

Single Phase Multifunctional DC Energy Meter RN22DC Series

User Manual V 1.0

DC DIN RAIL ENERGY METER IEC62053-41

ACCURATE • RELIABLE • SMART



ACCURATE
MEASUREMENT



ENERGY
MONITORING



RELIABLE
PERFORMANCE



EASY
INSTALLATION



ACCURATE
MEASUREMENT
Class 1.0 Accuracy



REAL-TIME
MONITORING
Voltage, Current,
Power, Energy



PULSE OUTPUT
1000 imp/kWh



SAFE & RELIABLE
Compliant with
IEC62053-41



EASY INSTALLATION
DIN Rail Mounting



HIGH
SAFETY



ADVANCED
TECHNOLOGY



ENERGY
EFFICIENCY



PREMIUM
QUALITY

Renatta

Measure Today, Power Tomorrow

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 RN22DC 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 RN22DC 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 RN22DC 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.

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Chapter 1. Product Introduction

1.1 Brief Introduction

RN22DC series are designed for direct current energy analysis and energy metering. The products adopt shunt access mode.

The current of the shunt supports a maximum of 2000 A. The shunt supports positive and negative connection modes to improve the wiring flexibility of the shunt. This series of meters can measure voltage, current, power and positive and negative charge in the DC system.

The RN22DC series have RS485 communication interface 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, kWh, Import/Export Energy;

Pulse Output, RS485 Communication With Highest Baudrate 38400bps;

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

The RN22DC is designed for applications such as telecom base stations, DC charging piles, and solar PV. In the actual use of the site, users can measure the total energy and the energy within a specified period of time. The test results can not only be used for local display, but also can be connected with industrial control equipment and computers to form a measurement and control system, which is suitable for various control systems, SCADA systems and energy management systems.

Chapter 2. Technical Specifications

2.1 Specifications

2.1.1 Electrical Specifications

Accuracy	Voltage/Current	Class 0.5
	Active Power	Class 1 / Class 0.5
	Active Energy	Class 1 / Class 0.5S
Data Upgrading Rate		1s (Optional: 100ms)
Voltage Input	Rated Voltage	1000 VAC
	Voltage Input	Measurement Range: 5-1000 VDC
Current Input	CT2	75mv; Optional: 60mV/45mV
	CT1	1-2000A
Aux.Power Supply	Operating Voltage	80-300VAC or 9-36V DC (Optional)
	Frequency	45 ~ 65 Hz
	Power consumption	< 4VA/0.5W
Pulse Output	Pulse Type	Open collector optocoupler
	Pulse Constant	Configuration:1000(Default), 100, 10, 1 imp/kWh
	Pulse Width	Configuration: 60, 100(Default), 200ms
	Pulse Output Type	Configuration: Import/Export/Total 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

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.	

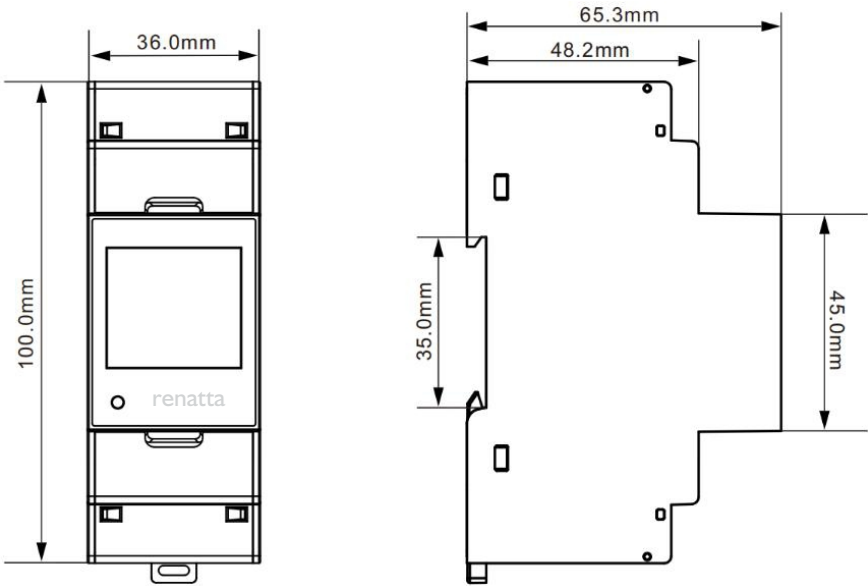
2.1.5 Safety Specifications

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

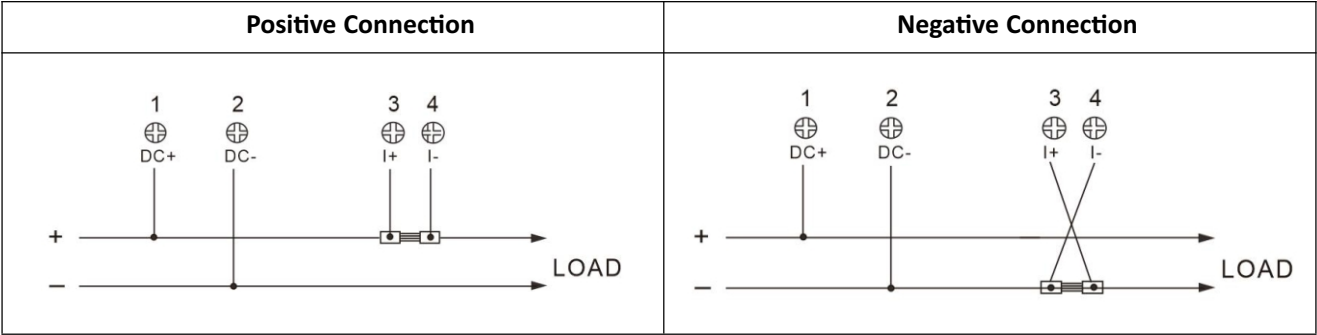
2.1.6 Communication Specifications

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

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: 26 ~ 14 AWG Torque: 0.4 N.m(Max.)
Temperature Rating of Connection Cable	23℃ ± 2℃

Chapter.3 Operation

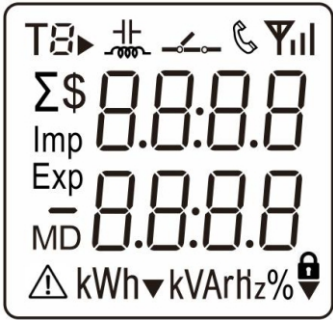
3.1 Button Definition

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 Active kWh		Import ActivekWh
	Export Active kWh		Voltage

500.0 A	Current	16.18 kW	Active Power
MD 174.0 kW	Max.Demand of Active Power	CT1 600 A	CT1
Addr 001	Modbus Address	BAUD 9.6 k	Baud rate
Prty n	Parity	Σ PLS 1000 kWh	Pulse Type and Pulse Constant
2103 1101	Serial Number	01 0.100	Software Version

Display of kWh

For DC22M series, the significant digit is displayed according to the value of energy.

The rule is 0.00 kWh→999999.99kWh→0.00 kWh.

3.3 Settings

3.3.1 Password

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

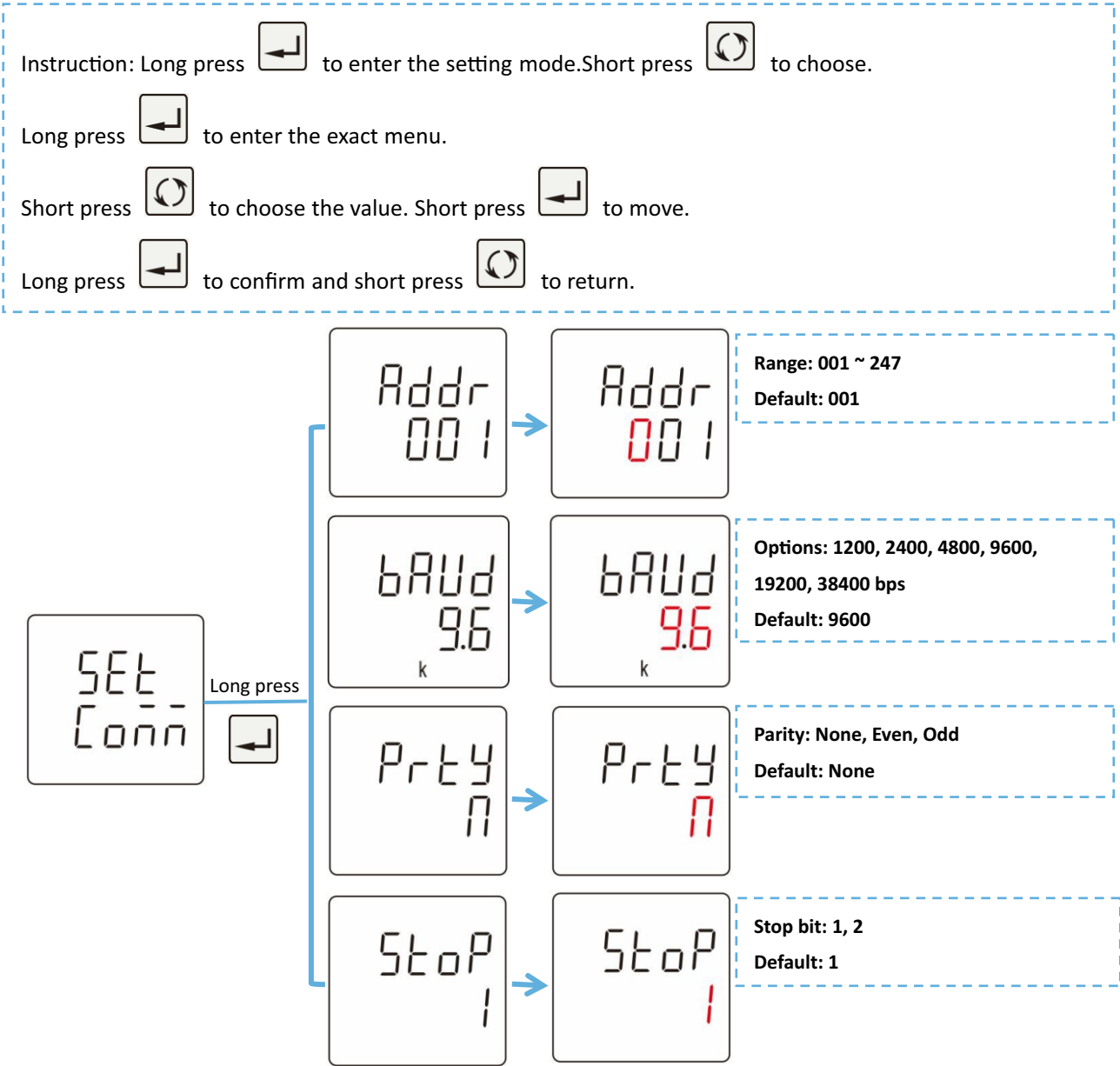


Short press  to choose the number and short press  to move.

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.

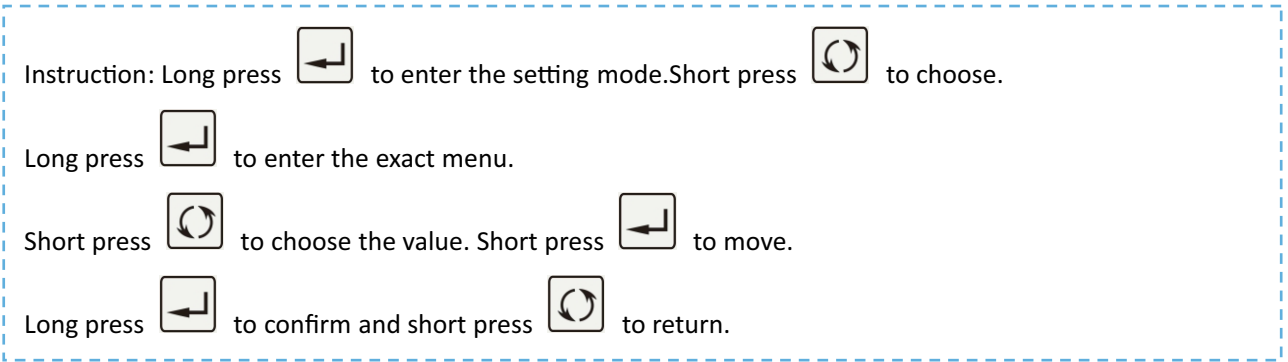
3.3.2 Communication Settings

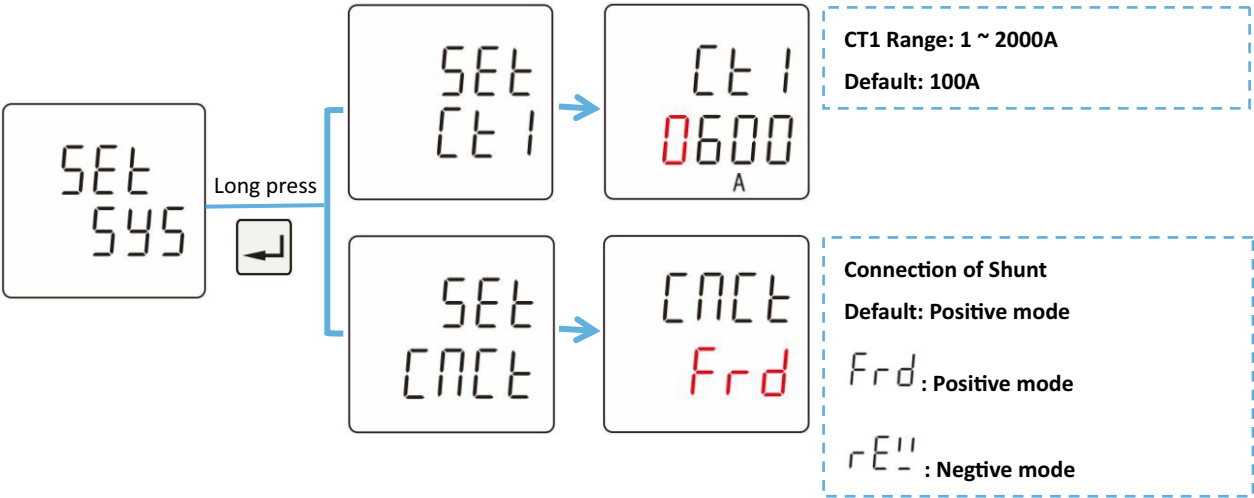
Communication settings include Modbus address, baud rate, parity, stop bit.



3.3 CT1 Settings

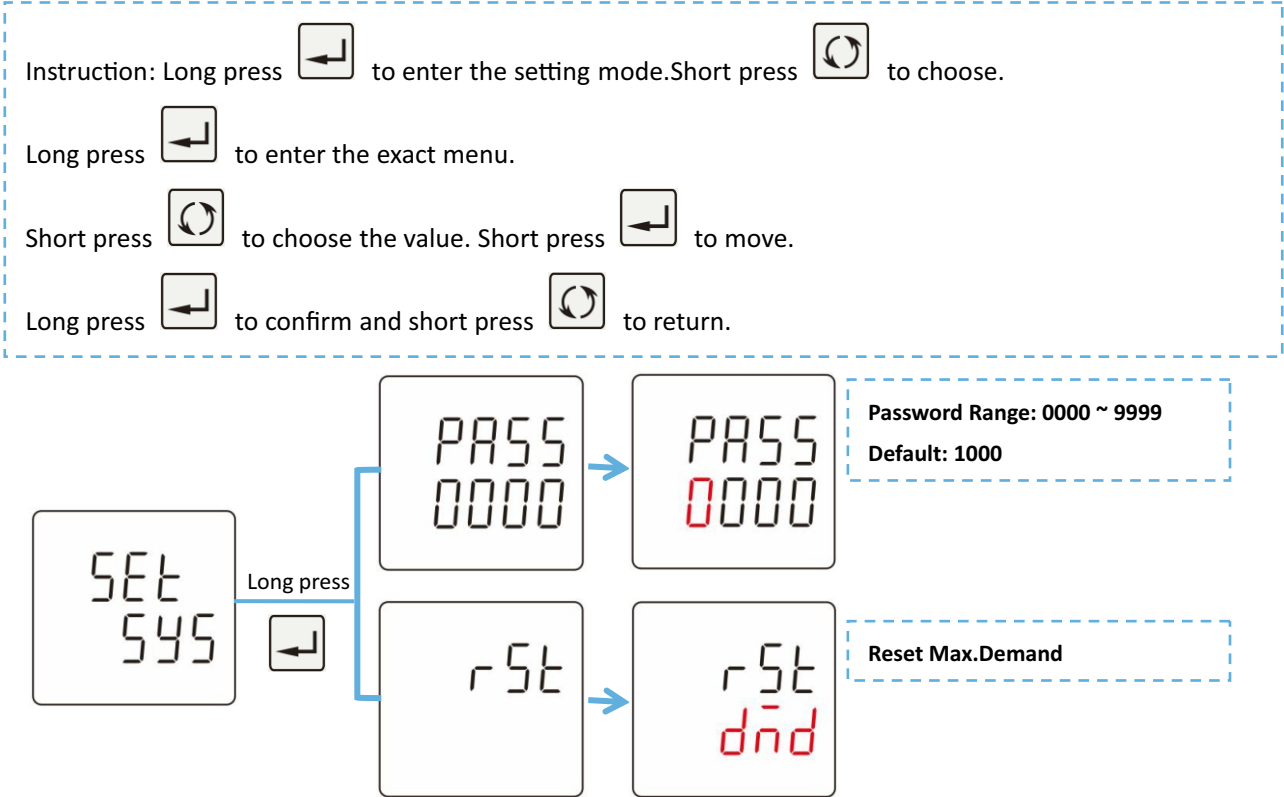
CT1 settings include the CT1 setting and shunt settings.





3.3.4 System Settings

System Setting is for setting password, reset Max.demand.



3.3.5 Pulse Settings

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

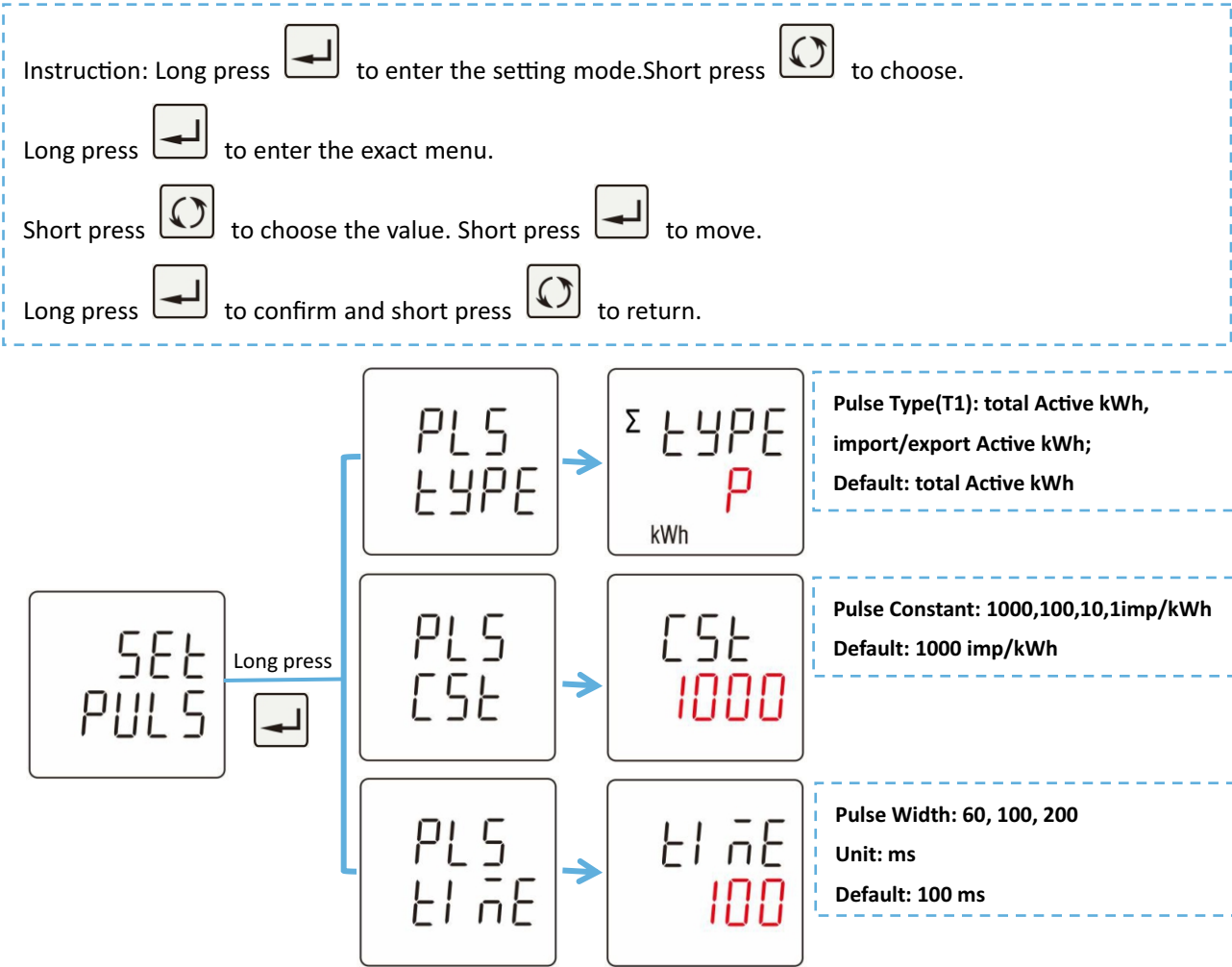
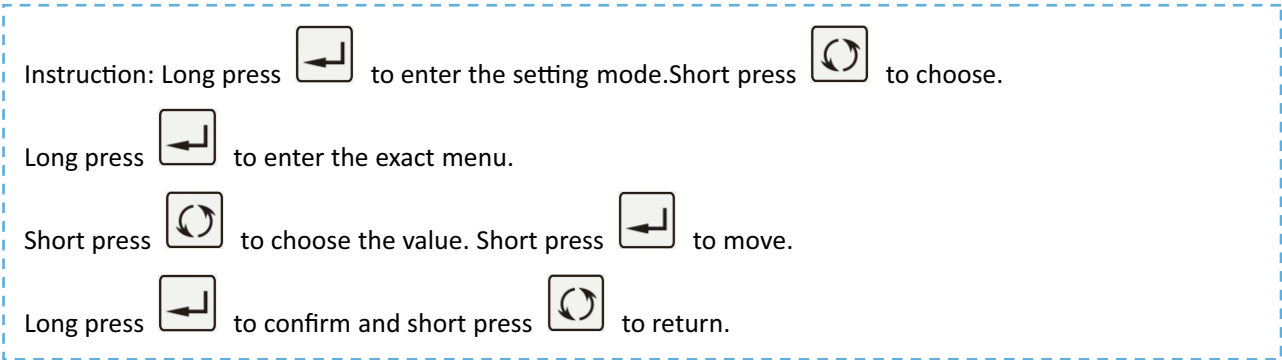


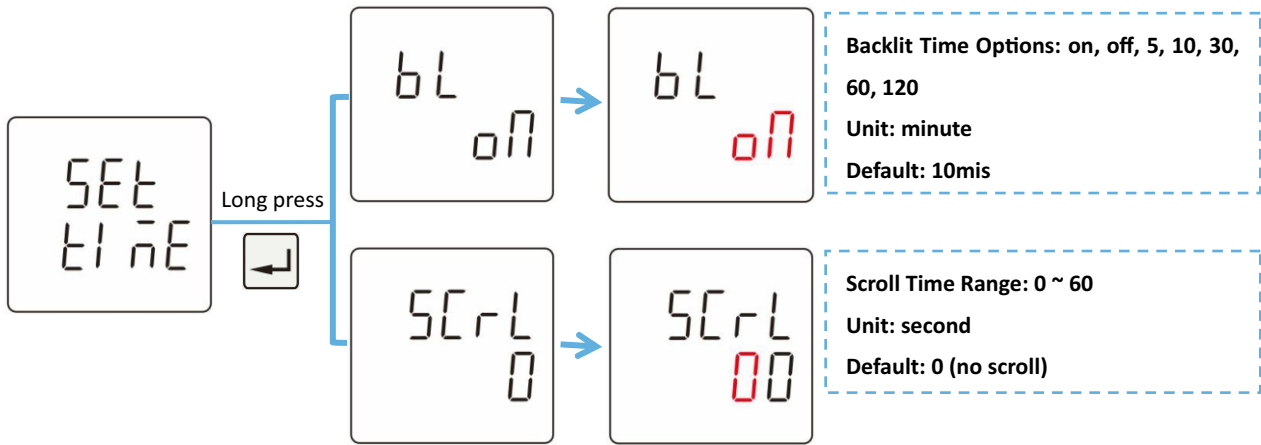
Table 1: Pulse Output Type

Character on Display	Pulse Output Type	Character on Display	Pulse Output Type	Character on Display	Pulse Output Type
Σ kWh	Total Active kWh	Imp kWh	Import Active kWh	Exp kWh	Export Active kWh

3.3.6 Time Settings

Time settings include backlit time, scroll time, date, time, tariff information.





Chapter 4. Modbus Registers

4.1 Mod bus Address

4.1.1 Measurement Parameters (In Float Format)

Input Register (Function code: 04 in Hex)				Modbus Protocol Start Address (Hex)	
Description	Length (bytes)	Data Format	Unit	Hi Byte	Lo Byte
Voltage	4	Float	V	00	00
Current	4	Float	A	00	0C
Active Power	4	Float	W	00	12
Active Power Demand(2)	4	Float	W	03	80
Current Demand	4	Float	A	03	86
Import Active Power Demand	4	Float	W	03	8E
Export Active Power Demand	4	Float	W	03	90
Max. Demand of Current	4	Float	A	03	9C
Max. Demand of Import Active Power	4	Float	W	03	A4
Max. Demand of Export Active Power	4	Float	W	03	A6
Import Active Energy	4	Float	kWh	06	00
Export Active Energy	4	Float	kWh	06	02
Total Active Energy	4	Float	kWh	06	08
Resettable Import Active Energy	4	Float	kWh	07	04
Resettable Export Active Energy	4	Float	kWh	07	06
Resettable Total Active Energy	4	Float	kWh	07	08

Note:

- (1). The power factor has its sign adjusted to indicate the direction of the current. Positive refers to import current, negative refers to export current;
- (2). The power sum demand calculation is = import – export.

4.1.2 Setting Parameters (In Float Format)

Holding Registers (Reading Function Code: 03 in Hex ; Writing Function Code: 10 in Hex)				Modbus Protocol Start Address (Hex)		
Parameters	Description	Length (bytes)	Data Format	Hi Byte	Lo Byte	Mode
Key Parameter Programming Authorization (KPPA)	Read: Get the Status of the KPPA 0 = not authorized; 1 = authorized Write the correct password to get KPPA to program key parameters.	4	FLOAT	60	00	R/W
Modbus Address	Set Modbus Address Range: 1 ~ 247, Default: 1	4	FLOAT	60	02	R/W
Baud rate	Set Baudrate 0 = 1200 bps 1 = 2400 bps 2 = 4800 bps 3 = 9600 bps (Default) 4 = 19200 bps 5 = 38400 bps	4	FLOAT	60	04	R/W
Parity and Stop Bit	Set Parity and Stop Bit 0 = No Parity, 1 Stop bit(Default) 1 = Even Parity, 1 Stop bit 2 = Odd Parity, 1 Stop bit 3 = None Parity, 2 Stop bit	4	FLOAT	60	06	R/W
Demand Period	Set Demand Period Range: 0~60 mins (Default: 60mins) Note: 0 = Update every second.	4	FLOAT	60	08	R/W
Slide Time	Set Slide Time Unit: Min Range: 1 ~ (Demand Period-1) Default: 1min	4	FLOAT	60	0A	R/W
Pulse Type	Set Pulse Type 1 = Import Active Energy 2 = Total Active Energy, (Default) 4 = Export Active Energy	4	FLOAT	60	0E	R/W
Pulse Ratio	Set Pulse Ratio, Range: 0~3 0 represents 1imp = 0.001kWh (Default) 1 represents 1imp = 0.01kWh 2 represents 1imp = 0.1kWh 3 represents 1imp = 1kWh Note: When pulse width is larger than 100ms,	4	FLOAT	60	10	R/W

	the constant can not be set to 1000imp/kWh.					
Pulse Width	Set Pulse Width , Unit: ms Option: 60, 100(Default) , 200ms Note: When pulse constant is set to 1000imp/kWh, the pulse width can not be set to 200ms.	4	FLOAT	60	12	R/W
Password	Set Password Range: 0000~9999 Default: 1000 (KPPA is asked.)	4	FLOAT	60	1A	R/W
Rated Current of Shunt	Rated Current of Shunt Range: 1-2000A (Default:5) (KPPA is asked.)	4	FLOAT	60	26	R/W
LCD Scroll Time	Automatic scroll display time Unit: second Range: 0~60, (Default: 0) Note: 0 = no scroll	4	FLOAT	60	EA	R/W
Backlit Time	Set Backlit Time Unit: minute Range: 0~120, or 255 (Default: 10) Note: 0 = Always on; 255 = Always off	4	FLOAT	60	EC	R/W
Running Time Since Power-on	Running Time Since Power-on Unit: 1min Note: Write 00 00 00 00 to reset the time.	4	FLOAT	61	06	R/W
Running Time with Load	Running time since the meter measures power Unit: 1min Note: Write 00 00 00 00 to reset the time.	4	FLOAT	61	08	R/W
Serial Number	Serial Number	4	ULONG	66	00	Read Only
Reset	0 = Reset Max. Demand 8 = Reset Monthly Energy 9 = Reset Daily Energy 10 = Reset Resettable Energy (KPPA is asked.)	2	UINT	66	03	Write Only
Software Version	Software version: XX.YY Data Definition: The first byte = XX; The second byte = YY	2	HEX	66	04	Read Only
Hardware Version	Hardware Version: XX.YY Data Definition: The first byte = XX; The second byte = YY	2	HEX	66	05	Read Only
Version Number on Display	Version Number on Display: XX.YY Data Definition: The first byte = XX; The second byte = YY	2	HEX	66	06	Read Only
Error Code	Read Meter Error Code	2	UINT	66	07	Read

	Definition: High byte is fixed at 00, and Low byte represents the error. 0 = No fault. 1 = battery low voltage fault. bit 1~7 is fixed at 0.					Only
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Examples:

1. Read Input Registers

Read: "Voltage":

Request: 01 04 00 00 00 02 71 CB		Response: 01 04 04 43 66 33 34 1B 38	
01	Meter address	01	Meter address
04	Function code	04	Function code
00	High byte of registers starting address	04	Byte count
00	Low byte of registers starting address	43	Data, (High Word, High Byte)
00	High byte of register number	66	Data, (High Word, Low Byte)
02	Low byte of registers number	33	Data, (Low Word, High Byte)
71	CRC Low	34	Data, (Low Word, Low Byte)
CB	CRC High	1B	CRC Low
		38	CRC High
Note: 43 66 33 34(Hex) = 230.2 (Floating Point)			

2. Read Holding Registers

Read: "Slide Time":

Request: 01 03 60 0A 00 02 FA 09		Response: 01 03 04 40 A0 00 00 EF D1	
01	Meter address	01	Meter address
03	Function code	03	Function code
60	High byte of registers starting address	04	Byte count
0A	Low byte of registers starting address	40	Data, (High Word, High Byte)
00	High byte of registers number	A0	Data, (High Word, Low Byte)
02	Low byte of registers number	00	Data, (Low Word, High Byte)
FA	CRC Low	00	Data, (Low Word, Low Byte)
09	CRC High	EF	CRC Low
		D1	CRC High
Note: 40 A0 00 00(Hex) = 5 (Floating point)			

3. Write Holding Registers

Write Demand Period as "30":

Request: 01 10 60 08 00 02 04 41 F0 00 00 4E 04		Response: 01 10 60 08 00 02 DE 0A	
01	Meter address	01	Meter address
10	Function code	10	Function code
60	High byte of registers starting address	60	High byte of registers starting address
08	Low byte of registers starting address	08	Low byte of registers starting address
00	High byte of registers number	00	High byte of registers number

02	Low byte of registers number	02	Low byte of registers number
04	02 = Byte Count	DE	CRC Low
41	Data, (High Word, High Byte)	0A	CRC High
F0	Data, (High Word, Low Byte)		
00	Data, (Low Word, High Byte)		
00	Data, (Low Word, Low Byte)		
4E	CRC Low		
04	CRC High		
Note: 41 F0 00 00(Hex) = 30 (Floating point)			

Chapter 5. Contact Information

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