Three Phase Multifunctional Energy Meter

TC55M-TCP Series

User Manual V 1.0

Rayfull Electric Technology(Zhejiang)Co., Ltd.

Rayfull Electic Technology(Zhejiang)Co., Ltd. reserves the right to modify the manual. Before placing orders, please contact us or your local agent for the latest version of the manual.

SAFETY INFORMATION

Please read this chapter carefully and examine the equipment carefully for potential damages which might arise during transport and to become familiar with it before continue to install, energize and work with TC55M-TCP series.

This chapter deals with important information and warnings that should be considered for safe installation and handling with a device in order to assure its correct use and continuous operation. If equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

WARNING ⚠	A hazardous situation which, if not avoided, **could result in** serious injury.
CAUTION ⚠	A hazardous situation which, if not avoided, **could result in** minor or moderate injury.
NOTICE	Practices not related to physical injury.

Please note: This booklet contains instructions for installation and use of TC55M-TCP series. Installation and use of a device also includes handling with dangerous currents and voltages therefore should be installed, operated, serviced and maintained by qualified personnel only.

Rayfull Electric is responsible for coordinating therating and the characteristics of the supply side overcurrent protection devices with the maximum current rating and, in the case of direct connectedmeters, with the UC rating of the metering equipment.

Before installing the TC55M-TCP series, please check the following points carefully:

- It's recommended to power off all connected external devices;
- The connecting wire, which connects the device to the external circuit, should be of an appropriate size in accordance with local regulations regarding the maximum allowable current breaker or other overcurrent protection devices used in the circuit;

- An external switch or circuit-breaker should be installed on the power supply wires, which will be used to disconnect the meter and the device supplying energy. It is recommended that this switch or circuit-breaker is placed near the meter because that is more convenient for the operator. The switch or circuit-breaker must comply with the specifications of the building's electrical design and all local regulations;
- An external fuse or thermal cut-off used as an overcurrent protection device for the meter must be installed on the supply side wires;
- It is recommended that this protection device is also placed near the meter for the convenience of the operator. The overcurrent protection device must comply with the specifications of the building's electrical design and all local regulations;
- The device can be installed on a TH35-7.5 DIN rail;
- This meter can be installed indoors or outdoors, enclosed in a meter box which is sufficiently protected, in accordance with local codes and regulations;
- To prevent tampering, an enclosure with a lock or a similar device can be used;
- The meter must be installed against a fire resistant wall;
- The meter must be installed in a well-ventilated and dry place;
- The meter must be installed in a protective box if the meter is exposed to dust or other contaminants;
- The meter can be installed and used after being tested and can be sealed afterwards;
- The meter should be installed in a location where the meter can be read easily;
- In case the meter is installed in an area with frequent surges, for example due to thunderstorms, welding machines, inverters, etc., the meter requires Surge Protection Device protection;
- The device should be sealed immediately after installing it in order to prevent tampering.

Content

Chapter 1. Product Introduction

1.1 Brief Introduction

TC55M-TCP series are three phase external CT connected multifunctional energy meter to measure and analyze the most important electrical parameters, including voltage, current, four-quadrant power parameters, power factor, total harmonic, and etc. And it can also read a variety of energy parameters, involving bidirectional active and reactive energy, four-quadrant energy, and so on. The series realizes the measurement and analysis of power parameters in various power grid environments, such as 1P2W, 3P3W and 3P4W.

The TC55M-TCP series have both RS485 communication and Ethernet TCP interfaces with highest baudrate 38400bps, supporting Modbus or DLT645 protocol for remote reading.

At the same time, the large-screen LCD and touch buttons help users to view and set various measurement parameters on site.

Password protection function is added to greatly improve the data security.

1.2 Product Characteristics

- Multifunctional Parameters: V, A, W, Var, VA, kWh, kVarh, PF, PA, ...;
- THD: Voltage THD and Current THD;
- Bidirectional Energy Measurement: Import/Export Active Energy, Import/Export Reactive Energy;
- Direct Voltage Input or High Voltage(PT) Input;
- Current Transformer Input: 1A/5A,or mV/mA CT input,or Rogowski coils (RC) input;
- CT Reverse-Connect Correction Function;
- Pulse output, RS485 communication with highest baudrate 38400bps;
- Ethernet TCP Port;
- Available Portocol: Modbus RTU, DL/T645-2007;
- Touch-Button: Improve the performance of buttons and reduce the operation error;
- Large-screen LCD display with configurable white backlit interval;
- LCD refresh time: 1 second, supporting manually or automatically scroll display (configurable).

1.3 Applications

TC55M-TCP series are designed for solar PV, EV charging, wind power generation and other electrical systems, which are also widely used in power monitoring systems, future community, SCADA systems and other

energy management systems.

Chapter 2. Technical Specifications

2.1 Specifications

2.1.1 Electrical Specifications

Accuracy	Voltage/Current	Class 0.5, Refer to IEC 61557-12
	Active Power	Class 0.5, Refer to IEC 61557-12
	Reactive Power	Class 2, Refer to IEC 61557-12
	Apparent Power	Class 1, Refer to IEC 61557-12
	Active Energy	Class 0.5S, Refer to IEC 62053-21/22, IEC 61557-12
	Reactive Energy	Class 2, Refer to IEC 62053-23; Class 2, Refer to IEC 61557-12
	Power Factor	Class 1, Refer to IEC 61557-12
	Frequency	Class 0.2, Refer to IEC 61557-12
Data Upgrading Rate		1s (Optional: 100ms)
Voltage Input	Rated Voltage	3x230VAC(L-N)/400VAC(L-L)
	Voltage Input	Measurement range: 30 ~ 300 VAC(L-N); 30 ~ 500 VAC(L-L)
	PT Input	Max. Input:500000 VAC
	Loop Impedance	1MΩ
	Frequency	45 ~ 65 Hz
	Overload Capacity	2x Rated Voltage by lasting 1s
Current Input	CT2	Rated value: 1A/5A(Default), 100mA/mV(Optional)
	CT1	1 ~ 9999 A
	Measurement range	0.003 ~ 6 A, Rated: 5A
	Loop Impedance	<0.01 ohm
	Overload Capacity	20x Max. Current by lasting 0.5s
Aux.Power Supply	Voltage Range	80 ~ 300 VAC / 100 ~ 420 VDC
	Frequency Range	45 ~ 65 Hz
	Power Consumption	< 4VA/0.5W
Pulse Output	Pulse Type	Open collector optocoupler
	Pulse Constant	Configuration: 0.001, 0.01, 0.1, 1, 10, 100 kWh/kvarh
	Pulse Width	Configuration: 60, 100(Default), 200ms
	Pulse Output Type	Configuration: Import/Export/Total active/Total Reactive kWh
	Class	Class A, Refer to IEC 62053-31
	Voltage Input	5 ~ 27 VDC
Pulse Light		Pulse constant:5000imp/kWh (Energy of Secondary Side)
Power Consumption Class	Self-Consumption per phase	Voltage Circuit: <2W/10VA; Current Circuit: <1VA

2.1.2 Mechanical Specifications

IP Class	LCD display: IP51(Indoor);

	Whole meter: IP30
Installation	TH35-7.5 DIN Rail
Flammability Class	UL 94 V-0
Utilization Category	UC2

2.1.3 Environment Specifications

Operation Temperature	-25 ~ +55℃
Storage Temperature	-40 ~ +80℃
Humidity	<90%, no condensing
Pollution Degree	2
Altitude	<2000m
Vibration Frequency	Range: 10~150Hz, Refer to IEC 60068-2-6

2.1.4 Electromagnetic Compatibility

Electrostatic Discharge	Refer to IEC 61000-4-2(1), Level 4
Immunity to Radiated Fields	Refer to IEC 61000-4-3(1), Level 3
Immunity to Electrical Fast Transients	Refer to IEC 61000-4-4(1), Level 4
Immunity to Surges	Refer to IEC 61000-4-5(1), Level 4
Immunity to Conducted Disturbances	Refer to IEC 61000-4-6(1), Level 3
Immunity to Magnetic Fields	Refer to IEC 61000-4-8(1)
Immunity to Voltage Dips	Refer to IEC 61000-4-11(1)
Radiated Emissions	EN55011, Class B
Conducted Emissions	EN55011, Class B
Harmonics Emissions	Refer to IEC61000-3-2(1)
(1): The experimental test is carried out according to the grade requirements of industrial grade products in IEC61326-1.	

2.1.5 Safety Specifications

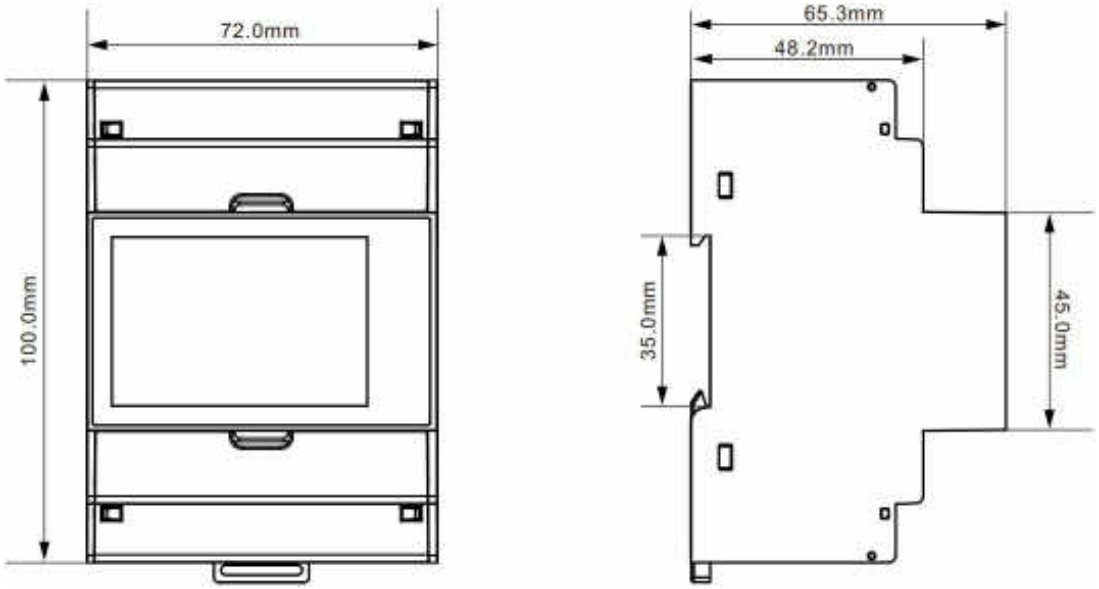
Installation Degree	CAT III, Refer to IEC 61010-1
Over-Voltage Degree	CAT III, Refer to IEC 61010-1
Insulation	AC Withstand Voltage: 4kVAC by lasting 1min
	Pulse Withstand Voltage: 6kVAC - 1.2/50μS waveform
Insulation Degree	Double Insulation, Refer to IEC 61010-1

2.1.6 Communication Specifications

Interfaces and Protocols	
Ethernet TCP	10/100M Base-T auto response, Modbus TCP
	Can be used as a TCP to RTU gateway
Modbus RTU	2-Wire RS485; Modbus RTU(Default), DL/T645-2007(Optional)
Baudrate	1200, 2400, 4800, 9600(Default), 19200, 38400 bps
Parity	None(Default), Even, Odd
Stop Bit	1(Default), 2

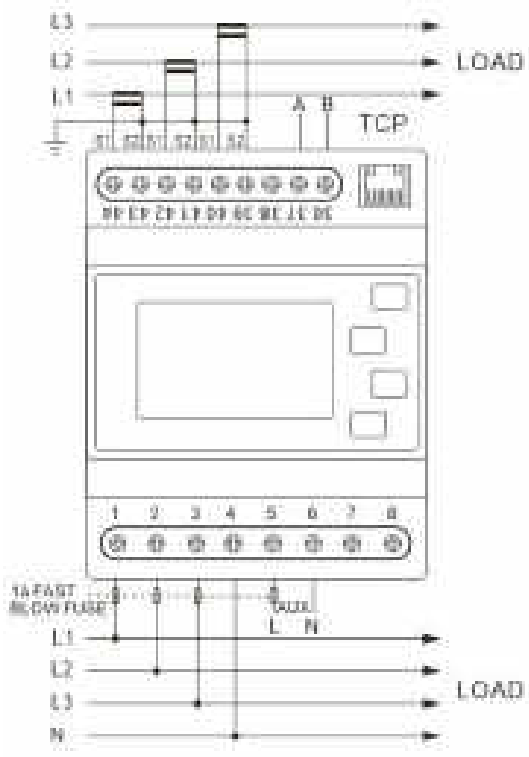
Response Time	<100ms
Bus Type	Semi-duplex
Distance	Max. 1000m
Bus Load	Max. 64pcs

2.2 Size

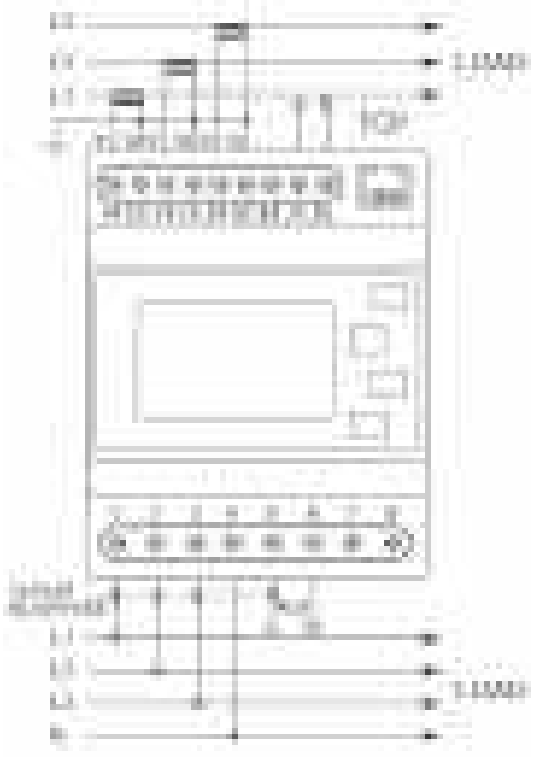


2.3 Wiring Diagram

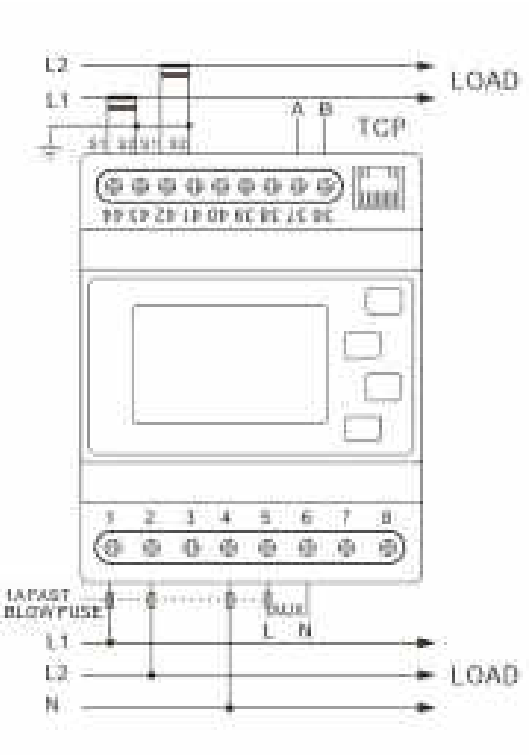
❖ **Three Phase 4 Wires**



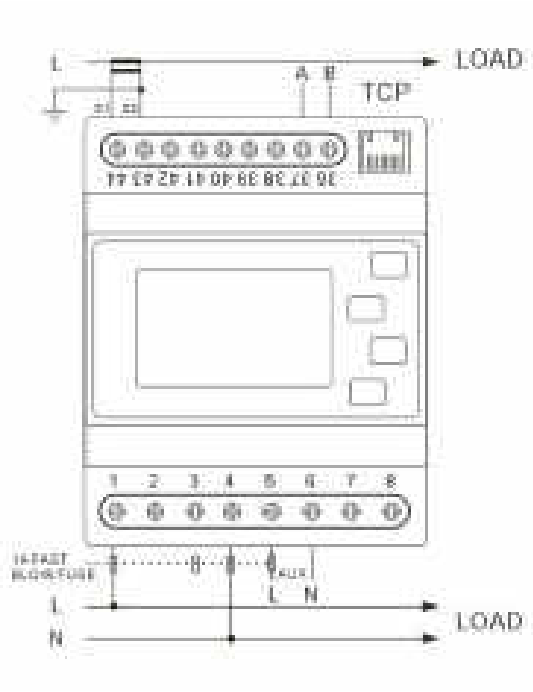
❖ **Three Phase 3 Wires**



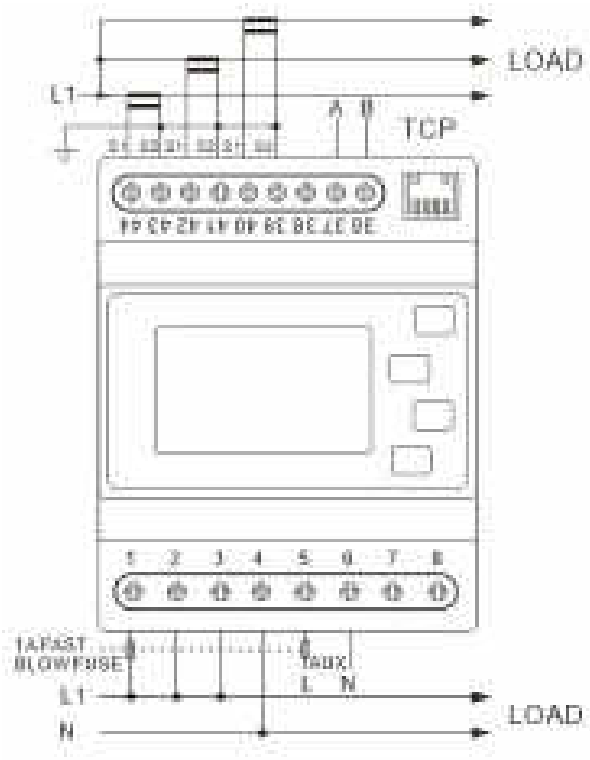
❖ **Two Phase 3 Wires**



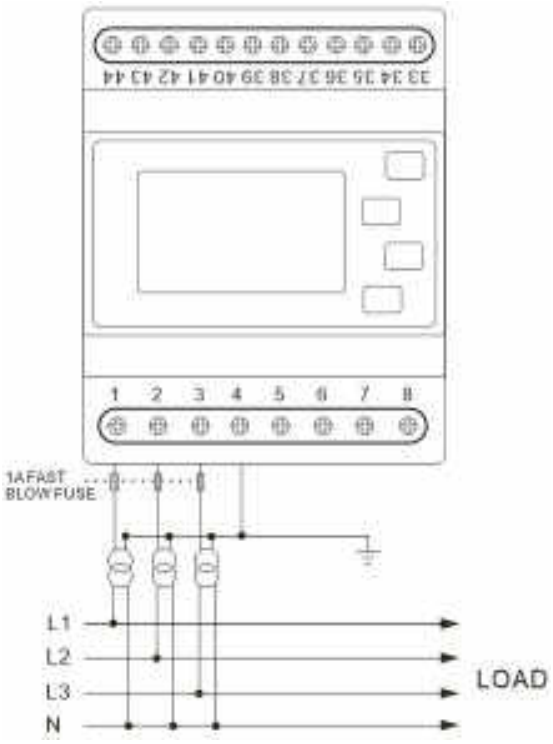
❖ **Single Phase 2 Wires (L+N, 1CT)**

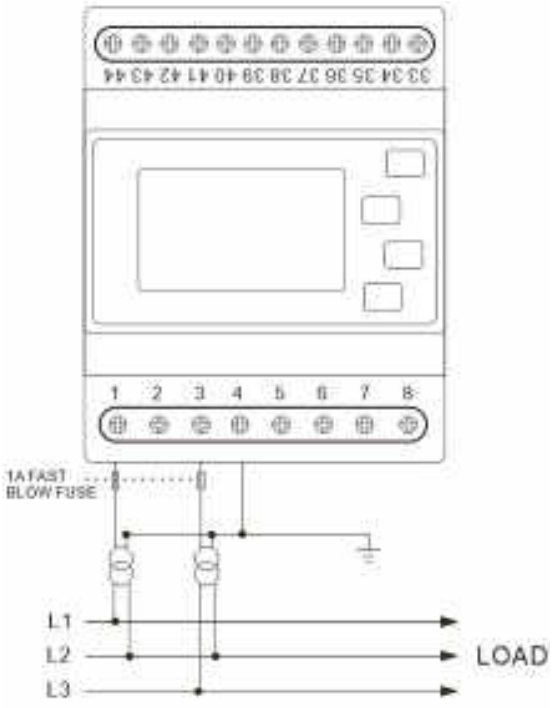


❖ **Single Phase 2 Wires (L+N, 3CT)**



2.3.1 PT Wiring



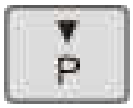


2.3.2 Terminals and Connection Cable

Voltage Input Terminals	Wire Diameter: 26 ~ 12 AWG Torque: 0.5 N.m (Max.)
Current Input Terminals	Wire Diameter: 26 ~ 12 AWG Torque: 0.5 N.m (Max.)
Aux.Power Supply Terminals	Wire Diameter: 26 ~ 12 AWG Torque: 0.5 N.m (Max.)
COMM/Pulse/DS Terminals	Wire Diameter: 26 ~ 12 AWG Torque: 0.5 N.m (Max.)
Temperature Rating of Connection Cable	23℃±2℃

Chapter 3. Operation

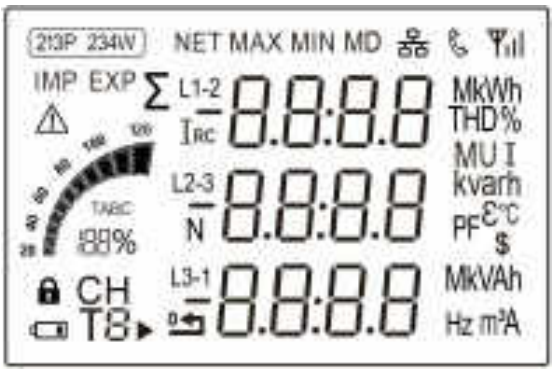
3.1 Button Definition

Button	Short-Press	Long-Press
	1, On main display: to check voltage, current, and so on; 2, On setting display or Aux. Display: to exit or return back to previous menu.	On main display: to enter the aux. displays.
	1, On main display: to check power factor, Max. Demand, and so on; 2, On setting display or Aux. Display: to page up or add value.	None
	1, On main display: to check power; 2, On setting display or Aux. Display: to page down or reduce value.	None
	1, On main display: to check energy and time; 2, On setting display: to move right.	1, On main display: to enter setting mode; 2, On setting display: to enter setting mode or to confirm.

Note: Long-press means the button is pressed longer than 3s, otherwise it's a short-press.

3.2 Displays

3.2.1 Full View of Display



After a short-press, the following displays will be showed.			
	Phase-to-Neutral Voltage Note: not available under 3P3W		Phase-to-Phase Voltage
	Current		Phase-to-neutral Voltage THD
	Phase-to-Phase Voltage THD Note: only available under 3P3W		Current THD
After a short-press, the following displays will be showed.			
	Total Power Factor and Frequency		Power Factor of Each Phase
	Max. current Demand of Each Phase		Max. Demand of Total Active Power/Reactive Power/Apparent Power
After a short-press, the following displays will be showed.			
	Active Power of Each Phase		Reactive Power of Each Phase

	Apparent Power of Each Phase		Total Active Power/Reactive Power/Apparent Power
 After a short-press, the following displays will be showed.			
	Total kWh		Import kWh
	Export kWh		Total kVarh
	Import kVarh		Export kVarh

■ **Display of kWh**

For TC55M-TCP series, the significant digit is displayed according to the value of energy.

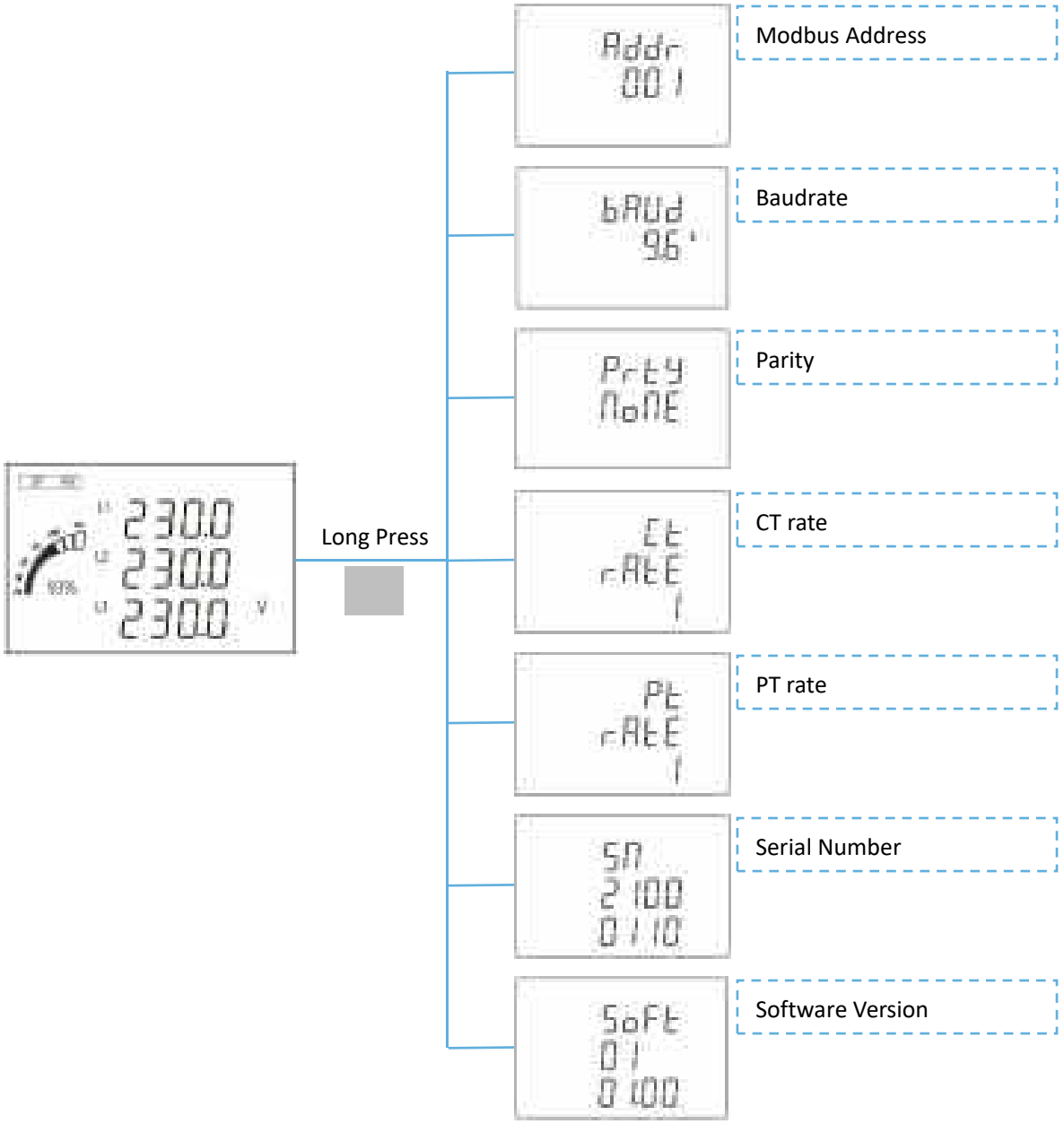
The rule is as below:

0.00 kWh/kVarh → 999999.99 kWh/kVarh → 1000000.0 kWh/kVarh → 9999999.9 kWh/kVarh → 10000000 kWh/kVarh → 99999999 kWh/kVarh → 0.00 kWh/kVarh

3.2.2 Auxiliary Displays

When it's on the main display, long press [ ] to enter the interfaces of auxiliary displays. Short press [ ] and [ ] to scroll. Short press [ ] to return to main display.

If there is no button operation longer than 1min, the meter will go back to main display automatically.



3.3 Settings

3.3.1 Password

On the main display, long press  to input the password. (Default: 1000)

Short press and and to choose the number and short press to move.

After inputting a password, long press to confirm. If the password is correct, the meter will enter setting mode.

Under the password input display, short press to go back to main display. Also, if there is no button operation longer than 1min, the meter will go back to main display automatically.

3.3.2 Modbus RTU Communication Settings

Communication settings include Modbus address, baud rate, parity, stop bit.

Instruction: Long press to enter the setting mode.

Short press and to choose.Long press to enter the exact menu.

Short press and to choose the value. Short press to move.

Long press to confirm and short press to return.

Stop bit: 1, 2

Default: 1

3.3.3 Modbus TCP Communication Settings

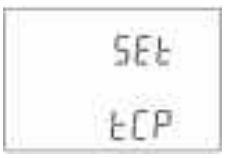
Ethernet parameter ettings Include DHCP, IP address, subnet mask, default gateway, IP port and save Ethernet parameters.

Instruction: Long press [ ] to enter the setting mode.

Short press [ ] and [ ] to choose.Long press [ ] to enter the exact menu.

Short press [ ] and [ ] to choose the value. Short press [ ] to move.

Long press [ ] to confirm and short press [ ] to return.



DHCP Function: Open, Close

Default: Close

IP address (1/4)

IP address is showed by 4 segments

IP address (2/4)

IP address is showed by 4 segments

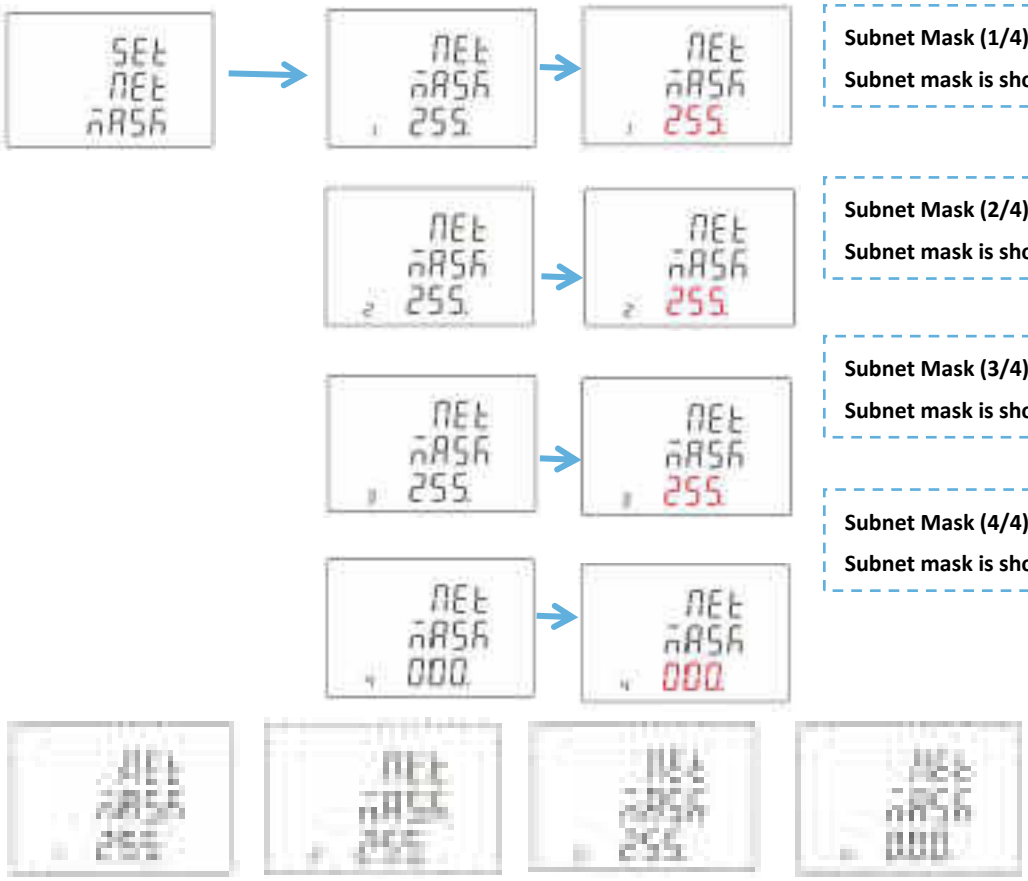
IP address (3/4)

IP address is showed by 4 segments

IP address (4/4)

IP address is showed by 4 segments

Note: The above is an example display for a complete IP address. The default address is 192.168.1.200



Subnet Mask (1/4)

Subnet mask is showed by 4 segments

Subnet Mask (2/4)

Subnet mask is showed by 4 segments

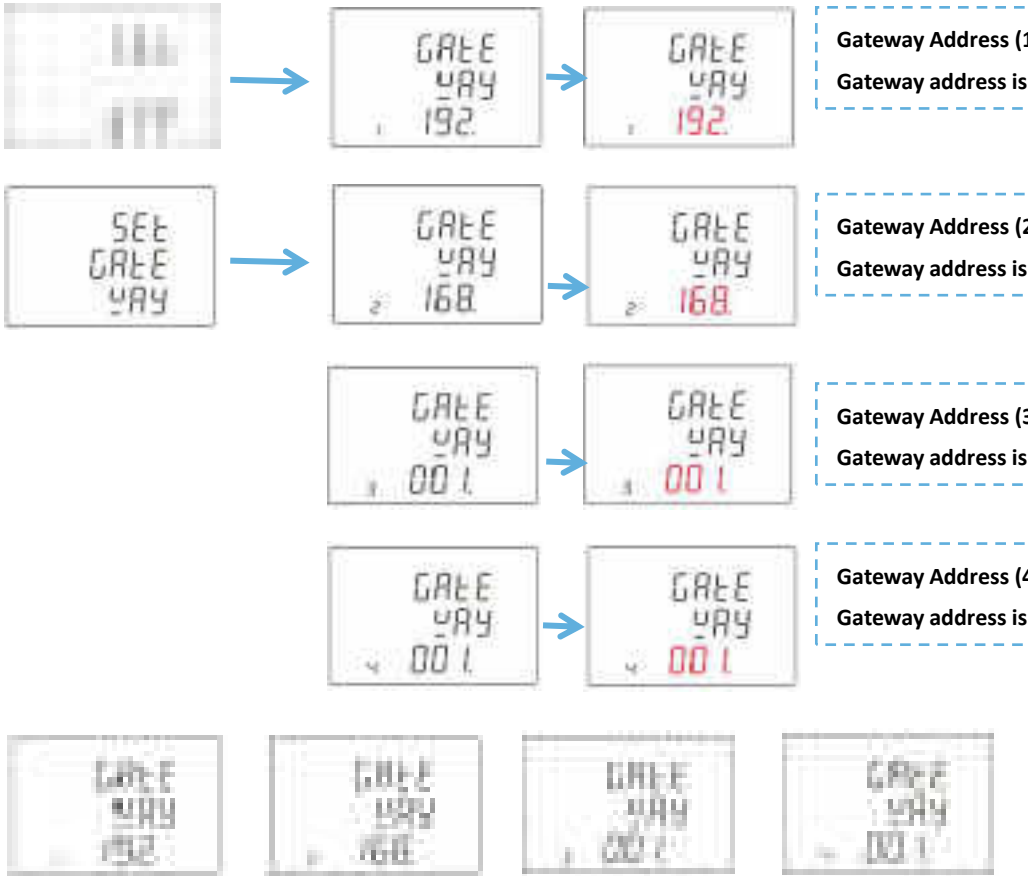
Subnet Mask (3/4)

Subnet mask is showed by 4 segments

Subnet Mask (4/4)

Subnet mask is showed by 4 segments

Note: The preceding example is for a complete subnet mask. The default address is 255.255.255.000.



Gateway Address (1/4)

Gateway address is showed by 4 segments

Gateway Address (2/4)

Gateway address is showed by 4 segments

Gateway Address (3/4)

Gateway address is showed by 4 segments

Gateway Address (4/4)

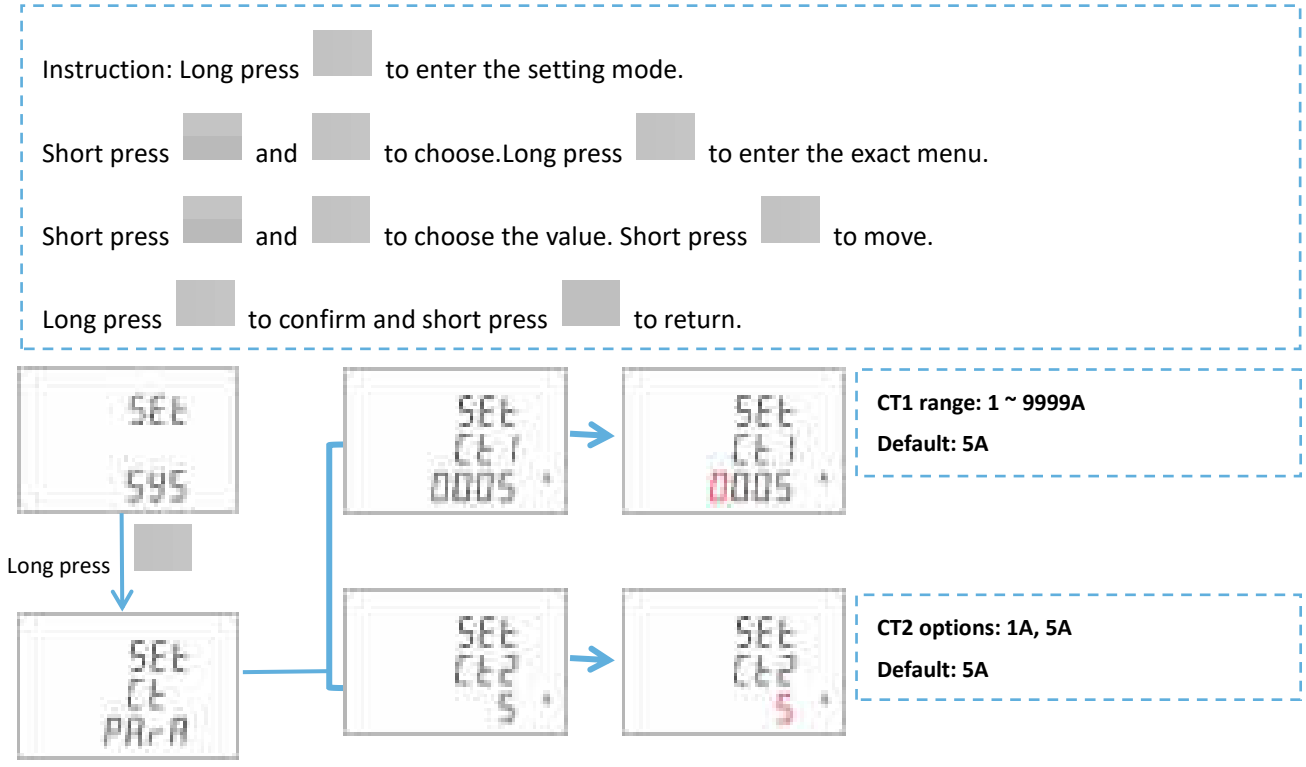
Gateway address is showed by 4 segments

Note: The preceding example shows a complete gateway address. The default gateway address is 192.168.1.1.

Note: After the Ethernet parameters are set, users need to save the Settings in this menu to save the settings If not saving, the meter will not save the set Ethernet parameters.

3.3.4 CT Settings

CT settings include CT1 value and CT2 value.



3.3.5 PT Settings

PT settings include PT1 value and PT2 value.

Instruction: Long press [ ] to enter the setting mode.

Short press [ ] and [ ] to choose.Long press [ ] to enter the exact menu.

Short press [ ] and [ ] to choose the value. Short press [ ] to move.

Long press [ ] to confirm and short press [ ] to return.

PT1 range: 30 ~ 600000V

Default: 230V

PT2 range: 30 ~ 600V

Default: 230V

3.3.6 System Settings

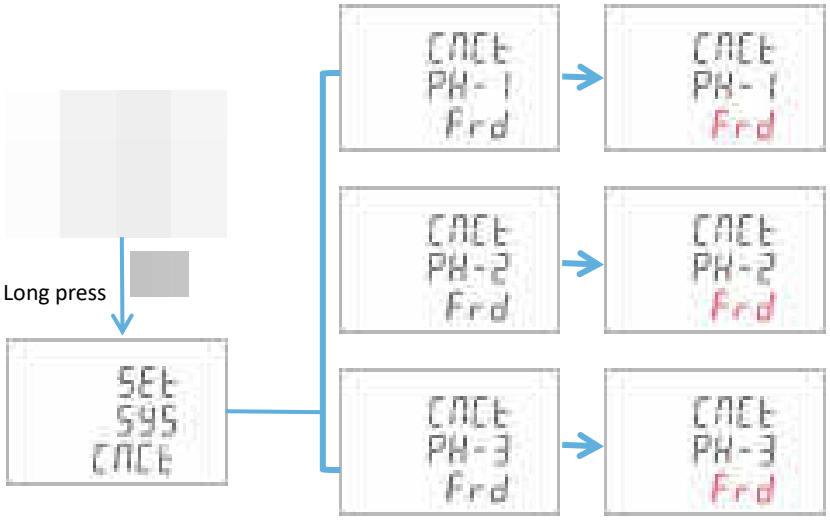
System settings include CT directions, password and reset Max.demand.

Instruction: Long press [ ] to enter the setting mode.

Short press [ ] and [ ] to choose.Long press [ ] to enter the exact menu.

Short press [ ] and [ ] to choose the value. Short press [ ] to move.

Long press [ ] to confirm and short press [ ] to return.



Direction of CTs

Note : Frd means forward;

rEV means reverse.

3.3.7 Pulse Settings

Pulse settings include pulse constant, pulse width, pulse output type.

Instruction: Long press to enter the setting mode.

Short press and to choose.Long press to enter the exact menu.

Short press and to choose the value. Short press to move.

Long press to confirm and short press to return.

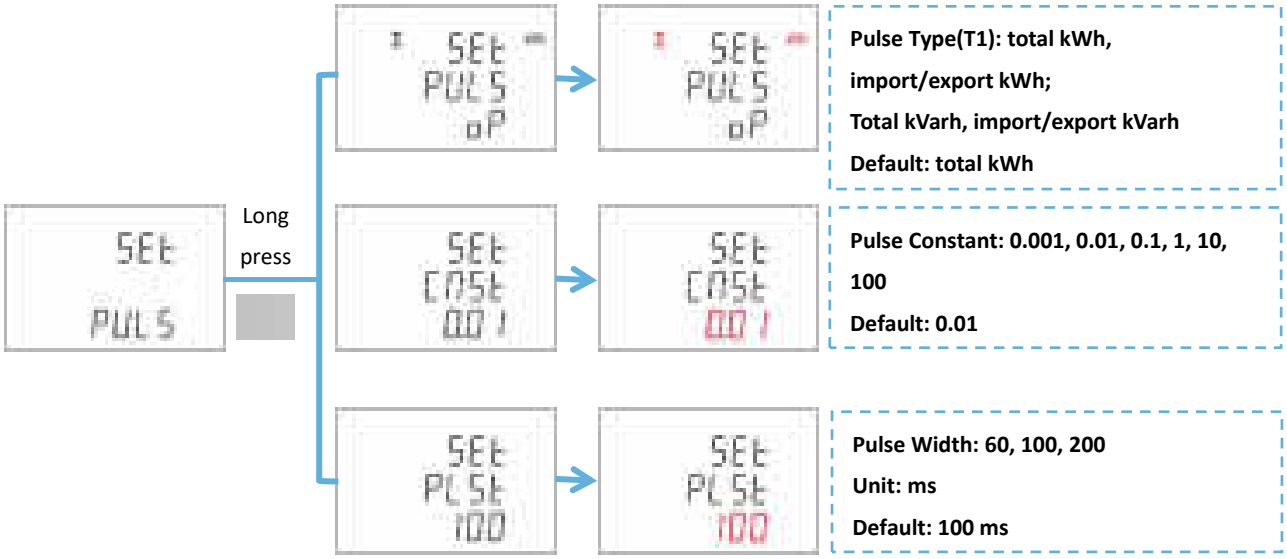


Table 1： Pulse Output Type

Character on Display	Pulse Output Type	Character on Display	Pulse Output Type	Character on Display	Pulse Output Type
Σ kWh	Total kWh	IMP kWh	Import kWh	EXP kWh	Export kWh
Σ kvarh	Total kVarh	IMP kvarh	Import kVarh	EXP kvarh	Export kVarh

3.3.8 Demand Settings

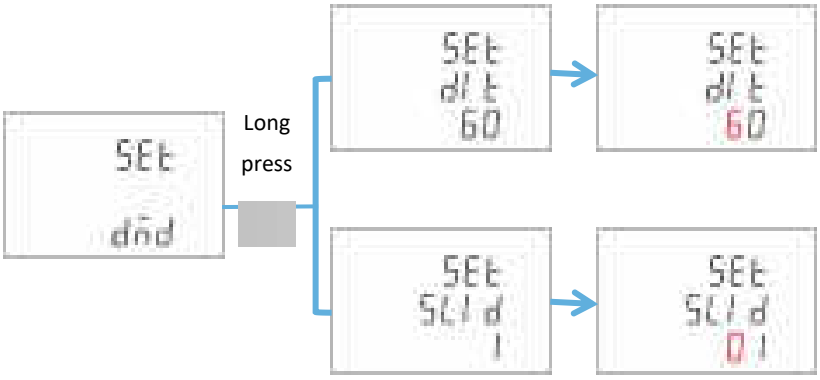
Demand settings include demand period, slide time.

Instruction: Long press [ ] to enter the setting mode.

Short press [ ] and [ ] to choose.Long press [ ] to enter the exact menu.

Short press [ ] and [ ] to choose the value. Short press [ ] to move.

Long press [ ] to confirm and short press [ ] to return.



Demand Period Rnge: 0~60

Unit: minute

Default: 60

Slide Time Range: 1~(demand period-1.

Unit: minute

Default: 1

3.3.9 Time Settings

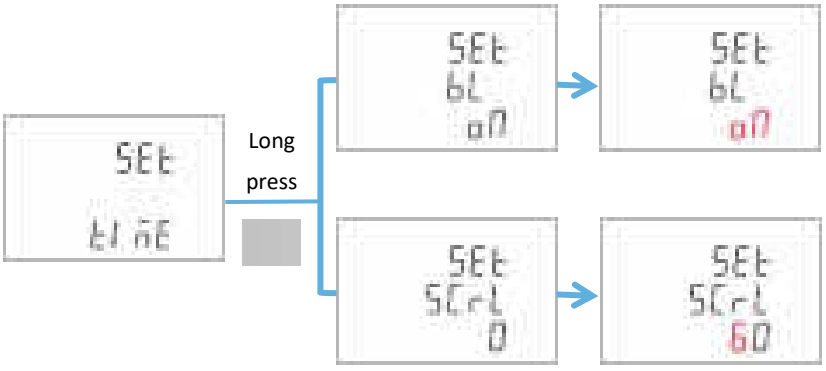
Time settings include backlit time, scroll time.

Instruction: Long press [ ] to enter the setting mode.

Short press [ ] and [ ] to choose.Long press [ ] to enter the exact menu.

Short press [ ] and [ ] to choose the value. Short press [ ] to move.

Long press [ ] to confirm and short press [ ] to return.



Backlit Time Options: on, off, 5, 10, 30, 60, 120

Unit: minute

Default: 10mis

Scroll Time Range: 0 ~ 60

Unit: second

Default: 0 (no scroll)

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