SEM228A Photoelectric Solar Radiation Sensor

User Manual

V22.07.02

1. Product introduction

The SEM228 total solar radiation sensor adopts the photoelectric principle and can be used to measure the total radiation value under sunlight. The radiation sensor adopts a high-precision photosensitive element, with wide spectral absorption, high absorption in the full spectral range, and good stability; at the same time, a dust cover with a light transmittance of up to 95% is installed outside the sensing element, and the dust cover is specially treated to reduce dust. Adsorption can effectively prevent the interference of environmental factors on internal components, and can measure the amount of solar radiation more accurately.

The product supports standard analog output or Modbus-RTU 485 communication protocol, which can directly read the current solar radiation value, and the wiring method is simple. The appearance is small and beautiful, and takes up little installation space. Products are widely used in solar energy utilization, meteorology, agriculture, building material aging and air pollution and other departments to do the measurement of total solar radiation.

1.1 Features

■ Using high-precision photosensitive elements, high absorption in the spectral range

■ Comes with level and adjustment hand wheel, easy to adjust on site

■ Adopt standard Modbus-RTU protocol

■ Highly transparent dust cover, good sensitivity, special surface treatment to prevent dust adsorption

■ Using all-aluminum shell, high protection level

■ Wide voltage power supply DC 7~30V

1.2 Technical parameter

Power supply range	7V~30V DC (0-10V output power supply voltage can only be DC 24V)	
Output method	485 (standard Modbus-RTU protocol)	
	Current output	4-20mA
	Voltage output	0-5V、0-10V
Power consumption	0.06W (RS485), 0.6W (analog output)	
Operating temperature	-25℃~60℃	
Measurement object	sunshine	
Measuring range	0~1800W/㎡	
Resolution	1W/㎡	
Response time	≤10S	
Nonlinear	＜±3%	
Annual stability	≤±3%	
Load capacity	Current output: ≤600Ω, voltage output: output resistance ≤250Ω	
Line length	60cm can be customized	

2. Product installation and wiring

2.1 Check before installation

■ One sensor device

■ Black waterproof plug-in male 70cm

■ Qualification certificate, warranty card

■ Installation screw pack

2.2 Installation method

1. Use screws through the mounting holes on the sensor to fix the sensor on the installation position.

2. Make sure the device is parallel to the ground (adjust the hand screw and check the level of the bubble to determine whether it is parallel).

3. After installation, remove the protective cover
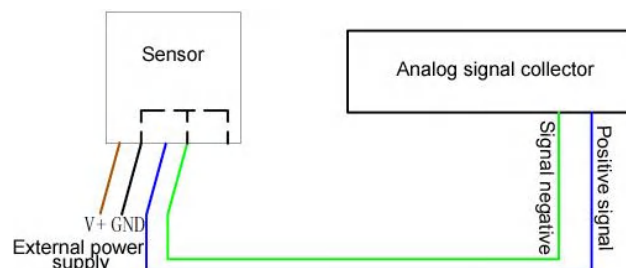

2.3 Equipment size
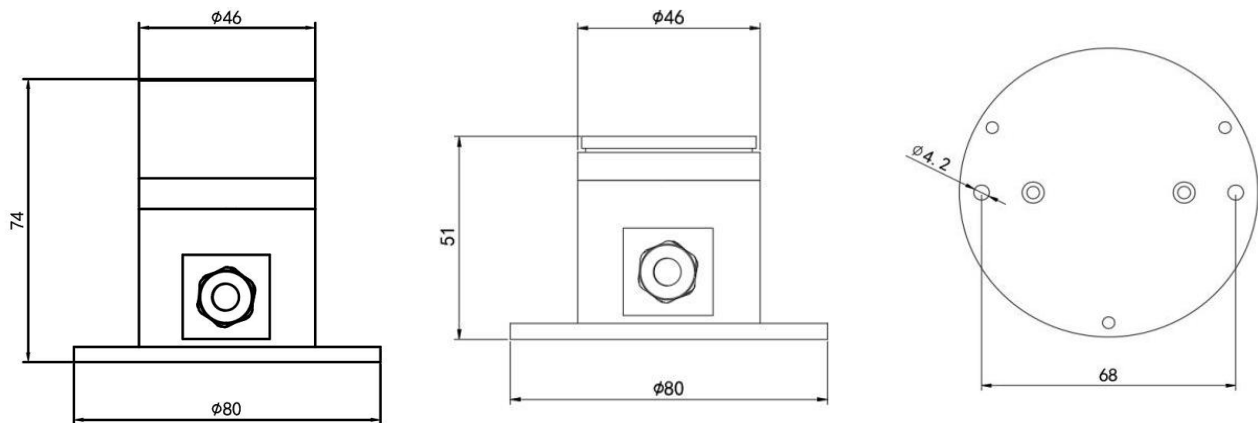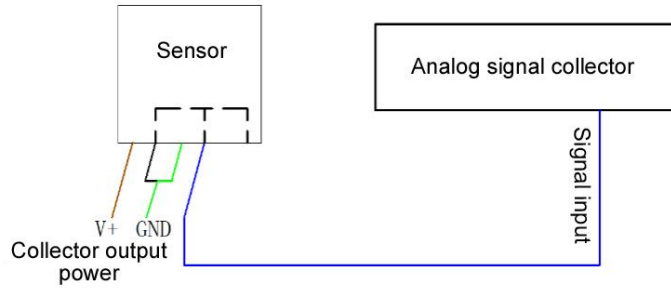

3. Output interface wiring

Analog signal type wiring method and calculation formula

	Thread color	Illustrate
Power supply	Brown	Positive power supply (10~30V DC)
	Black	Negative power supply
Communication	Blue	Positive signal
	Green	Signal negative

3.1 Wiring example

Four-wire connection diagram

Three-wire connection diagram

3.2 Calculation formula

3.2.1 Calculation method of current type signal output

For example, the range is 0~1800W/㎡, and the output signal is 4~20mA. When the output signal is 12mA, the current solar radiation value is calculated. The span of the solar radiation range is 1800W/㎡, which is expressed by a 16mA current signal, 1800W/㎡/16mA=112.5W/㎡/mA, that is, the current 1mA represents a solar radiation change of 112.5W/㎡, and the measured value is 12mA-4mA=8mA. 8mA*112.5W/㎡/mA=900W/㎡, the current solar radiation value is 900W/㎡.

3.2.2 Voltage type signal output conversion calculation

For example, the range is 0~1800W/㎡, 0-10V output, when the output signal is 5V, the current solar radiation value is calculated. The span of the solar radiation range is 1800W/㎡, which is expressed by a 10V voltage signal, 1800W/㎡/10V=180W/㎡/V, that is, a voltage of 1V represents a solar radiation change of 180W/㎡, and the measured value is 5V-0V=5V, 5V* 180W/㎡/V=900W/㎡, the current solar radiation value is 900W/㎡.

4. RS485 Type wiring

|	Thread color	Illustrate
Power supply	Brown	Positive power supply (7~30V DC)
	Black	Negative power supply
Communication	Green	485-A
	Blue	485-B

5. Configuration software installation and use

5.1 Software selection

Open the data package, select "Debugging Software"---"485 Parameter Configuration Software", find "RS485 parameter configuration tool 2.1" just open.

5.2 Parameter settings

①Select the correct COM port (check the COM port in "My Computer - Properties - Device Manager - Port"), the following figure lists the driver names of several different 485 converters.
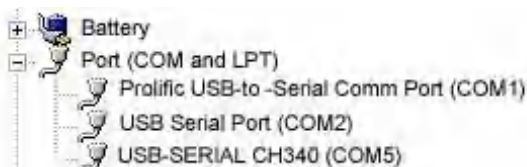
② Connect only one device and power it on, click the test baud rate of the software, the software will test the baud rate and address of the current device, the default baud rate is 4800bit/s, and the default address is 0x01.

③ Modify the address and baud rate according to the needs of use, and at the same time, you can query the current functional status of the device.

④ If the test is unsuccessful, please re-check the equipment wiring and 485 driver installation.

6. Communication protocol

6.1 Basic communication parameters

Code	8-bit binary
Data bit	8-bit
Parity bit	Without
Stop bit	1 bit
Error checking	CRC (Redundant Cyclic Code)
Baud rate	2400bit/s, 4800bit/s, 9600 bit/s can be set, the factory default is 4800bit/s

6.2 Data frame format definition

Using Modbus-RTU communication protocol, the format is as follows:

Initial structure ≥4 bytes of time

Address code = 1 byte

Function code = 1 byte

Data area = N bytes

Error check = 16-bit CRC code
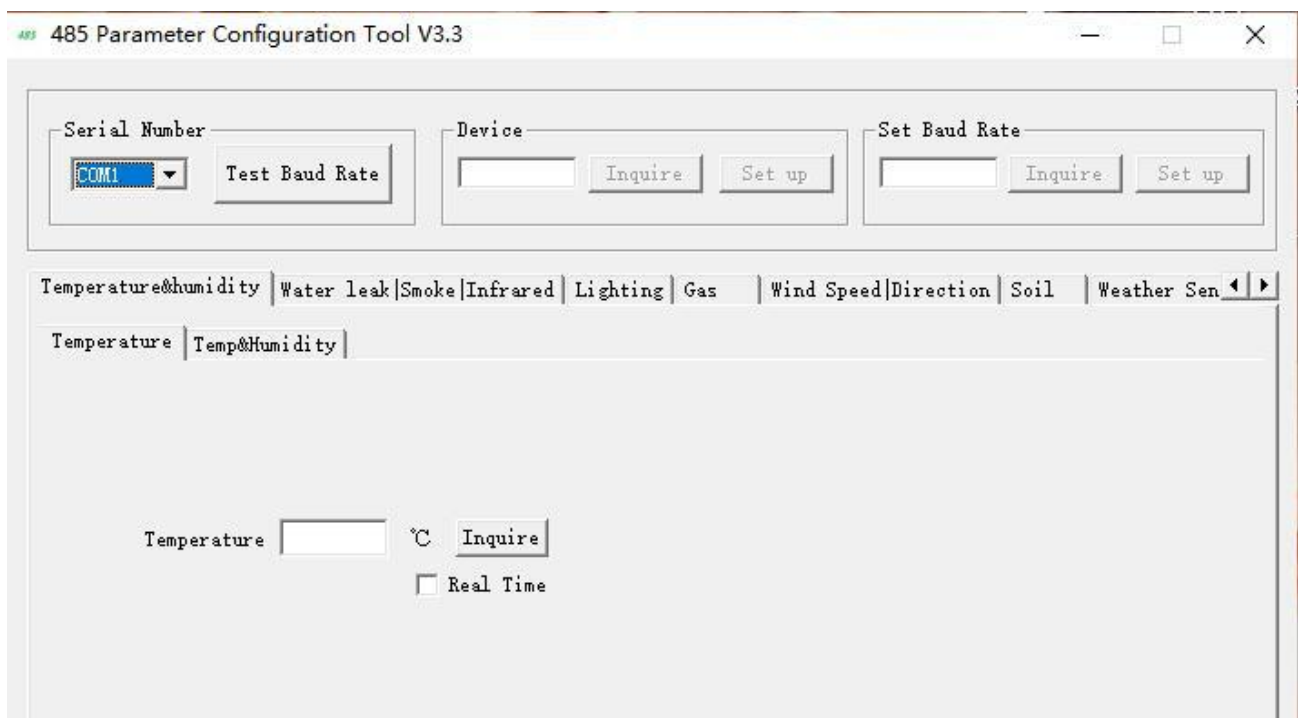
Time to end structure ≥ 4 bytes

Address code: the address of the transmitter, which is unique in the communication network (factory default 0x01).

Function code: the function instruction of the command sent by the host, the transmitter can use the function code 0x03 (read register data) 0x06 (write register).

Data area: The data area is the specific communication data, pay attention to the high byte of the 16bits data first!

CRC code: two-byte check code.

Host query frame structure:

Address code	Function code	Register start address	Register length	CRC low	CRC high
1 byte	1 byte	2 bytes	2 bytes	1 byte	1 byte

Slave machine response frame structure:

Address code	Function code	Number of valid bytes	Data area	Second data area	Nth data area	Check code
1 byte	1 byte	1 byte	2 bytes	2 bytes	2 bytes	2 bytes

6.3 Register address

Register address	Content	Operate	Scope and Definitions
0000 H	Solar radiation value	Read only	Actual value
0052H	Deviation	Read and write	Solar radiation deviation value (0~1800)
07D0 H	Device address	Read and write	1~254 (factory default 1)
07D1H	Device baud rate	Read and write	0 means 2400 1 for 4800 2 for 9600

6.4 Communication protocol example and explanation

6.4.1 Read the current solar radiation value

Inquiry frame: read value function code 03/04

Address code	Function code	Initial address	Data length	CRC low	CRC high
0x01	0x03	0x00 0x00	0x00 0x01	0x84	0x0A

acknowledgment frame

Address code	Function code	Number of valid bytes	Solar radiation value	CRC low	CRC high
0x01	0x03	0x02	0x00 0x64	0x9B	0xAF

solar radiation value:

0064 (hexadecimal) =100=> solar radiation value=100W/㎡ Air pressure calculation:

6.4.2 Write offset value

Inquiry frame: write numerical function code 06/10

Address code	Function code	Initial address	Modify the value	CRC low	CRC high
0x01	0x06	0x00 0x52	0x00 0x0A	0xA8	0x1C

Acknowledgment frame

Address code	Function code	Initial address	Modify the value	CRC low	CRC high
0x01	0x06	0x00 0x52	0x00 0x0A	0xA8	0x1C

Write the current solar radiation deviation value

000A (hexadecimal) =10=> Solar radiation deviation value=10W/㎡ Deviation value is 10W/㎡

6.4.3 Modify current address

Query frame (modify the current address to 0x02)

Address code	Function code	Initial address	Modify the value	CRC low	CRC high
0x01	0x06	0x07 0xD0	0x00 0x02	0x08	0x86

Acknowledgment frame

Address code	Function code	Initial address	Modify the value	CRC low	CRC high
0x01	0x06	0x07 0xD0	0x00 0x02	0x08	0x86

6.4.4 Modify the current baud rate

Query frame (modify the current address to 0x02)

Address code	Function code	Initial address	Modify the value	CRC low	CRC high
0x01	0x06	0x07 0xD1	0x00 0x02	0x59	0x46

Acknowledgment frame

Address code	Function code	Initial address	Modify the value	CRC low	CRC high
0x01	0x06	0x07 0xD1	0x00 0x02	0x59	0x46

6.4.5 Query current address

Query frame:

Address code	Function code	Initial address	Data length	CRC low	CRC high
0xFF	0x03	0x07 0xD0	0x00 0x02	0xD1	0x58

Acknowledgment frame

Address code	Function code	Returns the number of valid bytes	Address	Baud rate	CRC low	CRC high
0x01	0x03	0x04	0x00 0x01	0x00 0x01	0x6A	0x33

The real address read to the device is 01, and the baud rate is 0x01, which is 4800.

7. Cautions and Troubleshooting

Precautions:

1. When the customer receives the product, please confirm the product model, etc.

2. Do not connect with electricity, and only after the wiring is checked correctly can it be powered on

3. The sensor is a precision device, please do not disassemble the protective transparent cover at will

7.1 Troubleshooting:

① If the read value shows 0, check whether there is a light source, and check whether the product protective cover is removed

② The 485 bus is disconnected, or the A and B lines are reversed

③ Check whether the power supply conforms to the label

④ Equipment damage

⑤ Output or output error Reply frame

Possible reason:

a. The wiring method is incorrect or the wiring sequence is wrong.

b. The power supply voltage is wrong (for the 0-10V type, the power supply is 24V).

c. The distance between the transmitter and the collector is too long, causing signal disorder.

d. The data acquisition port is damaged.

e. Equipment damage.

8. Product Maintenance

1. The dust cover needs to be kept clean and wiped with a soft cloth regularly

2. There should be no water in the dust cover. If it encounters heavy rain, snow, ice and other weather for a long time, it is recommended to cover it.