OHTS1094 Photosynthetically Active Radiation (PAR) Sensor

1 Product Overview

The OHTS1094 is a quantum sensor based on the photoelectric effect principle, designed to measure Photosynthetically Active Radiation (PAR) within the wavelength range of 400 nm ～ 700 nm. The sensor employs a high-precision photoelectric sensing element with broad-spectrum absorption characteristics, offering high quantum responsivity within the 400 nm － 700 nm band and low annual drift. The sensing surface is equipped with an optical cosine corrector to ensure cosine response accuracy for incident angles, with the output signal maintaining a linear proportional relationship to direct radiation intensity.

The device features an all-aluminum alloy enclosure structure with an IP67 protection rating, incorporating a built-in spirit level and mechanical adjustment mechanism to support rapid field leveling. The communication interface utilizes an RS-485 bus, supporting the standard ModBus-RTU protocol, and can directly output instantaneous PAR values. It is suitable for long-term outdoor meteorological monitoring, agricultural ecological research, and plant physiological experiments.

2 Applications

- Meteorological observatory radiation monitoring
- Agricultural greenhouse light environment monitoring
- Plant photosynthesis efficiency research
- Forest canopy light interception measurement
- Grassland ecosystem energy assessment
- Precision agriculture lighting control
- Atmospheric pollution optical depth studies
- Crop growth model parameter acquisition
- Agrivoltaics light resource assessment
- Long-term ecological station observation

3 Features

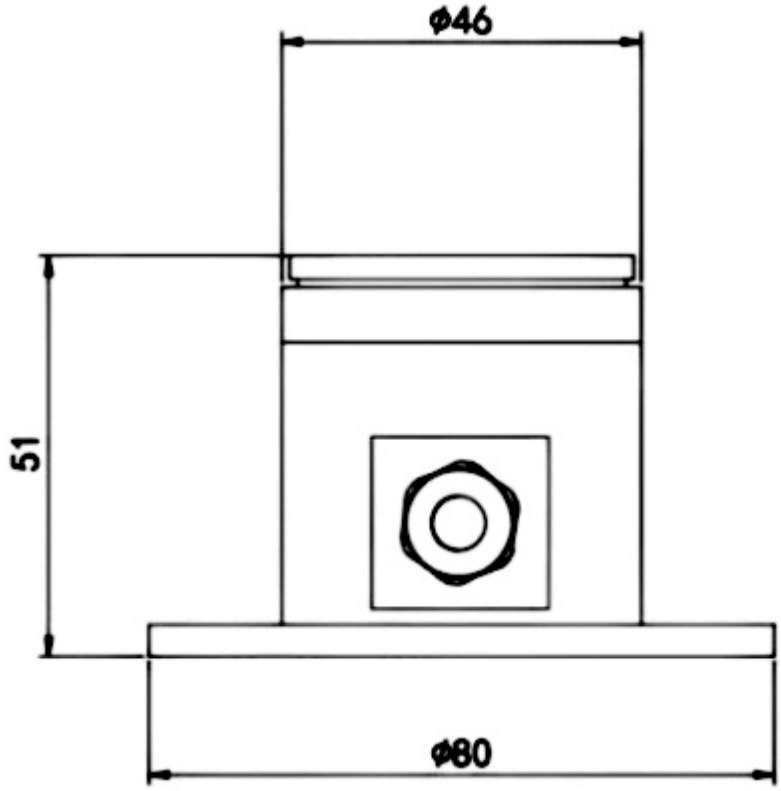
- Spectral response range strictly limited to the $400\,\mathrm{nm} \sim 700\,\mathrm{nm}$ photosynthetically active waveband
- All-aluminum alloy enclosure structure with IP67 protection rating for harsh outdoor environments
- Integrated bubble level and handwheel adjustment mechanism supporting field horizontal calibration
- Standard ModBus-RTU communication protocol compatible with industrial automation systems
- High-quality cosine diffuser ensuring cosine response accuracy for $0^\circ \sim 90^\circ$ incident angles
- Wide voltage power supply design supporting DC $7\,\mathrm{V} \sim 30\,\mathrm{V}$ input range
- Low power consumption design with quiescent power of $0.06\,\mathrm{W}$
- Fast response time reaching $0.1\,\mathrm{s}$

4 Technical Specifications

Parameter	Specification
Supply Voltage	DC $7\,\mathrm{V} \sim 30\,\mathrm{V}$
Communication Interface	RS-485 (ModBus-RTU Protocol)
Power Consumption	$0.06\,\mathrm{W}$
Operating Temperature	$-25^\circ\mathrm{C} \sim 60^\circ\mathrm{C}$
Spectral Response	$400\,\mathrm{nm} \sim 700\,\mathrm{nm}$
Measurement Range	$0 \sim 2500\,\mu\mathrm{mol}/(\mathrm{m}^2 \cdot \mathrm{s})$
Resolution	$1\,\mu\mathrm{mol}/(\mathrm{m}^2 \cdot \mathrm{s})$
Accuracy	$\pm 5\%$ ($1000\,\mu\mathrm{mol}/(\mathrm{m}^2 \cdot \mathrm{s})$, @550nm, 60%RH, $25^\circ\mathrm{C}$)
Response Time	$0.1\,\mathrm{s}$
Linearity	$\leq \pm 1\%$
Annual Stability	$\leq \pm 2\%$
Protection Rating	IP67

5 Physical Specifications

Parameter	Specification
Enclosure Material	Aluminum Alloy
Mounting Method	Screw fixation (M3 mounting holes)
Protection Rating	IP67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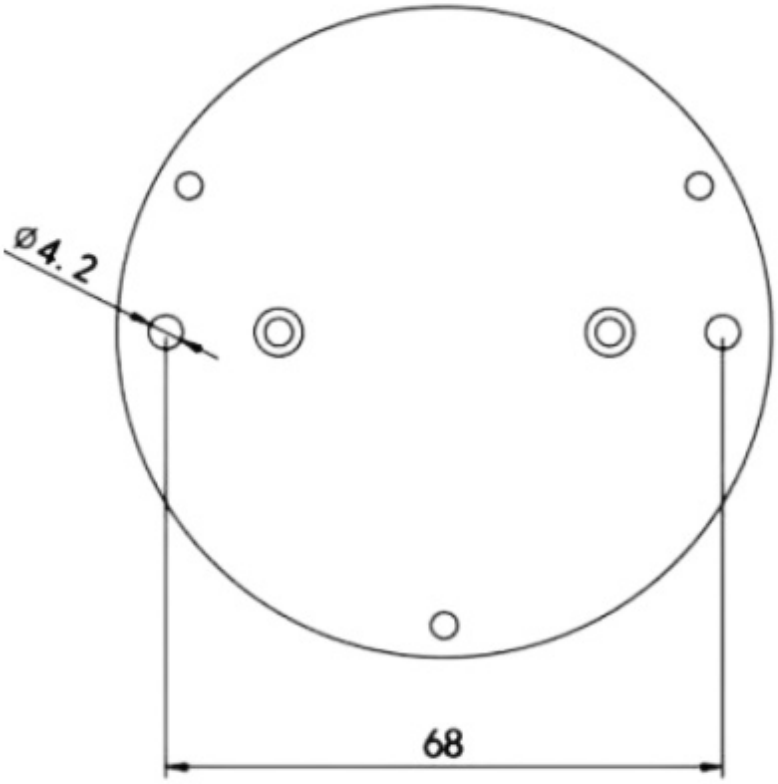

6 Installation

6.1 Pre-Installation Inspection

- Main device body
- Black waterproof mating connector (male, 70 cm length)
- Certificate of conformity and warranty card
- Mounting screw kit (including M3 fasteners)

6.2 Installation Steps

1. Use M3 screws through the mounting holes at the bottom of the sensor to secure the device to the mounting bracket or support
2. Adjust the base handwheel screws while observing the bubble level position to ensure the sensor sensing surface remains horizontal to the ground
3. After confirming leveling, remove the optical protective cover to expose the cosine corrector to the measurement environment

7 Wiring Definition

Function Category	Wire Color	Definition
Power	Brown	Positive Supply (DC 7 V ～ 30 V)
Power	Black	Negative Supply (GND)
Communication	Yellow (Green)	RS-485 A (+)
Communication	Blue	RS-485 B (-)

8 Communication Protocol and Data Conversion

8.1 Communication Parameters

Parameter	Setting
Encoding Format	8-bit binary
Data Bits	8 bits
Parity Check	None
Stop Bits	1 bit
Error Checking	CRC-16 (Cyclic Redundancy Check)
Baud Rate	Configurable: $2400\,\text{bit/s}$, $4800\,\text{bit/s}$, $9600\,\text{bit/s}$; Factory default: $4800\,\text{bit/s}$

8.2 Register Address Mapping

Register Address	Content	Access Rights	Range and Description
0000H	PAR Value	Read-only	16-bit unsigned integer, actual value
0052H	Offset Value	Read/Write	16-bit signed integer, used for zero-point calibration
07D0H	Device Address	Read/Write	$1 \sim 254$, factory default 1
07D1H	Baud Rate Configuration	Read/Write	$0 = 2400\,\text{bit/s}$, $1 = 4800\,\text{bit/s}$, $2 = 9600\,\text{bit/s}$

8.3 Data Conversion Formulas

Photosynthetically Active Radiation value conversion:

$$PAR = R_{0000\text{H}}$$

Where $R_{0000\text{H}}$ is the 16-bit unsigned integer value read from register 0000H, in units of $\mu\text{mol}/(\text{m}^2 \cdot \text{s})$.

Offset value conversion (for calibration):

$$Offset = R_{0052\text{H}}$$

Where $R_{0052\text{H}}$ is a 16-bit signed integer (two's complement representation), in the same units of $\mu\text{mol}/(\text{m}^2 \cdot \text{s})$. The final output value is the sum of the raw measurement value and the offset value.

8.4 Communication Examples

Read PAR Value (Function Code 0x03)

Request Frame:

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

Response Frame (Example value 0x0064):

Address	Function Code	Byte Count	Data	CRC Low	CRC High
0x01	0x03	0x02	0x00 0x64	0x9B	0xEF

Data Parsing: $0\text{x}0064 = 100$, indicating the current PAR value is $100\,\mu\text{mol}/(\text{m}^2 \cdot \text{s})$.

Modify Device Address (Function Code 0x06)

Changing address from 0x01 to 0x02:
Request Frame: Address 0x01, Function Code 0x06, Register 07D0H, Data 0x0002.

9 Precautions

1. **Safety Limitations**: This device is strictly prohibited from use as safety interlock equipment, emergency stop devices, or any protective applications where equipment failure could result in personal injury. This technical documentation must be thoroughly reviewed prior to installation, operation, or maintenance; non-compliance may result in serious personal injury.
2. **Model Verification**: Upon receipt of equipment, please verify that the product model and specifications match the order requirements.
3. **Electrical Safety**: Energized wiring operations are strictly prohibited. All wiring must be completed in a de-energized state and verified correct before power is applied.
4. **Mechanical Protection**: The sensor is a precision optical measurement device; unauthorized disassembly of the enclosure or contact with the optical sensing window is strictly prohibited to prevent optical path contamination or calibration failure.
5. **Troubleshooting**:
   - Continuous zero readings: Check if the measurement environment has sufficient light source and confirm the optical protective cover has been removed
   - Communication anomalies: Check if RS-485 A/B wires are reversed and verify correct bus termination resistor configuration
   - Address conflicts: Check for duplicate address devices on the bus (factory default address is 1)
   - Power anomalies: Measure whether supply voltage is within the DC 7 V ～ 30 V range
   - No device response: Check power polarity correctness and confirm consistent communication baud rate settings
6. **Maintenance Requirements**:
   - Regularly clean the cosine corrector surface with a soft cloth to maintain optical window cleanliness
   - Quarterly inspection of device leveling and fastener tightness

10 After-Sales Guarantee & Support

Warranty Period: 12 months from the date of purchase (based on valid proof of purchase date).

Warranty Coverage: Free repair and replacement of parts for failures due to material or manufacturing process defects under normal use and maintenance conditions.

Out-of-Warranty Service: Lifetime paid repair services provided after warranty expiration, charging only material costs and labor fees.

Non-Warranty Coverage:

- Equipment damage caused by improper installation, misuse, or non-compliant operation
- Disassembly, repair, modification, or replacement of internal components by unauthorized technicians
- Damage caused by water ingress, foreign object intrusion, or negligent use
- Failures due to force majeure (natural disasters, fire, etc.)
- Damage caused by operation outside parameters specified in the technical specifications

11 Manufacturer Information

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12 Revision History

Version	Date	Description
V1.0	-	Initial Release