# ME131

# Multi-circuit Smart Energy meter
# V1.1

## ME131 Multi-circuit Smart Energy meter

Master meter：ME131M

Submeter: ME131S

* Accuracy: 0.5S
* Sensor: CT or Rogowski coil, with RJ12 port
* Monitor up to 32 circuits
  (Single phase/Three phase）
* Integrated power supply for master meter
  and submeter
* Communication: Modbus-RTU, RS485,
* Max baud rate: 38.4 kbps
* Test version software

Compact and space-saving

Plug design

Centralized installation

Easy maintenance

Excellent function

Economical cost

ME131 multi-circuit smart energy meter is compatible with both Rogowski coil and voltage-output split core current transformer, which could realize dismantling-free conductor test, simplify test procedures and save construction costs.

# Contents

# 1 Product description



Dimension drawing

## ME131 Model No. naming rules

ME131-M2

**Master/Sub device type**
M: Master device, with power supply
S: Sub device, without power supply, attached to the master device.

**Power supply type**
2: 220V AC auxiliary power supply(95-265VAC)
3: 24V DC auxiliary power supply(18-36VDC)
5: Main circuit power supply(90-528VAC)

Note: ME131S series, without auxiliary power supply

ME131 multi-circuit smart energy meter supports three-phase three-wire and three-phase four-wire systems. It can measure multi electrical parameters such as current, voltage, power factor, harmonic, power and energy of electric network phase L1, L2 and L3.

With standard configuration of RS485 communication interface and standard Modbus-RTU protocol, ME131 is compatible with various configuration systems and could transmit the electrical parameters collected by the front end to the system data center in real time.

| Description | |
| --- | --- |
| Mounting type | Din Rail |
| Model No. | Master meter: ME131M, Submeter: ME131S |
| Type of current sensor | Rogowski coil<br>Voltage-output current transformer |
| Feature | Directly connect to Rogowski coil |
| Advantage | Wide current range, measurement without dismantling |
| Wiring system | 3P4W_3CT, 3P3W_3CT, 3P3W_2CT, 1P3W, 1P2W |
| Application field | Power analysis and energy consumption monitoring |
| Display screen | None |
| Weight | ME131M: 122g;<br>ME131S: 59g |
| Dimension | ME131M: L*W*D 9.3*8.0*3.6CM;<br>ME131S: L*W*D 9.3*8.0*1.81CM |
| Color | White |
| Current measurement | |
| Channel input voltage range | 0-900mVAC peak, 636 mV RMS |
| Measurement range | Different current sensors have different measuring ranges |

| | |
|---|---|
| Rogowski coil | 50mV/kA@50Hz(0-12000A), @60Hz(0-10000A)<br>85mV/kA@50Hz(0-7000A), @60Hz(0-6000A)<br>100mV/kA@50Hz(0-6000A), @60Hz(0-5000A)<br>... |
| Voltage-output CT | 0~99999A |
| **Voltage measurement** | |
| Measurement range | 0~600VAC |
| Maximum measured value | 720VAC |
| **Digital signal** | |
| Switching output | 1-circuit electromagnetic relay output, contact capacity: 3A 30V DC，3A 250V AC |
| Switching value input | Optocoupler isolation（5kVrms） |
| **Communication** | |
| RS485 Communication | One RS485 communication interface<br>Interface type: two-wire half-duplex<br>Communication baud rate: 2400bps~38400bps<br>Protocol: Modbus-RTU |
| **Power supply** | |
| Power supply | 85~265VAC/110~370VDC, 45~60Hz<br>(24V DC power supply version could be customized) |
| Maximum power consumption | ≤3.5VA |

# 2 Measurement parameters

| **Instantaneous value** | |
|---|---|
| Phase Voltage | U1, U2, U3, AVG, U0 (Zero sequence voltage） |
| Line Voltage | U12, U23, U31, AVG |
| Current | I1, I2, I3, AVG, In |
| Grid frequency | F1, F2, F3, Σ |
| Power factor PF | PF1, PF2, PF3, Σ |
| Fundamental power factor DPF | DPF1, DPF2, DPF3, Σ |
| Active power | P1, P2, P3, Σ |
| Reactive power | Q1, Q2, Q3, Σ |
| Apparent power | S1, S2, S3, Σ |
| **Energy** | |
| Active energy Pos. | EP1, EP2, EP3, Σ |
| Active Energy Neg. | EP1, EP2, EP3, Σ |
| Reactive Energy Pos. | EQ1, EQ2, EQ3, Σ |

| Reactive energy Neg. | EQ1, EQ2, EQ3, Σ |
|---|---|
| Apparent Energy | ES1, ES2, ES3, Σ |
| Tariff Energy | ET1, ET2, ET3, ET4, ET5, ET6 |
| **Harmonics** | |
| Voltage Harmonic Distortion | Total harmonic（U1, U2, U3）<br>Odd total harmonic（U1, U2, U3）<br>Even total harmonic（U1, U2, U3）<br>Sub-harmonic 1-50th（U1, U2, U3） |
| Current Harmonic Distortion | Total harmonic（I1, I2, I3）<br>Odd total harmonic（I1, I2, I3）<br>Even total harmonic（I1, I2, I3）<br>K-factor（I1, I2, I3）<br>Sub-harmonic 1-50th（I1, I2, I3） |
| Voltage Harmonic Value | Total harmonic（U1, U2, U3）<br>Sub-harmonic 1-50th（U1, U2, U3） |
| Current Harmonic Value | Total harmonic（I1, I2, I3）<br>Sub-harmonic 1-50th（I1, I2, I3） |
| **Phase** | |
| Phase sequence | Voltage, Current |
| Voltage angle | U1, U2, U3 |
| Current angle | I1, I2, I3 |
| Voltage-current angle | UI1, UI2, UI3 |
| **Demand** | |
| Demand | Total active power, total reactive power, total apparent power |
| Maximum demand of total active power | Maximum demand and time |
| Maximum demand of total reactive power | Maximum demand and time |
| Maximum demand of total apparent power | Maximum demand and time |
| **Unbalance** | |
| Voltage unbalance | Negative Sequence, zero Sequence |
| Current unbalance | Negative Sequence, zero Sequence |
| **Max. & Min.** | |
| Phase Voltage | Each phase and average |
| Line Voltage | Each phase and average |
| Current | Each phase and average |
| Active power | Each phase and total |
| Reactive power | Each phase and total |
| Apparent power | Each phase and total |

# 3 Accuracy and certification

| **Measurement Accuracy** | |
|---|---|
| Current measurement accuracy | 0.1%+ Current sensor accuracy |
| Voltage measurement accuracy | ±0.2%(60V~600V AC) |
| Grid frequency | ±0.01%(45~65Hz) |
| Power factor | ±0.005 |

| Active and apparent power | IEC62053-22    class 0.5S |
|---|---|
| Reactive power | IEC62053-21    class 1S |
| Active energy | IEC62053-22    class 0.5S |
| Reactive energy | IEC62053-21    class 1S |
| **Environment condition** | |
| Operating temperature | -25℃~+60℃ |
| Storage temperature | -40℃~+85℃ |
| Humidity range | 5~95% RH, 50℃  (non-condensing) |
| Class of pollution | 2 |
| Overvoltage capacity | III, Applicable to power distribution system below 277/480VAC |
| Insulation strength | IEC61010-1 |
| Altitude | 3000m Max |
| Anti-pollution grade | IP20 (Meet the standard of IEC 60629) |
| Quality guarantee | 12 months |
| **EMC (Electromagnetic compatibility)** | |
| Electrostatic discharge | Level IV(IEC61000-4-2) |
| Radiated immunity | Level III (IEC61000-4-3) |
| EFT Electrical fast burst immunity | Level IV (IEC61000-4-4) |
| Surge immunity | Level IV (IEC61000-4-5) |
| Conducted disturbance immunity | Level III (IEC61000-4-6) |
| Power frequency magnetic field immunity | 0.5mT (IEC61000-4-8) |
| Conduction and radiation | Class B (EN55022 ) |
| **Measurement standard** | |
| EN 62052-11，EN61557-12，EN 62053-21，EN 62053-22，EN 62053-23，EN 50470-1，EN 50470-3，EN 61010-1，EN 61010-2，EN 61010-031 | |

# 4 Connection

The energy meter is equipped with standard interface and convenient RJ12 interface to meet different functional requirements
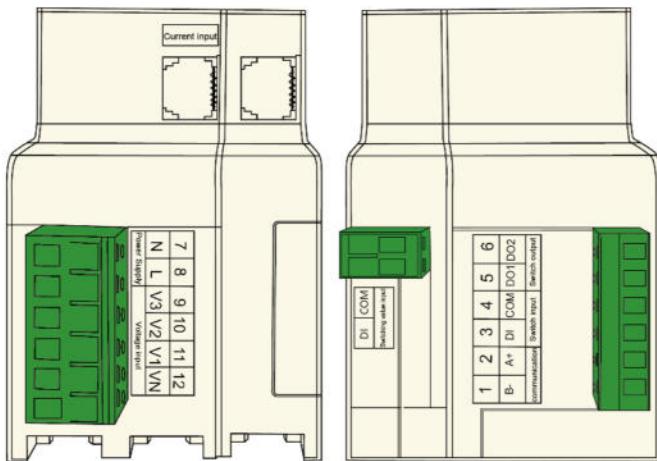
| Interface number | Interface name | Interface definition | Interface type | Remarks |
|---|---|---|---|---|
| 1 | B- | RS485 Communication B | Communication | RS485 communication |
| 2 | A+ | RS485 Communication A | | |
| 3 | DI | Digital input + | Switching value input | Digital input |
| 4 | COM | Digital input - | | |
| 5 | DO1 | Digital output 1 | Switching output | One relay output, normally open contact |
| 6 | DO2 | Digital output 2 | | |
| 7 | N | Power supply （-） | Power supply 85~265VAC | Power supply 85~265VAC，45~60Hz 110~370VDC (24V DC version could be customized) |
| 8 | L | Power supply （+） | | |
| 9 | V3 | Phase L3 Voltage input | Voltage input | Measuring voltage input channel |
| 10 | V2 | Phase L2 Voltage input | | |
| 11 | V1 | Phase L1 Voltage input | | |
| 12 | VN | Phase N Voltage input | | |

## 4.1 Power supply

The energy meter adopts external power supply, without internal direct power supply. The voltage range is: 85~265VAC/110~370VDC, 45~60Hz, maximum power consumption 3.5VA (24V DC version could be customized)

➢ Do not connect the meter when the cable is live.
➢ Before connecting the power supply, make sure that the power supply voltage is within the required range, otherwise the meter cannot work normally.

## 4.1 Voltage and current input

Energy meter supports wiring mode, three-phase four-wire_3CT(3P4W_3CT), three-phase three-wire _3CT(3P3W_3CT), three-phase three-wire_2CT(3P3W_2CT), one-phase three-wire(1P3W), one phase and two-wire(1P2W)

➢ The actual wiring mode of the meter must be consistent with the wiring mode configured inside the meter.
➢ Three-phase four-wire 3CT (3P4W_3CT) requires three current sensors, and the N-phase current is obtained through calculation.
➢ Three-phase three-wire 3CT (3P3W_3CT) requires three current sensors, and phase B current is measured by the sensor.
➢ Three-phase three-wire 2CT (3P3W_2CT) requires two current sensors, phase B current is obtained through calculation.
➢ The phase sequence of voltage and current must follow the phase sequence of L1L2L3, otherwise the meter will display voltage and current phase sequence error.
➢ When using the current sensor, note that the direction of the current arrow on the sensor must be consistent with the actual current direction, that is, the sensor current arrow points to the load end.

## 4..1 Set current input parameter:

Rogowski coil:

| Parameter name | |
| --- | --- |
| **Rogowski coil** | **Description** |
| Rcoil Pri | Rated current value of primary side (input current of Rogowski coil) |
| Rcoil Sec | Secondary output value (Rogowski coil output value) |
| Rated Current | Nominal current |
| Example: Coil Ratio is 85mV/kA@50Hz | |
| Rcoil Sec=85mV | |
| When measure 1000A, set nominal current =1000A | |
| When measure 1500A, set nominal current =1500A | |
| When measure 100A, to ensure high accuracy, set the nominal current =100A | |
| **If change coils with different ratio, the ratio should be reset.** | |

Current transformer：

| Parameter name | |
| --- | --- |

| Voltage output current transformer | Description |
|---|---|
| CT Pri | Rated current value of primary side (CT input current) |
| CT Sec | Secondary output value (CT output value) |
| Rated Current | Nominal current |
| Example: CT Ratio is 500A/333mV | |
| CT Pri =500A, CT Sec=333mV | |
| **If change CT with different ratio, the ratio should be reset.** | |

## 4..2 Test version software

Meter calibration



Electricity meter setting

**ME131 Test version of computer software**

Calibration | Read data | SET | Description

Communication parameter setting

Device address: 1    Baud rate: 2400    Parity check: None    Stop bit: 1bit    Set communication parameters

Product parameters

Model No.: ME131    Serial No.: 2522001001    SET

Set time | Reset

Set time | All values | Reset

Zero drift suppression | Set relay output

Voltage threshold: 0.10    Current threshold: 0.1    SET    ● Close ⬤ Break off    Set relay output

Standard value

|  | Voltage | Current | PF | Active power | Reactive power | Apparent power | Frequency |
|---|---|---|---|---|---|---|---|
| Standard | 220.0 V | 200.0 A | 0.500 | 22.000 Kw | 38.105 kVar | 44.000 kVa | 50.000 Hz |
| Error | 0.200 % | 0.500 % | 0.005 | 0.500 % | 0.500 % | 0.500 % | 0.005 Hz |

## 4..3 Voltage and current wiring mode is as follows:

**Three-phase four-wire 3CT**
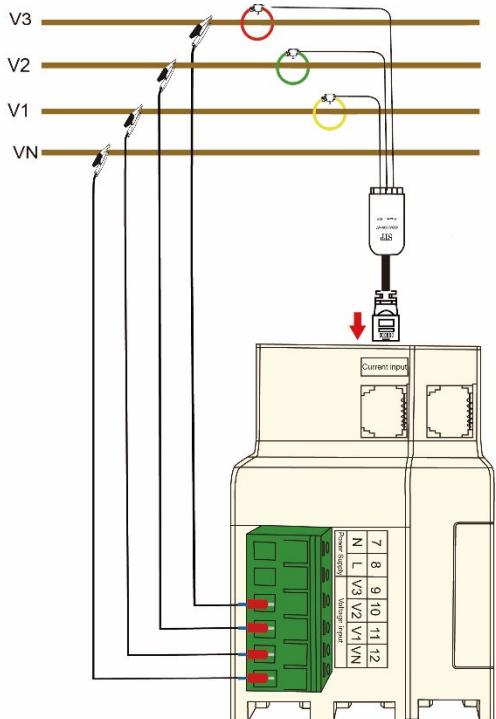
## Three-phase three-wire 3CT
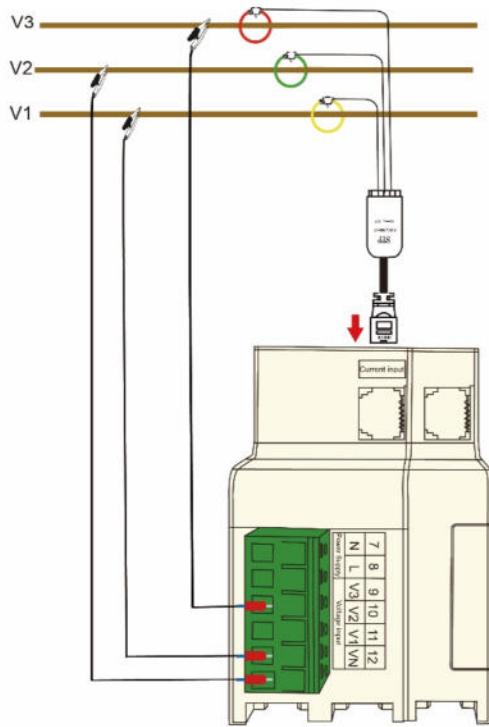


## Three-phase three-wire2CT
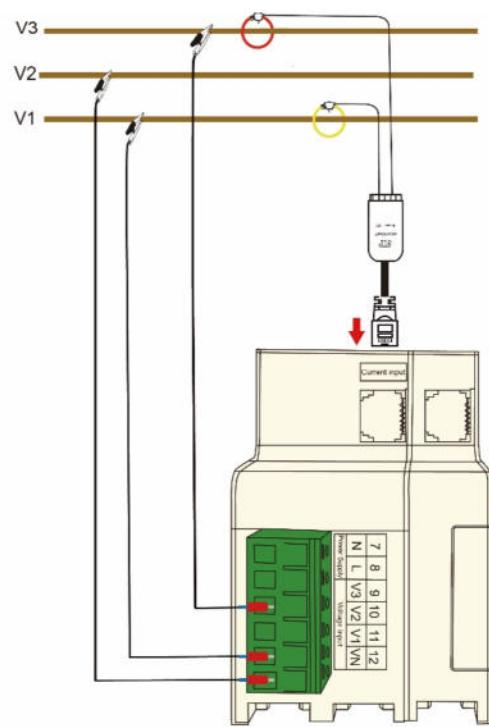


## One-phase three-wire
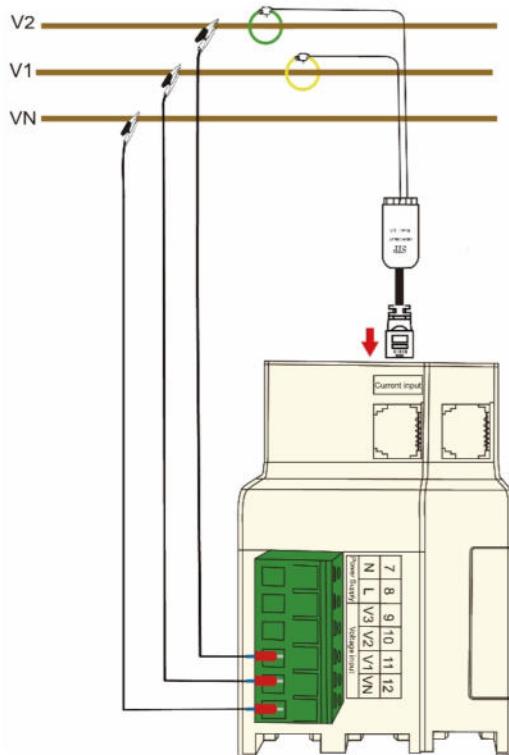


## One phase and two-wire
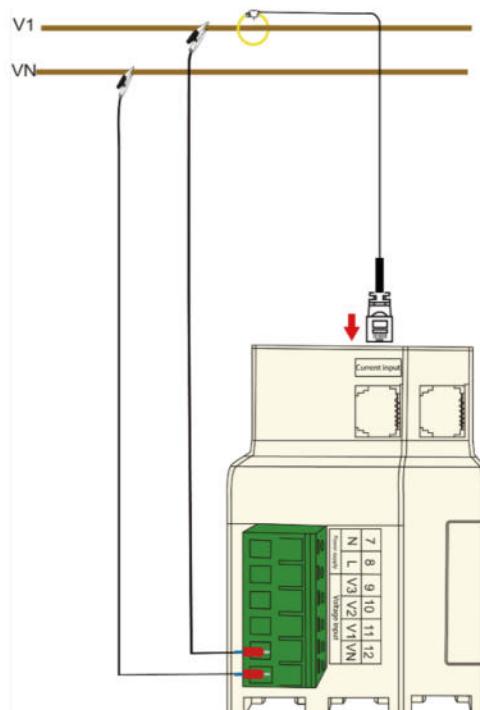
## 4.1 RS485

The meter is equipped with one RS485 communication interface, which supports ModBus-RTU protocol. The RS485 communication interface requires shielded twisted pair connection and daisy chain connection. In case of long distance and high speed, a 120 Ω resistance is required to be connected in parallel at both ends of the daisy chain.
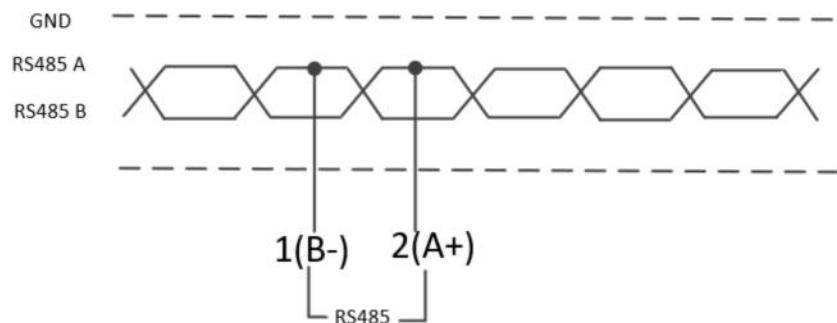


## 4.1 Relay output

The meter is equipped with a relay output, which is a normally open contact. The terminal blocks are identified as R1 and R0, where R0 is the common contact and R1 is the normally open contact. Maximum load capacity of relay: 3A 30V DC, 3A 250V AC
The closed state of the normally open contact of the relay can be read through Modbus. There are two relay output control modes, which can be modified through Modbus

| Relay output control mode | Description |
| --- | --- |
| Manual mode | Control relay output via Modbus |
| Alarm mode | Control the relay output through setting alarm parameters |
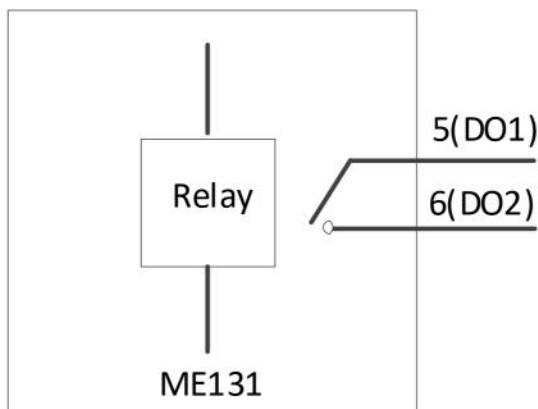


## 4.1 Digital input

The meter is equipped with a digital switching input. The terminal block identification is: 3 (DI), 4 (COM). The status of digital switch input can be read through RS485/ModBus protocol.

VCC1

R(750 Ω)    3(DI)      +
             4(COM)     -    5-40VDC

ME131
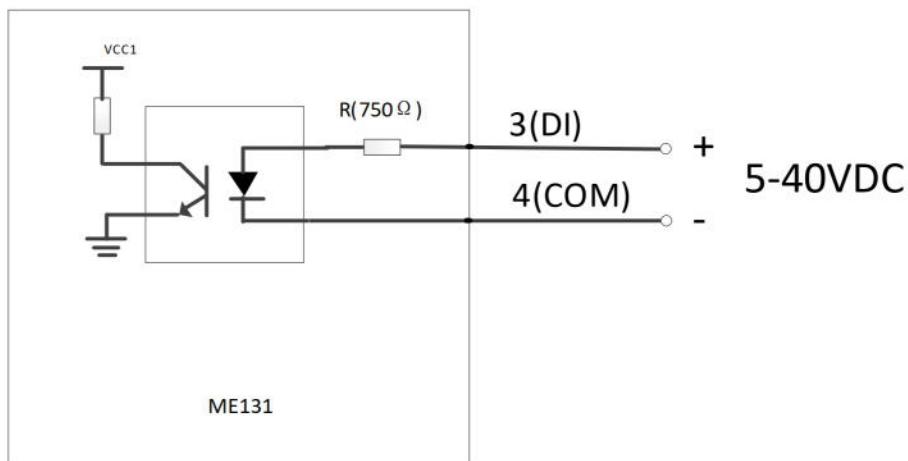
# 5 Function

## 5.1 Multi tariff

The meter provides multi-tariff electricity accumulation function, supporting up to 6 tariff.
There are two switching control modes for tariff, which can be modified through Modbus.

| Switching control mode of tariff | Description |
|---|---|
| Manual mode | Switch tariff through Modbus |
| RTC mode | Trigger tariff switching through RTC time period |

### 5..1 Manual control mode

The tariff can be switched through the configuration command 1071 of Modbus

### 5..2 RTC control model

In RTC control mode, tariff switching is triggered by real-time clock.
The RTC control mode supports 6 time periods (Ta, Tb, Tc, Td, Te, Tf) and 6 tariff (T1, T2, T3, T4, T5, T6). Any tariff can be specified for 6 time periods (Ta, Tb, Tc, Td, Te, Tf).
The time period and target tariff can be modified through Modbus.
The time period is set according to 24 hours, starting from the Ta starting time. The Tc starting time cannot be between the Ta starting time and the Tb starting time, and the Td starting time cannot be between the Ta starting time and the Tc starting time, and so on.

## 5.1 Demand

The energy meter provides active power, reactive power, apparent power demand and maximum demand.
The calculation method and calculation interval of demand can be configured through Modbus.

## 5..1 Calculation method of demand

The energy meter supports two demand calculation methods: fixed type and sliding type.

| Demand calculation method | Description |
|---|---|
| Fixed type | The meter will calculate and update the demand at the end of each interval |
| Sliding type | Update demand every 1 minute |

The following figure describes two methods of demand calculation, taking the demand interval of 15 minutes as an example:
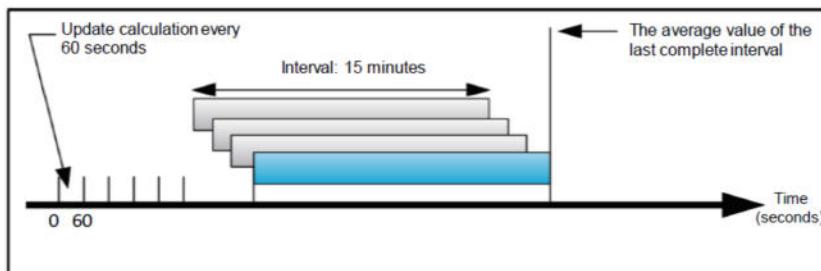


图 5-1 Sliding type
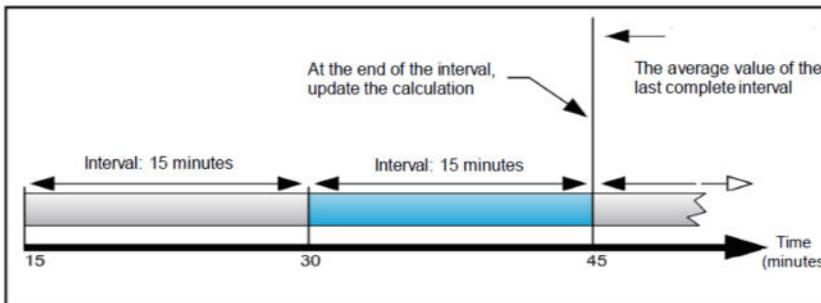


Figure 5-2 Fixed type

## 5.1 Alarm

The meter provides a variety of alarm parameter settings and alarm output, and the alarm parameters can be configured through Modbus.

| Alarm type | Description |
|---|---|
| Over current, each phase | If one phase value exceeds the alarm threshold, an alarm will be generated, When all phases are less than the release threshold, the alarm is released. |
| Under current, each phase | If one phase value exceeds the alarm threshold, an alarm will be generated, When all phases are greater than the release threshold, the alarm is released. |
| Over phase voltage, each phase | If one phase value exceeds the alarm threshold, an alarm will be generated, When all phases are less than the release threshold, the alarm is released. |

| | |
|---|---|
| Under phase voltage, each phase | If one phase value exceeds the alarm threshold, an alarm will be generated, When all phases are greater than the release threshold, the alarm is released. |
| Overline voltage, each phase | If one phase value exceeds the alarm threshold, an alarm will be generated, When all phases are less than the release threshold, the alarm is released. |
| Underline voltage, each phase | If one phase value exceeds the alarm threshold, an alarm will be generated, When all phases are greater than the release threshold, the alarm is released. |
| Overpower, total active (absolute value) | |
| Overpower, total reactive (absolute value) | |
| Overpower, total apparent | |
| Overdemand, total active power (absolute value), current | |
| Overdemand, total reactive power (absolute value), current | |
| Overdemand, total apparent power, current | |
| Over THD-U，each phase | If one phase value exceeds the alarm threshold, an alarm will be generated, When all phases are less than the release threshold, the alarm is released. |
| Over THD-I，each phase | If one phase value exceeds the alarm threshold, an alarm will be generated, When all phases are less than the release threshold, the alarm is released. |

## 5..1 Alarm output

Alarm output can be associated with buzzer and relay (relay control mode needs to be configured as alarm mode) output. After the alarm is released, the corresponding output will also be released.

## 5.1 Phase sequence detection

The meter supports three-phase voltage and current phase sequence detection, and can read the phase sequence status through Modbus.

Note: The correct phase sequence of voltage and current can only ensure the correct phase sequence of each, and cannot guarantee the corresponding relationship between voltage and current. Therefore, it is necessary to pay attention to the wiring mode.

# 6 Modbus Communication

| Communication | |
|---|---|
| Communication interface | RS485 |
| Communication protocol | Modbus RTU |

The standard communication protocol Modbus-RTU is adopted.

## 6.1 Modbus-RTU Communication parameters

Before Modbus-RTU communication, the following parameters need to be set:

| Parameter | Effective value | Default |
|---|---|---|
| Address | 1 – 247 | 1(via dial switch) |
| Baud rate | -1200<br>-2400<br>-4800<br>-9600<br>-19200<br>-38400 | 9600 |
| Data bits | 8 | 8 |
| Verification method | – No calibration<br>– odd check<br>– Even check | No calibration |
| Stop bit | 1-2 | 1 |

## 6.1 Setting the device address

The device address is set through a 5-bit dial switch, and the maximum settable address is 32.
The device address is calculated by adding the (weight value * dial status value) of five dials.

> **ⓘ Tips**
> ●   It takes effect immediately after the dial code setting.

Dial status value

| Dialing status<br>(Black is the dial code) | Dial status value | Remarks |
|---|---|---|
| ON | 1 | |
| ON | 0 | |

Dial weight value

| Dial number | Numerical weight | Remark |
|---|---|---|
| 1 | 1 | |
| 2 | 2 | |
| 3 | 4 | |
| 4 | 8 | |
| 5 | 16 | |

Example of setting device address

| Dial switch position (Black is the dial code) | Device address | Remark |
|---|---|---|
|  | The device address is 1, and the calculation is as follows: $1*1+2*0+4*0+8*0+16*0=1$ | Factory Default |
|  | The device address is 10, and the calculation is as follows: $1*0+2*1+4*0+8*1+16*0=10$ | |
|  | The device address is 21, and the calculation is as follows: $1*1+2*0+4*1+8*0+16*1=21$ | |
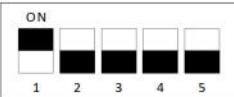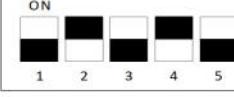
# 6.1 Modbus RTU Data frame

Modbus RTU data frame includes address field, function code, data and error check.
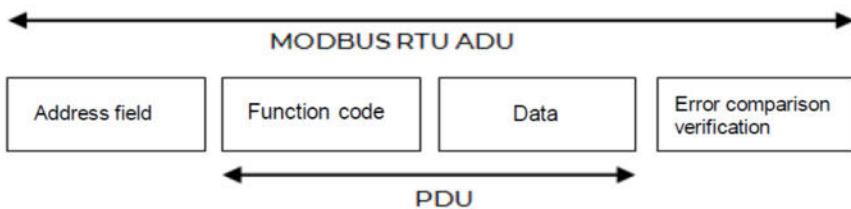


# 6.1 PDU Request data format

| Function code | Instructions |
|---|---|
| 8-Bits | N×8-Bits |

# 6.1 Function code

Function codes are used to indicate how the device processes the command. The following table shows the available function codes and their descriptions.

| Function code | | Name of function code | Function | Remark |
|---|---|---|---|---|
| Decimal system | Hexadecimal | | | |
| 3 | 03H | Read Holding Register | Used to read device parameters | |
| 16 | 10H | Write multiple registers | Used to configure device parameters | |

## 6.1 Register list

The register list has the following headings:

| Register alias | Register address | Operation read/write | Size | Type | Unit | Description |
|---|---|---|---|---|---|---|

• Register alias: It refers to the meaning of register.

• Register address: Address of Modbus data. The data address in this document is in decimal format.

• Operation: indicates the operation that the register can perform, R: read-only; W: Writable; WC: writable through instruction register.

• Size: Indicates the size of 16-bit data.

• Type: The type of data encoding.

• Unit: The unit of the register value.

• Description: Describe the function of this register.

**Data type list:**

The following table lists the data types used in this document:

| Type | Description | Range |
|---|---|---|
| UInt16 | Unsigned 16-bit integer | 0 – 65535 |
| Int16 | Signed 16-bit integer | -32768 – +32767 |
| UInt32 | Unsigned 32-bit integer | 0 – 4 294 967 295 |
| UInt64 | Unsigned 64-bit integer | 0 – 18 446 744 073 709 551 615 |
| UTF8 | 8-bit UTF code | Multibyte Unicode encoding |
| Float32 | 32-bit floating point | Standard IEEE floating point data (single precision) |
| Date Time | Date Time Type | - |
| Time | Time type | - |

Date Time detailed explanation:

| Byte | Position | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
| 1 | Year（2000 – 2099） | | | | | | | | | | | | | | | |
| 2 | Month (1 – 12) | | | | | | | | Date (1 – 31) | | | | | | | |
| 3 | Hour (0 – 23) | | | | | | | | Minute (0 – 59) | | | | | | | |
| 4 | Second (0 – 59) | | | | | | | | | | | | | | | |

Time type details:

| Byte | Position | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
| 1 | Hour (0 – 23) | | | | | | | | | | | | | | | |
| 2 | Minute (0 – 59) | | | | | | | | | | | | | | | |
| 3 | Second (0 – 59) | | | | | | | | | | | | | | | |

Configure the device via Modbus-RTU.

You can use function code 16 to write instructions to the device and configure the device parameters.

Device parameter configuration can only be configured by writing the corresponding data to the "configuration instruction register", that is, writing the corresponding data to the address starting from 300 to configure the corresponding parameters.

**Configuration result:**

The configuration result can be read through registers 424 and 425.

| Register address | Content | Size (16 bits) | Data (example) |
|---|---|---|---|
| 424 | Configuration instruction code | 1 | 1001(Set time) |
| 425 | Result | 1 | 0 = Effective operation<br>80 = Invalid instruction code<br>81 = Invalid command parameter<br>82 = Numbers of invalid instruction parameters<br>83 = Operation not performed |

# 6.1 Modbus-RTU Function code operation instructions

## 6..1 Operating instructions for function code (0x10=16)

Function code (0x10=16) is used to configure device parameters. Its request and return data format is as follows:

Request data format:

| Serial No. | Name | Type | Range（Decimal system） | Description |
|---|---|---|---|---|
| 1 | Device address | UInt8 | 1-247 | |
| 2 | Function code | UInt8 | 16 | |
| 3 | Register start address | UInt16 | - | High byte first (send order) |
| 4 | Number of registers | UInt16 | 1-123 | High byte first (send order) |
| 5 | Number of register bytes | UInt8 | | Number of registers * 2 |
| 6 | Write value of register 1 | UInt16 | - | High byte first (send order) |

| Serial No. | Name | Type | Range （Decimal system） | Description |
|---|---|---|---|---|
| 7 | ... | UInt16 | - | High byte first (send order) |
| 8 | Write value of register n | UInt16 | - | High byte first (send order) |
| 9 | CRC-16 check code | UInt16 | - | Low byte first (send order) |

Return data format:

| Serial No. | Name | Type | Range （Decimal system） | Description |
|---|---|---|---|---|
| 1 | Device address | UInt8 | 1-247 | |
| 2 | Function code | UInt8 | 16 | |
| 3 | Register start address | UInt16 | 300 | High byte first |
| 4 | Number of registers | UInt16 | 1-123 | High byte first |
| 5 | CRC-16 Check code | UInt16 | - | Low byte first |

Attention!

Function code (0x10=16) can only write data to the "configuration instruction register", and can only write data to the register starting from address 300.

For example:

Configure the equipment time (command=1200, set as: 2022-11-1 12:20:00).

| Serial No. | Meaning | Type | Value （Decimal system） | Value （Hexadecimal） | Description |
|---|---|---|---|---|---|
| 1 | Device address | UInt8 | 1 | 01 | |
| 2 | Function code | UInt8 | 16 | 10 | |
| 3 | Register start address | UInt16 | 300 | 012C | Configuration register start address |
| 4 | Number of configuration registers | UInt16 | 7 | 0007 | Configure time command + parameters 7 registers in total |
| 5 | Data length | UInt8 | 14 | 0E | Number of configuration registers * 2 |
| 6 | Register 300 written value | UInt16 | 1200 | 04B0 | Instruction code for configuring time 1200 |
| 7 | Register 301 written value | UInt16 | 2022 | 07E6 | Year=2022 |
| 8 | Register 302 written value | UInt16 | 11 | 000B | Month=11 |
| 9 | Register 303 written value | UInt16 | 1 | 0001 | Date=1 |
| 10 | Register 304 written value | UInt16 | 12 | 000C | Hour=12 |

| Serial No. | Meaning | Type | Value (Decimal system) | Value (Hexadecimal) | Description |
|---|---|---|---|---|---|
| 11 | Register 305 written value | UInt16 | 20 | 0014 | Minute=20 |
| 12 | Register 306 written value | UInt16 | 0 | 0000 | Second=0 |
| 13 | CRC-16 Check code | UInt16 | 35524 | 8AC4 | Low byte first (send order) |

The order of sending bytes is as follows:

01 10 01 2C 00 07 0E 04 B0 07 E6 00 0B 00 01 00 0C 00 14 00 00 C4 8A

If the configuration data is correct, the following data will be returned:

01 10 01 2C 00 07 41 FE

| Serial No. | Name | Type | Range(Hexadecimal) | Range(Decimal system) |
|---|---|---|---|---|
| 1 | Device address | UInt8 | 01 | 1 |
| 2 | Function code | UInt8 | 10 | 16 |
| 3 | Register start address | UInt16 | 012C | 300 |
| 4 | Number of registers | UInt16 | 0007 | 7 |
| 5 | CRC-16 Check code | UInt16 | 41FE | |

# 6..2 Function code（0x03=3）Operating instructions

Function code（0x03=3）is used to read the device register parameters. Its request data and return data format are as follows:

Request data format:

| Serial No. | Name | Type | Range(Decimal system) | Description |
|---|---|---|---|---|
| 1 | Device address | UInt8 | 1-247 | |
| 2 | Function code | UInt8 | 3 | |
| 3 | Start register address | UInt16 | - | High byte first (send order) |
| 4 | Number of registers | UInt16 | 1-125 | High byte first (send order) |
| 5 | CRC-16 check | UInt16 | - | Low byte first (send order) |

Return data format:

| Serial No. | Name | Type | Range(Decimal system) | Description |
|---|---|---|---|---|
| 1 | Device address | UInt8 | 1-247 | |
| 2 | Function code | UInt8 | 3 | |
| 3 | Read register bytes | UInt8 | - | Number of read registers * 2 |
| 4 | Value of register 1 | | - | High byte first |
| 5 | ... | | - | High byte first |
| 6 | Value of register n | | - | High byte first |
| 7 | CRC-16 check | UInt16 | - | Low byte first |

Example:

Read the voltage values of L1, L2 and L3 (the starting address of voltage register is: 1010):

| Serial No. | Name | Type | Range(Decimal system) | Range(Hexadecimal) | Description |
|---|---|---|---|---|---|
| 1 | Device address | UInt8 | 1 | 0x01 | |
| 2 | Function code | UInt8 | 3 | 0x03 | |
| 3 | Start register address | UInt16 | 1010 | 0x03F2 | |
| 4 | Number of registers | UInt16 | 6 | 0x0006 | |
| 5 | CRC-16 check | UInt16 | 32612 | 0x7F64 | Low byte first (send order) |

The order of sending bytes is as follows:

01 03 03 F2 00 06 64 7F

Return data:

01 03 0C 43 5C 00 00 43 5D 00 00 43 5E 00 00 14 AC

| Serial No. | Name | Type | Hexadecimal | Decimal system |
|---|---|---|---|---|
| 1 | Device address | UInt8 | 01 | 1 |
| 2 | Function code | UInt8 | 03 | 3 |
| 3 | Read register bytes | UInt8 | 0C | 12 |
| 4 | Phase L1 voltage | float32 | 435C0000 | 220V |
| 5 | Phase L2 voltage | float32 | 435D0000 | 221V |
| 6 | Phase L3 voltage | float32 | 435E0000 | 222V |
| 7 | CRC-16 check | UInt16 | 14AC | |

## 6..3 Error response

Error response data format:

| Serial No. | Name | Type | Decimal system | Hexadecimal | Remark |
|---|---|---|---|---|---|
| 1 | Device address | UInt8 | 1-247 | 0x01-0xF7 | |
| 2 | Function code | UInt8 | (128+3) (128+16) | (0x80+0x03) (0x80+0x10) | |
| 3 | Error code | UInt8 | | | |
| 4 | CRC-16 check | UInt16 | | | Low byte first |

Modbus Error code:

| Code | Name | Meaning |
|---|---|---|
| 0x01 | Illegal function code | The function code 3 or 16 supported by the device is not used |
| 0x02 | Illegal data address | The register data written or read is not within the address range supported by the device |
| 0x03 | Illegal data value | The data value written to the register does not meet the requirements |
| 0x04 | Equipment error | An unknown error occurred |

# 7 List of configuration instructions

## 7.1 System parameter setting

| Instruction code | Operation | Size | Type | Unit | Range (Decimal system) | Description |
|---|---|---|---|---|---|---|
| 1001 | W | 1 | UInt16 | - | 1,2,3,4,5 | Wiring mode<br>1=3P4W_3CT<br>2=3P3W_3CT<br>3=3P3W_2CT<br>4=1P3W<br>5=1P2W |
| | W | 1 | UInt16 | Hz | 50,60 | Grid frequency |
| | W | 1 | UInt16 | V | 1-65535 | Nominal voltage (excluding VT ratio) |
| | W | 2 | UInt32 | - | 1-99999999 | VT transformation ratio, amplification 10000 times |
| | W | 2 | UInt32 | - | 1-99999999 | CT transformation ratio, magnification 10000 times |

## 7.1 Parameter setting of phase L1L2L3 current transformer

| Instruction code | Operation | Size | Type | Unit | Range (Decimal system) | Description |
|---|---|---|---|---|---|---|
| 1002 | W | 1 | UInt16 | - | 0,1 | Phase L1L2L3 current access mode<br>0 = Rogowski coil intput<br>1 = VCT input |
| | W | 2 | UInt32 | A | 1-999999 | Phase L1L2L3 Rogowski coil input value |
| | W | 2 | UInt32 | mV@50 Hz<br>mV@60 Hz | 1-99999 | Phase L1L2L3 Rogowski coil output value<br>=Actual value*100<br>(Note: the output shall be set according to the grid frequency) |
| | W | 2 | UInt32 | A | 1-999999 | Phase L1L2L3 Rogowski coil nominal current |
| | W | 2 | UInt32 | A | 1-999999 | PHASE L1L2L3 VCT input value |
| | W | 2 | UInt32 | mV | 1-99999 | PHASE L1L2L3 VCT output value<br>=Actual value*100 |

| Instruction code | Operation | Size | Type | Unit | Range (Decimal system) | Description |
|---|---|---|---|---|---|---|
| | W | 2 | UInt32 | A | 1-999999 | PHASE L1L2L3VCT nominal current |

## 7.1 Parameter setting of N-phase current transformer

| Instruction code | Operation | Size | Type | Unit | Range (Decimal system) | Description |
|---|---|---|---|---|---|---|
| 1003 | W | 1 | UInt16 | - | 0,1 | N-phase current access mode<br><br>0 = Rogowski coil input<br>1 = VCT input |
| | W | 2 | UInt32 | A | 1-999999 | N-phase Rogowski coil input value |
| | W | 2 | UInt32 | mV@50 Hz mV@60 Hz | 1-99999 | N-phase Rogowski coil output value<br>=Actual value*100<br>(Note: the output shall be set according to the grid frequency) |
| | W | 2 | UInt32 | A | 1-999999 | N-phase Rogowski coil nominal current |
| | W | 2 | UInt32 | A | 1-999999 | N-phase VCT input value |
| | W | 2 | UInt32 | mV | 1-99999 | N-phase VCT output value =Actual value*100 |
| | W | 2 | UInt32 | A | 1-999999 | N-phase VCT nominal current |

## 7.1 Phase L1L2L3 Current direction setting

This configuration can be used to modify the current direction when the coil direction is inconsistent with the actual one.

| Instruction code | Operation | Size | Type | Unit | Range (Decimal system) | Description |
|---|---|---|---|---|---|---|
| 1010 | W | 1 | UInt16 | - | 0,1 | Phase L1 current direction<br>0 = Positive (default)<br>1 = Reverse |
| | W | 1 | UInt16 | - | 0,1 | L2 current direction<br>0 = Positive (default)<br>1 = Reverse |
| | W | 1 | UInt16 | - | 0,1 | L3 current direction<br>0 = Positive (default)<br>1 = Reverse |

## 7.1 Phase L1L2L3 Current channel setting

When the current and voltage do not correspond, you can use this configuration to modify the current channel selection so that the current and voltage correspond to each phase.

| Instruction code | Operation | Size | Type | Unit | Range (Decimal system) | Description |
|---|---|---|---|---|---|---|
| 1011 | W | 1 | UInt16 | - | 0，1，2 | L1 current channel selection<br>0 = Current channel 1 (default)<br>1 = Current channel 2<br>2 = Current channel 3 |
| | W | 1 | UInt16 | - | 0，1，2 | L2 current channel selection<br>0 = Current channel 1<br>1 = Current channel 2 (default)<br>2 = Current channel 3 |
| | W | 1 | UInt16 | - | 0，1，2 | L3 current channel selection<br>0 = Current channel 1<br>1 = Current channel 2<br>2 = Current channel 3 (default) |

## 7.1 Zero drift suppression setting

| Instruction code | Operation | Size | Type | Unit | Range (Decimal system) | Description |
|---|---|---|---|---|---|---|
| 1020 | W | 1 | UInt16 | % | 0~1000 | Voltage zero drift suppression takes (nominal voltage * VT ratio) as reference<br>= Actual value *100<br>Default：10 |
| | W | 1 | UInt16 | % | 0~1000 | Current zero drift suppression takes (nominal current * CT ratio) as reference.<br>=Actual value*100<br>Default：10 |

## 7.1 Demand parameter setting

| Instruction code | Operation | Size | Type | Unit | Range (Decimal system) | Description |
|---|---|---|---|---|---|---|
| 1060 | W | 1 | UInt16 | - | 0,1 | Demand calculation method<br>0 = Fixed type<br>1 = Sliding type |
| | W | 1 | UInt16 | Minute | 1-60 | Demand calculation interval |

## 7.1 Tariff mode setting

| Instruction code | Operation | Size | Type | Unit | Range (Decimal system) | Description |
|---|---|---|---|---|---|---|
| 1070 | W | 1 | UInt16 | - | 0,1 | Tariff switching mode<br>0 = Manual switching<br>1 = RTC switching |

## 7.1 Manual tariff setting

| Instruction code | Operation | Size | Type | Unit | Range (Decimal system) | Description |
|---|---|---|---|---|---|---|
| 1071 | W | 1 | UInt16 | - | 0-5 | Manual tariff setting<br>0 = tariff 1<br>1 = tariff 2<br>...<br>5 = tariff 6<br>(Note: this setting is only valid when the tariff mode is manual switching) |

## 7.1 RTC Tariff time period setting

| Instruction code | Operation | Size | Type | Unit | Range (Decimal system) | Description |
|---|---|---|---|---|---|---|
| 1072 | W | 3 | Time | - | - | Ta Start time |
| | W | 3 | Time | - | - | Tb Start time |
| | W | 3 | Time | - | - | Tc Start time |
| | W | 3 | Time | - | - | Td Start time |
| | W | 3 | Time | - | - | Te Start time |
| | W | 3 | Time | - | - | Tf Start time |

## 7.1 RTC Tariff selection setting

| Instruction code | Operation | Size | Type | Unit | Range (Decimal system) | Description |
|---|---|---|---|---|---|---|
| 1073 | W | 1 | UInt16 | - | 0-5 | Ta Tariff setting<br>0 = Tariff 1<br>1 = Tariff 2<br>...<br>5=Tariff 6 |
| | W | 1 | UInt16 | - | 0-5 | Tb Tariff setting |
| | W | 1 | UInt16 | - | 0-5 | Tc Tariff setting |
| | W | 1 | UInt16 | - | 0-5 | Td Tariff setting |
| | W | 1 | UInt16 | - | 0-5 | Te Tariff setting |
| | W | 1 | UInt16 | - | 0-5 | Tf Tariff setting |

## 7.1 Equipment time setting

| Instruction code | Operation | Size | Type | Unit | Range (Decimal system) | Description |
|---|---|---|---|---|---|---|
| 1200 | W | 1 | UInt16 | - | 2000-2099 | Year |
| | W | 1 | UInt16 | - | 1-12 | Month |
| | W | 1 | UInt16 | - | 1-31 | Date |
| | W | 1 | UInt16 | - | 0-23 | Hour |
| | W | 1 | UInt16 | - | 0-59 | Minute |
| | W | 1 | UInt16 | - | 0-59 | Second |

## 7.1 Communication parameter setting

| Instruction code | Operation | Size | Type | Unit | Range (Decimal system) | Description |
|---|---|---|---|---|---|---|
| 1210 | W | 1 | UInt16 | - | 1-247 | Slave address |
| | W | 1 | UInt16 | - | 0-4 | Baud rate<br>0 = 2400<br>1 = 4800<br>2 = 9600<br>3 = 19200<br>4 = 38400 |
| | W | 1 | UInt16 | - | 0, 1, 2 | Parity check<br>0 = No verification<br>1 = Odd check<br>2 = Even check |
| | W | 1 | UInt16 | - | 0, 1 | Stop bit<br>0 = 1bit<br>1 = 2bit |

## 7.1 Reset

| Instruction code | Operation | Size | Type | Unit | Range (Decimal system) | Description |
|---|---|---|---|---|---|---|
| 1301 | W | 1 | UInt16 | - | 1-5 | 1：Reset Max & Min value<br>2：Reset Max demand<br>3：Reset tariff energy<br>4：Reset energy<br>5：Reset all above values |

## 7.1 Relay output control mode

| Instruction code | Operation | Size | Type | Unit | Range (Decimal system) | Description |
|---|---|---|---|---|---|---|
| 2000 | W | 1 | UInt16 | - | 0-1 | Relay output control mode<br>0 = Manual control mode<br>1 = Alarm output control mode |

## 7.1 Relay output manual control

| Instruction code | Operation | Size | Type | Unit | Range (Decimal system) | Description |
|---|---|---|---|---|---|---|
| 2001 | W | 1 | UInt16 | - | 0-1 | Relay output control<br>0 = Relay output open circuit<br>1 = Relay output closed<br>(Note: this setting is only valid when the relay output control mode is manual control mode) |

## 7.1 Alarm setting

| Instruction code | Operation | Size | Type | Unit | Range (Decimal system) | Description |
|---|---|---|---|---|---|---|
| 3000 | W | 1 | UInt16 | - | - | Alarm ID |
| | W | 1 | UInt16 | - | 0,1 | Alarm function<br>0=Disable<br>1=Enable |
| | - | 1 | UInt16 | - | - | Save |
| | W | 2 | Float32 | - | 0-1000000 | Alarm activation threshold |
| | W | 2 | Float32 | % | - | Alarm release point<br>Percentage error relative to alarm activation threshold<br>*Example：*<br>*Overcurrent alarm activation threshold=100A*<br>Alarm release point =5%<br>*When the current value is less than 100-100 \* 5%=95A, the alarm is released* |
| | W | 1 | UInt16 | - | 0,1 | Buzzer output correlation<br>0= No correlation<br>1= Correlation |
| | W | 1 | UInt16 | - | 0,1 | Relay output correlation<br>0= No correlation<br>1= Correlation |

# 8 Register list

The register list has the following headings:

| Register alias | Register address | Operation read/write | Size | Type | Unit | Description |
|---|---|---|---|---|---|---|

- Register alias: Used to refer to the meaning of register
- Register address: The starting address of the modbus communication register. It is in decimal format, and the address is the real address without offset.
- Operation：Indicate the operations that the register can do. R: Readable; W: Can be written directly through 16 function codes; WC：The current register needs to be configured indirectly by writing configuration data to the address starting from instruction register 300
- Size: Indicates how many modbus registers are occupied. One modbus register is 16bit
- Type: Refer to the data type table for the type of data code
- Unit: Unit of register value
- Description: Describe the function of this register

Data type table

| Type | Description | Range |
|---|---|---|
| UInt16 | Unsigned 16-bit integer | 0~65535 |
| Int16 | Signed 16-bit integer | -32768~+32767 |
| UInt32 | Unsigned 32-bit integer | 0~4294967295 |
| UInt64 | Unsigned 64-bit integer | 0~18446744073709551615 |
| Int64 | Signed 64-bit integer | -9223372036854775808 ~ 9223372036854775808 |
| UTF8 | 8-bit UTF code | Multibyte Unicode encoding |
| Float32 | 32-bit floating point | Standard IEEE floating point data (single precision) |
| Date Time | Time type | - |

Date Time format:

| Byte | Position | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
| 1 | Year（2000 ~ 2099） | | | | | | | | | | | | | | | |
| 2 | Month (1 ~ 12) | | | | | | | | Date (1 ~ 31) | | | | | | | |
| 3 | Hour (0 ~ 23) | | | | | | | | Minute (0 ~ 59) | | | | | | | |
| 4 | Second (0 ~ 60) | | | | | | | | | | | | | | | |

# 8.1 Modbus Register List

## 8..1 Equipment parameters

| Register alias | Register start address (Decimal system) | Operation Read/Write | Size | Type | Unit | Description |
|---|---|---|---|---|---|---|
| Equipment model | 60 | R | 10 | UTF8 | - | |
| Serial No. | 70 | R | 2 | UInt32 | - | |
| APP Version No. | 72 | R | 1 | UInt16 | - | Format: X.Y |
| Date and time | 75 | R/WC | 4 | Date time | - | Reg.75: Year 2000-2099 Reg.76: Month (b15:b8), |

| Register alias | Register start address (Decimal system) | Operation Read/Write | Size | Type | Unit | Description |
|---|---|---|---|---|---|---|
| | | | | | | Date (b7:b0)<br>Reg. 77: Hour (b15:b8),<br>Minute (b7:b0)<br>Reg. 78: Second |

## 8..2 Communication parameters

| Register alias | Register start address (Decimal system) | Operation Read/ Write | Size | Type | Unit | Description |
|---|---|---|---|---|---|---|
| Slave address | 80 | R/WC | 1 | UInt16 | - | 1-247 |
| Baud rate | 81 | R/WC | 1 | UInt16 | - | 0=2400<br>1=4800<br>2=9600<br>3=19200<br>4=38400 |
| Verification method | 82 | R/WC | 1 | UInt16 | - | 0 = No verification<br>1 = Odd check<br>2 = Even check |
| Stop bit | 83 | R/WC | 1 | UInt16 | - | 0 = 1 bit<br>1 = 2 bit |

## 8..3 Relay

| Register alias | Register start address (Decimal system) | Operation Read/ Write | Size | Type | Unit | Description |
|---|---|---|---|---|---|---|
| Output control mode | 200 | R/WC | 1 | UInt16 | - | Relay output control mode<br>0 =Manual control mode<br>1 = Alarm output control mode |
| Relay output control | 201 | R/WC | 1 | UInt16 | - | Relay output control<br>0 = Relay output open circuit<br>1 = Relay output closed<br>(Note: this setting is only valid when the relay output control mode is manual control mode) |
| Relay output status | 202 | R | 1 | UInt16 | - | Relay output status<br>0 = open circuit<br>1 = closed |

## 8..4 Digital input status

| Register alias | Register start address (Decimal system) | Operation Read/ Write | Size | Type | Unit | Description |
|---|---|---|---|---|---|---|
| Digital input status | 210 | R | 1 | UInt16 | - | 0 = Digital input open circuit<br>1 = Digital input closed |

## 8..5 Voltage and current phase sequence

| Register alias | Register start address (Decimal system) | Operation Read/ Write | Size | Type | Unit | Description |
|---|---|---|---|---|---|---|
| Voltage and current phase sequence | 220 | R | 1 | UInt16 | - | 0 =Voltage phase sequence correct, Current phase sequence correct<br>1 =Voltage phase sequence error, Current phase sequence correct<br>2 =Voltage phase sequence correct, Current phase sequence error<br>3 =Voltage phase sequence error, Current phase sequence error |

Note: When the current is less than 1% of the nominal current, the current phase sequence may display errors.

## 8..6 Configure instruction register

| Register alias | Register start address (Decimal system) | Operation Read/ Write | Size | Type | Unit | Description |
|---|---|---|---|---|---|---|
| Instruction code | 300 | R/W | 1 | UInt16 | - | |
| Command parameters 001 | 301 | R/W | 1 | UInt16 | - | |
| Command parameters 002 | 302 | R/W | 1 | UInt16 | - | |
| ... | ... | R/W | 1 | UInt16 | - | |
| Command parameters 123 | 423 | R/W | 1 | UInt16 | - | |
| Configuration instruction code | 424 | R | 1 | UInt16 | - | |

| Register alias | Register start address (Decimal system) | Operation Read/ Write | Size | Type | Unit | Description |
|---|---|---|---|---|---|---|
| Configuration results | 425 | R | 1 | UInt16 | - | 0 = Effective operation<br>80 = Invalid instruction code<br>81 = Invalid command parameter<br>82 = Number of invalid instruction parameters<br>83= Operation not performed |

## 8..7 Power system parameters

| Register alias | Register start address (Decimal system) | Operation Read/ Write | Size | Type | Unit | Description |
|---|---|---|---|---|---|---|
| Wiring mode | 500 | R/WC | 1 | UInt16 | - | 0= Three-phase four-wire 4CT<br>1= Three-phase four-wire 3CT<br>2= Three-phase three-wire 3CT<br>3= Three-phase three-wire 2CT<br>4= One-phase three-wire<br>5= One phase and two-wire |
| Grid frequency | 501 | R/WC | 1 | UInt16 | Hz | |
| Nominal voltage | 502 | R/WC | 1 | UInt16 | V | Excluding VT ratio |
| VT Ratio | 503 | R/WC | 2 | UInt32 | - | Actual value=Read value/10000 |
| CT Ratio | 505 | R/WC | 2 | UInt32 | - | Actual value=Read value/10000 |
| PHASE L1L2L3 Current transformer | | | | | | |
| PHASE L1L2L3 Current access mode | 510 | R/WC | 1 | UInt16 | - | 0 = Rogowski coil<br>1 = VCT |
| PHASE L1L2L3 Rogowski coil Pri | 511 | R/WC | 2 | UInt32 | A | |
| PHASE L1L2L3 Rogowski coil Sec | 513 | R/WC | 2 | UInt32 | mV@50 Hz<br>mV@60 Hz | Actual value=Read value/100 |
| PHASE L1L2L3 Rogowski coil Nominal current | 515 | R/WC | 2 | UInt32 | A | |
| PHASE L1L2L3 VCT Pri | 517 | R/WC | 2 | UInt32 | A | |
| PHASE L1L2L3 VCT Sec | 519 | R/WC | 2 | UInt32 | mV | Actual value=Read value/100 |

| Register alias | Register start address (Decimal system) | Operation Read/Write | Size | Type | Unit | Description |
|---|---|---|---|---|---|---|
| PHASE L1L2L3 VCT Nominal current | 521 | R/WC | 2 | UInt32 | A | |
| N-phase Current transformer | | | | | | |
| N-phase Current access mode | 530 | R/WC | 1 | UInt16 | - | 0 = Rogowski coil<br>1 = CT |
| N-phase Rogowski coil Pri | 531 | R/WC | 2 | UInt32 | A | |
| N-phase Rogowski coil Sec | 533 | R/WC | 2 | UInt32 | mV@50 Hz<br>mV@60 Hz | Actual value=Read value/100 |
| N-phase Rogowski coil Nominal current | 535 | R/WC | 2 | UInt32 | A | |
| N-phase VCT Pri | 537 | R/WC | 2 | UInt32 | A | |
| N-phase VCT Sec | 539 | R/WC | 2 | UInt32 | mV | Actual value=Read value/100 |
| N-phase VCT Nominal current | 541 | R/WC | 2 | UInt32 | A | |

## 8..8 Current direction setting

| Register alias | Register start address (Decimal system) | Operation Read/Write | Size | Type | Unit | Description |
|---|---|---|---|---|---|---|
| Phase L1 current direction | 550 | R/WC | 1 | UInt16 | - | Phase L1 current direction<br>0=Positive (default)<br>1=Reverse |
| Phase L2 current direction | 551 | R/WC | 1 | UInt16 | - | Phase L2 current direction<br>0=Positive (default)<br>1=Reverse |
| Phase L3 current direction | 552 | R/WC | 1 | UInt16 | - | Phase L3 current direction<br>0=Positive (default)<br>1=Reverse |

## 8..9 Current channel selection

| Register alias | Register start address (Decimal system) | Operation Read/Write | Size | Type | Unit | Description |
|---|---|---|---|---|---|---|
| Phase L1 current channel | 553 | R/WC | 1 | UInt16 | - | Phase L1 current channel<br>0=Channel 1 （Default）<br>1=Channel 2<br>2=Channel 3 |

| Register alias | Register start address (Decimal system) | Operation Read/ Write | Size | Type | Unit | Description |
|---|---|---|---|---|---|---|
| Phase L2 current channel | 554 | R/WC | 1 | UInt16 | - | Phase L2 current channel 0=Channel 1 1=Channel 2（Default） 2=Channel 3 |
| Phase L3 current channel | 555 | R/WC | 1 | UInt16 | - | Phase L3 current channel 0=Channel 1 1=Channel 2 2=Channel 3（Default） |

## 8..10 Zero drift suppression parameters

| Register alias | Register start address (Decimal system) | Operation Read/ Write | Size | Type | Unit | Description |
|---|---|---|---|---|---|---|
| Voltage zero drift suppression | 600 | R/WC | 1 | UInt16 | % | Voltage zero drift suppression takes (nominal voltage * VT ratio) as reference Actual value=Read value/100 |
| Current zero drift suppression | 601 | R/WC | 1 | UInt16 | % | Current zero drift suppression takes (nominal current * CT ratio) as reference Actual value=Read value/100 |

## 8..11 Tariff parameters

| Register alias | Register start address (Decimal system) | Operation Read/ Write | Size | Type | Unit | Description |
|---|---|---|---|---|---|---|
| Current tariff | 800 | R | 1 | UInt16 | - | Current tariff 0-5=tariff 1-tariff 6 |
| Tariff switching mode | 801 | R/WC | 1 | UInt16 | - | Tariff switching mode 0= Manual switching 1=RTC switching |
| Manual tariff selection | 802 | R/WC | 1 | UInt16 | - | Manual tariff selection 0-5=Tariff 1-Tariff 6 |
| RTC Ta Start time | 803 | R/WC | 3 | Time | - | RTC Ta Start time |
| RTC Tb Start time | 806 | R/WC | 3 | Time | - | RTC Tb Start time |
| RTC Tc Start time | 809 | R/WC | 3 | Time | - | RTC Tc Start time |

| Register alias | Register start address (Decimal system) | Operation Read/Write | Size | Type | Unit | Description |
|---|---|---|---|---|---|---|
| RTC Td Start time | 812 | R/WC | 3 | Time | - | RTC Td Start time |
| RTC Te Start time | 815 | R/WC | 3 | Time | | RTC Te Start time |
| RTC Tf Start time | 818 | R/WC | 3 | Time | - | RTC Tf Start time |
| RTC Ta tariff selection | 821 | R/WC | 1 | UInt16 | - | Ta tariff selection 0-5=Tariff 1-Tariff 6 |
| RTC Tb tariff selection | 822 | R/WC | 1 | UInt16 | - | Tb tariff selection 0-5=Tariff 1-Tariff 6 |
| RTC Tc tariff selection | 823 | R/WC | 1 | UInt16 | - | Tc tariff selection 0-5=Tariff 1-Tariff 6 |
| RTC Td tariff selection | 824 | R/WC | 1 | UInt16 | - | Td tariff selection 0-5=Tariff 1-Tariff 6 |
| RTC Te tariff selection | 825 | R/WC | 1 | UInt16 | - | Te tariff selection 0-5=Tariff 1-Tariff 6 |
| RTC Tf tariff selection | 826 | R/WC | 1 | UInt16 | - | Tf tariff selection 0-5=Tariff 1-Tariff 6 |

## 8..12 Voltage, current, power and power factor

| Register alias | Register start address (Decimal system) | Operation Read/Write | Size | Type | Unit | Description |
|---|---|---|---|---|---|---|
| Current | | | | | | |
| IA | 1000 | R | 2 | Float32 | A | Phase L1 Current |
| IB | 1002 | R | 2 | Float32 | A | Phase L2 Current |
| IC | 1004 | R | 2 | Float32 | A | Phase L3 Current |
| Current Avg | 1006 | R | 2 | Float32 | A | Average value of three-phase current, L1L2L3 |
| IN | 1008 | R | 2 | Float32 | A | N-phase Current |
| Phase voltage | | | | | | |
| UA | 1010 | R | 2 | Float32 | V | UA-UN voltage |
| UB | 1012 | R | 2 | Float32 | V | UB-UN voltage |
| UC | 1014 | R | 2 | Float32 | V | UC-UN voltage |
| Phase Voltage Avg | 1016 | R | 2 | Float32 | V | Average value of three-phase phase voltage, L1L2L3 |
| U0 | 1018 | R | 2 | Float32 | V | Zero sequence voltage |
| Line voltage | | | | | | |

| Register alias | Register start address (Decimal system) | Operation Read/Write | Size | Type | Unit | Description |
|---|---|---|---|---|---|---|
| UAB | 1020 | R | 2 | Float32 | V | UA-UB voltage |
| UBC | 1022 | R | 2 | Float32 | V | UB-UC voltage |
| UCA | 1024 | R | 2 | Float32 | V | UC-UA voltage |
| Line Voltage Avg | 1026 | R | 2 | Float32 | V | Average value of three-phase line voltage |
| Active power | | | | | | |
| PA | 1028 | R | 2 | Float32 | kW | Phase L1 Active power |
| PB | 1030 | R | 2 | Float32 | kW | Phase L2 Active power |
| PC | 1032 | R | 2 | Float32 | kW | Phase L3 Active power |
| PTotal | 1034 | R | 2 | Float32 | kW | Total active power |
| Reactive power | | | | | | |
| QA | 1036 | R | 2 | Float32 | kVAR | Phase L1 Reactive power |
| QB | 1038 | R | 2 | Float32 | kVAR | Phase L2 Reactive power |
| QC | 1040 | R | 2 | Float32 | kVAR | Phase L3 Reactive power |
| QTotal | 1042 | R | 2 | Float32 | kVAR | Total reactive power |
| Apparent power | | | | | | |
| SA | 1044 | R | 2 | Float32 | kVA | Phase L1 Apparent power |
| SB | 1046 | R | 2 | Float32 | kVA | Phase L2 Apparent power |
| SC | 1048 | R | 2 | Float32 | kVA | Phase L3 Apparent power |
| STotal | 1050 | R | 2 | Float32 | kVA | Total apparent power |
| Power factor | | | | | | |
| PFA | 1052 | R | 2 | Float32 | - | Phase L1 Power factor |
| PFB | 1054 | R | 2 | Float32 | - | Phase L2 Power factor |
| PFC | 1056 | R | 2 | Float32 | - | Phase L3 Power factor |
| PFTotal | 1058 | R | 2 | Float32 | - | Total power factor |
| Fundamental power factor | | | | | | |
| DPFA | 1060 | R | 2 | Float32 | - | Phase L1 Fundamental power factor |
| DPFB | 1062 | R | 2 | Float32 | - | Phase L2 Fundamental power factor |
| DPFC | 1064 | R | 2 | Float32 | - | Phase L3 Fundamental power factor |
| DPFTotal | 1066 | R | 2 | Float32 | - | Total fundamental power factor |
| Frequency | | | | | | |
| FreqA | 1068 | R | 2 | Float32 | Hz | Phase L1 Frequency |
| FreqB | 1070 | R | 2 | Float32 | Hz | Phase L2 Frequency |
| FreqC | 1072 | R | 2 | Float32 | Hz | Phase L3 Frequency |
| FreqTotal | 1074 | R | 2 | Float32 | Hz | Three-phase integrated frequency |

## 8..13 Electric energy

There are two types of electric energy data: Int64 and UInt32, with different unit sizes.

When the total electric energy reaches $1.0 \times 10^9$ kWh, $1.0 \times 10^9$ kVarh, or $1.0 \times 10^9$ kVah, the electric energy of each phase will be automatically reset.

| Register alias | Register start address (Decimal system) | Oper ation Read/ Write | Size | Type | Unit | Description |
|---|---|---|---|---|---|---|
| Active energy-Int64 | | | | | | |
| EPAImp | 2500 | R | 4 | Int64 | Wh | Phase L1 Positive active energy |
| EPBImp | 2504 | R | 4 | Int64 | Wh | Phase L2 Positive active energy |
| EPCImp | 2508 | R | 4 | Int64 | Wh | Phase L3 Positive active energy |
| EPImp | 2512 | R | 4 | Int64 | Wh | Total positive active energy |
| EPAExp | 2516 | R | 4 | Int64 | Wh | Phase L1 Reverse active energy |
| EPBExp | 2520 | R | 4 | Int64 | Wh | Phase L2 Reverse active energy |
| EPCExp | 2524 | R | 4 | Int64 | Wh | Phase L3 Reverse active energy |
| EPExp | 2528 | R | 4 | Int64 | Wh | Total reverse active energy |
| Reactive energy-Int64 | | | | | | |
| EQAImp | 2532 | R | 4 | Int64 | VARh | Phase L1 Positive reactive energy |
| EQBImp | 2536 | R | 4 | Int64 | VARh | Phase L2 Positive reactive energy |
| EQCImp | 2540 | R | 4 | Int64 | VARh | Phase L3 Positive reactive energy |
| EQImp | 2544 | R | 4 | Int64 | VARh | Total positive reactive energy |
| EQAExp | 2548 | R | 4 | Int64 | VARh | Phase L1 Reverse reactive energy |
| EQBExp | 2552 | R | 4 | Int64 | VARh | Phase L2 Reverse reactive energy |
| EQCExp | 2556 | R | 4 | Int64 | VARh | Phase L3 Reverse reactive energy |
| EQExp | 2560 | R | 4 | Int64 | VARh | Total Reverse reactive energy |
| Apparent energy-Int64 | | | | | | |
| ESA | 2564 | R | 4 | Int64 | VAh | Phase L1 Apparent energy |
| ESB | 2568 | R | 4 | Int64 | VAh | Phase L2 Apparent energy |
| ESC | 2572 | R | 4 | Int64 | VAh | Phase L3 Apparent energy |
| ES | 2576 | R | 4 | Int64 | VAh | Total apparent energy |
| UInt32 Energy | | | | | | |
| Active energy- UInt32 | | | | | | |
| EPAImp | 2600 | R | 2 | UInt32 | kWh | Phase L1 Positive active energy |
| EPBImp | 2602 | R | 2 | UInt32 | kWh | Phase L2 Positive active energy |
| EPCImp | 2604 | R | 2 | UInt32 | kWh | Phase L3 Positive active energy |
| EPImp | 2606 | R | 2 | UInt32 | kWh | Total positive active energy |
| EPAExp | 2608 | R | 2 | UInt32 | kWh | Phase L1 Reverse active energy |

| Register alias | Register start address (Decimal system) | Operation Read/Write | Size | Type | Unit | Description |
|---|---|---|---|---|---|---|
| EPBExp | 2610 | R | 2 | UInt32 | kWh | Phase L2 Reverse active energy |
| EPCExp | 2612 | R | 2 | UInt32 | kWh | Phase L3 Reverse active energy |
| EPExp | 2614 | R | 2 | UInt32 | kWh | Total reverse active energy |
| Reactive energy- UInt32 | | | | | | |
| EQAImp | 2616 | R | 2 | UInt32 | kVARh | Phase L1 Positive reactive energy |
| EQBImp | 2618 | R | 2 | UInt32 | kVARh | Phase L2 Positive reactive energy |
| EQCImp | 2620 | R | 2 | UInt32 | kVARh | Phase L3 Positive reactive energy |
| EQImp | 2622 | R | 2 | UInt32 | kVARh | Total positive reactive energy |
| EQAExp | 2624 | R | 2 | UInt32 | kVARh | Phase L1 Reverse reactive energy |
| EQBExp | 2626 | R | 2 | UInt32 | kVARh | Phase L2 Reverse reactive energy |
| EQCExp | 2628 | R | 2 | UInt32 | kVARh | Phase L3 Reverse reactive energy |
| EQExp | 2630 | R | 2 | UInt32 | kVARh | Total reverse reactive energy |
| Apparent energy-UInt32 | | | | | | |
| ESA | 2632 | R | 2 | UInt32 | kVAh | Phase L1 Apparent energy |
| ESB | 2634 | R | 2 | UInt32 | kVAh | Phase L2 Apparent energy |
| ESC | 2636 | R | 2 | UInt32 | kVAh | Phase L3 Apparent energy |
| ES | 2638 | R | 2 | UInt32 | kVAh | Total apparent energy |

## 8..14 Tariff energy

There are two types of tariff energy data: Int64 and UInt32, with different unit sizes.

When the tariff energy reaches $1.0 \times 10^9$ kWh kWh, each tariff energy will be automatically reset.

| Register alias | Register start address (Decimal system) | Operation Read/Write | Size | Type | Unit | Description |
|---|---|---|---|---|---|---|
| Tariff energy-Int64 | | | | | | |
| ET1 | 2700 | R | 4 | Int64 | Wh | Tariff 1 Active energy |
| ET2 | 2704 | R | 4 | Int64 | Wh | Tariff 2 Active energy |
| ET3 | 2708 | R | 4 | Int64 | Wh | Tariff 3 Active energy |
| ET4 | 2712 | R | 4 | Int64 | Wh | Tariff 4 Active energy |
| ET5 | 2716 | R | 4 | Int64 | Wh | Tariff 5 Active energy |
| ET6 | 2720 | R | 4 | Int64 | Wh | Tariff 6 Active energy |
| Tariff energy-UInt32 | | | | | | |
| ET1 | 2750 | R | 2 | UInt32 | kWh | Tariff 1 Active energy |
| ET2 | 2752 | R | 2 | UInt32 | kWh | Tariff 2 Active energy |
| ET3 | 2754 | R | 2 | UInt32 | kWh | Tariff 3 Active energy |

| Register alias | Register start address (Decimal system) | Operation Read/ Write | Size | Type | Unit | Description |
|---|---|---|---|---|---|---|
| ET4 | 2756 | R | 2 | UInt32 | kWh | Tariff 4 Active energy |
| ET5 | 2758 | R | 2 | UInt32 | kWh | Tariff 5 Active energy |
| ET6 | 2760 | R | 2 | UInt32 | kWh | Tariff 6 Active energy |

## 8..15 Demand parameters

| Register alias | Register start address (Decimal system) | Operation Read/Write | Size | Type | Unit | Description |
|---|---|---|---|---|---|---|
| Basic parameters of demand | | | | | | |
| DMDMethod | 3000 | R/WC | 1 | UInt16 | - | Demand calculation method: 0=Sliding type 1=Fixed type |
| DMD block | 3001 | R/RC | 1 | UInt16 | Minute | Demand interval |
| PDMD Reset Time | 3002 | R | 4 | Date time | - | Max demand reset date and time |
| Power demand | | | | | | |
| PADemand | 3020 | R | 2 | Float32 | kW | Phase L1 Current active power demand |
| PAPeakDemand | 3022 | R | 2 | Float32 | kW | Phase L1 Max demand of active power |
| PAPeakDemandDate | 3024 | R | 4 | Date time | - | Phase L1 Time of occurrence for Max demand of active power |
| PBDemand | 3028 | R | 2 | Float32 | kW | Phase L2 Current active power demand |
| PBPeakDemand | 3030 | R | 2 | Float32 | kW | Phase L2 Max demand of active power |
| PBPeakDemandDate | 3032 | R | 4 | Date time | - | Phase L2 Occurrence time of max active power demand |
| PCDemand | 3036 | R | 2 | Float32 | kW | Phase L3 Current active power demand |
| PCPeakDemand | 3038 | R | 2 | Float32 | kW | Phase L3 Max demand of active power |
| PCPeakDemandDate | 3040 | R | 4 | Date time | - | Phase L3 Occurrence time of max active power demand |
| PSUMDemand | 3044 | R | 2 | Float32 | kW | Current total active power demand |
| PSUMPeakDemand | 3046 | R | 2 | Float32 | kW | Total max active power demand |
| PSUMPeakDemandDate | 3048 | R | 4 | Date time | - | Occurrence time of total max active power demand |

| Register alias | Register start address (Decimal system) | Operation Read/Write | Size | Type | Unit | Description |
|---|---|---|---|---|---|---|
| QADemand | 3052 | R | 2 | Float32 | kVar | Phase L1 Current reactive power demand |
| QAPeakDemand | 3054 | R | 2 | Float32 | kVar | Phase L1 Max demand of reactive power |
| QAPeakDemand Date | 3056 | R | 4 | Date time | - | Phase L1 Occurrence time of max reactive power demand |
| QBDemand | 3060 | R | 2 | Float32 | kVar | Phase L2 Current reactive power demand |
| QBPeakDemand | 3062 | R | 2 | Float32 | kVar | Phase L2 Max demand of reactive power |
| QBPeakDemand Date | 3064 | R | 4 | Date time | - | Phase L2 Occurrence time of max reactive power demand |
| QCDemand | 3068 | R | 2 | Float32 | kVar | Phase L3 Current reactive power demand |
| QCPeakDemand | 3070 | R | 2 | Float32 | kVar | Phase L3 Max demand of reactive power |
| QCPeakDemand Date | 3072 | R | 4 | Date time | - | Phase L3 Occurrence time of max reactive power demand |
| QSUMDemand | 3076 | R | 2 | Float32 | kVar | Current total reactive power demand |
| QSUMPeakDema nd | 3078 | R | 2 | Float32 | kVar | Max demand of total reactive power |
| QSUMPeakDema ndDate | 3080 | R | 4 | Date time | - | Occurrence time of total max reactive power demand |
| SADemand | 3084 | R | 2 | Float32 | kVa | Phase L1 Current apparent power demand |
| SAPeakDemand | 3086 | R | 2 | Float32 | kVa | Phase L1 Max apparent power demand |
| SAPeakDemandD ate | 3088 | R | 4 | Date time | - | Phase L1 Occurrence time of max apparent power demand |
| SBDemand | 3092 | R | 2 | Float32 | kVa | Phase L2 Current apparent power demand |
| SBPeakDemand | 3094 | R | 2 | Float32 | kVa | Phase L2 Max apparent power demand |
| SBPeakDemandD ate | 3096 | R | 4 | Date time | - | Phase L2 Occurrence time of max apparent power demand |
| SCDemand | 3100 | R | 2 | Float32 | kVa | Phase L3 Current apparent power demand |
| SCPeakDemand | 3102 | R | 2 | Float32 | kVa | Phase L3 Max apparent power demand |
| SCPeakDemandD ate | 3104 | R | 4 | Date time | - | Phase L3 Occurrence time of max apparent power demand |
| SSUMDemand | 3108 | R | 2 | Float32 | kVa | Current total apparent power demand |
| SSUMPeakDema nd | 3110 | R | 2 | Float32 | kVa | Total of max apparent power demand |

| Register alias | Register start address (Decimal system) | Operation Read/Write | Size | Type | Unit | Description |
|---|---|---|---|---|---|---|
| SSUMPeakDemandDate | 3112 | R | 4 | Date time | - | Occurrence time of total max apparent power demand |

## 8..16 Voltage and current harmonics

| Register name | Register start address (Decimal system) | Operation | Size | Type | Unit | Description |
|---|---|---|---|---|---|---|
| Current harmonic percentage | | | | | | |
| IATHD | 4000 | R | 2 | Float32 | % | Phase L1 current: Percentage of total harmonic |
| IBTHD | 4002 | R | 2 | Float32 | % | Phase L2 current: Percentage of total harmonic |
| ICTHD | 4004 | R | 2 | Float32 | % | Phase L3 current: Percentage of total harmonic |
| IATOHD | 4006 | R | 2 | Float32 | % | Phase L1 current: Odd total harmonic percentage |
| IBTOHD | 4008 | R | 2 | Float32 | % | Phase L2 current: Odd total harmonic percentage |
| ICTOHD | 4010 | R | 2 | Float32 | % | Phase L3 current: Odd total harmonic percentage |
| IATEHD | 4012 | R | 2 | Float32 | % | Phase L1 current: Even total harmonic percentage |
| IBTEHD | 4014 | R | 2 | Float32 | % | Phase L2 current: Even total harmonic percentage |
| ICTEHD | 4016 | R | 2 | Float32 | % | Phase L3 current: Even total harmonic percentage |
| IAHD1 | 4018 | R | 2 | Float32 | % | Phase L1 current: 1st harmonic percentage |
| IBHD1 | 4020 | R | 2 | Float32 | % | Phase L2 current: 1st harmonic percentage |
| ICHD1 | 4022 | R | 2 | Float32 | % | Phase L3 current: 1st harmonic percentage |
| ... | 4024-4311 | ... | ... | ... | ... | Phase L1L2L3 current: 2nd-49th harmonic percentage |
| IAHD50 | 4312 | R | 2 | Float32 | % | Phase L1 current: 50th harmonic percentage |
| IBHD50 | 4314 | R | 2 | Float32 | % | Phase L2 current: 50th harmonic percentage |
| ICHD50 | 4316 | R | 2 | Float32 | % | Phase L3 current: 50th harmonic percentage |
| Current harmonic value | | | | | | |

| Register name | Register start address (Decimal system) | Operation | Size | Type | Unit | Description |
|---|---|---|---|---|---|---|
| IAHDV1 | 4400 | R | 2 | Float32 | A | Phase L1 current: Fundamental current value |
| IBHDV1 | 4402 | R | 2 | Float32 | A | Phase L2 current: Fundamental current value |
| ICHDV1 | 4404 | R | 2 | Float32 | A | Phase L3 current: Fundamental current value |
| ... | 4406-4693 | ... | ... | ... | ... | Phase L1L2L3 current: 2nd-49th harmonic current value |
| IAHDV50 | 4694 | R | 2 | Float32 | A | Phase L1 current: 50th harmonic current value |
| IBHDV50 | 4696 | R | 2 | Float32 | A | Phase L2 current: 50th harmonic current value |
| ICHDV50 | 4698 | R | 2 | Float32 | A | Phase L3 current: 50th harmonic current value |
| Percentage of voltage harmonics | | | | | | |
| UATHD | 5000 | R | 2 | Float32 | % | Phase L1 voltage: Percentage of total harmonic |
| UBTHD | 5002 | R | 2 | Float32 | % | Phase L2 voltage: Percentage of total harmonic |
| UCTHD | 5004 | R | 2 | Float32 | % | Phase L3 voltage: Percentage of total harmonic |
| UATOHD | 5006 | R | 2 | Float32 | % | Phase L1 voltage: Odd total harmonic percentage |
| UBTOHD | 5008 | R | 2 | Float32 | % | Phase L2 voltage: Odd total harmonic percentage |
| UCTOHD | 5010 | R | 2 | Float32 | % | Phase L3 voltage: Odd total harmonic percentage |
| UATEHD | 5012 | R | 2 | Float32 | % | Phase L1 voltage: Even total harmonic percentage |
| UBTEHD | 5014 | R | 2 | Float32 | % | Phase L2 voltage: Even total harmonic percentage |
| UCTEHD | 5016 | R | 2 | Float32 | % | Phase L3 voltage: Even total harmonic percentage |
| UAHD1 | 5018 | R | 2 | Float32 | % | Phase L1 voltage: 1st harmonic percentage |
| UBHD1 | 5020 | R | 2 | Float32 | % | Phase L2 voltage: 1st harmonic percentage |
| UCHD1 | 5022 | R | 2 | Float32 | % | Phase L3 voltage: 1st harmonic percentage |
| ... | 5024-5311 | ... | ... | ... | ... | Phase L1L2L3 voltage: 2nd-49th harmonic percentage |
| UAHD50 | 5312 | R | 2 | Float32 | % | Phase L1 voltage: 50th harmonic percentage |
| UBHD50 | 5314 | R | 2 | Float32 | % | Phase L2 voltage: 50th harmonic percentage |

| Register name | Register start address (Decimal system) | Opera tion | Size | Type | Unit | Description |
|---|---|---|---|---|---|---|
| UCHD50 | 5316 | R | 2 | Float32 | % | Phase L3 voltage: 50th harmonic percentage |
| Voltage harmonic value | | | | | | |
| UAHDV1 | 5400 | R | 2 | Float32 | V | Phase L1 voltage:1st harmonic voltage value |
| UBHDV1 | 5402 | R | 2 | Float32 | V | Phase L2 voltage:1st harmonic voltage value |
| UCHDV1 | 5404 | R | 2 | Float32 | V | Phase L3 voltage:1st harmonic voltage value |
| ... | 5406-5693 | ... | ... | ... | ... | Phase L1L2L3 voltage: 2nd-49th harmonic voltage value |
| UAHDV50 | 5694 | R | 2 | Float32 | V | Phase L1 voltage: 50th harmonic voltage value |
| UBHDV50 | 5696 | R | 2 | Float32 | V | Phase L2 voltage: 50th harmonic voltage value |
| UCHDV50 | 5698 | R | 2 | Float32 | V | Phase L3 voltage: 50th harmonic voltage value |

## 8..17 Max and min value

| Register name | Register start address (Decimal system) | Opera tion | Size | Type | Unit | Description |
|---|---|---|---|---|---|---|
| Current Max and min value | | | | | | |
| IA Max | 6000 | R | 2 | Float32 | A | Phase L1 Maxi current |
| IB Max | 6002 | R | 2 | Float32 | A | Phase L2 Maxi current |
| IC Max | 6004 | R | 2 | Float32 | A | Phase L3 Maxi current |
| IAVG Max | 6006 | R | 2 | Float32 | A | Max three-phase average current |
| IN Max | 6008 | R | 2 | Float32 | A | Max value of N-phase current |
| IA Min | 6010 | R | 2 | Float32 | A | Phase L1 Min current |
| IB Min | 6012 | R | 2 | Float32 | A | Phase L2 Min current |
| IC Min | 6014 | R | 2 | Float32 | A | Phase L3 Min current |
| IAVGMin | 6016 | R | 2 | Float32 | A | Min three-phase average current |
| IN Min | 6018 | R | 2 | Float32 | A | Min value of N-phase current |
| Voltage Max and min value | | | | | | |
| UA Max | 6020 | R | 2 | Float32 | V | Phase UA-UN: Max voltage |
| UB Max | 6022 | R | 2 | Float32 | V | Phase UB-UN: Max voltage |
| UC Max | 6024 | R | 2 | Float32 | V | Phase UC-UN: Max voltage |
| Phase | 6026 | R | 2 | Float32 | V | Max of average phase voltage of |

| UAVGMax | | | | | | three phase |
|---|---|---|---|---|---|---|
| UA Min | 6030 | R | 2 | Float32 | V | Phase UA-UN: Min Voltage |
| UB Min | 6032 | R | 2 | Float32 | V | Phase UB-UN: Min Voltage |
| UC Min | 6034 | R | 2 | Float32 | V | Phase UC-UN: Min Voltage |
| UAVGMin | 6036 | R | 2 | Float32 | V | Min of average phase voltage of three phase |
| UAB Max | 6040 | R | 2 | Float32 | V | UA-UB Max line voltage |
| UBC Max | 6042 | R | 2 | Float32 | V | UB-UC Max line voltage |
| UCA Max | 6044 | R | 2 | Float32 | V | UC-UA Max line voltage |
| LineUAVGMax | 6046 | R | 2 | Float32 | V | Maximum of average line voltage of three phase |
| UAB Min | 6050 | R | 2 | Float32 | V | UA-UB Min Line voltage |
| UBC Min | 6052 | R | 2 | Float32 | V | UB-UC Min Line voltage |
| UCA Min | 6054 | R | 2 | Float32 | V | UC-UA Min Line voltage |
| LineUAVGMin | 6056 | R | 2 | Float32 | V | Min of average line voltage of three phase |
| **Max/min active power** | | | | | | |
| PA Max | 6060 | R | 2 | Float32 | kW | Phase L1 Max active power |
| PB Max | 6062 | R | 2 | Float32 | kW | Phase L2 Max active power |
| PC Max | 6064 | R | 2 | Float32 | kW | Phase L3 Max active power |
| PSUMMax | 6066 | R | 2 | Float32 | kW | Max three-phase total active power |
| PA Min | 6070 | R | 2 | Float32 | kW | Phase L1 Min active power |
| PB Min | 6072 | R | 2 | Float32 | kW | Phase L2 Min active power |
| PC Min | 6074 | R | 2 | Float32 | kW | Phase L3 Min active power |
| PSUMMin | 6076 | R | 2 | Float32 | kW | Min value of three-phase total active power |
| **Max/min reactive power** | | | | | | |
| QA Max | 6080 | R | 2 | Float32 | kVar | Phase L1 Max reactive power |
| QB Max | 6082 | R | 2 | Float32 | kVar | Phase L2 Max reactive power |
| QC Max | 6084 | R | 2 | Float32 | kVar | Phase L3 Max reactive power |
| QSUMMax | 6086 | R | 2 | Float32 | kVar | Max three-phase total reactive power |
| QA Min | 6090 | R | 2 | Float32 | kVar | Phase L1 Min reactive power |
| QB Min | 6092 | R | 2 | Float32 | kVar | Phase L2 Min reactive power |
| QC Min | 6094 | R | 2 | Float32 | kVar | Phase L3 Min reactive power |
| QSUMMin | 6096 | R | 2 | Float32 | kVar | Min value of three-phase total reactive power |
| **Max/min apparent power** | | | | | | |
| SA Max | 6100 | R | 2 | Float32 | kVa | Phase L1 Max apparent power |
| SB Max | 6102 | R | 2 | Float32 | kVa | Phase L2 Max apparent power |
| SC Max | 6104 | R | 2 | Float32 | kVa | Phase L3 Max apparent power |
| SSUMMax | 6106 | R | 2 | Float32 | kVa | Max three-phase total apparent power |

| SA Min | 6110 | R | 2 | Float32 | kVa | Phase L1 Min apparent power |
| SB Min | 6112 | R | 2 | Float32 | kVa | Phase L2 Min apparent power |
| SC Min | 6114 | R | 2 | Float32 | kVa | Phase L3 Min apparent power |
| SSUMMin | 6116 | R | 2 | Float32 | kVa | Min value of three-phase total apparent power |

## 8..18 Unbalance

| Register name | Register start address (Decimal system) | Operation | Size | Type | Unit | Description |
|---|---|---|---|---|---|---|
| Voltage negative sequence unbalance | 7000 | R | 2 | Float32 | % | Voltage negative sequence unbalance |
| Voltage zero-sequence unbalance | 7002 | R | 2 | Float32 | % | Voltage zero-sequence unbalance |
| Current negative sequence unbalance | 7004 | R | 2 | Float32 | % | Current negative sequence unbalance |
| Current zero-sequence unbalance | 7006 | R | 2 | Float32 | % | Current zero-sequence unbalance |

## 8..19 Current K factor

| Register name | Register start address (Decimal system) | Operation | Size | Type | Unit | Description |
|---|---|---|---|---|---|---|
| Current K factor | | | | | | |
| KFIA | 8000 | R | 2 | Float32 | - | Phase L1 Current K factor |
| KFIB | 8002 | R | 2 | Float32 | - | Phase L2 Current K factor |
| KFIC | 8004 | R | 2 | Float32 | - | Phase L3 Current K factor |

## 8..20 Voltage and current angle

| Register name | Register start address (Decimal system) | Opera tion | Size | Type | Unit | Description |
|---|---|---|---|---|---|---|
| Voltage angle: | | | | | | |
| UA | 8100 | R | 2 | Float32 | ° | Phase L1 Voltage angle |
| UB | 8102 | R | 2 | Float32 | ° | Phase L2 Voltage angle |
| UC | 8104 | R | 2 | Float32 | ° | Phase L3 Voltage angle |
| Current angle: | | | | | | |
| IA | 8106 | R | 2 | Float32 | ° | Phase L1 Current angle |
| IB | 8108 | R | 2 | Float32 | ° | Phase L2 Current angle |
| IC | 8110 | R | 2 | Float32 | ° | Phase L3 Current angle |
| Angle between voltage and current: | | | | | | |
| UIA | 8112 | R | 2 | Float32 | ° | Phase L1 Angle between voltage and current |
| UIB | 8114 | R | 2 | Float32 | ° | Phase L2 Angle between voltage and current |
| UIC | 8116 | R | 2 | Float32 | ° | Phase L3 Angle between voltage and current |

## 8..21 Alarm

| Register name | Register start address (Decimal system) | Opera tion | Size | Type | Unit | Description |
|---|---|---|---|---|---|---|
| Alarm Bitmap | | | | | | |
| Enabled Alarm Bitmap | | | | | | |
| Enable Alarm Bitmap 1 | 10000 | R | 1 | Bitmap | - | 0=Alarm Disable 1=Alarm Enable Bit N(0-15)=Alarm ID N(1-16) |
| Enable Alarm Bitmap 2 | 10001 | R | 1 | Bitmap | - | 0=Alarm Disable 1=Alarm Enable Bit N(0-15)=Alarm ID N(17-32) |
| Active alarm bitmap | | | | | | |
| Activate Alarm Bitmap 1 | 10010 | R | 1 | Bitmap | - | 0=Alarm not active 1=Alarm active Bit N(0-15)=Alarm ID N(1-16) |
| Activate Alarm Bitmap 2 | 10011 | R | 1 | Bitmap | - | 0=Alarm not active 1=Alarm active Bit N(0-15)=Alarm ID N(17-32) |

| Register name | Register start address (Decimal system) | Opera tion | Size | Type | Unit | Description |
|---|---|---|---|---|---|---|
| Current alarm output bit <br> (Note: there can be at most one alarm output at the same time) | | | | | | |
| Current alarm output bitmap 1 | 10020 | R | 1 | Bitmap | - | 0=Alarm not output <br> 1=Alarm output <br> Bit N(0-15)=Alarm ID N(1-16) |
| Current alarm output bitmap 2 | 10021 | R | 1 | Bitmap | - | 0=Alarm not output <br> 1=Alarm output <br> Bit N(0-15)=Alarm ID N(17-32) |
| Alarm parameters | | | | | | |
| Over current, each phase <br> (Note: if one phase exceeds the activation threshold, an alarm will be generated; if all phases are below the alarm release point, the alarm will be released) | | | | | | Alarm ID=1 |
| Enabling state | 10100 | R/WC | 1 | UInt16 | - | Enabling state <br> 0=Disable <br> 1=Enable |
| Activate threshold | 10102 | R/WC | 2 | Float32 | A | Alarm activate threshold |
| Alarm release point | 10104 | R/WC | 2 | Float32 | % | Error percentage of alarm release point relative to alarm activation threshold <br> Example: <br> *Alarm activation threshold =100A* <br> *Alarm release point =5%* <br> *When the current value is less than 100-100 * 5%=95A, the alarm is released* |
| Buzzer output correlation | 10106 | R/WC | 1 | UInt16 | - | Buzzer output correlation <br> 0=No correlation <br> 1=Correlation |
| Relay output correlation | 10107 | R/WC | 1 | UInt16 | - | Relay output correlation <br> 0=No correlation <br> 1=Correlation <br> (Note: control is only effective when the relay output mode is alarm output mode) |
| Under current, each phase | | | | | | Alarm ID=2 |
| Enabling state | 10120 | R/WC | 1 | UInt16 | - | Enabling state <br> 0=Disable <br> 1=Enable |
| Activate threshold | 10122 | R/WC | 2 | Float32 | A | Alarm activation threshold |
| Alarm release point | 10124 | R/WC | 2 | Float32 | % | Error percentage of alarm release point relative to alarm activation threshold |

| Register name | Register start address (Decimal system) | Operation | Size | Type | Unit | Description |
|---|---|---|---|---|---|---|
| Buzzer output correlation | 10126 | R/WC | 1 | UInt16 | - | Buzzer output correlation 0=No correlation 1=Correlation |
| Relay output correlation | 10127 | R/WC | 1 | UInt16 | - | Relay output correlation 0=No correlation 1=Correlation |
| Over phase voltage,L-N | | | | | Alarm ID=3 | |
| Enabling state | 10140 | R/WC | 1 | UInt16 | - | Enabling state 0=Disable 1=Enable |
| Activate threshold | 10142 | R/WC | 2 | Float32 | V | Alarm activation threshold |
| Alarm release point | 10144 | R/WC | 2 | Float32 | % | Error percentage of alarm release point relative to alarm activation threshold |
| Buzzer output correlation | 10146 | R/WC | 1 | UInt16 | - | Buzzer output correlation 0=No correlation 1=Correlation |
| Relay output correlation | 10147 | R/WC | 1 | UInt16 | - | Relay output correlation 0=No correlation 1=Correlation |
| Under phase voltage,L-N | | | | | Alarm ID=4 | |
| Enabling state | 10160 | R/WC | 1 | UInt16 | - | Enabling state 0=Disable 1=Enable |
| Activate threshold | 10162 | R/WC | 2 | Float32 | V | Alarm activation threshold |
| Alarm release point | 10164 | R/WC | 2 | Float32 | % | Error percentage of alarm release point relative to alarm activation threshold |
| Buzzer output correlation | 10166 | R/WC | 1 | UInt16 | - | Buzzer output correlation 0=No correlation 1=Correlation |
| Relay output correlation | 10167 | R/WC | 1 | UInt16 | - | Relay output correlation 0=No correlation 1=Correlation |
| Overline voltage, L-L | | | | | Alarm ID=5 | |
| Enabling state | 10180 | R/WC | 1 | UInt16 | - | Enabling state 0=Disable 1=Enable |
| Activate threshold | 10182 | R/WC | 2 | Float32 | V | Alarm activation threshold |
| Alarm release point | 10184 | R/WC | 2 | Float32 | % | Error percentage of alarm release point relative to alarm activation threshold |

| Register name | Register start address (Decimal system) | Operation | Size | Type | Unit | Description |
|---|---|---|---|---|---|---|
| Buzzer output correlation | 10186 | R/WC | 1 | UInt16 | - | Buzzer output correlation<br>0=No correlation<br>1=Correlation |
| Relay output correlation | 10187 | R/WC | 1 | UInt16 | - | Relay output correlation<br>0=No correlation<br>1=Correlation |
| Underline voltage, L-L | | | | | | Alarm ID=6 |
| Enabling state | 10200 | R/WC | 1 | UInt16 | - | Enabling state<br>0=Disable<br>1=Enable |
| Activate threshold | 10202 | R/WC | 2 | Float32 | V | Alarm activation threshold |
| Alarm release point | 10204 | R/WC | 2 | Float32 | % | Error percentage of alarm release point relative to alarm activation threshold |
| Buzzer output correlation | 10206 | R/WC | 1 | UInt16 | - | Buzzer output correlation<br>0=No correlation<br>1=Correlation |
| Relay output correlation | 10207 | R/WC | 1 | UInt16 | - | Relay output correlation<br>0=No correlation<br>1=Correlation |
| Overpower, total active (absolute value) | | | | | | Alarm ID=10 |
| Enabling state | 10220 | R/WC | 1 | UInt16 | - | Enabling state<br>0=Disable<br>1=Enable |
| Activate threshold | 10222 | R/WC | 2 | Float32 | kW | Alarm activation threshold |
| Alarm release point | 10224 | R/WC | 2 | Float32 | % | Error percentage of alarm release point relative to alarm activation threshold |
| Buzzer output correlation | 10226 | R/WC | 1 | UInt16 | - | Buzzer output correlation<br>0=No correlation<br>1=Correlation |
| Relay output correlation | 10227 | R/WC | 1 | UInt16 | - | Relay output correlation<br>0=No correlation<br>1=Correlation |
| Overpower, total reactive (absolute value) | | | | | | Alarm ID=14 |
| Enabling state | 10240 | R/WC | 1 | UInt16 | - | Enabling state<br>0=Disable<br>1=Enable |
| Activate threshold | 10242 | R/WC | 2 | Float32 | kVar | Alarm activation threshold |
| Alarm release point | 10244 | R/WC | 2 | Float32 | % | Error percentage of alarm release point relative to alarm activation threshold |

| Register name | Register start address (Decimal system) | Opera tion | Size | Type | Unit | Description |
|---|---|---|---|---|---|---|
| Buzzer output correlation | 10246 | R/WC | 1 | UInt16 | - | Buzzer output correlation<br>0=No correlation<br>1=Correlation |
| Relay output correlation | 10247 | R/WC | 1 | UInt16 | - | Relay output correlation<br>0=No correlation<br>1=Correlation |
| Overpower, total apparent | | | | | | Alarm ID=18 |
| Enabling state | 10260 | R/WC | 1 | UInt16 | - | Enabling state<br>0=Disable<br>1=Enable |
| Activate threshold | 10262 | R/WC | 2 | Float32 | kVA | Alarm activation threshold |
| Alarm release point | 10264 | R/WC | 2 | Float32 | % | Error percentage of alarm release point relative to alarm activation threshold |
| Buzzer output correlation | 10266 | R/WC | 1 | UInt16 | - | Buzzer output correlation<br>0=No correlation<br>1=Correlation |
| Relay output correlation | 10267 | R/WC | 1 | UInt16 | - | Relay output correlation<br>0=No correlation<br>1=Correlation |
| Overdemand, total active (absolute value), current | | | | | | Alarm ID=20 |
| Enabling state | 10280 | R/WC | 1 | UInt16 | - | Enabling state<br>0=Disable<br>1=Enable |
| Activate threshold | 10282 | R/WC | 2 | Float32 | kW | Alarm activation threshold |
| Alarm release point | 10284 | R/WC | 2 | Float32 | % | Error percentage of alarm release point relative to alarm activation threshold |
| Buzzer output correlation | 10286 | R/WC | 1 | UInt16 | - | Buzzer output correlation<br>0=No correlation<br>1=Correlation |
| Relay output correlation | 10287 | R/WC | 1 | UInt16 | - | Relay output correlation<br>0=No correlation<br>1=Correlation |
| Overdemand, total reactive power (absolute value), current | | | | | | Alarm ID=21 |
| Enabling state | 10300 | R/WC | 1 | UInt16 | - | Enabling state<br>0=Disable<br>1=Enable |
| Activate threshold | 10302 | R/WC | 2 | Float32 | kVar | Alarm activation threshold |
| Alarm release point | 10304 | R/WC | 2 | Float32 | % | Error percentage of alarm release point relative to alarm activation threshold |

| Register name | Register start address (Decimal system) | Operation | Size | Type | Unit | Description |
|---|---|---|---|---|---|---|
| Buzzer output correlation | 10306 | R/WC | 1 | UInt16 | - | Buzzer output correlation 0=No correlation 1=Correlation |
| Relay output correlation | 10307 | R/WC | 1 | UInt16 | - | Relay output correlation 0=No correlation 1=Correlation |
| Excess demand, total apparent, current | | | | | Alarm ID=22 | |
| Enabling state | 10320 | R/WC | 1 | UInt16 | - | Enabling state 0=Disable 1=Enable |
| Activate threshold | 10322 | R/WC | 2 | Float32 | kVA | Alarm activation threshold |
| Alarm release point | 10324 | R/WC | 2 | Float32 | % | Error percentage of alarm release point relative to alarm activation threshold |
| Buzzer output correlation | 10326 | R/WC | 1 | UInt16 | - | Buzzer output correlation 0=No correlation 1=Correlation |
| Relay output correlation | 10327 | R/WC | 1 | UInt16 | - | Relay output correlation 0=No correlation 1=Correlation |
| Over THD-U (total voltage harmonic), each phase | | | | | Alarm ID=30 | |
| Enabling state | 10340 | R/WC | 1 | UInt16 | - | Enabling state 0=Disable 1=Enable |
| Activate threshold | 10342 | R/WC | 2 | Float32 | % | Alarm activation threshold |
| Alarm release point | 10344 | R/WC | 2 | Float32 | % | Error percentage of alarm release point relative to alarm activation threshold |
| Buzzer output correlation | 10346 | R/WC | 1 | UInt16 | - | Buzzer output correlation 0=No correlation 1=Correlation |
| Relay output correlation | 10347 | R/WC | 1 | UInt16 | - | Relay output correlation 0=No correlation 1=Correlation |
| Over THD-I (total harmonic of current), each phase | | | | | Alarm ID=31 | |
| Enabling state | 10360 | R/WC | 1 | UInt16 | - | Enabling state 0=Disable 1=Enable |
| Activate threshold | 10362 | R/WC | 2 | Float32 | % | Alarm activation threshold |
| Alarm release point | 10364 | R/WC | 2 | Float32 | % | Error percentage of alarm release point relative to alarm activation threshold |

| Register name | Register start address (Decimal system) | Operation | Size | Type | Unit | Description |
|---|---|---|---|---|---|---|
| Buzzer output correlation | 10366 | R/WC | 1 | UInt16 | - | Buzzer output correlation<br>0=No correlation<br>1=Correlation |
| Relay output correlation | 10367 | R/WC | 1 | UInt16 | - | Relay output correlation<br>0=No correlation<br>1=Correlation |

# 9 Revision History

| Version | Date | Content modification | Reviser |
|---------|------|---------------------|---------|
| V1.0 | 2022/12/22 | Create documents | Walter |
| V1.1 | 2023/01/09 | 1. Added current direction setting Modbus register<br>2. Add the current channel selection Modbus register<br>3. Unified document format | Walter |