

**APM series Power Meters**  
**Installation and Operation Instruction V1.9**

## DECLARATION

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This company reserve power of revision of product specification described in this manual, without notice. Before ordering, please consult local anget for the latest specification of product.

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## 1. Overview

APM series power meters of ACREL are power meters that are designed according to IEC standards and synchronized with international advanced technology.

APM series meters have full power measurement, energy statistics, analysis of power quality and network communications and other functions, are mainly used for comprehensive monitoring of the quality of power supply network.

This series of meters use a modular design, with a rich function of the external DI / DO module, AI / AO module, event recording (SOE) module with T-Flash (TF) card, network communication module, Temperature and humidity measurement module, can achieve full power measurement of electrical circuit and monitoring of switch status, Dual RS485 with Ethernet interface can realize data copying of RS485 master station, eliminating the need for data switching exchange. PROFIBUS-DP interface can realize high-speed data transmission and networking function.

## 2. Type and specification

| Function                 |   | APM800<br>(class 0.5s)  | APM801<br>(class 0.2s) | APM810<br>(class 0.5s) |
|--------------------------|---|---|------------------------|------------------------|
| Measured parameters      | Total electrical measurement  | √   | √                      | √                      |
|                          | Four-quadrant energy  | √   | √                      | √                      |
| Pulse output of energy   | Pulse output of active/reactive energy  | √   | √                      | √                      |
| Demand                   | Three-phase current, active power, reactive power, real-time demand of apparent power, and maximum demand (including time stamp)  | √   | √                      | √                      |
| Extreme value statistics | Extremum of current, line voltage, phase voltage, active power, reactive power, apparent power, power factor, frequency, total harmonic of current, total harmonic of voltage in this month and last month (including time stamp) | √   | √                      | √                      |
| Power quality            | Unbalance of current, line voltage, phase voltage   | √   | √                      | √                      |
|                          | Voltage phase angle, current phase angle  | √   | √                      | √                      |
|                          | Voltage current phase Angle   | √   | √                      | √                      |
|                          | Total (odd, even) harmonic content of voltage and current   | ×   | ×                      | √                      |
|                          | Harmonic content of voltage and current (2-63 times)①   | ×   | ×                      | √                      |
|                          | Voltage crest factor  | ×   | ×                      | √                      |
|                          | Telephone waveform factor   | ×   | ×                      | √                      |
| Alarm records            | Current K-factor  | ×   | ×                      | √                      |
|                          | A total of 66 kinds of alarm types, each type can record the most recent 16 alarm records, support extended records by TF card  | √   | √                      | √                      |
| Event log                | Record the most recent 128 event records, support extended records by TF card   | √   | √                      | √                      |
| Communication            | Modbus protocol   | √   | √                      | √                      |
| I/O                      | 2 digital inputs + 2 digital outputs (2DI+2DO)  | √   | √                      | √                      |
| Extensions               | MD82  | 8 digital inputs + 2 digital outputs with changeover contacts (8DI+2DO) | √                      | √                      |
|                          | MLOG  | TF card storage (alarm records, event records,                          | √                      | √                      |

|  |      |  |   |   |   |
|--|------|--|---|---|---|
|  |      | electrical parameters and energy timing records, etc.)                       |   |   |   |
|  | MA84 | 8 analog inputs (class 0.5) + 4 analog outputs (class 0.5) (8AI+4AO)         | √ | √ | √ |
|  | MCM  | 1 RS485/Modbus-RTU, support master mode or slave mode                        | √ | √ | √ |
|  | MCP  | 1 Profibus-DP  | √ | √ | √ |
|  | MCE  | 1 Ethernet, support Modbus-TCP, http, SMTP, DHCP protocol                    | √ | √ | √ |
|  | MTH  | 4 ways of temperature measurement, 1 way of temperature and humidity control | √ | √ | √ |

Note ①: Accuracy of 2~42 times harmonic measurement in the frequency range of 45~65Hz is 1%, accuracy of 43~63 times harmonic measurement in frequency 50Hz is 2%.

### 3. Technical Parameters

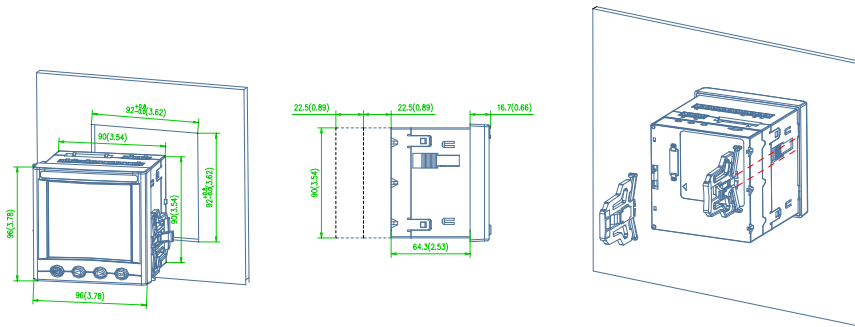
| Technical Parameters  | Index   |   |
|---|---|---|
| Signal  | Electrical network  | Three-phase three-wire, three-phase four-wire, see the wiring diagram;      |
|   | Frequency   | 45~65Hz;  |
|   | Voltage   | Rated value: AC 100V、110V、400V、690V;  |
|   |   | Overload: 1.2 times rated value(continuous); 2 times rated value /1 second; |
|   |   | Power consumption: < 0.5VA (per channel);                                   |
|   | Current   | Rated value: AC 1A, 5A, support 4 mm <sup>2</sup> line access;              |
| Overload: 1.2 times rated value(continuous); 10 times rated value/1 second; |   |   |
| Power consumption: < 0.5VA (per channel);                                   |   |   |
| Measurement accuracy  | Voltage、 current and power  | class 0.5s/class 0.2s (APM800、 APM810/APM801)                               |
|   | Active power  | class 0.5s/class 0.2s (APM800、 APM810/APM801)                               |
|   | Reactive power  | class 2   |
|   | Harmonic  | 1% (2rd~42nd) 、 2% (43rd~63rd)  |
| Switch inputs   | Dry contact inputs, built-in power supply;  |   |
| Relay outputs   | Contact type: open contact in main part, changeover contact in module;<br>Contact capacity: AC 250V/3A DC 30V/3A; |   |
| Pulse output of energy  | Output mode: Optocoupler pulse with open collector;<br>Pulse constant: 4000 (5A) 、 8000 (1A) imp/kWh;             |   |
| Analog outputs  | DC 0mA~20mA、 4mA~20mA、 0V~5V、 1V~5V output, accuracy class 0.5%, load resistance ≤ 500Ω;                          |   |
| Analog inputs   | DC 0mA~20mA、 4mA~20mA、 0V~5V、 1V~5V iutput, accuracy class 0.5%   |   |
| Storage card  | Standard Capacity:4G,TF Card Up to 32G Capacity;  |   |

|                               |  |   |
|-------------------------------|--|---|
| Communication                 |  | RS485 interface/Modbus-RTU protocol and DLT645 protocol<br>Profibus-DP interface/Profibus-DP protocol;<br>RJ45 interface (Ethernet) / Modbus-TCP, http, DHCP and other protocols;   |
| Power supply                  |  | Working range: AC/DC 85V~265V or AC/DC 115~415V(P2);<br>Power consumption: Power consumption of the main part ≤ 15VA;   |
| Safety                        | Power frequency withstand voltage                | The power frequency withstand voltage between the shell and the auxiliary power supply, each input and output terminal group is AC 4kV/1min;<br>The power frequency withstand voltage between the auxiliary power supply and each input and each output terminal group is AC 2kV/1min;<br>The power frequency withstand voltage between the voltage input and other input/output terminal groups is AC 2kV/1min;<br>The power frequency withstand voltage between the current input and other input/output terminal groups is AC 2kV/1min;<br>The power frequency withstand voltage between the relay output and other input/output terminal groups is AC 2kV/1min;<br>The power frequency withstand voltage between each terminal group of switch input, communication, analog output and pulse output is AC 1kV/1min; |
|                               | Insulation resistance                            | Inputs、 outputs to the shell>100MΩ;   |
| Electromagnetic compatibility |  | Meet IEC 61000 standard (Level 4);  |
| Protection level              |  | Display panel IP52  |
| Environment                   |  | Operating temperature: -20 °C ~ +65 °C;<br>Storage temperature: -20°C~+70°C;<br>Relative humidity: ≤95% without condensation;<br>Altitude: ≤2500m;  |
| Standards                     | IEC 60068-2-1<br>IEC 60068-2-2<br>IEC 60068-2-30 | Environmental Testing-Part 2-1:Tests Test A: Cold IDA<br>Part 2-1:Tests Test B: Dry heat<br>Part 2-30:Tests Test Db:Damp heat,cyclic(12+12h)  |
|                               | IEC 61000-4                                      | Electromagnetic compatibility-Testing and measurement techniques  |
|                               | IEC 61557-12                                     | Electrical safety in low voltage distribution system up to 1000V a.c. and 1500V d.c –Equipment for testing,measuring or monitoring of protective measures- Part12:<br>Performances measuring and monitoring devices(PMD)  |
|                               | IEC 62053-22                                     | Electricity metering equipment (a.c.)-Particular requirements - Part22:Static meter for active energy (class 0.2s and 0.5s)   |

## 4. Installation and wiring instructions

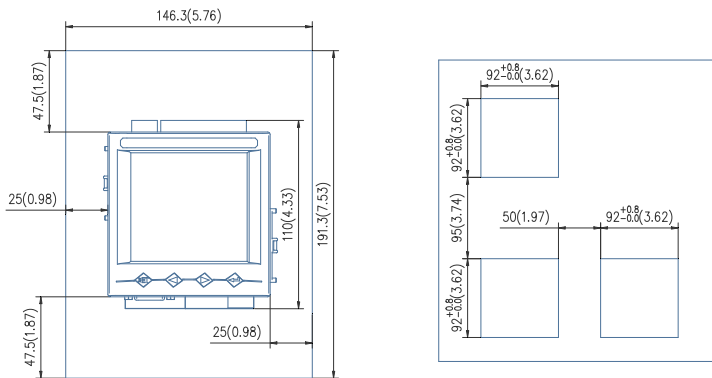
### 4.1 Installation dimensions

Meter and panel opening size(unit: mm(in))



Note: The maximum clamshell Angle is 90°.

Multiple meter installation (unit: mm(in))

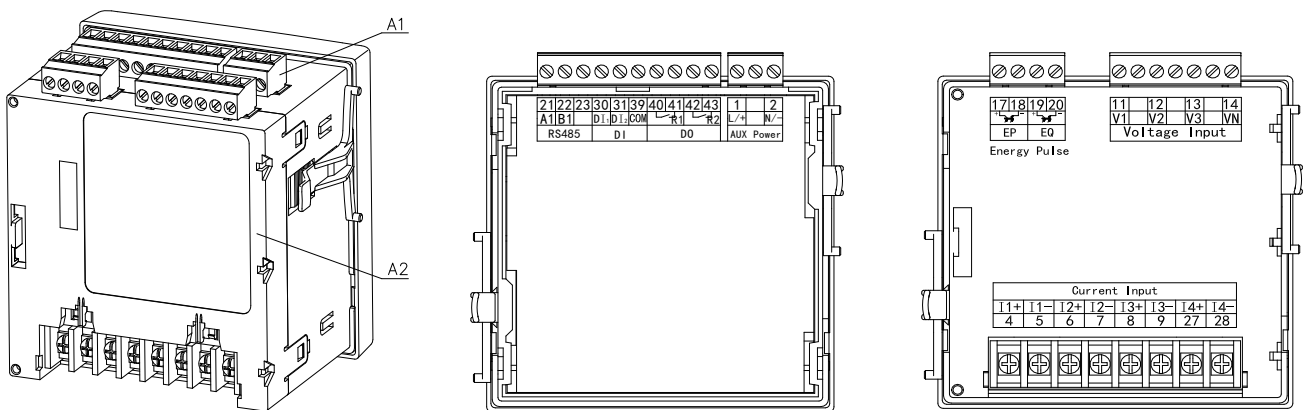


### 4.2 Wiring method

According to different design requirements, it is recommended to add a fuse (BS88 2A gG) to the power supply and voltage input terminals to meet the safety requirements of the relevant electrical specifications.

#### 4.2.1 Main part

Terminal diagram: "4,5,6,7,8,9" is the current signal input terminal number; "11,12,13,14" the voltage signal input terminal number; "1, 2" is the meter auxiliary power terminal number. "21, 22" is the communication terminal number; "17, 18, 19, 20" is the energy pulse output terminal number; "30, 31, 39" is the switch input terminal number; "40, 41, 42, 43" is the relay output terminal number. (Figure 1)

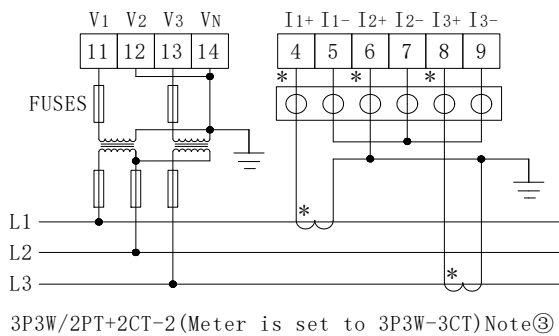
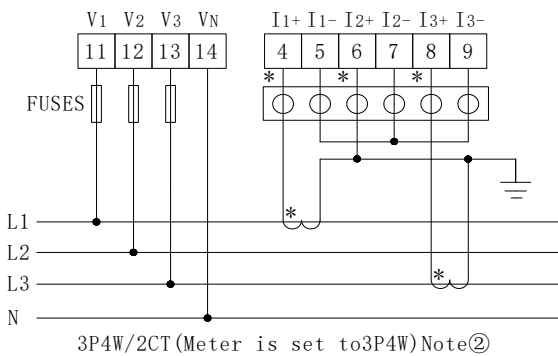
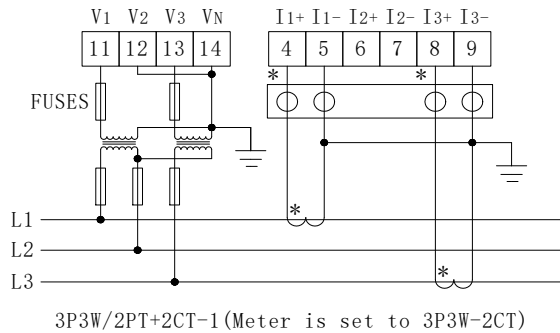
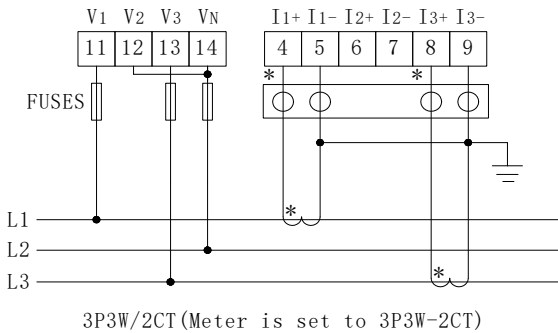
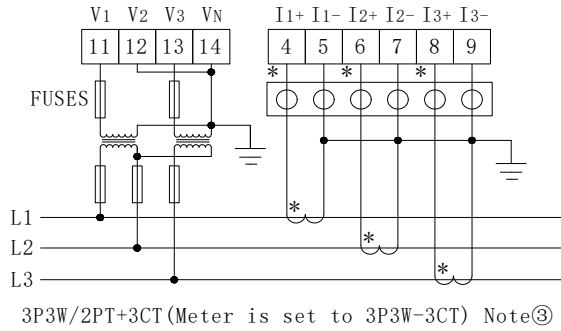
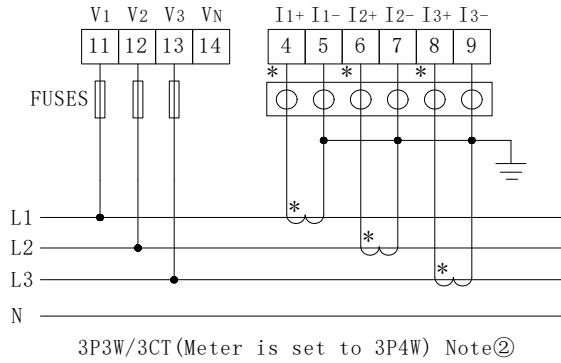
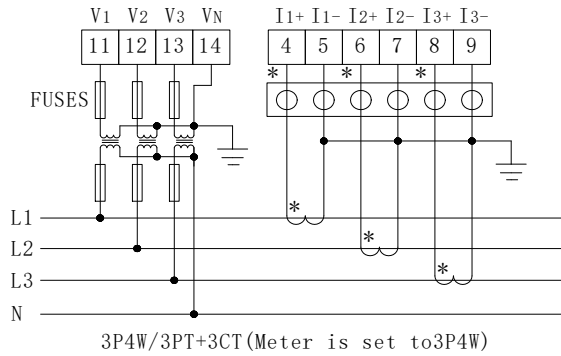
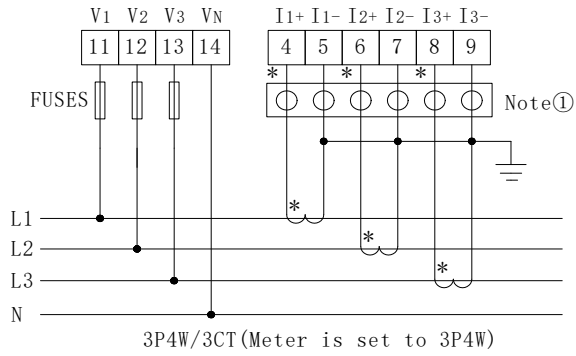


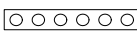
(Figure 1)

(A1)Auxiliary power supply, etc

(A2)Input of voltage and current

## Wiring method of signal input:



Note①:  This is a test terminal for shorting the secondary side of the CT.

Note②: Only for balanced three-phase loads.

Note③: Phase B current is only displayed and does not participate in other calculations.



## 4.2.2 Module parts

### Switch module

|              |    |    |    |                 |                 |                 |                 |                 |                 |                 |                 |                  |    |    |
|--------------|----|----|----|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|------------------|----|----|
| 70           | 77 | 71 | 72 | 78              | 73              | 30              | 31              | 32              | 33              | 34              | 35              | 36               | 37 | 39 |
| R1           |    | R2 |    | DI <sub>1</sub> | DI <sub>2</sub> | DI <sub>3</sub> | DI <sub>4</sub> | DI <sub>5</sub> | DI <sub>6</sub> | DI <sub>7</sub> | DI <sub>8</sub> | COM <sub>4</sub> |    |    |
| Relay Output |    |    |    |                 |                 | Digital Input   |                 |                 |                 |                 |                 |                  |    |    |

### Analog input and output module

|                 |                 |                 |                 |                 |                 |                 |                 |                  |                 |                 |                 |                 |                  |
|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|------------------|-----------------|-----------------|-----------------|-----------------|------------------|
| 60              | 61              | 62              | 63              | 64              | 65              | 66              | 67              | 69               | 50              | 51              | 52              | 53              | 59               |
| AI <sub>1</sub> | AI <sub>2</sub> | AI <sub>3</sub> | AI <sub>4</sub> | AI <sub>5</sub> | AI <sub>6</sub> | AI <sub>7</sub> | AI <sub>8</sub> | COM <sub>2</sub> | AO <sub>1</sub> | AO <sub>2</sub> | AO <sub>3</sub> | AO <sub>4</sub> | COM <sub>3</sub> |
| Analog Input    |                 |                 |                 |                 |                 |                 |                 |                  | Analog Output   |                 |                 |                 |                  |

### Ethernet module

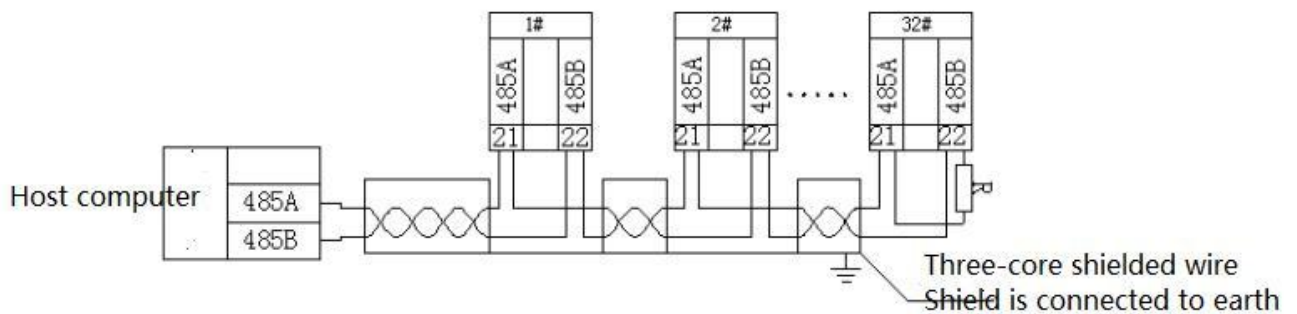
|       |    |    |     |  |             |  |
|-------|----|----|-----|--|-------------|--|
| 24    | 25 | 26 | LAN |  | PROFIBUS DP |  |
| A2    | B2 |    |     |  |             |  |
| RS485 |    |    |     |  |             |  |

### Temperature module

|       |    |        |     |     |    |             |      |      |      |      |      |      |      |    |
|-------|----|--------|-----|-----|----|-------------|------|------|------|------|------|------|------|----|
| 76    | 75 | 74     | 93  | 92  | 91 | 90          | 87   | 86   | 85   | 84   | 83   | 82   | 81   | 80 |
| Relay |    | Sensor |     |     |    | Thermometry |      |      |      |      |      |      |      |    |
| R1 R2 |    | V-     | SDA | SCL | V+ | NTC4        | NTC3 | PT2g | PT2b | PT2a | PT1g | PT1b | PT1a |    |

An example of wiring for the communication is shown in the figure below:

Correct wiring method: Communication Cable shield is connected to earth.



It is recommended to add a matching resistor between A and B at the end of the meter. The resistance range is 120Ω~10 kΩ.

**Note: 1.**When the meter has Profibus function, for the related communication configuration and GSD file, please refer to the CD

delivered with the meter.

2.The second RS485 communication only supports Modbus 03 command.

## 5. Packaging

The package contains the following items: Host (including plug-in terminal block), mounting brackets, factory inspection report, certificate (anti-counterfeiting label), installation instructions.

When opening the product packaging, please check carefully whether there is any damage. If any damage occurs, please inform ACREL company or agent promptly, and keep the damaged external packaging. The company will promptly replace it.

## 6. Engineering Construction Notes

### 6.1 Voltage input

The input voltage should not exceed 120% of the rated input voltage of the product (100V or 110V or 400V or 690V). Otherwise, the PT should be used; a 1A fuse must be installed on the voltage input; the wiring method of the product must be set according to the PT wiring of the product. The wiring method is as follows:

| Wiring method | Selection |
|---------------|-----------|
| 2 elements    | 3P3W      |
| 3 elements    | 3P4W      |

### 6.2 Current input

The standard rated input current is 1A or 5A. It requires the use of an external CT (recommended to use a wiring strip, not directly connected to the CT, in order to facilitate disassembly); ensure that the input current corresponds to the voltage, the phase sequence is consistent and the direction is consistent; if There are other meters connected in the CT circuit used, the wiring should be connected in series.

Before removing the current input connection of the product, be sure to disconnect the CT primary circuit or short the secondary circuit!

### 6.3 Communication Wiring

The meter provides asynchronous half-duplex RS485 communication interface, using MODBUS-RTU protocol, various data information can be transmitted on the communication line.

Theoretically, up to 128 power meters can be connected simultaneously on a single line. Communication address of each power meter can be set. When wiring, keep communication lines away from power cables or other strong electric-magnetic field

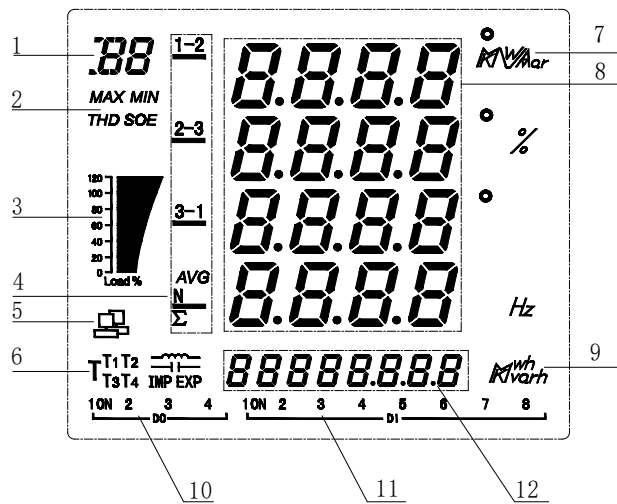
## 7. Operation instructions

### 7.1 Display description

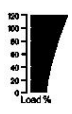
APM series uses LCD segment LCD display, the following table shows the segment codes for different characters.



|    |   |   |   |   |   |   |   |     |   |
|----|---|---|---|---|---|---|---|-----|---|
| A  | b | c | d | E | F | g | H | i/I |   |
| Ab | b | c | d | E | F | g | H | i   | I |
| J  | K | L | M | n | o | P | q | r   | S |
| J  | K | L | M | n | o | P | q | r   | S |
| t  | U | v | W | X | y | Z | - | -   | = |
| t  | U | v | W | X | y | Z | - | -   | = |

The following figure shows the screen when all character fields and indications are all lit.

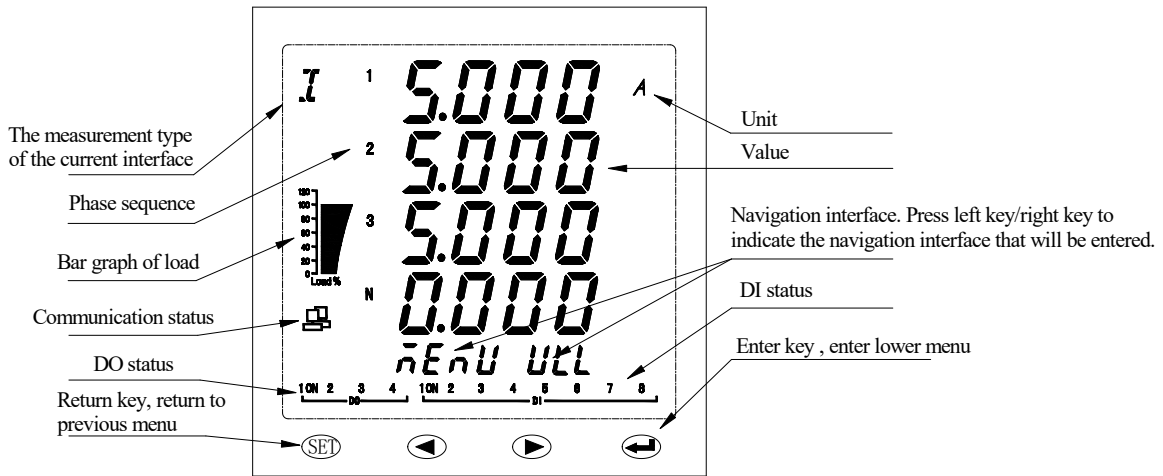


The following table is a description of all the measurement and indication.

| No. | Display content   | Instruction  |
|-----|---|--|
| 1   | I/U/P/Q/S/PF/d  | Identify what is displayed in the current measurement data display area 8:<br>Current / Voltage / Active Power / Reactive Power / Apparent Power / Power Factor / Demand |
|     | IO/AL/SD  | DI, DO, AI, AO status/alarm log/TF card status   |
| 2   | MAX/ MIN  | Records of maximum / minimum   |
|     | THD   | Total harmonic distortion  |
|     | SOE   | Sequence Of Event  |
| 3   | <br>Display of load size | Indicate the percentage of the current load current relative to the rated current, 90% to 110%, the histogram shows 100%, and so on.                                     |
| 4   | 1-2,2-3,3-1   | 1、 2、 3: Values of ABC three-phase, 1-2,2-3,3-1: Value of the AB, BC, CA three-line  |
|     | AVG   | Average value  |
|     | N   | Neutral current  |
|     | Σ   | Total power  |

|    |  |  |
|----|--|--|
| 5  | <br>Communication status symbol | Lights up to indicate that the current communication is being sent and received normally   |
| 6  | IMP/<br>EXP/                    | Absorption total active energy / release total active energy / inductive reactive energy / capacitive reactive energy                    |
| 7  | Unit of measurement data   | Current: A, kA; Voltage: V, kV; Active power: kW, MW; Reactive power: kVar, MVar; Apparent power: kVA, MVA; Percentage: %; Frequency: Hz |
| 8  | Display area of measurement data   | Current, voltage, power, power factor, time, parameter settings, etc.  |
| 9  | Units of energy  | Active energy: kWh, MWh; Reactive energy: kVarh, Mvarh   |
| 10 | DO status indication   | The status of DO1-DO4. The remaining DO can be viewed under the main loop IO   |
| 11 | DI status indication   | The status of DI1-DI8. The remaining DI can be viewed under the main loop IO   |
| 12 | Energy data area   | Left and right navigation bar, corresponding to the left and right buttons menu;<br>Electrical measurement display and parameter setting |

The meter will display the model number and version information, and then the current interface will be displayed.



## 7.2 Panel description

### Key description




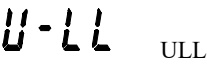


The four keys are, the SET key, the left key, the right key, and the enter key from left to right.

| Key   | Function   |
|-------|--|
| SET   | Return to previous menu                                  |
| Left  | Decrease parameter or switch navigation interface        |
| Right | Increase parameter or switch navigation interface        |
| Enter | Modify and confirm the parameters or enter the next menu |

### Extended module indicator light description

|         |               |                 |        |                       |
|---------|---------------|-----------------|--------|-----------------------|
|         | Flashing (1s) | Flashing (0.2s) | Bright | Extinguished          |
| (GREEN) | Module OK     | Module error    | /      | Module is not running |

### 7.3 Display overview

| First level menu  | Second level menu                        | Third level menu                         | Fourth level menu | Note                                |                            |
|---|--|--|-------------------|-------------------------------------|----------------------------|
| <br>MENU                   | SET (Settings)                           |  |                   | See the system settings for details |                            |
|   | RST (Reset)                              | E (Clear energy)                         |                   |                                     | See data reset for details |
|   |  | dMd (Clear demand)                       |                   |                                     |                            |
|   |  | ALM (Clear alarm record)                 |                   |                                     |                            |
|   |  | SOE (Clear event record)                 |                   |                                     |                            |
|   |  | MAX MIN (Clear extremum)                 |                   |                                     |                            |
|   |  | SD (Format TF card)                      |                   |                                     |                            |
| DIAG (diagnosis)  |  | Version, Software number, Module version |                   |                                     |                            |
| <br>I (current)          | I_Unablance (Unbalance of current)       |  |                   |                                     |                            |
|   | Current phase angle                      |  |                   |                                     |                            |
|   | Voltage current phase Angle              |  |                   |                                     |                            |
| <br>In (neutral current) |  |  |                   |                                     |                            |
| <br>U-LL (line voltage)  | U_Unablance (unbalance of line voltage)  |  |                   |                                     |                            |
|   | Offset (Line voltage offset)             |  |                   |                                     |                            |
| <br>U-LN (phase voltage) | V_Unablance (Unbalance of phase voltage) |  |                   |                                     |                            |
|   | offset (Phase voltage deviation)         |  |                   |                                     |                            |
|   | Angle (Voltage phase angle)              |  |                   |                                     |                            |
| <br>P (active power)     |  |  |                   |                                     |                            |

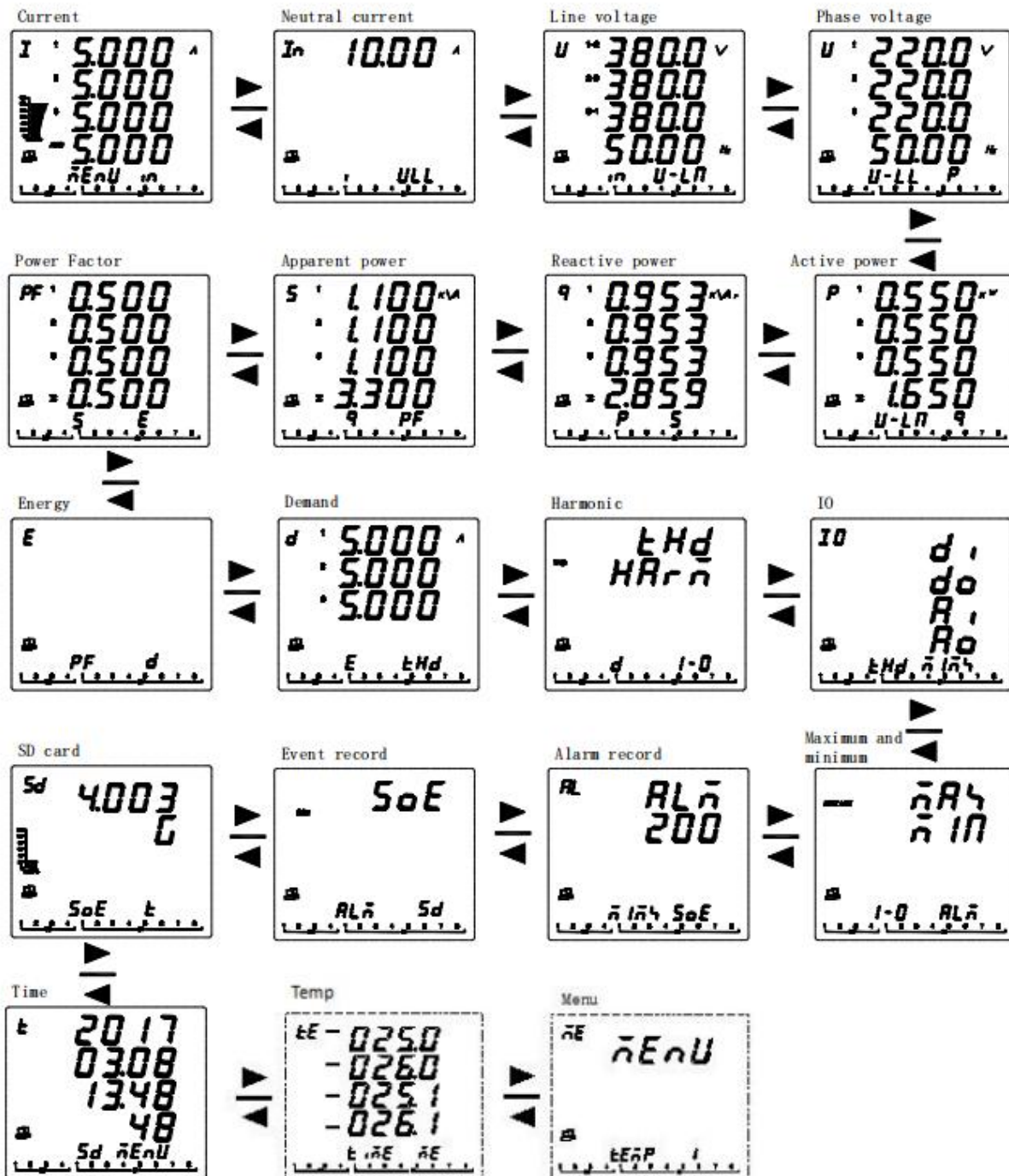
|  |   |                                       |  |                             |
|--|---|---------------------------------------|--|-----------------------------|
| <b>Q</b><br>Q (reactive power)                         |   |                                       |  |                             |
| <b>S</b><br>S (apparent power)                         |   |                                       |  |                             |
| <b>E</b><br>E (energy)                                 | IMP (Absorb active energy)                                |                                       |  | See energy view for details |
|  | EXP (Release active energy)                               |                                       |  |                             |
|  | EQL (Inductive reactive energy)                           |                                       |  |                             |
|  | EQC (Capacitive reactive energy)                          |                                       |  |                             |
| <b>d</b><br>d (current demand for three-phase current) | Current active power demand                               |                                       |  | See demand view for details |
|  | Current reactive power demand                             |                                       |  |                             |
|  | Current apparent power demand                             |                                       |  |                             |
|  | Phase A current maximum demand and time of occurrence     |                                       |  |                             |
|  | Phase B current maximum demand and time of occurrence     |                                       |  |                             |
|  | Phase C current maximum demand and time of occurrence     |                                       |  |                             |
|  | Active power maximum demand and time of occurrence        |                                       |  |                             |
|  | Reactive power maximum demand and time of occurrence      |                                       |  |                             |
| Apparent power maximum demand and time of occurrence   |   |                                       |  |                             |
| <b>PF</b><br>PF (power factor)                         |   |                                       |  |                             |
| <b>THD</b><br>THD                                      | UH THD (Total harmonic distortion of phase voltage)       | 2-63 harmonics of three phase voltage |  | See harmonics for details   |
|  | UH ODD (Total odd harmonic distortion of phase voltage)   |                                       |  |                             |
|  | UH EVEN (Total even harmonic distortion of phase voltage) |                                       |  |                             |
|  | IH THD (Total harmonic distortion of current)             | 2-63 harmonics of three phase current |  |                             |
|  | IH ODD (Total odd harmonic distortion of current)         |                                       |  |                             |
|  | IH EVEN (Total even harmonic distortion of current)       |                                       |  |                             |
|  | CF (Crest factor)   |                                       |  |                             |
|  | THFF (Telephone waveform factor)                          |                                       |  |                             |
| KF (K factor)  |   |                                       |  |                             |

|                                       |                                  |   |               |   |  |
|---------------------------------------|----------------------------------|---|---------------|---|--|
| <b>IO</b><br>IO (Inputs and outputs)  | DI (Digital input)               |   |               | See IO for details                      |  |
|                                       | DO (Digital output)              |   |               |   |  |
|                                       | AI (Analog input)                |   |               |   |  |
|                                       | AO (Analog output)               |   |               |   |  |
| <b>IN</b><br>IN (Maximum and minimum) | I (Current)                      | Maximum of this month and time of occurrence; |               | See the maximum and minimum for details |  |
|                                       | U (Voltage)                      |   |               |   |  |
|                                       | P (Active power)                 | Minimum of this month and time of occurrence; |               |   |  |
|                                       | Q (Reactive power)               | Maximum of last month and time of occurrence; |               |   |  |
|                                       | S (Apparent power)               | Minimum of last month and time of occurrence; |               |   |  |
|                                       | PF (Power factor)                |   |               |   |  |
|                                       | F (Frequency)                    |   |               |   |  |
| THD (Total harmonic distortion)       |                                  |   |               |   |  |
| <b>ALM</b><br>(Alarm record)          | LAST ALM (last 16 alarm records) | Detailed alarm record                         |               | See the alarm for details               |  |
|                                       | AT01 (Overcurrent alarm)         | 1 A (Phase A overcurrent)                     | Alarm details |   |  |
|                                       |                                  | 2 B (Phase B overcurrent)                     | ...           |   |  |
|                                       |                                  | 3 C (Phase C overcurrent)                     | ...           |   |  |
|                                       |                                  | 4 MAX (Maximum overcurrent)                   | ...           |   |  |
|                                       |                                  | 5 N (Neutral overcurrent)                     | ...           |   |  |
|                                       | AT02 (Undercurrent alarm)        | ...   | ...           |   |  |
| AT13 (Other alarm)                    | ...                              | ...   |               |   |  |
| <b>SOE</b><br>SOE (Event record)      | Record of the last 128 events    |   |               |   |  |
| <b>Sd</b><br>TF (TF card capacity)    |                                  |   |               |   |  |
| <b>t</b><br>TIME (system time)        |                                  |   |               |   |  |



|                                 |                                |  |  |  |
|---------------------------------|--------------------------------|--|--|--|
| tE n P<br>TEMP<br>(Temperature) | 4-way temperature              |  |  |  |
|                                 | 1-way temperature and humidity |  |  |  |
|                                 | Heated/blown state             |  |  |  |

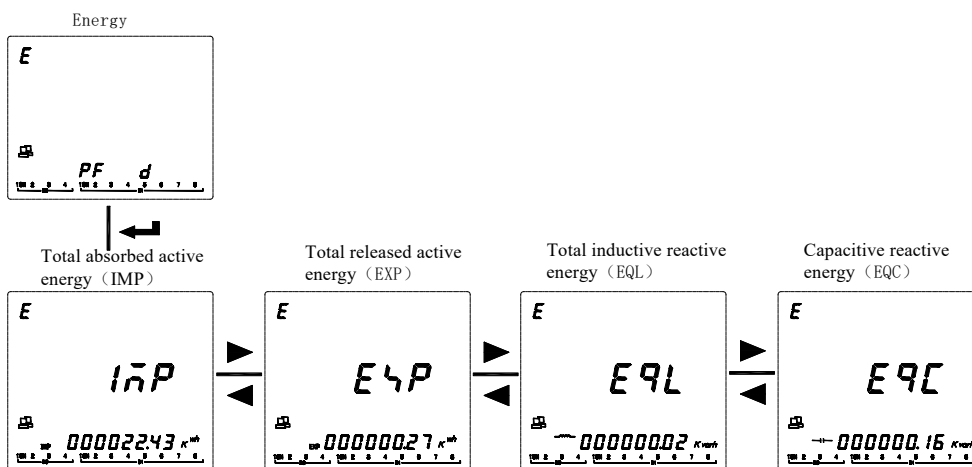
### 7.4 Measurement Parameters

**The power parameter overview:** After the meter is powered on, the current is displayed. Press the left and right keys to switch the display to the following interface (some parameters need to press the enter key to enter the next level):

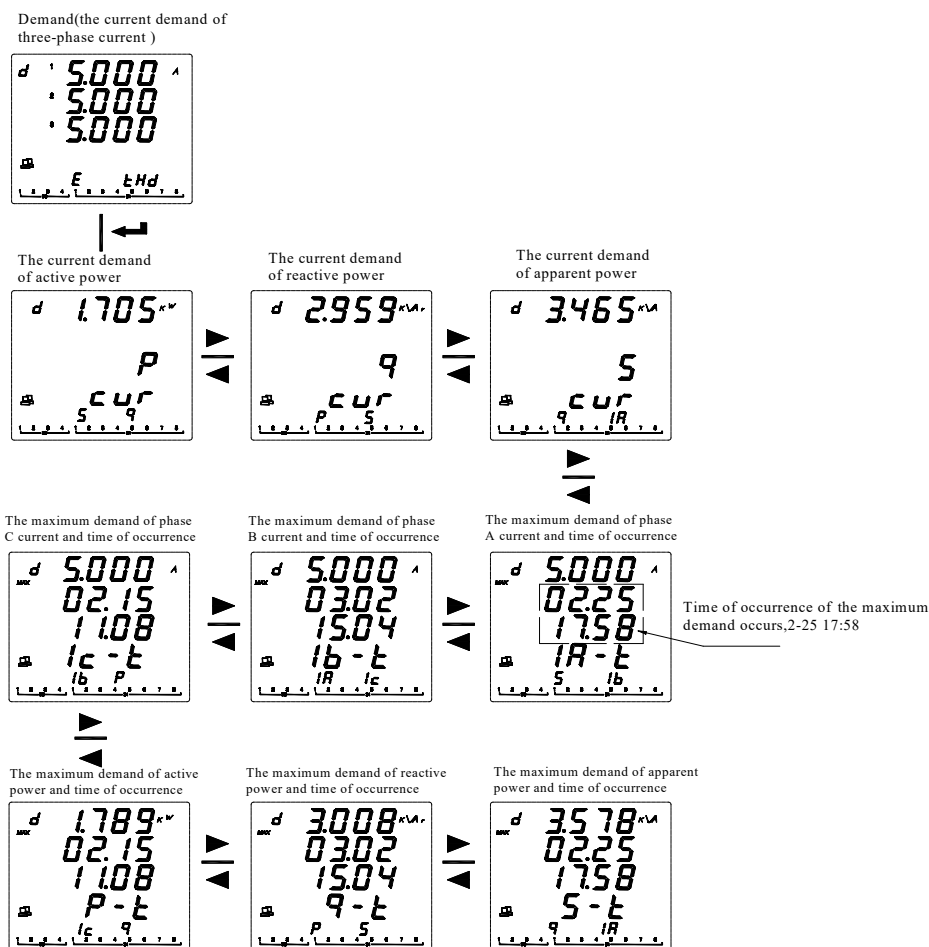




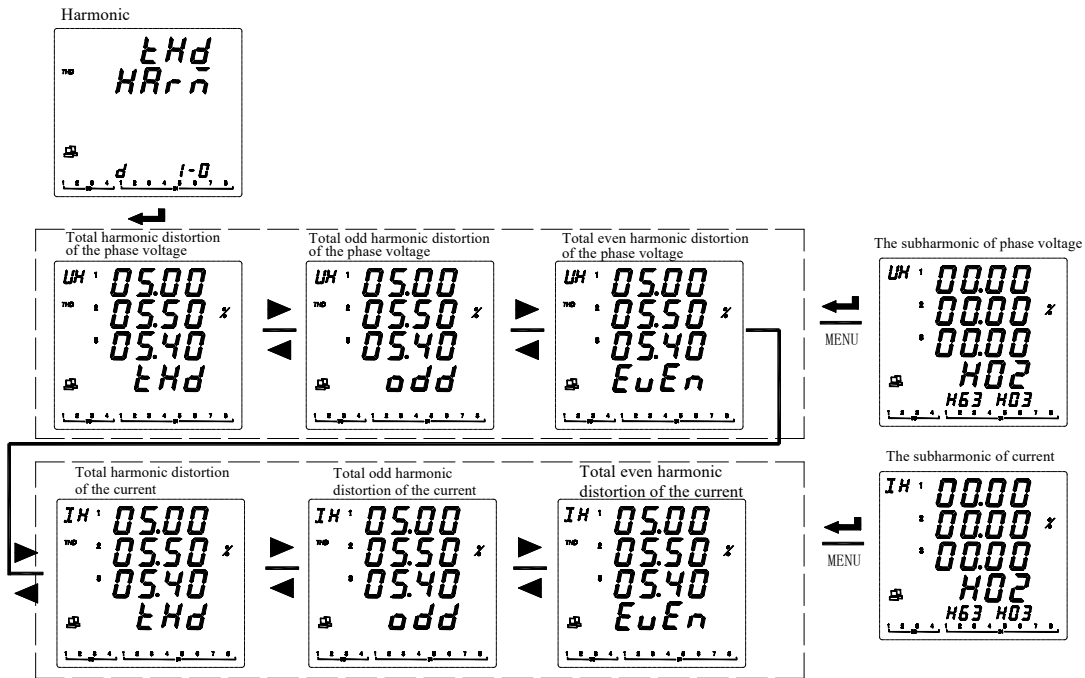
**View energy:** Press  $\blacktriangleleft$  button in the main interface until the current measurement data display area shows E, then press ENTER, press  $\blacktriangleright$  button to switch the display: IMP (total absorbed active energy)  $\longleftrightarrow$  EXP (total released active energy)  $\longleftrightarrow$   EQL (total inductive reactive energy)  $\longleftrightarrow$   EQC (capacitive reactive energy).



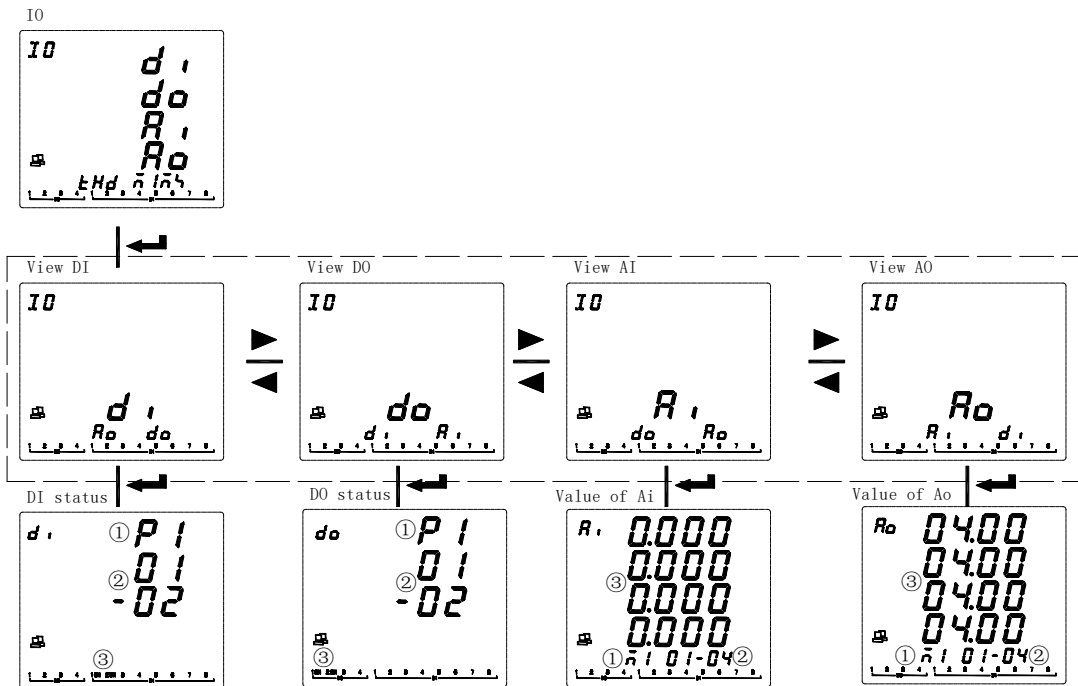
**View demand:** Press  $\blacktriangleleft$  button on the main screen until the current measurement data display area shows d. The measurement data area displays the current demand of three-phase current and press the enter key. Press  $\blacktriangleleft$  key to view the current demand of active power, the current demand of reactive power, the current demand of apparent power, the maximum demand of three-phase current and time of occurrence, and the maximum demand of three-phase power and time of occurrence.



**View harmonic (APM810 only):** Press ◀▶ key on the main screen until the current measurement data display area shows THD, the measurement data area shows THD, HARM, and press the enter key. Press the ▶ key to view the total harmonic distortion of the voltage, the total odd harmonic distortion of the voltage, the total even harmonic distortion of the voltage even, the total harmonic distortion of the current, the total odd harmonic distortion of the current, and the total even harmonic distortion of the current. After you press the enter key at the total harmonic distortion of voltage (or current) interface, you can view the subharmonics.



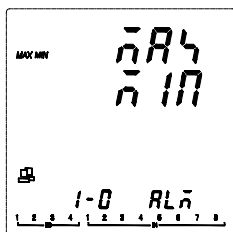
**View IO (Input and output):** Press ◀ key on the main screen until the current measurement data display area shows IO, and the measurement data area shows DI, DO, AI, AO, press enter. Press the ▶ keys to select the information to be viewed (DI: digital input, DO: digital output, AI: analog input, AO: analog output).



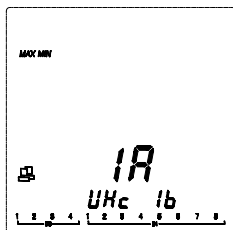
- ① P1:Main part; M1:Module 1 M2:Module 2,and so on.
- ② Take DI for example, DI1-DI2 status is indicated at ③,others is similar.
- ③ Indicate status or values of DI/DO/AI/AO.

**View maximum and minimum values:** Press ◀▶ key on the main screen until the current measurement data display area shows MAX MIN and press enter. Press ◀▶ key to select the extreme value record of the electric parameters (I, U, P, Q, S, PF, F, THD, etc.) to be viewed and press the Enter key. Press the ◀▶ key to view the current month's maximum value, the current month's minimum value, the previous month's maximum value, the previous month's minimum value, and the time of occurrence of the selected electrical parameter. When a month span occurs, the extreme value of this month is automatically deposited into the extreme value of the previous month.

Maximum and minimum



Select extreme value (Phase A current is selected currently)



▶▶ ... Others refer to table 1  
◀▶



| The current month's maximum value | The current month's minimum value | The previous month's maximum value | The previous month's minimum value |
|-----------------------------------|-----------------------------------|------------------------------------|------------------------------------|
|                                   |                                   |                                    |                                    |

The time of occurrence of phase A current is 16-9-8 3:58

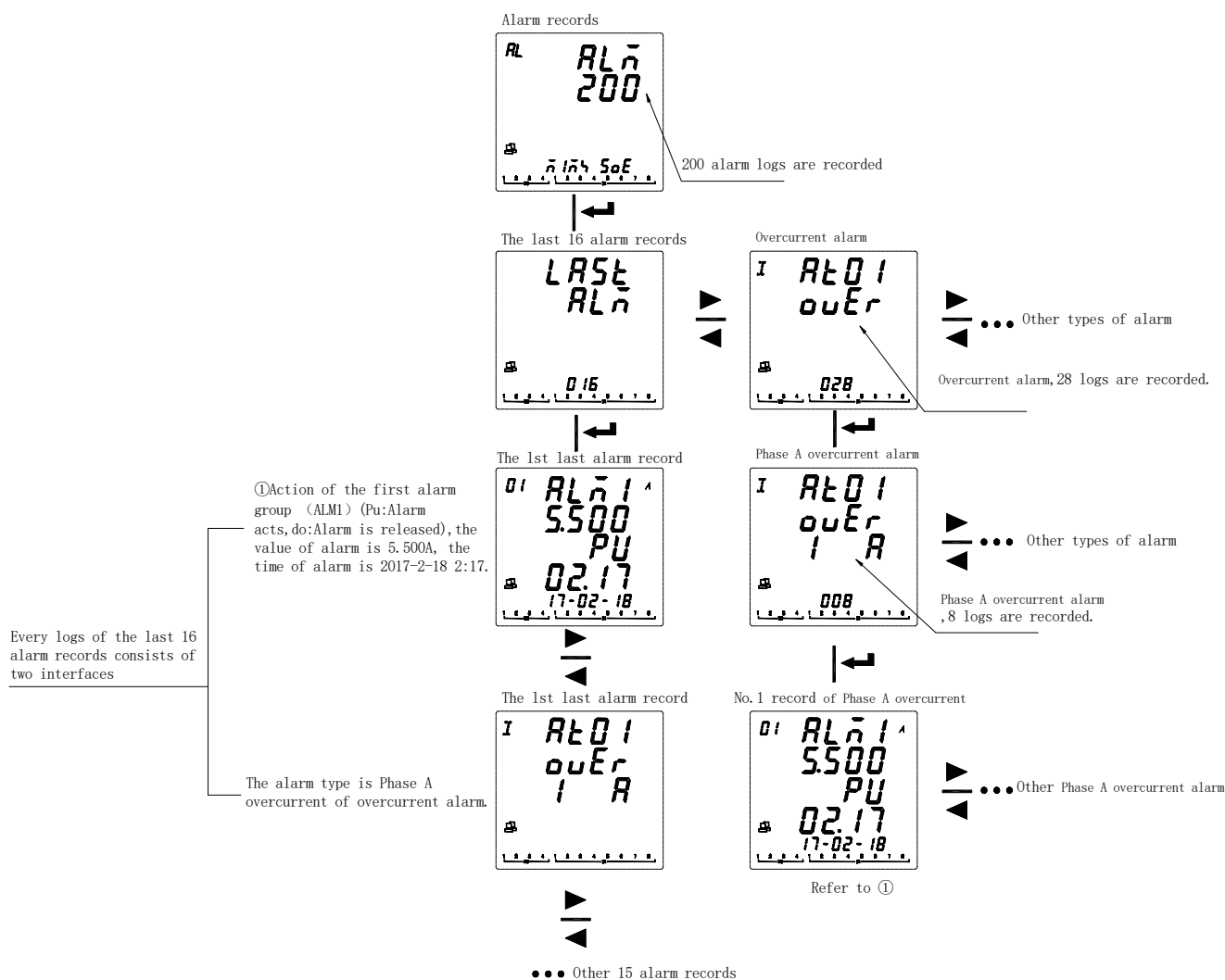
**Table 1: Extreme Values and symbol description**

| Symbol    | Instruction           | Symbol | Instruction                       | Symbol | Instruction                       |
|-----------|-----------------------|--------|-----------------------------------|--------|-----------------------------------|
| IA        | Phase A current       | PT     | Total active power                | IHC    | Total harmonic of Phase C current |
| IB        | Phase B current       | QA     | Phase A reactive power            | UHA    | Total harmonic of Phase A voltage |
| IC        | Phase C current       | QB     | Phase B reactive power            | UHB    | Total harmonic of Phase B voltage |
| IN        | Neutral current       | QC     | Phase C reactive power            | UHC    | Total harmonic of Phase C voltage |
| IAV       | Average current       | QT     | Total reactive power              |        |                                   |
| UA        | Phase A voltage       | SA     | Phase A apparent power            |        |                                   |
| UB        | Phase B voltage       | SB     | Phase B apparent power            |        |                                   |
| UC        | Phase C voltage       | SC     | Phase C apparent power            |        |                                   |
| ULN (AVG) | Average phase voltage | ST     | Total apparent power              |        |                                   |
| UAB       | Phase AB line voltage | PFA    | Phase A power factor              |        |                                   |
| UBC       | Phase BC line voltage | PFB    | Phase B power factor              |        |                                   |
| UCA       | Phase CA line voltage | PFC    | Phase C power factor              |        |                                   |
| ULL (AVG) | Average line voltage  | PFT    | Total power factor                |        |                                   |
| PA        | Phase A active power  | F      | Frequency                         |        |                                   |
| PB        | Phase B active power  | IHA    | Total harmonic of Phase A current |        |                                   |
| PC        | Phase C active power  | IHB    | Total harmonic of Phase B current |        |                                   |

**View the alarm:** Press ◀▶ on the main screen until AL is displayed in the current measurement data display area, ALM is displayed in the measurement data area, and then press the Enter key. You can view the last 16 alarm records (Last Alm) in chronological order and view alarm records by alarm type.

APM series of meters can record 66 kinds of alarms, divided into 13 kinds of alarm categories (AT01 overcurrent, AT02 undercurrent, etc., see Table 2), each type of alarm includes a number of alarm subcategories (for example, the AT01 overcurrent alarm includes Phase A overcurrent, Phase B overcurrent, Phase C overcurrent, etc., see Table 2). Each alarm subclass can record up to 16 alarm records. When there are 16 or more alarm records, the principle of first in, first out is implemented. The newly generated alarm will automatically overwrite the oldest record. Each alarm record contains the alarm value, alarm group, alarm action (action or recovery), and alarm time. If an expansion module (including a TF card) is purchased, all alarm data will be automatically synchronized to the TF card for storage.

Note: The TF card cannot record all more than 16 alarm records that were simultaneously generated within 2 seconds.



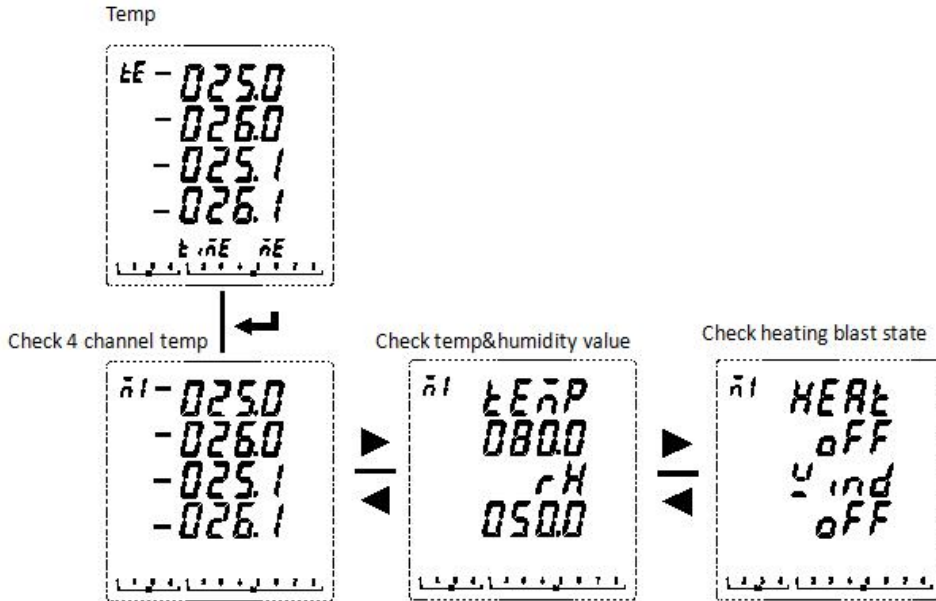
**Table 2: Alarm classification description:**

| Alarm categories            | Alarm subcategories |           | Alarm content                     | Alarm communication code |
|-----------------------------|---------------------|-----------|-----------------------------------|--------------------------|
|                             | Symbol I            | Symbol II |                                   |                          |
| AT01<br>(Overcurrent)       | I Over              | 1 A       | Phase A overcurrent               | 0                        |
|                             |                     | 2 B       | Phase B overcurrent               | 1                        |
|                             |                     | 3 C       | Phase C overcurrent               | 2                        |
|                             |                     | 4 MAX     | Maximum overcurrent               | 3                        |
|                             |                     | 5 N       | Neutral overcurrent               | 4                        |
| AT02<br>(Undercurrent)      | I Unde              | 1 A       | Phase A undercurrent              | 5                        |
|                             |                     | 2 B       | Phase B undercurrent              | 6                        |
|                             |                     | 3 C       | Phase C undercurrent              | 7                        |
|                             |                     | 4 MAX     | Minimum undercurrent              | 8                        |
|                             |                     | 5 N       | Neutral undercurrent l            | 9                        |
| AT03<br>(Overvoltage)       | U Over              | 1 A       | Phase A overvoltage               | 12                       |
|                             |                     | 2 B       | Phase B overvoltage               | 13                       |
|                             |                     | 3 C       | Phase C overvoltage               | 14                       |
|                             |                     | 4 L-N     | Maximum phase overvoltage         | 15                       |
|                             |                     | 5 AB      | Phase AB overvoltage              | 16                       |
|                             |                     | 6 BC      | Phase BC overvoltage              | 17                       |
|                             |                     | 7 CA      | Phase CA overvoltage              | 18                       |
|                             |                     | 8 L-L     | Maximum line overvoltage          | 19                       |
| AT04<br>(Undervoltage)      | U Unde              | 1 A       | Phase A undervoltage              | 20                       |
|                             |                     | 2 B       | Phase B undervoltage              | 21                       |
|                             |                     | 3 C       | Phase C undervoltage              | 22                       |
|                             |                     | 4 L-N     | Minimum phase undervoltage        | 23                       |
|                             |                     | 5 AB      | Phase AB undervoltage             | 24                       |
|                             |                     | 6 BC      | Phase BC undervoltage             | 25                       |
|                             |                     | 7 CA      | Phase CA undervoltage             | 26                       |
|                             |                     | 8 L-L     | Minimum line voltage undervoltage | 27                       |
| AT05<br>(Overpower)         | P Over              | 1 P       | Total active overpower            | 31                       |
|                             |                     | 2 Q       | Total reactive overpower          | 32                       |
|                             |                     | 3 S       | Total apparent overpower          | 33                       |
| AT06<br>(Underpower)        | P Unde              | 1 P       | Total active underpower           | 34                       |
|                             |                     | 2 Q       | Total reactive underpower         | 35                       |
|                             |                     | 3 S       | Total apparent underpower         | 36                       |
| AT07 (Demand alarm)         | Pd dMd              | 1 Over    | Overdemand alarm of active power  | 59                       |
|                             |                     | 2 Unde    | Underdemand alarm of active power | 60                       |
| AT08 (Power factor alarm)   | PF PF               | 1 Over    | Total over power factor           | 37                       |
|                             |                     | 2 Unde    | Total under power factor          | 38                       |
| AT09 (Total Harmonic Alarm) | THD                 | 1 IA      | Over THD of Phase A current       | 41                       |
|                             |                     | 2 IB      | Over THD of Phase B current       | 42                       |
|                             |                     | 3 IC      | Over THD of Phase C current       | 43                       |

|                                  |      |                |                                 |    |
|----------------------------------|------|----------------|---------------------------------|----|
|                                  |      | 4 UA           | Over THD of phase A voltage     | 44 |
|                                  |      | 5 UB           | Over THD of phase B voltage     | 45 |
|                                  |      | 6 UC           | Over THD of phase C voltage     | 46 |
| AT10 (Total Even Harmonic Alarm) | EVEN | 1 IA           | Over TEHD of Phase A current    | 47 |
|                                  |      | 2 IB           | Over TEHD of Phase B current    | 48 |
|                                  |      | 3 IC           | Over TEHD of Phase C current    | 49 |
|                                  |      | 4 UA           | Over TEHD of Phase A voltage    | 50 |
|                                  |      | 5 UB           | Over TEHD of Phase B voltage    | 51 |
|                                  |      | 6 UC           | Over TEHD of Phase C voltage    | 52 |
| AT11 (Total odd harmonics Alarm) | Odd  | 1 IA           | Over TOHD of Phase A current    | 53 |
|                                  |      | 2 IB           | Over TOHD of Phase B current    | 54 |
|                                  |      | 3 IC           | Over TOHD of Phase C current    | 55 |
|                                  |      | 4 UA           | Over TOHD of Phase A voltage    | 56 |
|                                  |      | 5 UB           | Over TOHD of Phase B voltage    | 57 |
|                                  |      | 6 UC           | Over TOHD of Phase C voltage    | 58 |
| AT12                             | di   | 1 di1          | DI1 ON/OFF                      | 62 |
|                                  |      | 2 di2          | DI2 ON/OFF                      | 63 |
|                                  |      | 3 di3          | DI3 ON/OFF                      | 64 |
|                                  |      | 4 di4          | DI4 ON/OFF                      | 65 |
| AT13 (Other)                     | Oth  | 1 I-Ubl        | Max unbalanced current          | 10 |
|                                  |      | 2 U-Ubl<br>L-N | Max unbalanced phase voltage    | 28 |
|                                  |      | 3 U-Ubl<br>L-L | Max unbalanced line voltage     | 29 |
|                                  |      | 4 F Over       | Over Frequency                  | 39 |
|                                  |      | 5 F Unde       | Under Frequency                 | 40 |
|                                  |      | 6 I Loss       | Current Loss                    | 11 |
|                                  |      | 7 U Loss       | Voltage Loss                    | 30 |
|                                  |      | 8 PHA Rev      | Phase Reversal                  | 61 |
| AT14(Temperature)                | Temp | 1              | 1 <sup>st</sup> way temperature | 66 |
|                                  |      | 2              | 2 <sup>nd</sup> way temperature | 67 |
|                                  |      | 3              | 3 <sup>rd</sup> way temperature | 68 |
|                                  |      | 4              | 4 <sup>th</sup> way temperature | 69 |

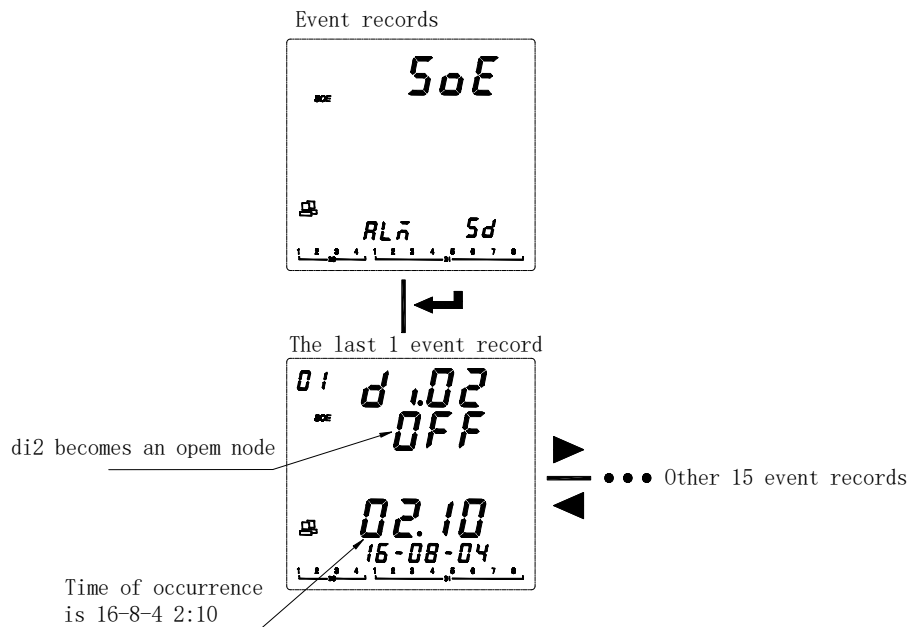
To check the temperature and humidity: Press < ▶ > key in the main interface, until the current measurement data display area displays TE, the measurement data area displays temperature, then press < ENTER > key. You can check the four channel temperature. At the temperature interface press < ▶ > Key to check the temperature and humidity sensor value and the state of the heating blast.





**View event record (SOE):** When the DI/DO status is changed, event records can be generated. The main body can store up to 128 event records. If you purchased an expansion module (including a TF card), all event log data will be automatically synchronized to the TF card for storage.

Note: The TF card cannot record all more than 16 alarm records that were simultaneously generated within 2 seconds.



**See the TF card data record:** After power off, remove the TF card and use a card reader or other device to plug it into the computer for reading.

The data log files included in the TF card are: Alarm (Alarm data), Energy (Timed recording energy data), Harmonic (Harmonic data), Maintain (Basic parameter data), Record (Timed recording electrical parameter data), SOE (Event log data),

APM800Config.ini (Parameter log file settings), Temperature (Temp&Humidity data) ReadMe.txt (Guide).

Note: If the system time is set incorrectly, the TF card will not be recognized.

① Alarm data: Open the Alarm folder. The folder contains subfolders named “Year\_Month” (For example: 2018\_02). The subfolder contains the .csv record file named “Alarm Type” (eg: Over THD. Csv), you can view the alarm data. The log file contains: date; time; alarm group; alarm type; alarm value; alarm status.

② View the timed energy record data: Open the Energy folder, and the folder contains the .csv record file (2018\_02.csv) named “Year\_Month” to view the timed energy record data. The log file contains: date; time; positive active energy; reverse active energy; inductive reactive energy; capacitive reactive energy; positive active energy in T1 period; positive active energy in T2 period; positive active energy in T3 period; positive active energy in T4 period.

**Note: The meter records 1 time energy data (primary side) by default for 1 hour. It also includes the positive active energy in each time period. The time interval can be set. The time interval unit is Hour.**

| Symbol | Content                    | Symbol  | Content                             |
|--------|----------------------------|---------|-------------------------------------|
| IMP    | Positive active energy     | IMP(T1) | Positive active energy in T1 period |
| EXP    | Reverse active energy      | IMP(T2) | Positive active energy in T2 period |
| EQL    | Inductive reactive energy  | IMP(T3) | Positive active energy in T3 period |
| EQC    | Capacitive reactive energy | IMP(T4) | Positive active energy in T4 period |

③ View harmonic data: Open the Harmonic folder, which contains subfolders named "Year\_Month" (For example: 2018\_03), and the subfolder contains a .csv log file named "Year\_Month\_Date" (eg :2018\_03\_31.csv), you can view harmonic data. The log file contains: date; time; three-phase phase-separated voltage, current total harmonic value (maximum, minimum); three-phase phase-separated voltage, total odd current harmonic, total even harmonic value (maximum, minimum) ); three-phase phase-separated voltage and current fractional harmonic values (maximum, minimum, recorded 2-63 harmonic data).

**Note: The meter records 1 time harmonic data (primary side) by default for 1 minute, the time interval can be set, and the time interval unit is minute.**

④ View the main parameter change record: Open the Maintain folder, the folder contains the "Maintain.csv" log file, you can view the parameter change record. The log file contains: date; time; parameter type (such as: primary side voltage and current value; secondary side voltage and current value; 485 communication address and baud rate); new parameter value.

⑤ View timed electrical parameter record data: Open the Record folder, which contains subfolders named “Year\_Month” (eg 2018\_03), and the subfolder contains the .csv log file named “Year\_Month\_Date” (Example: 2018\_03\_31.csv), you can view the timed electrical parameter record data. The log file is as follows:

**Note: The meter records 1 time electric parameter data (primary side) by default for 1 minute, the time interval can be set, and the time interval unit is minute.**

| Symbol | Content         | Symbol | Content               | Symbol  | Content                |
|--------|-----------------|--------|-----------------------|---------|------------------------|
| IA(A)  | Phase A current | UBC(V) | Phase BC line voltage | PT(W)   | Total active power     |
| IB(A)  | Phase B current | UCA(V) | Phase CA line voltage | QA(Var) | Phase A reactive power |

|             |                              |             |                              |         |                        |
|-------------|------------------------------|-------------|------------------------------|---------|------------------------|
| IC(A)       | Phase C current              | U_LL_AVG(V) | Average line voltage         | QB(Var) | Phase B reactive power |
| IN(A)       | Neutral current              | UA_UBL(%)   | Unbalance of Phase A voltage | QC(Var) | Phase C reactive power |
| I_AVG(A)    | Average current              | UB_UBL(%)   | Unbalance of Phase B voltage | QT(Var) | Total reactive power   |
| IA_UBL(%)   | Unbalance of Phase A current | UC_UBL(%)   | Unbalance of Phase C voltage | SA(VA)  | Phase A apparent power |
| IB_UBL(%)   | Unbalance of Phase B current | U_LN_UBL(%) | Unbalance of phase voltage   | SB(VA)  | Phase B apparent power |
| IC_UBL(%)   | Unbalance of Phase C current | UAB_UBL(%)  | Unbalance of AB line voltage | SC(VA)  | Phase C apparent power |
| I_UBL(%)    | Unbalance of current         | UBC_UBL(%)  | Unbalance of BC line voltage | ST(VA)  | Total apparent power   |
| UA(V)       | Phase A voltage              | UCA_UBL(%)  | Unbalance of CA line voltage | F(Hz)   | Frequency              |
| UB(V)       | Phase B voltage              | U_LL_UBL(%) | Unbalance of line voltage    | PFA     | Phase A power factor   |
| UC(V)       | Phase C voltage              | PA(W)       | Phase A active power         | PFB     | Phase B power factor   |
| U_LN_AVG(V) | Average phase voltage        | PB(W)       | Phase B active power         | PFC     | Phase C power factor   |
| UAB(V)      | AB line voltage              | PC(W)       | Phase C active power         | PF      | Total power factor     |

⑥View event log data: Open the SOE folder, which contains the .csv log file named "Year\_Month" (for example: 2018\_03.csv) to view the event log data. The log file contains: date; time; DIDO serial number; action type.

⑦Check the Temperature and humidity data: open the Temperature folder, folder containing "year \_ month \_ date" named. CSV record file (such as :2020\_03\_31. CSV), you can see the Temperature and humidity data.The record file contains: date;Time;Temperature and humidity measurement;Maximum and minimum.

**Note: The data in the TF card is read-only, and the file record data is excel. Please open it with Microsoft Office Excel07 version and above 07 version. If it is lower than Microsoft Office Excel07 version or WPS, there will be some data loss.**

## 7.5 System Settings

To set up the APM series meter, follow the instructions below:

- ① Press ◀ at the measurement screen until Menu is selected and press ENTER.
- ② Press ◀ until Set is selected and press ENTER.
- ③ Enter your password. The default password is 0001 and the universal password is 0008.
- ④ Select the parameters to be modified.

Modify the parameters as follows:

- ① When a value or character is selected, flashing indicates that it can be modified.
- ② 1) For values that do not need to distinguish ones, tens, hundreds, thousands, use the ◀ keys to change the currently selected value.  
2) To achieve the method to increase or decrease the value of ones, tens, hundreds, thousands, you need to press ◀ to select the bit that need to be modified, and press ▶ to change the value of the selected bit.
- ③ Press Enter to save the changes and move to the next area.
- ④ Press the SET button before saving, prompt for saving will appear. Press the left or right key to select yes/no. When you select yes, press Enter to save the setting parameters. When you select no, press Enter will not to save the setting parameters.

### 7.5.1 System Settings Overview (SET):

| First level            | Second level      | Third level  | Range  |
|------------------------|-------------------|--------------|--|
| Bus<br>(communication) | BUS 1 (First way) | Addr         | Address: 1-247   |
|                        |                   | Baud         | Baud rate: 1200, 2400, 4800, 9600, 19200, 38400  |
|                        |                   | Mode         | Mode: None 1sp (No parity, 1 stop bit)<br>None 2sp (No parity, 2 stop bits)<br>Odd 1sp (Odd check, 1 stop bit)<br>Even 1sp (Even parity, 1 stop bit) |
|                        | BUS2              | Same as BUS1 | Extended RS485 module  |
|                        | DLT 645           | Addr         | 645 Address: 0-999999999999  |
|                        | Profibus          | Addr         | Profibus Address: 1-127  |
| SYS (System)           | Rto.i             | I Pri        | Primary rated current: 1A-32760A   |
|                        |                   | I Scal       | =Pri*Scale (See current ratio setting)   |
|                        |                   | I Sec        | Secondary rated current rating: 1A, 5A   |
|                        |                   | In Pri       | Primary neutral rated current: 1A-32760A   |
|                        |                   | In Scal      | =Pri*Scal  |
|                        |                   | In Sec       | Secondary neutral rated current rating: 1A, 5A   |
|                        | Rto.u             | U Pri        | Primary rated voltage: 100V-1200kV   |
|                        |                   | U Scal       | =Pri*Scal  |
|                        |                   | U Sec        | Secondary rated voltage rating: 100V, 110V, 400V, 690V   |

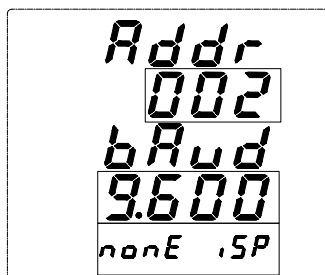
|                                   |  |       |  |
|-----------------------------------|--|-------|--|
|                                   | Line                                   |       | Wiring:<br>3P3W_3CT: Three-phase three-wire 3CT<br>3P3W_2CT: Three-phase three-wire 2CT<br>3P4W: Three-phase four-wire   |
|                                   | nom                                    | U.nom | Nominal value of secondary voltage,used to calculate voltage deviation   |
|                                   |  | F.nom | Nominal value of frequency used to calculate frequency deviation.  |
|                                   | Puls                                   |       | Pulse constant: 0-9999, see system setup section   |
| ALM (Alarm)                       | AL1                                    |       | The first group of alarms: see the alarm setting section for details.  |
|                                   | AL2                                    |       | The second group of alarms   |
| dMd<br>(Demand)                   | Wid                                    |       | Window sliding time: 1, 2, 3, 5 minutes  |
|                                   | Pd                                     |       | Period: 5-60 minutes   |
| Ubl<br>(Unbalance)                | Meth                                   |       | Calculation method of unbalance:<br>Absolute (Absolute value algorithm)<br>(The difference between the maximum value deviating from the average and average value) / average *100%<br>Rated (Rated algorithm)<br>If the average value of the denominator in the above equation is less than the rated value, the denominator is the rated value. |
| Di-o (Digital inputs and outputs) | DI                                     | Init  | Initial state: N-O (Normally open) / N-C (Normally closed)   |
|                                   |  | Init  | Initial state: N-O (Normally open) / N-C (Normally closed)   |
|                                   | DO                                     | TYPE  | ALM1 (Associated with alarm 1, see DO setting)<br>ALM2 (Associated with alarm 2, see DO setting)<br>COM (Communication control)  |
|                                   |  | DLY   | Effective when controlled by communication. When it is set to 0, it is the level control mode. If it is not 0, it is the pulse control mode. After the delay time is set, it will be disconnected. Unit: 1 second.   |
| Ai-o (Analog inputs and outputs)  | AI                                     | TYPE  | Input Type: 0-20mA, 4-20mA, 0-5V, 1-5V   |
|                                   |  | Dot   | Decimal point: 0-3   |
|                                   |  | High  | High value of display: 0-9999  |
|                                   |  | Low   | Low value of display: 0-9999   |
|                                   | AO                                     | TYPE  | Output Type: 0-20mA, 4-20mA, 0-5V, 1-5V  |
|                                   |  | SEL   | Select the corresponding signal, and see the analog output set.  |
|                                   |  | High  | Corresponding value of high point of analog output (Primary value)   |
|                                   |  | Low   | Corresponding value of low point of analog output (Primary value)  |
| ofs                               | Offset (Based on 16mA/4V)              |       |  |
| nET (Ethernet)                    | IP                                     |       | IP address   |
|                                   | SUB                                    |       | Subnet mask  |
|                                   | GATE                                   |       | Gateway  |
|                                   | PORT                                   |       | Port number: 1-9999  |
| Time                              | Minute, second,<br>year, month,<br>day |       | <b>See the time setting section</b>  |

|                        |      |       |  |
|------------------------|------|-------|--|
| PASS<br>(Password)     | set  |       | Password of parameter setting: 0-9999  |
|                        | rst  |       | Reset password: 0-9999   |
| LCD<br>(Backlight)     |      |       | 0: Always bright<br>Non-zero: After delaying the setted value, the backlight goes off in units of seconds. |
| WHD<br>(Temp&Humidity) | No X | H.dry | Heat to remove moisture, can set the temperature, Amount of hysteresis(Hys), delay (DLY).                  |
|                        |      | Heat  | Heating up, can set the temperature, Amount of hysteresis(Hys), delay (DLY).                               |
|                        |      | Fanc  | Air blast cooling, humidity can be set, Amount of hysteresis (Hys), delay (DLY).                           |

Hysteresis: In the process of temperature and humidity control, the difference between the temperature or humidity value of the actuator (heater or fan) when it starts working and the temperature or humidity value when it stops working is called hysteresis.

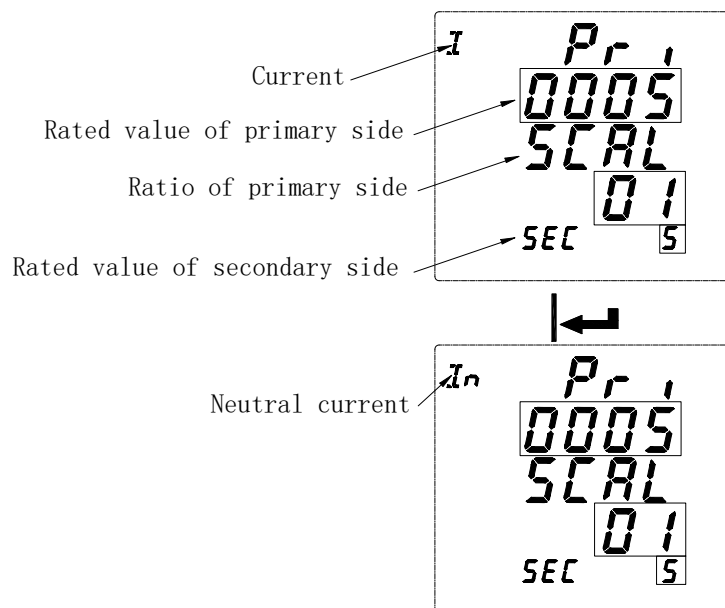
### 7.5.2 Communication settings

1. After entering setup mode (the same settings below), press **◀▶** until BUS is selected and press Enter.
2. Press the **◀▶** keys to select the communication parameters (bus1/bus2/DLT645/Profibus) and press the Enter key.
3. Set ADDR (communication address), range: 1-247 and press the Enter key.
4. Select bAUd (baud rate) and press the Enter key.
5. Select Mode (check mode and stop bit) and press the Enter key.
6. Press the SET button to return to the R485 BUS interface.



### 7.5.3 System setting (Current ratio)

1. Press **◀▶** until SYS is selected and press the Enter key.
2. Press **◀▶** until Rto.i is selected and press the Enter key.
3. Input the rated value of primary side current(I Pri) and press the Enter key.
4. Enter the ratio of primary side current (SCALE), optional \*01, \*10 times, used to set the primary side current greater than 9999A, the actual rated value of primary side current is Pri\*SCAL, If you need to set the primary side current to 10000A, you can set Pri=1000, SCAL=10;
5. Select the value of rated secondary side current (I Sec) and press the Enter key.
6. Enter the the rated value of primary side (In Pri), the ratio of primary side (SCAL), and the rated value of secondary side (In Sec) for the neutral current. Refer to steps 3, 4, and 5.



#### 7.5.4 Voltage ratio setting refers to current ratio setting

For example: If the current input is connected by external CT and the rated value is 40A/5A, set the rated value of primary side current to 40A, the scale value to 1, and the rated value of secondary current to 5A. Neutral current setting is the same. If the voltage input is connected by external PT and the rated value is: 6000V/400V, then set the rated value of the primary voltage to 6000V, the scale value to 1, and the rated value of secondary voltage to 400V.

#### 7.5.5 Pulse constant setting (Only APM801 can be set)

When the pulse constant is set to 0, the default is 8000 when the rated value of the secondary side current is 1A, and the default is 4000 when the rated value of the secondary side current is 5A. When the pulse constant is set to non-zero, the actual pulse constant is the setted value\*100. For example, if the set value is 50, the actual pulse constant is 5000.

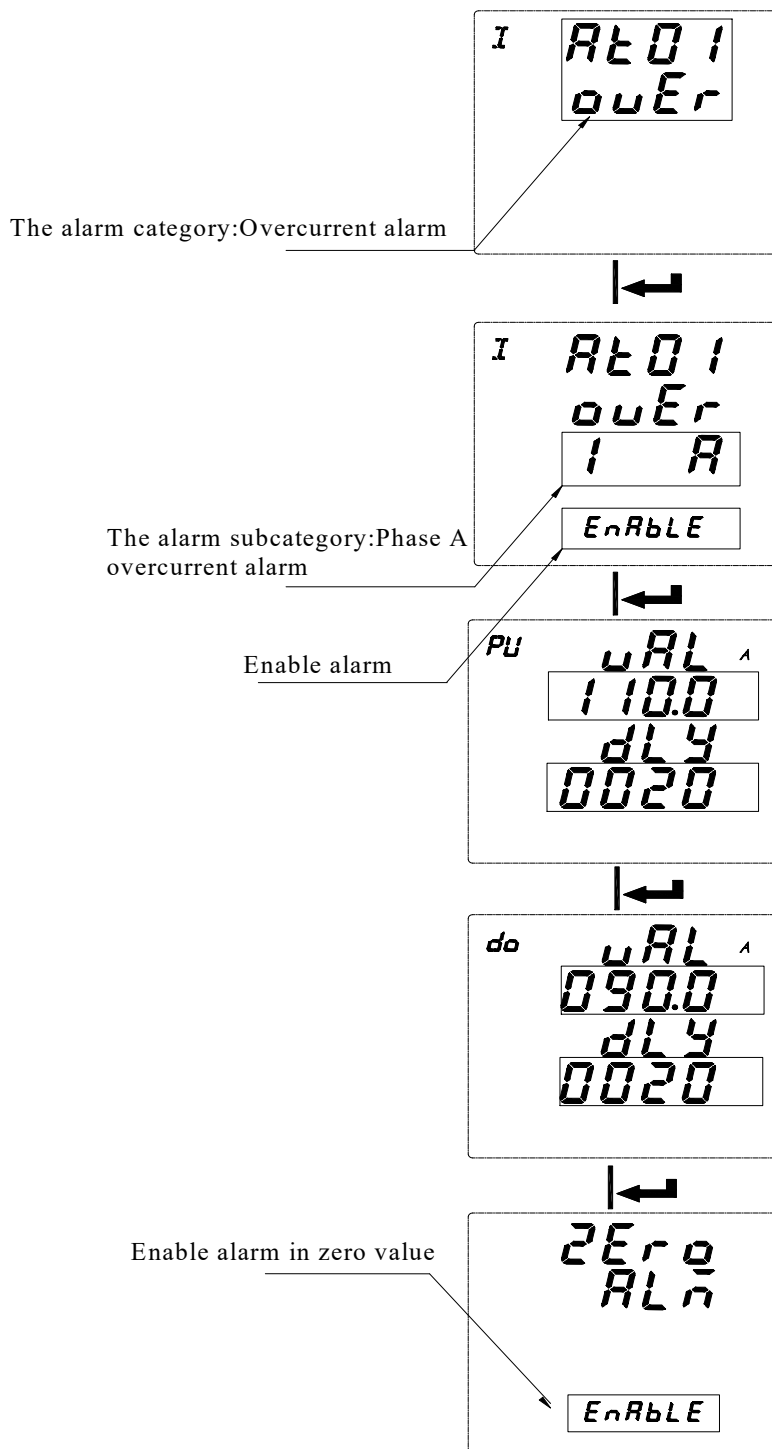
**Note:** ① The primary value must be greater than or equal to the secondary value.

② Only the APM801 can set the pulse constant.

#### 7.5.6 Alarm Settings

1. Press ◀ until ALM is selected and press the Enter key.
2. Press ▶ key to select the alarm group (a total of two groups of alarms) and press the Enter key.
3. Press the ◀▶ keys to select the alarm category (Refer to Table 2 of 7.4 Alarm View) and press the Enter key.
4. Under the alarm category, select the alarm subclass (Refer to Table 2 of 7.4 Alarm View) and press Enter key.
5. Enable selected alarm type (ENABLE or disable selected alarm type (DISABLE) and press the enter key.
6. Input the value of alarm action (primary value). For some parameters, you can set the negative value. Press the ◀▶ key at the same time to switch the positive and negative signs and press the enter key.
7. Enter the delay time of alarm action and press the enter key.

8. Enter the recovery value of alarm (primary value) and press the enter key.
9. Enter the delay time of alarm recovery and press the enter key.
10. Enable alarm in zero value (low value of alarm is effective) and press the enter key.
11. Return to the third step and make other alarm settings.
12. Press the SET button to return.



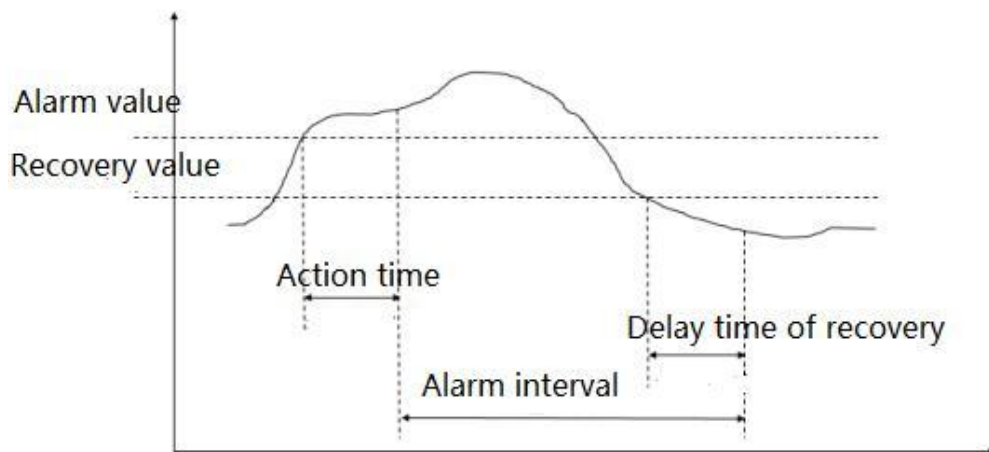
The parameter symbol description for settings



|                    | Indication area<br>symbol | Symbols of display area                        | Range           |
|--------------------|---------------------------|--|-----------------|
| Enable settings    |                           |  | ENABLE,DISABLE  |
| Parameter settings | PU (Pick Up)              | VAL (Alarm value)                              | 0-9999          |
|                    |                           | dLy (Alarm delay value, accurate to second)    | 0-9999          |
|                    | Do(Drop Out)              | VAL (Recovery value)                           | 0-9999          |
|                    |                           | dLy (Recovery delay value, accurate to second) | 0-9999          |
|                    |                           | ZERO ALM (Enable or disable zero alarm)        | ENABLE, DISABLE |

**Note: For high alarm types, the recovered value must be less than the alarm value. For low alarm types, the recovered value must be greater than the alarm value.**

The following is a schematic of how the meter handles alarm parameters.



#### Alarm description:

The meter has two groups of alarms. Each group of alarms can detect a variety of alarm conditions, including changes in the inputs of the electronic parameters, phase loss, reverse phase sequence, unbalance, and harmonics. The switch input and reverse phase sequence only need to set the enable bit, and other alarms need to set the alarm condition.

#### 7.5.7 Alarm Type Description

##### 7.5.7.1 Electric parameter alarm

**Overcurrent:** Zero alarm setting does not apply to overcurrent alarm. When the single phase current is greater than or equal to the action value and meets the set action delay time, the single phase overcurrent alarm starts; when the single phase current is lower than the set recovered value and meets the delay time. The single phase overcurrent alarm is released.

**Undercurrent:** When the single phase current is lower than or equal to the action value and meets the set action delay time, the single phase undercurrent alarm starts; when the single phase current is greater than the recovered value and meets the delay time, the single phase undercurrent alarm is released.

Note: When undercurrent alarm and zero alarm is enabled, single phase current is equal to 0, the alarm is valid; when

undercurrent is enabled and zero alarm is forbidden, when single phase current is equal to 0, the alarm is invalid.

#### 7.5.7.2 Phase current loss alarm

When any current (not all current) is equal to or lower than the action value and meets the delay time, phase A current loss alarm occurs; and when any of the following conditions occurs, the alarm is released:

The three-phase current is greater than the recovered value and meets the delay time

The three-phase current is lower than the phase loss action value.

#### 7.5.7.3 Reverse phase sequence alarm:

The values of action and recovery and delay time are not applicable to the reverse phase sequence alarm. When the phase sequence is not ABC normal phase sequence, an inverse phase sequence alarm is generated.

#### 7.5.7.4 DI alarm

When the DI state changes from the initial state, an alarm is generated.

Examples are as follows:

Set Phase A overcurrent alarm of the first group of alarm enabled.

Action value: The action value is a primary value. For example, if the alarm value is set to 5.500A, when Phase A current value exceeds 5.500A, the alarm condition is triggered and the timer starts.

Action delay time: When the alarm condition is triggered, if Phase A current value exceeds 5.500A, an alarm record will be generated after the setted delay time (accurate to the second), Alarm group (alarm 1), alarm type (Phase A overcurrent), alarm time (eg: 2017-5-12 14:15:20) will be recorded. If DO is associated with this alarm, the DO acts (see DO settings).

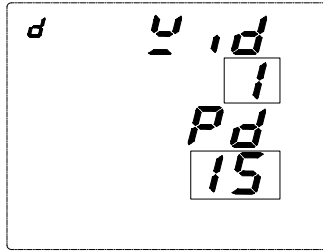
Recovered value: The recovered value is a primary value. For example, if the recovered value is set to 5.400A, after Phase A overcurrent alarm has occurred, when Phase A current value is lower than 5.400A, the released alarm condition is triggered and the timer starts. .

Recovered delay time: When the triggered alarm condition is released, if Phase A current value has been lower than 5.400A, the released alarm record will be generated after the setted delay time (accurate to second), and the alarm group (Alarm1), alarm type (Phase A overcurrent), the released alarm time (eg 2017-5-12 14:17:20) will be recorded. If DO is associated with this alarm, the DO returns to its initial state. It can be calculated that the alarm duration is 2 minutes.

**Note: The alarm is invalid when both the action value and the recovered value are zero.**

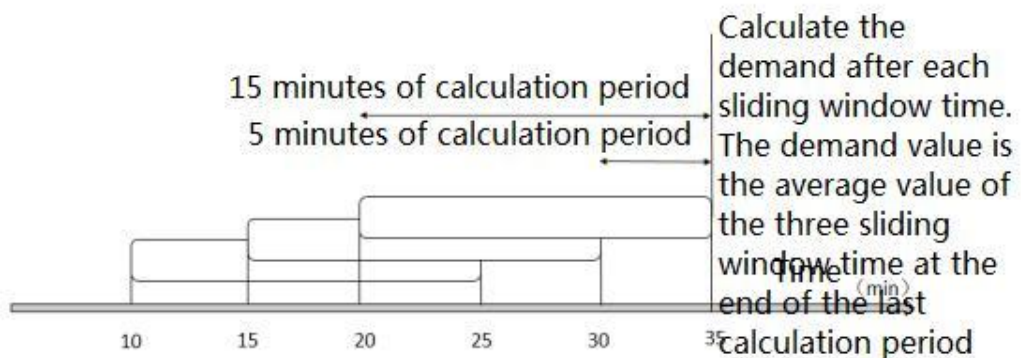
#### 7.5.8 Demand setting

1. Press ◀ until you select dMd and press the Enter key.
2. Set the window time (Wid) (1, 2, 3, 5) and press the Enter key.
3. Set the demand period (Pd) (1-60), which must be set to an integral multiple of the sliding window time and press the Enter key.
4. Press the SET button to return.



**Demand calculation method:**

APM series meters use the sliding window method to calculate the demand. In the sliding window calculation cycle, select a calculation period (Period) and a sliding window (Width). The calculation cycle of sliding window must be divided equally. For example, three 5-minute sliding windows (Wid = 5, Pd = 15) are set in a 15 minute calculation cycle. Refresh the current demand at the end of each sliding window. The schematic diagram is as follows:



**7.5.9 do settings**

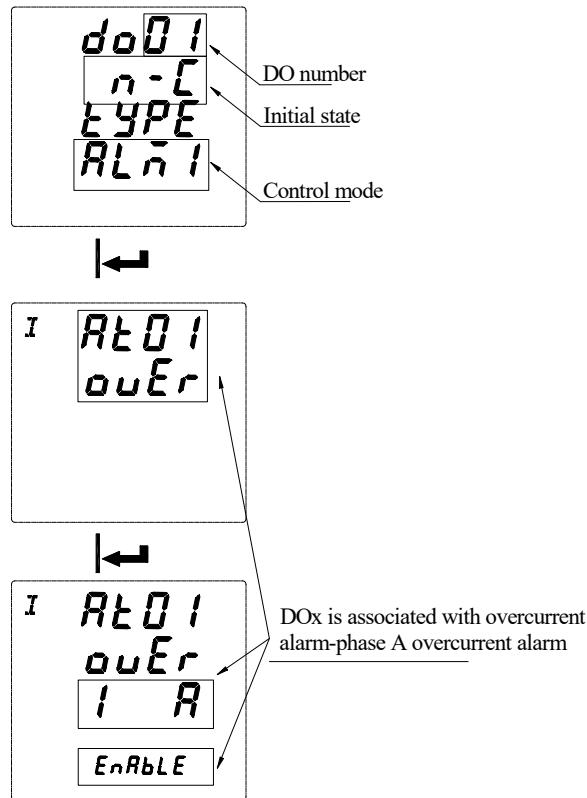
1. Press ◀ until dio is selected and press the Enter key.
2. Press ▶ until do is selected and press the Enter key.
3. Press the ◀▶ keys to select the do number (each main part contains 2 DO outputs and each MD82LOG module adds 2 DO outputs) and press the Enter key.
4. Press the ◀▶ keys to select Normally Open (N-O) or Normally Closed (N-C) and press the Enter key.
5. Press ▶ key to select the do output control mode. ALM1 (alarm group 1) and ALM2 (alarm group 2) are the alarm controls, and COM is the communication control. Press the Enter key.
6. 1) If you select the alarm (ALM1 or ALM2) control, press ▶ key to select the alarm category, press the Enter key. Select the alarm subclass, press the Enter key. Select whether to enable, press the Enter key. A DO can select multiple alarms for combined alarms.  
 2) If communication (COM) control is selected, modify the delay (DLY) time ranged 0-9999, unit 1 second. When it is set to 0, it is a level control. When it is not 0, it is a pulse mode control, and it is disconnected after the delay time is set.
7. Press the SET button to return.

**Note:**

- ① When the output control mode of do1 is selected as ALM (ALM1 or ALM2), and is not associated (DISABLE) with any alarm of ALM or associated with all alarms (ENABLE), When any alarm of this group (ALM1 or ALM2) is

generated , do1 will act.

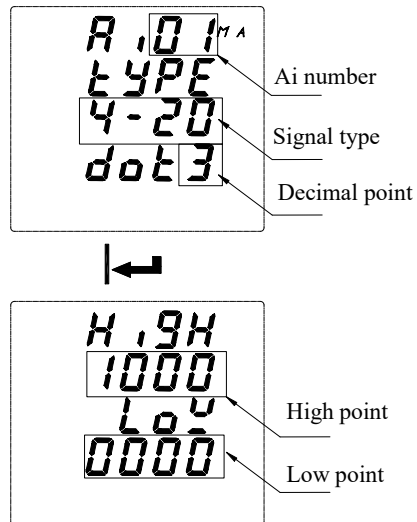
- ② When the output control mode of do1 is selected as ALM (ALM1 or ALM2) and associated (ENABLE) with Phase A overcurrent alarm and Phase A overpower alarm and not associated (DISABLE) with the other alarms. After the setting is completed, do1 acts when Phase A overcurrent or Phase A overpower alarm occurs.
- ③ Before selecting the alarm type associated with do, make sure that the alarm type is enabled in the alarm setting. If it is not enabled, the do does not act when this alarm condition occurs.



#### 7.5.10 Analog input setting (valid with analog module)

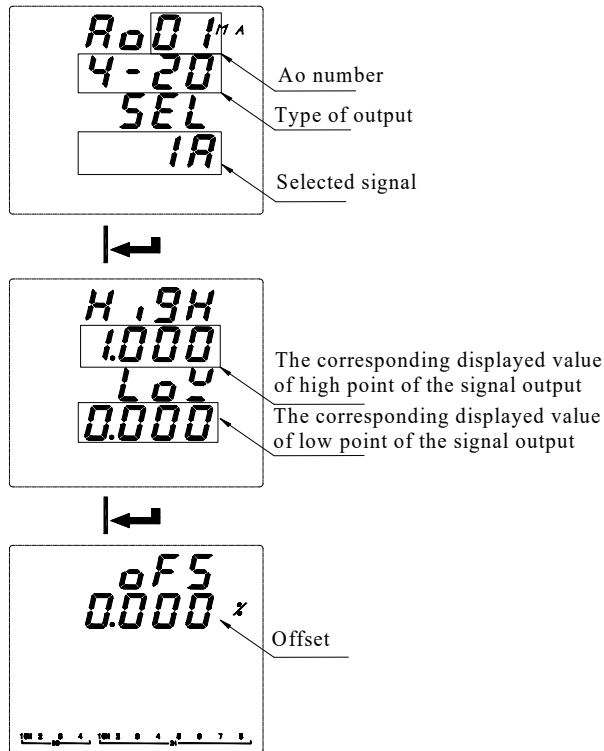
1. Press ◀ until Aio is selected and press the Enter key.
2. Press ◀ until Ai is selected and press the Enter key.
3. Press ◀ until the Ai channel to be modified is selected and press the Enter key.
4. Select the input type (make sure the input type is current input or voltage input, current input can choose 0-20mA, 4-20mA, voltage input can choose 0-5V, 1-5V). Press the Enter key.
5. Select the decimal point of display and press the Enter key.
6. Set the high value of the signal input corresponding to displayed value and press the Enter key.
7. Set the low value of the signal input corresponding to displayed value and press the Enter key.
8. Press the SET button to return.

For example: Ai1 is set to 4-20mA input and the decimal point is set to 1. The displayed value of high point of is set to 1000 and the displayed value of low point is set to 0. When the Ai1 signal input is 20mA, the displayed value is 100.0. When the signal input is 4mA, the displayed value is 0. When the signal input is 12mA, the displayed value is 50.0.



### 7.5.11 Analog output setting (Valid with analog module)

1. Press ◀ until Aio is selected and press the Enter key.
2. Press ▶ until Ao is selected and press the Enter key.
3. Press ▶ until the Ao channel to be modified is selected and press the Enter key.
4. Select the output type and press the Enter key.
5. Select the output corresponding signal (see Table 3) and press the Enter key.
6. Set the actual value of high point of the output corresponding to the signal and press the Enter key.
7. Set the actual value of low point of the output corresponding to the signal and press the Enter key.
8. Output offset, as a percentage of the reference value of 16mA (current output) or 4V (voltage output) and press the Enter key.
9. Press the SET button to return.



**Table 3: Output Signals**

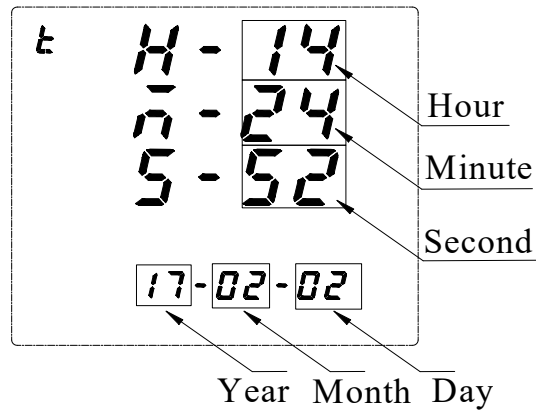
| No. | Symbol | Instruction           | No. | Symbol | Instruction            |
|-----|--------|-----------------------|-----|--------|------------------------|
| 0   | IA     | Phase A current       | 13  | QA     | Phase A reactive power |
| 1   | IB     | Phase B current       | 14  | QB     | Phase B reactive power |
| 2   | IC     | Phase C current       | 15  | QC     | Phase C reactive power |
| 3   | UA     | Phase A voltage       | 16  | QT     | Total reactive power   |
| 4   | UB     | Phase B voltage       | 17  | SA     | Phase A apparent power |
| 5   | UC     | Phase C voltage       | 18  | SB     | Phase B apparent power |
| 6   | UAB    | Phase AB line voltage | 19  | SC     | Phase C apparent power |
| 7   | UBC    | Phase BC line voltage | 20  | ST     | Total apparent power   |
| 8   | UCA    | Phase CA line voltage | 21  | PFA    | Phase A power factor   |
| 9   | PA     | Phase A active power  | 22  | PFB    | Phase B power factor   |
| 10  | PB     | Phase B active power  | 23  | PFC    | Phase C power factor   |
| 11  | PC     | Phase C active power  | 24  | PF     | Total power factor     |
| 12  | PT     | Total active power    | 25  | F      | Frequency              |

For example:

When Ao1 is set to 4-20mA output, the signal is selected as IA (Phase A current), the corresponding signal of output high point is 5.000A, and the corresponding signal of output low point is 0.000A. When Phase A current value is 5A, Ao1 output is 20mA; when Phase A current value is 0A, Ao1 output is 4mA; when Phase A current value is 2.5A, Ao1 output is 12mA. If the actual output is 3.99mA at 0A, then the offset can be set to  $(4-3.99)/16 = 0.062\%$  to make the zero output be 4mA.

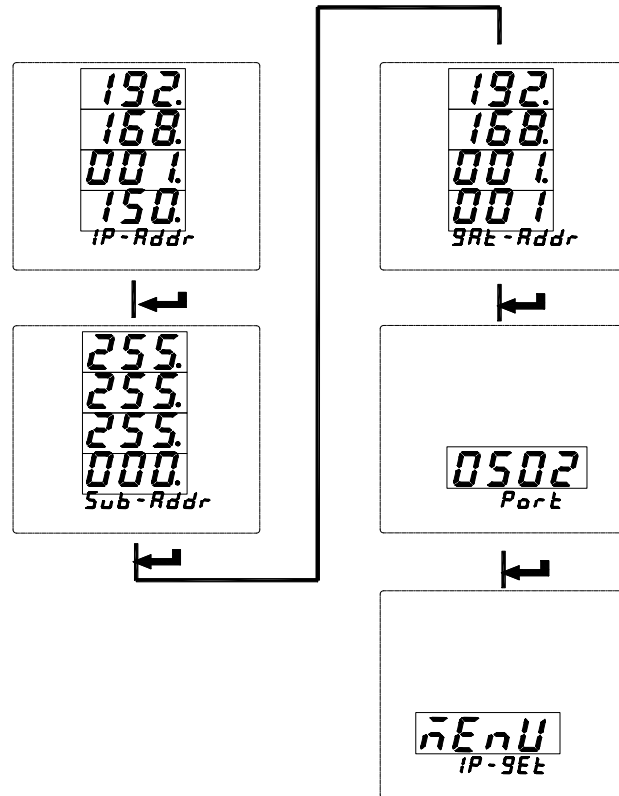
### 7.5.12 Time setting

1. Press **◀▶** until Time is selected and press the Enter key.
2. Set hour (H), press the Enter key.
3. Set minute (M), press the Enter key.
4. Set second (S), press the Enter key.
5. Set year and press the Enter key.
6. Set month and press the Enter key.
7. Set day and press the Enter key.
8. Press the SET button to return.



### 7.5.13 Network settings

1. Press **◀▶** until NET is selected and press the Enter key.
2. Enter the IP address and press the Enter key.
3. Enter the Subnet Mask (SUB) address and press the Enter key.
4. Enter the gateway address (GAT) and press the Enter key.
5. Enter the port address and press the Enter key.
6. Set the acquisition mode of IP address, MANU for manual acquisition, DHCP for automatic acquisition, press the Enter key.
7. Press the SET button to return.



#### 7.5.14 Setting of temp&humidity controlling

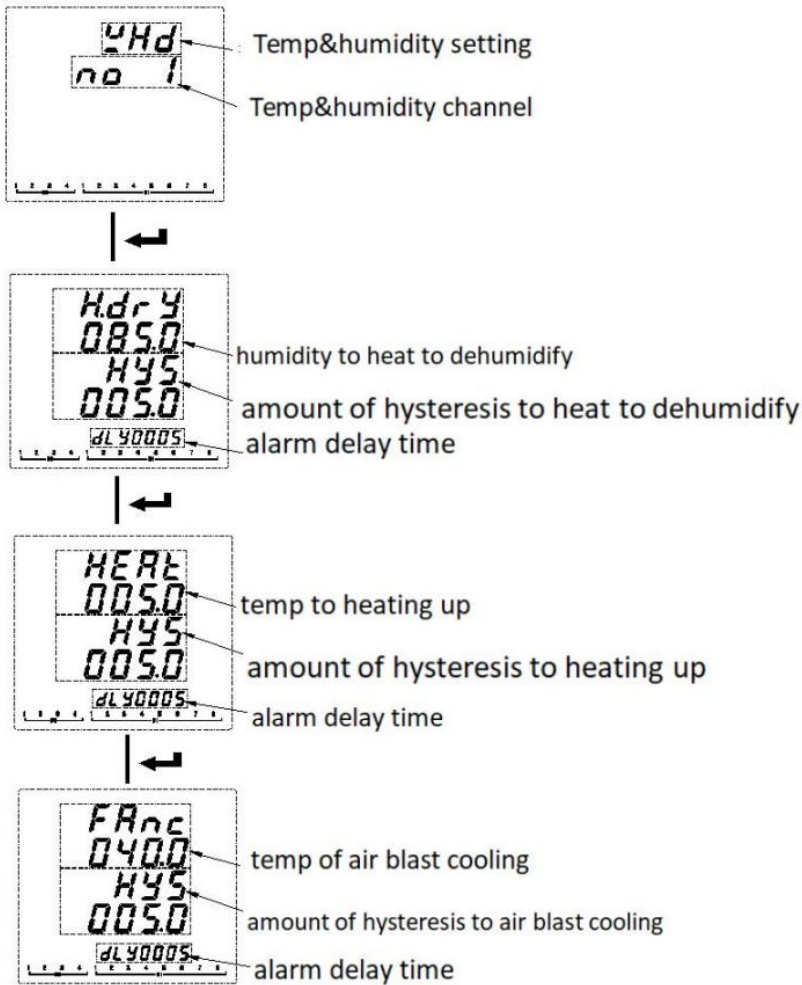
1. Press < ▶ > Key until WHD is selected, press < ENTER > key.
2. Input temperature and humidity channel to modify, press < ENTER > key.
3. Input the humidity to heat to dehumidify, press < ENTER > key.
4. Input amount of hysteresis to heat to dehumidify, press < ENTER > key.
5. Input alarm delay time of heating to dehumidify, press < ENTER > key.
6. Input temp to heating up, press < ENTER > key.
7. Input amount of hysteresis to heating up, press < ENTER > key.
8. Input alarm delay time of heating up, press < ENTER > key.
9. Input temp of air blast cooling, press < ENTER > key.
10. Input amount of hysteresis to air blast cooling, press < ENTER > key.
11. Input alarm delay time of air blast cooling, press < ENTER > key.

Note: Actual temperature > blowing air cooling value, open the blowing air;

Actual temperature < heating up value, open heating;

Actual humidity > heating dehumidification value, turn on heating.





### 7.5.15 Recording configuration of TF card

1. Insert the TF card into the computer, find the corresponding drive letter and open it.
2. Double-click to open APM800Config.ini.
3. [INTERVAL] is a configuration area of sampling interval.

Parameter (minute), indicates the recording interval of electrical parameter in minutes and range (1-30).

Energy (hour), indicates the recording interval of energy in hours and range (1-12).

[PARAMETER] is the configuration area to record the electrical parameter. For example: IA=1 means to record Phase A current, IA=0 means not to record Phase A current.

[ENERGY] is the configuration area to record energy configuration. For example: IMP = 1 means to record absorbed active energy, and IMP = 0 means not to record absorbed active energy.

4. Save after configuration is complete.

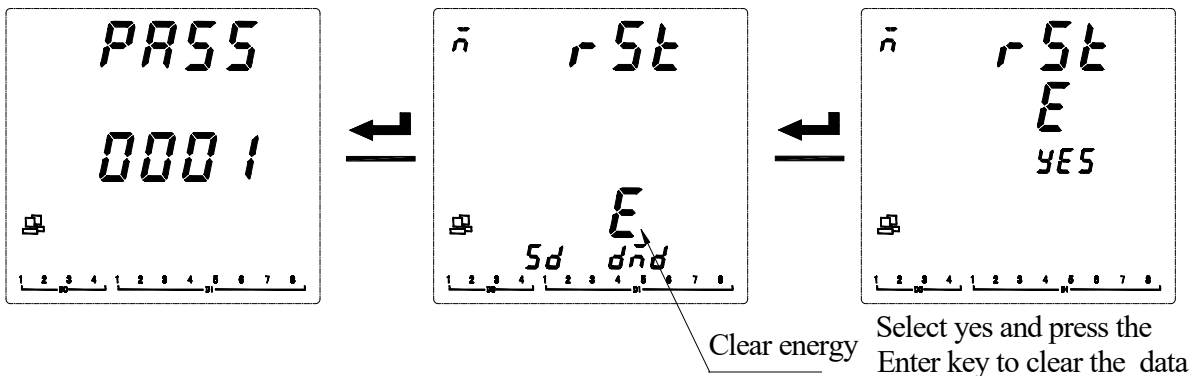
## 7.6 Resetting data

In order to reset the data of APM series meter, please follow the instructions below:

- ① Press **▶** at the measurement screen until Mune is selected and press the ENTER key.
- ② Press **▶** until Rst is selected and press the ENTER key.
- ③ Enter your password. The default password is 0001 and the universal password is 0008.
- ④ Select the data to be reset and press the ENTER key. Refer to the following table.
- ⑤ Press left or right key to select yes to clear the corresponding data, and select no to cancel.

| Symbol | Instruction               |
|--------|---------------------------|
| E      | Clear energy              |
| dMd    | Clear demand              |
| ALM    | Clear alarm records       |
| SOE    | Clear event records       |
| MIMX   | Clear maximum and minimum |
| SD     | Format TF card            |

The following is an example of clearing energy:



## 8. Ethernet Communication Guide

### 8.1 Ethernet Parameter Modification

#### 8.1.1 Modification by Button

Refer to 7.5 Network Settings of System Settings

#### 8.1.2 Modification by Modbus Communication

Follow these steps to modify the Ethernet parameters:

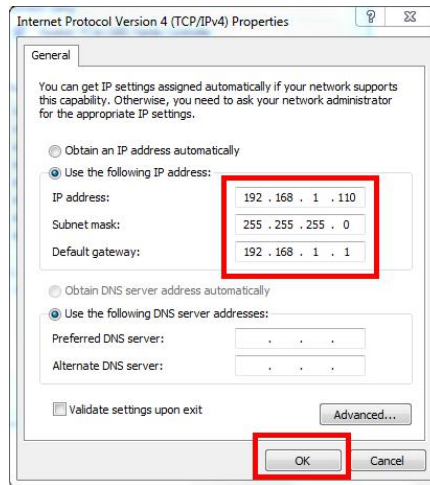
- 1) Send the command 0xABCD to the register with the address 29 to enter the Ethernet setting mode; Send the command 0 to the register with the address 29 to exit the Ethernet setting mode, and the modified parameters are not saved at this time.
- 2) The new value can be written to the register after entering the Ethernet setting mode. If the Ethernet mode is not entered, the modification is invalid.
- 3) Send the command 0XABCD to the the register with the address 37 to save the changes. After it is written successfully, the Ethernet module enters the restart mode. After the Ethernet module restarts successfully, the host can read the Ethernet

parameters correctly.

### 8.1.3 Modification by Web Pages

#### Local network settings

Firstly, enter the operating system (take win7 as an example), use the mouse to click on the network icon on the bottom right corner, click on "Open Network and Sharing Center", click on the change adapter settings, right-click the local connection, click properties, double-click Internet Protocol Version 4 (TCP / IPv4 ), you will see the page shown below. Please follow the instructions, select "Use the following IP address", and fill in the IP address 192.168.1.110 (the same subnet), the subnet mask 255.255.255.0, the default gateway 192.168.1.1 (The DNS part can be left blank). Click OK on the page and click OK on the Local Area Connection Properties page to wait for system to complete configuration.



Connect the Ethernet module and the computer with a twisted-pair B cable, power the meter. If the local connection on the bottom right corner of the computer monitor is connected at this point, you can continue to the next step. Otherwise, power off the meter, check the network cable and network settings.

#### WEB page configuration

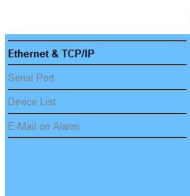
Open Internet Explorer, enter the Ethernet IP address in the address bar (<http://192.168.1.150/>, factory default setting), and the login screen shown in the figure below will appear.



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| Parameter                  | Minimum | Present | Maximum |
|----------------------------|---------|---------|---------|
| <b>Load Current (A)</b>    |         |         |         |
| Ia                         | 0.000   | 0.000   | 0.000   |
| Ib                         | 0.000   | 0.000   | 0.000   |
| Ic                         | 0.000   | 0.000   | 0.000   |
| <b>Voltage, L-N(V)</b>     |         |         |         |
| Ua                         | 0.0     | 0.0     | 0.0     |
| Ub                         | 0.0     | 0.0     | 0.0     |
| Uc                         | 0.0     | 0.0     | 0.0     |
| <b>Voltage, L-L(V)</b>     |         |         |         |
| Uab                        | 0.0     | 0.0     | 0.0     |
| Ubc                        | 0.0     | 0.0     | 0.0     |
| Uca                        | 0.0     | 0.0     | 0.0     |
| <b>Power Real (W)</b>      |         |         |         |
| Pa                         | 0.05    | 0.05    | 0.05    |
| Pb                         | 0.05    | 0.05    | 0.05    |
| Pc                         | 0.05    | 0.05    | 0.05    |
| PT Power                   | 0.05    | 0.05    | 0.05    |
| <b>Reactive (VAR)</b>      |         |         |         |
| Qa                         | 0.05    | 0.05    | 0.05    |
| Qb                         | 0.05    | 0.05    | 0.05    |
| Qc                         | 0.05    | 0.05    | 0.05    |
| QT                         | 0.05    | 0.05    | 0.05    |
| <b>Power Apparent (VA)</b> |         |         |         |
| Sa                         | 0.05    | 0.05    | 0.05    |
| Sb                         | 0.05    | 0.05    | 0.05    |
| Sc                         | 0.05    | 0.05    | 0.05    |
| ST                         | 0.05    | 0.05    | 0.05    |
| <b>Power Factor</b>        |         |         |         |
| PFa                        | 0.000   | 1.000   | 1.000   |
| PFb                        | 0.000   | 1.000   | 1.000   |
| PFc                        | 0.000   | 1.000   | 1.000   |
| PF                         | -0.400  | 1.000   | 1.000   |
| Frequency (Hz)             | 0.00    | 0.00    | 0.00    |

Click Setup to enter the Ethernet & TCP/IP configuration interface, as shown below:



**Ethernet & TCP/IP**

MANUAL
  DHCP

|                  |     |     |     |     |
|------------------|-----|-----|-----|-----|
| IP Address:      | 192 | 168 | 1   | 150 |
| Subnet Mask:     | 255 | 255 | 255 | 0   |
| Default Gateway: | 192 | 168 | 1   | 1   |

After the modification is completed, click Apply to wait for it to take effect.

## 8.2 Extension of RS485 Communication

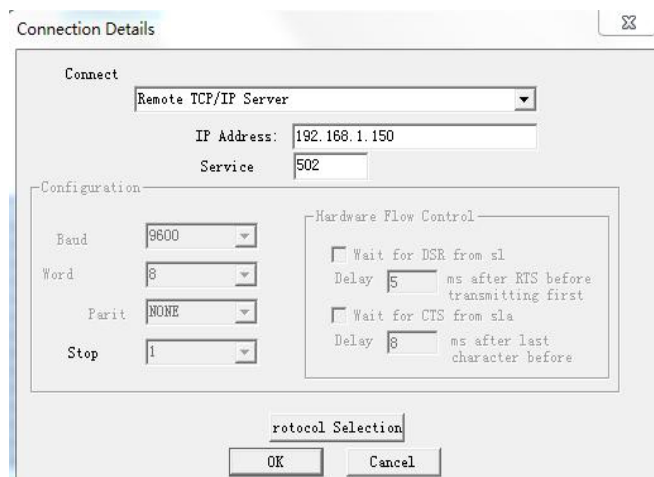
Extended 485 communication does not support the DLT-645 protocol and only supports the Modbus-RTU protocol.

### 8.2.1 Extending RS485 Communication as a Modbus Slave Station

When the second communication serves as a slave station, as the first channel RS485 communication, only supports the 0x03 command and does not support the 0x10 command. Refer to Chapter 8 for the address table.

### 8.2.2 Modbus TCP communication (Using ModScan software)

When using the Ethernet Modbus\_TCP protocol, it supports 0x01 (read coil status), 0x02 (read input status), 03 (read hold register), 0x05 (write single coil). (Note: When using the 01, 02, and 05 commands, they all correspond to the APM8xx meter's own information. DI1 and DO1 correspond to the starting address 0.)



The contents of the following address table are for Modbus TCP operation only. (Related to the slave information read by the user)

| Register (WORD) | Name                                     | Resolution | Data type (Read-write attribute) | Note   |
|-----------------|--|------------|----------------------------------|--|
| 39992-39993     | Group 32-1 slave status                  |            | Int32 (RO)                       | The high byte is first, the low byte is after, bit0 is the first group state, and 1 is the read failure, and the corresponding cache is cleared. |
| 39994-39995     | Group 64-33 slave status                 |            | Int32 (RO)                       | The same as above  |
| 39996-39997     | Group 96-65 slave status                 |            | Int32 (RO)                       | The same as above  |
| 39998-39999     | Group 128-97 slave status                |            | Int32 (RO)                       | The same as above  |
| 40000-57999     | Information area read from slave station |            | RO                               | Example is as follow   |
| 58000           | Read slave station timeout               | 1ms        | UInt16(RW)                       | Example is as follow   |
| 58001           | Slave station access interval time       | 1ms        | UInt16(RW)                       | Example is as follow   |
| 58002           | Group 1 slave station address            |            | UInt16(RW)                       | 1-247 (Slave address station, does not take effect when set to 0)  |
| 58003           | Group 1 communication start address      |            | UInt16(RW)                       | 0-65535  |
| 58004           | Group 1 communication length             |            | UInt16(RW)                       | (Does not take effect when set to 0)   |
| 58005-58385     | Group 2-128 slave station settings       |            | UInt16(RW)                       | Same as 58002-58004  |
| 58386-58399     | Reserved                                 |            |                                  |  |
| 58400-58527     | Failure rate                             |            | UInt16(RO)                       | Communication reads state of each group, the slave access failure rate of last 20 visits, 100% means the disconnection and clear cache           |
| 58600-58728     | Number of errors                         |            | UInt16(RO)                       | The cumulative number of failures used to debug slave access   |
| 58800-58928     | Number of transmissions                  |            | UInt16(RO)                       | The cumulative number of transmissions used to debug slave access  |

E. g:

The settings are as follows: The first group slave **station** address is 1, the start address is set to 0, the communication length is 125, the second group slave **station** address is 2, the start address is 20, and the communication length is 125, the read information area 40000-40124 corresponds to the information of the first group of slave **station** addresses 0-125, 40125-40249 corresponds to the information of the second group of slaves **station** 20-144, and so on, when the communication length of the 128 groups of devices is 125, the corresponding information area is 40000 -55999. If fail to read the information from the slave station, the read information area corresponding to the slave station is 0.

| Baud rate (bps) | Read slave station timeout<br>(Recommended setting time) | Slave station access interval time<br>(recommended setting time) |
|-----------------|--|--|
| 1200            | 2500ms   | 10-20ms  |
| 2400            | 2000ms   | 10-20ms  |
| 4800            | 1500ms   | 10-20ms  |
| ≥9600           | 1000ms   | 10-20ms  |

### 8.2.2 Extending RS485 Communication as modbus Master

When the extended communication is used as a master station, a small serial port server can be implemented in conjunction with the Ethernet interface.

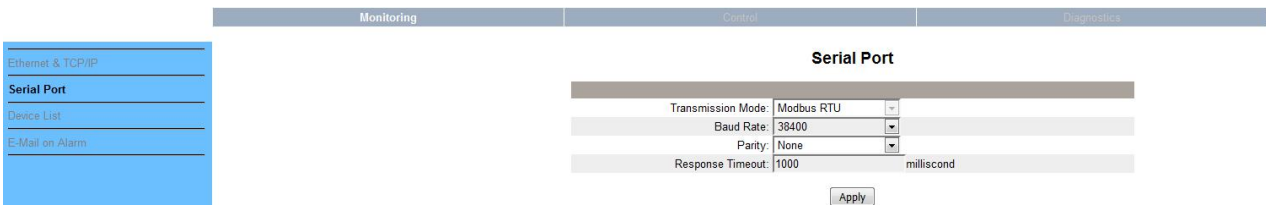
#### Extended serial port parameter configuration

##### Method 1:

Refer to bus1 in the communication settings of 7.5 system settings to modify the parameters of bus2.

##### Method 2:

According to the operation method of 9.1.3, after connecting the Ethernet module, click Setup->Serial Port to enter the serial port setting, and set the baud rate, check digit and response time. Click Apply when you are done to wait for it to take effect. As shown below:



#### Modbus master parameter reading

According to the operation method of 9.1.3, after connecting the Ethernet module, click Setup->Device List to enter the Modbus master parameter reading, as shown below.

1. Number of Viewable: Users can configure up to 128 groups of 03 read commands of slaves.
2. Local ID: Meter Slave Address
3. Starting Register: Start Register Address
4. Number Of Register: The length of the register.

**Note:** If you need to modify the above parameters, please refer to 9.2.2 to modify the settings with the corresponding address by Modbus-TCP. After the 9.2.2 setting is completed, click Device List to refresh again.

The module will read the data from the slave according to this configuration. The read data is stored in registers starting with address 40000, which can be read by Modbus-Tcp.

For example: Read by Modbus-Tcp, the first one is to read 10 data starting from register 0 with slave address 1 and read 40000-40009, the second is to read 10 data starting from register 0 with slave address 2, read 40010-40019, and so on.

| Monitoring         |                   |  | Control |  |  | Diagnostics                      |  |                     |
|--------------------|-------------------|--|---------|--|--|----------------------------------|--|---------------------|
| Ethernet & TCP/IP  |                   |  |         |  |  |                                  |  |                     |
| Serial Port        |                   |  |         |  |  |                                  |  |                     |
| <b>Device List</b> |                   |  |         |  |  |                                  |  |                     |
| E-Mail on Alarm    |                   |  |         |  |  |                                  |  |                     |
|                    |                   |  |         |  |  | Number of Viewable Devices: 16 ▾ |  |                     |
| Local ID           | Starting Register |  |         |  |  |                                  |  | Number Of Registers |
| 1                  | 0                 |  |         |  |  |                                  |  | 10                  |
| 2                  | 0                 |  |         |  |  |                                  |  | 10                  |
| 3                  | 0                 |  |         |  |  |                                  |  | 10                  |
| 4                  | 0                 |  |         |  |  |                                  |  | 10                  |
| 5                  | 0                 |  |         |  |  |                                  |  | 10                  |
| 6                  | 0                 |  |         |  |  |                                  |  | 10                  |
| 7                  | 0                 |  |         |  |  |                                  |  | 10                  |
| 0                  | 0                 |  |         |  |  |                                  |  | 0                   |
| 0                  | 0                 |  |         |  |  |                                  |  | 0                   |
| 0                  | 0                 |  |         |  |  |                                  |  | 0                   |
| 0                  | 0                 |  |         |  |  |                                  |  | 0                   |
| 0                  | 0                 |  |         |  |  |                                  |  | 0                   |
| 0                  | 0                 |  |         |  |  |                                  |  | 0                   |
| 0                  | 0                 |  |         |  |  |                                  |  | 0                   |
| 0                  | 0                 |  |         |  |  |                                  |  | 0                   |
| 0                  | 0                 |  |         |  |  |                                  |  | 0                   |
| 0                  | 0                 |  |         |  |  |                                  |  | 0                   |
| 0                  | 0                 |  |         |  |  |                                  |  | 0                   |
| 0                  | 0                 |  |         |  |  |                                  |  | 0                   |
| 0                  | 0                 |  |         |  |  |                                  |  | 0                   |
| 0                  | 0                 |  |         |  |  |                                  |  | 0                   |

### 8.3 Modbus\_TCP Communication Example (Using ModScan Software)

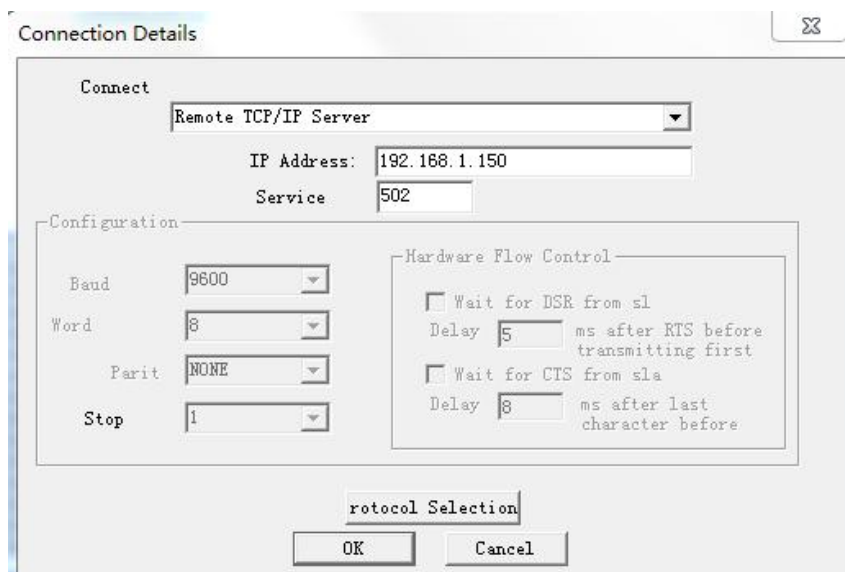
When using the Ethernet Modbus\_TCP protocol, only the 03 (read holding register) command is supported.

Open the ModScan32 software and set it as shown below. Click Connect and select Remote TCP/IP Server.

IP Address: The IP address of the Ethernet module (eg 192.168.1.150)

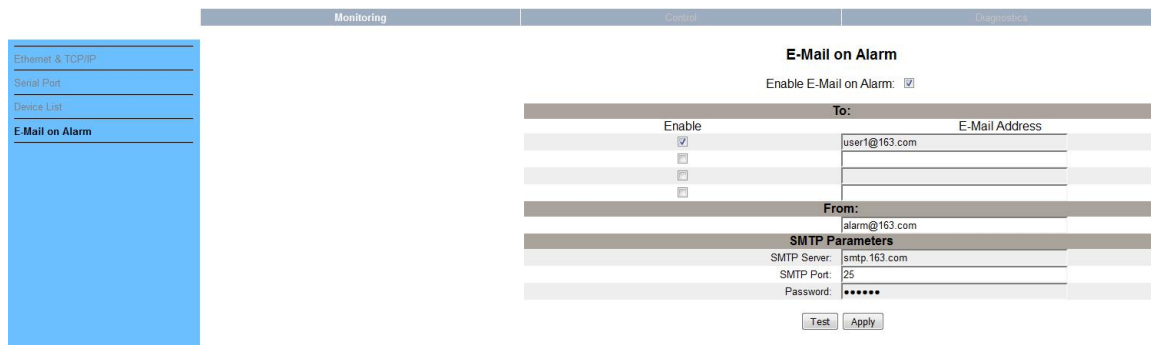
Service: Port number 502

Click OK button.



### 8.4 Mail Setting

The user can receive alarm notifications via email. According to the operation method of 8.1.3, after connecting the Ethernet module, click Setup->E-Mail on Alarm to enter the email setting. The user need to set up a sending email (From:alarm@163.com as shown below) and a password (Password), up to four receiving emails (To:user1@163.com as shown below) and email server settings, email server address and port settings can be found at the email service provider website. As shown in the following figure, user1@163.com will receive an alarm notification email from alarm@163.com when an alarm occurs.



## 9. Analysis of common fault

| Fault content                            | Analysis  | Note |
|--|---|------|
| No display on power                      | Check whether the power supply voltage is in the working voltage range.   |      |
| Incorrect reading of voltage and current | Check the rated voltage and current of the primary side and secondary side is correct.<br>Check whether the wiring mode setting is consistent with the actual wiring.<br>Check voltage transformer, current transformer is in good condition.   |      |
| Incorrect power or power factor          | Check whether the wiring mode setting is consistent with the actual wiring.<br>Check the voltage and current phase sequence is correct.   |      |
| Communication is abnormal                | Check whether the address, baud rate, parity, etc. in the communication settings are consistent with the host computer.<br>Check the RS485 converter is normal.<br>Parallel over 120 Ω resistance at the end of communication.  |      |
| Ethernet communication is abnormal       | Check whether the IP address, subnet mask, gateway address, and port number settings are correct.<br>Check whether the host computer and the meter network address is the same network segment  |      |
| The extended module flashes red          | As with the TF card, check if the TF card is loose or damaged (view in communication or display).<br>Check whether the meter time is accurate. If the meter system time is set incorrectly, the TF card will not be read.<br>If there is still a malfunction and the fault is not eliminated after the meter is restarted, it is necessary to return to the factory for repair. |      |
| The thermometer reads 0 or -100          | Check whether the module wiring is correct  |      |



# Modbus-TCP/IP

## 1. General communication architecture

A communicating system over MODBUS TCP/IP may include different types of device:

- A MODBUS TCP/IP Client and Server devices connected to a TCP/IP network.
- The Interconnection devices like bridge, router or gateway for interconnection between the TCP/IP network and a serial line sub-network which permit connections of MODBUS Serial line Client and Server end devices.

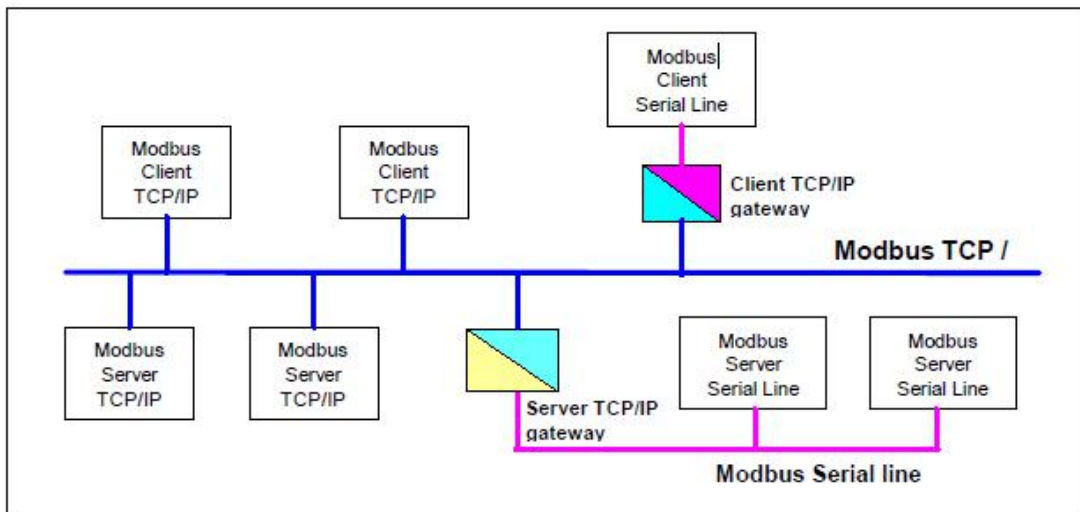


Figure 1: MODBUS TCP/IP communication architecture)

The MODBUS protocol defines a **simple Protocol Data Unit (PDU)** independent of the underlying communication layers. The mapping of MODBUS protocol on specific buses or networks can introduce some additional fields on the **Application Data Unit (ADU)**.

The client that initiates a MODBUS transaction builds the MODBUS Application Data Unit. The function code indicates to the server which kind of action to perform.

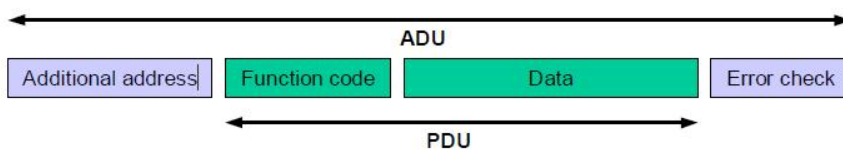
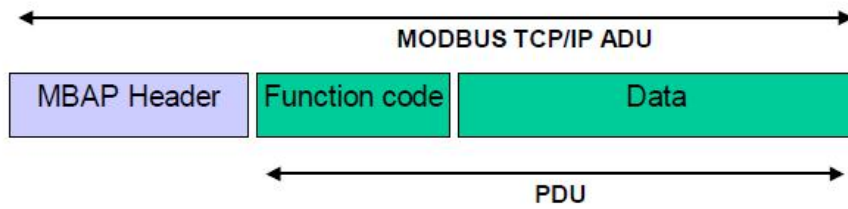


Figure 2: General MODBUS frame

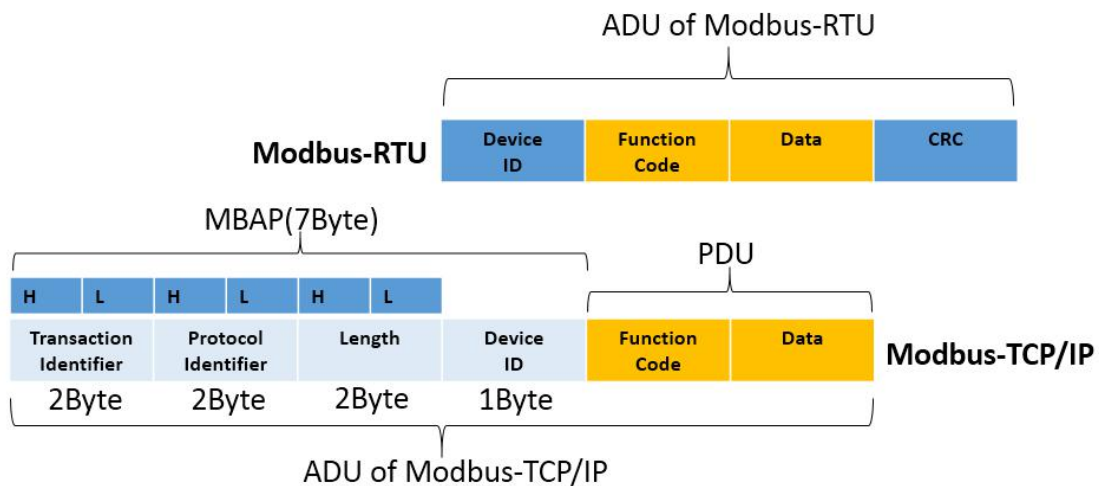
## 2. MODBUS On TCP/IP Application Data Unit

This section describes the encapsulation of a MODBUS request or response when it is carried on a MODBUS TCP/IP network.



**Figure 3:MODBUS request/response over TCP/IP**

A dedicated header is used on TCP/IP to identify the MODBUS Application Data Unit. It is called the MBAP header (MODBUS Application Protocol header)



**Figure 4:The differences of modbus frame between Modbus TCP/IP and Modbus RTU**

### 3. MBAP Header descriptio

The MBAP Header contains the following fields:

| Fields                 | Length | Description   | Client                               | Server   |
|------------------------|--------|---|--------------------------------------|--|
| Transaction Identifier | 2Byte  | Identification of a MODBUS Request / Response transaction                     | Initialized by the Client            | Recopied by the server from the received request |
| Protocol Identifier    | 2Byte  | 0x00:MODBUS protocol  | Initialized by the client            | Recopied by the server from the received request |
| Length                 | 2Byte  | Number of following bytes   | Initialized by the client ( request) | Initialized by the server (Response)             |
| Device ID              | 1Byte  | Identification of a remote slave connected on a serial line or on other buses | Initialized by the client            | Recopied by the server from the received request |

**The header is 7 bytes long:**

**Transaction Identifier:**It is used for transaction pairing, the MODBUS server copies in the response the transaction identifier of the request.

**For example:** Client may create the transaction identifier in sequence from 0x0001(0x00(H) 0x01(L)).

**Protocol Identifier:** It is used for intra-system multiplexing. The MODBUS protocol is identified by the value 0x00.

**Length:** The length field is a byte count of the following fields, including the Device ID and data fields.

**For example:** If a client wants to read several holding registers (function code 0x03), then the length will be 0x0006 (Byte) including device ID (1 Byte), function code (1 Byte), start address (2 Bytes), number of registers (2 Bytes).

**Device ID:** This field is used for intra-system routing purposes. It is typically used to communicate to a MODBUS or a MODBUS+ serial line slave through a gateway between an Ethernet TCP-IP network and a MODBUS serial line. This field is set by the MODBUS Client in the request and must be returned with the same value in the response by the server. **For example:** If the device ID of the meter is 1, then the byte of device ID should be 0x01.

**All Modbus/TCP ADU are sent via TCP on registered port 502.**

#### 4. Example


In this case we will use the TCP communication tool to show how to establish a connection from the computer to the power meter. In this scenario, the power meter is the server. Make sure the settings of Ethernet parameters in the meter are the same as the following:

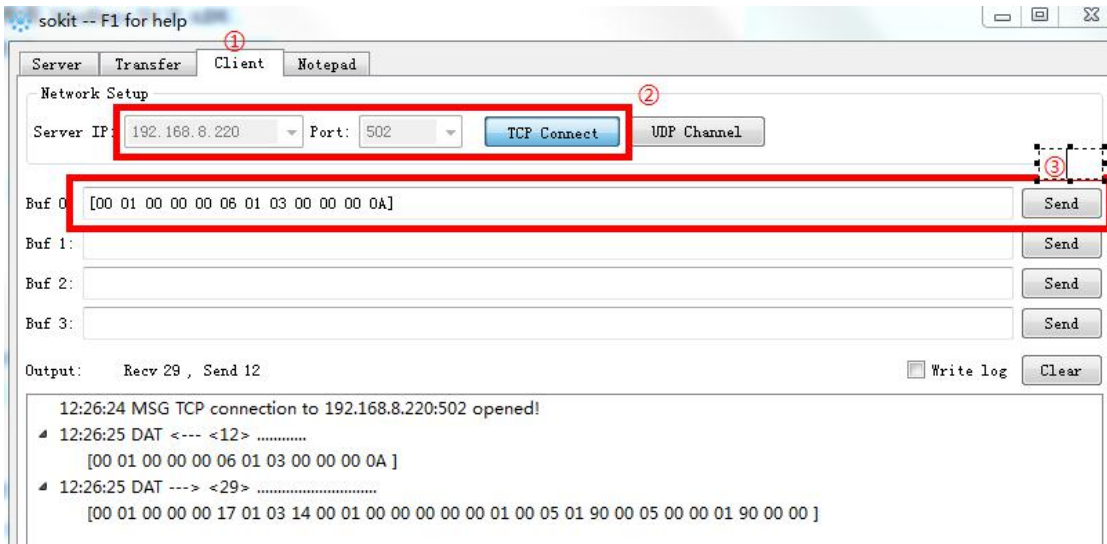
IP: 192.168.8.220

Port: 502

Device ID: 0x01

The PC is the client, with the IP address (for example: 192.168.8.110) which must be in the same subnet as the IP of the power meter. To read 0x000A holding registers from the address of 0x0000, take the following steps:

1. Double-click to open 'sokit.exe' , and switch to the label page of 'Client'.
2. Fill in the IP (192.168.8.220) and the port (502) of the network multi-functional power meter (server), and click the button of "TCP connect".
3. In 'Buf 0', fill in the frame ([00 01 00 00 00 06 01 03 00 00 00 0A], hexadecimal characters) including '[' to send, and click the button of 'Send'.



**Explanation :**

| Transaction Identifier | Protocol Identifier | Length                        | Unit Identifier | Function code          | Start Address | Number of Registers |
|------------------------|---------------------|-------------------------------|-----------------|------------------------|---------------|---------------------|
| 00 01                  | 00 00               | 00 06                         | 01              | 03                     | 00 00         | 00 0A               |
|                        | modbus              | bytes of the following fields | device ID       | read holding registers |               |                     |

## 1.Register listing

| Register | Description                           | unit | Data Type  | Parameters  |
|----------|---------------------------------------|------|------------|---|
| 0        | Meter address(COMM1)                  |      | Int16 (RW) | Range :1-247  |
| 1        | Baud rate(COMM1)                      |      | Int16 (RW) | 0: 38400<br>1: 19200<br>2: 9600(default)<br>3: 4800<br>4: 2400<br>5: 1200   |
| 2        | Parity(COMM1)                         |      | Int16 (RW) | 0: None Parity with one stop bit(default)<br>1: None Parity with two stop bits<br>2: Odd Parity with one stop bit<br>3: Even Parity with one stop bit |
| 3        | System Type                           |      | Int16 (RW) | Lower 7 bit:<br>0:3P3W_2CT,<br>1:3P4W,<br>2:3P3W_3CT  |
| 4        | Nominal Secondary Current             |      | Int16 (RW) | 1A or 5A  |
| 5        | Nominal Secondary Voltage L-L         |      | Int16 (RW) | 100V、110V、400V、690V   |
| 6        | Nominal Primary Current               | 1A   | Int16 (RW) | 0-32760A  |
| 7-8      | Nominal Primary Voltage L-L           | 1V   | Int32 (RW) | 0-1200KV  |
|          | Meter address(COMM2)                  |      |            |   |
| 10       | Baud rate(COMM2,slave)                |      | Int16 (RW) | 0: 38400<br>1: 19200<br>2: 9600<br>3: 4800<br>4: 2400<br>5: 1200  |
| 11       | Parity(COMM2,slave)                   |      | Int16 (RW) | 0: None Parity with one stop bit<br>1: None Parity with two stop bits<br>2: Odd Parity with one stop bit<br>3: Even Parity with one stop bit          |
| 13       | Neutral current secondary side rating |      | Int16 (RW) | 1A or 5A  |
| 14       | Neutral current primary side rating   | 1A   | Int16 (RW) | 1A-32760A   |
| 15       | Pulse constant                        | 100  | Int16 (RW) | 0-9999(APM801 is valid) (When it is 0, default value is used, 1A: 8000, 5A: 4000; When it is not 0, pulse constant = register value *100)             |
| 16       | Unbalance algorithm                   |      | Int16 (RW) | Unbalance algorithm(0: Rated, 1: Absolute)  |
| 18       | Profibus address                      |      | Int16 (RW) | 1-127   |
| 20       | Year                                  |      | Int16 (RW) | 0-99  |
| 21       | Month                                 |      | Int16 (RW) | 1-12  |
| 22       | Day                                   |      | Int16 (RW) | 1-31  |
| 23       | Hour                                  |      | Int16 (RW) | 0-23  |
| 24       | Minute                                |      | Int16 (RW) | 0-59  |

|       |   |        |            |   |
|-------|---|--------|------------|---|
| 25    | Second  |        | Int16 (RW) | 0-59  |
| 29    | Enable change parameter of Ethernet from RS485 Port |        | Int16 (RW) | code: 0XABCD  |
| 30-31 | IP Address  |        | Int32 (RW) | Sample: 192.168.3.8<br>ADDR 30: C0A8H<br>ADDR 31: 0308H   |
| 32-33 | Subnet Mask   |        | Int32 (RW) | Sample: 255.255.255.0<br>ADDR 32: FFFFH;<br>ADDR 33: FF00H  |
| 34-35 | Gateway   |        | Int32 (RW) | Sample: 192.168.3.1<br>ADDR 34: C0A8H;<br>ADDR 35: 0301H  |
| 36    | Port Number   |        | Int16 (RW) | 0-9999  |
| 37    | IP address allocation                               |        | Int16 (RW) | 0: Manual; 1: Automatic (DHCP)  |
| 38    | The code for Save the parameter of Ethernet         |        | Int16 (RW) | code: 0XABCD  |
|       |   |        |            |   |
| 40    | SD Storage State                                    |        | Int16 (RO) | 0,0x11: No SD Card<br>0x22: Bad SD Card<br>0x33: SD work well<br>0x44: Full storage<br>0x55: Formating<br>0x66: Error in Configuration File |
| 41    | SD Total capacity                                   | 1M     | Int16 (RO) | Unit : Megabytes  |
| 42    | SD Residual capacity                                | 1M     | Int16 (RO) | Unit : Megabytes  |
| 61    | Nominal voltage                                     | 0.1V   | Int16 (RO) | Secondary side nominal voltage for calculating voltage deviation  |
| 120   | Blast cooling value (Module 1)                      | 0.1°C  | Int16 (RW) | 0-9999  |
| 121   | Blast cooling hysteresis                            | 0.1°C  | Int16 (RW) | 0-9999  |
| 122   | Blast cooling delay                                 | 1s     | Int16 (RW) | 0-9999  |
| 123   | Heating up value                                    | 0.1°C  | Int16 (RW) | 0-9999  |
| 124   | Heating up hysteresis                               | 0.1°C  | Int16 (RW) | 0-9999  |
| 125   | Heating up delay                                    | 1s     | Int16 (RW) | 0-9999  |
| 126   | Heat dehumidification value                         | 0.1%   | Int16 (RW) | 0-9999  |
| 127   | Heat dehumidification hysteresis                    | 0.1%   | Int16 (RW) | 0-9999  |
| 128   | Hysteresis delay                                    | 1s     | Int16 (RW) | 0-9999  |
| 62    | Nominal frequency                                   | 0.01Hz | Int16 (RO) | Nominal frequency used to calculate frequency deviation   |
| 242   | Neutral current,                                    | 0.001A | Int16 (RO) | Secondary   |
| 243   | Voltage A-N   | 0.1    | Int16 (RO) | Secondary   |
| 244   | Voltage B-N   | 0.1    | Int16 (RO) | Secondary   |
| 245   | Voltage C-N   | 0.1    | Int16 (RO) | Secondary   |
| 246   | Voltage A-B   | 0.1    | Int16 (RO) | Secondary   |
| 247   | Voltage B-C   | 0.1    | Int16 (RO) | Secondary   |

|           |  |         |            |  |
|-----------|--|---------|------------|--|
| 248       | Voltage C-A                                  | 0.1     | Int16 (RO) | Secondary  |
| 249       | Current, Phase A                             | 0.001   | Int16 (RO) | Secondary  |
| 250       | Current, Phase B                             | 0.001   | Int16 (RO) | Secondary  |
| 251       | Current, Phase C                             | 0.001   | Int16 (RO) | Secondary  |
| 252       | Nominal Frequency                            | 0.01Hz  | Int16 (RO) |  |
| 253-254   | Active Power, Phase A                        | 0.01W   | Int32 (RO) | Secondary  |
| 255-256   | Active Power, Phase B                        | 0.01W   | Int32 (RO) | Secondary  |
| 257-258   | Active Power, Phase C                        | 0.01W   | Int32 (RO) | Secondary  |
| 259-260   | Active Power, Total                          | 0.01W   | Int32 (RO) | Secondary  |
| 261-262   | Reactive Power, Phase A                      | 0.01Var | Int32 (RO) | Secondary  |
| 263-264   | Reactive Power, Phase B                      | 0.01Var | Int32 (RO) | Secondary  |
| 265-266   | Reactive Power, Phase C                      | 0.01Var | Int32 (RO) | Secondary  |
| 267-268   | Reactive Power, Total                        | 0.01Var | Int32 (RO) | Secondary  |
| 269-270   | Real Power, Phase A                          | 0.01VA  | Int32 (RO) | Secondary  |
| 271-272   | Real Power, Phase B                          | 0.01VA  | Int32 (RO) | Secondary  |
| 273-274   | Real Power, Phase C                          | 0.01VA  | Int32 (RO) | Secondary  |
| 275-276   | Real Power, Total                            | 0.01VA  | Int32 (RO) | Secondary  |
| 277       | Active Power Factor, Phase A                 | 0.001   | Int16 (RO) | Secondary  |
| 278       | Active Power Factor, Phase B                 | 0.001   | Int16 (RO) | Secondary  |
| 279       | Active Power Factor, Phase C                 | 0.001   | Int16 (RO) | Secondary  |
| 280       | Active Power Factor, Total                   | 0.001   | Int16 (RO) | Secondary  |
| 300-301   | Active Energy In (EPI)                       | 1WH     | Int32 (RO) | Secondary  |
| 302-303   | Active Energy Out (EPE)                      | 1WH     | Int32 (RO) | Secondary  |
| 304-305   | Reactive Energy In( EQL)                     | 1WH     | Int32 (RO) | Secondary  |
| 306-307   | Reactive Energy Out (EQC)                    | 1WH     | Int32 (RO) | Secondary  |
| 1000      | Temp1  | 0.1°C   | Int16 (RO) | 1st way temp   |
| 1001      | Temp2  | 0.1°C   | Int16 (RO) | 2nd way temp   |
| 1002      | Temp3  | 0.1°C   | Int16 (RO) | 3rd way temp   |
| 1003      | Temp4  | 0.1°C   | Int16 (RO) | 4th way temp   |
| 1004      | whd_temp                                     | 0.1°C   | Int16 (RO) | Temperature and humidity sensor temperature  |
| 1005      | whd_rh                                       | 0.1%    | Int16 (RO) | Temperature and humidity sensor humidity   |
| 1006      | Temperature and humidity sensor status       |         | Int16 (RO) | Bit0: high temperature BIT1: low temperature<br>BIT2: high humidity Bit3: Heating BIT4:<br>blast bit7: Sensor status |
| 1007-1021 | Corresponding to the second and third module |         | Int16 (RO) |  |

| Register  | Description                | Unit   | Data Type  | Parameters |
|-----------|----------------------------|--------|------------|------------|
| 1100-1101 | Current, Phase A           | 0.001A | Int32 (RO) | Primary    |
| 1102-1103 | Current, Phase B           | 0.001A | Int32 (RO) | Primary    |
| 1104-1105 | Current, Phase C           | 0.001A | Int32 (RO) | Primary    |
| 1106-1107 | Current, Neutral           | 0.001A | Int32 (RO) | Primary    |
| 1108-1109 | Current, Average           | 0.001A | Int32 (RO) | Primary    |
| 1110      | Current Unbalance, Phase A | 0.1%   | Int16 (RO) | Primary    |

|           |                                 |         |            |                     |
|-----------|---------------------------------|---------|------------|---------------------|
| 1111      | Current Unbalance, Phase B      | 0.1%    | Int16 (RO) | Primary             |
| 1112      | Current Unbalance, Phase C      | 0.1%    | Int16 (RO) | Primary             |
| 1113      | Current Unbalance, Max          | 0.1%    | Int16 (RO) | Primary             |
| 1114      | Current angle between IA and IB | 0.1°    | Int16 (RO) |                     |
| 1115      | Current angle between IB and IC | 0.1°    | Int16 (RO) |                     |
| 1116      | Current angle between IC and IA | 0.1°    | Int16 (RO) |                     |
| 1120-1121 | Voltage Phase A-N               | 0.1V    | Int32 (RO) | Primary             |
| 1122-1123 | Voltage Phase B-N               | 0.1V    | Int32 (RO) | Primary             |
| 1124-1125 | Voltage Phase C-N               | 0.1V    | Int32 (RO) | Primary             |
| 1126-1127 | Voltage Average L-N             | 0.1V    | Int32 (RO) | Primary             |
| 1128-1129 | Voltage Phase A-B               | 0.1V    | Int32 (RO) | Primary             |
| 1130-1131 | Voltage Phase B-C               | 0.1V    | Int32 (RO) | Primary             |
| 1132-1133 | Voltage Phase C-A               | 0.1V    | Int32 (RO) | Primary             |
| 1134-1135 | Voltage Average (L-L)           | 0.1V    | Int32 (RO) | Primary             |
| 1136      | Voltage Unbalance Phase A-N     | 0.1%    | Int16 (RO) | Primary             |
| 1137      | Voltage Unbalance Phase B-N     | 0.1%    | Int16 (RO) | Primary             |
| 1138      | Voltage Unbalance Phase C-N     | 0.1%    | Int16 (RO) | Primary             |
| 1139      | Voltage Unbalance, L-N          | 0.1%    | Int16 (RO) | Primary             |
| 1140      | Voltage Unbalance, Phase A-B    | 0.1%    | Int16 (RO) | Primary             |
| 1141      | Voltage Unbalance, Phase B-C    | 0.1%    | Int16 (RO) | Primary             |
| 1142      | Voltage Unbalance, Phase C-A    | 0.1%    | Int16 (RO) | Primary             |
| 1143      | Voltage Unbalance,L-L           | 0.1%    | Int16 (RO) | Primary             |
| 1144      | Voltage angle between UA and UB | 0.1°    | Int16 (RO) |                     |
| 1145      | Voltage angle between UB and UC | 0.1°    | Int16 (RO) |                     |
| 1146      | Voltage angle between UC and UA | 0.1°    | Int16 (RO) |                     |
| 1150-1151 | Active Power, Phase A           | 0.01W   | Float (RO) | Primary             |
| 1152-1153 | Active Power, Phase B           | 0.01W   | Float (RO) | Primary             |
| 1154-1155 | Active Power, Phase C           | 0.01W   | Float (RO) | Primary             |
| 1156-1157 | Active Power, Total             | 0.01W   | Float (RO) | Primary             |
| 1158-1159 | Reactive Power, Phase A         | 0.01Var | Float (RO) | Primary             |
| 1160-1161 | Reactive Power, Phase B         | 0.01Var | Float (RO) | Primary             |
| 1162-1163 | Reactive Power, Phase C         | 0.01Var | Float (RO) | Primary             |
| 1164-1165 | Reactive Power, Total           | 0.01Var | Float (RO) | Primary             |
| 1166-1167 | Real Power, Phase A             | 0.01VA  | Float (RO) | Primary             |
| 1168-1169 | Real Power, Phase B             | 0.01VA  | Float (RO) | Primary             |
| 1170-1171 | Real Power, Phase C             | 0.01VA  | Float (RO) | Primary             |
| 1172-1173 | Real Power, Total               | 0.01VA  | Float (RO) | Primary             |
| 1174      | Phase Angle between UA and IA   | 0.1°    | Int16 (RO) |                     |
| 1175      | UB and IB phase Angle           | 0.1°    | Int16 (RO) |                     |
| 1176      | Phase Angle between UC and IC   | 0.1°    | Int16 (RO) |                     |
| 1179      | Nominal Frequency               | 0.01Hz  | Int16 (RO) | Same as Address 252 |
| 1180      | Active Power Factor, Phase A    | 0.001   | Int16 (RO) | Same as Address 277 |



|           |  |         |            |   |
|-----------|--|---------|------------|---|
| 1181      | Active Power Factor, Phase B                       | 0.001   | Int16 (RO) | Same as Address 278                                   |
| 1182      | Active Power Factor, Phase C                       | 0.001   | Int16 (RO) | Same as Address 279                                   |
| 1183      | Active Power Factor, Total                         | 0.001   | Int16 (RO) | Same as Address 280                                   |
| 1184-1199 | Reserve  |         |            |   |
| 1200-1201 | Current Demand MAX, Phase A                        | 0.001A  | Int32 (RO) | Primary   |
| 1202-1203 | Data and time the Current Demand MAX, Phase A      |         | Int16 (RO) | BIT12~BIT15:Year<br>BIT8~BIT12:Month<br>BIT0~BIT7:Day |
|           |  |         | Int16 (RO) | BIT8~BIT12:Hour<br>BIT0~BIT7: Minute                  |
| 1204-1205 | Current Demand MAX, Phase B                        | 0.001A  | Int32 (RO) | Primary   |
| 1206-1207 | Data and time the Current Demand MAX, Phase B      |         | Int16 (RO) | BIT12~BIT15:Year<br>BIT8~BIT12:Month<br>BIT0~BIT7:Day |
|           |  |         | Int16 (RO) | BIT8~BIT12:Hour<br>BIT0~BIT7: Minute                  |
| 1208-1209 | Current Demand MAX, Phase C                        | 0.001A  | Int16 (RO) | Primary   |
| 1210-1211 | Data and time the Current Demand MAX, Phase C      |         | Int16 (RO) | BIT12~BIT15:Year<br>BIT8~BIT12:Month<br>BIT0~BIT7:Day |
|           |  |         | Int16 (RO) | BIT8~BIT12:Hour<br>BIT0~BIT7: Minute                  |
| 1212-1213 | Active Power Demand MAX, Total                     | 0.01W   | Float (RO) | Primary   |
| 1214-1215 | Data and time the Active Power Demand MAX ,Total   |         | Int16 (RO) | BIT12~BIT15:Year<br>BIT8~BIT12:Month<br>BIT0~BIT7:Day |
|           |  |         | Int16 (RO) | BIT8~BIT12:Hour<br>BIT0~BIT7: Minute                  |
| 1216-1217 | Reactive Power Demand MAX, Total                   | 0.01Var | Float (RO) | Primary   |
| 1218-1219 | Data and time the Reactive Power Demand MAX ,Total |         | Int16 (RO) | BIT12~BIT15:Year<br>BIT8~BIT12:Month<br>BIT0~BIT7:Day |
|           |  |         | Int16 (RO) | BIT8~BIT12:Hour<br>BIT0~BIT7: Minute                  |
| 1220-1221 | Real Power Demand MAX, Total                       | 0.01VA  | Float (RO) | Primary   |
| 1222-1223 | Data and time the Real Power Demand MAX ,Total     |         | Int16 (RO) | BIT12~BIT15:Year<br>BIT8~BIT12:Month<br>BIT0~BIT7:Day |
|           |  |         | Int16 (RO) | BIT8~BIT12:Hour<br>BIT0~BIT7: Minute                  |
| 1224-1249 | Reserve  |         |            |   |
| 1250-1251 | Current Demand MAX, Phase A                        | 0.001A  | Int32 (RO) | Primary   |

|           |  |         |            |  |
|-----------|--|---------|------------|--|
| 1252-1253 | Current Demand MAX, Phase B                          | 0.001A  | Int32 (RO) | Primary  |
| 1254-1255 | Current Demand MAX, Phase C                          | 0.001A  | Int32 (RO) | Primary  |
| 1256-1259 | Reserve  |         |            |  |
| 1260-1261 | Active Power Demand , Total                          | 0.01W   | Float (RO) | Primary  |
| 1262-1263 | Reactive Power Demand , Total                        | 0.01Var | Float (RO) | Primary  |
| 1264-1265 | Real Power Demand, Total                             | 0.01VA  | Float (RO) | Primary  |
| 1266-1287 | Reserve  |         |            |  |
| 1288      | Current coefficient                                  |         | Int16 (RW) | Used to set the alarm value and read the alarm record value. If the current coefficient is -3, the Phase A overcurrent alarm action value (register 1301) is set to 6000, then the actual alarm value is $6000 * 10^{(-3)} = 6.000A$ |
| 1289      | Neutral current coefficient                          |         | Int16 (RW) | Refer to register 1288   |
| 1290      | Voltage coefficient                                  |         | Int16 (RW) | Refer to register 1288   |
| 1291      | Power coefficient                                    |         | Int16 (RW) | Refer to register 1288   |
| 1292-1299 | Reserve  |         |            |  |
| 1300      | The first group of alarms: Phase A overcurrent alarm |         | Int16 (RW) | When Bit0 is 1, the alarm is enabled, when Bit0 is 0, the alarm is disabled;<br>When Bit1 is 1, the zero-value alarm is disabled, when Bit1 is 0, the zero-value alarm is enabled.   |
| 1301      | Alarm action value                                   |         | Int16 (RW) | Primary. Range: 0 ~ 9999. If the current coefficient is -3, Phase A overcurrent alarm action value is set to 6000, then the actual alarm value is $6000 * 10^{(-3)} = 6.000A$ , other situation is similar..                         |
| 1302      | Alarm delay time                                     | 1s      | Int16 (RW) | Range: 0 ~ 9999.   |
| 1303      | Alarm recovery value                                 |         | Int16 (RW) | Primary. Range:0~9999  |
| 1304      | Delay time of Recovery                               | 1s      | Int16 (RW) | Range: 0 ~ 9999.   |

The first group of other alarm settings: refer to Phase A overcurrent alarm

|      |                                 |      |                            |      |                                 |
|------|---------------------------------|------|----------------------------|------|---------------------------------|
| 1305 | Phase B overcurrent alarm       | 1310 | Phase C overcurrent alarm  | 1315 | Maximum overcurrent alarm       |
| 1320 | Neutral overcurrent alarm       | 1325 | Phase A undercurrent alarm | 1330 | Phase B undercurrent alarm      |
| 1335 | Phase C undercurrent alarm      | 1340 | Minimum undercurrent alarm | 1345 | Neutral undercurrent alarm      |
| 1350 | Maximum current unbalance alarm | 1355 | Current loss alarm         | 1360 | Phase A overvoltage alarm       |
| 1365 | Phase B overvoltage alarm       | 1370 | Phase C overvoltage alarm  | 1375 | Maximum phase overvoltage alarm |
| 1380 | AB line overvoltage alarm       | 1385 | BC line overvoltage alarm  | 1390 | CA line overvoltage alarm       |
| 1395 | Maximum line overvoltage alarm  | 1400 | Phase A undervoltage alarm | 1405 | Phase B undervoltage alarm      |
| 1410 | Phase C undervoltage alarm      | 1415 | Minimum phase undervoltage | 1420 | AB line undervoltage alarm      |

|      |   |      |   |      |   |
|------|---|------|---|------|---|
|      |   |      | alarm   |      |   |
| 1425 | BC line undervoltage alarm                        | 1430 | CA line undervoltage alarm                        | 1435 | Minimum line undervoltage alarm                   |
| 1440 | Maximum phase voltage unbalance alarm             | 1445 | Maximum line voltage unbalance alarm              | 1450 | Line voltage loss alarm                           |
| 1455 | Total active overpower alarm                      | 1460 | Total reactive overpower alarm                    | 1465 | Total apparent overpower alarm                    |
| 1470 | Total active underpower alarm                     | 1475 | Total reactive underpower alarm                   | 1480 | Total apparent underpower alarm                   |
| 1485 | Over power factor alarm                           | 1490 | Under power factor alarm                          | 1495 | Over frequency alarm                              |
| 1500 | Under frequency alarm                             | 1505 | Over total harmonic of Phase A current alarm      | 1510 | Over total harmonic of Phase B current alarm      |
| 1515 | Over total harmonic of Phase C current alarm      | 1520 | Over total harmonic of Phase A voltage alarm      | 1525 | Over total harmonic of Phase B voltage alarm      |
| 1530 | Over total harmonic of Phase C voltage alarm      | 1535 | Over total even harmonic of Phase A current alarm | 1540 | Over total even harmonic of Phase B current alarm |
| 1545 | Over total even harmonic of Phase C current alarm | 1550 | Over total even harmonic of Phase A voltage alarm | 1555 | Over total even harmonic of Phase B voltage alarm |
| 1560 | Over total even harmonic of Phase C voltage alarm | 1565 | Over total odd harmonic of Phase A current alarm  | 1570 | Over total odd harmonic of Phase B current alarm  |
| 1575 | Over total odd harmonic of Phase C current alarm  | 1580 | Over total odd harmonic of Phase A voltage alarm  | 1585 | Over total odd harmonic of Phase B voltage alarm  |
| 1590 | Over total odd harmonic of Phase C voltage alarm  | 1595 | Over total demand of active power alarm           | 1600 | Under total demand of active power alarm          |
| 1605 | Reverse phase sequence alarm                      | 1610 | DI1 digital input alarm                           | 1615 | DI2 digital input alarm                           |
| 1620 | DI3 digital input alarm                           | 1625 | DI4 digital input alarm                           | 1630 | 1 <sup>st</sup> temp alarm                        |
| 1635 | 2 <sup>nd</sup> temp alarm                        | 1640 | 3 <sup>rd</sup> temp alarm                        | 1645 | 4 <sup>th</sup> temp alarm                        |

**The second group of alarm settings: refer to Phase A overcurrent alarm**

|      |                                 |      |                                       |      |                                      |
|------|---------------------------------|------|---------------------------------------|------|--------------------------------------|
| 1750 | Phase A overcurrent alarm       | 1755 | Phase B overcurrent alarm             | 1760 | Phase C overcurrent alarm            |
| 1765 | Maximum overcurrent alarm       | 1770 | Neutral overcurrent alarm             | 1775 | Phase A undercurrent alarm           |
| 1780 | Phase B undercurrent alarm      | 1785 | Phase C undercurrent alarm            | 1790 | Minimum undercurrent alarm           |
| 1795 | Neutral undercurrent alarm      | 1800 | Maximum current unbalance alarm       | 1805 | Current loss alarm                   |
| 1810 | Phase A overvoltage alarm       | 1815 | Phase B overvoltage alarm             | 1820 | Phase C overvoltage alarm            |
| 1825 | Maximum phase overvoltage alarm | 1830 | AB line overvoltage alarm             | 1835 | BC line overvoltage alarm            |
| 1840 | CA line overvoltage alarm       | 1845 | Maximum line overvoltage alarm        | 1850 | Phase A undervoltage alarm           |
| 1855 | Phase B undervoltage alarm      | 1860 | Phase C undervoltage alarm            | 1865 | Minimum phase undervoltage alarm     |
| 1870 | AB line undervoltage alarm      | 1875 | BC line undervoltage alarm            | 1880 | CA line undervoltage alarm           |
| 1885 | Minimum line undervoltage alarm | 1890 | Maximum phase voltage unbalance alarm | 1895 | Maximum line voltage unbalance alarm |
| 1900 | Line voltage loss alarm         | 1905 | Total active overpower alarm          | 1910 | Total reactive overpower alarm       |
| 1915 | Total apparent overpower alarm  | 1920 | Total active underpower alarm         | 1925 | Total reactive underpower alarm      |
| 1930 | Total apparent underpower alarm | 1935 | Over power factor alarm               | 1940 | Under power factor alarm             |
| 1945 | Over frequency alarm            | 1950 | Under frequency alarm                 | 1955 | Over total harmonic of Phase A       |

|      |   |      |   |      |   |
|------|---|------|---|------|---|
|      |   |      |   |      | current alarm                                     |
| 1960 | Over total harmonic of Phase B current alarm      | 1965 | Over total harmonic of Phase C current alarm      | 1970 | Over total harmonic of Phase A voltage alarm      |
| 1975 | Over total harmonic of Phase B voltage alarm      | 1980 | Over total harmonic of Phase C voltage alarm      | 1985 | Over total even harmonic of Phase A current alarm |
| 1990 | Over total even harmonic of Phase B current alarm | 1995 | Over total even harmonic of Phase C voltage alarm | 2000 | Over total even harmonic of Phase A voltage alarm |
| 2005 | Over total even harmonic of Phase B voltage alarm | 2010 | Over total even harmonic of Phase C voltage alarm | 2015 | Over total odd harmonic of Phase A current alarm  |
| 2020 | Over total odd harmonic of Phase B current alarm  | 2025 | Over total odd harmonic of Phase C current alarm  | 2030 | Over total odd harmonic of Phase A voltage alarm  |
| 2035 | Over total odd harmonic of Phase B voltage alarm  | 2040 | Over total odd harmonic of Phase C voltage alarm  | 2045 | Over total demand of active power alarm           |
| 2050 | Under total demand of active power alarm          | 2055 | Reverse phase sequence alarm                      | 2060 | DI1 digital input alarm                           |
| 2065 | DI2 digital input alarm                           | 2070 | DI3 digital input alarm                           | 2075 | DI4 digital input alarm                           |
| 2080 | 1 <sup>st</sup> way temp alarm                    | 2085 | 2 <sup>nd</sup> way temp alarm                    | 2090 | 3 <sup>rd</sup> way temp alarm                    |
| 2095 | 4 <sup>th</sup> way temp alarm                    |      |   |      |   |

Note: The action value of unbalance is the register value \*0.1%, the action value of power factor is the register value \*0.001, the action value of harmonic alarm is the register value \*0.01%, and the action value of frequency alarm is the register value \*0.01Hz.

| Register (WORD) | Description    | Unit           | Data Type   | Note  |
|-----------------|----------------|----------------|-------------|---|
| 2200            | Event record 1 |                | UInt16 (RO) | When Bit15 is 1, it means DI. When it is 0, it means DO.<br>When Bit14 is 1, it means ON. When it is 0, it means OFF.<br>Low byte indicates DI/DO number. |
| 2201            |                | Year、 Month    | UInt16 (RO) | High byte:Year; Low byte: Month   |
| 2202            |                | Day、 Hour      | UInt16 (RO) | High byte: Day ; Low byte: Hour   |
| 2203            |                | Minute、 second | UInt16 (RO) | High byte:Year; Low byte: Month   |

Other event records: Refer to event record 1

|      |                 |      |                 |      |                 |      |                 |      |                 |
|------|-----------------|------|-----------------|------|-----------------|------|-----------------|------|-----------------|
| 2204 | Event record 2  | 2208 | Event record 3  | 2212 | Event record 4  | 2216 | Event record 5  | 2220 | Event record 6  |
| 2224 | Event record 7  | 2228 | Event record 8  | 2232 | Event record 9  | 2236 | Event record 10 | 2240 | Event record 11 |
| 2244 | Event record 12 | 2248 | Event record 13 | 2252 | Event record 14 | 2256 | Event record 15 | 2260 | Event record 16 |

Note: To read the most recent 128 event records, you can read the register 20000-20513, refer to the format of register 2200-2203.

| Register (WORD) | Name                  | Resolution | Data(Read and write attribute) | Remarks  |
|-----------------|-----------------------|------------|--------------------------------|--|
| 2280            | 1ST group alarm state |            | UInt16 (RO)                    | Bit0-bit15 (the lowest digit is Bit0) corresponds to alarm number 0-15.For example: BIT0 corresponds to A phase overcurrent alarm, and so on |

|           |                       |  |             |                                  |
|-----------|-----------------------|--|-------------|----------------------------------|
| 2281      |                       |  | UInt16 (RO) | Corresponding alarm number 16-31 |
| 2282      |                       |  | UInt16 (RO) | Corresponding alarm number 32-47 |
| 2283      |                       |  | UInt16 (RO) | Corresponding alarm number 48-63 |
| 2284      |                       |  | UInt16 (RO) | Corresponding alarm number 64-79 |
| 2285      |                       |  | UInt16 (RO) | Corresponding alarm number 80-95 |
| 2286-2291 | 2nd group alarm state |  |             | Same with 1ST group alarm state  |

| Register (WORD) | Description           |               | Unit | Data Type   | Note  |
|-----------------|-----------------------|---------------|------|-------------|---|
| 2300            | Recent alarm record 1 | Alarm type    |      | UInt16 (RO) | High byte: Alarm group; Low byte: Alarm type (refer to 7.4 to view alarms - Communication number of alarm classification description) |
| 2301            |                       | Year、Month    |      | UInt16 (RO) | High byte: Year; Low byte: Month  |
| 2302            |                       | Day、Hour      |      | UInt16 (RO) | High byte: Day ; Low byte: Hour   |
| 2303            |                       | Minute、second |      | UInt16 (RO) | High byte:Year; Low byte: Month   |
| 2304            |                       | Alarm value   |      | UInt16 (RO) | Primary   |
| 2305            |                       | Alarm status  |      | UInt16 (RO) | 1: Alarm acts 0: Alarm released   |

Other recent alarm records: Refer to recent alarm record 1

|      |                 |      |                 |      |                 |      |                 |      |                 |
|------|-----------------|------|-----------------|------|-----------------|------|-----------------|------|-----------------|
| 2306 | Alarm record 2  | 2312 | Alarm record 3  | 2318 | Alarm record 4  | 2324 | Alarm record 5  | 2330 | Alarm record 6  |
| 2336 | Alarm record 7  | 2342 | Alarm record 8  | 2348 | Alarm record 9  | 2354 | Alarm record 10 | 2360 | Alarm record 11 |
| 2366 | Alarm record 12 | 2372 | Alarm record 13 | 2378 | Alarm record 14 | 2384 | Alarm record 15 | 2390 | Alarm record 16 |

Classification of alarm records (16 for each type of alarm, polling display, latest record covers the earliest record automatically): Refer to recent alarm record 1 for data format.

|       |   |       |                                       |       |                                      |
|-------|---|-------|---------------------------------------|-------|--------------------------------------|
| 10000 | Phase A overcurrent alarm (16 in total, the same below) | 10096 | Phase B overcurrent alarm             | 10192 | Phase C overcurrent alarm            |
| 10288 | Maximum overcurrent alarm                               | 10384 | Neutral overcurrent alarm             | 10480 | Phase A undercurrent alarm           |
| 10576 | Phase B undercurrent alarm                              | 10672 | Phase C undercurrent alarm            | 10768 | Minimum undercurrent alarm           |
| 10864 | Neutral undercurrent alarm                              | 10960 | Maximum current unbalance alarm       | 11056 | Current loss alarm                   |
| 11152 | Phase A overvoltage alarm                               | 11248 | Phase B overvoltage alarm             | 11344 | Phase C overvoltage alarm            |
| 11440 | Maximum phase overvoltage alarm                         | 11536 | AB line overvoltage alarm             | 11632 | BC line overvoltage alarm            |
| 11728 | CA line overvoltage alarm                               | 11824 | Maximum line overvoltage alarm        | 11920 | Phase A undervoltage alarm           |
| 12016 | Phase B undervoltage alarm                              | 12112 | Phase C undervoltage alarm            | 12208 | Minimum phase undervoltage alarm     |
| 12304 | AB line undervoltage alarm                              | 12400 | BC line undervoltage alarm            | 12496 | CA line undervoltage alarm           |
| 12592 | Minimum line undervoltage alarm                         | 12688 | Maximum phase voltage unbalance alarm | 12784 | Maximum line voltage unbalance alarm |
| 12880 | Line voltage loss alarm                                 | 12976 | Total active overpower alarm          | 13072 | Total reactive overpower alarm       |
| 13168 | Total apparent overpower                                | 13264 | Total active underpower alarm         | 13360 | Total reactive underpower            |

|       |   |       |   |       |   |
|-------|---|-------|---|-------|---|
|       | alarm   |       |   |       | alarm   |
| 13456 | Total apparent underpower alarm                   | 13552 | Over power factor alarm                           | 13648 | Under power factor alarm                          |
| 13744 | Over frequency alarm                              | 13840 | Under frequency alarm                             | 13936 | Over total harmonic of Phase A current alarm      |
| 14032 | Over total harmonic of Phase B current alarm      | 14128 | Over total harmonic of Phase C current alarm      | 14224 | Over total harmonic of Phase A voltage alarm      |
| 14320 | Over total harmonic of Phase B voltage alarm      | 14416 | Over total harmonic of Phase C voltage alarm      | 14512 | Over total even harmonic of Phase A current alarm |
| 14608 | Over total even harmonic of Phase B current alarm | 14704 | Over total even harmonic of Phase C current alarm | 14800 | Over total even harmonic of Phase A voltage alarm |
| 14896 | Over total even harmonic of Phase B voltage alarm | 14992 | Over total even harmonic of Phase C voltage alarm | 15088 | Over total odd harmonic of Phase A current alarm  |
| 15184 | Over total odd harmonic of Phase B current alarm  | 15280 | Over total odd harmonic of Phase C current alarm  | 15376 | Over total odd harmonic of Phase A voltage alarm  |
| 15472 | Over total odd harmonic of Phase B voltage alarm  | 15568 | Over total odd harmonic of Phase C voltage alarm  | 15664 | Over total demand of active power alarm           |
| 15760 | Under total demand of active power alarm          | 15856 | Reverse phase sequence alarm                      | 15952 | DI1 digital input alarm                           |
| 16048 | DI2 digital input alarm                           | 16144 | DI3 digital input alarm                           | 16240 | DI4 digital input alarm                           |
| 16336 | 1 <sup>st</sup> way temp alarm                    | 16432 | 2 <sup>nd</sup> way temp alarm                    | 16528 | 3 <sup>rd</sup> way temp alarm                    |
| 16624 | 4 <sup>th</sup> way temp alarm                    |       |   |       |   |

| Register (WORD) | Description  | Unit | Data Type   | Note  |
|-----------------|--|------|-------------|---|
| 2500            | Function selection of relay 1                                  |      | UInt16 (RW) | 0: Remote control;<br>1: First group alarm;<br>2: Second group alarm                                      |
| 2501-2531       | Function selection of relay 2-32                               |      |             | Same as function selection of relay 1   |
| 2532            | Output pulse width of relay 1 (effective by remote control)    | 1s   | Int16 (RW)  | When the delay time 0, it is a level trigger mode; when it is greater than 0, it is a pulse trigger mode. |
| 2533-2563       | Output pulse width of relay 2-32 (effective by remote control) |      |             | Same as output pulse width of relay 1   |
| 2564-2569       | Reserve  |      |             |   |
| 2570-2571       | Initial state of switch input                                  |      | Int32 (RW)  | Bits0:DI1, and so on, Bits31:DI32;<br>1: Initial state is ON; 0: Initial state is OFF                     |
| 2572-2573       | Initial state of switch output                                 |      | Int32 (RW)  | Bits0:DO1, and so on, Bits31:DO32;<br>1: Initial state is ON; 0: Initial state is OFF                     |
| 2574-2579       | Reserve  |      |             |   |
| 2580-2581       | Current status of switch input                                 |      | Int32 (RO)  | Bits0:DI1, and so on, Bits31:DI32;<br>1: Initial state is ON; 0: Initial state is OFF                     |
| 2582-2583       | Current status of switch output                                |      | Int32 (RW)  | Bits0:DO1, and so on, Bits31:DO32;<br>1: Initial state is ON; 0: Initial state is OFF                     |

|           |   |  |             |   |
|-----------|---|--|-------------|---|
| 2584-2589 | Reserve                                   |  |             |   |
| 2590-2601 | Associated alarm configuration of relay 1 |  | Int32(RW)*6 | See 2.9 DO settings in the instructions |

**Associated alarm configuration of other relays: Refer to associated alarm configuration of relay 1.**

|      |  |      |  |      |  |
|------|--|------|--|------|--|
| 2602 | Associated alarm configuration of relay 2  | 2614 | Associated alarm configuration of relay 3  | 2626 | Associated alarm configuration of relay 4  |
| 2638 | Associated alarm configuration of relay 5  | 2650 | Associated alarm configuration of relay 6  | 2662 | Associated alarm configuration of relay 7  |
| 2674 | Associated alarm configuration of relay 8  | 2686 | Associated alarm configuration of relay 9  | 2698 | Associated alarm configuration of relay 10 |
| 2710 | Associated alarm configuration of relay 11 | 2722 | Associated alarm configuration of relay 12 | 2734 | Associated alarm configuration of relay 13 |
| 2746 | Associated alarm configuration of relay 14 | 2758 | Associated alarm configuration of relay 15 | 2770 | Associated alarm configuration of relay 16 |
| 2782 | Associated alarm configuration of relay 17 | 2794 | Associated alarm configuration of relay 18 | 2806 | Associated alarm configuration of relay 19 |
| 2818 | Associated alarm configuration of relay 20 | 2830 | Associated alarm configuration of relay 21 | 2842 | Associated alarm configuration of relay 22 |
| 2854 | Associated alarm configuration of relay 23 | 2866 | Associated alarm configuration of relay 24 | 2878 | Associated alarm configuration of relay 25 |
| 2890 | Associated alarm configuration of relay 26 | 2902 | Associated alarm configuration of relay 27 | 2914 | Associated alarm configuration of relay 28 |
| 2926 | Associated alarm configuration of relay 29 | 2938 | Associated alarm configuration of relay 30 | 2950 | Associated alarm configuration of relay 31 |
| 2962 | Associated alarm configuration of relay 32 |      |  |      |  |

| Register (WORD) | Description                              | Unit                            | Data Type  | Note   |                                     |
|-----------------|--|---------------------------------|------------|--|-------------------------------------|
| 3000-3001       | Positive active energy(IMP)              | 1Wh                             | Float (RO) | Primary energy                                   |                                     |
| 3002-3003       | Reverse active energy (EXP)              | 1Wh                             | Float (RO) | Primary energy                                   |                                     |
| 3004-3005       | Inductive reactive energy (EQL)          | 1varh                           | Float (RO) | Primary energy                                   |                                     |
| 3006-3007       | Capacitive reactive energy (EQC)         | 1varh                           | Float (RO) | Primary energy                                   |                                     |
| 3500-3501       | Maximum of Phase A current in this month | Maximum                         | 0.001A     | Int32 (RO)                                       | Primary                             |
| 3502            |  | Year and month of occurrence    |            | Int16 (RO)                                       | High byte: Year; Low byte: Month    |
| 3503            |  | Day and hour of occurrence      |            | Int16 (RO)                                       | High byte: Day; Low byte: Hour      |
| 3504            |  | Minute and second of occurrence |            | Int16 (RO)                                       | High byte: Minute; Low byte: Second |
| 3505-3509       | Maximum of Phase B current in this month |                                 |            | Same as maximum of Phase A current in this month |                                     |
| 3510-3514       | Maximum of Phase C current in            |                                 |            | Same as maximum of Phase A current in this       |                                     |

|           |   |                                 |         |            |   |
|-----------|---|---------------------------------|---------|------------|---|
|           | this month  |                                 |         |            | month   |
| 3515-3519 | Maximum of neutral current in this month          |                                 |         |            | Same as maximum of Phase A current in this month      |
| 3520-3524 | Maximum of average current in this month          |                                 |         |            | Same as maximum of Phase A current in this month      |
| 3525-3526 | Maximum of Phase A voltage in this month          | Maximum                         | 0.1V    | Int32 (RO) | Primary   |
| 3527      |   | Year and month of occurrence    |         | Int16 (RO) | High byte: Year; Low byte: Month                      |
| 3528      |   | Day and hour of occurrence      |         | Int16 (RO) | High byte: Day; Low byte: Hour                        |
| 3529      |   | Minute and second of occurrence |         | Int16 (RO) | High byte: Minute; Low byte: Second                   |
| 3530-3534 | Maximum of Phase B voltage in this month          |                                 |         |            | Same as maximum of Phase A current in this month      |
| 3535-3539 | Maximum of Phase C voltage in this month          |                                 |         |            | Same as maximum of Phase A current in this month      |
| 3540-3544 | Maximum of average phase voltage in this month    |                                 |         |            | Same as maximum of Phase A current in this month      |
| 3545-3549 | Maximum of AB line voltage in this month          |                                 |         |            | Same as maximum of Phase A current in this month      |
| 3550-3554 | Maximum of BC line voltage in this month          |                                 |         |            | Same as maximum of Phase A current in this month      |
| 3555-3559 | Maximum of CA line voltage in this month          |                                 |         |            | Same as maximum of Phase A current in this month      |
| 3560-3564 | Maximum of average line voltage in this month     |                                 |         |            | Same as maximum of Phase A current in this month      |
| 3565-3566 | Maximum of Phase A active power in this month     | Maximum                         | 0.01W   | Float (RO) | Primary   |
| 3567      |   | Year and month of occurrence    |         | Int16 (RO) | High byte: Year; Low byte: Month                      |
| 3568      |   | Day and hour of occurrence      |         | Int16 (RO) | High byte: Day; Low byte: Hour                        |
| 3569      |   | Minute and second of occurrence |         | Int16 (RO) | High byte: Minute; Low byte: Second                   |
| 3570-3574 | Maximum of Phase B active power in this month     |                                 |         |            | Same as maximum of Phase A active power in this month |
| 3575-3579 | Maximum of Phase C active power in this month     |                                 |         |            | Same as maximum of Phase A active power in this month |
| 3580-3584 | Maximum of total phase active power in this month |                                 |         |            | Same as maximum of Phase A active power in this month |
| 3585-3586 | Maximum of Phase A reactive                       | Maximum                         | 0.01Var | Float (RO) | Primary   |
| 3587      |   | Year and month of occurrence    |         | Int16 (RO) | High byte: Year; Low byte: Month                      |



|           |   |                                 |        |            |   |
|-----------|---|---------------------------------|--------|------------|---|
| 3588      | power in this month                             | Day and hour of occurrence      |        | Int16 (RO) | High byte: Day; Low byte: Hour                          |
| 3589      |   | Minute and second of occurrence |        | Int16 (RO) | High byte: Minute; Low byte: Second                     |
| 3590-3594 | Maximum of Phase B reactive power in this month |                                 |        |            | Same as maximum of Phase A reactive power in this month |
| 3595-3599 | Maximum of Phase C reactive power in this month |                                 |        |            | Same as maximum of Phase A reactive power in this month |
| 3600-3604 | Maximum of total reactive power in this month   |                                 |        |            | Same as maximum of Phase A reactive power in this month |
| 3605-3606 | Maximum of Phase A apparent power in this month | Maximum                         | 0.01VA | Float (RO) | Primary   |
| 3607      |   | Year and month of occurrence    |        | Int16 (RO) | High byte: Year; Low byte: Month                        |
| 3608      |   | Day and hour of occurrence      |        | Int16 (RO) | High byte: Day; Low byte: Hour                          |
| 3609      |   | Minute and second of occurrence |        | Int16 (RO) | High byte: Minute; Low byte: Second                     |
| 3610-3614 | Maximum of Phase B apparent power in this month |                                 |        |            | Same as maximum of Phase A apparent power in this month |
| 3615-3619 | Maximum of Phase C apparent power in this month |                                 |        |            | Same as maximum of Phase A apparent power in this month |
| 3620-3624 | Maximum of total apparent power in this month   |                                 |        |            | Same as maximum of Phase A apparent power in this month |
| 3625-3626 | Phase A power factor in this month              | Maximum                         | 0.001  | Int32 (RO) | Primary   |
| 3627      |   | Year and month of occurrence    |        | Int16 (RO) | High byte: Year; Low byte: Month                        |
| 3628      |   | Day and hour of occurrence      |        | Int16 (RO) | High byte: Day; Low byte: Hour                          |
| 3629      |   | Minute and second of occurrence |        | Int16 (RO) | High byte: Minute; Low byte: Second                     |
| 3630-3634 | Phase B power factor in this month              |                                 |        |            | Same with Phase A power factor in this month            |
| 3635-3639 | Phase C power factor in this month              |                                 |        |            | Same with Phase A power factor in this month            |
| 3640-3644 | Total power factor in this month                |                                 |        |            | Same with Phase A power factor in this month            |
| 3645-3646 | Frequency in this month                         | Maximum                         | 0.01   | Int32 (RO) | Primary   |
| 3647      |   | Year and month of occurrence    |        | Int16 (RO) | High byte: Year; Low byte: Month                        |
| 3648      |   | Day and hour of occurrence      |        | Int16 (RO) | High byte: Day; Low byte: Hour                          |
| 3649      |   | Minute and second of occurrence |        | Int16 (RO) | High byte: Minute; Low byte: Second                     |

|           |  |                                 |       |            |  |
|-----------|--|---------------------------------|-------|------------|--|
|           |  | occurrence                      |       |            |  |
| 3650-3651 | THD of Phase A current in this month         | Maximum                         | 0.01% | Int32 (RO) |  |
| 3652      |  | Year and month of occurrence    |       | Int16 (RO) | High byte: Year; Low byte: Month             |
| 3653      |  | Day and hour of occurrence      |       | Int16 (RO) | High byte: Day; Low byte: Hour               |
| 3654      |  | Minute and second of occurrence |       | Int16 (RO) | High byte: Minute; Low byte: Second          |
| 3655-3659 | Maximum THD of Phase B current in this month |                                 |       |            | Same as THD of Phase A current in this month |
| 3660-3664 | Maximum THD of Phase C current in this month |                                 |       |            | Same as THD of Phase A current in this month |
| 3665-3669 | Maximum THD of Phase A voltage in this month |                                 |       |            | Same as THD of Phase A current in this month |
| 3670-3674 | Maximum THD of Phase B voltage in this month |                                 |       |            | Same as THD of Phase A current in this month |
| 3675-3679 | Maximum THD of Phase C voltage in this month |                                 |       |            | Same as THD of Phase A current in this month |

Minimum in this month, maximum in previous month, minimum in last month: Refer to maximum in this month.

|      |   |      |   |      |   |
|------|---|------|---|------|---|
| 3680 | Minimum of Phase A current in this month        | 3685 | Minimum of Phase B current in this month        | 3690 | Minimum of Phase C current in this month        |
| 3695 | Minimum of neutral current in this month        | 3700 | Minimum of average current in this month        | 3705 | Minimum of Phase A voltage in this month        |
| 3710 | Minimum of Phase B voltage in this month        | 3715 | Minimum of Phase C voltage in this month        | 3720 | Minimum of average voltage in this month        |
| 3725 | Minimum of AB line voltage in this month        | 3730 | Minimum of BC line voltage in this month        | 3735 | Minimum of CA line voltage in this month        |
| 3740 | Minimum of average line voltage in this month   | 3745 | Minimum of Phase A active power in this month   | 3750 | Minimum of Phase B active power in this month   |
| 3755 | Minimum of Phase C active power in this month   | 3760 | Minimum of total active power in this month     | 3765 | Minimum of Phase A reactive power in this month |
| 3770 | Minimum of Phase B reactive power in this month | 3775 | Minimum of Phase C reactive power in this month | 3780 | Minimum of total reactive power in this month   |
| 3785 | Minimum of Phase A apparent power in this month | 3790 | Minimum of Phase B apparent power in this month | 3795 | Minimum of Phase C apparent power in this month |
| 3800 | Minimum of total apparent power in this month   | 3805 | Minimum of Phase A power factor in this month   | 3810 | Minimum of Phase B power factor in this month   |
| 3815 | Minimum of Phase C power factor in this month   | 3820 | Minimum of total power factor in this month     | 3825 | Minimum of frequency in this month              |
| 3830 | Minimum THD of Phase A current in this month    | 3835 | Minimum THD of Phase B current in this month    | 3840 | Minimum THD of phase current in this month      |
| 3845 | Minimum THD of Phase A voltage in this month    | 3850 | Minimum THD of Phase B voltage in this month    | 3855 | Minimum THD of Phase C voltage in this month    |

|      |   |      |   |      |   |
|------|---|------|---|------|---|
| 3860 | Maximum of Phase A current in last month        | 3865 | Maximum of phase current in last month          | 3870 | Maximum of Phase C current in last month        |
| 3875 | Maximum of neutral current in last month        | 3880 | Maximum of avrage current in last month         | 3885 | Maximum of Phase A voltage in last month        |
| 3890 | Maximum of Phase B voltage in last month        | 3895 | Maximum of Phase C voltage in last month        | 3900 | Maximum of average voltage in last month        |
| 3905 | Maximum of AB line voltage in last month        | 3910 | Maximum of BC line voltage in last month        | 3915 | Maximum of CA line voltage in last month        |
| 3920 | Maximum of average line voltage in last month   | 3925 | Maximum of Phase A active power in last month   | 3930 | Maximum of Phase B active power in last month   |
| 3935 | Maximum of Phase C active power in last month   | 3940 | Maximum of total active power in last month     | 3945 | Maximum of Phase A reactive power in last month |
| 3950 | Maximum of Phase B reactive power in last month | 3955 | Maximum of Phase C reactive power in last month | 3960 | Maximum of total reactive power in last month   |
| 3965 | Maximum of Phase A apparent power in last month | 3970 | Maximum of Phase B apparent power in last month | 3975 | Maximum of Phase C apparent power in last month |
| 3980 | Maximum of total apparent power in last month   | 3985 | Maximum of Phase A power factor in last month   | 3990 | Maximum of Phase B power factor in last month   |
| 3995 | Maximum of Phase C power factor in last month   | 4000 | Maximum of total power factor in last month     | 4005 | Maximum of frequency in last month              |
| 4010 | Maximum THD of Phase A current in last month    | 4015 | Maximum THD of Phase B current in last month    | 4020 | Maximum THD of Phase C current in last month    |
| 4025 | Maximum THD of Phase A voltage in last month    | 4030 | Maximum THD of Phase B voltage in last month    | 4035 | Maximum THD of Phase C voltage in last month    |
| 4040 | Minimum of Phase A current in last month        | 4045 | Minimum of Phase B current in last month        | 4050 | Minimum of Phase C current in last month        |
| 4055 | Minimum of neutral current in last month        | 4060 | Minimum of average current in last month        | 4065 | Minimum of Phase A voltage in last month        |
| 4070 | Minimum of Phase B voltage in last month        | 4075 | Minimum of Phase C voltage in last month        | 4080 | Minimum of average voltage in last month        |
| 4085 | Minimum of AB line voltage in last month        | 4090 | Minimum of BC line voltage in last month        | 4095 | Minimum of CA line voltage in last month        |
| 4100 | Minimum of average line voltage in last month   | 4105 | Minimum of Phase A active power in last month   | 4110 | Minimum of Phase B active power in last month   |
| 4115 | Minimum of Phase C active power in last month   | 4120 | Minimum of total active power in last month     | 4125 | Minimum of Phase A reactive power in last month |
| 4130 | Minimum of Phase B reactive power in last month | 4135 | Minimum of Phase C reactive power in last month | 4140 | Minimum of total reactive power in last month   |
| 4145 | Minimum of Phase A apparent power in last month | 4150 | Minimum of Phase B apparent power in last month | 4155 | Minimum of Phase C apparent power in last month |
| 4160 | Minimum of total apparent power in last month   | 4165 | Minimum of Phase A power factor in last month   | 4170 | Minimum of Phase B power factor in last month   |
| 4175 | Minimum of Phase C power factor in last month   | 4180 | Minimum of total power factor in last month     | 4185 | Minimum of frequency in last month              |
| 4190 | Minimum THD of Phase A                          | 4195 | Minimum THD of Phase B current                  | 4200 | Minimum THD of Phase C                          |

|      |  |      |  |      |  |
|------|--|------|--|------|--|
|      | current in last month                        |      | in last month                                |      | current in last month                        |
| 4205 | Minimum THD of Phase A voltage in last month | 4210 | Minimum THD of Phase B voltage in last month | 4215 | Minimum THD of Phase C voltage in last month |

| Register (WORD) | Description  | Unit   | Data Type  | Note    |
|-----------------|--|--------|------------|---------|
| 4500-4561       | 2nd-63rd harmonic of Phase A current                     | 0.01%  | Int16 (RO) |         |
| 4562-4623       | 2nd-63rd harmonic of Phase B current                     | 0.01%  | Int16 (RO) |         |
| 4624-4685       | 2nd-63rd harmonic of Phase C current                     | 0.01%  | Int16 (RO) |         |
| 4686-4747       | 2nd-63rd harmonic of Phase A voltage                     | 0.01%  | Int16 (RO) |         |
| 4748-4809       | 2nd-63rd harmonic of Phase B voltage                     | 0.01%  | Int16 (RO) |         |
| 4810-4871       | 2nd-63rd harmonic of Phase C voltage                     | 0.01%  | Int16 (RO) |         |
| 4872            | THD of Phase A current                                   | 0.01%  | Int16 (RO) |         |
| 4873            | THD of Phase B current                                   | 0.01%  | Int16 (RO) |         |
| 4874            | THD of Phase B current                                   | 0.01%  | Int16 (RO) |         |
| 4875            | THD of Phase A voltage                                   | 0.01%  | Int16 (RO) |         |
| 4876            | THD of Phase B voltage                                   | 0.01%  | Int16 (RO) |         |
| 4877            | THD of Phase C voltage                                   | 0.01%  | Int16 (RO) |         |
| 4878            | Total odd harmonic distortion (TOHD) of Phase A current  | 0.01%  | Int16 (RO) |         |
| 4879            | TOHD of Phase B current                                  | 0.01%  | Int16 (RO) |         |
| 4880            | TOHD of Phase C current                                  | 0.01%  | Int16 (RO) |         |
| 4881            | TOHD of Phase A voltage                                  | 0.01%  | Int16 (RO) |         |
| 4882            | TOHD of Phase B voltage                                  | 0.01%  | Int16 (RO) |         |
| 4883            | TOHD of Phase C voltage                                  | 0.01%  | Int16 (RO) |         |
| 4884            | Total even harmonic distortion (TEHD) of Phase A current | 0.01%  | Int16 (RO) |         |
| 4885            | TEHD of Phase B current                                  | 0.01%  | Int16 (RO) |         |
| 4886            | TEHD of Phase C current                                  | 0.01%  | Int16 (RO) |         |
| 4887            | TEHD of Phase A voltage                                  | 0.01%  | Int16 (RO) |         |
| 4888            | TEHD of Phase B voltage                                  | 0.01%  | Int16 (RO) |         |
| 4889            | TEHD of Phase C voltage                                  | 0.01%  | Int16 (RO) |         |
| 4890-4891       | Total RMS value of phase A fundamental current           | 0.001A | Int32 (RO) | Primary |
| 4892-4893       | Total RMS value of phase B fundamental current           | 0.001A | Int32 (RO) | Primary |
| 4894-4895       | Total RMS value of phase C fundamental current           | 0.001A | Int32 (RO) | Primary |

|   |  |  |            |            |   |
|---|--|--|------------|------------|---|
| 4896-4897   | Total RMS value of phase A fundamental voltage | 0.1V                                   | Int32 (RO) | Primary    |   |
| 4898-4899   | Total RMS value of phase B fundamental voltage | 0.1V                                   | Int32 (RO) | Primary    |   |
| 4900-4901   | Total RMS value of phase C fundamental voltage | 0.1V                                   | Int32 (RO) | Primary    |   |
| 4902-4903   | Total RMS value of Phase A harmonic current    | 0.001A                                 | Int32 (RO) | Primary    |   |
| 4904-4905   | Total RMS value of Phase B harmonic current    | 0.001A                                 | Int32 (RO) | Primary    |   |
| 4906-4907   | Total RMS value of Phase C harmonic current    | 0.001A                                 | Int32 (RO) | Primary    |   |
| 4908-4909   | Total RMS value of Phase A harmonic voltage    | 0.1V                                   | Int32 (RO) | Primary    |   |
| 4910-4911   | Total RMS value of Phase B harmonic voltage    | 0.1V                                   | Int32 (RO) | Primary    |   |
| 4912-4913   | Total RMS value of Phase C harmonic voltage    | 0.1V                                   | Int32 (RO) | Primary    |   |
| 4914-5399   | Reserve  |  |            |            |   |
| 5400  | Setting of the 1st transmission output         | Transmission type and signal selection |            | Int16 (RW) | High byte: Transmission type (1:4-20mA, 2:0-20mA, 3:1-5V, 4:0-5V)<br>Low Byte: Signal Selection (Refer to Table 3 in 7.5 System Setup - Analog Output Settings) |
| 5401  |  | Corresponding value of the high point  |            | Int16 (RW) | Primary   |
| 5402  |  | Corresponding value of the low point   |            | Int16 (RW) | Primary   |
| <p>For example: 4-20mA is selected for the transmission type, and phase A current is selected for the signal. The corresponding value of the high point is 5000, and the corresponding value of the low point is 0, and the actual decimal point of the current display is 3 bits.<br/>When the actual current value of phase A is 5.000A, the transmission output is 20mA. When the actual current value of phase A current is 0, the output is 4 mA. When the actual current value of phase A is 2.500 A, the transmission output is 12 mA.</p> |  |  |            |            |   |

**Other settings of transmission output: refer to setting of the 1st transmission output**

|      |  |      |  |      |  |
|------|--|------|--|------|--|
| 5403 | Setting of the 2nd transmission output | 5406 | Setting of the 3rd transmission output | 5409 | Setting of the 4th transmission output |
|------|--|------|--|------|--|

|      |   |      |   |      |   |
|------|---|------|---|------|---|
| 5412 | Setting of the 5th transmission output  | 5415 | Setting of the 6th transmission output  | 5418 | Setting of the 7th transmission output  |
| 5421 | Setting of the 8th transmission output  | 5424 | Setting of the 9th transmission output  | 5427 | Setting of the 10th transmission output |
| 5430 | Setting of the 11th transmission output | 5433 | Setting of the 12th transmission output | 5436 | Setting of the 13th transmission output |
| 5439 | Setting of the 14th transmission output | 5442 | Setting of the 15th transmission output | 5445 | Setting of the 16th transmission output |
| 5448 | Setting of the 17th transmission output | 5451 | Setting of the 18th transmission output | 5454 | Setting of the 19th transmission output |
| 5457 | Setting of the 20th transmission output | 5460 | Setting of the 21st transmission output | 5463 | Setting of the 22nd transmission output |
| 5466 | Setting of the 23rd transmission output | 5469 | Setting of the 24th transmission output | 5472 | Setting of the 25th transmission output |
| 5475 | Setting of the 26th transmission output | 5478 | Setting of the 27th transmission output | 5481 | Setting of the 28th transmission output |
| 5484 | Setting of the 29th transmission output | 5487 | Setting of the 30th transmission output | 5490 | Setting of the 31st transmission output |
| 5493 | Setting of the 32nd transmission output | 5496 |   | 5499 |   |

| Register (WORD) | Description                     |   | Unit | Data Type  | Note   |  |
|-----------------|---------------------------------|---|------|------------|--|--|
| 5600            | Setting of the 1st analog input | Input type and decimal point of display |      | Int16 (RW) | High byte: Input type (1:4-20mA, 2:0-20mA, 3:1-5V, 4:0-5V)<br>Low Byte: Decimal point of display (0-3) | For example: 4-20mA is selected for the input type, and decimal point is 3 digits. The display value of input high point is set to 5000, and the display value of input low point is 0.<br>When the analog input is 20mA, the display value is 5.000, when the analog input is 4mA, the display value is 0.000, and when the analog input is 12mA, the display value is 2.500. |
| 5601            |                                 | Display value of input high point       |      | Int16 (RW) | The display value of input high point (0-9999)   |  |
| 5602            |                                 | Display value of input low point        |      | Int16 (RW) | The display value of input low point (0-9999)  |  |

**Other settings of analog input: Refer to the 1st analog input settings**

|      |                                  |      |                                  |      |                                  |
|------|----------------------------------|------|----------------------------------|------|----------------------------------|
| 5603 | Setting of the 2nd analog input  | 5606 | Setting of the 3rd analog input  | 5609 | Setting of the 4th analog input  |
| 5612 | Setting of the 5th analog input  | 5615 | Setting of the 6th analog input  | 5618 | Setting of the 7th analog input  |
| 5621 | Setting of the 8th analog input  | 5624 | Setting of the 9th analog input  | 5627 | Setting of the 10th analog input |
| 5630 | Setting of the 11th analog input | 5633 | Setting of the 12th analog input | 5636 | Setting of the 13th analog input |
| 5639 | Setting of the 14th analog input | 5642 | Setting of the 15th analog input | 5645 | Setting of the 16th analog input |
| 5648 | Setting of the 17th analog input | 5651 | Setting of the 18th analog input | 5654 | Setting of the 19th analog input |
| 5657 | Setting of the 20th analog input | 5660 | Setting of the 21st analog input | 5663 | Setting of the 22nd analog input |
| 5666 | Setting of the 23rd analog input | 5669 | Setting of the 24th analog input | 5672 | Setting of the 25th analog input |
| 5675 | Setting of the 26th analog input | 5678 | Setting of the 27th analog input | 5681 | Setting of the 28th analog input |
| 5684 | Setting of the 29th analog input | 5687 | Setting of the 30th analog input | 5690 | Setting of the 31st analog input |
| 5693 | Setting of the 32nd analog input |      |                                  |      |                                  |

| Register (WORD) | Description                              | Unit  | Data Type  | Note  |
|-----------------|--|-------|------------|---|
| 5696-5727       | Inverse value of No.1-32 analog Input    |       | Int16 (RO) | Inverse value of No.1-32 analog Input   |
| 5728-5759       | The actual value of No.1-32 analog Input | 0.001 | Int16 (RO) | The unit is mA when the input selection is 4-20mA or 0-20mA, and the unit is V when 1-5V or 0-5V is selected. |

Note: 1. Read-write property: "RO" is read-only, parameter is read with 0X03H command; "R/W" is readable and writable, and system parameter is written with 0X10H command. Do not write data to unlisted or unwritable Address.

2. For Int32 type data, the high bits are in the front and the low bits are in the back

## 2. Correspondence between communication value and actual value

It is agreed that Val<sub>t</sub> is the communication readout value and Val<sub>s</sub> is the actual value.

### 2.1 Voltage, Current, Power Factor, Frequency, Unbalance (Secondary)

The series of measured values are read with 03 command of the Modbus-RTU communication protocol. Each item occupies 1 word. The correspondence between the communication value and the actual secondary measurement value is shown in the following table:

| Applicable parameters  | Resolution | Correspondence                            | Unit    |
|--|------------|---|---------|
| Voltage ,U <sub>an</sub> 、 U <sub>bn</sub> 、 U <sub>cn</sub> 、 U <sub>ab</sub> 、 U <sub>bc</sub> 、 U <sub>ca</sub> | 0.1V       | Val <sub>s</sub> =Val <sub>t</sub> *0.1   | V       |
| Current ,I <sub>A</sub> 、 I <sub>B</sub> 、 I <sub>C</sub>  | 0.001A     | Val <sub>s</sub> =Val <sub>t</sub> *0.001 | A       |
| Power factor, PF <sub>A</sub> 、 PF <sub>B</sub> 、 PF <sub>C</sub> 、 PF <sub>总</sub>                                | 0.001      | Val <sub>s</sub> =Val <sub>t</sub> *0.001 | No unit |
| Frequency, F   | 0.01Hz     | Val <sub>s</sub> =Val <sub>t</sub> *0.01  | Hz      |
| Unbalance ,I(ubl), ULL(ubl),ULN(ubl)   | 0.1        | Val <sub>s</sub> =Val <sub>t</sub> *0.1   | %       |



For example: To read phase A voltage  $U_{an}$ , the data can be read at address 243 in Int16eger reading mode by MODSCAN, the communication read-out value  $Val_t$  is 2200, then  $Val_s = 2200 * 0.1 = 220V$ .

## 2.2 Voltage, Current, Power Factor, Frequency, Unbalance (Primary)

The series of measured values are read with 03 command of the Modbus-RTU communication protocol. The voltage and current occupy 2 words, and the power factor, frequency, and unbalance occupy 1 byte. The correspondence between the communication value and the actual secondary measurement value is shown in the following table:

| Applicable parameters  | Resolution | Correspondence          | Unit    |
|--|------------|-------------------------|---------|
| Voltage, $U_{an}$ , $U_{bn}$ , $U_{cn}$ , $U_{ab}$ , $U_{bc}$ , $U_{ca}$ | 0.1V       | $Val_s = Val_t * 0.1$   | V       |
| Current, $I_A$ , $I_B$ , $I_C$   | 0.001A     | $Val_s = Val_t * 0.001$ | A       |
| Power factor, $PF_A$ , $PF_B$ , $PF_C$ , $PF_{Total}$                    | 0.001      | $Val_s = Val_t * 0.001$ | No unit |
| Frequency, F   | 0.01Hz     | $Val_s = Val_t * 0.01$  | Hz      |
| Unbalance, $I(ubl)$ , $ULL(ubl)$ , $ULN(ubl)$                            | 0.1        | $Val_s = Val_t * 0.1$   | %       |

For example: To read phase A voltage  $U_{an}$ , the data can be read at address 1120-1121 in Int16eger reading mode by MODSCAN, the communication read-out value is 9 at address 1120, communication read-out value is 10176 at address 1121, that is, communication read-out value  $Val_t$  is  $9 * 65536 + 10176 = 600000$ , then  $Val_s = Val_t * 0.1 = 600000 * 0.1 = 60kV$ .

## 2.3 Active power, reactive power, apparent power and energy (Secondary side; W/Var/VA/kWh)

The series of measured values are read with 03 command of the Modbus-RTU communication protocol. Each item occupies 1 word. The power resolution 0.01, the correspondence between the communication value and the actual value is as follows:  $Val_s = Val_t * 0.01$ ; The energy resolution is 1, and the correspondence between the communication value and the actual value is as follows:  $Val_s = Val_t * 1$ ; where  $Val_t = \text{first word} * 65536 + \text{second word}$ .

For example: To read phase A active power Pa, the data can be read at address 253-254 in Int16eger reading mode by MODSCAN ,the communication read-out value is 1 at address 253 and 26000 at address 254, that is ,Val\_t=1×65536+26000=91536, then Val\_s = Val\_t\*0.01 = 915.36W.

For example: To read positive active energy IMP, the data can be read at address 300-301 MODSCAN in Int16eger reading mode by MODSCAN , the communication read-out value is 0 at address 300 and 19000 at address 301, that is, Val\_t=0x65536+19000=19000, then Val\_s =Val\_t\*1=19000Wh=19kWh.

## 2.4 Active power, reactive power, apparent power and energy (primary side; W/Var/VA/kWh)

The series of measured values are read with 03 command of the Modbus-RTU communication protocol. Each item occupies a float (two words). The power resolution is 0.01, and the correspondence between the communication value and the actual value is as follows: Val\_s=Val\_t\*0.01; the energy resolution is 1, and the correspondence between the communication value and the actual value is as follows: Val\_s=Val\_t\*1; Val\_t is calculated as follows:

The floating point variable data type value uses the sign bit to represent the sign of the data, and the exponent and mantissa represent the size of the data. The data format used by the meter is the IEEE754 data format, which has 24-bit precision, and the high bit of mantissa is always "1", so it is not saved and the distribution of bits is as follows:

1 sign bit, 8 exponent bits, 23 mantissas bits, the sign bit is the highest bit, and the mantissa is the lowest 23 bits.

Specific examples are as follows:

Read-out number (2word, arranged from highest to lowest ,4 bytes in total (0x474B, 0xAC00), 32bit):

Sign bit S , Index bit E , Mantissa M

Sign bit S=0, ("1" is negative, "0" is positive)

Calculate the index E=10001110 and convert it into a decimal number 142;

Calculate the mantissa M=100 1011 1010 1100 0000 0000 into a decimal number 4959232.

Calculation formula: primary side power

$$= (-1)^S \times 2^{(E-127)} \times \left(1 + \frac{M}{2^{23}}\right)$$

The result of the above example is as follows:

$$\left(-1\right)^0 \times 2^{\left(142 - 127\right)} \times \left(1 + \frac{4959232}{2^{23}}\right) = 52140 = 521.4kWh$$

For example: To read phase A active power PA, the data can be read at address 1150-1151 in Floating Pt reading mode by MODSCAN,the read-out value Val\_t=110000, then Val\_s =Val\_t\*0.01=1100W.

For example: To read phase positive active energy IMP, the data can be read at address 3050-3051 in Floating Pt reading mode by MODSCAN,the read-out value Val\_t=589000, then Val\_s =Val\_t\*1=589000Wh=589kWh.

## 2.5 Harmonic data of voltage and current

The series of measured values are read with 03 command of the Modbus-RTU communication protocol. Each item occupies 1 word. The resolution is 0.01, and the correspondence between the communication value and the actual value is as follows: Val\_s=(Val\_t\*0.01).

For example: To read current 3rd harmonic content, the data can be read at address 4501 in Integer reading mode by MODSCAN, the communication readout Val\_t is 157, then Val\_s = (Val\_t\*0.01)%=1.57%.

## 2.6 Demand

Demand includes three phase currents and active power, reactive power, and the maximum demand of apparent power and time of occurrence. The demand data format is as follows:

| Address | Address 1    | Address 2 | Address 3  |  |       | Address 4 |      |        |
|---------|--------------|-----------|--|--|-------|-----------|------|--------|
| Content | H16          | L16       | H8   |  |       | L8        | H8   | L8     |
|         | INT32        |           | H4   |  | L4    |           |      |        |
|         | Demand value |           | Year (Only a bit is reserved, ten bit needs to be filled in according to the current time) |  | Month | Day       | Hour | Minute |

Note: H8 indicates eight high bits, L8 indicates eight low bits, and others are similar.

Take reading the maximum demand of phase A current (1200~1203) as an example, the read-out value is 0x0000 0x157C 0x7512 0x0E16

| Address  | 1200                | 1201 | 1202   |  |       | 1203 |      |        |     |
|----------|---------------------|------|--|--|-------|------|------|--------|-----|
| Content  | H16                 | L16  | H8   |  |       | L8   | H8   | L8     |     |
|          | 0x0000              |      | 0x157C   |  | 0x7   |      |      |        | 0x5 |
|          | Demand value        |      | Year   |  | Month | Day  | Hour | Minute |     |
| Analysis | 0*65536+0x157C=5500 |      | 17 (ten bit needs to be filled in according to the current time) |  | 5     | 18   | 14   | 22     |     |

The maximum demand for Phase A current is: At 14:22 on May 18, 2017, the demand value is 5.500A.

## 2.7 Event Record

Event record 1 - event record 16, recorded in order of time, that is, event record 1 records the data of the most recent event, and event record 16 records the data of the earliest event, the data format of each event record is as follows:

| Address | Address 1      |                      |    |    |    |    |    |    | Address 2     | Address 3 |       | Address 4 |      |        |        |
|---------|----------------|----------------------|----|----|----|----|----|----|---------------|-----------|-------|-----------|------|--------|--------|
| Content | H8             |                      |    |    |    |    |    |    | L8            | H8        | L8    | H8        | L8   | H8     | L8     |
|         | B7             | B6                   | B5 | B4 | B3 | B2 | B1 | B0 |               | Year      | Month | Day       | Hour | Minute | Second |
|         | 0: DO<br>1: DI | 0: Open<br>1: Closed |    |    |    |    |    |    | Switch number |           |       |           |      |        |        |

Take reading the event record 1 (2200~2203) as an example, the read-out value is 0x4000 0x1101 0x160D 0x3820.

| Address  | 2200           |                      |    |    |    |    |    |     | 2201          | 2202 |       | 2203 |      |        |        |
|----------|----------------|----------------------|----|----|----|----|----|-----|---------------|------|-------|------|------|--------|--------|
| Content  | H8             |                      |    |    |    |    |    |     | L8            | H8   | L8    | H8   | L8   | H8     | L8     |
|          | B7             | B6                   | B5 | B4 | B3 | B2 | B1 | B0  |               | 0x11 | 0x01  | 0x16 | 0x0D | 0x38   | 0x20   |
|          | 0: DO<br>1: DI | 0: Open<br>1: Closed |    |    |    |    |    |     | Switch number | Year | Month | Day  | Hour | Minute | Second |
| Analysis | DO             | Closed               |    |    |    |    |    | DO1 | 17            | 1    | 22    | 14   | 56   | 32     |        |

DO1 changed from open to closed at 14:56:32 on January 22, 2017.

## 2.8 Alarm Record

The data format of the alarm record is as follows:

| Address | Address 1  |  | Address 2 |       | Address 3 |      | Address 4 |        | Address 5   | Address 6    |
|---------|--|--|-----------|-------|-----------|------|-----------|--------|-------------|--------------|
|         | H8   | L8   | H8        | L8    | H8        | L8   | H8        | L8     |             |              |
| Content | Alarm group<br>0: The alarms of the first group<br>1: The alarms of the second group | Alarm type (Refer to 7.4 Alarms viewing - entry number for alarm classification description) | Year      | Month | Day       | Hour | Minute    | Second | Alarm value | Alarm status |
|         |  |  |           |       |           |      |           |        |             |              |

Take reading the latest alarm record (2300-2305) as an example, the read-out value is 0x000C 0x1101 0x160E 0x3820 0x0960 0x0001.

| Address  | 2300                          |                           | 2301 |       | 2302 |      | 2303   |        | 2304        | 2305         |
|----------|-------------------------------|---------------------------|------|-------|------|------|--------|--------|-------------|--------------|
|          | H8                            | L8                        | H8   | L8    | H8   | L8   | H8     | L8     |             |              |
| Content  | 0x00                          | 0x0C                      | 0x11 | 0x01  | 0x16 | 0x0E | 0x38   | 0x20   | 0x0960      | 0x0001       |
|          | Alarm group                   | Alarm type                | Year | Month | Day  | Hour | Minute | Second | Alarm value | Alarm status |
| Analysis | The alarms of the first group | Phase A overvoltage alarm | 17   | 1     | 22   | 14   | 56     | 32     | 2400        | Act          |

Phase A overvoltage alarm (the first group of alarms) occurs at 14:56:32, January 22, 2017, the alarm value is 240.0V.

## 2.9 DO Settings

Associated alarm configuration format of do settings is as follows:

| Address | Address 1   |     |     |     | Address 2    |    |    |  |  |
|---------|---|-----|-----|-----|--------------|----|----|--|--|
|         | H16   |     |     |     | L16          |    |    |  |  |
| Content | INT32   |     |     |     |              |    |    |  |  |
|         | B31   | B30 | B29 | ... | B2           | B1 | B0 |  |  |
|         | Associated with the alarm number 31 of the first group (Alarm of over active power) |     |     |     | ...and so on |    |    | Associated with the alarm number 0 of the first group (phase A overcurrent alarm) (1: valid; 0: invalid) |  |
|         |   |     |     |     |              |    |    |  |  |
| Address | Address 3   |     |     |     | Address 4    |    |    |  |  |
|         | H16   |     |     |     | L16          |    |    |  |  |
| Content | INT32   |     |     |     |              |    |    |  |  |
|         | B31   | B14 | B13 | ... | B2           | B1 | B0 |  |  |
|         | Associated with the alarm number 63 of the first group                              |     |     |     | ...and so on |    |    | Associated with the alarm number 32 of   |  |
|         |   |     |     |     |              |    |    |  |  |

|         |  |     |    |  |            |     |              |    |   |  |
|---------|--|-----|----|--|------------|-----|--------------|----|---|--|
|         | (DI2 alarm)  |     |    |  |            |     |              |    | the first group (Alarm of over reactive power)                      |  |
| Address | Address 5  |     |    |  | Address 6  |     |              |    |   |  |
| Content | H16  |     |    |  | L16        |     |              |    |   |  |
|         | INT32  |     |    |  |            |     |              |    |   |  |
|         | B3<br>1  | ... | B6 | B5   | B4         | B3  | B2           | B1 | B0  |  |
|         |  | ... |    | Associated first group alarm No. 69(Fourth channel temperature alarm)  |            |     |              |    | Associated with the alarm number 64 of the first group (DI3 alarm)  |  |
| Address | Address 7  |     |    |  | Address 8  |     |              |    |   |  |
| Content | H16  |     |    |  | L16        |     |              |    |   |  |
|         | INT32  |     |    |  |            |     |              |    |   |  |
|         | B31  |     |    |  | B<br>30    | B29 | ...          | B2 | B1  | B0   |
|         | Associated with the alarm number 31 of the second group (Alarm of over active power) |     |    |  |            |     | ...and so on |    |   | Associated with the alarm number 0 of the second group (phase A overcurrent alarm)     |
| Address | Address 9  |     |    |  | Address 10 |     |              |    |   |  |
| Content | H16  |     |    |  | L16        |     |              |    |   |  |
|         | INT32  |     |    |  |            |     |              |    |   |  |
|         | B31  |     |    |  | B<br>14    | B13 | ...          | B2 | B1  | B0   |
|         | Associated with the alarm number 63 of the second group (DI2 alarm)                  |     |    |  |            |     | ...and so on |    |   | Associated with the alarm number 31 of the second group (Alarm of over reactive power) |
| Address | Address 11   |     |    |  | Address 12 |     |              |    |   |  |
| Content | H16  |     |    |  | L16        |     |              |    |   |  |
|         | INT32  |     |    |  |            |     |              |    |   |  |
|         | B31  | ... | B6 | B1   | B4         | B3  | B2           | B1 | B0  |  |
|         |  | ... |    | Associated second group alarm No. 69(Fourth channel temperature alarm) |            |     |              |    | Associated with the alarm number 64 of the second group (DI3 alarm) |  |

Take reading the associated alarm settings of DO1 (2590-2601) as an example, the read-out value is 0x0000 0x0007 0x0000 0x0000 0x0000 0x0000 0x0000 0x0000 0x0000 0x0000

|         |   |          |          |              |          |          |   |
|---------|---|----------|----------|--------------|----------|----------|---|
| Address | 2590  |          |          |              | 2591     |          |   |
| Content | H16   |          |          |              | L16      |          |   |
|         | INT32   |          |          |              |          |          |   |
|         | B31   | B30      | B29      | ...          | B2       | B1       | B0  |
|         | <b>0</b>  | <b>0</b> | <b>0</b> | <b>0</b>     | <b>1</b> | <b>1</b> | <b>1</b>  |
|         | Associated with the alarm number 31 of the first group (Alarm of over active power) |          |          | ...and so on |          |          | Associated with the alarm number 0 of the first group (phase A overcurrent alarm) |

The remaining addresses in this example are all 0 and are no longer listed.

If the current DO1 function is controlled by the alarm of the first group, in this example, DO1 is associated with the phase A overcurrent alarm, the phase B overcurrent alarm, and the phase C overcurrent alarm of the first group.