SPM90 Single Phase DC Energy Meter

Installation & Operation Manual

V1.6

⚠ **Danger and warning!**

This device can be installed only by professionals.

The manufacturer shall not be held responsible for any accident caused by

the failure to comply with the instructions in this manual.

⚠ **Risks of electric shocks, burning, or explosion**

- This device can be installed and maintained only by qualified people.

- Before operating the device, isolate the voltage input and power supply

  and short-circuit the secondary windings of all current transformers.

- Use appropriate voltage tester to make sure the voltage has been

  cut-off.

- Put all mechanical parts, doors, or covers in their original positions

  before energizing the device.

- Always supply the device with the correct working voltage during its

  operation.

**Failure to take these preventive measures could cause damage to
equipment or injuries to people.**

CONTENTS

1. Product Overview

SPM90 is designed for scenarios such as DC panel, charging pile and telecom base stations. This meter series can measure voltage, current, power and active energy in DC system. Not only can it be used as local display, but it can also be used in measuring system by connecting with industrial control equipment and computers. It is a high-performance automation meter that can work with modern DC power distribution system in industrial and mining industry, civil building and building automation.

Product performance fully meets the according technical requirements of GB / T 29318-2012 (Energy measurement of non-vehicle charger of electrombile) and Class 0.5 of DL/T 1484-2015 (Technical Regulations of DC energy power).

Main function of this product:

- Real-time measurement of electrical parameters: voltage, current and power
- Measurement of bidirectional energy
- 1CH RS485 communication, 1CH electric pulse output optional.
- Supports MODBUS and DL/T645—2007 communication protocol.

2. Order Information

| SPM90 – ☐ – ☐	
① ②	
①: Shunt specification (Required)	
1	100A Shunt
1.5	150A Shunt
2	200A Shunt
3	300A Shunt
4	400A Shunt
②: Energy pulse (Optional)	
P	Energy pulse

If shunt in other specifications are needed, please contact us in advance.

Note: When selecting shunt, make sure the the actual current is within 80% of scale span, preventing the influence on the accuracy on the shunt caused by long-time large current.
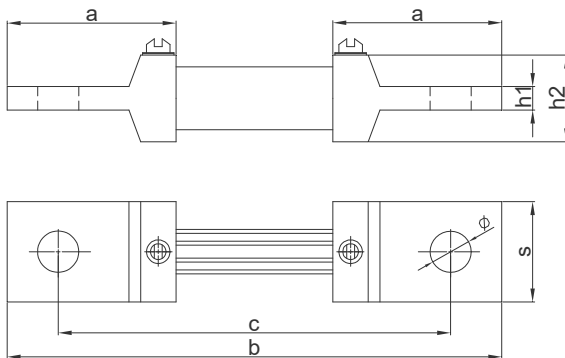
3. Appearance and Installation Dimension

3.1 Outline Dimensional Drawing

Unit: mm
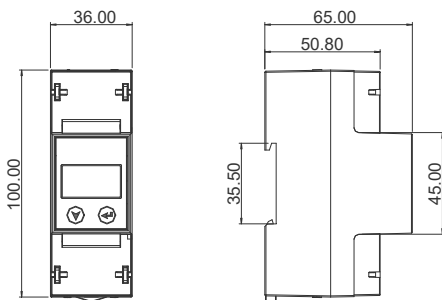
Pic. 1 DC meter dimensional drawing

SPECS	a	b	c	s	h1	h2	φ
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

Pic. 2 Dimensional diagram of Shunt

3.2 Installation Diagram
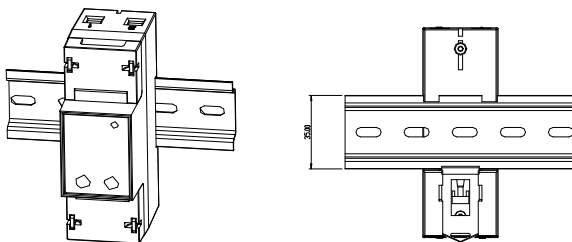
4. Display and Keyboard Instructions

4.1 Full Display

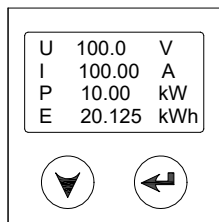There is a one-inch dot matrix LCD with backlight on SPM 90, whose resolution is 128*64. With 2 keys and menu prompt, switching among different functions can be realized.

Note: Backlight turns off if the meter is left with no operation for 60s. Backlight will not turn on unless there is operation again.

U	100.0	V
I	100.00	A
P	10.00	kW
E	20.125	kWh

4.2 Statue Inquiry

Indicator	Color	Indicating	Indicated message
PULSE	Red	Flash	Electric energy pulse

4.3 Keyboard Instructions

Note: Same keys play different functions if different interfaces.

Switching among equative menu

Exit/Confirm
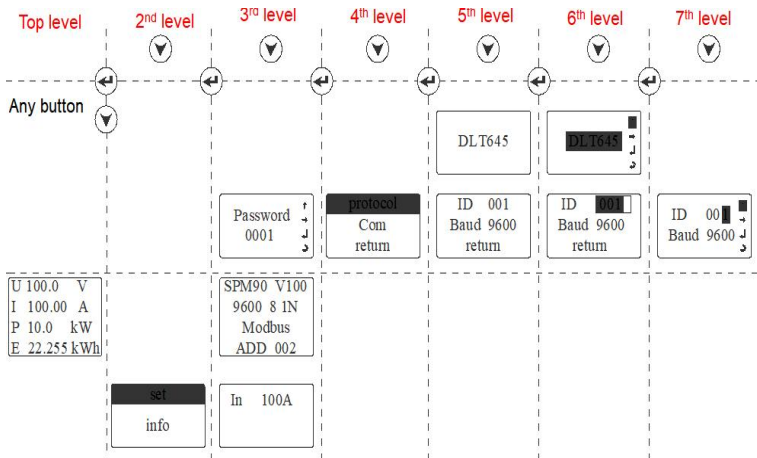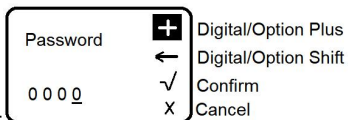
4.4 Real-time Data Display Procedure

Menu tree diagram:

Pic.3 Operation Menu Tree Diagram

Keyboard instruction: ⊙Page down among equtive menu ⏎Next menu,

confirm button;

Editing Instruction:

Password		
	+	Digital/Option Plus
	←	Digital/Option Shift
	√	Confirm
0 0 0 0	X	Cancel

⊙Editing options

switching ⏎Editing option execution.

6

4.5 Power On Display Interface

Data display

U: DC voltage

I : DC current

P: Power

E : Energy

1、 Startup interface:

The meter self-examines with power on, LCD lights up, dot matrix fully displays, entering into startup interface 3s later

```
U   100.0    V
I   100.00   A
P   10.00    kW
E   20.125   kWh
```
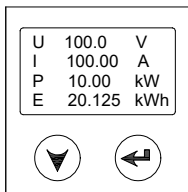
Note: Press confirm button to enter main menu check interface.

2, Main menu interface: Press ▼ to select different submenu, press ⏎ to enter submenu, as shown below:

```
set
info
```

3, Set menu: After entering the set menu, input the correct password to enter the Set menu display interface.

```
Password
0000
```
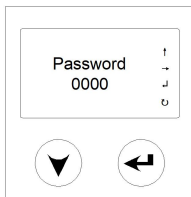
After inputting password 0001, entering submenu.
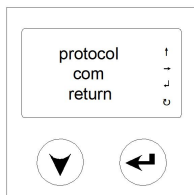
Detailed introduction of Set Menu will be shown in "4.6 Parameters Settings".

4, Info Menu: After entering the info menu, program version information, protocol and protocol equipment information and device ID can be viewed.

4.6 Parameters Settings

■ **Meter Programming**	2, Communication Setting: Press

■ **Meter Programming**

SPM90 can program the following

setting parameters:

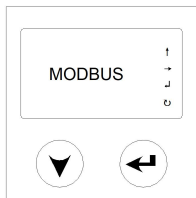| Programmable items |
|---|
| Communication protocol |
| Communication Setting |

1, Communication protocol: Press

to enter the communication

interface, alternatives of

communication protocol can be set.

Communication protocol can be set:

Modbus and DLT645, as shown

below:

```
┌─────────────────┐
│                 │
│              ↑  │
│  MODBUS      →  │
│              ↵  │
│              ↺  │
│                 │
│   ▼      ←      │
└─────────────────┘
```
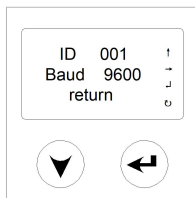
2, Communication Setting: Press

to enter communication

interface, communication address

and baud rate can be set, as shown

below. Communication address

range:

Baud rate can be set: 2400, 4800,

9600, 19200.

```
┌─────────────────┐
│                 │
│  ID   001    ↑  │
│  Baud 9600   ↵  │
│   return     ↺  │
│                 │
│   ▼      ←      │
└─────────────────┘
```

5. Measurement Capability

5.1 Real-time Basic Electrical Parameters

SPM90 can measure basic electrical parameters including voltage, current and power.

Real-time reading	Measurement range
Current	
Shunt 100A	0 ~ 100A
Shunt 150A	0 ~ 150A
Shunt 200A	0 ~ 200A
Shunt 300A	0 ~ 300A
Shunt 400A	0 ~ 400A
Voltage	2~1000V
Power	2W ~ 400kW

5.1.1 Voltage

Voltage measurement range of SPM90 is 2~1000V. Users should be noted this to prevent saturation of internal measurement circuit, which may cause inaccurate measurement.

Note: If "U ERR V" is displayed when voltage is over 50V, it means that wires on port 1 and 2 are reversely connected.

5.1.2 Current

Shunt module is needed when SPM90 measures the current. The shunt is actually a resistor with very small resistance. Voltage appears when there is current running through, which can be shown on ampere meter. Shunt specifications: 100A, 150A, 200A, 300A, 400A.

Note: If "I   ERR A" is displayed when the meter accessed load, then it means that wires on the port 3 and 4 are reversely connected.

5.2 Energy Parameters

The maximum energy SPM90 can measure is 999999.999, with three decimal places. When it reaches the maximum value, it automatically turns over to 0.

5.3 Electric Energy Pulse

Pulse width fixes at 90ms, pulse constant is 100imp/kWh.

6. Communication

6.1 Overview

SPM90 get communicated with 1CH RS485. Please refer to picture shown below for wiring diagram. In real application, to prevent signal reflection, a resistor of about 120Ω will be connected at the end of RS485 network for signal matching. Users should be noted this.
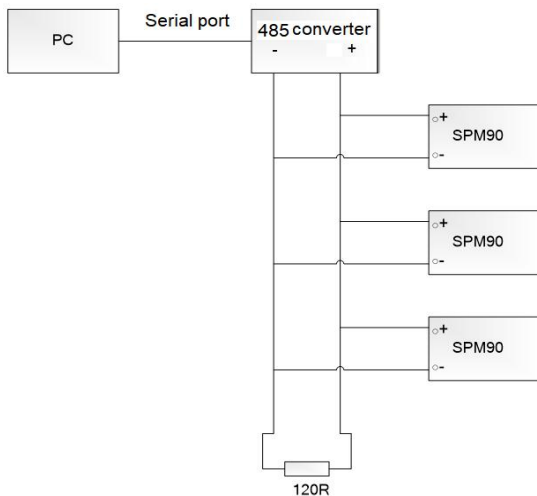
Pic.9 RS485 communication port wiring diagram on SPM90

6.2 Communication Media

30 pieces of SPM90 can work together in one network at most, which are wired via NO. 22 shielded twisted pair. If no repeaters, then the longest distance of wire should be 1200 meters.

6.3 Communication Protocol

SPM90 is in accordance with the MODBUS-RTU and DL/T 645-2007 protocol, which can be set via the setting interface. For detailed information of protocol, please refer to the manual of "SPM90_MODBUS Communication Protocol" and "SPM90_DL/T 645-2007 Communication Protocol".

6.4 Communication Parameters

Whether the meter can communicate with the master station depends on whether the communication parameters are correct. Communication parameters include:

Meter address ID: This is the identification of the meter on the network. It's requested that the ID of every meter in the same network is the only one.

Baud rate of communication 1: 2400, 4800, 9600, 19200 are optional.

6.5 Anti Strong Electricity Function of Communication Port

Communication Port on SPM90 supports Anti Strong Electricity Function. The meter won't be burnt when wired into strong electricity (380VAC) for a short time(within 5 mins). Communication function gets back to normal when strong electricity is removed.

7. Technical Parameters

Parameter		Range	
Rated Working Parameter	Rated working voltage	9-36VDC	
	Rated current	100A、150A、200A、300A、400A	
	Rated input voltage	1000VDC	
	Parameter	**Range**	**Accuracy**
Electrical Parameter Accuracy	Voltage	2-1000V	0.2%
	Current	1% ~120% of rated current	0.2%
	Energy	0~999999.999kWh	Class 0.5
	Power	2W ~ 400 kW	0.5%
	Parameter	Performance	
	Consumption	≤ 1W	
	Pulse constant	100imp/kWh	
	Rated voltage of shunt	75mV	
Environment Temperature	Normal working temperature	-20℃ ~ +55℃	
	Extreme working temperature	-25℃ ~ +75℃	
	Storage temperature	-30℃ ~ +80℃	
	Working humidity	Under 95%	
	Insulation resistance	≥ 100MΩ	
	Impulse voltage	6000V	
IP Protection grade	Complete machine	IP20	

|	Item	Reference standard	Experiment grade
Electromagnetic compatibility	ElectroStatic Discharge	GB/T17626.2-2006 (IEC61000-4-2:2001)	Grade 3
	Radiated immunity of radiofrequency electromagnetic fields	GB/T17626.3-2006 (IEC61000-4-3:2002)	Grade 4
	Electrical fast transient burst immunity	GB/T17626.4-2008 (IEC61000-4-4:2004)	Grade 4
	Surge (impact) immunity	GB/T17626.5-2008 (IEC61000-4-5:2005)	Grade 4
	Conduction noise immunity of radio-frequency field induction	GB/T17626.6-2008 (IEC61000-4-6:2006)	Grade 3
	Electromagnetic emission limiting value	GB 4824-2013 (CISPR11: 2010)	Conformed
	Voltage sag、shot-time interruption immunity	GB/T17626.11-2008 (IEC61000-4-11:2004)	Conformed

8. Appendix

8.1 Terminals Definition

No.	Definition	Description
1	V+	Positive polarity of voltage input
2	V-	Negative polarity of voltage input
3	I+	Positive polarity of voltage input
4	I-	Negative polarity of current input
5	485A	RS485 positive polarity
6	485B	RS485 negative polarity
7	POW-	Negative polarity of power input
8	POW+	Positive polarity of power input
9	NC	/
10	NC	/
11	Pulse-	Negative polarity of energy pulse
12	Pulse+	Positive polarity of energy pulse

8.2 Typical Wiring Diagram

Wiring of SPM90-1-P is as follows:

⚠ Between A and B point, do not connect any other device !
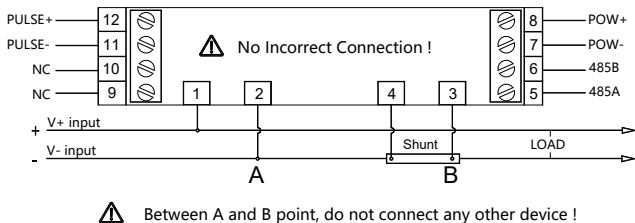
Note:

1. If -P is not included in order, then terminal 9, 10, 11, 12 are not added on the meter.

2. When installing and wiring, meter shall work with the shunt in the same package. Otherwise, measuring accuracy will be influenced.

3. The current sampling circuit must be connected to the SPM90 and cannot be mixed with other device. That is, it is not allowed to connect any other device between A and B point in the above figure to prevent damage to the instrument due to voltage circuit.
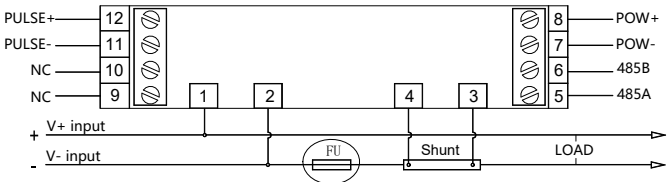
Examples of errors:

Example 1
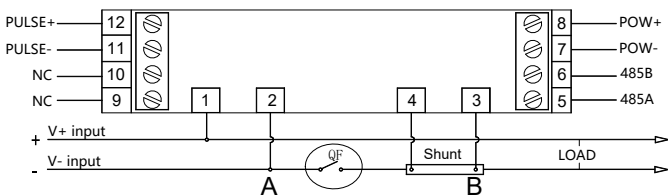
⚠ A circuit breaker is connected between A and B point, which is wrong!

Example 2

⚠ A fuse is connected between A and B point, which is wrong!

Notice:

- PILOT reserves the right to modify this manual without prior notice in view of continued improvement.

Pilot ZHUHAI PILOT TECHNOLOGY CO., LTD