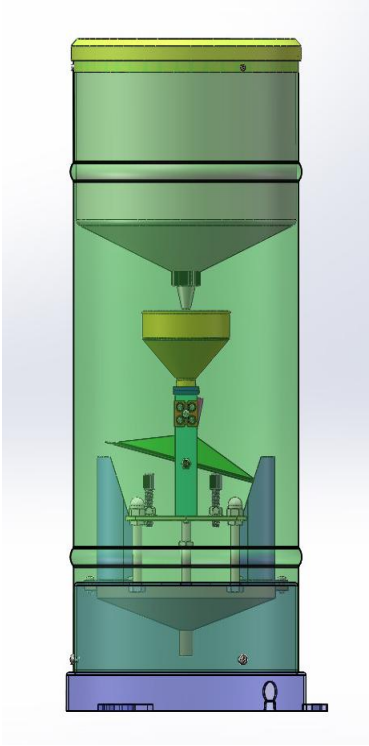
KH.JDB Rain Gauge (windproof) Instructions



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KEHAOINFO

Shenzhen KEHAO Information Technology Co., LTD

catalogue

Summary

KH.JDB Series of windproof tipping rain sensor is suitable for coastal or island areas of meteorological (station), hydrology, agriculture, expressway, railway and other departments to measure liquid precipitation, precipitation intensity, precipitation start and end time.

This sensor complies with the following specifications and standards: SL61-2003 Hydrological Automatic Weather System specification; GB/T201978.2-2014 Precipitation Observation Instrument Part 2: Funnel Rain Gauge Sensor

The key technical indexes

(1) Water carrying diameter: Φ200+0.6mm The angle of the outer blade is 40°-45°

(2) Measurement of precipitation intensity: less than or equal to 4mm/min and can work at 8mm/min

(3) Resolution: 0.2mm,0.5mm

(4) Error: ≤±4% (indoor static test, rain intensity is 2mm/min)

(5) Output signal: switch on/off signal

(6) Operating temperature: -20℃~60℃

(7) Working humidity: ≤95%RH (40℃)

(8) Switch capacity: DC, V ≤ 12V, I ≤ 500mA

(9) Body specification: 304 stainless steel, diameter 200 ㎜, height 550 ㎜, thickness 1 ㎜

(10) Base structure: windproof flange

(11) Drainage mode: labyrinth drainage

Principles of structure

The structural principle of the sensor (see figure on the back page) is described as follows:

The system consists of the following key components: stainless steel outer casing, water inlet port, filter screen, funnel, triangular work platform, permanent magnet, dry reed tube, gemstone bearing screw, hexagonal locking nut, tipping component, limit screw, round locking nut, bracket, base, windproof cover, footrests, level bubble, leveling screw, cable sheath, terminal connectors, and backup dry reed tube.

Rainwater collected at the downspout is filtered through a mesh installed on the main funnel and then directed into a metering tipping bucket. The ——-type tipping bucket, molded from plastic, features a central partition dividing it into two triangular compartments with equal capacity. This mechanically bistable structure operates as follows: when one compartment collects water, the other remains idle. When the collected volume reaches a preset threshold (6.28,15.7, 31.4ml), gravity causes the bucket to tip over, activating the idle state while the other compartment continues collecting. Upon reaching its operational capacity, the idle compartment automatically tilts and enters standby. A permanent magnet mounted on the tipping bucket's side wall scans through two dry reed switches (driven by magnetic fields) during tilting motions, causing their circuits to open/close alternately. Each bucket tilt triggers a pulse signal from the dry reed switch. This dual-switch design ensures reliable operation, whereas single-switch systems remain disconnected except when the magnet scans the bucket during tilting.

The number of times the bucket is turned is counted by scanning the dry reed tube with a magnet and sending out pulse signals. Each pulse signal recorded represents 0.2, 0.5 or 1.0 mm of precipitation on the ground, so as to realize the purpose of precipitation telemetry.

Instrument inspection

1. Open the packing box, take out the packing list and instruction manual, check and accept each item; read the instruction manual to understand the structure and performance of the instrument.
2. Check the overall appearance of the instrument to see if any parts are damaged in transportation and whether any fasteners are loose.
3. Check the axial working clearance of the bucket component △=0.2mm, which can be measured by hand to detect the axial movement distance and carefully listen to its weak impact sound.
4. Check the friction characteristics of the bearing of the tipping part. For this purpose, gently lift the tipping part flat with your hand and then release it. The tipping part should turn sensitively without sticking, which indicates that the friction torque of the bearing and the axial working clearance of the tipping shaft meet the requirements.
5. Rotate the tipping component to activate the single dry reed switch. When the magnet approaches the bottom side of the reed, the double dry reed switch activates. Verify proper alignment between the magnet and reed using a multimeter's ohm range. Ensure the conduction resistance is ≤0.5Ω and insulation

resistance ≥1MΩ.

6. For the inspection of instrument measurement accuracy, please refer to the relevant chapter.

Visual inspection: Check whether there is any damage after the instrument is taken out of the packing case; whether the tipping is flexible; whether the gap between the rotating shaft and bearing screw of the tipping is appropriate, which should be adjusted to about 0.2mm; whether the limiting screw is loose.

Debug method

Before leaving the factory, the instrument has been tested and verified by the inspection agency. Therefore, in general, users do not need to adjust it, and can be directly installed on site for use.

After installation, fill the water inlet with 6.28,15.7, and 31.0 mL of clean water to observe if the tipping bucket rotates, check for signal output, and verify whether the limit screw's position (reference point) has shifted. If the reference point changes, recalibrate it. The adjustment procedure is as follows: Use a graduated cylinder to fill the bucket with 6.2, 15.2, and 31.0 mL of water. If the bucket doesn't tilt, move the limit screw upward to reduce rotation angle. If the bucket tilts prematurely before reaching 6.5 mL, it indicates insufficient rotation angle. In this case, lower the limit screw downward to increase rotation angle. Repeat this adjustment process several times until the locking nut is securely fastened.

If the instrument works for one flood season, the 10,20 and 50 ml measuring cylinder is used to check whether the base point changes, and the method is the same as above.

This sensor features a 200mm diameter rain gauge port, with each dou (Chinese unit of volume) representing a rainfall depth of 0.2, 0.5, 1.0mm on the ground surface. Available in three capacities: 6.28ml, 15.7ml, and 31.4ml. Under natural rainfall conditions, water droplets adhere to the tipping wall while bubbles form around the container's periphery, which increases the displacement volume per dou. To account for practical measurement losses, calibration uses fixed reference points of 6.2ml, 15.2ml, and 31.0ml of clean water.

Instrument error calculation $E_b = \frac{V_t - V_p}{V_p}$ method:

Eb: Tipping metering error (%)

Vt: The amount of water turned by the tipping bucket is equal to the number of tipping buckets × the amount of water per bucket ml

Vp: the self-drainage volume of the instrument measured manually in ml

The artificial constant pressure water injection test was carried out at a rainfall intensity of 2mm/min

Rain sensor: JD-02, every 6s turn a bucket;

JD-05 type, turn a bucket every 15s;

JD-10 type, turn a bucket every 30 seconds.

Count 100 times, measure the self-drainage of the instrument with a cylinder, and calculate it according to the above formula. The error should not exceed ±4%.

If the deviation is too large, the base point should be adjusted again.

If Eb is more than 4%, it indicates that the amount of water injected per dou is too small and the rotation angle of the tipping bucket is too small. The limit screw should be adjusted to make it drop

and increase the amount of water injected per dou.

If Eb is less than-4%, it indicates that the water injection per dou is too large and the turning angle of the tipping bucket is too large. The limit screw should be adjusted to rise and reduce the water injection per dou.

The debugging work should be repeated several times, and finally the locking nut will be locked.

Instrument installation

The requirements for on-site installation of instruments are detailed in SL21-90 "Precipitation Observation Code". The following matters should be paid attention to during installation:

1. The installation height of the rain gauge sensor is 0.7m (the distance from the plane of the rain receiving aperture to the ground of the observation field). For the continuity and comparability of the observation data in this region, 1.2m height can also be used in northern China.
2. When installing the rain gauge, use a level to level the rainwater inlet.
3. The rain gauge sensor is mounted on three installation holes of the base feet and fixed to the concrete base with three M8 foot bolts, screw threads (or expansion screws). The depth of the base embedded in the soil should ensure that the instrument is firmly installed and does not shake or tilt in the storm.

Note: When pouring the foot concrete, it should be ensured that the three foot bolts are M8╳60 and divided into 120°, and the diameter of the circumference where the center of the three foot screws is located is ф236mm or ф280mm. It is selected by the user.

4. Adjust the leveling screw to make the round water bubble in the center. After the instrument is leveled, slowly tighten the three fixing screws. If the water bubble changes, adjust it again and fix it.

5. The base shall have a drainage pipe outlet and a cable passage. If it is necessary to collect the drainage volume to monitor the measurement accuracy of the system, a small chamber (pit) for placing a water collection container shall be built.

6. The signal output cable is a two-core shielded wire (A43VVT2*16/0.15 microphone wire).

7. The cable passes through the rubber sheath of the instrument base and is tightened with a nut to increase tensile strength and prevent wire disconnection during wiring. The two core wires of the cable are stripped to a length of 20mm each, folded in half, twisted into strands, and inserted into the two connection holes of the common signal transmitter component. The connections are secured with screws.

8. Gently flip the bucket parts with your hand to check whether the signal of the receiving part is normal.

9. Conduct manual water supply verification.

10. Put the rain collector cylinder on the instrument base, and then the instrument is installed.

Instrument maintenance

1. Pay attention to protect the instrument from collision, especially the mouth of the instrument should not be deformed or damaged; ensure the stability of the body of the instrument and the level of the mouth. The measuring tool and leveling rod can be used for inspection every year. For unmanned rain gauges, special safety measures should be taken for the instruments.

2. During the use of the instrument, it is necessary to dredge regularly (silt, dust, leaves, insects and other debris) according to the local actual situation, check and unclog the waterway, wipe the ring opening and inner surface of the rain receiver to ensure smooth water discharge.
3. If there is mud and sand in the water tank of the tipping part, it can be cleaned with a cleaning brush dipped in water or alcohol. Do not touch the inner wall of the tank with your fingers to prevent oil pollution and affect the measurement accuracy of the tipping part.
4. If resistance is felt during the tipping process of the bucket component, clean both ends of the bucket shaft journal and the inner bore of the jewel bearing with water or alcohol. This is particularly crucial for stations exposed to frequent sandstorms. If cleaning proves ineffective, it may indicate prolonged use of worn bushings, wear, or cracking of the jewel bearing. To check: trace a line along the bearing's inner surface with a thumbtack. If resistance occurs, this confirms wear or cracking, requiring replacement of the bearing assembly. If damage is confirmed, replace the entire bucket shaft. These maintenance tasks should be performed by the manufacturer.
5. Do not add oil to the gem bearing, so as not to suck dust, because the dust (containing alumina and silicon carbide components) is very hard, the grinding force is very strong, like a grinding agent, can make the bearing surface wear, friction torque increase, leading to premature damage.
6. The axial working clearance of the support shaft of the tipping part should be checked frequently. △ Too large or too small will affect the normal operation of the tipping part.

When replacing the gem bearing or tipping shaft, the axial working

clearance of the tipping shaft should be adjusted carefully. Because the hardness of the gem bearing is high and the quality is brittle, the neck area of the tipping shaft is very small, and the pressure per unit area is very large. If the △ is too large and the assembly is careless, it is easy to damage the gem bearing.

7. Adjust the limit screw and locking nut of the tilting angle of the tipping part. Do not turn it arbitrarily, and pay close attention to avoid loosening it. The round bubble should be placed in the middle. The correctness of these two parts is the basis of the measurement accuracy of the instrument.
8. During the ice period, when the instruments are stopped in the northern station, they can be taken back to the room for a comprehensive inspection and maintenance.
9. The instrument is placed indoors, or in the field. If it is sure that there is no rain or sun, the mouth of the instrument can be covered with a cylinder cover to prevent dust from falling into the rain vessel.

Common faults and troubleshooting methods

After working on the instrument for a period of time, the following common faults may occur. Please repair the instrument according to the methods listed in the table. For damaged parts of the instrument, contact the manufacturer for replacement.

In winter, when the temperature is lower than-10℃, the instrument should be taken back to the room for preservation to prevent the damage of the level bubble.

List of common faults and troubleshooting methods

Phenomenon	**Perhaps Reason**	**Methodology or recommendations for exclusion**
Beyond expectation	1. The position of the limit screw is changed 2. The inner wall of the bucket is dirty and stained with dirt 3. There is dirt between the bucket shaft and the bearing, the gap between the shaft is too small to rotate smoothly; or the gem bearing is broken. 4. Abnormal signal transmission 5. The measurement of the instrument's own drainage capacity is not accurate 6. Damaged ligule tube	Fill the measuring cylinder with 6.2, 15.2, 31.0ml water to see the tipping of the tipping bucket, then "up" and "down" move the limit screw and lock it. Heat with 10% alkali water for 40° for one hour, then soak naturally cooled for 24 hours. Alternatively, rinse with water and alcohol. Clean the bearing and shaft with alcohol, adjust the axial clearance to 0.2~0.25mm, and ask the manufacturer for the gem bearing screw again. Check that the distance between the magnet shell and the dry reed tube should be within 2mm Check the measurement tools for displacement, and the method shall conform to the regulations. renewal
The central	1. Dry tongue tube	Replace the dry reed tube.

station keeps reporting rainfall data, but it actually hasn't rained.	damage 2. The distance between the magnet and the dry reed tube is too large 3. Wire disconnection 4. The bucket is stuck and does not turn over	Adjust the bearing screw so that the distance between the dry reed tube shell and the magnet fixing shell is not more than 2mm Dry tongue tube, output aviation plug, the contact wire of the plug socket is disconnected and rewelded. Find out the cause of the jam, eliminate the fault and debug again.
The number of flips and turns does not match the number of signal outputs	1. The signal transmitting device of the measuring station fails to send or does not send signals 2. Change the position of the limit screw 3. Dry tongue tube The material of the tongue is not good 4. The dry tongue tube sometimes does not hold	Check the transmitter and receiver The position of the limit screw rises to the left and right, making the rotation Angle of the tipping cup smaller. The vibration caused by the tipping causes dry tongue tube aspiration (adjust the limit screw). After the magnet is attracted, the magnetized tongue plate and the magnet are not released after leaving (replace the tongue tube) Reduce the distance between the dry reed tube and the magnet. Adjust the gap between the magnet and the reed tube.

9. Product integrity

(1) The instrument itself

Coning rain sensor..... 1 unit

(2) Spare parts of the instrument

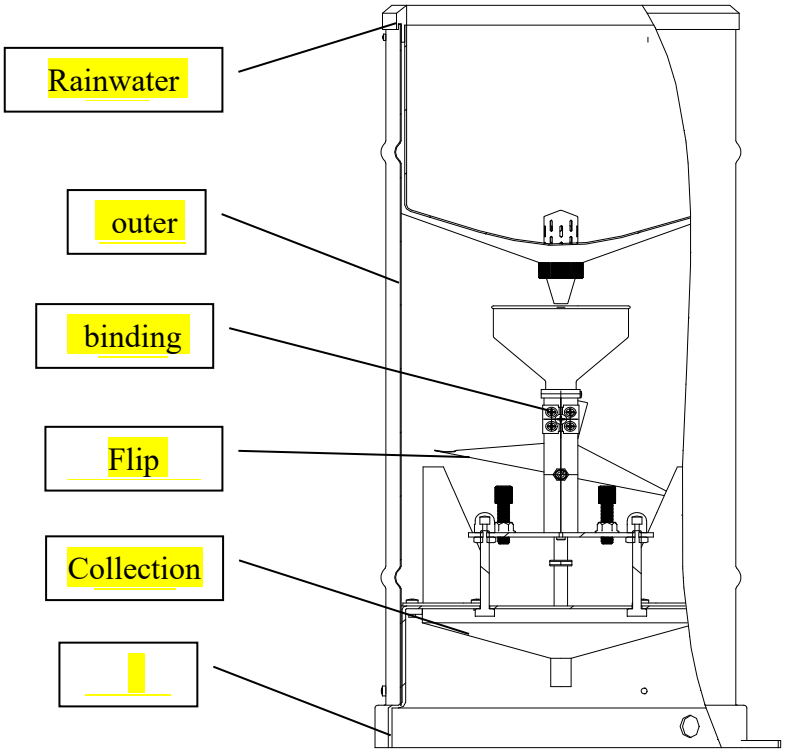
Single dry tongue tube..... 1 piece
Dry tongue tube Double dry tongue tube..... 2 pieces

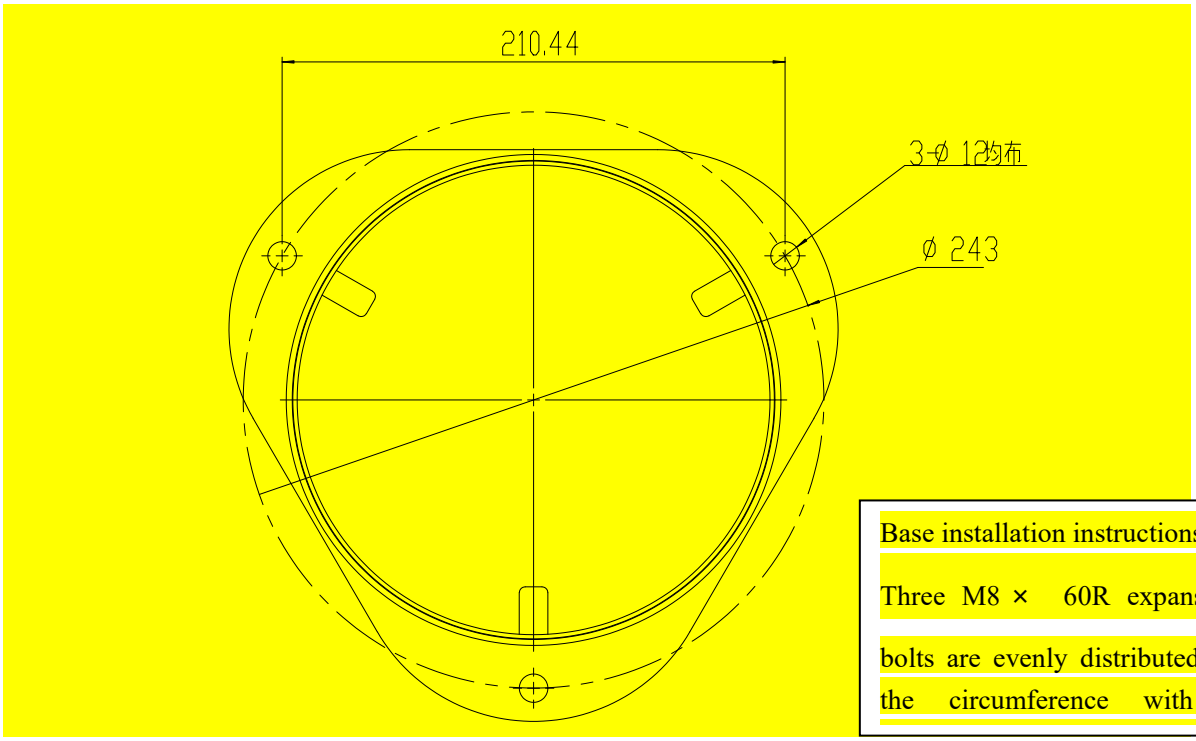
(3) Instrument accessories

1. Anchor bolts (washer, nut) M8╳60 (expansion screw set) ..3 sets

2.Instructions..... 1 copy

3. Product certificate.....1 copy





Base installation instructions:

Three M8 × 60R expansion bolts are evenly distributed on the circumference with a

Schematic diagram of structure of