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Application cases in the power industry

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1. Product Overview:

To address industry challenges such as detection range, power supply, communication, networking, remote updates, self-diagnosis, and adaptive correction, our company has developed three product series—General, IoT, and Intelligent—designed to meet diverse monitoring and detection requirements.

2. Product introduction and product application in the power industry:

2.1 CE series product classification: (12 inspection types, more than 4000 specifications)

1) **Current**: AC, DC (pulsating, bidirectional), AC and DC universal.
2) **Voltage**: AC, DC (pulsating, bidirectional), AC and DC universal.
3) **Power**: active power, reactive power, power factor, DC power
4) **Frequency**: square wave, sine wave, zero crossing arbitrary wave, power frequency, high frequency
5) **Multiple parameters**: current, voltage, active and reactive power, power factor, frequency, active and reactive energy.
6) **Temperature**: thermal resistance, thermocouple
7) **Switch**: dry contact
8) **Resistance**: resistance, potentiometer
9) **Capacitors and inductors**: capacitors, inductors
10) **Ultrasonic**: ultrasonic position sensor, ultrasonic transducer non-destructive testing
11) **Electromagnetic field**: space electromagnetic field detection, electromagnetic field detection in conductor
12) **Communication**: RS485/232, CAN, PLC, Ethernet; wireless: Zigbee, NBIOT, 4G, radio frequency, etc.

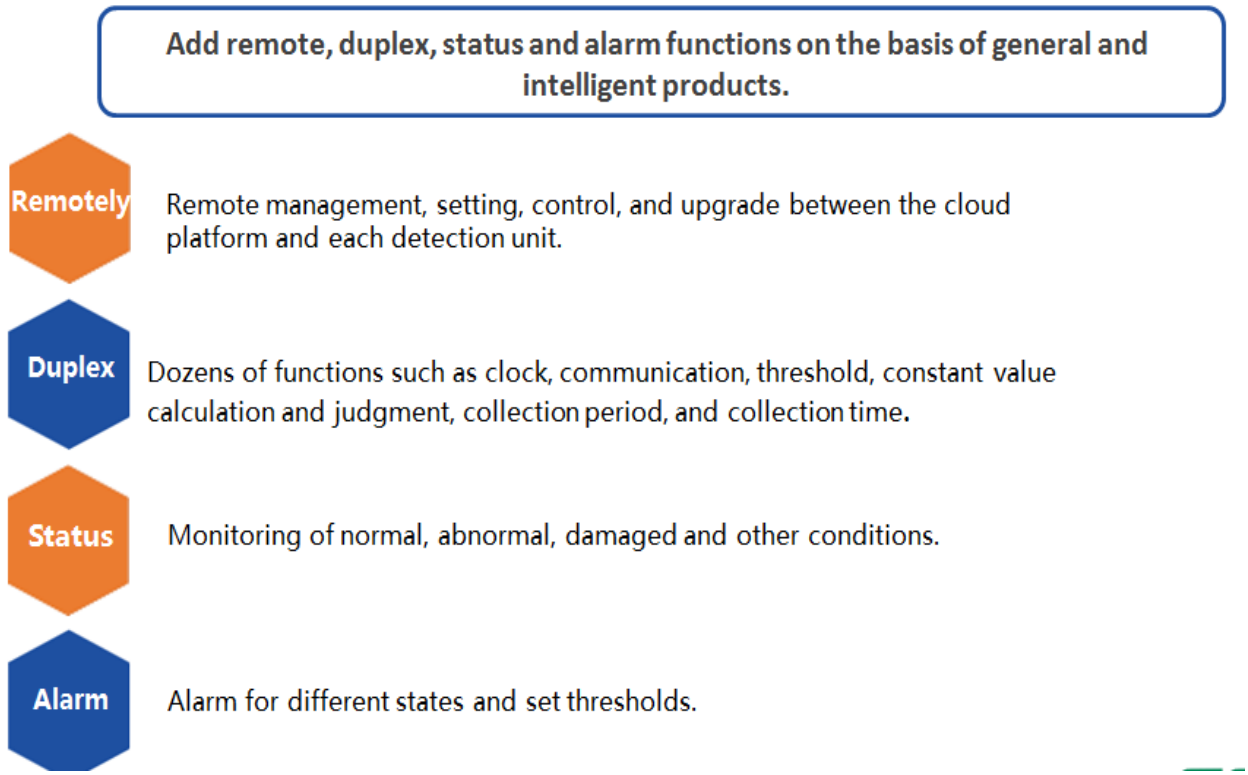
Features::

- Wide detection range, high precision, multiple output types,
- The products feature a robust, practical design and are easy to install.
- Detailed structural diagrams are available in the external reference guide.

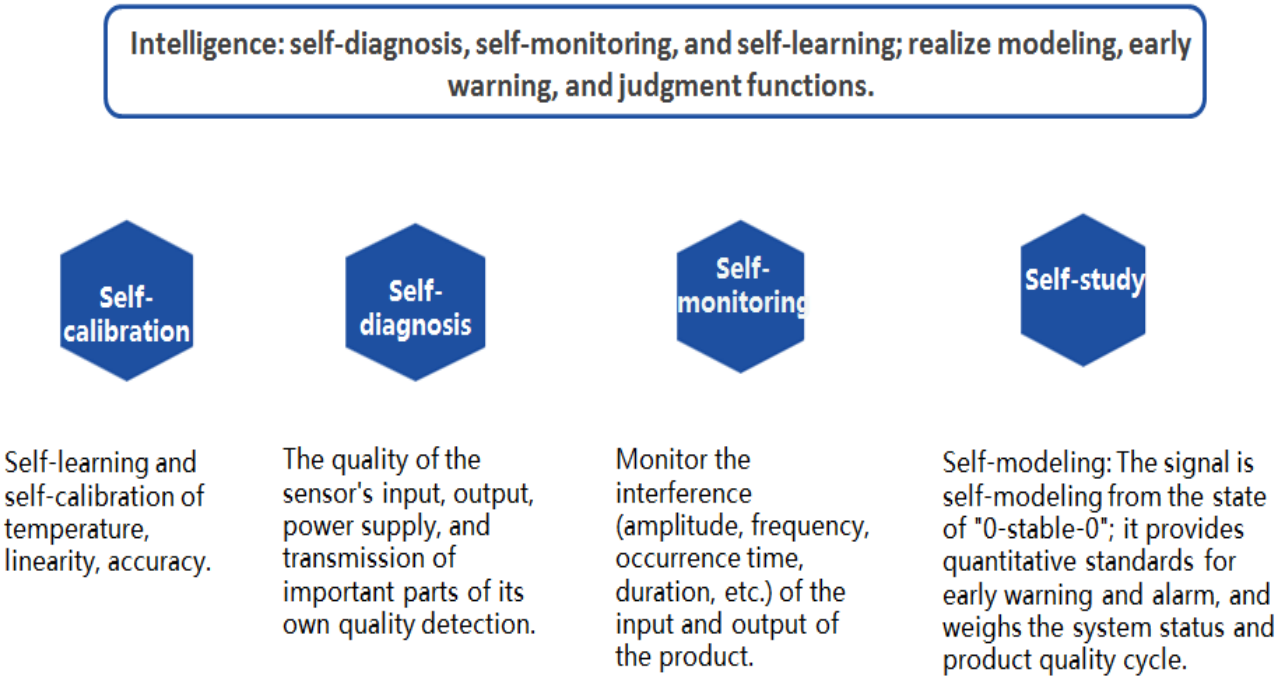





2.2 IoT series products



2.3 Smart products



2.4 Application examples of general series products:

1. Low-voltage switch cabinets, high-voltage switch cabinets, DC power panels


Low voltage switch cabinet


High voltage switch cabinet



DC panel

Application:

- AC secondary input, output current, voltage, power, frequency detection;
- Battery pack charge and discharge voltage and current monitoring;
- Insulation monitoring of equipment and systems.

2. Excitation Monitoring


Application:

- AC and DC current and voltage monitoring of excitation control;
- High-speed excitation power monitoring;
- Excitation signal isolator;
- High-speed detection and tracking output.

3. Unique Product and System:

3.1 Non-contact AC voltage products:

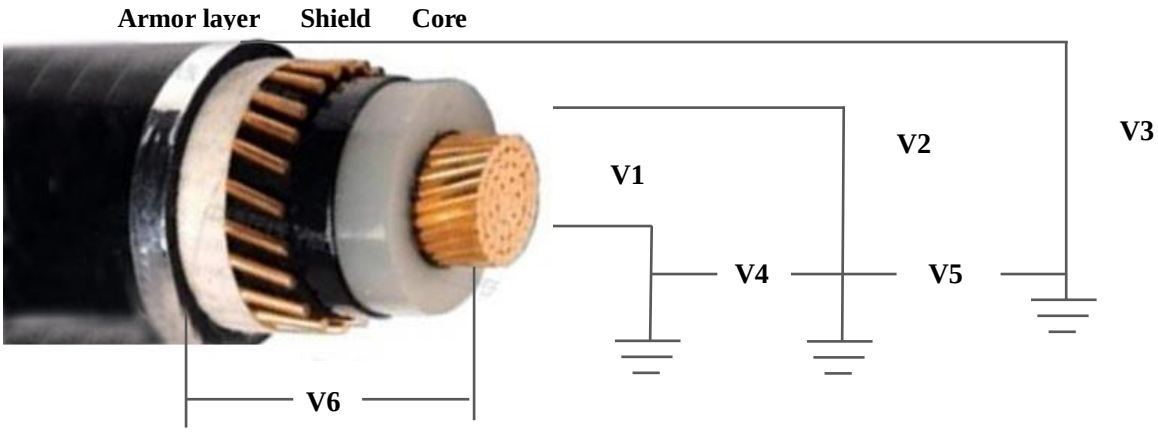
Features:

Safe-voltage detection with wide range and frequency coverage, adaptable probe designs, multiple output/transmission modes, and intelligent functions.

Application:

Non-contact detection for monitoring cable voltages, enabling efficient assessment of cable condition and insulation integrity.

3.1.1 Schematic diagram of cable voltage detection

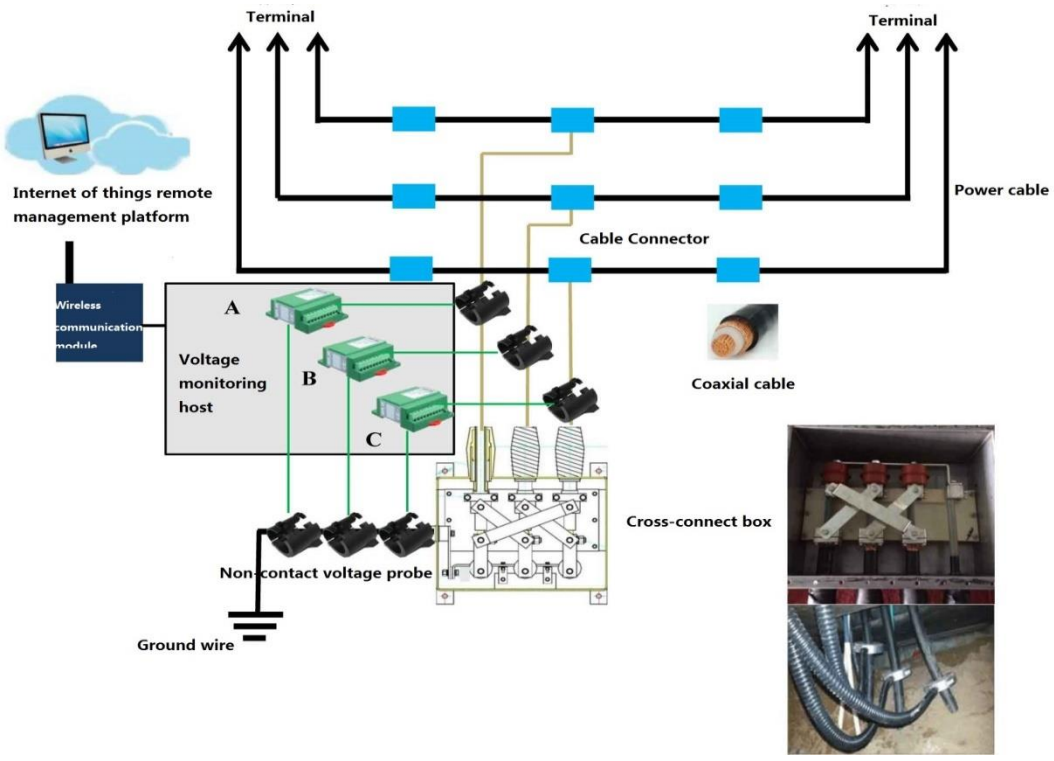


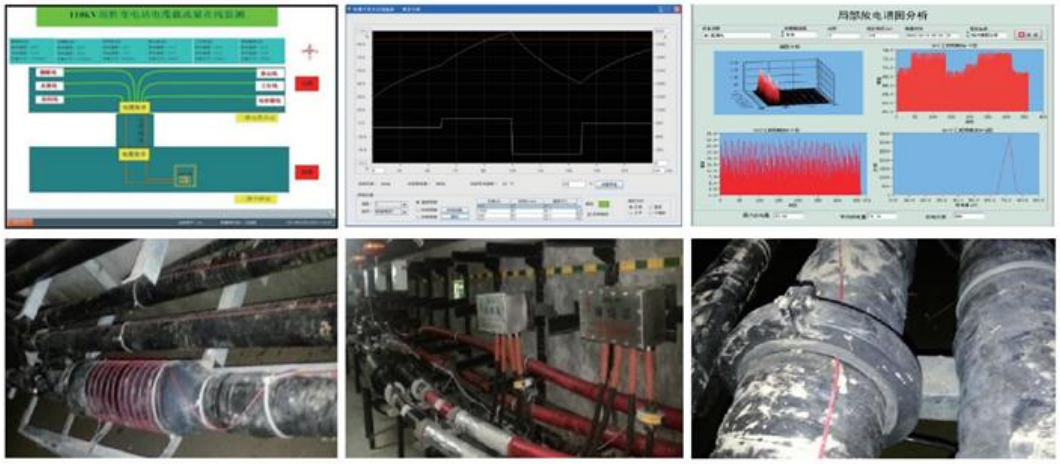
No.	Monitoring type	No.	Monitoring type
V1	Core to ground voltage	V4	Voltage difference between core and shield
V2	Shield to ground voltage	V5	Voltage difference between shielding layer and armor layer
V3	armor layer to ground voltage	V6	Voltage difference between core and armor layer

Application:

- Monitor voltage between the components of the power cable
- Assess cable condition, insulation integrity, and faults through voltage measurements.

3.1.2 Cable Sheath Ground Voltage Monitoring System





Application: Monitoring jacket-to-ground voltage to ensure grounding safety

3.1.3 Industry Adoption

Thanks to its unique safe-voltage detection method, this product has been widely adopted by railways for monitoring PTX and XB signal boxes as well as signal lights. Over 20,000 units were deployed in 2020 alone..

3.2 Simultaneous monitoring of multiple signals

Technical features: High-precision simultaneous detection of power frequency, pulse, high-frequency, and low-frequency signals on the same conductor.

Specific application: Fault diagnosis for power system equipment based on traveling waves, harmonics, and power frequency signals.

The Multi-channel Intelligent Wireless Interference Monitoring Analyzer is widely used in railway fault diagnosis and troubleshooting.

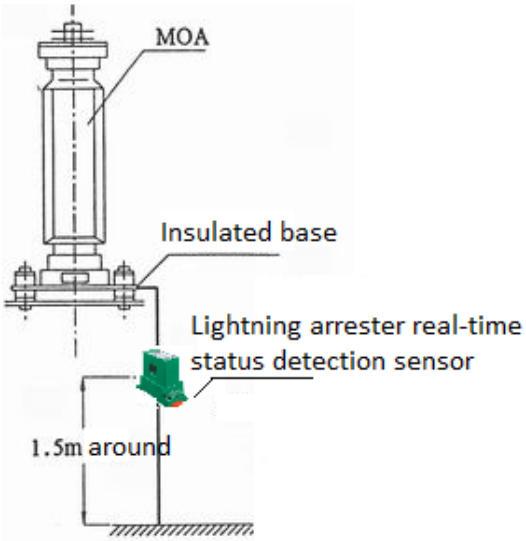
1	The system is equipped with a variety of high-precision sampling probes, and the interface and extension cable can be flexibly equipped.
2	The system is equipped with a probe current/voltage range 0-1KA/V, and the DC voltage range is better.
3	The system has built-in power supply, working at room temperature for more than 24 hours, and working at low temperature (-40 degrees) for more than 8 hours.
4	The system uses Sata interface solid state drive (fast read and write, zero noise, long life, anti-collision, low power consumption).
5	The device has IP65 waterproof/dustproof and superior shockproof function.
6	The weight of the whole machine is less than 5 kg (without side head), which is convenient for going out and carrying.
7	The system has remote setting and alarm functions: low battery alarm, storage alarm, communication alarm, etc.
8	The system has a voltage test port insulation withstand voltage greater than 3000V.

Case:


3.3 Leakage current detection

Features: Strong anti-interference capability, enabling accurate detection of signals in the 0.2–10 mA range with a resolution down to ±30 μA.

Application: The solution is broadly utilized for insulation monitoring of essential equipment and systems, leakage detection, and insulation testing in electric maintenance vehicles, power supply panels, and other devices across the power industry. Especially significant is arrester condition monitoring, which is about to be launched but is already widely applied.



3.4 Smart Power Carrier Communication Products

Technical features:

- Provides smart functions such as self-organizing networks, power adaptation, communication self-checks, and distance optimization.
- Intelligent power carrier modules, capable of long-distance transmission (up to 15 km) with high-speed response (750 ms), are widely deployed in railway high-speed applications, with more than 10,000 units used annually. In addition, a power carrier meter-reading system for gateway meters was jointly developed with the Xi'an Electric Power Bureau.

For details, please refer to Annex 1 "Power Line Carrier Technical Specification (PLC) -V20-11"

3.5 DC high voltage detection products

Product features: The input terminal incorporates specialized high-voltage protection methods and components, enabling DC voltage detection up to 5000 V. Advanced isolation technology ensures high reliability, providing 10 kV DC isolation and withstand capability between the input, output, and power supply.

Specific application: A 3.3 kV rectifier built with high-voltage variable-frequency SGCT technology, featuring DC voltage monitoring and detection of both the magnitude and symmetry of the positive and negative voltages produced by the rectifier module.

3.6 High-voltage vacuum switch action detection

Technical features: Utilizes non-contact voltage measurement combined with high-precision clock technology.

Specific application: The system measures the opening time of the vacuum switch in locomotive high-voltage switchgear—including command, action, and response—and determines its on/off state with precision.

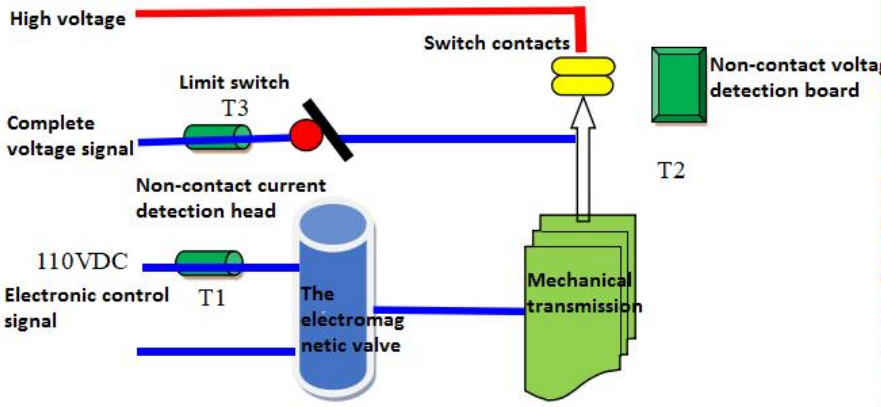


Figure 1

Figure 2

3.7 Lightning series detection products

Technical features:

- Provides comprehensive monitoring functions, including lightning current, lightning voltage, operating overvoltage, and leakage current;
- Offers comprehensive measurement of parameters such as peak value, time, waveform, energy, polarity, frequency, and steepness .

See Annex 2 "Lightning Internet of Things Monitoring System 20.06.22" for details

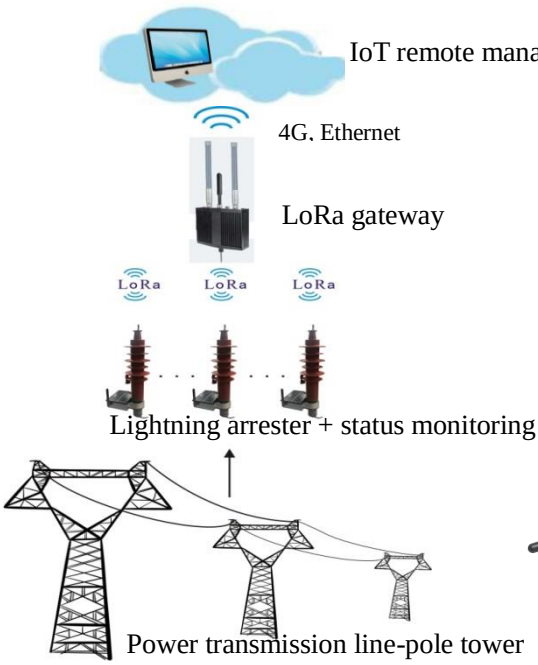
4 Internet of Things and Intelligent Systems

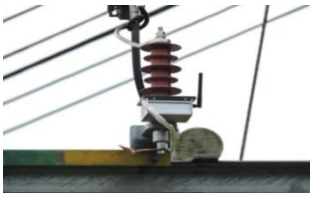
4.1 Power distribution network lightning arrester IoT monitoring system

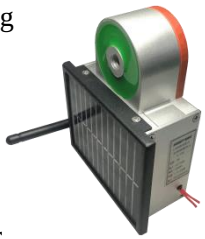
System features: The system features a passive wireless design—requiring no external power supply and enabling wireless transmission—ensuring low power consumption and easy deployment. Its IoT-based monitoring platform delivers comprehensive monitoring of lightning current parameters. It has been rated as the most recommended product by China Southern Power Grid. It has been used by Shaoguan Fuyuan Electric Power Bureau, Yangjiang Electric Power Bureau, and Guangzhou Zengcheng Electric Power Bureau.

System purpose:

- Detects the status of lightning arresters in the distribution network, indicating whether they are operating normally or disconnected.
- Provides continuous monitoring of lightning current in lightning arresters within the distribution network .
- Supports remote management functions, including data visualization and analysis, equipment alarms, remote configuration, and firmware updates. .







4.2 Remote detection and monitoring demonstration system of the Internet of Things:

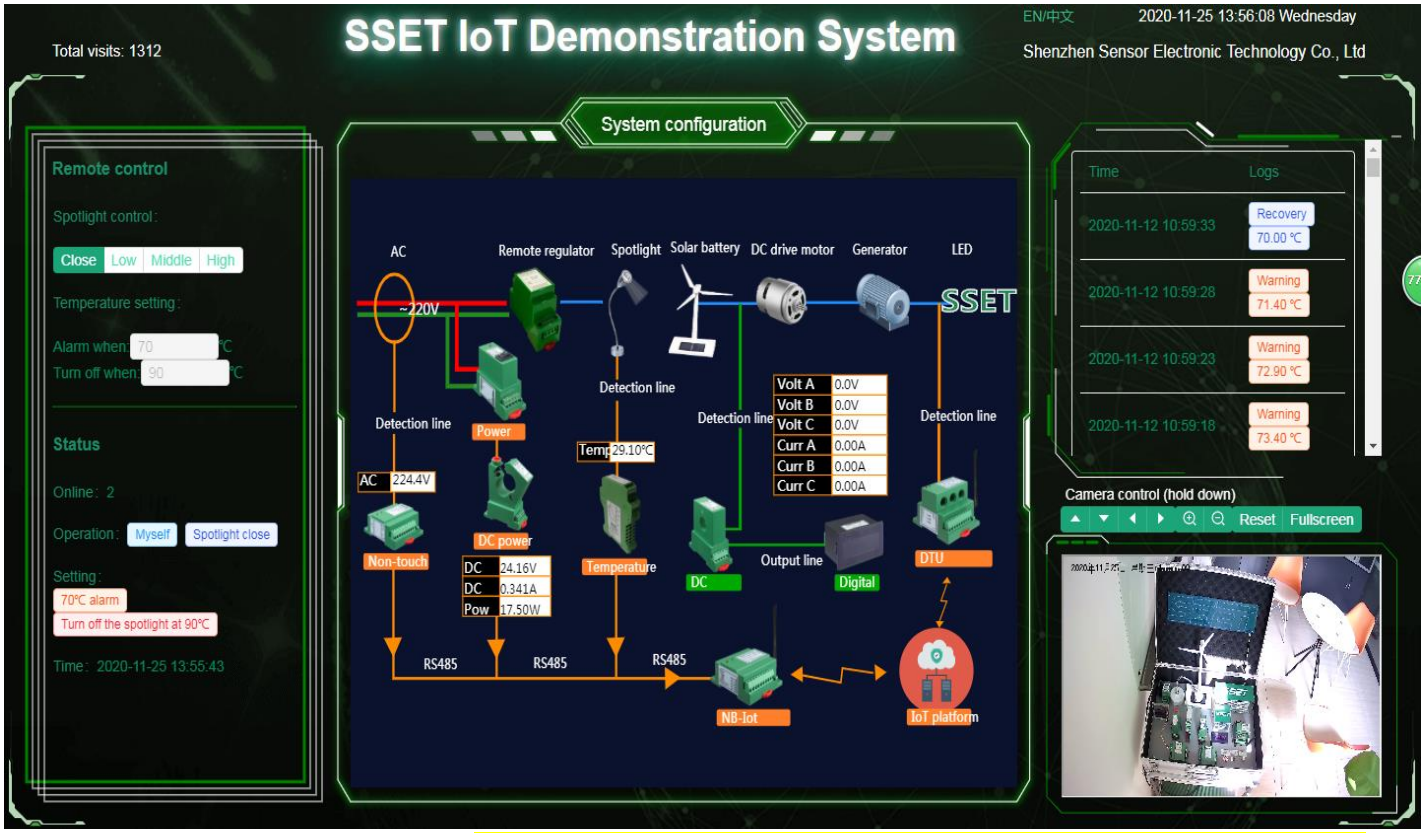
Technical features: Supports IoT functions including data communication, remote configuration, remote updates, remote control, and remote video management. Please visit our demo site at
URL: https://screen.szsset.com:8110/#/index

Operating experience:

1) Once you enter the page, you can use the remote on/off function with three brightness levels, available under ‘Spotlight Brightness Control’ in the upper-left corner.，
2) In the on state, you can see the operating status of the system (light on-solar power-generator-load on)

from the lower right corner of the video, and real-time changes and upload of monitoring data at each point.

3) In the upper-right corner of the webpage is the alarm area, which triggers an alert at 70 °C and initiates automatic shutdown at 90 °C. These thresholds can be configured remotely.
4) You can adjust the video screen size at any time, switching between front and rear views to observe system details.



Product and platform functions: see Annex 3 "Introduction to IoT Series Sensors and Platforms V19.7-1"

4.3 Railway locomotive traction return IoT monitoring system:

System functions

1) Monitors the return status of the main and branch circuits in the traction system, including the suction line, rail, and integrated grounding line.
2) Performs analysis, status evaluation, and alarm handling.
3) **Overall return flow:** monitors the total return current and provides analysis, status assessment, and alarms for normal or abnormal conditions.
4) **Branch return flow:** monitors each return-flow branch individually, with analysis, status judgment, and alarms for normal or abnormal operation.
5) **Suction line:** monitors the operating condition of the suction line (single, double, or four-line configurations), with analysis, status evaluation, and alarms for normal or abnormal states.
6) **Connection line:** monitors the connection line between the rail and the return circuit, enabling assessment of rail current imbalance.

7) **Grounding wire:** monitors the grounding wire of the connection plate and provides analysis, status judgment, and alarms for normal or abnormal conditions.
8) **Big data application:** integrates the above five categories of monitoring data for interactive analysis and graphical visualization on the platform. Over time, accumulated data supports the development of mathematical models correlating train speed and traction current, enabling standardized management and optimization. The system also provides normal, early-warning, and alarm classifications to support proactive operation and maintenance.

Application:

- After standard operating data and waveforms are established, the system analyzes real-time measurements, evaluates their status, and issues alarms based on comparison with the reference data.
- Alarm thresholds can be set remotely—for example at 20%, 40%, or 60% of the operating range—to monitor different loop conditions.
- Waveform curves can be generated according to the selected sampling period.
- Determines whether the suction line maintains proper contact with the connecting plate, return line, and rail connection line.
- Identifies the train's operating speed (high-speed or low-speed) and type (passenger or freight).
- Evaluates whether the suction-line return system meets design specifications.


Suction line monitoring


Rail side lead monitoring


Choke flow lead monitoring


Choke flow lead monitoring


Choke flow lead monitoring


Lateral joint monitoring

4.4 Internet of Things Monitoring System for Distribution Network Lightning Arrester Working Condition:

Status description: Guangzhou's distribution network contains roughly one million lightning arresters. Currently, lightning strikes cause a damage rate of up to 5%, resulting in significant economic losses and posing a serious threat to grid safety. Because zinc-oxide arresters have unique characteristics that make deterioration difficult to detect and maintain, real-time monitoring has become essential.

Existing domestic and international technologies offer few cost-effective solutions. Leveraging our expertise in lightning monitoring, we have initiated a joint project with the China Southern Power Research Institute to address this challenge. The project plan has already been completed

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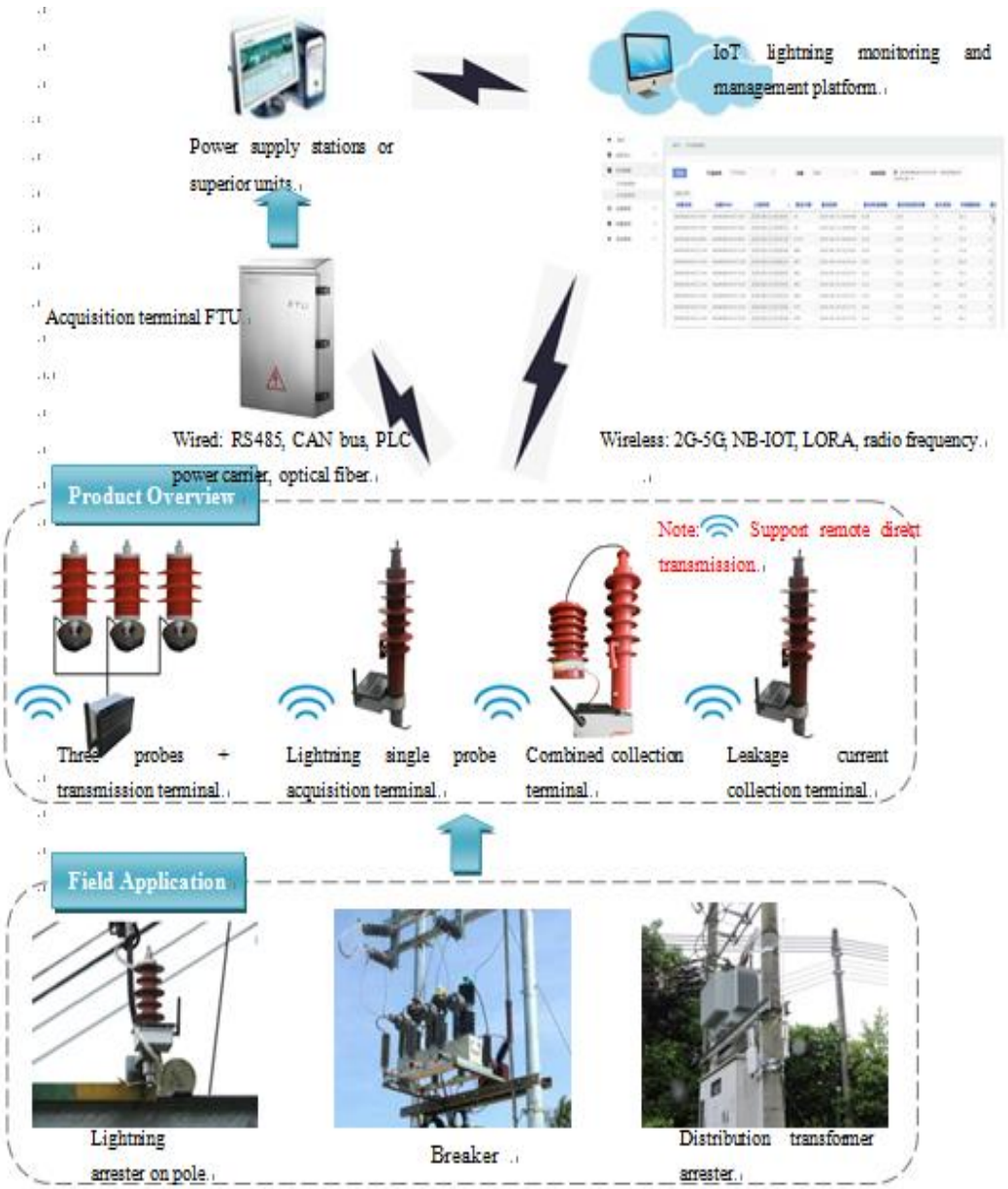
Technical Difficulties:

1) Research on the leakage current detection unit of arrester based on micro current sensor, wide range, high frequency signal acquisition. That is, in various technical methods of extracting pure resistive leakage current from the total leakage current, the defects and advantages are filled and merged. Using FFT, wavelet, windowing and other software technologies to accurately and timely monitor the important parameters that reflect the working condition of the arrester: pure resistive current.
2) Research on a new type of intelligent discharge counter based on Roche high current sensor, wide frequency band, wide range, high frequency signal acquisition device. Research and master the detection, noise removal, and recording software and hardware technologies of large amplitude, wide frequency band, wide range, and high frequency signals. Accurately and quantitatively record the impact state of the arrester, record the amplitude and waveform of the arrester leakage current under the continuous lightning intrusion wave overvoltage, and study measures to improve the energy tolerance of the arrester, including optimizing the arrester material and structure, or installing a series of small gaps to reduce Energy absorbed under small continuous lightning strikes.
3) Research the detection unit based on safe voltage potential detection. Using non-contact detection technology and high insulation methods, it provides technical support for the safe detection of power grid fluctuations, operating over voltages, lightning voltages, and grounding resistance.
4) Research is based on the "duplex" software and hardware between cloud platforms and between cloud platforms and devices. Realize remote device management, remote settings, and remote update functions.
5) A mathematical model based on multi-element interference and neural network algorithms. Eliminate actual interference such as temperature, humidity, pollution, phase-to-phase capacitance, and voltage fluctuations, and accurately judge the working condition of the arrester.

Technical solution block diagram



Lightning rod lightning monitoring IoT system in 2018