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Arduino Forum PR-300AL-RA-N01 Total Solar Radiation Sensor Instruction Manual

Contents

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Arduino Forum PR-300AL-RA-N01 Total Solar Radiation Sensor

Specifications

- **Power supply range**: DC 7-30V
- **Output method:** Modbus-RTU protocol

Product Introduction

Product Overview
PR-300AL-RA-N01 total solar radiation sensor adopts photoelectric principle and can be used to measure solar radiation in the spectral range of 0.3~3μm. 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 adopts the standard 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. The products are widely used in solar energy utilization, meteorology, agriculture, aging of building materials and air pollution to measure solar radiation energy.

Features

- Using high-precision photosensitive elements, high absorption in the entire spectral range
- Self-contained level and adjustment handwheel, easy to adjust on site
- Adopt standard Modbus-RTU protocol
- Highly transparent dust cover, good sensitivity, special surface treatment to prevent dust adsorption
- Wide voltage power supply DC 7~30V

Main parameters

Power supply range	7V~30V DC
output method	485 (standard Modbus-RTU protocol)
Power consumption	0.06W
Working humidity	0%~100%RH
Operating temperature	-25℃~60℃
Measurement object	sunshine
Measuring range	0~1800W/
Resolution	1W/
Response time	≤10S
nonlinear	±2%
annual stability	±2%
cosine response	≤±10%

DIMENSION
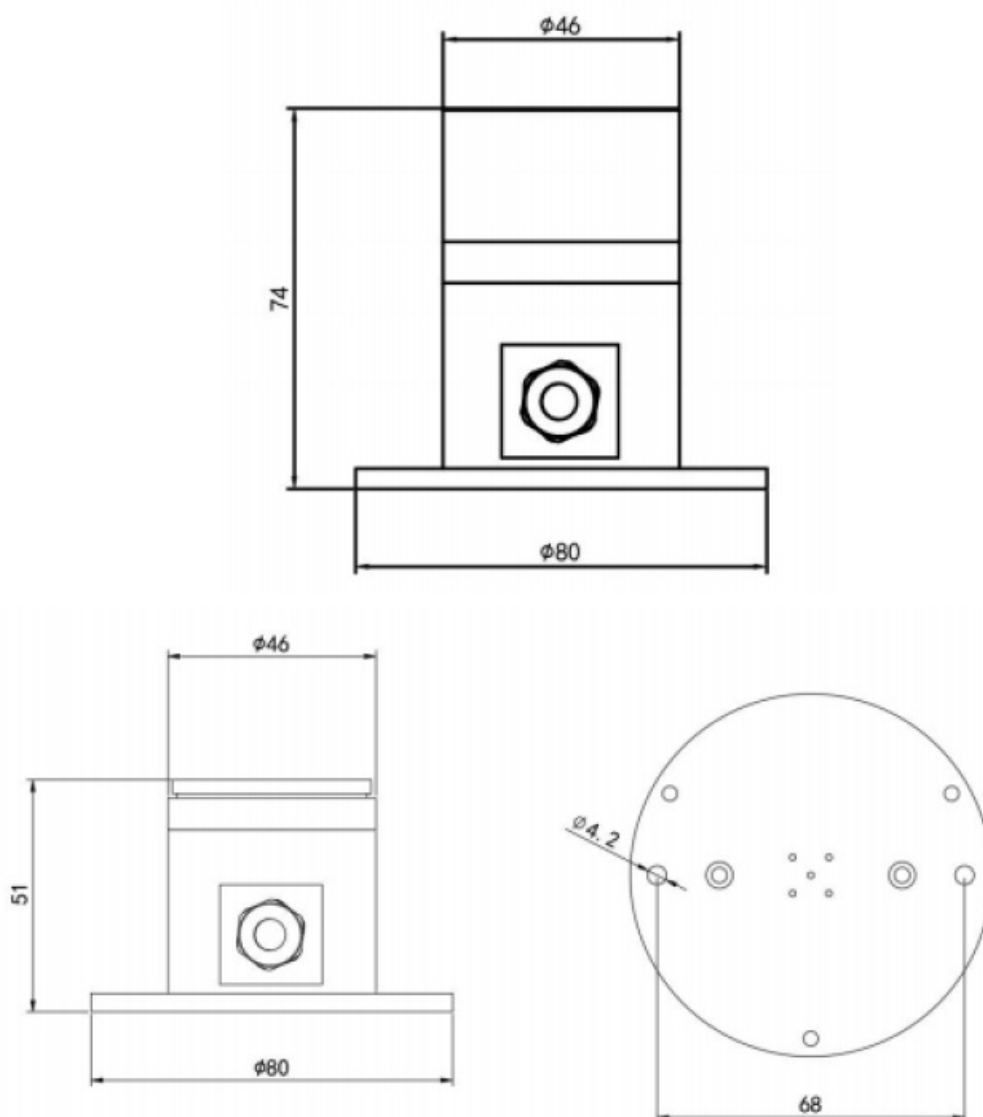
System Frame Diagram
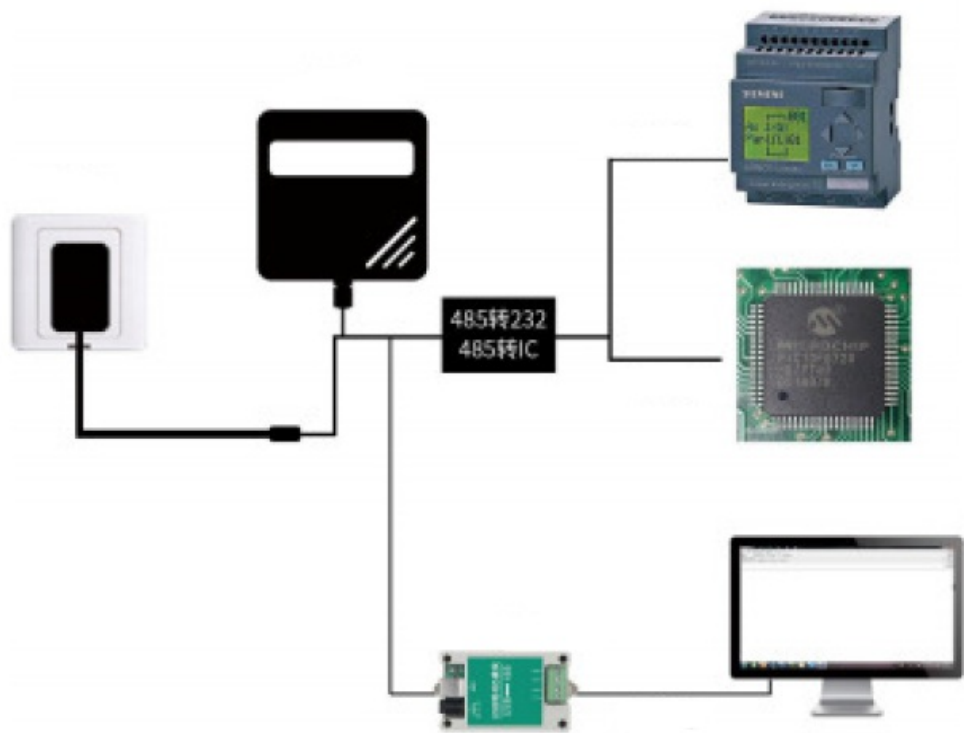
This product can also be used in combination of multiple sensors in a 485 bus. In theory, a bus can have 254 485 sensors, the other end is connected to a PLC with a 485 interface, a single-chip microcomputer is connected through a 485 interface chip, or a USB to 485 can be used to communicate with the Computer connection, use the sensor configuration tool provided by our company for configuration and testing (only one device can be connected when using this configuration software).

Hardware Connections

1. **Interface description**

   The power interface is a wide voltage power supply input of 7-30V. When wiring the 485 signal line, pay attention that the two lines of A/B cannot be reversed, and the addresses of multiple devices on the bus cannot be conflicted.

2. **Sensor Wiring**

	thread color	illustrate
power supply	brown	Positive power supply (7~30V DC)
	black	negative power supply
communication	green	485-A
	blue	485-B

3. **Installation method**
   1. Use screws through the mounting holes on the sensor to fix the sensor on the mounting bracket

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

Configuring Software Installation and Use

Our company provides the matching "485 parameter configuration software", which can easily use the computer to read the parameters of the sensor, and flexibly modify the device ID and address of the sensor.

Note that there is only one sensor on the 485 bus when using automatic acquisition by software.

Connect the sensor to the computer

- After the sensor is correctly connected to the computer via USB to 485 and provides power, you can see the correct COM port in the computer (check the COM port in "My Computer – Properties – Device Manager – Port").
- Open the data package, select "Debugging Software"—"485 Parameter Configuration

- Software", find and open it.
- If the COM port is not found in the device manager, it means that you have not installed the USB to 485 driver (included in the data package) or the driver has not been installed correctly, please contact the technician for help.

Use of sensor monitoring software

1. The configuration interface is shown in the figure. First, obtain the serial port number according to the method in Chapter 3.1 and select the correct serial port.
2. 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.

Communication Protocol

Basic communication parameters

coding	8 bit binary
data bits	8 bits
parity bit	none
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

Data frame format definition

Adopt 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:** It is 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, this transmitter only uses the function code 0x03 (read register data).
- **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	Check code low	Check code high
1 byte	1 byte	2 byte	2 byte	1 byte	1 byte

Slave 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 byte	2 byte	2 byte	2 byte

Register Address

register address	content	operate	Scope and Definitions
0000 H	solar radiation value	read only	actual value
0052H	Deviation value	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 for 2400 1 for 4800 2 for 960

Communication protocol example and explanation
Read the current solar radiation value

- **Inquiry frame**: read numerical function code 03/04

address code	function code	starting address	Data length	Check code low	Check code high
0x01	0x03	0x00 0x00	0x00 0x01	0x84	0x0A

- acknowledgment frame

address code	function code	Returns the number of valid bytes	solar radiation value	Check code low	Check code high
0x01	0x03	0x02	0x00 0x64	0x9B	0xAF

Solar radiation value: 0064 (hexadecimal) =100=> solar radiation value=100W/

Write offset value
Inquiry frame: write numerical function code 06/10

address code	function code	register ground	Modify the value	Check code low	Check code high
0x01	0x06	0x00 0x52	0x00 0x0A	0xA8	0x1C

acknowledgment frame

address code	function code	register ground	Modify the value	Check code low	Check code 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/

Modify the current address
Query frame (modify the current address to 0x02)

address code	function code	starting address	Modify the value	Check code low	Check code high
0x01	0x06	0x07 0xD0	0x00 0x02	0x08	0x86

acknowledgment frame

address code	function code	starting address	Modify the value	Check code low	Check code high
0x01	0x06	0x07 0xD0	0x00 0x02	0x08	0x86

Modify the current baud rate
Query frame (assuming the modified baud rate is 9600)

address code	function code	starting address	Modify the value	Check code low	Check code high
0x01	0x06	0x07 0xD1	0x00 0x02	0x59	0x46

Acknowledgment frame

address code	function code	starting address	Modify the value	Check code low	Check code high
0x01	0x06	0x07 0xD1	0x00 0x02	0x59	0x46

Query current address
Query frame:

address code	function code	starting address	Data length	Check code low	Check code high
0xFF	0x03	0x07 0xD0	0x00 0x02	0x91	0x59

Acknowledgment frame

address code	function code	Returns the number of valid bytes	address	baud rate	Check code low	Check code high
0xFF	0x03	0x04	0x00 0x01	0x00 0x01	0x50	0x50

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

Common Problems and Solutions

Precautions:

1. When the customer receives the product, please confirm the product model, etc.
2. Do not connect with live power, and power on only after the wiring check is correct.
3. The sensor is a precision device, please do not disassemble the protective transparent cover at will

    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 meets the label
    4. Equipment damage

Product Maintenance

1. The dust cover should 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.

FAQ

Q: How many sensors can be connected in a 485 bus?
A: In theory, a bus can have up to 254 Type 485 sensors.

Q: How to avoid conflicts when addressing multiple devices on the bus?
A: Ensure that the addresses of multiple devices on the bus do not conflict.

Q: What is the recommended method for adjusting the sensor on-site?
A: Use the self-contained level and adjustment handwheel for easy on-site adjustments.

Documents / Resources

Arduino Forum PR-300AL-RA-N01 Total Solar Radiation Sensor [pdf] Instruction Manual
PR-300AL-RA-N01 Total Solar Radiation Sensor, PR-300AL-RA-N01, Total Solar Radiation Sensor, Solar Radiation Sensor, Radiation Sensor

References

- **User Manual**