# SPM91
# DIN Rail Single Phase Energy Meter
# Installation & Operation Manual V1.7

**Pilot**® ZHUHAI PILOT TECHNOLOGY CO.,LTD.

## ⚠ **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. General Information

SPM91 DIN rail energy meter is a kind of new style single phase whole electronic type meter. The meter is completely conformed to the relative requirements of the International Standard IDT IEC 62053-21:2003 (Class 1). It is an integration of up-to-date micro-electronics technique, special large scale integrate circuit, advanced technique of digital sampling technique and SMT techniques etc.

SPM91 is used for measuring active energy, voltage, current, active power, reactive power, apparent power, power factor, input active energy, output active energy, input reactive energy, output reactive energy, total active energy, total reactive energy in a rated frequency of 50Hz or 60Hz single phase alternating current circuit. It displays total active energy, voltage, current, active power via LCD and is characterized with good reliability, compact size, light weight, specious nice appearance and easy installation.

# 2. Features

◆ 35mm DIN installing, in accordance with Standard DIN ED50022

◆ High accuracy, active energy accuracy up to class 1

◆ Measure and display V, I, P, kWh value

◆ 6+1 digits LCD display (999999.9 kWh)

◆ Passive pulse output, output signal is in accordance with Standard DIN43864

◆ LED indicates pulse

◆ Key-press for local parameter setting

◆ RS485 communication port, Modbus protocol

◆ Support DLT645-2007 communication protocol

# 3. Order Information



# 4. Figure and Installation Dimension

**SPM91 dimension: (Unit: mm)**
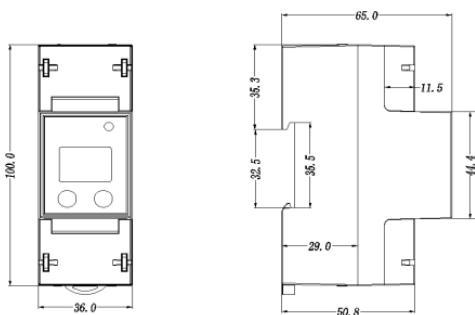


**SPM91 installation**
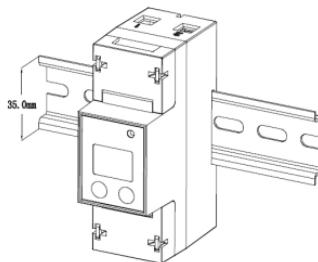
## 5. Wiring

SPM91 is directly connection type, (maximum rated current ≤ 63A) Wiring as shown below:
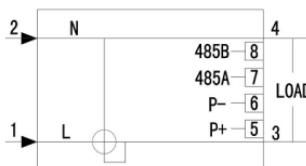


Pulse interface is passive, range of cut-in power: 5-30Vdc.

## 6. Display and Keys

### 6.1 Display Instruction

| | |
|---|---|
| A: Communication prompt | |
| B: Reverse prompt | |
| C: Run prompt | |
| D: Data display |  |
| E: Unit | |
| F: Shift / Enter key | |
| G: Flip / Value key | |

Device panel has an indicator light: PULSE.

It is indicator light for pulse output：For each pulse output, the indicator light flashes once, synchronous pulse output.

## 6.2 Menu Description

### 6.2.1 Real-time Data Query

After power on, short press flip key, users can cycle query active energy, voltage, current, active power.
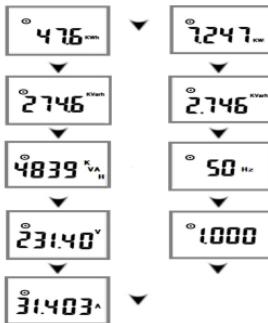


### 6.2.2 Configuration Data Query

Under real-time data query interface, long press (> 3S) Enter key to enter the configuration data query interface, short press the flip button, users can cycle check:

Under this interface long press (>3S) the flip button, can back to the real-time data query interface.
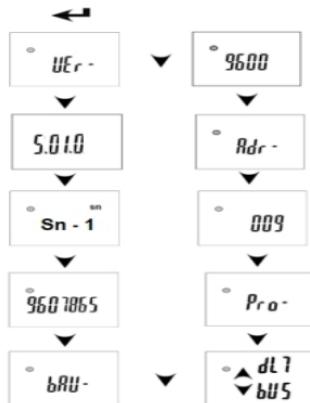
(1) VEr represent version number,

(2) bAU represent baud rate ,

(3) Adr represent address.

(4) Pro represent communication select

**6.2.3 Configuration Data Modify**

Under the configuration data query interface, long press (> 3S) Enter key to enter the configuration data modification interface, but entering the configuration data modification interface need to enter the correct password, the default password is "0000", if enter the wrong password, the meter will prompt error, and automatically back to the configuration data query interface.

After entering the configuration data modification interface, short press the flip, can cycle query prompt of baud rate (bAU) , baud rate, prompt of address (Adr) , address, prompt of password (PSd) , password, clear energy prompt (CLr), clear energy command options.

Under this interface long press (>3S) the flip button, can back to the real-time data query interface.

Under this interface short press the Enter key, can enter the modification status, if the corresponding data bits flashing, it prompt that data can be modified.

**Note: Err is error promote**
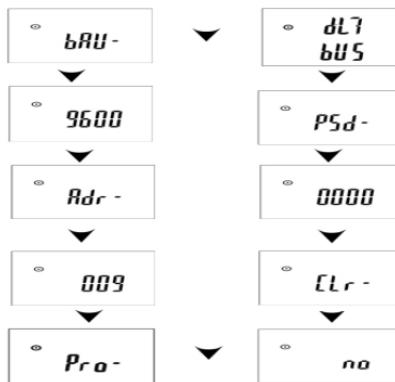
◆ **Setting Example-1: Modify Communication Address**

1. Long press (> 3S) Enter key to enter the configuration data modification interface, enter the correct password

2. Short press the flip key, enter the Adr menu.

3. Short press the Enter key, the address data starts flashing.

4. Under this interface short press the flip key for modifying data, short press the Enter key to shift.

5. After modifying the data to the desired address, press (> 3S) Enter button to save the address.

6. Complete address modification.

◆ **Setting Example-2: Clear Energy**

1. Long press (> 3S) Enter key to enter the configuration data modification interface, enter the correct password

2. Short press the flip key, enter the Clr menu

3. Short press the Enter key, the remove command starts flashing, the default display (no) command

4. Under this interface short press the flip key for choosing (YES) or (no) command.

5. Select (YES) to clear energy, (no) does not clear, long press the Enter key (> 3S) to confirm

6. Automatically back to CLr menu.

# 7. Main Technical Data

| | |
|---|---|
| **Rated voltage** | 220Vac, direct |
| **Rated (Max.) current** | 5(63)A direct |

| | |
|---|---|
| **Input frequency** | 50Hz or 60Hz |
| **Power supply** | self-supply<br><br>230V, (184V-275V) |
| **Starting current** | 0.4%Ib |
| **Power consumption** | <2W |
| **Insulating property** | Power frequency withstand voltage: AC 2 KV<br><br>Impulse withstand voltage: 6KV |
| **Accuracy** | Class 1 ( IEC62053-21) |
| **Pulse output** | 1000imp/kWh |
| **Communication** | RS485 output, Modbus-RTU protocol<br><br>Address: 1~247<br><br>Baud rate: 2400bps, 4800bps, 9600bps |
| **Connection mode** | 1-phase 2-wire |
| **Dimension** | 36 × 100 × 65mm |
| **Installation mode** | Standard 35mm DIN rail |
| **Operating environment** | Operating temperature: -20℃~+55℃<br><br>Storage temperature: -25℃~+70℃<br><br>Relative humidity: 5%~95%,non-condensing |
| **Electrostatic discharge immunity test** | IEC61000-4-2,Level 4 |
| **Radiated immunity test** | IEC61000-4-3,Level 3 |
| **Electrical fast transient/ burst immunity test** | IEC61000-4-4,Level 4 |
| **Surge immunity test (1,2/50µs~8/20µs)** | IEC61000-4-5,Level 4 |

| Conducted Emissions | EN55022, Class B |
|---|---|
| Radiated Emissions | EN55022, Class B |

## 8. Communication Protocol

SPM91 support standard Modbus communication protocol, and support 0x03 and 0x10 command. Please refer to below registers list.

Because some data is too long, the device uses two registers to present. And these data is transits in way of "low byte in the former, high byte in the back".

| Register No. | Definition | Remarks |
|---|---|---|
| Real-time data registers (0x03 RO) | | |
| 40001 | Total active energy | × 0.1, unit: kWh |
| 40002 | | Low byte in the back, high byte in the former. Range: 0-999999.9 |
| 40003 | Voltage | × 0.01, unit: V |

| | | |
|---|---|---|
| 40004 | Current | × 0.001, unit: A |
| 40005 | | Low byte in the back, high byte in the former. |
| 40006 | Active power | × 0.1, unit: W |
| 40007 | | The highest byte is the sign byte. |
| 40008 | Apparent power | × 0.1, unit: VA |
| 40009 | | The highest byte is the sign byte. |
| 40010 | Reactive power | × 0.1, unit: Var |
| 40011 | | The highest byte is the sign byte. |
| 40012 | Frequency | × 0.01, unit: Hz |
| 40013 | Power factor | × 0.001 |
| 40014 | Input active energy | × 0.1, unit: KWH |
| 40015 | | |
| 40016 | Output active energy | × 0.1, unit: KWH |
| 40017 | | |
| 40018 | Reserved | |
| 40019 | Reserved | |
| 40020 | Input reactive energy | × 0.1, unit: KVarh |
| 40021 | | |
| 40022 | Output reactive energy | × 0.1, unit: KVarh |
| 40023 | | |
| 40024 | Total reactive energy | × 0.1, unit: KVarh |
| 40025 | | |
| 40026 | Total apparent energy | × 0.1, unit: KVA |
| 40027 | | |

| 40028 | Energy decimal point display setting | Default is 1, unit: KWH<br><br>Set 1: LCD display 0.1, Modbus x 0.1<br><br>Set 2: LCD display 0.01, Modbus x 0.01<br><br>Set 3: LCD display 0.001, Modbus x 0.01 |
|---|---|---|
| **Configuration parameter register (0x10 RW)** | | |
| 40202 | Modbus address | Range:1-247 |
| 40203 | Baud rate | 0:4800bps 1:9600bps  2:2400bps  3:1200bps |
| 40207 | Password | 0x0000-0xFFFF |
| 40251 | Clear energy | Write 901 to clear energy |

## DLT645-2007 communication protocol register address

| Label | | | | Format | Data length (Byte) | Unit | Function | | Data name |
|---|---|---|---|---|---|---|---|---|---|
| DI 3 | DI 2 | DI 1 | DI 0 | | | | R | W | |
| 00 | 00 | 00 | 00 | XXXXXX.XX | 4 | kWh | * | | Combination active energy |
| 00 | 00 | FF | 00 | XXXXXX.XX | 4 | kWh | * | | Combination active energy data block |
| 00 | 01 | 00 | 00 | XXXXXX.XX | 4 | kWh | * | | Positive active energy |
| 00 | 01 | FF | 00 | XXXXXX.XX | 4 | kWh | * | | Positive active energy data |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | block |
| 00 | 02 | 00 | 00 | XXXXXX.XX | 4 | | kWh | * | | Negative active energy |
| 00 | 02 | FF | 00 | XXXXXX.XX | 4 | | kWh | * | | Negative active energy data block |
| 00 | 03 | 00 | 00 | XXXXXX.XX | 4 | | kvarh | * | | Combination Q 1 energy |
| 00 | 03 | FF | 00 | XXXXXX.XX | 4 | | kvarh | * | | Combination Q 1 energy data block |
| 00 | 04 | 00 | 00 | XXXXXX.XX | 4 | | kvarh | * | | Combination Q 2 energy |
| 00 | 04 | FF | 00 | XXXXXX.XX | 4 | | kvarh | * | | Combination Q 2 energy data block |
| 02 | 03 | 01 | 00 | XX.XXXX | 3 | | kW | * | | A-phase P |
| 02 | 03 | 00 | 00 | XX.XXXX | 3 | | kW | * | | Instantaneous total P |
| 02 | 03 | FF | 00 | XX.XXXX | 3 | | kW | * | | Instantaneous total P data block |
| 02 | 04 | 01 | 00 | XX.XXXX | 3 | | kvar | * | | A-phase Q |
| 02 | 04 | 00 | 00 | XX.XXXX | 3 | | kvar | * | | Instantaneous total Q |

| 02 | 04 | FF | 00 | XX.XXXX | 3 | kvar | * | | Instantaneous total Q data block |
|---|---|---|---|---|---|---|---|---|---|
| 02 | 05 | 01 | 00 | XX.XXXX | 3 | kVA | * | | A-phase S |
| 02 | 05 | 00 | 00 | XX.XXXX | 3 | kVA | * | | Instantaneous total S |
| 02 | 05 | FF | 00 | XX.XXXX | 3 | kVA | * | | Instantaneous total S data block |
| 02 | 01 | 01 | 00 | XXX.X | 2 | V | * | | A-phase voltage |
| 02 | 01 | FF | 00 | XXX.X | 2 | V | * | | Voltage data block |
| 02 | 02 | 01 | 00 | XXX.XXX | 2 | A | * | | A-phase current |
| 02 | 02 | FF | 00 | XXX.XXX | 2 | A | * | | Current data block |
| 02 | 80 | 00 | 02 | XX.XX | 2 | Hz | * | | Grid frequency |
| 02 | 06 | 01 | 00 | X.XXX | 2 | | * | | A-phase power factor |
| 02 | 06 | 00 | 00 | X.XXX | 2 | | * | | Instantaneous total PF |
| 02 | 06 | FF | 00 | X.XXX | 2 | | * | | Instantaneous total PF data block |
| 04 | 00 | 04 | 01 | XXXXXXX XXXXX | 6 | | * | * | Meter address |

| 09 | 09 | 09 | 09 | XX | 1 | | | * | * | Baud rade: 0-4800 1-9600 2-2400 |
|----|----|----|----|----|---|---|---|---|---|---|
| 09 | 09 | 09 | 08 | XX | 1 | | | * | * | 0-MODBUS 1-DLT645 |
| 04 | DD | 11 | 00 | ................ .... | 20 | | | * | | Software version number |

**Notice:**

PILOT reserves the right to modify this manual without prior notice in view of

continued improvement.

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