T330

# ADL400

Installation and operation instruction T1.2

**ACREL Co.,Ltd**

## Declaration



Acrel reserves the right to modify the product specifications herein without notification. Please consult the local agent about the latest specifications before placing a purchase order.

Manual revision record

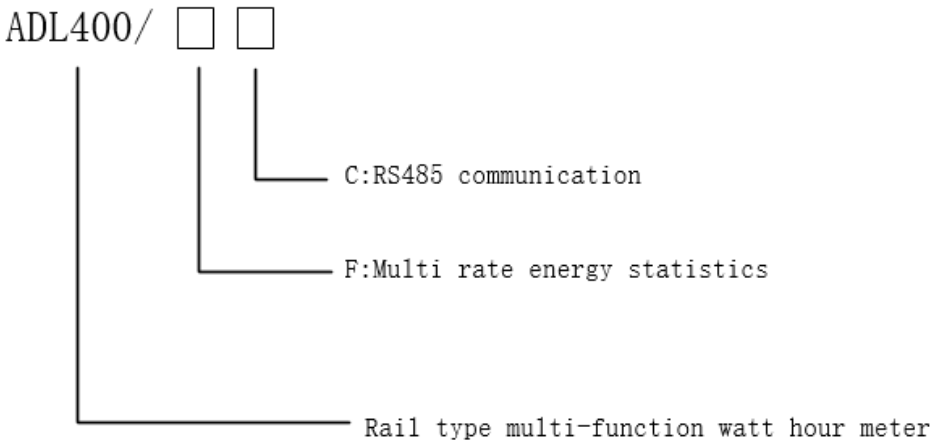
| Data | Old | New | Change |
|---|---|---|---|
| 2024.8.28 | | T1.0 | 1.First version, Add 277/480V options |
| 2024.9.18 | T1.0 | T1.1 | 2.Add a fast response address table |
| 2025.3.05 | T1.1 | T1.2 | 3.Add  dimensional tolerance |

# content

# 1 General

ADL400 is a smart meter designed for power supply system, industrial and mining enterprises and utilities to calculate the electricity consumption and manage the electric demand. It features the high precision, small size and simple installation. It integrates the measurement of all electrical parameters with the comprehensive electricity metering and management provides various data on previous 48 months, checks the 31st harmonic content and the total harmonic content. It is fitted with RS485 communication port and adapted to MODBUS-RTU .ADL400 can be used in all kinds of control systems, SCADA systems and energy management systems. The meter meet the related technical requirements of electricity meter in the IEC62053-21standards.

# 2 Type description




# 3 Function description

Table 1 Function description list

| Function | Function description | Function provide |
|---|---|---|
| Measurement of energy | Active kWh (positive and negative) | ■ |
| | Reactive kvarh (positive and negative) | ■ |
| | A,B,C split phase active energy | ■ |
| Measurement of electrical parameters | U、I | ■ |
| | P、Q、S、PF、F | ■ |
| Measurement of harmonics | 2~31$^{ST}$ Voltage and Current harmonic | ■ |
| LCD Display | 12 bits section LCD display, background light | ■ |
| Key programming | 3 keys to communication and set parameters | ■ |

| | | |
|---|---|---|
| Pulse output | Active pulse output | ■ |
| Multi-tariff and functions | Date, time | □ |
| | Max demand and occurrence time | □ |
| | Frozen data on last 48 months, last 90days | □ |
| | Adapt 14 time zones, 8 time interval lists, 14 time interval by day and 8 tariff rates | □ |
| Communication | Communication interface: RS485, Communication protocol: MODBUS-RTU | ■ |

# 4 Technical parameter

Table 2 technical parameter descriptions

| **project** | | | **performance parameter** | |
|---|---|---|---|---|
| Specification | | | 3 phase 3 wires | 3 phase 4 wires |
| Measurement | Voltage | Reference voltage | 3×100V、 3×380V、3×480V | 3×57.7/100V、 3×220/380V、3×277/480V |
| | | Voltage range | 3×100V - 3×450V | 3×57.7/100V - 3×260/450V |
| | | Consumption | <10VA(Single phase) | |
| | | Impedance | >2MΩ | |
| | | Accuracy class | Error±0.2% | |
| | Current | Input current | 3×1(6)A， 3×10(80)A | |
| | | Consumption | <1VA Single phase rated current | |
| | | Accuracy class | Error±0.2% | |
| | Power | | Active, reactive, apparent power, error±0.5% | |
| | Frequency | | 45～65Hz，Error±0.2% | |
| Metering | Energy | | Active energy(Accuracy class: 0.5); reactive energy(Accuracy class 2) | |
| | Clock | | ≤0.5s/d | |
| Digit signal | Energy pulse output | | 1 active photocoupler output | |
| pulse | Width of pulse | | 80±20ms | |
| | Pulse constant | | 400imp/kWh,10000imp/kWh(Correspond with the basic current) | |
| communication | Interface and communication protocol | | RS485：Modbus RTU | |
| | Range of communication address | | Modbus RTU:1~ 254； | |
| | Baud rate | | 1200bps~38400bps | |
| envir-onment | working temperature | | -25℃~+55℃ | |
| | Relative humidity | | ≤95%(No condensation) | |

Attention: 2*277/480V Only for secondary access

# 5 Dimension drawings

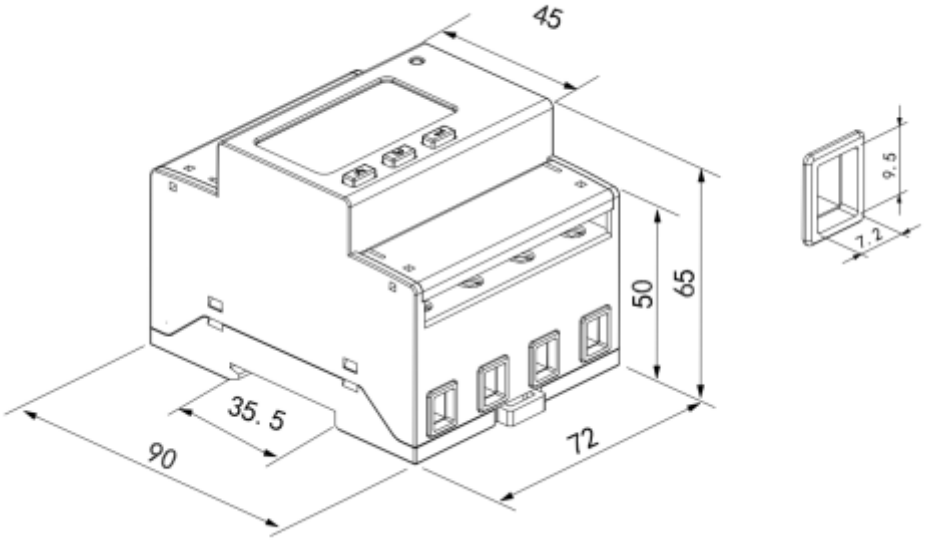



Fig 1 direct connect

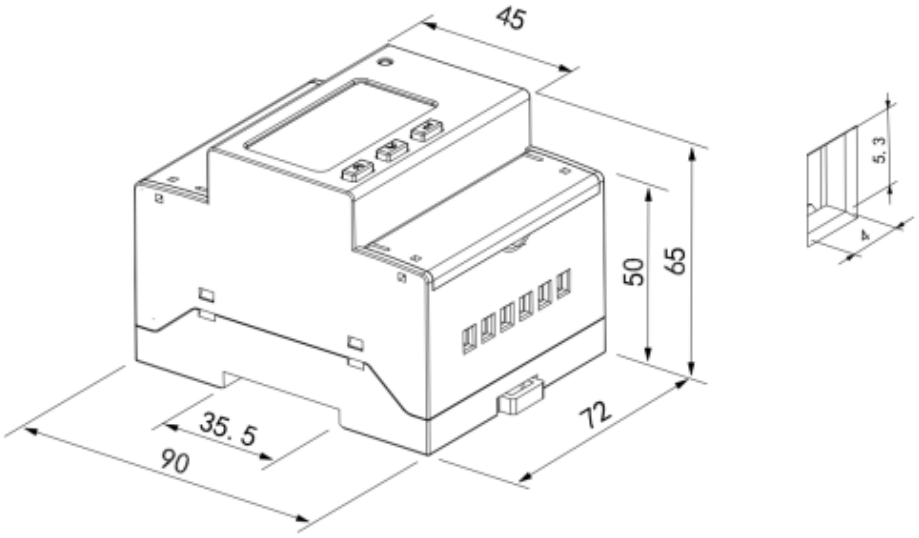



Fig 2 connect via CT

Note：

1. The torque of direct connect should not be greater than 3-4N·m， and the torque of connect via CT should not be greater than 1.5-2N·m。

2. Product external dimensional tolerance: ±1mm；Terminal hole dimensional tolerance: ±0.5mm。

# 6 Wiring and installing

## 6.1 Wiring sample of voltage and current

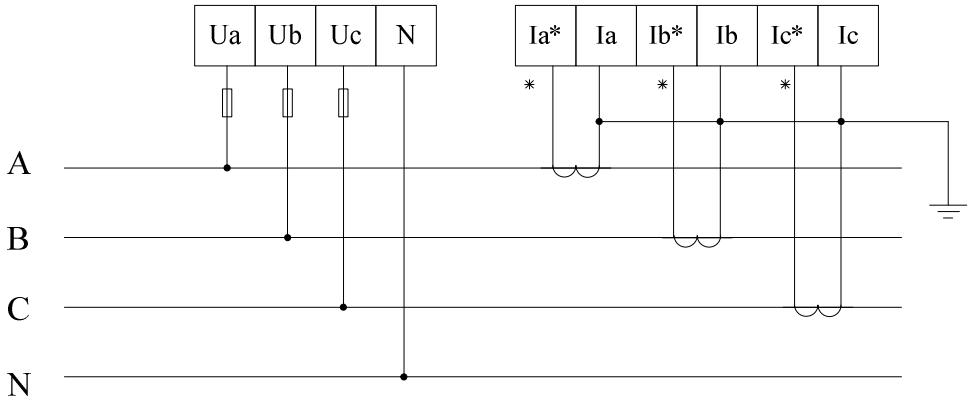



Fig 3 Three phase four lines connect via CT

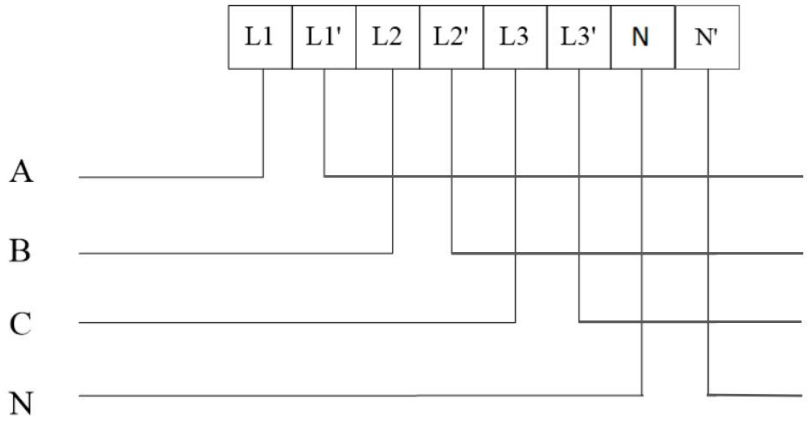



Fig 4 Three phase four lines direct connect

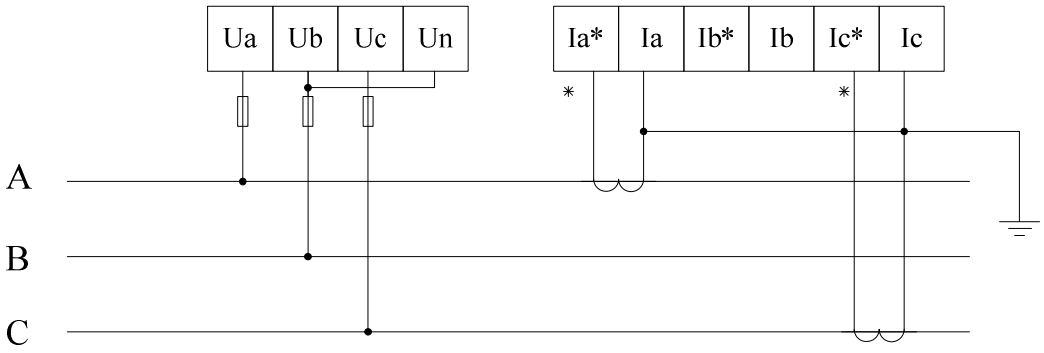



Fig 5 Three phase three lines connect via CT

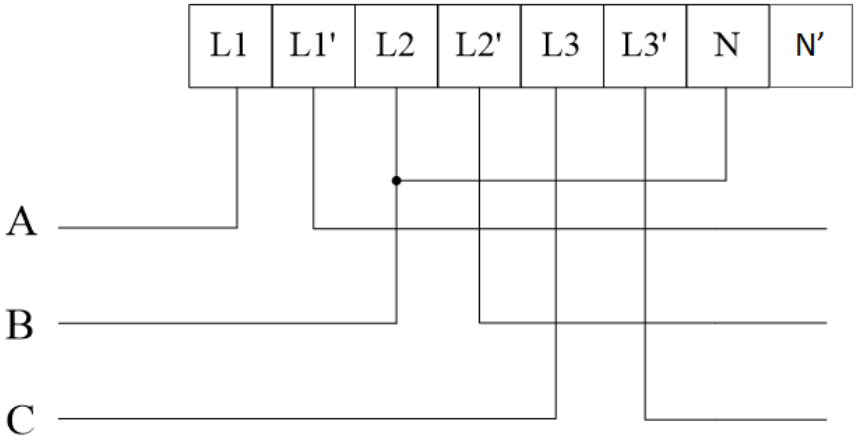



Fig 6 Three phase three lines direct connect

### 6.2 Wiring diagram of communication and pulse terminals

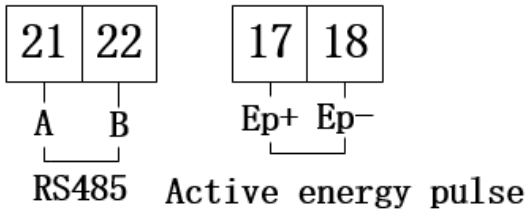



Fig 7 Communication, pulse connection

## 7 Function description

### 7.1 Measurement

It can measure the electrical parameter,include U、I、P、Q、S、PF、F、1~31th harmonic。
Such as:U = 220.1V，f = 49.98Hz,　I = 1.99A，P = 0.439kW

### 7.2 Metering

Can measure the active energy、forward active energy、reversing active energy、forward reactive energy、reversing reactive energy.

### 7.3 Timing

Eight timing tables, fourteen time zones, one table has fourteen timing, eight rates。

### 7.4 Demand

The description about demand:

Table 3 Demand description list

| | |
|---|---|
| Demand | The average power in the demand cycle. |
| Maximum demand | The maximum value of demand in a period of time. |
| Slip time | A recurrence method to measure the demand from any time point during a period shorter than the demand period. The demand |

| | |
|---|---|
| | measured by this means is called sliding demand. The recurrence time is sliding window time. |
| Demand cycle | The time period between two same average value of demand. |

The default demand cycle is 15 minutes, slip time is 1 minute.

The meter can measure 4 kinds of maximum demand: forward active, reversing active, inductive reactive, capacitive reactive maximum demand and the occur time of them.

### 7.5 History data statistics

The meter can record last 48 months or last 90 days history energy in each tariff.

## 8 Operation and display

### 8.1 Key function description

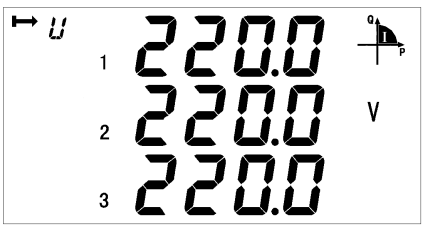
Table 4 Key's function description

| icon | Name | Function |
|---|---|---|
|  | Voltage and current<br>Up key | Check the voltage and current<br>Leftward and change flash in programming menu |
|  | Power<br>Down key | Check the power<br>Rightward and change the value on flash |
|  | Energy<br>Enter key | Check the energy<br>In/out programming menu<br>Save changes |

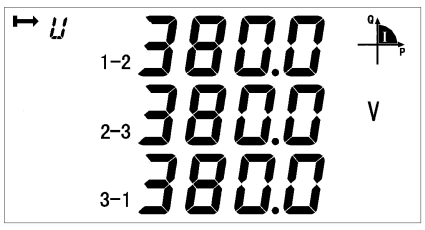
### 8.2 Display menu

The meter will show the forward active energy after powering. The customers can change the information showing by pressing the keys. The menu description is listed as below:

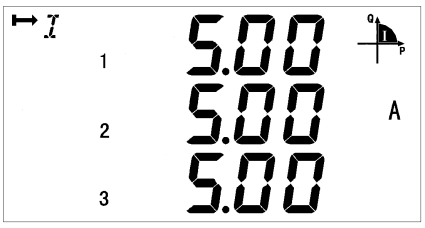
Table 5 display descriptions




Three-phase voltage




Three phase line voltage

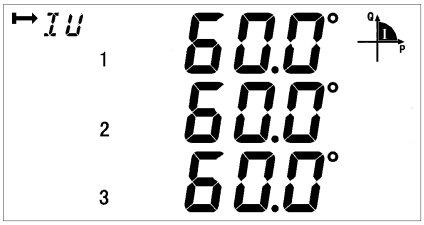



Three-phase Current

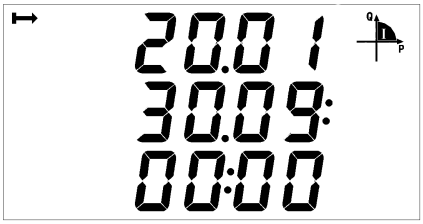

Frequency


Harmonic content of three phase Voltage

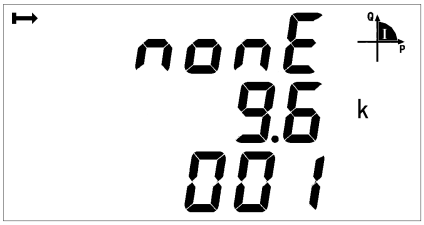

Harmonic content of three phase Current



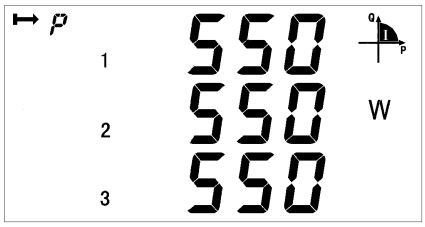

Phase angle




Time

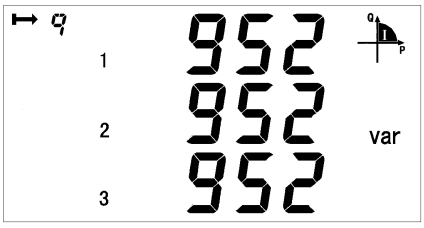



Check bit, baud rate, table address, software version number, full display detection;



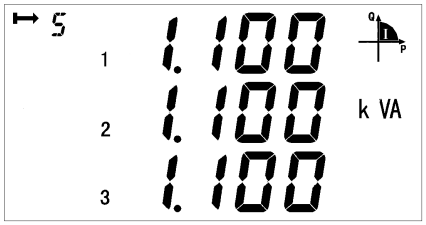

Three phase active power


Total active power



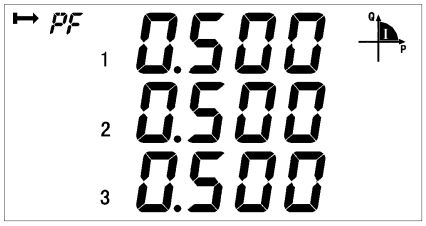

Three phase reactive power


Total reactive power




Three phase apparent power


Total apparent power




Three phase power factor

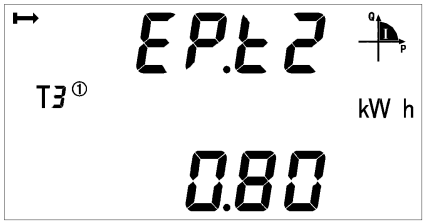

Total power factor

T3 represents the normal period, ① represents the first time table


(Current value is1616.89kWh)

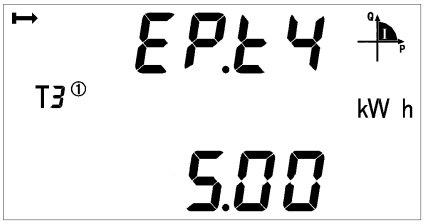
Current total active energy


Current spike active energy




Current peak active energy


Current flat active energy




Current valley active energy

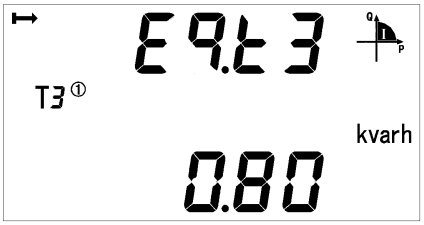

Current forward active total energy


Current reversing active total energy

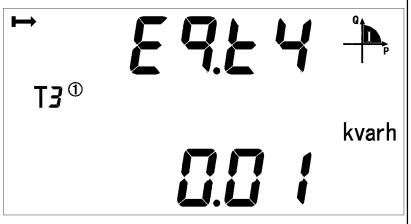

Current total reactive energy


Current reactive spike energy

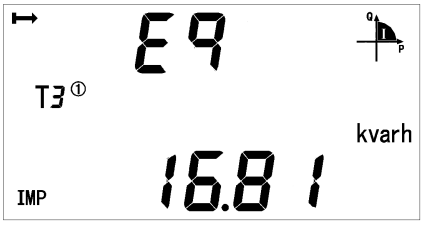

Current reactive peak energy



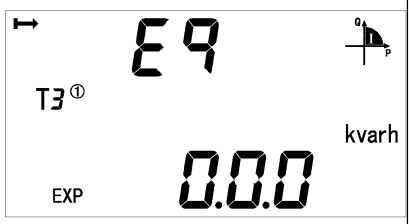

Current reactive flat energy



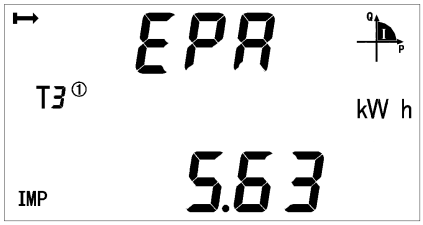

Current reactive valley energy




Current forward reactive total energy

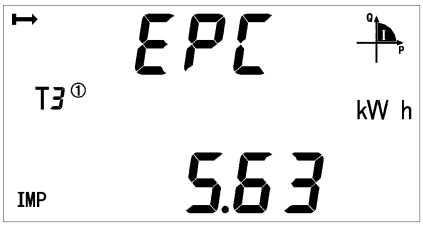



Current reversing reactive total energy




Current forward active energy on A phase


Current forward active energy on B phase




Current forward active energy on C phase

Note:

1 All the display menus above are in the model of ADL400 three phases four lines with multi-tariff rate function and can be changed by the keys.

2 There will not be power or power factor on each phase and will only show total power and power factor (Active, reactive, apparent) under the three phase three lines.

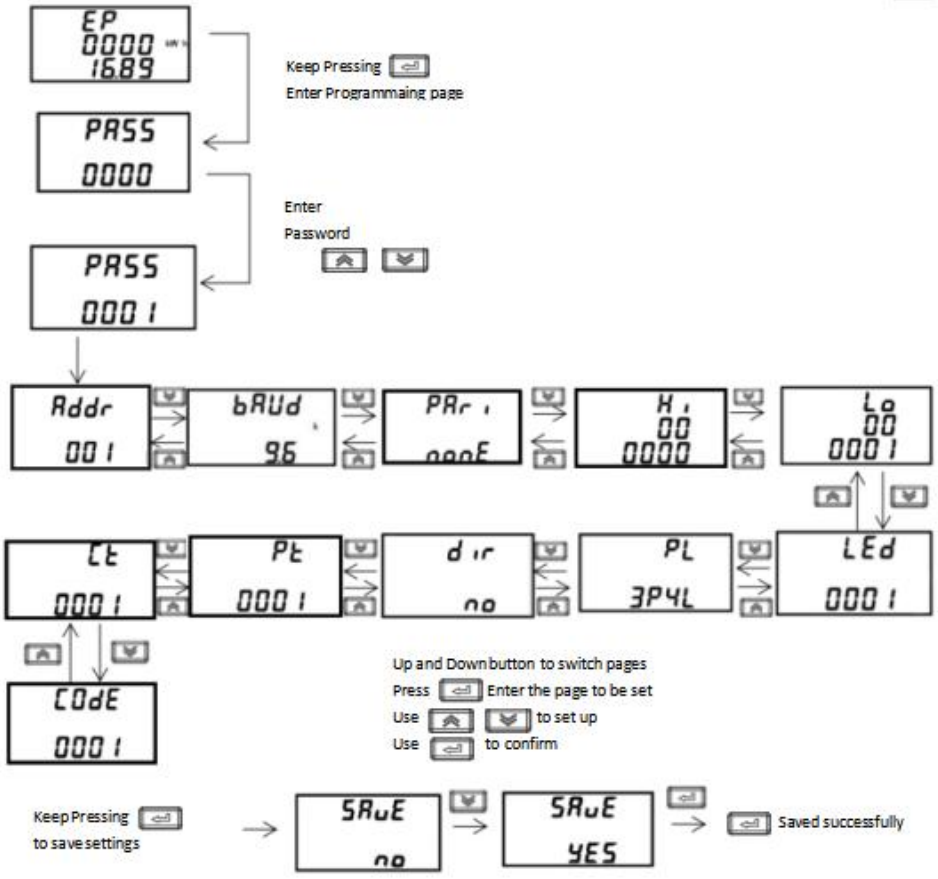
3 There will not be date, time, maximum demand and energy by time without the function of multi-tariff rate.

4 The amount of rate energy displayed is determined by the maximum rate of the set time meter, for example, if the maximum rate set is T5 (rate 5), then the meter displays the rate energy 1-5.

5 When the energy is displayed, when the number of digits exceeds 4 digits, it is displayed in two lines, and it can be read continuously. The graph below shows an electrical energy value of 1616.89 kWh. The direct access model energy data shows 2 decimal places, and the secondary access model energy data shows 1 decimal place.


## 8.3 Key Menu

Keep press  at any main menu and get in “PASS” interface, and then press  show “0000”, and enter the code. If you enter a wrong code, it will show “fail” and back to main menu; and if you enter a right code, you can set the parameter. After setting the parameter and keep press  , it will show “save” and save the change by pressing in “yes” interface  and quit without save by pressing  in “no” interface.




## 8.4 Data settings

Table 6 Menu description

| Num | Second menu | | |
|---|---|---|---|
| | Symbol | Mean | Range |
| 1 | ADDR | Communicate's ADDR settings | 1-254 |
| 2 | Baud | Baud choose | 1200、2400、4800、9600、19200、38400 |
| 3 | Pari | Parity choose | None、Odd、Even |
| 4 | LED | Backlight time | 0-255minutes，more than 000 stay light-on<br>Default value：1min |
| 5 | PL | Wiring sample | 3P4L:3 phase 4 wires<br>3P3L:3 phase 3 wires |
| 6 | DIR | direction of current | no-Forward<br>yes-Reverse |
| 7 | S-TY | Apparent power calculation method | PQS<br>RMS |
| 8 | EF-E | time-sharing measurement function | EF-Function on<br>E-Function off |
| 9 | Pt | Voltage transformer settings | 1-9999 |

| | | | |
|---|---|---|---|
| 10 | Ct | Current transformer settings | 1-9999 |
| 11 | CoDE | Code settings | 1-9999 |
| 12 | PHAS | Phase angle calculation method | No-Angle between each current and each voltage<br>Yes-Angle between three-phase current and phase a voltage |
| 13 | nost | Starting power shield | Shielding range:0.1-2.0%<br>(*UnIn) |

Note: Marked yellow is the default value.

# 9 Communication description

The meter adapts MODBUS-RTU protocol, and the baud rate can be chosen from 1200bps、2400 bps、4800 bps、9600bps、19200bps and 38400 bps. The parity defaults to None.

The meter needs shielded twisted pair conductors to connect. Customers should consider the whole network's parameters such like communication wire's length, the direction, communication transformer and network cover range, etc.

Note:

1、Wiring should follow the wiring requirements;

2、Connect all the meter in the RS485 net work even some do not need to communication, which is benefit for error checking and testing.

3、Use two color wires in connecting wires and all the A port use the same color.

4、No longer than 1200 meters of RS485 bus line.

## 9.1 ADDR List

MODBUS-RTU protocol has 03H and 10H command to read and write registers respectively. The following chart is registers' address list:

| Address | Name | R/W | Length (Bytes) | Type | Unit | Note |
|---|---|---|---|---|---|---|
| 008DH | PT | R/W | 1 | uint16 | | |
| 008EH | CT | R/W | 1 | uint16 | | |
| 1000H | slave address | R/W | 1 | uint16 | | 1-247 |
| 1001H | baud rate | R/W | 1 | uint16 | | 1200，2400，4800，9600，19200，38400， |
| 1002H | parity | R/W | 1 | uint16 | | Low byte<br>0：None<br>1：Odd<br>2：Even<br>High byte<br>0： 1stop<br>1：1.5stop |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | | | | 2：2stop |
| 1010H | Grid | R/W | 1 | uint16 | | 0:3P4L 1:3P3L |
| 101DH | Password | R/W | 1 | uint16 | | 1-9999 |
| 1035H | Apparent power calculation mode | R/W | 1 | uint16 | | 0：RMS 1：PQS |
| 2000H | A-phase voltage | R | 2 | float | V | 1.Slow register |
| 2002H | B-phase voltage | R | 2 | float | V | |
| 2004H | C-phase voltage | R | 2 | float | V | |
| 2006H | AB-line voltage | R | 2 | float | V | |
| 2008H | BC-line voltage | R | 2 | float | V | |
| 200AH | CA-line voltage | R | 2 | float | V | |
| 200CH | A-phase current | R | 2 | float | A | |
| 200EH | B-phase current | R | 2 | float | A | |
| 2010H | C-phase current | R | 2 | float | A | |
| 2012H | N-phase current | R | 2 | float | A | |
| 2014H | A-phase active power | R | 2 | float | kW | |
| 2016H | B-phase active power | R | 2 | float | kW | |
| 2018H | C-phase active power | R | 2 | float | kW | |
| 201AH | Total active power | R | 2 | float | kW | |
| 201CH | A-phase reactive power | R | 2 | float | Kvar | |
| 201EH | B-phase reactive power | R | 2 | float | Kvar | |
| 2020H | C-phase reactive power | R | 2 | float | Kvar | |
| 2022H | total reactive power | R | 2 | float | Kvar | |
| 2024H | A-phase apparent power | R | 2 | float | KVA | |
| 2026H | B-phase apparent power | R | 2 | float | KVA | |
| 2028H | C-phase apparent power | R | 2 | float | KVA | |
| 202AH | Total apparent power | R | 2 | float | KVA | |
| 202CH | A-phase power factor | R | 2 | float | | |
| 202EH | B-phase power factor | R | 2 | float | | |
| 2030H | C-phase power factor | R | 2 | float | | |
| 2032H | Total power factor | R | 2 | float | | |
| 2034H | Frequency | R | 2 | float | Hz | |
| 2100H | A-phase voltage | R | 2 | float | V | 1.Fast register<br>（response rate <=100ms） |
| 2102H | B-phase voltage | R | 2 | float | V | |
| 2104H | C-phase voltage | R | 2 | float | V | |
| 2106H | AB-line voltage | R | 2 | float | V | |
| 2108H | BC-line voltage | R | 2 | float | V | |

| | | | | | | |
|---|---|---|---|---|---|---|
| 210AH | CA-line voltage | R | 2 | float | V | |
| 210CH | A-phase current | R | 2 | float | A | |
| 210EH | B-phase current | R | 2 | float | A | |
| 2110H | C-phase current | R | 2 | float | A | |
| 2112H | N-phase current | R | 2 | float | A | |
| 2114H | A-phase active power | R | 2 | float | kW | |
| 2116H | B-phase active power | R | 2 | float | kW | |
| 2118H | C-phase active power | R | 2 | float | kW | |
| 211AH | Total active power | R | 2 | float | kW | |
| 211CH | A-phase reactive power | R | 2 | float | Kvar | |
| 211EH | B-phase reactive power | R | 2 | float | Kvar | |
| 2120H | C-phase reactive power | R | 2 | float | Kvar | |
| 2122H | total reactive power | R | 2 | float | Kvar | |
| 2124H | A-phase apparent power | R | 2 | float | KVA | |
| 2126H | B-phase apparent power | R | 2 | float | KVA | |
| 2128H | C-phase apparent power | R | 2 | float | KVA | |
| 212AH | Total apparent power | R | 2 | float | KVA | |
| 212CH | A-phase power factor | R | 2 | float | | |
| 212EH | B-phase power factor | R | 2 | float | | |
| 2130H | C-phase power factor | R | 2 | float | | |
| 2132H | Total power factor | R | 2 | float | | |
| 2134H | Frequency | R | 2 | float | Hz | |
| 3000H | active electric energy | R | 4 | double | kWh | |
| 3004H | forward active electric energy | R | 4 | double | kWh | |
| 3008H | reverse active electric energy | R | 4 | double | kWh | |
| 300CH | reactive electric energy | R | 4 | double | kVarh | |
| 3010H | forward reactive electric energy | R | 4 | double | kVarh | |
| 3014H | reverse reactive electric energy | R | 4 | double | kVarh | |
| 3018H | apparent electric energy | R | 4 | double | kVAh | |
| 301CH | active electric energy of phase A | R | 4 | double | kWh | |
| 3020H | forward active electric energy of phase A | R | 4 | double | kWh | |
| 3024H | reverse active electric energy of phase A | R | 4 | double | kWh | |
| 3028H | reactive electric energy of phase A | R | 4 | double | kVarh | |
| 302CH | forward reactive electric energy of phase A | R | 4 | double | kVarh | |

| | | | | | | |
|---|---|---|---|---|---|---|
| 3030H | reverse reactive electric energy of phase A | R | 4 | double | kVarh | |
| 3034H | active electric energy of phase B | R | 4 | double | kWh | |
| 3038H | forward active electric energy of phase B | R | 4 | double | kWh | |
| 303CH | reverse active electric energy of phase B | R | 4 | double | kWh | |
| 3040H | reactive electric energy of phase B | R | 4 | double | kVarh | |
| 3044H | forward reactive electric energy of phase B | R | 4 | double | kVarh | |
| 3048H | reverse reactive electric energy of phase B | R | 4 | double | kVarh | |
| 304CH | active electric energy of phase C | R | 4 | double | kWh | |
| 3050H | forward active electric energy of phase C | R | 4 | double | kWh | |
| 3054H | reverse active electric energy of phase C | R | 4 | double | kWh | |
| 3058H | reactive electric energy of phase C | R | 4 | double | kVarh | |
| 305CH | forward reactive electric energy of phase C | R | 4 | double | kVarh | |
| 3060H | reverse reactive electric energy of phase C | R | 4 | double | kVarh | |

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