SPM90B DC Energy Meter

User Manual

V1.1.0

ZHUHAI PILOT TECHNOLOGY CO.,LTD

Safety Precautions

 DANGERS AND WARNINGS

This equipment may only be installed by qualified professionals.

The manufacturer assumes no liability for malfunctions caused by failure to comply with the instructions in this manual.

 RISK OF ELECTRIC SHOCK, BURN, OR EXPLOSION

The equipment may only be installed and maintained by qualified personnel.

Before performing any operation on the equipment, isolate the voltage inputs and power supply, and short-circuit the secondary windings of all current transformers.

Use a suitable voltage detection device to confirm that the voltage has been disconnected.

Before energizing the equipment, restore all mechanical components, doors, and covers to their original positions.

The equipment must be supplied with the correct rated voltage during operation.

Failure to observe these precautions may result in serious injury.

We have verified the consistency between the hardware and software descriptions in this manual. However, as it is impossible to completely eliminate errors, we cannot guarantee absolute consistency. Data in this manual will be reviewed periodically, and necessary revisions will be made in new editions. Suggestions for improvement are welcome. Changes in future versions will not be announced separately.

CONTENTS

Chapter 1 Product Overview

SPM90B dual-circuit DC energy meter is designed for application scenarios such as DC screens, charging piles, and telecommunications base stations. This series of meters can measure voltage, current, power, and bidirectional energy in DC systems. It can not only be used for local display but also connect with industrial control equipment and computers to form a measurement and control system. It can also be used as a high-performance automatic meter in modern DC power supply and distribution systems for industrial and mining enterprises, civil buildings, and building automation.

The product performance meets the relevant technical requirements of GB/T 29318-2024 Electric Energy Measurement for Electric Vehicle Off-Board Chargers, GB/T 33708-2017 Static DC Energy Meters, and JJF 1779-2019 Type Evaluation Outline for Electronic DC Energy Meters (Class 0.5).

The product mainly realizes the following functions:

- Real-time measurement of electrical parameters including voltage, current, and power
- Bidirectional energy measurement, where combined active total energy = input energy + output energy
- 2 RS485 communication ports, 1 infrared communication port, and 2 optical/electrical pulse outputs (electrical pulses can be reused as second pulses)
- Support for ModbusRTU and DL/T645—2007 communication protocols
- Settled energy data of the previous 12 months
- SPM90B can be configured with two tariff schemes, and the tariff scheme can be switched automatically by setting the time. Each tariff scheme includes day type setting, billing season setting, daily tariff table setting, and special day setting
- 64 operation records (including programming records and time calibration records)
- Records of maximum and minimum values of electrical parameters

Chapter 2 Product Selection

2.1 Product Model Description

SPM90B - □ - □ - □ ① ② ③	
①Model Code (Optional, one code can be selected if needed)	
C	2nd RS485 interface, supporting infrared transceiving function
②Model Code (Optional, one code can be selected if needed; if not selected, the default is 9-72VDC power supply with 3-wire connection)	
AC	85-275VAC/100-300VDC power supply with 3-wire connection
4W	9-72VDC power supply with 4-wire connection
AC4W	85-275VAC/100-300VDC power supply with 4-wire connection
③Current Specification (Optional, only one code can be selected if needed; if not selected, the default is 100A)	
50	Supporting connection with 50A shunt
100	Supporting connection with 100A shunt
150	Supporting connection with 150A shunt
200	Supporting connection with 200A shunt
300	Supporting connection with 300A shunt
400	Supporting connection with 400A shunt
500	Supporting connection with 500A shunt
600	Supporting connection with 600A shunt
700	Supporting connection with 700A shunt
800	Supporting connection with 800A shunt
1000	Supporting connection with 1000A shunt
1200	Supporting connection with 1200A shunt
Note 1: SPM90B is equipped with dual-circuit measurement and 1 RS485 interface as standard. Note 2: Time-of-use (TOU) energy, historical energy, and max/min value functions are standard configurations and not reflected in the product selection.	

SPM90B DC energy meter provides real-time measurement of voltage, current, power, and bidirectional energy.

According to the line current, different specifications of shunts can be equipped for measuring

the current in the line. Customers shall note the required current specifications and quantities in the order contract based on on-site conditions.

2. 2Accessory Description

The optional shunts provided by SPM90B for users are as follows:

Name	Specification	Accuracy
Shunt	50A/75mV	0.2%
Shunt	100A/75mV	0.2%
Shunt	150A/75mV	0.2%
Shunt	200A/75mV	0.2%
Shunt	300A/75mV	0.2%
Shunt	400A/75mV	0.2%
Shunt	500A/75mV	0.2%
Shunt	600A/75mV	0.2%
Shunt	700A/75mV	0.2%
Shunt	800A/75mV	0.2%
Shunt	1000A/75mV	0.2%
Shunt	1200A/75mV	0.2%

【Note】If shunts of other specifications are required, customers can purchase them by themselves. It is necessary to ensure that the actual current value is within 80% of the full range as much as possible, so as to avoid the impact of heat generated by the shunt under long-term large current on the output accuracy of the shunt. The shunts purchased from regular manufacturers shall have an accuracy class of ≤0.2% (with an output of 75mV); otherwise, the measurement accuracy will be affected.

Chapter 3 Installation and Wiring

3.1 Outline Dimensions and Installation Drawing

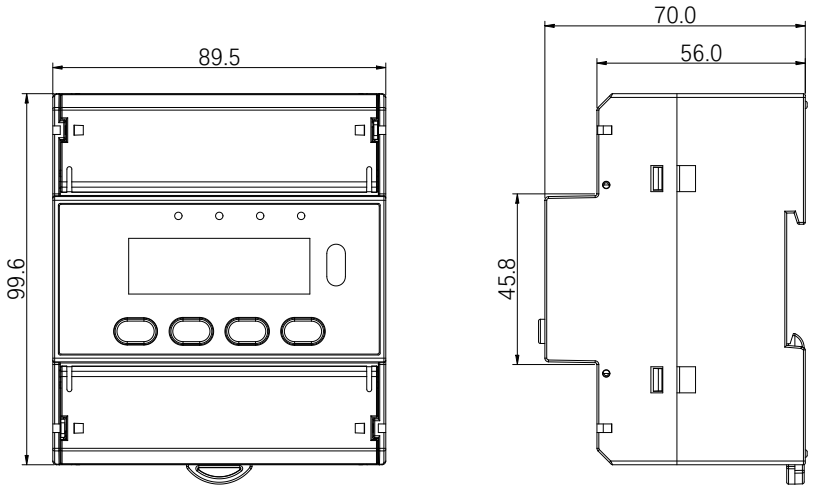
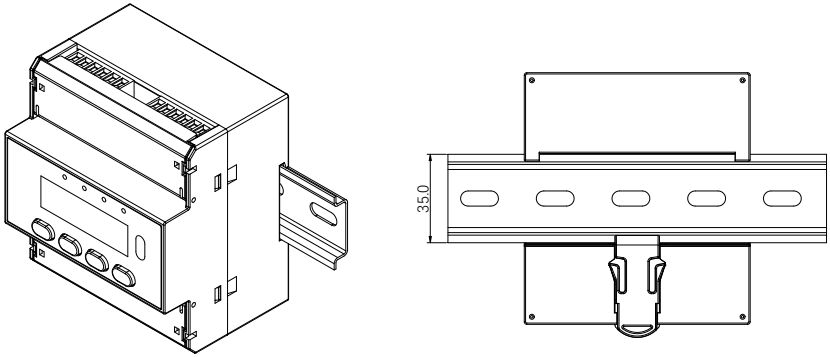


Figure 1 Product Outline Dimensions(mm)



Note: Standard DIN35 rail installation

Figure 2 Product Installation Dimensions(mm)

3.2 Shunt Outline Dimension Drawing

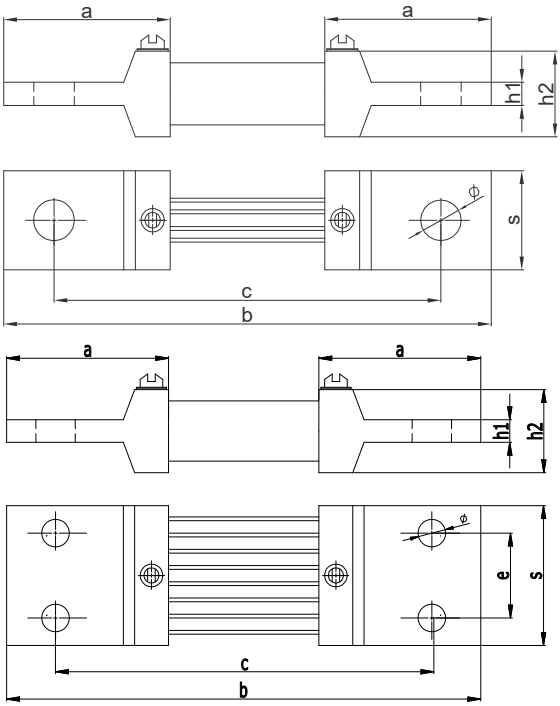


Figure 3 Product Outline Dimensions(mm)

Speci.	a	b	c	s	h1	h2	φ	e
50A	43±0.5	116±2	85±1	22±1	5.5±0.5	21±1	8.5±0.5	/
100A	43±1	116±2	85±1	22±0.5	5.5±0.2	21±0.5	8.5±0.2	/
150A	43±1	116±2	85±1	22±0.5	5.5±0.2	21±0.5	8.5±0.2	/
200A	43±1	116±2	85±1	22±0.5	5.5±0.2	21±0.5	8.5±0.2	/
300A	43±1	126±2	100±1	26±0.5	5.5±0.2	21±0.5	10.5±0.2	/
400A	43±1	126±2	100±1	38±0.5	5.5±0.2	21±0.5	10.5±0.2	/
500A	43±0.5	126±2	100±1	45±0.5	5.5±0.3	21±0.5	10.5±0.5	/
600A	43±0.5	126±2	100±1	62±0.5	5.5±0.3	21±0.5	10.5±0.5	/
700A	43±0.5	126±2	100±1	76±1	5.5±0.3	21±0.5	10.5±0.5	50±1
800A	43±0.5	126±2	100±1	76±1	5.5±0.5	21±1	10.5±0.5	50±1
1000A	43±0.5	126±2	100±1	96±1.5	5.5±0.5	21±1	10.5±0.5	50±1
1200A	43±0.5	126±2	100±1	96±1	5.5±0.5	21±1	10.5±0.5	50±1

3.3 Product Terminal Diagram

3.3.1 Terminal Diagram for 3-Wire Connection

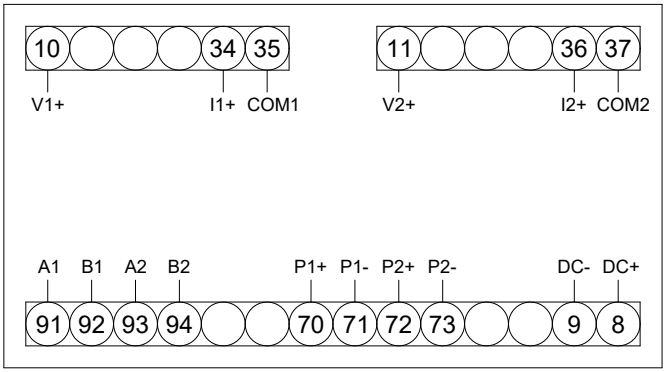


Figure 4 Terminal Diagram for 3-Wire Connection

The terminal definition is explained as follows:

No.	Definition	Description	No.	Definition	Description
10	V1+	Positive terminal of 1st circuit voltage input	91	A1	Positive terminal of 1st RS485
34	I1+	Positive terminal of 1st circuit current input	92	B1	Negative terminal of 1st RS485
35	COM1	Common terminal for 1st circuit voltage and current	93	A2	Positive terminal of 2nd RS485
11	V2+	Positive terminal of 2nd circuit voltage input	94	B2	Negative terminal of 2nd RS485
36	I2+	Positive terminal of 2nd circuit current input	70	P1+	Positive terminal of 1st pulse output
37	COM2	Common terminal for 2nd circuit voltage and current	71	P1-	Negative terminal of 1st pulse output
			72	P2+	Positive terminal of 2nd pulse output
			73	P2-	Negative terminal of 2nd pulse output
			9	DC-	Negative terminal of auxiliary power supply
			8	DC+	Positive terminal of auxiliary power supply

Note: For 85-275VAC/100-300VDC power supply, terminals 8 and 9 (power supply terminals) are marked as L(+) and N(-).

3.3.2 Terminal Diagram for 4-Wire Connection

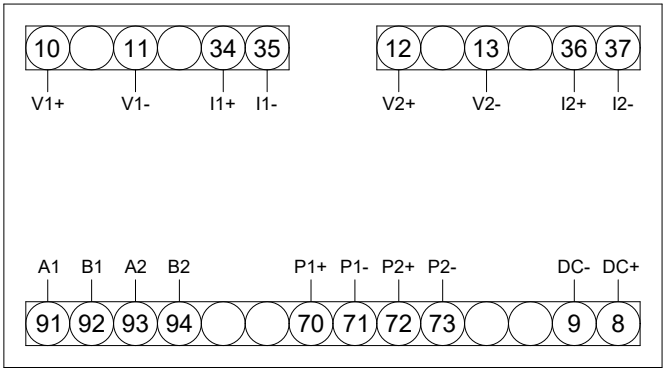


Figure 5 Terminal Diagram for 4-Wire Connection

The terminal definition is explained as follows:

No.	Definition	Description	No.	Definition	Description
10	V1+	Positive terminal of 1st circuit voltage input	91	A1	Positive terminal of 1st RS485
11	V1-	Negative terminal of 1st circuit voltage input	92	B1	Negative terminal of 1st RS485
34	I1+	Positive terminal of 1st circuit current input	93	A2	Positive terminal of 2nd RS485
35	I1-	Negative terminal of 1st circuit current input	94	B2	Negative terminal of 2nd RS485
12	V2+	Positive terminal of 2nd circuit voltage input	70	P1+	Positive terminal of 1st pulse output
13	V2-	Negative terminal of 2nd circuit voltage input	71	P1-	Negative terminal of 1st pulse output
36	I2+	Positive terminal of 2nd circuit current input	72	P2+	Positive terminal of 2nd pulse output
37	I2-	Negative terminal of 2nd circuit current input	73	P2-	Negative terminal of 2nd pulse output
			9	DC-	Negative terminal of auxiliary power supply
			8	DC+	Positive terminal of auxiliary power supply

Note: For 85-275VAC/100-300VDC power supply, terminals 8 and 9 (power supply terminals) are marked as L(+) and N(-).

3.4 Meter Wiring

3.4.1 Power Supply Wiring

SPM90B is powered by DC by default. Connect the positive pole to DC+ and the negative pole to DC-. The rated working power supply is DC12V, with a range of 9-72VDC. When the model code includes "AC", the power supply is 85-275VAC/100-300VDC; connect the phase wire to the L/+ terminal and the neutral wire to the N/- terminal.

3.4.2 Voltage and Current Wiring for 3-Wire Connection

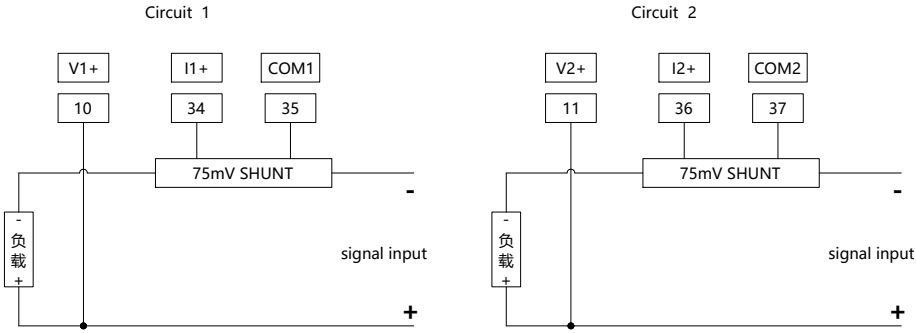


Figure 6 Voltage and Current Wiring Diagram

Notes:

1) To ensure accurate measurement, the shunt shall be connected in series to the negative pole near the load end.
2) To ensure measurement accuracy, it is recommended to use multi-strand copper cables with a wire diameter of ≥1.5 mm² (16AWG) and a wire length of ≤1.5 meters. A wire diameter of 2.5 mm² (13AWG) and a wire length of 1.5 meters are recommended.

3.4.3 Voltage and Current Wiring for 4-Wire Connection

The 4-wire connection supports two wiring methods: negative pole current shunt connection and positive pole current shunt connection.

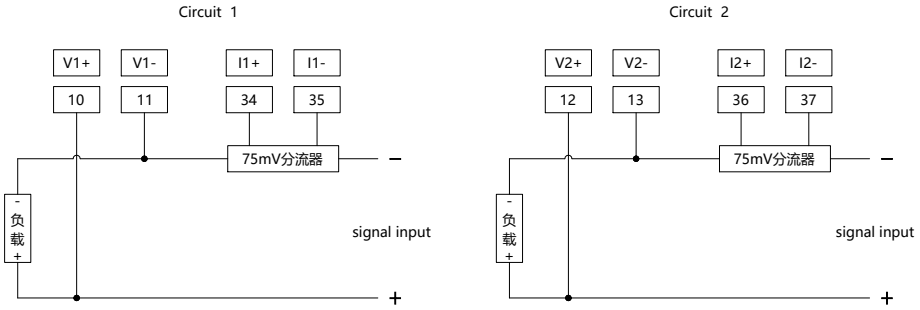


Figure 7 Negative Pole Current Shunt Connection

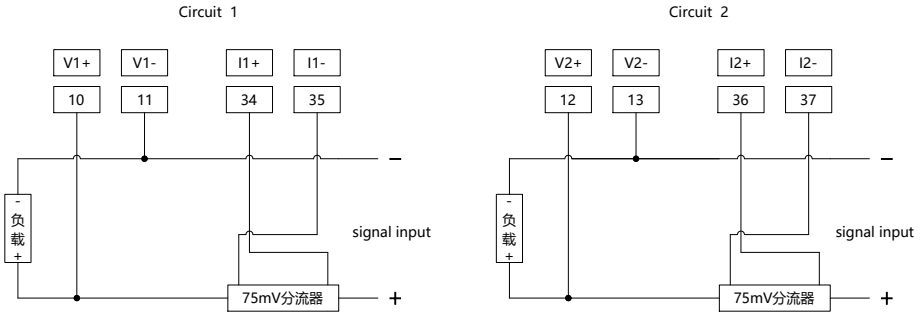


Figure 8 Positive Pole Current Shunt Connection

3.4.4 Pulse Output Wiring

SPM90B provides two energy pulse outputs, with terminals marked as P1+/P1- and P2+/P2-. The pulse output can be connected to a +5V/+12V/+24V power supply (Note 1).

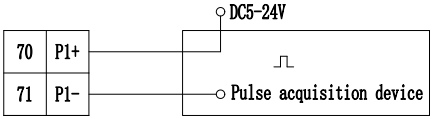


Figure 9 Electrical Pulse Output Wiring Diagram

Note 1: The maximum current output by the power supply must be less than 50mA; otherwise, the contact pulse output may be damaged.

3.4.5 Communication Wiring

SPM90B provides up to 2 RS485 communication ports, with terminals marked as A1/B1 and A2/B2.

A maximum of 30 SPM90B meters can be connected in the same network, and they can be connected to a host computer through an RS485 converter. The communication cable can be 18AWG shielded twisted pair. Without a repeater, the total length should not exceed 1200 meters.

The A/B poles of the RS485 ports of each device must be connected correctly. Please refer to the following figure for the connection method. In actual on-site situations, to prevent signal reflection, a resistor of approximately 120 ohms is usually connected in parallel at the end of the RS485 bus for signal matching; users should pay attention to this.

SPM90B has 2 communication addresses for the DL/T645-2007 protocol and 2 communication addresses for the Modbus-RTU protocol. Each RS485 communication port can access the data of 2 circuits through 2 circuit addresses.

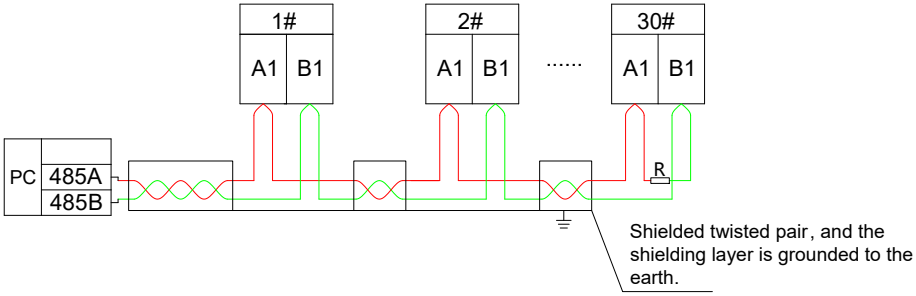


Figure 10 SPM90B RS485 Communication Port Connection Diagram

Note:The communication port of SPM90B has a strong electricity protection function, that is, short-term access to strong electricity (≤220VAC) will not cause damage, and the communication can return to normal after the strong electricity is removed.

Chapter 4 Display and Key Operation Instructions

4.1 Key Description

Note: The same key has different functions in different interfaces.

 Main menu switching / Decrease cursor position value / Long press to return to the previous main menu

 Submenu switching / Move cursor to the right

 Confirm

 Return

Note: If there is no key operation within 60 seconds, the backlight will turn off automatically and will only turn on again when a key operation is performed.

4.2 LED Indicator Description

LED Indicator	Description
RUN	Operation indicator: flashes slowly once every 1 second during operation
COM	Communication indicator: flashes quickly twice when there is communication
PULSE1	Total active energy pulse output indicator for the first circuit
PULSE2	Total active energy pulse output indicator for the second circuit

4.3 Data Display Menu

Real-time measurement data is displayed in the form of main menus and submenus. Use the  key to flip through main menus and the  key to flip through submenus. The measurement data display menu is as follows:

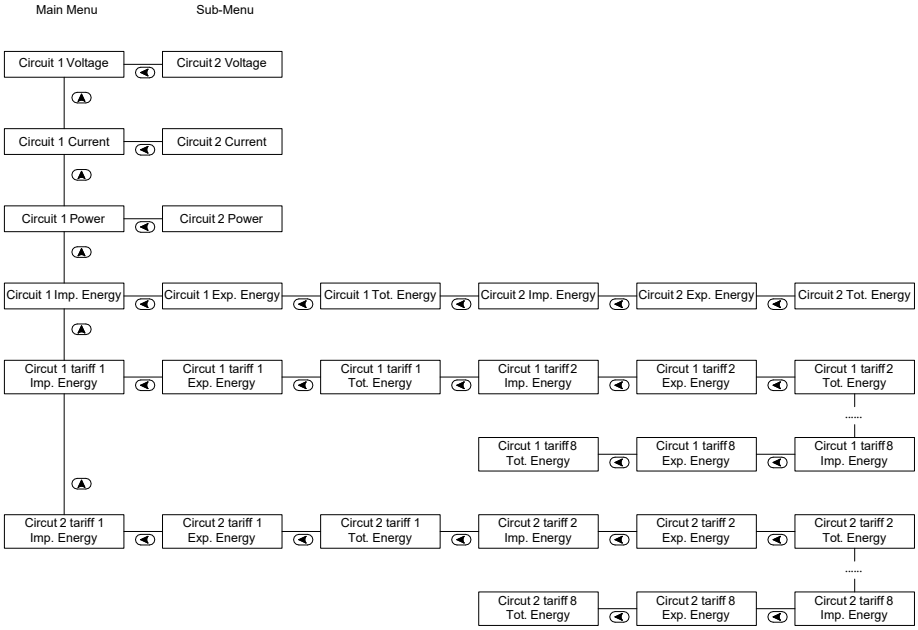
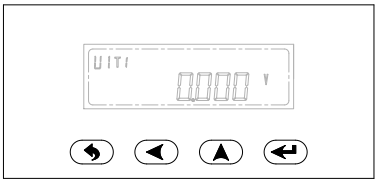
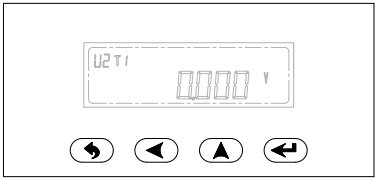
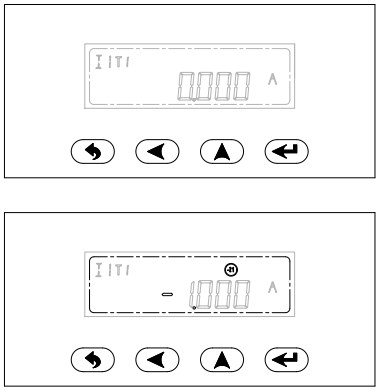
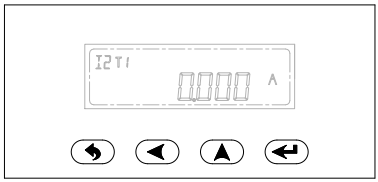
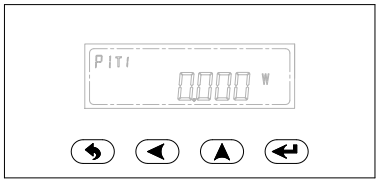
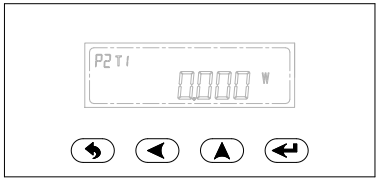
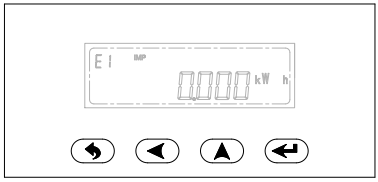
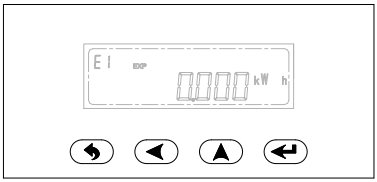
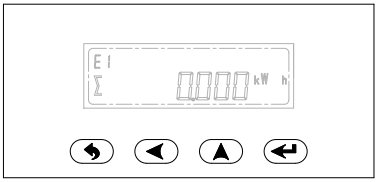
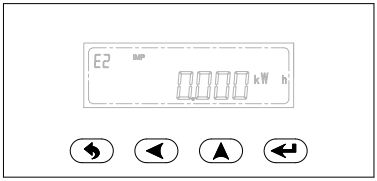
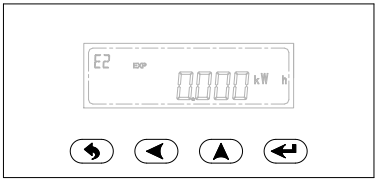
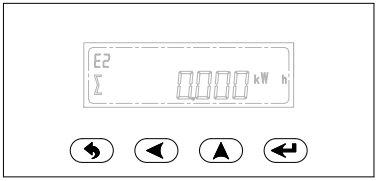
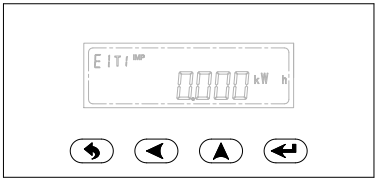


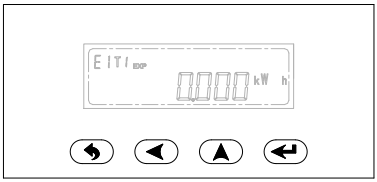
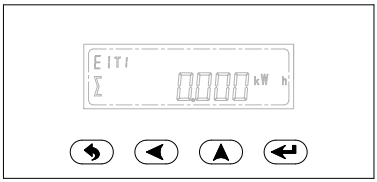
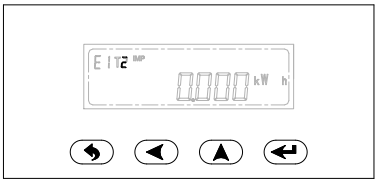
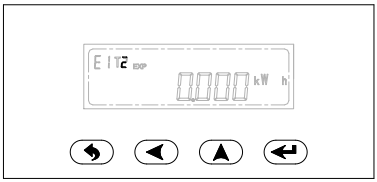
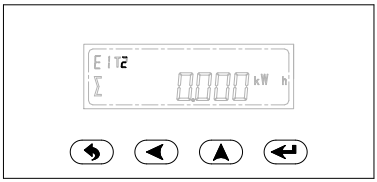
Figure 11 Measurement Data Display Menu

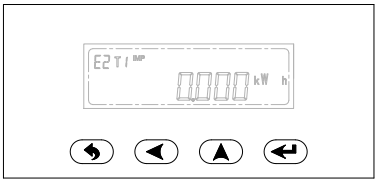
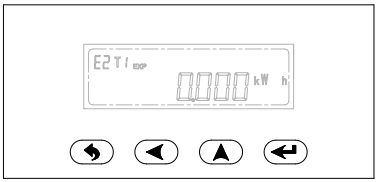
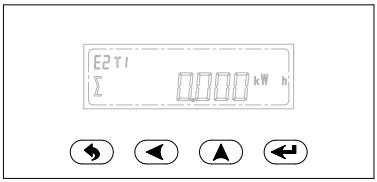
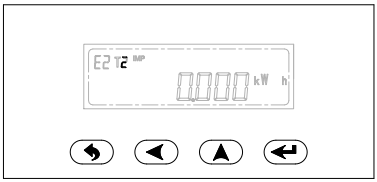
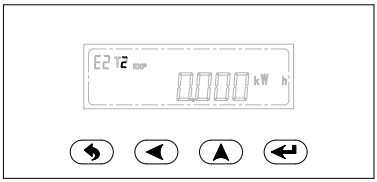
4.4 Data Display Interface

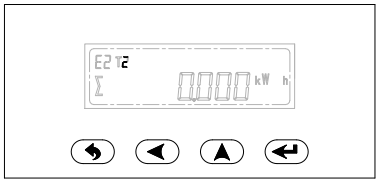
1. (Main Interface) Circuit 1 Voltage: U1 represents the voltage of Circuit 1, and T1 indicates that the current operating time is in Tariff 1 period. Press the ◀ key to switch to the Circuit 2 Voltage display interface. Press the ▲ key to switch to the Circuit 1 Current display interface	
1.1 (Sub - interface) Circuit 2 Voltage: U2 represents the voltage of Circuit 2. Press the ◀ key to switch to the Circuit 1 Voltage display interface. Press the ▲ key to switch to the Circuit 1 Current display interface	

2. (Main Interface) Circuit 1 Current Press the ◀ key to switch to the Circuit 2 Current display interface. Press the ▲ key to switch to the Circuit 1 Power display interface. Note:In actual use, if the current signal is connected in reverse, the current will be displayed as a negative value. Taking the reverse connection of Circuit 1 Current as an example, the Circuit 1 Current will be displayed as a negative value, and ⓘ will be shown on any data interface.	
2.1 (Sub - interface) Circuit 2 Current Press the ◀ key to switch to the Circuit 1 Current display interface. Press the ▲ key to switch to the Circuit 1 Power display interface	
3. (Main Interface) Circuit 1 Power Press the ◀ key to switch to the Circuit 2 Power display interface. Press the ▲ key to switch to the Circuit 1 Input Energy display interface	
3.1 (Sub - interface) Circuit 2 Power Press the ◀ key to switch to the Circuit 1 Power display interface. Press the ▲ key to switch to the Circuit 1 Input Energy display interface	
4. (Main Interface) Circuit 1 Input Energy Press the ◀ key to switch to the Circuit 1 Output Energy display interface. Press the ▲ key to switch to the Circuit 2 Input Energy display interface	

4.1 (Sub - interface) Circuit 1 Output Energy Press the ◀ key to switch to the Circuit 1 Total Energy display interface. Press the ▲ key to switch to the Circuit 2 Input Energy display interface	
4.2 (Sub - interface) Circuit 1 Total Energy Press the ◀ key to switch to the Circuit 1 Input Energy display interface. Press the ▲ key to switch to the Circuit 2 Input Energy display interface	
5. (Main Interface) Circuit 2 Input Energy Press the ◀ key to switch to the Circuit 2 Output Energy display interface. Press the ▲ key to switch to the Circuit 1 TOU Rate 1 Input Energy display interface	
5.1 (Sub - interface) Circuit 2 Output Energy Press the ◀ key to switch to the Circuit 2 Total Energy display interface. Press the ▲ key to switch to the Circuit 1 TOU Rate 1 Input Energy display interface	
55.2 (Sub - interface) Circuit 2 Total Energy Press the ◀ key to switch to the Circuit 2 Input Energy display interface. Press the ▲ key to switch to the Circuit 1 TOU Rate 1 Input Energy display interface	
6. (Main Interface) Circuit 1 TOU Rate 1 Input Energy Press the ◀ key to switch to the Circuit 1 TOU Rate 1 Output Energy display interface. Press the ▲ key to switch to the Circuit 2 TOU Rate 1 Input Energy display interface	

6.1 (Sub - interface) Circuit 1 TOU Rate 1 Output Energy Press the ◀ key to switch to the Circuit 1 TOU Rate 1 Total Energy display interface. Press the ▲ key to switch to the Circuit 2 TOU Rate 1 Input Energy display interface	
6.2 (Sub - interface) Circuit 1 TOU Rate 1 Total Energy Press the ◀ key to switch to the Circuit 1 TOU Rate 2 Input Energy display interface. Press the ▲ key to switch to the Circuit 2 TOU Rate 1 Input Energy display interface	
6.3 (Sub - interface) Circuit 1 TOU Rate 2 Input Energy Press the ◀ key to switch to the Circuit 1 TOU Rate 2 Output Energy display interface. Press the ▲ key to switch to the Circuit 2 TOU Rate 1 Input Energy display interface	
6.4 (Sub - interface) Circuit 1 TOU Rate 2 Output Energy Press the ◀ key to switch to the Circuit 1 TOU Rate 2 Total Energy display interface. Press the ▲ key to switch to the Circuit 2 TOU Rate 1 Input Energy display interface	
6.5 (Sub - interface) Circuit 1 TOU Rate 2 Total Energy Press the ◀ key to switch to the Circuit 1 TOU Rate 3 Input Energy display interface. Press the ▲ key to switch to the Circuit 2 TOU Rate 1 Input Energy display interface **Note**: The TOU rate energy is displayed according to the user's actual settings, with a maximum of 8 rate segments.	

7. (Main Interface) Circuit 2 TOU Rate 1 Input Energy Press the ◀ key to switch to the Circuit 2 TOU Rate Output Energy display interface. Press the ▲ key to switch to the Circuit 1 Voltage display interface	
7.1 (Sub - interface) Circuit 2 TOU Rate 1 Output Energy Press the ◀ key to switch to the Circuit 2 TOU Rate Total Energy display interface. Press the ▲ key to switch to the Circuit 1 Voltage display interface	
7.2 (Sub - interface) Circuit 2 TOU Rate 1 Total Energy Press the ◀ key to switch to the Circuit 2 TOU Rate 2 Input Energy display interface. Press the ▲ key to switch to the Circuit 1 Voltage display interface	
7.3 (Sub - interface) Circuit 2 TOU Rate 2 Input Energy Press the ◀ key to switch to the Circuit 2 TOU Rate 2 Output Energy display interface. Press the ▲ key to switch to the Circuit 1 Voltage display interface	
7.4 (Sub - interface) Circuit 2 TOU Rate 2 Output Energy Press the ◀ key to switch to the Circuit 2 TOU Rate 2 Total Energy display interface. Press the ▲ key to switch to the Circuit 1 Voltage display interface	

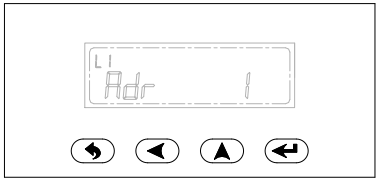
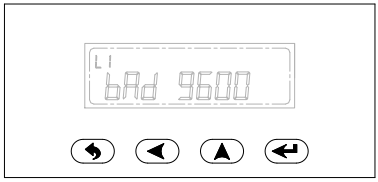
7.5 (Sub - interface) Circuit 2 TOU Rate 2 Total Energy Press the ◄ key to switch to the Circuit 2 TOU Rate 3 Input Energy display interface. Press the ▲ key to switch to the Circuit 1 Voltage display interface Note: The TOU rate energy is displayed according to the user's actual settings, with a maximum of 8 rate segments.	

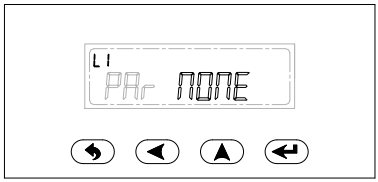
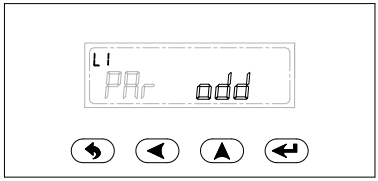
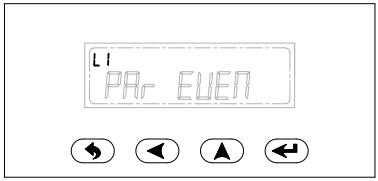
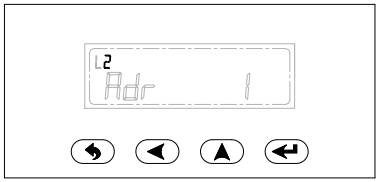
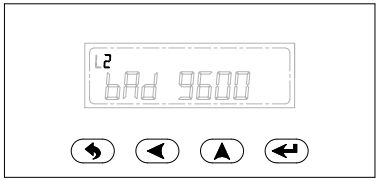
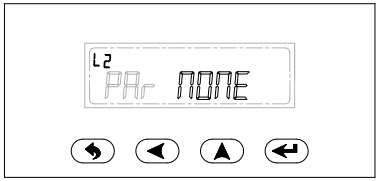
4.5 Parameter Setting Interface

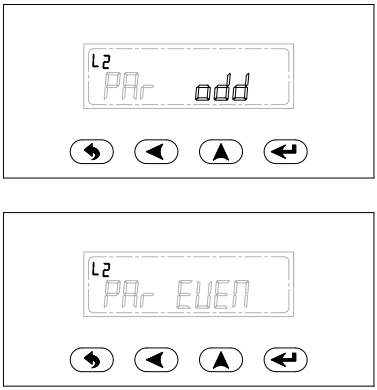
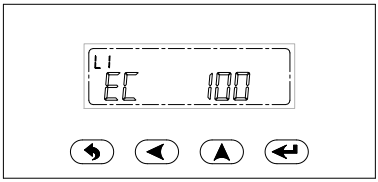
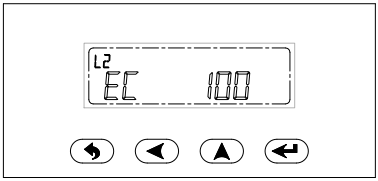
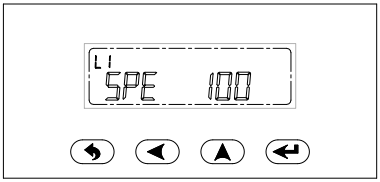
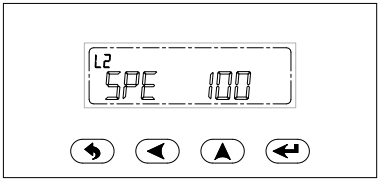
Press the ↵ key to enter the "Channel 1 Communication Address" setting interface, then press the ↵ key to input the password. The initial password of SPM90B is 01. Press the ▲ key to increase the value. After modifying the value, press the ↵ key to save and return.

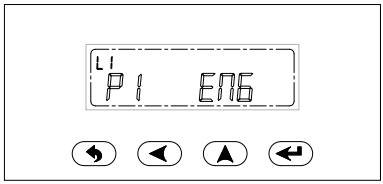
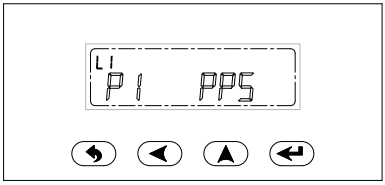
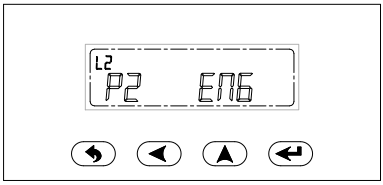
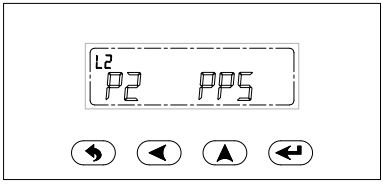
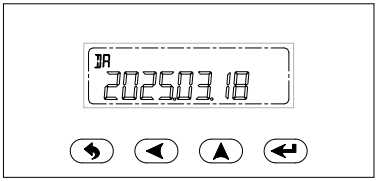
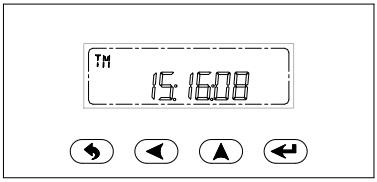
Press the ▲ key to switch to the desired setting menu. Press the ↵ key to enter the setting menu modification interface. Press the ▲ key to increase the value and the ◄ key to move the cursor. After completing the settings, press the ↵ key to save the setting parameters and return to the setting menu. Press the ↩ key to exit the setting interface.

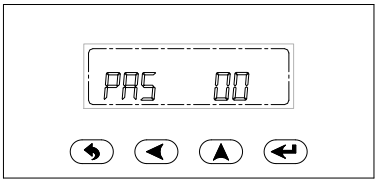
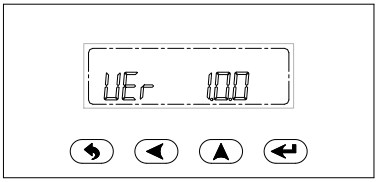
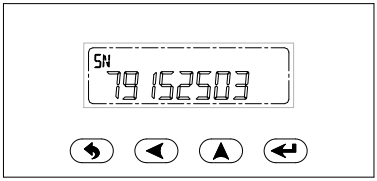
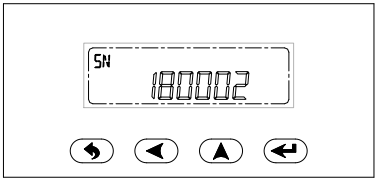
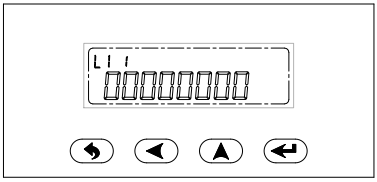
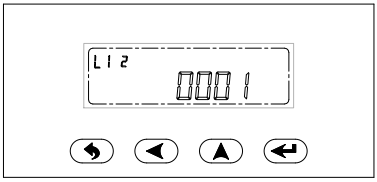
The setting menus included in SPM90B are as follows:

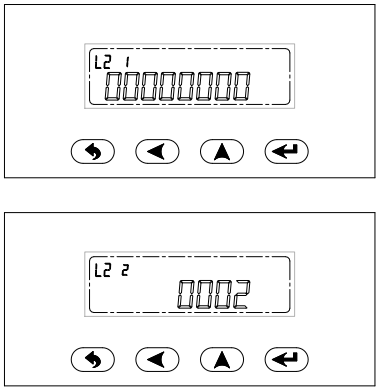
1. Channel 1 Communication Address: Press the ↵ key on the real-time data display interface to enter the communication address interface, where you can set SPM90B's communication address. Setting range: 1-247; default is 1.	
2. Channel 1 Communication Baud Rate: Press the ▲ key to enter the communication baud rate interface, where you can set SPM90B's communication baud rate. Baud rate options: 1200, 2400, 4800, 9600, 19200; default is 9600.	

3. Channel 1 Communication Parity Bit: Press the ▲ key to enter the communication parity bit configuration interface, where you can set SPM90B's communication parity bit. Parity bit options: No Parity, Odd Parity, Even Parity. They are displayed as "none", "odd", "even" on the setting interface respectively; default is "even".	  
4. Channel 2 Communication Address: Press the ▲ key to enter the communication address interface, where you can set SPM90B's communication address. Setting range: 1-247; default is 2.	
5. Channel 2 Communication Baud Rate: Press the ▲ key to enter the communication baud rate interface, where you can set SPM90B's communication baud rate. Baud rate options: 1200, 2400, 4800, 9600, 19200; default is 9600.	
6. Channel 2 Communication Parity Bit: Press the ▲ key to enter the communication parity bit configuration interface, where you can set SPM90B's communication parity bit. Parity bit options: No Parity, Odd Parity, Even Parity. They are displayed as "none", "odd", "even" on the setting interface respectively; default is "even".	

	
7. Pulse Constant of Measurement Circuit 1: Press the ▲ key to enter the pulse constant setting interface, where you can set the pulse constant. Supported pulse constants: 10, 50, 100, 500, 1000, 3200, 3600, 5000, 6400, 12800, unit: imp/kWh.	
8. Pulse Constant of Measurement Circuit 2: Press the ▲ key to enter the pulse constant setting interface, where you can set the pulse constant. Supported pulse constants: 10, 50, 100, 500, 1000, 3200, 3600, 5000, 6400, 12800, unit: imp/kWh.	
9. Shunt Specification of Measurement Circuit 1: Press the ▲ key to enter the shunt specification setting interface, where you can set a value ranging from 0 to 2000A.	
10. Shunt Specification of Measurement Circuit 2: Press the ▲ key to enter the shunt specification setting interface, where you can set a value ranging from 0 to 2000A.	

11. Energy Pulse Function Multiplexing of Measurement Circuit 1: Press the ▲ key to enter the energy pulse function multiplexing setting interface. Supports Energy Pulse - ENG and Second Pulse - PPS; default is “-ENG”.	 
12. Energy Pulse Function Multiplexing of Measurement Circuit 2: Press the ▲ key to enter the energy pulse function multiplexing setting interface. Supports Energy Pulse - ENG and Second Pulse - PPS; default is “-ENG”.	 
13. System Date: Press the ▲ key to enter the system date setting interface, where you can set the system date.	
14. System Time: Press the ▲ key to enter the system time setting interface, where you can set the system time.	

15. Password: Press the ▲ key to enter the device password setting interface, where you can set the device password.	
16. Version Information: Press the ▲ key to enter the version information viewing interface.	
17. SN Code: Press the ▲ key to enter SPM90B SN code viewing interface. The SN code is displayed on two interfaces.	 
18. Channel 1 Communication DL/T645 Address: Press the ▲ key to enter the communication address interface, where you can set SPM90B's DL/T645 communication address. Set the high 8 bits first, then the low 4 bits; default is 000000000001.	 

19. Channel 2 Communication DL/T645 Address: Press the key ▲ to enter the communication address interface, where you can set SPM90B's DL/T645 communication address. Set the high 8 bits first, then the low 4 bits; default is 000000000002.	

Note: Description of communication address adaptation and data routing functions.

This device has the function of intelligent communication routing, and can automatically select the correct data loop to respond according to the address configuration of the devices connected on two RS485 interfaces, thus ensuring the accuracy and convenience of communication. The specific rules are as follows:

1. When the address is duplicate or is a DLT645 wildcard address.

When there are duplicate addresses on two RS485 interfaces, or an interface uses DLT645 wildcard address, the system will match and return the corresponding loop data according to the physical interface that accepts the request (i.e. which RS485 interface).

In this mode, the data of the first loop will be returned fixedly through the request initiated by infrared data association.

2. When the address is independent and clear.

When the device addresses on the two RS485 interfaces are unique and clear, the system will enter the address matching mode. No matter whether the request comes from any RS485 interface or infrared data association, the communication address (Modbus or DLT645 address) in the request data frame will be analyzed, and the corresponding loop data will be automatically matched and returned.

Chapter 5 Measurement Performance

5.1 Real - time Basic Electrical Parameters

SPM90B can measure the values of basic electrical parameters such as voltage, current, and power.

The DC voltage measurement range is 10 - 1000V (long - term overvoltage of 1.5 times is allowed, with a maximum of 1500V).

Current measurement requires the use of a shunt module, and the measurement range is 1% - 120%. The current level range is 50A/75mV - 2000A/75mV.

5.2 Energy Metering

5.2.1 Real - time Energy

SPM90B provides a wealth of energy metering data to facilitate users in analyzing system energy consumption. The energy data provided by SPM90B includes: input/output/net value/sum/combined active total energy.

Energy Type	DLT645 Maximum Range	Storage and Modbus Readable Range
Combined Active Total Energy	99999.99kWh	99999999.9999kWh
Import/Export/ Net Value/Sum Active Energy	999999.99kWh	99999999.9999kWh
Custom Energy	999999.99kWh	/

Note: Combined active total energy = input energy + output energy.

5.2.2 Time - of - Use (TOU) Rate Energy

SPM90B provides energy measurement for 8 TOU rates. The TOU rate energy includes: combined active total/input/output active energy.

5.2.3 Historical Energy

SPM90B provides energy data for the past 12 months. The monthly historical energy includes: real - time combined active total/input/output active energy, as well as combined active total/input/output active energy for 8 TOU rates.

5.3 Energy Pulses

Pulse width: The pulse width PW (referring to the duration of the high - level signal) is 30ms by default.

Pulse constant: The pulse constant can be set: 10, 50, 100, 500, 1000, 3200, 3600, 5000, 6400, 12800imp/kWh. The default is the following configuration:

- 100imp/kWh（≤300A）
- 50imp/kWh （＞300A，≤600A）
- 10imp/kWh （＞500A，≤1200A）

Note: Pulse constant will change after changing the shunt specification.

5.4 Time - of - Use (TOU) Rates

SPM90B can be configured with two sets of TOU rate schemes, and the TOU rate scheme can be automatically switched by setting the time. Each set of TOU rate schemes includes the setting of day type, billing season, daily rate table, and special day. In the power system, electricity prices may differ on working days, weekends, and holidays, and they may also vary between peak load periods and off - peak load periods. This function is an energy metering method provided to meet the needs of peak - valley time - of - use electricity pricing. It can calculate and accumulate the electricity consumption of each time - of - use rate separately according to the pre - set billing time periods and rates to achieve the function of time - sharing metering.

In the TOU rate function, the time setting is based on an annual cycle. Ordinary days and special days can be set each year, and a maximum of 90 special days can be set. A maximum of 12 billing seasons can be set in a year. A week can be set to 4 billing day types, namely Billing Day Type 1, Billing Day Type 2, Billing Day Type 3, and Billing Day Type 4, and the corresponding daily rate table numbers are set respectively. A maximum of 20 daily rate tables can be set. Each daily rate table divides the 24 hours of a day into a maximum of 12 time periods with a step size of 15 minutes, and each time period corresponds to a unique rate. A maximum of 8 types of rates can be set. For holidays, if separate settings are required, it can be realized by setting the special day register to specify the date of the special day and the corresponding daily rate table.

The parameter ranges are as follows:

Billing seasons:There can be 1 - 12 billing seasons. The start time of Billing Season 1 is January 1st and cannot be changed. If the date is set to 0xFFFF or another non - existent date, it is considered an invalid date. If the date of a certain billing season in the billing season scheme is set to 0xFFFF, all subsequent dates after this billing season should be set to 0xFFFF. The setting rule for the billing season scheme is that the date of the subsequent billing season should be later than that of the previous one, unless all subsequent billing seasons are set to 0xFFFF.

Billing day types:There are 4 billing day types, namely Billing Day Type 1, Billing Day Type 2,

Billing Day Type 3, and Billing Day Type 4, and the daily rate tables can be set separately for each type.

Daily rate tables:A maximum of 20 daily rate tables can be set, and each table can have a maximum of 12 time periods. The minimum time unit for each time period is 15 minutes. If the value is 0, it means that within this billing season, Daily Rate Table 1 is used, and its valid time is from the start date of this billing season to the start date of the next billing season. If the start date of the next billing season is set to 0xFFFF, its valid time is from the start date of this billing season to the end of the current year. For each daily rate table, the setting rule for the time periods is that the time of the subsequent time period should be later than that of the previous one, unless all subsequent time periods are set to 0xFFFF.

Special days: 0 - 90 special days can be set, and a separate daily rate table can be specified for each special day.

Rates: 8 rates can be set.

The relevant parameters involved in this function can only be set and viewed through communication.

Example:If the user's daily energy metering is divided into 8 time periods, the time period division is as shown in the following table:

Time Period	Start Time of Time Period	Rate
Time Period 1	0:00	1
Time Period 2	3:00	2
Time Period 3	6:00	4
Time Period 4	9:00	3
Time Period 5	12:00	1
Time Period 6	15:00	4
Time Period 7	18:00	2
Time Period 8	21:00	3

The start time of Time Period 1 is 0:00 and the end time is 3:00, with a billing segment of 1; the start time of Time Period 2 is 3:00 and the end time is 6:00, with a billing segment of 2; and so on. The start time of Time Period 8 is 21:00 and it ends at 0:00 the next day, with a billing segment of 3.

If the start time of the user's TOU rate metering is a non - zero time, the following example can be referred to for operation.

Example 4:If a customer's daily energy metering is divided into 5 time periods, the time period

division is as shown in the following table:

Time Period	Start Time of Time Period	Rate
Time Period 1	6:00	1
Time Period 2	10:00	2
Time Period 3	12:00	1
Time Period 4	14:00	3
Time Period 5	20:00	4

The start time of Time Period 1 is 6:00 and the end time is 10:00, with a billing segment of 1; the start time of Time Period 2 is 10:00 and the end time is 12:00, with a billing segment of 2; and so on. The start time of Time Period 5 is 20:00 and it ends at 6:00 the next day, with a billing segment of 4. The energy with the same rate is calculated together.

5.5 Maximum and Minimum Value Recording

SPM90B records the maximum and minimum values of voltage, current, and power, and the maximum and minimum values are determined based on signed numbers.

5.6 Operation Logs

To facilitate users in tracing the parameter configuration of SPM90B, SPM90B provides 64 operation logs, which can be viewed by the user through communication.

When viewed through communication, the time inside SPM90B is recorded in the UNIX time format. The so - called UNIX time refers to the total number of seconds from the current moment to 00:00:00 on January 1, 1970.

After a record is generated, if the software provided by our company is used for analysis, the information in the following format can be obtained:

No.	Log UTC Time	Log Type	Log Value
0	2024-11-01 11:08:46	1:Information	50:COM1 Parameter Modification

Chapter 6 Technical Specifications

Parameter		Range	
Rated Parameters	Power Supply	If the model code contains "AC", it is 85 - 275VAC/100 - 300VDC; otherwise, it is 12VDC (9 - 72VDC)	
	Input Current	Configurable values include 50A, 100A, 200A, 300A, 400A, 500A, 600A, 700A, 800A, 1000A, 1200A, etc. (maximum measured value is 2000A)External 75mV shunt input is adopted	
	Input Voltage	1000VDC (1.5 times overvoltage is allowed, maximum 1500VDC)	
	Parameter	Accuracy	Resolution
Accuracy	Voltage	0.2%	0.001V
	Current	0.2%	0.0001A
	Energy	0.5 级	0.0001kWh
	Power	0.5%	0.0001W
	Parameter	Performance	
	Power Consumption	≤ 1.5W (≤3W for 4W and AC4W models)	
Ambient Temperature	Normal Operating Temperature	-25℃ ~ +65℃	
	Extreme Operating Temperature	-40℃ ~ +75℃	
	Storage Temperature	-40℃ ~ +75℃	
	Operating Humidity	95%以下	
Insulation Performance	Power Frequency Withstand Voltage	4400VAC	
	Insulation Resistance	≥ 100MΩ	
	Impulse Voltage	6000V	
	Item	参照标准	试验等级
Electromagnetic Compatibilit	Electrostatic Discharge Immunity	GB/T17626.2-2018 (IEC61000-4-2:2025)	Level 4
	Radio Frequency	GB/T17626.3-2023	Level 3

y	Electromagnetic Field Radiation Immunity	(IEC61000-4-3:2020)	
	Electrical Fast Transient/Burst Immunity	GB/T17626.4-2018 (IEC61000-4-4:2020)	Level 4
	Surge (Impact) Immunity	GB/T17626.5-2019 (IEC61000-4-5:2014)	Level 4
	Immunity to Conducted Disturbances Induced by Radio Frequency Fields	GB/T17626.6-2017 (IEC61000-4-6:2006)	Level 3
	Electromagnetic Disturbance Limits	GB 4824-2019 (CISPR11:2016)	Class B
	Power Frequency Magnetic Field Immunity Test	GB/T 17626.8-2006 (IEC 61000-4-8:2009)	400A/m
	External Constant Length Measurement Immunity	IEC62052-11:2020	1000At
	Voltage Dips, Short Interruptions Immunity	GB/T 17626.11-2023 (IEC61000-4-11:2020)	Compliant

Note: The accuracy of electrical parameters can be met in the normal working temperature range.

Chapter 7 Maintenance and Troubleshooting

Possible Problem	Possible Cause	Possible Solution
No display after applying control power	Power not applied to device	Check whether the correct working voltage is added to the power supply terminal of the equipment. Check if control power fuse is blown.
Incorrect measurement or not as expected	Voltage measurement incorrect	Check whether the voltage wiring is reliable Check whether the measured voltage matches the rated parameters of the equipment. Check whether the positive and negative terminals of voltage are connected incorrectly.
	Current measurement incorrect	Check whether the measured current matches the rated parameters of the equipment.
	Power measurement incorrect	Check whether the positive and negative terminals of voltage are connected incorrectly.
Host computer cannot communicate with device	Device baud rate incorrect	Check device baud rate matches defined value.
	Comm link missing terminator	Check if 120Ω resistor is added.
	Comm link interference	Check communication shield is properly grounded.
	Communication line broken	Check communication cable is disconnected.
	Device baud rate incorrect	Check device baud rate matches defined value.

Notice:

- PILOT reserves the right to modify this manual without prior notice if there is anything needed to change.
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