

PAR sensor Product User Manual

1 Overview

The sunshine duration sensor provides accurate measurement of sunshine duration for continuous outdoor monitoring. When the radiation voltage received by the sensor exceeds the preset threshold of 200 mV, it starts accumulating sunshine duration data. The accumulated value is automatically recorded by the data logger and reset at 00:00 every day.

Designed with a high-precision photosensitive element and precision cosine corrector, the sensor delivers high sensitivity, stable performance, and reliable measurement accuracy while minimizing the influence of environmental factors. With no moving parts and low power consumption, the sensor is ideal for long-term outdoor observation.

2 Feature

- **High-Precision Sensor Design:** Uses a high-precision sensor element for accurate and reliable measurement.
- **Wide Voltage Design:** Provides high cost-effectiveness with a wide voltage design.
- **Digital Linear Correction:** Provides high measurement accuracy and stable performance.
- **Natural Sunlight Calibration:** Calibrated with natural sunlight to minimize the influence of external light sources.
- **Flexible Installation:** Flexible installation and convenient operation.
- **Compact and Lightweight Design:** Compact size, lightweight structure, and vibration resistance.

3 Application

The sunshine duration sensor is widely used in research fields including meteorology, agriculture, forestry, aquaculture, and construction. It is also suitable for applications such as laboratories and urban lighting where sunshine duration monitoring is required.

4 Product Information

4.1 Specs

Parameter	Specification
Measurement Parameter	Sunshine Duration
Measurement Unit	h (hours)
Measurement Range	0~24 h
Resolution	0.1 h
Accuracy	±2%
Temperature Dependence	< ±0.08%/°C
Non-linearity	< ±2%

Annual Drift	< $\pm 2\%$
Output Signal	Output Signal (Analog) Specification: 0~2 V / 0~5 V / 0~10 V / 4~20 mA (optional); RS485, Modbus-RTU protocol (default address: 01); SDI-12 serial communication protocol
Supply Voltage	5~24 V DC (for 0~2 V output, RS485, SDI-12); 12~24 V DC (for 0~5V, 0~10V, 4~20mA output)
Power Consumption	1.8 mW
Warm-up Time	1 s after power-on
Response Time	< 1 s
Storage Temperature	-40 to 80°C
Storage Humidity	< 100% RH
Cable Specification	2 m, 3-wire cable (analog output); 2 m, 4-wire cable (RS485); 2 m cable (custom cable length available).

4.2 Current Output Impedance Requirements

Supply Voltage	Maximum Load Resistance
9 V DC	< 250 Ω
12 V DC	< 400 Ω
20 V DC	< 500 Ω
24 V DC	< 900 Ω

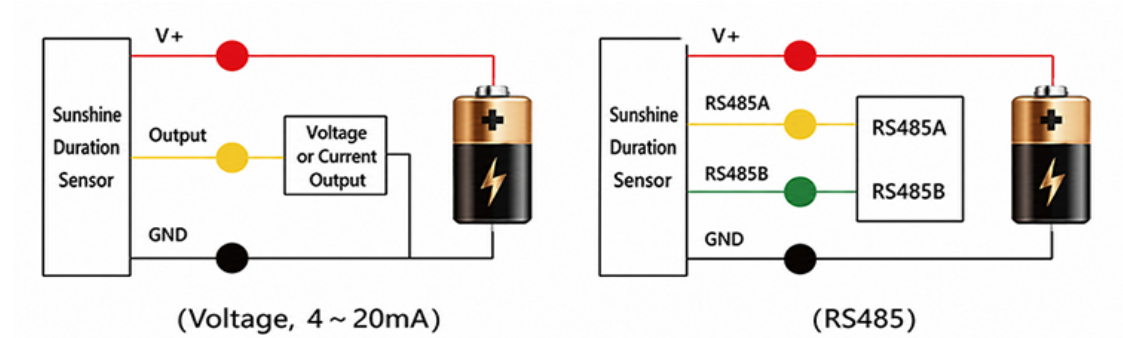
5 Dimension (Unit: mm)



6 Installation and Operation

The sunshine duration sensor supports connection with various data acquisition devices equipped with differential inputs, such as data loggers, data acquisition cards,

and remote data acquisition modules. Please refer to the wiring diagram below for connection details.



7 Data Conversion Method

- H: Sunshine duration, unit: hour (h)
- V: Voltage value collected by the data logger, unit: V (volt).
- A: Current value collected by the data logger, unit: mA

Output Signal	Conversion Formula (0~24 h)
0~2 V DC	$H = 12 \times V$
0~5 V DC	$H = 4.8 \times V$
0~10 V DC	$H = 2.4 \times V$
4~20 mA	$H = 1.5 \times A - 6$

RS485 Signal (Default Address: 01):

Standard Modbus-RTU protocol; baud rate: 9600 bps; parity: None; data bits: 8; stop bits: 1.

7.1 Modify Address

Example:Change the sensor address from 01 to 02,Host → Slave.

Original Address	Function Code	Register Address High Byte	Register Address Low Byte	Starting Address High Byte	Starting Address Low Byte	CRC16 Low Byte	CRC16 High Byte
0X01	0X06	0X00	0X30	0X00	0X02	0X08	0X04

7.2 Data Query

Query the data (sunshine duration) of the sensor with address 01.

Host → Slave.

Address	Function Code	Starting Register Address High Byte	Starting Register Address Low Byte	Register Quantity High Byte	Register Quantity Low Byte	CRC16 Low Byte	CRC16 High Byte
0X01	0X03	0X00	0X00	0X00	0X04	0X44	0X09

If the sensor receives the command correctly, it returns the following data.

Slave → Host.

Address	0X01	
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Function Code	0X03	
Data Length	0X08	
Register 0 Data High Byte	0X00	Current day's sunshine duration: 9.0 h;Sunshine duration from 00:00 to the current time
Register 0 Data Low Byte	0X5A	
Register 1 Data High Byte	0X00	Instant sunshine duration: 2.0 h;Sunshine duration accumulated between two queries.
Register 1 Data Low Byte	0X14	
Register 2 Data High Byte	0X00	Previous day's sunshine duration: 10.0 h;Sunshine duration within the previous 24 hours.
Register 2 Data Low Byte	0X64	
Register 3 Data High Byte	0X07	Total sunshine duration: 180.0 h;Total sunshine duration after sensor power-on.
Register 3 Data Low Byte	0X08	
CRC16 Low Byte	0X1D	
CRC16 High Byte	0XF8	

7.3 Clock Query and Setting

Query the sensor clock (year, month, day, hour, minute, and second) of the sensor with address 01.

Host → Slave

Address	Function Code	Starting Register Address High Byte	Starting Register Address Low Byte	Register Quantity High Byte	Register Quantity Low Byte	CRC16 Low Byte	CRC16 High Byte
0X01	0X03	0X00	0X34	0X00	0X03	0X44	0X05

If the sensor receives the command correctly, it returns the following dat.

Slave → Host

Address	Function Code	Data Length	Year	Month	Day	Hour	Minute	Second	CRC16 Low Byte	CRC16 High Byte
0X01	0X03	0X06	0X22	0X01	0X07	0X14	0X49	0X33	0X2C	0XC2
			BCD format, representing: 22-01-07 14:49:33							

If the sensor clock has deviation, it can be calibrated through Modbus-RTU communication.

Host→Slave.

Address	0X01	
Function Code	0X10	
Starting Register Address High Byte	0X00	
Starting Register Address Low Byte	0X34	

Register Quantity High Byte	0X00	
Register Quantity Low Byte	0X03	
Data Length	0X06	
Year	0X22	BCD format, representing: 22-01-07 14:49:33
Month	0X01	
Day	0X07	
Hour	0X14	
Minute	0X49	
Second	0X30	
CRC16 Low Byte	0XEA	
CRC16 High Byte	0X1C	

If the sensor receives the command correctly, it returns the following response.

Slave → Host.

Address	Function Code	Starting Register Address High Byte	Starting Register Address Low Byte	Register Quantity High Byte	Register Quantity Low Byte	CRC16 Low Byte	CRC16 High Byte
0X01	0X10	0X00	0X34	0X00	0X03	0XC1	0XC6

7.4 Sunshine Duration Reset Setting

Reset Sunshine Duration Value.

Host → Slave.

Original Address	Function Code	Register Address High Byte	Register Address Low Byte	Data Content High Byte	Data Content Low Byte	CRC16 Low Byte	CRC16 High Byte
0X01	0X06	0X00	0X37	0X00	0X03	0X78	0X05

If the sensor receives the command correctly, the sensor returns the same data frame.

8 Precautions for Use

1. When receiving the product, please check whether the package is intact and confirm that the sensor model and specifications match the purchased product.
2. The installation location should be kept away from chemically corrosive environments.
3. The sensor and cable should be kept away from high-voltage electricity and heat sources.
4. The sensor is a precision instrument and should be stored in a dry, well-ventilated indoor environment at normal temperature.
5. The sensor is a precision instrument. Users should not disassemble it during use to avoid product damage.