# DW9L Series 3 Phase Energy Meter Operation Manual

Toky Electrical Co., Ltd

Thank you for choosing our products. In order to facilitate you to use this instrument safely, correctly and efficiently,

please read this manual carefully and pay attention to the following points when using it.

⚠ Note:

This equipment can only be installed by professionals. The manufacturer will not be responsible for any failure caused by failure to follow the instructions in this manual.

⚠ Risk of electric shock, burning or explosion

※ Equipment can only be installed and maintained by qualified personnel

※ Before making any operation, isolate the voltage input and power supply, and short-circuit the secondary windings of all current transformers。

※ Using a suitable voltage detection device to confirm that the voltage has been cut off.

※ Before the equipment is powered on, all mechanical parts, doors and covers should be returned to their original positions.

※ The equipment should provide the correct rated voltage in using

Any operation not following the manual will cause accident and damage to the product

Information provided in this manual can be modified without prior notice.
The company reserves the right of interpretation of the information.

# Ⅰ. Description

## 1.1 The instrument implements relevant national standards

| DL/T 614-2007 | <Multifunction Energy Meter> |
|---|---|
| GB/T 17215.301-2007 | <Multifunction Harmonic Meter Special Requirements> |
| GB/T 17215.322-2008 | < 2nd and 3rd Class Static AC Active Power Meter> |
| GB/T 17215.323-2008 | <2nd and 3rd Level Static AC Reactive Power Meter> |
| DL/T 645-2007 | <Multifunctional Energy Meter Communication Protocol> |
| GB/T 15284-2002 | <Multi-rate electric energy meter special requirements> |
| GB/T 14549-1993 | <Power Quality Public Power Harmonics> |
| GB/T 15543-2008 | <Three-phase voltage allows unbalance> |

## 1.2 Features and Application

This instrument with high cost performance can directly replace the conventional measurement indicating instrument, energy meter, harmonic measuring instrument and related auxiliary units. As an advanced intelligent, digital power grid front-end acquisition component, it can be used in various control system and is with the features of easy to install, simple wiring, easy maintenance, small engineering capacity, field programmable input parameters etc, also can complete the networking with the industry's different PLC, industrial control computer communications software.

Main Features:

※ Large size segment LCD display, simple and convenient operation, rich interface information;

※ Measyure parameter. like U、I、P、Q、S、PF、Hz etc.

※ With 4-quadrant reactive power record function;

※ Metering forward and reverse energy, reaching 12-hour multi-rate energy metering；

※ Measuring demand statistics, maximum record function of U.I

※ Measuring the voltage and current of power network in frequency 2-31harmonics,total harmonic distortion THD;

※ Measuring power network quality parameters such as voltage and current imbalance of the power network;

※ Supply 4 loopds digital input function, adopts dry node signal input mode

※ Supply 2 loops alarm (250V/5A) digital input function: Can be used in variou places for over-limit alarm indication, protection control output and remote control functions；

※ Supply 1 loop active power, 1 loop reactive power analog output;

※ Supply 1 loop RS485 communication, MODBUS-RTU communication procotol ( optional DLT645 protocol)

※ Supply 1 loop analog transmission output 4-20mA；

Typical Application：

※ Energy Management System      ※ Power Monitoring System

※ Intelligent Building      ※ Intelligent Switchboard

※ High and low voltage switch cabinet      ※ Distribution network automation

## 1.3 Function List

| Function | | DW9L-IRC38 |
|---|---|---|
| Real-time measurement | 3 phase voltage | ● |
| | Grid frequency | ● |
| | 3 phase current | ● |
| | Zero phase current | ● |
| | 3 phase active power | ● |
| | 3 phase reactive power | ● |
| | 3 phase apparent power | ● |
| | 3 phase power factor | ● |
| | Positive sequence, negative sequence, zero sequence | ○ |
| Energy Metering | Active Power | ● |
| | 4-quadrant reactive power | ● |
| Power Quality | Maximum of voltage and current | ● |
| | Unbalance of voltage and current | ● |
| | Total Harmonic | ● |
| | 32 times voltage harmonic rate | ● |
| | 32 times current harmonic rate | ● |
| Multi-rate | 4 rates, 12 period measurement | ● |
| Demand | Active Power, Reactive Power and Maximum demand record | ● |
| Clock | With a real-time clock that can be timed | ● |
| Record | Undervoltage, overvoltage, undercurrent, overcurrent | ○ |
| | Alarm Action | ○ |
| | Programming parameters | ○ |
| | Clear energy, demand, etc. | ○ |
| Energy Pulse | 1 lopp active power, 1 loop reactive power | 2 |
| Transmission Output | 1 lopp 4～20mA transmission output | 1 |
| Switch Input | Passive dry contact | 4 |
| Alarm Output | AC250V/5A Remote control/ alarm | 2 |
| Communication | RS485: support MODBUS-RTU/DLT645-2007 | 1 |
| Display | Big size segment LCD display | ● |
| Size | Hole Size | 92*92mm |
| | Dimensions | 96*96*100mm |

Remark: " ● " standard ； " ○ " optional

## 1.4 Measurement Parameter Range

| Measurement Parameter | Indirect Measurement Range | Accuraccy |
|---|---|---|
| Voltage | 2.0V～500KV | 0.2% |
| Current | 0.02A～6000A | 0.2% |
| Active Power | 1W～100MW (negative consistent) | 0.5% |
| Reactive Power | 1var～1000Mvar ( negative consistent) | 0.5% |
| Apparent power | 1VA～100MVA | 0.5% |
| Power Factor | -1.000～1.000 | 0.5% |
| Frequency | 30Hz～500Hz | 0.2% |
| Active Energy | 0～999999.99kWh(note) | 0.5% |
| Reactive Energy | 0～999999.99kvarh (note) | 2% |

Note: Energy metering is a secondary-side value. Please multiply the PT and CT values when you measure the electric energy.

# II.Technical Parameters

| Item | | | Performance parameters |
|---|---|---|---|
| Input Measurement Display | | Network | 3 phase 4 wires/ 3 phase 3 wire/ Single phase |
| | Voltage | Rated value | AC3x220V/380V |
| | | Overload | Continuous:1.2 times Instantaneous:2 times/2s |
| | | Power Consumption | <0.6VA (each phase) |
| | | impedance | >500kΩ |
| | | Accuracy | RMS measurement, Accuracy 0.2% |
| | Current | Rated Value | AC5A（AC1A can be ordered） |
| | | Overload | Continuous: 1.2 times Instantaneous: 2 times/2s |
| | | Power Consumption | <0.4VA (each phase) |
| | | impedance | <20mΩ |
| | | Accuracy | RMS measurement, Accuracy 0.2% |
| | Frequency | | 30--500HZ，Accuracy 0.01Hz |
| | Power | | active, reactive, apparent power, accuracy: 0.5% |
| | Harmonic | | Power, Harmonic Accuracy: A |
| | Energy | | Active Power: accuracy 0.5S; Reactive Power: accuracy 2 |
| | Clock | | Clock error：0.5s/d (Reference temperature：23℃) |
| | Display | | Large screen segment LCD display |
| Current | Power Supply | | AC/DC 100V～240V |
| | Consumption | | <8VA |
| Output | Communication | | 1. RS485 Communication；<br>2. Correspond internation standard MODBUS-RTU protocol<br>3. Correspond national standard DLT645-2007 protocol；<br>4. Communication Baud Rate: 1200、2400、4800、9600、19200；<br>5. Checking Method: optional no checking, even checking, odd checking |
| | Pulse | | Passive optocoupler collector output |
| | Alarm Output | | relay output: capacity: 5A/250VAC or 5A/30VDC；<br>programmable alarm or remote control method； |
| | Transmission Output | | 4-20mA current analog output |
| | Switch Input | | remote: passive dry junction input |
| Environment | Working Environment | | -10～55℃ |
| | Storage Environment | | -20～75℃ |
| Safety | Resistance | | Input and power >2kV, Input and output>2kV |
| | Insulation | | Input, output, Power Supply Case>50MΩ |
| Electromagnetic Compatibility | Electrostatic discharge immunity | | Correspond GB/T 17626.2-2006   3 level |
| | Electrical fast pulse group immunity | | Correspond GB/T 17626.4-2008   4 level |
| | Surge immunity | | Correspond GB/T 17626.5-2008   4 level |
| | RF conducted immunity | | Correspond GB/T 17626.6-2008   4 level |
| | Power frequency magnetic field immunity | | Correspond GB/T 17626.8-2006   4 level |
| | Radiation immunity | | Correspond GB/T 17626.3-2006 |

## III. Installation and wiring

### 3.1 Loading List

| Meter | Mounting brackets | Instructions | Certification |
|---|---|---|---|
| 1( PC ) | 1（Set） | 1（PC） | 1（PC） |

### 3.2 Shape and mounting hole size

| Model (mm) | Case Size (mm) | Hole Size (mm) | Minimum installation distance | | Length(mm) |
|---|---|---|---|---|---|
| | | | Horizontal Direction | Vertical direction | |
| 96x96 | 91x91 | 92x92+0.5 | 120 | 120 | 100 |

Panel Size

96.0

96.0

Power Meter

Side Size

104.6
99.0
5.6
91.3
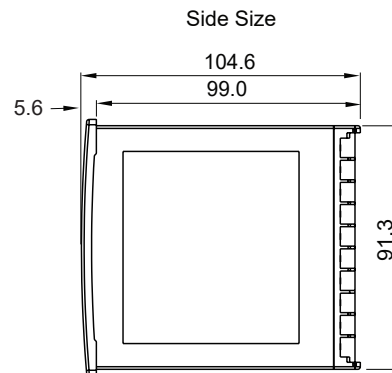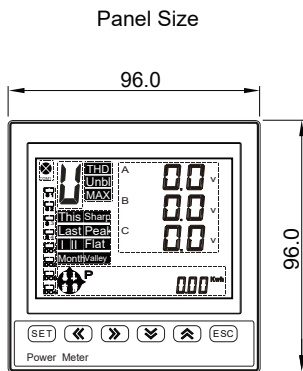
### 3.3 Installation method (as shown in the right figure)

1) Open 92*92 (mm) hole in fixed distribution cabinet;
2) Remove the meter and take out the fixed bracket;
3) The instrument is pressed into the mounting hole from the front;
4) Insert the instrument holder and tighten the screws to secure the meter

92.0mm

92.0mm
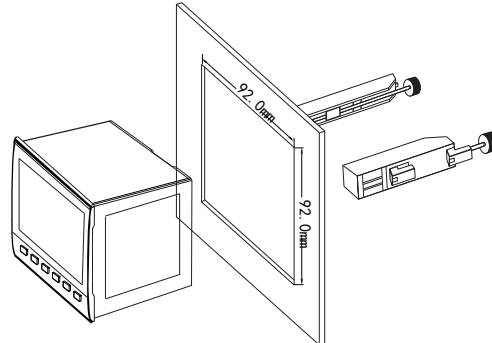
### 3.4 Instrument terminal diagram

Rear view

| L (+) | 1 | Ua (Ua) | 20 | 10 | B− |
|---|---|---|---|---|---|
| N (−) | 2 | Ub | 21 | 11 | A+ |
| NO | 3 | Uc (Uc) | 22 | 12 | COM |
| NC | 4 | Un (Ub) | 23 | 13 | S1 |
| ACOM | 5 | IA* | 24 | 14 | S2 |
| NO | 6 | IA | 25 | 15 | S3 |
| NC | 7 | IB* | 26 | 16 | S4 |
| AO+ | 8 | IB | 27 | 17 | RP |
| AO− | 9 | IC* | 28 | 18 | AP |
| | 0 | IC | 29 | 19 | PCOM |

## 3.5 Terminal corresponding wiring chart

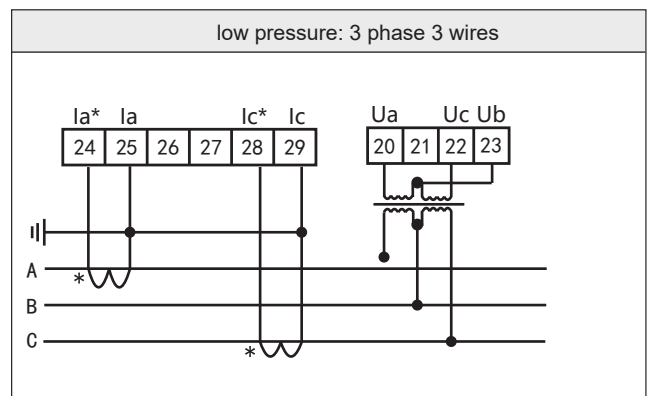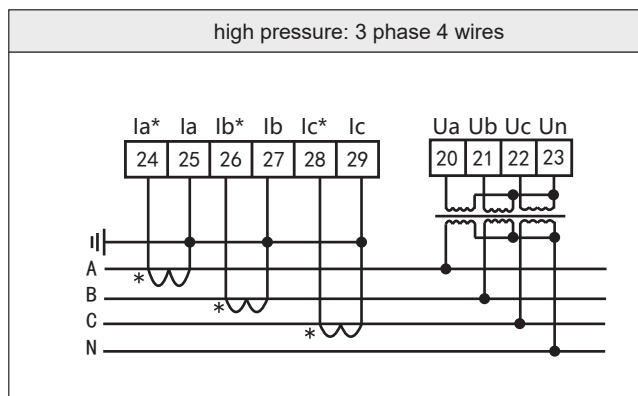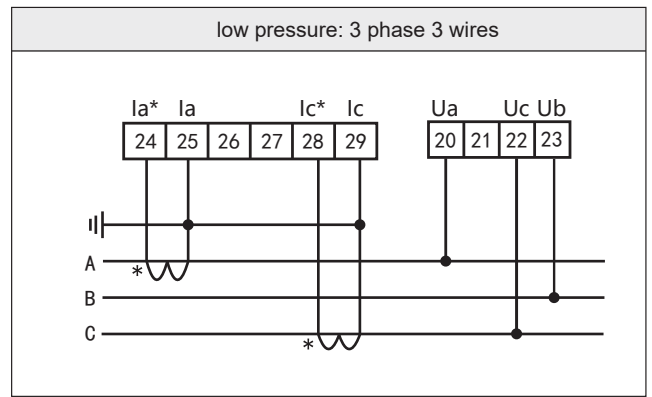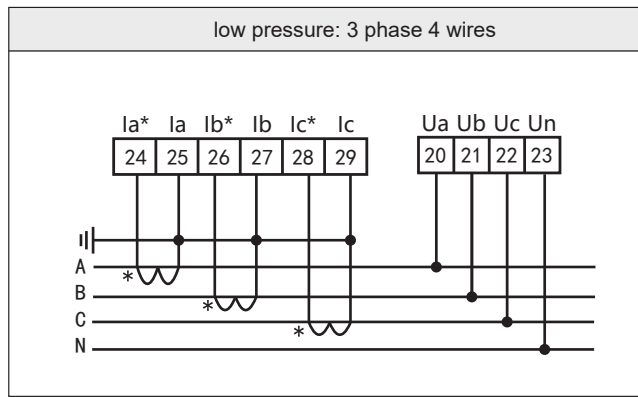| Category | Corresponding terminal number | Corresponding letter | Input and output directions | Description |
|---|---|---|---|---|
| Power | 1 | L(+) | Input | Optional AC and DC power supply; Range: AC: 85～265V DC:100～240V |
| | 2 | N(-) | Input | |
| Alarm or remote control output | 3 | NO | Output | NO: 1st alarm open |
| | 4 | NC | Output | NC:1st alarm close |
| | 5 | ACOM | Output | Alarm or remote control |
| | 6 | NO | Output | NO:2nd alarm open |
| | 7 | NC | Output | NC:2nd alarm close |
| Transmission Output | 8 | AO+ | Output | 4～20mA outflow positive |
| | 9 | AO- | Output | 4～20mA outflow negative |
| Blank | 0 | Blank | | Unused |
| Communication | 10 | B- | Output/Input | RS485 Negative communication |
| | 11 | A+ | Output/Input | RS485 Positive communication |
| Switch Input | 12 | COM | Input | Switch input common (communication mask access point) |
| | 13 | S1 | Input | Switch input 1st loop |
| | 14 | S2 | Input | Switch input 2nd loop |
| | 15 | S3 | Input | Switch input 3rd loop |
| | 16 | S4 | Input | Switch input 4th loop |
| Energy Pulse | 17 | RP | Output | Reactive energy pulse poer |
| | 18 | AP | Output | Active energy pulse port |
| | 19 | PCOM | Output | Pulse output common port |
| Voltage Signal Input | 20 | UA(Ua) | Input | 3 phase 4 wires A phase voltage input(3 phase 3 wires A phase voltage input) |
| | 21 | UB | Input | 3 phase 4 wires B phase voltage input |
| | 22 | UC(Uc) | Input | 3 phase 4 wires C phase voltage input(3 phase 3 wires C phase voltage input) |
| | 23 | UN(Ub) | Input | 3 phase 4 wires 0 phase voltage input(3 phase 3 wires B phase voltage input) |
| Current Signal Input | 24 | IA* | Input | A phase current inflow |
| | 25 | IA | Input | A phase current outflow |
| | 26 | IB* | Input | B phase current inflow |
| | 27 | IB | Input | B phase current outflow |
| | 28 | IC* | Input | C phase current inflow |
| | 29 | IC | Input | C phase current outflow |

Description:

① The brackets in the voltage input terminal indicate the 3 phase 3 wires connection

② The current "*" is the current input terminal, all outgoing lines must be unified. Otherwise, the measurement will be inaccurate.

③ If there is any change in the wiring, please take the wiring diagram of the instrument case as the standard.

## 3.6 Connection Drawing



low pressure: 3 phase 4 wires



low pressure: 3 phase 3 wires



high pressure: 3 phase 4 wires



low pressure: 3 phase 3 wires



low pressure: single phase



high pressure: single phase
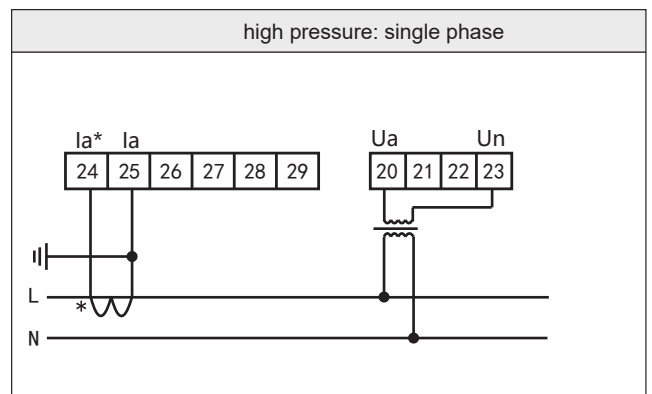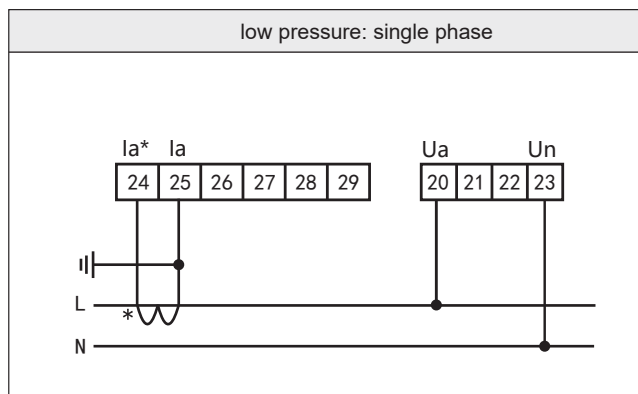
Note:

① When the input voltage is higher than the rated input voltage of the product, you should consider using a PT. For ease of maintenance, it is recommended to use a wiring board.。

② The standard rated input current is 5A, 1A or greater than 5A, the external CT should be used. If there are other meters connected to the CT, the wiring should be connected in series. Before removing the current input connection of the product, it is necessary to disconnect the primary circuit of the CT or short the secondary circuit. It is recommended to use the terminal block for maintenance.

③ To ensure that the input voltage and current correspond, the phase sequence is consistent and the direction is the same, otherwise there will be errors in the values and symbols of power and energy, etc.。

④ The instrument can work in 3 phase 4 wires mode or 3 phase 3 wires mode. The user should select the appropriate wiring mode according to the field use conditions. The 3 phase 3 wires mode is generally used without a center line, and the 3 phase 4 wires mode is used with a center line. It should be noted that the on-site wiring must be the same as the wiring set in the meter, otherwise the meter's measurement data is incorrect.

## 3.7 Power Supply

The instrument has a universal (AC/DC) power input interface. If no special explanation is given, it is a standard product of AC220V power interface. The limit working voltage of the instrument is AC 85-265V. Please ensure that the supplied power is suitable for this series. Products to prevent damage to the product. Also recommended:

① It is recommended to use AC power to install 1A fuse on the side of the line of fire；

② For areas with poor network quality, it is suggested that a surge suppressor be installed in the power circuit to prevent lightning strikes and a fast pulse train suppressor be installed.
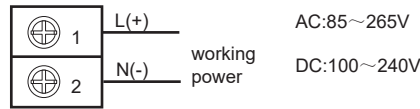


## 3.8 Relay output

This meter with relay output function can be used for alarm indication and protection control output function in various occasions. When the digital output is valid, the relay output is on, and when the digital output is off, the relay output is off.

① High Alarm

When the high alarm indicates that the alarm threshold is higher than the alarm item, the relay switch output turns on.

② Low Alarm

When the low alarm indicates that the alarm threshold is lower than the alarm item, the relay switch output turns on;

③ Remote control relay

If the relay output control is selected as the remote control mode, the output of the relay is set to "remote control" through the programming operation, and the output of the relay can be controlled through communication.
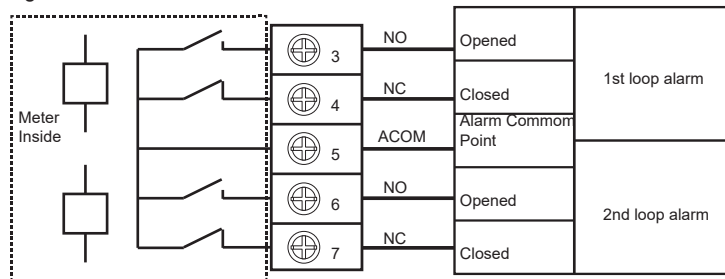


## 3.9 Switch Input

The instrument has a switch input detection function and adopts the dry node signal input method. The instrument is equipped with a +24V working power supply inside, and no external power supply is required. When it is connected externally, it is collected by the instrument switch input module DI, and the interface shows that it is in the open state. When it is disconnected externally, it will be disconnected through the digital input module DI of the instrument collector, and the interface will be in the open state.
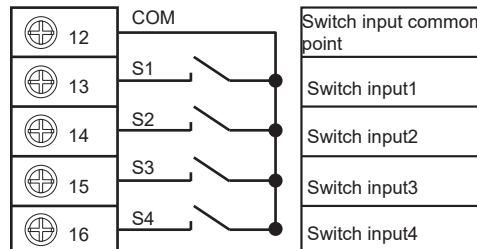


## 3.10 Analog output

The instrument has an analog output function and can be set by any of 26 power levels. The analog output of the instrument can be used to achieve the analog output function of the electrical parameters (4-20mA).

Electrical parameters: output: 4-20mA, accuracy:±0.5%F.s

Overload: 120% effective output, maximum current 24mA

Load: Rmax = 600Ω
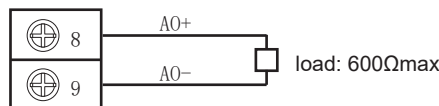


## 3.11 Energy Pulse Output

Energy metering and pulse output: the meter provides positive and negative active energy metering, 2 loops energy pulse output functions and RS485 digital interface to complete the display and remote transmission of energy data. The energy pulse (resistance signal) of the photocoupler relay with open-collector level is used to realize the remote transmission of active energy (forward) and reactive energy (forward), and the remote computer terminal, PLC and DI switch acquisition module is used to collect the instrument. The total number of pulses to achieve energy cumulative measurement. Use the pulse output method to check the accuracy of the electrical energy (national measurement procedures: comparison method of pulse error of the standard form)。

① Electrical characteristics: VCC<=48V IZ<=50mA in the circuit diagram of the pulse acquisition interface

② Pulse constant: 9000 imp/kWh(kvarh),the fastest pulse speed does not exceed 200mS. Its significance is: when the meter accumulates 1kWh (1kvarh) output pulse number is 9000.
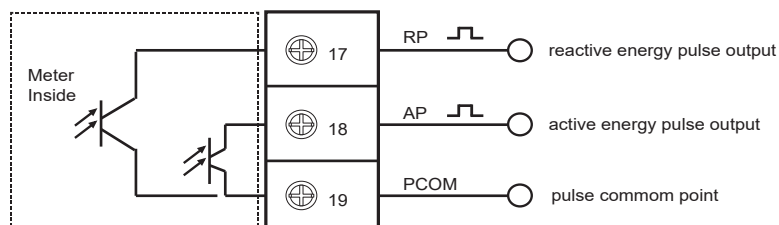
## 3.12 Communication Output

The device has a two-wire RS-485 communication port with terminals labeled A+, B-. High-speed optocoupler isolation and protection circuits prevent common-mode and differential-mode voltage interference, lightning strikes, and miswiring from damaging the communications port.

The RS-485 communication mode allows a maximum of 32 instruments to be connected on one bus. In this case, an RS-232C/RS-485 converter is required. The communication cable can be an ordinary shielded twisted pair cable. The total length cannot exceed 1200 meters. The positive and negative polarity of the RS-485 port of each device must be connected correctly, and one end of the cable shield is grounded. If the shielded twisted pair is long, it is suggested to connect a 120Ω resistor at the end to improve the reliability of communication.



Please use shielded twisted pair connection

# IV. Operation Instructions

## 4.1 Panel diagram



## 4.2 Display Area Description

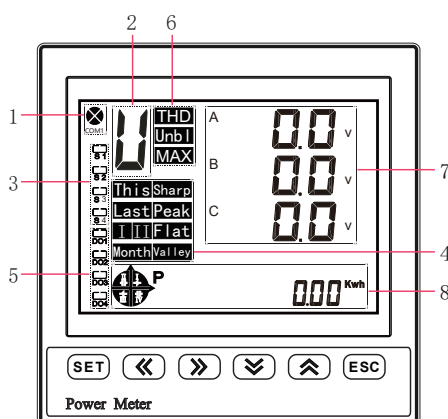| No. | Display Description |
|-----|---------------------|
| 1 | Communication indicator: The indicator will keep blinking while it is passing |
| 2 | Display the current display category of the data display area: like the voltage corresponds to "U", the current corresponds to "A", etc. |
| 3 | Switch input indicator, when a certain amount of switch is closed, the corresponding switch display frame will be filled with solid. If the second way switch is turned on, the display state is as follows： S 2 |
| 4 | Indicating the corresponding rate of multi-rate： This Month indicate this month / Last I Month indicate last month / Last II Month indicate last two months / Sharp indicate "sharp" / Peak indicate "peak" / Flat indicate "flat" / Valley indicate "valley" |
| 5 | Alarm or remote output indicator: When an alarm occurs, the corresponding output indicator will be filled with solid. Such as: |
| 6 | THD Indicate total harmonic content / Unbl Indication imbalance / MAX Indicates the maximum |
| 7 | Measurement data real-time display area, can display the voltage, current, power etc |
| 8 | Power display area: Measurement range is 0～999999.99, Exceeding the maximum will automatically flip |

## 4.3 Key Description Form

| Key symbol | Key Name | Measurement Mode | Setting Mode | |
|-----------|----------|------------------|--------------|--|
| | | | parameter selection status | Parameter modification status |
| SET | Confirm Key | 1. short press to switch display categories: instantaneous electrical parameters→ voltage harmonic→current harmonic→ Multi-rate electricity 2. long press to enter setup menu | enter the next menu | confirm the changes |
| « | Left shift key | backward turning in the display class | visit last parameter | cursor left |
| » | Right shift key | forward turning in the display class | visit next parameter | cursor right |
| ⩒ | Reduce key | lower power display switch back | enter the parameter modification status | decrease of value |
| ⩑ | Increase key | lower power display forward switch | enter the parameter modification status | increase of value |
| ESC | return key | short press for the lower power display column and return to integrated active power display | exit the last operation until you exit the setup menu | |

## 4.4 26 English letters display method on LED:
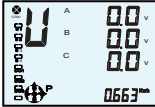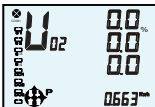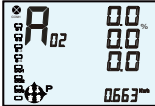
Because this instrument uses a pen-type liquid crystal, it may not be intuitive when displaying characters. Therefore, when reading ambiguity occurs, please check according to the following form. The characters that appear in the instrument have been mapped to the following form.

| English letter | A | B | C | D | E | F | G | H | I | J | K | L | M |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| display method | R | b | C | d | E | F | G | H | ı | J | Ƴ | L | ⁻n |
| English letter | N | O | P | Q | R | S | T | U | V | W | X | Y | Z |
| display method | n | o | P | q | r | S | ƭ | U | ˙˙ | ᵤ | ⁻ᵤ | y | ⁼ |

## 4.5 Measurement display page description

① Press "SET" key to switch display categories, namely, instantaneous electrical parameters → voltage subharmonic → current subharmonic → complex rate → instantaneous electrical parameters；

② In a certain display class, the display is displayed by pressing the "《" and "》" keys；

③ In the instantaneous electrical parameters, voltage sub-harmonics, and current sub-harmonics, the energy can be viewed through the "⌄" and "⌃" keys, which are:
integrated active energy → positive active energy → negative active energy → integrated reactive energy → positive reactive energy → negative reactive energy → first quadrant reactive energy → second quadranteactive energy → third quadrant reactive energy → fourth quadrant reactive energy

## Measurement display page list

| Display category | Display content | |
|---|---|---|
| Instantaneous electrical parameters | Screen 1 | 3 phase voltage（press"ESC" key to display 3 phase wire voltage) |
| | Screen 2 | 3 phase current |
| | Screen 3 | 3 phase active power |
| | Screen 4 | 3 phase reactive power |
| | Screen 5 | 3 phase apparent power |
| | Screen 6 | 3 phase power factor |
| | Screen 7 | Combined power and power factor |
| | Screen 8 | system frequency |
| | Screen 9 | Current demand |
| | Screen 10 | Maximum demand |
| | Screen 11 | Voltage imbalance |
| | Screen 12 | Current imbalance |
| | Screen 13 | maximum voltage |
| | Screen 14 | maximum current |
| | Screen 15 | total harmonic content of voltage |
| | Screen 16 | total harmonic content of current |
| | Screen 17 | 0 phase current |
| Voltage Harmonics | Screen 1 | 3 phase voltage 2nd harmonic content |
| | ⋮ | ⋮ |
| | Screen 30 | 3 phase voltage 31th harmonic content |
| Current Harmonics | Screen 1 | 3 phase current 2nd harmonic content |
| | ⋮ | ⋮ |
| | Screen 30 | 3 phase current 31th harmonic content |
| Multi-rate electricity | Screen 1 | date |
| | Screen 2 | time |
| | Screen 3 | monthly sharp energy |
| | Screen 4 | monthly peak energy |
| | Screen 5 | monthly flat energy |
| | Screen 6 | monthly valley energy |
| | ⋮ | ⋮ |
| | Screen 13 | flat energy last two month |
| | Screen 14 | valley energy last two month |

## 4.6 Menu Operation Illustration

Under user menu status

1. Press " SET " key more than 3 second, if the user password is set, it will pop up the password input box, input the correct password to enter the user' menu to modify the patameter.
2. If the current display is the first class, press confirm key " SET ", to enter next class display, click " ≪ "、" ≫ " key to change the menu item 。
3. If the current display is second or third class , press " ESC " key to return to previous class display
4. If the current display is third class，press " ≫ "、" ≪ " key to flash digit, press key " ≪ "、" ≫ " to shift place，Keep pressing " ≫ "、" ≪ " to change value; press confirm key " SET " to keep the value; If press the " ESC " key, it does not save the set value and return to second class.
5. After modifying the parameters, press " ESC ",to exit user menu, return to measuring status.

## Menu Structure and Function Description

| 1st Level | 2nd Level | | 3rd Level | Description |
|---|---|---|---|---|
| System Setting `SEt` | Clear Energy | `CLrE` | `0000` | Input "1111"to clear energy;Input "2222"to clear maximum demand; Input "3333" to clear event; Input"4444"to clear the maximum of voltage, current; input "1234" to reset to factory setting |
| | User password | `USEr` | `0000` | Setting user password |
| | Backlight time | `bLt` | `0000` | Backlight delay time , unit is second . If set as 0 , mean keep on lighting all the time. |
| | Software version | `UEr` | `1.1` | Software version |
| Signal Input `InP` | Network | `LIn` | `3-3/ 3-4` | Select the input network of the measured signal |
| | Volt transform | `Pt1` | `0.1-999.9` | Primary coil voltage , unit kV |
| | Volt transform | `Pt2` | `10.0-999.9` | Secondary coil voltage , unit V |
| | Current transform | `Ct1` | `1-999.9` | Primary coil current , unit A |
| | Current transform | `Ct2` | `1.0-999.9` | Secondary coil current ,unit A |
| Communication Parameter `Con` | Address | `Add` | `1-247` | Meter Address Range |
| | Baud Rate | `bAd` | `1k2/2k4/ 4k8/ 9k6` | Baud Rate:1k2 means 1200,2k4 means 2400,4k8means 4800,9k6 means 9600,19k means19200 |
| | Data order | `dtF` | `HL / LH` | Data sequence: high word first or low word first |
| | Checking Bit | `Prty` | `no/EUEn/odd` | No check/even check/odd check |
| | Protocol Selection | `Cmod` | `modb/ d645` | MODB: select MODBUS-RTU protocol    D645:select DLT645 protocol |
| | ADD 1 | `Id1` | `0-99` | DLT645 address 1, two decimal number display |
| | ADD 2 | `Id2` | `0-99` | DLT645 address 2, two decimal number display |
| | ADD 3 | `Id3` | `0-99` | DLT645 address 3, two decimal number display |
| | ADD 4 | `Id4` | `0-99` | DLT645 address 4, two decimal number display |
| | ADD 5 | `Id5` | `0-99` | DLT645 address 5, two decimal number display |
| | ADD 6 | `Id6` | `0-99` | DLT645 address 6, two decimal number display |

Continued from the front chart

| | | | | |
|---|---|---|---|---|
| Switch Settings `AL` | Alarm mode | `Ad1` | `1-68` | When character " do " is remote control mode, otherwise it is alarm mode reference "4.9 alarm, transmission parameter comparison chart" |
| | Alarm Unit | `Ut1` | `1/K/M` | 1: means international standard unit, K: means 1000 times of international standard unit, M: means1000000 times of international standard unit. |
| | Alarm Action Value | `AL1` | `0-999.9` | 1st alarm value setting, consistent with the basic display unit |
| | Alarm hysteresis value | `HY1` | `0-999.9` | 1st alarm hysteresis value setting, consistent with the basic display unit |
| | Alarm relay setting | `oUt1` | `rLY1/rLY2` | 1st alarm relay output setting |
| | Alarm start delay | `dLA1` | `0-99` | alarm start delay time , unit : second |
| | Alarm finish delay | `dLb1` | `0-99` | alarm finish delay time , unit : second |
| | 2nd loop alarm parameter setting way refers to the 1st loop alarm | | | |
| Analog output `br` | Transmit mode selection | `brM` | `0-32` | Refer to "4.9 alarm, transimission parameter comparison chart" |
| | Transmit unit | `Utr` | `1/K/M` | 1: means international standard unit, K: means 1000 times of international standard unit, M: means1000000 times of international standard unit. |
| | Transmit high limit | `brH` | `0-999.9` | Transmit output 20mA |
| | Transmit low limit | `brL` | `0-999.9` | Transmit output 4mA |
| Time setting `tiME` | Year | `YEAr` | `0-99` | Year |
| | Month | `Mon` | `1-12` | Month |
| | Day | `dAY` | `1-31` | Day |
| | Hour | `HoUr` | `0-23` | Hour |
| | Minute | `Min` | `0-59` | Minute |
| | Second | `SEC` | `0-59` | Second |
| Multi-rate setting `FFL` | Period 1 rates | `FL1` | `0-3` | Period 1 rates, 0,1,2,3 stands sharp, peak, flat, valley |
| | Period 2 rates | `FL2` | `0-3` | Period 2 rates, 0,1,2,3 stands sharp, peak, flat, valley |
| | ⋮ | ⋮ | ⋮ | ⋮ |
| | Period 12 rates | `FL12` | `0-3` | Period 12 rates, 0,1,2,3 stands sharp, peak, flat, valley |
| | Period 1 Start time | `Ft1` | `0000-2345` | Period 1 Start Time |
| | Period 2 Start time | `Ft2` | `0000-2345` | Period 2 Start Time |
| | ⋮ | ⋮ | ⋮ | ⋮ |
| | Period 12 Start time | `Ft12` | `0000-2345` | Period 12 Start Time |

## 4.7 Menu modification example

① Setting the current ratio method

measure state

```
0000
0000
0000
```

(SET)>5s → 1st level

**SEt** — system setting

《 》

**InP** — sin

(SET) → 2nd level

**InP LIn**

《 》

**InP Pt1**

《 》

**InP Pt2**

《 》

**InP Ct1**

(SET) → 3rd level

**InP Ct1 0001**

(☆)(☆) → modified state

**InP Ct1 0002** — Primary current setting （Unit:A）

《 》

**InP Ct2**

(SET) → **InP Ct2 0001**

(☆)(☆) → **InP Ct2 0002** — Secondary current setting （unit:A）
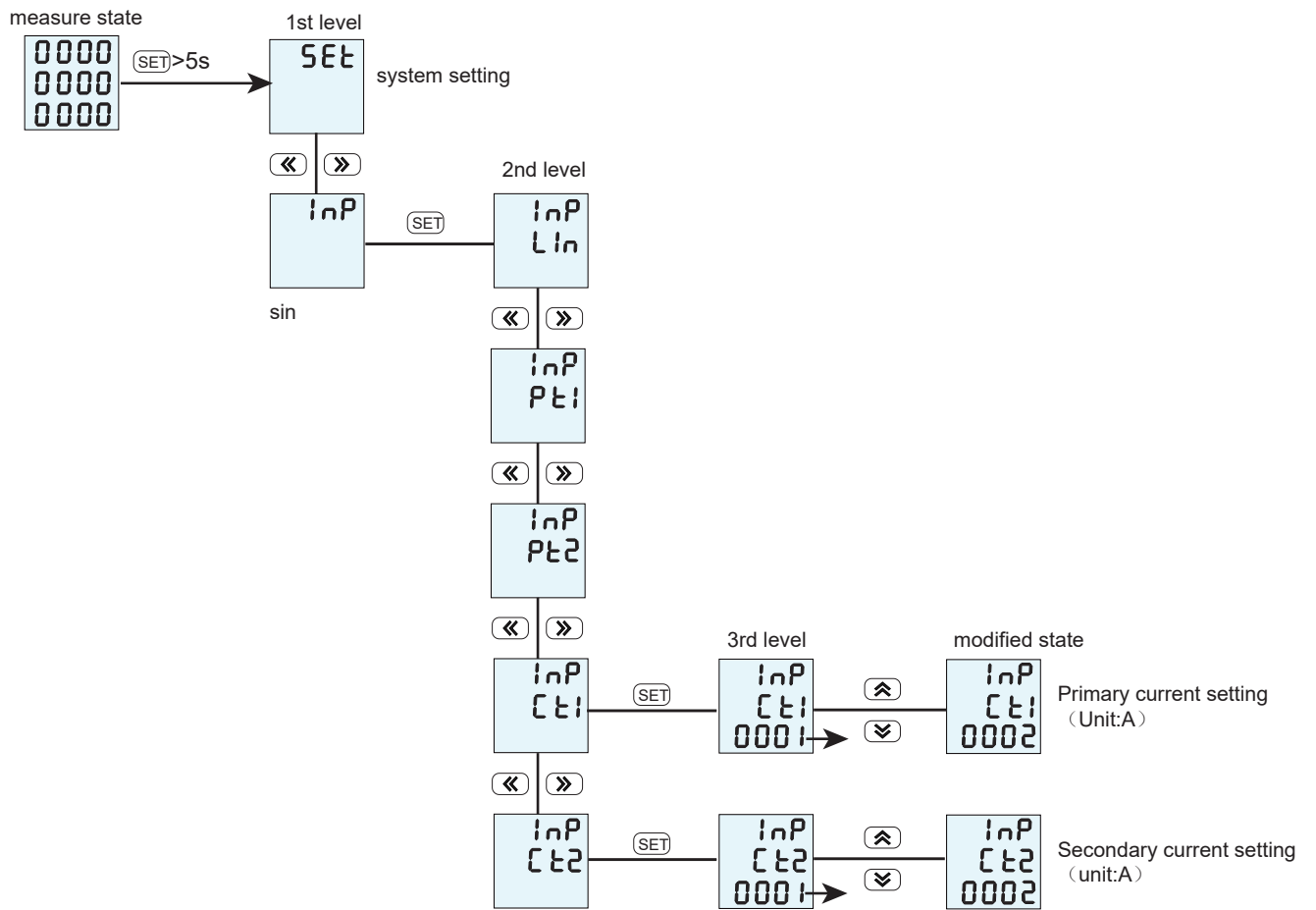
② Setting the communication address method

measure state

```
0000
0000
0000
```

(SET)>5s → 1st level

**SEt** — system setting

《 》

**InP** — signal setting

《 》

**Con** — communication setting

(SET) → 2nd setting

**Con Add1**

(SET) → 3rd setting

**Con Add1 0001**

(☆)(☆) → modified state

**Con Add1 0002** — Instrument address setting

《 》

**Con bAd1**

《 》

**Con dtF**
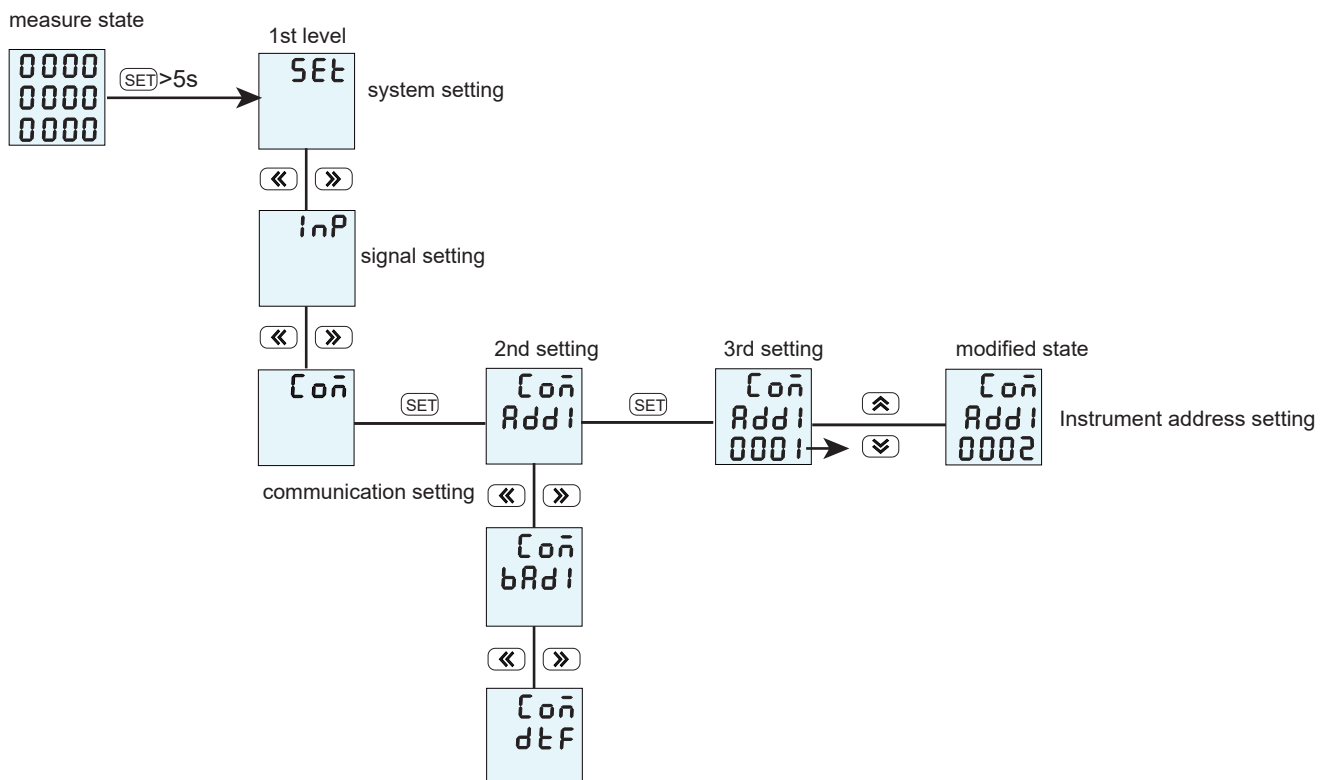
## 4.8 Multi-rate setting instructions

① The 0, 1, 2, and 3 in the rate menu correspond to Sharp, Peak, Flat, and Valley rates, respectively. Customers can choose to use Two or more of these rates;

② The rate corresponds to the start time of the rate in that period. Similarly, customers can use only 2 or more of these hours.

For example：The sharp, peak, flat, valley time set by Shenzhen Power Supply Bureau are as follows

Peak hours：09:00-11:30、14:00-16:30、19:00-21:00（total 7 hours）；

Flat hours：07:00-09:00、11:30-14:00、16:30-19:00、21:00-23:00（total 9 hours）；

Valley hours：23:00- next time 07:00（total 8 hours）

The meter settings are as follows：

| Rate menu | Setting value | Remark | Time menu | Setting value | Remark | Corresponding communication value(note) |
|---|---|---|---|---|---|---|
| FL1 | 2 | Flat | FT1 | 07.00 | 07:00 | 28 |
| FL2 | 1 | Peak | FT2 | 09.00 | 09:00 | 36 |
| FL3 | 2 | Flat | FT3 | 11.30 | 11:30 | 46 |
| FL4 | 1 | Peak | FT4 | 14.00 | 14:00 | 56 |
| FL5 | 2 | Flat | FT5 | 16.30 | 16:30 | 66 |
| FL6 | 1 | Peak | FT6 | 19.00 | 19:00 | 76 |
| FL7 | 2 | Flat | FT7 | 21.00 | 21:00 | 84 |
| FL8 | 3 | Valley | FT8 | 23.00 | 23:00 | 92 |
| FL9 | 3 | Valley | FT9 | 23.00 | 23:00 | 92 |
| FL10 | 3 | Valley | FT10 | 23.00 | 23:00 | 92 |
| FL11 | 3 | Valley | FT11 | 23.00 | 23:00 | 92 |
| FL12 | 3 | Valley | FT12 | 23.00 | 23:00 | 92 |

Note: For correspondence, the corresponding multi-rate period is divided into 96 segments by 15 minutes per day for 24 hours a day, from 0-95,0 to 00:00 for a 24-hour system, and 95 to 24:45 for a 24-hour system, corresponding to the time It is the start time of the rate energy during this period.

| Multiple rate schedule correspondence form | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| hour | ：minute | period | hour | ：minute | period | hour | ：minute | period | hour | ：minute | period | hour | ：minute | period | hour | ：minute | period |
| 0 | ：0 | 0 | 4 | ：0 | 16 | 8 | ：0 | 32 | 12 | ：0 | 48 | 16 | ：0 | 64 | 20 | ：0 | 80 |
| 0 | ：15 | 1 | 4 | ：15 | 17 | 8 | ：15 | 33 | 12 | ：15 | 49 | 16 | ：15 | 65 | 20 | ：15 | 81 |
| 0 | ：30 | 2 | 4 | ：30 | 18 | 8 | ：30 | 34 | 12 | ：30 | 50 | 16 | ：30 | 66 | 20 | ：30 | 82 |
| 0 | ：45 | 3 | 4 | ：45 | 19 | 8 | ：45 | 35 | 12 | ：45 | 51 | 6 | ：45 | 67 | 20 | ：45 | 83 |
| 1 | ：0 | 4 | 5 | ：0 | 20 | 9 | ：0 | 36 | 13 | ：0 | 52 | 17 | ：0 | 68 | 21 | ：0 | 84 |
| 1 | ：15 | 5 | 5 | ：15 | 21 | 9 | ：15 | 37 | 13 | ：15 | 53 | 17 | ：15 | 69 | 21 | ：15 | 85 |
| 1 | ：30 | 6 | 5 | ：30 | 22 | 9 | ：30 | 38 | 13 | ：30 | 54 | 17 | ：30 | 70 | 21 | ：30 | 86 |
| 1 | ：45 | 7 | 5 | ：45 | 23 | 9 | ：45 | 39 | 13 | ：45 | 55 | 17 | ：45 | 71 | 21 | ：45 | 87 |
| 2 | ：0 | 8 | 6 | ：0 | 24 | 10 | ：0 | 40 | 14 | ：0 | 56 | 18 | ：0 | 72 | 22 | ：0 | 88 |
| 2 | ：15 | 9 | 6 | ：15 | 25 | 10 | ：15 | 41 | 14 | ：15 | 57 | 18 | ：15 | 73 | 22 | ：15 | 89 |
| 2 | ：30 | 10 | 6 | ：30 | 26 | 10 | ：30 | 42 | 14 | ：30 | 58 | 18 | ：30 | 74 | 22 | ：30 | 90 |
| 2 | ：45 | 11 | 6 | ：45 | 27 | 10 | ：45 | 43 | 14 | ：45 | 59 | 18 | ：45 | 75 | 22 | ：45 | 91 |
| 3 | ：0 | 12 | 7 | ：0 | 28 | 11 | ：0 | 44 | 15 | ：0 | 60 | 19 | ：0 | 76 | 23 | ：0 | 92 |
| 3 | ：15 | 13 | 7 | ：15 | 29 | 11 | ：15 | 45 | 15 | ：15 | 61 | 19 | ：15 | 77 | 23 | ：15 | 93 |
| 3 | ：30 | 14 | 7 | ：30 | 30 | 11 | ：30 | 46 | 15 | ：30 | 62 | 19 | ：30 | 78 | 23 | ：30 | 94 |
| 3 | ：45 | 15 | 7 | ：45 | 31 | 11 | ：45 | 47 | 15 | ：45 | 63 | 19 | ：45 | 79 | 23 | ：45 | 95 |

## 4.9 Alarm output and transmission output parameter

| Parameter | Switch output (low alarm) code | | Switch output (high alarm) code | | transmission output（4-20mA）code | |
|---|---|---|---|---|---|---|
| Ua(A phase voltage) | 1 | （UaL） | 2 | （UaH） | 1 | （Ua） |
| Ub(B phase voltage) | 3 | （UbL） | 4 | （UbH） | 2 | （Ub） |
| Uc(C phase voltage) | 5 | （UcL） | 6 | （UcH） | 3 | （Uc） |
| U( phase voltage of A, B or C) | 7 | （UL） | 8 | （UH） | 4 | （no） |
| Uab(AB wire voltage) | 9 | （UabL） | 10 | （UabH） | 5 | （Uab） |
| Ubc(BC wire voltage) | 11 | （UbcL） | 12 | （UbcH） | 6 | （Ubc） |
| Uca(CA wire voltage) | 13 | （UcaL） | 14 | （UcaH） | 7 | （Uca） |
| UL(wire voltage of AB、BC、CA ) | 15 | （ULL） | 16 | （ULH） | 8 | （no） |
| Ia(A wire current) | 17 | （IaL） | 18 | （IaH） | 9 | （Ia） |
| Ib(B wire current) | 19 | （IbL） | 20 | （IbH） | 10 | （Ib） |
| Ic(C wire current) | 21 | （IcL） | 22 | （IcH） | 11 | （Ic） |
| I(phase current of A、B、C) | 23 | （IL） | 24 | （IH） | 12 | （no） |
| Pa(A phase active power) | 25 | （PaL） | 26 | （PaH） | 13 | （Pa） |
| Pb(B phase active power) | 27 | （PbL） | 28 | （PbH） | 14 | （Pb） |
| Pc(C phase active power) | 29 | （PcL） | 30 | （PcH） | 15 | （Pc） |
| P(total active power) | 31 | （PL） | 32 | （PH） | 16 | （Ps） |
| Qa(A phase reactive power) | 33 | （QaL） | 34 | （QaH） | 17 | （Qa） |
| Qb(B phase reactive power) | 35 | （QbL） | 36 | （QbH） | 18 | （Qb） |
| Qc(C phase reactive power) | 37 | （QcL） | 38 | （QcH） | 19 | （Qc） |
| Q(total reactive power) | 39 | （QL） | 40 | （QH） | 20 | （Qs） |
| Sa(A phase apparent power) | 41 | （SaL） | 42 | （SaH） | 21 | （Sa） |
| Sb(B phase apparent power) | 43 | （SbL） | 44 | （SbH） | 22 | （Sb） |
| Sc(C phase apparent power) | 45 | （ScL） | 46 | （ScH） | 23 | （Sc） |
| S( total apparent power) | 47 | （SL） | 48 | （SH） | 24 | （Ss） |
| PFa(A phase power factor) | 49 | （PFaL） | 50 | （PFaH） | 25 | （PFa） |
| PFb(B phase power factor) | 51 | （PFbL） | 52 | （PFbH） | 26 | （PFb） |
| PFc(C phase power factor) | 53 | （PFcL） | 54 | （PFcH） | 27 | （PFc） |
| PF(total power factor) | 55 | （PFL） | 56 | （PFH） | 28 | （PFs） |
| F frequency | 57 | （FL） | 58 | （FH） | 29 | （F） |
| EP（total active power） | 59 | （EPL） | 60 | （EPH） | 30 | （EP） |
| EQ（total reactive power） | 61 | （EQL） | 62 | （EQH） | 31 | （EQ） |
| 0 wire current | 63 | （InL） | 64 | （InH） | 32 | （In） |
| unbalance | 65 | （UNNB） | 66 | （ULNB） | 0 | （no） |
| unbalance | 67 | （INNB） | 68 | （PNNB） | | |

# V. Simple Troubleshooting

| Problem | Reason | Solution |
|---|---|---|
| No display after adding control power | Power failed to join the device | Check whether the correct operating voltage is added to the L/+ and N/- terminals of the device<br>Check if control power fuse is burned |
| The measurement value is incorrect or does not meet expectations | Incorrect voltage measurement | Check if the neutral connection is reliable<br>Check whether the measured voltage matches the rated parameter of the equipment<br>Check if the PT ratio parameter setting is correct |
| | Incorrect current measurement | Check whether the measured current matches the rated parameter of the device<br>Check CT ratio parameter setting is correct |
| | Incorrect power measurement | Check the measurement mode setting is correct<br>Check the voltage and current phase sequence is correct<br>Check the current name is wrong |
| Switch status does not change | Switching voltage | Check whether the external node type matches the device's rated parameters<br>Check the external wiring is correct |
| Relay does not operate | No control command received | Check the communication link is correct |
| | Incorrect relay operation mode | Check current relay is in correct mode |
| The upper end cannot communicate with the device | Device communication address is incorrect | Check whether the device address is consistent with the definition |
| | Device communication rate is incorrect | Check whether the device communication rate is consistent with the definition |
| | Communication link is not connected to terminating resistor | Check whether the 120 ohm resistor is added |
| | Communication link is disturbed | Check that the communication shield is well grounded |
| | Communication line interruption | Check the communication cable is disconnected |

# VI.Event record description

Event recording is currently an optional feature and can only be read through communications. The specific instructions are as follows:

6.1 Event Types

Including the followed 10 types：

| No. | Correspondence data | Event Desciption |
|---|---|---|
| 1 | 1 | Power on the meter |
| 2 | 2 | modified parameter |
| 3 | 3 | Clear Energy |
| 4 | 4 | Clear Demand |
| 5 | 5 | Clear Event |
| 6 | 6 | Clear maximum |
| 7 | 7 | 1st alarm action |
| 8 | 8 | 1st alarm end |
| 9 | 9 | 2nd alarm action |
| 10 | 10 | 2nd alarm end |

6.2 Event Record Format

| Event Type | Event Occurred Time | | | | | |
|---|---|---|---|---|---|---|
| 1-10 | Year | Month | Day | Hour | Minute | Second |

A total of 32 groups of events were included, both of which included event types and times. The event record uses a sequential recording method: the first record is always the most latest event and extends back to a total of 32 records. Records older than the latest 32 records will be discarded.

6.3 Reading of event records

| ADD | Order | Data ADD | | Data length | | CRC | |
|---|---|---|---|---|---|---|---|
| XX | 03 | 45 | XX | 00 | 07 | XX | XX |

Eg, To read the latest first record, the data is as follows：

"01 03 45 00 00 07 13 EC"

Answers are as follows：

"01 03 0E 00 01 00 0E 00 09 00 12 00 11 00 07 00 21 0C F7"

Indicates that the event is a modified parameter. The moment of occurrence is2014-9-18 17:07:33

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# VII. Communication Protocol Description

## 7.1 MODBUS-RTU protocol

7.1.1 Meter meets MODBUS-RTU communication protocol,adopts RS485 half-duplex communication to check 16-bit CRC. The meter does not return the check error.

① All RS485 loop communication should follow master and slave mode.In this way, information and data are transferred between a single master station and up to 32 slave stations (monitoring devices);

② The master station will initialize and control all the information transmitted on the RS485 communication loop;

③ In any case, communication cannot be started from a slave station

④ Communication on all RS485 loops takes place in a "packaged" manner. A data packet is a communication frame. A packet can contain up to 128 bytes.

⑤ The master station sends called request and the slave sends called response.；

⑥ In any case, the slave can only respond to one request from the master station;

### 7.1.2 Data Format

| Start Bit | Data Bit | Checking Bit | Stop Bit |
|---|---|---|---|
| 1 | 8 | None, Even, Odd checking(Programmable) | 1 |

### 7.1.3 Communication frame format

| Frame Content | Bytes | Instructions | |
|---|---|---|---|
| Slave Station Add | 1 | Valid slave address range is 1-247 | |
| Function Code | 1 | 0X03 | Read one or more current register values |
| | | 0X06 | Writes the specified value to an internal register |
| | | 0X10 | Writes the specified value to multiple internal registers |
| Data Add | 2 | The location where the data area is stored when the slave executes a valid command. Different variables occupy different number of registers, some address variables occupy two registers, 4 bytes of data, some variables occupy a register, 2 bytes of data, please use according to the actual situation | |
| Data length | 2 | The length of data that needs to be read or written | |
| Data | Variable | Slave station returns data or master data to be written | |
| CRC Check Code | 2 | The MODBUS-RTU mode uses 16-bit CRC. The sending device shall calculate CRC16 on each data in the parcel, and the final result shall be stored in the test domain. The receiving device shall also calculate CRC16 on each data (other than the check field) in the parcel and compare the result field check fields. Only the same package can be accepted. | |

### 7.1.4 Communication exception handling

If the master sends an illegal packet or if the master requests an invalid data register, an abnormal data response will be generated. This abnormal data response consists of the slave address, function code, fault code, and check field. When the high-order bit position of the function code domain is 1, it indicates that the data frame at this time is an abnormal response.

According to MODBUS communication requirements, abnormal response function code = request function code + 0x80; when abnormal response occurs, the highest position of function number is 1. For example, if the host request function number is 0x04, the function number returned from the slave corresponds to 0x84.

The following chart shows the meaning of exception error codes:

| error code | Name | Description |
|---|---|---|
| 0X01 | Function code error | The meter received an unsupported function number |
| 0X02 | Variable address error | The host specified data location is over the range of the meter or an illegal register operation has been received |
| 0X03 | The limit of the data value | The data value sent by the host exceeds the data range corresponding to the instrument or the data structure is incomplete |
| 0X04 | Incorrect or out of frame length | The function code and the communication frame length are inconsistent or request exceeds the limit |

### 7.1.5 Communication frame delay

There should be an appropriate delay between the requests from the master station for the two frames. When the baud rate is 9600. In order to ensure a correct response, it is recommended that a 300mS delay be reserved between the two frames. When the baud rate decreases, the communication delay should increase appropriately.

## 7.2 Communication frame format description

### 7.2.1 Function Code "03": Read multiple register input

Eg: The host reads the UA (A phase voltage), and it is measured that the A phase voltage is 220.0V. The UA's address code is 0x4000 because UA is a fixed-point number (4 bytes) and occupies 2 data registers. The corresponding hexadecimal data of 220.0V is: 0x0000898 (2200)。

Host sent message format: (default high word first)

| Hosting Sending | Bytes | Information Send | Remark |
|---|---|---|---|
| Slave address | 1 | 01 | Send to slave at address 01 |
| Function Code | 1 | 03 | Read register |
| Start Add | 2 | 0x4000 | Start Add |
| Data Length | 2 | 0x0002 | Read 2 registers (4 bytes in total) |
| CRC Code | 2 | 0xD1CB | The host calculates the CRC code |

Return message format from slave response:

| Slave response | Bytes | Returned information | Remark |
|---|---|---|---|
| Slave address | 1 | 01 | From slave 01 |
| Function code | 1 | 03 | Read register |
| Reading | 1 | 04 | 2 registers total 4 bytes |
| Register data | 1 | 0x00 | High byte of contents at address 0x4000 memory |
| | 1 | 0x00 | High byte of contents at address 0x4000 memory |
| | 1 | 0x08 | Low byte of contents at address 0x4000 memory |
| | 1 | 0x98 | Low byte of contents at address 0x4000 memory |
| CRC code | 2 | 0xFC59 | The CRC code calculated by the host |

7.2.2 function code "06": writing ingle register

eg:Host writes fixed-point number 1st alarm mode AD1. Assume that the address code of AD1 is 0x4900 because AD1 is a fixed-point number and occupies 1 data register, and decimal 11 corresponds to 0x000B.

Packet format sent by the host:

| Host sending | Bytes | Send Message | Example |
|---|---|---|---|
| Slave address | 1 | 01 | Sending to slave 01 |
| Function code | 1 | 06 | Writing single register |
| Initial address | 1 | 0x49 | The high byte of the adrress of the register to be written |
| Write data | 1 | 0x00 | The low byte of the adrress of the register to be written |
| | 1 | 0x00 | High byte of data |
| | 1 | 0x0B | Low byte of data |
| CRC code | 2 | 0xDE51 | The CRC code calculated by the host |

Return message format from slave response:

| Host sending | Bytes | Send Message | Example |
|---|---|---|---|
| Slave address | 1 | 01 | Sending to slave 01 |
| Function code | 1 | 06 | Writing multiple register |
| Initial address | 1 | 0x49 | The high byte of the starting adrress of the register to be written |
| | 1 | 0x00 | The low byte of the starting adrress of the register to be written |
| Write data | 1 | 0x00 | High byte of data |
| | 1 | 0x0B | Low byte of data |
| CRC code | 2 | 0xDE51 | The CRC code calculated by the host |

7.2.3 function code "10": write multiple register

eg: Host writes fixed-point number 1st alarm mode AD1. Assume that the address code of AD1 is 0x4900 because AD1 is a fixed-point number and occupies 1 data register, and decimal 11 corresponds to 0x000B.

Packet format sent by the host:

| Host sending | Bytes | Send Message | Example |
|---|---|---|---|
| Slave address | 1 | 01 | Sending to slave 01 |
| Function code | 1 | 10 | Writing multiple register |
| Initial address | 1 | 0x49 | The high byte of the starting adrress of the register to be written |
| | 1 | 0x00 | The low byte of the starting adrress of the register to be written |
| Data word length to be written | 1 | 0x00 | The word length of the write data is high byte |
| | 1 | 0x01 | The word length of the write data is low byte |
| To write data bytes long | 1 | 0x02 | The byte length of data (1 byte in total) |
| Write data | 1 | 0x00 | High byte of data |
| | 1 | 0x0B | Low byte of data |
| CRC Code | 2 | 0x3F53 | The CRC code calculated by the host |

The format of the message returned from the slave response correctly

| Slave response | Bytes | Send Message | Example |
|---|---|---|---|
| Slave address | 1 | 01 | From slave 01 |
| Function code | 1 | 10 | Writing multiple register |
| Initial address | 2 | 0x4900 | Starting address is 0000 |
| Save data word length | 2 | 0x0002 | Save 2 words of data |
| CRC Code | 2 | 0x1795 | The CRC code calculated by the host |

### 7.2.4 CRC code calculation method

① Preset a 16-bit register to hexadecimal FFFF (that is all 1); call this register CRC register；

② Compare the first 8-bit binary data (the first byte of the communication message frame) with the lower 8 bits of the 16-bit CRC register and place the result in the CRC register.

③ Move the contents of the CRC register one bit to the right (towards the lower bit) to fill in the highest bit with 0 and check the shifted-out bit after the right shift;

④ If the shift-out bit is 0: repeat step 3 (right shift one bit again); if the shift-out bit is 1: CRC register and polynomial A001 (1010 0000 0000 0001) XOR;

⑤ Repeat steps 3 and 4 until right shift 8 times so that the entire 8-bit data is all processed；

⑥ Repeat Step 2 to Step 5 to process the next byte of the communication message frame.

⑦ After all the bytes of the communication information frame are calculated according to the above steps, the high and low bytes of the obtained 16-bit CRC register are exchanged；

⑧ The final CRC register content is: CRC code.

Attched：CRC calculation C language source code

```
unsigned int GET_CRC(unsigned char * buf,unsigned charnum)
{
        unsigned  chari,j;
        unsigned int     WCRC  =        0xffff;
        for(i=0;i<num;i++)
        {
                WCRC        ^=      (unsigned int)(buf[i]);      //      Cyclic redundancy check
                for(j=0;j<8;j++)
                {
                        if(WCRC&1)
                        {
                                WCRC          >>=    1;
                                WCRC          ^=     0XA001;
                        }
                        else
                        WCRC          >>=    1;
                }
        }
        return(WCRC);                                          //      Get CRC check code
}
```

## 7.3 Power meter communication address mapping

| | | Instantaneous electrical parameter communication address | | | | |
|---|---|---|---|---|---|---|
| 1 | 0x4000 | Phase voltage A | 2 | long | R | 0.1V |
| 2 | 0x4002 | Phase voltage B | 2 | long | R | |
| 3 | 0x4004 | Phase voltage C | 2 | long | R | |
| 4 | 0x4006 | Wire voltage AB | 2 | long | R | |
| 5 | 0x4008 | Wire voltage BC | 2 | long | R | |
| 6 | 0x400a | Wire voltage CA | 2 | long | R | |
| 7 | 0x400c | Phase current A | 2 | long | R | 0.001A |
| 8 | 0x400e | Phase current B | 2 | long | R | |
| 9 | 0x4010 | Phase current C | 2 | long | R | |
| 10 | 0x4012 | Active power A | 2 | long | R | 0.1W |
| 11 | 0x4014 | Active power B | 2 | long | R | |
| 12 | 0x4016 | Active power C | 2 | long | R | |
| 13 | 0x4018 | Total active power | 2 | long | R | |
| 14 | 0x401a | Reactive power A | 2 | long | R | 0.1var |
| 15 | 0x401c | Reactive power B | 2 | long | R | |
| 16 | 0x401e | Reactive power C | 2 | long | R | |
| 17 | 0x4020 | Total reactive power | 2 | long | R | |
| 18 | 0x4022 | Apparent power A | 2 | long | R | 0.1VA |
| 19 | 0x4024 | Apparent power B | 2 | long | R | |
| 20 | 0x4026 | Apparent power C | 2 | long | R | |
| 21 | 0x4028 | Total apparent power | 2 | long | R | |
| 22 | 0x402a | Power factor A | 2 | long | R | 0.001 |
| 23 | 0x402c | Power factor B | 2 | long | R | |
| 24 | 0x402e | Power factor C | 2 | long | R | |
| 25 | 0x4030 | Total power factor | 2 | long | R | |
| 26 | 0x4032 | Frequency | 2 | long | R | 0.01Hz |
| 27 | 0x4034 | Active power | 2 | long | R | 0.001kWh |

| 28 | 0x4036 | Reactive power | 2 | long | R | 0.001kvarh |
|---|---|---|---|---|---|---|
| 29 | 0x4038 | Positive active power | 2 | long | R | 0.001kWh |
| 30 | 0x403a | Negative active power | 2 | long | R | |
| 31 | 0x403c | Positive reactive power | 2 | long | R | 0.001kvarh |
| 32 | 0x403e | Negative reactive power | 2 | long | R | |
| 33 | 0x4046 | Current active power demand | 2 | long | R | 0.1W |
| 34 | 0x4048 | Maximum active power demand | 2 | long | R | |
| 35 | 0x404a | Current reactive power demand | 2 | long | R | 0.1kvar |
| 36 | 0x404c | Maximum reactive power demand | 2 | long | R | |
| 37 | 0x4052 | A phase voltage total harmonic content | 2 | long | R | 0.1% |
| 38 | 0x4054 | B phase voltage total harmonic content | 2 | long | R | |
| 39 | 0x4056 | C phase voltage total harmonic content | 2 | long | R | |
| 40 | 0x4058 | A phase current total harmonic content | 2 | long | R | |
| 41 | 0x405a | B phase current total harmonic content | 2 | long | R | |
| 42 | 0x405c | C phase current total harmonic content | 2 | long | R | |
| 43 | 0x405e | 0 phase current | 2 | long | R | 0.001A |
| 44 | 0x4060 | Phase voltage maximum | 2 | long | R | 0.1V |
| 45 | 0x4062 | Wires voltage maximum | 2 | long | R | |
| 46 | 0x4064 | Current maximum | 2 | long | R | 0.001A |
| 47 | 0x4066 | Voltage imbalance | 2 | long | R | 0.1% |
| 48 | 0x4068 | Current imbalance | 2 | long | R | |
| 49 | 0x406a | A, B phase voltage angle | 2 | long | R | 1° |
| 50 | 0x406c | B, C phase voltage angle | 2 | long | R | |
| 51 | 0x406e | C, A phase voltage angle | 2 | long | R | |
| 52 | 0x4070 | First quadrant reactive energy | 2 | long | R | 0.001kvarh |
| 53 | 0x4072 | Second quadrant reactive energy | 2 | long | R | |
| 54 | 0x4074 | Third quadrant reactive energy | 2 | long | R | |
| 55 | 0x4076 | Fourth quadrant reactive power | 2 | long | R | |
| Multi-rate energy communication address | | | | | | |
| 1 | 0x4100 | Total cumulative total active energy | 2 | long | R | 0.001kWh |
| 2 | 0x4102 | Total cumulative sharp active energy | 2 | long | R | |
| 3 | 0x4104 | Total cumulative peak active energy | 2 | long | R | |
| 4 | 0x4106 | Total cumulative flat active energy | 2 | long | R | |
| 5 | 0x4108 | Total cumulative valley active energy | 2 | long | R | |
| 6 | 0x410a | Cumulative total active energy this month | 2 | long | R | |
| 7 | 0x410c | Cumulative total sharp active energy this month | 2 | long | R | |
| 8 | 0x410e | Cumulative total peak actenergy this month | 2 | long | R | |
| 9 | 0x4110 | Cumulative total flat actenergy this month | 2 | long | R | |
| 10 | 0x4112 | Cumulative total valley actenergy this month | 2 | long | R | |
| 11 | 0x4114 | Cumulative total active energy last month | 2 | long | R | |
| 12 | 0x4116 | Cumulative total sharp active energy last month | 2 | long | R | |
| 13 | 0x4118 | Cumulative total peak active energy last month | 2 | long | R | |
| 14 | 0x411a | Cumulative total flat active energy last month | 2 | long | R | |
| 15 | 0x411c | Cumulative total valley active energy last month | 2 | long | R | |
| 16 | 0x411e | Cumulative total active energy last two months | 2 | long | R | |
| 17 | 0x4120 | Cumulative total sharp active energy last two months | 2 | long | R | |
| 18 | 0x4122 | Cumulative total peak active energy last two months | 2 | long | R | |
| 19 | 0x4124 | Cumulative total flat active energy last two months | 2 | long | R | |
| 20 | 0x4126 | Cumulative total valley active energy last two months | 2 | long | R | |

| | | Fractional harmonic communication address | | | | |
|---|---|---|---|---|---|---|
| 1 | 0x4200 | A phase voltage 0th harmonic | 1 | Int | R | 0.01% |
| 2 | 0x4220 | A phase current 0th harmonic | 1 | Int | R | |
| | | Reserved Expansion | | | | |
| 1 | 0x4300 | B phase voltage 0th harmonic | 1 | Int | R | 0.01% |
| 2 | 0x4320 | B phase current 0th harmonic | 1 | Int | R | |
| | | Reserved Expansion | | | | |
| 1 | 0x4400 | C phase current 0th harmonic | 1 | Int | R | 0.01% |
| 2 | 0x4420 | C phase current 0th harmonic | 1 | Int | R | |
| | | Event record communication address | | | | |
| 1 | 0x4500 | Latest event type | 1 | short | R | |
| 2 | 0x4501 | the latest event occurred time | 1 | short | R | Year |
| 3 | 0x4502 | | 1 | short | R | Month |
| 4 | 0x4503 | | 1 | short | R | Day |
| 5 | 0x4504 | | 1 | short | R | Hour |
| 6 | 0x4505 | | 1 | short | R | Minute |
| 7 | 0x4506 | | 1 | short | R | Second |
| | | ......（30 events in the middle） | | | | |
| 8 | 0x45d9 | 32nd event type | 1 | short | R | |
| 9 | 0x45da | 32nd event occurred time | 1 | short | R | Year |
| 10 | 0x45db | | 1 | short | R | Month |
| 11 | 0x45dc | | 1 | short | R | Day |
| 12 | 0x45dd | | 1 | short | R | Hour |
| 13 | 0x45de | | 1 | short | R | Minute |
| 14 | 0x45df | | 1 | short | R | Second |
| | | System Parameter Communication Adress | | | | |
| 1 | 0x4800 | Wiring Method(1) | 1 | int | R/W | |
| 2 | 0x4801 | Voltage transformation ratioPT1 | 1 | int | R/W | 0.1 |
| 3 | 0x4802 | Voltage transformation ratio PT2 | 1 | int | R/W | 0.1 |
| 4 | 0x4803 | Current transformation ratioCT1 | 1 | int | R/W | |
| 5 | 0x4804 | Current transformation ratio CT2 | 1 | int | R/W | 0.1 |
| 6 | 0x4805 | Communication Address 1 | 1 | int | R/W | No decimal point |
| 7 | 0x4806 | Baud Rate 1(attached 2) | 1 | int | R | |
| 8 | 0x4807 | Data Format 1 | 1 | int | R/W | |
| 9 | 0x4818 | Communication Address 2 | 1 | int | R/W | |
| 10 | 0x4819 | Baud Rate 2(attached 2) | 1 | int | R | |
| 11 | 0x480a | Data Format 2 | 1 | int | R/W | |
| 12 | 0x480b | Switch Output(attached 4) | 1 | int | R | |
| 13 | 0x480c | Switch Input(attac5) | 1 | int | R | |
| 14 | 0x480d | Remote Control Input(attached 6) | 1 | int | R/W | |
| 15 | 0x480f | Backlight time | 1 | int | R/W | |
| | | Alarm parameter communication address | | | | |
| 1 | 0x4900 | 1st Alarm Mode | 1 | int | R/W | |
| 2 | 0x4901 | 1st Alarm Unit(attached 3) | 1 | int | R/W | |
| 3 | 0x4902 | 1st Alarm Value | 1 | int | R/W | 0.1 |
| 4 | 0x4903 | 1st Alarm Backlash | 1 | int | R/W | 0.1 |
| 5 | 0x4904 | 1st Alarm Output Mode( attached 7) | 1 | int | R/W | No decimal point |
| 6 | 0x4905 | 1st Action Delay | 1 | int | R/W | |
| 7 | 0x4906 | 1st Removal Delay | 1 | int | R/W | |

| | | Transmission parameter address | | | | | |
|---|---|---|---|---|---|---|---|
| 1 | 0x4a00 | 1st transmission method value | 1 | int | R/W | No decimal point | |
| 2 | 0x4a01 | 1st transmission unit(attached 3) | 1 | int | R/W | | |
| 3 | 0x4a02 | 1st transmission high limit value | 1 | int | R/W | 0.1 | |
| 4 | 0x4a03 | 1st transmission low limit value | 1 | int | R/W | 0.1 | |
| | | Muti-rates parameter communication address | | | | | |
| 1 | 0x4b00 | Period 1 rates | 1 | int | R/W | 0-3 | |
| 2 | 0x4b01 | Period 2 rates | 1 | int | R/W | | |
| 3 | 0x4b02 | Period 3 rates | 1 | int | R/W | | |
| 4 | 0x4b03 | Period 4 rates | 1 | int | R/W | | |
| 5 | 0x4b04 | Period 5 rates | 1 | int | R/W | | |
| 6 | 0x4b05 | Period 6 rates | 1 | int | R/W | | |
| 7 | 0x4b06 | Period 7 rates | 1 | int | R/W | | |
| 8 | 0x4b07 | Period 8 rates | 1 | int | R/W | | |
| 9 | 0x4b08 | Period 9 rates | 1 | int | R/W | | |
| 10 | 0x4b09 | Period 10 rates | 1 | int | R/W | | |
| 11 | 0x4b0a | Period 11 rates | 1 | int | R/W | | |
| 12 | 0x4b0b | Period 12 rates | 1 | int | R/W | | |
| 13 | 0x4b0c | Time slot 1 | 1 | int | R/W | 0-95 | |
| 14 | 0x4b0d | Time slot 2 | 1 | int | R/W | | |
| 15 | 0x4b0e | Time slot 3 | 1 | int | R/W | | |
| 16 | 0x4bf | Time slot 4 | 1 | int | R/W | | |
| 17 | 0x4b10 | Time slot 5 | 1 | int | R/W | | |
| 18 | 0x4b11 | Time slot 6 | 1 | int | R/W | | |
| 19 | 0x4b12 | Time slot 7 | 1 | int | R/W | | |
| 20 | 0x4b13 | Time slot 8 | 1 | int | R/W | | |
| 21 | 0x4b14 | Time slot 9 | 1 | int | R/W | | |
| 22 | 0x4b15 | Time slot 10 | 1 | int | R/W | | |
| 23 | 0x4b16 | Time slot 11 | 1 | int | R/W | | |
| 24 | 0x4b17 | Time slot 12 | 1 | int | R/W | | |
| | | Reserved Expansion | | | | | |
| | | System Timing Communication Data | | | | | |
| 1 | 0x4c00 | Year | 1 | int | R/W | 0-99 | |
| 2 | 0x4c01 | Month | 1 | int | R/W | 1-12 | |
| 3 | 0x4c02 | Day | 1 | int | R/W | 1-31 | |
| 4 | 0x4c03 | Hour | 1 | int | R/W | 0-23 | |
| 5 | 0x4c04 | Minute | 1 | int | R/W | 0-59 | |
| 6 | 0x4c05 | Second | 1 | int | R/W | 0-59 | |
| | | Reserved Expansion | | | | | |

Attached 1: Wiring instructions：

| Communication ADD | Value | Display character | Instructions |
|---|---|---|---|
| 0X4800 | 0 | 3-4 | 3 phase 4 wires connection |
| | 1 | 3-3 | 3 phase 3 wires connection |

Attached 2: Communication baud rate

| Communication ADD | Value | Display character | Instructions |
|---|---|---|---|
| 0X4806 | 0 | 1.2k | baud rate 1200bps |
| | 1 | 2.4k | baud rate 2400bps |
| | 2 | 4.8k | baud rate 4800bps |
| | 3 | 9.6k | baud rate 9600bps |
| | 4 | 19.2k | baud rate 19200bps |

Attached 3: Alarm and transmission unit

| Communication ADD | Value | Display character | Instructions |
|---|---|---|---|
| 0X4901、0X4908<br>0X4A01、0X4A05 | 0 | 1 | Unit: 1 |
| | 1 | K | Unit: K |
| | 2 | M | Unit: M |

Attached 4: Alarm output status indication

| Communication ADD | Bit Number | Alarm loop | Instructions |
|---|---|---|---|
| 0X480B | BIT2-BIT15 | Unused | Unused |
| | BIT1 | Alarm 2 | 0：Alarm does not act； |
| | | | 1：Alarm action； |
| | BIT0 | Alarm 1 | 0：Alarm does not act； |
| | | | 1: Alarm action； |

Attached 5: Switch input status indication

| Communication ADD | Bit Number | Alarm loop | Instructions |
|---|---|---|---|
| 0X480C | BIT4-BIT15 | Unused | Unused |
| | BIT3 | Switch input 4 | 0：disconnect |
| | | | 1：connect |
| | BIT2 | Switch input 3 | 0：disconnect |
| | | | 1:connect |
| | BIT4 | Switch input 2 | 0：disconnect |
| | | | 1：connect |
| | BIT0 | Switch input 1 | 0：disconnect |
| | | | 1：connect |

Attached 6: Remote output command description

| Communication ADD | Bit number | Alarm loop | Instructions |
|---|---|---|---|
| 0X480D | BIT2-BIT15 | Unused | Unused |
| | BIT1 | remote control 2 | 0：disconnect relay； |
| | | | 1: connect relay； |
| | BIT0 | remote control 1 | 0: disconnect relay； |
| | | | 1: connect relay； |

Attached 7: the relay output selection

| Communication ADD | Value | Display character | Instructions |
|---|---|---|---|
| 0X4904、0X490B | 0 | RLY1 | Select the first relay as output |
| | 1 | RLY2 | Select the second relay as output |

# VIII. DLT645 Communication instructions

## 8.1 Instructions

① The instrument is not designed in full compliance with the specifications of the National Grid. Therefore, only some of the parameters can be read using the DLT645 protocol. The specific readable parameters can be found in the following communication address correspondence form.

② National network meter communication data are primary side data without PT and CT. Therefore, in order to prevent read data from overflowing, the instrument data read through DLT645 should be secondary data.

③ Specific DLT645 communication protocol, please refer to "DLT645-2007 multi-function energy meter communication protocol"

### 8.2 DLT645 communication address correspondence form

| No. | Parameter Name | Communication | Number of reply bytes | Number of answers | Remark |
|-----|----------------|---------------|-----------------------|-------------------|--------|
| | | | Instantaneous Parameters | | |
| 1 | A phase voltage | 0x02010100 | 2 | 1 | |
| 2 | B phase voltage | 0x02010200 | 2 | 1 | |
| 3 | C phase voltage | 0x02010300 | 2 | 1 | |
| 4 | Voltage Data Block | 0x0201FF00 | 2 | 3 | |
| 5 | A phase current | 0x02020100 | 3 | 1 | |
| 6 | B phase current | 0x02020200 | 3 | 1 | |
| 7 | C phase current | 0x02020300 | 3 | 1 | |
| 8 | Current Data Block | 0x0202FF00 | 3 | 3 | |
| 9 | Combined Active Power | 0x02030000 | 3 | 1 | |
| 10 | A phase active power | 0x02030100 | 3 | 1 | |
| 11 | B phase active power | 0x02030200 | 3 | 1 | |
| 12 | C phase active power | 0x02030300 | 3 | 1 | |
| 13 | Active Power Data Block | 0x0203FF00 | 3 | 4 | Instantaneous Parameters |
| 14 | Combined Reactive Power | 0x02040000 | 3 | 1 | |
| 15 | A phase reactive power | 0x02040100 | 3 | 1 | |
| 16 | B phase reactive power | 0x02040200 | 3 | 1 | |
| 17 | C phase reactive power | 0x02040300 | 3 | 1 | |
| 18 | Reactive Power Data Block | 0x0204FF00 | 3 | 4 | |
| 19 | Combined Apparent Power | 0x02050000 | 3 | 1 | |
| 20 | A phase apparent power | 0x02050100 | 3 | 1 | |
| 21 | B phase apparent power | 0x02050200 | 3 | 1 | |
| 22 | C phase apparent power | 0x02050300 | 3 | 1 | |
| 23 | Apparent Power Data Block | 0x0205FF00 | 3 | 4 | |
| 24 | Combined Power Factor | 0x02060000 | 3 | 1 | |
| 25 | A phase power factor | 0x02060100 | 3 | 1 | |
| 26 | B phase power factor | 0x02060200 | 3 | 1 | |
| 27 | C phase power factor | 0x02060300 | 3 | 1 | |
| 28 | Power Factor Data Block | 0x0206FF00 | 3 | 4 | |
| 29 | Grid Frequency | 0x02800002 | 3 | 1 | |
| 30 | Active Integrated Energy | 0x00000000 | 4 | 1 | Cumulative Energy |
| 31 | Positive Active Integrated Energy | 0x00010000 | 4 | 1 | |
| 32 | Negative Active Integrated Energy | 0x00020000 | 4 | 1 | |

## Connect to the chart

| | | Fractional Harmonic Rate | | | |
|---|---|---|---|---|---|
| 1 | A phase voltage 1st harmonic | 0x020A0101 | 2 | 1 | A phase voltage harmonic data |
| 2 | ...... | | | | |
| 3 | A phase volateg 21st harmonic | 0x020A0115 | 2 | 1 | |
| 4 | A phase voltage harmonic data | 0x020A01FF | 2 | 21 | |
| 5 | B phase voltage 1st harmonic | 0x020A0201 | 3 | 1 | B phase voltage harmonic data |
| 6 | ...... | | | | |
| 7 | B phase voltage 21st harmonic | 0x020A0215 | 2 | 1 | |
| 8 | B phase voltage harmonic data | 0x020A02FF | 2 | 21 | |
| 9 | C phase voltage 1st harmonic | 0x020A0301 | 2 | 1 | C phase voltage harmonic data |
| 10 | ...... | | | | |
| 11 | C phase voltage 21st harmonic | 0x020A0315 | 2 | 1 | |
| 12 | C phase voltage harmonic data | 0x020A03FF | 2 | 21 | |
| 13 | A phase current 1st harmonic | 0x020B0101 | 2 | 1 | A phase current harmonic data |
| 14 | ...... | | | | |
| 15 | A phase current 21st harmonic | 0x020B0115 | 2 | 1 | |
| 16 | A phase current harmonic data | 0x020B01FF | 2 | 21 | |
| 17 | B phase current 1st harmonic | 0x020B0201 | 2 | 1 | B phase current harmonic data |
| 18 | ...... | | | | |
| 19 | B phase current 21st harmonic | 0x020B0215 | 2 | 1 | |
| 20 | B phase current harmonic data | 0x020B02FF | 2 | 21 | |
| 21 | C phase current 1st harmonic | 0x020B0301 | 2 | 1 | C phase current harmonic data |
| 22 | ...... | | | | |
| 23 | C phase current 21st harmonic | 0x0205FF00 | 2 | 1 | |
| 24 | C phase current harmonic data | 0x020B03FF | 2 | 21 | |

# COMMIX Software Instruction

## 1. Configurate commix software
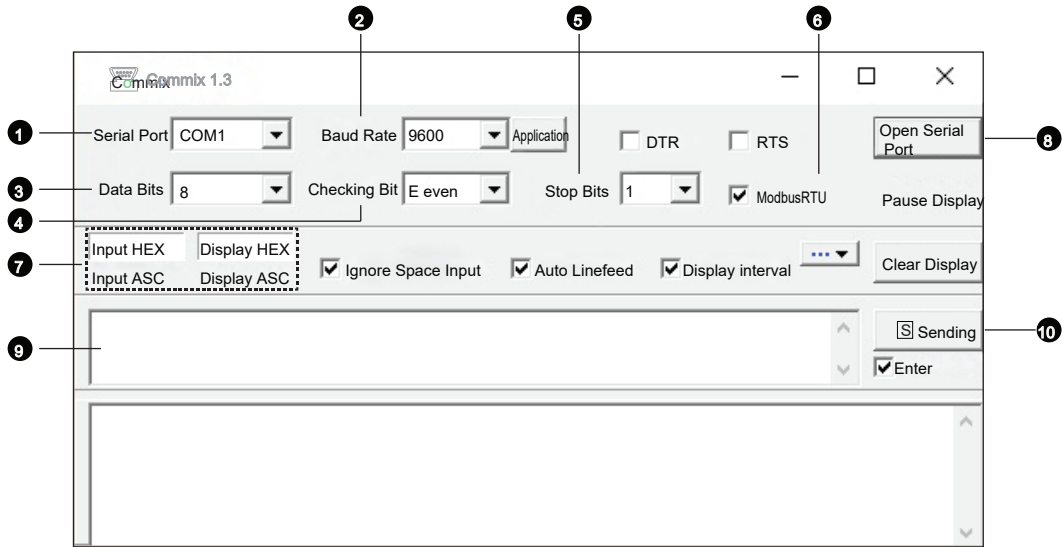


Picture 1

1. Setting the serial port to the serial port your computer is using; for example, if my computer's serial port is COM1, set it to "COM1";
2. Configuring the baud rate; configure the baud rate according to the baud rate set by the instrument, such as 9600
3. Configuring communication data bits; default 8-bit
4. Configuring parity bit; default no parity, can set "even parity" "odd parity"
5. Configuring stop bit; default 1 stop bit
6. Setting data check mode; set to MODBUS-RTU check mode, as shown in Picture 2
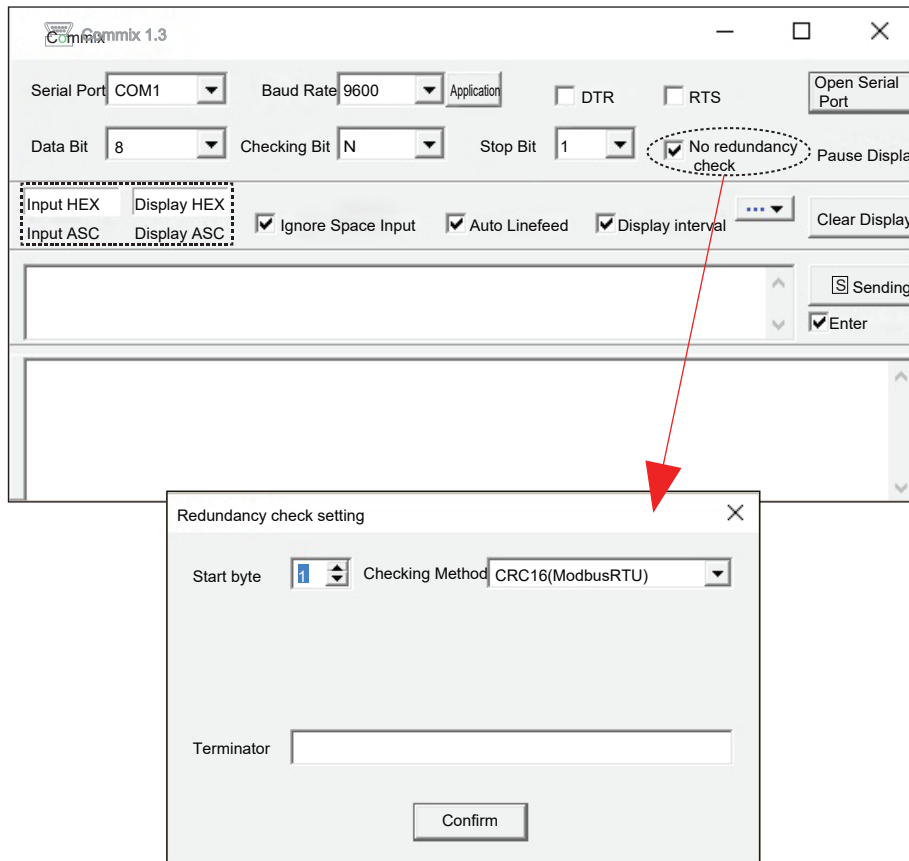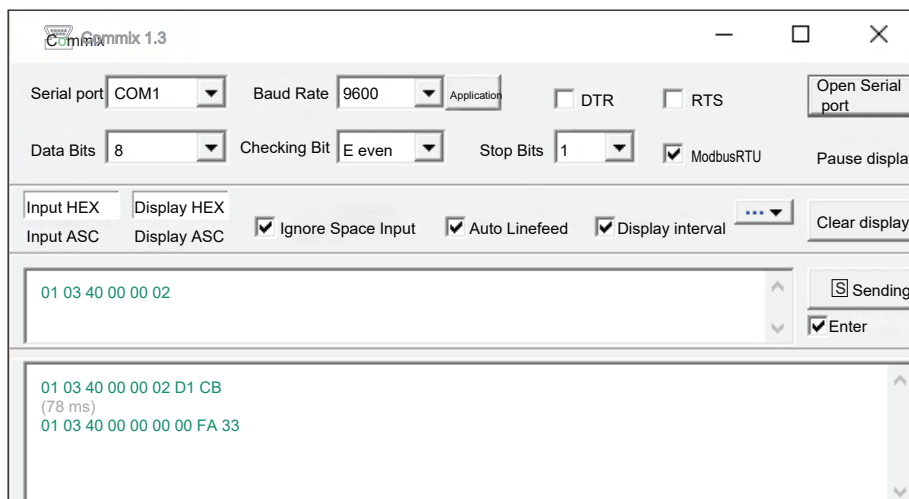


Picture 2

7. Configure the sending and receiving data display mode; set to "HEX" display mode
8. After configuring the above functions, open the serial port；
9. Input corresponding request message in sending window, CRC is added automatically；
10. Click " Send " to display the corresponding data in the receiving window.

## 2. Send and receive

According to the sending corresponding request message by communication protocol, corresponding measurement or setting data can be obtained. If you need to read the A phase voltage, you can use the following message to access, as shown in the following pictures.



Picture 3

1. Window 1 is the sending message input window; input the requested message in this window, note that CRC is automatically added;
2. Window 2 is the message display window; in this window, the complete message received and sent is displayed: the request message sent by the host with a green behavior and the response message returned by the slave with a blue action.。