PECTECH SRL
Via A. Brustolon, 2A, 35031
Abano Terme (PD)

# PEC-EM3-5A-LW-MID

## Three-phase multifunction energy meter




User Guide V1.1

PECTECH SRL
Via A. Brustolon, 2A, 35031
Abano Terme (PD)

## Safety Information - Important Information

Read these instructions carefully and look at the equipment to become familiar with the device before trying to install, operate, service or maintain it. The following special messages may appear throughout this bulletin or on the equipment to warn of potential hazards or to call attention to information that clarifies or simplifies a procedure.



The addition of either symbol to a “Danger” or “Warning” safety label indicates that an electrical hazard exists which will result in personal injury if the instructions are not followed.



This is the safety alert symbol. It is used to alert you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.

| **DANGER** |
| --- |
| **DANGER** indicates an imminently hazardous situation which,if not avoided, will result in death or serious injury. |

| **WARNING** |
| --- |
| **WARNING** indicates a potentially hazardous situation which, if not avoided, can result in death or serious injury. |

| **CAUTION** |
| --- |
| **CAUTION** indicates a potentially hazardous situation which, if not avoided, can result in minor or moderate injury. |

| ***NOTICE*** |
| --- |
| **NOTICE** is used to address practices not related to physical injury. The safety alert symbol shall not be used with this signal word. |

**Please Note**

Electrical equipment should be installed, operated,serviced, and maintained only by qualified personnel. No responsibility is asumed by Pectech for any consequences arising out of the use of this material.

A qualified person is one who has skills and knowledge related to the construction, installation, and operation of electrical equipment and has received safety training to recongnize and avoid the hazards involved.

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# Chapter 1. Overview

## 1.1. Introduction

PEC-EM3-5A-LW-MID is three phase DIN rail installation mutil-function energy meter that support wireless LoRaWAN communication.This product carry out measurement and analysis of variety of parameters, such as voltage, current, the four quadrant power parameters, power factor, harmonic content etc. ; Meanwhile they can also provide the measurement of multiple energy type, such as two way active energy, reactive energy, monthly and daily electricity consumption statistics. This series of products can support several wiring systems such as single and three phases, is suitable for power monitoring for photovoltaic inverter ,new energy electricity consumption statistic analysis,real time power monitoring and a variety of other environments, has the multi-function, high stability and long life characteristics.

This product with RS485 communication interface, baud rate maximum support 38400bps. It can easily realize the function of remote data read, and adopt the design of large-screen LCD and touch-sensitive key, which can easily carry out the local view and set operation of varity parameters. The product has the function of password protection, which ensures the data security of the product. . Its complete communication function is very suitable for various control systems, SCADA systems and energy management systems.

## 1.2. Characteristics

- Support external voltage transformer access, input voltage minimum support 30V.
- MID comply with current transducer CT out 1_5A
- Built in LoRaWAN communication
- Pulse output
- current transformer reverse connection correction
- DIN Rail mounting, standard 4 modulus width.
- Touch button design improves button operability and reduces button failure rate
- Multi-function parameter measurement, providing voltage, current, active power, reactive power, apparent power, power factor, phase Angle, etc.
- To provide the analytical data of the total harmonic contents of voltages and currents
- Provide a variety of statistical data and local storage functions, such as two-way power, demand and other statistical data. Provide monthly electricity consumption statistics for the last 12 months and daily electricity consumption statistics for the last 31 days
- supports the dual-timing function of the meter startup running time and load running time.
- Support RS485 communication function, baud rate up to 38400bps, support Modbus RTU protocol.
- LCD refresh time is 1 second, support manual or automatic scroll display (configurable)

## 1.3. Parameters

| | |
|---|---|
| **1. The Unit can measure and display** | |
| **Instantaneous RMS Values** | |
| Current | Per phase |
| Voltage | L-L, L-N |
| Frequency | 45 to 65Hz |
| Active power | Total and per phase |
| Reactive power | Total and per phase |
| Apparent power | Total and per phase |
| Power factor | Total and per phase |
| **Energy Values (include: import, export, import + export)** | |
| Active energy | 0 to 99999999.999 kWh (LCD display number of digits: 6+2 -> 7+1 -> 8+0) |
| Reactive energy | 0 to 99999999.999 kvarh (LCD display number of digits: 6+2 -> 7+1 -> 8+0) |
| Multi-Tariff active energy (T1 - T4) | 0 to 99999999.999 kWh (LCD display number of digits: 6+2 -> 7+1 -> 8+0) |
| **Maximum Demand Values** | |
| Max.Demand of current | Per phase |
| Max.Demand of active power | Total |
| Max.Demand of reactive power | Total |
| Max.Demand of apparent power | Total |
| **2. The Unit can measure and communication read** | |
| **Energy Values** | |
| Apparent Energy (total) | 0 to 99999999.999 kVAh |
| Per phase energy | Active energy and reactive energy, include: import, export, import+export<br>Range: 0 to 999999.999 kWh/kvarh |
| Multi-Tariff reactive energy<br>(T1 - T4) | 0 to 99999999.999 kvarh, include: import, export, import+export |
| Monthly electricity consumption for the last 12 months | Total active energy<br>Range: 0 to 99999999.999 kWh |
| Daily energy consumption for the last 31 days | Total active energy<br>Range: 0 to 99999999.999 kWh |
| **3. The Unit can settable** | |
| LoRaWAN class | Uplink interval time, Re-join interval time, ADR, Confirmed mode, APP KEY, LoRaWAN Information, Re-start LoRaWAN |
| Communication class | Modbus address, baud rate, parity bit, stop bit |
| Current transformer (CT 1/5A) class | CT1 (Primary), range from 1 to 9999<br>CT2 (Secondary), range is 1 or 5 |
| Voltage transformer (PT) class | PT1 (Primary), range from 30 to 500000<br>PT2 (Secondary), range is 30 to 500 |
| System configuration class | User password (HMI), Power system type |
| Demand class | Demand interval period, Slide time |
| Pulse output class | Pulse output type, Pulse output width, Pulse output rate |
| Time class | Automatic scroll display time, Backlight time, System time (RTC), Tariff time |

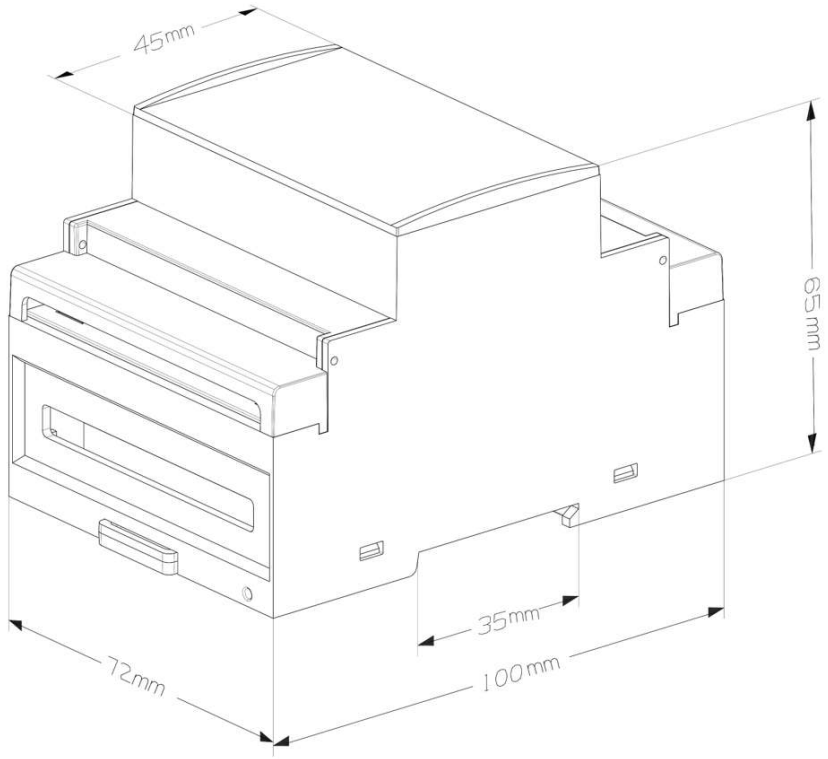
# Chapter 2. Technical parameters specification

## 2.1. Specification

| **Electrical Characteristics** | | |
|---|---|---|
| Type of measurement | | RMS including harmonics on AC system |
| Measurement accuracy | Voltage, Current | Class 0.5, according IEC 61557-12 |
| | Active power | Class 0.5, according IEC 61557-12 |
| | Reactive power | Class 2, according IEC 61557-12 |
| | Apparent power | Class 1, according IEC 61557-12 |
| | Active energy | Class 0.5S, according IEC 62053-22, IEC 61557-12 |
| | Reactive energy | Class 2, according IEC 62053-23, IEC 61557-12 |
| | Power factor | Class 1, according IEC 61557-12 |
| | Frequency | Class 0.2, according IEC 61557-12 |
| | Harmonic distortion | Class 2, according IEC 61557-12 |
| Data update rate | | 1 second. |
| Input-Voltage | Rate voltage (Un) | 230 Vac (L-N) / 400 Vac (L-L) |
| | Measured range (Direct connection) | 30 to 300 Vac (L-N), 30 to 500 Vac (L-L) |
| | PT primary | 30 to 500000 |
| | Impedance | 1MΩ |
| | Frequency range | 45 to 65 Hz |
| | Overload capacity | 2*Un for 1 second |
| Input-Current | CT2 (Secondary) | 1A or 5A |
| | CT1 (Primary) | 1 to 9999 A |
| | Measured range | 0.003 - 6 A, (Ib = 5A) |
| | Impedance | <0.01 ohm |
| | Overload capacity | 120A for 0.5 second |
| Auxiliary power supply | Operating range | 80 ~ 300 Vac / 100 ~ 420 Vdc |
| | Frequency | 45 ~ 65 Hz |
| | Power consumption | < 4VA/0.5W |
| Pulse output | Interface type | Open collector optocoupler |
| | Pulse constant | Per pulse equal 0.001/0.01/0.1/1/10/100 kWh/kvarh |
| | Pulse width | 60/100/200 milliseconds (Configurable) default is 100milliseconds |
| | Pulse output type | Import/export/total active energy, Import/export/total reactive energy (Configurable) |
| | Class | Class A, according IEC 62053-31 |
| | Input voltage | 5 ~ 27 Vdc |
| Pulse indicator light on the panel | | Pulse constant is 5000imp/kWh, Represents the total active energy of the secondary side |
| Real-time clock accuracy | | 0.5 s/d |

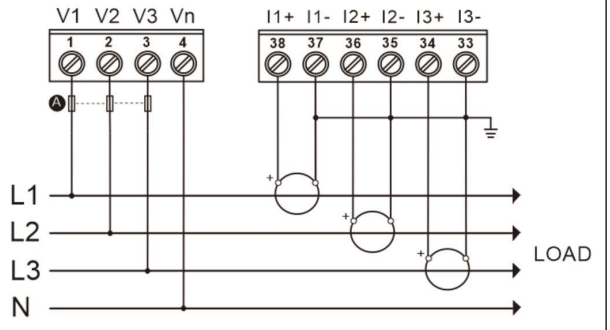
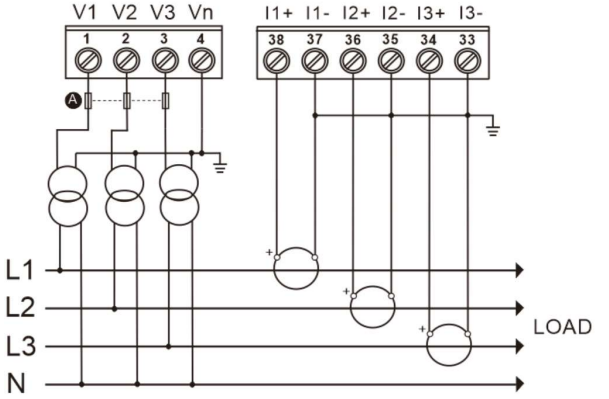
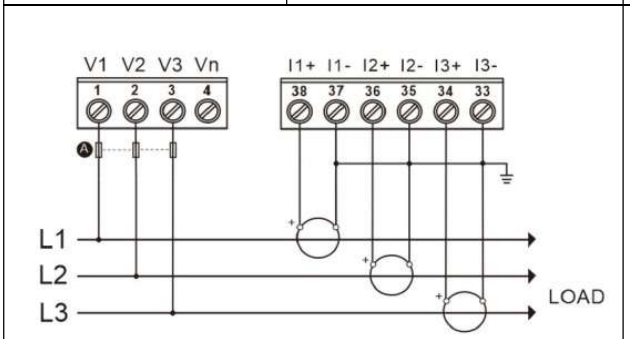
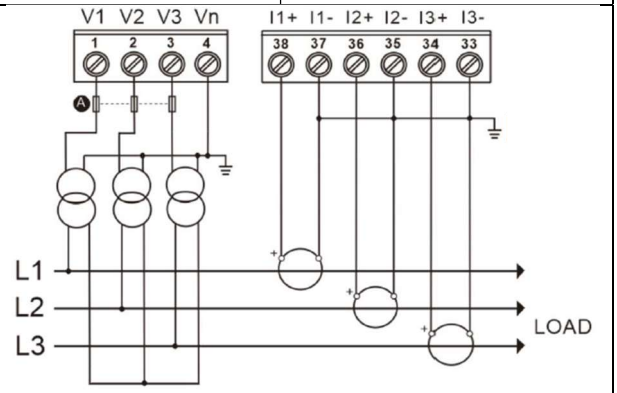
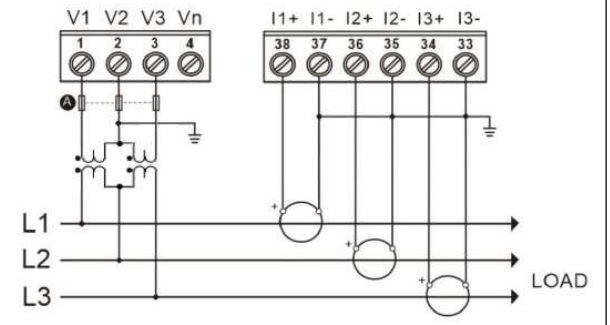
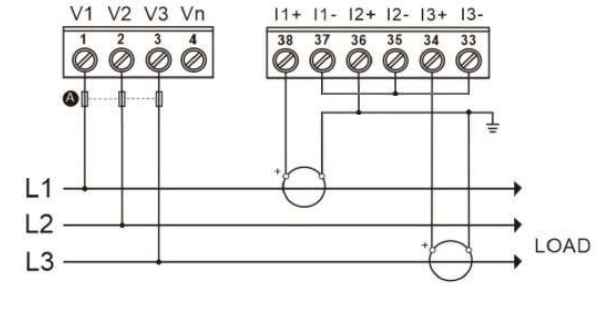
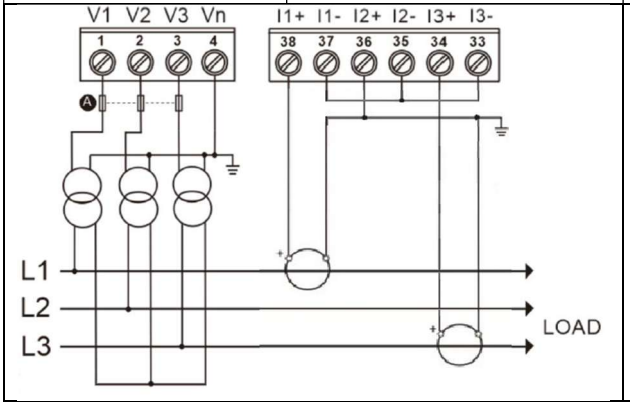
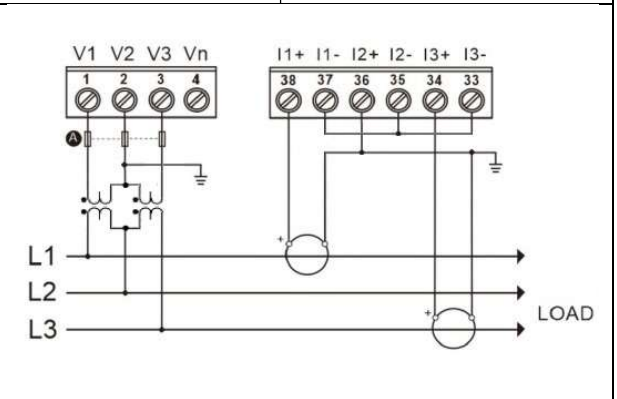
| | |
|---|---|
| **Environmental Characteristics** | |
| Operating Temperature | -25 to +70℃ |
| Storage Temperature | -40 to +80℃ |
| Humidity | < 90%, non-condensing |
| Pollution Degree | 2 |
| Altitude | Up to 2000m |
| Vibration | 10 Hz to 150Hz, IEC 60068-2-6 |
| **Electromagnetic Characteristics** | |
| Electrostatic Discharge | Level 4, according IEC 61000-4-2(1) |
| Immunity to Radiated Fields | Level 3, according IEC 61000-4-3(1) |
| Immunity to Electrical Fast Transients | Level 4, according IEC 61000-4-4(1) |
| Immunity to Surges | Level 4, according IEC 61000-4-5(1) |
| Immunity to Conducted Disturbances | Level 3, according IEC 61000-4-6(1) |
| Immunity to Magnetic Fields | IEC 61000-4-8(1) |
| Immunity to Voltage Dips | IEC 61000-4-11(1) |
| Radiated Emissions | Class B, according EN55011 |
| Conducted Emissions | Class B, according EN55011 |
| Harmonics | IEC 61000-3-2(1) |
| (1): The experimental test is carried out according to the grade requirements of industrial grade products in IEC61326-1 | |
| **Safety** | |
| Measurement Category | CAT III, according IEC 61010-1 |
| Overvoltage Category | CAT III, according IEC 61010-1 |
| Insulation | AC Voltage Test: 4kV for 1 minute |
| | Impulse Voltage Test: 6kV - 1.2/50μS waveform |
| Protective Class | II, according IEC61010-1 |
| **BUS Communications** | |
| Interfaces standard and protocols | 2-wire RS485, Modbus RTU |
| Buad rate | 1200 to 38400 bps, default is 9600 bps |
| Parity bit | None, Even, Odd, default is None |
| Stop bit | 1 or 2, default is 1 |
| Response time | <100ms |
| Transmission mode | half-duplex |
| Transmission distance | Up to 1000m |
| Max. Bus loading | 64 pcs |
| **Wireless Communications** | |
| Supported wireless types | LoRaWAN V1.0.4, Class C |

| **Mechanical Characteristics** | |
|---|---|
| IP Degree of Protection (IEC 60529) | Designed to IP51 front display, IP30 meter body |
| Dimensions (W X H X D) | 72 x 100 x 66 mm |
| Mounting Position | DIN Rail mounting |
| Material of meter case | UL 94 V-0 |

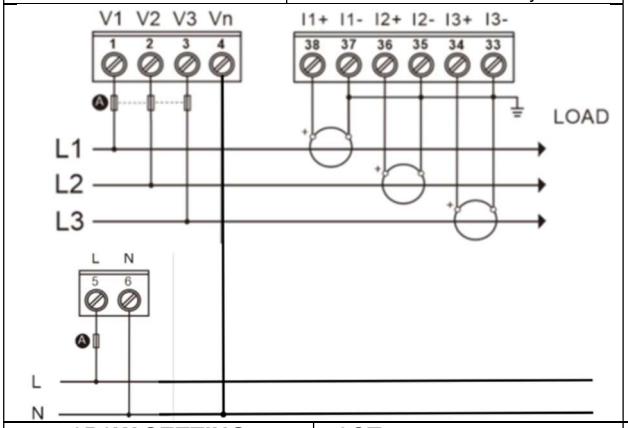


## 2.2. **Wiring Diagrams**

# Measurement input wiring

| **3P4W SETTING** | 3CT DIAGRAM | **3P4W SETTING** | 3PT+3CT DIAGRAM |
|---|---|---|---|
|  | |  | |
| **3P4W SETTING** | 3CT DIAGRAM without neutral | **3P4W SETTING** | 3PT+3CT DIAGRAM without neutral |
|  | |  | |
| **3P4W SETTING** | 2PT+3CT DIAGRAM without neutral | **3P4W SETTING** | 2CT DIAGRAM without neutral |
|  | |  | |
| **3P4W SETTING** | 3PT+2CT DIAGRAM without neutral | **3P4W SETTING** | 2PT+2CT DIAGRAM without neutral |
|  | |  | |

**3P4W SETTING** | 3CT DIAGRAM + auxiliary neutral

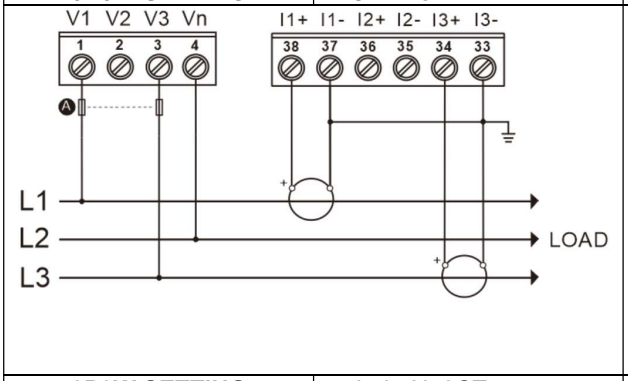



<u>3P3W</u> INSERTION (WITHOUT NEUTRAL)

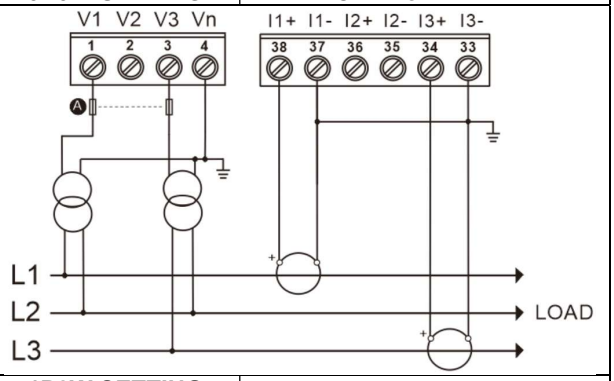
Device works in triangular mode, aren't available lines measures as $V_{L-N}$ , $P_{1,2,3}$ , $Q_{1,2,3}$ , $S_{1,2,3}$ , $PF_{1,2,3}$

Measures available $V_{L-L}$ , $I_{1,2,3}$ , $P_{TOT}$ , $Q_{TOT}$ , $S_{TOT}$ , $PF_{TOT}$

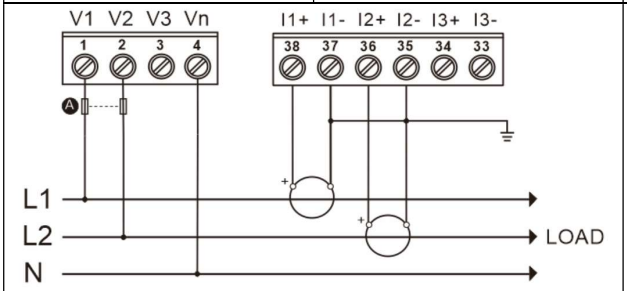
**3P3W SETTING** | 2CT DIAGRAM without neutral



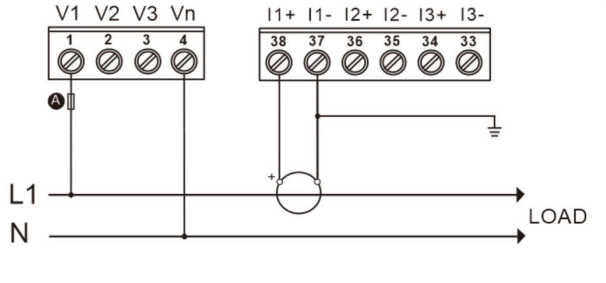

**3P3W SETTING** | 2PT+2CT DIAGRAM without neutral



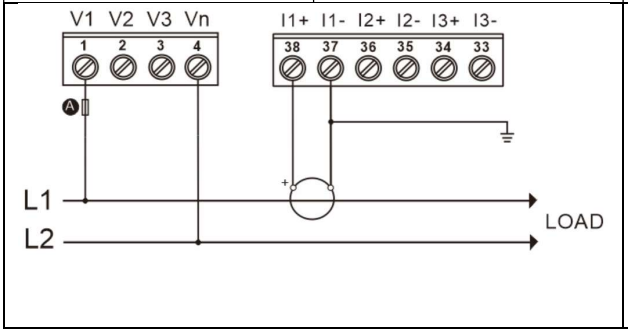

**2P3W SETTING** | L+L+N, 2CT DIAGRAM



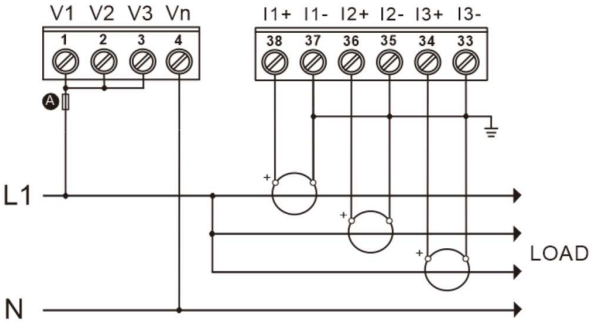

**1P2W SETTING** | L+N，1CT DIAGRAM



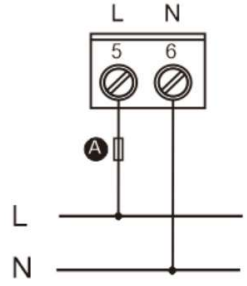
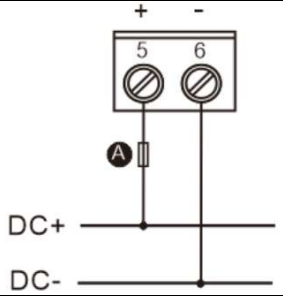

**1P2W SETTING** | L+L，1CT DIAGRAM




**1P2W SETTING** | L+N，3CT DIAGRAM



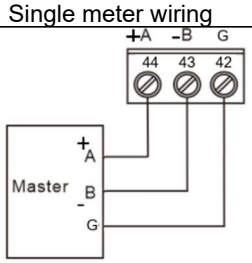
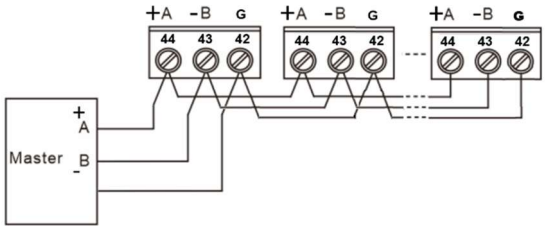
**Auxiliary power wiring**

| AC Power | DC Power |
|---|---|
|  |  |





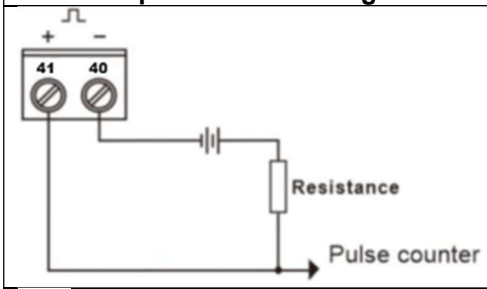
**Communication terminal wiring**

| Single meter wiring | Multiple meters wiring |
|---|---|
|  |  |





**Pulse output terminal wiring**





A : 500 mA fast fuse.

| **Terminal specification parameters** | |
|---|---|
| Voltage measurement input terminal | Wire size: 0.82 ~ 3.31 $mm^2$ (18 ~ 12 AWG)<br>Torque: 0.5 ~ 0.6 N.m |
| Current measurement input terminal | Wire size: 1.318 ~ 3.31 $mm^2$ (16 ~ 12 AWG)<br>Torque: 0.5 ~ 0.6 N.m |
| Auxiliary power terminal | Wire size: 0.82 ~ 3.31 $mm^2$ (18 ~ 12 AWG)<br>Torque: 0.5 ~ 0.6 N.m |
| Communication terminal | Wire size: 0.82 ~ 3.31 $mm^2$ (18 ~ 12 AWG)<br>Torque: 0.5 ~ 0.6 N.m |

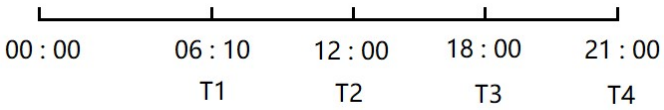
# Chapter 3. General function description

## 3.1. Multi-tariffs function

The multi-tariffs function refers to the function that the meter realizes time-sharing measurement of electric quantity. The power meter divides the 24 hours of a day into several time periods, and then specifies the rate number for each time period. Then the power meter sortes the amount of electricity in time division according to the pre-divided time period, and stores it to the position of the rate number corresponding to each time period, so as to realize the function of time-division measurement of electricity.

The meter used the method of the tariff number correlation to the starting time point to realize the tariff segment division. The power meter support up to 8 starting time points and up to 4 tariff segments (T1, T2, T3 and T4).

Figure 3-1: The starting time points of the tariff segment



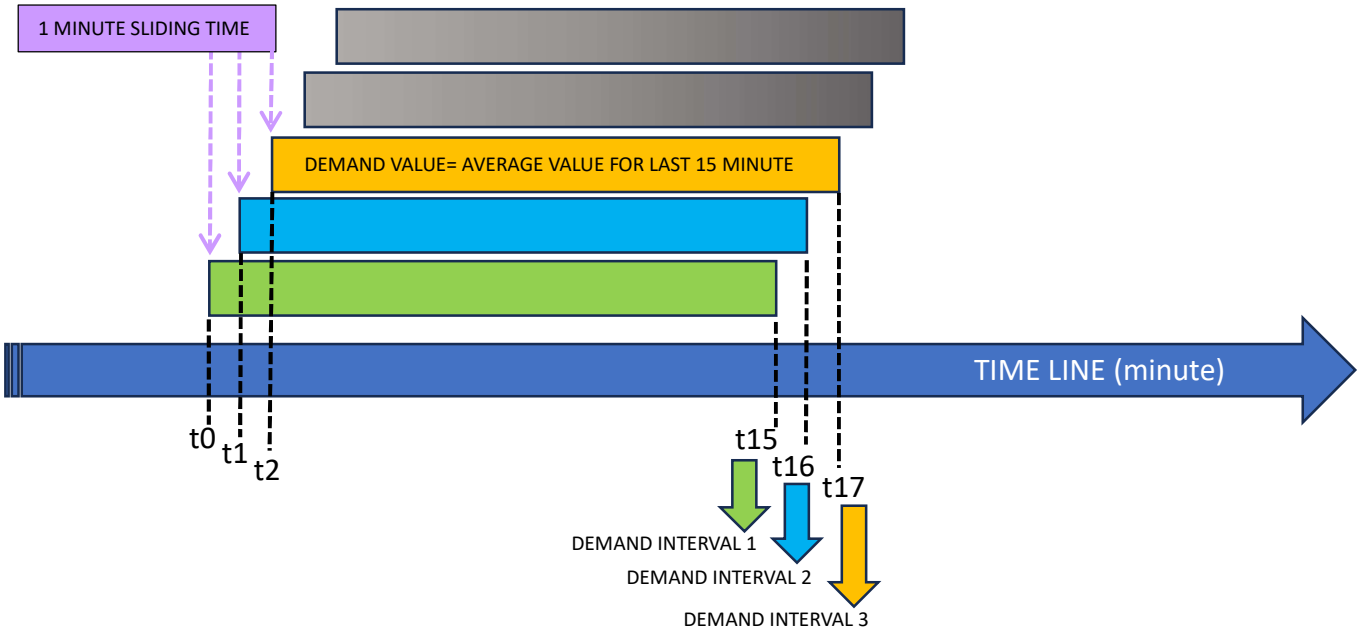

As shown in Figure 3-1, 06:10 marks the start time of tariff 1 (T1), 12:00 the tariff 2 (T2), 18:00 tariff 3 (T3) and 21:00 designated as the tariff 4 (T4). That means tariff 1 range is 06:10 to 12:00, tariff 2 range is 12:00 to 18:00, tariff 3 range is 18:00 to 21:00, tariff 4 range is 21:00 to next 06:10 when start again the T1.

Note: The tariff parameters can be set by communication commands (Please refer to the relevant communication protocol document for the register address).

## 3.2. **Demand calculation method**

Power meter calculates and update the demand using sliding window method as follow:

Figure 3-2: Diagram of sliding block interval calculation method

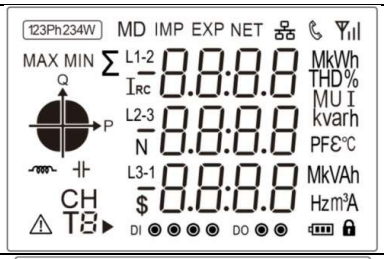
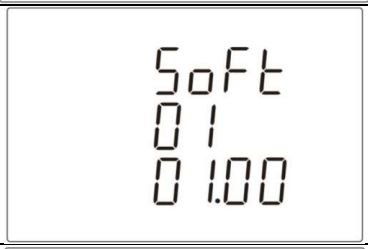
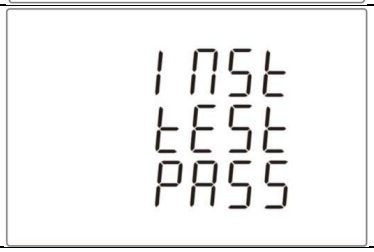



As shown in Figure 3-2, the first demand calculation is shown after 15 minute from turn on (demand calculation between the 0th and the 15th minute) then at16th minute do the second demand calculation (demand calculation between the 1th and the 16th minute).
Once again at the 17th minute the third (demand calculation between the 2th and the 17th minute) and so on.

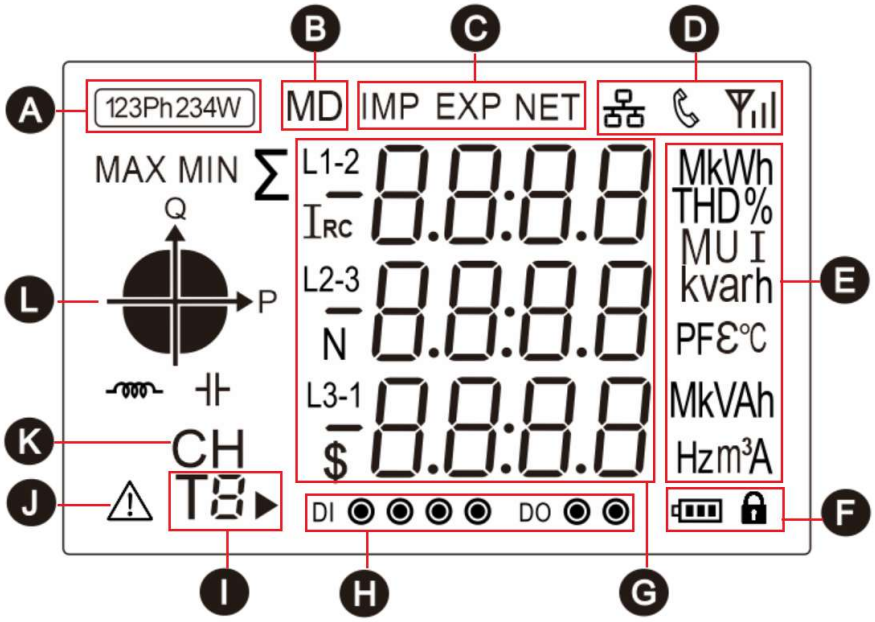
# Chapter 4. Operation

## 4.1. Meter startup instructions

Each time PEC-EM3 turned on start self-test process, display the sequence as follow:

| | | |
|---|---|---|
| First screen display | Display full screen characters |  |
| Second screen display | Displays the software version number of the power meter |  |
| Three screen display | Display the results of the self-test |  |

## 4.2. LCD display area description



A: The power grid type icon represents the current measurement type of the meter.

B: Maximum demand icon.

C: Direction icon for import and export energy.

D: A status indicator icon for the meter.

E: An icon of a unit of measurement data.

F: Battery status Icon and lock icon, displays the battery status and indicates that the device is locked [*].

G: Measured values.

H: An icon of digital I/O status for the meter.

I: Multi tariff icon indicating the tariff segment to which the current energy. ▶ represents the tariff number displayed as the running tariff segment. For example:  The figure on the left represents that the tariff 2 (T2) segment is running, and the accumulated energy will be counted into the corresponding energy area of tariff 2 (T2).

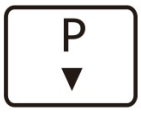
J: Warning Status icon.

K: Channel indicator icon for multiple measurement channels.

L: Quadrant indicator icon indicating the quadrant of the current load.

[*] lock function is only factory set-up, it’s not maneageable by end users

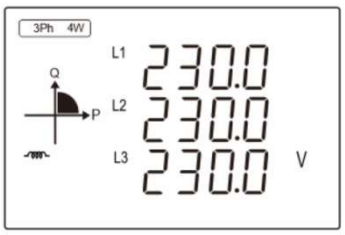
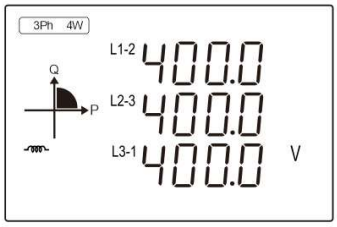
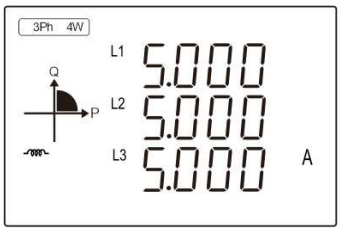
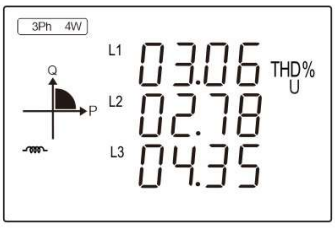
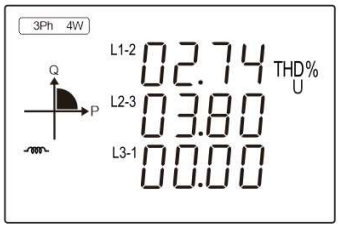
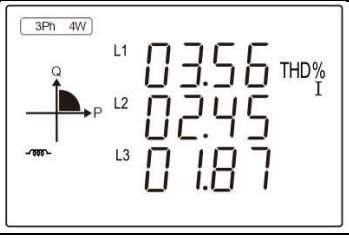
## 4.3. **Button definition description**

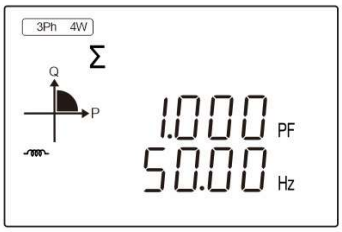
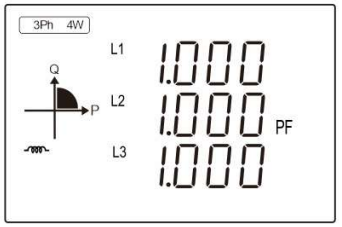
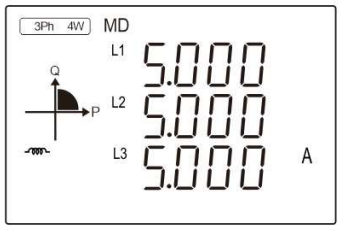
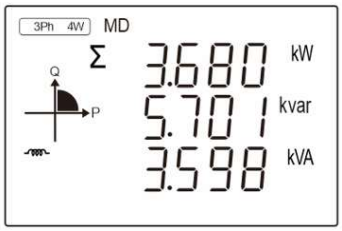
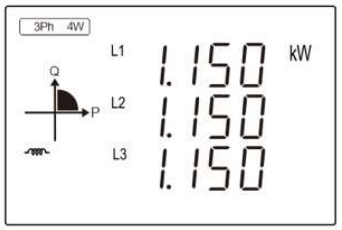
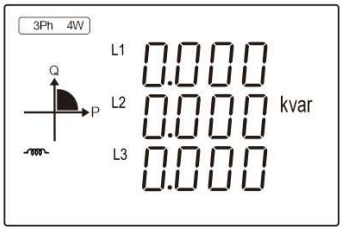
| Button | Definition | Click | Press 3 second |
|---|---|---|---|
|  | Button 1: Escape key (Esc) | 1. In the setting screen or auxiliary screen: exit or return to the previous screen.<br>2. In the main display screen: page scroll for parameters such as voltage and current. | Under the main display screen: enter the auxiliary display screen. |
|  | Button 2: Up key (Up) | 1. In the main display screen: view the power factor, maximum demand.<br>2. In the setting screen or auxiliary screen: scroll up to display the page or the increasing number. | Null |
|  | Button 3: Down key (Dn) | 1. In the main display screen: veiw the power information.<br>2. In the setting screen or auxiliary screen: scroll down to display the page or the decreasing number. | Null |
|  | Button 4: Enter key (Et) | 1. In the main display screen: veiw energy data and system time.<br>2. In the setting screen: right move the setting cursor. | 1. In the main display screen: enter the setting mode.<br>2. In the setting screen: enter the setting state or carry out confirmation operation. |

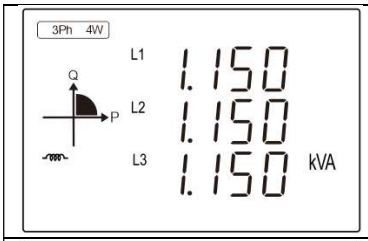
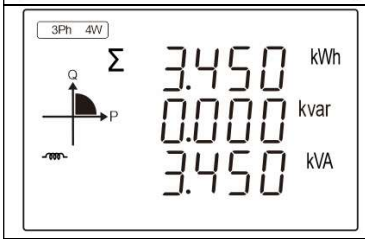
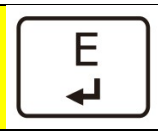
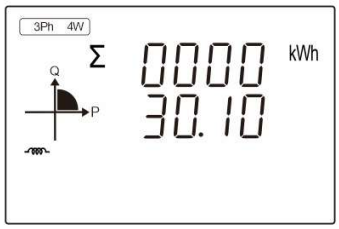
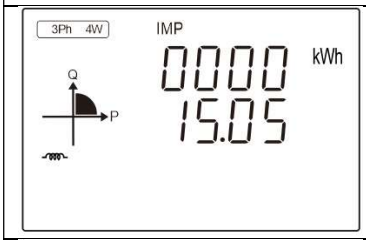
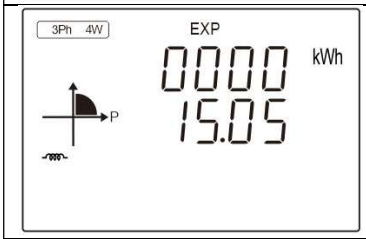
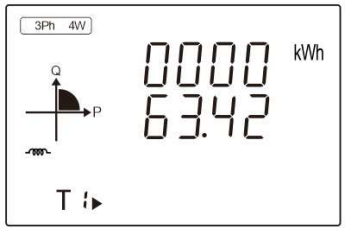
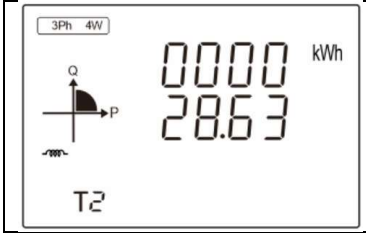
## 4.4. **Description of display screen**

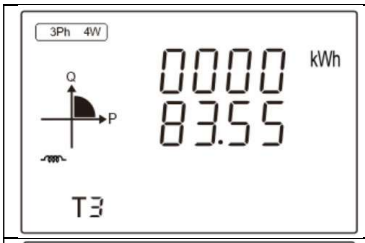
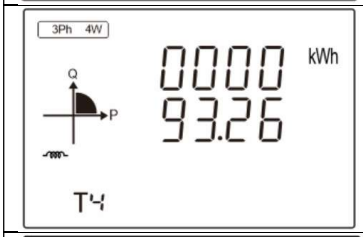
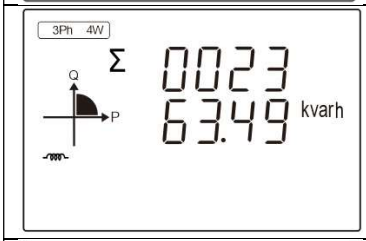
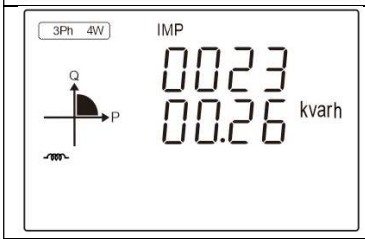
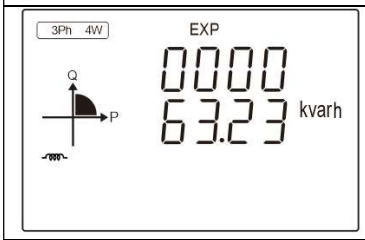
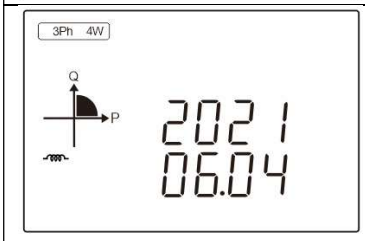
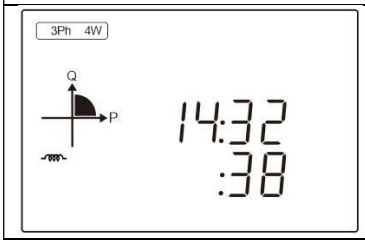
### 4.4.1. Main display screen

After the meter is powered on and passes the self-test process, the interface entered is defined as the main display interface, which is used to display the main measurement parameters, electric quantity data, instrument information and other data of the product. Users can scroll the display page by pressing the button 1 to button 4.

| LCD display | Description |
|---|---|
| | U/I Esc |
|  | A display screen for three-phase L-N voltage.<br><br>Example:<br>L1-N voltage = 230.0V<br>L2-N voltage = 230.0V<br>L3-N voltage = 230.0V<br><br>Note: In 3P3W mode, this screen is not displayed |
|  | A display screen for three-phase L-L voltage.<br><br>Example:<br>L1-2 voltage = 400.0V<br>L2-3 voltage = 400.0V<br>L3-1 voltage = 400.0V<br><br>Note: In 1P2W mode, this screen is not displayed |
|  | A display screen for three-phase current.<br><br>Example:<br>L1 current = 5.001A<br>L2 current = 5.002A<br>L3 current = 5.000A |
|  | A display screen for three-phase L-N voltage THD.<br><br>Example:<br>L1 voltage THD = 3.06%<br>L2 voltage THD = 2.78%<br>L3 voltage THD = 4.35% |
|  | A display screen for three-phase L-L voltage THD.<br><br>Example:<br>L1-2 voltage THD = 2.74%<br>L2-3 voltage THD = 3.80%<br>L3-1 voltage THD = 0.00%<br><br>Note: This screen is displayed only in 3P3W mode. |
|  | A display screen for three-phase current THD.<br><br>Example:<br>L1 current THD = 3.56%<br>L2 current THD = 2.45%<br>L3 current THD = 1.87% |

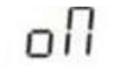
| PF/HZ ▲ | |
|---|---|
|  | Total power factor and frequency display screen<br><br>Example:<br>Total power factor = 1.000<br>Frequency = 50.00Hz |
|  | Three - phase power factor display screen<br><br>Example:<br>L1 power factor = 1.000<br>L2 power factor = 1.000<br>L3 power factor = 1.000 |
|  | Max.demand of three-phase display screen<br><br>Example:<br>Max.Demand of L1 current = 5.000A<br>Max.Demand of L2 current = 5.000A<br>Max.Demand of L3 current = 5.000A |
|  | Max.demand of total active/reactive/apparent power display screen<br><br>Example:<br>Max.Demand of total active power = 3.680 kW<br>Max.Demand of total reactive power = 5.701 kvar<br>Max.Demand of total apparent power = 3.598 kVA |
| **P ▼** | |
|  | Per phase active power display screen<br><br>Example:<br>L1 active power = 1.150 kW<br>L2 active power = 1.150 kW<br>L3 active power = 1.150 kW |
|  | Per phase reactive power display screen<br><br>Example:<br>L1 reactive power = 0 kvar<br>L2 reactive power = 0 kvar<br>L3 reactive power = 0 kvar |

| | |
|---|---|
|  | Per phase apparent power display screen<br><br>Example:<br>L1 apparent power = 1.150 kVA<br>L2 apparent power = 1.150 kVA<br>L3 apparent power = 1.150 kVA |
|  | Total active/reactive/apparent power display screen<br><br>Example:<br>Total active power = 3.450 kW<br>Total reactive power = 0 kvar<br>Total apparent power = 3.450 kVA |
|  | |
|  | Total active energy<br><br>Example:<br>Total active energy = 30.10 kWh |
|  | Import active energy<br><br>Example:<br>Import active energy = 15.05 kWh |
|  | Export active energy<br><br>Example:<br>Export active energy = 15.05 kWh |
|  | Tariff 1 active energy<br><br>Example: Tariff 1 active energy = 63.42kWh |
|  | Tariff 2 active energy<br><br>Example: Tariff 2 active energy = 28.63kWh |

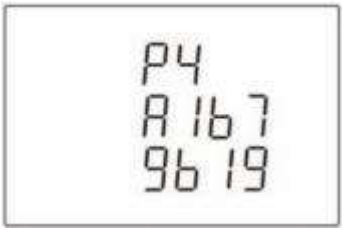
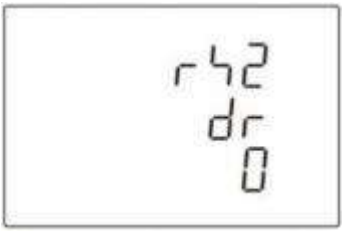
| | |
|---|---|
|  | Tariff 3 active energy<br>Example: Tariff 3 active energy = 83.55kWh |
|  | Tariff 4 active energy<br>Example: Tariff 4 active energy = 93.26kWh |
|  | Total reactive energy<br>Example: Total reactive energy = 2363.49kvarh |
|  | Import reactive energy<br>Example: Import reactive energy = 2300.26kvarh |
|  | Export reactive energy<br>Example: Export reactive energy = 63.23kvarh |
|  | Displaying the current date of the system real-time clock.<br>Example: The current date is June 4, 2021 |
|  | Displaying the current time of the system real-time clock.<br>Example: The current time is 14:32.38 |
| Icon description of the load nature:<br> is mean : The load is an inductive load ,  is mean : The load is a capacitive load. | |

### 4.4.2. **Auxiliary display screen**

Under the main display screen, press button 1 for 3 second to enter of auxiliary display. At this point, click button 2 or button 3 can be scroll the page needs to be viewed. Can click button 1 to return to the main display screen. If there is no button operation in more than 1 minute the meter will automatically return to the main display screen.

| No. | LCD display | Description |
|---|---|---|
| 1 |  | The join the network status of the OTAA.<br><br>By pressing the button 4 for 3 seconds can the meter can be triggered immediately to join LoRaWAN gateway.<br><br>Note: The second and third line of characters on the screen represents the networking status.<br><br>  mean: joined LoRaWAN gateway.<br><br>  mean: The meter is being join to the LoRaWAN gateway.<br><br>  mean: The meter has not been joined to the gateway and is waiting to be join. The bottom characters represents the wait time. |
| 2 |  | Unique ID of the device (DEUI).<br><br>By pressing the button 4 for 3 seconds can view DEUI information. |
| 2-1 |  | The DEUI is 64bit hex-coded, so it is divided into two screen (P1-P2). Here the screen display represents the DEUI is 00 80 E1 15 00 2C BD 92. |

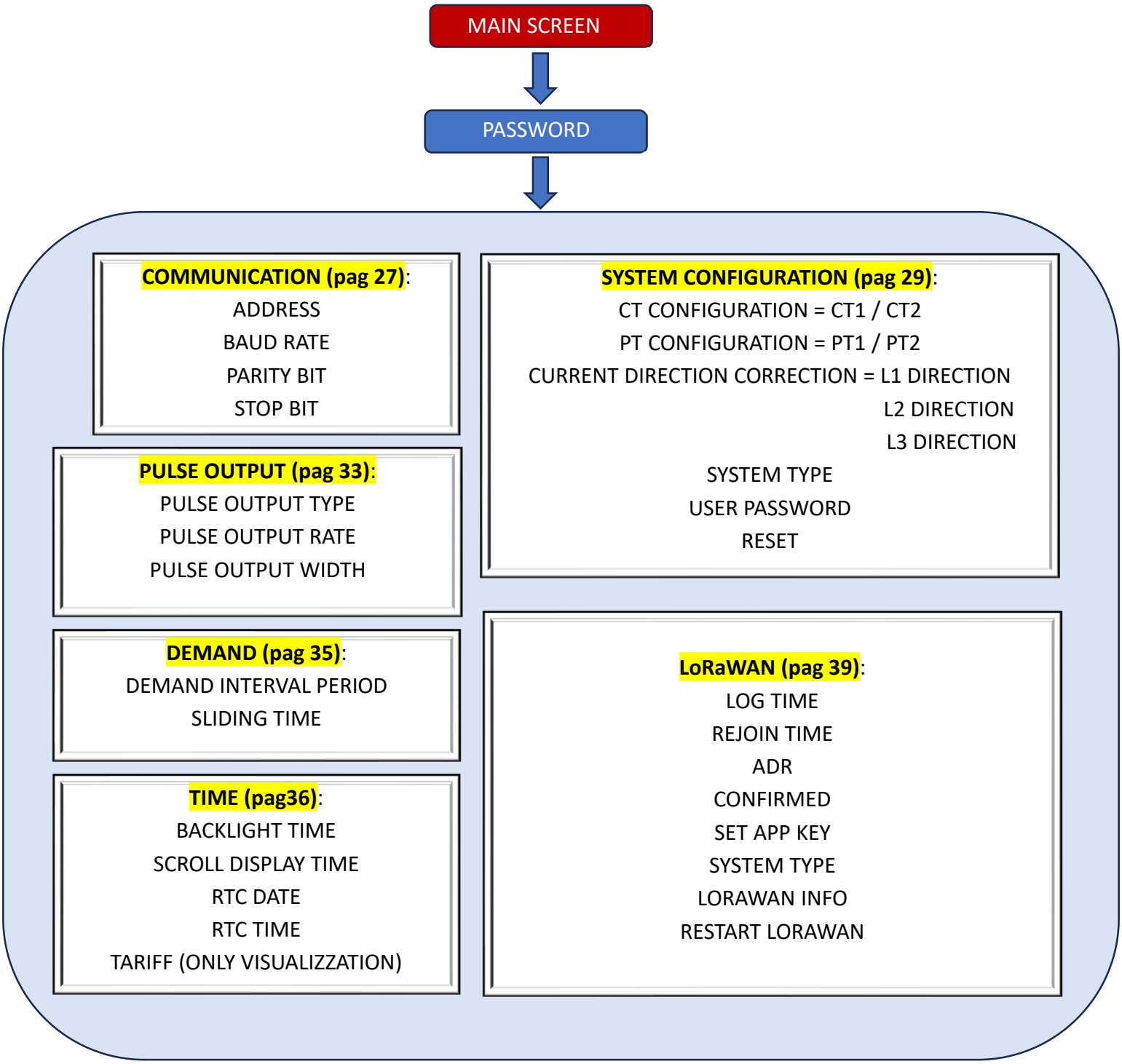
| | | |
|---|---|---|
| 2-2 |  | |
| 3 |  | Applicatie Identifier (APP EUI).<br><br>By pressing the button 4 for 3 seconds can view APP EUI information. |
| 3-1 |  | The APP EUI is 64bit hex-coded, so it is divided into two screen (P1-P2). Here the screen display represents the APP EUI is 01 01 01 01 01 01 01 01. |
| 3-2 |  | |
| 4 |  | Application key for OTAA mode (APP KEY).<br><br>By pressing the button 4 for 3 seconds can view APP KEY information. |
| 4-1 |  | The APP KEY is 128bit hex-coded, so it is divided into four screen (P1-P4). Here the screen display represents the APP KEY is 1F D9 8E E4 D4 EA CE 4C 17 C1 0C 52 A1 B7 9B 19. |
| 4-2 |  | |

| | | |
|---|---|---|
| 4-3 |  | |
| 4-4 |  | |
| 5 |  | ADR: Allow network server to adjust the datarate of the device. |
| 6 |  | The log interval time.<br><br>The log interval is meant to instruct the meter in which interval measurements need to be saved to the logbook. |
| 7 |  | The re-join interval time.<br><br>If no downlink data from the gateway is received within the re-join interval time, the meter will determine that LoRaWAN has been disconnected, and the meter will perform the join operation again. |
| 8 |  | RX2 data rate to receive downlinks.<br><br>Example: DR0 |
| 9 |  | RX2 frequency to receive downlinks. Unit: MHz<br><br>Example: 869.5MHz |

| | | |
|---|---|---|
| 10 |  | LoRaWAN Test.<br><br>By pressing the button 4 for 3 seconds the device can send a device status uplink to the joined LoRaWAN network.<br><br>Note: The third line of characters on the screen represents the sending status.<br>RaR mean: No send operation is performed.<br>RI⊥ mean: Sending operation is being performed.<br>ue mean: Send successfully.<br>FRIL mean: Send failure. |
| 11 |  | Ratio of current transformer (CT) |
| 12 |  | Ratio of voltage transformer (PT) |
| 13 |  | The serial number of meter<br><br>Example: The serial number is 21000110. |
| 14 |  | Software version number |

## 4.5. **Setting-up**

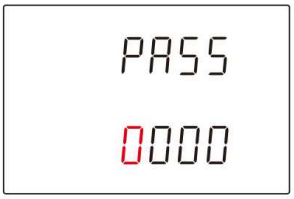
The logical diagram of the parameter setting menu is as follows:



**How to enter the "Parameter setting Menu" screen:**

Step 1: In the main display screen, press button 4 for 3 second to enter the user password input mode.

**Note:** The user password input screen is shown in the figure on the right.




Step 2: Enter the correct user password (*) and press button 4 for 3 second to confirm.

**(*) How to enter a password:**

A: Click button 2 and button 3 to increase or decrease the number of flashing bits.

B: Click button 4 to move the flashing position to the right.

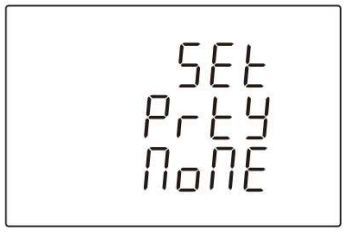
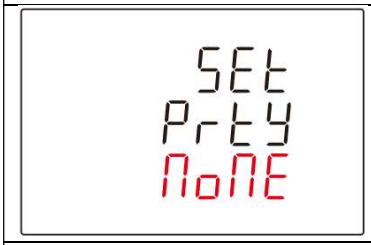
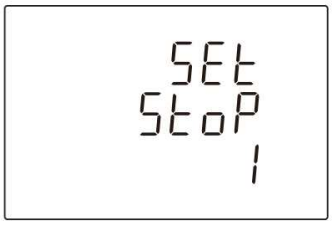
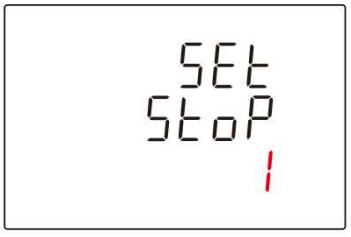
C: After entering the correct password, press button 4 for 3 second for confirmation. If the password is verified correctly, the power meter will enter the screen of "Parameter Setting menu".

Note: Under the user password input screen, can click button 1 to return to the main display screen. If there is no button operation in more than 1 minute under this screen, the power meter will automatically return to the main display screen.

### 4.5.1. Set communication class parameters

Communication parameters include: Modbus address, baud rate, parity bit, stop bit.

<table>
<tr><td colspan="2">1. After entering the "Parameter Setting Menu" screen, select the setting screen (as shown in the figure below), and then press button 4 for 3 second to enter the communication parameter setting screen.<br>  </td></tr>
<tr><td colspan="2">2. Setting the modbus communication address</td></tr>
<tr><td>  </td><td>Modbus address setting range: 001 to 247, default is 001.<br><br>Press button 4 for 3 second to enter the setting state, and the digit of the setting becomes the flashing state.<br>Click button 2 or button 3 to scroll the page and select the next setting interface.<br>Click button 1 to exit the setting menu and return to the previous setting screen.</td></tr>
<tr><td>  </td><td>Click button 2 or button 3 to increase or decrease the number of set bits.<br>Click button 4 can be moved the set bits to the right.<br>Press button 4 for 3 second to confirm the setting. The meter will save the setting value and exit the setting state.<br>Click button 1 to exit the setting state without saving the setting parameters.</td></tr>
<tr><td colspan="2">3. Setting the baud rate</td></tr>
<tr><td>  </td><td>Baud rate can be setting: 1200, 2400, 4800, 9600, 19200, 38400 bps, default is 9600bps.<br><br>Press button 4 for 3 second to enter the setting state, and the digit of the setting becomes the flashing state.<br>Click button 2 or button 3 to scroll the page and select the next setting interface.<br>Click button 1 to exit the setting menu and return to the previous setting screen.</td></tr>
<tr><td>  </td><td>Click button 2 or button 3 to select the baud rate.<br>Press button 4 for 3 second to confirm the setting. The meter will save the setting value and exit the setting state.<br>Click button 1 to exit the setting state without saving the setting parameters.</td></tr>
</table>

| | |
|---|---|
| 4. Setting the parity bit | |
|  | Parity bit can be setting: None, Even, Odd, default is None.<br><br>Press button 4 for 3 second to enter the setting state, and the character of the setting becomes the flashing state.<br>Click button 2 or button 3 to scroll the page and select the next setting interface.<br>Click button 1 to exit the setting menu and return to the previous setting screen. |
|  | Click button 2 or button 3 to select the parity bit.<br>Press button 4 for 3 second to confirm the setting. The meter will save the setting value and exit the setting state.<br>Click button 1 to exit the setting state without saving the setting parameters. |
| 5. Setting the stop bit | |
|  | Stop bit can be setting: 1 or 2, default is 1.<br><br>Press button 4 for 3 second to enter the setting state, and the digit of the setting becomes the flashing state.<br>Click button 2 or button 3 to scroll the page and select the next setting interface.<br>Click button 1 to exit the setting menu and return to the previous setting screen.<br><br>**Note:** The stop bit can only be set to 2 if the check bit is equal to None. |
|  | Click button 2 or button 3 to select the stop bit.<br>Press button 4 for 3 second to confirm the setting. The meter will save the setting value and exit the setting state.<br>Click button 1 to exit the setting state without saving the setting parameters. |

### 4.5.2. Set CT class parameters

CT parameters include: primary side value (CT1) and secondary side value (CT2) of the current transformer.

1. After entering the "Parameter Setting Menu" screen, select the setting screen (as shown in the figure below), and then press button 4 for 3 second to enter the system parameter setting screen.




2. Select the setting screen (as shown in the figure below), and then press button 4 for 3 second to enter the CT class parameters setting screen.




2.1. Setting CT1



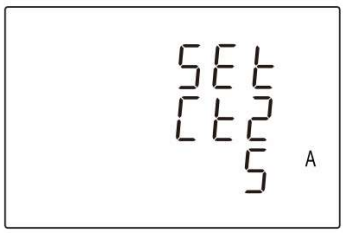

CT1 setting range: 1 to 9999A, default is 5A.

Press button 4 for 3 second to enter the setting state, and the digit of the setting becomes the flashing state.
Click button 1 to return to the previous level setup menu.



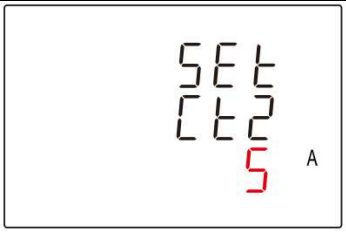

Click button 2 or 3 to increase or decrease the number of set bits.
Click button 4 can be moved the set bits to the right.
Press button 4 for 3 second to confirm the setting. The power meter will save the setting value and exit the setting state.
Click button 1 to exit the setting state without saving the setting parameters.

2.2. Setting CT2




CT2 can be set: 1A or 5A, default is 5A.

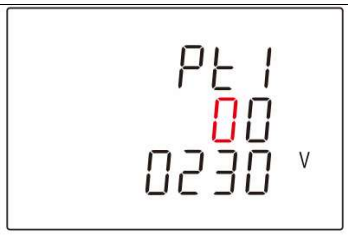
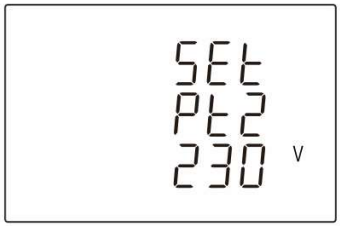
Press button 4 for 3 second to enter the setting state, and the digit of the setting becomes the flashing state.
Click button 1 to return to the previous level setup menu.

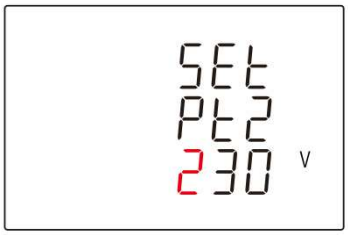



Click button 2 or 3 to select the CT2.
Press button 4 for 3 second to confirm the setting. The power meter will save the setting value and exit the setting state.
Click button 1 to exit the setting state without saving the setting parameters.

### 4.5.3. Set PT class parameters

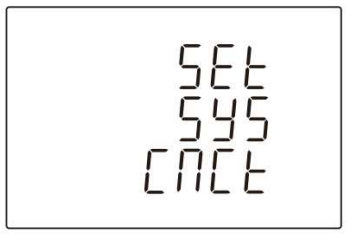
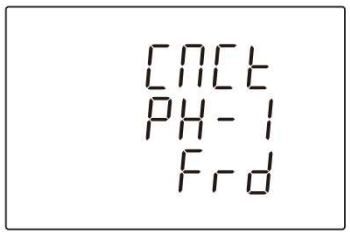
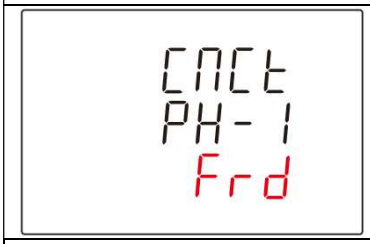
PT parameters include: primary side value (PT1) and secondary side value (PT2) of the voltage transformer.

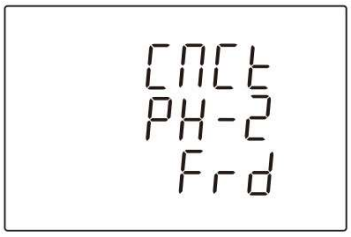
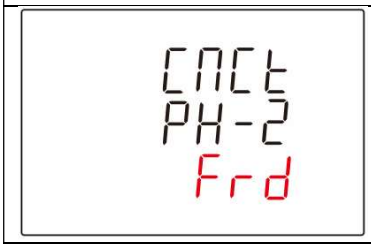
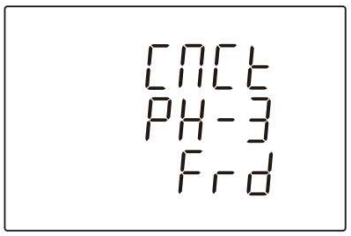
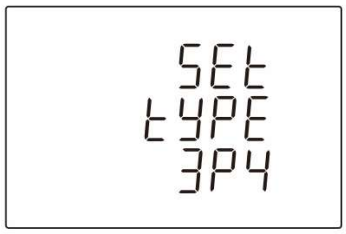
<table>
<tr><td colspan="2">1. After entering the "Parameter Setting Menu" screen, select the setting screen (as shown in the figure below), and then press button 4 for 3 second to enter the system parameter setting screen.<br>  </td></tr>
<tr><td colspan="2">2. Select the setting screen (as shown in the figure below), and then press button 4 for 3 second to enter the PT class parameters setting screen.<br>  </td></tr>
<tr><td colspan="2">2.1. Setting PT1</td></tr>
<tr><td>  </td><td>PT1 setting range: 30 to 500000V, default is 230V.<br><br>Press button 4 for 3 second to enter the setting state, and the digit of the setting becomes the flashing state.<br>Click button 1 to return to the previous level setup menu.</td></tr>
<tr><td>  </td><td>Click button 2 or 3 to increase or decrease the number of set bits.<br>Click button 4 can be moved the set bits to the right.<br>Press button 4 for 3 second to confirm the setting. The power meter will save the setting value and exit the setting state.<br>Click button 1 to exit the setting state without saving the setting parameters.</td></tr>
<tr><td colspan="2">2.2. Setting PT2</td></tr>
<tr><td>  </td><td>PT2 setting range: 30 to 500V, default is 230V.<br><br>Press button 4 for 3 second to enter the setting state, and the digit of the setting becomes the flashing state.<br>Click button 1 to return to the previous level setup menu.</td></tr>
</table>

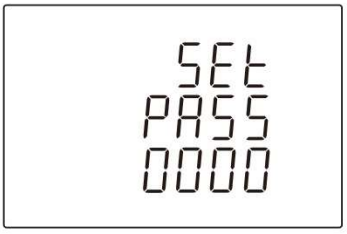
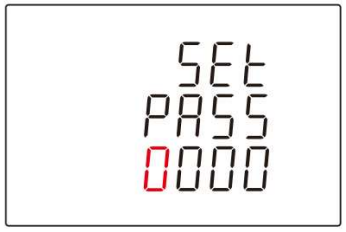
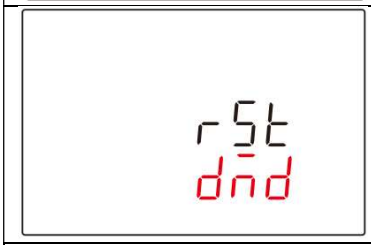
| | |
|---|---|
|  | Click button 2 or 3 to increase or decrease the number of set bits.<br>Click button 4 can be moved the set bits to the right.<br>Press button 4 for 3 second to confirm the setting. The power meter will save the setting value and exit the setting state.<br>Click button 1 to exit the setting state without saving the setting parameters. |

### 4.5.4. Set system class parameters

System class parameters include: system current direction correction, system type, gateway mode, user password, reset max. demand or historical electricity consumption log.

| | |
|---|---|
| 1. After entering the "Parameter Setting Menu" screen, select the setting screen (as shown in the figure below), and then press button 4 for 3 second to enter the system class parameter setting screen.<br>  | |
| 2. Setting system current direction correction | |
|  | Press button 4 for 3 second to enter the next level setting menu.<br>Click button 2 or button 3 to scroll the page and select the next setting interface.<br>Click button 1 to return to the previous level setup menu. |
| 2.1. Set L1 current direction correction | |
|  | L1 current direction correction can be set: forward or reverse, default is forward.<br><br>Click button 3 to scroll down to the Settings screen of L2 current direction correction.<br>Press button 4 for 3 second to enter the setting state, and the character of the setting becomes the flashing state.<br>Click button 1 to return to the previous level setup menu. |
|  | Click button 2 or 3 to select the current direction.<br>Press button 4 for 3 second to confirm the setting. The power meter will save the setting value and exit the setting state.<br>Click button 1 to exit the setting state without saving the setting parameters.<br><br>**Note:** Frd represents forward, rEU represents reverse. |
| 2.2. Set L2 current direction correction | |

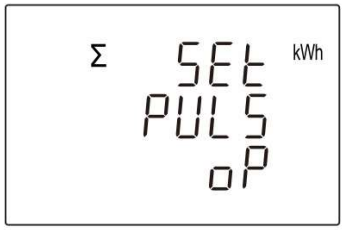
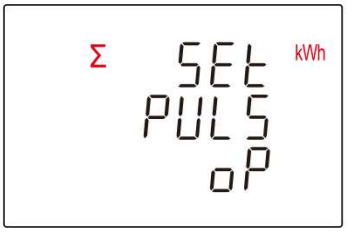
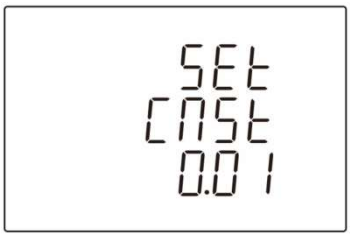
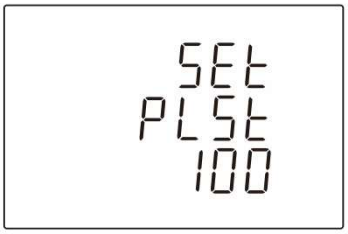
| | |
|---|---|
|  | L2 current direction correction can be set: forward or reverse, default is forward.<br><br>Click button 3 to scroll down to the Settings screen of L3 current direction correction.<br>Press button 4 for 3 second to enter the setting state, and the character of the setting becomes the flashing state.<br>Click button 1 to return to the previous level setup menu. |
|  | Click button 2 or 3 to select the current direction.<br>Press button 4 for 3 second to confirm the setting. The power meter will save the setting value and exit the setting state.<br>Click button 1 to exit the setting state without saving the setting parameters.<br><br>**Note:** Frd represents forward, rEU represents reverse. |
| 2.3. Set L3 current direction correction | |
|  | L3 current direction correction can be set: forward or reverse, default is forward.<br><br>Click button 2 to scroll down to the Settings screen of L2 current direction correction.<br>Press button 4 for 3 second to enter the setting state, and the character of the setting becomes the flashing state.<br>Click button 1 to return to the previous level setup menu. |
|  | Click button 2 or 3 to select the current direction.<br>Press button 4 for 3 second to confirm the setting. The power meter will save the setting value and exit the setting state.<br>Click button 1 to exit the setting state without saving the setting parameters.<br><br>**Note:** Frd represents forward, rEU represents reverse. |
| 3. Set system type | |
|  | The system type supported by the power meter includes the five types: 1P2W, 2P3W, 3P3W, 3P4W, default is 3P4W.<br><br>Press button 4 for 3 second to enter the setting state, and the character of the setting becomes the flashing state.<br>Click button 2 or button 3 to scroll the page and select the next setting interface.<br>Click button 1 to exit the setting menu and return to the previous setting screen. |
|  | Click button 2 or button 3 to select the system type.<br>Press button 4 for 3 second to confirm the setting. The meter will save the setting value and exit the setting state.<br>Click button 1 to exit the setting state without saving the setting parameters. |
| 4. Setting user password | |

| | |
|---|---|
|  | User password setting range:0000 to 9999, default is 0000.<br><br>Press button 4 for 3 second to enter the setting state, and the digit of the setting becomes the flashing state.<br>Click button 2 or button 3 to scroll the page and select the next setting interface.<br>Click button 1 to exit the setting menu and return to the previous setting screen. |
|  | Click button 2 or button 3 to increase or decrease the number of set bits.<br>Click button 4 can be moved the set bits to the right.<br>Press button 4 for 3 second to confirm the setting. The meter will save the setting value and exit the setting state.<br>Click button 1 to exit the setting state without saving the setting parameters. |
| 5. Reset Max. demand or historical electricity consumption log | |
|  | Press button 4 for 3 second to enter the reset state.<br>Click button 2 or button 3 to scroll the page and select the next setting interface.<br>Click button 1 to exit the setting menu and return to the previous setting screen. |
|  | Click button 2 or button 3 to select the reset options.<br>Press button 4 for 3 second to confirm the reset. The meter will reset the selected option and exit the reset state.<br>Click button 1 to exit the reset state without reset the selected option. |
| Note:<br>LEG is mean: Historical monthly and historical daily consumption of energy. (this option is supported only for the Mulit-tariff meter)<br>dnd is mean: Max. demand. | |

### 4.5.5. Set pulse output class parameters

Pulse output class parameters include: pulse output type, pulse output rate and pulse output width.

| |
|---|
| 1. After entering the "Parameter Setting Menu" screen, select the setting screen (as shown in the figure below), and then press button 4 for 3 second to enter the pulse output class parameter setting screen. |

| | |
|---|---|
|  | |
| 2. Setting pulse output type | |
|  | The type of energy represented by the pulse output.<br>Options that can be set: total active energy, import active energy, export active energy, total reactive energy, import reactive energy, export reactive energy, default is total active energy.<br><br>Press button 4 for 3 second to enter the setting state, and the character of the setting becomes the flashing state.<br>Click button 2 or button 3 to scroll the page and select the next setting interface.<br>Click button 1 to return to the previous level setup menu. |
|  | Click button 2 or button 3 to select the pulse output type.<br>Press button 4 for 3 second to confirm the setting. The meter will save the setting value and exit the setting state.<br>Click button 1 to exit the setting state without saving the setting parameters. |
| 3. Setting pulse output rate | |
|  | Pulse output rate can be set: 0.001, 0.01, 0.1, 1, 10, 100, default is 0.01.<br><br>Press button 4 for 3 second to enter the setting state, and the digit of the setting becomes the flashing state.<br>Click button 2 or button 3 to scroll the page and select the next setting interface.<br>Click button 1 to return to the previous level setup menu.<br><br>**Note:** Digital representation of pulse output rate: how much kWh/ kvarh is each pulse. Example: Setting the pulse output rate to 0.1 means that each output pulse is equal to 0.1kwh /kvarh. |
|  | Click button 2 or button 3 to select the pulse output rate.<br>Press button 4 for 3 second to confirm the setting. The power meter will save the setting value and exit the setting state.<br>Click button 1 to exit the setting state without saving the setting parameters. |
| 4. Setting pulse output width | |
|  | The pulse output width represents the effective duration of the pulse output.<br>Options that can be set: 60, 100, 200, unit is ms, default is 100ms.<br><br>Press button 4 for 3 second to enter the setting state, and the digit of the setting becomes the flashing state.<br>Click button 2 or button 3 to scroll the page and select the next setting interface.<br>Click button 1 to return to the previous level setup menu. |

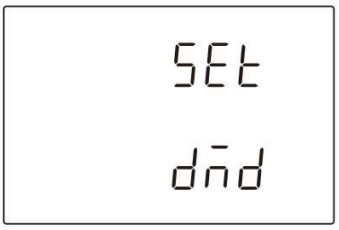
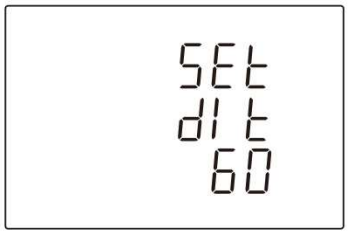
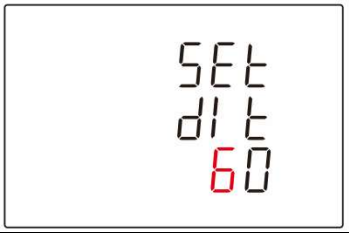
| | |
|---|---|
|  | Click button 2 or button 3 to select the pulse output width.<br>Press button 4 for 3 second to confirm the setting. The power meter will save the setting value and exit the setting state.<br>Click button 1 to exit the setting state without saving the setting parameters. |

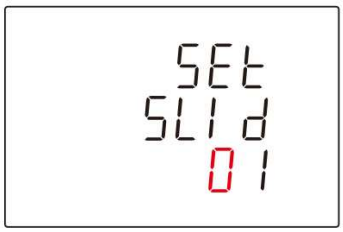
Table 4-1: List of pulse output type

| Character | Pulse output type |
|---|---|
| Σ kWh | Total active energy |
| Σ kvarh | Total reactive energy |
| IMP kWh | Import active energy |
| IMP kvarh | Import reactive energy |
| EXP kWh | Export active energy |
| EXP kvarh | Export reactive energy |

### 4.5.6. Set demand class parameters

Demand class parameters include: demand interval period and sliding time.

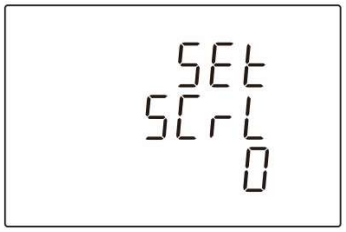
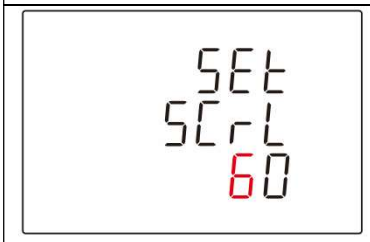
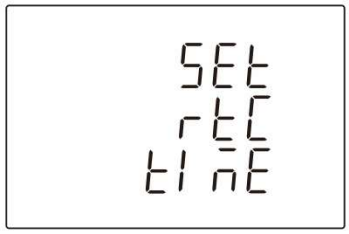
| | |
|---|---|
| 1. After entering the "Parameter Setting Menu" screen, select the setting screen (as shown in the figure below), and then press button 4 for 3 second to enter the demand class parameter setting screen.<br>  | |
| 2. Setting demand interval period | |
|  | Demand interval period can be set: 0 to 60, unit is minute, default is 60 minutes.<br><br>Press button 4 for 3 second to enter the setting state, and the digit of the setting becomes the flashing state.<br>Click button 2 or button 3 to scroll the page and select the next setting interface.<br>Click button 1 to return to the previous level setup menu.<br><br>Note: If the demand interval period is set to 0 minutes, then the demand is updated every second. |
|  | Click button 2 or button 3 to increase or decrease the number of set bits.<br>Click button 4 can be moved the set bits to the right.<br>Press button 4 for 3 second to confirm the setting. The meter will save the setting value and exit the setting state.<br>Click button 1 to exit the setting state without saving the setting parameters. |

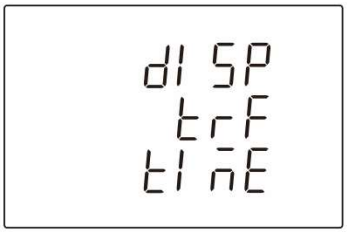
| 3. Setting sliding time | |
|---|---|
|  | Sliding time setting range: 1 to (demand interval period), unit is minutes, default is 1 minute.<br><br>Press button 4 for 3 second to enter the setting state, and the digit of the setting becomes the flashing state.<br>Click button 2 or button 3 to scroll the page and select the next setting interface.<br>Click button 1 to return to the previous level setup menu.<br><br>**Note:** The slip time has no effect when the demand interval period is set to 0. |
|  | Click button 2 or button 3 to increase or decrease the number of set bits.<br>Click button 4 can be moved the set bits to the right.<br>Press button 4 for 3 second to confirm the setting. The meter will save the setting value and exit the setting state.<br>Click button 1 to exit the setting state without saving the setting parameters. |

### 4.5.7. Set time class parameters

Time class parameters include: backlight time, automatic scroll display time, System time (RTC) and Tariff time.

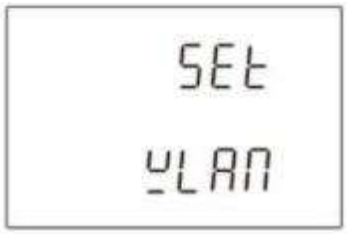
| 1. After entering the "Parameter Setting Menu" screen, select the setting screen (as shown in the figure below), and then press button 4 for 3 second to enter the time class parameter setting screen.<br>  | |
|---|---|
| 2. Setting backlight time | |
|  | Backlight time can be set: on, off, 5, 10, 30, 60, 120, unit is minute, default is 60 minutes.<br><br>Press button 4 for 3 second to enter the setting state, and the character of the setting becomes the flashing state.<br>Click button 2 or button 3 to scroll the page and select the next setting interface.<br>Click button 1 to return to the previous level setup menu.<br><br>Note:<br>1. The character “on” means the backlight is always on, and “off” means the backlight is always off.<br>2. If you need to setting other values within 120 minutes, use the communication command to do so. |

| | |
|---|---|
|  | Click button 2 or button 3 to select the backlight time.<br>Press button 4 for 3 second to confirm the setting. The power meter will save the setting value and exit the setting state.<br>Click button 1 to exit the setting state without saving the setting parameters.<br><br>**Note:** on That means is on. oFF That means is off. |
| 3. Setting automatic scroll display time | |
|  | Automatic scroll display time set range: 0 to 60, unit is second, default is 0 second.<br><br>Press button 4 for 3 second to enter the setting state, and the digit of the setting becomes the flashing state.<br>Click button 2 or button 3 to scroll the page and select the next setting interface.<br>Click button 1 to return to the previous level setup menu.<br><br>**Note:** Automatic scroll display time is 0, means no automatic wheel display |
|  | Click button 2 or button 3 to increase or decrease the number of set bits.<br>Click button 4 can be moved the set bits to the right.<br>Press button 4 for 3 second to confirm the setting. The power meter will save the setting value and exit the setting state.<br>Click button 1 to exit the setting state without saving the setting parameters. |
| 4. Setting date of RTC | |
|  | Press button 4 for 3 second to enter the setting state, and the digit of the setting becomes the flashing state.<br>Click button 2 or button 3 to scroll the page and select the next setting interface.<br>Click button 1 to return to the previous level setup menu. |
|  | Click button 2 or button 3 to increase or decrease the number of set bits.<br>Click button 4 can be moved the set bits to the right.<br>Press button 4 for 3 second to confirm the setting. The meter will save the setting value and exit the setting state.<br>Click button 1 to exit the setting state without saving the setting parameters. |
| 5. Setting system time (RTC) | |
|  | Press button 4 for 3 second to enter the setting state, and the digit of the setting becomes the flashing state.<br>Click button 2 or button 3 to scroll the page and select the next setting interface.<br>Click button 1 to return to the previous level setup menu. |

| | |
|---|---|
|  | Click button 2 or button 3 to increase or decrease the number of set bits.<br>Click button 4 can be moved the set bits to the right.<br>Press button 4 for 3 second to confirm the setting. The meter will save the setting value and exit the setting state.<br>Click button 1 to exit the setting state without saving the setting parameters. |
| 6. View tariff time | |
|  | View menu for tariff information.<br><br>Press button 4 for 3 second to enter the screen for view tariff information.<br>Click button 2 or button 3 to scroll the page and select the next setting interface.<br>Click button 1 to return to the previous level setup menu.<br><br>Note: The menu cannot be setting and can only be viewed. |
|  | The screen for displaying the tariff information.<br><br>1. The number displayed in the first line of the screen represents the sequence number of the selected starting time point. The meter supports 8 starting time points and 4 tariff segments.<br>2. The character displayed in the second line of the screen represents the current tariff is T1. The meter supports 4 tariff segments. (T1 to T4)<br>3. The character displayed in the third line of the screen represents the starting time of the tariff segment (format is hours: minutes).<br>FEE 1 That means tariff segment is tariff 1 (T1).<br>FEE2 That means tariff segment is tariff 2 (T2).<br>FEE3 That means tariff segment is tariff 3 (T3).<br>FEE4 That means tariff segment is tariff 4 (T4).<br><br>Click button 1 scroll the page and select the next screen.<br>Press button 1 for 3 second to exit the setting state without saving the setting parameters.<br><br>Note: If FEE0 is displayed, the time segment is invalid and does not belong to any tariff. |

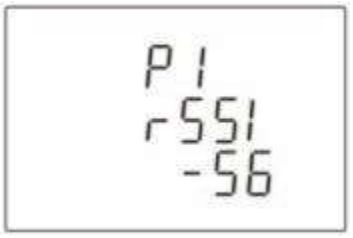
### 4.5.8. Set LoRaWAN class parameters

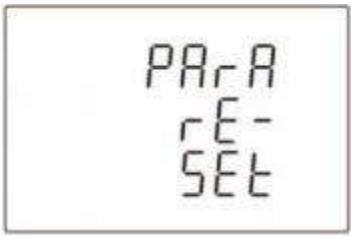
The LoRaWAN parameters include: Log interval time, Re-join interval time, ADR, Confirmed mode, APP KEY, LoRaWAN Information, Re-start LoRaWAN.

<table>
<tr><td colspan="2">1. After entering the "Parameter Setting Menu" screen, select the setting screen (as shown in the figure below), and then press button 4 for 3 second to enter the communication parameter setting screen.<br>  </td></tr>
<tr><td colspan="2">2. Setting the log interval time</td></tr>
<tr><td>  </td><td>The log interval time setting option: 5, 10, 15, 30, 45, 60, default is 15, unit is minute.<br><br>The log interval is meant to instruct the meter in which interval measurements need to be saved to the logbook.<br><br>Click button 2 or button 3 to scroll the page and select the next setting interface.<br>Press button 4 for 3 second to enter the setting state, and the digit of the setting becomes the flashing state.<br>Click button 1 to exit the setting menu and return to the previous setting screen.</td></tr>
<tr><td>  </td><td>Click button 2 or button 3 to select the uplink interval time.<br>Press button 4 for 3 second to confirm the setting. The meter will save the setting value and exit the setting state.<br>Click button 1 to exit the setting state without saving the setting parameters.</td></tr>
<tr><td colspan="2">3. Setting the re-join interval time</td></tr>
</table>

| | |
|---|---|
|  | The re-join interval time setting option: off, 30, 60, 90, 9600, 120, 150, 180, 210, default is 60, unit is minute.<br><br>Click button 2 or button 3 to scroll the page and select the next setting interface.<br><br>Press button 4 for 3 second to enter the setting state, and the digit of the setting becomes the flashing state.<br><br>Click button 1 to exit the setting menu and return to the previous setting screen. |
|  | Click button 2 or button 3 to select the re-join interval time.<br><br>Press button 4 for 3 second to confirm the setting. The meter will save the setting value and exit the setting state.<br><br>Click button 1 to exit the setting state without saving the setting parameters. |
| 4. Setting the ADR | |
|  | The ADR setting option: off or on, default is on.<br><br>Click button 2 or button 3 to scroll the page and select the next setting interface.<br><br>Press button 4 for 3 second to enter the setting state, and the character of the setting becomes the flashing state.<br><br>Click button 1 to exit the setting menu and return to the previous setting screen. |
|  | Click button 2 or button 3 to select the ADR.<br><br>Press button 4 for 3 second to confirm the setting. The meter will save the setting value and exit the setting state.<br><br>Click button 1 to exit the setting state without saving the setting parameters. |
| 5. Setting the APP KEY | |

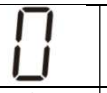
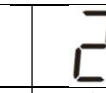
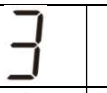
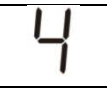
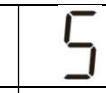
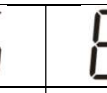
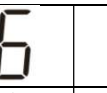
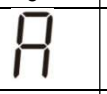
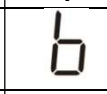
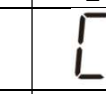
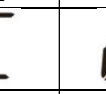
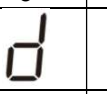
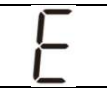
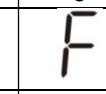
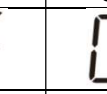
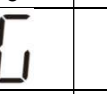
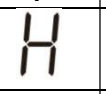
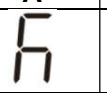
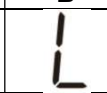
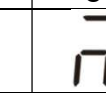
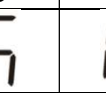
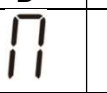
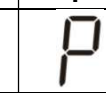
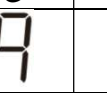
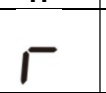
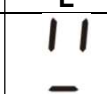
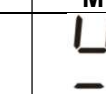
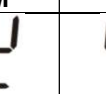
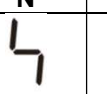
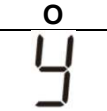
| | |
|---|---|
|  | APPKEY setting menu provides the function of view, generation and save of APPKEY.<br><br>Click button 2 or button 3 to scroll the page and select the next setting interface.<br>Press button 4 for 3 second to enter the APP KEY setting screen.<br>Click button 1 to exit the setting menu and return to the previous setting screen. |
| 5.1. Setting the APP KEY | |
|  | |
| | 1F D9 8E E4 D4 EA CE 4C 17 C1 0C 52 A1 B7 9B 19.<br>  |
| 5.2. Automatic generation APP KEY | |
|  | Automatic generation APP KEY.<br><br>Press button 4 for 3 second to enter the generation state.<br>Click button 1 to exit the setting menu and return to the previous setting screen. |
|  | Press button 4 for 3 second to confirm the generation. The meter will automatic generation APP KEY and exit the generation state.<br>Click button 1 to exit the generation state without automatic generation APP KEY. |
| 5.3. Save APP KEY | |

| | |
|---|---|
|  | Save APP KEY.<br><br>Press button 4 for 3 second to enter the save state.<br>Click button 1 to exit the setting menu and return to the previous setting screen. |
|  | Press button 4 for 3 second to confirm the save. The meter will save APP KEY and exit the save state.<br>Click button 1 to exit the save state without save of APP KEY. |
| 6. Display the LoRaWAN Information | |
|  | Click button 2 or button 3 to scroll the page and select the next setting interface.<br>Press button 4 for 3 second to enter the screen for veiw LoRaWAN information.<br>Click button 1 to return to the previous level setup menu. |
|  | The received field strength.<br><br>Click button 2 or button 3 scroll the page and select the next screen.<br>Click button 1 to return to the previous level setup menu. |
|  | The signal to noise ratio.<br><br>Click button 2 or button 3 scroll the page and select the next screen.<br>Click button 1 to return to the previous level setup menu. |
|  | The join the network status of the OTAA.<br><br>Click button 2 or button 3 scroll the page and select the next screen.<br>Click button 1 to return to the previous level setup menu. |

| | |
|---|---|
| 7. Re-start LoRaWAN | |
|  | Click button 2 or button 3 to scroll the page and select the next setting interface.<br>Press button 4 for 3 second to enter the re-start LoRaWAN state.<br>Click button 1 to exit the setting menu and return to the previous setting screen. |
|  | Press button 4 for 3 second to confirm the re-start. The meter will re-start LoRaWAN and exit the reset state.<br>Click button 1 to exit the re-start state without re-start LoRaWAN. |
| 8. Reset to factory configuration | |
|  | Click button 2 or button 3 to scroll the page and select the next setting interface.<br>Press button 4 for 3 second to enter the reset state.<br>Click button 1 to exit the setting menu and return to the previous setting screen. |
|  | Press button 4 for 3 second to confirm the reset. The meter will reset to factory configuration and exit the reset state.<br>Click button 1 to exit the reset state without reset. |

# Appendix

## Appendix A – LCD character definition table

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
|  |  |  |  |  |  |  |  |  |  |
| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|  |  |  |  |  |  |  |  |  |  |
| A | B | C | D | E | F | G | H | I | J |
|  |  |  |  |  |  |  |  |  |  |
| K | L | M | N | O | P | Q | R | S | T |
|  |  |  |  |  |  | | | | |
| U | V | W | X | Y | Z | | | | |

## Appendix B – Failure code reference table

| No. | LCD display | Fault description |
|---|---|---|
| 1 | Err-01 | The battery voltage is too low |
| 2 | Err-02 | WLAN module fault |
| 3 | Err-03 | 1. The battery voltage is too low<br>2. WLAN module fault |

## Appendix C – Alarm prompt comparison table

| No. | The action of the meter | Alarm definition |
|---|---|---|
| 1 | LCD display alarm icon ⚠ | Occurs over voltage, over current or power exceeds the limit |

**Appendix D – LoRaWAN protocol description**

# 1. Protocol Description

## 1.1. Data Description

A complete data packet generated based on this protocol during communication is called a data frame (referred to multiple times in the following text as a data packet of this protocol), and the individual data fields in the data frame and the data fields in the Data area (such as registers and specific data values being considered as two data fields when reading metering data) are called data segments.

### 1.1.1. Data transmission

The data transmission of this agreement starts with StartCode and ends with the CRC16 field.
When the length of a single data segment in a data frame exceeds one byte, unless otherwise specified, the **large end** mode is adopted, that is, low bytes are in front and high bytes are in the back.

- Example:
  The content of the MeterID data segment in a certain data frame is: 00 00 00 01 23 45 67 89.
  In 1.1.2, the MeterID is defined as uint8_t with a length of 8 array, the MeterID of the meter is 0x0000000123456789;

### 1.1.2. Data frame format

The protocol data frame format is as follows:

| No | Name | Bytes | Type | Description |
|---|---|---|---|---|
| 0 | StartCode | 4 | uint8_t [4] | Protocol start code |
| **No** | **Name** | **Bytes** | **Type** | **Description** |
| | | | | **0x584F4341** |
| 1 | Version | 1 | uint8_t | Protocol version number, see 1.1.2.1 |
| 2 | Length | 2 | uint16_t | The total length of DeviceID+CtrlCode+Data+CRC16, in bytes |
| 3 | MeterID | 8 | uint8_t [8] | Table number or other number that can uniquely identify the device, (when the actual length of the device is less than 8 bytes, the high order of the array is filled with zero), and the MeterID is all 0 during broadcasting |
| 4 | CtrlCode | 2 | uint16_t | Control code, see 1.1.2.2 |

| | | | | |
|---|---|---|---|---|
| 5 | Data | M | uint8_t [M] | Data area |
| 6 | CRC16 | 2 | uint16_t | The content of CRC16 verification includes: Version, Length, MeterID, CtrlCode, and Data |

- Example:

  The data frame set by the server for a certain meter time is:
  58 4F 43 41 01 00 10 00 00 00 01 23 45 67 89 C0 09 64 8B 58 1C F2 0D

✓ StartCode: 0x58 4F 43 41
✓ Version: 0x01
✓ Length: 0x00 10->16 (D)
✓ MeterID: 0x 00 00 00 01 23 45 67 89
✓ CtrlCode: 0x C0 09->11000000 00001009 (B) Write command, need to reply, write basic data command, write electricity meter time
✓ Data: 0x64 8B 58 1C ->1686853660 (D) timestamp
✓ CRC16:0x F2 0D

#### 1.1.2.1 Version Description

The Version byte is only updated when there is a significant change in the protocol.

| No | Protocol Version | Corresponding Version Bytes | Description |
|---|---|---|---|
| 0 | V0.1 | 0x01 | Beta version |
| 1 | V1.0 | 0x01 | First stable release |
| 2 | V1.1 | 0x01 | This version has been officially put into use |
| 3 | V1.2 | 0x01 | FW update |
| 4 | V1.31 | 0x01 | FW update |

#### 1.1.2.2. CtrlCode Description

CtrlCode is defined as follows

| No | bit | definition | description |
|---|---|---|---|
| 0 | 0~7 | CtrlCode_L | Specific control instructions, see specific chapter definitions |
| 1 | 8~11 | CtrlCode_H | Used to distinguish instruction classification, such as when reading metering data, this field is: 0x1 |
| 2 | 12 | Read back reset | Set 1 when the meter replies to the read command |
| 3 | 13 | Set to reset | Set to 1 when the meter replies to the setting command |
| 4 | 14 | Reset required | see below |
| 5 | 15 | Read/Write Bit | 1: Write Instruction, 0: Read Instruction |

**Reply bit explanation:**

When the server sends data:

- ✓ Read and write bit: 1
- ✓ **Request to reset:** 0:

  The meter does not need to reply to this command; 1: The electricity meter needs to reply to this command (when replying, **set the reply position 1**);

- ✓ Read write bit: 0

  **Request for reset:** 0: The meter is treated as a read instruction (when the meter replies, **it will be read back to position 1**); 1: Respond to the active reporting of the electricity meter for the server, and the electricity meter does not perform reading instruction processing;

When the meter goes up with data:

- ✓ **Request to reset:** 0: No server response required; 1: The server needs to reply (when the server replies, **it will request a reply at position 1**. If the meter does not receive a reply within the **reply timeout time (see 1.4)**, it will set the meter status to wireless communication position 1 (see 2.1.3));

**The read and write bits of the meter's uplink data should always be 0.**

## 1.2. Communication instructions

### 1.2.1. Data Reading and Writing

The data reading and writing is initiated by the application server (upper computer), and the meter terminal agrees.
The read/write control bit is the highest bit of CtrlCode, with 1 being the write instruction and 0 being the read instruction. When the meter replies, the read/write bit and reset are always 0. If the server sends data with a reset setting, the meter needs to reply with the setting result. The lower 12 bits of CtrlCode are the same as the CtrlCode of the downlink data frame. The returned data is as follows:

| No | Code | Description |
|---|---|---|
| 0 | 0x0 | Set successfully |
| 1 | 0x1 | This value is not supported |

### 1.2.2. Actively reporting data

The table supports active reporting instructions such as scheduled reporting and fault reporting, and the reporting content and time support configuration, as shown in Chapter 4.

### 1.2.3. Protocol Exception Return

After receiving the data frame sent by the application server (upper computer), the table end will analyze it. If an error occurs during the parsing process, the error needs to be returned to the upper computer.

When returning, CtrlCode is: 0x0E22, and the Data area contains an error code of 1 byte in length. The error code is defined as follows:

| No | Code | Description |
|---|---|---|
| 0 | 0x0 | No errors |
| 1 | 0x1 | Protocol version error |
| 2 | 0x2 | Data length error |
| 3 | 0x3 | Control code does not exist |
| 4 | 0x4 | This read instruction is not supported |
| 5 | 0x5 | This write instruction is not supported |
| 6 | 0x6 | CRC verification error |
| 7 | 0x7 | No permission |

*Note: Only when the corresponding resolution of StartCode and MeterID is correct will the table record return an exception, which means that the table end will not return an exception during broadcasting.*

- Example:
  The server sends the data frame for a certain meter as:
  58 4F 43 41 01 00 10 00 00 00 01 23 45 67 89 C0 09 64 8B 58 1C 90 AA (CRC check bit error)
  The meter should return:
  58 4F 43 41 01 00 0D 00 00 00 01 23 45 67 89 0E 22 **06** FD C0

### 1.2.4. Server replies to electricity meters

When the CtrlCode reply bit is 1 when the meter sends upstream data, the server needs to reply to the meter. The reply is that the control code is exactly the same as the upstream control code of the meter, and the reply data length is 1. The definition is as follows:

| No | Code | Description |
|---|---|---|
| 0 | 0x0 | No errors |

## 1.3 Data encryption

The current transmission data frame is not encrypted.

## 1.4 Other Protocol Parameters

| No | Definition | Value | Description |
|---|---|---|---|
| 0 | Response timeout | 10 | When the meter requests a response from the server, the time it takes to wait for the server to respond, in seconds |

# 2. Basic information of electricity meters

This chapter defines the basic information of electricity meters supported by this agreement, including parameters such as meter type, firmware version, system time, relay status, as well as the definition of reading and writing methods and data formats for these parameters.

**The basic information of the electricity meter corresponds to CtrlCode_H: 0x00**, and the low bit is defined as follows:

| No | Name | CtrlCode_L | Data Type | Data Length | Read | Write | Description |
|---|---|---|---|---|---|---|---|
| 0 | Set Permissions | 0x00 | uint16_t | 2 | * | * | Electricity meter setting permissions, as defined in 2.1.1 |
| 1 | System Type | 0x01 | uint8_t | 1 | * | ** | The type of electricity meter, which is set to be protected by permissions, as defined in 2.1.2 |
| 2 | MeterID | 0x02 | uint8_t | 8 | * | ** | Set to be protected by permissions |
| 3 | Serial Number | 0x03 | uint32_t | 4 | * | | Serial number of the |
| 4 | Electricity meter status | 0x04 | uint32_t | 4 | * | ** | The status of the electricity meter is set to be protected by permissions, as defined in 2.1.3 |
| 5 | Software version number | 0x05 | uint16_t | 2 | * | | Program internal version: XX.YY, high byte corresponds to XX |
| 6 | Hardware version number | 0x06 | uint16_t | 2 | * | | Hardware version of the meter: XX.YY, with high byte corresponding to XX |
| 7 | Version number of LCD display | 0x07 | uint16_t | 2 | * | | Electricity meter startup display version: XX.YY, high byte corresponding to XX |
| 8 | Phenotype code | 0x08 | uint32_t | 4 | * | | Not available |
| 9 | System time | 0x09 | uint32_t | 4 | * | ** | Electricity meter time, timestamp format, unit: seconds, time zone is UTC (0 time zone) |
| 10 | Electricity meter system time BCD | 0x0A | uint8_t [] | 8 | * | ** | Electricity meter time, BCD format, see 2.1.5 |
| 11 | Rate Period | 0x0B | uint8_t [] | 24 | * | ** | Rate period time, BCD format, see 2.1.6 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 12 | Electricity meter startup and running time | 0x0C | uint32_t | 4 | * | ** | The start and run time of the meter is set to be protected by permissions, in minutes. Only 0 can be written to indicate clear |
| 13 | Load running time | 0x0D | uint32_t | 4 | * | ** | Load running time, unit: minutes, can only write 0 to indicate clear |
| 14 | Electricity meter password | 0x0E | uint16_t | 2 | ** | ** | The password for the electricity meter is protected by permission for reading and writing, with a range of 0000~0x9999. |
| 15 | Demand cycle | 0x10 | uint8_t | 1 | * | ** | Demand cycle, set to be protected by permissions, unit minute, range: 0-60, |
| 16 | Slip time | 0x11 | uint8_t | 1 | * | ** | Slip time, set to be protected by permissions, in minutes. |
| 17 | Reset | 0x12 | uint8_t | 1 | | ** | Settings are protected by permissions, as defined in 2.1.7 |
| 18 | Pulse 1 output type | 0x13 | uint8_t | 1 | * | ** | The output type of pulse 1 is set to be protected by permissions, as defined in 2.1.8 |
| 19 | Pulse 1 output ratio | 0x14 | uint8_t | 1 | * | ** | The output ratio of pulse 1 is set to be protected by permissions, as defined in 2.1.8 |
| 20 | Pulse 1 output width | 0x15 | uint8_t | 1 | * | ** | The output width of pulse 1 is set to be protected by permissions, as defined in 2.1.8 |
| 21 | Wiring direction of current transformer | 0x16 | uint8_t | 1 | * | ** | The wiring direction of the three-phase current transformer is set to be protected by permissions, as defined in 2.1.9 |
| 22 | PT1 of voltage transformer | 0x17 | uint32_t | 4 | * | ** | Range: 30-500000 V, set to be protected by permissions |
| 23 | PT2 of voltage transformer | 0x18 | uint32_t | 4 | * | ** | Range: 30- 500V, set to be protected by permissions |
| 24 | CT1 of current transformer | 0x19 | uint32_t | 4 | * | ** | Range: 1~9999A, set to be protected by permissions |
| 25 | CT2 of current transformer | 0x1A | uint32_t | 4 | * | ** | Range: 1or5A, set to be protected by permissions |
| 26 | ModBus communication address | 0x1D | uint8_t | 1 | * | ** | ModBus communication address, set to permission protected, can be set to 1-247 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 27 | Baud rate of electricity meter | 0x1E | uint8_t | 1 | * | ** | The baud rate of the electricity meter is set to be protected by permissions, as defined in 2.1.10 |
| 28 | Check bit and stop bit for wired communication | 0x1F | uint8_t | 1 | * | ** | The meter check and stop bits are set to be protected by permissions, as defined in 2.1.10 |
| 29 | LCD wheel display time | 0x20 | uint8_t | 1 | * | * | Unit: seconds, setting range: 0-255,0 represents no rotation display |
| 30 | Backlight on time | 0x21 | uint8_t | 1 | * | * | Unit: minutes, range: 0-120or255; 255 represents constant extinction |

[*] = available [**] = Setting permissions

## 2.1. Description

This section further explains the reading and writing of the basic information of the electricity meter.

### 2.1.1. Setting Permissions

To read and set protected parameters or control the electricity meter through the upper computer, the electricity meter setting permission is required.

When using this control code for reading, the return value is: **0x0=permission not obtained; 0x1=Permission obtained**

Use this control code to write the correct meter password to obtain parameter setting permissions, which can be activated for 10 minutes.

**All references to permissions in this agreement refer to this setting of permissions, and labeling the read write area with ** means that the operation is protected by this setting of permissions**

### 2.1.2. System type

This parameter represents the current measurement type of the meter, and the data definition is as follows:

| No | Value | Name | Description |
|---|---|---|---|
| 0 | 0x1 | Single phase two wire | |
| 1 | 0x2 | Three phase three wire (2CT) | |
| 2 | 0x3 | Three phase four wire | |
| 3 | 0x4 | Two phase three wire | |

| | | | |
|---|---|---|---|
| 3 | 0x5 | Three phase three wire (3CT) | |

### 2.1.3. Electricity meter status

The status of the electricity meter mainly reflects whether there is currently any abnormality in the meter. When the corresponding bit is 0, it indicates normal status, and when the bit is 1, it indicates abnormality. There are a total of 32 bits, and the bits not mentioned are reserved bits, which are defaulted to 0. Bits that are not supported by different meters are also defaulted to 0.

This parameter supports server read and write. **Only supports clearing a certain abnormal state, that is, writing 0, the position to be cleared during writing 0, and other positions 1. If you want to clear the battery voltage abnormal state, write 0xFFFFFFFE**

| No | bit | name | description |
|---|---|---|---|
| 0 | 0 | Battery voltage | Is the battery voltage normal |
| 1 | 1 | -- | -- |
| 2 | 2 | Wireless communication | Can I receive a response from the server normally |

### 2.1.4. BCD time format

Data segment definition: 20-year-month-day-week-hour-minute-second;

**Note: The first byte is fixed to 20**

### 2.1.5. Rate Period

Data segment definition: rate number minute hour.
Both minute and hour bytes are in BCD format, with values ranging from 00 to 59 and 00 to 23, respectively.

At most 8 rate ranges can be set simultaneously, and unused rate range bytes are all 0x00.

### 2.1.6. Reset

The server issues this command to control the meter for reset operation, which is **protected by the set permissions** and only writes:

| No | Value | Name |
|---|---|---|
| 0 | 0x0 | Reset maximum demand |
| 1 | 0x1 | Reset active power |
| 2 | 0x2 | Reset reactive power level |
| 3 | 0x3 | Reset all battery levels |
| 4 | 0x4 | -- |
| 5 | 0x5 | Reset SOE event record |
| 6 | 0x6 | Reset DI count value |
| 7 | 0x7 | Reset historical power statistics |
| 8 | 0x8 | Reset monthly electricity consumption information |

| | | |
|---|---|---|
| 9 | 0x9 | Reset daily electricity consumption information |
| 10 | 0xFF | Meter restart |

**Note: The restart command of the 0xFF meter may not receive a response. Once the meter receives this command, it will directly perform a reset operation.**

### 2.1.7. Pulse output

Output type of meter pulse:

| No | Value | Name |
|---|---|---|
| 0 | 0x1 | Positive active electric energy |
| 1 | 0x2 | Total active electrical energy |
| 2 | 0x4 | Reverse active electric energy |
| 3 | 0x5 | Positive reactive energy |
| 4 | 0x6 | Total reactive energy |
| 5 | 0x8 | Reverse reactive energy |

Pulse output ratio:

| No | Value | Name |
|---|---|---|
| 0 | 0x0 | One pulse is 0.001kWh (kvarh) |
| 1 | 0x1 | One pulse is 0.01kWh (kvarh) |
| 2 | 0x2 | One pulse is 0.1kWh (kvarh) |
| 3 | 0x3 | One pulse is 1kWh (kvarh) |
| 4 | 0x4 | One pulse is 10kWh (kvarh) |
| 5 | 0x5 | One pulse is 100kWh (kvarh) |

Pulse output width:

Set the pulse output width of pulse 1, in ms, with options of 60,100,200ms.

### 2.1.8. Wiring direction of three-phase current transformers

Setting this parameter is protected by setting permissions.

| No | Value | Name |
|---|---|---|
| 0 | 0x0 | L1 forward, L2 forward, L3 forward |
| 1 | 0x1 | L1 reverse, L2 forward, L3 forward |
| 2 | 0x2 | L1 forward, L2 reverse, L3 forward |
| 3 | 0x3 | L1 reverse, L2 reverse, L3 forward |
| 4 | 0x4 | L1 forward, L2 forward, L3 reverse |
| 5 | 0x5 | L1 reverse, L2 forward, L3 reverse |
| 6 | 0x6 | L1 forward, L2 reverse, L3 reverse |
| 7 | 0x7 | L1 reverse, L2 reverse, L3 reverse |

### 2.1.9. Electricity meter password

Reading and writing the meter password in BCD format data, which is more intuitive. The BCD code seen can be directly used to log in to the meter.

Please note that the password read by the electricity meter through other protocols (Modbus) may be a regular numerical value.

### 2.1.10. uart parameters

-Baud rate:

| No | Value | Name |
|---|---|---|
| 0 | 0x0 | 1200bps |
| 1 | 0x1 | 2400bps |
| 2 | 0x2 | 4800bps |
| 3 | 0x3 | 9600bps |
| 4 | 0x4 | 19200bps |
| 5 | 0x5 | 38400bps |

- Check bit and stop bit:

| No | Value | Name |
|---|---|---|
| 0 | 0x0 | No verification, 1-bit stop bit |
| 1 | 0x1 | Even parity, 1-bit stop bit |
| 2 | 0x2 | Odd parity, 1-bit stop bit |
| 3 | 0x3 | No verification, 2-bit stop bit |

## 2.2. Example

Some servers provide examples of reading and writing basic information about electricity meters to assist in explaining chapter content.

Data data is highlighted in bold green

### 2.2.1. Example of setting permissions for reading and writing:

- Example of setting permissions for reading electricity meters:
  - Server issued: 58 4F 43 41 01 00 0C 00 00 00 01 23 45 67 89 00 00 F8 2A
  - Electric meter response: 58 4F 43 41 01 00 0E 00 00 00 01 23 45 67 89 10 00 **00 00** 60 1D (return data: 0x00, indicating that the setting permission is not currently obtained)
- Example of setting permissions for writing electricity meters:
  - Server issued: 58 4F 43 41 01 00 0E 00 00 00 01 23 45 67 89 C0 00 **00 00** A0 25 (meter password: 0000, and meter response required)
  - Meter response: 58 4F 43 41 01 00 0D 00 00 00 01 23 45 67 89 20 00 **00** D6 85

### 2.2.2. Reading and Writing Electricity Meter Status

- Example of reading meter status:
  - Server issued: 58 4F 43 41 01 00 0C 00 00 00 01 23 45 67 89 00 04 2B 3B
  - Electric meter response: 58 4F 43 41 01 00 10 00 00 00 01 23 45 67 89 10 04 **00 00 00 03** B1 26 (return data: 0x00000003, indicating that the current battery voltage and relay control are in an abnormal state)

- Example of writing electricity meter status:
  - Server issued: 58 4F 43 41 01 00 10 00 00 00 01 23 45 67 89 C0 04 **00 00 00 00** 20 75 (reset abnormal and request meter reply)
  - Electric meter response: 58 4F 43 41 01 00 0D 00 00 00 01 23 45 67 89 20 04 **00** 16 87 (successful setting of electric meter response)

### 2.2.3. Example of reading software version number

- Example of reading software version number:
- Server issued: 58 4F 43 41 01 00 0C 00 00 00 01 23 45 67 89 00 05 FB EA
- Electric meter response: 58 4F 43 41 01 00 0E 00 00 00 01 23 45 67 89 10 05 **01 10** 3D 0D (return data: 0x0110, corresponding software version number: 01.10)

### 2.2.4. Reading and writing electricity meter time (BCD format)

- Example of BCD time for reading electricity meters:
  - Server issued: 58 4F 43 41 01 00 0C 00 00 00 01 23 45 67 89 00 0A FF AA
  - Electric meter response: 58 4F 43 41 01 00 14 00 00 00 01 23 45 67 89 10 0A **20 19 06 28 07 10 44 20** EF 7A (return data: 0x2019062807104420, corresponding time: Sunday, June 28, 2019 10:44:20)
- Example of BCD time for writing an electricity meter:
  - Server issued: 58 4F 43 41 01 00 14 00 00 00 01 23 45 67 89 C0 0A **20 23 06 16 05 14 17 20** 09 B1 (written on Friday, June 16, 2023, 14:17:20, and requires meter response)
  - Electric meter reply: 58 4F 43 41 01 00 0D 00 00 00 01 23 45 67 89 20 0A **00** 76 83 (successful meter reply setting)

# 3. Electricity meter measurement data

This chapter defines how to read the metering data of an electricity meter, and the corresponding data fields during reading are defined as follows:

| No | Field | Definition | Description |
|---|---|---|---|
| 0 | CtrlCode_H | **Fixed to 0x01** | |

| | | | |
|---|---|---|---|
| 1 | CtrlCode_L | Read the number of meter measurement data | Range: 1~10, meter will not respond if it exceeds the defined range |
| 2 | Data | Electricity meter measurement data register | The number of registers corresponds to CtrlCode_L. The register definition is shown in 5. Electricity meter measurement value register, with a single register length of 2 bytes and a large end mode |

**The measurement data format for reporting is: Reg1 (uint16_t)+Data1 (byte [M])+Reg2... (both registers and data are in big end mode)**

- Example of reading meter metering data:
  - Server issued: 58 4F 43 41 01 00 20 00 00 00 01 23 45 67 89 01 0A **00 02 00 05 00 09 00 0D 00 11 00 15 00 41 00 5B 00 79 00 A1** AC 03 (read 10 measurement data)
  - Electricity meter response: 58 4F 43 41 01 00 68 00 00 00 01 23 45 67 89 11 0A **00 02 43 5B E6 66 00 05 40 9F 5C 28 00 09 44 86 26 66 00 0D 43 59 E6 66 00 11 44 88 E3 33 00 15 3F 7A E1 47 00 41 42 C7 FA E1 00 5B 41 F3 85 1E 00 79 42 A0 38 51 41 A0 28 F5 41 A0 28 F5 41 A0 28 F5 41 A0 28 F5 00 A0 41 29 99 99 40 29 99 99 40 29 99 99 40 29 99 99 40 29 99 99** 39 B6
  - Reply to data analysis:
    - 0x0002 435BE666->L3 phase voltage=219.9V; ■ 0x0005 409F5C28->L3 phase current=4.98A;
    - 0x0009 44862666->L3 active power=1073.2W;
    - 0x000D 4359E666->L3 reactive power=217.9var;
    - 0x0011 4488E333->L3 apparent power=1095.1VA; ■ 0x0015 3F7AE147->L3 power factor=0.98;
    - 0x0041 42C7FAE1->Forward active energy=99.99kWh; ■ 0x005B 41F3851E ->Active energy at rate 1=30.44kWh;
    - 0x0079 42A03851 41A028F5 41A028F5 41A028F5 41A028F5->Total active electricity consumption for the current month: sum of all rates=80.11kWh, rate 1=20.02kWh, rate 2=20.02kWh, rate 3=20.02kWh, rate 4=20.02kWh (all rates here are the same for demonstration purposes only, which is unlikely to happen in reality);
    - 0x00A0 41299999 40299999 40299999 40299999 40299999->Total active electricity consumption on that day: sum of all rates=10.6kWh, rate 1=2.65kWh, rate 2=2.65kWh, rate 3=2.65kWh, rate 4=2.65kWh (all rates here are the same for

demonstration purposes only, and it is unlikely that such a situation will occur in reality);

## 3.1. Special instructions for reading metering registers

**Note: The following situations may skip some metering register reads:**

- The read instruction issued contains a metering data register that is not supported by the meter and will directly skip this register;
  - When the meter reads a register, it will calculate whether the accumulated length of the next register data exceeds the maximum allowed length for a single piece of data (this length is defined differently according to different communication methods, regional regulations, and equipment). If it exceeds this length, it will skip this register and continue trying to read the next one.

If the number of metering registers ultimately read is less than the number of metering registers at the time of instruction issuance, the return frame will modify **CtrlCode-L** to the actual number of registers read (modify the first byte of the Data area during active reporting). That is to say, the actual number of returned metering register data may be less than the number at the time of instruction issuance.

**Reading unsupported data example:**

- Server distribution: 58 4f 43 41 01 00 20 00 00 00 01 23 45 67 89 01 **0a** **00 a0 00 c7 00 c8 00 c9 00 a4 00 a5 00 a6 00 a7 00 a8 00 a9** a8 c3 (read 10 data)
- Electric meter response: 58 4f 43 41 01 00 a6 00 00 00 01 23 45 67 89 11 **07** **00 a0 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 a4 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 a5 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 a6 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 a7 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 a8 3d a3 d7 0a 00 00 00 00 00 00 00 00 3d 8d 4f df 3c 34 39 58 00 a9 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00** (actual return of 7 measurement data)
- Analysis: Assuming the electricity meter is a 4P induction type electricity meter, it does not support the three metering registers 0x00C7, 0x00C8, and 0x00C9 in the issued instruction. Therefore, when reading, it will directly skip and only return the supported seven metering register data, and modify **CtrlCode-L** to 07.

**Example of reading overly long data:**

- Server issued: 58 4f 43 41 01 00 20 00 00 00 01 23 45 67 89 01 **0a** **00 a0 00 a1 00 a2 00 a3 00 a4 00 a5 00 a6 00 a7 00 a8 00 a9** 92 7b (read 10 data)
- Electricity meter response: 58 4f 43 41 01 00 bc 00 00 00 01 23 45 67 89 11 **08** **00 a0 00 00**

**00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 a1 00 00 00 00 00 00 00 00 00**

**00 00 00 00 00 00 00 00 00 00 00 00 a2 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00**

**00 00 00 00 00 a3 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 a4 00**

**00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 a5 00 00 00 00 00 00 00**

**00 00 00 00 00 00 00 00 00 00 00 00 00 a6 00 00 00 00 00 00 00 00 00 00 00 00 00 00**

**00 00 00 00 00 00 a7 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00** b3 2c

(actual return of 8 measurement data)

- Analysis: Assuming that the wireless communication technology used in the electricity meter is LoRa, the network layer protocol is LoRaWAN, and the usage region is Europe (frequency band EU868), according to regulatory restrictions, the maximum number of bytes for a single transmission is around 200. Therefore, the maximum length of a single transmission frame for XGP is set to 200 bytes (the maximum length of the Data area is 181 bytes). The total length of the 10 metering register data frames read by issuing this instruction is 239 bytes, exceeding the length limit. In order to control the length within the limit, the last two metering register reads were skipped, only the first 8 metering register data was returned, and the **CtrlCode-L** was modified to 08.

# 4. Electricity meter reporting

This chapter defines the active reporting of electricity meters, which includes three types: **scheduled reporting, status change reporting, alarm and event reporting** **The CtrlCode_H: 0x02 corresponding to the data frame during meter reporting or when the upper computer sets the meter reporting**

## 4.1. Regular reporting

The wireless meter supports timed data reporting function, and a total of **10 channels** are supported for reporting. This means that 10 different channels can be reported through settings, and these 10 channels can have different reporting periods and content.

**When no settings are made, the default reporting channel is enabled: 1. Reporting requires a reply, with a reporting interval of 60 minutes. The reporting content depends on the phenotype**

### 4.1.1. Regular reporting format

The definition of data frame related fields during active reporting is as follows:

| No | Field | Definition | Description |
|---|---|---|---|
| 0 | CtrlCode_H | **Fixed to 0x02** | |
| 1 | CtrlCode_L | **Channel number** | Range: 1~10 |
| 2 | Data [0] | Number of electricity meter measurement data | Range: 1~10 |
| 3 | Data [1~N] | Measurement data at the time of reporting | |

**The measurement data format for reporting is: Reg1 (uint16_t)+Data1 (byte [M])+Reg2... (both registers and data are in big end mode)**

- Example of regularly reporting data:
  - Active reporting of electricity meters: 58 4F 43 41 01 00 69 00 00 00 01 23 45 67 89 42 01 **0A 00 02 43 5B E6 66 00 05 40 9F 5C 28 00 09 44 86 26 66 00 0D 43 59 E6 66 00 11 44 88 E3 33 00 15 3F 7A E1 47 00 41 42 C7 FA E1 00 5B 41 F3 85 1E 00 79 42 A0 38 51 41 A0 28 F5 41 A0 28 F5 41 A0 28 F5 41 A0 28 F5 00 A0 41 29 99 99 40 29 99 99 40 29 99 99 40 29 99 99 40 29 99 99** 13 00 (Request server response)
  - Reporting data analysis:
    - 0x0A ->The reported data frame contains 10 pieces of measurement data;
    - 0x0002 435BE666->L3 phase voltage=219.9V;
    - 0x0005 409F5C28->L3 phase current=4.98A;
    - 0x0009 44862666->L3 active power=1073.2W;
    - 0x000D 4359E666->L3 reactive power=217.9var;
    - 0x0011 4488E333->L3 apparent power=1095.1VA;
    - 0x0015 3F7AE147->L3 power factor=0.98;
    - 0x0041 42C7FAE1->Forward active energy=99.99kWh;
    - 0x005B 41F3851E ->Active energy at rate 1=30.44kWh;
    - 0x0079 42A03851 41A028F5 41A028F5 41A028F5 41A028F5->Total active electricity consumption for the current month: sum of all rates=80.11kWh, rate

1=20.02kWh, rate 2=20.02kWh, rate 3=20.02kWh, rate 4=20.02kWh (all rates here are the same for demonstration purposes only, which is unlikely to happen in reality);

- 0x00A0 41299999 40299999 40299999 40299999 40299999->Total active electricity consumption on that day: sum of all rates=10.6kWh, rate 1=2.65kWh, rate 2=2.65kWh, rate 3=2.65kWh, rate 4=2.65kWh (all rates here are the same for demonstration purposes only, and it is unlikely that such a situation will occur in reality);

- Server response: 58 4F 43 41 01 00 0D 00 00 00 01 23 45 67 89 42 01 **00** 98 25 (server response)

If the set metering register contains content that is not supported by the meter or if the return length exceeds the maximum allowed length, all set metering register data may not be returned. Please refer to 3.1 for detailed analysis.

**Unsupported data example set:**

- Server setting instructions: 58 4f 43 41 01 00 28 00 00 00 01 23 45 67 89 C2 08 **F1 01 F2 01 F3 00 02 F4 00 A0 00 C7 00 C8 00 C9 00 A4 00 A5 00 A6 00 A7 00 A8 00 A9** C7 8D (set channel 8 to report 10 register data)
- Electricity meter channel 8 report: 58 4f 43 41 01 00 A7 00 00 00 01 23 45 67 89 42 08 **07 00 a0 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 a4 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 a5 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 a6 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 a7 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 a8 3d a3 d7 0a 00 00 00 00 00 00 00 3d 8d 4f df 3c 34 39 58 00 a9 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00** 4D 03 (actual report of 7 measurement data)
- Analysis: Assuming the electricity meter is a 4P induction type electricity meter, it does not support reporting the three metering registers 0x00C7, 0x00C8, and 0x00C9 in the channel. Therefore, when reporting, it will directly skip reporting only the supported seven metering register data, and modify **Data[0]** to 07.

**Example of setting too long data:**

- Server setting instructions: 58 4f 43 41 01 00 28 00 00 00 01 23 45 67 89 C2 01 **F1 01 F2 01 F3 00 01 F4 00 A0 00 A1 00 A2 00 A3 00 A4 00 A5 00 A6 00 A7 00 A8 00 A9** E7 86 (set

channel 1 to report 10 register data)

- Electricity meter channel 1 report: 58 4f 43 41 01 00 bd 00 00 00 01 23 45 67 89 42 01 **08 00 a0 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 a1 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 a2 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 a3 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 a4 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 a5 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 a6 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 a7 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00** 52 F8 (actual return of 8 measurement data)
- Analysis: Assuming that the wireless communication technology used in the electricity meter is LoRa, the network layer protocol is LoRaWAN, and the usage region is Europe (frequency band EU868), according to regulatory restrictions, the maximum number of bytes for a single transmission is around 200. Therefore, the maximum length of a single transmission frame for XGP is set to 200 bytes (the maximum length of the Data area is 181 bytes). The total length of the 10 metering register data frames set in channel 1 is 239 bytes, exceeding the length limit. In order to control the length within the limit, the last two metering registers were skipped for reading, and only the first 8 metering register data were reported. At the same time, **Data[0]** was modified to 08.

### 4.1.2. Setting and Reading Regular Reports

The setting and reading of scheduled reporting refer to the setting and reading of different reporting channels. When issuing setting or reading instructions, the relevant fields of data frames are defined as follows:

| No | Field | Definition | Description |
|---|---|---|---|
| 0 | CtrlCode_H | **Fixed to 0x02** | |
| 1 | CtrlCode_L | **Channel number** | Range: 1-10 |
| 2 | Data [N] | Channel information field | Sent when setting, returned when reading |

- The channel information field needs to be included in the Data field of the downlink data frame when setting the reporting channel, including the parameters to be set; Reply to all parameters of the channel including the parameters to be set; Reply to all parameters of the channel when reading

Channel information field:

| No | Parameter | Definition | Data Type | Data Length | Read | Write | Description |
|---|---|---|---|---|---|---|---|

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 0 | 0xF1 | Is the channel enabled for reporting | uint8_t | 1 | * | * | 0: Not turned on, 1: turned on |
| 1 | 0xF2 | Is the channel enabled to reset? | uint8_t | 1 | * | * | 0: Not turned on, 1: turned on |
| 2 | 0xF3 | Channel reporting interval time | uint16_t | 2 | * | * | Unit: minutes, values range from 1 to 1440 |
| 3 | 0xF4 | Channel reporting metering data register | uint16_t | 20 | * | * | See 5. Meter measurement value register. Unconfigured registers are filled with 0xFFFF |

- Example of reading the electricity meter reporting channel:
  - Server issued: 58 4F 43 41 01 00 0C 00 00 00 01 23 45 67 89 02 02 59 AA (to read the parameters of reporting channel 2)
  - Electric meter response: 58 4F 43 41 01 00 28 00 00 00 01 23 45 67 89 12 02 **F1 00 F2 00 F3 0F 00 F4 FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF** F5 6A
  - Reply to data analysis:
    - 0xF1 00->Active reporting of channel 2 is not enabled; ■ 0xF2 00->Channel 2 reports not enabling reset;
    - 0xF3 000F ->Channel 2 reporting interval is 15 minutes;
    - 0xF4 FFFF FFFF FFFF FFFF FFFF FFFF FFFF FFFF FFFF FFFF ->Channel 2 has no reporting register set;
- Example of setting up an electricity meter reporting channel:
  - Server issued: 58 4F 43 41 01 00 25 00 00 00 01 23 45 67 89 C2 02 **F1 01 F2 01 F4 00 02 00 05 00 09 00 0D 00 11 FF FF FF FF FF FF FF FF FF FF** 71 BB (request reply, do not want to change the reporting interval here, data frame does not include this field) ○ Set data parsing:
    - 0xF1 01->Enable active reporting of channel 2;
    - 0xF2 01->Channel 2 reports enabling reset;
    - 0xF4 0002 0005 0009 000D 0011 FFFF FFFF FFFF FFFF FF FF ->Channel 2

reports that 5 metering registers have been set;

- Electric meter response: 58 4F 43 41 01 00 0D 00 00 00 01 23 45 67 89 22 02 **00** 76 25 Example of reading the electricity meter reporting channel (read again after successful setting):
- Server issued: 58 4F 43 41 01 00 0C 00 00 00 01 23 45 67 89 02 02 59 AA (to read the parameters of reporting channel 2)
- Electric meter response: 58 4F 43 41 01 00 28 00 00 00 01 23 45 67 89 12 02 **F1 01 F2 01 F3 0F 00 F4 00 02 00 05 00 09 00 0D 00 11 FF FF FF FF FF FF FF FF FF FF** 1C 04
- Reply to data analysis:
  - 0xF1 01->Enable active reporting of channel 2;
  - 0xF2 01->Channel 2 reports enabling reset;
  - 0xF3 000F ->The reporting interval for channel 2 is 15 minutes (unmodified);
  - 0xF4 0002 0005 0009 000D 0011 FFFF FFFF FFFF FFFF FFFF ->Channel 2 reports successful register setting;