AUTOMATIC TRACKING DIRECT RADIATION INSTRUMENT

TBS-2C
MANUAL

OVERVIEW：

To measures the radiation which is vertical solar surface (angle of view about 0.5 °) and the scattered radiation from a very narrow ring-shaped sky around the sun,it is called direct solar radiation and it is measured with a direct radiation instrument.

PRINCIPLE & STRUCTURAL CHARACTERISTICS

It is mainly composed of a light tube and an automatic tracking device. The inside of the light tube is composed of seven light bars, an inner tube, a thermopile, and a desiccant tube. Seven light bars are used to reduce internal reflections, form the opening angle of the instrument, and limit the turbulence of air inside the instrument. On the outside of the light barrier is an inner tube, which seals the dry air inside the light barrier and the outer tube to reduce the impact of ambient temperature on the thermopile. A JGS3 quartz glass plate is installed in the outer cylinder mouth, which can transmit radiation light with a wavelength of 0.27-3.2μm, which is convenient for direct solar radiation measurement. A desiccant is installed in the cylinder to prevent the formation of moisture condensation.

The inductive part of the direct radiation meter is the core part of the light tube, which is composed of a fast-responding wire-wound electroplating thermopile. The side of the induction part facing the sun is coated with matte black paint. Below is the thermal contact of the thermopile. When sunlight hits the thermal contact, the temperature rises. It forms a temperature difference with the cold contact on the other side, which generates an electromotive force. The electromotive force It is directly proportional to the intensity of direct solar radiation.

The automatic tracking device is composed of a base plate, a latitude dial, a stepping motor, a conductive ring, and a turbine box (for adjusting the sun's inclination). The stepping motor is the power source, and it can only be controlled and operated by the "Straight Table Controller" produced by our company (do not twist the automatic tracking device by hand). The tracking device has high accuracy, and the rotation angle error is within 0.25 ° within one week, that is, less than 1 minute. As long as it is installed correctly, accurate automatic tracking can be achieved.

TECHNICAL SPECIFICATION

1. Sensitivity: 7 ～ 14μV／W.m-2
2. Time constant: ≤15S (99%)
3. Internal resistance: about 80 ohms
4. Tracking accuracy: <168h ± 1 °
5. Opening angle: 4 °
6. Annual stability: ± 1% (sensitivity change rate)
7. Working environment: -45 ℃ ～ + 45 ℃
8. Power supply: AC220V or DC12V

9. Weight: 5Kg

10. Measuring range: 0 ～ 2000W / m2

11. Signal output: 0 ～ 20mV (4 ～ 20mA can be output with DL-2 standard current transmitter)

12. Measurement accuracy: working table <5%; standard table <2%

INSTALLATION & USE

1. The installation site of the straight table should ensure that the direct sunlight of the sun is not affected by any obstacles in all seasons and times (from sunrise to sunset). If there is an obstacle, the height angle of the obstacle in the direction of sunrise and sunset must not exceed 5 °. At the same time, try to avoid places with serious air pollution such as smoke and fog. It is usually installed in the observation field with other radiometers, but it can also be installed on the roof platform. The stand should be installed firmly, and the level of the instrument should not be changed even if it is severely impacted and shaken (such as strong wind). The tracking accuracy of the straight meter is related to the accuracy of the installation. Although it is simple, you must be careful.

2. The direct radiation meter should be debugged according to the following four steps before use:

① Latitude: first look up the table to find the local latitude (see attached table 1), then release the knobs 9 and 11 on the latitude dial (see attached picture 1), and turn the dial 10 according to the local geographic latitude (see attached picture 1) , Fasten after alignment.

② Zero point: Connect the controller's power line and control line (connected to 4 places in Figure 1), turn the handle bidirectional switch to make the motor rotate quickly, and press the handle left and right to move the handle in both directions. The switch adjusts the direction of rotation of the motor. The ultimate purpose is to make the straight time reference line (see 14 in Figure 1) indicate 0 o'clock. At this time, turn the switch to the middle position to enter the tracking state.

③ Time: The time here refers to the local true solar time. The calculation method is as follows:

True solar time = Beijing time-(120 °-local longitude) / 15 ° + time difference / 60

Local longitude: refers to the east longitude. See Table 1. Unit: Degree.

Time difference: Check Schedule II, unit: minute

For example: 2001/9/12 9:00 (Beijing time), find the true solar time at 121 ° 07′E.

First look up table 2

Time difference = 3

Real solar time = 9.00- (120-121.117) / 15 + 3/60

= 9 + (1.117 × 4 + 3) / 60

= 9: 07: 28

That is: the time for the straight watch (the time of the straight time reference line) should be 7 minutes 28 seconds faster or faster than the Beijing time (watch time). If you go to the straight watch at 8:00 (watch time), the straight watch should respond to 8:07 minutes and 28 seconds; if you go to the straight watch at 11:25, the straight watch should respond to 11:32 minutes and 28 seconds.

Note: After the above debugging operations are completed, the bidirectional switch of the straight meter controller should be kept in the automatic tracking state (the bidirectional switch should be in the middle position).

④ Adjust the light spot on the light tube (that is, the sun tilt, north-south, and horizontal adjustment)

After the latitude, zero, and time are adjusted, it is time to adjust the light spot on the light tube so that the light point passes through the small hole on the edge of the light tube (15 in Figure 1) and falls on the other edge. The center of the light spot (16 in Figure 1). The above 3 steps can be used to achieve the above purpose.

a. Adjust the sun tilt. That is, adjusting the height of the light spot on the light tube. Adjust the sun's inclination (ie, declination) by turning the sun's inclination adjustment button (13 in Figure 1). For the size of the inclination, refer to Appendix III;

b. Adjust and align north-south. That is to adjust the overall direction of the straight table (bottom plate). For north-south alignment, the north-south line must first be determined. The main methods for determining the North-South line are as follows:

Theodolite method: observe the sun at noon with a theodolite (through dark glass), and then lower the objective lens to a point on the horizontal plane. This point is connected to the observation point, that is, the north-south line, and the north-south line is drawn on the instrument pillar.

Plumb line method: This is the more commonly used method. At noon in the true solar time, observe its projection with a plumb line (local meridian), so that the north-south bit line on the base of the instrument coincides with it, as far as possible within ± 0.25 °.

The orientation is often not correct at one time. After several alignments, the base is initially fixed.

c. Adjust the level. Use 3 horizontal adjustment knobs (2 in Figure 1) to adjust the bubble in the horizontal bubble to the center.

After the adjustment of the above steps, the alignment of the light spot is completed, and then the instrument is firmly fixed on the stand. After the straight meter is installed, you should try to track the sun for a period of time to check whether it is accurate. Otherwise, you should adjust it repeatedly until it is accurate. In addition, if the straight meter loses power during use, it needs to be re-commissioned according to the above steps.

3. Wiring instructions:

Color	Output description	Corresponding plug pin
Brown line	Power +	4-pin plug 1 pin
black line	Power -	2-pin of 4-pin plug
Yellow line	Signal +	3-pin for 4-pin plug
Blue wire, shielded wire	Signal -	4-pin for 4-pin plug

4. Direct radiation instrument and solar radiation recorder can directly display and record the instantaneous value of direct solar radiation; if used with a radiation ammeter, the instantaneous value of radiation needs to be obtained by the following conversion:

Direct radiation instantaneous value (W / m2) = radiation current meter display value (mV) × 1000 / radiometer sensitivity;

MAINTENANCE

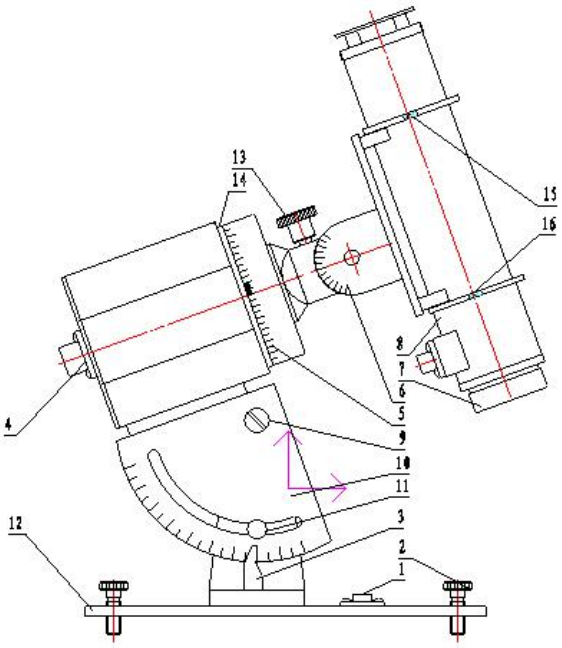
1. Compared with other radiometers, direct radiometers not only require sensitive components, but also need accurate tracking to obtain accurate direct radiation. It is not easy to keep track of the sun continuously, accurately and reliably under all weather conditions all year round, so it is necessary to strictly abide by the operating regulations.

2. Every day at the beginning of work, you should check whether the quartz glass window of the light tube is clean. If there is any dust or water vapor condensate, you should blow it with an ear suction ball or wipe it with soft cloth and optical lens paper.

3. The tracking situation should be checked once a day, and adjusted in time (point to light).

4. This instrument is a precision instrument. It must be debugged in strict accordance with the operating procedures. Never use excessive force. Handle it carefully to reduce vibration to avoid damage.

5. The radiation meter has been used for more than two years, and its sensitivity must be recalibrated by the manufacturer or the metrology department.



1. Horizontal bubble
2.Horizontal adjustment button
3.Pointer
4.Connect the socket to the collector
5.Time scale
6. Declination scale
7. Desiccant cartridge
8.Light tube
9.Connecting bolt
10.Latitude dial
11.Latitude adjustment button
12, floor
13.Sun tilt adjustment button
14.Time Baseline
15, light hole
16, light spot