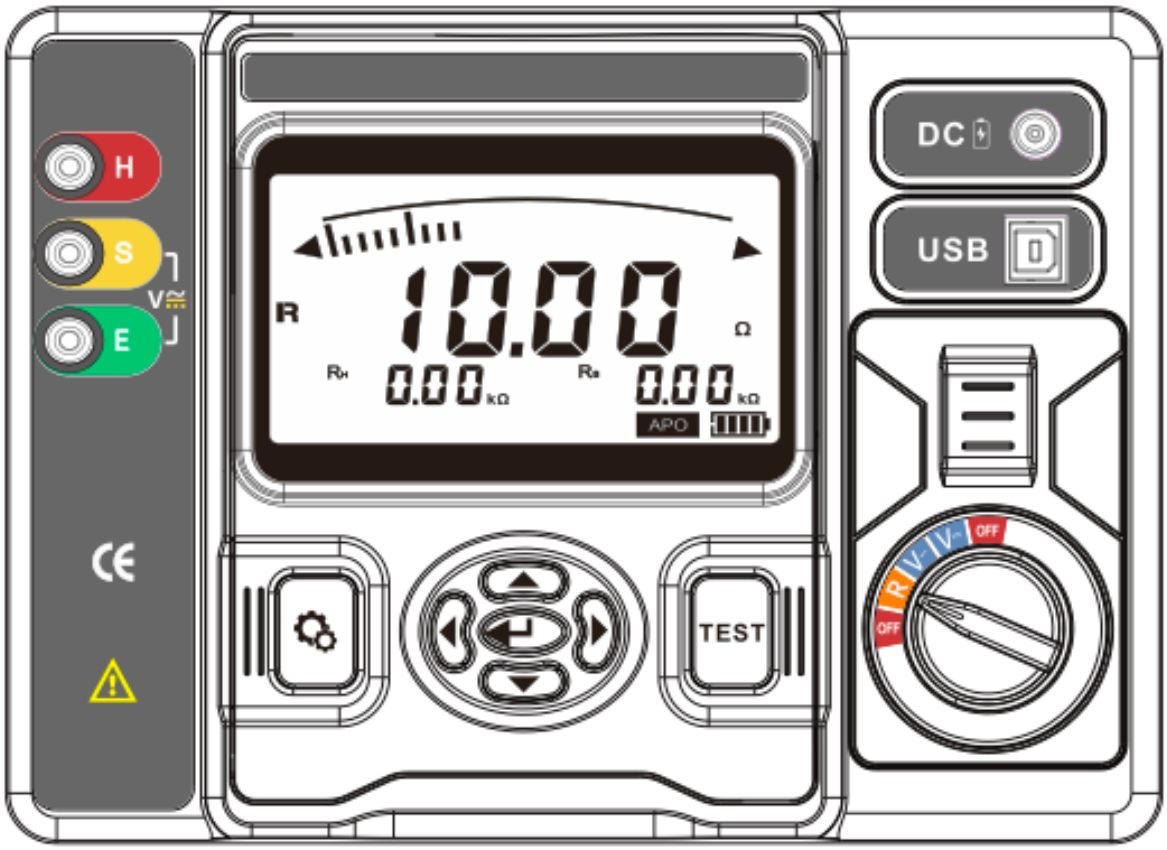
FÖHR

ES3000P

MULTI FUNCTION EARTH RESISTANCE TESTER



INSTRUCTION MANUAL

CONTENT

I. Safety Precautions and Procedures

Thank you for purchasing our company's **digital grounding resistance tester**. Before using the instrument for the first time, in order to avoid possible electric shock or personal injury, please be sure to **read and strictly observe the safety rules and precautions listed in this manual.**

In any case, the use of this instrument should pay special attention to safety.

- The instrument is designed, produced and inspected according to IEC61010 safety specifications.
- In any case, the use of this instrument should pay special attention to safety.
- When measuring, high-frequency signal generators such as mobile phones should not be used next to the meter to avoid errors.
- Pay attention to the text and symbols on the body of the instrument.
- Before use, make sure that the instrument and accessories are in good condition. The insulation layer of the instrument and test wire is not damaged, exposed or broken.
- During the measurement, it is forbidden to touch exposed conductors and the circuit being measured.
- Make sure the connection plug of the wire is tightly inserted in the meter connector.
- Do not apply more than 100V AC voltage or DC voltage between the test terminal and the interface, doing so may damage the meter.
- Do not measure in flammable places, sparks may cause explosion.
- When the instrument is in use and the enclosure or test wire is broken and the metal is exposed, please stop using it.
- Do not place and store the instrument for a long period of time under conditions of high temperature, humidity, condensation, and direct sunlight.
- When charging the battery, make sure the test line has been removed from the meter and the meter is off.
- The meter displays the battery voltage low symbol  ” and should be charged in time.
- Pay attention to the measuring range and use environment specified by this instrument.
- The use, disassembly, calibration and maintenance of this instrument must be performed by authorized personnel.

- Because of the reason of this instrument, if it is dangerous to continue using it, it should be immediately stopped and sealed immediately, and it should be handled by a qualified organization.
- The "⚠" safety warning sign in the instrument and manual must be operated strictly in accordance with the contents of this manual.

II. Introduction

Digital grounding resistance tester, also known as **the three-wire grounding resistance tester, grounding resistance meter, etc.,** It is an advanced ground resistance tester that integrates multiple measurement methods.The grounding resistance test is measured 3-wire method, simple 2-wire method, selection method and double-clamp method controlled by the microprocessor. It adopts a large-diameter current clamp design and utilizes dual-clamp measurement technology. There is no need to drive auxiliary grounding electrodes or isolate the grounding body from the equipment, thus achieving online measurement, It is widely applied in telecommunications, power, meteorology, computer rooms, oil fields, power distribution lines, tower transmission lines, gas stations, factory grounding grids, lightning rods, etc. The instrument is features precise, rapid, simple, stable and reliable testing.

The multi-functional ground resistance tester is controlled by a microprocessor and can accurately detect ground resistance, soil resistivity, ground voltage and DC voltage. It uses fast filtering technology to minimize interference. The resistance value of the auxiliary electrode is displayed on the same screen to facilitate the judgment of measurement errors caused by environmental factors and to more accurately measure the true grounding resistance value.It can store 500 sets of data simultaneously. It can be connected to a mobile phone APP via Bluetooth or to a computer host computer via USB to achieve functions such as wireless or wired remote measurement, reading historical data, and exporting report analysis. It has unique functions such as numerical retention and intelligent alarm prompts.

The multi-functional ground resistance tester is composed of a main unit, upper computer software, mobile phone APP software, test leads, USB cables, chargers and grounding pins.

model

Model	Function
ES3000P	Two,Three ac,ground resistance,AC Voltage,DC Voltage

III.Rang and Accuracy

1. The ranges, accuracies and resolutions for each mode

Measurement function	Range	Accuracy	Resolution
the two-three method to measure the earth resistance tester)	0.00Ω～19.99Ω	±1.5%rdg±7dgt	0.01Ω
	20.0Ω～199.9Ω		0.1Ω
	200Ω～1999Ω		1Ω
	2.00kΩ～19.99kΩ		10Ω
AC Voltage	0.000～9.999V	±1.5%rdg±50dgt	0.001V
	10.00～99.99V		0.01V
	100.0～750.0V		0.1V
DC Voltage	0.000～9.999V	±1.5%rdg±50dgt	0.001V
	10.00～99.99V		0.01V
	100.0～999.9V		0.1V
temperature characteristic	temperature characteristic::Add the test accuracy ×0.1/℃ within the operating temperature range. Outside the range of 18℃ to 28℃ For example 8 ℃ : plus or minus 0.2% RDG plus or minus 10 DGT precision (basic) + 0.1 x 10 (temperature) x 0.2% (RDG + 10 DGT) = + / - 0.4% RDG + 20 DGT		

Note: 1. Reference condition: Accuracy when Rh Rs<100Ω.

Working conditions :Rh max =3kΩ+100R < 50kΩ;Rs max =3kΩ+100R < 50kΩ

2.It depends on the measurement accuracy of R, π=3.14, a: 0.1m to 100.0m;

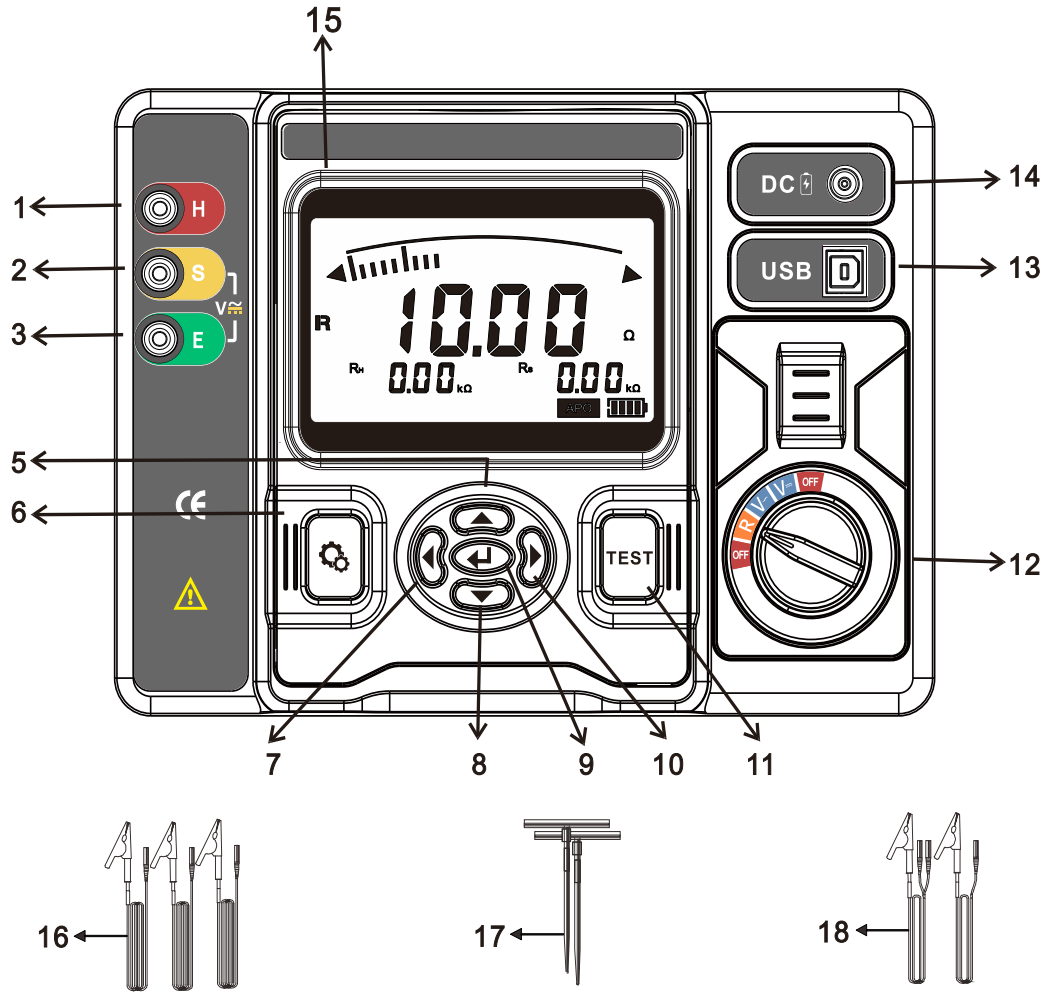
2. Technical Specifications

Environmental temperature and humidity	23℃±5℃, below 75%rh
interference voltage	＜20V（Should avoid）
interference current	＜2A（should avoid）
Electrode spacing when measuring R	a＞5d
Electrode spacing when measuring ρ	a＞20h
Power	The 11.1V lithium battery (built-in) can continuously measure over 1000 times when fully charged in AC resistance mode
Backlight	Controllable gray screen backlight, suitable for use in dim places
measurement way	Precise four wire,three-wire measurement, simple two-wire measurement
Measurement methods	Two-wire method measurement: Rated current method, measure the maximum current of 42.0mA Grounding voltage: Average value rectification (between S-E interfaces) Dc voltage: Average value rectification (between S-E interfaces)
Test voltage waveform	sine wave
Test frequency	128Hz

Open Circuit Test Voltage	AC 30.0V Max
Display mode	Display mode Large size HD segmented LCD screen
Instrument size	L/W/H: 277.2mm×227.5mm×153mm
Test line	3 strips: red 15m, yellow10m, green 5m each one
Simple test line	2pcs: 1.5m red and 1.5m green each
Auxiliary Grounding rod	2PCS: Φ10mm×200mm
Measure time	Ground voltage: approximately 3 times per second Grounding resistance: approximately 10 seconds per time
USB interface	With USB interface, software monitoring, storage data can be uploaded to the computer
Bluetooth connection	Yes,It can perform real-time monitoring on mobile phones, data reading and other functions
Communication Line	USB Communication line1 pcs,1.5m length One USB communication line, 1.5m long
Data storage	500 groups, "MEM" storage indication, showing the "FULL" symbol indicates that the storage is full
Data review	The "MR" symbol indicates when consulting data
Overflow display	Over-range overflow function: "OL" symbol display
Auxiliary grounding test	It has the function of auxiliary grounding resistance value testing, ranging from 0.00Ω to 20.00kΩ
Alarm function	Alarm when the measured value exceeds the alarm setting value
automatic shut	The "APO" indicator indicates that it will automatically shut down after 15 minutes of startup (default)
Power consumption	Standby: 80mA Max(Backlight off) 90mA Max(Backlight on)
	Measurement: 120mA Max(Backlight off) 130mA Max(Backlight on)
Weight	Instrument: 1880g(including battery)
	Test lead: 861.5g(including simple test lead)
	Auxiliary grounding rod: 425g(2pcs)
Working temperature and	-10℃～40℃; below 80%rh

humidity	
Storage temperature and humidity	-20℃～60℃; below 70%rh
overload protection	Measure the grounding resistance: AC 280V between each port of H-E and S-E for 3 seconds
insulation resistance	20MΩ or above (500V between the circuit and the casing)
Pressure resistance	AC 3700V/rms(between circuit and housing)
electromagnetic property	IEC61326(EMC)
Suitable for safety regulations	IEC61010-1(CAT Ⅲ 300V、CAT IV 150V、pollution level 2); IEC61010-031; IEC61557-1(Grounding resistance);

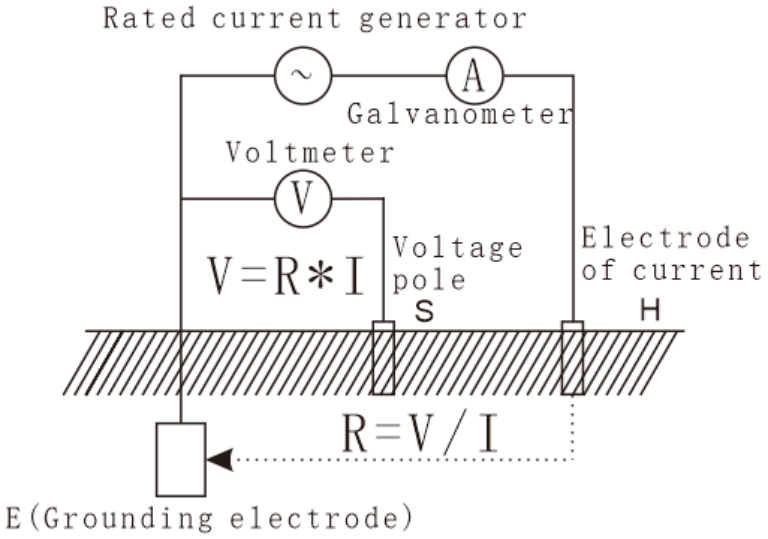
IV. Structure



1. H Interface (current pole)
2. S Interface (voltage pole)
2. E Interface ground pole)
5. Up button
6. Backlight button (set button)
7. Left arrow key
8. Down button
9. confirm key
10. .Right arrow key
11. Test buttons
12. Turntable control keys
13. USB interface
14. DC Plug-in socket
15. LCD
16. Test leads
17. Auxiliary grounding rod
18. Simple test lead

V. Measuring principle

1. The three-wire method for measuring grounding resistance values adopts the rated current method (suitable for accurately measuring single-point grounding systems). This involves passing an alternating rated current I between the E grounding electrode and the H current electrode, then calculating the potential difference V between the E grounding electrode and the S voltage electrode. The ground resistance value R is calculated using the formula R=V / I.。



2. Among the above methods, the working error (B) is the error obtained within the rated working conditions, which is calculated from the inherent error (A) and the variable error (Ei) existing in the instrument used.

$$B=\pm(|A|+1.15\times\sqrt{E_2^2+E_3^2+E_4^2+E_5^2})$$

A: Inherent error
E2:Changes caused by changes in the power supply voltage
E3:Changes caused by temperature changes
E4:Interference with voltage changes
E5:Changes in contact electrode resistance

3. The average rectification method is used for ground voltage measurement.

5. The average rectification method is used for DC voltage measurement.

VI.Method of operation

1.Startup & Shutdown

Rotate the turntable to turn the turntable to the non- "OFF" mode to start up, and to the "OFF" mode to shut down. The instrument will automatically shut down after 15 minutes (default) after starting up.

2.Check battery voltage

1.After the machine is turned on, if the screen shows a low battery voltage symbol “  ”, It means that the battery is low. Please charge it in time. Only when the battery is sufficient can the accuracy of measurement be guaranteed.

2.The power consumption during the test is higher than the standby. If the screen shows a low battery voltage symbol during the test “ ”, It means that the battery is about to run out of power. Please charge it in time to ensure the accuracy during testing.

3.If the power is insufficient to support the test, it will automatically shut down. Please charge it again before testing.

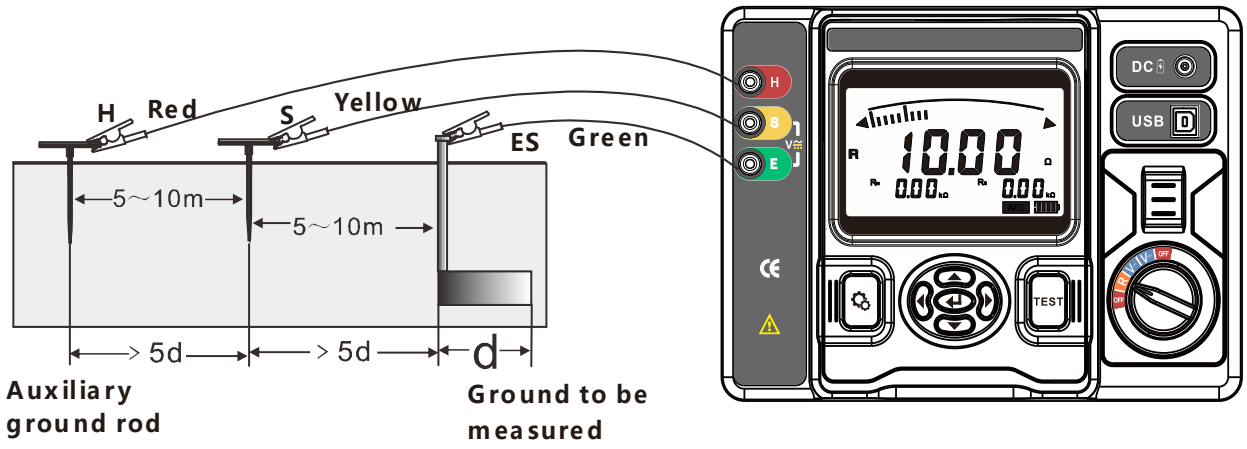
3. Three Wired method precision test grounding resistance

⚠	**When testing the grounding resistance, first confirm the ground voltage value of the grounding wire, that is, the voltage value between H and E or S and ES must be below 20V. If the ground voltage is above 5V, the instrument will display the NOISE symbol, which may cause errors in the measurement of the grounding resistance. In this case, disconnect the power supply of the equipment to be tested first, reduce the ground voltage, and then proceed with the grounding resistance test.**

Third-line test As shown in the following figure, note that the three-wire test cannot eliminate the influence of wire resistance changes on the measurement, nor can it eliminate the influence of contact resistance changes between the instrument and the test leads, or between the test leads and the auxiliary grounding rod on the measurement. If you need to remove the influence of wire resistance, you can short the three test leads after each startup, and then long press "▲" to eliminate the resistance value of the test leads. This elimination function is not remembered. The instrument needs to be reset after being restarted.

When measuring, the oxide layer on the surface of the grounding body under test also needs to be removed.

⚠	The distance between the grounding body E under test and the current electrode H should be at least five times the depth (h) to which the grounding body under test is buried underground, or five times the length (d) of the electrode of the grounding body under test buried underground.
	To measure the total grounding resistance of a complex grounding system, the distance d is the distance of the maximum diagonal of the grounding system.
	During the test, the test leads must not be wound around each other; otherwise, it may affect the test accuracy.



For multi-point independent grounding systems or larger grounding grids, test leads of 50m or longer can be selected for testing, as shown in the following figure:

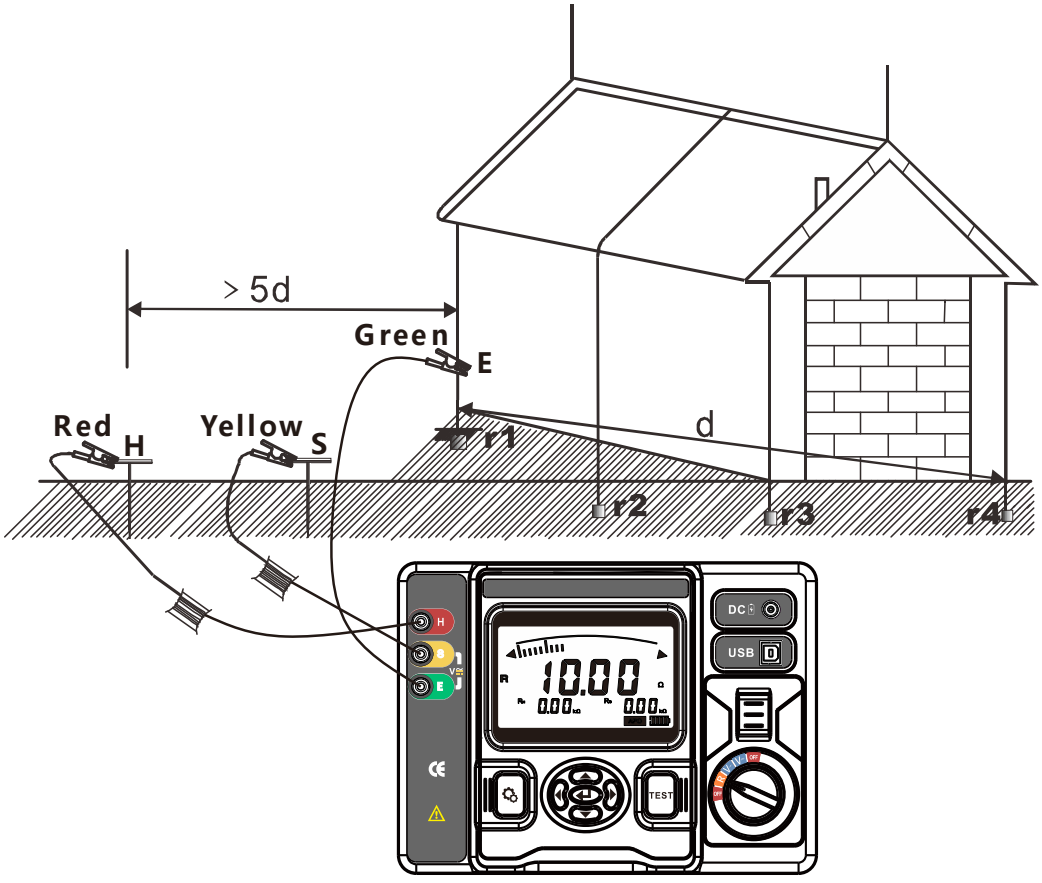


图 6.3.2

R=r1 // r2 // r3 // r4 // r5 // r6 // … // rn(r1…rn All are independent grounding points)

R——meter reading

r1…rn——They are independent grounding points

rH——Auxiliary current electrode H to ground resistance

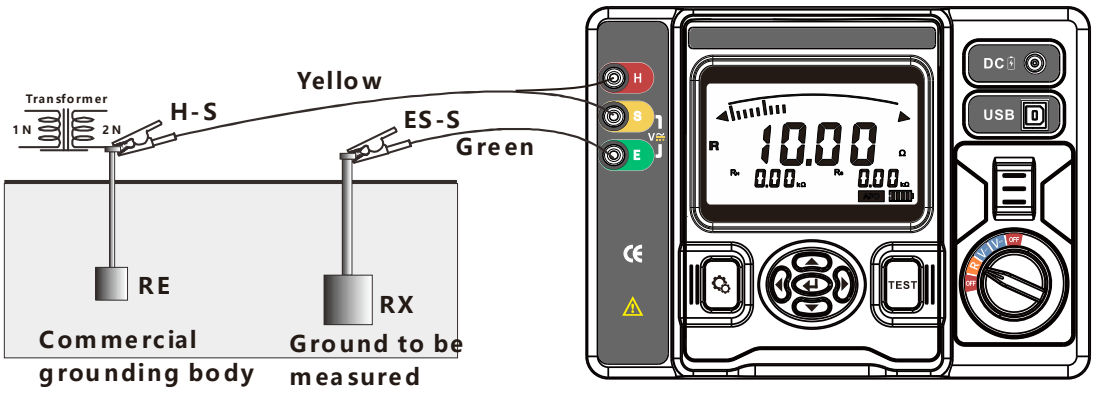
rS——The earth resistance of the auxiliary voltage pole S

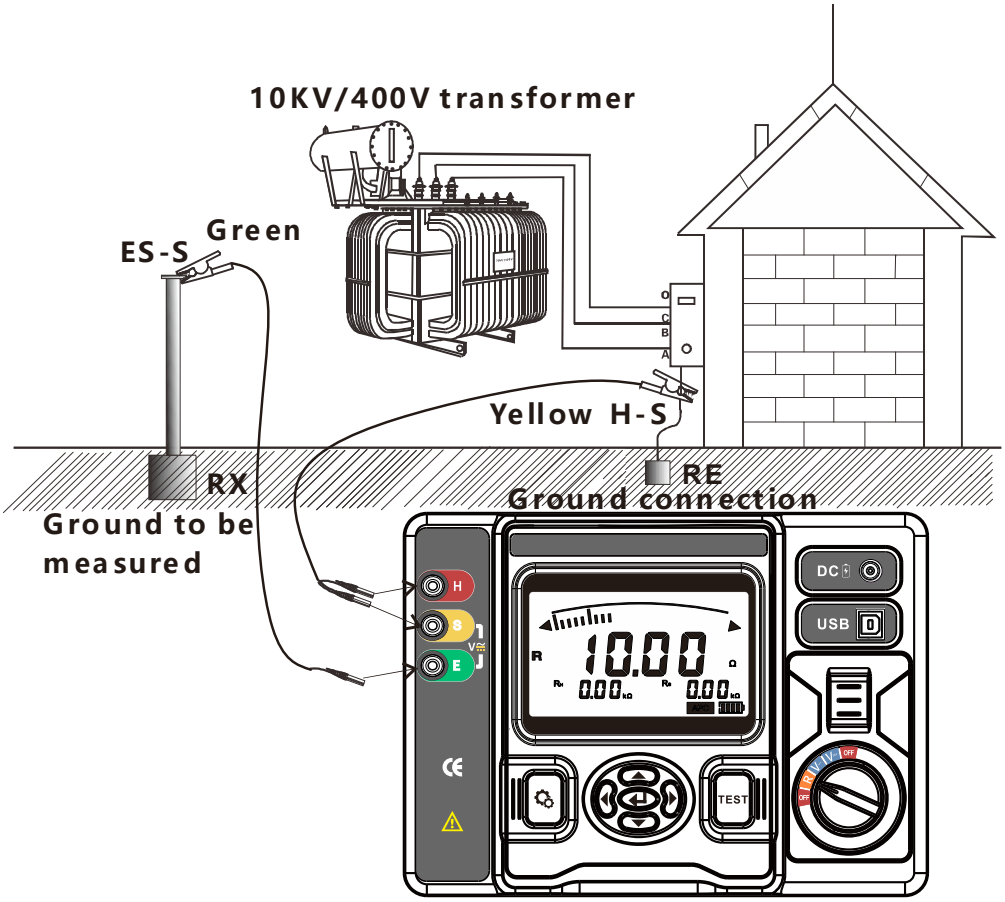
After connecting the TEST leads, turn the dial to "RE" to enter the grounding resistance test mode. Press the "TEST" key to start the test. During the test, there will be a reverse count indicator. After the test is completed, stable data will be displayed, namely the grounding resistance value R of the tested grounding body and the grounding resistance values RH and RS of the auxiliary current electrode H and the auxiliary voltage electrode S。

4. Two-wire simple test for grounding resistance

Two-wire test: This method is a simple measurement approach without the use of auxiliary grounding rods. It utilizes the grounding electrode with the smallest existing grounding resistance value as the auxiliary grounding electrode and connects it with two simple test leads (i.e., short-circuiting the H-S interface and the E interface). Metal water pipes, fire hydrants and other metal embedded objects, common grounding of commercial power systems or lightning protection grounding electrodes of buildings can be used to replace auxiliary grounding rods H and S. When measuring, pay attention to removing the oxide layer at the connection point of the selected metal auxiliary grounding body. The wiring is as shown in the following figure. The operation of the instrument is the same as that of the four-wire test.

	**When using the commercial power system grounding as an auxiliary grounding pole measurement, it must be confirmed that it is the commercial power system grounding pole first, otherwise the circuit breaker may start, which is dangerous.**
	When measuring the grounding resistance by the simple two-wire method, it is advisable to select a grounding electrode with a smaller re value as the auxiliary grounding electrode as much as possible. Only in this way can the instrument reading be closer to the true value. When measuring, please give priority to choosing metal water pipes and metal fire hydrants as auxiliary grounding electrodes.





The simple method to measure the grounding resistance, the meter reading is the sum of the grounding resistance value of the tested grounding body and the grounding resistance value of the commercial grounding body, namely:**R=RX＋re**

Where: R: is the instrument reading value;

RX: is the grounding resistance value of the measured grounding body;

Re: is the grounding resistance value of a common grounding body such as a commercial power system.

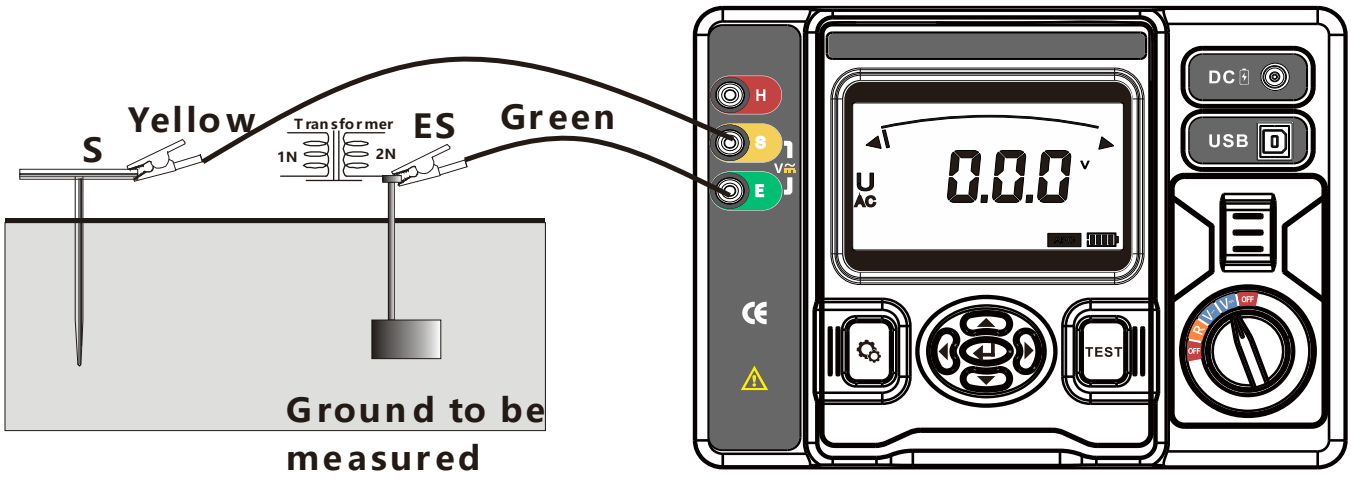
Then, the grounding resistance value of the measured grounding body is:**RX=R－re**

5. Grounding voltage test/ACV

⚠	**An auxiliary grounding rod is required for ground voltage testing.**
	As long as the instrument is connected to the earth through the test line and auxiliary grounding rod, other test lines of the instrument interface cannot be connected to the L and N lines of the commercial power supply, otherwise it will cause leakage and the circuit breaker may start, which is dangerous.
	Ground voltage test should not exceed 750V.

Ground voltage: that is, when an electrical equipment has a ground fault, the potential difference between the casing of the grounding equipment, the grounding wire and the grounding body and the zero potential point. The ground voltage is the potential difference with the earth as the reference point, and the earth is the zero potential point.

When conducting grounding voltage tests, an auxiliary grounding rod should be used. Note the difference from commercial AC voltage tests. See the following figure: After the instrument, auxiliary grounding rod and test leads are all connected properly, turn the rotor to the "V-AC" position, and the test voltage will be displayed in real time

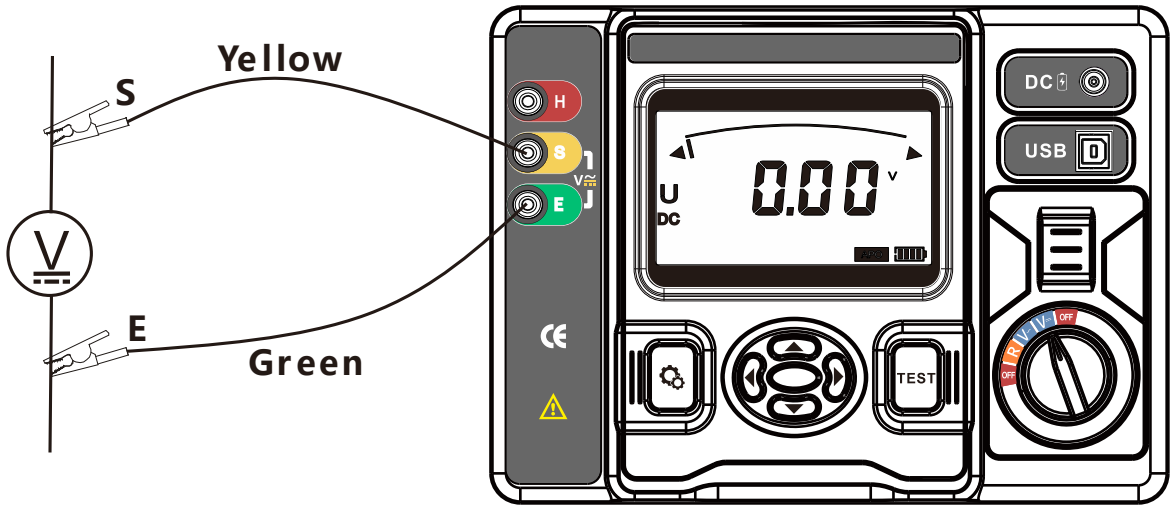


6. DC Voltage test/DCV

	The DC voltage test can be used as a supplement to the ground voltage test to measure the DC component
	As long as the instrument is connected to the earth through the test line and auxiliary grounding rod, other test lines of the instrument interface cannot be connected to the L and N lines of the commercial power supply, otherwise leakage will occur and the circuit breaker may start, which is dangerous.
	The DC voltage test should not exceed 1000V.

DC voltage: that is, when an electrical equipment has a ground fault, the potential difference between the casing of the grounded equipment, the grounding wire and the grounding body and the zero potential point. The DC component potential difference can be measured with the earth as the reference point, and the earth is the zero potential point

The wiring method for the Dc grounding voltage test is the same as that for the "AC grounding voltage test". When the rotor is turned to the "V Dc" position, the test voltage is displayed in real time



7. Backlight control

After turning on the machine, press the "⚙" key to turn on or off the backlight. The backlight function is suitable for dim places. The backlight is turned off by default every time the machine is turned on.

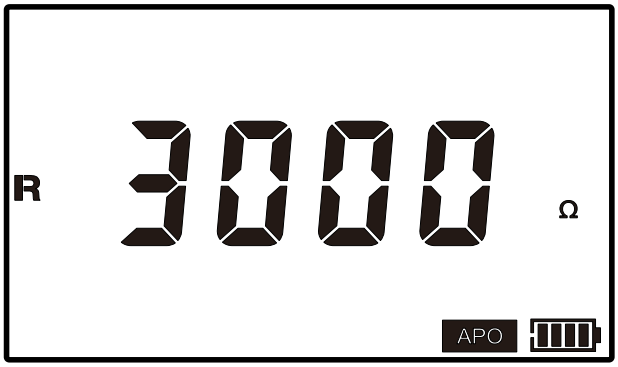
8. Shutdown time setting

Long press the "▼" key (for more than 3 seconds) to enter the alarm setting, and then briefly press the" ▲"to switch the setting mode (there are up to three setting modes, namely alarm value setting, shutdown time setting (displaying the" APO "icon), and electrode spacing setting (specific to soil resistivity). The method to distinguish modes can be based on the unit. Then, briefly press the "▼" key to move the cursor, press the"▼ "or"▶ "key to change the size of the current number, and long press the" ↵"key to save the set value of a and return to the previous mode. The maximum value can be set to 30 minutes, and 0 minutes indicates that the timed shutdown function is turned off.

9. Alarm value setting

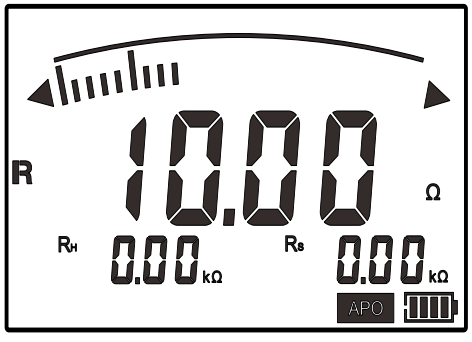
After power on, long press "⚙" Key, open and close the alarm function, and display the page "🔊" 。Long press " ▼" Key (more than 3 seconds) to enter the alarm Settings, and then press it again "▲" you can choose other Settings mode (there are up to three Settings modes, namely alarm value setting, shutdown time setting (display "APO" icon), electrode spacing setting (soil resistivity specific). The mode can be distinguished by looking at the unit), and then press short "▼" Move the cursor, press "◀" or "▶" Change the current number size with the key, and hold down the key "↵" saves the set a value and returns the previous pattern.

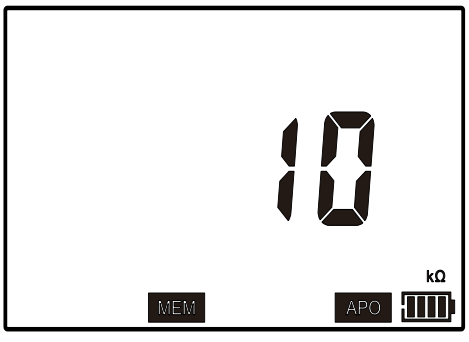
The instrument is flashing "🔊" symbol is sent out and the alarm sound "dud-dud-dud" is issued. The maximum value of the grounding voltage alarm is set to 750V, the maximum value of the DC voltage is set to 999V, and the maximum value of the grounding resistance and soil resistivity alarm is set to 9999Ω.

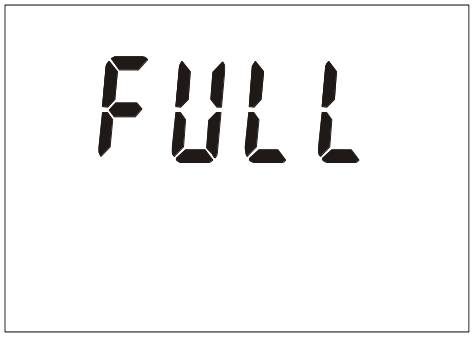


10.Data locking/storage

After the machine is turned on, measure is completed and press short " ↵" The key saves the current displayed data and automatically numbers the storage. If the storage is full, the instrument displays the "FULL" symbol as shown in the figure below: The measured data is 10.00Ω.

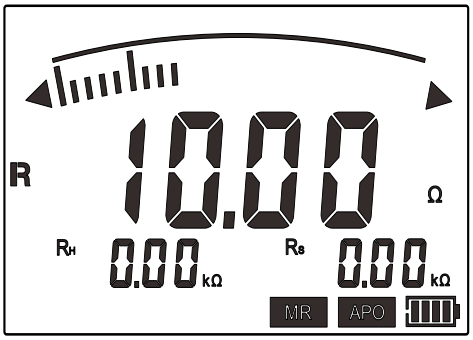


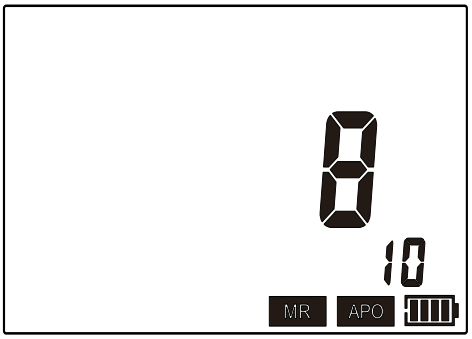


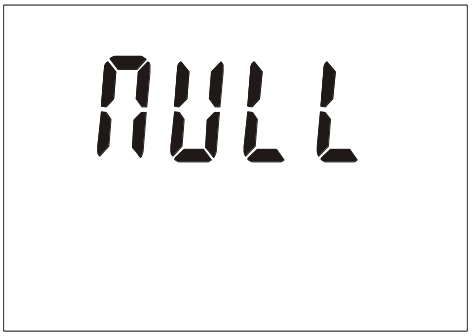


11.Data lookup/deletion

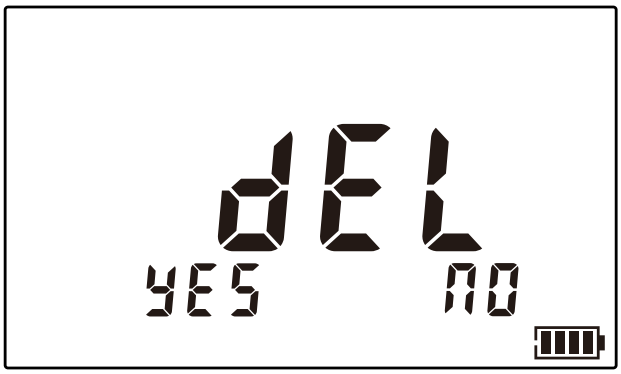
After the boot or measurement is completed, long press "↵" Key (more than 3 seconds) to enter the data viewing, storage data interface and storage data group number are displayed in sequence. Press "◀" or "▶" The key selects the array number and corresponding data with a step value of 1, and presses "▼" or "▲" key selects the array number and corresponding data with a step value of 10, and then long press the key "↵" Key out for viewing. When viewing, the number 8 in the figure below is the current group number, and 10 is the total group number. If there is no stored data, LCD displays "NULL", as shown in the figure below.







In data viewing mode, short press "↵" Key to enter data deletion, press "◀" or "▶" key Select "YES" or "NO". Select "NO" to not delete the data, select "YES" to delete the stored data, as shown in the figure below.



12.Data upload

⚠	Do not connect a computer to read data while various tests are being carried out, otherwise the ground voltage may damage the computer Or instruments.

(Note: the driver and upper computer need to be installed before connection)

upper monitor ： Connect the USB communication line between the computer and the instrument, turn on the instrument, run the monitoring software. If the USB connection is successful, there is a switching mode test function, save the measurement data, so that you can read the stored historical data, upload to the computer and save it.

(Note: Install the APP before connecting)

Bluetooth APP: When the instrument is turned on, on any interface, long press the "▶" button to turn on or off Bluetooth. Open the APP that has been installed on your phone, find the Bluetooth device with the name "RSS" on the interface, and click on the name to connect to the device.

VII.Maintenance and service

1.Batteries

1、When the battery voltage is too low, the battery symbol is displayed "▭", At this time, timely charging should be done to ensure the accuracy of measurement.

2、It takes about 4 hours to charge the battery from empty to full. Whether the battery is full or not depends on the DC indicator light of the charger. The red light indicates that the battery is charging, and the green light indicates that the battery is full.

3,When the battery is fully charged, it can continuously measure over 1000 in the AC ground resistance mode. The screen brightness and power consumption of different loads also vary.

4、The screen flashes and then goes black. It may be that the battery power is not enough to start the machine. Please charge it fully before starting the measurement.

5.The battery life of the new instrument can be charged and discharged about 500 times. When the battery is not durable, contact the instrument dealer for replacement. Do not replace it by yourself.

2.Repair, inspection and cleaning

> ⚠Warn
> Customers are not allowed to modify, dismantle or repair the product. The responsibility may cause fire, electric shock or personal injury. If you dismantle or modify the product by yourself, you will be deemed to have abandoned the one-year free warranty service.

1、Revise

The correction cycle varies according to the customer's use or environment. It is recommended to determine the correction cycle according to the customer's use or environment and entrust our company to carry out regular corrections.

2、Cleaning

When cleaning the instrument, please use a soft cloth dipped in a small amount of water or neutral detergent and gently wipe. Please use a dry soft cloth to gently wipe the display area. Do not use gasoline, alcohol, acetone, ether, methanol, diluent, or detergents containing gasoline. Otherwise, it may cause deformation and discoloration of the instrument.

3、Transport

To avoid secondary damage caused by impact during transportation, please be sure to double pack. We do not guarantee any damage caused by transportation. When returning for repair, please write down the fault content and return address, contact person, phone number and other necessary information on paper and send it back with the instrument.

VIII.Packing list

Items	specifications	quantity
instrument	*	1 unit (built-in battery)
Instrument bag	*	1pcs
Auxiliary grounding rod	*	2rods
Monitor software CD	*	1pcs
USB Communication lines	1.5m	1pcs
Test leads	Red, yellow and green	3pcs
Simple test cable	Red and green	2pcs
charger	12.6V/1A/ The line length is 1.1m	1pcs
User manual warranty	*	1set

The contents of this user manual are not intended to justify the use of the product for special purposes.
The company shall not be liable for any other loss caused by the use.
The company reserves the right to modify the contents of the user manual. If there is any modification, no further notice will be given.

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