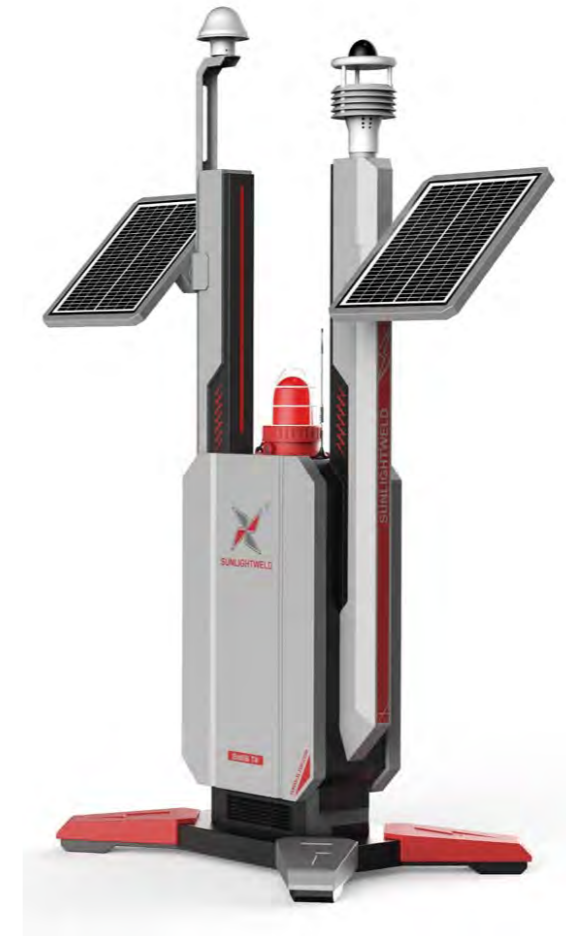




SUNLIGHTWELD



SP 2.0 Lightning Warning System User Manual

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SUNLIGHTWELD

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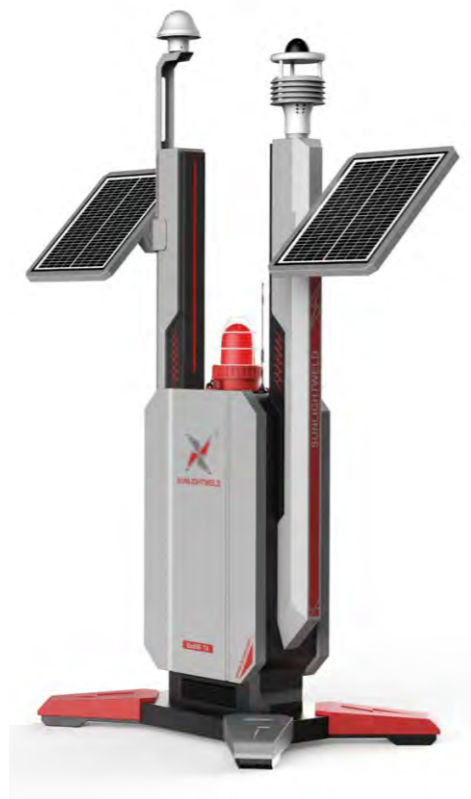
1. Product Introduction

1.1 Overview

Thanks for purchasing our SP2.0 Lightning Warning System. This user manual will introduce product information, installation&maintenance, instructions for use, etc., to help you master the application method of this product as soon as possible. If you have any questions about the contents of this manual, please contact Sunlight company and we will try our best to solve your problems.

SP2.0 Lightning Warning System, developed with advanced MEMS technology by using MEMS ground atmospheric electric field sensor as a data acquisition module, is an international pioneering product.

It has no motor and other easy-to-wear and movable mechanical parts, and has better stability and higher reliability than traditional field-grinding sensors. By measuring the ground atmospheric electric field and its changes, the product sends out an early warning signals in advance before lightning comes, protecting buildings and personnel from lightning damage. It has the advantages of low power consumption, convenient installation, easy integration and network detection. Mainly for the application requirements of atmospheric electric field detection in the fields of aerospace, national defense, power grid, communications, railway, petroleum and petrochemical, meteorology and scientific research.



The appearance of SP2.0 Lightning Warning System

1.2 Product Application Range

Ensure the safety conditions for the launch of satellites, missiles and other aircraft.

Lightning protection and early warning for automatic weather stations, power grids, petrochemicals (large refineries, oil pipelines), transportation (high-speed rail, high-speed trains), airports, field seismic stations, forest fire prevention, housing construction, communication equipment, schools, tourist attractions, and recreational facilities, etc.

Meteorological observation and atmospheric science research, etc.

1.3 Use Environmental Conditions

The system works properly under the following conditions:

- ① Working temperature: $-40^{\circ}\text{C} \sim 85^{\circ}\text{C}$;
- ② Relative humidity: $0 \sim 95\%$ ($+25^{\circ}\text{C}$);
- ③ Atmospheric pressure: $80 \sim 106$ kPa;
- ④ Mechanical environment: no significant vibration and shock occasions, no serious dripping and splashing around, no corrosive gases that damage the insulation.

Recommended installation method:

- ⑤ It is recommended to be installed on a bracket with a height of 1.2 - 1.5m and a diameter of $\phi 45\text{mm}$
- ⑥ Installed in an outdoor open area (the measured data in the indoor environment is meaningless).
- ⑦ The environment should be as far as possible to avoid easy contact between humans and animals.

The following environments should be avoided as much as possible:

- ⑧ Smoke or dust environment
- ⑨ Under high-voltage lines, close to metal objects or mast structures;
- ⑩ Under trees, external air conditioning or water supply and drainage pipes, exhaust fans, air conditioning chilled water towers;
- ⑪ Rapidly changing environments, such as construction sites or areas with heavy vehicle traffic.

2. Technical specifications

2.1 Product Size

Figure 2-1 is the overall diagram of SP 2.0 Lightning Warning System and its dimensions (unit: mm)



Figure 2-1 Dimensions of SP 2.0 Lightning Warning System

2.2 Technical Parameters

Based on intelligence and security considerations, the software and hardware system of SP2.0 Lightning Warning System can be applied in most environment, even in harsh environment or in remote locations. Detailed technical indicators and parameters are shown in Table 2.1:

Technical Parameter	Technical Indicators
Time in Advance for Warning	≥10min
Early Warning Accuracy	≥80%
Detection Radius	10-15km
Resolution	20V/m
Measuring Range	-50kV/m ~ +50kV/m
Precision	Better than 5%
Protection	IP65
Explosionproof	Ex ia IIC T6GA
Anti-corrosion	WF2
Power Supply	Solar Power Mains Power 220V (optional)
Alert Level	Level 1—Level 3
Communication Mode for Data	4G Full Netcom, RS232, RS485
Lifespan of Detection Module	≥3years
Working Environment Temperature	-40~85°C
Working Environment Humidity	20~90%RH
Operating Voltage	12V
Five Elements of Meteorology	Wind speed, direction, temperature, humidity, atmospheric pressure

Table 2.1 Technical Parameters

2.3 Product Features and Advantages

Equipment Features

- ① Solar charging or mains power supply two ways automatically switch, to ensure that the equipment 24 hours online;
- ② IP65 protection grade, WF2 anti-corrosion grade, Ex IA IIC T6 GA explosion-proof grade;
- ③ Yellow, orange and red three level audible and visual alarm:
Alarm Level 1 : 1.5kV/M (abnormal electric field)
Alarm Level 2 : 2.5kV/M (thunderstorm forming)
Alarm Level 3 : 3.5kV/M (thunderstorm is imminent)
- ④ The linkage air-termination device can be automatically raised and lowered under online/offline conditions (optional)

The lifting system automatically raised when lightning warning signal is triggered or system alarms, take the initiative to pick up lightning when lightning strikes, and the lifting system will automatically descend to a safe height if it falls below the Alarm Level 1 for ten consecutive minutes, in addition, the system also supports manual arming and disarming.

product Advantages

- High-sensitivity, low-power** electric field-sensitive chip technology
- Optimized lightning warning algorithm**
no motor and other easy-to-wear mechanical parts, **low power consumption, easy integration and network detection**, especially suitable for hazardous chemical industry
adapt to various harsh environments
Multiple power supply modes, suitable for various occasions
- Easy and convenient installation**
Single-point and multi-point networking for early warning
Abundant extension equipment

3. System Principle and Composition

3.1 Composition Structure

SP2.0 Lightning Warning System is mainly composed of MEMS ground atmospheric electric field sensor, early warning host, power supply unit, customer terminal, software and weather sensor etc., The sensor acts as a collection module to detect atmospheric electric field data and transmit it to early warning host; After processing the data, The early warning host transmits it to software platform and other software servers for display ; When lightning comes, the software server triggers audible and visual alarm to remind user taking lightning protection measures,

meantime the hardware device also gives audible and visual alarm and sends a control signal to the lightning arrester to automatically raise the pole for receiving flash; The above mentioned are the main components function and implementation methods of the lightning warning system.

The structure of lightning warning system is shown in Figure 3-1:

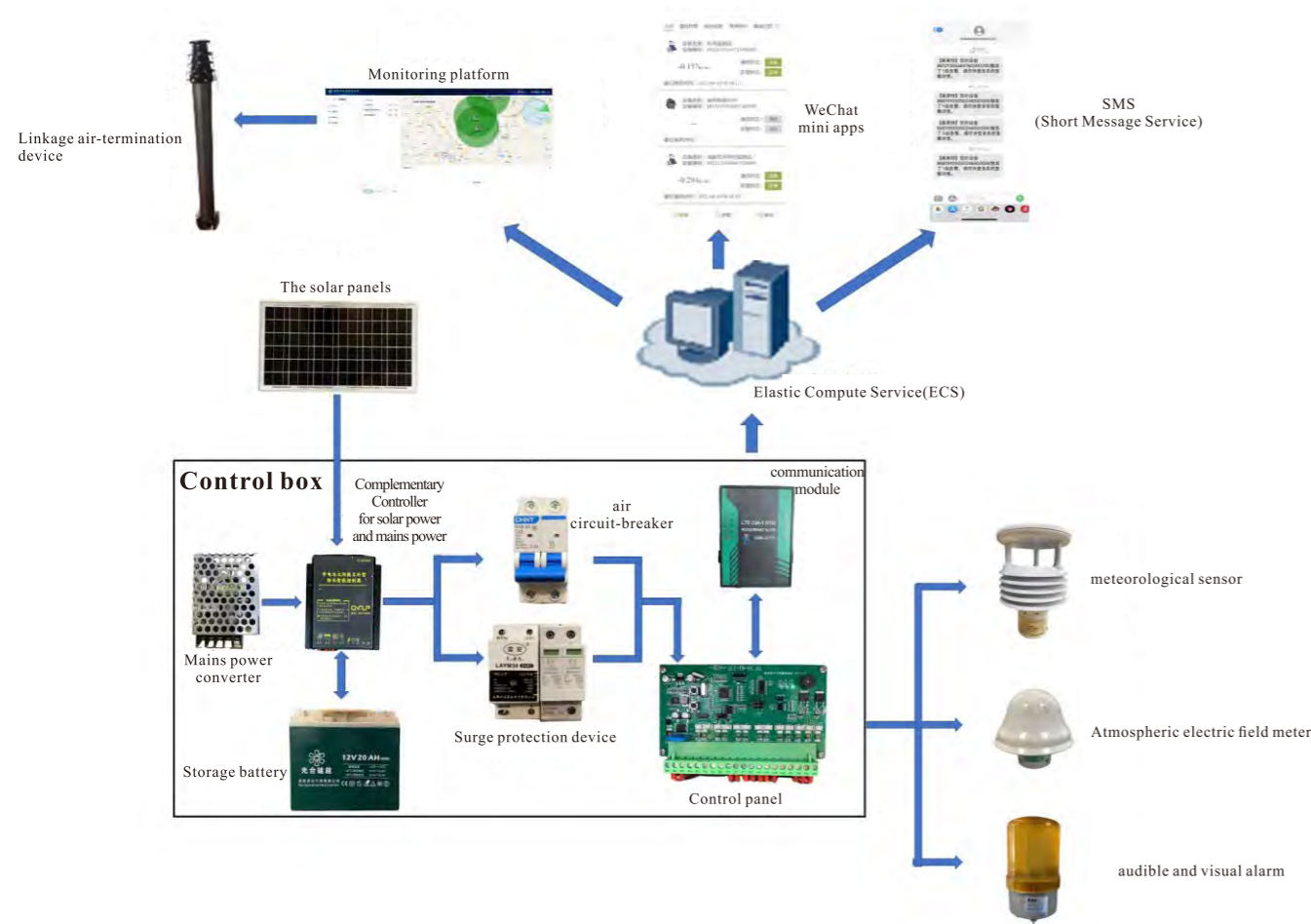


Figure 3-1 Structure of lightning warning system

3.2 Principle of Function Implementation

SP2.0 lightning early warning system takes MEMS electric field sensor as the detection mechanism, and uses electric field differential combined with threshold value to optimize the lightning early warning algorithm which can effectively avoid the false alarm problem caused by human interference (strong electrostatic objects passing by in a short time), and further improve early warning accuracy. By using solar power supply, electric field detection data is corrected through the data acquisition and analysis module in the controller and analyzed based on the optimization of lightning warning algorithm whether trigger an alarm or not.

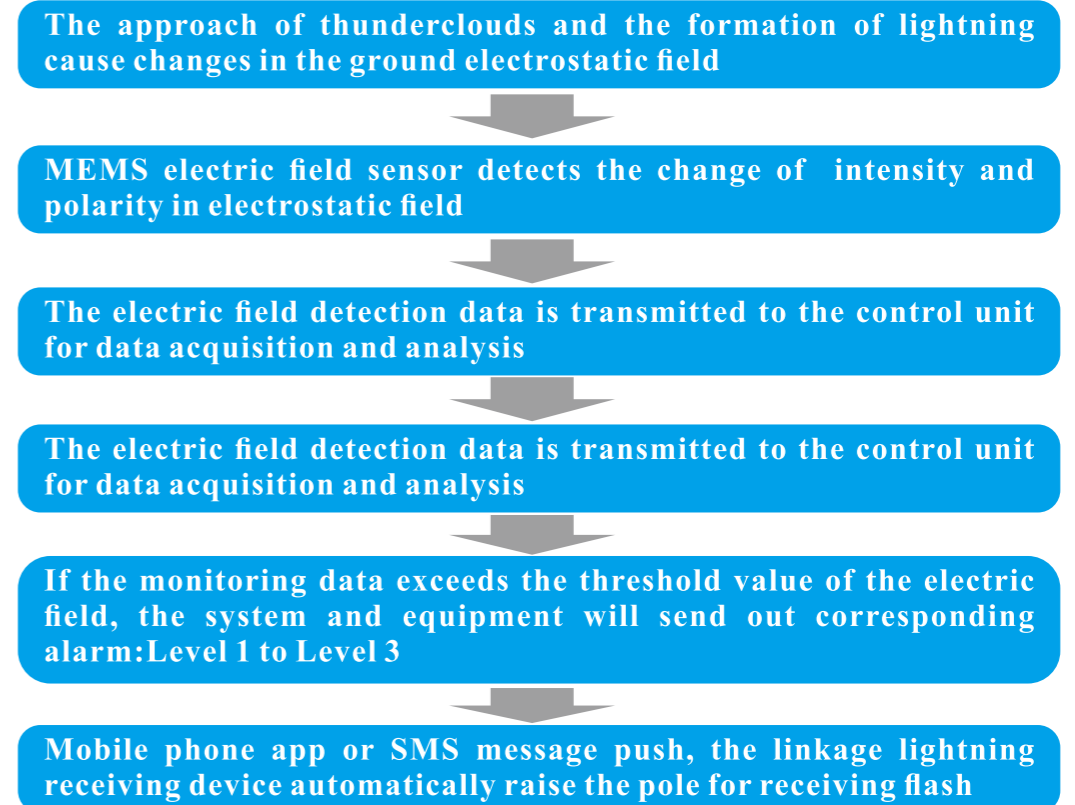


Figure 3-2 Schematic flow chart of lightning warning system for data acquisition

3.3 Function Introduction

The SP2.0 lightning warning system uses MEMS atmospheric electric field sensors to detect and analyze thunderclouds by monitoring intensity and polarity changes of the ground electric field. At any time, the system can detect thunderclouds approaching within a radius of 20km according to the changes of the environmental electrostatic field, sending out lightning warning signals about 5-30 minutes before lightning strikes, so as to take appropriate lightning protection measures in time. The lightning warning system can timely and accurately provide local lightning warning information and proactively prevent lightning disasters.

The hardware part of the lightning warning system includes atmospheric electric field sensor, early warning host, power supply module, audible and visual alarm, weather sensor (such as temperature&humidity sensor, wind&wind direction sensor, atmospheric pressure sensor, etc.) and fixed brackets. The software part has various service types such as PC terminal, local server, mobile terminal, and data interface. The main functions are as follows:

1. Real-time monitoring of atmospheric electric field;
2. Three-level lightning warning function: yellow, orange and red;
3. Real-time atmospheric electric field data display and trend analysis;
4. Historical data query, analysis and export;
5. Equipment self-check and low-power alarm;
6. The warning information is displayed on the mobile terminal synchronously
7. Support multi-directional warning prompt: SMS, platform, audible and visual alarms, etc;
8. Support data monitoring for ambient temperature and humidity, wind strength and wind direction.

4.Installation Instructions

The MEMS ground atmospheric electric field sensor must be installed in an open outdoor area that is not covered. During installation, the following conditions must be avoided:

- 1.Smokes or dust or Objects that can produce smoke and dust;
- 2.Under high-voltage lines, close to metal objects or mast structures;
- 3.Iron chain fence, sharp metal;
- 4.Too close to leafy trees;
5. External air conditioning , exhaust fans, air conditioning chilled water towers;
- 6.Rapidly changing environments, such as construction sites
- 7.Areas with heavy vehicle traffic;
- 8.Probe Angle shall not be less than 120°

It is recommended to install the equipment by following the three procedures:

- 1.Fix the base and bracket
- 2.System configuration and installation
- 3.Check before trial operation.

4.1 Fixing the Base and Bracket

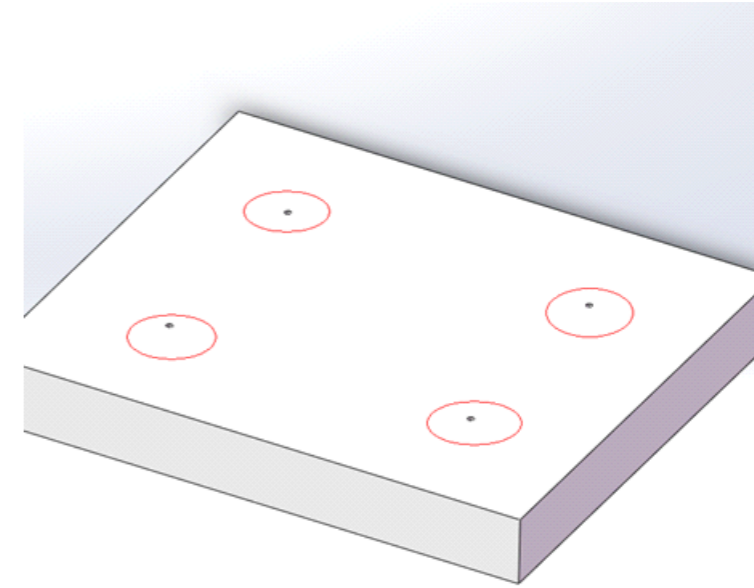
Installation diagram:

Materials:

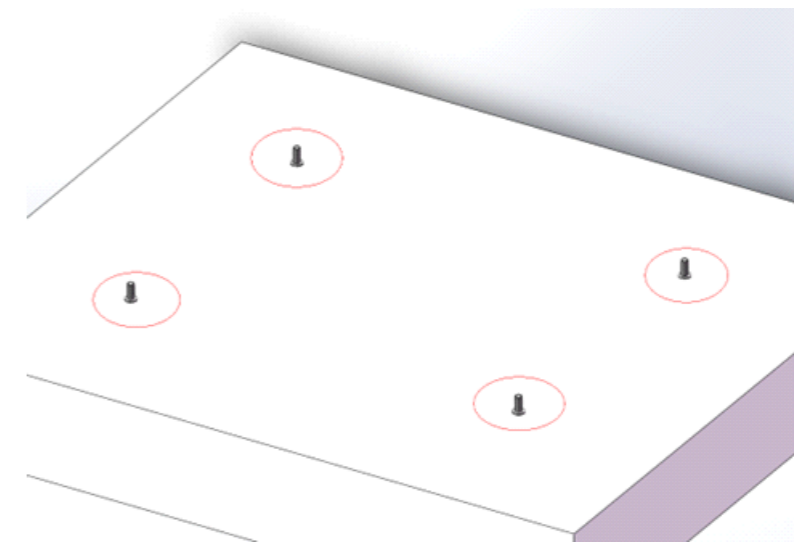
Materials	Specification and model	Quantity	Notes
StainlessSteel ExpansionBolt	M12*100	4	Gasketand Nut attached
ImpactDrill		1	
ImpactDrill Bit	16mm	1	
SocketWrench	18	1	
SocketWrench	13	1	
StainlessSteel Hexagon SocketBolt	M8*45	6	Gasket
InnerHexagonSpanner	S6	1	
Mark Pen		1	
StainlessSteel Hexagon SocketBolt	M6*16	16	
InnerHexagonSpanner	S5	1	

Table 2.1 Technical Parameters

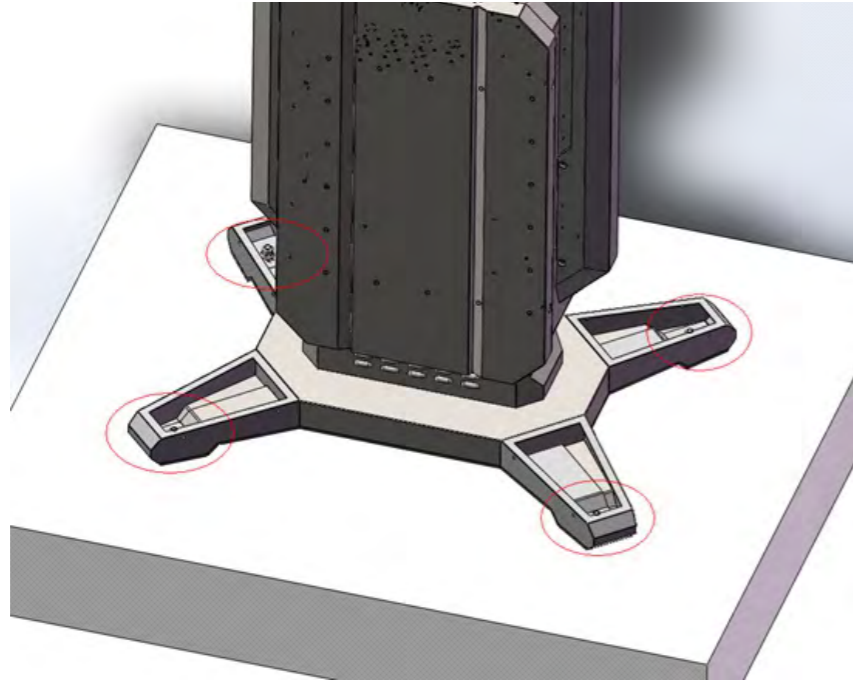
Installation step 1: locate the drilling template or measure the size of the center (790mm x 560mm) at the exact location for installation, and mark the positions where the hole needs to be drilled. Then use an impact drill equipped with a 16mm bit to drill holes with depth of over 80mm



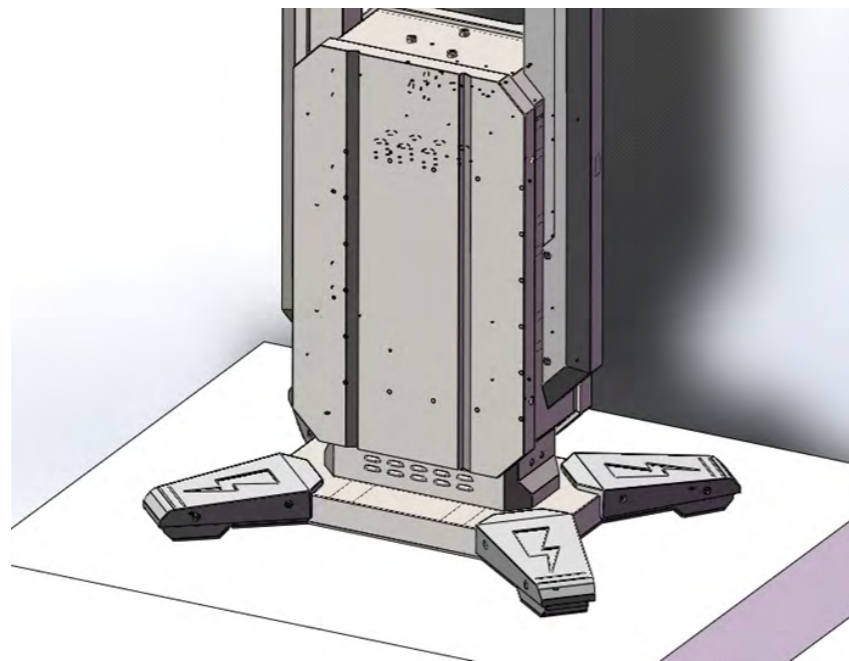
Installation step 2: place the M12 * 100mm expansion bolt in the hole, adjust it until the gasket is level with the ground, screw the nut to ensure that the expansion bolt tightens the hole wall, and then remove the nuts and gasket.



Installation step 3: Align the baseplate mounting hole with the expansion bolt and place them on the ground, use the nuts and gasket removed in the previous step to lock the baseplate on the ground; After locking, put on four decorative covers and tighten the bolts.



tighten the expansion bolts



Tighten the four decorative covers

4.2 System Configuration and Installation

Before the system is installed and used, please ensure that the fixing bracket has been firmly installed and properly connected to each related component: the connecting cable, power supply module and atmospheric electric field meter.

4.3 Inspection Before Commissioning

- Make sure the equipment is fixed and installed securely.
- ② Check whether the power cord or communication line is accurate.
- ③ Check whether the electric field sensor is connected correctly.
- ④ Check whether the software settings related to the system in the control software correspond to the equipment.

5. Software Instructions

5.1 Register & Login

This software system only supports account registration and cancellation by super administrators, and does not support individual account opening. After purchasing the lightning warning system, our company immediately opens a software application account for user. The user can access the domain name <http://www.sltsgs.com/#/login> in any browser, and enter the account number and password to log in. The login interface is as shown in Figure 5-1:

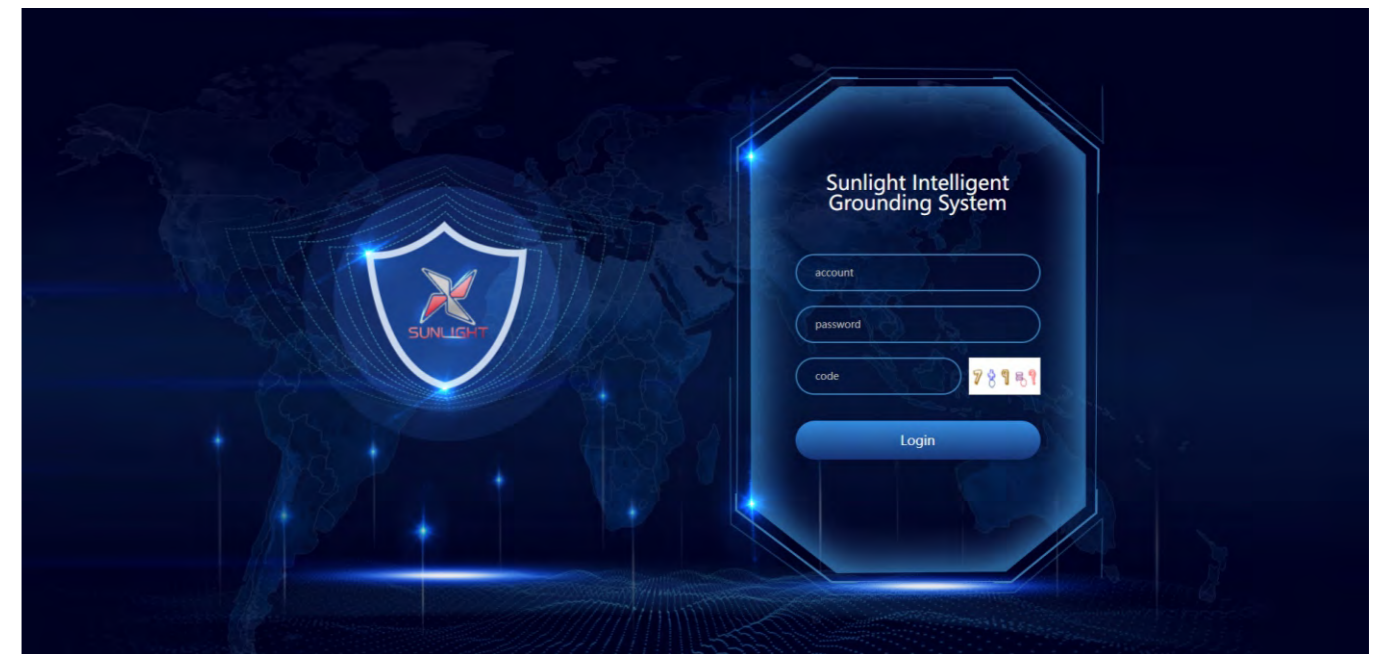


Figure 5-1 login interface

5.2 Management

The monitoring system needs to be configured before use. Enter the service management interface, and its function selection interface is shown in Figure 5-2. Our company will provide technical guidance and training for each user. The user can set up the basic functions of the lightning warning monitoring platform under the on-site guidance or online training .

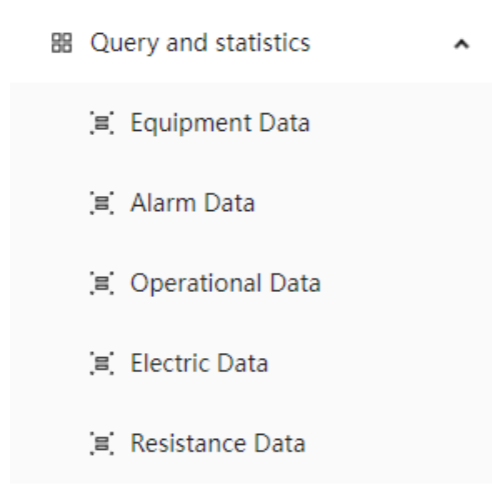


Figure 5-2 service management interface

5.3 Real-time Lightning Monitoring

After setting up monitoring points, users can check the operation status of all monitoring points and lightning warning monitoring status on the platform homepage, as shown in Figure 5-3 and Figure 5-4

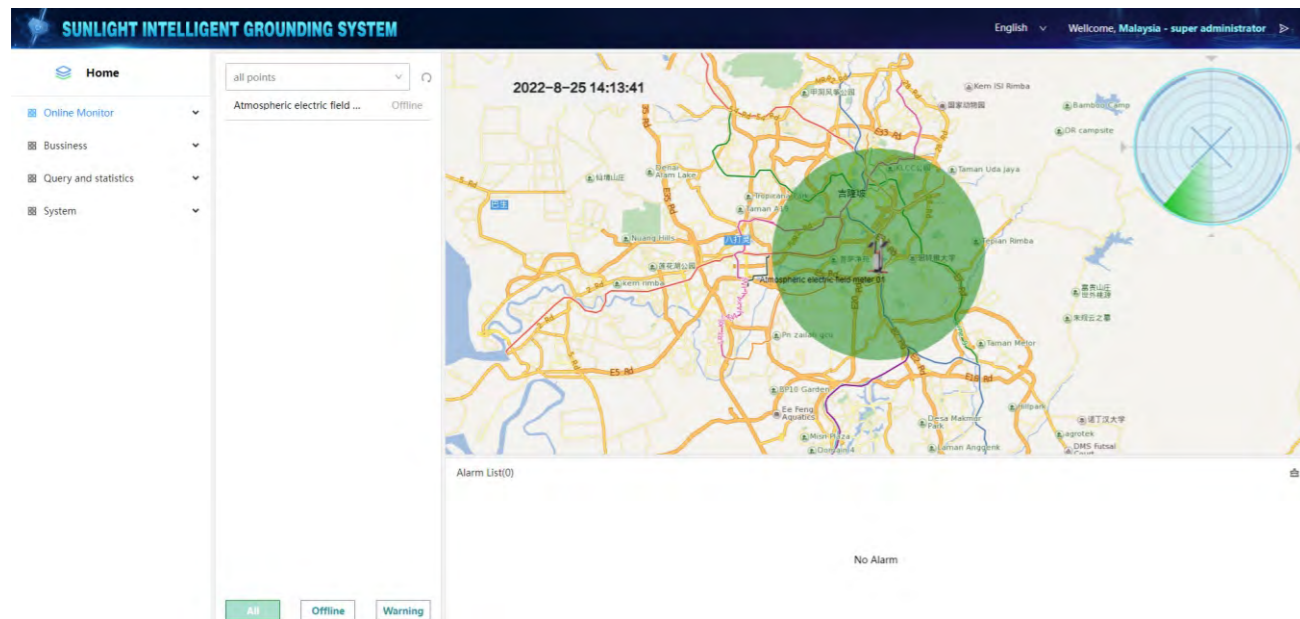


Figure 5-3 platform homepage

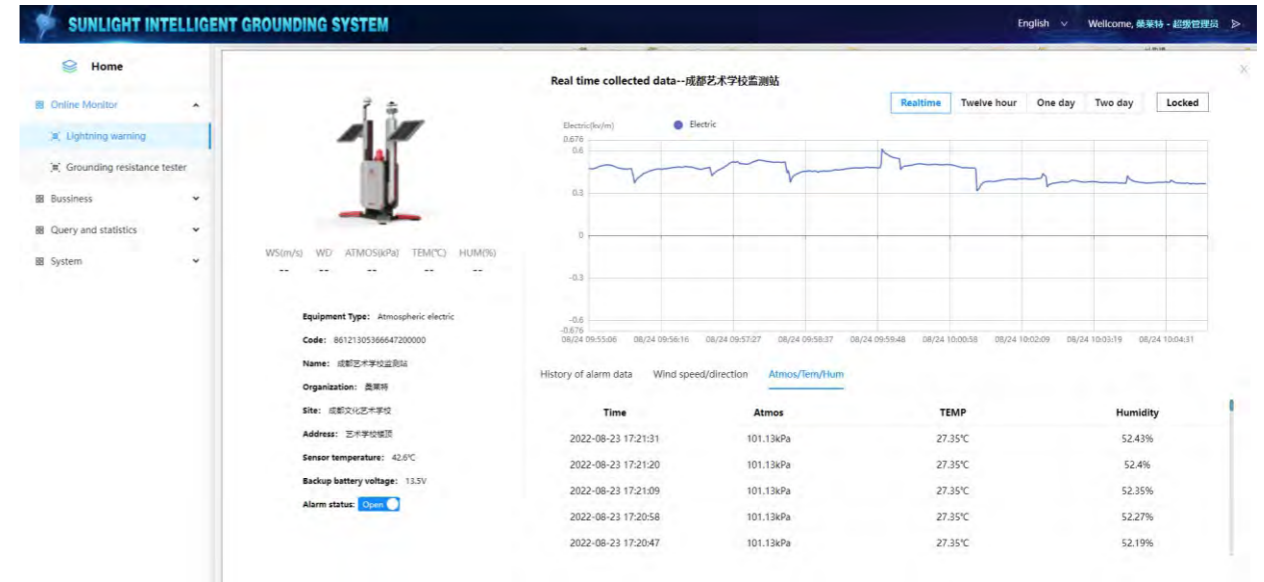


Figure 5-4 platform homepage

1. The center map of the homepage can show the installation location and running status of the equipment: green indicates normal, red indicates fault.
2. The left side of the homepage displays the operating status of all devices in the form of a list. When the equipment is offline or in an alarm, you can click on the corresponding device to view the trend chart of atmospheric electric field data within 48 hours at most, basic information(temperature, humidity, wind direction and atmospheric pressure) & alarm information of the device, so that users can deal with equipment abnormalities as soon as possible.
3. At the bottom of the homepage is the alarm interface. When the upcoming lightning is detected, three levels of alarm will be made according to the atmospheric electric field threshold. Warning level from low to high respectively: yellow alarm, orange alarm, and red alarm. In addition, when there is low voltage or low power, an alarm will be triggered, indicating the abnormal status of the device.

5.4 Query&Statistics

Click query statistics to view all monitored data under the user account, as shown in Figure 5-5

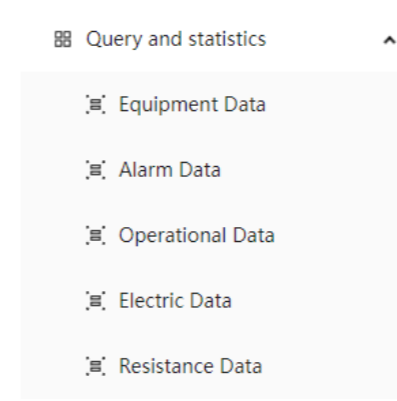


Figure 5-5 query statistics

1. Data query: Users can view the original monitoring data of all equipment under user account, our technicians can provide support for data analysis.

2. Alarm data query: Users can view all information about lightning warnings or equipment alarms, as well as the progress for alarm removal.

3. Operating data statistics: Users can view the monitoring records of all types of devices under user account, as well as the operating data of the platform in the past year, providing the basis for data analysis.


4. Atmospheric electric field query: Users can view all atmospheric electric field monitoring data of the lightning warning system, and generate a data trend chart according to the time period selected by the user, and support data export, which enables users to do analysis of lightning event.

5.5 Supplementary Instructions for Software Platform

6. Troubleshooting and Problem Solving

When the system cannot work normally, first check whether the power supply is normal. If the system still cannot work properly, please troubleshoot according to the methods provided in the following table.

Fault Symptoms	Causes	Solutions
Device Offline	Power off/ Disconnect	Check the power supply module, mains power connection, solar module, then power on again
	Main Control Board Abnormality	(1) Check whether the module power indicator is always on (2) Check whether the communication indicator flashes normally (3) Restart the device
	Communication Module Abnormality	(1) Check whether the 4G module link indicator is always on (2) Check whether the antenna is connected properly (3) Check whether the SIM card is in arrears (4) Restart the device
Data Abnormality	There's Interference in the probe part	Check whether there is dust, bird droppings and other adhesion on the probe part. Wipe the probe after power off ,and then power on.

 Note: If the fault cannot be solved by yourself, you must contact the manufacturer for maintenance. Users are not allowed to replace the circuit board or module inside the product by themselves.

7. NOTES

7.1 Packaging

1.The product should be packed in wooden box, corrugated board or calcium-plastic board. Corrugated boards shall be in accordance with the basic dimensions specified by the State, its volume should be large enough to stuff enough shock-proof materials around the equipment when placed in the box, ensuring there's no loosening, collision or rotation of the equipment. At last, the whole packaging will be packed in wooden box , ensuring transportation safety.

2.All equipment shall be inspected before packaging, and equipment that pass the inspection are issued by the inspectors with a product certificate,which should contain the name and model of the equipment, the name of the manufacturer, the signature of the inspector and the date of inspection. At the same time, the key components and assembly parts shall be packed with the equipment according to the list of supply scope, and relevant technical documents shall be attached to ensure the normal installation and use after the equipment is delivered.

3.The paper documents delivered with the equipment include certification, warranty card, product manual and list of accessories, etc. When receiving the product, the user needs to check whether the package is complete and sign for receipt. After signing for receipt, the users should not return the goods without any reason.At the same time, it is necessary to check whether the paper materials are complete, if there is any omissions, please contact our company for supplement. The followings are the original template of our certificate and warranty card:

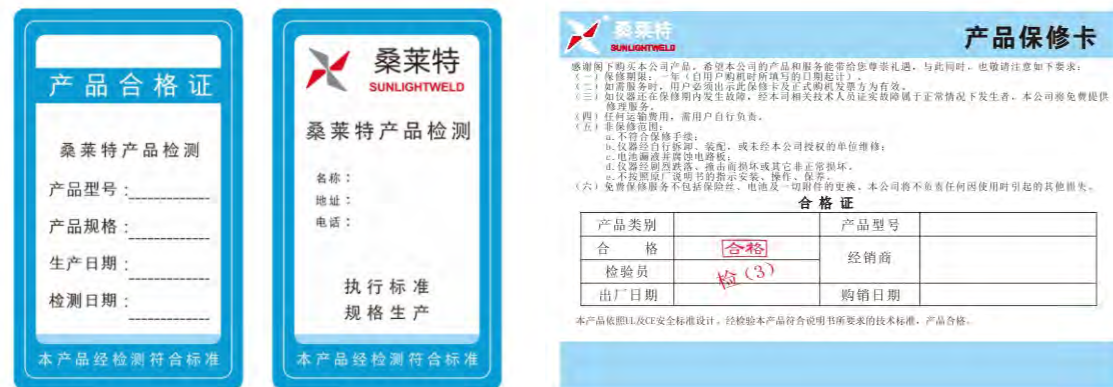


Figure 7-1 Certificate and Warranty card

7.2 Storage and Transportation

This product shall be protected from rain and snow after packaging, and can be transported by highway, railway, ship and air .

When handling a single product manually, pay attention to holding and placing it steadily to avoid hurting personnel and bumping the product; When multiple products packed together are hoisted by machinery, pay attention to operate in strict accordance with the operation specifications of hoisting machinery to avoid rough loading and unloading.

This product can be stored in -10~40°C and the average relative humidity of 90% (25°C) , the packaged product can be stored in the above mentioned environment for more than 1 year.

7.3 Maintainance

1. If the system cannot work properly, check whether the power supply is normal.
2. If the power supply is normal, but the system still cannot work properly, check and repair according to the troubleshooting method provided in Chapter 6.
3. If the fault cannot be solved by yourself, you must contact the manufacturer for maintenance. Users are not allowed to replace the circuit board or module inside the product by themselves.

8. After-sale Service Warranty

1. Training Instructions:

- ① Before the equipment is delivered for use, our company will provide all detailed descriptions and common faults descriptions of main components, etc., so that users can get a preview of this equipment .
- ② When the equipment is accepted for use, our company will dispatch professional and technical personnel to conduct operation and maintenance training , make sure the operators are familiar with all the operations and master the correct use & maintenance methods, so as to extend the service life of the equipment.

2. Training Content:

(1) Onsite / Online training: Product Introduction - operation instructions - FAQ - maintenance - precautions (duration: 2h)

* Product Introductions: System introduction / Introduction for software and hardware composition and function .

* Operation instructions: instructions for equipment assembly process, instructions for software platform operating.

* FAQ: Description of problems encountered during equipment operation as well as solutions.

* Maintenance: Introduction for equipment maintenance.

* Notes: Instructions for precautions during equipment use.

(2) Operations: equipment commissioning - platform operation (duration: 4h)

* Equipment commissioning: provide installation guidance, teaching video and remote online guidance

* Platform operation: including equipment online platform, equipment management, data processing and other operations.

8.2 After-sale Service Warranty

Sunlight company has established a perfect after-sale service system and strict management system to make sure the after-sales service can be effectively guaranteed. We have set up an after-sales service department to ensure timely, unique and effective response to every request from our clients by coordinating internal resources and eliminating all prevarication and delays.

Sunlight After-sales service tenet: "customer first, timely guarantee, enthusiastic service, and effective work".

Scope of warranty service: Sunlight provides warranty maintenance services for equipment failures caused by product quality problems under normal use conditions as guided by the user manual.

After-sales service period: Our company guarantees to respond within 1 hour after receiving customer feedback. The warranty period and after-sales service period are within 18 months from the date of the final acceptance of the equipment or within 12 months from the date of receiving the product by users.

9. Contact Us

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