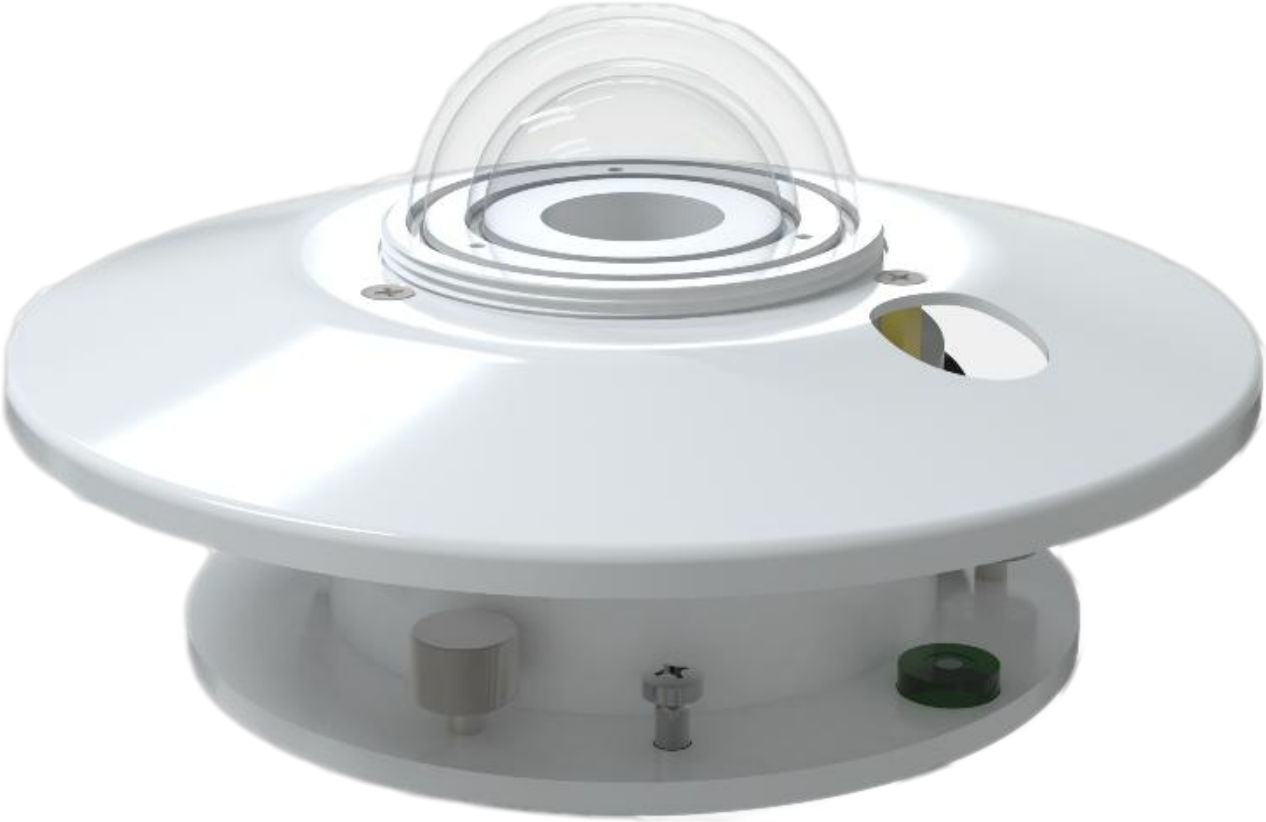
OHTS1095 Pyranometer (Solar Total Radiation Transmitter)

1 Product Overview



The OHTS1095 Pyranometer is designed based on the thermoelectric effect principle, utilizing a wire-wound electroplated thermopile as the sensing element. The sensing surface is coated with a high-absorptivity black coating that converts solar radiation into thermal energy and subsequently into a thermoelectric electromotive force (thermal EMF) through the radiation thermal effect. The sensor features a double-layer quartz glass dome (95% transmittance) that effectively suppresses air convection and thermal radiation from the dome itself while blocking infrared radiation from the outer cover. An integrated temperature compensation circuit ensures measurement accuracy across a wide temperature range. By configuring a shadow ring, the device can be extended to measure diffuse radiation.

This transmitter adopts the standard ModBus-RTU communication protocol, outputting data via an RS-485 interface and supporting remote parameter configuration. The compact aluminum alloy housing makes it suitable for long-term outdoor monitoring applications.

2 Application Scenarios

- Solar resource assessment and photovoltaic (PV) system efficiency monitoring
- Global solar radiation flux density measurement at meteorological observation stations
- Photosynthetically Active Radiation (PAR) monitoring in agro-ecosystems
- Building material aging tests and durability evaluation
- Radiation budget studies in atmospheric pollution monitoring
- Building thermal performance analysis and energy consumption assessment
- Data acquisition for climate research observation networks
- Feasibility studies for renewable energy projects
- Illumination monitoring in greenhouse environmental control systems
- Radiation observation for polar/marine scientific expeditions

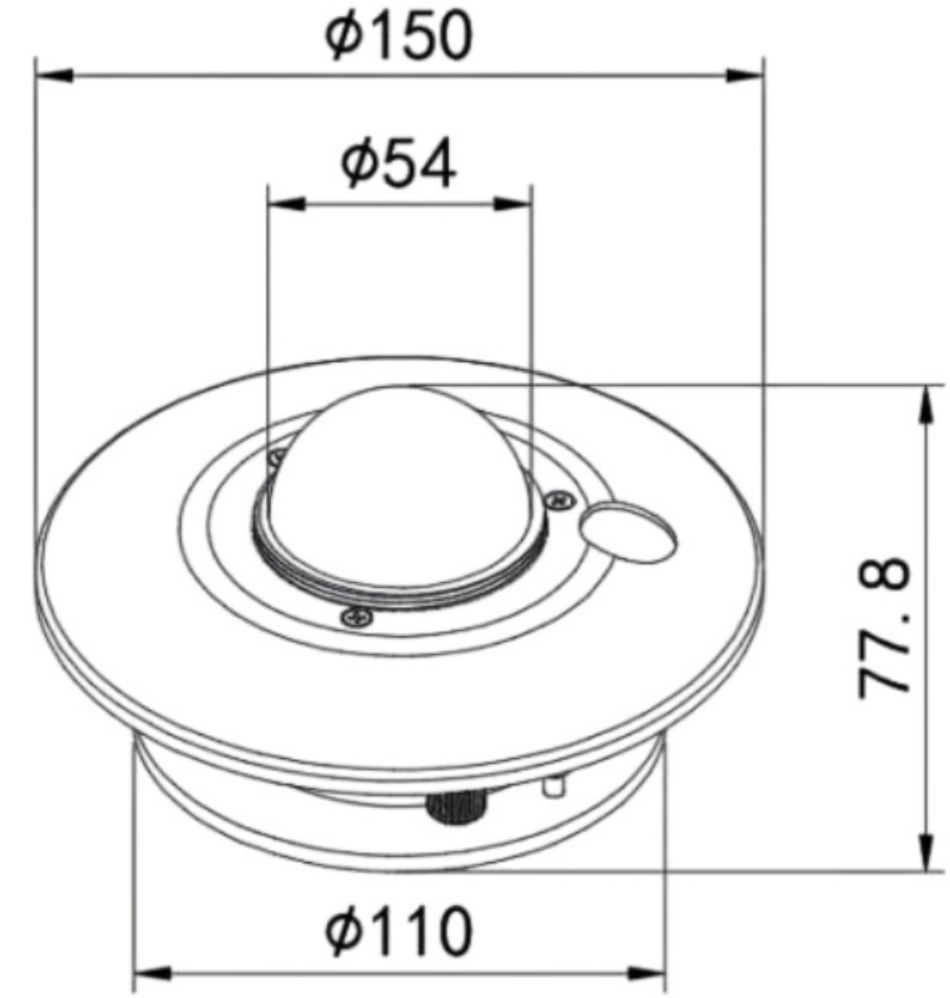
3 Product Features

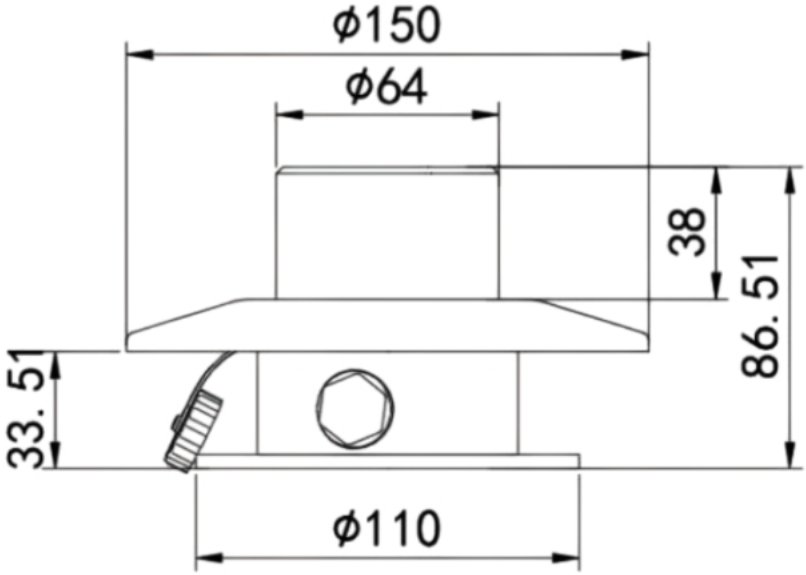
- Thermopile sensing element with high measurement sensitivity
- Double-layer quartz glass dome structure with 95% transmittance and specially treated surface to inhibit dust adhesion
- Wide spectral response range of 0.3μm~3μm
- Fast response time with built-in temperature compensation circuit ensuring measurement accuracy across the full scale
- Aluminum alloy housing protection suitable for outdoor environments
- Standard ModBus-RTU protocol supporting device address and baud rate configuration

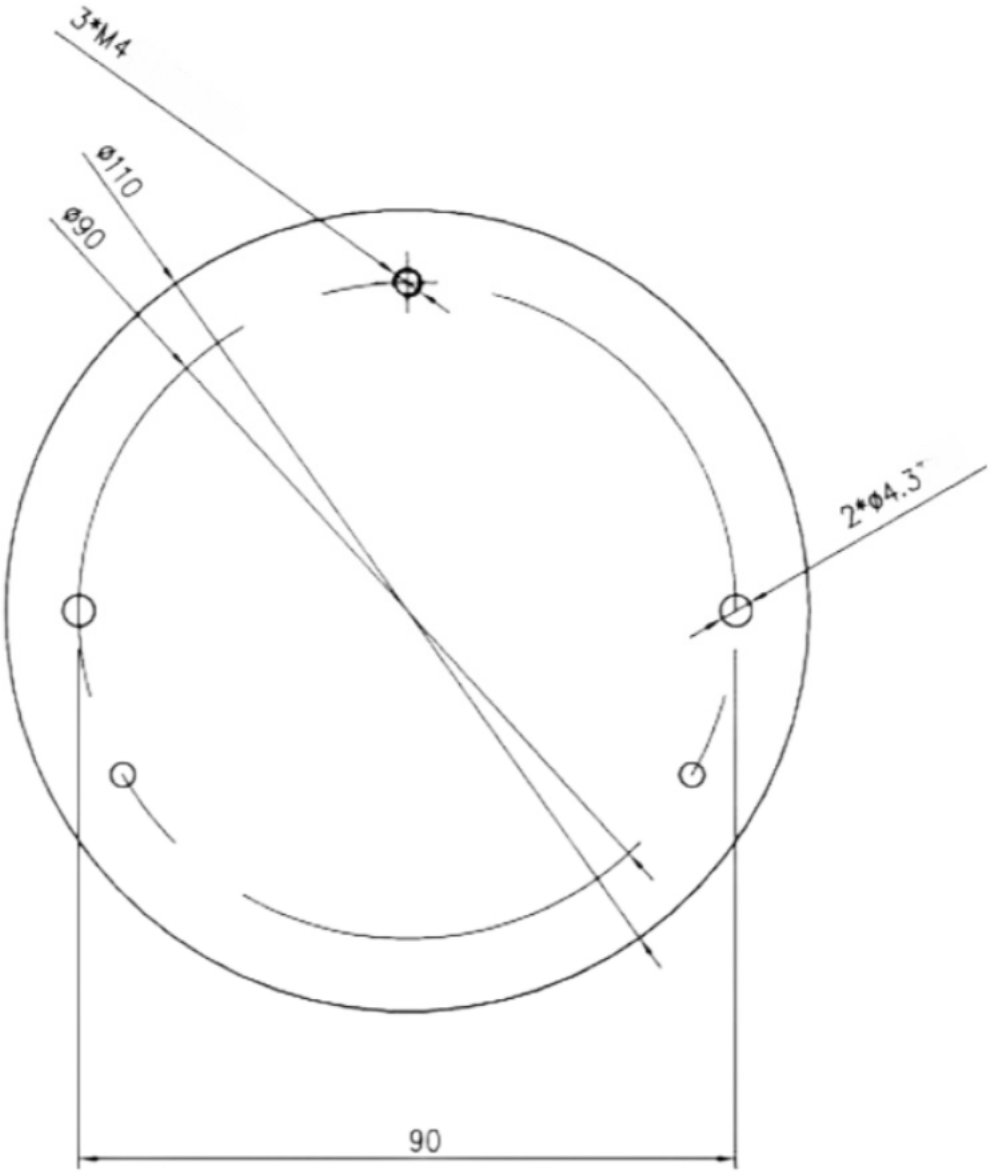
4 Technical Specifications

Parameter	Specification
Supply Voltage	10V~30V DC
Output Interface	RS-485 (Standard ModBus-RTU Protocol)
Power Consumption	0.2W
Operating Temperature	-40℃~+60℃
Operating Humidity	0%RH~95%RH (Non-condensing)
Sensitivity	7~14 $\mu V \cdot W^{-1} \cdot m^2$
Internal Resistance	200Ω~400Ω
Response Time (95%)	≤30s
Non-linearity Error	≤±3%
Directional Response Error	≤±30W/m²
Temperature Response Error	≤±3% (-30℃~+50℃)
Spectral Range	0.3μm~3μm
Measuring Range	0~2000W/m²
Resolution	1W/m²
Measurement Accuracy	±3%
Annual Stability	≤±3%
Cosine Response Error	≤±5%
Tilt Response Error	≤2%
Zero Drift	≤6W/m²

5 Physical Specifications

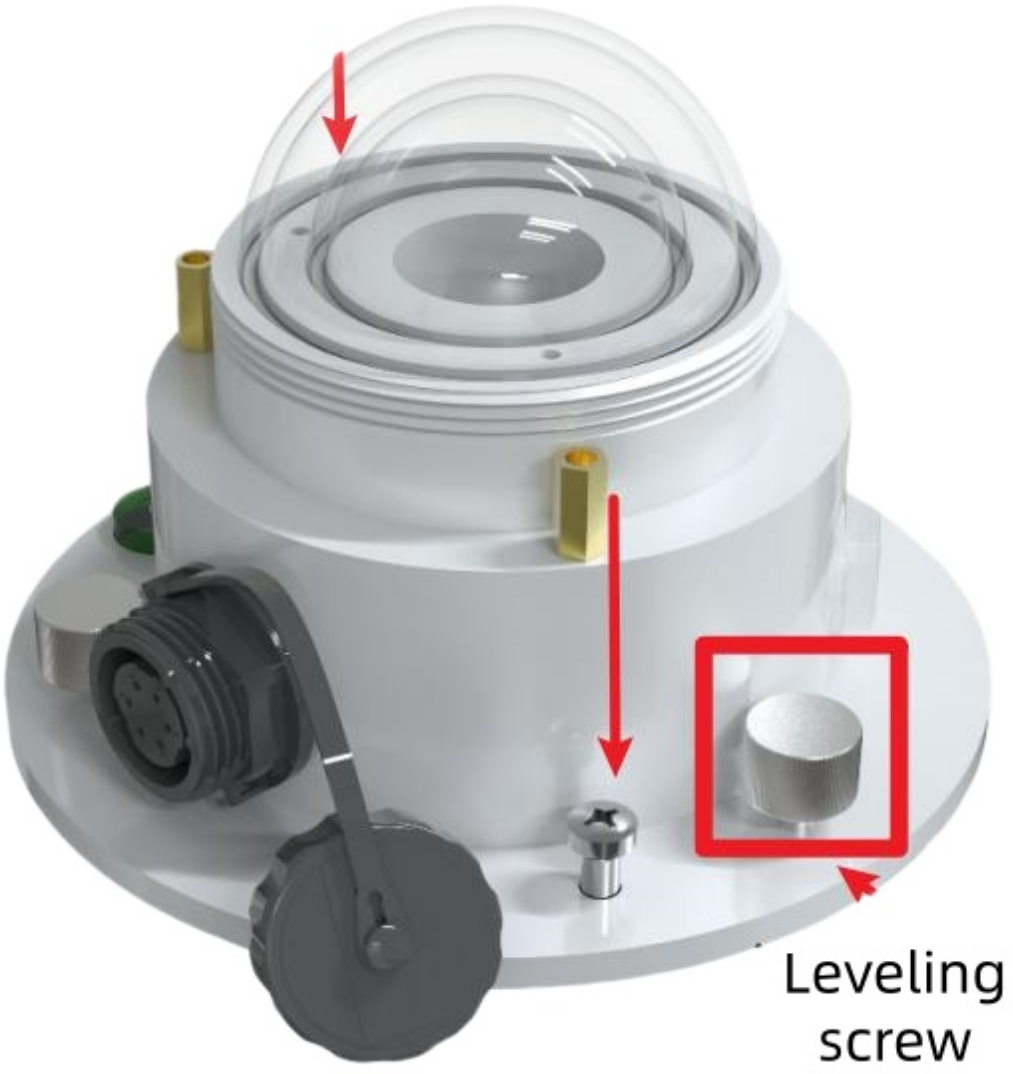

ϕ150
ϕ54
77.8
ϕ110

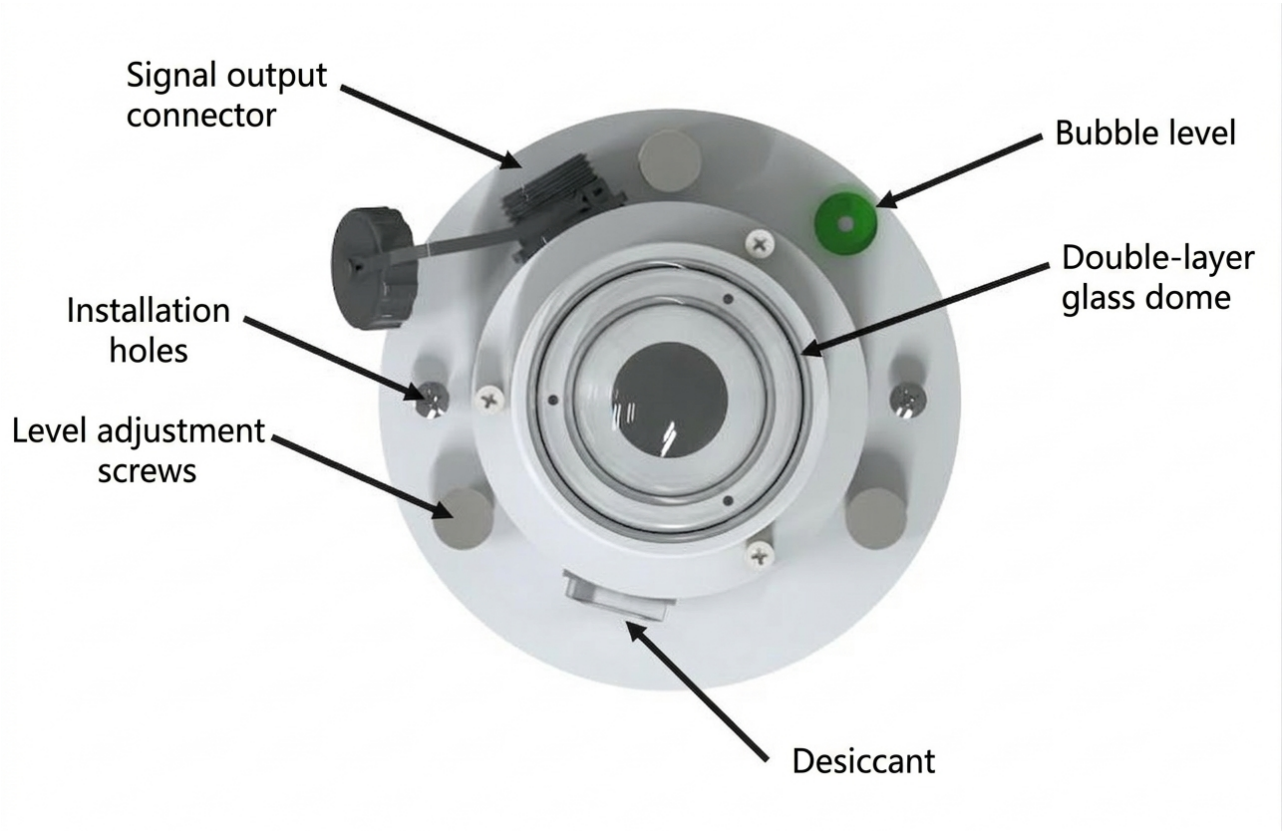

ϕ150
ϕ64
38
86.51
33.51
ϕ110



Item	Description
Housing Material	Aluminum Alloy
Protective Structure	Double-layer Quartz Glass Dome
Mounting Method	Bracket Fixation (via bottom mounting holes)
Mechanical Dimensions	Refer to mechanical dimension drawings above

6 Installation Instructions


Leveling
screw


Signal output
connector
Bubble level
Double-layer
glass dome
Installation
holes
Level adjustment
screws
Desiccant

6.1 Pre-installation Checklist

- (1) Solar Total Radiation Transmitter unit
- (1) package of mounting screws
- (1) signal cable
- (1) calibration certificate
- (1) certificate of conformity
- (1) warranty card

6.2 Installation Steps

1. Ensure the mounting bracket is parallel to the horizontal plane; adjust using the leveling knob
2. Secure the sensor to the mounting bracket using screws through the bottom mounting holes
3. After installation, remove the protective cover from the sensor
4. Avoid collision or damage to the glass dome during installation to prevent affecting measurement accuracy
5. Select an installation location with open surroundings free of obstructions, ensuring the sensing surface remains unshaded throughout the day
6. Allow a 30-minute warm-up period after power-on; measurements should only be taken after the sensor reaches thermal equilibrium

7 Wiring Definition

Wire Color	Definition	Description
Brown	VCC (Positive)	10V~30V DC
Black	GND (Negative)	Ground
Yellow	RS-485 A	Differential Signal Positive (D+)
Blue	RS-485 B	Differential Signal Negative (D-)

7.1 Communication Basic Parameters

Parameter	Setting
Encoding	8-bit Binary
Data Bits	8 Bits
Parity	None
Stop Bits	1 Bit
Error Check	CRC-16 (Cyclic Redundancy Check)
Baud Rate	2400/4800/9600 bit/s configurable; default 4800 bit/s from factory

7.2 Data Frame Format

ModBus-RTU Communication Protocol:

Master Query Frame:

Address Code	Function Code	Register Start Address	Register Length	CRC Low Byte	CRC High Byte
1 Byte	1 Byte	2 Bytes	2 Bytes	1 Byte	1 Byte

Slave Response Frame:

Address Code	Function Code	Valid Byte Count	Data Area 1	Data Area 2	Data Area N	CRC
1 Byte	1 Byte	1 Byte	2 Bytes	2 Bytes	2 Bytes	2 Bytes

Note: For 16-bit data, the high byte precedes the low byte.

7.3 Register Addresses

Register Address	PLC/Configuration Address	Content	Function Code	Range and Definition
0x0000	40001	Solar Radiation Value	0x03	Actual value, unit: W/m²
0x0052	40083	Offset Value	0x03/0x06	0~2000 (W/m²)
0x07D0	42001	Device Address	0x03/0x06	1~254; default 1 from factory
0x07D1	42002	Device Baud Rate	0x03/0x06	0=2400 bit/s, 1=4800 bit/s, 2=9600 bit/s

7.4 Data Conversion Formulas

Solar Radiation Value Conversion:

$$Value_{W/m^2} = Data_H \times 256 + Data_L$$

Offset Value Conversion:

$$Offset_{W/m^2} = Data_H \times 256 + Data_L$$

Where $Data_H$ represents the high byte of the register and $Data_L$ represents the low byte of the register.

7.5 Communication Examples

4.4.1 Read Current Solar Radiation Value (Address 0x01)

Query Frame:

Address Code	Function Code	Start Address	Data Length	CRC Low Byte	CRC High Byte
0x01	0x03	0x00 0x00	0x00 0x01	0x84	0x0A

Response Frame:

Address Code	Function Code	Valid Byte Count	Solar Radiation Value	CRC Low Byte	CRC High Byte
0x01	0x03	0x02	0x00 0x64	0x9B	0xEF

Data Analysis: 0x0064 = 100; Solar Radiation Value = 100W/m²

4.4.2 Write Offset Value

Query Frame:

Address Code	Function Code	Register Address	New Value	CRC Low Byte	CRC High Byte
0x01	0x06	0x00 0x52	0x00 0x0A	0xA8	0x1C

Response Frame:

Address Code	Function Code	Register Address	Modified Value	CRC Low Byte	CRC High Byte
0x01	0x06	0x00 0x52	0x00 0x0A	0xA8	0x1C

Data Analysis: 0x000A = 10; Written Offset Value = 10W/m²

4.4.3 Modify Current Address (Change to 0x02)

Query Frame:

Address Code	Function Code	Start Address	New Value	CRC Low Byte	CRC High Byte
0x01	0x06	0x07 0xD0	0x00 0x02	0x08	0x86

Response Frame:

Address Code	Function Code	Start Address	Modified Value	CRC Low Byte	CRC High Byte
0x01	0x06	0x07 0xD0	0x00 0x02	0x08	0x86

4.4.4 Modify Current Baud Rate (Change to 9600 bit/s)

Query Frame:

Address Code	Function Code	Start Address	New Value	CRC Low Byte	CRC High Byte
0x01	0x06	0x07 0xD1	0x00 0x02	0x59	0x46

Response Frame:

Address Code	Function Code	Start Address	Modified Value	CRC Low Byte	CRC High Byte
0x01	0x06	0x07 0xD1	0x00 0x02	0x59	0x46

4.4.5 Query Current Address

Query Frame:

Address Code	Function Code	Start Address	Data Length	CRC Low Byte	CRC High Byte
0xFF	0x03	0x07 0xD0	0x00 0x01	0x91	0x59

Response Frame:

Address Code	Function Code	Valid Byte Count	Address	CRC Low Byte	CRC High Byte
0xFF	0x03	0x02	0x00 0x01	0xD1	0x58

Read Address Code 0x0001 = 1; Current device address is 1.

8 Precautions

8.1 Safety Warnings

- This device is strictly prohibited from use as a safety device or emergency stop device, and must not be used in applications where equipment failure could result in personal injury
- Technical manuals must be consulted prior to installation, operation, or maintenance; failure to comply may result in equipment damage or personal injury

8.2 Installation and Usage

- Verify product model and specifications upon receipt
- Strictly prohibit wiring while powered; apply power only after verifying correct wiring
- The sensor is a precision optical device; do not disassemble the glass dome arbitrarily
- Ensure the installation location remains unshaded throughout the day, avoiding shadows from buildings, trees, or other obstructions on the sensing surface

8.3 Troubleshooting

- If readings remain at 0, check whether the protective cover has been removed and confirm solar irradiance is present
- Verify RS-485 wiring is correct (A/B polarity)
- Check that supply voltage meets the 10V~30V DC requirement
- If the above checks are normal but communication is still impossible, hardware failure may be present

8.4 Maintenance

- Regularly clean the glass dome using a soft cloth or chamois to maintain surface cleanliness
- Strictly prevent water ingress into the glass dome; it is recommended to install protective covering during heavy rain, snow, or freezing conditions
- Regularly check the desiccant status in the dryer; if it changes from blue to pink, replace immediately or dry for reuse

9 Warranty and Support

Item	Content
Warranty Period	12 months from date of purchase (valid purchase certificate required)
Warranty Coverage	Under normal use and maintenance conditions, failures due to material or workmanship defects qualify for free repair and parts replacement
Post-warranty Service	Lifetime maintenance service provided after warranty expiration (reasonable fees apply)
Non-warranty Items	Damage caused by improper installation/use/operation; disassembly/repair/modification by unauthorized personnel; water ingress or foreign object intrusion; natural disasters; operation outside specified parameters

10 Manufacturer Information

Company Name: Shanghai OrangeHorse Electronic Technology Co., Ltd.

Address: Room 612, Building 1, No. 1355 Chengbei Road, Jiading District, Shanghai

Phone: +86-13918734576

Email: support@orangehorsetech.com

Website: www.orangehorsetech.com

11 Revision History

Version	Revision Date	Revision Content
V1.0	-	Initial Release