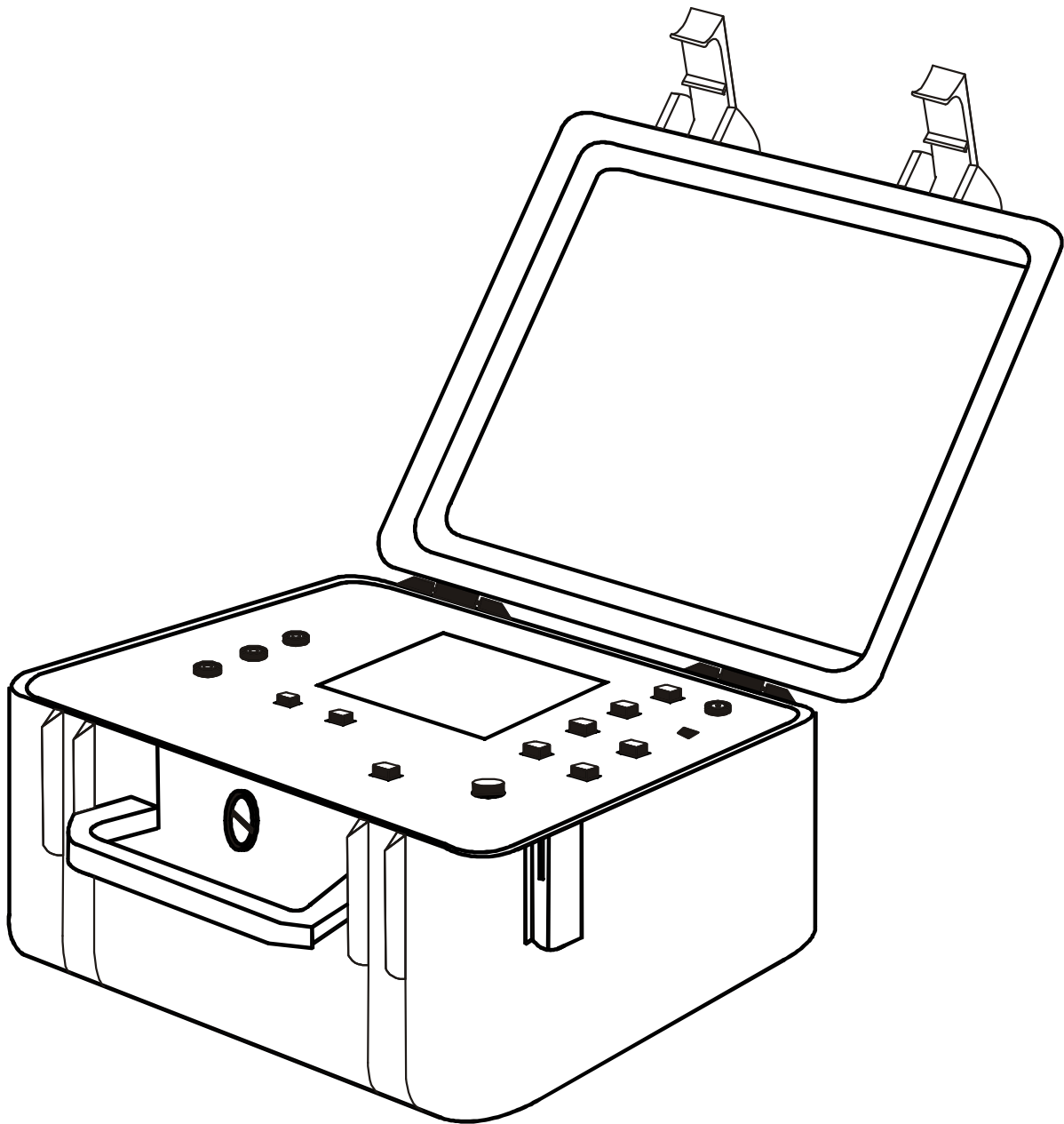


Digital Earth Resistance Tester



ES3000 USER MANUAL

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Guangzhou Zhengneng Electronic Technology Co.,Ltd.


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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.

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

- I 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., is a commonly used meter for measuring grounding resistance. It adopts a large LCD gray-white screen backlight display and microprocessor technology to meet the requirements of two-wire and three-wire test resistance. Suitable for telecommunications, electricity, meteorology, computer rooms, oil fields, power distribution lines, iron tower transmission lines, gas stations, factory grounding networks, lightning rods and so on. Instrument testing is precise, fast, simple, stable and reliable.

The digital grounding resistance tester is controlled by the microprocessor and can automatically detect the connection status of each interface and the interference voltage and interference frequency of the ground network, and has the function of testing the auxiliary grounding resistance value. At the same time store 500 sets of data, resistance measurement range: $0.01\ \Omega \sim 3000\ \Omega$, grounding voltage range: $0.01 \sim 100.0V$. Online monitoring data through monitoring software, USB data uploaded to PC and unique features such as intelligent alarm alert

The digital grounding resistance tester consists of host, monitoring software, test line, USB cable, and grounding rod. It has the functions of reading, checking, saving, reporting and printing of historical data.

III. Rang and Accuracy

Measurement function	Range	Accuracy	Resolution
Grounding Resistance	$0.01\ \Omega \sim 30.00\ \Omega$	$\pm 1.5\%rdg \pm 5dgt$ (Auxiliary ground resistance $100\ \Omega \pm 5\%$, voltage to ground $<10V$)	$0.01\ \Omega$
	$30.1\ \Omega \sim 300\ \Omega$		$0.1\ \Omega$
	$301\ \Omega \sim 3000\ \Omega$		$1\ \Omega$
Grounding Voltage	$0.01 \sim 10.00V\ AC$	$\pm 1\%rdg \pm 3dgt$	$0.01V$
	$10.1 \sim 100.0V$		$0.1V$

(Remark: $23^{\circ}C \pm 5^{\circ}C$, below 75%rh)

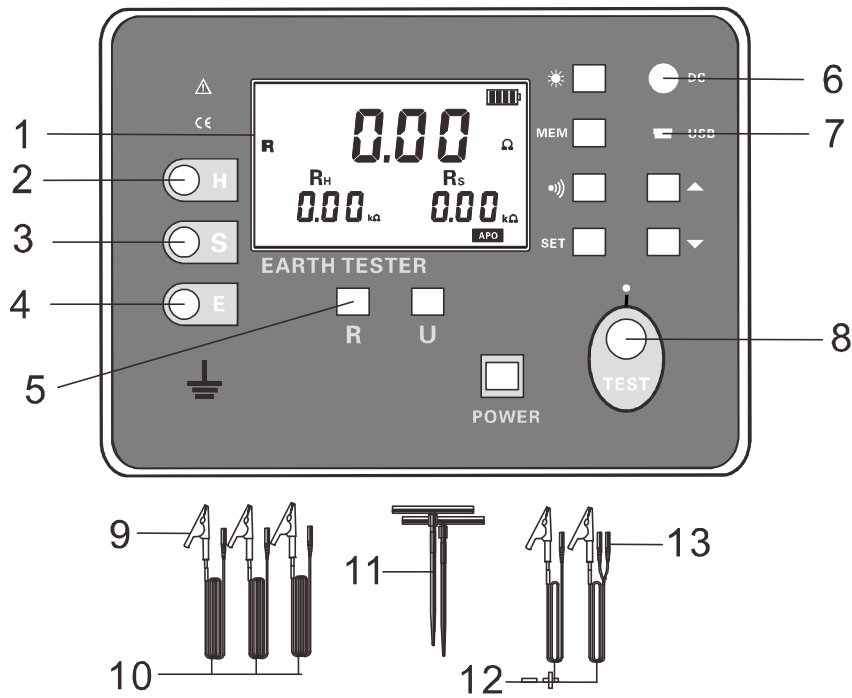
IV. Technical Specifications

Grounding Resistance Range	$0.01\ \Omega \sim 3000\ \Omega$	Accuracy $\pm 1.5\%rdg \pm 5dgt$
Grounding	$0.01\ \Omega$	

Resistance Resolution	
Grounding Voltage Range	0.01~100.0V AC Accuracy $\pm 1\%rdg \pm 3dgt$
Grounding Voltage Resolution	0.01V
Baseline conditions	23°C $\pm 5^\circ\text{C}$, below 75%rh (Auxiliary ground resistance $100\Omega \pm 5\%$, voltage to ground <10V)
Function	Earth resistance measurement, ground voltage measurement, low value resistance measurement
Power	DC 6V Lead-acid batteries
Backlight	Controllable gray screen backlight, suitable for use in dim places
measurement mode	Precise three-wire measurement, simple two-wire measurement
Measurement methods	Grounding resistance: rated current change pole method, test current > 20mA (sine wave), 128Hz; Ground Voltage: Average Rectification
Test frequency	128Hz
Display mode	4-bit large LCD display, gray screen backlight
Measurement instructions	LED flashing indicator during measurement, LCD countdown display
LCD size	108mm \times 65mm
Instrument size	L/W/H: 277.2mm \times 227.5mm \times 153mm
Test line length	3 strips: red 15m, yellow 10m, green 5m each one
Simple test line	2 strips: red 1.6m, green 1.6m each one
Auxiliary Grounding rod	2PCS: $\phi 10\text{mm} \times 200\text{mm}$
Measure time	Ground voltage : about 2 times/sec; grounding resistance: about 5 seconds/time
Measurement times	5000 times or more
Line voltage	Measuring grounding voltage : AC 600V or less
USB interface	With USB interface, software monitoring, storage data can be uploaded to the computer, save and print
Communication Line	One USB communication line, 1.5m long
Data storage	500 groups, flashing "FULL" symbol indicates that the memory is full

Data review	Data review function: "MR" symbol display
Overflow display	Over-range overflow function: "OL" symbol display
Alarm function	Alarm when the measured value exceeds the alarm setting value
Battery voltage	Real-time display of battery power, reminding timely charging when battery voltage is low
Power consumption	Backlight: 25mA Max
	Standby: 25mA Max(Backlight off)
	measuring: 70mA Max(Backlight off)
Weight	Instrument: 2397g(含电池)
	Test lines: 861.5g(含简易测试线)
	Auxiliary grounding rod: 425g(2根)
	Instrument bag: 271g
Working temperature and humidity	-10°C~40°C; below 80%rh
Storage temperature and humidity	-20°C~60°C; below 70%rh
Overload protection	Grounding resistance: AC 280V/3 seconds between E-H and E-S ports
Insulation resistance	10MΩ以上(500V between circuit and housing)
Pressure resistance	AC 3700V/rms(between circuit and housing)
Electromagnetic properties	IEC61010-4-3 , Wireless frequency electromagnetic field ≤1V/m
Suitable for safety regulations	IEC61010-1 、 IEC1010-2-31 、 IEC61557-1,5 、 IEC60529(IP54)、Pollution level 2、CAT III 300V

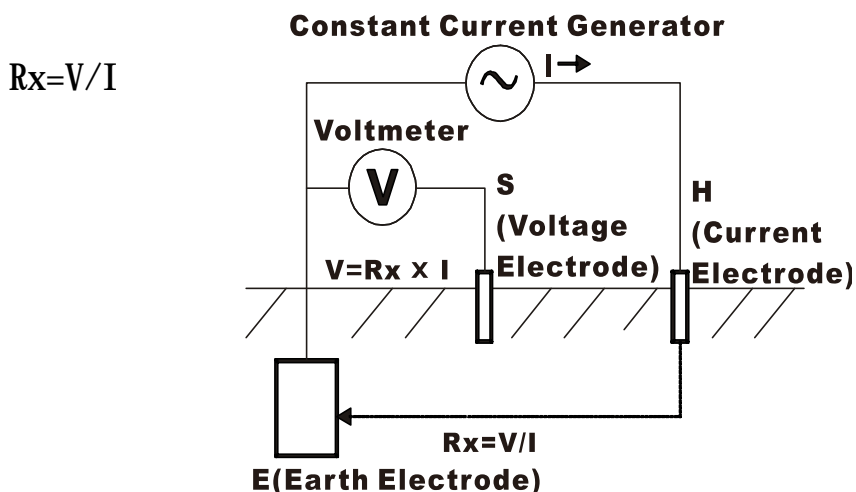
V. Structure



- 1. LCD
- 2. H interface: current pole
- 3. S interface : voltage pole
- 4. E interface : grounding pole
- 5. Function button
- 6. DC charging
- 7. USB interface
- 8. Test button
- 9. Safety Alligator Clip
- 10. Test line
- 11. Grounding rod
- 12. Easy test line
- 13. Simple test line short connector

VI. Measuring Principle

1. Ground voltage measurement using average rectification.
2. The grounding resistance value is measured using the rated current change method, that is, the rated current I (30mA Max, 128Hz) flowing between the measuring object E (ground electrode) and H (current electrode); seeking E and S (voltage electrode) Potential difference V , then the method to determine the ground resistance R_x .







3. The working error (B) is the error within the rated operating conditions, which is calculated from the inherent error (A) and variation error (E_i) of the existing instrument.

$$B = \pm (|A| + 1.15 \times \sqrt{(E_1^2 + E_2^2 + E_3^2 + E_4^2 + E_5^2 + E_7^2 + E_8^2)})$$

- A: inherent error
- E1: Changes due to location changes
- E2: Changes due to power supply voltage changes
- E3: Changes due to temperature changes
- E4: Changes due to disturbance voltage variations
- E5: Changes due to contact electrode resistance
- E7: Changes due to system frequency changes
- E8: Changes due to system voltage changes

VII. Functional Quick Check


POWER	Switch on/off
MEM	Data browsing/value setting
 Backlight button	Backlight control
TEST button	Start measuring
 button	Delete data measurement selection
 button	Wire resistance check/delete data measurement selection
SET button	Set alarm value/delete data
MEM button	Data Lock/Store/View
 button	Alarm function start/alarm threshold setting
R and U	Measure gear selection

VIII. Operation


1. Switch on/off

Press the POWER button to switch on and off. After turning on the machine, the lower corner shows "APO" and it will automatically shut down after 15 minutes when it is not operating.

2. Battery Voltage Check

After powering on, if the LCD shows a low battery voltage symbol “”, it indicates that the battery is running low. Please charge it in time. The battery power is sufficient to ensure the accuracy of the measurement. When the battery power decreases, the power indicator bar decreases.

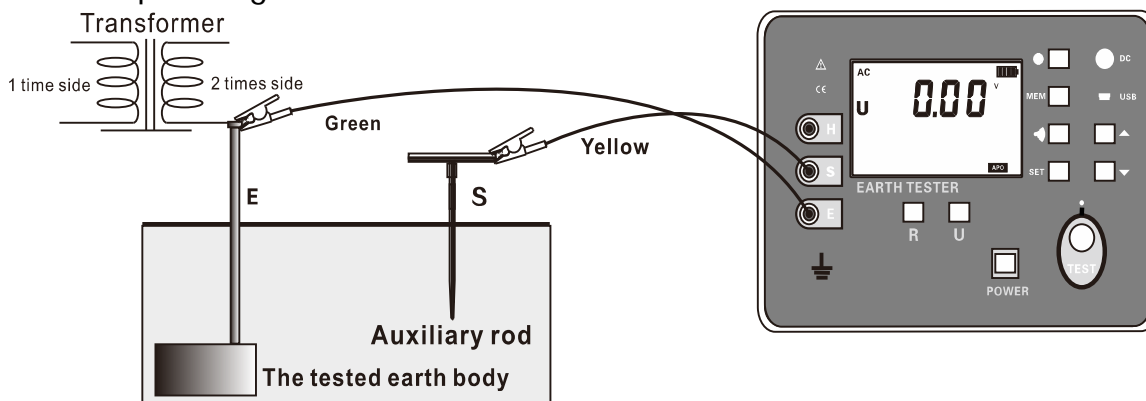
3. Ground Voltage Measurement

	Before measuring, please make sure that the plug of the test line is fully inserted into the corresponding interface of the meter.
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	If the plug is not fully inserted or contacted, the measurement value may be incorrect.
	This instrument can not be used for commercial power supply voltage measurement, special circumstances need to measure, only can use the S and E interfaces connect to measure, the commercial power supply voltage cannot be measured when the H and S interfaces are shorted. Otherwise, the voltage is measured in the ground loop of the circuit breaker and the circuit breaker may start.
	Do not apply more than 100V across the measurement interface when measuring ground voltage.
	When measuring ground voltage, do not touch exposed conductors to avoid electric shock.

After the auxiliary grounding rod and test line are connected, switch the function button U to the voltage level, the LCD displays the ground voltage, and the measured voltage to ground cannot exceed 100 V.

Under normal circumstances, measure the ground voltage and connect only the corresponding test lines of the S and E interfaces. As shown:



Notice	When measuring the grounding resistance, first confirm that the voltage to the ground must be less than 10V. If the voltage is more than 10V, the measured value of the grounding resistance may cause an error. At this time, the grounded device shall be powered off first. After the ground voltage drops, measure the ground resistance again.
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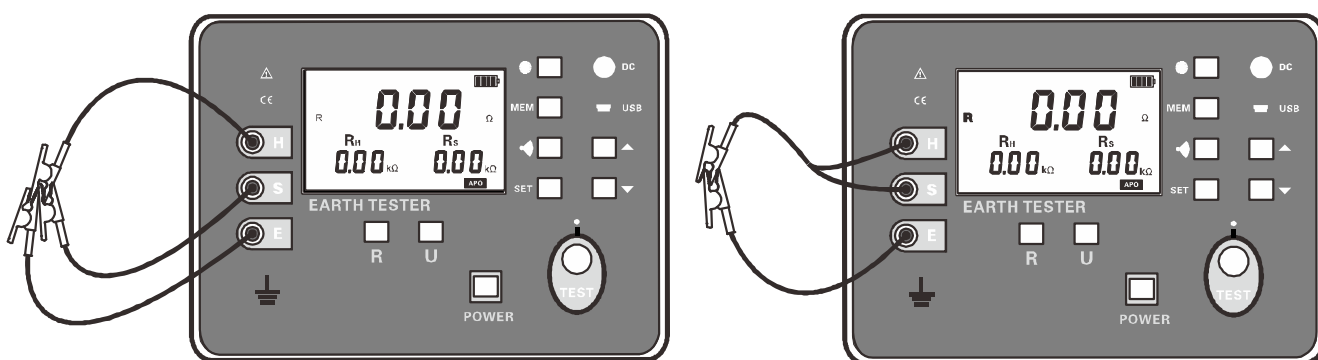
4. Wire resistance check

In order to improve the precision and stability of the grounding resistance measured in the field, the error caused by the change of the wire resistance due to the test line being used for a long time is avoided; To avoid the error caused by the test line not completely inserted into the

instrument interface or poor contact; to avoid the error caused by the user to replace or lengthen the test line, the line resistance check function is specially designed to measure the low-value resistance more accurately.

After connecting the test line and the meter, short the other end of all the test lines. As shown in the figure below, press the function button R to switch to the corresponding ground resistance measurement position. Press “▲” key to start calibration, LED indicator flashes during calibration, LCD countdown display, LCD display after calibration.

Shutdown does not save the verification line resistance. The next time it is turned on, it needs to be recalibrated.

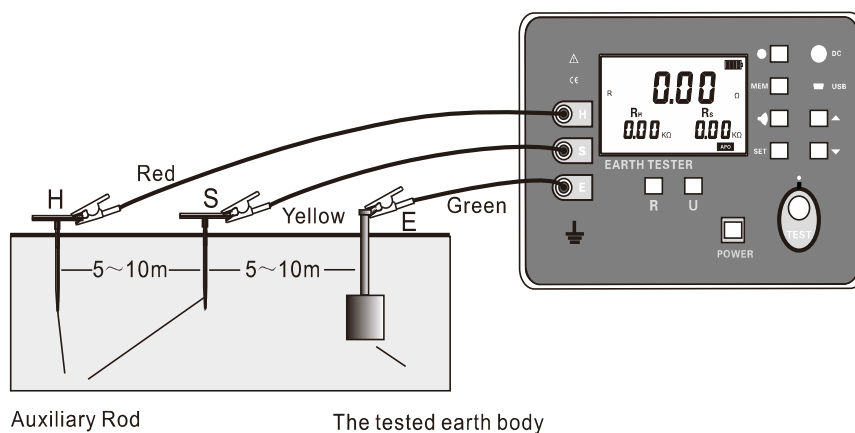


5. Grounding Resistance Precision Measurement

	<p>Before measuring, please make sure that the plug of the test line is fully inserted into the corresponding interface of the meter. If the plug is not fully inserted or contacted, the measurement value may be incorrect.</p>
	<p>For low-value ground resistance measurement, the measurement is more accurate after line resistance check</p>
	<p>When the grounding resistance is measured, the maximum voltage of about 50V will be generated between the E and H interfaces! Do not apply voltage between the measurement interfaces. Please be careful to avoid electric shocks.</p>
	<p>When measure ground resistance , the test line can not be mixed, the test line should be measured separately</p>
	<p>The auxiliary grounding rods H, S can be buried in places where there is a large amount of water, so as to reduce the auxiliary grounding resistance value and can reduce the indication error.</p>

After the precision measurement grounding resistance adopts three-wire connection, the auxiliary grounding rod and the test line are all connected, switch the function to measure the resistance R mode, and press the “TEST” key to start measure. LED flashes during measurement, LCD countdown display, light off after measurement is complete, LCD shows measured value. From the measured object, every 5 to 10 meters, insert the auxiliary grounding rod into the earth in a straight line. Connect the grounding test lines (red,

yellow, and green) from the H, S, and E ports of the meter to the auxiliary current electrode H, auxiliary voltage electrode S, and ground electrode E under test. As shown:

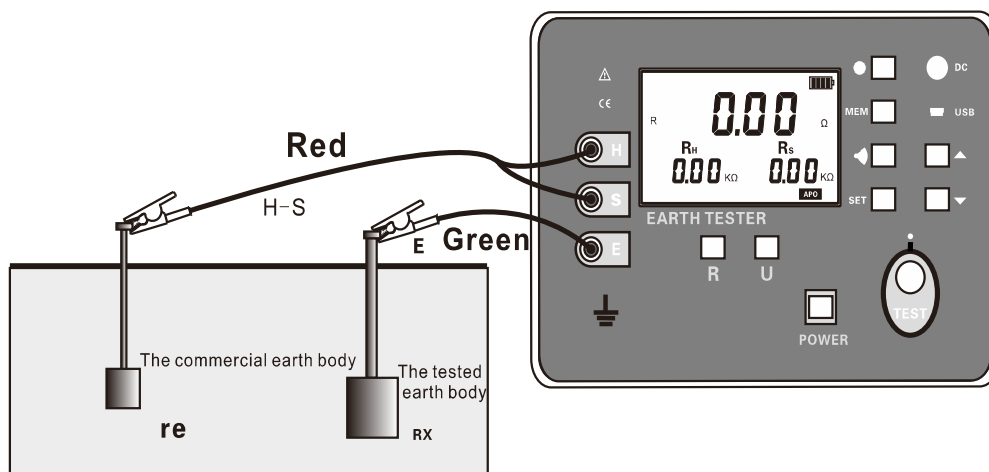


6. Simple Method for Measuring Ground Resistance

	<p>When using the commercial power system grounding as an auxiliary grounding pole to measure, it must be confirmed by the checker that it is the grounding pole of a commercial power system</p>
	<p>Cannot use this meter to confirm grounding pole of commercial power system</p>

This method is a simple measurement method that does not use an auxiliary grounding rod. The grounding electrode with the smallest grounding resistance is used as the auxiliary grounding electrode, and two simple test wires are connected (that is, the H and S interfaces are short-circuited). Instead of the auxiliary grounding rods H, S, metal burying materials such as metal pipes or fire hydrants, common grounding of commercial power systems, or lightning protection grounds of buildings may be used. Take care to remove the oxide layer at the connection point of the selected metal auxiliary grounding body during measurement.

Grounding resistance simple test wiring as shown below, other operations and precision measurement.



The simple method measures the grounding resistance. The instrument reading value is the sum of the grounding resistance of the measured grounding body and the grounding resistance of the commercial grounding body. That is:

$$RE = RX + re$$

And: RE is the meter reading value;

RX is the grounding resistance value of the grounding body under test;

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

Then, the grounding resistance of the measured grounding body is:

$$RX = RE - re$$

Use a simple method to measure the grounding resistance, and try to select the grounding body with a small re value as the auxiliary grounding electrode so that the meter reading is closer to the true value. When measuring, please choose metal water pipe and fire hydrant as auxiliary ground electrode.

Notice	Simple method to measure the grounding resistance, also need to confirm that the voltage to the ground must be below 10V. If the voltage is above 10V, the measured value of the grounding resistance may have errors. At this time, first power off the device of the grounding body under test. Measure the grounding resistance after the grounding voltage drop..
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7. Backlight Control

After power on, press “☀” key to turn the backlight on or off, and the backlight function is suitable for dim places. The default backlight turns off every time you turn it on.

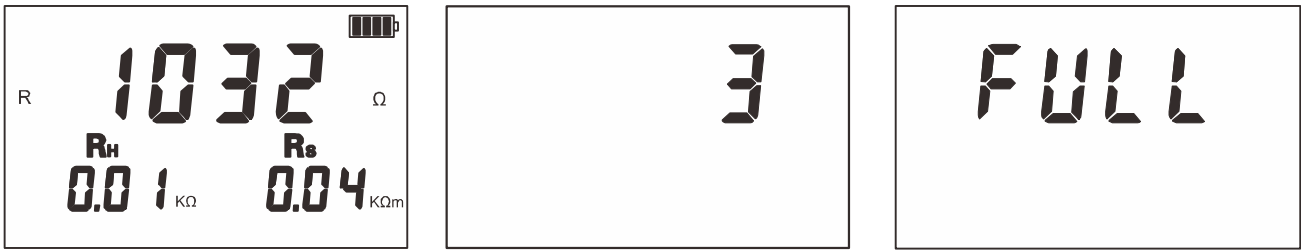
8. Alarm Setting

After power on, short press “●))” to turn on and off the alarm function. Short press “SET” key to set the resistance alarm value, press “●))” key to move the cursor, press “▲” or “▼” key to change the current size, and then press “SET” key to save and exit. When the measured value is greater than the alarm critical setting value and the alarm function is turned on, the meter displays the “●))” symbol and issues a “beep-beep-beep--” alarm sound.

9. Data Lock/Storage

After the power-on or measurement is completed, short press “MEM” key to lock the current display data, and automatically numbered and storage. If the memory is full, the meter displays the “FULL” symbol. As shown below:

The measurement data is $1032\ \Omega$. Short press "MEM" to display the data showed that it is stored as the third group.



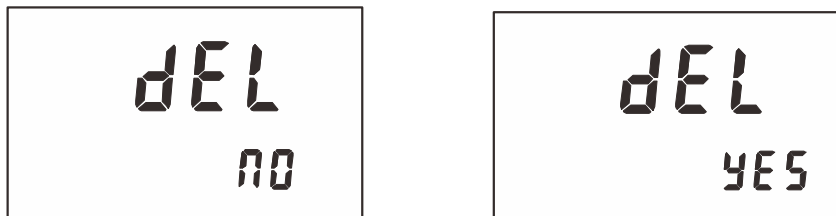
10. Data Review/Delection

After the power on or measurement is completed, press and hold the "MEM" button (more than 3 seconds) to enter the data review mode. The interface corresponding to the stored data interface and the stored data group number flash alternately. Press "▲" or "▼" key to select the corresponding data of the array number with a step by 1, hold down the "▼" or "▲" key to select the array number with a step by 5, then press "MEM" to exit. See below

In the figure below, the number 3 is the current group number, and 6 is the total group number. If no data is stored, the LCD displays "NULL". See the figure below.



Under data review status, press "SET" key to enter data deletion, press "▲" or "▼" key to select "NO" or "YES", select "NO" and then press "SET" key to not return data review status, select "YES". Press the "SET" key again to delete the stored data. After the deletion, the following figure is displayed.




11. Data Upload

Connect the USB communication cable of the computer and the instrument, turn on the instrument and run the monitoring software. If the USB connection

is successful, the stored historical data can be read, uploaded to the computer and saved.

The monitoring software has on-line real-time monitoring and historical query functions, dynamic display, alarm value setting and alarm indication function, and functions such as reading, viewing, saving and printing of historical data.

IX. Battery Instructions

The instrument is powered by a 6V lead-acid battery. When the battery power is reduced, the power indicator bar is reduced. When the voltage drops to 5V, the battery symbol “” is displayed. Please charge in time. Low voltage affects the measurement accuracy.

X. Accessories

Instrument	1PC
Instrument bag	1PC
Auxiliary grounding rod	2PCS
Monitoring software CD	1PC
USB communication line	1PC
Test line	3PCS
Simple test line	2PCS
6V Battery (built-in)	1PC
charger	1PC
Manual, certificate	1SET

The contents of this user manual cannot be used as a reason to use the product for special purposes.

The company is not responsible for other losses caused by use.

The company reserves the right to modify the contents of the user manual. If there is any change, it will not be notified.



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