Single Phase Multifunctional Energy Meter

SD20L-D Series

User Manual V 1.0



Rayfull Electric Technology(Zhejiang)Co., Ltd.

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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 SD20L-D 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 SD20L-D 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 SD20L-D 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;

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- 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.

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Chapter 1. Product Introduction

1.1 Brief Introduction

SD20L-D series are the single phase multifunctional energy meter to measure and analyze the most important electrical parameters, including voltage, current, four-quadrant power parameters, power factor, and etc. And it can also read a variety of energy parameters, involving bidirectional active and reactive energy, four-quadrant energy, monthly and daily energy consumption statistics, and so on.

The SD20L-D series have both LoRaWAN and RS485 communication interface with highest baudrate 38400bps, supporting Modbus or DLT645 protocol for remote reading.

And it also has built-in relay for remote control.

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

- Input: Max. 80A Direct Input;
- Multifunctional Parameters: V, A, W, Var, VA, kWh, kVarh, PF, ...;
- Bidirectional Energy Measurement: Import/Export Active Energy, Import/Export Reactive Energy;
- Meter Running Time and Load Running Time Measurement;
- LoRaWAN Wireless Communication;
- RS485 Communication with Highest Baudrate 38400bps;
- In-built relay, support relay remote control;
- 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).
- 2 Module, TH35-7.5 DIN-Rail

1.3 Applications

SD20L-D series are designed for solar PV, EV charging, wind power generation and other electrical systems,

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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 1 / 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 1 / 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	230 VAC
	Voltage Input	85 ~ 300 VAC
	Frequency	45 ~ 65 Hz
	Overload Capacity	2x Rated Voltage by lasting 1s
Current Input	Current Input	0.15 ~ 80 A, Rated 5A
	Overload Capacity	30x Max. Current by lasting 0.01s
Pulse Output	Pulse Type	Open collector optocoupler
	Pulse Constant	Configuration:1000(Default), 100, 10, 1 imp/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: 1000imp/kWh
Power Consumption Class	Self-Consumption	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

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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

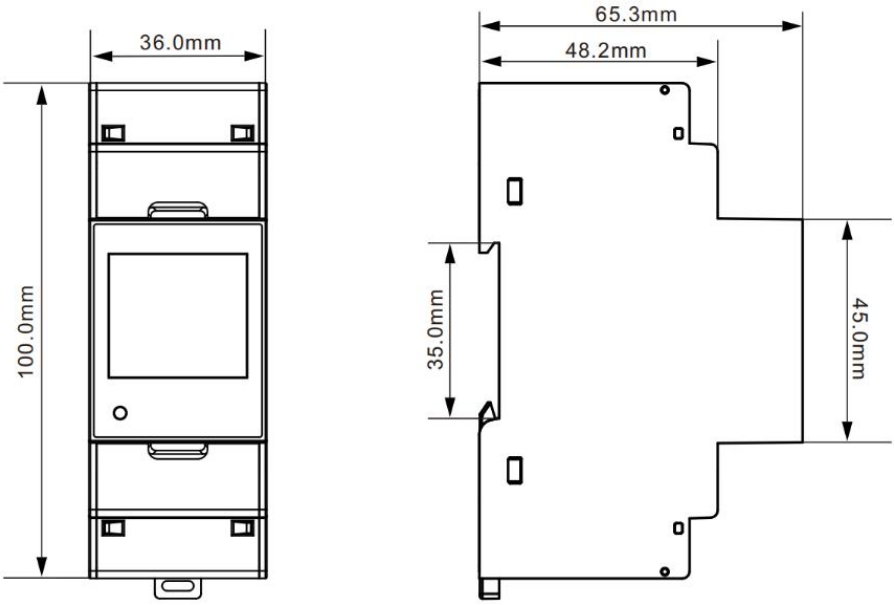
Installation Degree	CAT III, Refer to IEC 61010-1
Over-Voltage Degree	CAT III, Refer to IEC 61010-1
Insulation	AC Withstand Voltage: 4kVAC by lasting 1min
	Pulse Withstand Voltage: 6kVAC - 1.2/50μS waveform
Insulation Degree	Double Insulation, Refer to IEC 61010-1

2.1.6 Communication Specifications

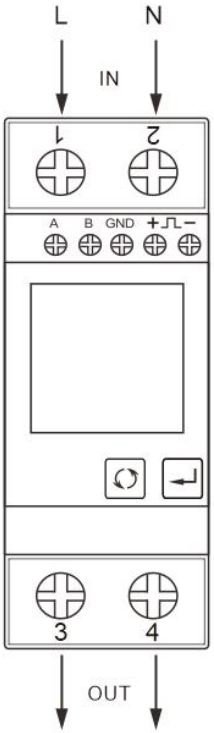
Interface and Protocol	2-Wire RS485; Modbus RTU(Default), DL/T645-2007(Optional)
Baudrate	1200, 2400, 4800, 9600(Default), 19200, 38400 bps
Parity	None(Default), Even, Odd
Stop Bit	1(Default), 2
Response Time	<100ms
Bus Type	Semi-duplex
Distance	Max. 1000m
Bus Load	Max. 64pcs
Wireless	
LoRaWAN	LoRaWAN V1.0.4.Class C

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2.2 Size



2.3 Wiring Diagram



2.3.1 Terminals and Connection Cable

Comm and Pulse Terminals	Wire Diameter: 26 ~ 14 AWG Torque: 0.4 N.m (Max.)
Measurement Input Terminals	Wire Diameter: 14 ~ 4 AWG Torque: 4 N.m(Max.)
Temperature Rating of Connection Cable	23℃±2℃

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Chapter.3 Operation

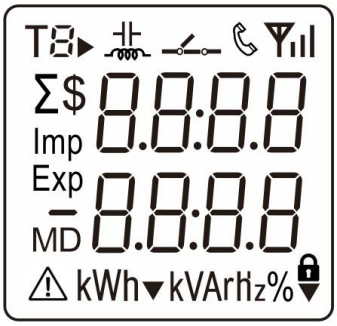
3.1 Button Definition

Button	Short-Press	Long-Press
	Scroll Displays	On setting display: to exist or return back to previous menu.
	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.

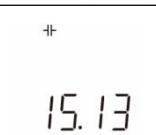
Note: Long-press means the button is pressed longer than 3s, otherwise it's a short-press.

3.2 Displays

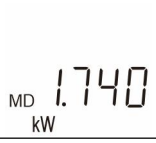
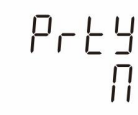
3.2.1 Full View of Display



 After a short-press, the following displays will be showed.

	Total kWh		Import kWh
	Export kWh		Total kVarh
	Import kVarh		Export kVarh
	Voltage  : inductive		Current
	Active Power		Reactive Power  : capacitive

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	Apparent Power		Power Factor
	Frequency		Max. Demand of Active Power
	Modbus Address		Baud rate
	Parity		Pulse Type and Pulse Constant
	Serial Number		Software Version

■ **Display of kWh**

For SD20L-D series, the significant digit is displayed according to the value of energy.

The rule is 0.00 kWh/kVarh→999999.99kWh/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  to scroll and long press  to return to main display.

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

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➢ LoRaWAN Information:

1. Status of LoRaWAN to Join OTAA



Instruction: Long press  to join OTAA.

Note: the 2nd and 3rd line indicate the current status.

on: Join LoRaWAN network successfully;



: in the process of joining LoRaWAN network;



: The joining operation is queued up to the network.

The 3rd line also indicates the time left to wait. Unit: s

The left figure shows there are 230s left for the meter to join the network

Note: After the meter is powered on, a waiting time of 5-600 seconds will be randomly generated to prevent a large number of products from being powered on at the same time to join the network congestion.

2. DEVEUI Information



Instruction: Long press  to next menu.

Short press  to scroll.

Short press  to return.



The DEVEUI consists of 8 bytes in Hex(P1-P2).

The left figure shows the DEVEUI of current meter is 00 80 E1 15 00 2C BD 92.



3. APPEUI Information

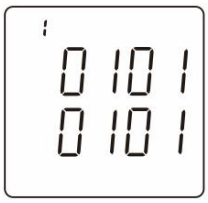


Instruction: Long press  to next menu.

Short press  to scroll.

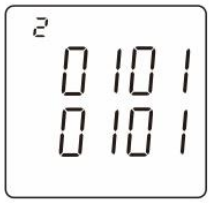
Short press  to return.

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The APPEUI consists of 8 bytes in Hex(P1-P2).

The left figure shows the APPEUI of current meter is 01 01 01 01 01 01 01 01.



4. APPKEY Information



Instruction: Long press  to next menu.

Short press  to scroll.

Short press  to return.



The APPEUI consists of 16 bytes in Hex(P1-P4).

The left figure shows the APPKEY of current meter is 1F D9 8E E4 D4 EA CE 4C 17 C1 0C 52 A1 B7 9B 19.







5. Status of ADR



ON: ADR is open;
OFF: ADR is off.

Note: ADR function refers to the function that the devices and gateways in LORAWAN network automatically negotiate to adjust the communication rate.

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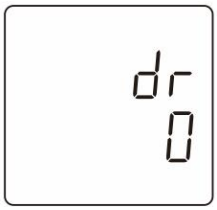
6. Offline Detection Time



Unit: Min.
The left figure shows the current offline detection time is 60mins.

Note: This function is used to detect whether the meter is offline. If it is judged to be offline, the meter automatically re-joins the network.
The rules for determining offline are as follows: If the meter does not receive any data from the gateway within the set time range, it is judged offline.
Also, the meter will automatically send a heartbeat packet to the gateway at the appropriate window according to the set time. If the gateway replies with a confirmation message, the meter will determine that the network is online.

7. RX2 Rate of LoRaWAN Network



The left figure shows the RX2 rate of current meter is DR0.

8. RX2 Frequency Band of LoRaWAN Network



The left figure shows the frequency band of RX2 is 869.5MHz.

9. Test of Upload



Instruction: Long press 

to send a request from meter to gateway.

Note: the3rd line indicates the current status of operation.

NoN: No request is ready to be sent (null);

WAIt: Requesting now and wait for result;

oK: Request is successfully sent;

FAIL: Request is failed.

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3.3 Settings

3.3.1 Password

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



Short press  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, long 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.

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3.3.2 Communication Settings

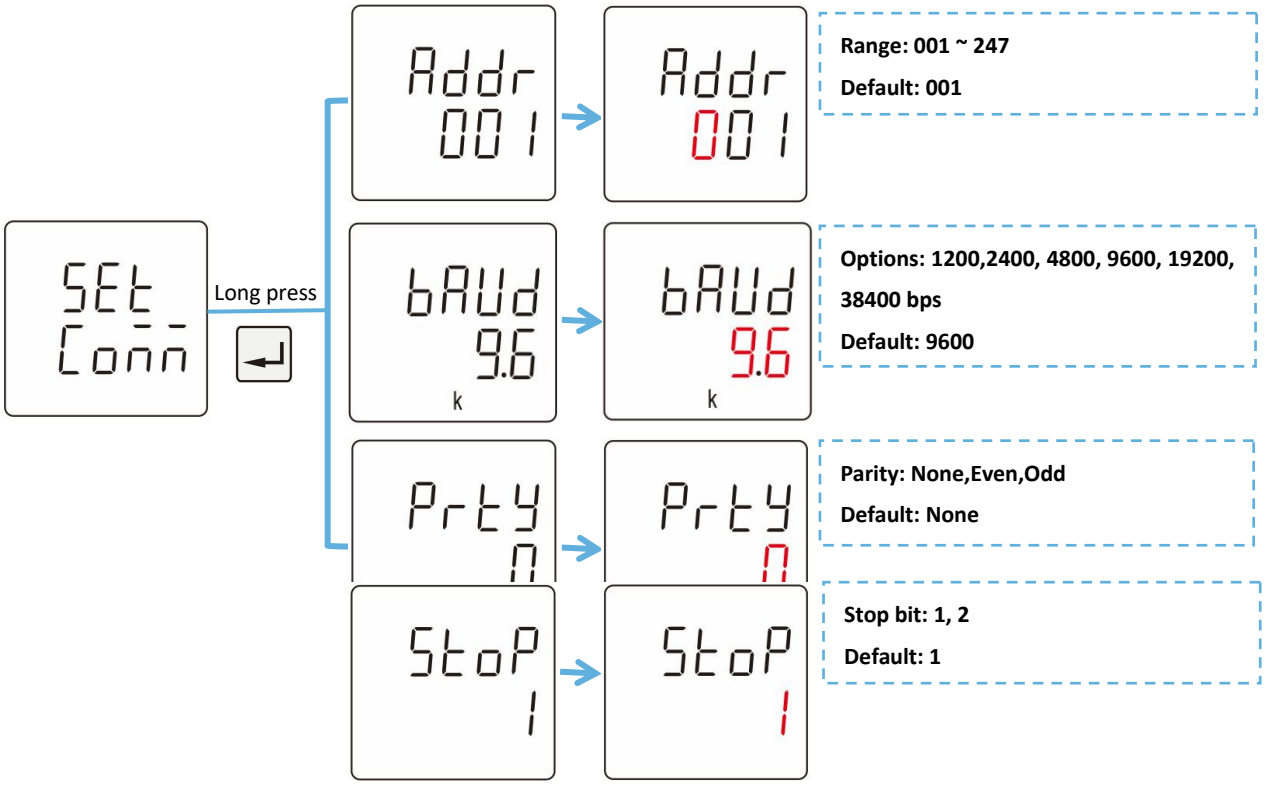
Communication settings include Modbus address, baud rate, parity, stop bit.

Instruction: Long press to enter the setting mode.Short press to choose.

Long press to enter the exact menu.

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

Long press to confirm and short press to return.



3.3.3 System Settings

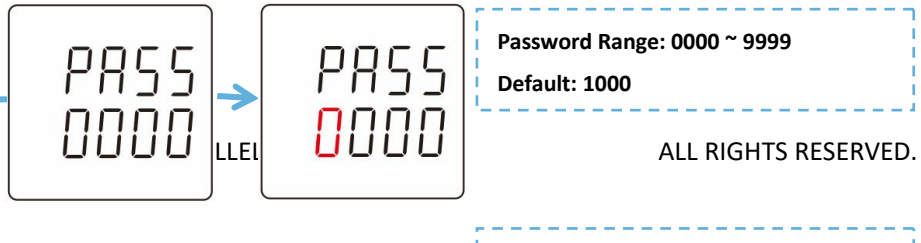
System Settings include password, reset Max. Demand.

Instruction: Long press to enter the setting mode.Short press to choose.

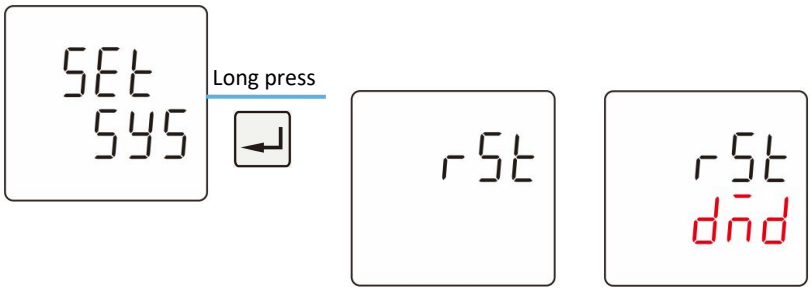
Long press to enter the exact menu.

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

Long press to confirm and short press to return.



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3.3.4 Pulse Settings

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

Instruction: Long press to enter the setting mode.Short press to choose.

Long press to enter the exact menu.

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

Long press to confirm and short press to return.

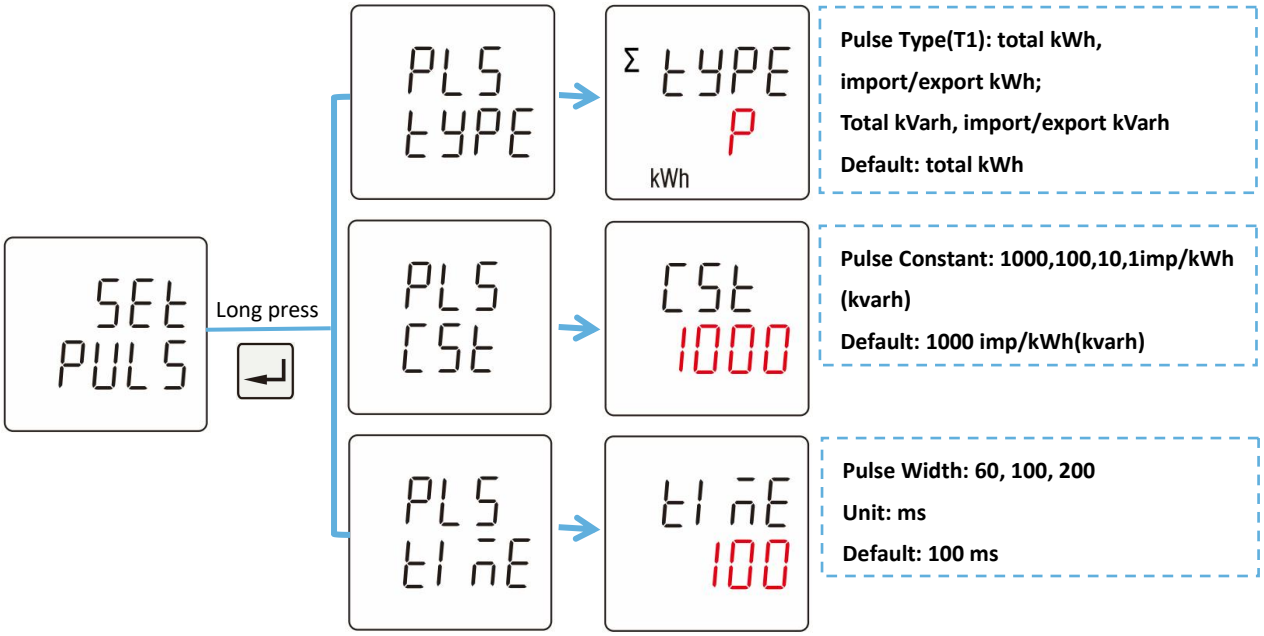


Table 1：Pulse Output Type

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

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3.3.5 Demand Settings

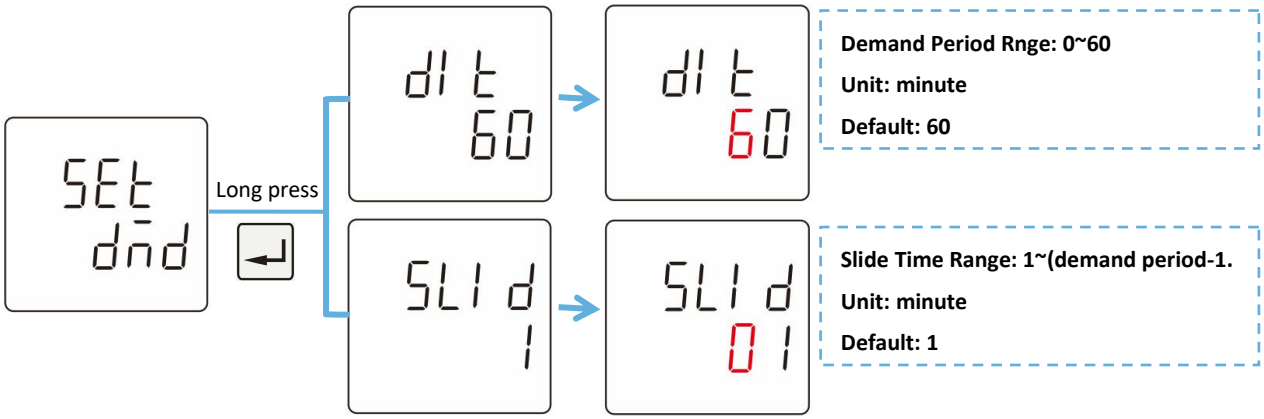
Demand settings include demand period, slide time.

Instruction: Long press  to enter the setting mode.Short press  to choose.

Long press  to enter the exact menu.

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

Long press  to confirm and short press  to return.



3.3.6 Time Settings

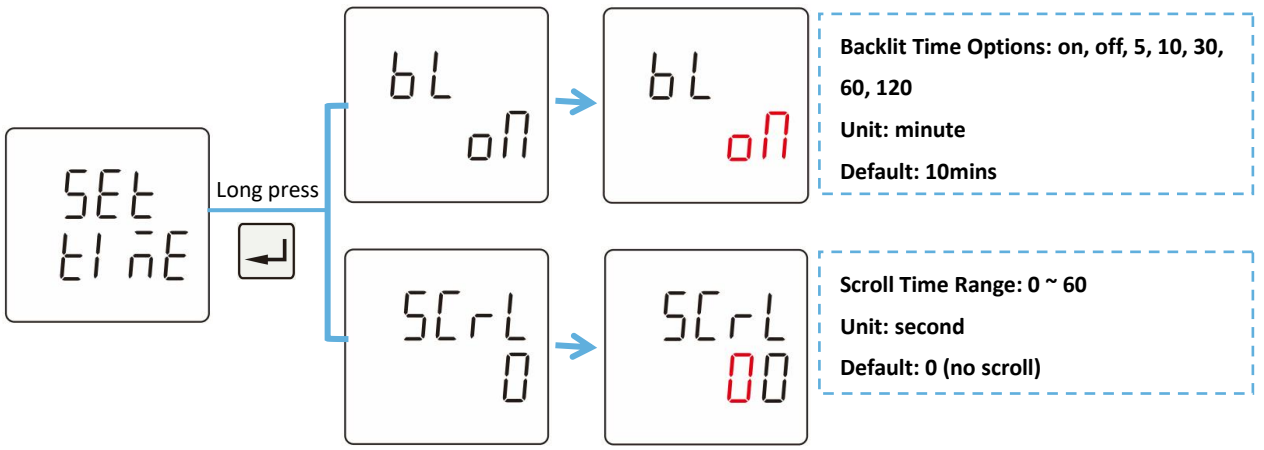
Time settings include backlit time, scroll time.

Instruction: Long press  to enter the setting mode.Short press  to choose.

Long press  to enter the exact menu.

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

Long press  to confirm and short press  to return.



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3.3.7 LoRaWAN Communication Settings

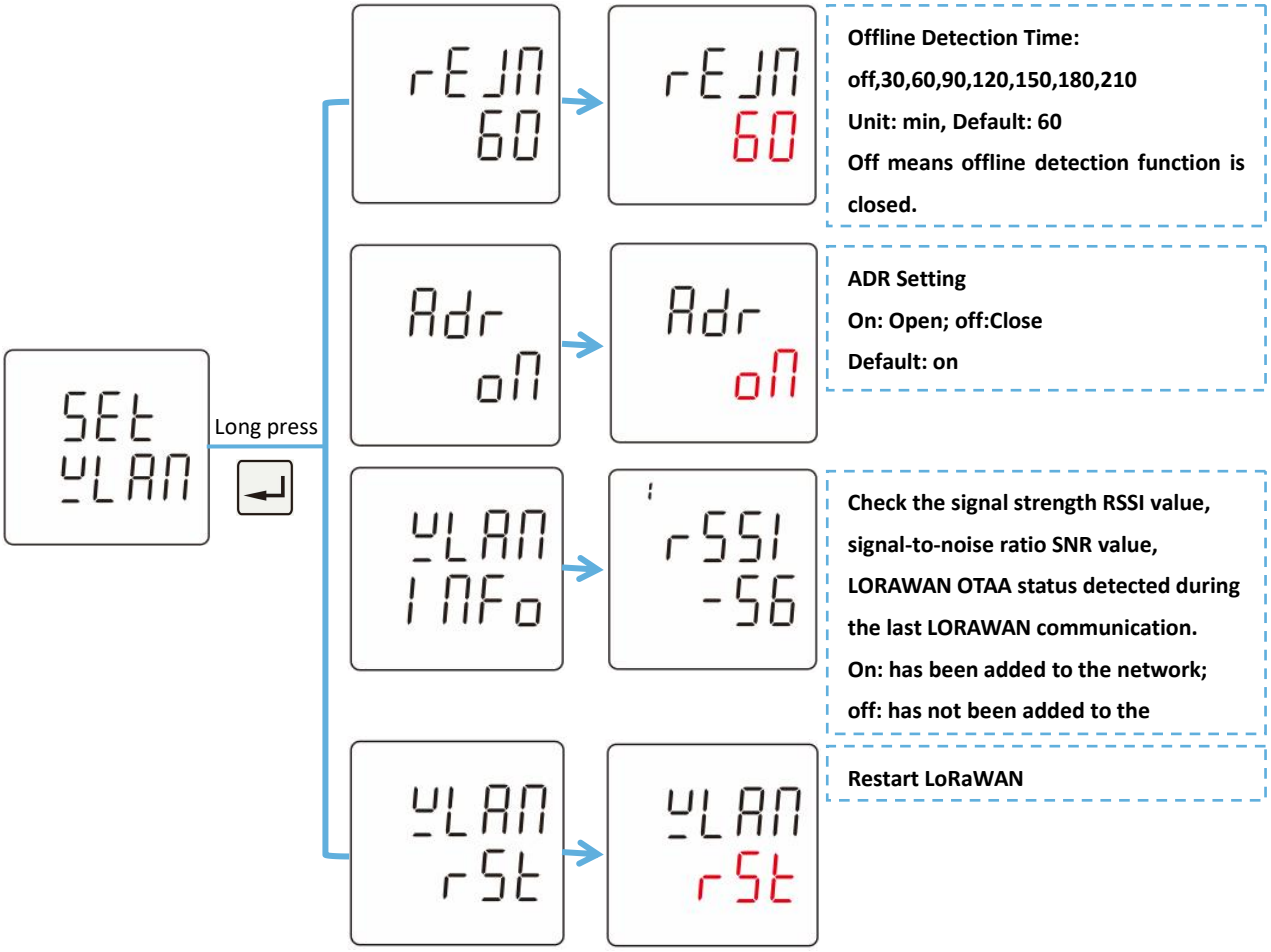
LORAWAN Communication settings include offline detection time, ADR function, LoRaWAN information, restart LoRaWAN module.

Instruction: Long press to enter the setting mode.Short press to choose.

Long press to enter the exact menu.

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

Long press to confirm and short press to return.



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3.3.8 Alarm Settings

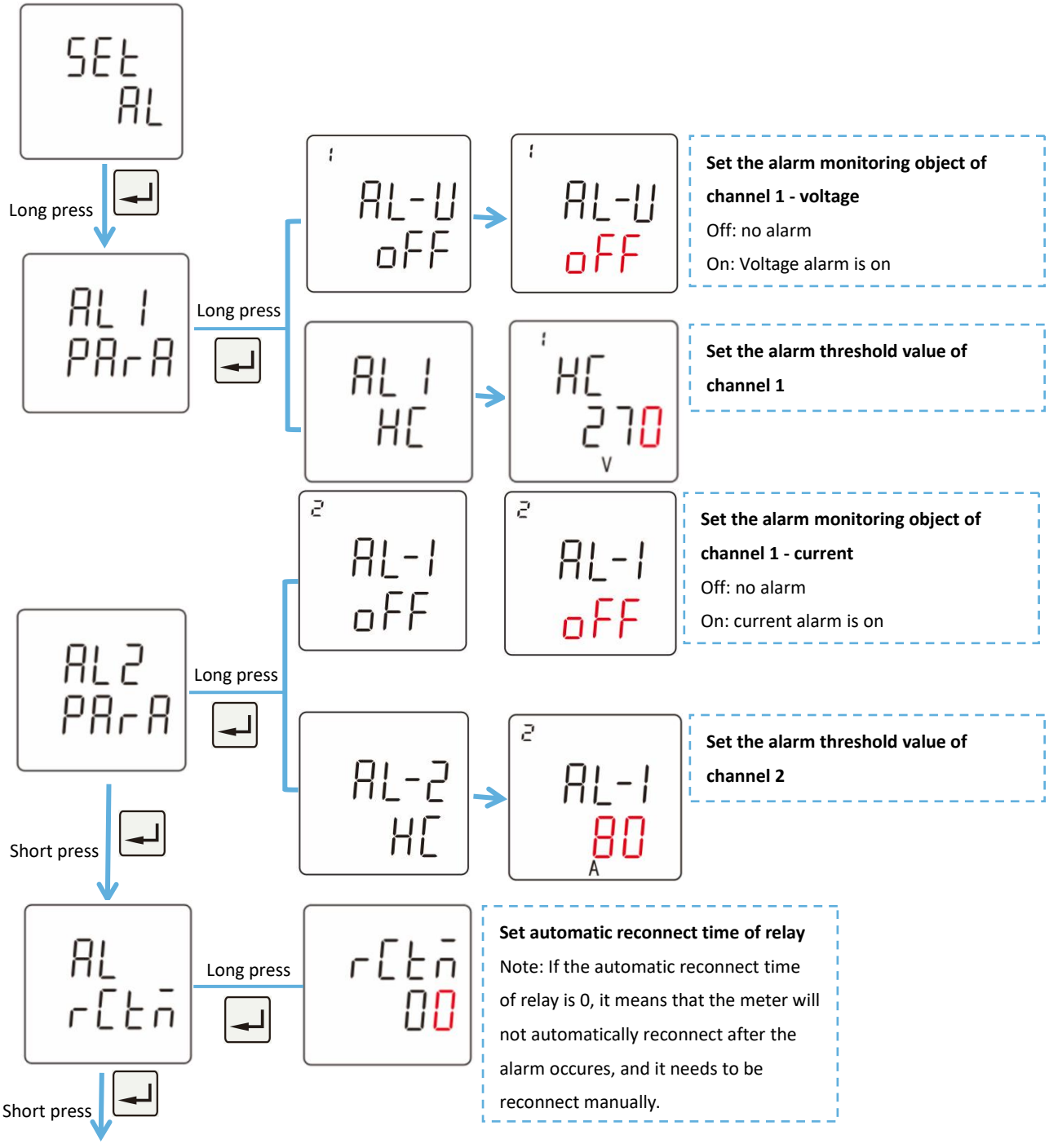
Alarm settings include alarm object, alarm threshold value, automatic reconnect time of relay and alarm status.

Instruction: Long press to enter the setting mode.Short press to choose.

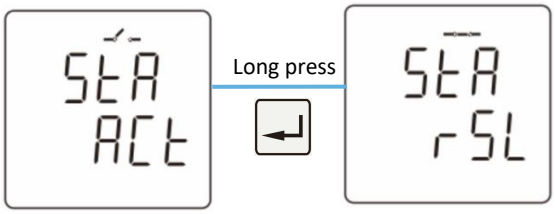
Long press to enter the exact menu.

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

Long press to confirm and short press to return.



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View alarm status

rSL : indicates no alarm is triggered now.

Alarm	Description	Alarm	Description	Alarm	Description
U	Voltage	I	Current	P	Active Power
q	Reactive Power	S	Apparent Power	F	Frequency
NULL	No alarm object is associated.(alarm function is disabled)				

3.3.9 Manual Controlled Relay

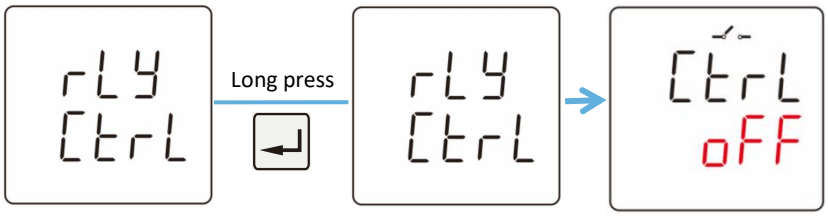
Relay control include manually control the connect and disconnect the relay.

Instruction: Long press to enter the setting mode.Short press to choose.

Long press to enter the exact menu.

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

Long press to confirm and short press to return.



Manually control the relay

oFF : relay is disconnected

on : relay is connected

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Appendix I Fault Code Description

No.	Fault code	Fault description
1	Err-01	The battery voltage is too low
2	Err-02	Relay cannot be disconnected fault
3	Err-03	1. Relay cannot be disconnected fault 2. The battery voltage is too low
4	Err-04	WIFI module fault
5	Err-05	1. The battery voltage is too low 2. WIFI module fault
6	Err-06	1. Relay cannot be disconnected fault 2. WIFI module fault
7	Err-07	1. Relay cannot be disconnected fault 2. The battery voltage is too low 3. WIFI module fault

Appendix II Alarm Definition on Meter

No.	Display On the Mmeter	Alarm Definition
1	LCD display alarm icon ⚠, but no fault code	The overlimit alarm of the monitored object occurs
2	LCD does not display alarm icon ⚠, but it does display fault code	Meter fault

Appendix III Status of Indicator

No.	STA LED flashing status	Description
1	Fast flashing	Indicates that the current WIFI is in Smartconfig state.
2	Slow flashing	Indicates that the current WIFI is in AP-config state.
3	On for 0.25 seconds and off for 2 seconds	Indicates that the current WIFI is configured but not connected to the route.
4	On for 0.25 seconds and off for 1 seconds	Indicates that the current WIFI is configured and connected to the router, but not connected to the cloud.
5	On	WIFI connects to a router and connects to the cloud.

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