overload: 2 x rated value; 100A/sec (withstand)

Measurement: True-RMS

burden: < 0.2VA

4.1.3 Input Leakage Current

Rated Value: Requires an external leakage current transformer (CT).

Transformer Turns Ratio: 1000:1.

Measurement: True-RMS

Range of input frequency: 45~65Hz

4.2 Measurement Accuracy

- Energy Measurement: Class 0.5
- Frequency Accuracy: ±0.1HzTemperature Drift Coefficient: 50 PPM/°C (within 0-50°C)

4.3 Communication

- RS485 interface
- Baud rate: 2400bps ~38400bps, can be set freely
- MODBUS-RTU protocol

4.4 Operating Environment

- Operating temperature: - 20℃ - +75℃
- Storage temperature: -40℃ - +85℃
- Relative humidity: 5%-90%, non-condensing
- Altitude: below 2,000m
- Safety Environmental Conditions: The surrounding environment should be free of explosive hazards, insulating-damaging or metal-corrosive gases, and conductive dust

4.5 Safety

Dielectric Strength (Withstand Voltage) & Insulation Strength:

- Power supply and voltage input circuits: > 2kV
- Current circuits: > 2.5kV

4.6 Size and Weight

- Size 96×96×75mm;
- Weight: 0.4Kg

4.7 Power Supply

- Rated Voltage: 220VAC (+20%／-50%) @ 50/60Hz / 220V DC;
- Power consumption: < 2.5W
- Online standby consumption: 0.1W
- DO relay consumption: 0.5W/CH
- DI on-off input consumption: 0.3W/CH
- Backlight consumption: 0.3W/CH

4.8 PIR Infrared Human Body Sensor

- Detection distance: 0～5m
- Detection angle: 60°

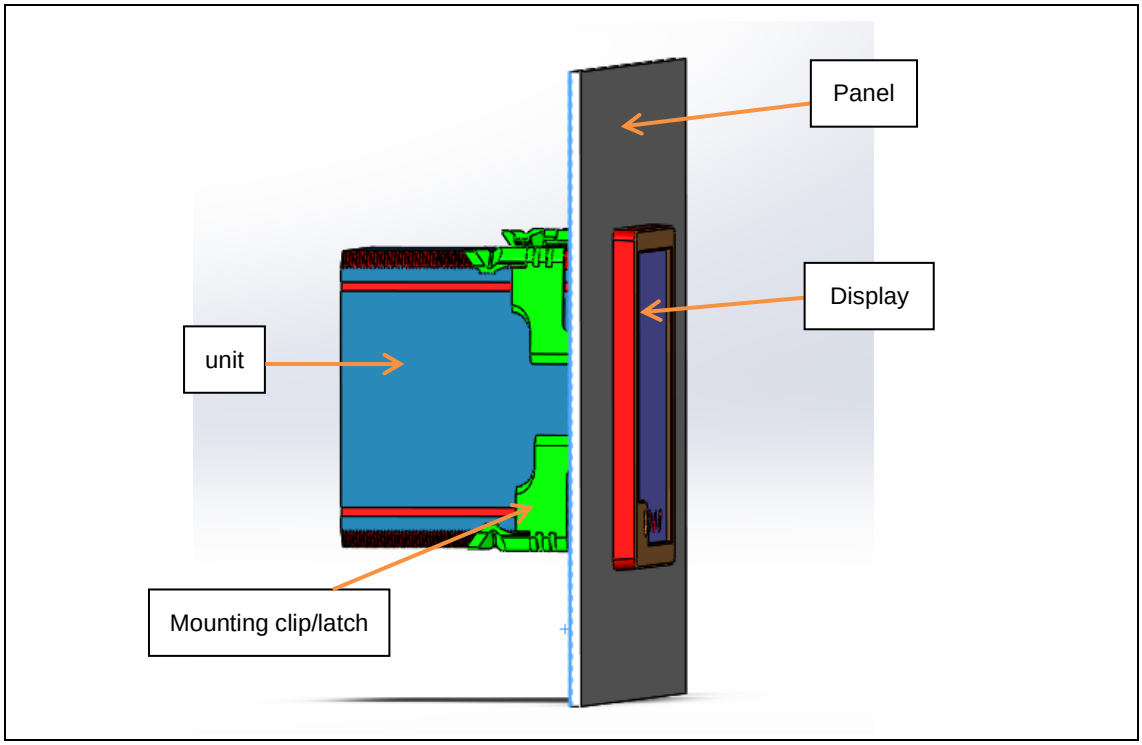
Chapter 5 Package Content

Package contains the following items:

- Unit (with plug-in terminal blocks)
- Installation parts
- Product manual

Chapter 6 Installation and Wiring

6.1 Illustration of Installed Meter

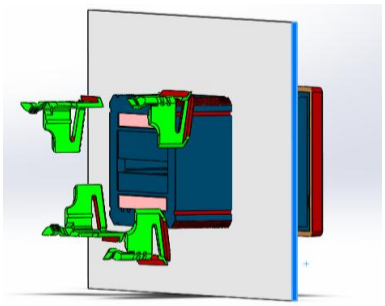
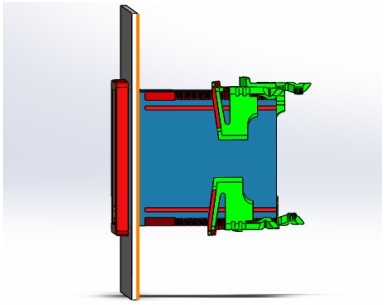
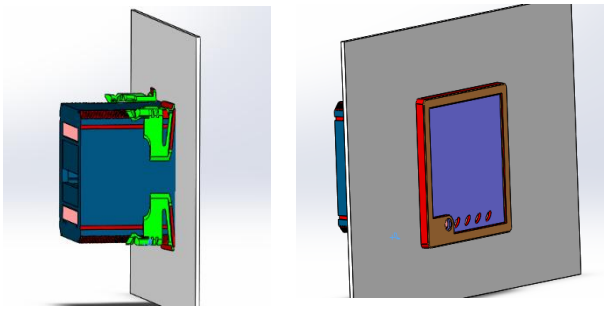


6.2 Installation Cutout

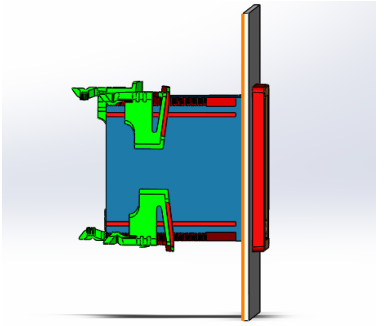
Required cutout size: 85mm×85mm

6.3 Installation

Prior to installation, release and remove all plastic mounting clips/latches from the unit

Installation instructions	
	1. Insert the unit through the installation cutout
	2. Install the 4 clips back on to the unit
	3. Press the clips firmly against the panel till the unit sits tightly in the cutout

6.4 Disassembly

Disassembly instruction	
	1. Perform the reverse action by first releasing and removing the clips, then pulling the unit out of the cutout

6.5 Wiring Method

6.5.1 PM126 Terminal Block Introduction

Upper terminals													
11	12	13	14	15	16	17	18	19	20	21	22	23	24
⏚	L/+	N/-	COM	DI1	DI2	DI3	DI4	O11	O12	O21	O22	A/+	B/-
Auxiliary power supply			Digital input					Optional modules				RS485	

Middle row terminals														
25	26	27	28	29	30	31	32	33	34	35	36	37	38	39
O32	O31	O42	O41	O52	O51	O62	O61	COM	DI5	DI6	DI7	DI8	D-	D+
Optional modules								Digital inputs					RS485	

Lower Terminals									
1	2	3	4	5	6	7	8	9	10
V1	V2	V3	VN	I11	I12	I21	I22	I31	I32
A phase voltage input	B phase voltage input	C phase voltage input	Neutral Line voltage input	A phase current in	A phase current out	B phase current in	B phase current out	C phase current in	C phase current out

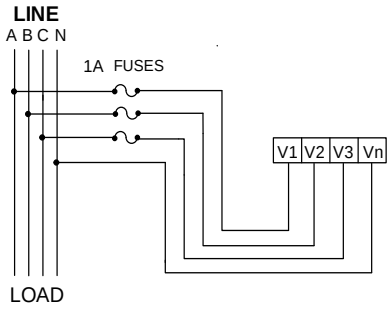
6.5.2 Summary of PM126 Connection Diagram

Note: A **1A fuse** must be installed on the **secondary side of the PT** (or at the meter input terminal for direct connection).

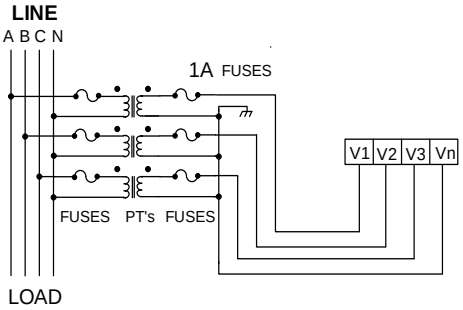
The **PM126series** allows independent configuration of **current and voltage wiring**, meaning the **voltage and current circuits are wired separately**. The wiring method must be set according to the selected configuration **(3LN, 2LL, 3LL).**

- **When using a three-phase four-wire direct connection, three-phase four-wire with 3 PTs, or single-phase voltage connection,** the voltage wiring mode should be set to **3LN**.
- **When using a three-phase three-wire direct connection,** the voltage wiring mode should be set to **3LL**.
- **When using a three-phase three-wire 2 PT connection or a three-phase three-wire V-type connection,** the voltage wiring mode should be set to **2LL**.

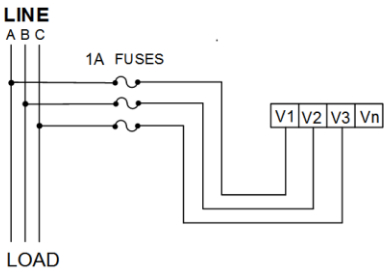
For the 2LL wiring mode, the **B-phase current is calculated** using the principle that the sum of the three-phase current vectors equals zero. Therefore, the **B-phase current terminal does not require wiring**.



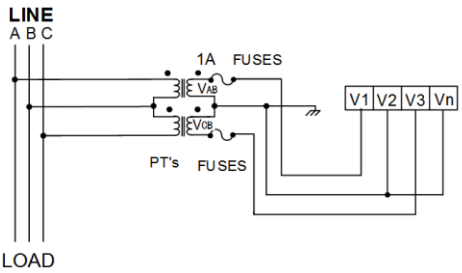
three-phase four-wire direct connection (3LN), low voltage



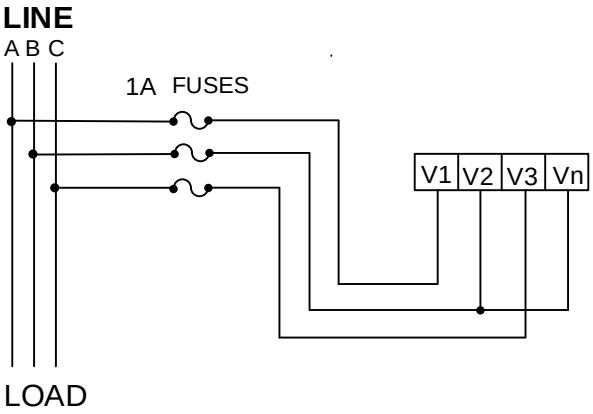
three-phase four-wire 3PT (3LN), high voltage



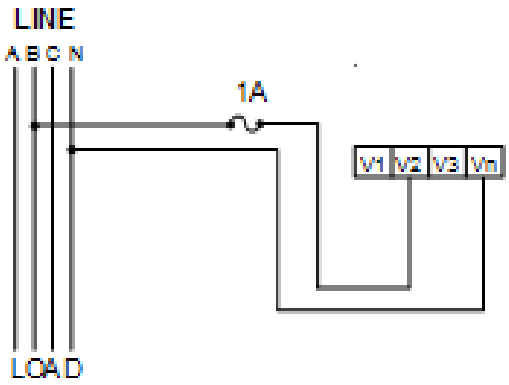
three-phase three-wire direct connection (3LL); low voltage



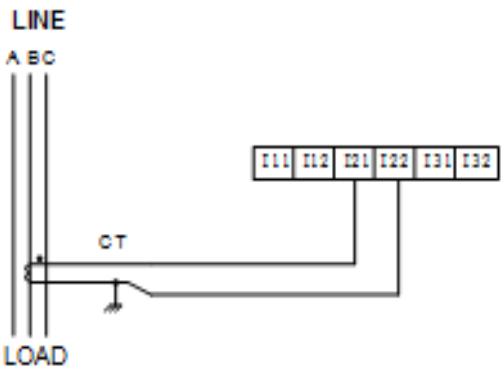
three-phase three-wire 2PT (V type, 2LL); high voltage



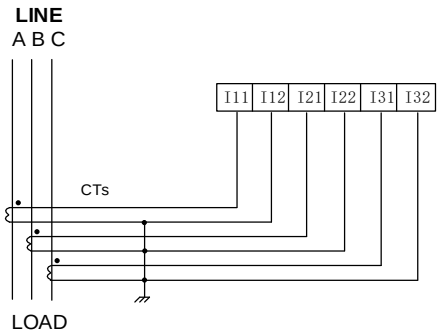
Three-Phase Three-Wire V-Type (2LL); Low Voltage



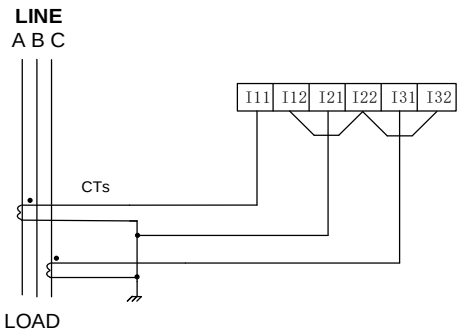
single-phase voltage connection (3LN)



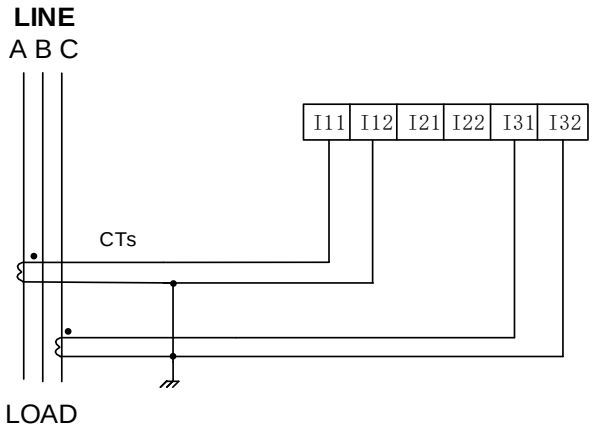
Single—phase 1 CT



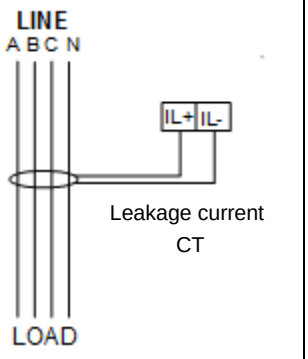
Three-Phase 3CT (Applicable to 3LN, 3LL)



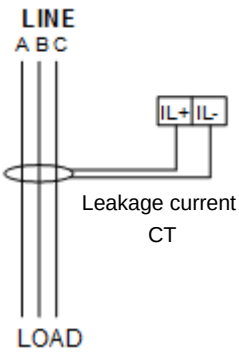
Three-Phase 2CT (V-Type) (Applicable to 3LN, 3LL)



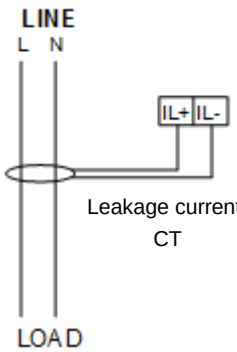
Three-Phase 2CT Direct Connection (Only Applicable to 2LL)



Connection of three—phase four-wire electric leakage current transformer

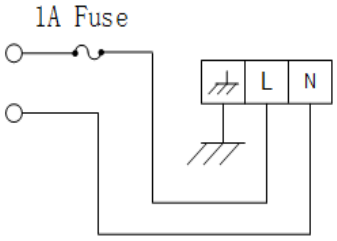
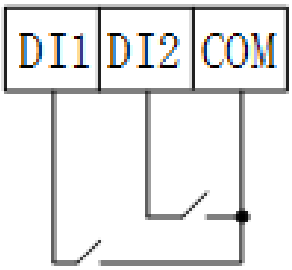
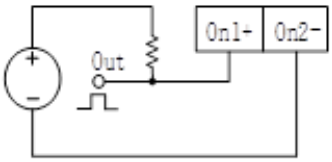
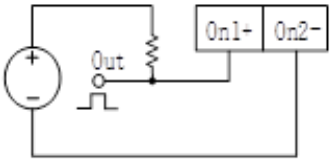


Connection of three—phase three-wire electric leakage current transformer



Connection of single—phase electric leakage current transformer

Note: When wiring the leakage current transformer, there is no distinction between positive and negative polarity. The L+ and L− symbols in the diagram are only used to differentiate the two terminals.

Power Supply			
	auxiliary power supply wiring		On/off input wiring diagram
direct-current power supply		Current detection device	
	electric energy pulse output wiring		Transmitting output wiring

Chapter 7 Safety

7.1 Auxiliary Power Supply Inputs

Make sure to place a 1A fuse upstream of the auxiliary power supply input.

7.2 Measured Voltage Inputs

Make sure that input voltage does not exceed the rated input voltage (100 v or 400 v).

Make sure to match voltage input phase to the corresponding current input channel, i.e. that phase No. and phase order are corresponding (or else digital and sign errors will occur).

7.3 Current Inputs

- The standard rated input current is 5A. If the current exceeds 5A, an external CT (Current Transformer) must be used.
- Ensure that the input current corresponds to the voltage, with matching phase sequence and direction.
- If the CT is connected to other instruments, the wiring should be done in series.
- Before removing the current input wiring from the device, always disconnect the CT primary circuit or short-circuit the secondary circuit first!

7.4 CT Installation

For convenience of disassembly, it is recommended to use a shorting bar, and not to wire to CT directly.

7.5 Communication Wiring

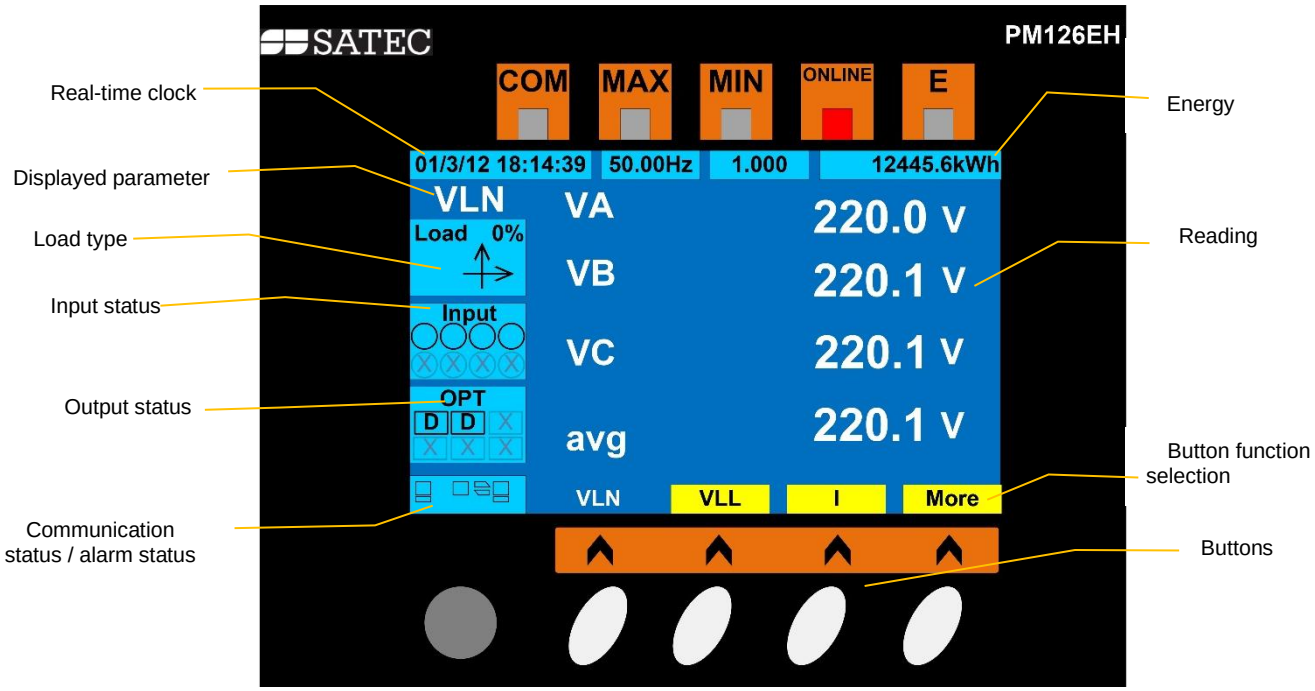
The unit features a serial asynchronous half-duplex RS485 communication interface, and the MODBUS-RTU protocol. One line can host up to 32 units. Each unit can have its address set, and different units have different communication connecting terminal numbers.

A shielded twisted pair cable with a copper mesh should be used for communication wiring, with a wire diameter of no less than 0.5mm². During installation, ensure that the communication cable is kept away from high-voltage cables or strong electromagnetic field environments to avoid interference.

Chapter 8 Unit Operation

8.1 Powering on the Unit

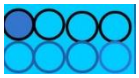
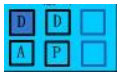
After wiring, power up the device, which will power up the display (default: phase voltage readings):



8.1.1 Description

After wiring, power up the device, which will power up the display (default: phase voltage readings

Name	Example	Description
Time	**13/1/10 9:23:30** (1st display box at top-left)	Displays current time
Frequency	**50.00** (2nd display box at top)	Displays frequency; includes 2 decimal digits
Power factor	**1.000** (3rd display box at top)	Displays total power factor; includes 2 decimal digits
electric energy	**1234.5kWh** (4th display box at top)	Displays total electric energy
Parameter type displayed	**Phase voltage** (top left corner)	Indicating type of displayed value
Phase A voltage	VA 220.0V	Displays value of A-phase voltage
phase B voltage	VB 220.0V	Displays value of B-phase voltage
phase C voltage	VC 220.0V	Displays value of C-phase voltage
Average phase voltage	Average 220.0V	Displays average value of three-phase voltage

Load type	 (first light-blue display box on left)	Displays load type  indicates inductive load  is capacitive load
Load rate	2% (first light-blue display box on left)	Percentage of nominal current
Power sign	 (first light-blue display box on left)	 indicates that active power is positive and reactive power is positive  indicates that active power is negative and reactive power is positive  indicates that active power is negative and reactive power is negative  indicates that active power is positive and reactive power is negative
DI input status	 The indicators from left to right (first row, then 2nd) respectively represent DI1 to DI8. (2nd light-blue display box on left)	Indicates that this channel is selected as DI, and the DI signal status is ON Indicates that this channel is selected as DI, and the DI signal status is OFF Indicates that this channel is not selected as DI
Output status	 The indicators represent outputs of DO1, DO2, AO4 and PO5. (3rd light-blue display box on left)	D indicates that this channel is selected as DO and the output status is ON D indicates that this channel is selected as DO and the output status is OFF A indicates that this channel is selected as AO and the output status is OFF P indicates that this channel is selected as PO and the output status is OFF IL indicates that this channel is selected as IL (leakage current input) X indicates that this channel is not selected as any output
Communication status	 (top of 4th light-blue display box on left)	indicates no communication between system and client indicates that system and client are communicating indicates that system and slave computer are communicating indicates that there is no communication between system and slave computer

<table>
<tr><td>Loudspeaker</td><td> 
(bottom of 4th light-blue display box on left)</td><td>When buzzer sounds,  flickers;
When buzzer sounds,  is not displayed</td></tr>
<tr><td>Alarm sign</td><td> 
(bottom of 4th light-blue display box on left)</td><td>When an alarm is on,  flickers;
When alarm is off,  is not displayed</td></tr>
<tr><td>Infrared sensing</td><td> 
(bottom of 4th light-blue display box on left)</td><td>  flickering indicates detection of infrared sensing
no  display indicates no infrared sensing</td></tr>
<tr><td>Button function</td><td><table><tr><td>L-N voltage</td><td>L-L voltage</td></tr><tr><td>current</td><td>more</td></tr></table>(bottom of display)</td><td>VLN corresponds to function of button S1. Press S1 to display phase voltage
VLL corresponds to function of button S2, press to display line voltage
I corresponds to function of button S3, press to display current
More (S4) switches functionality of S1-3, press S4 to display more parameter display options</td></tr>
<tr><td>Communication</td><td>indicator flickers</td><td>communication indication</td></tr>
<tr><td>Upper limit</td><td>indicator on</td><td>upper limit alarm</td></tr>
<tr><td>Lower limit</td><td>indicator on</td><td>lower limit alarm</td></tr>
<tr><td>Online</td><td>indicator on</td><td>indicates that the unit is in working state</td></tr>
<tr><td>energy</td><td>indicator flickers</td><td>Energy pulse output</td></tr>
</table>

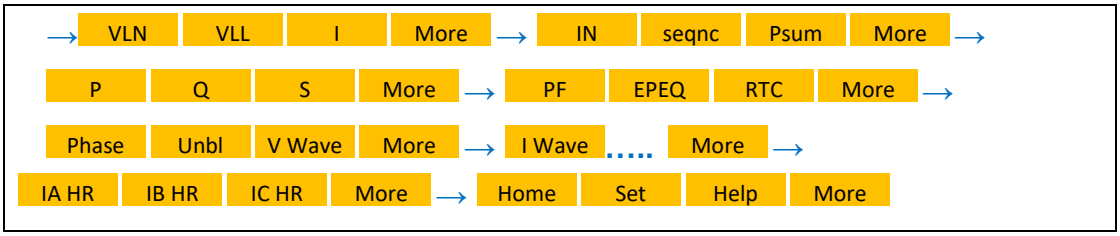
8.1.2 Buttons

The unit features 4 push-buttons:

- The active function of each button (function can alter) is displayed right above the button, at the very bottom of the display
- In default mode, pressing the corresponding button allows viewing of related data.
- In editing mode, select corresponding key for required action.
- Press and hold (for 2 seconds) the More key, to enter the main menu and navigate the menu to select the requested data display mode.

8.2 Viewing Basic Parameters

After the unit is powered up, it will enter the default mode of displaying basic measurement parameters. Click on the corresponding key to view the desired parameter. The background color of the key function description will then assume the color of the main display area; click the More key to present / switch the key functionality among the following options:

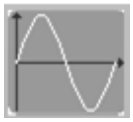
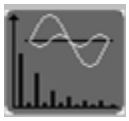
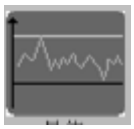


The functions of each button are as follows:

VLN	RT L-N voltage and its average value
VLL	RT phase line voltage and its average value
I	RT phase current and its average value
IN	three-phase current and neutral current
seqnc	symmetrical components
Psum	Accumulative P, Q, S and average Frequency for all phases
P	Active/real power per phase
Q	Reactive power per phase
S	Apparent power per phase
PF	Power Factor per phase
EPEQ	Energy counters for active/reactive/apparent @ import/export
RTC	Real Time Clock
Phase	Phase angle of voltage and current
Unbl	unbalance degree of voltage and current
V Wave	Voltage RT waveform
I Wave	Current RT waveform
IA HR	Phase A current harmonics
IB HR	Phase B current harmonics
IC HR	Phase C current harmonics
Home	Main menu
Set	Enter password for configuration menu
Help	Legend explaining all graphic indicators

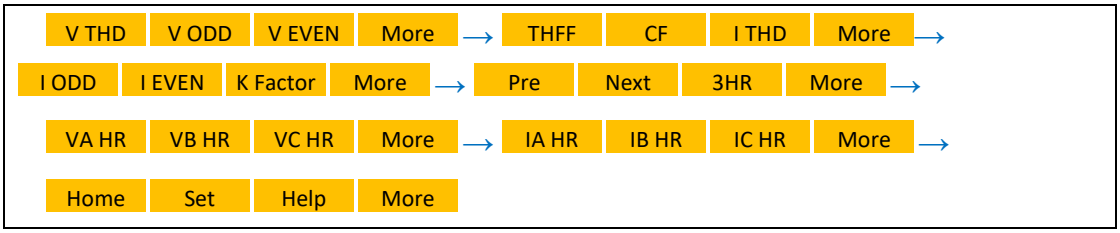
8.3 View other parameters

Press More and hold to enter the main menu. In the main menu, you may select the desired measurement parameter display set. Click ESC to exit the main menu; click Left and Right to navigate; click Enter to select the desired mode.

			
Base	Harmonic	Max/Min	Demand
			
TOU E	Wave	Record	Set
			
Alarm Silc			
	Back	Left	Right	Enter

8.4 Harmonics Display

Select **harmonic** to display harmonic parameters. In this mode, click More to navigate the following options:

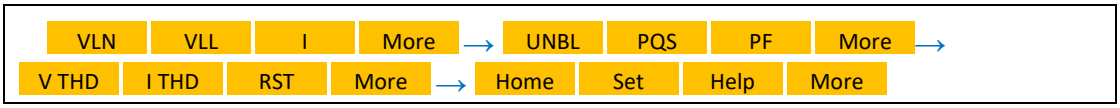


The functions of each button are as follows:

V THD	total harmonic distortion of voltage
V ODD	Odd-Order Harmonic Distortion Rate of Voltage
V EVEN	Even-Order Harmonic Distortion Rate of Voltage
THFF	Voltage Telephone Crest Factor
CF	Voltage Crest Factor
I THD	total harmonic distortion of current
I ODD	Odd-Order Harmonic Distortion Rate of Current
I EVEN	Even-Order Harmonic Distortion Rate of current
K Factor	Current K-Factor
Pre	Previous harmonic
Next	Next harmonic
3HR	3rd Harmonic
VA HR VB HR VC HR IA HR IB HR IC HR	Display harmonics of VA,VB,VC, IA, IB and IC in form of histogram

8.5 View extremum

Select **Max./Min.** from the main menu to display various minimum and maximum values. In this mode, click More to navigate the following options:

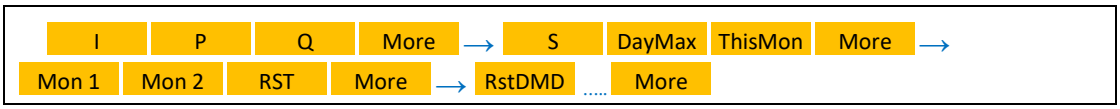


The functions of each button are as follows:

VLN	Maximum and minimum values of phase voltage
VLL	Maximum and minimum values for line voltage
I	Maximum and minimum values for current
UNBL	Maximum and minimum values for Voltage and Current Unbalance
PQS	Maximum and minimum values for total power
PF	Maximum and minimum values for power factor
V THD	Maximum and minimum values for Total Harmonic Distortion of voltage
I THD	Maximum and minimum values for Total Harmonic Distortion of current
RST	Reset maximum and minimum values

8.6 View Demand

Select Demand in the main menu to display demand parameters. In this mode, click More to navigate the following options:

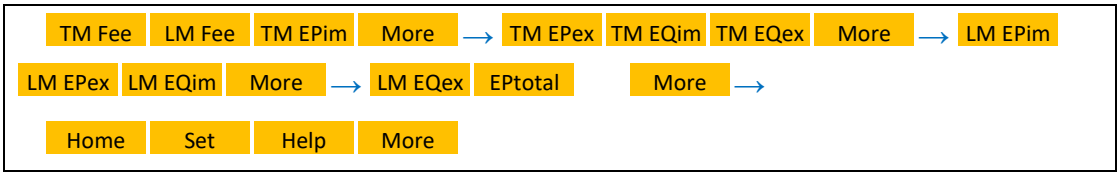


The functions of each button are as follows:

I	average demand of three-phase current
P	demand of total active power
Q	demand of total reactive power
S	demand of total apparent power
DayMax	Maximum daily power demand (P Max: active power; N Max: reactive power)
ThisMon	Maximum power demand for current month (P Max: active power; N Max: reactive power)
Mon 1	Last month
Mon 2	Month before last
RST	reset the current Demand values
RstDMD	reset the current Maximum Demand values

8.7 View Time of Use electric energy

Select TOU E in the main menu to display Time of Use data. In this mode, click More to navigate the following options:

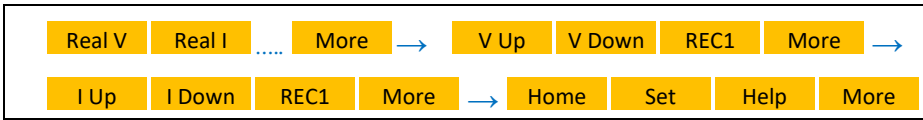


The definitions of each button are as follows.

TM Fee	Currency
LM Fee	
TM EPim	Active electric energy consumed this month
TM EPex	Active electric energy exported this month
TM EQim	Reactive electric energy consumed this month
TM EQex	Reactive electric energy exported this month
LM EPim	Active electric energy consumed last month
LM EPex	Active electric energy exported last month
LM EQim	Reactive electric energy consumed last month
LM EQex	Reactive electric energy exported last month
EPtotal	Total active energy consumed

8.8 View wave forms in waveform recorder

Select Wave in the main menu to display wave form recordings and real-time waveforms. In this mode, click More to navigate the following options:



The functions of each button are as follows:

Real V	Real—time waveform of voltage
Real I	Real—time waveform of current
V Up V Down REC1	View voltage waveforms in waveforms recording
I Up I Down REC1	View current waveforms in waveforms recording

8.9 View SOE and Alarm Logs

Select **Record** in the main menu to display SOE (Sequence of Events) and alarm logs. Press More to navigate the options. Use the **Up** and **Down** keys to scroll the logs chronologically.

8.10 Input (DI) Status Indication (Displayed in the "Input" Display Area on the Screen)

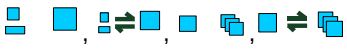
All DIs are wet contact, which means that they are powered internally at 24V DC and require no external power supply.

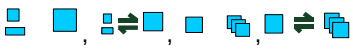
- For channels configured as DI, the corresponding position will display ○
- When a DI received a signal input, the corresponding position will display ●
- For channels not configured as DI, the corresponding position will display ⓧ
- DI status can only be viewed and cannot be modified.

8.11 Output (DO,AO,PO) Status Indication (Displayed in the Output Display Area, "OPT",on the Screen)

- For channels configured as DO output, the corresponding position displays D. When the DO output is active, the corresponding position displays D. The DO status can be set via the panel or communication.
- For channels configured as AO output, corresponding position displays A When the AO output is active, corresponding position displays A AO status can only be viewed and cannot be modified
- For channels configured as PO output, corresponding position displays P When the PO output is active, corresponding position shows P. PO status can only be viewed and cannot be modified.
- For channels not configured as any output, corresponding position shows X.

8.12 Communication Indication (Communication Status, Alarm Display Area)

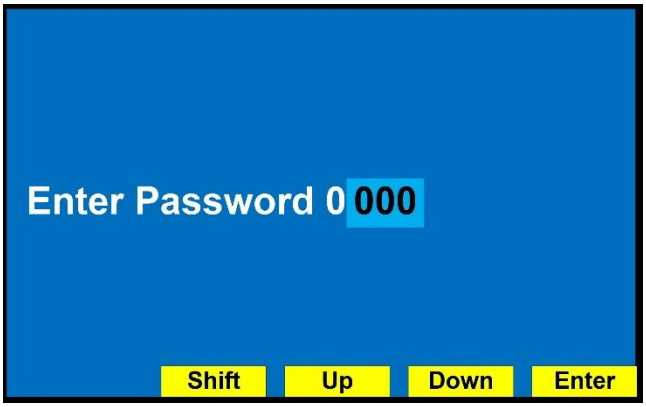
The unit uses the  icons to indicate communication status.

- Make sure the serial RS485 com wire is correctly connected.
- Communication indication icons  are used for indicating data communication status.
- When this unit receives data, it shows  or  , and the communication indicator flickers. Communication failure will be indicated by either  or  .

Chapter 9 System Programming Mode

9.1 Entering System Programming Mode

Press and hold the More button to enter the main menu, then select **Set** to enter system programming mode. To enter settings, a password must be entered (factory default: 1000) as follows:



1. Press the **Shift** button to select digit for editing.
2. Press the Up / Down buttons to set desired digit
3. Once the password is set press Enter.
   - If password is entered correctly (factory default: 1000), system settings screen will be displayed, featuring COM setting on top.
   - If password is incorrect, system will return "password error" and return to the main menu. To exit settings mode press ESC.

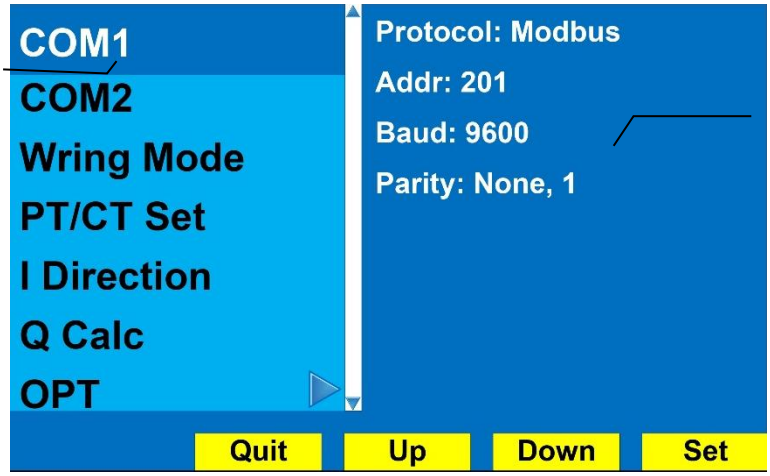
Please note:

- button functions change between programing mode and display mode)
- All system settings are stored in non-volatile memory and will be saved until changed.
- The password will not reset in case of power-down.

9.2 Operating Settings Mode

After entering settings mode, the root menu display is as following.

The background color of selected item is dark blue



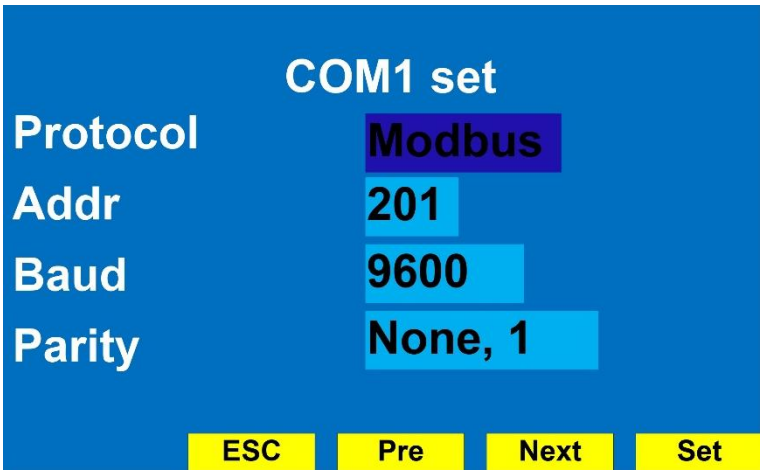
Parameter description of selected item.

9.2.1 Operating Instructions

- The function of each button is displayed as a button icon on the color screen directly above the physical push buttons.
- Press Up and Down to select the option that needs editing. The background color of the selected option turns dark blue.
- The right-side display area on the screen will show the current parameters of the selected settings.
- Press Quit to exit settings mode
- Press Set to enter editing interface for the highlighted setting
- In programming mode, the following settings can be configured:
  - Communication settings: configure the device address and baud rate.
  - Transformer ratio settings: set primary and secondary values of PT and CT.
  - Input/output settings: configure DO (Digital Output) parameters and energy pulse output parameters.
  - Demand settings: set sliding interval time and number of sliding windows.
  - Upper and lower limit alarm settings: configure alarms (on or off) and related parameters for the 16 available channels.
  - Clock setting: set real-time clock.
  - Password setting: reset password used to access the settings mode.
  - Reset settings: reset Min./Max. values, demand, and electric energy, or perform a factory reset.

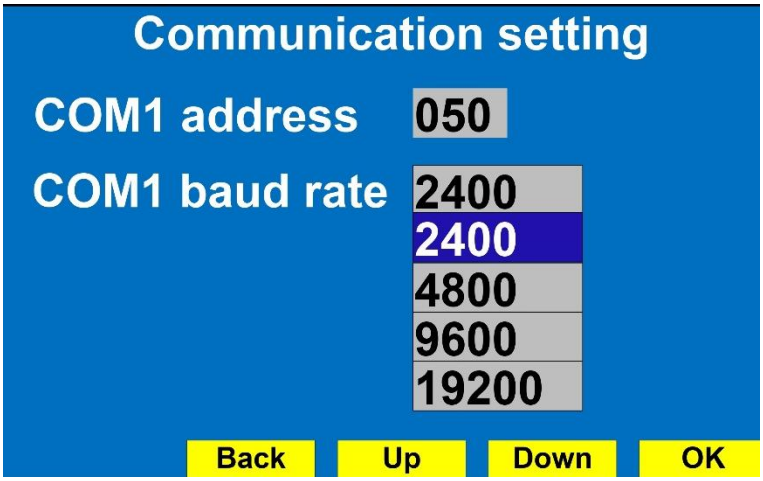
9.2.2 Communication Settings (Example)

1. Communication settings display interface is as below:



- Press Pre and Next to switch between edited parameters
- Press Set to edit parameters
- Press Up / Down to either choose desired value, or to change desired digit
- Press Shift to choose desired digit for editing
- Press Enter to confirm data entry and return to communication configuration menu
- Press ESC to exit communication settings, and return to root menu display

2. Selecting baud-rate is as below:



The above is a demonstration for configuring communication Settings. Configuring other parameters is performed similarly.

9.3 Communication Setting

The communication address can be set between 1 and 247. Available baud rates are 1200, 2400, 4800, 9600, 19200, and 38400. By default, the unit includes one RS485 port (COM1). If a second RS485 port (COM2) is enabled, its settings will appear in the communication settings menu. The communication address and baud rate for COM1 and COM2 are configured independently.

9.4 Transformer Ratio Setting

The transformer ratio is set according to primary and secondary values of voltage and current transformers.

- Voltage Ratio: Set according to the primary and secondary values of the potential transformer (PT).
- Current Ratio: Set according to the primary and secondary values of the current transformer (CT).

To prevent **zero drift** in **electromagnetic interference (EMI) environments,** the **zero threshold for current can be adjusted.**

Adjustment Range: 0–100mA (secondary side value)

9.5 Current Direction

Current input requires proper direction. Normally, current flows from terminal No. 1 (e.g., I1) to terminal No. 2 (e.g., I2). If wiring is incorrect, you can reverse the current direction in the unit, instead of rewiring. This is done in the I Direction settings by switching phase direction from Positive to Negative.

By default, the direction of **all three-phase currents** should be set to Positive. If a phase is wired in reverse, adjust the direction of the corresponding current to Negative.

9.6 I/O Configuration

The amount and character of I/O embedded in the unit during production are determined when ordering the product. The available I/O options are: DO, PO (electric energy pulse output), AO (4~20mA), IL (electric leakage input), T (temperature measurement).

Configuration rules: the maximum amount of I/O available with a unit are 6 at most. Among the 6 options, port 1 and 2 can be ordered as any type of I/O, while ports 3 through 6 can host all I/O **other than** AO.

9.6.1 Port-Specific Settings:

DO (Digital Output):

- Set the **DO operating mode** (Level or Pulse).
- If **Pulse mode** is selected, configure the **pulse width**.

PO (Pulse Output):

- Select the **type of energy pulse output**.

AO (Analog Output):

- Select the **parameter for AO output**.
- Configure the **measurement values corresponding to 4mA and 20mA**.

IL (Leakage Input):

- Configure the **turns ratio of the leakage current transformer (secondary side fixed at 1).**

The **Energy Pulse Settings submenu** under **General Port Settings** is used to configure:

Pulse constants and **pulse width** for **PO and optical energy pulse outputs**

9.7 Demand Settings

Sliding Interval (T2):

- Defines how often the demand calculation window moves forward.
- Each time the interval elapses, the demand is recalculated.
- **Setting range: 1–20 minutes**.

Number of Sliding Windows:

- Determines how many sliding intervals contribute to the demand calculation.
- The final demand value is the **average over these intervals**.
- **Setting range: 1–60.**

Example:

If:

- **Sliding Interval (T2) = 3 minutes**
- **Sliding Window Count = 5**

Then:

- The demand value **updates every 3 minutes**.
- The displayed demand is the **average of the past 15 minutes (3 minutes × 5 windows)**

9.8 Setting Upper and Lower Limit Alarm

There are **16 alarm channels**, each with **independently configured alarm conditions**.

- The **alarm main switch** and **logical relationships between alarm channels** are configured in the **Basic** alarm settings.
- The logical relationship between channels can be set as **AND** or **OR**.
  - **AND logic has a higher priority than OR logic.**
  - **Adjacent channels with an AND relationship** will only trigger an alarm when **all conditions are met simultaneously.**
- The **logical relationship switch can be disabled**, in which case all channels will follow an **OR logic**, meaning each channel **triggers alarms independently**

9.9 Clock Settings

The data range can be set from year 2000 to 2099.

9.10 TOU Energy Setting

Settings are found under **TOU E**. A year can is divided into six time periods, each of which can be configured with independent daytime periods and corresponding rates. Up to 12 different rates can be assigned across these periods. The available rate types for each period are: Peak, High, Low, and Default. The **settlement time** for TOU energy can be specified for each month. If set to **the natural end of the month**, **the monthly TOU energy settlement** will occur at **00:00 on the 1st of each month**, and a new settlement cycle begins.

9.11 Waveform Recorder Setting

The unit can record the waveforms of three-phase voltage and current. In the menu (**Waveform -> Basic Set**), the user may configure the sampling rate of each cyclic wave, switch on/off toggling for waveform recording (**Manual Trigger**), and set the time delay which qualifies events for recording, which is the minimal length if the event (**Manual Trig delay**). Waveform recording can be triggered by up to 6 different triggers which can be configured to determine activating source (alarm or DI) and length of desired recording, set in millisecond, as **Trig time**.

9.12 Voltage Swell/Sag Setting

Voltage swell/sag means that voltage is higher or lower than the set value. A reference voltage must be set, and a limit value for percentage of allowed deviation of voltage, as a swell or sag, as well as setting a delay time for qualifying as an event. Voltage swell/sag sets off a DO output.

9.13 Display Setting

Setting display theme: the user can select display color based on personal preferences. There are 5 display themes for selection.

Backlight setting: the displayed backlight can be set as constant or can be set to turn off after a period of idling without button operation, so as to reduce electric energy consumption. toggling Pir trig backlight enables backlight to switch on when user proximity is detected by the proximity infrared sensor.

9.14 Sound Setting

Key Beep: sets whether button pushing produces sound

Pir Beep: sets whether triggering PIR sensor sounds a tone

Alarm Beep: sets whether alarm activation is audible. If set as audible, the alarm keeps ringing audibly, until the parameter triggering the alarm trigger is back to normal or alarm is manually silenced.

Alarm Auto silence: Alarm sound will subside once alarm condition/trigger is no longer active.

Alarm Manual silence: sets for how long alarm will sound without change in condition/trigger status.

9.15 Pir (Proximity Infrared) Setting

Pir trig backlight: toggling this option sets the unit's backlight to go on when physical proximity is detected

Pir Count: enables continuous counting of all sensor activation, which is useful as a security feature for monitoring any movement of individuals passing by the unit.

Pir count mode: sets whether counter operates at "All Time" or at a specifically "Set Time", which is set below as Pir count period. All Time leaves the counter on continuously. Set Time specifies a set time period during a 24-hour day (e.g., 18:00 – 05:30) during which the counter is active.

9.16 Reset

MAX/MIN: resets the recorded maximum and minimum values and applies current time as the new benchmark for extremum statistics.

DMD: clears the stored demand value and restarts the cycle of demand calculation.

DMD MAX: resets maximum demand value

Energy: resets energy counter. To prevent mistakes, when attempting to reset, the user is required to enter the password. The factory-set password for clearing the energy counter is 8015.

TOU Energy: clearing TOU records. Also requires entering the password; 8015, same as that for resetting energy counter.

Pir Cnt: clears the current record/count of Pir movement detections.

FactorySet: All configured parameters will be reset to factory-set default values.

9.17 Setting Password

Enter **Password** to change the password used for entering the programming mode. The default factory-set password is 1000.

9.18 View Version Number

In the **About** tab, you can view version number of firmware and the installation date of that version.

Chapter 10 Instructions for Communication Configuration and Operation

10.1 Overview of MODBUS-RTU Communication

This chapter explains how to use software to operate the PM126 via its communication port. To fully grasp the content, it is important to understand the MODBUS protocol, review previous chapters, and be familiar with the product's functions and applications.

This chapter includes an overview of the MODBUS protocol, a detailed explanation of the communication format, application examples for the PM126, and a parameter address list with descriptions, data types, and access permissions. Following these guidelines will help you configure and operate the PM126 effectively.

10.1.1 Overview of MODBUS Protocol

PM126 uses the MODBUS-RTU protocol, which specifically defines essential components like check codes and data series for reliable data exchange. This protocol operates using a master-slave (half-duplex) connection, where signals are transmitted in alternating directions over a single communication line. Initially, the master device addresses a specific terminal device (slave), which then sends a response back to the master in the opposite direction. Communication is strictly between the master (e.g., PC, PLC) and terminal devices, preventing any direct data exchange between terminals. This design ensures that terminal devices remain idle during initialization and only respond to signals directed to them, optimizing communication efficiency.

10.1.2 Inquiry - Answer Cycle

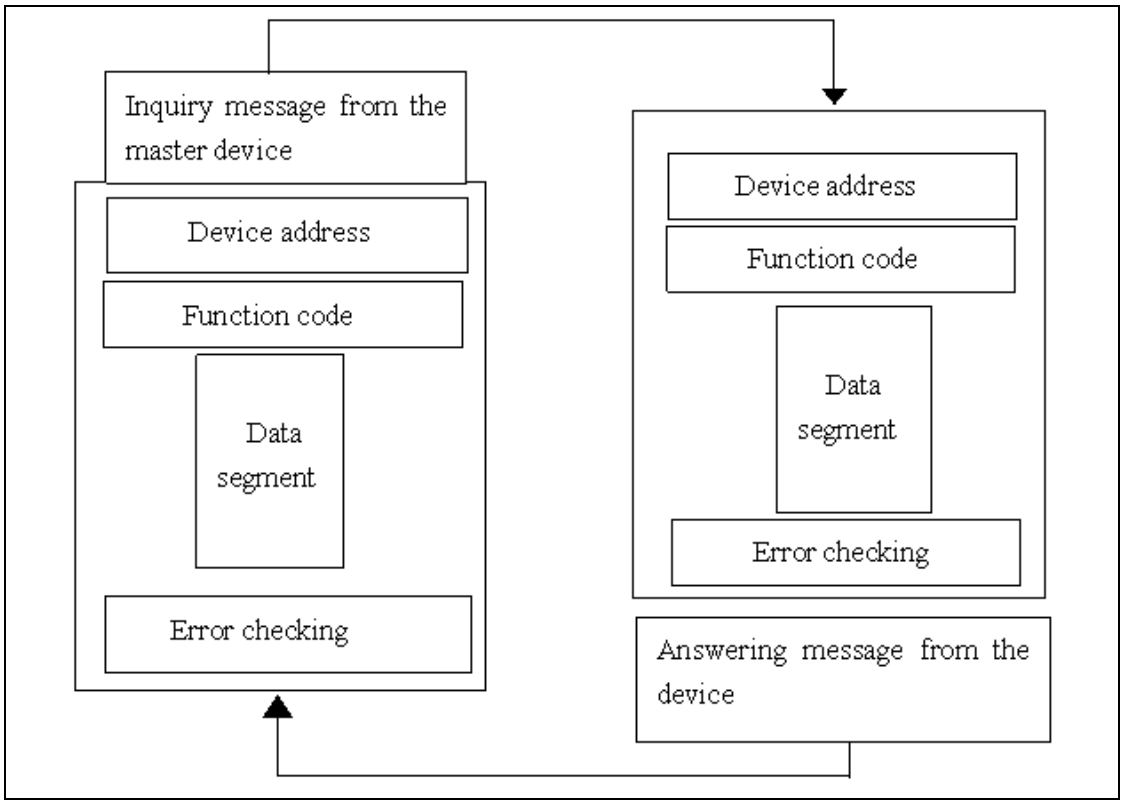


Figure 1 Master-slave inquiry and answer cycle

10.1.3 Query

The function code in the query message informs the selected slave device about the specific function to execute. The data field contains any additional information necessary for the slave device to perform the function. For example, function code 03 requests the slave device to read holding registers and return their contents. The data field must include the information to instruct the slave device, such as where to start reading the registers and the number of registers to read. The error-checking field provides a method for the slave device to verify the correctness of the message content.

10.1.4 Response

If the slave device generates a valid response, the function code in the response message corresponds to the function code in the query message. The data field includes the data collected by the slave device, such as register values or status. If an error occurs, the function code will be modified to indicate that the response message is an error, and the data field will contain a code describing the error information. The error-checking field allows the master device to verify whether the message content is valid.

10.1.5 Transmission Mode

Transmission mode refers to a series of independent structures within a data frame and the specific rules used to transmit data. The following defines the transmission mode compatible with the MODBUS protocol in RTU mode.

Bits in Each Byte

- 1 start bit
- 8 data bits, with the least significant bit sent first
- No parity bit (odd parity, even parity optional)
- 1 stop bit (or 2 stop bits)

Error checkingCRC (cyclic redundancy check)

10.1.6 Protocol

When a data frame reaches the terminal device, it enters the addressed device through a simple "port." The device removes the "envelope" (header) of the data frame, reads the data, and if no errors are found, executes the requested task. It then adds its own generated data to the "envelope" and returns the data frame to the sender.

The returned response data includes the following components:

- **Address:** The terminal slave address
- **Function:** The command that was executed
- **Data:** The requested data generated from executing the command
- **Check:** A checksum

If any errors occur, a successful response will not be generated. Instead, an error indication frame will be returned.

10.1.7 Format of Data Frame

Address	Function	Data	Check
8-Bits	8-Bits	N x 8-Bits	16-Bits

10.1.8 Address Field

The address field is located at the beginning of the frame and consists of one byte (8-bit binary code), with values ranging from 0 to 255 in decimal. In our system, only addresses 1 to 247 are used, with other addresses reserved. These bits specify the user-designated terminal device address, which will receive data from the connected host. Each terminal device must have a unique address, and only the terminal addressed in the query will respond. When the terminal sends back a response, the slave address in the response indicates to the host which terminal is communicating with it.

10.1.9 Function Field

The function field code specifies the operation to be performed by the addressed terminal. The table below lists the function codes used in the PM126series, along with their meanings and purposes.

Code	Meaning	Behavior
01	Read DO Status	Retrieves the current status (ON/OFF) of digital (relay) outputs
02	Read DI Status	Retrieves the current status (ON/OFF) of digital inputs
03	Read data register	Retrieves the current binary value of one or more registers
05	Control DO	Control output status (ON/OFF) of digital (relay) output
16	Preset Multiple Registers	Sets binary values into a series of multiple registers

10.1.10 Data Field

The data field contains the information required by the terminal to perform a specific function or the data collected by the terminal in response to a query. The content of this field can include numerical values, reference addresses, or configuration settings. For example, if the function field code instructs the terminal to read a register, the data field must specify which register to start from and how many data points to read. The embedded addresses and data vary depending on the type and configuration of the slave device.

10.1.11 Error Check Field

This field allows the host and terminal to detect errors during data transmission. Occasionally, due to electrical noise or other interference, a set of data may be altered while being transmitted between devices. Error checking ensures that the host or terminal does not respond to data that has been altered during transmission, thereby enhancing the system's safety and efficiency. The error-checking mechanism uses a 16-bit Cyclic Redundancy Check (CRC16) method.

10.1.12 Error Indication Frame and Error Codes

If the slave devices detected logical error in the data sent by the host, such as an invalid address or an **out-of-range data request**, it responds with an error indication frame to the host.

Error Indication Frame Definition:

- The most significant bit (MSB) of the **Function** field is set to 1, while the other bits remain unchanged.
- The **Data** field specifies the type of error (i.e., Error Code).

Note: If a CRC error occurs, the slave does not return any data.

Example:
If the host requests to read the status of digital outputs but provides an address outside the valid range, the slave responds with an error code indicating the issue:

Addr	Fun	Byte count	Err Code	CRC16 lo	CRC16 hi
0AH	81H	01H	FFH	12H	04H

In this example, the error code is **02H**, and the function field is **81H** (the most significant bit - b7 - of the requested function code **01H** is set to 1).

Error Codes Explanation:

- **01H:** Invalid function code
- **02H:** Invalid register address
- **03H:** Invalid data length
- **04H:** Device failure

This mechanism ensures that the **master device** can diagnose issues in communication with the **slave device.**

10.1.13 Error Detection Method

The error-checking (CRC) field occupies two bytes and contains a 16-bit binary value. The CRC value is calculated by the transmitting device and appended to the data frame. The receiving device recalculates the CRC value upon receiving the data and compares it with the value in the CRC field. If the two values do not match, an error has occurred.

1. **CRC Calculation Process**
2. **Initialization:**
   A 16-bit register is preset to all 1s.
3. **Byte-by-Byte Processing:**
   Each byte of the data frame (8 bits) is processed against the current value of the register.
   - Only the 8 data bits of each byte are used for CRC generation. Start, stop, and parity bits (if any) do not affect the calculation.
4. **Bitwise Operations:**
   - The 8 bits of the current byte are XORed with the current value of the register.
   - The result is shifted one bit to the right (towards the least significant bit, LSB), and a 0 is shifted into the most significant bit (MSB).
   - The LSB is checked:
     - If the LSB is 1, the register is XORed with a preset fixed value (0A001H).
     - If the LSB is 0, no operation is performed.

5. **Repetition:**
   - The above process is repeated 8 times (for each bit of the byte).
   - Once all 8 bits of the byte are processed, the next byte of the data frame is XORed with the current value of the register, and the process repeats.
6. **Final CRC Value:**
   - After all bytes in the data frame have been processed, the resulting value in the register is the CRC value.

This calculated CRC value ensures that any changes to the data frame during transmission, such as corruption or interference, can be detected by the receiving device

.

1. **CRC Generation Process**
2. **Initialize the CRC Register:**
   - Set a 16-bit register (referred to as the CRC register) to 0FFFFH (all 1s).
3. **Process the First Byte:**
   - XOR the first 8 bits (1 byte) of the data frame with the low byte of the CRC register.
   - Store the result back into the CRC register.
4. **Shift and Check the CRC Register:**
   - Right-shift the CRC register by 1 bit.
   - Fill the most significant bit (MSB) with 0.
   - Check the least significant bit (LSB):
     - If the LSB is 0: Repeat the right-shift process (Step 3).
     - If the LSB is 1: XOR the CRC register with a fixed preset value (0A001H).
5. **Repeat for 8 Bits:**
   - Repeat Step 3 a total of 8 times to process all bits of the current byte.
6. **Process Remaining Bytes:**
   - Repeat Steps 2 to 4 for each subsequent byte in the data frame until all bytes are processed.
7. **Finalize the CRC Value:**
   - After all bytes have been processed, the final value in the CRC register is the CRC value.
8. **Alternative Method: Table-Based CRC Calculation**
   - This method involves using a precomputed lookup table for CRC values, which significantly speeds up the calculation process.
   - While faster, this method requires more memory to store the lookup table.
   - For details on implementing this method, refer to relevant documentation or resources.

This step-by-step process ensures accurate CRC calculation and error detection during data transmission.

10.1.14 Detailed Communication Application Format

The examples in this section use the format shown in the table below (numbers are in hexadecimal):

Addr	Fun	Datastart reg hi	Data start reg lo	Data #of regs hi	Data #of regs lo	CRC16lo	CRC16hi
0AH	03H	00H	00H	00H	03H	04H	B0H

- **Addr:** slave address
- **Fun:** function code
- **Data start reg hi:** High byte of data start address register
- **Data start reg lo:** Low byte of data start address register
- **Data #of reg hi**: High byte of data read amount register
- **Data #of reg lo:** Low byte of data read amount register
- **CRC16 Hi:** High of byte of cyclic redundancy check
- **CRC16 Lo:** Low byte of cyclic redundancy check

10.1.15 Reading Digital Output Status (Function Code 01)

Query Data Frame

- The query data frame is sent by the host to the slave device. Function code 01 allows users to obtain the ON/OFF status of the digital outputs (DO, relays) at the specified address of a slave device (1=ON, 0=OFF). In addition to the slave address and function field, the data field must include the initial address of the DO (relay) to be read and the number of DOs (relays) to read.
- In the PM126series, the addresses for DOs (relays) start from **0000H** (DO1=0000H, DO2=0001H). The following example retrieves the status of DO1 and DO2 from a slave device with an address of 10.
- (Example: The PM126series can configure up to 6 DOs, with addresses ranging from **0000H** to **0005H**.)

Addr	Fun	DO start reg hi	DO start reg lo	DO #of regs hi	DO #of regs lo	CRC16lo	CRC16hi
0AH	01H	00H	00H	00H	02H	BCH	B0H

Response Data Frame

The response data frame is sent by the slave device back to the host. It contains the slave address, function code, byte count, data, and CRC error check. In the data field, each DO occupies 1 bit (1=ON, 0=OFF). The least significant bit (LSB) of the first byte corresponds to the addressed DO value, and subsequent DO values follow in order.

Example of a response for reading digital output status:

Addr	Fun	Byte count	Data	CRC16 lo	CRC16 hi
0AH	01H	01H	02H	D2H	6DH

Data field definition:

0	0	0	0	0	0	DO2	DO1
b7	b6	b5	b4	b3	b2	b1	b0

MSB LSB

(DO1 = OFF, DO2=ON)

Error Indication Codes

If the host requests an invalid address or an incorrect number of data points, the slave returns an error indication code (see explanation in **10.1.12**).

10.1.16 Reading Digital Input Status (Function Code 02)

Query data frame

- This function allows users to retrieve the ON/OFF status of Digital Inputs (DI, 1=ON, 0=OFF). In addition to the slave address and function field, the data frame must include the initial address of the DI to be read and the number of DIs to read in the data field.
- In the PM126series, there are 8 DIs, with addresses ranging from **0000H** to **0007H**. The following example demonstrates reading the status of DI1 and DI2 from a slave device with an address of 10.

The following example is status of DI1 and DI2 of slave device, of which the address is 10.

Addr	Fun	DI startAddr hi	DI startAddr lo	DI # regs of hi	DI # regs of lo	CRC16 lo	CRC16 hi
0AH	02H	00H	00H	00H	02H	F8H	B0H

- **Addr:** Slave address (10 in this example)
- **Fun:** Function code (02H for reading digital input status)
- **DI start reg hi/lo:** Starting address of the DI to be read (0000H for DI1)
- **DI #of regs hi/lo:** Number of DIs to read (2 in this example)
- **CRC16 lo/hi:** Cyclic redundancy check (calculated based on the entire frame)

Response data frame

The response contains the following components:

- **Slave Address:** The address of the slave device.
- **Function Code:** The function code (02H in this case).
- **Byte Count:** Number of bytes in the data field.
- **Data:** The ON/OFF status of the requested Digital Inputs (DIs). Each DI occupies one bit (1=ON, 0=OFF). The least significant bit (LSB) of the first byte corresponds to the addressed DI value, with subsequent DI values following in order.
- **CRC:** Cyclic Redundancy Check for error detection.

The following example is a real example of reading digital input status response.

Addr	Fun	Byte count	Data	CRC16 lo	CRC16 hi
0AH	02H	01H	01H	62H	6CH

Data is DI's status and its definition is:

0	0	0	0	0	0	DI2	DI1
b7	b6	b5	b4	b3	b2	B1	b0

MSB LSB

(DI1=ON, DI2=OFF)

Figure 4-6: response of reading status of DI1 and DI2

Error code

If the address that the master computer requests does not exist, or if the data amount is not correct, error code (FFH) would be returned.

10.1.17 Read Data (Function 03)

Query Data Frame

This function allows users to obtain the data collected and recorded by the device, as well as system parameters. The number of data points requested by the host in a single query is not limited, but it must not exceed the defined address range.

Example:

- Reading three collected basic data points (**F, Va, Vb**) from a slave device with address 10.
- Each data point is treated as a floating-point value, occupying 2 addresses.
- Each address in the data frame occupies 2 bytes.

Addresses for Data Points in PM126Series:

- **F:** 4000H and 4001H
- **Va:** 4002H and 4003H
- **Vb:** 4004H and 4005H

Addr	Fun	Data start Addr hi	Datastart Addrlo	Data#of regs hi	Data #of regs lo	CRC16 lo	CRC16 hi
0AH	03H	40H	00H	00H	06H	D1H	73H

Response Data Frame

The response includes the following components:

- **Slave Address:** The address of the responding slave device.
- **Function Code:** Indicates the function executed (03H for reading holding registers).
- **Byte Count:** Specifies the total number of bytes in the data field.
- **Data:** Contains the requested data values in sequence.
- **CRC:** Cyclic Redundancy Check for error detection.

Addr	Fun	Bytecount	Data1 hi	Data1 lo	Data2 hi	Data2lo	Data3hi	Data3lo	Data4hi	Data4lo
0AH	03H	0CH	42H	48H	00H	00H	42H	C7H	CCH	CDH

1. **Data Explanation**
2. **F = 42480000H**
   - Floating-point representation of **50 Hz**.
3. **Va = 42C7CCCDH**
   - Floating-point representation of **99.9 V**.
4. **Vb = 42C8051FH**
   - Floating-point representation of **100.1 V**.

Each value is stored in 4 bytes (32-bit IEEE 754 floating-point format). The data is presented in the order of the requested registers.

Data5 hi	Data5 lo	Data6 hi	Data6 lo	CRC16 lo	CRC16 hi
42H	C8H	05H	1FH	87H	09H

Error code

If the host requests an invalid address, the slave device returns an **error indication code**. When an error occurs, the response frame will indicate the error by setting the **MSB (Most Significant Bit)** of the function code to **1**, and the **data field** will contain the specific error code. For example, if a register address error occurs, the error code **02H** will be included in the response.

This mechanism ensures clear communication of issues between the master and slave devices.

10.1.18 Control DO (Relay) (Function Code 05)

Query data frame

This data frame is used to forcefully set an individual Digital Output (DO) to **ON** or **OFF**.

- In the PM126series, DO addresses start from **0000H** (e.g., DO1 = 0000H, DO2 = 0001H).
- Note: The definition of **ON** may not always mean a closed output loop. Depending on the parameter settings, setting **ON** could also result in a hardware pulse output.
- **Data:**
  - **FF00H:** Sets the DO to the **ON** state.
  - **0000H:** Sets the DO to the **OFF** state.
  - Any other value causes the slave device to send an **error indication code** and does not affect the DO state.

Example: Request to Set DO1 of Slave Device 10 to ON

Addr	Fun	DO addr hi	DO addr lo	Value hi	Value lo	CRC16 lo	CRC16 hi
0AH	05H	00H	00H	FFH	00H	8DH	41H

- **Addr:** Slave address (10 in this example).
- **Fun:** Function code (05H for controlling DO).
- **DO reg hi/lo:** Address of the DO to be controlled (0000H for DO1).
- **Data hi/lo:** Data to set the DO state:
  - **FF00H:** Set DO1 to **ON**.
  - **0000H:** Set DO1 to **OFF**.
- **CRC16 lo/hi:** Cyclic redundancy checks for error detection.

This query sets **DO1** to the **ON** state for slave device 10.

Response data frame

Normal response to this command is to send back the received data after changing DO status.

Addr	Fun	Doaddr hi	Do addrlo	Valuehi	Valuelo	CRC16 lo	CRC16 hi
0AH	05H	00H	00H	FFH	00H	8DH	41H

Figure 4-10 control response of independent DO

Error code

If the address that the master computer requests does not exist, or if the data amount is not correct, error code (FFH) would be returned.

10.1.19 Preset Multiple Registers (Function Code 16)

Query data frame

The **Function Code 16 (10H)** allows users to modify the contents of multiple registers. In the PM126series, system parameters and energy measurements can be written using this function code. The host can write up to **16 registers (32 bytes)** in one request.

Example: Writing Active Energy Import (EP_imp)

This example demonstrates presetting the active energy import (**EP_imp**) for slave device 10 to **17807783.3 kWh**.

Storage and Scaling:

- The energy value is stored as **X 0.1 kWh**, so the value to be written is: 17807783.3×10=17807783317807783.3 \times 10 = 17807783317807783.3×10=178077833
  - **Decimal Value:** 178077833
  - **Hexadecimal Value:** 0A9D4089H

Register Details:

- Address of **EP_imp: 0156H** (high) and **0157H** (low).
- Total size: 32 bits (4 bytes)

Addr	Fun	Data Startreg hi	Data startreg lo	Data#ofregs hi	Data #ofregs lo
0AH	10H	01H	56H	00H	02H

- **Addr:** Slave address (10).
- **Fun:** Function code (16H for presetting multiple registers).
- **Start reg hi/lo:** Starting register address (0156H).
- **# of regs hi/lo:** Number of registers to write (2 registers for 32-bit value).
- **Byte count:** Number of data bytes to write (4 bytes for the 32-bit value).
- **Data:** The 32-bit value to be written: 0A 9D 40 89H (big-endian format).
- **CRC16 lo/hi:** CRC for error detection (to be calculated).

Byte Count	Valuehi	Valuelo	Valuehi	Valuelo	CRC lo	CRC hi
04H	0AH	9DH	40H	89H	3CH	5DH

Response data frame

For a **Preset Single Register** request, the normal response is sent after the register value has been successfully updated. The response includes the following components:

- **Machine Address:** The address of the slave device.
- **Function Code:** The function code confirming the operation.
- **Start Register Address:** The starting address of the register that was updated.
- **Number of Registers:** The number of registers updated (usually 1 for a single register).
- **CRC Checksum:** Ensures data integrity.

Addr	Fun	Data start reg hi	Data startreg lo	Data #of Regs hi	Data #ofRegslo	CRC16 lo	CRC16 hi
0AH	10H	01H	56H	00H	02H	A1H	5FH

Explanation of Components

- **Addr:** Slave address.
- **Fun:** Function code (06H for writing a single register).
- **Start reg hi/lo:** Address of the modified register.
- **# of regs hi/lo:** Number of registers updated (always 1 for this function).
- **CRC16 lo/hi:** CRC checksum for error detection.

Error code

If the address that the master computer requests does not exist, or if the data amount is not correct, error code (FFH) would be returned

Application Details and Parameter Address Table for the PM126

- Measurement values in the PM126 are read using **Command 03** of the Modbus-RTU communication protocol.
- **DI address areas** are read using **Command 02**, while **DO addresses** are:
  - Read using **Command 01**.
  - Written using **Command 05**.
- For **Float-type data** in the address range **4000H~4047H**, the communication value corresponds directly to the actual value on the primary side.
- For other addresses, the relationship between the communication value and the actual value is as follows:

  Val t = Communication Read-Out Value

  Val s = Actual Value
- Refer to the table below for the correspondence

Available Parameter	Correspondence	Unit
Voltage value V1,V2,V3, Vvavg,V12,V23,V31,Vlavg	Val_s=Val_t X (PT1 / PT2) /10	V
Current value I1,I2,I3, Iavg, In	Val_s=Val_t X(CT1/CT2) /1000	A
Power value P1, P2, P3, Q1, Q2, Q3, S1, S2, S3, PLsum, QLsum, SLsum	Val_s=Val_t X (PT1 / PT2) X (CT1/CT2 /10	W, var, VA
Power value Psum, Qsum, Ssum	Val_s=Val_t X (PT1 / PT2) X (CT1/CT2)	
Electric energy quantity, EP_imp, EP_exp, EP_total, EP_net, EQ_imp, EQ_exp, EQ_total, EQ_net	Val_s=Val_t /10	kWh kvarh
Power factor value PFa, PFb, PFc, PF	Val_s=Val_t / 1000	N/A
Frequency F	Val_s=Val_t / 100	Hz
Device Temperature	Val_s=Val_t / 10	Celsius degree
Harmonic ratio	Val_s=Val_t / 100	%
Harmonic distortion rate	Val_s=Val_t / 100	%
Leakage current	Val_s = Val_t	mA
Voltage Crest Factor	Val_s=Val_t / 1000	N/A
Current-Voltage Form Factor	Val_s=Val_t / 100	%
Current K Factor	Val_s=Val_t/10	N/A
Phase Angle	Val_s=Val_t/10	Degrees
Current-Voltage Unbalance	val_s=Val_t/10	%

Note: PT1/PT2 is PT ratio; CT1/CT2 is CT ratio.

Example: The communication read-out value of Va is 2246, with PT1 = 100 and PT2 = 100.

The actual value of Va is calculated as:

Va = 2246 ×（100/100）/10 = 224.6V.

Thus, the actual voltage value of Va is 224.6V.

The following is the DI address area: Read with Command 02H				
Address	**Parameter**	**Read-write property**	**Number range**	**Data type**
0000H	DI1	1 = ON , 0 = OFF	BIT	R
0001H	DI2	1 = ON , 0 = OFF	BIT	R
0002H	DI3	1 = ON , 0 = OFF	BIT	R
0003H	DI4	1 = ON , 0 = OFF	BIT	R
0004H	DI5	1 = ON , 0 = OFF	BIT	R
0005H	DI6	1 = ON , 0 = OFF	BIT	R
0006H	DI7	1 = ON , 0 = OFF	BIT	R
0007H	DI8	1 = ON , 0 = OFF	BIT	R

The following is the DO address area: Read with Command 01H, Write with Command 05H				
Address	**Parameter**	**Read-write property**	**Number range**	**Data type**
0000H	DO1	1 = ON , 0 = OFF	BIT	R/W
0001H	DO2	1 = ON , 0 = OFF	BIT	R/W
0002H	DO3	1 = ON , 0 = OFF	BIT	R/W
0003H	DO4	1 = ON , 0 = OFF	BIT	R/W
0004H	DO5	1 = ON , 0 = OFF	BIT	R/W
0005H	DO6	1 = ON , 0 = OFF	BIT	R/W

Definition of read-write property: R-readable, W-writable, P-no data loss after power off

The following is the system parameter address area: Read with Command 03H, Write with Command 10H. U, I, PQS are secondary side values.				
Address	**Parameter**	**Read-write property**	**Number range**	**Data type**
1000H	Protection Password	R/W/P	0~9999	word
1001H	High byte, secondary 485(COM2) device address	R/W/P	1~247	word
	Low byte, main 485(COM1) device address	R/W/P	1~247	
1002H	High byte, secondary 485(COM2) baud rate	R/W/P	0-5: corresponding to 1200,2400,4800, 9600,19200,38400bps	word
	Low byte, main 485(COM2) baud rate	R/W/P	0-5: corresponding to 1200,2400,4800, 9600,19200,38400bps	
1003H~1004H	Reserved	-	-	-
1005H	PT1 high byte	R/W/P	0~220. x10000 PT1=hi*10000+lo	word
1006H	PT1 low byte	R/W/P	0~9999 PT1:100~2200000	word
1007H	PT2	R/W/P	100, 220, 380	word
1008H	CT1	R/W/P	1~6000	word
1009H	CT2	R/W/P	1or 5	word
100AH	High 8—bit: IN threshold	R/W/P	0-100	word
	Low 8—bit: current threshold	R/W/P	0-100	
100BH	single sliding window period	R/W/P	1~20	word
100CH	Required amount of sliding windows	R/W/P	1~60	word
100DH	Reserved	-	-	-
100EH	Clear demand	W	Write 1 to clear demand	word

100FH	Clear extremum		W	Write 1 to clear extremum	word
1010H	Reserved		-	-	-
1011H	Current direction		R/W/P	Bit0: IA current direction 0-positive direction, 1-reverse direction Bit1: IB current direction Bit2: IC current direction	word
1012H~1014H	Reserved		-	-	-
1015H	O1 type		R	0-n/a 1-DO 2-PO 3-AO 4-ILelectric leakage measuring 5-T temperature measuring	word
1016H	DO	DO1 operation mode	R/W/P	0-level mode 1- pulse mode	word
	PO	PO1 pulse output electric energy selection		0——Ep_imp 1——Ep_exp 2——Eq_imp 3——Eq_exp 4——Ep_total 5——Ep_net 6——Eq_total 7——Eq_net 8——no output	
	AO	AO1 parameter address		0~65535	
1017H	DO	DO1 pulse width setting	R/W/P	0~65535	word
	PO	Reserved			
	AO	AO1 corresponding value to 4mA			
1018H	DO	Reserved	R/W/P	0~65535	word
	PO	Reserved			
	AO	AO1 corresponding value to 20mA			
1019H~102CH	Setting of O2~O6 is same as setting of O1				
102DH	Setup of electric energy pulse width		R/W/P	1~100 1unit is 10ms	word

102EH	pulse constant of DO electrical degree namely, pulse number/kWh	R/W/P	1~6000 1unit -1 pulse	word
102FH	Reserved			
1030H	Period of lighting backlight	R/W/P	0 –normally on 1 – 1 mins 2– 5 mins 3 – 10 mins 4 – 30 mins	word
1031H	Infrared, phonic control	R/W/P	Bit0: infrared triggering backlight 0-disable, 1-enable Bit1: infrared security count 0-disable, 1-enable Bit2: security count mode 0-always; 1-set period Bit3: infrared tone 0-off, 1-on Bit4: key tone 0-off, 1-on Bit5: alarm tone 0-off, 1-on Bit6: Automatic alarm silencing 0-off, 1-on Bit7-15: Reserved	word
1032H	Display themes color plan	R/W/P	0~4	word
1033H	Enable voltage swell/sag	R/W/P	Bit0: enable swell 0-disable, 1-enable Bit1:VB enable swell Bit2:VC enable swell Bit3:VA enable sag Bit4:VB enable sag Bit5:VC enable sag	word
1034H	Reference value of measuring voltage	R/W/P	0~999	word
1035H	Voltage sag threshold (%)	R/W/P	10~90	word
1036H	Voltage sag delay time	R/W/P	0~3000 1 unit-10ms	word
1037H	Voltage sag and output to relay	R/W/P	0-no output 1-DO1 2-DO2	word

1035H	Voltage swell threshold (%)	R/W/P	110~190	word
1036H	Voltage swell delay time	R/W/P	0~3000 1 unit-10ms	word
1037H	Voltage swell and output to relay	R/W/P	0-no output 1-DO1 2-DO2	word
1038H~103FH	Reserved			
1040H	Real—time clock (year) setup	R/W/P	2000 ~ 2099	word
1041H	Real—time clock (month) setup	R/W/P	1 ~ 12	word
1042H	Real—time clock (day)setup	R/W/P	1 ~ 31	word
1043H	Real—time clock (hour) setup	R/W/P	0~24	word
1044H	Real—time clock (minute) setup	R/W/P	0~59	word
1045H	Real—time clock (second) setup	R/W/P	0~59	word
1046H	Main alarm switch	R/W/P	0-disable, 1-enable	word
1047H	Reserved			
1048H	on-off switch of each alarm channel	R/W/P	0~65535 Bit0: control channel 1, 0-disable, 1-enable. Bit1: control channel 3, and so on Bit15: control channel 16	word
1049H	Logic switch between alarm channels	R/W/P	0~65535 Bit0: logic relation between channel 1 and channel 2, 0-and, 1-or. Bit1: logic relation between channel 2 and channel 3, and so on Bit14: logic relation between channel 15 and channel 16, Bit15: logic switch, 0-disable logic relation, 1-enable logic relation	word

The following is address area of single alarm record setting: 03H function code reading, 10H function code writing				
Address	**Parameter**	**Read-write property**	**Number range**	**Data type**
104EH	Group 1: selection of parameter numbers	R/W/P	0~46, please refer to explanation of off-limit alarm function	word
104FH	Group 1: comparison method	R/W/P	0~alarm set-up value	word
1050H	Group 1: alarm setup value	R/W/P	0~65535	word
1051H	Group 1: delay time	R/W/P	0~3000（x 10ms）	word
1052H	Group 1: output to relay	R/W/P	0-no output 1-DO1 2-DO2	word
1053H~109DH	setup of group 2 to group 16 is same as setup of group 1			

The following is address area of time-sharing electric energy setup: 03H function code reading, 10H function code writing				
Address	**Parameter**	**Read-write property**	**Number range**	**Data type**
1100H	Enable time—sharing electric energy	R/W/P	0-disable, 1-enable	word
1101H	Time—sharing electric energy settlement method	R/W/P	0-end of natural month 1-according to fixed date	word
1102H	Time—sharing electric energy settlement date	R/W/P	1~31	word
1103H	Settlement tome, minute number in one day	R/W/P	0~1439	word
1104H	End time of time zone 1	R/W/P	High 8 bits: month Low 8 bits: date	word
1105H	rate of day period 1 in time zone 1	R/W/P	0-tip 1- peak 2-cereal 3-flat	word
1106H	End time of day period 1 in time zone 1 (minutes number in one day)	R/W/P	0~1439	word
1107H~111CH	Setup of day period 2 to period 12 in time zone 1 is same as setup of day period 1 in time zone 1			
111DH~1135H	Setup of time zone 2 is same as setup of time zone 1			
1136H~114EH	Setup of time zone 3 is same as setup of time zone 1			
114FH~1167H	Setup of time zone 4 is same as setup of time zone 1			
1168H~1180H	Setup of time zone 5 is same as setup of time zone 1			
1181H~1199H	Setup of time zone 6 is same as setup of time zone 1			

119AH	Rate currency amount at tip period	R/W/P	1~4000 ￥0.001/kwh	word
119BH	Rate currency amount at peak period	R/W/P	1~4000 ￥0.001/kwh	word
119CH	Rate currency amount at cereal period	R/W/P	1~4000 ￥0.001/kwh	word
119DH	Rate currency amount at flat period	R/W/P	1~4000 ￥0.001/kwh	word

The following is address area of time—sharing electric energy parameter of current month: 03H function code reading, 10H function code writing				
Address	**Parameter**	**Read-write property**	**Number range**	**Data type**
119AH~119BH	consume active power (tip)	R/W	0~999999999	Dword
119CH~119DH	release active power (tip)	R/W	0~999999999	Dword
119EH~119FH	absorb reactive power (tip)	R/W	0~999999999	Dword
11A0H~11A1H	release reactive power (tip)	R/W	0~999999999	Dword
11A2H~11A3H	consume active power (peak)	R/W	0~999999999	Dword
11A4H~11A5H	release active power (peak)	R/W	0~999999999	Dword
11A6H~11A7H	absorb reactive power (peak)	R/W	0~999999999	Dword
11A8H~11A9H	release reactive power (peak)	R/W	0~999999999	Dword
11AAH~11ABH	consume active power (cereal)	R/W	0~999999999	Dword
11ACH~11ADH	release active power (cereal)	R/W	0~999999999	Dword
11AEH~11AFH	absorb reactive power (cereal)	R/W	0~999999999	Dword
11B0H~11B1H	release reactive power (cereal)	R/W	0~999999999	Dword
11B2H~11B3H	consume active power (flat)	R/W	0~999999999	Dword
11B4H~11B5H	release active power (flat)	R/W	0~999999999	Dword
11B6H~11B7H	absorb reactive power (flat)	R/W	0~999999999	Dword
11B8H~11B9H	release reactive power (flat)	R/W	0~999999999	Dword
11BAH~11BBH	consume active power (total)	R/W	0~999999999	Dword
11BCH~11BDH	release active power (total)	R/W	0~999999999	Dword
11BEH~11BFH	absorb reactive power (total)	R/W	0~999999999	Dword
11C0H~11C1H	release reactive power (total)	R/W	0~999999999	Dword

The following is address area of time—sharing electric energy parameter of last month: 03H function code reading, 10H function code writing				
Address	**Parameter**	**Read-write property**	**Number range**	**Data type**
11C2H~11C3H	consume active power (tip)	R/W	0~999999999	Dword
11C4H~11C5H	release active power (tip)	R/W	0~999999999	Dword
11C6H~11C7H	absorb reactive power (tip)	R/W	0~999999999	Dword
11C8H~11C9H	release reactive power (tip)	R/W	0~999999999	Dword
11CAH~11CBH	consume active power (peak)	R/W	0~999999999	Dword
11CCH~11CDH	release active power (peak)	R/W	0~999999999	Dword
11CEH~11CFH	absorb reactive power (peak)	R/W	0~999999999	Dword
11D0H~11D1H	release reactive power (peak)	R/W	0~999999999	Dword
11D2H~11D3H	consume active power (cereal)	R/W	0~999999999	Dword
11D4H~11D5H	release active power (cereal)	R/W	0~999999999	Dword
11D6H~11D7H	absorb reactive power (cereal)	R/W	0~999999999	Dword
11D8H~11D9H	release reactive power (cereal)	R/W	0~999999999	Dword
11DAH~11DBH	consume active power (flat)	R/W	0~999999999	Dword
11DCH~11DDH	release active power (flat)	R/W	0~999999999	Dword
11DEH~11DFH	absorb reactive power (flat)	R/W	0~999999999	Dword
11E0H~11E1H	release reactive power (flat)	R/W	0~999999999	Dword
11E2H~11E3H	consume active power (total)	R/W	0~999999999	Dword
11E4H~11E5H	release active power (total)	R/W	0~999999999	Dword
11E6H~11E7H	absorb reactive power (total)	R/W	0~999999999	Dword
11E8H~11E9H	release reactive power (total)	R/W	0~999999999	Dword

The following is address area of time--control switch setup parameter: 03H function code reading, 10H function code writing				
Address	**Parameter**	**Read-write property**	**Number range**	**Data type**
1200H	Allow time--control switch	R/W	Bit0: allow DO1 time--control 0-off, 1-on Bit1: allow DO2 time--control Bit2~Bit15 Reserved	word
1201H	Allow control of DO1 sunrise and sunset in every week	R/W	Bit0: Monday 0-off, 1-on Bit1~Bit6: Tuesday to Sunday Bit7~Bit15: Reserved	word
1202H	Enable control of DO2 sunrise and sunset in every week	R/W	Same as above	word
1203H~1204H	Reserved			
1205H	longitude	R/W	0~18000	word
1206H	latitude	R/W	0~6000	word
1207H	DO1 channel 1 open time	R/W	Bit15: allow channel 1 to open Bit14: Reserved Bit13: Sunday allow group 1 Bit12: Saturday allow group 1 Bit11: Friday allow group 1 Bit10~Bit0: DO1 open time (minute number since zero hour)	word
1208H	DO1 channel 1close time	R/W	Bit15: allow channel 1 to close Bit14: Thursday allow Bit13: Wednesday allow Bit12: Tuesday allow Bit11: Monday allow Bit10~Bit0: DO1 close time	word
1209H	DO1 channel 2 open time	R/W	same as channel 1	word
120AH	DO1 channel 2 close time	R/W		word
120BH	DO1 channel 3 open time	R/W	same as channel 1	word
120CH	DO1 channel 3 close time	R/W		word

120DH	DO1 channel 4 open time	R/W	same as channel 1	word
120EH	DO1 channel 4 close time	R/W		word
120FH	DO1 channel 5 open time	R/W	same as channel 1	word
1210H	DO1 channel 5 close time	R/W		word
1211H	DO1 channel 6 open time	R/W	same as channel 1	word
1212H	DO1 channel 6 close time	R/W		word
1213H	DO1 channel 7 open time	R/W	same as channel 1	word
1214H	DO1 channel 7 close time	R/W		word
1215H	DO1 channel 8 open time	R/W	same as channel 1	word
1216H	DO1 channel 8 close time	R/W		word
1217H	DO1 channel 9 open time	R/W	same as channel 1	word
1218H	DO1 channel 9 close time	R/W		word
1219H	DO1 channel 10 open time	R/W	same as channel 1	word
121AH	DO1 channel 10 close time	R/W		word
121BH	DO1 channel 11 open time	R/W	same as channel 1	word
121CH	DO1 channel 11 close time	R/W		word
121DH	DO1 channel 12 open time	R/W	same as channel 1	word
121EH	DO1 channel 12 close time	R/W		word
121DH~1234H	Open and close time of channel 1 to channel 12 of DO2 is set same as DO 1.			
1235H～123FH	Reserved			
1240H～1241H	EP's total fee of tip period of current month	R/W	unit: 0.1 yuan	Dword
1242H～1243H	EP's total fee of peak period of current month	R/W	unit: 0.1 yuan	Dword
1244H～1245H	EP's total fee of cereal period of current month	R/W	unit: 0.1 yuan	Dword
1246H～1247H	EP's total fee of flat period of current month	R/W	unit: 0.1 yuan	Dword
1248H～1249H	EP's total fee of tip period of last month	R/W	unit: 0.1 yuan	Dword
124AH～124BH	EP's total fee of peak period of last month	R/W	unit: 0.1 yuan	Dword
124CH～124DH	EP's total fee of cereal period of last month	R/W	unit: 0.1 yuan	Dword
124EH～124FH	EP's total fee of flat period of last month	R/W	unit: 0.1 yuan	Dword

The following is address area of basic measuring parameter: 03H function code reading				
Address	**Parameter**	**Read-write property**	**Number range**	**Data type**
130H	Frequency F	R	4500～6500	word
131H	Phase voltage V1	R	0～65535	word
132H	Phase voltage V2	R	0～65535	word
133H	Phase voltage V3	R	0～65535	word
134H	Phase voltage average value VLNavg	R	0～65535	word
135H	Line voltage V12	R	0～65535	word
136H	Line voltage V23	R	0～65535	word
137H	Line voltage V31	R	0～65535	word
138H	Line voltage average value VLLavg	R	0～65535	word
139H	phase (line) current I1	R	0～65535	word
13AH	phase (line) current I2	R	0～65535	word
13BH	phase (line) current I3	R	0～65535	word
13CH	Three—phase current average current Iavg	R	0～65535	word
13DH	neutral current In	R	0～65535	word
13Eh	split-phase active power P1	R	-32768～32767	Integer
13Fh	split-phase active power P2	R	-32768～32767	Integer
140H	split-phase active power P3	R	-32768～32767	Integer
141H	system active power Psum	R	-32768～32767	Integer
142H	spilt--phase reactive powerQ1	R	-32768～32767	Integer
143H	spilt--phase reactive powerQ2	R	-32768～32767	Integer
144H	spilt--phase reactive powerQ3	R	-32768～32767	Integer
145H	system reactive power Qsum	R	-32768～32767	Integer
146H	spilt--phase apparent power S1	R	0～65535	word
147H	spilt--phase apparent power S2	R	0～65535	word
148H	spilt--phase apparent power S3	R	0～65535	word
149H	system apparent power Ssum	R	0～65535	word
14AH	spilt--phase power factor PF1	R	-1000～1000	Integer
14BH	spilt--phase power factor PF2	R	-1000～1000	Integer
14CH	spilt--phase power factor PF3	R	-1000～1000	Integer
14DH	system power factor PF	R	-1000～1000	Integer

14EH~14FH	system active power PLsum	R	-65535～65535	Long
150H~151H	system reactive power QLsum	R	-65535～65535	Long
152H~153H	system apparent power SLsum	R	-65535～65535	Long

The following is address area of electric energy parameter: 03H function code reading				
Address	**Parameter**	**Read-write property**	**Number range**	**Data type**
156H~157H	active electric energy Ep_imp	R	0～999999999	Dword
158H~159H	active electric energy Ep_exp	R	0～999999999	Dword
15AH~15BH	Inductive reactive electric energy Eq_imp	R	0～999999999	Dword
15CH~15DH	Capacitive reactive electric energy Eq_exp	R	0～999999999	Dword
15EH~15FH	net active electric energy Ep_total	R	0～999999999	Dword
160H~161H	Internet active electric energy Ep_net	R	0～999999999	Dword
162H~163H	net reactive electric energy Eq_total	R	0～999999999	Dword
164H~165H	Internet reactive electric energy Eq_net	R	0～999999999	Dword

The following is address area of basic measuring parameters: 03H function code reading, U, I, PQS are values of primary side values				
Address	**Parameter**	**Read-write property**	**Number range**	**Data type**
3FFFH	Infrared triggering count	R/P	0~65535	word
4000H~4001H	Frequency F	R	4500～6500	float
4002H~4003H	Phase voltage V1	R	0～65535	float
4004H~4005H	Phase voltage V2	R	0～65535	float
4006H~4007H	Phase voltage V3	R	0～65535	float
4008H~4009H	Phase voltage average value VLNavg	R	0～65535	float
400AH~400BH	Line voltage V12	R	0～65535	float
400CH~400DH	Line voltage V23	R	0～65535	float
400EH~400FH	Line voltage V31	R	0～65535	float
4010H~4011H	Line voltage average value VLLavg	R	0～65535	float
4012H~4013H	phase (line) current I1	R	0～65535	float
4014H~4015H	phase (line) current I2	R	0～65535	float
4016H~4017H	phase (line) current I3	R	0～65535	float

4018H~4019H	Three—phase current average current Iavg	R	0～65535	float
401AH~401BH	neutral current In	R	0～65535	float
401CH~401DH	split-phase active power P1	R	-32768～32767	float
401EH~401FH	split-phase active power P2	R	-32768～32767	float
4020H~4021H	split-phase active power P3	R	-32768～32767	float
4022H~4023H	system active power Psum	R	-32768～32767	float
4024H~4025H	spilt--phase reactive powerQ1	R	-32768～32767	float
4026H~4027H	spilt--phase reactive powerQ2	R	-32768～32767	float
4028H~4029H	spilt--phase reactive powerQ3	R	-32768～32767	float
403AH~402BH	system reactive power Qsum	R	-32768～32767	float
402CH~402DH	spilt--phase apparent power S1	R	0～65535	float
402EH~402FH	spilt--phase apparent power S3	R	0～65535	float
4030H~4031H	system apparent power Ssum	R	0～65535	float
4032H~4033H	spilt--phase power factor PF1	R	0～65535	float
4034H~4035H	spilt--phase power factor PF2	R	-1～1	float
4036H~4037H	spilt--phase power factor PF3	R	-1～1	float
4038H~4039H	system power factor PF	R	-1~1	float
403AH~403BH	system active power PLsum	R	-1～1	float
403CH~403DH	unbalance degree of Voltage U	R	0%~100%	float
403EH~403FH	unbalance degree of Current I	R	0%~100%	float
4040H~4041H	load property (L/C/R)	R	76.0/67.0/82.0 (ASCII码)	float
4042H~4043H	Demand of active power	R	-32768～32767	float
4044H~4045H	Demand of reactive power	R	-32768～32767	float
4046H~4047H	Demand of apparent power	R	-32768～32767	float

The following is address area of electric energy parameter: 03H function code reading, 10H function code writing				
Address	**Parameter**	**Read-write property**	**Number range**	**Data type**
4048H~4049H	active electric energy Ep_imp	R/W/P	0～999999999	Dword
404AH~404BH	active electric energy Ep_exp	R/W/P	0～999999999	Dword
404CH~404DH	reactive electric energy Ep_imp	R/W/P	0～999999999	Dword
404EH~404FH	reactive electric energy Ep_exp	R/W/P	0～999999999	Dword
4050H~4051H	active electric energy TOTAL	R/W/P	0～999999999	Dword
4052H~4053H	active electric energy NET	R/W/P	0～999999999	Dword
4054H~4055H	reactive electric energy TOTAL	R/W/P	0～999999999	Dword
4056H~4057H	reactive electric energy NET	R/W/P	0～999999999	Dword
4058H~4059H	Reserved	-	-	-

The following is address area of harmonic parameters: 03H function code reading				
Address	**Parameter**	**Read-write property**	**Number range**	**Data type**
405AH	V1 or V12 total harmonic distortion rate THD_V1	R	0～10000	word
405BH	V2 or V31 total harmonic distortion rate THD_V2	R	0～10000	word
405CH	V3 or V23 total harmonic distortion rate THD_V3	R	0～10000	word
405DH	Phase/line voltage average total harmonic distortion rate THD_V	R	0～10000	word
405EH	I1 total harmonic distortion rate THD_I1	R	0～10000	word
405FH	I2 total harmonic distortion rate THD_I2	R	0～10000	word
4060H	I3 total harmonic distortion rate THD_I3	R	0～10000	word
4061H	Line voltage average total harmonic distortion rate THD_I	R	0～10000	word
4062H~407FH	V1 or V12 harmonic ratio (2~31 times)	R	0～10000	word
4500H~451FH	V1 or V12 harmonic ratio (32~63 times)	R	0～10000	word
4700H~473FH	V1 or V12 harmonic ratio (64~127 times)	R	0～10000	word
4080H	V1 or V12 odd harmonic distortion rate	R	0～10000	word

4081H	V1 or V12 even harmonic distortion rate	R	0～10000	word
4082H	V1 or V12 crest coefficient	R	0～10000	word
4083H	V1 or V12 Form Factor	R	0～10000	word
4084H~40A1H	V2 or V31 harmonic parameter	Same as V1		word
4520H~453FH	V2 harmonic ratio (32~63 times)	R	0～10000	word
4740H~477FH	V2 harmonic ratio (64~127 times)	R	0～10000	word
40A2H	V2 or V31 odd harmonic distortion rate	R		0～10000
40A3H	V2 or V31 even harmonic distortion rate	R	0～10000	word
40A4H	V2 or V31 crest coefficient	R	0～65535	word
40A5H	V2orV31 Form Factor	R	0～10000	word
40A6H~40C3H	V3 or V23 harmonic parameter	Same as V1	word	
4540H~455FH	V3 harmonic ratio (32~63 times)	R	0～10000	word
4780H~47BFH	V3 harmonic ratio (64~127 times)	R	0～10000	word
40C4H	V3 or V23 odd harmonic distortion rate			
40C5H	V3 or V23 even harmonic distortion rate			
40C6H	V3 or V23 crest coefficient			
40C7H	V3 or V23 Form Factor			
40C8H~40E5H	I1 harmonic ratio (2~31 times)	R	0～10000	word
4520H~457FH	I1 harmonic ratio (32~63 times)	R		0～10000
47C0H~47FFH	I1 harmonic ratio (64~127 times)	R	0～10000	word
40E6H	I1 odd harmonic distortion rate	R	0～10000	word

The following is address area of extremum record (maximum value, minimum value and occurring time) parameters: 03H function code reading				
Address	**Parameter**	**Read-write property**	**Number range**	**Data type**
4136H	V1 maximum value	R	-32768~32767	Integer
4137H~413CH	occurring time: year, month, day, hour, minute, second	R	time	Integer
413DH	V2 maximum value	R	-32768~32767	Integer
413EH~4143H	occurring time: year, month, day, hour, minute, second	R	time	Integer
4144H	V3 maximum value	R	-32768~32767	Integer
4145H~414AH	occurring time: year, month, day, hour, minute, second	R	time	Integer
414BH	V12 maximum value	R	-32768~32767	Integer
414CH~4151H	occurring time: year, month, day, hour, minute, second	R	time	Integer
4152H	V23 maximum value	R	-32768~32767	Integer
4153H~4158H	occurring time: year, month, day, hour, minute, second	R	time	Integer
4159H	V31 maximum value	R	-32768~32767	Integer
415AH~415FH	occurring time: year, month, day, hour, minute, second	R	time	Integer
4160H	I1 maximum value	R	-32768~32767	Integer
4161H~4166H	occurring time: year, month, day, hour, minute, second	R	time	Integer
4167H	I2 maximum value	R	-32768~32767	Integer
4168H~416DH	occurring time: year, month, day, hour, minute, second	R	time	Integer
416EH	I3 maximum value	R	-32768~32767	Integer
416FH~4174H	occurring time: year, month, day, hour, minute, second	R	time	Integer
4175H	Maximum value of system active power	R	-32768~32767	Integer
4176H~417BH	occurring time: year, month, day, hour, minute, second	R	time	Integer
417CH	Maximum value of system reactive power	R	-32768~32767	Integer
417DH~4182H	occurring time: year, month, day, hour, minute, second	R	time	Integer
4183H	Maximum value of system apparent power	R	-32768~32767	Integer
4184H~4189H	occurring time: year, month, day, hour, minute, second	R	time	Integer

418AH	Maximum value of system power factor	R	-32768~32767	Integer
418BH~4190H	occurring time: year, month, day, hour, minute, second	R	time	Integer
4191H	Maximum value of frequency	R	-32768~32767	Integer
4192H~4197H	occurring time: year, month, day, hour, minute, second	R	time	Integer
4198H	Maximum value of active demand	R	-32768~32767	Integer
4199H~419EH	occurring time: year, month, day, hour, minute, second	R	time	Integer
419FH	Maximum value of reactive demand	R	-32768~32767	Integer
41A0H~41A5H	occurring time: year, month, day, hour, minute, second	R	time	Integer
41A6H	Maximum value of apparent power demand	R	-32768~32767	Integer
41A7H~41ACH	occurring time: year, month, day, hour, minute, second	R	time	Integer
41ADH	Voltage unbalance degree's maximum value	R	-32768~32767	Integer
41AEH~41B3H	occurring time: year, month, day, hour, minute, second	R	time	Integer
41B4H	Current unbalance degree's maximum value	R	-32768~32767	Integer
41B5H~41BAH	occurring time: year, month, day, hour, minute, second	R	time	Integer
41BBH	V1（V12） harmonic distortion rate's maximum value	R	-32768~32767	Integer
41BC~41C1H	occurring time: year, month, day, hour, minute, second	R	time	Integer
41C2H	V2（V31） harmonic distortion rate's maximum value	R	-32768~32767	Integer
41C3~41C8H	occurring time: year, month, day, hour, minute, second	R	time	Integer
41C9H	V3（V23） harmonic distortion rate's maximum value	R	-32768~32767	Integer
41CA~41CFH	occurring time: year, month, day, hour, minute, second	R	time	Integer
41D0H	I1 harmonic distortion rate's maximum value	R	-32768~32767	Integer
41D1~41D6H	occurring time: year, month, day, hour, minute, second	R	time	Integer
41D7H	I2 harmonic distortion rate's maximum value	R	-32768~32767	Integer

41D8~41DDH	occurring time: year, month, day, hour, minute, second	R	time	Integer
41DEH	I3 harmonic distortion rate's maximum value	R	-32768~32767	Integer
41DF~41E4H	occurring time: year, month, day, hour, minute, second	R	time	Integer
41E5H~4293H are minimum values of the above parameters and they share same format with the maximum values.				

The following is address area of sequence component parameter: 03H function code reading **U1 (or U12), I1 fundamental positive sequence, negative sequence and zero sequence, expressed by real and imaginary parts.**				
Address	**Parameter**	**Read-write property**	**Number range**	**Data type**
4294H	U1 positive sequence (real part)	R	-32768~32767	Integer
4295H	U1 positive sequence (imaginary part)	R	-32768~32767	Integer
4296H	U1 negative sequence (real part)	R	-32768~32767	Integer
4297H	U1 negative sequence (imaginary part)	R	-32768~32767	Integer
4298H	U1 zero sequence (real part)	R	-32768~32767	Integer
4299H	U1 zero sequence (imaginary part)	R	-32768~32767	Integer
429AH	I1 positive sequence (real part)	R	-32768~32767	Integer
429BH	I1 positive sequence (imaginary part)	R	-32768~32767	Integer
429CH	I1 negative sequence (real part)	R	-32768~32767	Integer
429DH	I1 negative sequence (imaginary part)	R	-32768~32767	Integer
429EH	I1 zero sequence (real part)	R	-32768~32767	Integer
429FH	I1 zero sequence (imaginary part)	R	-32768~32767	Integer

The following is address area of phase angle parameters: 03H function code reading **This area stores phase angles that each voltage and current lag behind V1 (or V12). These parameters can be used to judge phase—sequence relation.**				
Address	**Parameter**	**Read-write property**	**Number range**	**Data type**
42A0H	Phase angle that V2 lags behind V1 V1/V2	R	0~3600	word
42A1H	Phase angle that V3 lags behind V1 V1/V3	R	0~3600	word
42A2H	Phase angle that I1 lags behind V1 V1/I1	R	0~3600	word
42A3H	Phase angle that I2 lags behind V1 V1/I2	R	0~3600	word
42A4H	Phase angle that I3 lags behind V1 V1/I3	R	0~3600	word
42A5H	Phase angle that V23 lags behind V12 V12/V23	R	0~3600	word
42A6H	Phase angle that I1 lags behind V12 V12/I1	R	0~3600	word
42A7H	Phase angle that I2 lags behind V12 V12/I2	R	0~3600	word
42A8H	Phase angle that I3 lags behind V12 V12/I3	R	0~3600	word

The following is address area of alarm event record parameters: 03H function code reading				
Address	**Parameter**	**Read-write property**	**Number range**	**Data type**
42A9H	No. 1 group: alarm status	R	0~65535	word
42AAH	Group 1: serial number of parameter	R	0~50	word
42ABH	Group 1: off-limit or recovery value	R	Relevant to specific parameters	word
42ACH~42B2H	Group 1: occurring time: year, month, day, hour, minute, second, millisecond	R	Time	word
42B3H~42BCH	No. 2 group's alarm record	same as group one		
42BDH~42C6H	No. 3 group's alarm record	same as group one		
42C7H~42D0H	No. 4 group's alarm record	same as group one		
42D1H~42DAH	No. 5 group's alarm record	same as group one		
42DBH~42E4H	No. 6 group's alarm record	same as group one		
42E5H~42EEH	No. 7 group's alarm record	same as group one		
42EFH~42F8H	No. 8 group's alarm record	same as group one		
42F9H~4302H	No. 9 group's alarm record	same as group one		

4303H~430CH	No. 10 group's alarm record	same as group one
430DH~4316H	No. 11 group's alarm record	same as group one
4317H~4320H	No. 12 group's alarm record	same as group one
4321H~432AH	No. 13 group's alarm record	same as group one
432BH~4334H	No. 14 group's alarm record	same as group one
4335H~433EH	No. 15 group's alarm record	same as group one
433FH~4348H	No. 16 group's alarm record	same as group one

The following is address area of SOE record: 03H function code reading				
Address	**Parameter**	**Read-write property**	**Number range**	**Data type**
4399H	SOE first record's year	R	2000~2099	word
439AH	SOE first record's month	R	1~12	word
439BH	SOE first record's day	R	1~31	word
439CH	SOE first record's minute	R	0~23	word
439DH	SOE first record's minutes	R	0~50	word
439EH	SOE first record's second	R	0~59	word
439FH	SOE first record's millisecond	R	0~999	word
43A0H	SOE first record's DI status	R	0~65535	word
43A1H~4438H	SOE second to twentieth record	Same as first record		

The following is address area of current demand parameters: 03H function code reading including real—time current demand and its occurring time				
Address	**Parameter**	**Read-write property**	**Number range**	**Data type**
4600H~4601H	A—phase current demand	R		float
4602H~4603H	B—phase current demand	R		float
4604H~4605H	C—phase current demand	R		float
4606H~4607H	Average value of current demand	R		float

The following is address area of demand forecasting parameters: 03H function code reading including real—time current demand and its occurring time				
Address	**Parameter**	**Read-write property**	**Number range**	**Data type**
4608H~4609H	Active power demand	R		float
460AH~460BH	Reactive power demand	R		float
460CH~460DH	Apparent power demand	R		float
460EH~460FH	A—phase current demand	R		float
4610H~4611H	B—phase current demand	R		float
4612H~4613H	C—phase current demand	R		float
4614H~4615H	Average value of three—phase current demand	R		float

The following is address area of demand extremum (including occurring time of counting) parameters: 03H function code reading				
Address	**Parameter**	**Read-write property**	**Number range**	**Data type**
4620H	A—phase current's maximum demand	R		word
4621H~4626H	occurring time: year, month, day, hour, minute, second	R	time	Integer
4627H	B—phase current's maximum demand	R		word
4628H~462DH	occurring time: year, month, day, hour, minute, second	R	time	Integer
462EH	C—phase current's maximum demand	R		word
462FH~4634H	occurring time: year, month, day, hour, minute, second	R	time	Integer
4635H	Average value of three—phase current maximum demand	R		word
4636H~463BH	occurring time: year, month, day, hour, minute, second	R	time	Integer
463CH~4642H	Occurring time of counting demand extremum: year, month, day, hour, minute, second	R	time	Integer

The following is address area of electric leakage parameters: 03H function code reading				
Address	**Parameter**	**Read-write property**	**Number range**	**Data type**
4649H	electric leakage	R	0-1000 （mA）	Integer

The following is address area of waveform record setup: 03H function code reading, 16 function code writing				
Address	**Parameter**	**Read-write property**	**Number range**	**Data type**
5000H	sampling number per cycle	R/W	0-256 points 1-128 points 2-64 points 3-32 points 4-16 points 5-8 points	word
5001H	Waveform storage mode	R/W	0-keep full memory, 1- circulating memory	word
5002H	Allowing triggering channel	R/W	BIT0-triggering condition1 BIT1-triggering condition2 BIT2-triggering condition3 BIT3-triggering condition4 BIT4-triggering condition5 BIT5-triggering condition6	word
5003H	Allow manual triggering	R/W	0-off, 1-on	word
5004H	Manual triggering time	R/W	0-1000（x10ms）	word
5005H	Selection of channel of triggering condition 1	R/W	0~15: Alarm1~Alarm16 16~23: DI1~DI8	word
5006H	Triggering time of triggering condition 1	R/W	0-1000 (x10ms)	word
5007H~5010H	Triggering conditions 2 to 6, same as triggering condition 1	R/W	Time	word

The followings are address areas of waveform record: 03H function code reading				
Address	**Parameter**	**Read-write property**	**Number range**	**Data type**
5040H	Record 1status	R	0 - record is blank 1- record is valid	word
5041H	record 1triggering condition	R	0- manual triggering 1~6: number of triggering condition	word
5042H	record 1 triggering time (year)	R	2000~2099	word
5043H	record 1 triggering time (month)	R	1~12	word
5044H	record 1 triggering time (day)	R	1~31	word
5045H	record 1 triggering time (hour)	R	0~23	word
5046H	record 1 triggering time (minute)	R	0~59	word
5047H	record 1 triggering time (second)	R	0~59	word
5048H	record 1 triggering time (millisecond)	R	0~999	word
5049H	Reserved			
504AH	Record 1 V1 total harmonic distortion rate of waveform		0~65535	word
504BH	record 1 V1 odd harmonic distortion rate		0~65535	word
504CH	record 1 V1 even harmonic distortion rate		0~65535	word
504DH	record 1 V2 total harmonic distortion rate of waveform		0~65535	word
504EH	record 1 V2 odd harmonic distortion rate		0~65535	word
504FH	record 1 V2 even harmonic distortion rate		0~65535	word
5050H	record 1 V3 total harmonic distortion rate of waveform		0~65535	word
5051H	record 1 V3 odd harmonic distortion rate		0~65535	word
5052H	record 1 V3 even harmonic distortion rate		0~65535	word
5053H	record 1 I1 total harmonic distortion rate of waveform		0~65535	word
5054H	record 1 I1 odd harmonic distortion rate		0~65535	word
5055H	record 1 I1 even harmonic distortion rate		0~65535	word
5056H	record 1 I2 total harmonic distortion rate of waveform		0~65535	word

5057H	record 1 I2 odd harmonic distortion rate		0~65535	word
5058H	record 1 I2 even harmonic distortion rate		0~65535	word
5059H	record 1 I3 total harmonic distortion rate of waveform		0~65535	word
505AH	record 1 I3 odd harmonic distortion rate		0~65535	word
505BH	record 1 I3 even harmonic distortion rate		0~65535	word
505CH~505FH	Reserved			
5060H~519FH	record 1 V1 waveform (320 points)		-32768~32768	Integer
51A0H~52FFH	record 1 V2 waveform (320 points)		-32768~32768	Integer
5300H~545FH	record 1 V3 waveform (320 points)		-32768~32768	Integer
5460H~55BFH	record 1 I1 waveform (320 points)		-32768~32768	Integer
55C0H~571FH	record 1 I2 waveform (320 points)		-32768~32768	Integer
5720H~587FH	record 1 I3 waveform (320 points)		-32768~32768	Integer
5880H~60C0H	waveform record 2, same as waveform record 1			
60C0H~713FH	waveform record 3, same as waveform record 1			
7140H~797FH	waveform record 4, same as waveform record 1			
7980H~81BFH	waveform record 5, same as waveform record 1			
81C0H~89FFH	waveform record 6, same as waveform record 1			
8A00H~923FH	waveform record 7, same as waveform record 1			
9240H~9A7FH	waveform record 8, same as waveform record 1			
9A80H~A2BFH	waveform record 9, same as waveform record 1			
A2C0H~AAFF	waveform record 10, same as waveform record 1			

10.1.20 Explanation of Data and Operational Properties

Data Types

- **"BIT":** Refers to a 1-bit binary value.
- **"word":** Refers to a 16-bit unsigned integer.
- **"Integer":** Refers to a 16-bit signed integer.
- **"Dword":** Refers to a 32-bit unsigned integer.
- **"float":** Refers to 32-bit floating-point data.

Read-Write Properties

- R (Read-only):
  - Use Command 02H to read DI.
  - Use Command 01H to read DO.
  - Use Command 03H to read other parameters.

R/W (Read and Write):

- Write (control) DO using **Command 05H**.
- Write system parameters using **Command 10H**.
- **Note:** Writing to unlisted addresses or addresses without writable properties is prohibited.
- **P:** Data is retained even when the device is powered off.

Measurement and Electric Energy Parameters

- Electric energy and basic measurement parameters are **32-bit floating data,** occupying **2 addresses.**
- Upper-computer software must convert hexadecimal data from two addresses to floating-point data to obtain parameter values.
- **Electric Energy Calculation:**
  - Divide the communication value by **10** to get the actual value (e.g., communication value 999999999 corresponds to actual value **99999999.9 kWh or kvarh**).
  - When the communication value reaches **999999999**, it resets automatically.

Writable Energy Parameters

- Energy parameters can be cleared manually or set to a specific value as required.

Baud Rate Setup

- Supported values: **1200 bps, 2400 bps, 4800 bps, 9600 bps, 19200 bps, 38400 bps.**
- Values outside this range are disallowed.
- If an invalid value is set, the device defaults to **9600 bps.**

DO Setup and Modes

- **Relay Output Mode:**
  - Supports relay output and pulse output modes.
  - **Pulse Mode:**
    - When DO outputs **1**, the system sends a pulse of the configured width, then resets the relay.
    - The DO status read afterward will return to **0**.

Energy Storage and Display

- **Storage Interval:** Electric energy values are stored every **5 minutes**.
- **Displayed Values:**
  - Net active electric energy.
  - Net reactive electric energy.
  - Other components can be accessed via communication or customized.

Creeping Test Standard

- False actuation test standard for electric energy:
  - Creeping voltage: **0.5V**.
  - Creeping current: **0.025A**.
- Energy measurement begins only when both voltage and current exceed the creeping values.

Power Accuracy Adjustments

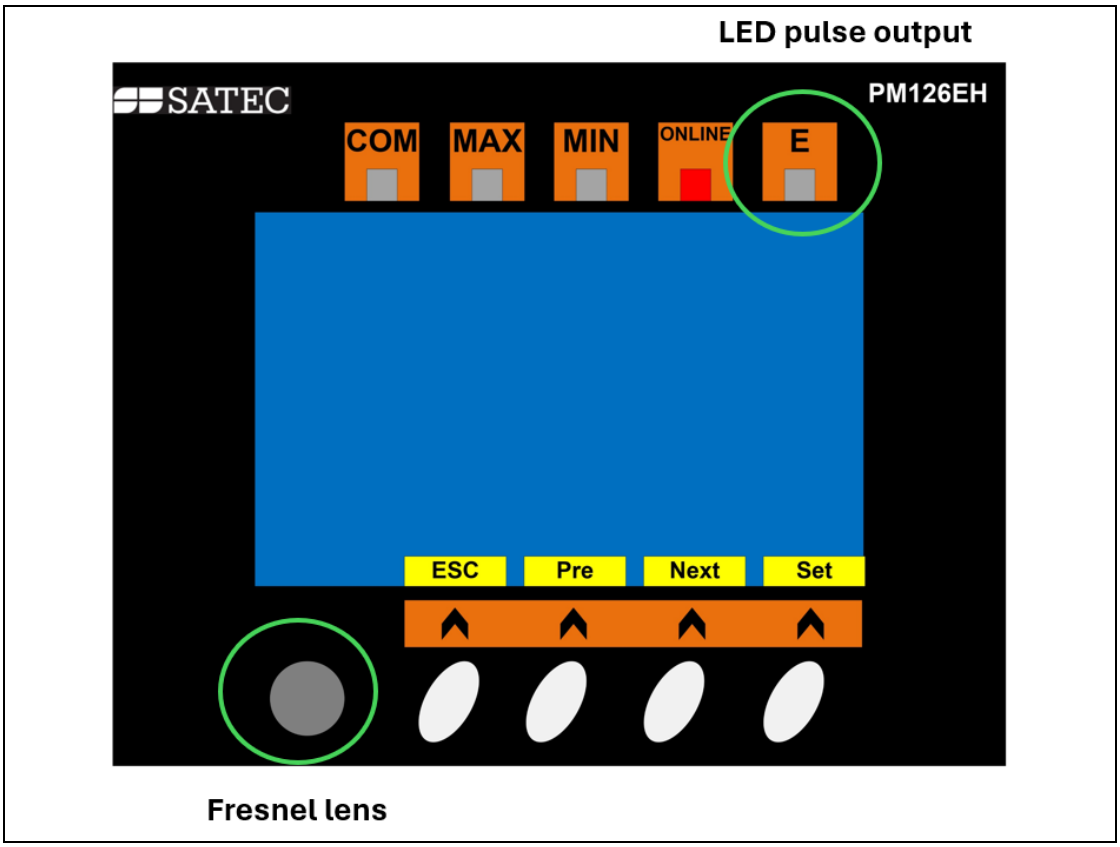
- **PLsum = 10 × Psum, QLsum = 10 × Qsum:**
  - High-accuracy calculations are useful for weak signal conditions.
  - Clients with less stringent accuracy requirements can opt for simplified processing.

Chapter 11 User Guide for Main Functions and Common Problems

11.1 Application of PM126 PIR Infrared Proximity Detector

Main applications:

- Intrusion alarm / recording security feature
- Recording presence of staff; work attendance journal function
- Human presence can trigger specific functionality or activate backlight, to reduce device power consumption



PM126 PIR is implemented by a Fresnel lens on the instrument panel, detecting pyroelectric infrared signals from a moving human body (see lens location schematic above). To ensure full PIR functionality, make sure not to block this lens in any way.

PM126 PIR function, combined with the host computer software, enables advanced field presence status recording.

Address	Parameter	Read-write property	Number range	Data type
3FFFH	Infrared triggering counting	R/P	0~65535	Word

The 3FFF H register records the number of infrared detections on site. Whenever a person enters the site, the value in this register grows by 1, and the host computer only needs to poll the device according to a fixed time interval.

The data of the 3FFF H register is not lost after powering off.

In conjunction with the clock logging, event logging or alarm processing of the host computer, such logging can be used as an intrusion alarm for entry of unauthorized personnel, or as an automated work log for regular on-site rotational inspections by staff.

11.2 Electric Energy Pulse Output

In the PM126's standard configuration, it is fitted with an optical pulse output (see above) which can be used for calibrating or signaling electrical energy via an optical calibration device.

The power parameter corresponding to the optical signal pulse output is the total active power, and the pulse width and pulse constant are affected by the following registers:

Address	Parameter	Read-write property	Number range	Data type
102DH	Power pulse width setting	R/W/P	1~100 1 unit is 10ms	word
102EH	Electrical energy pulse constant. i.e. number of pulses/kWh	R/W/P	1~6000 1unit-10 pulses	word

11.3 Harmonics

This unit can measure and analyze individual harmonics up to the 63rd harmonic, including total harmonic distortion rate, odd-order harmonic distortion rate, even-order harmonic distortion rate, Crest Factor, and telephone waveform factor (THF/TIF).

11.4 Waveform Recording

The unit provides 10 waveform recordings. Each recording includes waveform data for three-phase current and voltage, with each waveform containing 320 sampled data points. The number of sampling points per cycle can be configured as needed, with selectable sampling rates of 8, 16, 32, 64, 128, or 256 points per cycle.

Waveform recording can be triggered manually or based on specific conditions.

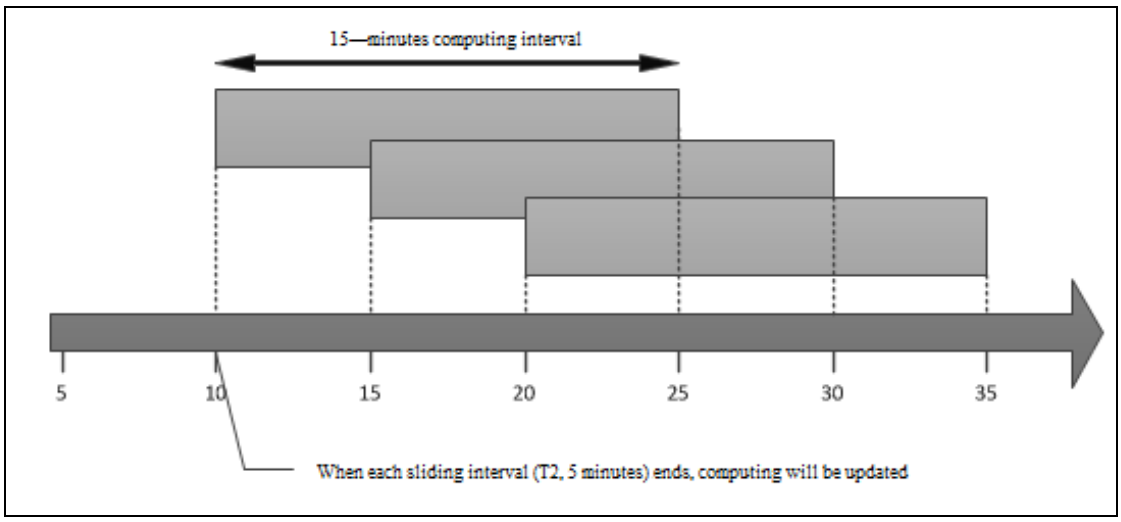
- **Manual triggering:** The recording is started by sending a command via the 485 interface.
- **Conditional triggering:** The recording starts when an alarm occurs or when the DI input changes from OFF to ON.
- The configurable parameters related to waveform recording include:
- **Storage mode:** Can be set to "Hold when full" or "Circular storage."
- **Number of samples per cycle:** Can be set to 8/16/32/64/128/256. Since the total number of recorded waveform points is fixed at 320, a lower sampling rate (fewer samples per cycle) results in a longer recorded duration (more cycles).
- **Trigger time:** Refers to the duration from when waveform recording starts to when it ends, which can be set in the range of 0 to 10,000 ms.

11.5 Demand

Demand refers to the **average power consumption** over a specified time interval (**T1**). The system calculates the demand using the **sliding average method**.

- **Sliding interval (T2):**
  - Can be set between **1 to 20 minutes**
  - Default value: **5 minutes**
- **Total demand period (T1):**
  - Determined by the **number of sliding windows:**
    - **T1 = Sliding Interval (T2) × Number of Sliding Windows**
  - Can be set between **1 to 60 minutes**
  - Default value: **15 minutes (3 sliding windows)**

This method ensures a **continuous and updated** demand calculation based on a rolling time window.



This model of the **smart power distribution meter** provides multiple demand readings, including **synchronous demand, predicted demand, and maximum demand.**

- **Synchronous Demand:**
  - The **real-time demand value** calculated within each **T1 period**.
  - It is updated **at the end of each T2 period** with the latest computed value from the previous T2 cycle.
- **Predicted Demand:**
  - At the end of each **T1 period**, the system predicts the **next cycle's demand value** based on the **trend of the original electrical parameters.**
- **Maximum Demand:**
  - The **highest recorded synchronous demand** since the **last reset**.
- **Clearing Demand Data**
- Demand values can be **reset (cleared).**
- Clearing demand resets **all demand records and variables involved in demand calculations to zero.**
- After clearing, the system behaves as if it has been **powered on again**, but only for demand-related functions.

11.6 Extremum Statistics

This unit can perform real-time statistical analysis of extreme values for various parameters, including **phase/line voltage, current, active power, reactive power, apparent power, power factor, demand, imbalance, and harmonic distortion rate**. It records both the **maximum and minimum values** of these parameters along with the corresponding timestamps.

The recorded extreme values are stored in **non-volatile memory**, ensuring that they are **not lost in the event of a power failure.**

11.7 Off-Limit Alarm Function

This unit features an **over-limit alarm function**. When a parameter exceeds a predefined range and remains beyond the limit for a specified duration, the over-limit alarm is triggered.

When an alarm occurs, the following details are recorded as an event:

- Parameter index
- Parameter value at the time of alarm
- Alarm status
- Timestamp of alarm occurrence

A maximum of **16 alarm records** can be stored. When the storage is full, the oldest record will be overwritten by new entries.

If **inter-channel logic relationships** are enabled, the alarm can be configured to trigger only when conditions in multiple channels are met simultaneously. The logic relationships between adjacent channels can be set as **"AND"** or **"OR":**

- **"AND" has higher priority than "OR".**
- The **"OR" logic** divides the 16 channels into independent groups, where the logic conditions within each group are evaluated separately.
- Within a group, the alarm is triggered **only if all channel conditions in that group are met**.
- Once an alarm is active, it will return to a normal state **only when at least one channel condition is no longer met**.

. Address	Parameter	Number range	Read-write property
104eH	Group 1: parameter serial number	0～47	R/W
104fH	Group 1: comparison method	1:greater than, 2:equal to, 3: less than	R/W
1050H	Group 1: setup value	related to specific parameters	R/W
1051H	Group 1: delay time	0～3000 (×10ms)	R/W
1052H	Group 1: output to DO	0:no output 1-2: output to DO serial number	R/W

The **parameter index** refers to the selection of a specific parameter related to the alarm group. For example, if **"0 - Frequency"** is chosen, the alarm group will evaluate this parameter based on predefined conditions.

Below is the **corresponding table of alarm parameter indices:**

parameter name	F	V1	V2	V3	VLNavg	V12	V23	V31	VLLavg	I1
parameter serial No.	0	1	2	3	4	5	6	7	8	9
parameter name	I2	I3	Iavg	IN	P1	P2	P3	Psum	Q1	Q2
parameter serial No.	10	11	12	13	14	15	16	17	18	19
parameter name	Q3	Qsum	S1	S2	S3	Ssum	PF1	PF2	PF3	PF
parameter serial No.	20	21	22	23	24	25	26	27	28	29
parameter name	UNBL-V	UNBL-I	Load type	THD-V1	THD-V2	THD-V3	THD-V	THD-I1	THD-I2	THD-I3
parameter serial No.	30	31	32	33	34	35	36	37	38	39
parameter name	THD-I	DMD-P	DMD-Q	DMD-S	DMD-I1	DMD-I2	DMD-I3			
parameter serial No.	40	41	42	43	44	45	46			

Comparison Method, Set Value:

Defines the **alarm condition**, such as:

- **Greater than (>)**
- **Equal to (=)**
- **Less than (<)** the set value.
- **Delay Time:**
  - Specifies **how long** the alarm condition must remain true **before** it is considered an actual event.
- **Output to DO (Digital Output):**
- **Set to 0** → When this alarm occurs, it **does not trigger** a digital output (DO).
- **Set to 1** → When this alarm occurs, it triggers **DO1** (DO1 closes).
  - DO1 remains **closed** until **all alarms assigned to DO1 return to normal**, at which point **DO1 reopens**.

11.8 Time-of-Use (TOU) Energy Measurement

Time-of-Use (TOU) refers to dividing the day into multiple continuous time periods, with each period assigned a different billing rate **(Peak, High, Low, and Default)**. The meter determines the applicable rate based on its internal clock and separately measures energy consumption for each rate category. This enables **time-based energy metering and differential billing**.

TOU Time Zone Configuration:

- Up to **6 time zones** can be configured.
- Each time zone has a **daily time period table**, with a maximum of **12 time periods per day**.
- Each daily time period can be assigned to **one of four rate categories:**
  - **Peak**
  - **High**
  - **Low**
  - **Default**

Time Zone Settings:

- The configured date represents **the end date** of the time zone.
- Time zones must be **set in chronological order** (from earliest to latest).
- If the **end date** of the next time zone is earlier than the previous one, the system will consider the **time zone configuration complete**. The system will then **stop accepting new time periods,** treating the setup as complete.

Daily Time Period Settings:

- The configured time represents **the end time** of that specific daily time period.
- Time periods must be **set in chronological order** (from earliest to latest).
- If the **end time** of the next time period is earlier than the previous one, the system will consider the **time period configuration complete** and will then **stop accepting new time periods**, treating the setup as complete.

This functionality allows **flexible time-based electricity billing** based on predefined time slots and rates.

11.9 Time-of-Use (TOU) Energy Monetary Settlement Function

By configuring the **rate settings** in the setup interface, the pricing method can be set directly.

The display interface **calculates and presents summarized data** for different time periods and rates, providing a **clear and intuitive** view of energy consumption costs based on the TOU pricing structure.

11.10 SOE (Sequence of Events) Recording

The **SOE (Sequence of Events) log** consists of **20 records**, each with the same format. Each record contains:

- **Timestamp** of the **DI (Digital Input) state change**, including **year, month, day, hour, minute, second, and millisecond.**
- **DI state** at the time of change.

11.11 Latitude and Longitude-Based Time Control switch

Main Application

The **latitude and longitude time control function** is used for applications such as **streetlight control**. Once the device is set with the **latitude and longitude** of its location, it calculates the **sunrise and sunset times** for each day of the year. The switch status is then controlled based on these sunrise and sunset times.

The system has **two time-controlled switch channels (DO1, DO2)**, each of which can be independently enabled or disabled.

- Each channel has **12 programmable ON/OFF time schedules** and **one additional control based on sunrise and sunset times.**
- **Scheduled ON/OFF control** operates based on user-set times.
- **Sunrise/sunset control** automatically adjusts DO switch times based on the calculated sunrise and sunset times:
  - **At sunrise → DO output turns OFF**
  - **At sunset → DO output turns ON**

Time-Control Switch Setup Steps

1. Enter the Setup Menu

- Press the **More** button until the **Settings** button appears.
- Press the **Settings** button to enter the **password input screen**.
- The default password is **1000**. Enter the password and press **Confirm** to access the **setup menu**.

2. Set Latitude and Longitude

- Navigate to **Menu → Input/Output → Time Control Switch → Latitude/Longitude Settings**.
- You can **quickly select a city** to automatically input latitude/longitude.
- If the required city is not listed, **manually enter the latitude and longitude**.
  - **Longitude range: 0° to 180° East**
  - **Latitude range: 0° to 60° North**
- The **latitude/longitude data** is used to calculate daily **sunrise and sunset times** based on **Beijing Time**.

3. Enable the Time-Controlled Channel

- Navigate to **Menu → Input/Output → Time Control Switch → DO1 Channel → Channel Enable.**
- Select **"Yes"** to enable **time control for DO1**.

4. Configure Sunrise/Sunset Control

- Navigate to **Menu → Input/Output → Time Control Switch → DO1 Channel → Channel Enable.**
- Select the **days of the week** for which sunrise/sunset control should be active.
- If no days are selected, **sunrise/sunset control will be disabled** for that channel.

5. Configure Time-Controlled Periods

- Each channel supports **12 programmable ON/OFF time periods.**
- Each period can be configured to **activate on specific days of the week.**
- Navigate to **Menu → Input/Output → Time Control Switch → DO1 Channel → Period n** to configure a specific time period.

6. Set DO ON Time for a Period

- In the **Enable ON** setting, select **"Yes".**
- In the **ON Time** setting, specify the **hour and minute** at which DO should turn **ON**.

7. Set DO OFF Time for a Period

- In the **Enable OFF** setting, select **"Yes".**
- In the **OFF Time** setting, specify the **hour and minute** at which DO should turn **OFF.**

8. Set Active Days for a Period

- For each time period, specify **which days of the week** the period should be active

11.12 Combination of Wiring Methods

The PM126series allows independent combinations of current and voltage wiring configurations for the measurement circuit. That is, the voltage and current wiring are independent of each other. As long as the wiring follows the instructions shown in the diagram, the system will function correctly without requiring any software adjustments.

For actual on-site installations, wiring must be strictly in accordance with the instructions in this manual.

11.13 Single-Phase Measurement

For single-phase measurement, both voltage and current should be connected to **Phase B** (refer to section **6.5**).

In this mode:

- The system's **functions and display content** will **exclude** parameters related to the three-phase system and **Phases A and C.**
- The read content of modbus address has no significance here

11.14 Single-Channel Leakage Current Function

The system can be configured for a **single-channel leakage current detection function (must be specified at the time of ordering for hardware support).**

- The **leakage current detection port** can be assigned to **any one of the six configurable ports.**
- The **turns ratio** must be set based on the **leakage current transformer's (CT) primary turns,** with the **secondary side fixed at 1 turn.**
- The **turns ratio setting menu path:**
  Menu → General Ports → Port n (the port configured for leakage detection).

Leakage Alarm and Tripping Function

By integrating with the **upper/lower limit alarm function**, the system can trigger:

- **Over-limit alarms**
- **Tripping protection**

Tripping and alarm actions can be configured through **two digital output (DO) channels** and the upper/lower limit alarm settings, allowing **each of the two ports** to be assigned independent actions.

Related Sections

- **6.5.1, 9.6, 9.8**

Related MODBUS Register Address

- **4649H:** This register stores the **leakage current value (in mA).**
- **No scaling factor is required**, as the value read from the register is the actual leakage current measurement

11.15 Phase Angle

The **phase angle** is used to **verify wiring correctness** and detect potential wiring errors.

- When the **voltage wiring mode is set to 3LN**, the meter measures the **phase angles of V2, V3, I1, and I3 relative to V1.**
- When the **voltage wiring mode is set to 2LL or 3LL**, the meter measures the **phase angles of V23, I1, I2, and I3 relative to V12.**

Note:

- **Phase angle values are not displayed on the screen.**
- They can only be **retrieved via communication protocols** (e.g., Modbus).

11.16 Sequence Components

Positive, negative, and zero sequence components are used to analyze voltage and current **asymmetry** in a three-phase system. When system voltage or current becomes unbalanced, the three-phase components can be decomposed into:

- **Positive sequence:** Represents balanced, normal rotation of the system.
- **Negative sequence:** Indicates imbalance or reverse-phase conditions.
- **Zero sequence:** Represents components that are in-phase across all three phases.

This instrument measures the positive, negative, and zero sequence components of:

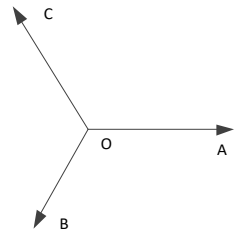
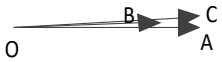
- **V1 (or V12)**
- **I1**

Note:

- **Sequence component values are not displayed on the screen.**
- They can only be retrieved via communication protocols (e.g., Modbus).

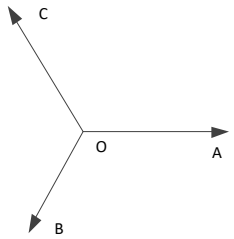
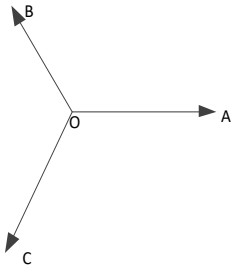
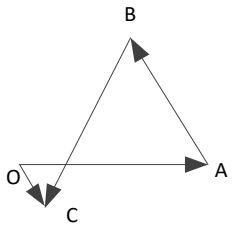
11.16.1 Positive Sequence Component

Positive sequence component rotates B phase 120° in counter-clockwise direction, and rotates C phase 120° in clockwise direction, and remains A phase still. On third of the sum of the rotated phasor is positive sequence component.

		
Original three—phase fundamental component	Component after rotation	Sum of three—phase component after rotation (OC)

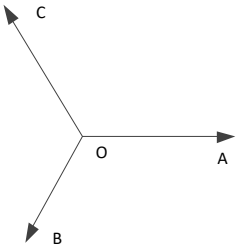
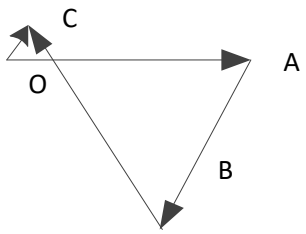
11.16.2 Negative Sequence Component

Negative sequence component rotates B phase 120° in clockwise direction, and rotates C phase 120° in anti-clockwise direction, and remains A phase still. On third of the sum of the rotated phasor is negative sequence component.

		
Original three—phase fundamental component	Component after rotation	Sum of three—phase component after rotation (OC)

11.16.3 Zero Sequence Component

One third of the sum of fundament component of three—phase voltage or current is zero sequence component.

	
Original three—phase fundamental component	Sum of three—phase fundamental component (OC)

11.17 Multiple MODBUS Register Addresses for the Same Variable

Certain variables in the **PM126** have **multiple corresponding MODBUS register addresses**. This design serves the following purposes:

- Compatibility with other series products
- To allow users to access both primary-side and secondary-side values; for example, U, I, POS, these secondary side values are stored in form of floating data. The data being read is visual. The Modbus register area of floating—point storage is: 4000H~4047H.
- To improve resolution (discernable ratio) of numerical value, for example, PLsum is stored in Dword(Long) type, and its unit is 0.1W. Psum is stored in Integer type, and its unit is 1W.
- Users can apply relative addresses to store based on own requirements.
- No matter which address is applied, its read—out value comes from one measuring result inside the instrument, and it would not influence final computing and accuracy. However, users shall pay attention that numerical values of different register may need to be converted.

11.18 Ethernet Interface

The **PM126** includes an **optional Ethernet interface**, which allows users to:

- **View real-time measurement data via a web browser**
- Communicate using **Modbus-TCP** and **Modbus-RTU** protocols

The device's **default IP address** is **192.168.1.31**, which can be changed in the settings menu.

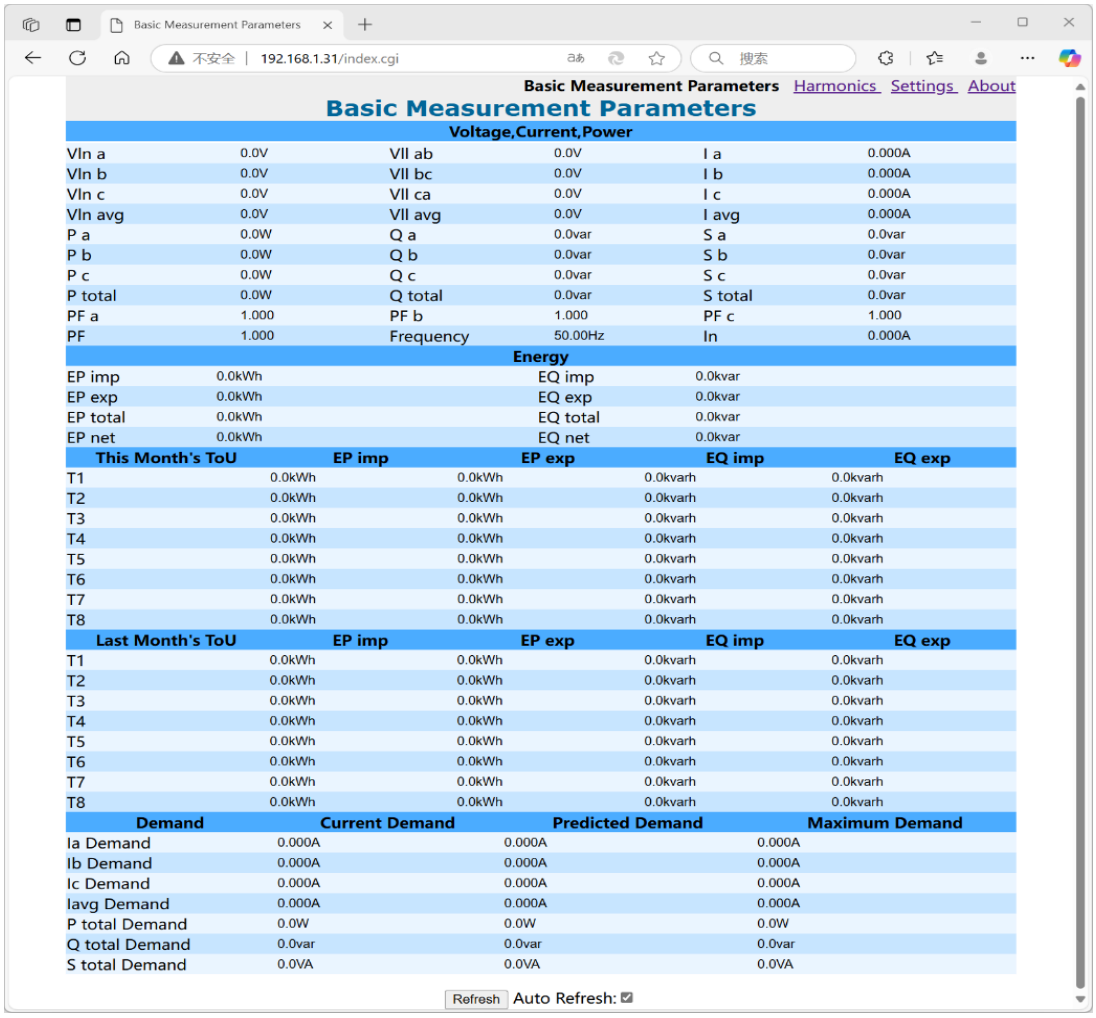
11.18.1 Viewing Measurement Parameters via Web Browser

Open Internet Explorer (IE) and enter the instrument's IP address in the address bar. Press Enter to access the basic measurement parameter interface.

In this page, you can view real-time values for:

- **Voltage**
- **Current**
- **Power**
- **Energy**
- **Time-of-Use (TOU) Energy**
- **Demand**

The displayed parameters automatically refresh every 2 seconds. To pause auto-refresh, uncheck the Auto Update checkbox. A graphical display interface is also provided.



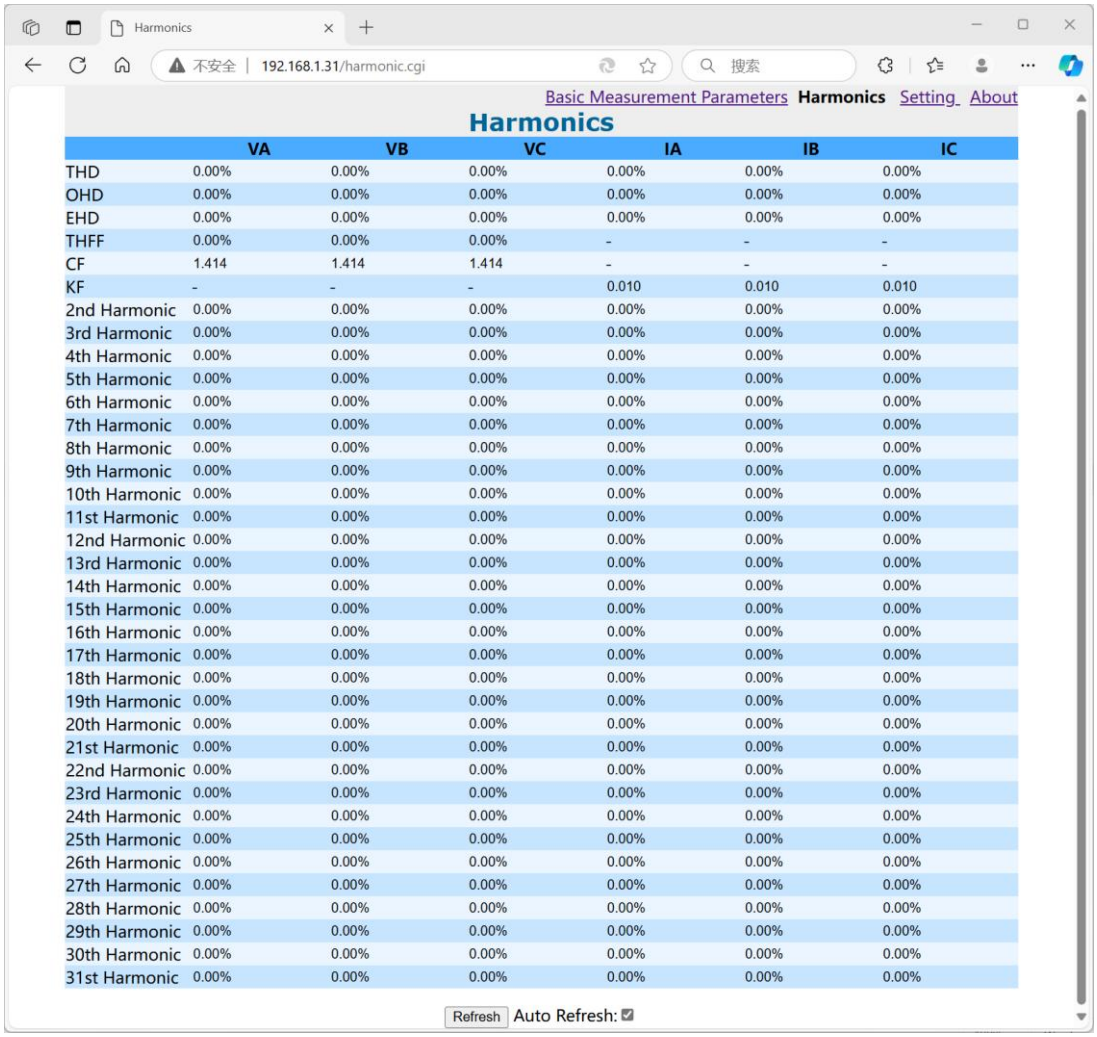
11.18.2 Viewing Harmonics via Web Browser

Click the **Harmonics** link in the **top-left corner** of the web page to enter the **harmonics viewing interface**.

In this interface, you can view:

- **Total Harmonic Distortion (THD)**
- **Individual harmonic components from the 2nd to the 31st order**

A graphical harmonics display is shown in the interface.



	VA	VB	VC	IA	IB	IC
THD	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
OHD	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
EHD	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
THFF	0.00%	0.00%	0.00%	-	-	-
CF	1.414	1.414	1.414	-	-	-
KF	-	-	-	0.010	0.010	0.010
2nd Harmonic	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
3rd Harmonic	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
4th Harmonic	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
5th Harmonic	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
6th Harmonic	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
7th Harmonic	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
8th Harmonic	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
9th Harmonic	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
10th Harmonic	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
11st Harmonic	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
12nd Harmonic	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
13rd Harmonic	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
14th Harmonic	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
15th Harmonic	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
16th Harmonic	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
17th Harmonic	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
18th Harmonic	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
19th Harmonic	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
20th Harmonic	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
21st Harmonic	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
22nd Harmonic	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
23rd Harmonic	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
24th Harmonic	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
25th Harmonic	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
26th Harmonic	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
27th Harmonic	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
28th Harmonic	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
29th Harmonic	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
30th Harmonic	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
31st Harmonic	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%

11.18.3 Setting Ethernet Parameters

Click **Settings** link in the **top-left corner** of the web page to enter the **Ethernet configuration interface**.

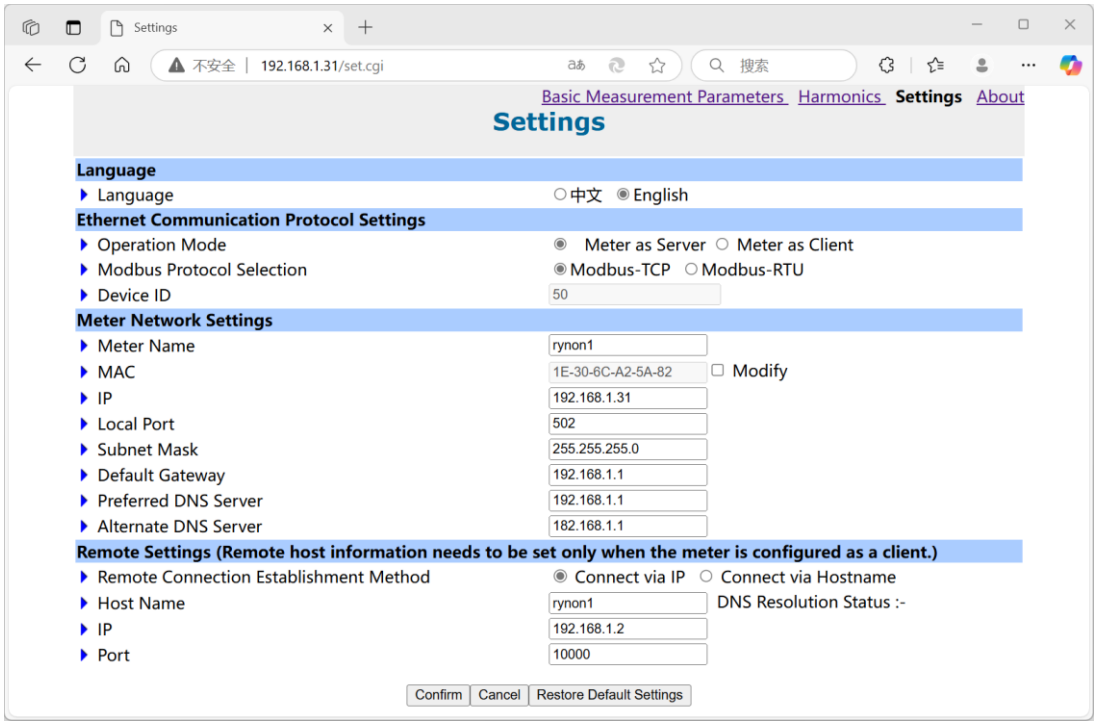
The Ethernet interface supports two modes of operation:

- **Instrument as Server**
- **Instrument as Client**
- When using the **Modbus-TCP protocol**, the instrument is typically set as the **server (default port: 502)**, and the upper computer acts as the **client**.
- When using the **Modbus-RTU protocol**, configuration must be performed in conjunction with **virtual serial port software.**

The **device name** is used to distinguish between different devices and can contain **up to 16 alphanumeric characters.**

When the instrument operates as a **client**, you must configure the **remote server information:**

- If connecting via **IP address**, enter the **server's IP address** and **port number**.
- If connecting via **host name**, enter the **host name (or domain name)** and **port number**.



11.18.4 Virtual Serial Port Configuration

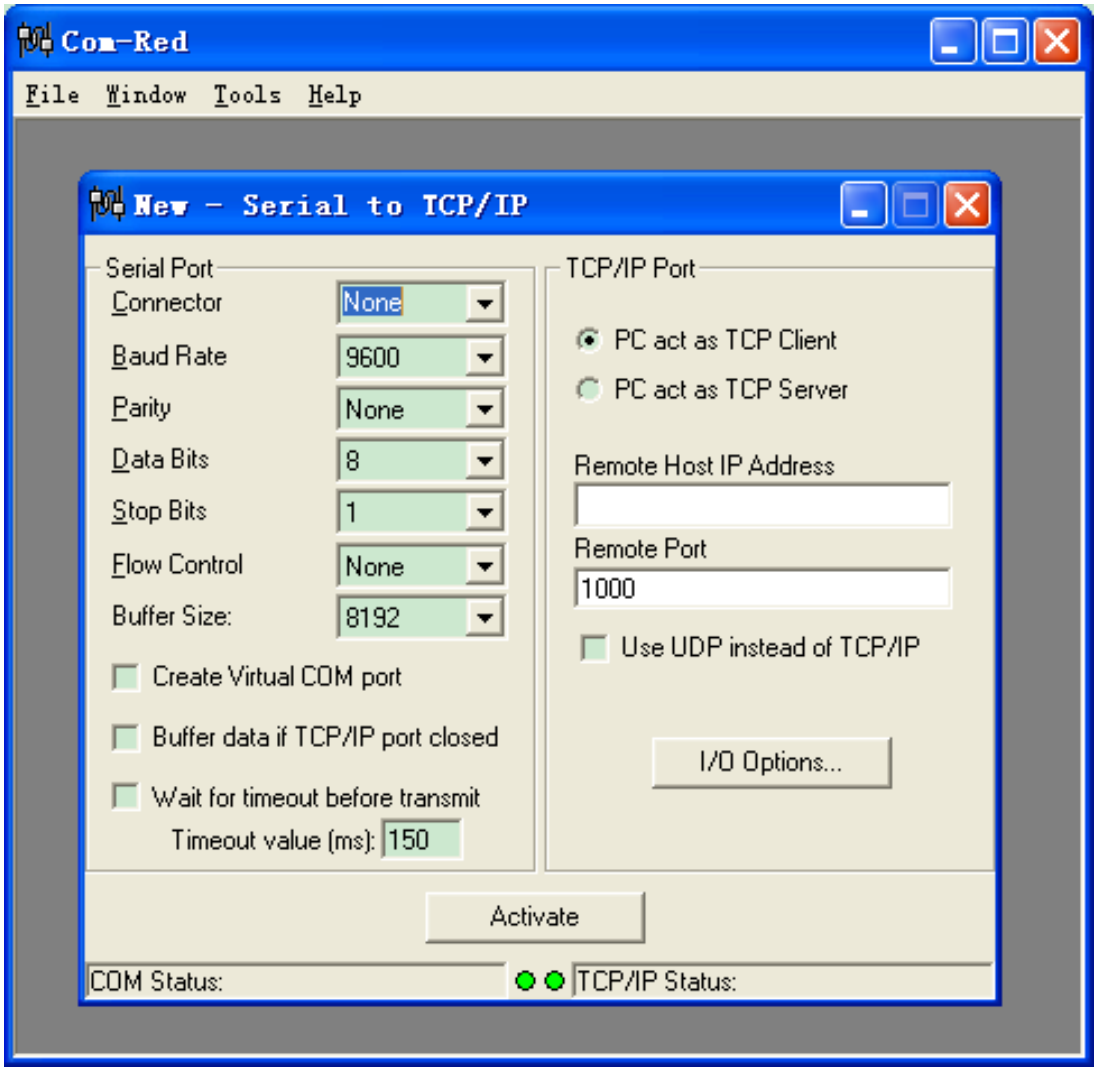
When the protocol is set to **Modbus-RTU**, the instrument must be used in conjunction with **virtual serial port software**, allowing the **upper computer software to communicate with the instrument via a virtual COM port.**

Installing the Virtual Serial Port Driver

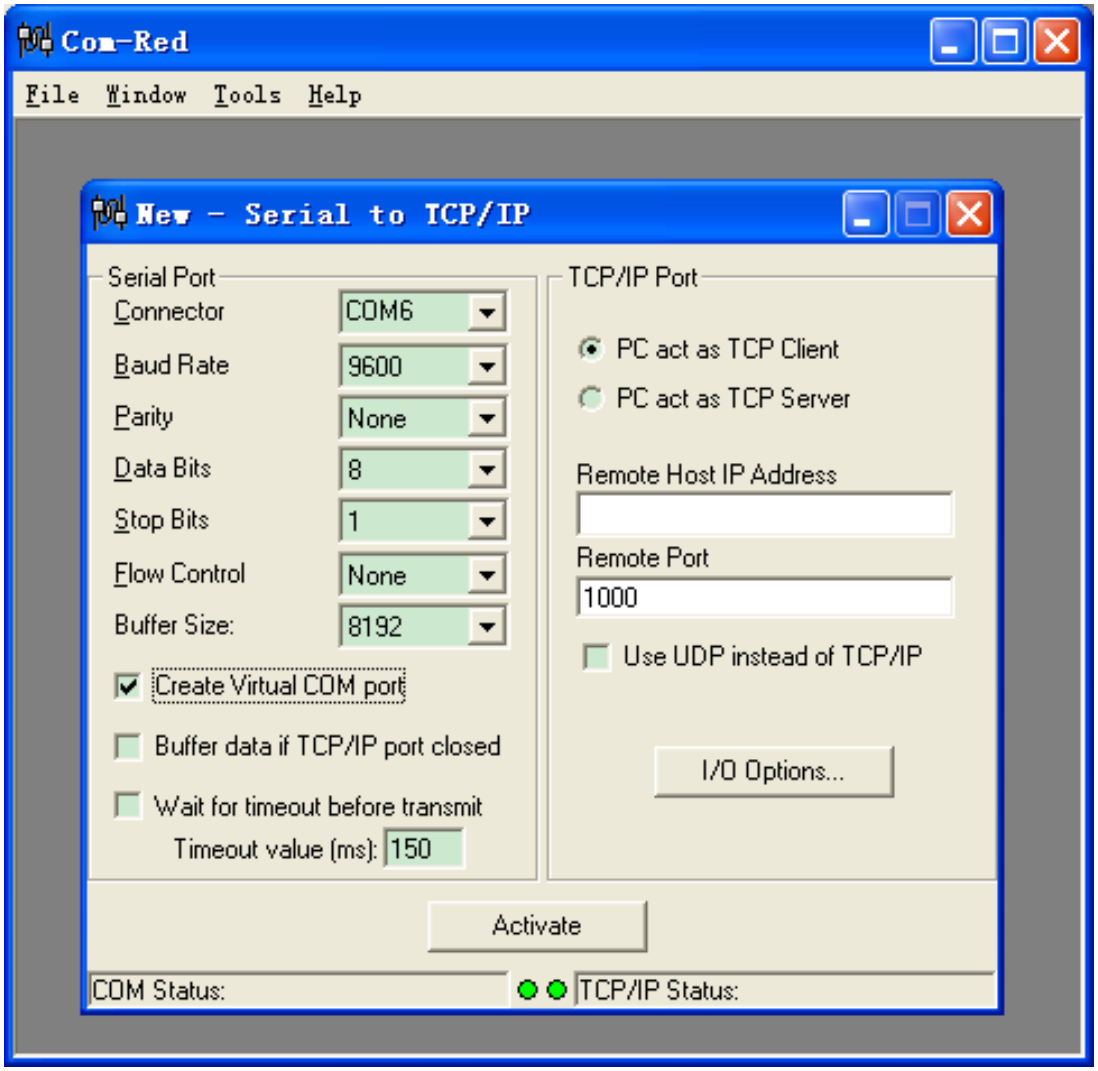
- **System Requirement:** Windows XP
- Run the installer: **"Virtual Serial Port Driver.EXE"** to install the driver onto the system.

Configuring the Driver

- **Double-click the driver icon** to launch it.
- From the menu, select: **File → New**
- This opens the **Serial to TCP/IP** configuration window (see illustration in the manual)



Virtual Serial Port Settings Interface



Serial Port Parameter Settings

Configuring the Virtual Serial Port

Set the desired **COM port number**, and configure the following serial parameters:

- **Baud Rate:** 9600
- **Data Bits:** 8
- **Stop Bits:** 1

Make sure to check the box **"Create Virtual COM Port".**
Refer to the figure labeled **"Serial Port Parameter Settings"** for guidance.

Configuring TCP/IP

Case 1: PC as TCP Client, Instrument as Server

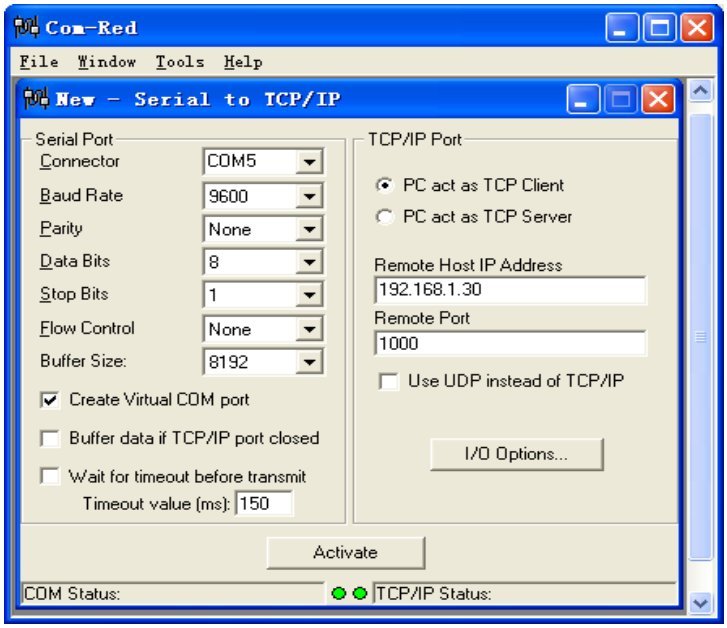
1. Select **"PC act as TCP Client"**
2. Set **Remote Host IP Address** to the IP address of the instrument's Ethernet interface
3. Set **Remote Port** to the instrument's Ethernet port number
4. Click **"Activate"** to create the virtual COM port

⚠ **Note:** Do **not** check **"Use UDP instead of TCP/IP"** – this setup uses **TCP** protocol.
Ensure the instrument's **Ethernet mode** is set to **Server**.

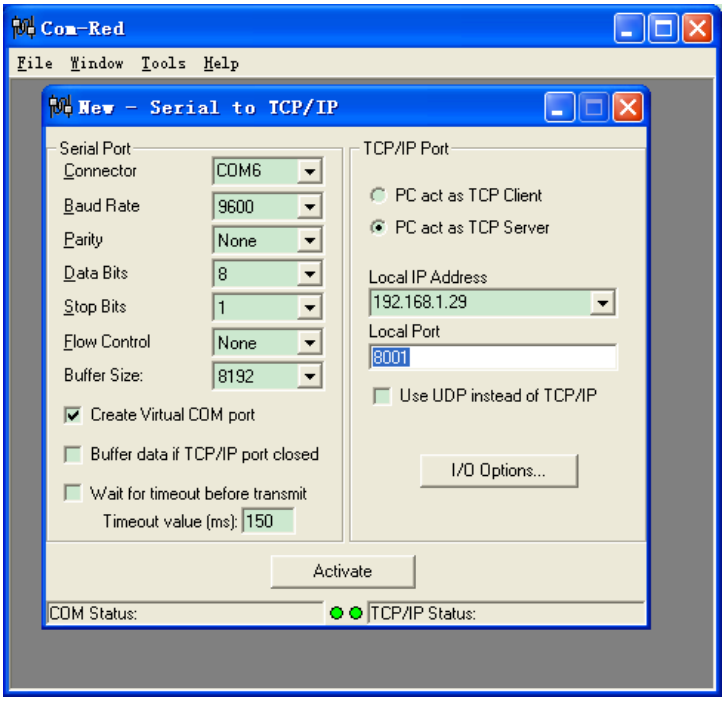
Case 2: PC as Server, Instrument as TCP Client

1. Select **"PC act as TCP Server"**
2. In **Local IP Address**, choose the IP address of the PC
3. Set the **Local Port** on the PC
4. Click **"Activate"** to create the virtual COM port

⚠ **Note:** Again, do **not** select **"Use UDP instead of TCP/IP".**
The instrument's Ethernet mode must be set to **Client.**



PC as Client



PC as Server

11.18.5 Relationship Between Instrument Ethernet Configuration and PC Virtual Serial Port Settings

This section explains how to correctly pair the Ethernet settings on the **instrument (meter)** with the **virtual serial port configuration on the PC**, depending on which device is acting as the **server**

Here is the translation formatted to match the structure of the original tables:

11.18.6 Instrument as Client

Operating Mode	**Instrument Ethernet Configuration**	**PC Virtual Serial Port Configuration**
Operating mode	Instrument as client, Modbus-RTU protocol	Select **PC act as TCP Server** Do **not** select **Use UDP instead of TCP/IP**
Local IP	192.168.1.30 (can be modified)	192.168.1.79 (PC's IP)
Local Port (module's own port)	20108 (can be modified)	1000 (can be modified)
Remote IP	192.168.1.79 (same as PC's local IP)	–
Remote Port (target port to connect)	1000 (same as PC's local port)	–

11.18.7 Instrument as Server

Operating Mode	**Instrument Ethernet Configuration**	**PC Virtual Serial Port Configuration**
Operating mode	Instrument as server, Modbus-RTU protocol	Select **PC act as TCP Client** Do **not** select **Use UDP instead of TCP/IP**
Local IP	192.168.1.30 (can be modified)	192.168.1.79 (PC's IP)
Local Port (module's own port)	1000 (can be modified)	–
Remote IP	–	192.168.1.30 (same as instrument's local IP)
Remote Port (target port to connect)	–	1000 (same as instrument's local port)

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