Huazheng®

HZ3151
Insulation Resistance Tester



Huazheng Electric Manufacturing (Baoding) Co., Ltd

Dear user:

Thank you for choosing HZ3151 Insulation Resistance Tester.

We hope that this instrument can make your work easier and more enjoyable, so that you can get the feeling of office automation in the test and analysis work.

Before using the instrument, please read this manual, and operate and maintain the instrument according to the manual to prolong its service life. "Just a light press, the test will be completed automatically" is the operating characteristics of this instrument.

If you are satisfied with this instrument, please tell your colleagues; if you are not satisfied with this instrument, please call (0312) 6775656 to tell you to serve you at all times-Baoding Huazheng Electric Manufacturing Co., Ltd., our company will definitely make you satisfied !

Contents

I.Security Warning 1

II. Packaging Content 2

III. Features 2

IV. Technical Indicators 3

V. Product Appearance 6

VI. Operating Instructions 7

6.1 Test Wiring 8

6.2 Operation 10

VII. Detailed Explanation Of Test Mode 21

7.1 IR test mode 21

7.2 DAR absorption ratio test mode 21

7.3 PI polarization index test mode 22

7.4 SV step voltage test mode 22

7.5 DD dielectric discharge rate test mode 22

VIII. Packing List 23

I.Security Warning

◆ The safety performance of this instrument complies with the IEC61010-1 standard.

◆ Please read this manual thoroughly before use and abide by the safety regulations and specification parameters in the manual during the test.

◆ During the insulation resistance test, there will be a dangerous voltage of up to 5kV on the test clip of the instrument; operators should not touch the circuit under test to avoid electric shock accidents.

◆ Before conducting insulation resistance test wiring, you must check and make sure that the tested product is in a power-off state.

◆ Before testing, it is necessary to check whether the withstand voltage value of the test line used matches the maximum output voltage value of the instrument used, so as to ensure the safety of testers and test accuracy.

◆ After starting the insulation resistance test, do not disconnect the test line from the tested object before the measurement is completed; otherwise, the tested object will not be discharged, resulting in the risk of electric shock.

◆ Do not test in a flammable place, sparks generated during the test may cause an explosion.

◆ It may be dangerous to perform insulation resistance test in a humid environment, and it is recommended not to conduct the test in this condition.

◆ Do not test if dirt or carbides that impair insulation properties are found on the test leads or the output ports of the instrument.

◆ When the instrument is abnormal or damaged, please stop using it immediately.

◆ This instrument is a special instrument with a certain degree of danger, please do not disassemble or repair it without authorization.

◆ The parameters of the built-in battery pack of the instrument are compatible with the performance parameters of the instrument. Users are not allowed to replace the battery by themselves to avoid abnormal operation of the instrument.

◆ The built-in battery pack of this instrument is a lithium-ion battery and a special charging circuit; when the instrument is not used for a long time, it should be charged once every 3 months to maintain the performance parameters of the built-in battery.

Note: Do not short-circuit the test line during the insulation resistance test; when short-circuited or disconnected, the tip of the test line will discharge. Excessive discharge may degrade the performance of the instrument.

II. Packaging Content

After you receive the shipping box, open the box and inspect it for damage. If the shipping container is damaged, or the instrument is damaged, please notify the shipping company and your nearest sales office of our company.

Please check that you received the following items in your kit:

Standard configuration:

√1 tester

√1 set of test lines (1 red high voltage test line, 1 blue shielded protection line, 1 black shielded high voltage test line)

√1 three-core power cord

√3 250V/2A fuses

√1 printed user manual

√1 certificate and warranty card

√1 factory test report

III. Features

3.1 The fully isolated power supply scheme is adopted, and the low-voltage circuit (battery-powered, human-computer interaction operation circuit) is completely electrically isolated from the high-voltage circuit (NC high-voltage power supply, signal sampling circuit); the isolation voltage is as high as 30kV, thereby ensuring the safety of operators.

3.2 It adopts an industrial-grade 7-inch color LCD screen with a high resolution of 1024×600, a viewing angle of 85°, and a brightness of 400cd/m ^{2} ; it adopts a capacitive touch screen of explosion-proof glass, which has a good operating feel and a durable display.

3.3 It has a single-button shuttle function + buttons with color backlight, giving operators a better operating experience.

3.4 With 6 voltage ranges:

100V, 250V, 500V, 1000V, 2500V, 5000V.

Custom voltage mode 50V ~ 5000V continuously adjustable, step voltage 10V.

3.5 The maximum output short-circuit current is 6mA; and 1mA, 2mA, 3mA, 4mA, 5mA, 6mA are adjustable.

3.6 The maximum continuous output power is 25W.

3.7 With an independent discharge circuit, it can quickly discharge the test product after the test is completed.

3.8 It has the test functions of insulation resistance IR, absorption ratio DAR, polarization index PI, dielectric discharge rate DD and step voltage SV.

3.9 Support R600s/R30s and R600s/R15s two DAR absorption ratio calculation modes.

3.10 It has the functions of DC and AC voltmeters, can automatically identify DC voltage and AC voltage signals, and can measure the frequency of AC voltage signals.

3.11 It has the function of measuring cable length.

3.12 With controllable hardware filter and software filter, the anti-interference performance of the instrument is greatly improved.

3.13 The test time in various test modes is saved independently and does not affect each other, which is convenient for the next use.

3.14 It has the functions of automatic shutdown of the instrument when it is idle and automatic shutdown when the battery is low, and the automatic shutdown time can be set.

3.15 With USB storage function, test data can be exported to USB in batches; and it supports the function of upgrading the main control firmware and high-voltage power supply firmware through USB.

3.16 Built-in large-capacity lithium battery and built-in fast charger; both the instrument panel and LCD screen can indicate the current charging status.

IV. Technical Indicators

Insulation resistance measurement, test voltage 5kV:	
Resistance range	**resolution**
0～9.99kΩ	0.01kΩ
10.0～99.9kΩ	0.1kΩ

100～999kΩ	1kΩ
1.00～9.99MΩ	10kΩ
10.0～99.9MΩ	100kΩ
100～999MΩ	1MΩ
1.00～9.99GΩ	10MΩ
10.0～99.9GΩ	100MΩ
100～999GΩ	1GΩ
1.00～9.99TΩ	10GΩ

Note: The full-scale resistance value is related R_{FS} to the test voltage U_N, and it can be calculated by referring to the following formula:

$$R_{FS} = 2 \times 10^9 \times U_N$$

R_{FS} The unit of Ω is Ω, U_N and the unit of Ω is V.

Under each test voltage, the relationship between the resistance test accuracy and the full-scale resistance	
Resistance range	**precision**
$R < \frac{R_{FS}}{10}$	±5%
$\frac{R_{FS}}{10} \leq R \leq R_{FS}$	±20%
The full-scale resistance value corresponding to each test voltage	
Test voltage	**Full scale resistance value R_{FS}**
100V	200GΩ
250V	500GΩ
500V	1.00 TΩ
1000V	2.00 TΩ
2500V	5.00 TΩ
5000V	10.0 TΩ

testing time	
Setting range	Adjustable from 10 seconds to 99 minutes
Test power	
Fixed test voltage	100V, 250V, 500V, 1000V, 2500V, 5000V
Custom Test Voltage	50V～5000V The minimum step voltage is 10V. When using the single-button shuttle control, the step voltage value will automatically switch between 10V, 100V, and 200V with the speed of the shuttle. The higher the speed, the higher the step voltage value.
Voltage output accuracy	0%～+10%
short circuit current	1mA～6mA, adjustable, step 1mA
Short-circuit current accuracy	±5%
continuous output power	25W
Voltmeter	
Measuring range	AC/DC 10V～660V, ±(2%+3 characters)
AC voltage frequency	25Hz～85Hz, resolution 0.1Hz, accuracy ±0.2Hz
Output voltage measurement	
precision	±(2%+3 words)
Capacitance measurement	
Measuring range	10nF～25uF, test voltage ≥100V
precision	±10%±5nF

Capacitance sample discharge rate	
discharge rate	From 5kV to 50V, ≤0.47s/uF
Conditions of use and shape	
AC power	85～264Vrms, 50/60Hz, 65VA
Built-in battery	16.8V, 4400mAH lithium battery
built-in charger	16.8V 2.3A
battery life	5kV@100MΩ load, about 6 hours
Dimensions	320mm (length) × 270mm (width) × 150mm (height)
weight	3.9kg
Operating temperature	-10℃～50℃
Relative humidity	<90%, no condensation

V. Product Appearance



1. Capacitive touch screen.

   The display size is 7 inches; the resolution is 1024×600.

2. Test the power supply "+" positive output terminal.

3. GUARD (guard ring) terminal.

4. Test the negative output terminal of the power supply "-" and the connection terminal of the shielding layer of the test wire.

   The upper terminal is the test lead shield connection terminal.

   The lower terminal is the negative output terminal of the test power supply "-".

5. Start, stop test button, with RGB color backlight.

   On the test parameter setting interface or test data display interface, press and hold for 2 seconds to start the test, and short press to stop the test. And when the backlight of the button is green, it means that the test has stopped; when it is red, it means that the test is in progress.

6. Menu button. Short press to quickly enter the main menu interface.

7. Return key. Quickly return to the previous interface or exit the current function.

8. Power button. Long press for 2 seconds to power on, long press for 2 seconds to power off.

9. One-button jog shuttle with RGB color backlight.

   You can quickly adjust the cursor position and debug the value, and the key is equivalent to the "confirm" key.

10. RS232 communication interface, optional RS485 communication interface.

11. USB interface. For storing test data and instrument upgrade firmware files, please use FAT or FAT32 format USB.

12. power interface. That is, the built-in charger AC power input, built-in 250V 2A fuse.

13. charging indicator.

    Red: Charging; Green: Fully charged.

    The built-in charger has a maximum charging time limit of 5 hours. Once the charging time exceeds 5 hours, the charging function will be automatically turned off and the charging indicator will go out.

VI. Operating Instructions

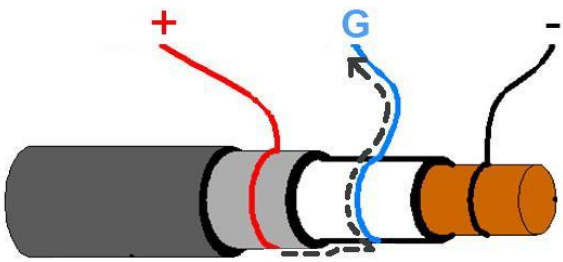
6.1 Test Wiring

6.1.1 Terminal blocks

There are 3 sets of test terminals:

- Respectively test power supply "+" positive output terminal group, 1 wiring terminal;
- Test power "-" negative output terminal group, 2 wiring terminals, the upper terminal is the shielding layer connection terminal, the lower terminal is the test power "-" negative output terminal, the current is at the test power "-" negative output terminal middle measurement;
- GUARD (protection ring) terminal group, 1 wiring terminal, used to eliminate the influence of the surface leakage current of the test object on the test result.

6.1.2 Use of GUARD (guard ring) terminal



Leakage current

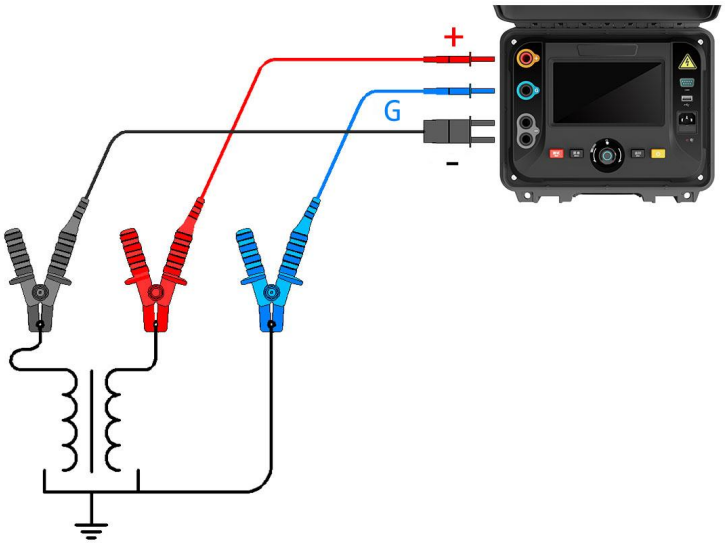
The GUARD terminal has the same potential as the negative output terminal of the test power supply "-"; since the leakage resistance is actually connected in parallel with the resistance to be tested, the use of GUARD (protection ring) will shunt the leakage current flowing through the surface so that it cannot enter the current detection circuit. Thereby, the measurement accuracy of the insulation resistance value is improved. When the test voltage is high and the insulation resistance of the test object is large, it is recommended to use the GUARD terminal.

6.1.3 Test Wiring

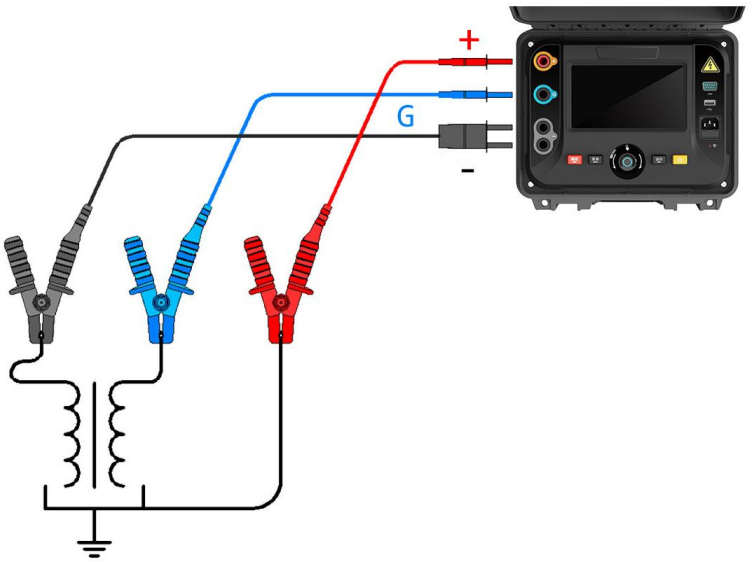
In order to eliminate the influence of the surface leakage resistance of transformers, cables and other test objects, the three-wire test method can be used, but do not ground the "-" terminal used for current measurement. When the test voltage is low and the insulation resistance of the test object is small, it is not necessary to connect the GUARD terminal.

- When measuring the insulation resistance between transformer windings, the GUARD

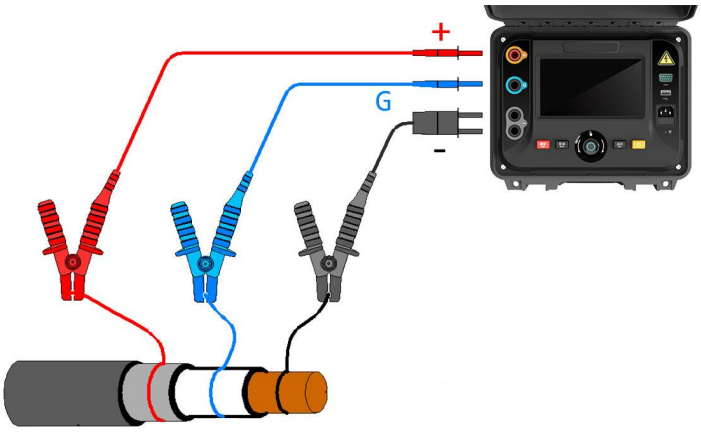
terminal should be connected to the transformer oil tank.



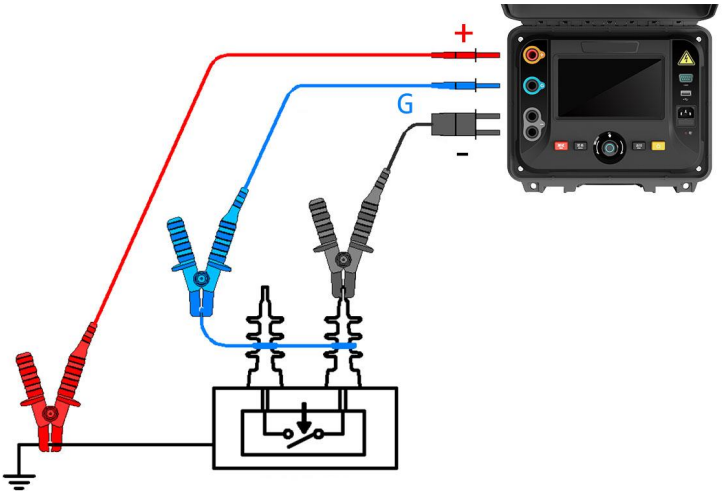
- When measuring the insulation resistance between the transformer winding and the transformer oil tank, the GUARD terminal should be connected to the winding not being tested.



- When measuring the insulation resistance between the cable conductor and the cable sheath, wind a conductive metal foil or wire on the insulator as shown in the figure below, and connect it to the GUARD terminal of the instrument.



● When measuring the insulation resistance of a high voltage circuit breaker, the GUARD terminal should be connected to the terminal insulator of the circuit breaker.



6.2 Operation

6.2.1 Switching on and off

● Press and hold the power button for 2 seconds to start and shut down the device.

● The instrument has an automatic shutdown function, which can be turned off, and the automatic shutdown time can be set; after the automatic shutdown function is activated, the instrument will automatically shut down after a certain period of time.

● The instrument has the function of automatic shutdown when the battery is low. When the battery is exhausted, it will automatically stop the test process and automatically shut down.

Note: In all the above situations, the display will display corresponding prompt information.

6.2.2 Test operation

On the standby interface (test parameter setting interface), press and hold the "Test" button for 2 seconds to enter the test data display interface and start the test; short press the "Test" button or "Back" button on the test data display interface to stop the test; long press "Test" key to start the test again.

6.2.3 Status bar

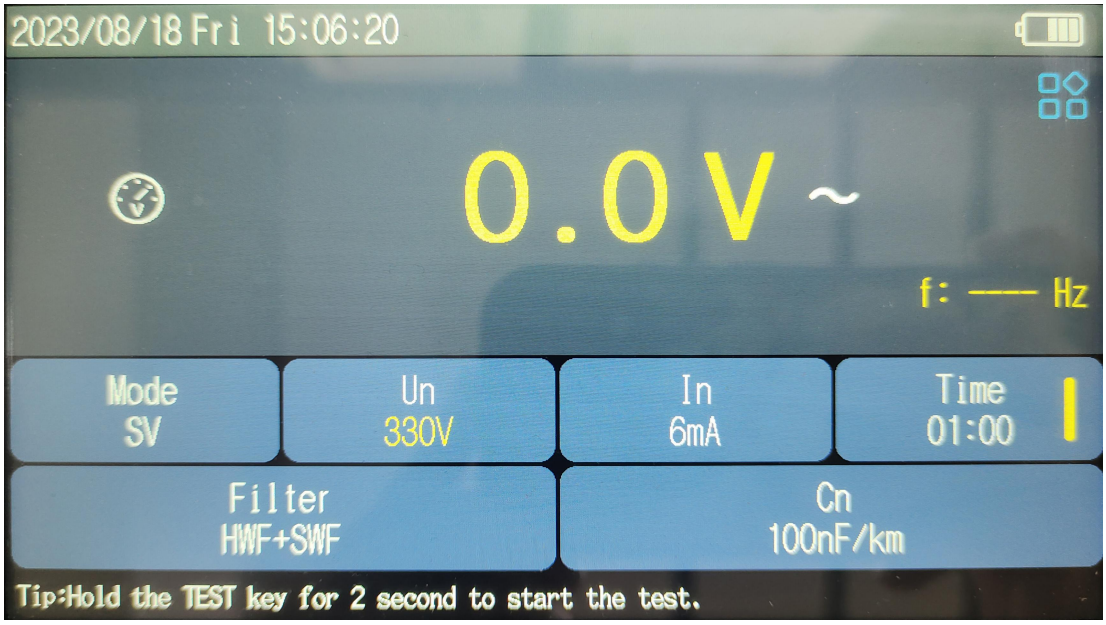
The status bar is located at the top of the display and is used to display the current date, current time, peripheral working status, battery information, etc.

icon	illustrate
	Instrument control status icon. This icon is displayed when the control right of the instrument is deprived by APP. (This function is limited to instruments with APP function)
	Test record view icon. When the current instrument interface is in the test record query interface, this icon is displayed; when viewing the test record collective data, the icon flashes to remind the user that the current display is the test record data.
	Wired communication connection successful icon. This icon is displayed when the wired communication interface of the instrument is successfully connected with external devices.
	Bluetooth connection successful icon. This icon is displayed when the instrument is successfully connected to an external device via the Bluetooth interface.
	USB flash drive icon. This icon is displayed when the USB flash drive is inserted into the USB interface of the instrument and the initialization is successful.
	Battery charging icon. This icon is displayed when the instrument is connected to AC power and the charging function is normal.
	Battery level icon. Displays the current charge level of the built-in

	battery and its charging status. The icon flashes when the battery is low. When the battery is charging, the frame is red. When the battery is fully charged, the frame is green. **Note: When charging in the power-on state, the charger cannot reach the full state due to the standby current of the instrument; at this time, the charger will enter the full charge state immediately after the power is turned off.**

6.2.4 Voltmeter function and insulation resistance test parameter setting

After the instrument is turned on, it enters the standby interface. In this interface, the instrument works in the voltmeter mode, and the insulation resistance test parameters can be set, as shown in the figure below:



One-button shuttle, touch, and keys can operate this display:

Rotate the one-button jog shuttle to control the focus position of the display interface, and press the one-button jog shuttle to confirm the operation.

Touch the icon or short press the "Menu" button to enter the main menu interface.

Long press the "Test" button for 2 seconds to start the test process and enter the test data display interface.

- **Voltmeter:**

The voltmeter function can automatically measure the AC voltage value or DC

voltage value input by the "+" terminal and "-" terminal;

When the measured voltage is DC voltage, display the DC voltage symbol and its positive and negative polarity;

When the measured voltage is AC voltage, the AC voltage symbol and its frequency value are displayed; when the frequency of the AC voltage signal exceeds the range, its frequency is displayed as "----".

● **Insulation resistance test parameter setting**

① **Test mode:** Select the test mode, click this option to pop up the test mode selection operation interface, see the left picture:

IR test: conventional insulation resistance test mode; automatically judge whether to perform DAR test and PI test according to the set test time.

DAR test: absorption ratio test mode;

PI test: polarization index test mode;

SV test: step voltage test mode;

DD test: Dielectric discharge rate test mode.

② **Test voltage:** set the test voltage value, click this option to pop up the test voltage setting operation interface, see the left picture:

It has 6 fixed voltage test gears, namely: 100V, 250V, 500V, 1000V, 2500V, 5000V.

When the custom test voltage mode is selected, the step voltage value of the touch operation is 10V; the step voltage value of the single-key jog shuttle operation is 10V, 100V, and 200V variable, and the faster the speed of the single-key jog shuttle, the larger the step value .

③ **Short-circuit current:** Set the maximum output current value, click this option to pop up the short-circuit current setting operation interface, see the left picture:

The short-circuit current can be adjusted in the range of 1mA to 6mA, with a step of 1mA.

④ **Test time:** set the test time, click this option will pop up the test time setting operation interface, see the left picture:

The test time can be adjusted from 10 seconds to 99 minutes.

The test time in various test modes is saved independently and does not affect each other, which is convenient for the next use.

IR test mode: conventional insulation resistance test mode; when the set test time is greater than or equal to the time required for the DAR test, the DAR test will be performed automatically, and the DAR related results will be displayed after the test is completed.

DAR test mode: the test time cannot be set, and it is fixed at 1 minute.

PI test mode: The test time cannot be set, and it is fixed at 10 minutes.

Note: When the yellow mark on this option is on, it means that the test time can be set; otherwise, it means that the test time is a fixed value and cannot be set.

⑤ **Filter setting:** Set the software and hardware filter parameters. Click this option to pop up the filter setting operation interface, see the left picture:

Power frequency setting: set the working frequency of the industrial frequency power system, and the hardware filter system and software filter system will filter out the interference signal of this frequency (the domestic application is fixed at 50Hz, and the foreign application should be selected according to the frequency value of the power system).

Hardware filter: The instrument has a built-in dedicated hardware filter, which can be enabled when the external interference is large or the test data is unstable.

Software Filter: Set whether to enable the software filter to further filter out interference signals.

⑥ **Cn (cable rated capacitance) setting:** set the rated capacitance of the cable under test per kilometer, click this option and the Cn setting operation interface will pop up, see the left picture:

Since the instrument has the function of measuring the capacitance of the test object, when the rated capacitance per kilometer of the cable is known, the approximate capacitance of the tested cable can be calculated according to the measured capacitance of the test product and the set rated capacitance per kilometer of the cable. length.

6.2.5 Main menu operation

In the main menu, four functional modules can be selected: "insulation test", "record query", "clock setting" and "system setting".

Insulation test: Select this function module to enter the insulation resistance test parameter design interface;

Record query: select this function module to view, edit and export the saved test data;

Clock setting: select this function module to set the built-in real-time clock of the instrument;

System Settings: Select this function module to view the basic information of the instrument, instrument settings, firmware upgrades, etc.

6.2.6 Insulation resistance test

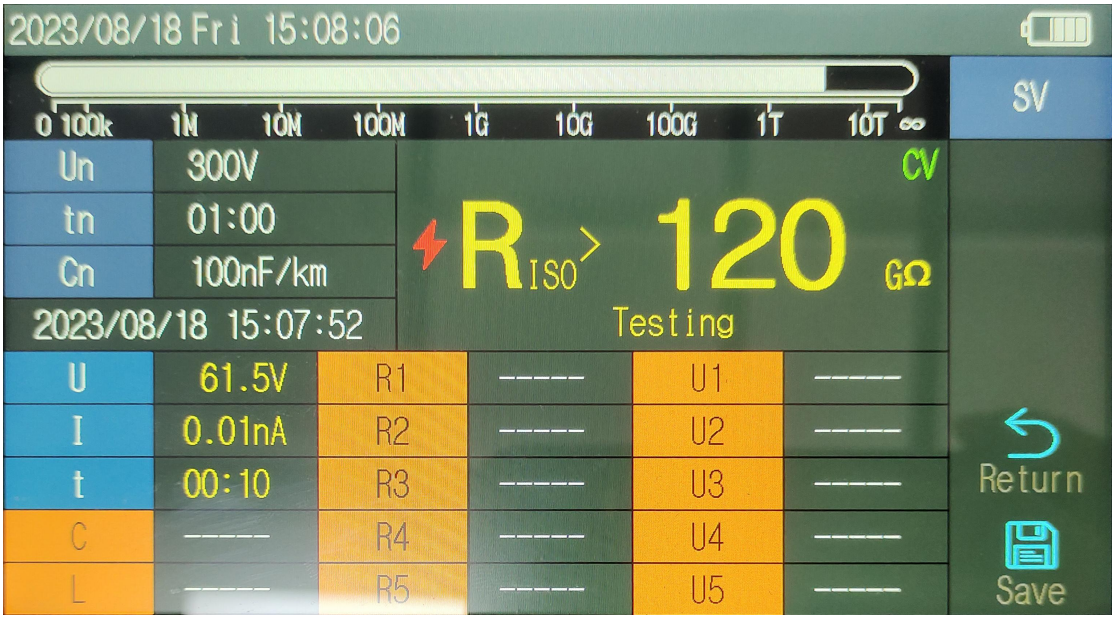
safety warning:

● Before conducting insulation resistance test wiring, it should be confirmed whether the test object is live; even if the test object has been powered off, there may be induced electricity on the test object. If the induced voltage is too high, it will threaten the personal safety of the operator. At this time, it must be operated in accordance with the safety regulations.

● Using the built-in voltmeter function of the instrument to measure the electrification of the test object, the measured voltage value should be within the measurement range specified by the voltmeter. When the measured voltage is too high, the inside of the instrument will be seriously heated and even cause the instrument to burn out.

● After the test is stopped or the test is completed, switch the instrument to the voltmeter mode so as to check the electrification of the test object; the test line can only be removed after the discharge of the test object is completed.

On the insulation resistance test parameter setting interface, press and hold "Test" for 2 seconds, it will enter the test data display interface and start the test, as shown in the figure below:



Short press the "Test" button or "Back" button on this interface to stop the test manually; long press the "Test" button for 2 seconds to start the test again. At the initial stage of the start-up test, the high-voltage power supply is in the soft-start state; at the initial stage of the stop test, the instrument will discharge the external test object; at this time, the backlight of the "Test" button and the single-key shuttle are red and flashing rapidly, and the buzzer emits a rapid " Beep...beep...beep..." the message beeped. When entering the normal test state, the backlight of the "Test" button and the one-button shuttle will be red and flash once per second, and the buzzer will emit a "beep..." sound once per second.

Display data description:

● Insulation resistance diagram and test mode



The current and final measured insulation values are displayed in the form of analog diagrams, and the set test mode is displayed on the far right.

● Test parameter setting



Un: set test voltage value;

tn: set test time;

Cn: Set the rated capacitance of the cable per kilometer;

Test start date and time.

displays  the icon indicates that the data item can be adjusted; after clicking the

corresponding data item, the data item will flash, indicating that it has entered the value editing state. During the normal test of insulation resistance, the test voltage value can be adjusted (one-key shuttle operation); after the test is completed, the rated capacitance per kilometer of the cable can be adjusted (one-key shuttle operation).

● Real-time insulation resistance value and test status

Display the measured real-time insulation resistance value R_{ISO}, the working status of the high voltage test power supply, the insulation resistance test status and the test voltage value when the test is completed.

① When $R_{ISO}$the real-time insulation resistance value exceeds the range, ">Full-scale resistance value" will be displayed here.

② Working status of high voltage test power supply:

icon	illustrate
	Blinking this icon indicates that the high voltage power supply is working.
CV	Displaying this icon means that the high-voltage test power supply is currently in the state of constant voltage output.
CC	Displaying this icon means that the high voltage test power supply is currently in the state of constant current output.
	Displaying this icon indicates that the high voltage test power supply has experienced an overtemperature fault and the test has stopped.

③ During the insulation test, it will display the prompt information of the current test status, and display the test voltage value when the test is completed.

● Real-time test data and final test data

U	0.0V	R15s	1.77TΩ	DAR	1.10
I	0.00nA	R60s	1.94TΩ	PI	----
t	10:00	R600s	>4.00TΩ	DD	0.03
C	5nF			tdd	01:00
L	0.060km			Idd	-0.18nA

U: DC voltage value measured in real time.

I: The DC voltage value measured in real time, the positive value is the output current, and the negative value is the discharge current of the test product.

t: Test time timer.

C: Capacitance of the test product.

L: Estimated cable length.

R15s: The insulation resistance value of the test object when the test time timer reaches 15 seconds.

Note: When "System Settings" → "Device Settings" → "DAR Mode" is set to "R60S/R30S", the logo here will display "R30s" and display the insulation resistance value of the test product when the test time timer reaches 30 seconds .

R60s: The insulation resistance value of the test object when the test time timer reaches 60 seconds.

R600s: The insulation resistance value of the test object when the test time timer reaches 600 seconds.

DAR: Absorption ratio value.

PI: polarization index.

tdd: 1 minute timer for discharge during DD dielectric discharge rate test.

Idd: DD dielectric discharge rate test discharge current value of the sample after 1 minute of discharge.

Notice:

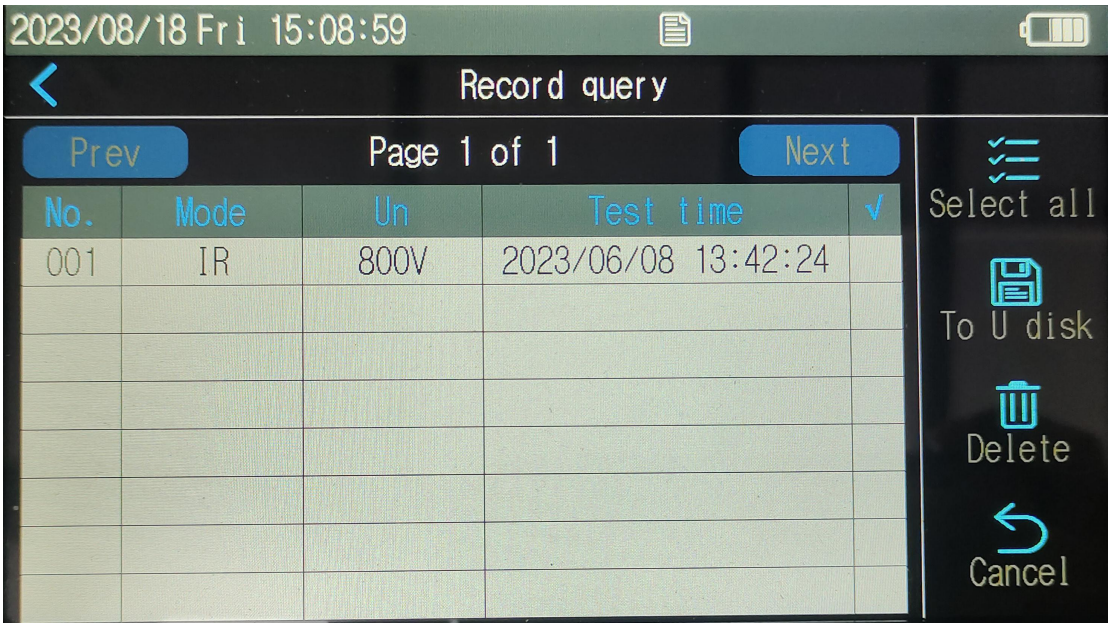
1. **Whether the R15s, R30s, R60s, R600s, DAR, PI, DD, tdd, and Idd values are displayed depends on whether the set test mode and test time meet the requirements.**
2. **When the insulation resistance value of R15s, R30s, R60s, R600s exceeds the range, the related DAR and PI values will not be calculated, and "----" will be displayed.**
3. **In the SV test mode, the values of R1~R5 and U1~U5 will be displayed.**

● Operation function buttons

These two can only be used when the test is stopped or the test is completed; "Return to setting" can return to the insulation resistance test parameter setting interface; "Save data" is used to save the current test data to the instrument's built-in memory or an

external USB.

6.2.7 Record query



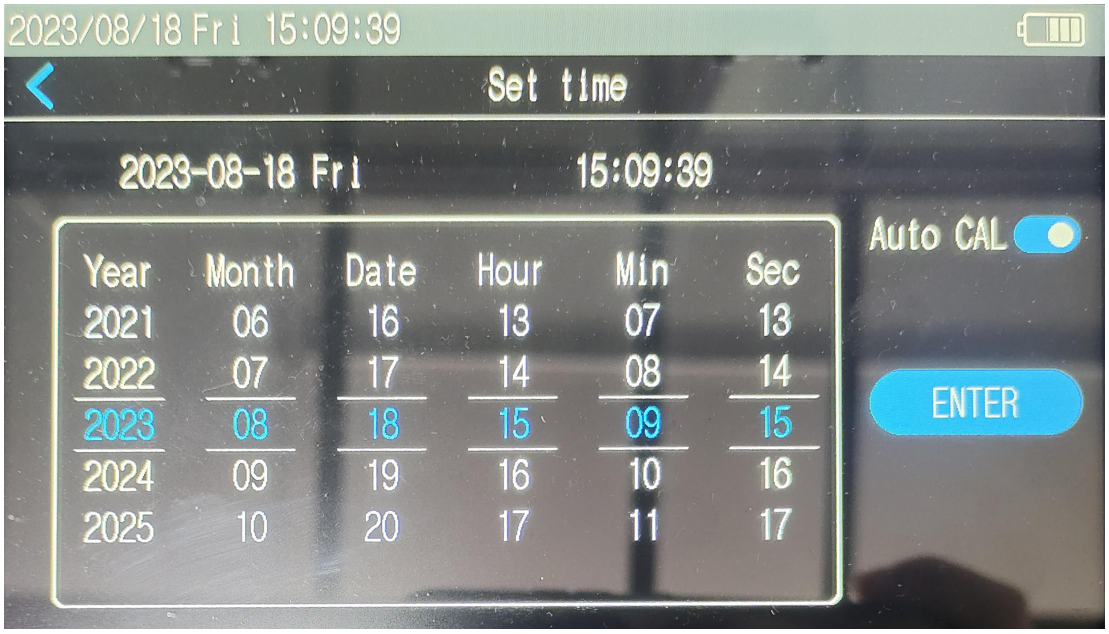
Functions of the test record query interface:

- View saved test records;
- Batch delete saved test records;
- Batch transfer the saved test records to an external USB flash drive.

Click a single test record to view its detailed test data; long press a single test record to enter the edit mode, you can select multiple test records, and delete them or transfer them to a USB flash drive.

6.2.8 Clock setting

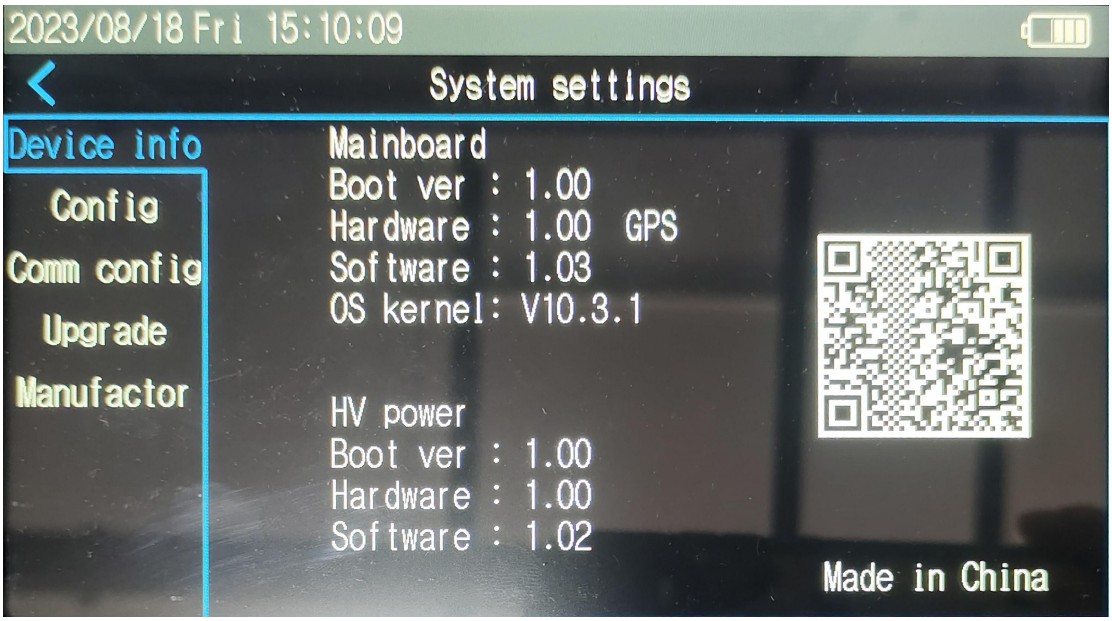
The clock setting interface is shown in the figure below:



The date and time can be adjusted by touching and sliding, or by using the one-button jog shuttle.

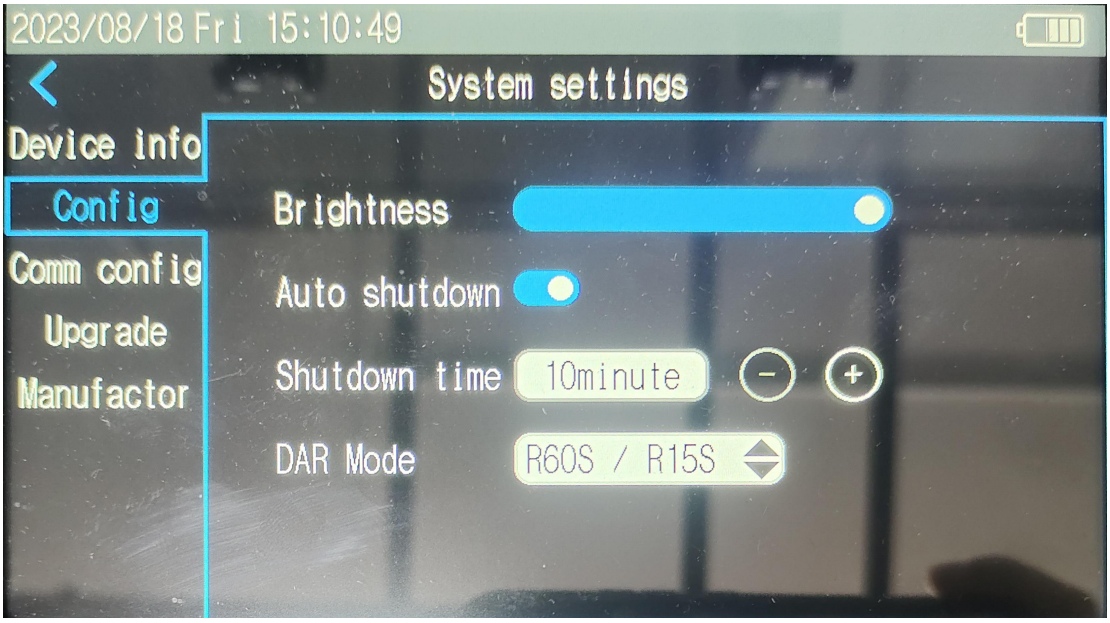
6.2.9 System Settings

● **Device information**



You can view the software and hardware version numbers of the main control system and high-voltage power supply.

● **Device settings**



Single language models do not have a "Language Selection" option.

● Firmware upgrade is used to upgrade the firmware of the main control system and the firmware of the high-voltage power supply; the manufacturer's settings are for in-factory debugging and are not open to users.

VII. Detailed Explanation Of Test Mode

7.1 IR test mode

Conventional insulation resistance test mode; automatically judge whether to perform DAR test and PI test according to the set test time, this mode will not automatically perform DD dielectric discharge rate test.

7.2 DAR absorption ratio test mode

The fixed test time of the DAR absorption ratio test mode is 1 minute, and the calculation formula of the domestic standard is:

$$DAR = \frac{R60s}{R15s}$$

Where: $R15s$--- The insulation resistance value at the 15th second after the start of the test;

$R60s$--- Insulation resistance value at 60 seconds after the start of the test.

Internationally more popular calculation formulas are as follows:

$$DAR = \frac{R60s}{R30s}$$

Where: $R30s$--- the insulation resistance value at the 30th second after the start of the

test;

$R60s$--- Insulation resistance value at 60 seconds after the start of the test.

The calculation mode of DAR absorption ratio can be set through "System Settings" → "Device Settings" → "DAR Mode".

7.3 PI polarization index test mode

The fixed test time of PI polarization index test is 10 minutes, and its calculation formula is:

$$PI = \frac{R600s}{R60s}$$

Where: $R60s$--- the insulation resistance value at 60 seconds after the start of the test;

$R600s$--- The insulation resistance value at the 600th second after the start of the test.

7.4 SV step voltage test mode

In the SV step voltage test mode, the set test voltage value and test time are divided into 5 equal parts, that is, the step voltage value and the step time value. The whole test process is divided into 5 steps, and the test voltage value is gradually increased according to the calculated voltage step value and time step value.

The minimum output voltage value of the instrument is 50V, so in the SV step voltage test mode, the calculated step voltage value should be greater than or equal to this value; otherwise, the initial step is tested according to the minimum voltage value of 50V.

Note: When the test voltage value and test time value are calculated in 5 equal divisions, they are integer operations without decimal parts. In order to achieve the expected test effect, it is best to set the test voltage value and test time value to an integer multiple of 5.

7.5 DD dielectric discharge rate test mode

The DD dielectric discharge rate test is a diagnostic insulation test performed after the insulation resistance measurement has been completed. Typically the insulation is connected to the test voltage for 10 minutes to 30 minutes and then discharged before the DD test. After 1 min, the discharge current was measured to detect charge reabsorption by the insulating material. A higher reabsorption current indicates that the insulation layer is contaminated (mainly caused by moisture), and this test mode is suitable for the

diagnosis of multilayer insulation. Its calculation formula is:

$$DD = \frac{I_{dis\ 1min}}{U \times C}$$

In the formula: $I_{dis\ 1min}$--- The current value after 1 minute of conventional discharge, unit: nA

C--- Measured capacitance, unit: uF

U--- Test voltage value, unit: V

DD value	<2	twenty four	4 - 7	>7
Insulation state	good	slightly worse	Difference	very bad

VIII. Packing List

No.	Item	Qty
1	Main engine	1
2	Power line	1
3	Red high voltage test line	1
4	Blue shielded protective line	1
5	Black shielded high voltage test line	1
6	Fuse pipe	3