



Intelligent management  
of lightning risk

# LIGHTNING WARNING SYSTEM

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A B O U T  
E Y Z A O  
T E C H N O L O G Y

Hangzhou EYZAO Technology Co., Ltd. is a science and technology enterprise in Zhejiang province. It has passed ISO9001, ISO14001, ISO45001 and other management system certifications. It develops and produces lightning warning system, surge protector, surge backup protector, intelligent lightning monitoring system and other products. Products through UL, CSA, TUV, CQC, CE and other authoritative certification, is one of the few domestic lightning warning and wind power surge protector technology professional manufacturers.

EYZAO Technology continuous research frontier technology of lightning protection science and technology, with P1 fully functional lightning protection level laboratories and lightning warning tablet laboratory, easy to build EW3.0 lightning warning system has the invention patent, patent appearance, explosion-proof certification, are widely used in oil storage base, petrochemical industry, tourism scenic spots, meteorological observation, playground, golf course, ports and other industries.

EYZAO Technology is committed to protecting people and property safety, providing customers with high standards of lightning warning solutions.



**Application achievements:** More than 30 application industries: rail transit, petrochemical, wind power generation, IDC room, communications, radio and television, banking, hospital, theater, automobile industry, power system, etc.

**Mission of company:** More safer and intelligent;







**Company values:** Customer first, respect for talent, unity of knowledge and practice, optimistic and persistence.

# The lightning was reported before the warning Easy to avoid lightning strikes

Eco System

The warning signal of equipment disconnection  
and power failure is still unblocked

## Application field

<p>01</p> <p>Oil storage base Petroleum chemical industry</p>		<p>03</p> <p>Radio and television Meteorological observation</p>		<p>05</p> <p>Cultural relics hexiang Scenic spots</p>	
	<p>02</p> <p>Ports Aerospace</p>		<p>04</p> <p>The airport Power Hospital School</p>		<p>06</p> <p>Amusement places The golf course</p>

# 1.Overview of lightning warning system

EW3.0 is a new generation of digital lightning early warning system developed and produced by Hangzhou EYZAO Technology Co., Ltd. It is designed based on the principle of field grinding, and changes in atmospheric electric field intensity are obtained through constant rotation of the motor. It consists of a "stator" (induction plate) and a "rotor" (grounding shield plate). The rotor is driven to rotate by a motor with constant speed, so that the stator is alternately exposed to the electric field or shielded, thus generating an induced charge that is proportional to the external electric field strength. The stator is connected to the amplification processing circuit and the waveform adjustment circuit, and outputs the voltage signal. After calibration, the voltage can represent the strength and polarity change of the atmospheric electric field.

EW3.0 lightning early warning system is designed to meet the requirements of ground atmospheric electric field strength measurement. The solid aluminum shell can adapt to various harsh environments. The inverted structure can effectively avoid the invasion of bird droppings, rain, fallen leaves, etc. At the same time, it has the characteristics of low power consumption, easy installation, simple maintenance, etc., which can be used to continuously measure the change of atmospheric electric field strength for a long time.

EW3.0 lightning early warning system can monitor the electric field data of thunderstorm cloud in real time and accurately forecast the local lightning activity. When lightning is approaching, the early warning system does not need any manual operation and analysis under the default settings. The program can automatically complete all data analysis and automatically send out yellow, orange and red warning signals, and upload the warning information to the management system.

EW3.0 The lightning warning system has no interference or signal emission, and will not have any impact on various electrical and electronic equipment in the protection area. Within its coverage, multiple audible and visual alarm systems can be installed, which are jointly controlled by the early warning host, effectively reducing user costs.

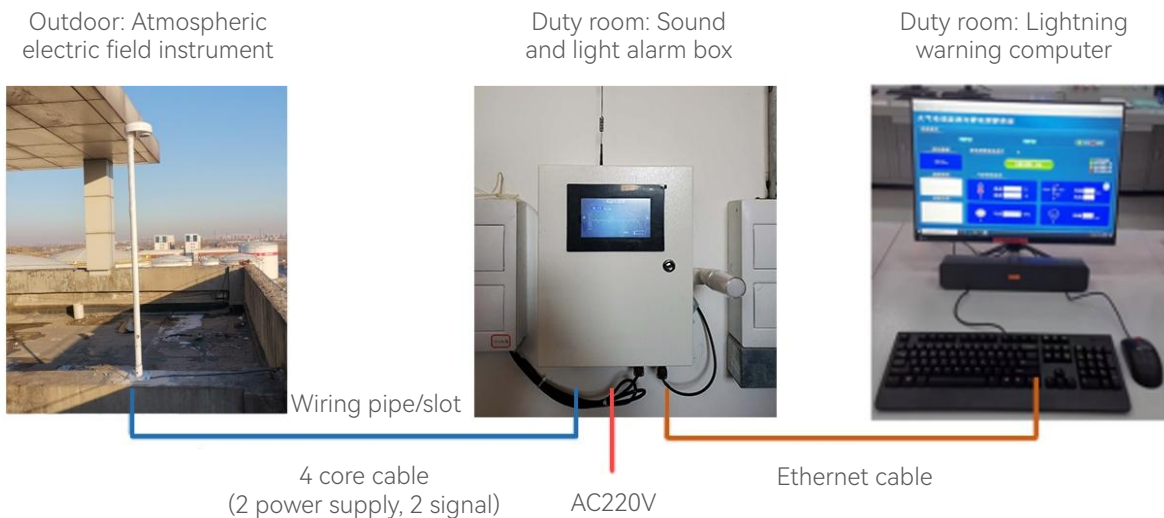


## 1.1 Function of lightning warning system

IEC62793 puts forward the basic definition of lightning early warning system: a system that can send a warning signal to the target protection area before lightning strikes. At the same time, IEC62793 believes that "lightning warning" has three main functions:

1. Remind field operators to stop or suspend outdoor operations in time, enter safe areas for lightning protection, and prevent lightning damage;
2. For some operations that may cause major hazards, appropriate measures shall be taken in time before lightning strikes to prevent major lightning accidents. For example, outdoor operations in flammable and explosive places must be stopped or suspended at this time;
3. The automatic opening and closing system is adopted to isolate the power supply line from lightning and protect some important equipment or uninterruptible valuable services.

Sufficient early warning time can ensure that users take various emergency plans in time to achieve the purpose of active lightning protection. At the same time, compared with early warning or forecast in meteorological sense (several hours to several days), users only need to take lightning protection measures when lightning is approaching, to ensure that daily work will not be affected too much.



## 1.2 Working Principle of the lightning early warning system

EW3.0 lightning early warning system adopts field grinding atmospheric electric field instrument, which can continuously monitor and record the four stages of lightning occurrence. It measures the strength and direction of electric field by using the principle of induced charge generated on the conductor placed in the electric field.

The induced charge  $Q(t)$  on the stator in the probe of the atmospheric electric field meter is a function of time, and its value is proportional to the external electric field strength  $E$ . See Formula (1).

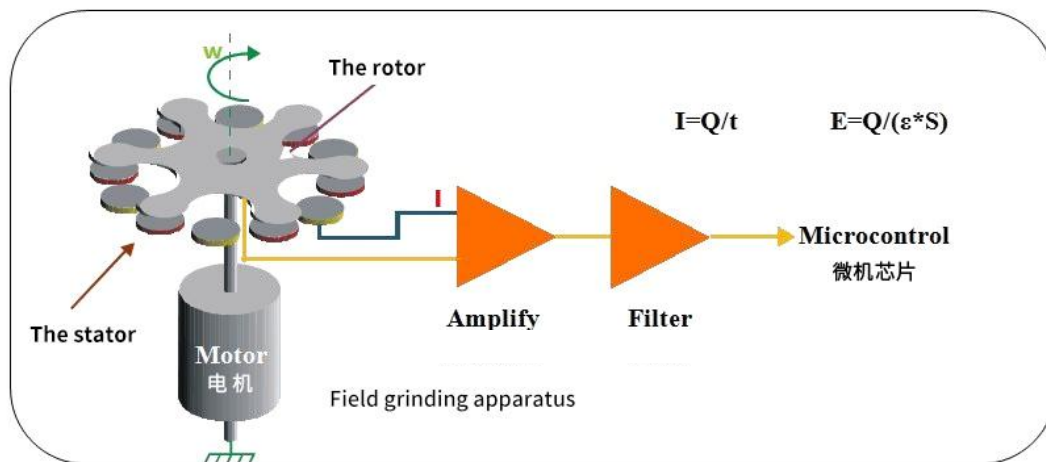
$$Q(t) = -\epsilon_0 E S(t)$$

Where:  $Q(t)$ : the induced charge on the stator in the probe of the atmospheric electric field meter, in amperes (A);

$\epsilon_0$ : permittivity of free space;

$S(t)$ : surface area of stator exposed to electric field, in square meters ( $m^2$ )

Therefore, when the exposed area of the stator changes with time,  $Q(t)$  is an alternating current signal. As the electric field strength is proportional to the induced current, the external electric field strength can be obtained by measuring the equivalent voltage value generated by the induced current flowing through a large resistance. The proportional coefficient between the equivalent voltage value generated by the induced current flowing through a large resistance and the external electric field strength value can be obtained through calibration.



Measurement principle model

### 1.3 Technical Specifications

The host power supply	220Vac
The probe power	24VDC
Detection range	20KM
Detection range	±300kV/m
Detection accuracy	±5%
Probe level	IP65、Material aluminum alloy
Alarm way	SMS, sound and light, computer, etc
Communication mode	LAN, Beidou satellite, 4G, etc
The machine power consumption	< 7W
The power consumption of the probe	< 3.5W
The probe size	Φ130*120/Φ240*100
The probe weight	2.4kg/2.5kg
The warning level	Yellow, orange and red alert level three
Data interface	RS485
Working temperature	-30-65°C
The probe form	Field mill type (non-electronic type)
The power supply mode	Mains electricity, solar energy
Solar panel (mm)	1000*800
Main box (mm)	500*660*320 (solar energy)450*350*180 (mains)Material 304 stainless steel
Explosion-proof grade	Ex d IIB T4 Gb
Conform to the standard	GB/T 27962 Meteorological disaster warning signal icon GB/T 38121 Lightning protection thunderstorm warning system GB/T 40619 Technical specification for lightning proximity warning based on lightning positioning system T/CECS 688 Technical specification for lightning warning system T/CMSA0012 Technical requirements for lightning monitoring and warning in places of explosion and fire hazards QX/T 262 Technical Guide for Lightning Approach warning QX/T 566 grinding atmospheric electric field instrument



## 2.Composition of lightning warning system

EW3.0 lightning early warning system hardware is mainly composed of field grinding atmospheric electric field instrument, early warning main box and peripheral components.



Atmospheric electric field meter

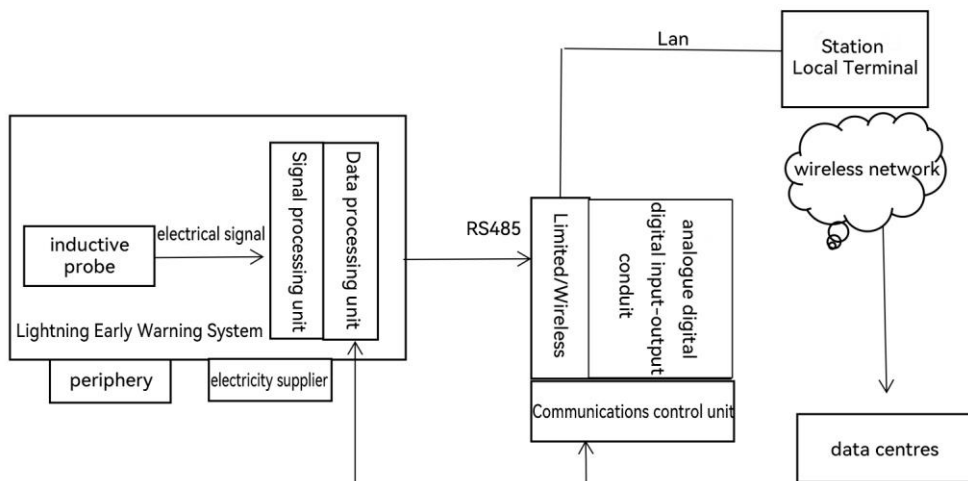


Early warning main box

### 2.1 Field mill type atmospheric electric field instrument

The atmospheric electric field instrument is composed of induction probe and data processing unit.

The data processing unit is the key component of the atmospheric electric field instrument. It is composed of A/D conversion circuit, central processor, GPS clock, data memory, control circuit and interface, etc. Its main function is to measure the voltage signal output by the probe, complete A/D conversion of probe signal, signal sampling, and perform data operation processing, quality control, recording and storage on the sampled value to achieve data communication and transmission.



## **2.2 Early warning main box -- communication control unit**

The communication control unit is responsible for packaging, sorting and verifying the observation data and early warning status data of the atmospheric electric field instrument. It can send data according to the preset communication mode and transmission time interval, or adjust the communication mode and transmission time interval through remote command.

The communication control unit has a network port and a wireless module, which can interact with the atmospheric electric field instrument through RS-232/485 port, with the intranet server through LAN port, or with the cloud or data center through the wireless module. The wireless module supports 2G, 3G, 4G, Beidou communication, etc.

When wireless transmission module is adopted, multi-point transmission can be realized, and data can be sent to two data center stations at least at the same time.

The communication control unit is also equipped with input and output channels of analog quantity and digital quantity, which can change the digital quantity according to the early warning information provided by the atmospheric electric field instrument, receive analog quantity and digital quantity signals from other equipment, and send the data to the data center station through the wireless module.

## **2.3 Early warning main box -- power supply unit**

The power supply control unit is responsible for providing working power for the system. Usually, the battery is used for power supply (DC 12V or 24V). The solar panel is used to charge the battery. If the conditions for mains connection are met, single-phase mains 220V can also be used to charge the battery.

The power supply unit shall take current limiting protection and anti reverse connection measures to provide stable output current and conduct voltage conversion as required.

## **2.4 software**

### **2.4.1 Acquisition software**

The acquisition software runs in the data processing unit of the atmospheric electric field instrument, and has the functions of data acquisition, data processing, data storage and data transmission.

## 2.4.2 Client Software

The client software is used to process, display, store, query and transmit the observed data of the atmospheric electric field instrument. It is the application software installed in the local terminal microcomputer or remote data center terminal. When the atmospheric electric field value reaches the alarm threshold, the software has the function of sound and image alarm.

## 2.5 Level 3 Lightning Warning Information

p1) Level 1 is yellow warning: there may be lightning activity, the atmospheric electric field in the covered area is increasing, and the electric field fluctuates. The location of the ground flash return point is 10-20km away from the base, and lightning may occur within 30 minutes, which may cause a lightning accident.

(2) The second level is orange alert: the possibility of lightning is high, the atmospheric electric field in the covered area is rapidly enhanced, and the electric field variation and fluctuation are aggravated. The location of the ground flash return point is 5-10km away from the base, and lightning may occur within 5 to 20 minutes, resulting in an increase in the possibility of lightning accident.

(3) The third level is a red warning: lightning is about to occur, the atmospheric field in the covered area fluctuates violently, the location of the ground flash return point is 0-5km from the base, and lightning is likely to occur at any time, resulting in a high possibility of lightning accident.



## 2.6 Early warning response Plan

### 1) Preparation for early warning response

—**Designate monitoring management personnel:** Designate daily lightning early warning management personnel in the schedule of monitoring personnel to monitor, check and record the working status of the lightning early warning system and the implementation status of the warning mechanism;

—**Set up sound and light alarm equipment:** install three-color alarm lights in the monitoring room, and equip with buzzer alarm;

—**Set up the cluster broadcasting system:** install the cluster broadcasting system in each key area of the key place, which can be wired or wireless, and pre-record the alarm voice according to the three alarm levels; The alarm voice should contain the following contents:

- a) lightning warning level;
- b) Expected time range of lightning activity;
- c) Simple instructions for relevant personnel.

—**Setting up the SMS system:** Install the cloud MAS SMS program on the server and input the mobile phone numbers of managers at all levels. The SMS content should include the following contents:

- a) lightning warning level;
- b) Time range of early warning lightning activity;
- c) Simple instructions for relevant personnel.

—**Formulating lightning early warning emergency management files:** Lightning early warning management personnel shall record and manage the files at each lightning early warning system operation. The specific contents of the file are as follows:

- a) Graded activation time of lightning early warning instrument;
- b) Response implementation status at all levels;
- c) State record of automatic alarm device;
- d) Records of actually observed lightning activity;
- e) Signature of management personnel.

### 3) Level B early warning response

#### —Monitoring personnel:

Record the time of alarm occurrence;

Check whether the alarm device is in the correct working state;

Confirm that the key area managers have completed the level 1 response and entered the level 2 response state;

Monitor and check whether outdoor personnel (tourists and staff) have begun evacuation and evacuation;

Fill in the administrative file.

#### —Regional staff:

Verify that the alarm device sends the correct alarm;

Assist in the evacuation of outdoor personnel (tourists and staff), especially large open areas.

### 4) Grade A early warning response

#### —Monitoring personnel:

Be on alert (including fire fighters);

Record the time of alarm occurrence;

Check whether the alarm device is in the correct working state;

Confirm that the managers of key areas have completed the level 2 response and entered the level 3 response state;

Monitor and check whether there are still outdoor personnel, emergency notification should be taken if necessary;

Switch internal power supply and turn off non-important electrical equipment;

Check the working condition of fire fighting equipment;

Fill in the administrative file.

#### —Outdoor workers:

Confirm the timely delivery of alarm in each area;

### 2) C-level early warning response

#### —Monitoring personnel:

Record the time of alarm occurrence;

Check whether the alarm device is in the correct working state, whether the correct alarm;

Inform the management or staff of the key areas;

Check the working condition of fire fighting equipment;

Fill in the administrative file.

#### —Regional staff:

Confirm that the alarm has been sent in time;

Postponement of outstanding outdoor work;

Prepare for the evacuation of tourists.

Confirm that visitors are in a safe area;  
Report site evacuation status to management;  
Stop operation of equipment (e.g. cable cars, sightseeing cars, etc.).

#### 5) The end of lightning activity

All departments shall return to the normal working state, continue the suspended production plan, reschedule the postponed activities, and the equipment management personnel shall check whether the equipment has returned to the normal working state.

Relevant staff should patrol to check whether there are lightning disasters in the area of the phenomenon.



## 3. Other functional applications

### 3.1 Lightning Location Function

For many industries, short-term warning except lightning is not enough to meet the needs of users, so it is necessary to install lightning positioning function to accurately locate the lightning location, so as to enhance the accuracy of warning.

Lightning locator, also known as lightning monitoring locator, is a kind of automatic meteorological detection equipment for monitoring lightning occurrence, which uses the characteristics of sound, light and electromagnetic field of lightning return radiation to telemeter the discharge parameters of lightning return. It can detect the time, location, intensity and polarity of lightning.

EW3.0 can integrate meteorological lightning location data into the algorithm to provide more accurate lightning warning information.

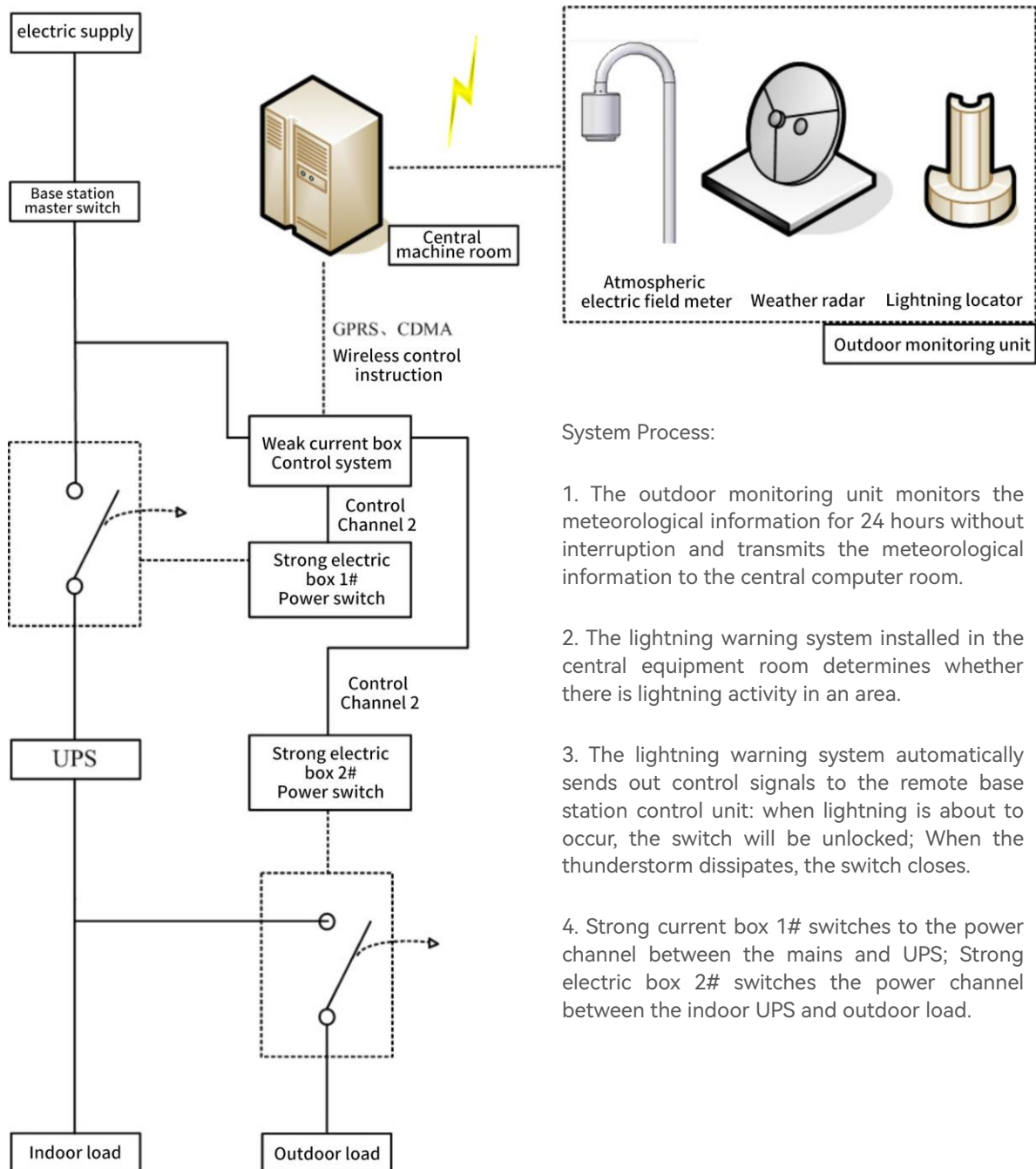


### 3.2 Automatic Power Switch function

With the rapid development of computer technology, all kinds of communication base stations and other facilities have been built, and the weather changing climate in recent years, frequent lightning phenomenon, around the base station communication facilities have been destroyed, serious lightning strike in a row, even just a few days, because the computer communication equipment belong to the microelectronic devices (i.e., weak current equipment), the overvoltage impact resistant ability is very weak, By the power cord, signal transmission lines, the intensity of ground invasion of lightning surge is very big, through the introduction of the power cable, signal transmission line lightning induction impact current is big, enough to make many microelectronic devices suffered varying degrees of damage, and endanger the personal safety, caused huge direct economic losses, but more importantly will lead to the entire network paralysis, important data is lost, The indirect economic loss is inestimable, which requires us to have a better solution to the lightning protection problem of the communication base station and the computer room.

The EW3.0 automatically switches the power supply by installing circuit breakers. When the lightning alarm signals, the EW3.0 cuts off the mains power supply line and switches the power supply mode to the UPS. This effectively reduces the risk of lightning surge into internal devices without affecting the normal operation of devices.





**System Process:**

1. The outdoor monitoring unit monitors the meteorological information for 24 hours without interruption and transmits the meteorological information to the central computer room.
2. The lightning warning system installed in the central equipment room determines whether there is lightning activity in an area.
3. The lightning warning system automatically sends out control signals to the remote base station control unit: when lightning is about to occur, the switch will be unlocked; When the thunderstorm dissipates, the switch closes.
4. Strong current box 1# switches to the power channel between the mains and UPS; Strong electric box 2# switches the power channel between the indoor UPS and outdoor load.

### 3.3 Lifting lightning rod function

For some scenic spots and ancient buildings, when lightning comes, it is necessary to do a good job of external lightning protection measures in time, so as to protect important buildings from lightning damage. Lightning rod protection of this kind of building, often high, prone to the impact of natural disasters such as typhoons, in order to protect the lightning rod, need to give it the lifting function, in ordinary it is the state of contraction; When lightning comes, it will rise to achieve external lightning protection function.

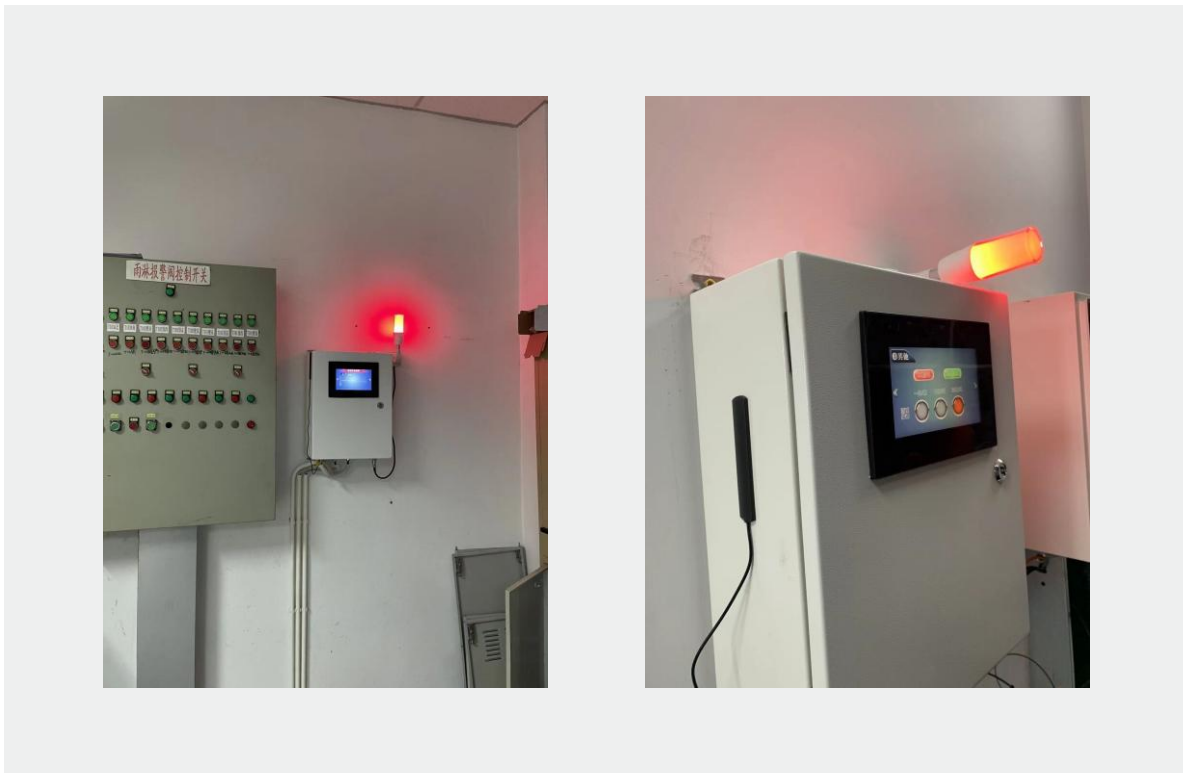
Lightning early warning linkage lifting lightning rod system, when lightning comes, the first warning, and the warning signal is transmitted to the system, the system then operates the lightning rod rising, the whole process of intelligent automation, lightning early warning and lightning protection together, better realize the protection of scenic spots and ancient buildings.



### 3.4 Function of sound and light alarm box

For many scenic spots, golf courses, or the petrochemical industry, it is necessary to timely remind the crowd to evacuate and make lightning protection preparations before the thunder and lightning. Therefore, it is necessary to install sound and light alarm system or sound and light alarm lamp to effectively remind the crowd. With the development of technology, the current lightning early warning system can combine the lightning early warning system with the sound and light alarm system, so as to realize the alarm function intelligently and efficiently.

The alarm light and the main box are set separately in the acousto-optic alarm box. Through communication, the atmospheric electric field instrument transmits the warning signal to the acousto-optic alarm box. The acousto-optic alarm light will alarm at different levels according to different warning signals to timely remind outdoor personnel to avoid risk.



### 3.5 Functions of six meteorological elements

For many industries, real-time monitoring of six meteorological elements, such as temperature, relative humidity, wind direction, wind speed, atmospheric pressure, and precipitation, is an important factor to protect equipment security. EW3.0 combines the six meteorological elements to meet users' real-time monitoring requirements.

The equipment measures the wind speed and direction by measuring the time difference of ultrasonic arrival, uses the 24G radar module to detect the rain and snow state, uses the air humidity sensor to sense the temperature and humidity, uses the barometric gauge to measure the pressure, and gives corresponding alarms of different levels based on the six meteorological elements and lightning warning signals.



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