Operation Manual

Insulation Resistance Tester

HM2306

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Directory

Safety warning

●Read and understand safety warnings and test precautions before using the instrument and during use.

● Before the test, the power should be guaranteed.

●When the instrument has high voltage output, there will be a warning sound. Personnel are not allowed to touch the test product or the metal parts of the instrument. Corresponding safety measures should be taken.

●This instrument has the function of automatic discharge, it can also discharge automatically for the sample with large electric capacity to ensure the safety of operators.

● The instrument must be operated by qualified and professionally trained personnel.

●Please wear insulating gloves before use. Do not operate when the instrument surface is wet or the operator's hands are wet.

●Do not touch the circuit under test immediately during or after the measurement, which may lead to electric shock accident. Please operate according to the discharge voltage displayed by the tester.

●Stop testing when dirt or carbides are found on the test line or test port that could easily damage the insulation characteristics.

● Do not test in flammable places. Sparks may cause explosions.

● If the instrument is abnormal, please stop using it. For example, broken or exposed metal parts of the instrument.

● Do not install replacement parts or make any unauthorized modifications to the instrument. Please contact us for maintenance.

Note:

the specifications in this manual are only suitable for the instruments you are using, and we have the right to change them。The safety performance of this instrument conforms to international

standards IEC61010—1：2001。

Dear users: you are welcome to use the anti-interference insulation resistance tester. For your safety and ensure the normal use of the instrument, please read this instruction carefully before operation.

1. Instructions

●Insulation resistance tester is a compact, high voltage output, battery powered testing instrument, can be used to measure the absorption ratio, polarization index insulation resistance test items.

●Application places: insulation resistance tester is to solve high voltage substations, powerplant site under strong interference for large high voltage transformer, electric motor, generator, a long power cable, tubular busbar and electrical insulation quality assessment and design, instrument power output is big, the real-time voltage measurement (try actually charged voltage), leakage current measurement, automatic discharge (discharge voltage measurement) is especially suitable for large capacitive try and 110 kv power interference of test site.

●Strong anti-interference ability, single machine can resist AC2000 ac interference, will not damage the instrument.

2. Performance features

- Design in strict accordance with safety standards, output voltage:500v 、1000v、2500v、5000v、10kv。
- AC2000V, 50mA induction current can cope with the harsh test environment.
- 5.7 ″large screen display, actual test voltage display, leakage current display.
- Capacitance measurement function.
- Short circuit current≥10mA。
- Automatic calibration function of the instrument, automatic calibration accuracy before testing.
- This instrument has the functions of live voltage measurement, leakage current measurement and automatic discharge for the actual samples. It can intuitively see whether the sag voltage of the test instrument with load meets the national requirements through the live voltage measurement function for the actual samples. In addition, the insulation condition of the sample can be directly seen through the measurement function of live voltage and leakage current of the sample.
- It can automatically measure and remember the values of R15S, R60S and R10min, and display the polarization index (PI), inductance absorption ratio (DAR) test values and test time.
- Excellent anti-interference performance, especially used in

power system of 110KV and above large capacity transformer and long distance power cable.

- Automatic discharge: the advanced high-voltage discharge technology is adopted to rapidly discharge the capacitive sample. When discharging, the discharge voltage is measured in real time (the test voltage of the sample is up to 0v). For the large-capacitance sample, manual discharge is required to ensure the safety of personnel due to the presence of the charge absorbed by the medium.
- Internal rechargeable lithium battery power supply or ac power supply, real ac and dc dual-use does not affect the test accuracy.
- The analog pointer coexists with the digital display, and the number reflects the accuracy of the insulation resistance of the tested product, and the analog pointer can reflect the dynamic change of insulation resistance during the test process.
- Alarm function during voltage boost. The buzzer has alarm function when the device has high voltage output, indicating that there is high voltage output.
- Battery quantity digital display and under voltage alarm protection function.
- Intelligent battery charging management can effectively

prevent battery life shortening or damage caused by overcharging.

●Automatic shutdown function: this instrument has automatic shutdown function. It will shut down automatically 10 minutes after the End of measurement.

●Short circuit protection, short circuit state will not burn the instrument.

3 Technical indicators

3.1 Main indicators

The rated voltage(kV)	**0.5、1、2.5、5、10（kv）**
Measure the voltage (kV)	**Nominal voltage ×（1±10%） the load resistance shall not be lower than the range 1%**
The minimum error is 10% RDG scope	**(0.001～100)GΩ/10kV** **(0.001～100)GΩ/5kV** **(0.001～50)GΩ/2.5kV** **(0.001～20)GΩ/1kV** **(0.0001～10)GΩ/0.5kV**
The minimum error is 20% RDG scope	**(100～5000)GΩ/10kV** **(100～4000)GΩ/5kV** **(50～200)GΩ/2.5kV** **(50～100)GΩ/1kV** **(10～20)GΩ/0.5kV**

Capacitance CX	0.01-10UF Resolution 0.03 Precision 20%
No requirement	>10T
Output short circuit current	≥10mA
DAR、PI Measuring range	Measuring range: 0.01 ～9999.99 Maximum error: ±(1%RDG＋1d)
Output voltage display error	±(3%RDG + 1d)

3.2 Other indicators

Anti-interference capability：50 mA（Induced voltage 2000V）AC 50Hz

Insulation resistance： 50 MΩ (10kV)

(Measure the distance between the circuit and the housing)

Withstand voltage： AC 3kV 50Hz 1min

(Measure the distance between the circuit and the housing)

5.7 Inch screen Resolution 320 x240

Working temperature and humidity： －10℃ ～ +50℃ 85%RH

Storage temperature and humidity： －15℃ ～ +55℃ 90%RH

Power supply:

lithium battery (battery 1:17.5v 2.8ah battery 2:8.5v 2.8ah)

Charging: AC 220V (1±10%)

Working hours: about 8 hours continuously.

Overall dimensions： 385mm(L)×298mm(W)×196mm(D)

Weight： ≈ 5kg

4. Instrument profile

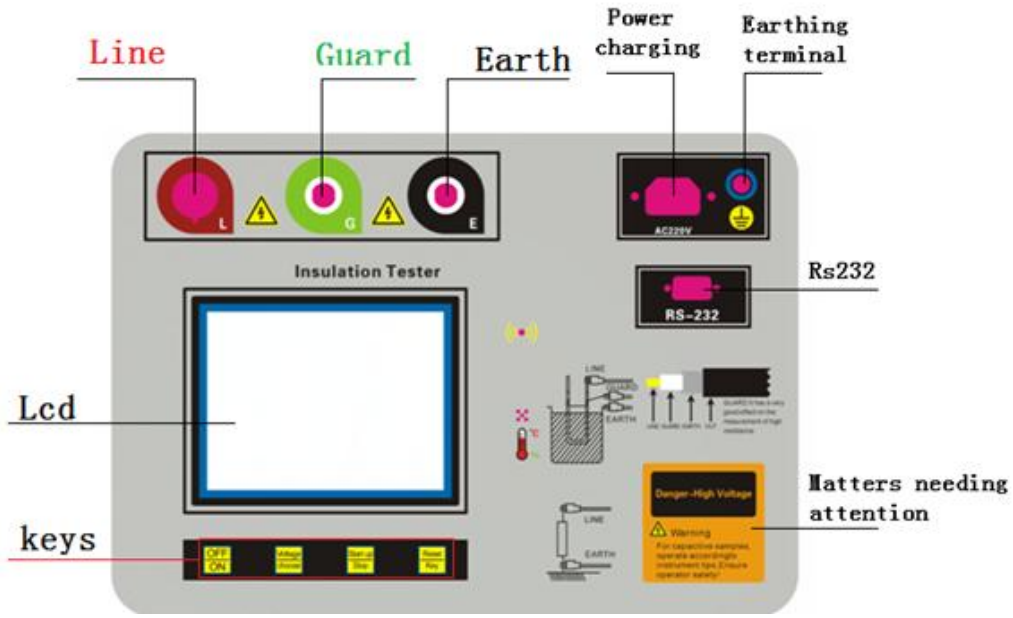


Figure 4.1 structure diagram

Instrument box introduction:

Our company adopts specially designed chassis, which is dustproof, waterproof and impact resistant

Design protection level: IP67

Design impact resistance: IK08

When opening the case, please follow the diagram.

Figure 4.2 schematic diagram of unpacking

5. Test line connection method

5.1 Precautions before use:

●Before the test line, it is necessary to ensure that the tested products have been completely discharged and isolated.

●The instrument must be operated by suitable trained personnel.

●Never touch the test circuit during the test.

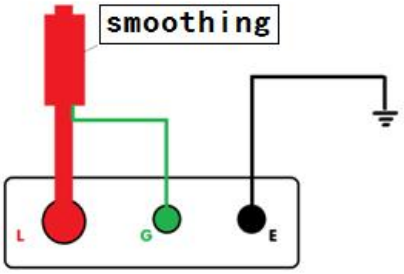


Figure 5.1 schematic diagram

●Make sure that the meter e-terminal (grounding terminal) is grounded. Please note that L, G and E must be plugged in, which should be consistent with figure 5.1. The “L” and “G” marks of the test wire plug shall correspond to the “L” and “G” marks of the instrument jack.

●Confirm that the tested product is safely grounded, and the test product does not carry strong electricity.

●Auxiliary grounding may not be connected, E must be grounded.

●Make sure the battery is fully charged. If the battery is under

voltage, it will not start up.

●Press the "ON/OFF" button for about 2 seconds, and the LCD will display the working interface.

●LCD display "wait" .

●Voltage selection button select the voltage range, touch the "Start up/stop" button, the high voltage is connected, the LCD display "START  " instrument E、 L End of the high voltage output, buzzer warning sound sounded continuously, please pay attention to safety! Press the "Start up/stop" button again and the instrument will stop measuring and display "WAIT" .

● After the test is completed, press the "Start up/stop" button, and press the "Start up/stop" button to stop the voltage boost. When the instrument appears "automatic discharge voltage 0v, wire removal is safe", the wire can be removed.

a. Test voltage: is the actual voltage value on the test subject at the beginning of the measurement as the charging time increases (related to the selected voltage).

b. Leakage current: it decreases with the increase of voltage and time, and finally changes to a small range. When the leakage current increases with the increase of voltage and time, it proves that the sample may have insulation defects.

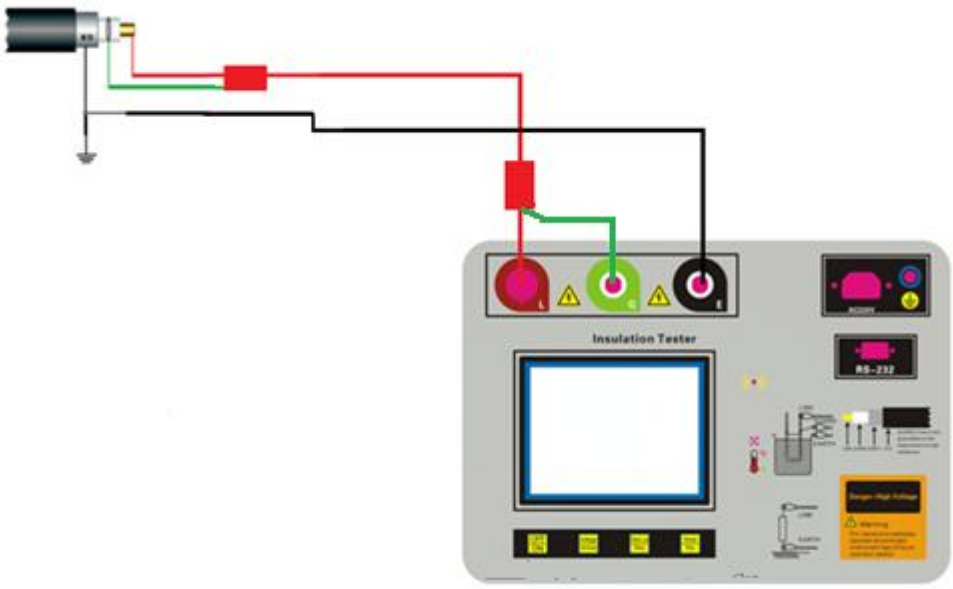
c. Automatic discharge function: when the instrument stops the test, it adopts advanced high-voltage rapid discharge

technology to conduct the automatic discharge of the sample. According to the live voltage on the sample, it gradually discharges to 0v, and when “automatic discharge voltage 0v, wire removal is safe” occurs, the wire can be removed. For example, if the voltage on the sample is 10000v, the discharge voltage will be gradually changed from 10000v to 0v, and the discharge voltage will be monitored in real time.

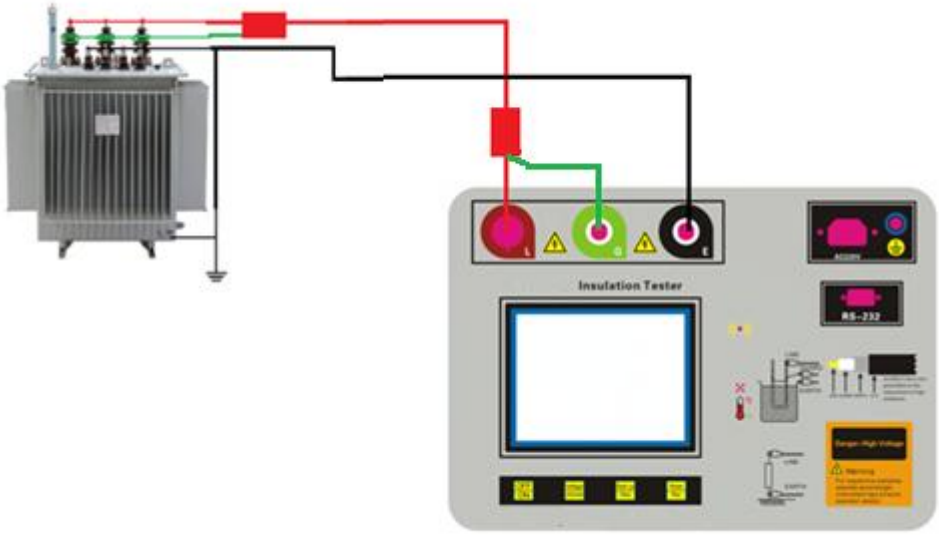
5.2 G(guard ring) Used correctly

There is no need to use G shielding terminals for basic insulation tests where surface leakage is rarely measured. That is, the insulator is clean and has no adverse current channel. But in the cable test, there may be a surface leakage channel through the insulator due to moisture and dirt between the exposed cable and the sheath. In this case, the effects of this leakage need to be eliminated, especially under high pressure test. A bare wire can be used to wrap tightly around the insulation and be connected to the shielding terminal G by a third test wire.

Note: high voltage shielding means that high voltage shielding shall not be grounded. When not in use, please clip it on the L line. The G of the instrument End must be inserted to prevent the leakage caused by the high voltage test line sweeping from affecting the measurement accuracy.



Cable insulation resistance test (figure 5.2)



Measurement of transformer insulation resistance (figure 5.3)

The shield terminal is at the same potential as the negative high voltage terminal. Since the leakage resistance is in parallel with the resistance being tested, the use of shielding terminals diverts the surface leakage current from the measuring circuit. The instrument then reads the leakage current of the insulator regardless of the surface leakage.

6. The host operating

6.1 Equipment ON and OFF

Long press the “**ON/OFF**” button on the left side of the panel for 2 seconds, the instrument is in the power on state, and in the power off state, press the LCD display next time to enter the interface, The instrument is turned on. Press the “**ON/OFF**” button again for 2 seconds, the LCD is off, the instrument is off, and the instrument is automatically off without any operation for 10 minutes.

6.2 Introduction to software functions：

6.2.1 Voltage selection interface

(Figure 6.2.1) Voltage selection interface, in the rated voltage selection interface. Voltage gears are 500V, 1kV, 2.5kv, 5kV and 10kV respectively. Select the rated voltage with the “Voltage choose” key.

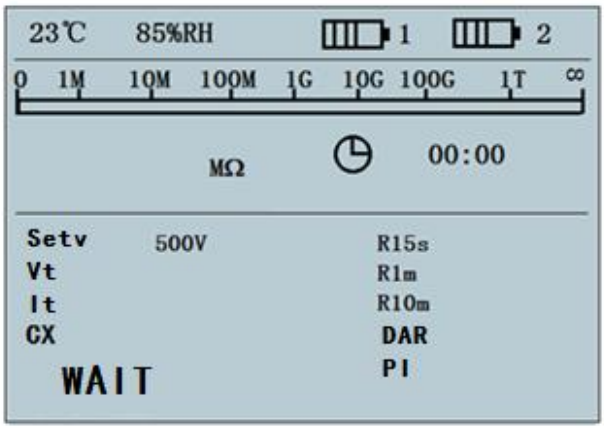


Figure 6.2.1 voltage selection interface

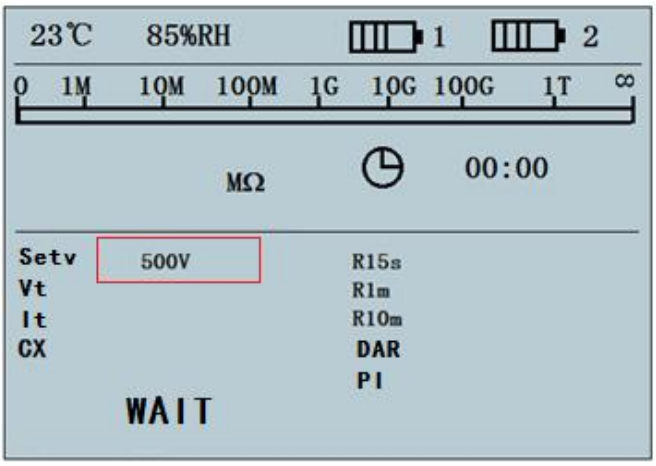


Figure 6.2.2 interface before test

(Figure 6.2.2) For the pre-test interface. Battery status and measurement status "WAIT" are displayed in the system information. In the test main interface, "Voltage choose" represents the voltage selected according to the requirements of the test subject, "Vt" represents the real-time voltage of the port, and "It" represents the real-time leakage current of the test subject. R15s represents the resistance value at 15s, R1m represents the resistance value at 1 minute, and R10m represents the resistance value at 10 minutes. At this time, it is in the state of waiting for measurement, and the appropriate voltage can be selected as required.

6.2.3 Start of test interface

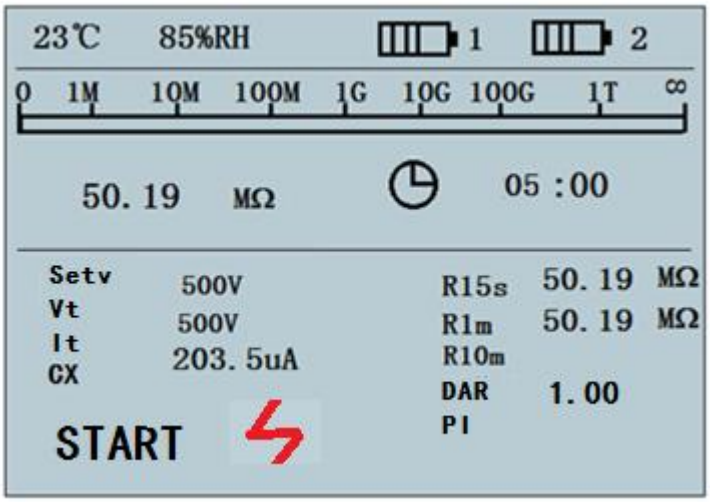


Figure 6.2.3 shows the interface under test.

The system indicates that the high voltage is on, the instrument starts to measure the insulation resistance, and the measurement status shows “START”. Start timing (00 mins: 00 seconds). A timing cycle is 10 minutes 00 seconds. When the cycle meter is full, it will automatically flip and start timing again from 00 minutes, 00 seconds. Testing, insulation resistance, real-time clock, R15s resistance, R1m (1 minute) resistance, and R10m (10 minutes) resistance shown in testing main interface left half, set voltage, port, battery voltage, the measured voltage, temperature and humidity absorption ratio, polarization index, real-time leakage current and the instrument work status display to the testing main interface right half, See figure 6.2.3.。

When the high voltage measurement is started, the buzzer will sound an alarm. The characteristic parameters in the measurement process, such as R15s, R1m, R10m, absorption ratio K (K=R60s/R15s)

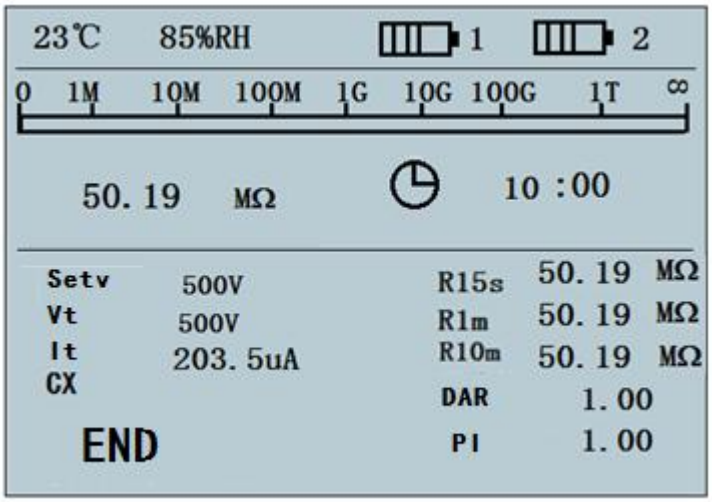
and polarization index PI (PI=R10m/R1m), will be displayed in the main interface of the test in sequence. Press “Start up/stop” to End measurement. (press one time to start high voltage measurement and then press another time to stop measurement in default setting).

6.2.4 Leakage current detection function:

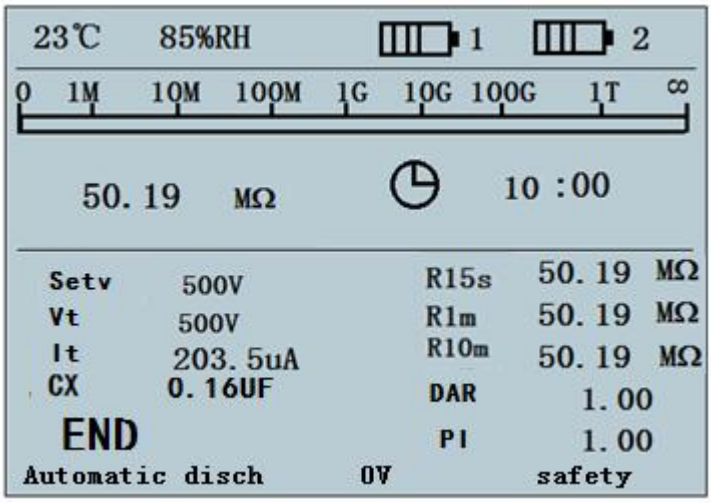
The change of leakage current with load is detected in real time, which directly reflects the insulation condition of the sample. When the voltage rises to the required test voltage, the leakage current remains constant and decreases, then the insulation is qualified, and vice versa.

6.2.5 End of test interface

The real-time data at the End of the measurement and the characteristic parameters in the measurement process will be retained in the main test interface. The system working state is “END” , the sound of the buzzer stops, the measured voltage continues to show the residual voltage of the test port, at this time, the instrument will automatically discharge the tested product.



(Figure 6.2.5End of test interface)



(Figure 6.2.6Automatic discharge interface)

Press the "Start up/stop" button after the measurement, the instrument will automatically discharge to the test subject. After the discharge, the bottom part of the test interface will automatically appear " Automatic disch 0V safety".As shown in figure6.2.6。

Automatic discharge: the advanced high-voltage discharge technology is adopted to rapidly discharge the capacitive sample. When discharging, the discharge voltage is measured in real time (the test voltage of the sample is up to 0v). For the

large-capacitance sample, manual discharge is required to ensure the safety of personnel due to the presence of the charge absorbed by the medium.

7. Charging

7.1 Battery check

●The built-in large-capacity battery is 2.8ah. When the battery is low in power, in order not to affect the work, it can be measured by ac power supply or after it is fully charged.

● After plugging into the ac socket, the instrument will automatically enter the battery management interface, which will not cause undercharge and overcharge. It will take about 8 hours for the battery inside the instrument to be fully charged, and the instrument will show “Battery full” after being fully charged.

● In order to extend the battery life, our company develops intelligent battery management, which displays the battery voltage and peak battery voltage and charging time when the battery is fully charged.

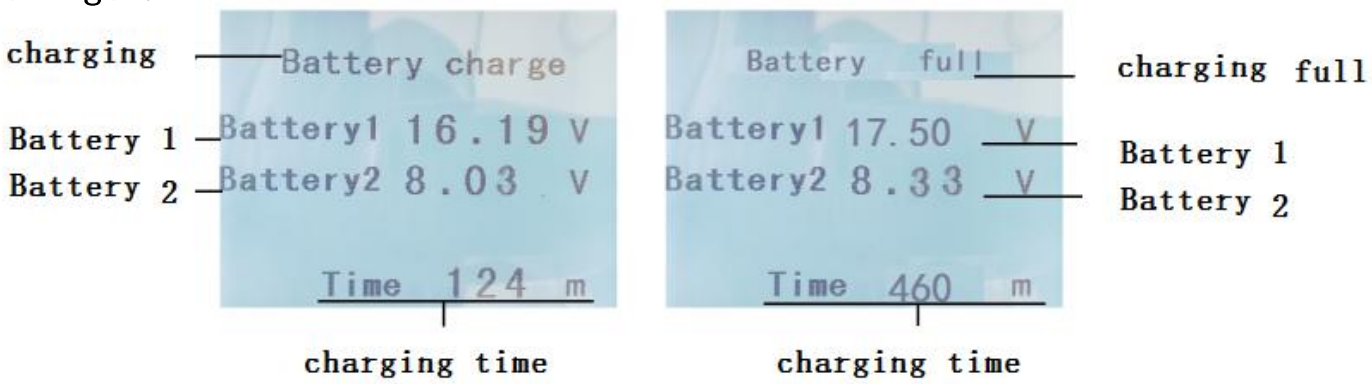


Figure 7 (battery management)

7.2 Note for battery usage:

Do not leave the battery in full discharge. Frequent charging will maximize battery life.

●Charging should be done in a dry environment.

●When charging indoors, keep the environment well ventilated.

●Charging must be under 0 ℃ and 40 ℃ temperature.

●Keeping the battery charged is good for the battery, not bad for it.

●If the instrument is idle for a long time, it should be charged for 8 hours every six months. (if the temperature is more than 40 ℃, should increase the charging frequency)

The meter should be stored in the charging state of about 50% of the battery. If the battery is undercharged, it should be charged in time. Otherwise, it cannot be started up.

In testing and verification, the test line configured with the instrument should be used to ensure the normal operation.

Always keep instrument and test line clean.

Do not be exposed to damp, rain, sun or fall.

After the instrument is used to measure the high-capacity sample, the user must discharge the sample again according to the relevant high-voltage operation rules.

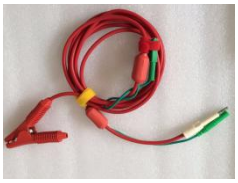
8. Notes for use of the instrument:

In testing and verification, the test line configured with the instrument should be used to ensure the normal operation and verification.

Always keep instrument and test line clean.

Do not be exposed to damp, rain, sun or fall.

9. The attachment

No.	Name	QTY	Picture
1	Power cable	1	
2	Testing cable 1	1	
3	Testing cable 2	1	
4	Fuse 1	4	
5	Fuse 2	8	

10. Common phenomenon and explanation

Common phenomenon	Description and disposal
The LCD screen has no display after starting up.	The battery power is not enough, the LCD display is normal after AC220V is connected, charge with alternating current or measure with alternating current.
The test shows that>10TΩ。	In low voltage rank, insert two test line, respectively, at the end of the instrument of the "E" and "L", the other end of the nipple together, insulation resistance show 0 mΩ, conduction normal out of test line. Otherwise, the test line is open.
	There may be poor contact between the test line and the tested product.
	The insulation resistance of the tested product exceeds the upper limit of the meter range.
The output voltage is not rated.	The resistance of the tested material is too small to pull down the output voltage.
	Calibration voltmeter internal resistance is too low, may be lower than the lower limit of the meter range, at this time should choose high-voltage high-resistance meter.
	If L and E have short circuit, the measured voltage above 5000v is about 4000v during short circuit; Whether G and E are short circuit, this instrument adopts high voltage shielding method, G cannot be grounded in normal use!
Test data is highly unstable or unreliable.	Check whether the tested product is safely grounded and confirm that the test product is not electrified.
	Check whether the G terminal (protection ring) is reliably and effectively connected. Do not use it grounded!
	Test with a standard resistance with a known resistance value and a power no less than (U2/R). If the resistance value deviates too much, inform our company for warranty or repair.

11. The correct use of G(guard ring)

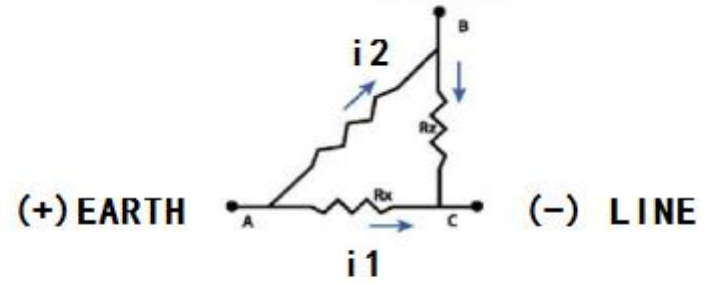


Figure 11-1

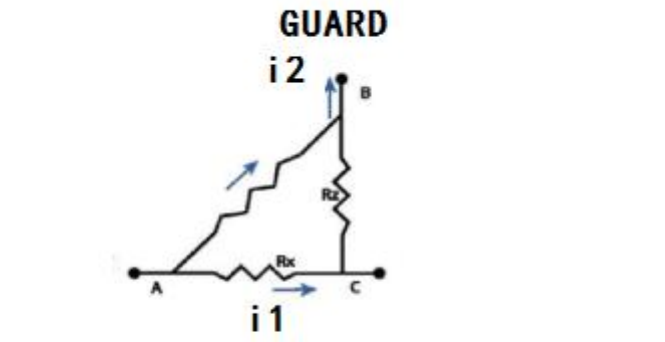
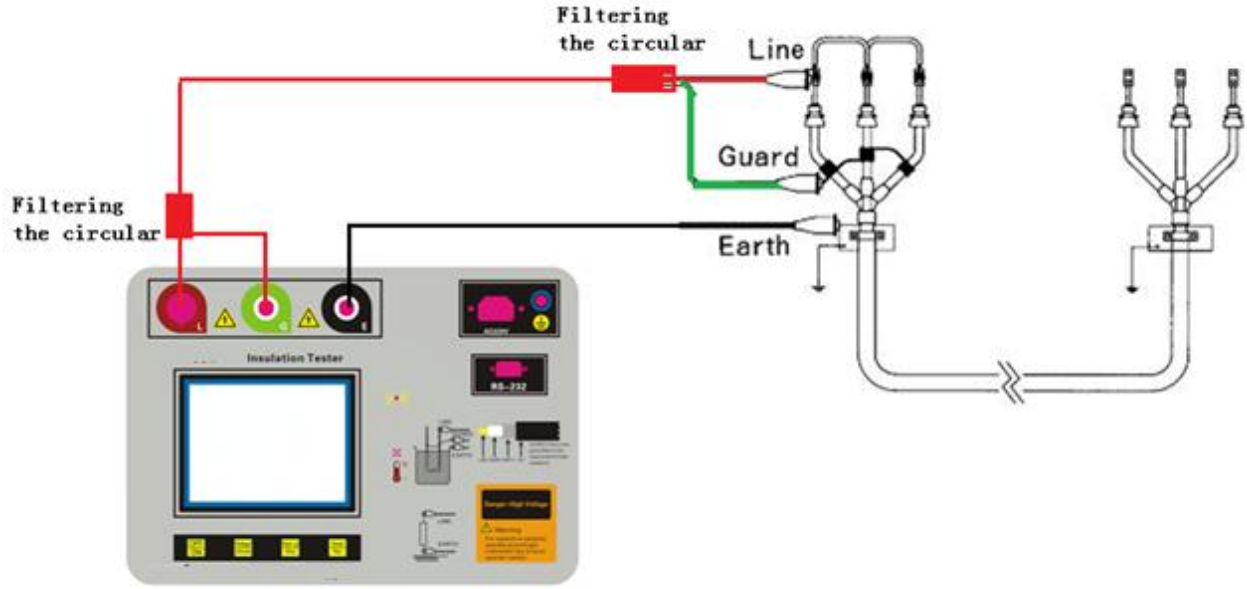


Figure 11-2

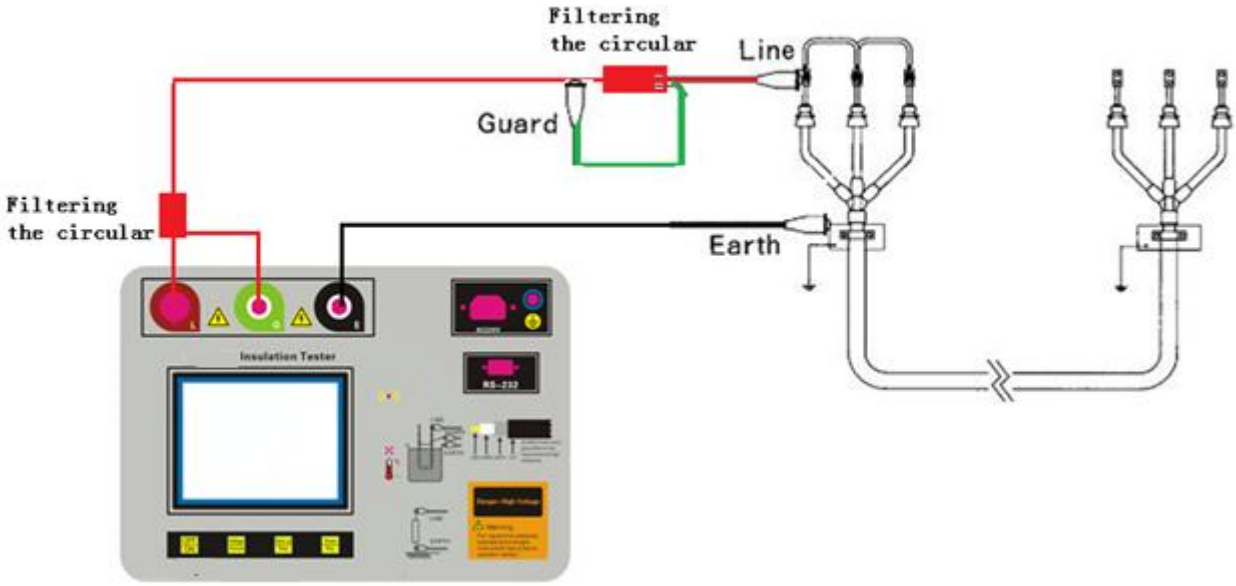
FIG. 11-1 in the test circuit, the shielding terminal G is not connected. At this time, the current flowing back to the receiver L is the leakage current i1 and the leakage current i2 on the surface of the insulator, so the measured insulation resistance is inaccurate.

In the test circuit shown in FIG. 11-2, the shielding terminal guides the surface leakage current causing errors to G, so the current receiver L only measures the leakage current i1, and the measured insulation resistance is correct.

11.3Three line measurement (GUARD):



11.4 Two line measurement:



12. Evaluation of insulation quality

All electrical devices and equipment insulation resistance, especially large capacity insulation resistance test, must meet the requirements of relevant specifications and standards, in order to ensure the safety of field operation. Whether it is electrical cables, segmented protective equipment, or motors, generators, etc., the electrical conductor part must be insulated with a high insulation resistance material to minimize the outflow of current.

The quality of these insulating materials will deteriorate over time due to the environment, working conditions, or other external forces acting on the equipment. It reduces the electrical resistivity of the insulating material, thereby increasing the leakage current, which may eventually lead to serious accidents threatening personal or property safety, and may result in the shutdown of the plant, resulting in economic losses.

For new installation or after rectification equipment, in addition to run before test, routine preventive test (including insulation test), also can avoid the happening of this kind of accident, before accidents, these tests can be effectively to the aging condition of insulation, and early defect detection, in the early stages of the fault development, can be found and processed.

Here, we first need to distinguish between two commonly confused test methods: withstand voltage test (dielectric strength test) and insulation test.

Voltage withstand test: it is called "destructive test", which is to load a high voltage surge on the insulator and detect whether there is a breakdown phenomenon in the insulator. In practice, this surge phenomenon can occur in lightning strikes, or power transmission line failure occurs when the induced voltage. The main purpose of this experiment is to test the insulation of the tested products and their ability to withstand various overvoltages. Normally, the withstand voltage test is carried out using ac voltage, but dc voltage can also be used for the test.

Insulation resistance test: it is a non-destructive test under conventional test conditions. Through the tested equipment load flow voltage (the voltage value of less than "pressure test"), and then calculates the resistance of the test results, the unit to KΩ, MΩ, GΩ or TΩ said that the measured resistance value, which represent the quality of the insulation between the two conductors. Because the insulation resistance test is a "non-destructive test", it is particularly effective in detecting insulation aging of electrical equipment and devices in operation. To carry out this test, insulation resistance tester or high voltage adjustable digital megohm meter shall be used.

Principle of insulation test and factors affecting test:

Insulation resistance tester is based on ohm's law. The insulation resistance value can be calculated by loading a known dc voltage (which is lower than the test voltage of the withstand test) and then measuring the current flowing through the insulating material. In theory, the value of insulation resistance is very big, but it is not the infinite, so by measuring through the insulating material of low current, insulation resistance tester can calculate and show the value of insulation resistance, the resistance value represents the quality of electrical insulation between two conductors, and indicates the risk of leakage current in insulation materials.

When a constant voltage is applied to a measured object, many factors will affect the value of the insulation resistance of the measured object, that is, the current value of the insulation material through which it flows. For example, temperature or humidity may greatly affect the measurement results. First of all, we first analyze the natural characteristics of the current flowing through the measured object (insulating material) in the insulation test, and assume that these factors do not affect the measurement results.

These methods are used to continuously measure the value of insulation resistance within a specified time. The advantage of

this kind of test method is that the environmental temperature does not have a great influence on the experimental results. Therefore, as long as the environmental temperature of the equipment under test does not change dramatically during the test, the measured results need not be revised.

This kind of method is ideal for the preventive test and insulation monitoring of rotary motor.

If the insulation is in good condition, the leakage current will be small, so the total current at the initial stage of the test is mainly capacitor charging current and dielectric absorbing current. As the test voltage continues to load, the measured insulation resistance continues to rise as these interfering currents gradually decrease. In the case of good insulation condition of the subject, the stability time required to measure the insulation resistance depends on the type of insulation material.

If the insulation has deteriorated, the leakage current is very large and constant, usually exceeding the capacitor charging current and the dielectric absorbing current. In this case, when the high voltage is applied, the measured insulation resistance value will soon stabilize.

According to the load time of the test voltage, the variation of insulation resistance of the insulation material is

analyzed, which can be used to evaluate the insulation quality of the tested products.

DAR :defined as the ratio of insulation resistance value in 60s to that in 15s in the same test.

DAR	Insulation condition
＜1.25	Bad
＜1.6	Good
＞1.6	Very Good

PI: In the same test, the ratio of insulation resistance value at 10min to that at 1min.

PI	Insulation condition
＜2	There is a problem
2-4	Good
＞4	Very Good

Noun interpretation:

1.Reset-key: In case of emergency, cut off the high voltage output to ensure the safety of operators. After pressing Reset-key, the on-off button must be pressed again to restart the tester.

2. GUARD is the measuring principle of high voltage shielding method. GUARD should not be used earthwise. Please read the instruction book carefully.