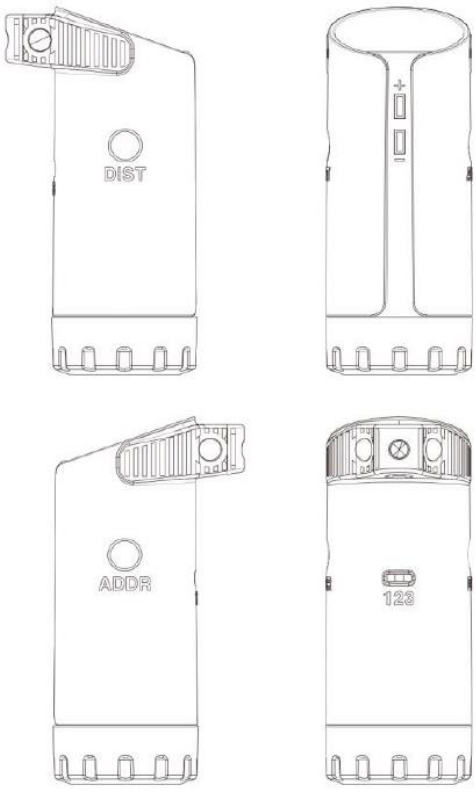
BFN-1003-L

Electrostatic Sensor User Manual

User Manual



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V1.0.0

SHENZHEN HORB TECHNOLOGY CORP. LTD.

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Company Profile

Shenzhen HORB Technology Corp.Ltd. (Hereinafter Referred To As “HORB”) Was Established In 2001 , Headquarter Located In Baoan District Of Shenzhen City, Listed On The National Stock Transfer System(Stock Code: 870762),It Has Been Approved As A National High-Tech Enterprise, A Specialized And Special New Enterprise In Guangdong Province, A "Contract-Abiding And Credit-Worthy" Enterprise In Guangdong Province, The Sixth Innovation Top 100 Enterprise Of Shenzhen City, Post-Doctoral Innovation Practice Base, Shenzhen Vocational And Technical College Practice Base… HORB Is The Vice Director Of Shenzhen Clean Industry System Solution (The Chairman Unit Of The Anti-Static Professional Committee), The Vice President Of Shanghai ESD Association, The Member Of Anti-Static Equipment Of China Electronic Instruments Industry Association, And The Member Of ESD Association Of The United States.

HORB Technology Has Long Been Committed To The Research And Development And Service Of "Controlled Environment Intelligent System Solutions", Based On Clean Control Technology, Electrostatic Protection Technology, Vision And Information Technology. Provide P+1 Smart Clean Space Engineering, P02 Clean Cloud Smart Control Platform, P03 Smart VMI Consumables Integration, +1 Solution Integrating Consulting And Training. Customers Are Mainly Concentrated In High-End Electronics Manufacturing, Biomedicine, Military Industrial Institutes, And Government And Enterprise Units.

We Have Applied For And Approved More Than 30 Invention Patents, More Than 30 Utility Model Patents, 3 PCT International Patent, More Than 10 Software Copyrights, More Than 30 Domestic Trademarks, 4 Madrid Trademarks, About 30 Products CE Certified, National Industrial Production Permit, ISO9001, ISO14001,OHSAS18001, ISO13485 System Certification, LA Certification, Domestic Second-Class Medical Device Certification, Multi-Country Medical Device Product Certification And System Certification. Participation In The Preparation Of 6 National Standards, 1 Industry Standard, 3 Group Standard.

HORB People Do Not Forget The Original Ideals And Aspirations, Always Adhere To Provide Customers With High-Quality Products And Services. Best Resource, Owned By HORB, Is The First Professional Organization In China To Focus On The Research And Promotion Of ESD Protection Technology And Clean Technology, Shenzhen Higher Vocational College’s Contracted Industry-University-Research Cooperation Unit, Clean Engineering Professional Teaching Agent, iNARTE Authorized China Regional Examination Center Of ESD Engineers Of United States, Senior Consultant Of Multiple Institutions And Enterprises. As Of The End Of 2022, Serving More Than 5,000 Enterprises And Training Professional Talents With More Than 40,000 Person-Times And Efforts To Be Made To Provide The Country With More Professional And Technical Personnel In The Industry.

HORB Is Adhering To The “Being Customer –Focused, Credibility And Openness, Profession And Diligence, Co-Creation And Sharing” Values, To Achieve “To Make Every Enterprise & Family More Safe And Cleaner, To Make Every Customer More Moved, To Make Every Employee More Happier, To Make Every Partner More Satisfied” Corporation Mission, Constantly Improve The Competitiveness Of Enterprises, Has Been Set Up Own Brands: HORB, Clean Cloud, BFN, ECO, KANBO, Yijielianghang, BEST-RESOURCE, Sijiali, Howay,Gradually Formed A Stronger Core Technology And Brand Advantages, Set Up Domestic Offices In Beijing, Yantai, Qingdao, Suzhou, Chongqing, And Chengdu, And Set Up Overseas Subsidiaries In Hong Kong, Thailand, Vietnam, The Philippines, India, And Germany. And With Many Domestic And Foreign Brand Enterprises, Such As: Huawei, OPPO, BOE, Foxconn, Flextronics, Samsung, WD, Seagate, Sony, Military Institutes, Government And Enterprise Units Have Established Long-Term Cooperative Relations.

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1. Product Overview

- The BFN-1003-L Electrostatic Sensor is a testing instrument developed and produced by Horb Technology for detecting the electrostatic voltage on the surface of electrostatically charged objects. It adopts non-contact measurement technology, which minimizes the influence of the testing instrument on the electrostatic field on the object surface and ensures the accuracy of measurement.

2. Industry Applications

- It can be widely used in electronics, optoelectronics, plastic and other industries.

3. Product Features

- Comfortable hand feel and elegant appearance
- Detecting distance selectable via DIP switch
- Wide detection potential range and high detection accuracy
- Alarm threshold can be set, red light alarm when exceeding the threshold
- High-definition, all-round LCD data display terminal
- Real-time transmission of monitoring data to PC
- Comfortable operation and easy to use

4. Product Performance and Technical Functions

4.1 Performance Parameters

✧ Technical Specifications

No.	Technical Specification	Value
1	Working Voltage	DC8-24V
2	Working Current	<50mA
3	Sampling Time	1ms
4	Vibration	<1KHz
5	Noise	<5dB
6	Signal Output	RS485 (115200bps,8,1,n,n), ≥20ms; Open collector (<50V/100mA)
7	Communication Distance	<300m
8	Alarm Indication	Red LED
9	Threshold Setting Range	0~±5000V
10	Detection Angle	<15°
11	Warm-up Time after Startup	5s
12	Infrared Control Range	<20°, 1m

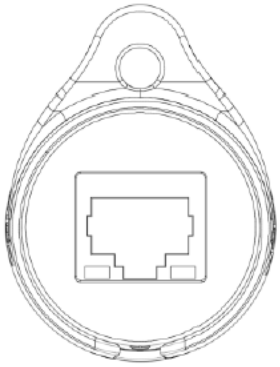
Note: Product improvement and upgrading may lead to changes in product specifications and performance. Please refer to the actual product for details, and no prior notice will be given.

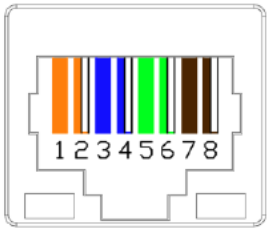
✧ Electrostatic Voltage Gear Range and Minimum Resolution Corresponding to Each Detection Distance

Detection Gear	Detection Distance Code	Detection Distance	Range	Resolution	Measurement Error	Zero Drift	Calibration
1	0	5mm	±2000V	1V	10%	±1V	×
	1	10mm	±4000V	3V		±3V	
	2	25mm	±10000V	5V		±5V	
	3	50mm	±15000V	10V		±10V	
	4	100mm	±20000V	10V		±10V	√
	5	150mm	±20000V	10V		±20V	×
	6	200mm	±20000V	15V		±30V	
	7	250mm	±20000V	20V		40V	
2	8	300mm	±20000V	10V		20V	√
	9	350mm	±20000V	15V		30V	×
	A	400mm	±20000V	15V		30V	
	B	450mm	±20000V	15V		30V	
3	C	500mm	±20000V	10V		30V	√
	D	550mm	±20000V	15V		30V	×
	E	600mm	±20000V	15V		60V	
	F	700mm	±20000V	20V		80V	
Note: Incorrect setting of detection gear and distance code will make it impossible to guarantee the accuracy of the measured electrostatic voltage value.							

Note: Product improvement and upgrading may lead to changes in product specifications and performance. Please refer to the actual product for details, and no prior notice will be given.

✧ Network Port Wiring Information

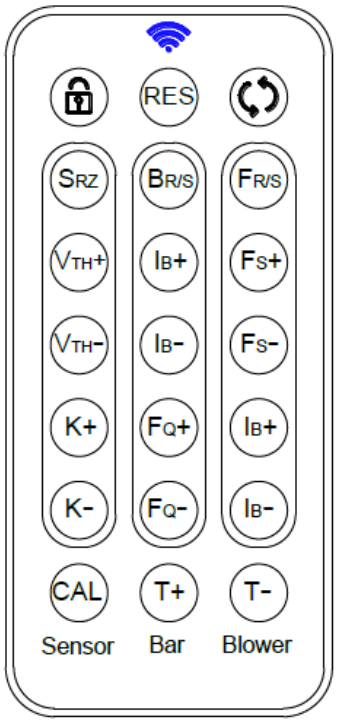




1,2	Orange, White-Orange	VCC
3	Blue	RS485+B
4	White-Blue	RS485+A
5,6	Green, White-Green	GND
7	Brown	C1
8	White-Brown	C2
9	Metal Shield Shell	PE

Note: Product improvement and upgrading may lead to changes in product specifications and performance. Please refer to the actual product for details, and no prior notice will be given.

✧ Infrared Remote Control Command Technical Functions



Customer Operation:

S_{RZ}: Zero Clearing

$V_{TH}+/V_{TH}-$: Threshold adjustment, unit is 10V

Unlocking:

1. After unlocking, any key press will extend the unlock time for another 30 seconds.
2. After unlocking, if no key is pressed for 30 seconds, the remote control will lock automatically.

4.2 Operation Technical Tips

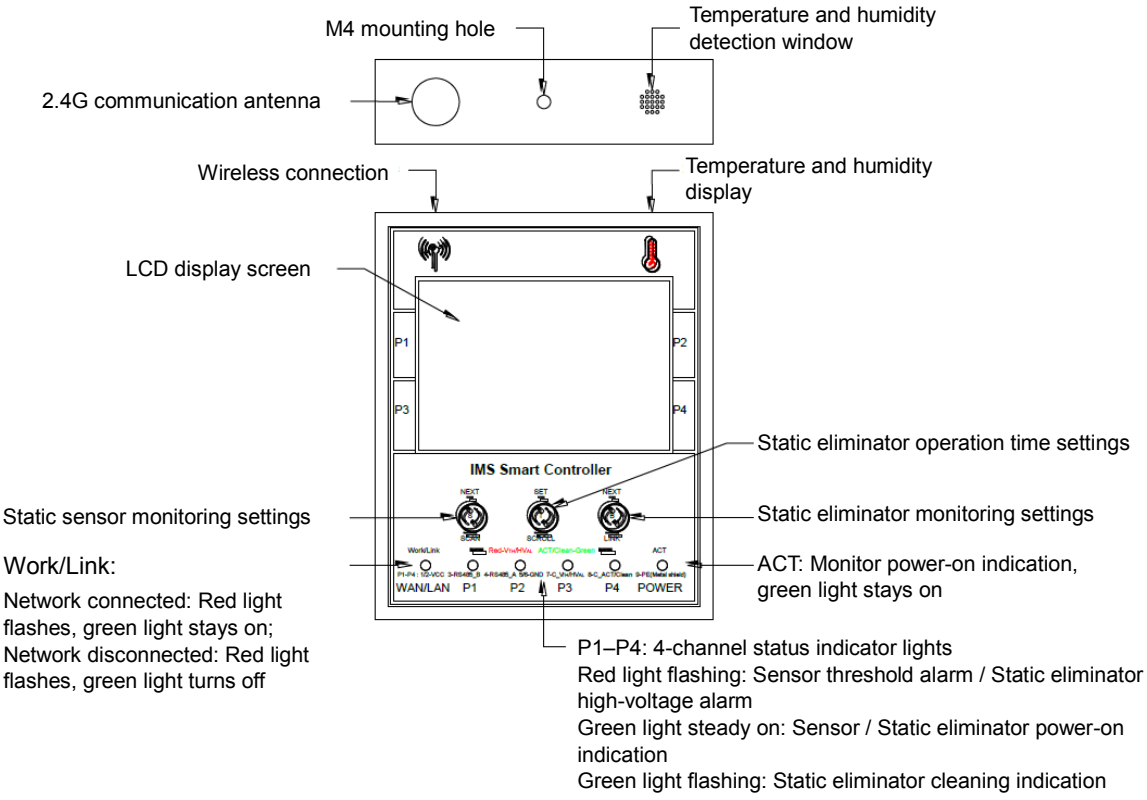
- When operating, aim at the front LED of the product (distance no more than 1m), press the unlock key first, then press the corresponding function key for setting; the red light flashes when the key is pressed.
- For zero adjustment, the calibration plate should be much larger than the sensor detection window, and both the plate and the sensor should be well grounded.
- For calibration, the calibration plate should be much larger than the sensor detection window, and the sensor should be well grounded.
- No obstacles are allowed between the sensor and the detected object, otherwise the accuracy of the detection result will be affected.
- No electrical equipment that may affect the sensor is allowed within the sensor's detection distance range.
- To accurately measure a charged object, the plane of the sensor's detection window must be parallel to the surface of the measured object.
- When the charged object is smaller than the calibration plate, the measured value will be smaller than the actual electrostatic value of the charged object.
- When the charged object is larger than the calibration plate, the measured value will be larger than the actual electrostatic value of the charged object.
- Do not perform zero clearing in a charged state or during electrostatic measurement (excluding electrostatic calibration); if zero clearing is performed during electrostatic testing, the displayed electrostatic value will be zero.
- Influence of Temperature and Humidity on Electrostatic Detection:

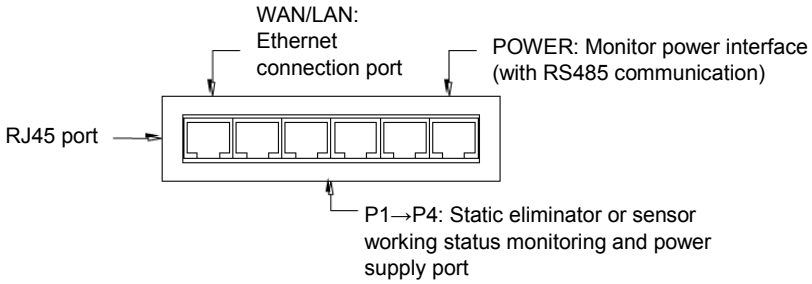
a) The lower the temperature and the lower the humidity, the less moisture in the air, the easier it is for surrounding objects to generate static electricity by friction, and the greater the interference to electrostatic detection.
b) The higher the temperature and the higher the humidity, the more moisture in the air, the more active the movement of water molecules, which is easy to cause corona or spark discharge for the calibration device, and has a greater impact on the uniform electric field generated by the calibration device, which will weaken the uniform electric field.
c) At the same humidity, the lower the temperature, the less moisture in the air, the easier it is for surrounding objects to generate static electricity by friction, and the greater the impact on electrostatic detection.
d) Therefore, the ambient temperature and humidity during electrostatic calibration/detection should be clearly indicated.

- Due to the existence of cosmic rays, trace radioactive substances in the environment and the use of various electrical equipment, there will inevitably be more or less positive and negative ions in the detection space, which will also have a certain impact on the detection results.

4.3 Monitoring Terminal Display Information

- Working Status: Monitors whether the sensor is working normally and the alarm output status.
- Device Address: Displays the set address of the sensor.
- Detection Distance: Displays the set detection distance of the electrostatic sensor.
- Threshold Voltage: Displays the set safe (alarm) threshold of electrostatic voltage.
- Real-time Voltage: Displays the measured electrostatic voltage value on the surface of the object.





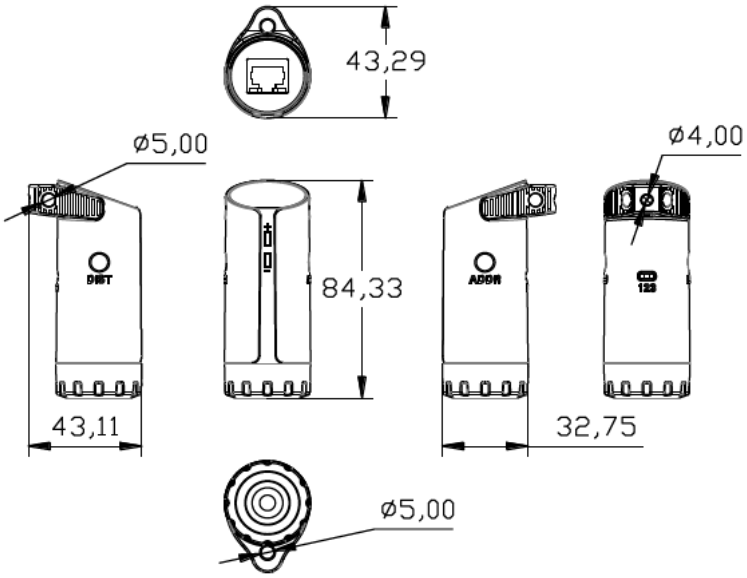
4.4 Mechanical Parameters

✧ Sensor Mechanical Parameters

Overall Dimension: <44×33×85mm (L×W×H)

Net Weight: About 49.7g

Sensor Overall Dimension Drawing:

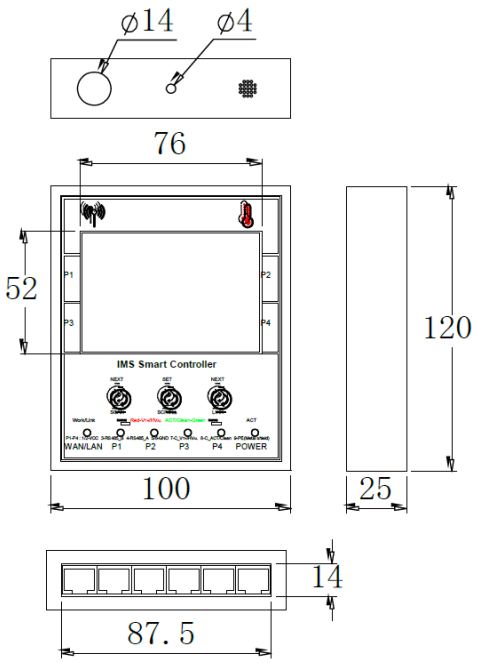


✧ Monitoring Terminal Mechanical Parameters

Overall Dimension: 100×120×25mm (L×W×H)

Net Weight: About 400g

System Monitoring Terminal Overall Dimension Drawing:

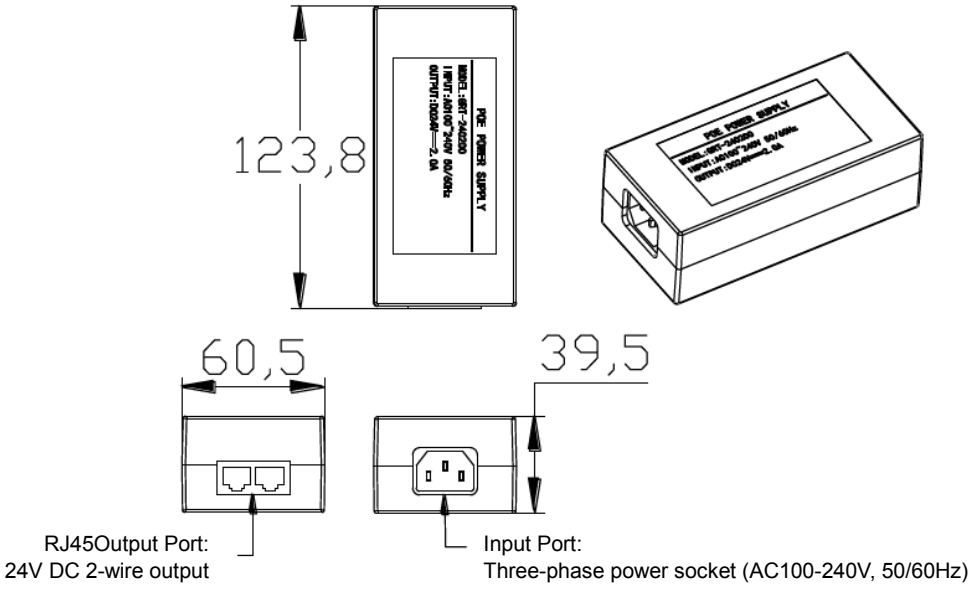


✧ Adapted Power Supply Mechanical Parameters

Overall Dimension: 124×61×40mm (L×W×H)

Net Weight: About 234g

Adapted Power Supply Overall Dimension Drawing:

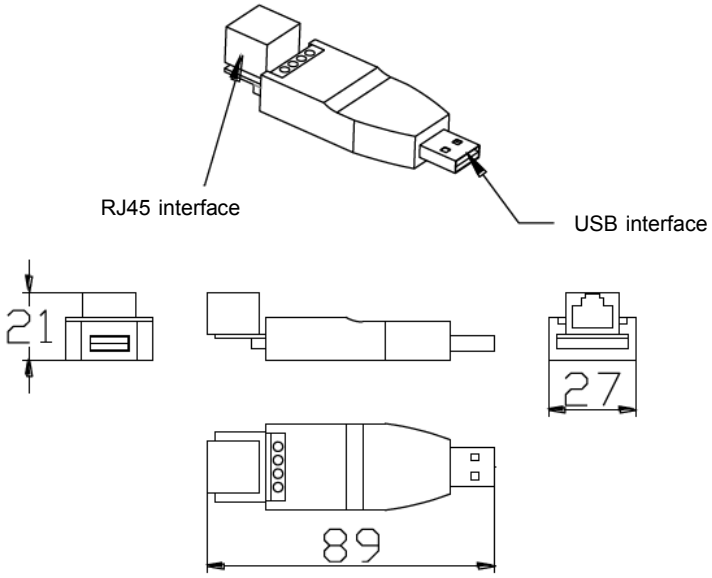


✧ Communication Converter Mechanical Parameters

Overall Dimension: <90×28×22mm (L×W×H)

Net Weight: About 20.5g

Communication Converter Overall Dimension Drawing:

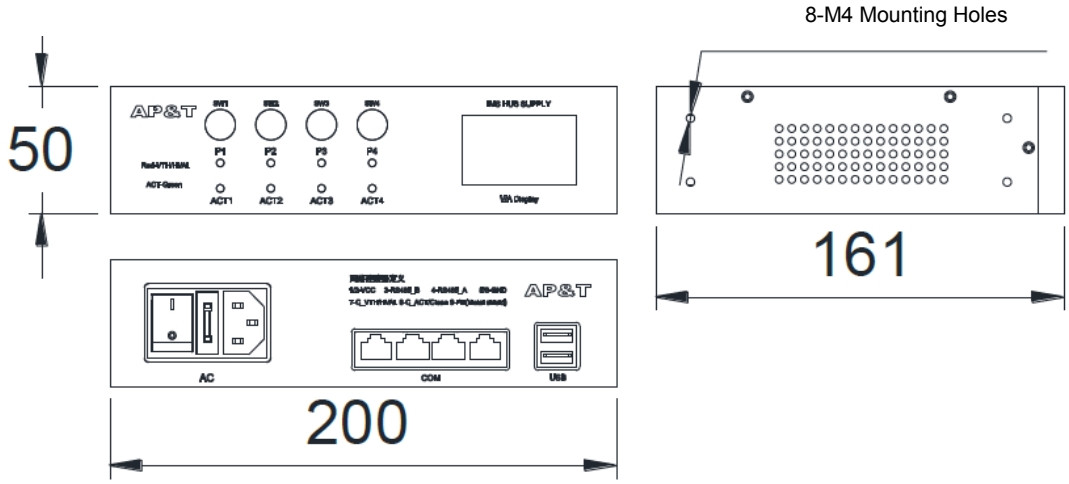


✧ System Hub Server Power Supply Mechanical Parameters

Overall Dimension: 200×161×50mm (L×W×H)

Net Weight: About 1029g

System Integrated Power Supply Overall Dimension Drawing:



5. Working Environment

- ◆ Working Temperature: 0°C~+50°C
- ◆ Working Humidity: 30~65%RH

6. Product Calibration

- ◆ Calibration environmental conditions and requirements are as follows:

a) Ambient Temperature: 20°C±3°C

b) Relative Humidity: 40-45%RH

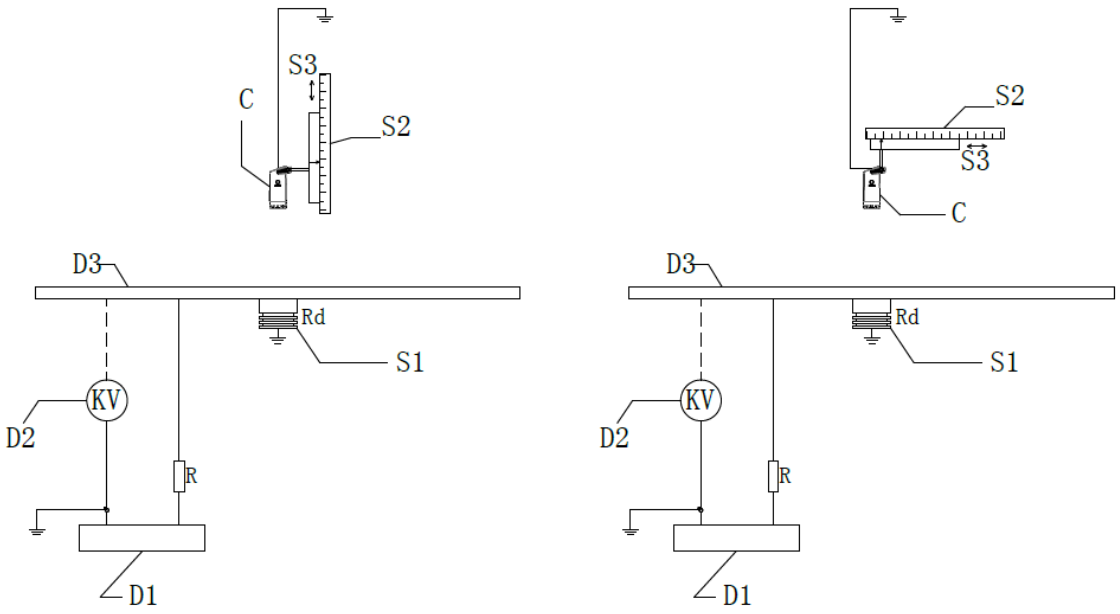
c) No measurable electric field, magnetic field, positive or negative ions around

d) Equipped with ground wire with ground wire resistance <10Ω

- ◆ Calibration Equipment

a) The calibration instruments and equipment must be calibrated by metrological technical institutions, meet the calibration requirements, and be within the validity period.

b) The main calibration equipment consists of DC high-voltage meter, DC high-voltage power supply, standard plate electrode, distance regulator, etc. The sensor is located on the center line of the calibration plate.



Vertical Test　　Horizontal Test

◆ Requirements for Equipment and Devices

✧ C: Calibrated product (Electrostatic Sensor)

✧ D1: DC high-voltage power supply: Output range -20KV~+20KV, continuously adjustable or minimum step 10V, measurement uncertainty less than 1/4 of the allowable error limit of the calibrated meter.

✧ D2: DC high-voltage meter: Measurement range -40KV~+40KV, measurement uncertainty less than 1/4 of the allowable error limit of the calibrated meter.

✧ D3: Standard plate electrode: The plate electrode should be round or square with rounded corners, and the curvature radius of the electrode edge should be suitable to avoid corona phenomenon; the area of the plate should be large enough, with diameter or side length not less than 0.4m. The company's calibration plate is a 600mm×600mm square stainless steel plate.

✧ R: Protective resistor: The voltage withstand strength of the resistor should be >20KV, the current passing through the protective resistor and human body <5mA, and the resistance value R meets the following formula requirements:

$$R/(R+R_d)<0.1\%$$

Where: R is the protective resistance in ohms (Ω);

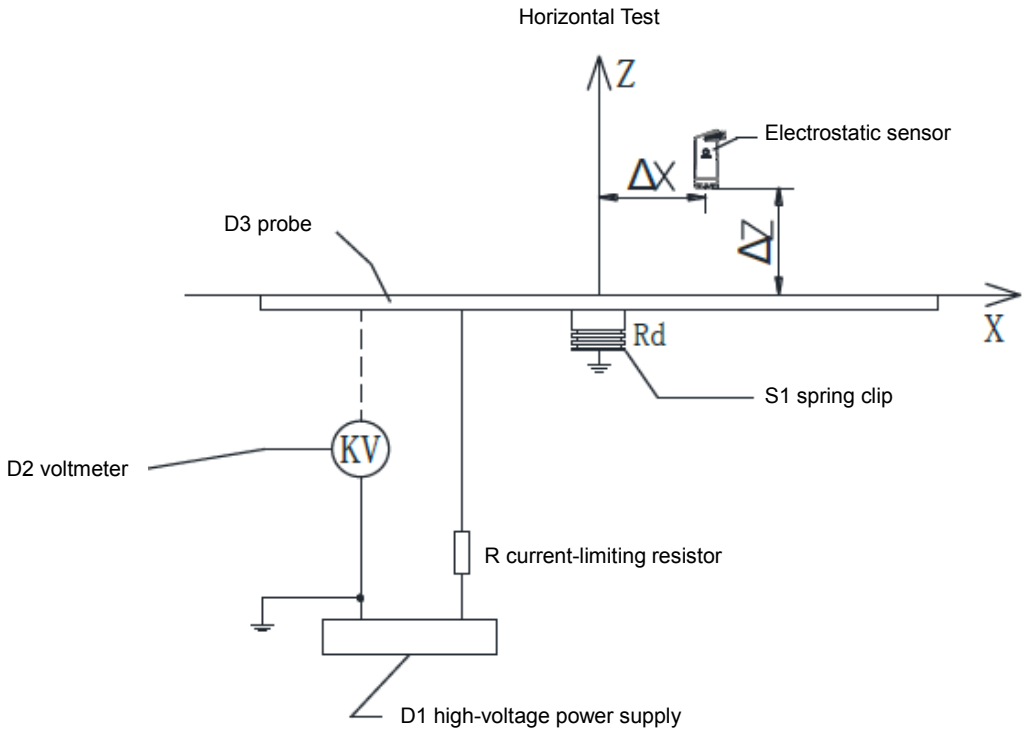
R_d is the resistance of the insulating support in ohms (Ω), with $R_d > 10^{13}\Omega$, and voltage withstand strength >25KV.

Different resistance values of the above two resistors may lead to different detected electrostatic voltage values under the same standard voltage.

- ✧ S1: Insulating support
- ✧ S2: Scale ruler: Measurement range 0mm~750mm, measurement uncertainty less than 0.5mm
- ✧ S3: Distance regulator: Place the sensor on the calibration device with the front end of the sensor extended; the geometric shape and material of the support should minimize the impact on the electric field distribution around the front end of the sensor.

7. Product Detection Performance Test

◆ The test is divided into vertical test and horizontal test, Sensor Test Device Schematic:



◆ Vertical Test between Sensor and Standard Plate Electrode

The electrostatic voltage values at 3 groups of test distances were detected. The standard plate electrode is a 600mm×600mm stainless steel electrode. The test distance is the distance from the surface of the plastic shell on the side of the electrostatic sensor's detection window to the surface of the calibration plate electrode (the sensor is located directly above the center point of the calibration electrode). The light gray thick solid line in Figure 10 is the calibration voltage line with a slope of 1, a virtual line intended to mark the ideal situation where the actual measured voltage value of the sensor is completely consistent with the voltage value applied to the standard plate. (See Figure 10-1 and Figure 10-2 Vertical Test Data Graph of Standard Plate Electrode)

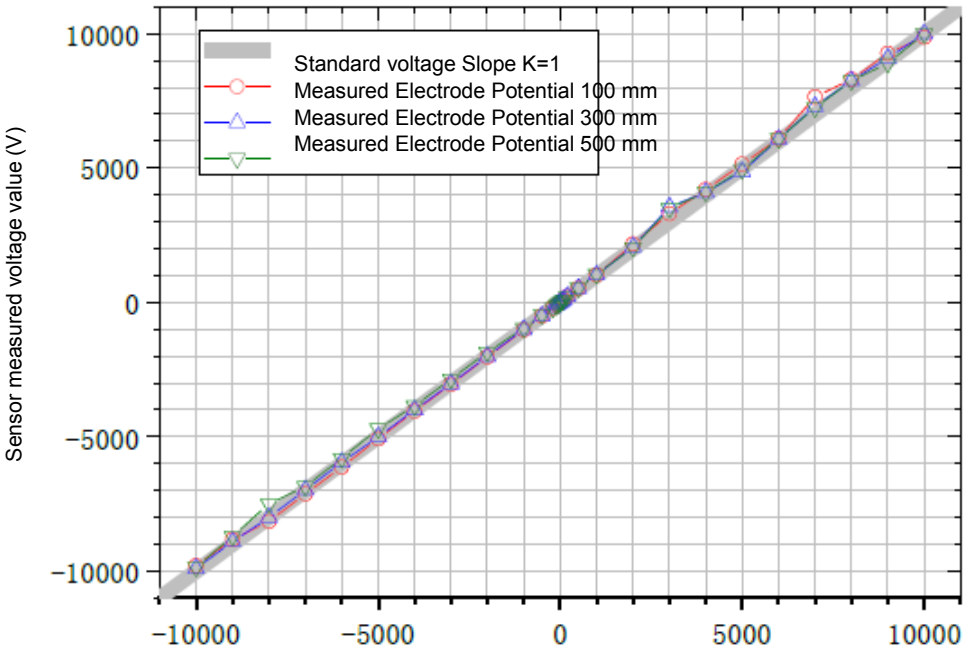


Figure 10-1 Measured Data of
Equilibrium Electrode Potential

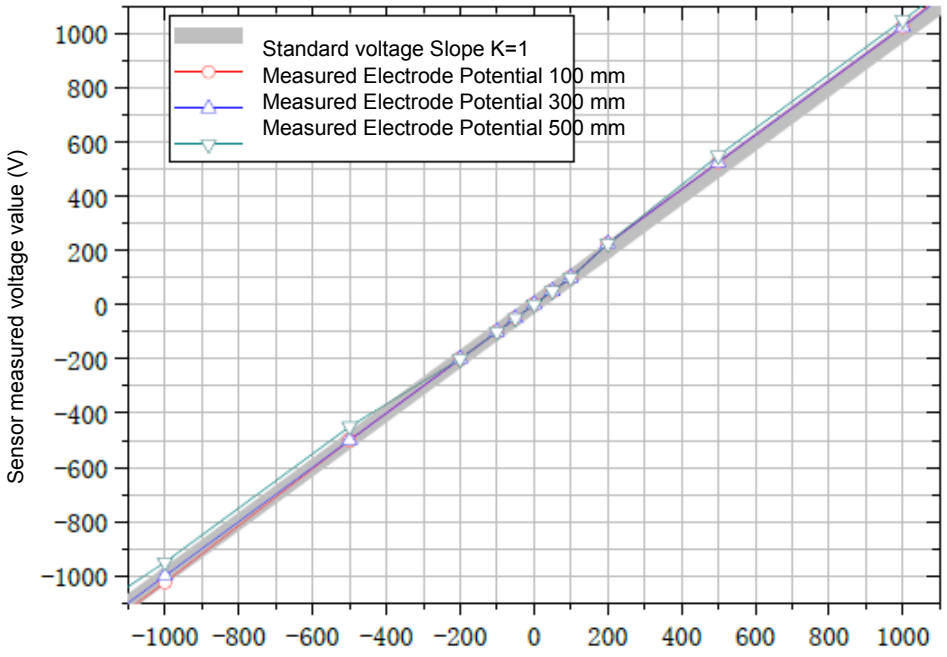


Figure 10-2 Measured Data of
Equilibrium Electrode Potential

◆ Horizontal Test between Sensor and Standard Plate Electrode

✧ Figure 11 shows the test data at different horizontal test distances under the conditions of a vertical test distance of 500 mm, standard plate electrodes of 600 mm × 600 mm stainless steel electrodes, and taking the center position of the calibration plate as the coordinate origin of the sensor.

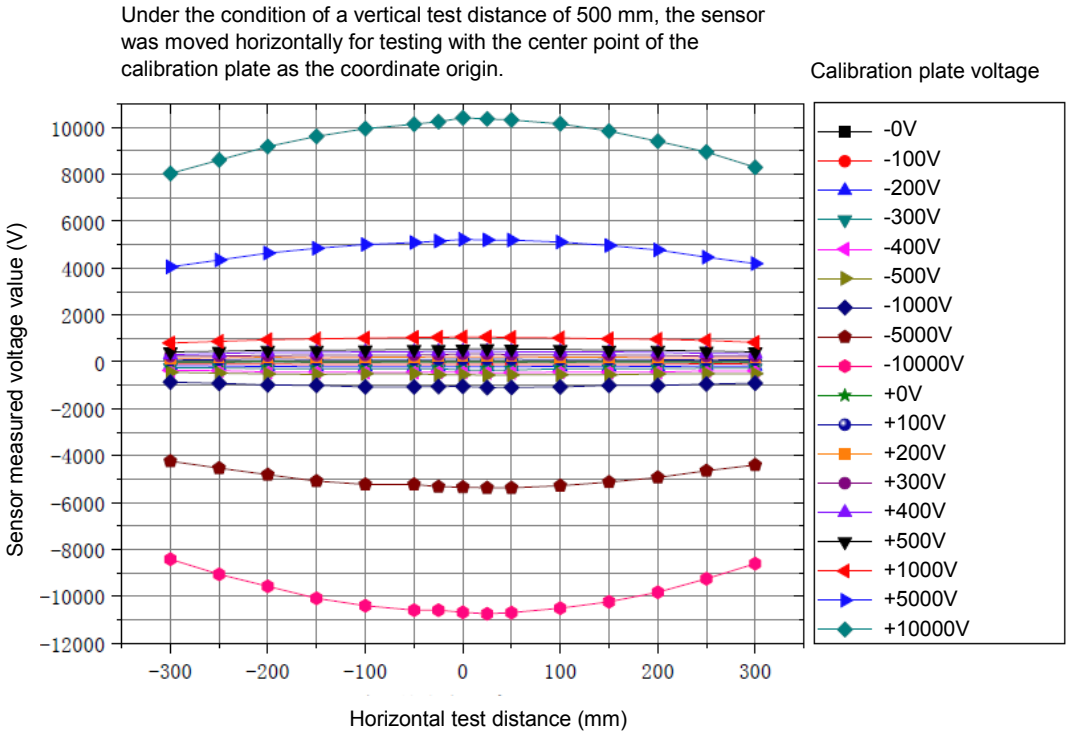


Figure 11-1

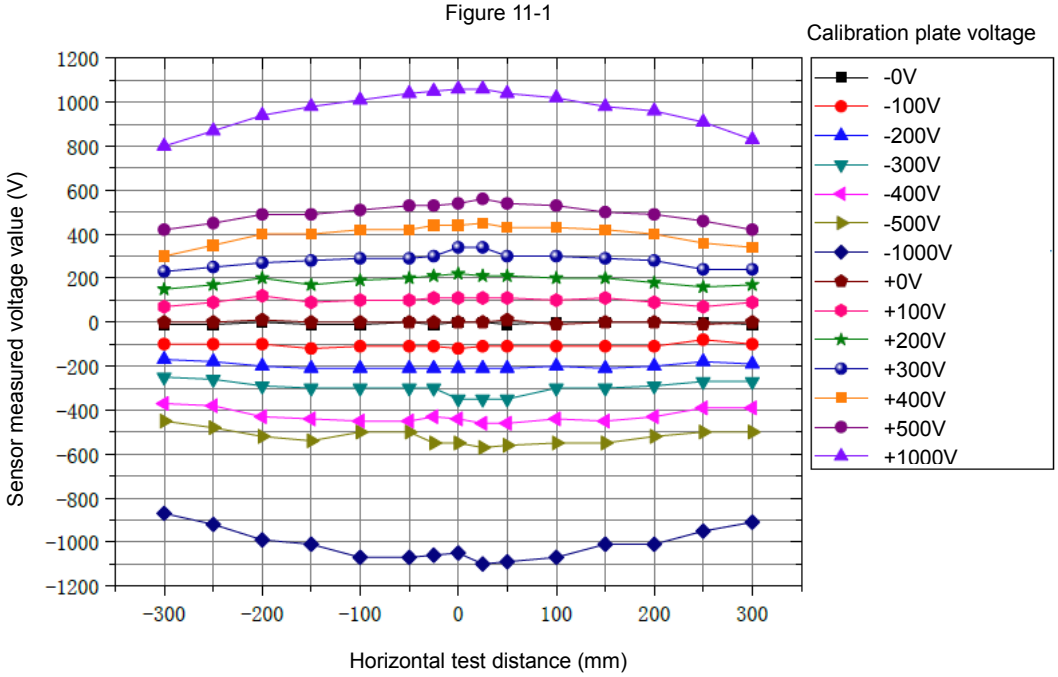


Figure 11-2

From the above two horizontal test figures, it can be seen that for the 600×600 mm calibration plate, at a vertical test distance of 500 mm, the measurement error of the sensor can be kept within 10% within the horizontal distance range of -200 mm ≤ X ≤ 200 mm.

✧ Figure 12 shows the test data at different horizontal test distances under the conditions of a vertical test distance of 300 mm, standard plate electrodes of 600 mm × 600 mm stainless steel electrodes, and taking the center position of the calibration plate as the coordinate origin of the sensor.

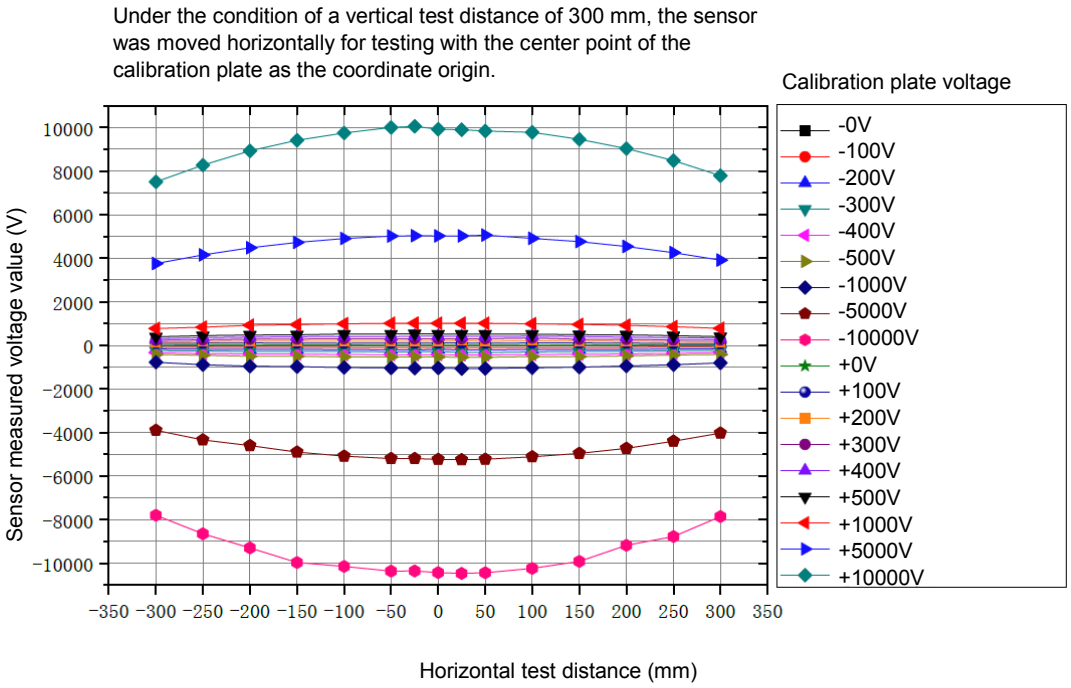


Figure 12-1

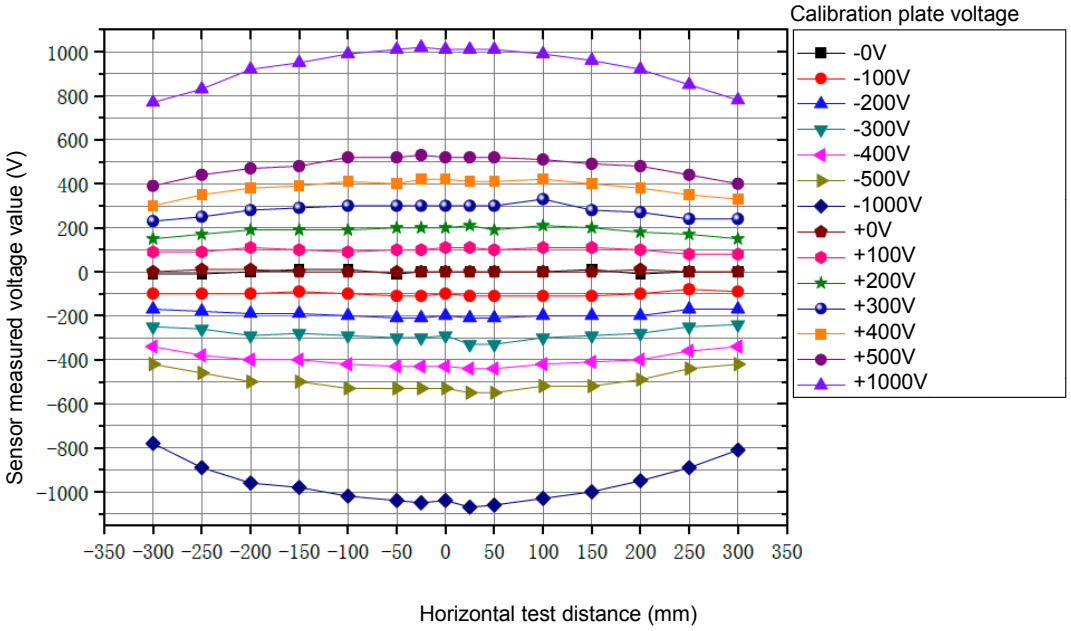


Figure 12-2

From the above two horizontal test figures, it can be seen that for the 600×600 mm calibration plate, at a vertical test distance of 300 mm, the measurement error of the sensor can be kept within 10% within the horizontal distance range of -200 mm ≤ X ≤ 200 mm.

✧ Figure 13 shows the test data at different horizontal test distances under the conditions of a vertical test distance of 100 mm, standard plate electrodes of 600 mm × 600 mm stainless steel electrodes, and taking the center position of the calibration plate as the coordinate origin of the sensor.

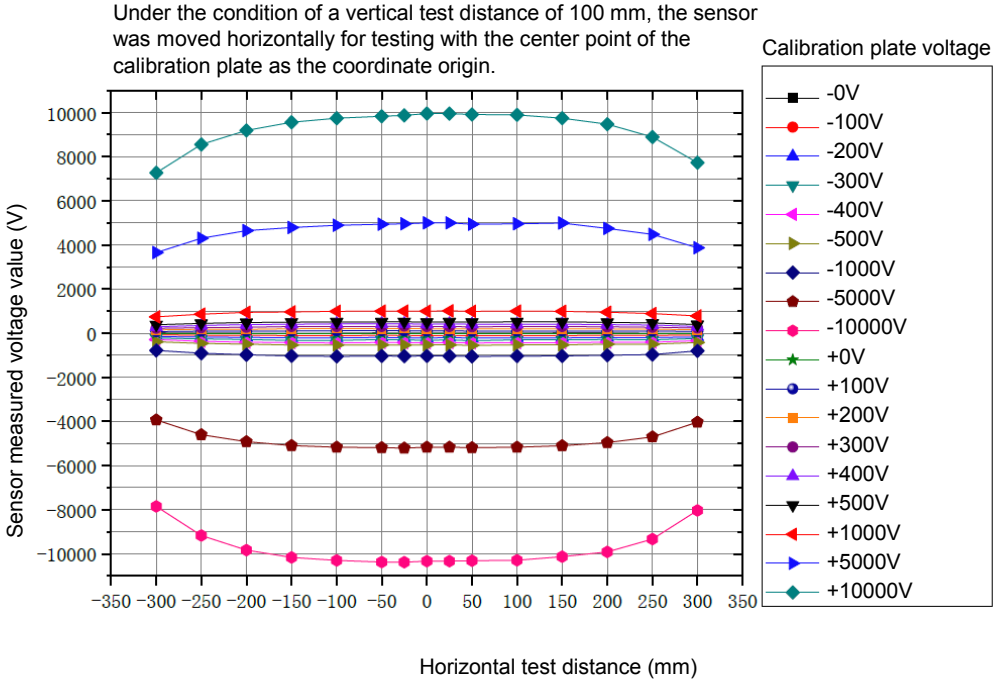


Figure 13-1

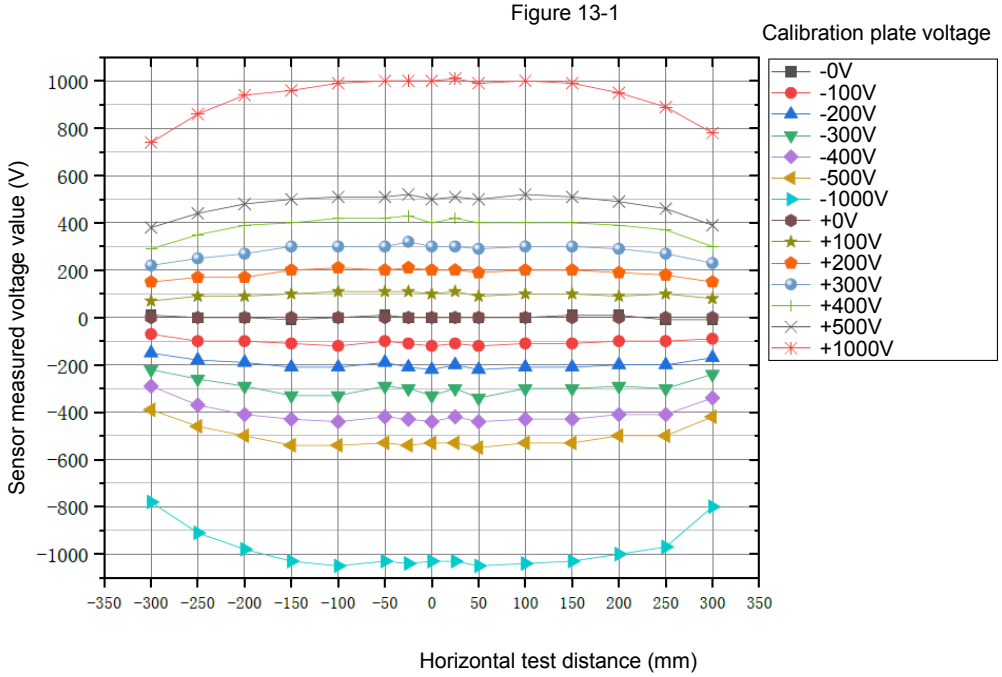
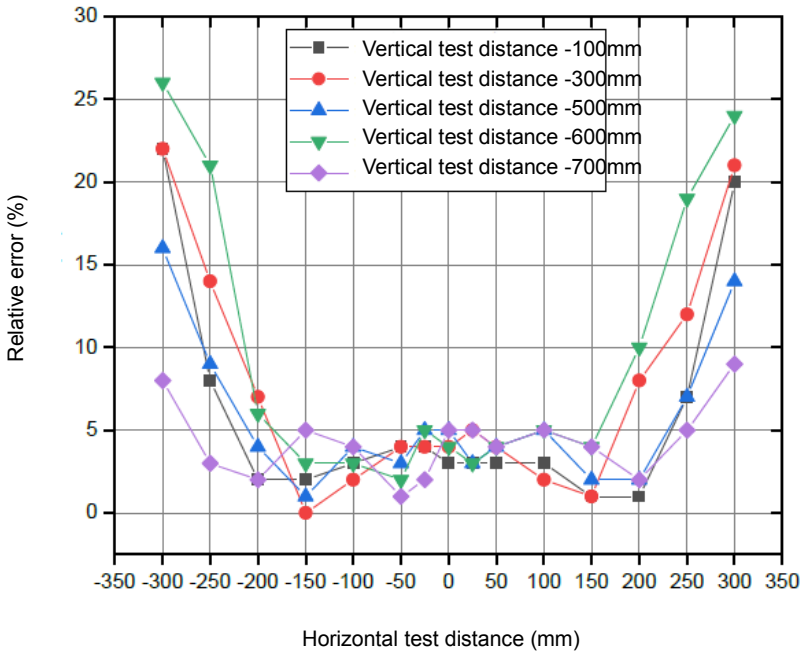


Figure 13-2

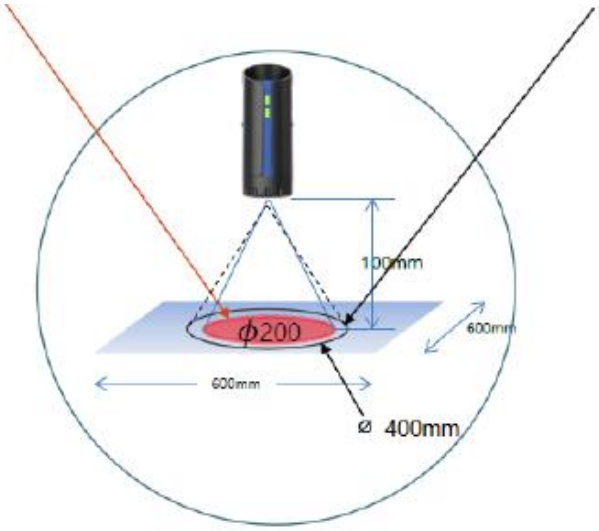
From the above two horizontal test figures, it can be seen that for the 600×600 mm calibration plate, at a vertical test distance of 100 mm, the measurement error of the sensor can be kept within 10% within the horizontal distance range of -200 mm ≤ X ≤ 200 mm.

✧ Relative error of horizontal sensor detection. When an electrostatic sensor is installed and used, if it is not positioned at the center of the object surface, measurement errors as shown in the following figure will occur:



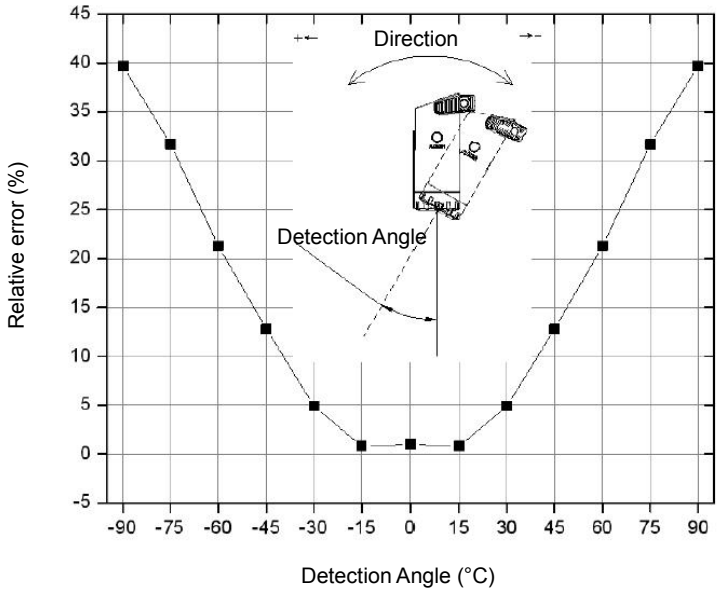
The error is within 5% within a diameter of 200 mm.

The error is within 10% within a diameter of 400 mm.



◆ Relative error of sensor detection angle

✧ When an electrostatic sensor is installed and used, if it is not perpendicular to the surface of the charged object, measurement errors as shown in the following figure will occur:



✧ That is: when the installation angle < 30°, the relative error ≤ 5%.

8. Operation and Precautions

◆ Operation Instructions

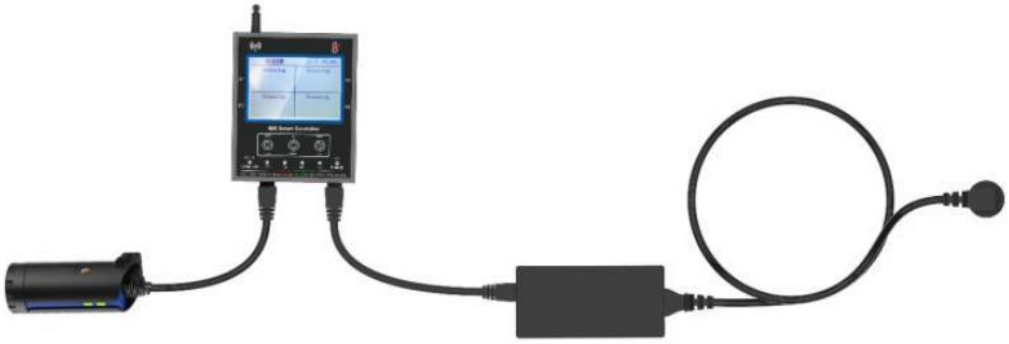
When in use, the plane of the electrostatic detection window of the sensor should be parallel to the surface of the measured object. Select the detection distance (i.e., the standard detection distances specified above: 5mm, 10mm, 25mm, 50mm, 100mm, 150mm, 200mm, 250mm, 300mm, 350mm, 400mm, 450mm, 500mm, 550mm, 600mm, 700mm) and detection gear according to the electrostatic quantity of the charged object and the use environment; the detection data displayed by the terminal at this time is the most accurate.

◆ Online Connection Method

✧ (The monitoring terminal, integrated power supply and communication software need to be purchased separately. For the complete online connection method, refer to the User Manual of System Monitoring Terminal and System Integrated Power Supply.)

✧ The network ports of the power output of the 24V power adapter, the network port of the monitoring terminal and the network port of the electrostatic sensor are both power ports and communication ports, and the network ports on the three devices are universal.

a) Connect to the monitoring terminal



b) Connect to PC

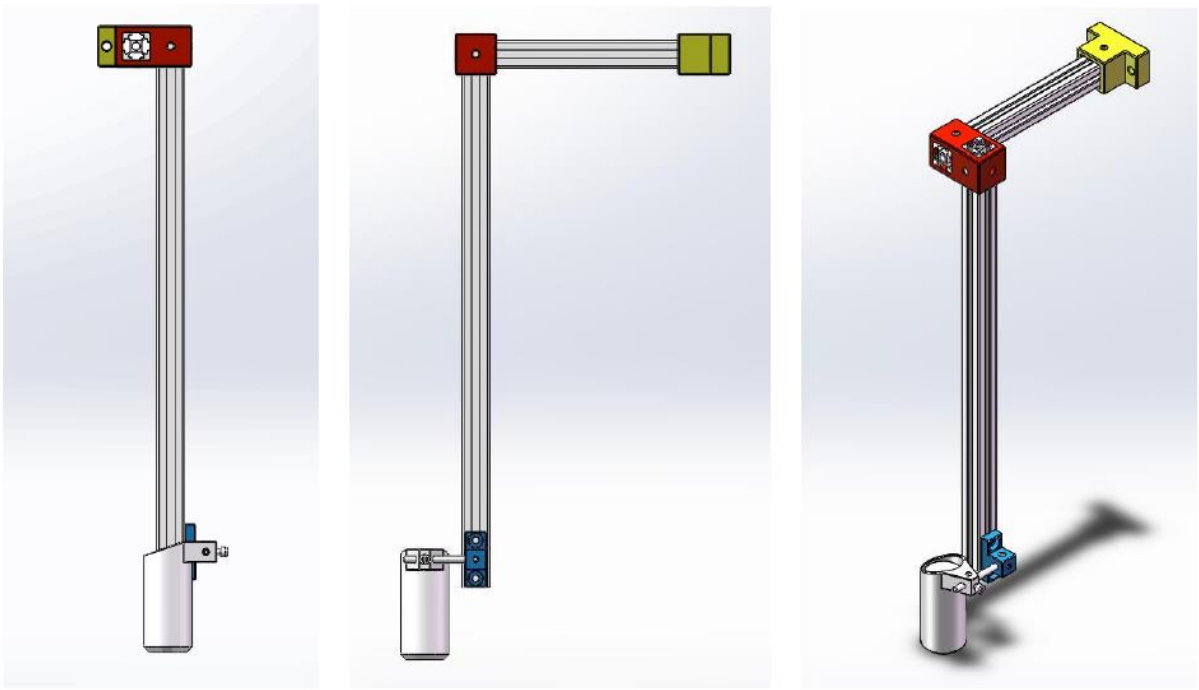
◆ Operation Steps (See the Attached Drawings Below)

a) According to the electrostatic quantity of the charged object and the use environment, use a Phillips screwdriver with a diameter of 3mm to turn the circular DIP switch to select the test distance.
b) According to the electrostatic quantity of the charged object and the use environment, toggle the strip DIP switch to select the detection gear.
c) Set the electrostatic safety (alarm) threshold through the remote control or monitoring software according to the electrostatic voltage tolerance of the protected product.

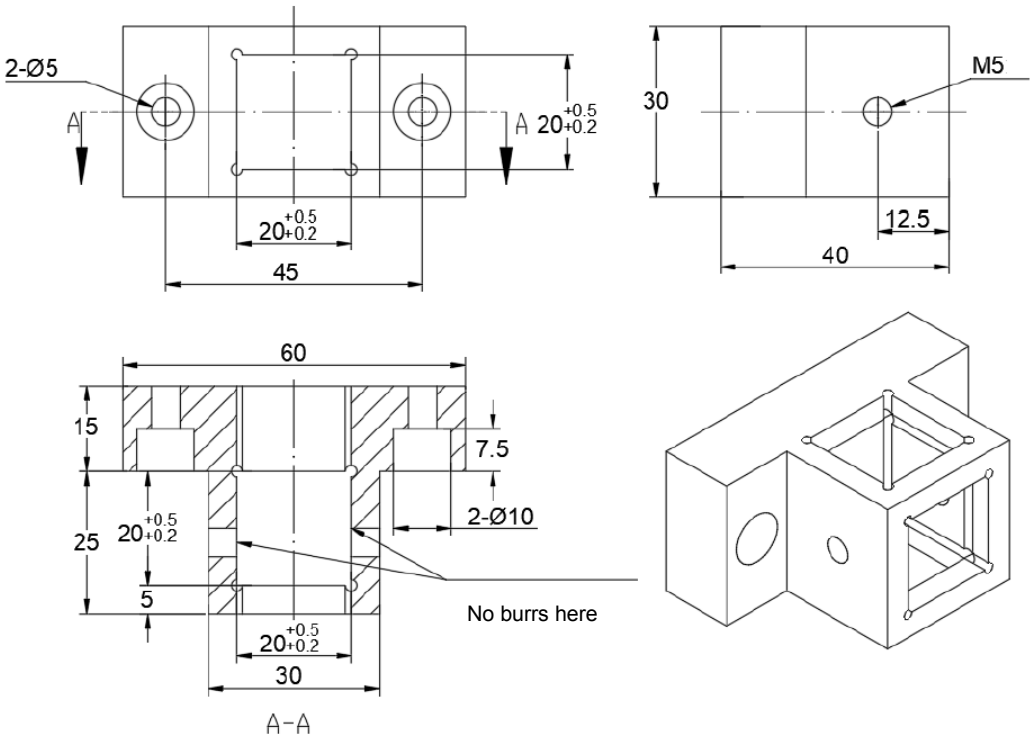
Note: When the detected electrostatic voltage value is within the set electrostatic threshold, the threshold alarm indicator is green; when it exceeds the set threshold, it is red.

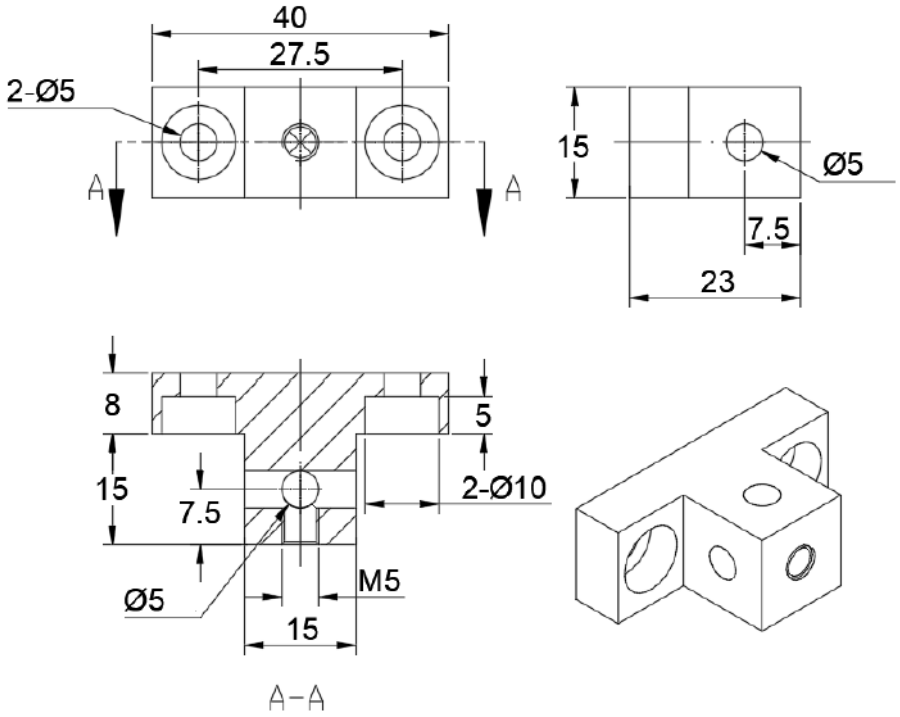
d) Set the device address by turning the circular DIP switch with a Phillips screwdriver with a diameter of 3mm according to the production station.

◆ Installation Diagram:

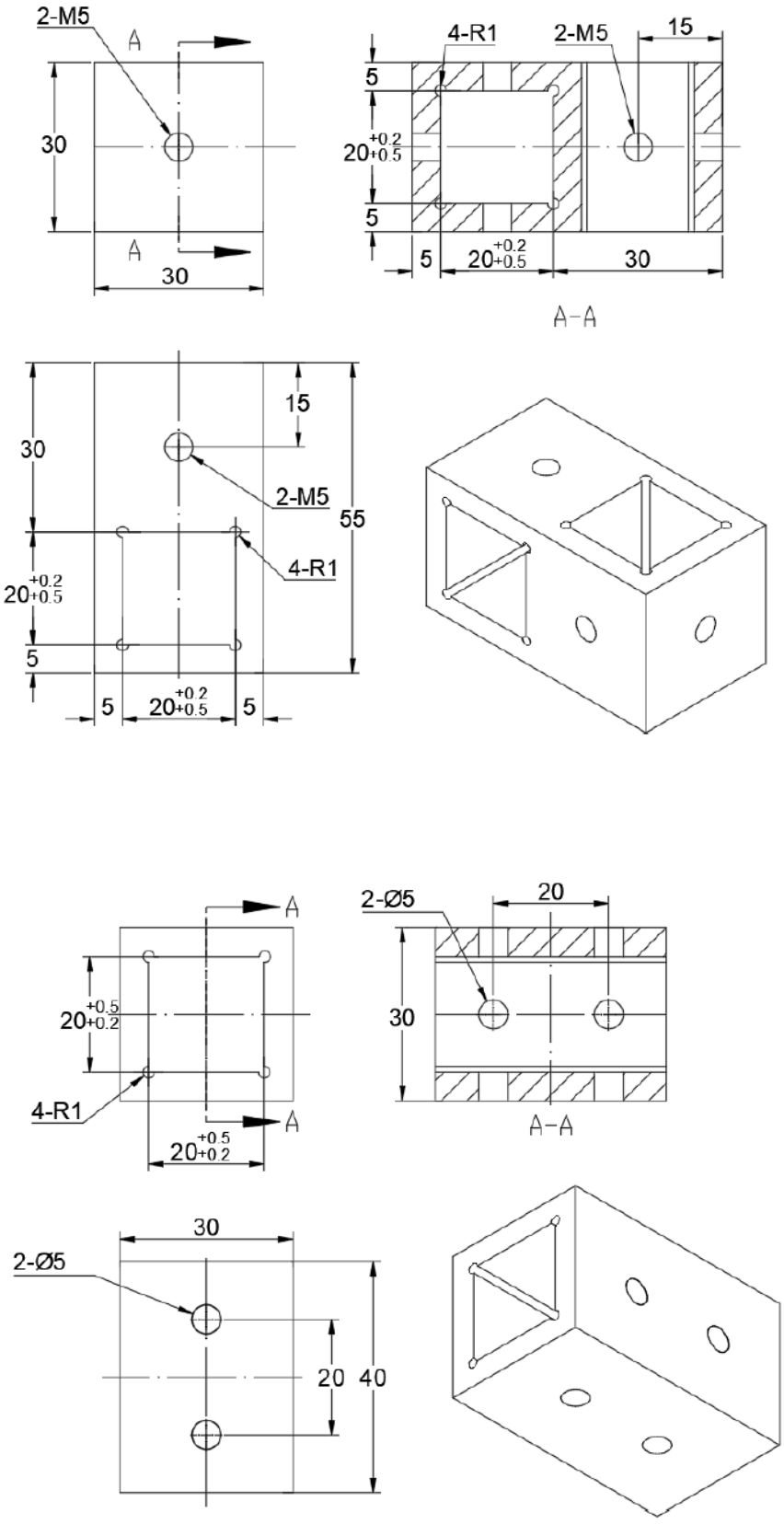


✧ Structure diagram of each installation fixture:

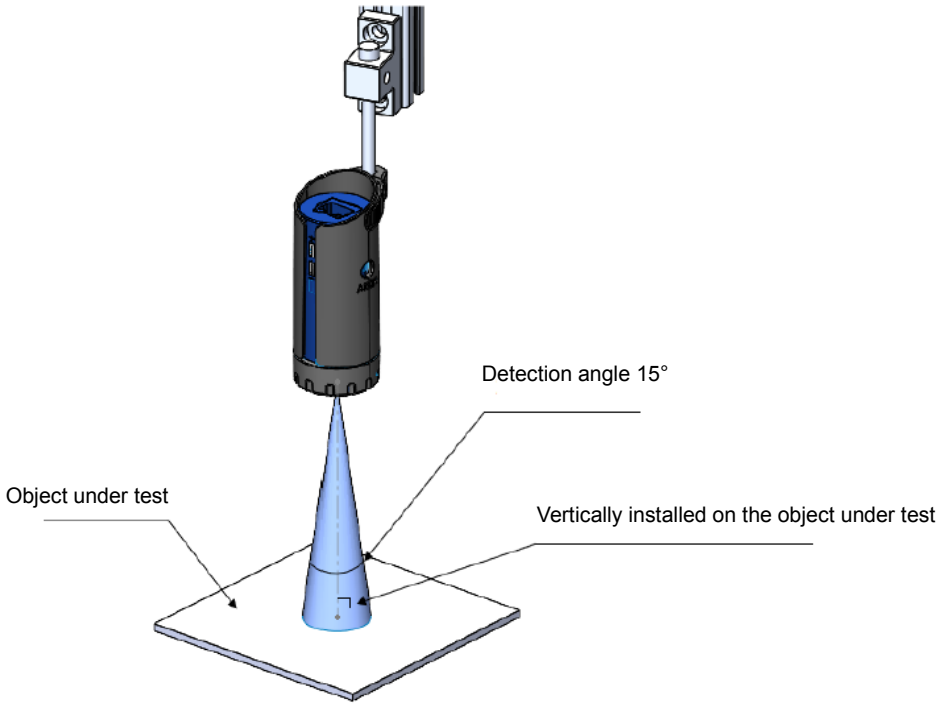




✧ Structure Diagram of Installation Rod Connector:



✧ Structure Diagram of Installation Rod Connector:



◆ **Installation and Use Precautions**

✧ **General Precautions:**

➢ Please read the user manual carefully before use to use the device correctly.

➢ Before powering on the product, check the specifications of the equipped power supply; any power supply that does not meet the specifications will damage or even cause malfunctions to the product.

➢ Operate within the specified ambient temperature (0~50℃).

➢ During testing, keep a distance of more than 1m between the person and the product to avoid the influence of human static electricity on the test; the tester must wear anti-static clothing, anti-static cap and anti-static shoes.

➢ The insertion depth of the φ5 diameter stainless steel mounting rod shall not exceed the position of the detection gear switch on the back of the sensor.

➢ The surface of the φ5 diameter stainless steel mounting rod shall have no insulating coating.

➢ Do not touch the electrostatic detection head during detection.

➢ Ensure that the sensor window is not contaminated by particles and dust.

➢ No obstacles are allowed between the sensor and the detected object, otherwise the accuracy of the detection result will be affected.

➢ No electrical equipment that may affect the sensor is allowed within the sensor's detection distance range, otherwise internal equipment and chips may malfunction or be damaged.

➢ To accurately measure a charged object, the plane of the sensor's detection window must be parallel to the surface of the measured object.

➢ Use the product 5 seconds after power connection; otherwise, the data display may be unstable sometimes.

- When the charged object is smaller than the calibration plate, the measured value will be smaller than the actual electrostatic value of the charged object.
- When the charged object is larger than the calibration plate, the measured value will be larger than the actual electrostatic value of the charged object.
- Do not perform zero clearing in a charged state or during electrostatic measurement (excluding electrostatic calibration); if zero clearing is performed during electrostatic testing, the displayed electrostatic value may be zero.
- Do not install near high-voltage equipment such as high-voltage power supplies, electrostatic generators, ion generators and static eliminators; high voltage will affect the performance and detection accuracy of the sensor.
- Fasten the sensor when installing in a high-vibration area; otherwise, data errors may occur.
- Check the product power cord/communication cable regularly; replace it immediately if damaged, otherwise it may easily cause electric leakage, poor communication, abnormal operation and other problems.
- Mechanical shocks such as falling and collision of the product may lead to malfunctions.

✧ **Warning Notes:**

- The whole set of equipment must be reliably grounded during use, otherwise it may easily cause abnormal operation or even damage of the sensor.
- It is strictly forbidden to use this equipment in flammable and explosive environments.
- It is strictly forbidden to touch the electrostatic detection window with sharp objects.
- It is strictly forbidden for the product to come into contact with water stains, otherwise abnormalities may occur, leading to electric shock or fire.
- Exceeding the detection range may cause product malfunctions.
- Turn off the power when inspecting or replacing the product, otherwise electric shock or fire may occur.
- This detector is a precision device, do not disassemble it.
- Unauthorized disassembly of the product is strictly prohibited; internal maintenance and repair must be carried out by professional personnel.
- The product is specially designed for detecting static electricity on the surface of objects; it is strictly forbidden to use it for other purposes. Any abnormal use may cause machine malfunctions, electric shock, fire and other hidden dangers.

◆ **Fault Analysis and Troubleshooting**

No.	Fault Phenomenon	Possible Causes	Solutions
1	Power port indicator not on	Poor contact of power cord Incorrect power cord connection Mismatched power supply	Check that the power cord is intact and connected firmly Check that the power cord is wired correctly Check the power supply specifications and model (INPUT:100-240VAC 50/60Hz; OUTPUT:24VDC 2000mA)
2	Abnormal measured electrostatic voltage value or excessive error	Poor grounding of the sensor	Abnormal measured electrostatic voltage value or excessive error
3	Threshold alarm indicator green light not on	-	Return to the factory for repair
4	Threshold alarm indicator red light not on	The set electrostatic threshold is too large or exceeds the range	Determine the electrostatic alarm threshold reasonably according to the use environment and electrostatic control requirements with reference to the gear range setting table
5	Peculiar smell from the product	Burned components	Return to the factory for repair
6	For other unlisted problems or problems that cannot be solved through the above solutions - Contact the manufacturer or seller		

9. Maintenance

- ◆ To ensure the good performance of the product, store the device in a dark and dry place when not in use, and do not place heavy objects on it.
- ◆ This device is a precision detector, do not subject it to strong vibration during use.

10. After-sales Service

- ◆ The BFN-1003-L Electrostatic Sensor has undergone rigorous testing, inspection and aging treatment before leaving the factory, and its performance fully meets the relevant indicators marked in the user manual. Horb Technology makes the following commitments to users: within one year from the date of purchase, we will repair or replace any defective parts inspected by our company free of charge. However, this commitment does not apply to the following situations:

a) Misuse of the device;
b) Damage caused by negligence or accident during use;
c) Unauthorized modification, disassembly or repair by non-authorized service departments of Horb Technology;
d) Malfunctions caused by external factors such as fire, earthquake, flood and abnormal voltage.

- Except for the repair or replacement of parts within the scope of this regulation, Horb Technology shall not bear any other related obligations and liabilities of the product users.

11. Packaging Accessories

- Warranty Card × 1
- User Manual × 1
- Power Adapter × 1
- 2.5m Power Network Cable × 1
- National Standard Three-phase Power Cord × 1
- Infrared Remote Control × 1
- M4×8 Round Head Knurled Phillips Thumb Adjustment Screw × 1
- DIP Switch Rotating Screwdriver Set × 1 (Including 1 flathead screwdriver, 2 Phillips screwdrivers)
- Installation Parts