

be very challenging due to the large diagonal distances, which can range from hundreds to thousands of meters. If there is a problem with the grounding resistance, it is usually due to the connection points between the down conductors and the network (the welding points indicated by arrows in the diagram).

It is impractical to excavate and rework the entire underground network; doing so would essentially mean rebuilding the entire system. Instead, for large grounding systems, we can install testing devices on the main and branch grounding down conductors to monitor the connection status between the down conductors and the underground network. By measuring the metal loop connection resistance, we can assess the grounding status of the down conductors.

3、Single-Point Grounding System

If there is no overhead wire between grounding network A and grounding network B and they are not connected above ground, then grounding network A and grounding network B are independent single-point groundings. In this case, the testing device cannot directly measure the grounding resistance of a single-point grounding system and will display an "OL" (Over Limit) symbol, indicating that it exceeds the maximum range of the tester. At this point, you need to add one or two auxiliary grounding electrodes to form a loop, then install the testing device. For two or more single-point grounding systems within close proximity, you can connect the grounding down conductors of each single-point system above ground using metal conductors to form a loop, and then use the testing device to monitor the system.

4、Three-Point Method

In the diagram, the grounding electrode under test is A, and two additional auxiliary grounding electrodes are B and C. The electrodes A, B, and C are connected together on the ground. By installing a testing device on each of the three grounding electrodes, you can accurately measure the grounding resistance at point A. The calculation is as follows:

$$R1=RA+RB \parallel RC-----(1) ;$$

$$R2=RB+RA \parallel RC-----(2) ;$$

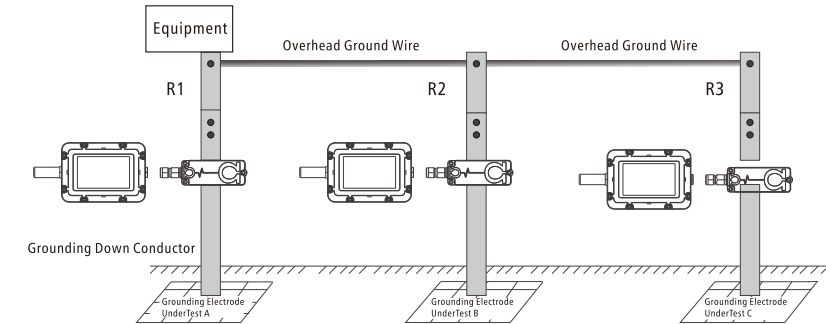
$$R3=RC+RA \parallel RB-----(3)。$$

R1, R2, and R3 are the results from the testing device.

RA, RB, and RC are the grounding resistances of the three electrodes relative to the ground.

By solving the system of three equations, you can accurately determine the grounding resistance RA of the tested electrode. You will also obtain the grounding resistances of the auxiliary electrodes RB and RC, as well as the combined parallel grounding resistance of RA, RB, and RC.

Another advantage of the three-point method is that the added auxiliary electrodes B and C are connected in parallel with the tested electrode AAA. This parallel configuration results in a combined actual grounding resistance that is less than RA, thus improving the grounding of the tested electrode. Specifically, $RA \parallel RB \parallel RC < RA$. During actual installation, the grounding resistance of auxiliary electrodes B and C should be controlled to within 10 times the engineering standard requirement for the tested grounding system. For example, if the required grounding resistance is no more than 4Ω , then $RC < 40\Omega$, $RB < 40\Omega$. Ideally, the smaller RB and RC are, the better they will improve the grounding system being tested.



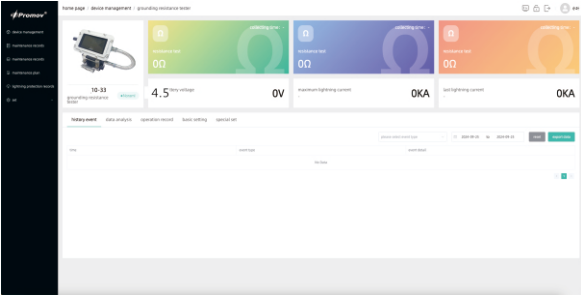
Software Platform

Download and install Google Chrome.
Enter the address: <http://8.140.30.66:58088/> to access the login interface

Login Interface

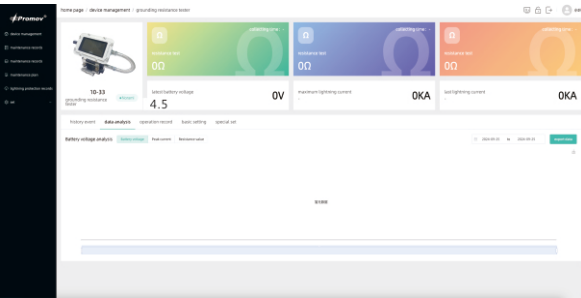


History



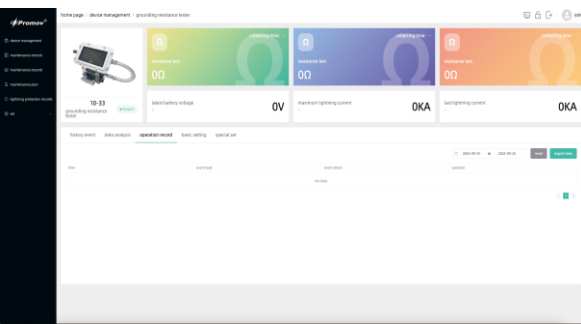
Display the historical records of devices in a tabular format, supporting type and time period searches, and data export.

Data Analysis



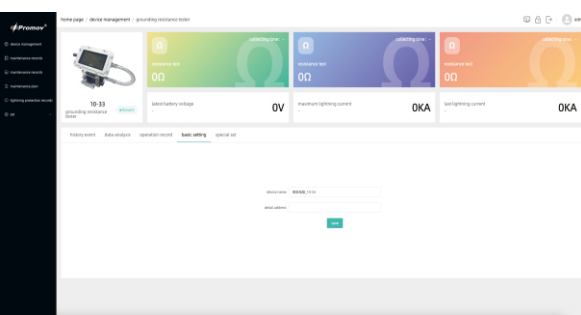
Display the device operation records in a tabular format, supporting time period searches and data export.

Operation Record



Users can set the following parameters: device name, detailed address.

Basic Settings



XIAMEN TAIHANG TECHNOLOGY CO.,LTD

Tel : +86-0592-5764219 Fax : +86-0592-5764098 Email: taihang@taihang.cc
<http://www.promov.cc>



Online Ground Resistance Monitoring Device

Realize Online Monitoring of Circuit Grounding Resistance

XIAMEN TAIHANG
TECHNOLOGY CO.,LTD



TJ1 Circuit Ground Resistance Online Monitoring Instrument

The TJ1 Circuit Ground Resistance Online Monitoring Instrument features a switchable design, allowing for installation without disconnecting the grounding download, making it convenient and quick. It supports online testing and non-contact measurement, passes through grounding conductors without affecting lightning protection grounding effectiveness or normal operation of facilities. It requires no self-testing and provides real-time monitoring. Suitable for various applications including transmission line tower grounding, underground mine grounding, meteorological lightning protection grounding, oil and gas industry grounding, communications grounding, substation grounding, railway facility grounding, building and warehouse grounding, and electrical equipment grounding.

Functional Features:

- Online non-contact measurement, supports networking multiple devices, real-time data upload.
- Implement functions for historical data storage, querying, statistics, and analysis.
- Hinged structure installation; no need to disconnect the grounding wire. The wire passes through the core without affecting lightning protection, making it convenient and quick.
- Wired and wireless communication methods, with antenna transmission power less than 30 dBm.
- Features lightning peak recording function, real-time recording of lightning peak values and occurrence times.
- The product meets Zone 1 explosion-proof classification, with explosion-proof marking Ex db mb IIC T6 Gb.

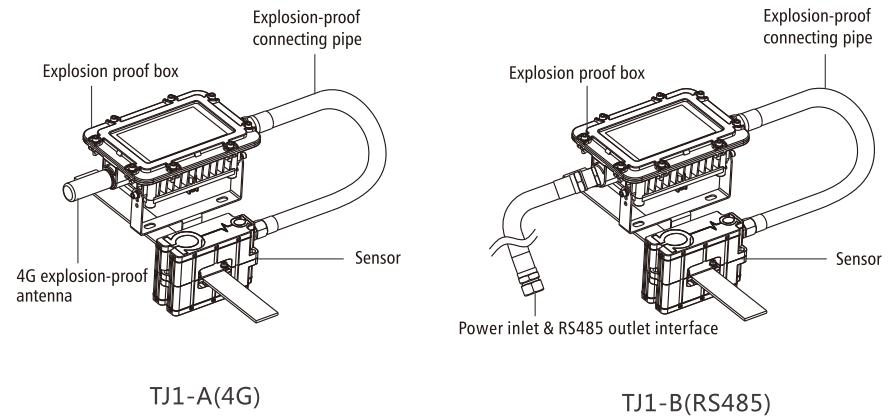
Specifications

Model	TJ1-A	TJ1-B
Power supply	5VDC (Solar panel + battery)	12~24VDC
Measurement method	Circuit method	Circuit method
Impedance range	0.10Ω ~ 100.00Ω	0.10Ω ~ 100.00Ω
Resolution	0.01Ω	0.01Ω
Accuracy	0.10~0.99Ω : ± (1%+0.10Ω) 1.00~49.90Ω : ± (1.5%+0.10Ω) 50.00~100.00Ω : ± (2%+0.50Ω) (20°C±5°C , <70%RH)	0.10~0.99Ω : ± (1%+0.10Ω) 1.00~49.90Ω : ± (1.5%+0.10Ω) 50.00~100.00Ω : ± (2%+0.50Ω) (20°C±5°C , <70%RH)
Range for setting automatic monitoring interval	1 ~ 999hour	1 ~ 999hour
Test duration	30s/per Max	30s/per Max
Communication method	4G	RS485
Data display	System software display	System software display
Operating temperature and humidity	-30°C ~ 55°C ; 5% ~ 95%RH	-30°C ~ 55°C ; 5% ~ 95%RH
Storage temperature and humidity	-30°C ~ 60°C ; 5% ~ 95%RH	-30°C ~ 60°C ; 5% ~ 95%RH
Electromagnetic characteristics	IEC61010-4-3 , Wireless frequency electromagnetic field ≤ 1 V/m	IEC61010-4-3 , Wireless frequency electromagnetic field ≤ 1 V/m
Insulation resistance	Above 10 MΩ (between circuit and enclosure, 500V)	Above 10 MΩ (between circuit and enclosure, 500V)
Enclosure protection rating	IP66	IP66
Explosion-proof rating	Ex db mb IIC T6 Gb	Ex db mb IIC T6 Gb
Corrosion resistance rating	WF2	WF2

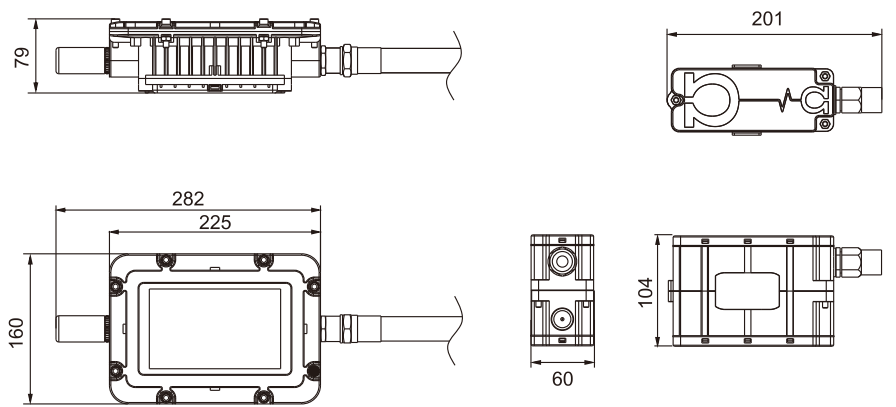
ADDITIONAL FEATURES

Lightning peak recording	Recording Range: 1~100 kA (10/350μs) Measurement Accuracy: ±(20% + 0.5 kA) (20°C ± 5°C, < 70% RH) Data Storage: 0-99 records including resistance value, resistance measurement time, lightning peak current, and lightning occurrence time
--------------------------	---

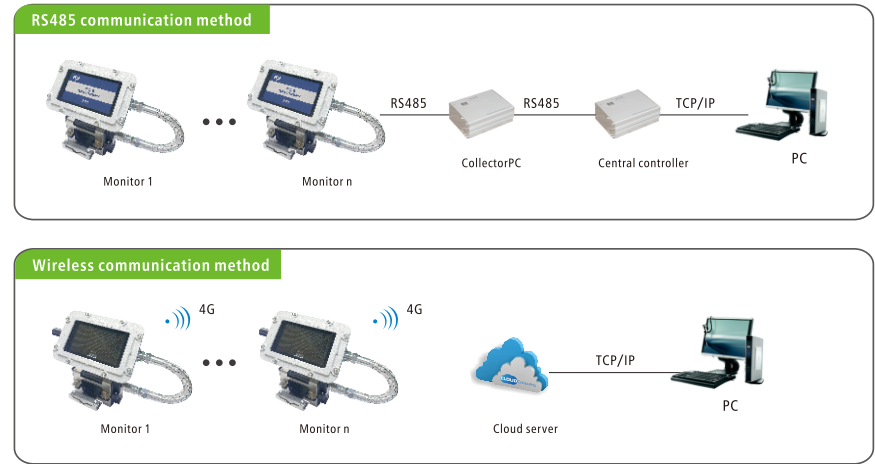
Interface Description



Installation Dimensions(mm)



Network System

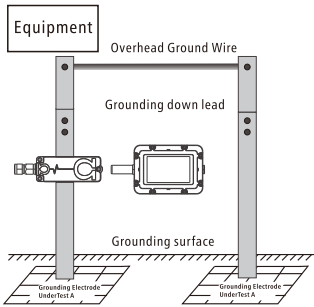


Detection Principle

The basic principle of the TJ1 ground resistance online monitor is to measure the loop resistance. The sensor first applies an excitation pulse signal to the ground loop under test. This generates an induced pulse potential EEE on the loop. Under the action of this potential EEE, a current III is produced in the loop. The sensor measures both EEE and III, and the loop resistance is then calculated using the formula $R = E/IR = E/IR = E/I$.

1. Definition of loop impedance

As shown in the diagram, the loop resistance includes the grounding resistance from point A to the ground, the resistance of the grounding down conductor (metal conductor), the resistance of the overhead metal wire, the connection resistance between the grounding down conductor and the overhead metal wire, and the combined grounding resistance value from point B to the ground. For a grounding system that forms such a loop, a testing device can be directly installed for monitoring. If the grounding system does not form a loop, additional auxiliary grounding electrodes need to be added to create a loop before installing the testing device. Refer to the subsequent section on single-point grounding systems.



If the combined loop resistance measured by the testing device for grounding network A and grounding network B is 5 ohms, i.e., $RA + RB + R \text{ overhead wire} + R \text{ down conductor} = 5.0\Omega$, then the actual grounding resistance of networks A and B connected in parallel will be less than or equal to 2.5Ω. Based on this, you can determine if the actual grounding resistance of network A, when parallel to network B, is qualified. If the combined grounding resistance of networks A and B is less than the engineering standard requirement, then both networks A and B are considered qualified.

2. Metal Loop Connection Resistance Testing

If grounding network A and grounding network B are connected both above and below ground, the testing device will measure the resistance of the metal loop, which is typically very low, in the range of a few ohms or less. This is the metal loop connection resistance, also known as the equipotential resistance, not the grounding resistance. Thus, the testing device can conveniently measure the metal loop connection resistance.

In large grounding systems, such as those used in substations, oil depots, or large buildings, the underground network is usually a large, unified system. Multiple grounding down conductors extend to the surface and are connected above ground, as shown in the diagram. For such large grounding systems, measuring the grounding resistance can

