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INSTRUMENTATION

# Solar Tracker+Direct Radiation sensor

BGT-ZZQ(L)

## 1. Product Introduction

Automatic solar tracker tracking method are the sensor tracking method and solar movement tracking

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method.he sensor tracking method is real-time sampling by photoelectric converter.Calculate analysis and compare the change Intensity of sunlight.Which drives the mechanism to track the sun.Make the direct radiation tracking measurement more accurate.
Direct solar radiation sensor is a first-class standard radiometer used to measure the radiation perpendicular to the sun's surface and the very narrow circumsolar sky around the sun. It conforms to the international standard of iso9060 (specification and classification of solar, hemispherical and direct heliometers). It can be used as primary standard direct radiation meter. It is suitable for all kinds of harsh environments with fast response and high accuracy.)

## 2. Product application

- Solar photovoltaic power generation
- Solar water heater and solar energy engineering
- Solar energy building field
- Solar lab
- Ecological research of agriculture and forestry
- Polar, oceanic and glacial climate studies
- Research on weather and climate

## 3. Automatic tracking parameter

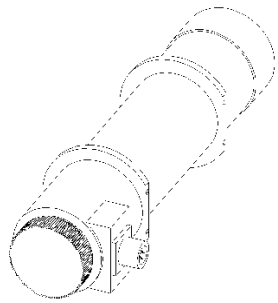
| Tracking accuracy | 0.5° |
|---|---|
| Load | 10kgs |
| Working temperature | -30℃ ~ +60℃ |
| Power supply | 12-20V DC |
| Rotation Angle | Elevation: -5-120 degrees, azimuth 0-350 |
| Tracking method | Sun tracking +GPS tracking |
| Weight | 5 kgs |
| Power consumption | Running power consumption 3.6W, standby power consumption 0.95W |

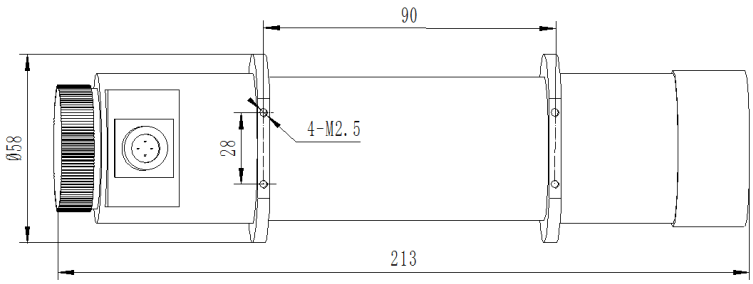
## 4. Direct solar sensor technical Parameters

| Spectral range | 280 ~ 3000nm |
|---|---|
| measuring range | 0 ~ 2000W/m2 |
| Sensitivity | 7 ~ 14μV / W.m-2 |
| Tracking accuracy | ＜168h±1° |
| time constant | ≤6S(99%) |
| Open angle | 4° |
| Annual stability | ±1%（Sensitivity change rate） |
| Internal resistance | About 10-30 ohms. |
| Power | 9-30V DC |

| | |
|---|---|
| Output | RS485 Modbus(External transmitter)<br>0-20mA |
| measurement accuracy | < 2% |
| Instrument line length | Standard：3m or customized |
| work environment | -45℃ ~ +55℃,humidity）≤100%RH |
| Rated voltage | 300v,（Temperature class）:80℃ |
| Product weight | 1.5kgs |

## 5. Direct solar radiation dimension figure



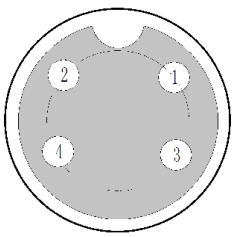



## 6. Wiring Definition

For RS485 output, cable is a 4-core wire, and the wire sequence definition:

| Red | Black | Yellow | Green |
|---|---|---|---|
| Power+(DC12~24V) | GND | RS485_A | RS485_B |

For 0~20mV raw output, cable is a 4-core wire, and the wire sequence definition:




1.Signal +
2.Signal-
3.Empty(do not need connect)
4.Shielded wire(do not need connect)

## 7. Direct solar radiation Modbus Protocol Communication

The direct solar radiation sensor adopts the standard Modbus-RTU communication protocol, the factory default communication address is 0x01, and the baud rate is 9600.

### 7.1 Read register command

Upper computer send:

| Name | number of bytes | Descriptions |
|---|---|---|
| Device commnication address | 1 | 0xXX: Direct solar radiation sensor communication address/broadcast address. |
| Function code | 1 | 0x03: Read the register function code |
| Register address high byte | 1 | 0xXX: Read register start address high byte |
| Register address low byte | 1 | 0xXX: Read register start address low bytes |
| Read register length high bytes | 1 | 0xXX: Read register length high bytes |
| Read register length Low bytes | 1 | 0xXX: Read register length low bytes |
| CRC checksum | 2 | CRC check |

Example: 01 03 00 00 00 01 84 0A (Read radiation value message)

FF 03 05 01 00 01 C0 D8 (Read the device communication address message)

FF 03 05 03 00 01 61 18 (Read baud rate message of device communication)

### 7.2 Write register command

| Name | number of bytes | Descriptions |
|---|---|---|
| Device commnication address | 1 | 0xXX: Direct solar radiation sensor communication address/broadcast address |
| Function code | 1 | 0x10: Write register function code |
| Register address high byte | 1 | 0xXX: Write to register start address high byte |
| Register address low byte | 1 | 0xXX: Write to register start address low byte |
| Register number high bytes | 1 | 0xXX: Write register number high bytes |
| Register number low bytes | 1 | 0xXX: Write register number low bytes |
| Data byte length | 1 | 0xXX: Data byte length |
| Register data high byte | 1 | 0xXX: The register data written is high in bytes |
| Register data low byte | 1 | 0xXX: Write low bytes of register data |
| … | … | … |
| CRC checksum | 2 | CRC check |

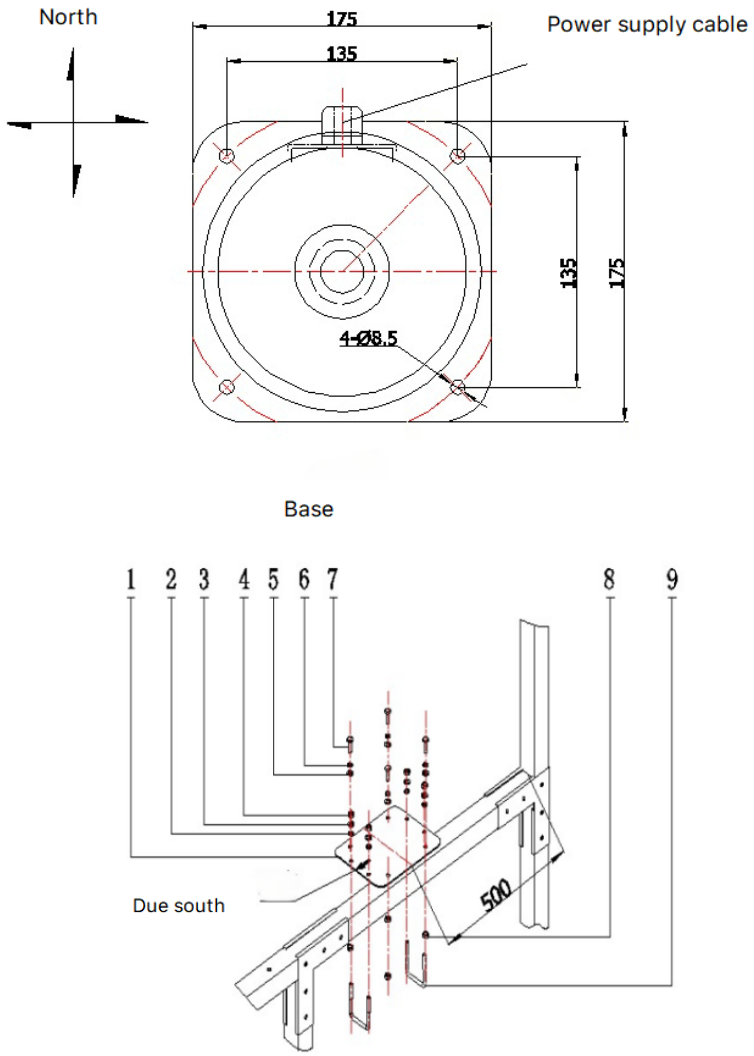
Example: 01 10 05 01 00 01 02 02 00 F3 E1 (Set device address to 0x02 message)
01 10 05 03 00 01 02 05 00 F0 33 (Set baud rate to 57600 message)

### 7.3 Register declaration

| Register address | Register name | Read-write feature | Output |
|---|---|---|---|
| 0x0000 | radiation value | R | 0 ~ 2000 W/m² Decimal-free shaping |
| 0x0501 | Device communication address | R/W | 0 to 255 (0xFF indicates the broadcast address) The default communication address is 0x01 The high byte is the communication address of the device Low byte reservation |

| | | | |
|---|---|---|---|
| 0x0503 | Baud rate | R/W | 1 ~ 6<br>1:48,000, 2:9,600, 3:19,200, 4:38,400, 5:57,600, 6:115,200<br>Default 2: indicates that the baud rate is 9600<br>The high byte is the communication baud rate<br>Low byte reservation |

## 8. Solar tracker base tray assembly and installation drawing




Solar tracker base drawing

## 9. Solar tracker installation

1. The installation site shall ensure that the direct sun is not affected by any obstacles in all seasons and times (from sunrise to sunset). If there are obstacles, the height Angle of the obstacles in the direction of sunrise and sunset shall not exceed 5°, and at the same time, try to avoid places with serious air pollution such as smoke and fog. It is usually mounted on the observatory with other radiometers, but can also be mounted on a roof platform. The bench should be firmly installed, and the level of the instrument should

not be changed even if it is subjected to serious shocks and vibrations (such as strong winds, etc.). The tracking accuracy of the direct sensor is related to the accuracy of the installation.
2. Check whether the support is installed in the north (that is, the wind direction and speed of the stand column are in the due north) and whether the support is horizontal.
Then fix the sun tracker bottom connector on the support (500mm away from the wind speed direction column to ensure that the sun tracker does not encounter obstacles when rotating), and then fix the sun tracker and the base connector, pay attention to the sun tracker base has a true north sign (if there is no installation sign, please consult the manufacturer), please install in the direction indicated.
Then install the sensor connector (the black sensor and the direct radiation sensor are fixed on the connectoralready), connect the white connector with the reserved hole on the top of the sun tracker, and then connect the direct radiation sensor wire to the direct radiation sensor (since the motor is rotating every day, Therefore, the direct radiation data connection line should leave a reservation of 600mm, to prevent the resistance of the line during the movement of the instrument from working normally), and connect the blue seven-core plug of the light-sensitive probe with the seven-core socket of the tracker.
At last, power on the sun tracker and conduct initialization detection after powering on the sun tracker. At this time, do not have any operation on the sun tracker (such as forcibly turning to the rotating motor by hand is prohibited). When the sun tracker is turned to the same Angle as the sun, start to calibrate the light spot on the side of the straight face light cylinder, adjust the light cylinder screw so that the sun light is aligned on the light spot through the fixing light hole. Lock the light cylinder fixing screw after alignment. (Calibration is best done in sunny weather). As shown above

## 10. Working principle

The latest solar tracker has a built-in GPS receiver, which can fully complete the instrument setup process, increasing the stability and function of the instrument.
The Sun tracker features automatic initial setup anywhere in the world by automatically obtaining location and time information. Installation and operation does not require a computer, the operation is more convenient;Indicate the working state of the instrument through the buzzer; Continuous clock synchronization provides continuous, stable and high-precision positioning for direct radiation measurement. Can assemble all models of direct radiation meter on the market, high compatibility.The four-quadrant light balance sensor and sun trajectory tracking technology can automatically track the sun's movement. So that the sunlight shines vertically on the sensor. The system consists of automatic tracking device, sensor and other parts. The tracking system runs according to the combination of solar motion trajectory and optical tracking. The automatic tracking method is adopted (tracking the sun from east to west), and the sun declination Angle tracking is automatically adjusted, which can realize the automatic real-time tracking of the sun throughout the day.
The direct radiation sensor is mainly composed of seven light bars, an inner cylinder, a thermopile and a desiccant cylinder. Seven light bars are used to reduce internal reflection, create an open Angle of the instrument, and limit turbulence in the air inside the instrument. Outside the light bar is an inner cylinder, which makes the dry air inside and outside the light bar sealed to reduce the influence of ambient temperature on the thermopile. A JGS3 quartz glass plate is installed in the outer cylinder, which can pass through the radiation light of 0.27-3.2μm wavelength, which is convenient for direct solar radiation measurement. The cylinder is packed with desiccant to prevent the formation of water vapor condensation.
The induction component of the direct radiometer is the core part of the optical cylinder, which is composed of a wire wound electroplated thermopile with fast response. The induction component is

coated with matte black paint on the sun side, below is the thermopile hot contact, when the sun shines on the hot contact, the temperature rises, it forms a temperature difference with the cold contact on the other side, resulting in an electromotive force, which is proportional to the direct radiation intensity of the sun.

## 11. Attention

When installing, use a compass to determine the true north, and install the base in the direction of the sign. It is strictly forbidden to forcibly turn the rotary motor by hand.
During installation, 600mm of the data connection line should be reserved on the side near the direct radiation meter to prevent the meter from working normally due to the resistance of the line during the movement.

## 12. Maintenance

1. Daily should be timely check whether the glass window is clean, if there is dust, water vapor condensation should be blown in time with the ear ball or with soft cloth, optical lens paper wipe. When testing, remove the glass shield of the direct radiation meter;
2. Wipe clean water after rain, and defrost frequently in winter to avoid numerical errors caused by refraction of water beads.
3. The table into the water and moisture, found that there is a fine water mist or desiccant white (desiccant itself is blue) should be dried as soon as possible (50-55 degrees), or replace the desiccant, otherwise it will cause the accuracy of the data will be reduced.
4. The instrument is a precision instrument, in strict accordance with the operating procedures for debugging, must not be too much force, carefully put gently, reduce vibration, so as not to damage.

## 13. Troubleshooting

1. Direct radiation countless value display, view the automatic tracking system tracking, timely adjustment (to the light spot). Check whether there is an object blocking the tracking sensor tracker is normal, please check whether the light cylinder has 0-20mv output, check whether the data cable is intact, please contact the manufacturer in time, after-sales according to the situation to do the corresponding solution.
2. The radiation meter used for more than two years, its sensitivity must be re-calibrated by the manufacturer or measurement department