

OHTS1097 Tilted Pyranometer

1 Product Overview



The OHTS1097 Tilted 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-absorbance black coating to measure solar radiation within the spectral range of $0.3 \sim 3 \mu\text{m}$. The sensor generates a thermoelectric EMF by absorbing solar radiation and incorporates a temperature compensation circuit to enhance measurement accuracy. A double-layer quartz glass dome is positioned above the sensing surface, providing $\geq 95\%$ transmittance to effectively suppress air convection effects and eliminate radiation interference from the dome itself.

This transmitter supports adjustable tilt-angle installation, suitable for measuring solar irradiance on inclined surfaces, with a measurement range of $0 \sim 2000 \text{ W/m}^2$ and a resolution of 1 W/m^2 . The communication interface utilizes RS-485 bus, supporting standard Modbus-RTU protocol for direct output of current radiation measurements. The device is applicable in fields such as solar energy utilization system performance evaluation, meteorological monitoring, agricultural ecological

research, and building material aging tests.

2 Applications

- Monitoring and performance evaluation of tilted surface radiation for solar PV/thermal systems
- Global solar irradiance measurement at meteorological stations
- Research on light energy utilization efficiency in agricultural ecosystems
- Weathering resistance testing and aging evaluation of building materials
- Solar radiation data acquisition for building energy-saving design
- Radiation balance observation at environmental monitoring stations
- Illumination intensity monitoring for greenhouse cultivation
- Tilt angle optimization for solar water heaters
- Performance validation of tilt angles for PV power station arrays
- Research-grade solar radiation observation networks

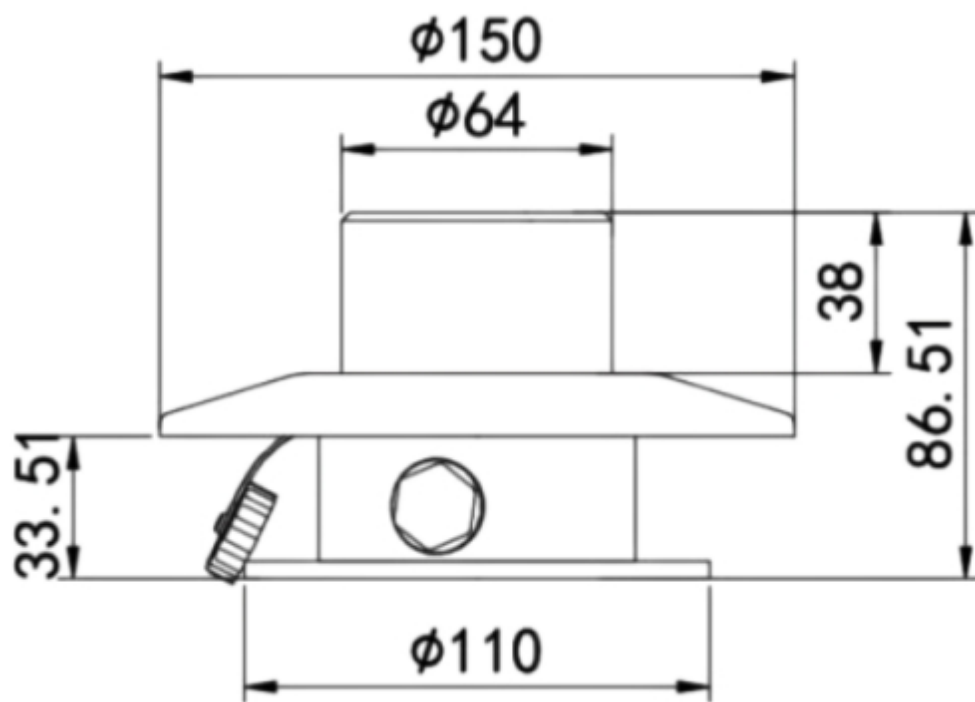
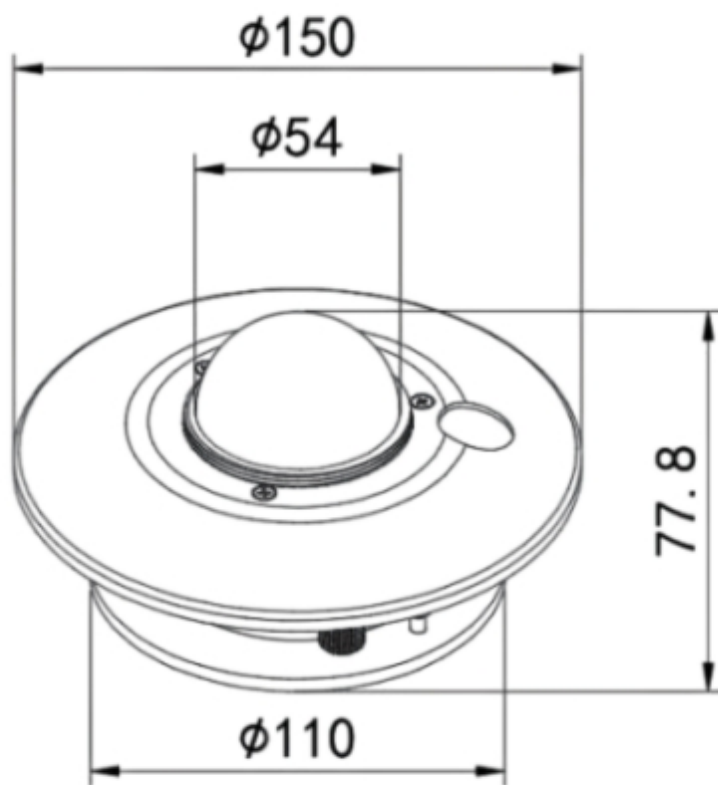
3 Features

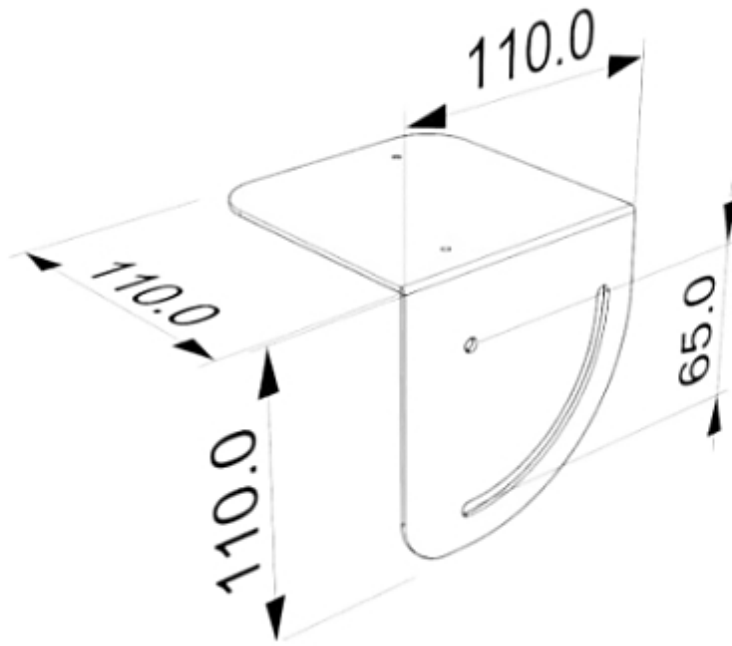
- Utilizes thermopile sensing element with sensitivity of $7 \sim 14 \mu\text{V} \cdot \text{W}^{-1} \cdot \text{m}^2$ and internal resistance of $200 \sim 400 \Omega$
- Double-layer quartz glass dome structure with special anti-fouling surface treatment to reduce dust adhesion
- Full spectral response range $0.3 \sim 3 \mu\text{m}$, cosine response error $\leq \pm 5\%$
- Response time (95%) $\leq 30 \text{ s}$, temperature response error $\leq \pm 3\%$ ($-30^\circ\text{C} \sim +50^\circ\text{C}$)
- Integrated temperature compensation algorithm, nonlinearity error $\leq \pm 3\%$
- Standard Modbus-RTU communication protocol with configurable baud rate
- Low power design, rated power consumption 0.2 W
- Industrial-grade protection, operating temperature range $-40^\circ\text{C} \sim +60^\circ\text{C}$

4 Technical Specifications

Parameter	Specification
Electrical Characteristics	
Supply Voltage	10 V ~ 30 V DC
Power Consumption	0.2 W
Output Interface	RS-485 (Standard Modbus-RTU Protocol)
Environmental Characteristics	
Operating Temperature	-40°C ~ +60°C
Operating Humidity	0%RH ~ 95%RH (Non-condensing)
Optical and Measurement Characteristics	
Spectral Range	0.3 ~ 3 μm
Measurement Range	0 ~ 2000 W/m ²
Resolution	1 W/m ²
Accuracy	±3%
Sensitivity	7 ~ 14 μV · W ⁻¹ · m ²
Internal Resistance	200 ~ 400 Ω
Response Time (95%)	≤ 30 s
Nonlinearity Error	≤ ±3%
Directional Response Error	≤ ±30 W/m ²
Temperature Response Error	≤ ±3% (-30°C ~ +50°C)
Cosine Response Error	≤ ±5%
Tilt Response Error	≤ 2%
Zero Drift	≤ 6 W/m ²
Annual Stability	≤ ±3%

5 Physical Specifications



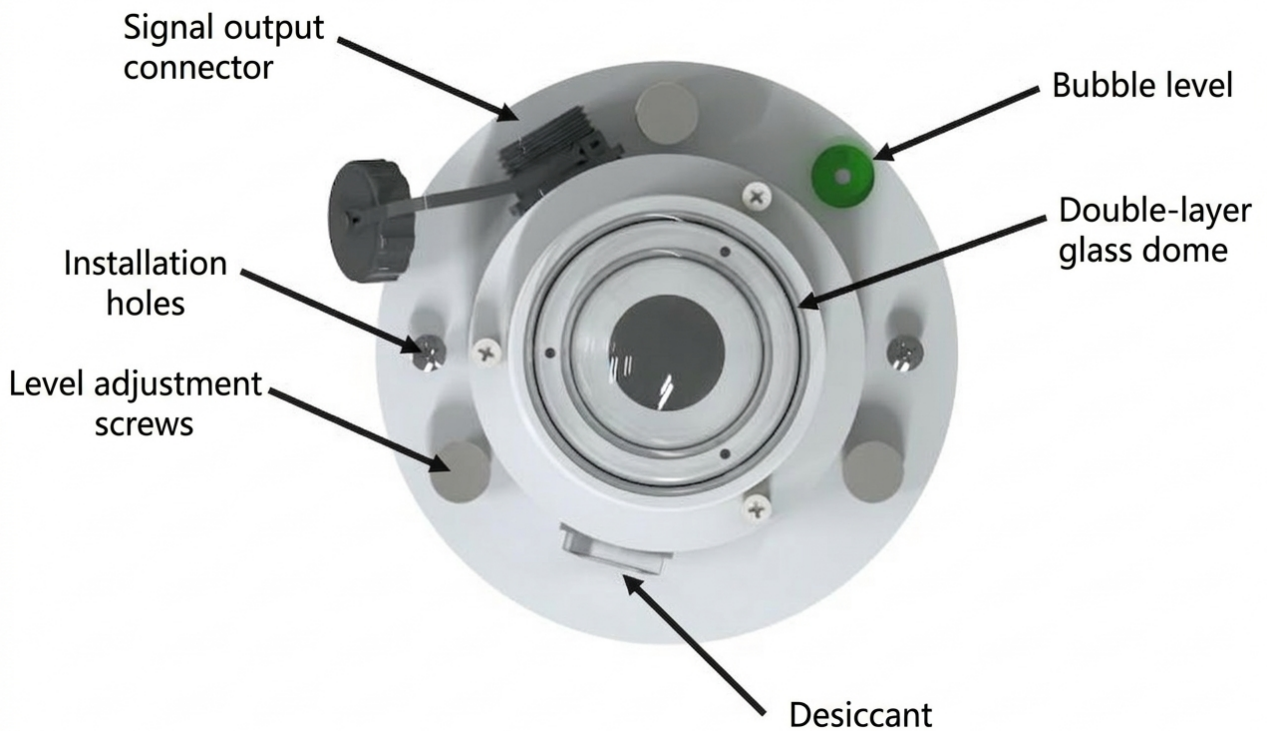


Unit: mm

Parameter	Value
Mounting Hole Spacing	Complies with standard bracket specifications
Housing Material	Metal protective enclosure
Protection Level	Outdoor protection design (with desiccant compartment)

6 Installation

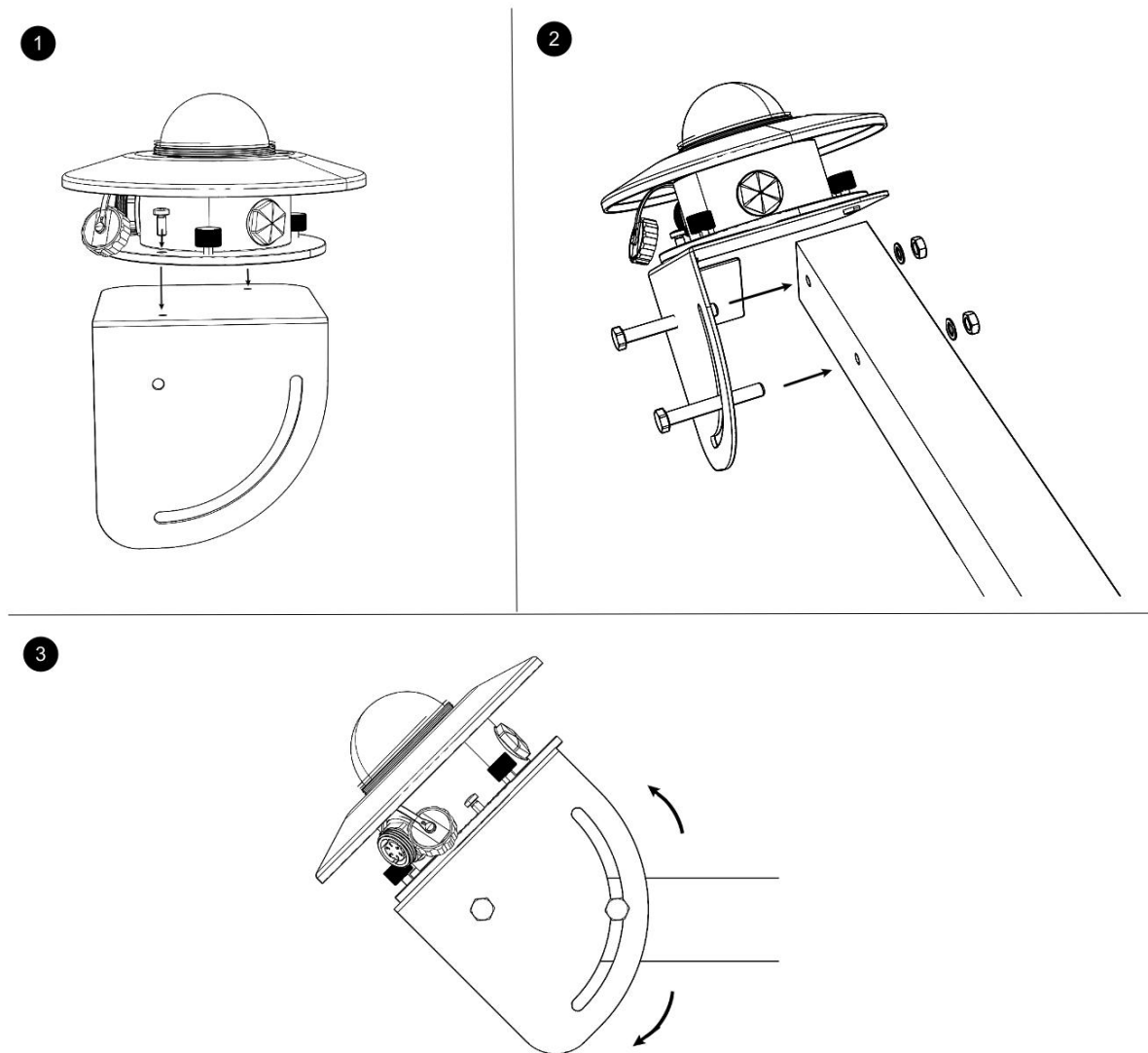
6.1 Pre-Installation Inspection



Package contents:

- OHTS1097 Tilted Pyranometer main unit ×1
- Mounting screw kit ×1
- Signal cable ×1
- Graduated mounting bracket ×1
- Certificate of conformity ×1
- Warranty card ×1

6.2 Mechanical Installation



1. Ensure the horizontal reference plane of the mounting bracket is parallel to the ground at the measurement location
2. Secure the sensor to the graduated mounting bracket using screws through the bottom mounting holes
3. Insert long screws through the graduated bracket into the crossbar (pre-drilling required), adding nuts, flat washers, and spring washers on the back side; keep screws loose at this stage
4. Adjust the graduated bracket to the target measurement tilt angle, then tighten screws to lock the position
5. Select an installation location with open surroundings and no obstructions, ensuring the sensing surface receives full sun exposure without shadows throughout the day

6.3 Power-Up Preparation

After power-on, the device requires a 30 min warm-up period to reach thermal stability before formal measurements can commence.

7 Wiring Definition

Function Category	Wire Color	Definition	Electrical Characteristics
Power	Brown	Positive (+)	10 ~ 30 V DC
Power	Black	Negative (-)	GND
Communication	Yellow	RS-485 A	Differential signal line
Communication	Blue	RS-485 B	Differential signal line

8 Communication Protocol and Data Conversion

8.1 Basic Communication Parameters

Parameter	Configuration
Encoding Format	8-bit binary
Data Bits	8 bits
Parity	None
Stop Bits	1 bit
Error Checking	CRC-16 (Cyclic Redundancy Check)
Baud Rate	2400/4800/9600/19200/38400/57600/115200 bit/s, factory default 4800 bit/s

8.2 Data Frame Format

Adopts Modbus-RTU communication protocol:

Master Query Frame Structure:

Address Code	Function Code	Register Start Address	Register Length	CRC Low	CRC High
1 byte	1 byte	2 bytes (High byte first)	2 bytes	1 byte	1 byte

Slave Response Frame Structure:

Address Code	Function Code	Valid Byte Count	Data Field	CRC
1 byte	1 byte	1 byte	<i>N</i> bytes (16-bit data, high byte first)	2 bytes

8.3 Register Address Mapping

Register Address (HEX)	PLC/SCADA Address	Content	Supported Function Codes	Range and Definition
0x0000	40001	Radiation Value	0x03/0x04	Actual measured value, unit W/m ²
0x0052	40083	Offset Value	0x03/0x04/0x06/0x10	Radiation offset compensation value, range 0 ~ 2000
0x07D0	42001	Device Address	0x03/0x04/0x06/0x10	1 ~ 254, factory default 1
0x07D1	42002	Device Baud Rate	0x03/0x04/0x06/0x10	0:2400, 1:4800, 2:9600, 3:19200, 4:38400, 5:57600, 6:115200, 7:1200

8.4 Data Conversion Rules

Radiation Value Data Conversion:

The 16-bit unsigned integer read from register `0x0000` represents the actual radiation value without requiring unit conversion.

$$\text{Radiation Value (W/m}^2\text{)} = \text{Register Value}$$

Example: If the read value is `0x0064` (decimal 100), then:

$$\text{Solar Irradiance} = 100 \text{ W/m}^2$$

Offset Value Data Conversion:

The 16-bit unsigned integer written to register `0x0052` directly represents the offset compensation quantity.

$$\text{Offset Value (W/m}^2\text{)} = \text{Written Value}$$

Example: If writing `0x000A` (decimal 10), then:

$$\text{Radiation Offset Value} = 10 \text{ W/m}^2$$

8.5 Communication Examples

1. Read Current Radiation Value

Query frame (Address 0x01):

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

Response frame:

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

2. Write Offset Value

Query frame (Set offset to 10 W/m²):

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

3. Modify Device Address

Query frame (Change address to 0x02):

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

4. Modify Baud Rate

Query frame (Change baud rate to 9600 bit/s, corresponding value 0x02):

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

5. Query Current Address (Broadcast Address 0xFF)

Query frame:

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

The response frame returns the actual device address.

9 Precautions

9.1 Safety Warnings

- This device is strictly prohibited from use as safety interlock devices or emergency stop control components; do not use in applications where equipment failure may cause personal injury
- Power must be disconnected before installation, wiring, and maintenance operations; energized work is prohibited
- The sensor is a precision optical device; do not disassemble the glass dome arbitrarily and avoid mechanical impact

9.2 Installation Environment

- The installation location shall ensure year-round exposure without obstructions; avoid shadows from buildings, trees, or other objects falling on the sensing surface
- After power-on, the device requires a 30 min warm-up period before precise measurements can be performed
- Ensure the desiccant in the desiccant compartment is active (blue state); replace or regenerate if it turns pink

9.3 Maintenance

- Regularly clean the glass dome surface with soft cloth or chamois to maintain optical window cleanliness
- During continuous rain, snow, or freezing weather, it is recommended to cover the device to prevent condensation or water accumulation inside the glass dome
- Regularly check the desiccant condition to prevent internal condensation from affecting measurement accuracy

9.4 Troubleshooting

Fault Phenomenon	Troubleshooting Measures
Reading persistently 0	Check if protective cover is removed; confirm sufficient lighting conditions
Communication abnormal	Check RS-485 wiring polarity (A/B sequence) and bus termination resistance
Abnormal reading	Check if supply voltage is within 10 ~ 30 V DC range
Device unresponsive	Check power polarity and cable connection reliability

10 After-Sales Guarantee & Support

10.1 Warranty Terms

The warranty period is 12 months from the date of purchase (subject to valid proof of purchase). During the warranty period, free repair and parts replacement services are provided for failures caused by material or workmanship defects under normal use and maintenance conditions.

After the warranty period expires, lifetime paid repair services are provided, charging only for material costs and labor fees.

10.2 Exclusions

The following situations are not covered by warranty:

- Equipment damage caused by incorrect installation, use, or operation
- Disassembly, modification, or repair by unauthorized personnel not approved by Shanghai OrangeHorse Electronic Technology Co., Ltd.
- Damage caused by water ingress, foreign object intrusion, or negligent use
- Equipment failures caused by natural disasters or force majeure
- Damage caused by operation beyond the working parameters specified in the technical specifications

11 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

12 Revision History

Version	Date	Revision Content
V1.0	-	Initial release