Liquid Platicizer &PVC Sheet Volume Resistivity Tester
BLS-212

Operation Manual

Please read the manual carefully before usage

Contents

Thank you for choosing our BLS-212 Liquid Platicizer Volume resistivity Tester ! It is our great honor to be our customer. We not only provide you with fine quality products, but also provide you with satisfactory services!

The manual mainly introduces the structure, working principles, operation method and safety precautions,etc.

Special note: Sometimes in order to improve the performance of the device, we will make some changes to the software or mechanical part, which may result in inconsistencies in the operating system and the use guide in some details. It is hereby stated that the instructions for the equipment you purchased are subject to the actual equipment of the test equipment. At the time of writing the manual, we will inevitably have errors and omissions.We warmly welcome your comments or suggestions.

I.Overview

The instrument can measure ultra-high resistance and measure very weak current. It adopts large-scale integrated circuits and the latest patented technology, which makes the instrument small, lightweight and accurate. The digital liquid crystal displays the resistance while directly displaying the current flowing through the resistance under test. The resistance range is from $1\times10^{4}\Omega\sim1\times10^{18}\Omega$, and the current measurement range is 2×10^{-4}A $\sim1\times10^{-16}$A. The internal test voltage is DC10V, 50V, 100V, 250V, 500V, 1000V.

The instrument has high precision, quick display, good stability and convenient reading. It is suitable for the inspection of resistance values of anti-static products such as anti-static shoes, anti-static plastic rubber products, computer room anti-static raised floor, and insulation resistance measurement of insulating materials and electronic appliances.In addition to measuring resistance, the instrument can directly measure current such as dark current of electronic devices.

II.Main Features

Resistance measurement range:$1\times10^{4}\Omega\sim1\times10^{18}\Omega$

Current measurement range :2×10^{-4}A $\sim1\times10^{-16}$A

Small size, light weight and high accuracy;

Resistance, current, and resistivity are displayed simultaneously on large color screen;

Stable performance and convenient reading;

Both resistance and current can be measured;

There are six choices of test voltages: DC10V, 50V, 100V, 250V, 500V, 1000V;

Easy to use, directly read and display digital results under any resistance range and test voltage, eliminating the need to multiply a factor, making measuring ultra-high resistance as simple as measuring a common resistance with a multimeter.

III. Main Application Range

1.High-resistance test of materials such as anti-static products (anti-static shoes, anti-static plastic rubber products, computer room anti-static raised floor, etc.) resistance value detection;

2.Material volume resistance (resistivity) and surface resistance (resistivity) measurement;

3.Electrochemistry and materials testing, as well as physical, optical and materials research;

4.Weak current measurement such as photoelectric effect and device dark current measurement.

IV.Technical Indexes

1.Resistance measurement range:$1\times10^{4}\Omega\sim1\times10^{18}\Omega$,Divided into ten ranges.

2.Current measurement range :2×10^{-4}A $\sim1\times10^{-16}$A

3.Digital color screen touch display

4.Accuracy: Accuracy is better than the following table:

Measurement Range	Effective display range	20～30℃ RH<80%

10^4	0.01~19.99	1%
10^5	0.01～19.99	1%
10^6	0.01～19.99	1%
10^7	0.01～19.99	1%
10^8	0.01～19.99	1%
10^9	0.01～19.99	1%
10^{10}	0.01～19.99	5%+2
10^{11}	0.01～19.99	5%+2
10^{12}	0.01～19.99	5%+5
10^{13}	0.01～19.99	10%+5
10^{14}	0.01～19.99	10%+5
10^{14} or above	0.01～19.99	10-15%+5

(Errors may increase beyond the effective display range)The accuracy of test current is the same as resistance

5.Voltage test accuracy is 10%

6.Working environment ： Temperature: -10℃～50℃,Humidity:<90%

7. Test voltage: DC10V,50V,100V,250V,500V,1000V±10%

8.Power supply：AC 220V，50HZ，Power consumption：10W

9.Dimension:300ｍｍ× 280ｍｍ× 150 mm

10.Weight:About 3.0KG

V.Working Principles

According to Ohm's Law, the measured resistance R is equal to the applied voltage V divided by the passing current I. which is

$$R = \frac{V}{I}$$

The working principle of the conventional instrument is that the measurement voltage V is fixed, and the resistance value is read by measuring the current I flowing through the object to be measured with the scale of the calibration resistance. As can be seen from the above equation, since the current I is inversely proportional to the resistance, rather than proportional, the display value of the resistance is non-linear, that is, when the resistance is infinite, the current is zero, that is, the zero position of the meter is ∞, The nearby scale is very dense and the resolution is very low. The entire scale is non-linear. Moreover, since the voltage V is also changed somewhat when measuring different resistances, the accuracy of the ordinary high resistance meter is difficult to improved.

The BLS-212 simultaneously measures the voltage V across the resistor and the current I flowing through the resistor. The calculation of the voltage divided by the current is completed through the inner large-scale integrated circuit, and then the obtained result is digitally displayed after A/D conversion. unlike the conventional high resistance meter, even if the voltage V across the resistor and the current I flowing through the resistor change simultaneously, the resistance value displayed does not change due to the change of the measured voltage V or the change of current I. Therefore, even if the measured voltage, the measured resistance, the power supply voltage, etc. changes, there is no big influence to the test result. The measurement accuracy is very high. In theory, the error can be zero. The actual error can be a few thousandths or a few thousandths.

VI.Connection Instructions for 3 Electrodes

The measuring resistor can be used with two electrodes, one connected to the high voltage electrode and the other connected to the current electrode. The ground wire of the instrument is used for shielding. When measuring high resistance, it should be connected with the ground of the shielding box to prevent interference. When measuring low resistance, it can be not used.

A three-electrode measurement method is recommended in the National Standard GB1410 Test Method for Insulation Volume Resistivity and Surface Resistivity of Solid Insulation Materials:

It consists of three separate electrodes:

1. The center is a cylinder with a diameter of 50mm. There is no specified height in the standard, but it is generally 40mm.
2. The outer cylinder is a ring, the inner diameter of the ring is 60mm, and the outer diameter is 80mm. There is no specified height in the standard, but it is generally 40mm.
3. The bottom is a flat plate with a diameter of 100mm. There is no thickness specified in the standard, but it is generally 5mm.

If use these 3 electrodes to measure the surface resistance or volume resistance of the material, please connect according to the diagram below:

1. Measuring surface resistance: (resistance measured when current flows through the surface of the object being measured)

Connect the high voltage output (red) to the circular disc electrode

Connect the current input terminal (core wire) to the cylindrical electrode

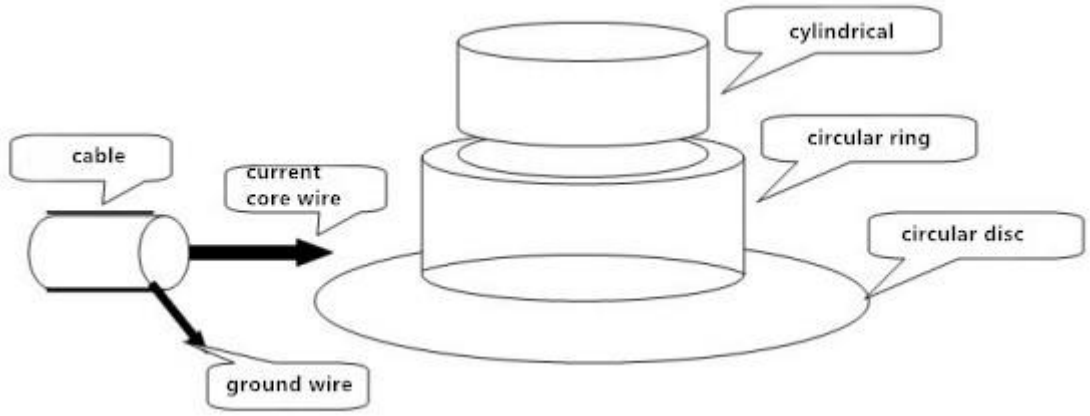
Connect the ground (black, shielded wire) to the circular ring electrode

2. Measuring volume resistance: (resistance measured when current flows through the inner of the object being measured)

Connect the high voltage output (red) to the circular disc electrode

Connect the current input terminal (core wire) to the cylindrical electrode

Connect the ground (black, shielded wire) to the circular ring electrode



Place the material to be measured on the circular disc electrode, and place the cylindrical electrode in the middle of the circular ring electrode. First turn the switch on the shielding cabinet to the 0 position in the middle. At this time there is no high voltage output. Cover the shielding cabinet and then connect the wires of the instrument.

If the switch is at the Rv position on the left, the volume resistance Rv is measured, at which time the voltage is applied to the underlying circular disc electrode, and current flows from the circular disc electrode through the body of the material to be measured to the cylindrical electrode

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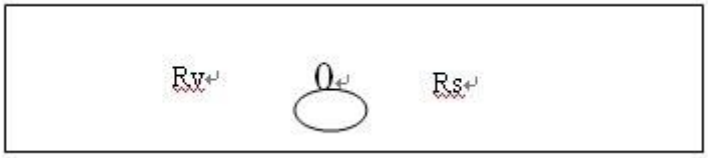
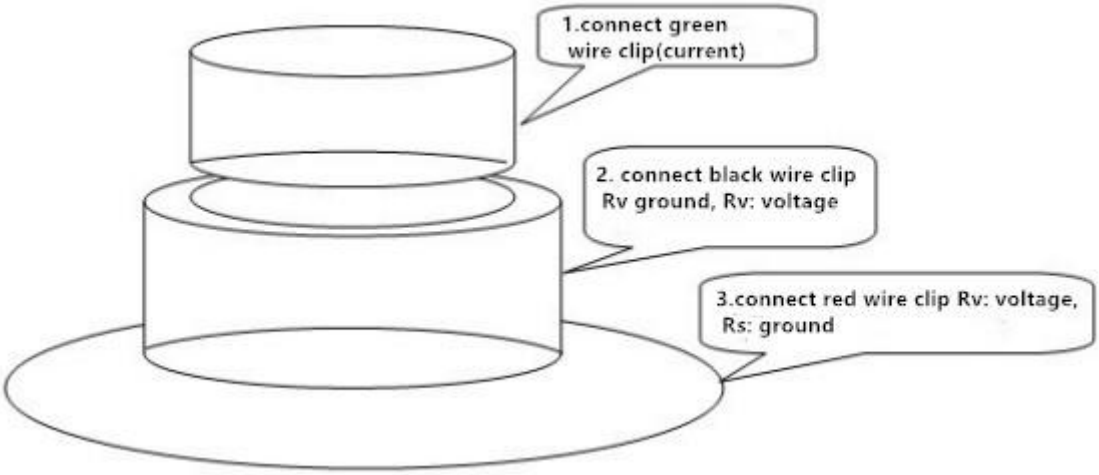


If the switch is at the Rs position on the right, the surface resistance Rs is measured, at which point the circular ring electrode is changed to voltage,and the circular disc electrode is wiring, and current flows from the circular ring electrode through the material surface to the cylindrical electrode.



1. Change the green clip to the red clip
2. unchanged
3. No user wiring

VII.Operation Steps

1. Connect the power cord

Make sure the power supply is 220VAC/50Hz

2. Connect the Power

Set the current resistance range to 10^4, the voltage range to 10V, and turn the power on.

3. Zero setting

The system automatically zeros.

4.Connect the line

Connect the test line and connect the host to the shield box with the test line. When measuring the volume resistance, the test button is set to the Rv side. When the surface resistance is measured, the test button is set to the Rs side. Then start the instrument.

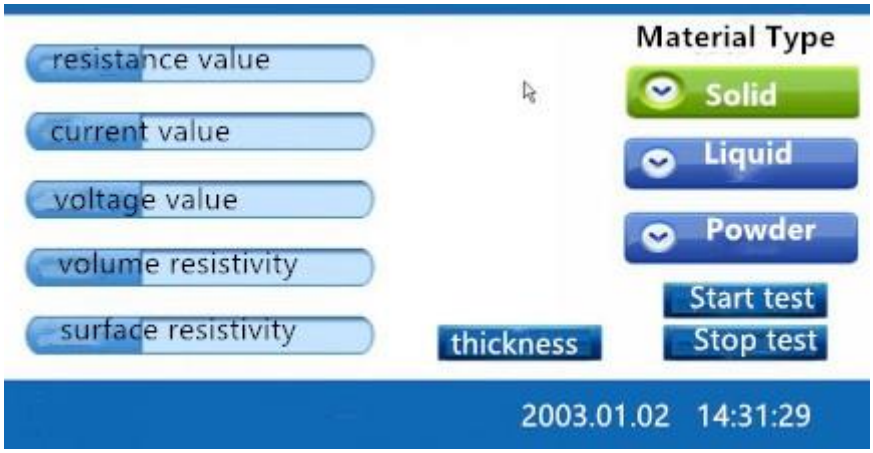
5.Select the appropriate test voltage

The voltage selection switch is on the rear panel. Note: the measurement voltage should not be arbitrarily changed during the test. The test device or test instrument may be damaged due to excessive voltage or excessive current.

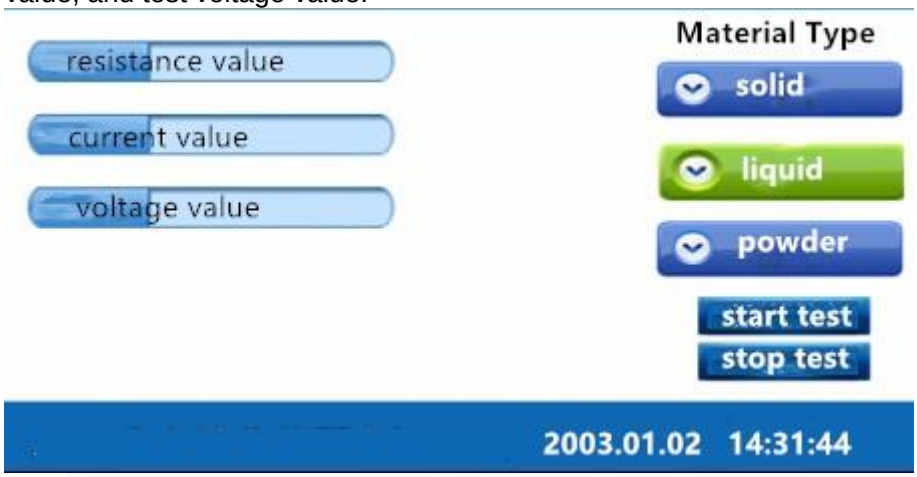
6.Test

6.1The host display interface is as shown in the figure. Select the type of test material.

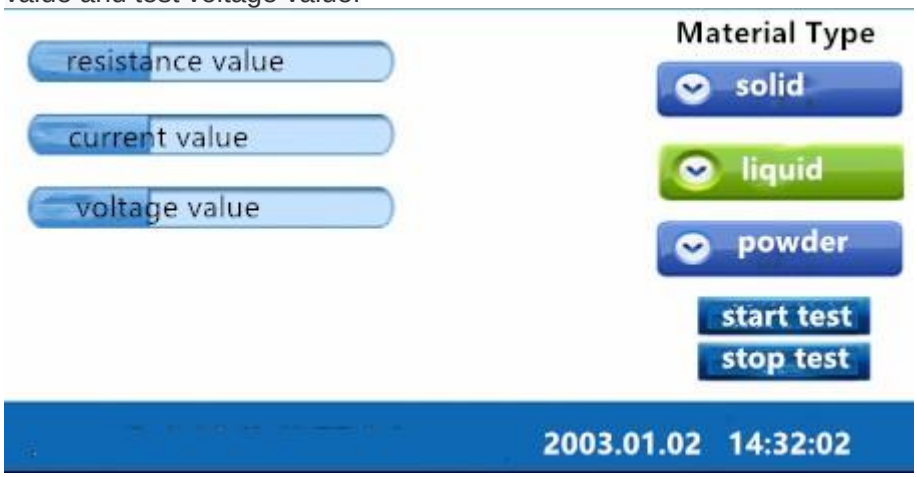
6.1.1When test solid, click the thickness to enter the sample thickness, click “start test” and the instrument will display the resistance value, current value, test voltage value, and automatically calculate the resistivity.



6.1.2 When test liquid , click “Start Test” and the instrument will display the resistance value, current value, and test voltage value.



6.1.3When test powder, click to “start test”. The instrument will display the resistance value, current value and test voltage value.



6.2 When measuring, gradually set from low gear to high grade, and pause for 1~2 seconds for each display to observe the displayed number. When the measured resistance is greater than the measuring range of the instrument, the resistance meter displays “1”. At this time, the instrument should continue to be dialed to he position with higher range. It should stop when the measuring instrument has displayed value. The current number multiplied by the grade is the measured resistance value. When there is displayed number, do not dial to a higher level, or the instrument will over-range, the internal protection circuit will start working and the measurement accuracy of the instrument will decrease.

7.After the test is completed, pull the resistance current range to “10^4”, turn off the power after the voltage range is adjusted to 10V.

The range switch shall be set back to the range position of 10^4 ("zero setting") for each measurement to avoid damage to the instrument when starting up or short-circuit of the measuring end.

8.The current and $10^{15}\Omega$ or above ultra high resistance measurements should test the current first, and then calculate the resistance through Ohm's Law that voltage divided by the current is resistance,

9. The volume resistance and surface resistance conversion

During the test, when using the shielding box to perform volume resistance and surface resistance conversion, the power must be turned off before the gear position conversion, otherwise the voltage will be shocked to the host and cannot display or be damaged.

VIII.Calculation of Volume Resistivity and Surface Resistivity

1. Volume resistance and surface resistance readings

Volume resistance:

According to the provisions of the national standard GB1410 standard 11.1: start the timing after adding the specified DC voltage to the surface of the sample, and make a measurement for each of the following electrification times: 1 min, 2 min, 5 min, 10 min, 50 min , 100 min. If two consecutive measurements yield the same result, the test can be ended and the current value used to calculate the volume resistance. As an acceptance test, the volume resistivity is calculated using a fixed aging time, such as the current value after 1 MIN, in accordance with the relevant specifications.

Surface resistance:

According to the provisions of GB1410 standard 11.2: the resistance should be measured after the electrification time of 1MIN, even if the current has not reached a stable state during this time.

2. Volume resistivity calculation：

The volume resistivity is calculated as follows：

$$P_v = R_x \frac{A}{h}$$

In the formula：**P_V** stands for volume resistivity, and the unit is（Ω.cm）；

R_X standds for test resistance and the unit is"Ω"；

A stands for the effective area of the protected electrode, and the unit is "m^2 or cm^2"

h stands for the average thickness of the sample, and the unit is "m" or "cm".

Remarks：A=19.635（cm^2）

3. Calculation of surface resistivity:

The surface resistivity is calculated as follows:

$$P_s = R_x \frac{P}{g}$$

In the formula：

Where: Ps - volume resistivity, in ohm meters (Ω.cm);

RX——measured surface resistance in ohms (Ω);

P - the effective perimeter of the protected electrode in meters (m) or (cm (cm))

G——distance between two electrodes in meters (m) or centimeters (cm)

Remarks: P = 15.708 (cm) g = 0.2 (cm)

IX.Note

(Please read the following carefully, it may cause damage or electric shock to the instrument)

1.Check whether the voltage range of the rear panel is 10V and whether the current and resistance range is set at 10^4.

2. Turn on the power supply and make zero setting, (pay attention that the host must not be connected to the shielded box line at this time). When the "Rx" is open circuit at both ends, zeroing makes the current meter display 0000. Then power off.

3. Flatten the sample to be tested in the center of the unprotected electrode, then press the sample with the protective electrode, and then insert the protected electrode (the unprotective electrode, the protective electrode, the electrode that is protected should be coaxial and make sure that there is no short circuit between the electrodes).

4.When the volume resistance is measured, the test button needs to be dialed to the Rv side, and when the surface resistance is measured, the test button needs to be dialed to the Rs side.

5.Connect the test line to connect the host and the shielded box. Set the range to 10^4, and turn on the power switch button on the rear panel of the host. Adjust the voltage button from the rear panel of the instrument to the required measurement voltage. (Example: according to GBT 1692-2008 Vulcanized rubber Insulation resistivity measurement, the standard states that the voltage is required to be measured at 500V, then the voltage should rise to 500V)

6.The current resistance range button is gradually increased from the low value position. Each time pause 1-2 seconds to observe the displayed number. When the measured resistance is greater than the instrument measurement range, and the resistance meter displays “1”. At this time, the instrument should continue to dial to higher range position. When the instrument has displayed value, it should stop. After one minute of electrification,measure the resistance. The current number multiplied by the grade is the measured resistance.

7.When the test is completed, first turn the range to (10^4), then dial the measurement voltage to 10V. Finally, turn the test button to the center position and turn off the power. Then proceed to the next test.

8. It should be zeroed when the two ends of the “Rx” are circuit open. Generally, once zero set, there is no need to zero set again during the test.

9.Do not short-circuit at both ends of “RX” to avoid the micro current amplifier being affected by large current.

10.Do not arbitrarily change the measurement voltage during the test.

11.When measuring, gradually shift from the lower level to higher level.

12.After power on, the finger should not touch the metal part of the high voltage line

13.Do not touch the test end of the micro current during the test.

14.When measuring high resistance, the object being tested should be shielded by shielded box.

15.It is strictly forbidden to change the voltage range at will during the test or open the host when there is power on.

16.It is strictly forbidden to replace the test sample if the resistance range is not at 104 or the voltage is not at 10V.

X.Incorrect Operation and Consequences

The BLS-212 Liquid Platicizer & PVC Sheet Volume resistivity Tester is precision instrument capable of measuring extremely high resistance and very low current because the machine has an ultra-high performance electrometer amplifier. Although the instrument has various protection measures, this ultra-high performance of the electrostatic amplifier may cause permanent damage or excessive measurement accuracy and performance due to excessive current surge, overvoltage or discharge in the following improper operation.

Testing process	**Incorrect operation**	**Consequences**
Before starting	Not put the voltage to 10V,or not put the the resistance current range to 10^4	Overcurrent surge causes damage to the instrument amplifier

Testing process	Adjust the rear panel voltage range arbitrarily to change the test voltage	Overcurrent or reverse discharge shock causes damage to the instrument due to overcurrent
Testing process	Change the body resistance on the shielding box, surface electrical test switch	Overcurrent or reverse discharge shock causes damage to the instrument due to overcurrent
Testing process	Test voltage is too high, resulting in breakdown of test material	Overcurrent or reverse discharge shock causes instrument overcurrent damage or measurement performance degradation
Testing process	Short circuit of micro current measuring line and high voltage line	Overcurrent or reverse discharge shock causes instrument overcurrent damage or measurement performance degradation
Test complete	The voltage range is not set to 10V, and the resistance current range is set to 10^4 when shutdown.	Overcurrent or reverse discharge shock causes the instrument due to overcurrent and damage or decrease the measurement performance

XI.Common Measurement Problems

1.Why there are different readings when measure the same object with different resistance ranges?

This is to prevent the over-voltage from damaging the instrument when measure the resistance. When there over-range occurs, the protection circuit in the instrument starts to work, and lower the test voltage to protect the amplifier. There are different results to measure the same object under different voltages. Besides, if the reading is lower than 199 when measure the resistance, that is to say, there are only digits and the first digit is “1”, the accuracy will be lowered. Therefore, when measuring the resistance, when the first reading changes from 1 to a certain reading, the switch should not be turned to a higher range to prevent excessive current surge to the instrument. In actual application, the readings with more digits is more accurate than the one with less digit.

2.Why big differences may occur when measure the current of some objects with different ranges?

This is because the current output from a general object is not constant current, and the instrument has a certain internal resistance. If the internal resistance of the selected range on the instrument is too large so that the voltage will affect the output current of the object to be measured and it may cause error. Generally, the lower the current, the higher the internal resistance of the range, so the larger current range should be selected when measuring the current. In actual application, as long as the ammeter has reading, the smaller the reading is, the more accurate it is.

3. Why the reading is always unstable when measuring?

The conductivity of ordinary material does not have stable current just like the standard resistance. Many material, especially antistatic materials, whose electrical conductivity does not conform to Ohm's Law, so the reading is unstable when measured.

This is not the problem of the instrument, but rather the performance of the object being measured. Some standards stipulate to measure 1 minute. Usually, when measuring high resistance or micro current, the measurement accuracy is not good, and only 2 or 3 digits are required for the measurement reading. In addition, if the shielding is not good when measuring large resistance, the reading of the instrument will result in unstable reading due to the external electromagnetic signal.

4. Before turning off the power,why is it necessary to turn the range switch to 10^4 after the measurement is completed?

This is because there is certain capacitance of the measured object and the input end of the instrument. The capacitor is charged to the voltage when measuring the resistance. If the instrument does not dial to 10^4 before the power is turned off, this charged capacitor will discharge to the amplifier inside the instrument and damage the instrument. When higher capacitance the measured object has , and the higher the measured voltage is, the higher the electric energy the capacitance will store, and the easier the instrument get damaged. Especially when the resistance is high range or low current range, the instrument is very sensitive and the instrument is more likely to be overloaded and damaged. Therefore, it is a must to turn the range switch to 10^4 before turn off the power.

5. Why do not change the test voltage of the measured object during the resistance measurement?

If the test voltage of the measured object is changed during the measurement of the resistance, and no matter the voltage becomes higher or lower, it will generate large pulse current which is very likely to cause the instrument over-range or damaged. On the other hand, if the voltage suddenly changes, the instrument will be damaged by the (distribution) capacitance discharge or reverse discharge of the measured object. Some objects have low withstand voltage, so when the measurement voltage is changed, it may cause large current to damage the instrument. If measurement voltage needs to be changed, please make sure the object to be measured does not break down due to excessive voltage, and first turn the range switch to 10^4, and then turn off the power, and then adjust the required voltage from the rear panel of the instrument. Some materials are non-linear, that is, the voltage and current are not in accordance with Ohm's Law. When the voltage is changed, the measured resistance will also change because the current does not change linearly.

6.Before turn off the power, why is it necessary to turn the voltage range switch to 10V when the measurement is completed?

This is because the capacitor in the instrument has very high voltage(as high as above 1200V). The electric energy of these capacitors can keep for a long time. If not turn the voltage range switch to 10V before turn off the power, the high voltage capacitance will discharge quickly and will cause danger and electric shock. If only dial the power cord, but not also turn the voltage range to 10V, the capacitors can also have high voltage after a long time and will have danger to the personnel or cause electric shock to other objects. When the instrument has problems, please do not open the instrument cabinet at randomly because there may have high voltage electric shock. Instead, the instrument can be sent back to the factory to repair, or ask the professionals for help.