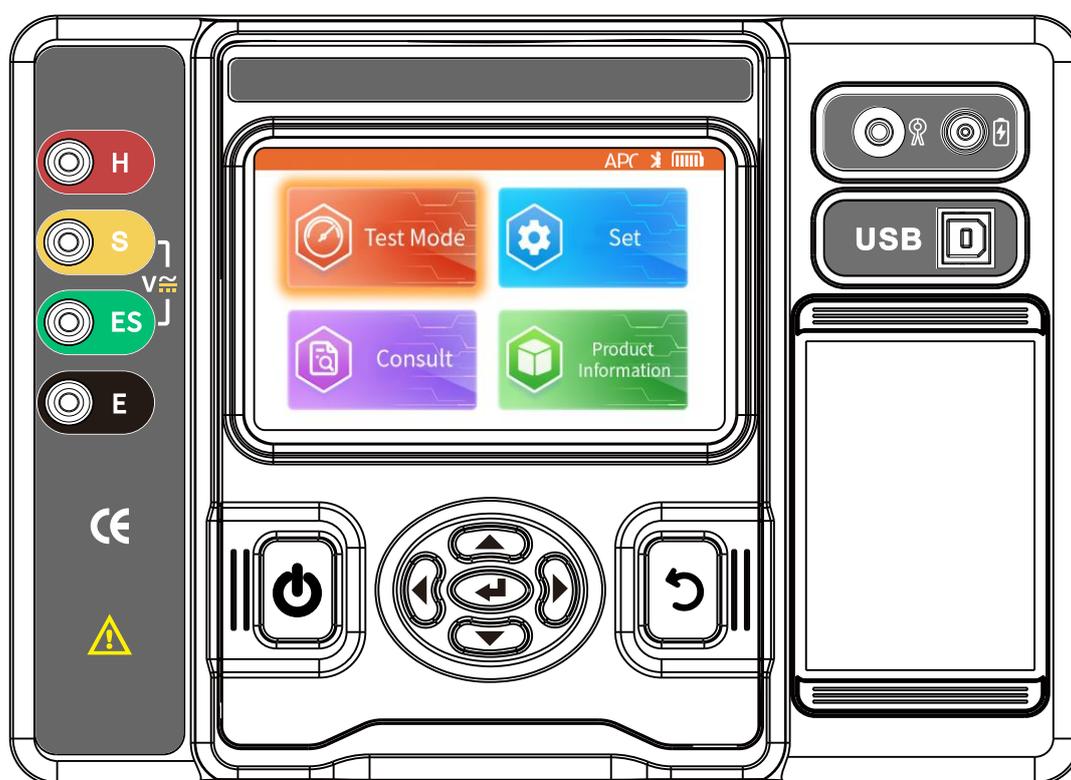


Multi-function Earth Resistance Tester



ES3002E Instruction Manual

.....
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1. Safety Rules and Precautions

We appreciate your purchase of our multi-function ground resistance tester. Before initial use, to prevent potential electric shock or personal injury, you must: Thoroughly read and strictly comply with all safety rules and precautions listed in this manual.

Under any circumstances, special attention must be paid to safety when using this instrument.

1. This instrument is designed, manufactured, and tested in compliance with IEC61010 safety standards.
2. Always prioritize safety when operating this instrument.
3. During measurement, keep high-frequency signal generators (e.g., mobile phones) away from the instrument to avoid measurement errors.
4. Observe all labels and symbols on the instrument body.
5. Before use, verify that the instrument and accessories are intact. Ensure test leads have no insulation damage, exposed wires, or broken connections.
6. Never touch exposed conductors or live circuits during measurement.
7. Confirm all connectors are securely inserted into the instrument interfaces.
8. Do not apply more than 100V AC/DC between test terminals and interfaces to prevent instrument damage.
9. Avoid measurements in flammable environments - sparks may cause explosions.
Immediately discontinue use if the casing or test leads become damaged with exposed metal parts.
10. Do not store or leave the instrument in high-temperature, humid, condensing, or direct sunlight conditions for extended periods.
11. When charging the battery, ensure test leads are disconnected and the instrument is powered off.
12. Recharge promptly when the low battery symbol "" appears.
13. Adhere to the specified measurement ranges and operating environments.
14. Only authorized personnel may operate, disassemble, calibrate, or repair this instrument.
15. Immediately cease use and quarantine the instrument if malfunction poses danger, then contact authorized service.
16. The "" safety warning symbol in the instrument/manual indicates mandatory compliance with specified safety procedures.

2. Introduction

The **multi-function ground resistance tester**, also known as the ground resistance tester, integrates multiple measurement methods into one advanced instrument. In addition to the traditional function of measuring ground resistance by driving auxiliary ground electrodes, it also features the unique capability of measuring without auxiliary ground electrodes. Through microprocessor control, it precisely measures ground resistance using four-wire, three-wire, simplified two-wire, selective, and dual-clamp methods. The large-diameter current clamp design employs dual-clamp measurement technology, enabling online measurement without the need for auxiliary ground electrodes or isolating the grounding body from equipment. It is widely used in telecommunications, power systems, weather stations, equipment rooms, oil fields, power distribution lines, transmission towers, gas stations, factory grounding networks, lightning rods, etc. The instrument is characterized by accurate, fast, simple, stable, and reliable testing.

The **multi-function ground resistance tester** is microprocessor - controlled and can accurately measure ground resistance, soil resistivity, ground voltage, DC voltage, DC resistance, and AC current. It uses fast filtering technology to minimize interference. The auxiliary electrode resistance value is displayed on the same screen, making it easy to determine measurement errors caused by environmental factors and ensuring more accurate measurement of the true ground resistance value. It can store up to 500 sets of data and supports Bluetooth connectivity to a mobile app or USB connectivity to a PC for wireless or wired remote measurement, historical data retrieval, and report export. It also features unique functions such as data hold and intelligent alarm prompts.

The **multi-function ground resistance tester** includes the main unit, PC software, mobile app software, test leads, USB cable, charger, and grounding stakes.

Model

Model	Functions
ES3002E	two/three/four-wire AC ground resistance- Soil resistivity、three/four-wire selective method、Dual-clamp resistance、DC resistance、AC voltage、DC voltage、AC current

3. Range and Accuracy

1. Measurement Ranges, Accuracy, and Resolution

Measurement Function	Range	Accuracy	Resolution
two/three/four-Wire Ground Resistance (Re)	0.000 Ω ~ 19.999 Ω	±1.5%rdg ± 70dgt	0.001 Ω
	20.00 Ω ~ 199.99 Ω		0.01 Ω
	200.0 Ω ~ 1999.0 Ω		0.1 Ω
	2.000k Ω ~ 19.999k Ω		1 Ω
	20.00k Ω ~ 200.00k Ω		10 Ω
DC Resistance (R-)	0.000 Ω ~ 19.999 Ω	±1.5%rdg ± 70dgt	0.001 Ω
	20.00 Ω ~ 199.99 Ω		0.01 Ω
	200.0 Ω ~ 1999.9 Ω		0.1 Ω
	2.000k Ω ~ 19.999k Ω		1 Ω
	20.00k Ω ~ 200.00k Ω		10 Ω
Selective Method Ground	0.00 Ω ~ 20.00 Ω	±2%rdg ± 30dgt	0.01 Ω
	20.0 Ω ~ 200.0 Ω		0.1 Ω
	0.200k Ω ~ 3.000k Ω		1 Ω
Dual-Clamp Ground Resistance (Re)	0.00 Ω ~ 9.99 Ω	±10%rdg ± 10dgt	0.01 Ω
	10.0 Ω ~ 99.9 Ω		0.1 Ω
	100 Ω ~ 200 Ω	±15%rdg ± 10dgt	1 Ω
Soil Resistivity	0.00 Ω _m ~ 99.99 Ω _m	ρ = 2 π aR (注 2)	0.01 Ω _m
	100.0 Ω _m ~ 999.9 Ω _m		0.1 Ω _m

(ρ)	1000 Ω m ~ 9999 Ω m		1 Ω m
	10.00k Ω m ~ 99.99k Ω m		10 Ω m
	100.0k Ω m ~ 999.9k Ω m		100 Ω m
	1000k Ω m ~ 9999k Ω m		1k Ω m
AC Voltage	0.000 ~ 9.999V	±1.5%rdg ± 50dgt	0.001V
	10.00 ~ 50.00V		0.01V
AC Current	0.00mA ~ 9.99mA	±2%rdg ± 50dgt	0.01mA
	10.00mA ~ 99.99mA		0.01mA
	100.0mA ~ 999.9mA		0.1mA
	1.000A ~ 9.999A		1mA
	10.00A ~ 99.99A		10mA
	100.0A ~ 999.9A		0.1A
DC Voltage	0.000 ~ 9.999V	±1.5%rdg ± 50dgt	0.001V
	10.00 ~ 50.00V		0.01V
Temperature Characteristics	Temperature Characteristics: Add specified accuracy × 0.1/° C (when operating outside 18° C to 28° C). Example at 8° C: ±0.2%rdg ± 10dgt (base accuracy) + 0.1 × 10 (temperature difference) × (0.2%rdg + 10dgt) = ± 0.4%rdg ± 20dgt		

Note: 1. Reference Conditions: Accuracy specified when R_h and $R_s < 100 \Omega$.
 Operating Conditions: Maximum $R_h = 3k \Omega + 100R < 50k \Omega$, Maximum $R_s = 3k \Omega + 100R < 50k \Omega$

2. Accuracy depends on the measurement precision of R, $\pi = 3.14$,
 a : 0.1m - 100.0m

2. General Specifications

Ambient temperature and humidity	23°C ±5°C, below 75% rh
Interfering voltage	<20V (should be avoided)
Interfering current	<2A (should be avoided)
Electrode - to - electrode distance when measuring R	a>5d
Electrode - to - electrode distance when measuring ρ	a>20h
Power Supply	11.1V lithium - ion battery (built - in), can continuously measure in AC resistance mode when fully charged for more than 1000 times
Screen brightness	Controllable, users can adjust it according to the scene
Measurement method	Precision four - wire, three - wire method measurement, simple two - wire, selective, dual - clamp method to measure ground resistance
Measurement method details	Two - three - four - wire method measurement: Polarity - changing method, measurement current 42.0mA Max Soil resistivity: Four - pole method Selective measurement: Polarity - changing method, measurement current 42.0mA Max Dual - clamp method: Non - contact mutual induction measurement method, test current 40mA Max DC resistance: Polarity - changing method AC current: Average value rectification (clamp - type) Ground voltage: Average value rectification (between S - ES interfaces) DC voltage: Average value rectification (between S - ES interfaces)

Test voltage waveform	Sine wave
Test frequency	128Hz
Open - circuit Test Voltage	AC 30.0V Max DC 30.0V Max
Electrode Interval Range	0.1m~100.0m
Display Mode	Color - display screen
Instrument Size	Length×Width×Height: 277.2mm×227.5mm×153mm
Current Clamp Size	Length×Width×Height: 101mm×27mm×214mm
Test Wires	4 pieces: 15m red, 15m black, 10m yellow, 10m green each
Simple Test Wires	2pcs: 1.5m red and 1.5m green each
Auxiliary Grounding Rod	4 pieces: ϕ 10mm×200mm
Current Clamp	Banana plug×1, audio plug×1
Current clamp caliber	ϕ 50mm
Current Clamp Leads	Length 2m
Measurement Time	AC current: about 3 times/second Ground - to - earth voltage: about 3 times/second Grounding resistance, soil resistivity: about 10 seconds/time
USB Interface	Has a USB interface, and stored data can be uploaded to a computer through software
Bluetooth Connection	Yes, real - time monitoring, data reading and other functions can be carried out on a mobile phone
Data Line	USB communication line, 1.5m
Data Storage	500 groups, "FULL" symbol indicates that the storage is full
Overflow Display	Over - range displays "OL" symbol
Auxiliary Grounding Test	Has the function of auxiliary grounding resistance test, 0.00k Ω ~200.00k Ω
Alarm Function	An alarm is issued when the measured value exceeds the set alarm value (buzzer alarm)
Automatic Power off	"APO" indicator, automatic power off after 15

	minutes (default)
Power Consumption	Screen brightness: 190mA Max(maximum brightness) 140mA Min(minimum brightness)
	Measurement: 200mA Max(maximum brightness) 150mA Min(minimum brightness)
Weights	instrument: 1975g(include battery)
	current clamp: 940g(2 pcs)
	test lead: 1300g(includes simple test lead)
	auxiliary grounding rods: 850g(4 rods)
Working temperature and humidity	-10°C~40°C; 80%rh or below
Storage temperature and humidity	-20°C~60°C; 70%rh or below
Over-load Protection	Measurement of ground-to-earth voltage: H - E, S - E (port - to - port) AC 280V/3 seconds
Insulation Resistance	20M Ω or above (between the circuit and the shell 500V)
Withstand Voltage	AC 3700V/rms(between the circuit and the shell)
Electromagnetic Compatibility	IEC61326(EMC)
Safety Class	IEC61010-1 (CAT III 300V, CAT IV 150V, pollution degree 2); IEC61010-031; IEC61557-1 (earth resistance); IEC61557-5 (soil resistivity); JJG 366-2004 (earth resistance meter); JJG 1054-2009 (clamp-on earth resistance meter).

4. Instrument Structure

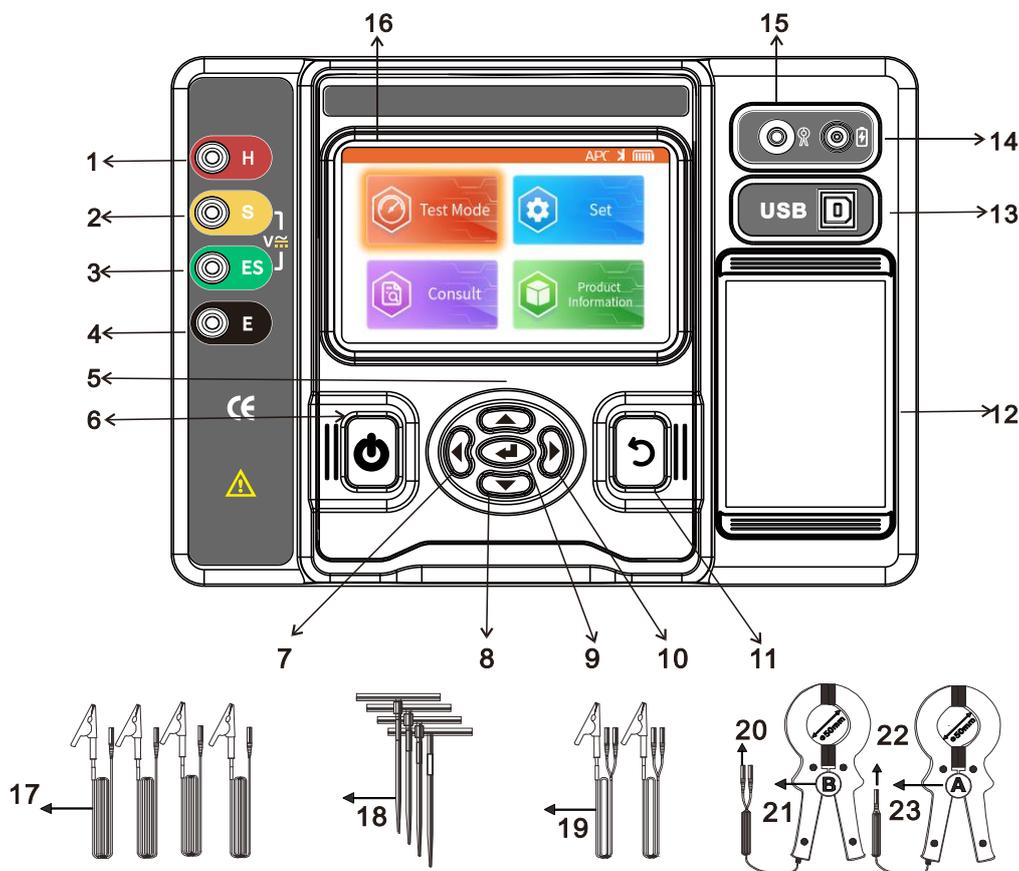


Figure 4.1

- 1.H Interface (Current Electrode)
- 2.S Interface (Voltage Electrode)
- 3.ES Interface (Auxiliary Ground Electrode)
- 4.E Interface (Grounding Electrode)
- 5.Up Button
- 6.Power Button (On/Off)
- 7.Left Button
- 8.Down Button
- 9.Confirm Button
- 10.Right Button
- 11.Test Button
- 12..Printer
- 13.USB Interface
- 14.DC Charging Socket
- 15.Receiving Current Clamp A Interface
- 16.LCD
- 17.Test Cable
- 18.Auxiliary Ground Rod
- 19.Simple Test Cable
- 20.Connection Port for Excitation Current Clamp B. The red banana plug is the dotted terminal, and the black one is the common terminal.
- 21.Excitation Current Clamp B
- 22.Connection Port for Receiving Current Clamp A
- 23.Receiving Current Clamp A

5. Measurement Principle

1. three-wire and four-wire Methods for Measuring Ground Resistance Value
 The measurement adopts the rated current pole - changing method (suitable for accurately measuring single - point grounding systems), that is, an alternating - current rated current I flows between the grounding electrode E (measurement object) and the current electrode H . The potential difference V between the grounding electrode E and the voltage electrode S is obtained, and the ground resistance value R is calculated according to the formula $R = V/I$. In order to ensure the accuracy of the test, the three - wire method is adopted, and an auxiliary ground electrode ES is added. In actual testing, ES and E are clamped at the same point of the grounding body

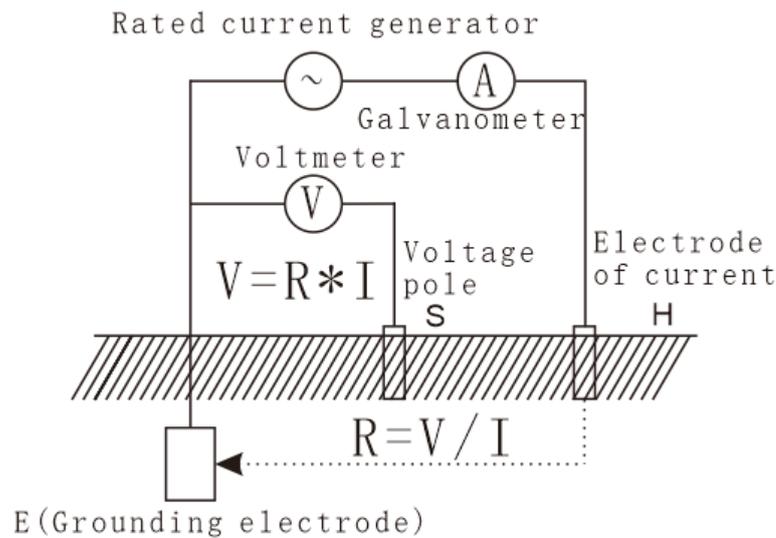


Figure 5.1.1

2. Measurement of grounding resistance value by the selection - method
 The measurement adopts the current - pole - changing method (suitable for measuring the grounding resistance value of one of the grounding grids in a parallel grounding system without unfastening). An alternating - current I is applied between the grounding electrodes $Re1$, $Re2$, $Re3$ and the current electrode H . The current $I3$ flowing through $Re3$ is measured by the current clamp A , and at the same time, the potential difference V between the grounding electrode $Re3$ and the voltage electrode S is measured. The grounding resistance value $Re3$ is calculated according to the formula $Re3 = V/I3$. In order to ensure the accuracy of the test, the

four - wire method is adopted, and an auxiliary grounding electrode ES is added. During the actual test, ES and E are clamped at the same point on the grounding body.

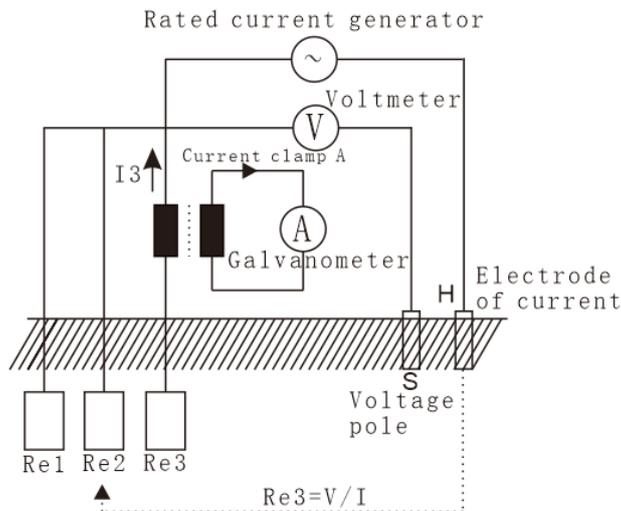


Figure 5.2.1

3. The dual - clamp method for measuring the grounding resistance value (suitable for measuring in a multi - independent - point parallel grounding system without auxiliary grounding stakes). An alternating - current electromotive force V is generated by the excitation clamp B. Under the action of the alternating - current electromotive force V , a current I is generated in the loop. Then, the feedback current I is detected by the current clamp A, and the resistance value is calculated according to the formula $R = V/I$. In the figure, $R = R_e + R_1 // R_2 // R_3 // \dots // R_n - 1 // R_n$. When $R_1 // R_2 // R_3 // \dots // R_n - 1 // R_n$ (the resistance value after multiple grounding points are connected in parallel) is much smaller than R_e , then $R \approx R_e$

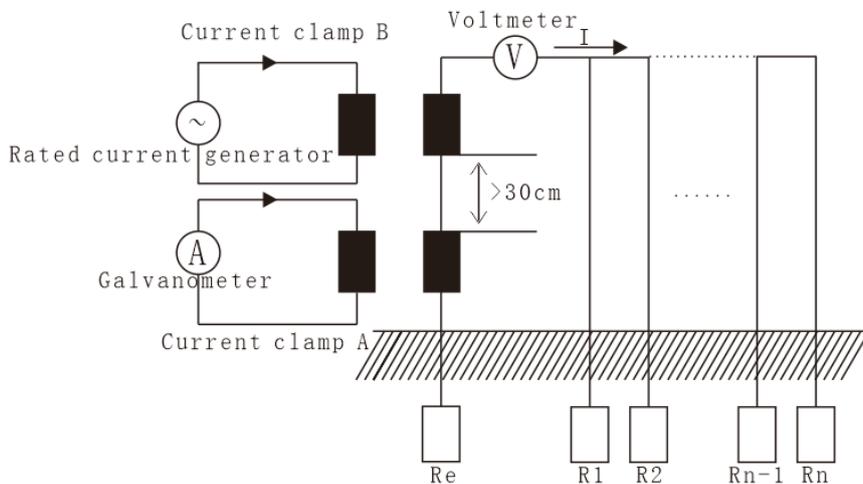


Figure 5.3.1

4. The measurement of soil resistivity (ρ) adopts the four - electrode method (Wenner method): An alternating current I flows between the grounding electrode E and the current electrode H . The potential difference V between the voltage electrode S and the auxiliary ground electrode ES is measured. The resistance value R between the two middle points is obtained by dividing the potential difference V by the alternating current I . The electrode interval distance is a (m). According to the formula $\rho = 2\pi aR$ (Ωm), the value of soil resistivity is obtained. When the distance between H and S is equal to the distance between S and ES (both are a), it is the Wenner method. For the convenience of calculation, please make the electrode spacing a much larger than the burial depth h . Generally, it should satisfy $a > 20h$. See the figure below.

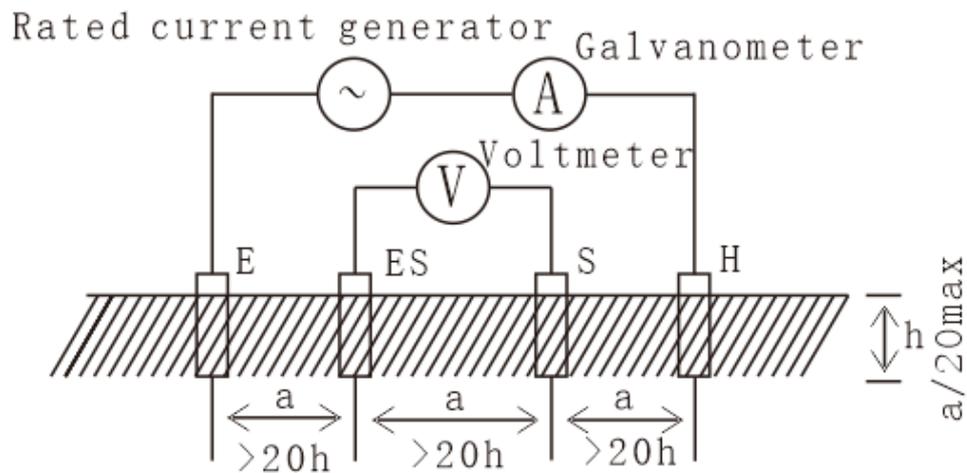


Figure 5.4.1

5. two - three - four - wire DC resistance testing uses the rated current pole - changing method (suitable for measuring equipotential bonding resistance). That is, a DC rated current I flows through the measurement object R . The potential difference V across R is obtained, and the resistance value R is calculated according to the formula $R = V/I$. To ensure the accuracy of the test, the four - wire method is adopted, and an auxiliary ground electrode ES is added. During actual testing, ES and E are clamped at the same point of the object under test.

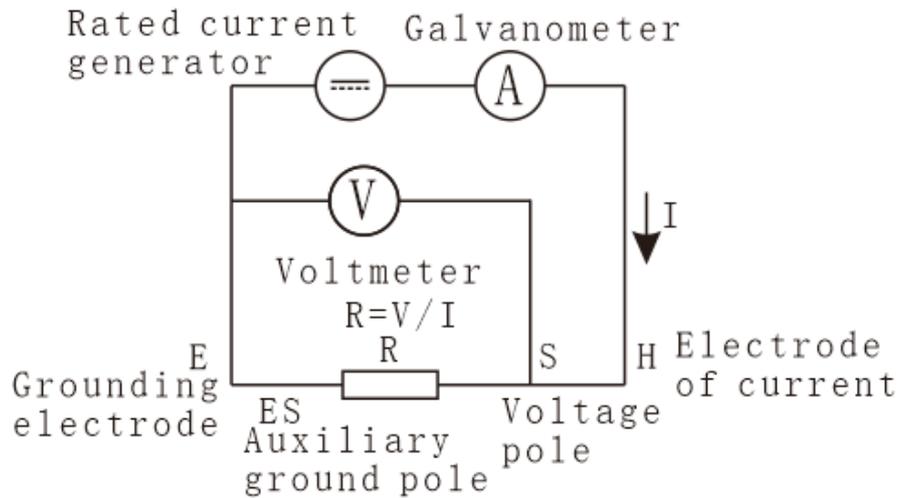


Figure 5.5.1

6. In the above methods, the working error (B) is the error obtained under the rated working conditions, which is calculated from the inherent error (A) of the instrument in use and the variable error (E_i).

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

- A: Inherent error E₂: Variation caused by power supply voltage change
- E₃: Variation caused by temperature change
- E₄: Variation caused by interference voltage change
- E₅: Variation caused by contact electrode resistance

7. The average - value rectification method is used for measuring the ground voltage.
8. The average - value rectification method is used for measuring the AC leakage current
9. The average - value rectification method is used for measuring the DC voltage.

6. Operating Instructions

1. Power On/Off

Press the "Power On/Off" button to turn on the device when it is in the off state, and press the same button to turn it off when it is in the on state.

2. Battery Voltage Check

1、After turning on the device, if the low - battery voltage symbol "" is displayed in the upper - right corner of the screen, it indicates that the battery is running low. Please charge the battery in time. Sufficient battery power is necessary to ensure the accuracy of measurements.

2、The power consumption during testing is higher than that in standby mode. If the low - battery voltage symbol "" is displayed on the screen during testing, it means that the battery is about to run out. Please fully charge the battery in time to ensure the accuracy during testing.

3、The device will automatically turn off when the battery power is insufficient to support testing. Please charge the battery before conducting the test again.

3. Interface Introduction

3.1 Main Interface

On the main interface, you can enter the corresponding mode by clicking the corresponding icon.

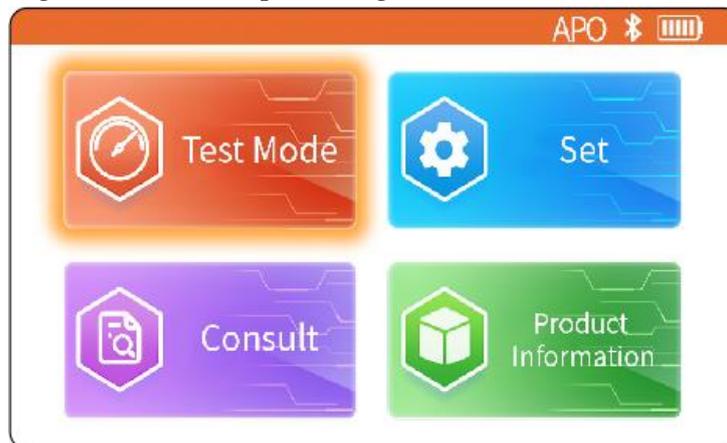


Figure 6.3.1

3.2 Settings interface

You can access it by clicking the “Settings” icon in the main interface. In this mode, you can drag and drop the “” icon to set the appropriate backlight brightness.

Click on the two icons “” and “” on the right of the shutdown time to set the automatic shutdown time, the range is 0-30 minutes, where 0 represents to close the automatic shutdown function. APO” icon is hidden, while the other numbers represent that the automatic timer shutdown function is on and the ‘APO’ icon will be shown.

Clicking on the two icons “” “” to the right of the electrode spacing, you can set the spacing of the electrodes, which is used to measure the soil resistivity, and the range can be set from 0.1 to 100.0 meters. In order to be able to quickly set the electrode spacing and shutdown time you can click on the “” icon, which can be switched to operate the data digit or ten.

Clicking on the “” “” button switches the settings to be operated (“Backlight Brightness”, “Shutdown Time”, “electrode spacing”). Click “” “” button to modify the setting data of the current selection item.

Click “” icon to switch between Chinese and English.

Click “” icon to turn on or off Bluetooth, turn on the upper right corner shows “” icon, turn off to hide.

Click “” icon to enter the alarm interface, set the alarm value.

Click “” icon or “” button can return to the main interface.”

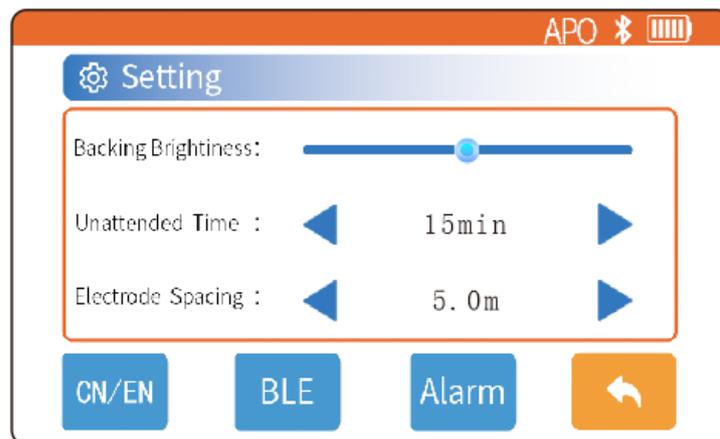


Figure 6.3.2

3.3 Alarm interface

Click the “Setting” icon in the main interface to enter the setting interface, and then click the “Alarm” icon under the setting interface to enter the alarm setting interface.

Click the icon of “◀” “▶” on the right side of test mode to switch the mode of alarm setting.

Click the icon “◀” “▶” on the right side of the alarm threshold to set the alarm value, when the measured value is greater than the set alarm value, the buzzer will emit “beep-beep-beep-beep-beep-beep” alarm sound. When the measured value is greater than the set alarm value, the buzzer will sound “beep-beep-beep-beep-beep” .

Click “⊗” icon, you can switch the digit, tens digit, hundreds digit and thousands digit of the operation data.

Click “▲” “▼” button to switch the test mode to be operated. Click “◀” “▶” button to modify the setting data of the current selection item.

Click on the “🔊” icon to turn off the whole alarm mode, i.e. the buzzer will not beep even if the measured value is greater than the alarm value. Click on the “🔊×” icon again to turn the alarm mode on.

Click "  " icon or "  " button to return to the main interface.

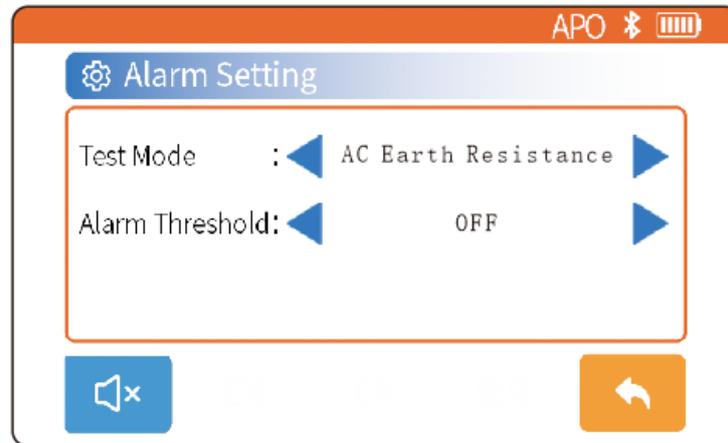


Figure 6.3.3

3.4 Test Interface

You can enter the test interface by clicking the "Test Mode" icon in the main interface.

Click the "  " icon or "  " / "  " button to switch the test mode.

Click "  " icon or "  " button to save a set of data of current measurement.

Click "  " icon or "  " button to start the test.

Click "  " icon or "  " button to print a set of data of current measurement.

Click the "  " icon to enter the current mode of the wiring diagram prompt.

Click on the center of the interface can quickly enter the alarm interface, set the alarm value.

In the "AC grounding resistance test mode", "three/four wires selection method", "DC resistance" mode, long press "  " in "AC Ground Resistance Test Mode", "three/four Wire Selection Method" and "DC Resistance" mode to eliminate the resistance value of the test wire.

Click "  " icon or "  " button to return to the main interface.

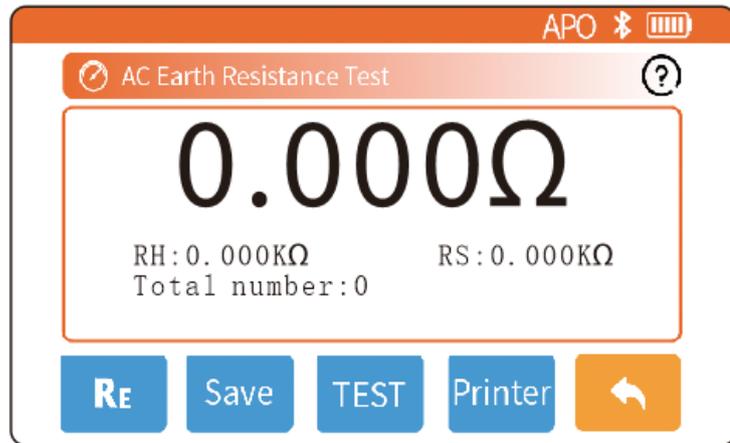


Figure 6.3.4

3.5 Access interface

You can enter the reading interface by clicking the “Read” icon in the main interface.

Clicking on the “▲” icon or “▲” button will be +10 on the basis of the current group, such as: the current group is 1, then click on the button will read the data of the 11th group.

Clicking on the “▼” icon or the “▼” button will add -10 to the current group, e.g. if the current group is 11, then clicking on the button will read the data of group 1.

Clicking on the “▶” icon or the “▶” button will add +1 to the current group, e.g. if the current group is 1, then clicking on the button will read the data of group 2.

Clicking on the “◀” icon or the “◀” button will add -1 to the current group, e.g. if the current group is 11, clicking on the button will read the data of the 10th group.

Click “🗑️” icon to enter the historical data deletion interface.

Click “Printer” icon or “🖨️” button to print the data displayed in the current interface.

Click “↶” icon or “↶” button to return to the main interface.

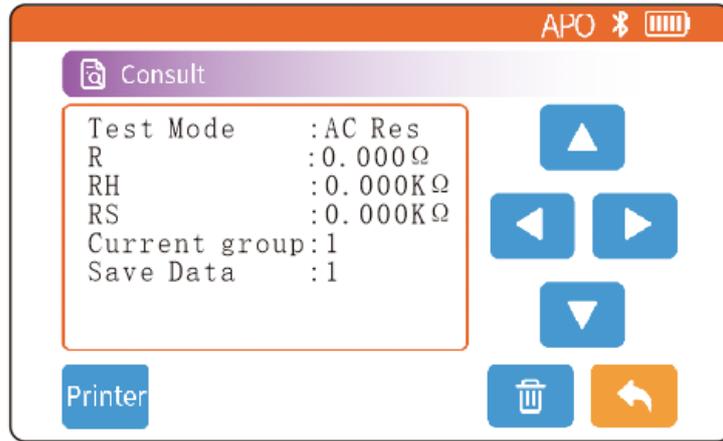


Figure 6.3.5

3.6 Historical data deletion interface

Click the “Read” icon in the main interface to enter the reading interface, and then click the “” icon to enter the historical data deletion interface.

Clicking the “” icon means confirming to delete all the data in the history cache and return to the reading interface.

Clicking the “” icon means you give up deleting the data in the history cache and return to the reading interface.

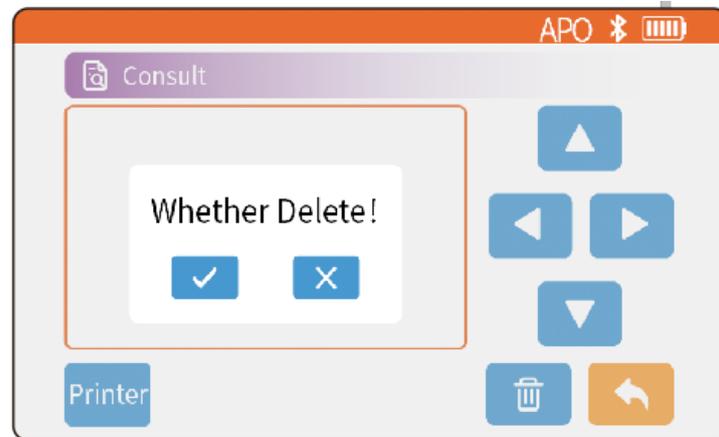


Figure 6.3.6

3.7 Product Information Interface

You can enter the product information interface by clicking the “product information” icon in the main interface.

You can return to the main interface by clicking the “” icon or the “” button.

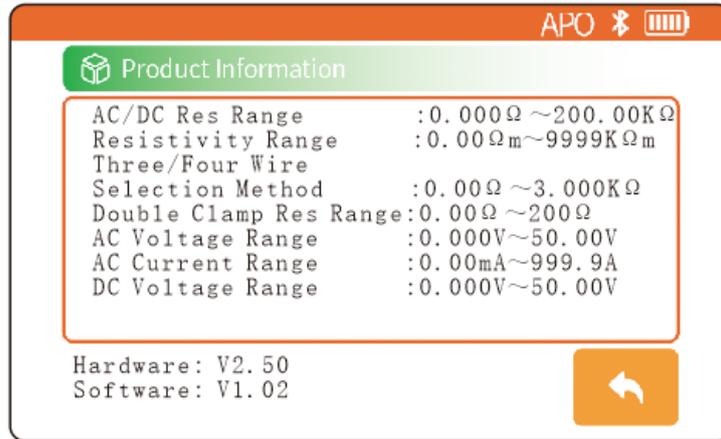


Figure 6.3.7

3.8. Measurement Mode Wiring Tip Screen

Tap the screen at any time to return to the interface that enters the mode.

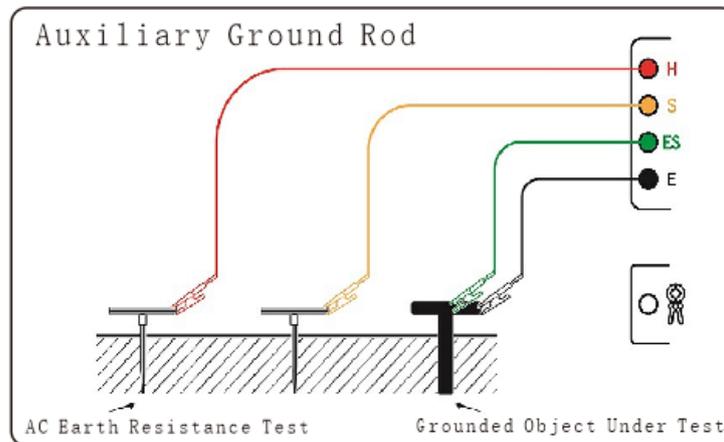


Figure 6.3.8

4. Key Icon Description

	AC Ground Resistance Button		Resistivity Button
	Three/Four Wire Selection Method		Dual Clamp Ground Resistance Button
	DC Resistance Button		AC Voltage Button
	AC Current Button		DC Voltage Button
	Test On/Off Button		Data save Button
	Data Print Button		Back button
	Wiring Reminder Button		Chinese/English switching Button
	Bluetooth switch Button		Enter Alarm Interface Keypad
	Alarm On/Off Button		Operation multiplier Button
	Delete Historical Data Button		+10 Button
	-10 Button		+1 Button
	-1 Button		

Each button icon has a corresponding function, the specific function requires the user to click to experience

5. Four-wire precision testing of grounding resistance

Four-wire test: four-wire method of testing can eliminate the measured grounding body, auxiliary grounding rod, test clips, instrument input interface (usually dirt or rust) between the surface of the contact resistance on the measurement of the impact, can eliminate the impact of changes in line resistance on the measurement of the test, better than three-wire test.

The following figure: from the object under test, respectively, S, H auxiliary grounding rod in a straight line deeply buried in the earth, the grounding test wire (black, green, yellow, red) from the instrument's E, ES, S, H interfaces corresponding to the connection to the measured grounding electrode E, auxiliary voltage electrode S, auxiliary current electrode H.

	<p>The distance between the grounding body under test, E, and the current pole, H, shall be at least five times the depth of burial of the grounding body under test (h) or five times the length of the electrode of the grounding body under test (d).</p>
	<p>Measure the total grounding resistance of a complex grounding system at a distance (d) that is the maximum diagonal distance of that grounding system.</p>
	<p>The test wires should not be twisted around each other during the test, otherwise the accuracy of the test may be affected.</p>

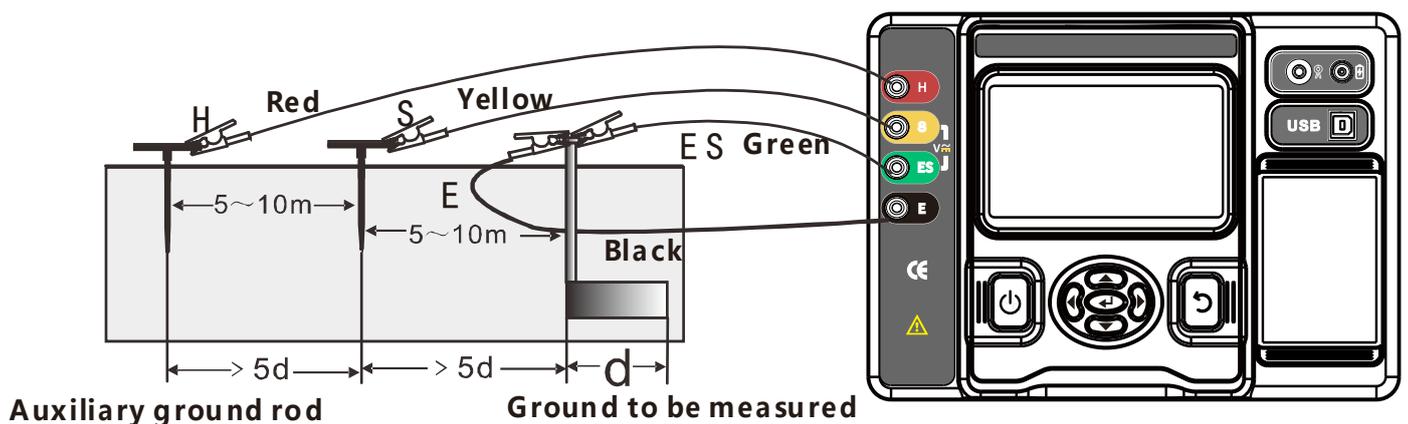


Figure 6.5.1

For multi-point independent grounding systems or larger ground networks, an optional 50m or longer test line can be used for testing, as shown below:

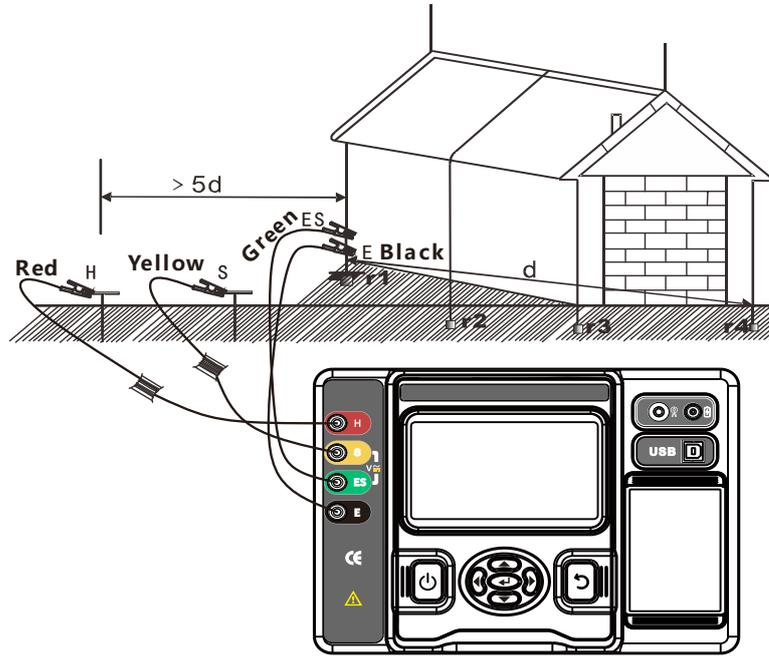


Figure 6.5.2

$R=r_1//r_2//r_3//r_4//r_5//r_6//\dots//r_n$ ($r_1\dots r_n$ are independent of the ground point)

R --Meter reading

$r_1\dots r_n$ --are independent grounding point

r_H --Auxiliary current pole H resistance to ground

r_S --Auxiliary voltage pole S resistance to ground

After connecting the test line, enter the “AC grounding resistance test” mode, press the “TEST” key to start the test, the test, the buzzer “beep beep beep beep”, icon “TEST” During the test, the buzzer will be beeping and the icon will be flashing alternately with “TEST”, the countdown indicator will be displayed during the test, and the stable data will be displayed after the test is completed, i.e. the grounding resistance value of the grounding body to be tested, R , and the grounding resistance values of the auxiliary current pole H and the auxiliary voltage pole S, R_H and R_S .

6. Three-wire test grounding resistance

Three-wire test: As shown in the figure below, short the ES and E interfaces of the meter, that is, three-wire test, the meter operation is the same as the four-wire test. Three-wire test can not eliminate the impact of changes in line resistance on the measurement, but also can not eliminate the impact of changes in contact resistance between the meter and the test line, the test line and the auxiliary grounding rod on the measurement, the measurement is also required to remove the oxidation layer on the surface of the grounding body under test.

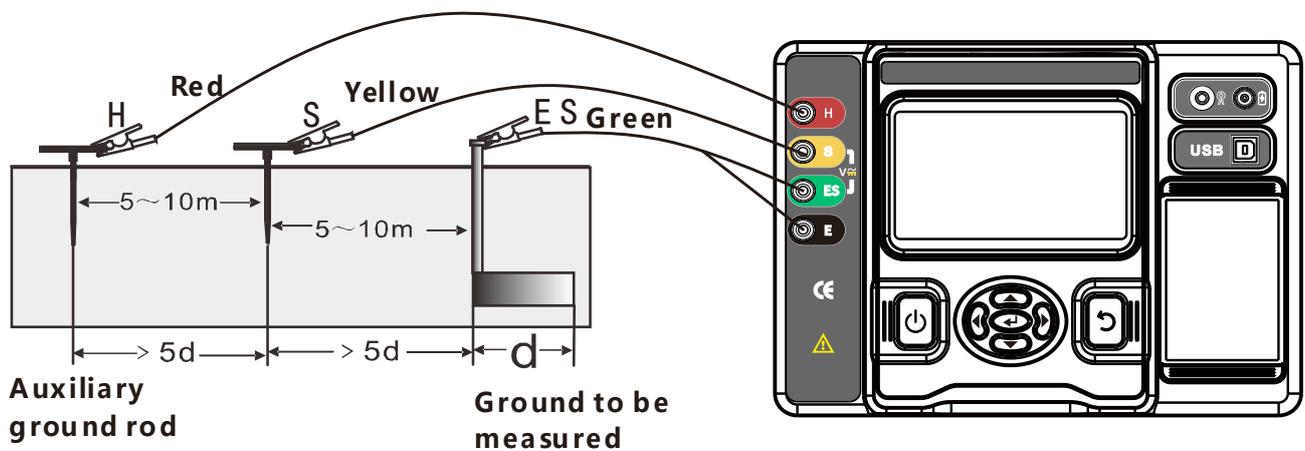


Figure 6.6.1

7. Two-wire simple test grounding resistance

two-wire test: This method is a simple measurement method without the use of auxiliary grounding rods, the use of the existing grounding electrode with the smallest grounding resistance value as an auxiliary grounding electrode, the use of two simple test line connection (i.e., H-S connector short connection, E-ES connector short connection). You can use metal water pipes, fire hydrants and other metal buried objects, common ground of the commercial power system or the building's lightning protection grounding pole, etc. instead of the auxiliary grounding rod H, S, measurement, pay attention to the removal of the selected metal auxiliary grounding body connection point of the oxidized layer. The wiring is as shown below, and the meter operation is the same as the four-wire test.



When selecting a commercial power system ground as an auxiliary grounding electrode for measurement, you must first confirm that it is the grounding electrode of the commercial power system, otherwise the circuit breaker may start and be dangerous.

Using the simple two-wire method to measure the grounding resistance, try to choose a grounding body with a small re value as the auxiliary grounding pole, so that the meter reading is closer to the true value. Please give preference to metal water pipes and metal fire hydrants as auxiliary grounding electrodes when measuring.

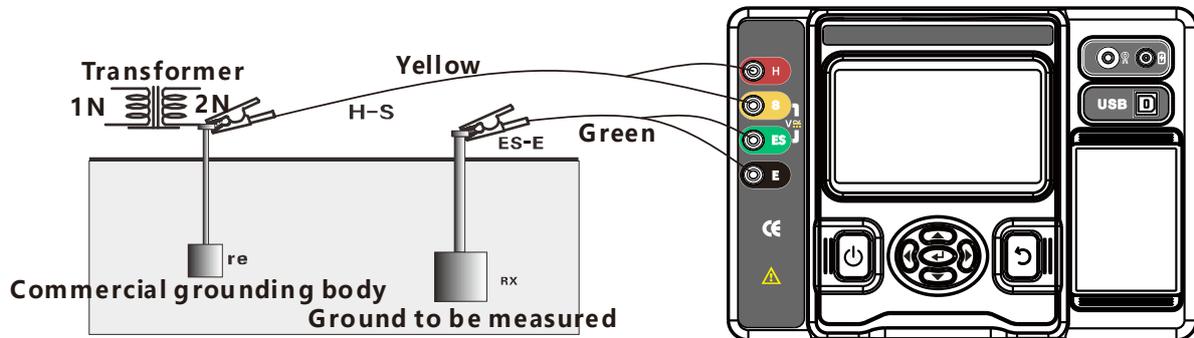


Figure 6.7.1

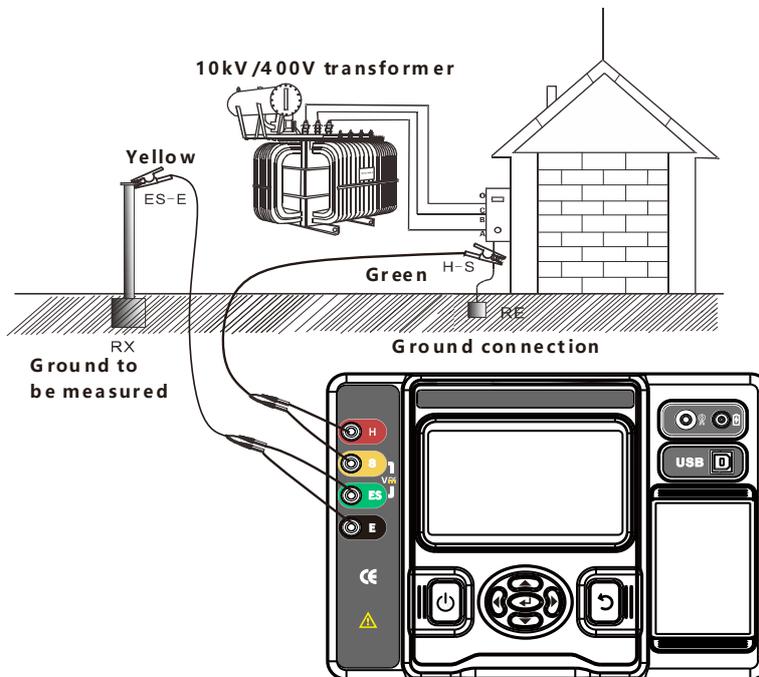


Figure 6.7.2

Simple method of measuring ground resistance, the meter reading is the sum of the ground resistance value of the grounding body under test and the ground resistance value of the commercial grounding body, i. e. :

$$R = RX + re$$

Where: R - for the meter reading value;

RX - for the measured grounding body grounding resistance value;

re - for commercial power systems and other common grounding body ground resistance value.

Then, the ground resistance value of the grounding body under test is:

$$RX = R-re$$

8. Four-wire selection method of testing grounding resistance

four-wire selection method can be accurately measured without unbuttoning the case of one of the grounding body grounding resistance value, four-wire method of testing can be eliminated to test the grounding body, auxiliary grounding rod, test clips, instrument input interface (usually dirt or rust) between the surface of the contact resistance on the measurement of the impact, can be eliminated to the measurement of changes in the line resistance, is better than the three-wire test.

See the following figure: from the object under test, respectively, S, H auxiliary grounding rod in a straight line deeply buried in the earth, the grounding test wire (black, green, yellow, red) from the instrument's E, ES, S, H interface to start corresponding to the connection to the measured grounding electrode E, auxiliary voltage electrode S, auxiliary current electrode H. Insert the current clamp A audio plug into the instrument's current clamp interface, the current clamp into the lead wire of the grounded body under test. Pay attention to the direction of the current clamp, the current must flow from the front of the current clamp to ensure the accuracy of the measurement.



When testing the grounding resistance, first confirm the leakage current size of the grounding line, grounding line current in 2A or less, grounding line current is greater than 100mA, the grounding resistance measurement value may produce error, this time the first to be measured grounding body of the equipment is de-energized, so that the leakage current of the grounding line to drop before the grounding resistance test. At the same time to ensure that the selection method of testing the current must flow from the front of the current clamp into the current clamp, otherwise it can not be normal testing of grounding resistance value.

Current clamp A receives the current signal direction from the ground to the ground upstream, current clamp A front for the direction of current inflow, that is, there is a current clamp A logo on the ground clamp the ground line.

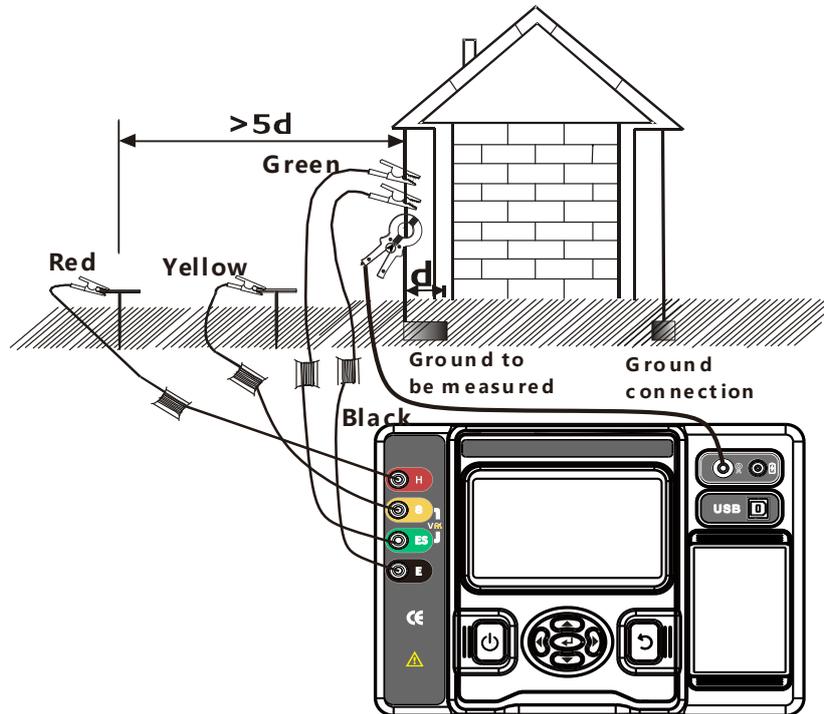


Figure 6.8.1

After connecting the test line, enter the “three/four-wire selection method test” mode, press the “TEST” button to start the test, the test process has a countdown indication, after the completion of the test to display stable data, that is, the above figure on the left side of the grounding body to be tested in the grounding resistance value of R.

For multi-point independent grounding system or larger ground network, you can choose to test 50m or longer test line for testing, as follows: the measurement results for the ground resistance value of r_1 , not affected by $r_2, r_3, r_4, r_5 \dots$ ground resistance value.

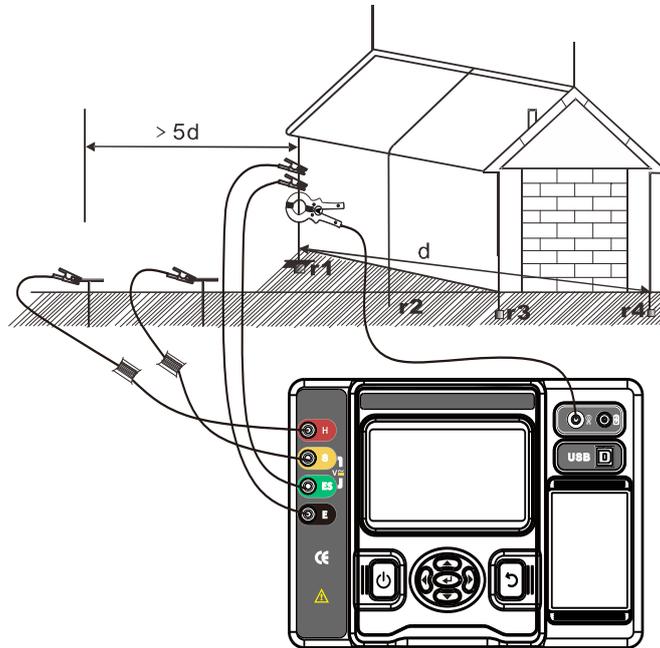


Figure 6.8.2

The following chart: measure the tower grounding resistance in the case of unbuttoned four-wire selection method can be accurately measured by the measured tower grounding resistance value R_e , with the traditional three-wire four-wire method in the case of unbuttoned measured resistance value for R_e and R_1, R_2, R_3 parallel resistance value, if there is a fault in the R_e , and R_1, R_2, R_3 parallel resistance value of the case of the smaller with the traditional three-wire four-wire method it is difficult to find out where the R_e fault point is easily overlooked. R_e fault point is located, easy to be ignored.

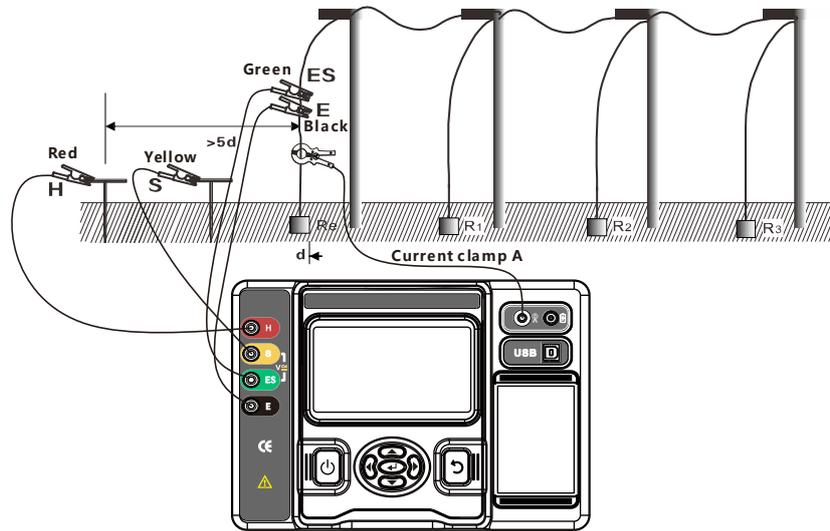


Figure 6.8.3

9. Three-wire selective method of testing grounding resistance

three-wire selective testing: As shown in the figure below, shorting the ES and E interfaces of the instrument is the three-wire selective testing, and the operation of the instrument is the same as that of the four-wire selective testing. Three-wire selective testing can not eliminate the impact of changes in line resistance on the measurement, but also can not eliminate the impact of changes in contact resistance between the meter and the test line, the test line and auxiliary grounding rod on the measurement, the measurement is also required to remove the oxidation layer on the surface of the grounding body under test.

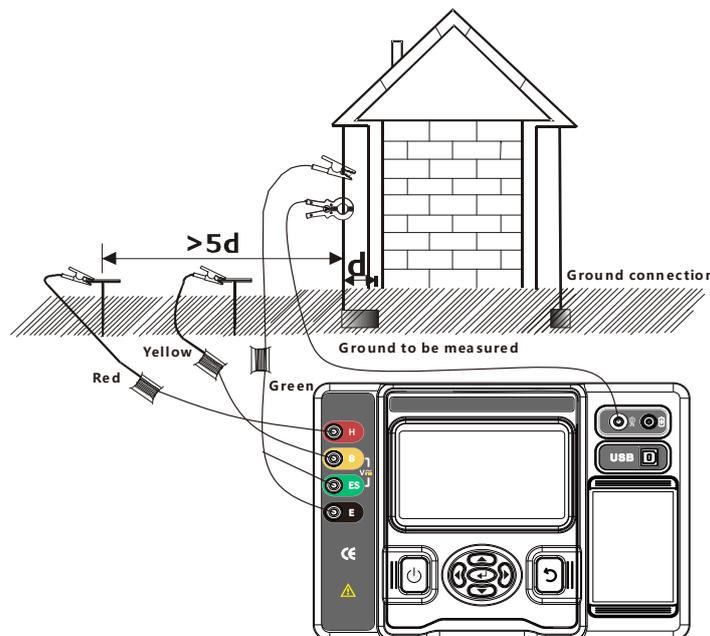


Figure 6.9.1

10. Double clamp method of testing grounding resistance

Double clamp method is suitable for measuring the independent multi-point grounding system, the following figure, in the multi-point grounding system without the need to hit the ground stake to measure the grounding resistance value, the red plug will be inserted into the instrument H interface at the end of the current clamp B, the black plug is inserted into the instrument E interface, the audio plug will be inserted into the instrument current clamp interface of the current clamp A, will be measured in the two current clamp clamp into the circuit, pay attention to the direction of the two current clamps should be the same and to keep the spacing is more than 0.5m.

	<p>When testing the grounding resistance, first confirm the leakage current size of the grounding line, the grounding line current is greater than 100mA, the measured value of grounding resistance may produce error, at this time, first of all, the equipment to be measured grounding body is disconnected, so that the leakage current of the grounding line to drop before the grounding resistance test. At the same time to ensure that the double clamp method of testing the current must flow from the front of the current clamp into the current clamp, otherwise it can not be normal testing of grounding resistance value. Ensure that the current clamp spacing is greater than 0.5m, otherwise errors will occur.</p>
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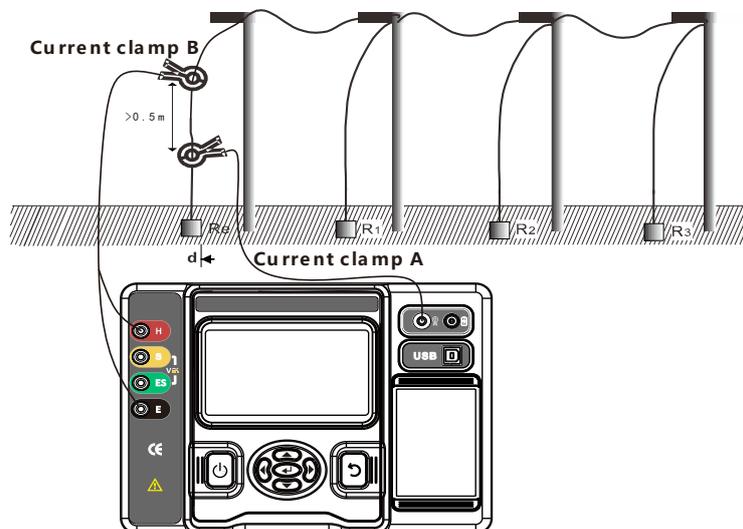


Figure 6.10.1

After connecting the test line, enter the “double clamp test” mode, press the “**TEST**” key to start the test, the test process has a countdown indication and the test progress bar graph indication, after the completion of the test shows stable data, that is, the grounding resistance value of the grounding body to be measured $R = R_e + R_1 // R_2 // R_3$, when $R_1 // R_2 // R_3 \ll R_e$, can be approximated as $R \approx R_e$.

11. Soil resistivity test

Soil resistivity ρ is an important factor in determining the grounding resistance of the grounding body. Different nature of the soil, of course, there are different soil resistivity, is the same kind of soil, due to the temperature and water content and so on different, soil resistivity will also occur with significant changes. Therefore, in order to have a correct basis for grounding device design, so that the design of the grounding device more in line with the needs of the actual work, the soil resistivity must be measured.

Soil resistivity is measured by the quadrupole method (Wenner method).

Calculate the soil resistivity ρ in Ωm according to the formula $\rho = 2 \pi a R$ (Ωm), where:

a - electrode spacing

R - resistance of the soil between the S-ES electrodes

Four-pole method (Wenner method): connect the test line according to the following figure, pay attention to the spacing between the auxiliary grounding rods and the depth of burial, respectively, H, S, ES, E auxiliary grounding rods in a straight line deeply buried in the earth, the grounding test line (red, yellow, green, black) from the meter's H, S, ES, E interface to correspond to the beginning of the connection to be measured H, S, ES, E auxiliary grounding rods.

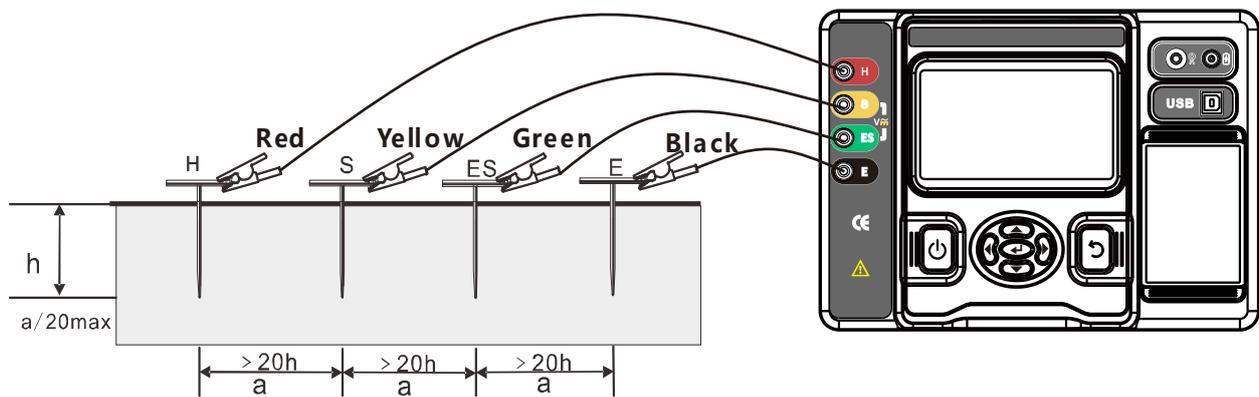


Figure 6.11.1

According to Wenner’s method to determine the value of the measured soil resistivity is about the distance between the two grounding rod a depth of the soil resistivity, you can change the value of a to check the homogeneity of the soil, so as to design a suitable grounding electrode.

Auxiliary grounding rod spacing settings: After connecting the test line, enter the setting interface, as shown:

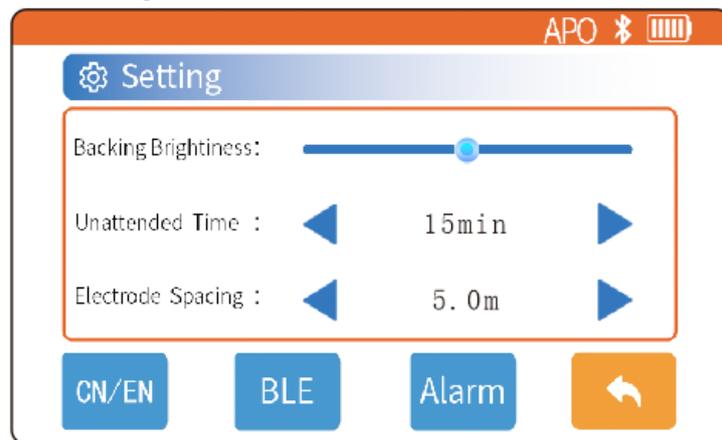


Figure 6.11.2

The digits and hundreds of the electrode spacing can be quickly manipulated by clicking on the “ $\times 1$ ” key.

By clicking the “ $\blacktriangleleft \blacktriangleright$ ” key to set the spacing of the grounding rod, after the setting is completed.

In “Soil Resistivity Test” mode, press the “TEST” key to start the test, and count down to show the progress of the test, and then display the stabilized soil resistivity value after completing the test.

12. DC resistance testing

DC resistance test is used for equipotential connection resistance, resistance between metal components and other tests, four-wire test can eliminate the test clip, instrument input interface (usually dirt or rust) between the surface of the contact resistance on the measurement of the impact of line resistance can be eliminated on the measurement of the impact of change, better than two-wire test.

The following figure: Measure the resistance value of the connection between the equipment and the grounding body, one end of the test line (black, green, yellow, red) were inserted into the instrument's E, ES, S, H interface, the test line E, ES clamped to the equipment grounding line lead, S, H clamped to the grounding lead close to the ground end.

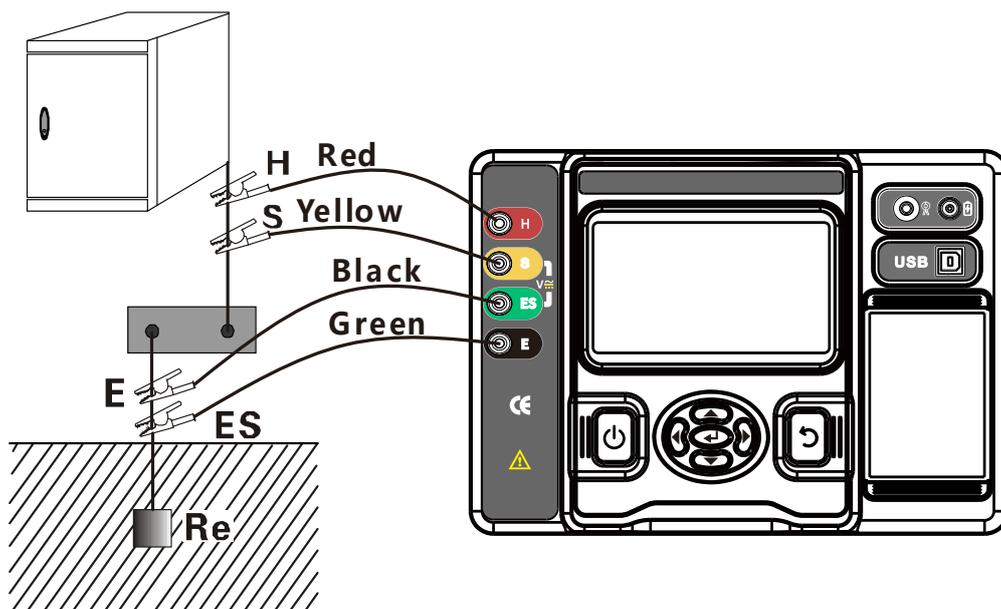


Figure 6.12.1

After connecting the test line, enter the “DC resistance test” mode, press the “**TEST**” key to start the test, the test process has a countdown indication, after the completion of the test to display stable data, that is, the measured equipment and the grounding body equipotential bonding resistance value R.

13. AC current test

As shown in the figure, insert the audio plug of current clamp A into the current clamp interface of the meter, and clamp the current clamp into the wire under test.

	<p>The line current under test should not exceed 1000A and should only be tested with current clamps (audio plugs). The H and E end signal excitation clamp must not be used to measure current, otherwise the meter may be damaged.</p>
	<p>When measuring current, use current clamp A. Exchanging current clamps will produce errors.</p>
	<p>When measuring load current, the current clamp clamps the fire line (single), when measuring leakage current the fire line zero line together (two) or clamp the ground line.</p>
	<p>Measurement of leakage current should be avoided when the surrounding electromagnetic field interference.</p>

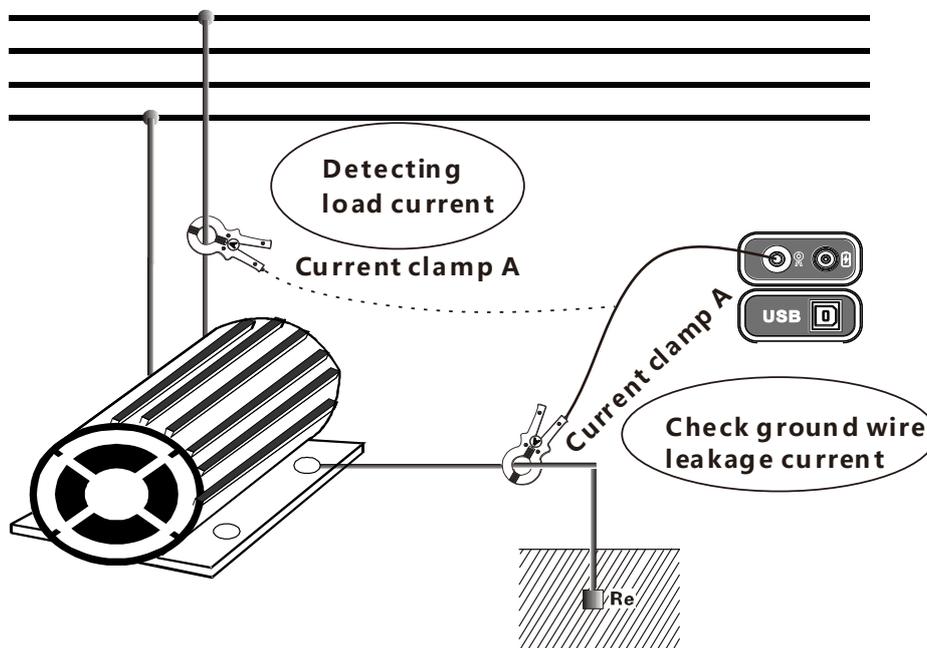


Figure 6.13.1

After connecting the current clamp, enter the "AC current test" mode, and the display screen will directly show the effective value of the current.

14. Ground voltage test/ACV

	<p>The ground voltage test requires the use of 1 auxiliary grounding rod.</p>
	<p>As long as the meter has a connection to earth through the test wire and auxiliary grounding rod, other test wires of the meter interface cannot be connected into the L and N wires of the commercial power supply, otherwise it causes leakage and the circuit breaker may be activated, which is dangerous.</p>
	<p>The grounding voltage test must not exceed 50V.</p>

Grounding voltage: that is, when an electrical equipment grounding fault occurs, the potential difference between the shell of the grounding equipment, grounding wire, grounding body, etc. and the zero-potential point, the grounding voltage is the earth as a reference point, and the potential difference between the earth and the earth, the earth for the zero-potential point.

An auxiliary grounding rod is required for grounding voltage testing. See the figure below: instrument, auxiliary grounding rod, test line are connected, enter the “AC voltage test” mode, the display directly shows the effected voltage value.

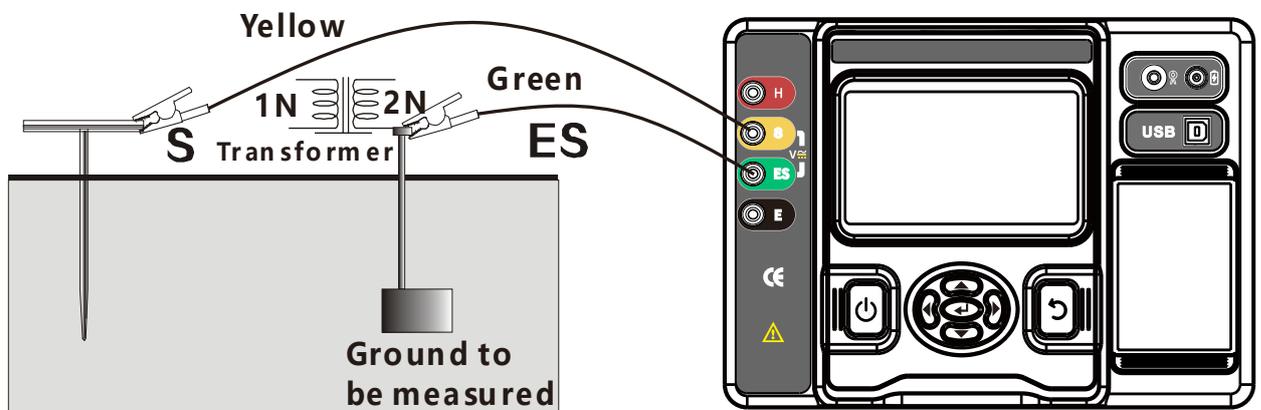


Figure 6.14.1

15. Direct current 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 meter is connected to earth via the test lead and auxiliary grounding rod, the other test leads of the meter interface must not be connected to the L and N leads of the commercial power supply, otherwise it will cause a leakage of electricity, and the circuit breaker may be activated, which is dangerous.
	DC voltage test can not exceed 50V.

DC voltage: that is, when a ground fault occurs in electrical equipment, the potential difference between the shell of the grounding equipment, grounding wire, grounding body, etc. and the zero potential point, can be measured with the earth as a reference point for the DC component potential difference, the earth is the zero potential point.

DC grounding voltage test wiring method and “AC grounding voltage test” the same, see the figure below: instrument, auxiliary grounding rod, test line are connected, enter the “DC voltage test” mode, the display directly shows the voltage effected value.

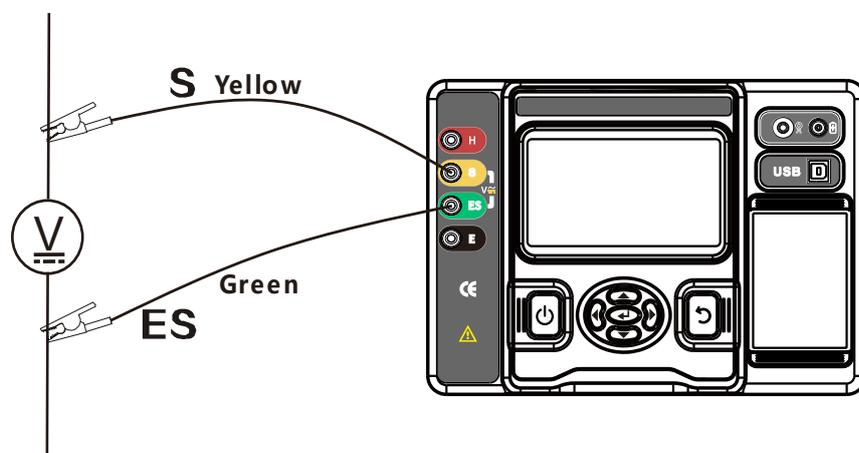


Figure 6.15.1

16. Data upload



It is prohibited to connect the computer to read data when various tests are being conducted, otherwise the ground voltage may damage the computer or meter.

(Note: you need to install the driver and host computer before connection)

Upper computer: connect the computer and the USB communication line of the meter, the meter is powered on, run the monitoring software, if the USB connection is successful, there is a switching mode test function, save the measurement data, i. e., you can read the stored historical data and upload it to the computer and save it and so on.

(Note: APP needs to be installed before connection)

Bluetooth APP: When the instrument is turned on, in the main interface, click on the “Settings” icon to enter the settings interface, click on the “” button to turn on Bluetooth. Open the installed APP on your cell phone, find the Bluetooth device with the name of “RSS” in the interface, click the name to connect the device.

7. Maintenance and Service

1. Battery

1、When the battery voltage is too low, the battery symbol shows "", at this time should be charged in time to ensure the accuracy of the measurement.

2、Charging from empty to full charge is about 4 hours, whether the battery is full or not is subject to the DC indicator of the charger, the red light indicates that the charging is in progress, and the green light indicates that it is full.

3、At full battery state in the AC grounding resistance mode can be measured continuously more than 1000, the screen brightness and power consumption of different loads are also different;

4、The screen will be black when you turn on the meter, the battery power may not be enough to turn on the meter, please turn on the meter again when it is fully charged.

5、The battery life of the new meter can be charged and discharged about 500 times, when the battery is not durable, you can contact your dealer to replace it, do not replace it by yourself.

2. Repair, Inspection and Cleaning

 **WARNING**

Customers are requested not to remodel, disassemble or repair. It may cause fire, electric shock or injury. If you disassemble or remodel by yourself, it is regarded as the user giving up the one-year free warranty service.

1、 Calibration

The calibration cycle varies depending on the customer's usage conditions or environment. It is recommended to determine the calibration cycle according to the customer's usage condition or environment, and entrust the company to carry out calibration on a regular basis.

2、 Cleaning

To remove dirt from the instrument, gently wipe it with a soft cloth moistened with a small amount of water or neutral detergent. Gently wipe the display area with a dry, soft cloth. Do not use gasoline, alcohol, acetone, ether, ketone, thinner, or detergents containing gasoline. Otherwise, it may cause deformation and discoloration of the instrument.

3、 Transportation

In order to avoid secondary damage caused by impact during transportation, please make sure to double pack. We do not guarantee the damage caused by transportation. When returning the instrument for repair, please write down the fault content and the return address, contact person, telephone number and other necessary information on a piece of paper and send it back to us together with the instrument.

8. Packing Listt

Name	Specification	Quantity
Meter	*	1 unit (built-in battery)
Meter bag	*	1 pcs
Auxiliary grounding rod	*	4 pcs
Current clamp	Banana plug * 1, audio plug * 1	2 pcs
Monitoring software CD	*	1 copy
USB communication cable	1.5m	1 pcs
Test cable	Red , yellow , green , black	4 pcs
Simple test cable	yellow, green	2 pcs
Charger	12.6V/1A/line length 1.1m	1 pcs
User's manual Warranty card	*	1 set

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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