KUSAM-MECO®

High Voltage Insulation Resistance Tester

KM5305
KM5310



MANUAL

KUSAM ELECTRICAL INSTRUMENTS LLP.

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Precaution for Use

Thanks you for purchasing our product **High performance High Voltage Insulation Resistance Tester**. Before you use this tester for the first time, to avoid the possible electric shock or personal injury, please be certain: **Read carefully and strictly follow the safety rules and precautions listed in this manual. In any case, should pay special attention to safety for using this instrument:**

- Before the test, please make sure that the tested object is in turned off state or the power has been disconnected. This instrument cannot be used for testing live equipment and devices.
- Before the test, please make sure that the instrument and accessories are in good condition, the instrument shell and the insulation layer of the test wire are not damaged, exposed or broken.
- After the test, the test connection wire should not be disconnected before the terminal voltage return to zero to ensure complete discharge of equipment and devices.
- The instrument output high voltage, please be sure to connect the test line first and test line connection plug has been tightly inserted into the instrument interface. Press the test button to testing after the hand is away the test line, otherwise there is danger of electric shock.
- During the measurement, prohibit to touch the bare conductor or the measuring circuit.
- During usage, please stop to using when exposed metal is caused by outside shell or test wires broken.
- Do not use the instrument when the hands and the instrument surface are wet.
- It is strictly forbidden to use the tester in the environment of explosive gas, steam or dust.
- Do not place and store the tester for a long time under high-temperature and humidity, condensation and direct sunlight.
- Use, disassembly, calibration, and repair of this tester must be performed by authorized personnel.
- Due to the reason of this instrument, if it is dangerous to continue to using, should be stopped and sealed immediately, and handled by an authorized institution.
- The safety warning sign "⚠" in the manual must be safely operated by the user in strict accordance with these manual contents.

1. Introduction

KM5310 High Performance High Voltage Insulation Resistance Tester is a high performance high voltage insulation resistance tester of well research and development by our company. The instrument has perfect testing function of various insulation resistance parameters and excellent anti-interference ability, which **can be used to test the insulation resistance of large capacity high voltage electrical equipment and transmission lines in substation with strong induction electric environment**. The instrument adopts true color touch screen, and all the test data and battery power are displayed on the same screen for viewing clear and obvious. The combination of knob switch and button makes the operation very simple. The user does not need to memorize the operation method, but just click "**HELP**" on the screen to pop up the operation method, effectively guiding the user to operate the instrument. The instrument has the function of rapid discharge, the charge of the tested object is released automatically after the test. The voltage monitor of the instrument automatically monitoring the live voltage of the measured object, when the voltage exceeding 36V will automatically prohibits testing and effectively protects the instrument and operator.

The instrument adopts large capacity rechargeable lithium battery pack. The test timer of the instrument automatically records the test time and stores the test results with date and time. The touch screen can easily check the historical data recorded. The fully isolated USB interface can upload the test data to the PC safely. The instrument is equipped with the test line with double insulation and shielding layer, and the high voltage rod is equipped with replaceable crocodile clip and hook, which can adapt to various test places. The instrument adopts a strong double-shell structure, and the outer case of the instrument has a protection rating of IP65, which can prevent the intrusion of moisture and dust as well as prevent to impact in the transportation and storage process, effectively protect the instrument.

KM5310 High Performance High Voltage Insulation Resistance Tester with a wide measurement range, high resolution, convenient operation, strong and durable, accurate and reliable, stable performance and strong anti-interference ability. The instrument with insulation resistance test (IR), polarization index test（PI), dielectric absorption ratio test (DAR), ramp test mode (RAMP), filtered resistance test mode (FR 10S、20S、30S、40S four selections), voltage test (V), capacity measurement (uF), current measurement (nA) and others function. The instrument is suitable for testing the insulation resistance of large equipment such as electric equipment which with large capacity, high voltage and in strong induction electric environment, and transmission line, which is the power, telecommunications, meteorology, computer rooms, oil fields, mechanical and electrical installation and maintenance and power supply departments of industrial and mining enterprises commonly used but essential instruments.

KM5310 high performance high voltage insulation resistance tester product feature:

1.1. Insulation resistance range up to 30TΩ（15KV），20TΩ（10KV），10TΩ（5KV）.
1.2. Output rated voltage max reach 7 gears (250V，500V，1KV，2.5KV，5KV，10KV，15KV).
1.3. Max short circuit current 7mA
1.4. Insulation resistance test (IR), polarization index test（PI), dielectric absorption ratio test (DAR).
1.5. Ramp test mode (RAMP), filtered resistance test mode (FR).
1.6. Voltage monitor function, automatically monitoring the live voltage of the measured object
1.7. Test timer function, automatically record the test time.
1.8. Automatic discharge function, the charge of the tested object is released automatically after the test.
1.9. Automatic shutdown function.
1.10. Large size touch colorful screen.
1.11. Double-shell structure, sturdy and durable, protection rating of IP65
1.12. Large capacity rechargeable lithium battery pack.
1.13. Storage function, can automatically store 1000 groups of real-time test data with test date, time and timing.
1.14. Upload function, equipped with USB interface, the recorded data can be uploaded to the computer via USB communication cable for data statistical analysis.

2. Model Category

Product Model	Rated Voltage	Insulation Resistance Range	Short Circuit Current
KM5305	250V，500V，1KV，2.5KV，5KV	0.50MΩ~10.0TΩ	>7mA
KM5310	250V，500V，1KV，2.5KV，5KV，10KV	0.50MΩ~20.0TΩ	>7mA
KM5315	250V，500V，1KV，2.5KV，5KV，10KV，15KV	0.50MΩ~30.0TΩ	>7mA

3. Insulation Resistance Range and Accuracy

Rated Voltage	Insulation Resistance Rage	Accuracy	Remark
250V	0.50MΩ ~ 50.0GΩ	±5%rdg±3dgt	
	50.0GΩ ~ 500GΩ	±20%rdg±3dgt	
500V	1.00MΩ ~ 100GΩ	±5%rdg±3dgt	

	100GΩ ~ 1.00TΩ	±20%rdg±3dgt	
1000V	1.00MΩ ~ 200GΩ	±5%rdg±3dgt	
	200GΩ ~ 2.00TΩ	±20%rdg±3dgt	
2500V	1.00MΩ ~ 500GΩ	±5%rdg±3dgt	
	500GΩ ~ 3.00TΩ	±20%rdg±3dgt	
5000V	1.00MΩ ~ 1.00TΩ	±5%rdg±3dgt	
	1.00TΩ ~ 10.0TΩ	±20%rdg±3dgt	
10KV	1.00MΩ ~ 2.00TΩ	±5%rdg±3dgt	
	2.00TΩ ~ 20.0TΩ	±20%rdg±3dgt	
15KV	1.00MΩ ~ 3.00TΩ	±5%rdg±3dgt	
	3.00TΩ ~ 30.0TΩ	±20%rdg±3dgt	

1 TΩ（Tera ohm）=1000GΩ=10^{12}Ω

1 GΩ（Giga ohm）=1000MΩ=10^{9}Ω

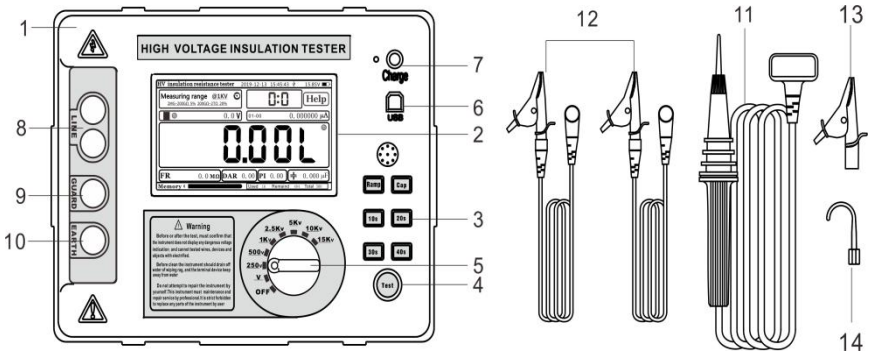
1 MΩ（Mega ohm）=1000KΩ=10^{6}Ω

4. Technical Specification

Function	Insulation resistance measurement (IR); polarization index measurement (PI); absorption ratio (DAR); filtered resistance test (four time selection 10S,20S,30S,40S); Voltage measurement(V); capacity measurement（uF）; current measurement（nA）
Power Supply	Rechargeable lithium battery 6.2Ah
Rated Voltage	KM5305：250V，500V，1KV，2.5KV，5KV KM5310：250V，500V，1KV，2.5KV，5KV，10KV KM5315：250V，500V，1KV，2.5KV，5KV，10KV，15KV
Output Voltage Accuracy	（5%～10%）±10V
Insulation Resistance Test Range	KM5305：0.50MΩ～10.0TΩ KM5310：0.50MΩ～20.0TΩ KM5315：0.50MΩ～30.0TΩ
Output Short Circuit Current	≥7mA
Polarization Index Test	YES
Dielectric Absorption Ratio	YES

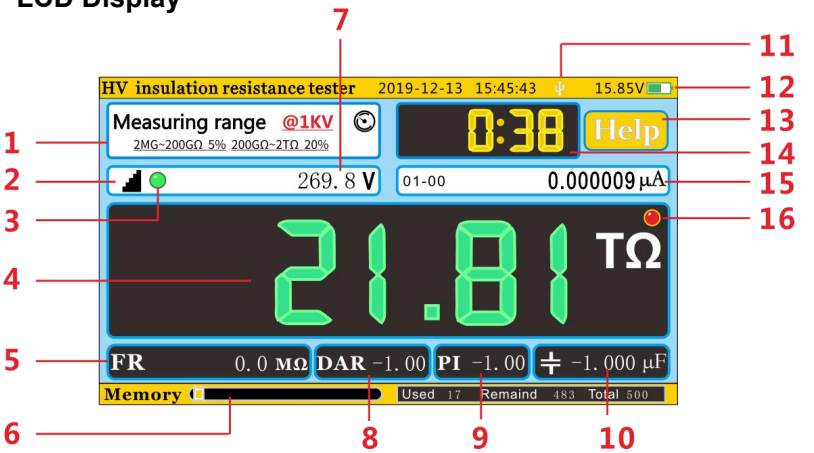
Test	
Ramp Test Mode	Step up to the preset voltage by testing with 10% stepped size of the preset voltage.
Filtered Resistance Test Mode	10S、20S、30S、40S four selections
Voltage Test	Range：AC/DC:0V～1000V；Accuracy: ±5%rdg±3V
Capacitance Test	Range：10nF～50uF；Accuracy: ±10%rdg±10nF
Current Test	Range：0.01nA～9mA；Accuracy: ±5%rdg±0.5nA
Voltage Monitor	Monitor the voltage of the measured object, and monitor discharge status after test, forbidden to test when voltage exceed 36V, protect instrument and operator.
Test Timer	Automatic record test time, time range: 0s~9999s
Storage Function	Automatically store the test data with test date and time, total of 1000 groups
Upload Function	Upload the stored data to computer via USB communication cable.
Battery Power Display	With battery power display, when battery voltage low will remind to replace the battery
Automatic Shutdown	After 15 minutes start up will shut down automatically without any operation
Meter Dimension	280mm×260mm×160mm
Meter Weight	4900g (include the battery)
Test Wires	Red color high voltage test wire 1 pcs (with alligator clip 1PCS and hook 1PCS), green color test wire 1PCS, black color test wire 1PCS
Protection Level	Close the case IP65, open the case IP40
Working Environment	-20℃～50℃；80%rh
Store Environment	-25℃～65℃；80%rh
Insulation Resistance	50MΩ（1000v）（between the test circuit and shell）
Withstand Voltage	AC 3Kv 50Hz 1min（between the test circuit and shell）
Suitable Safety Standard	IEC61010-1，IEC61326-1

5. Tester Structure



1	Outside case
2	Touch colorful screen
3	Function selection button
4	Test button
5	Measurement range selection switch
6	USB interface
7	Charge interface
8	LINE high voltage terminal（Red）
9	GUARD protection terminal（Green）
10	EARTH grounding terminal（Black）
11	High voltage test rod（Red）
12	Alligator clip test line（each 1pcs of green and black）
13	High voltage rod replace clip
14	High voltage rod replace hook

6. LCD Display



1	Description of knob switch gears
2	Display mode
3	The tested device terminal voltage indication
4	Insulation resistance
5	Insulation resistance filter value
6	Memory space occupancy
7	Output voltage
8	Dielectric absorption ratio(DAR)
9	Polarization index
10	Capacitance
11	USB connection indication
12	Battery power indication
13	HELP button
14	Test time
15	Output Current
16	High voltage output indication

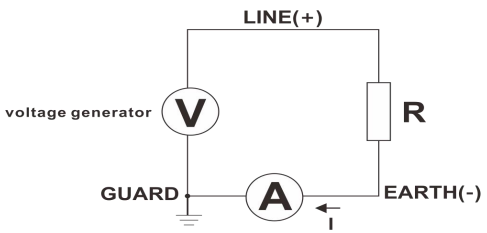
7. Measurement Method

7.1. Measurement Procedure

The testing process as following steps: instrument inspection; Inspection of the tested equipment ;Determine the measurement voltage; Set the measurement mode; Connect the instrument to the tested device; Measurement and recording the measurement results; Instrument storage after measurement.

7.2. Insulation Resistance Test

The principle of insulation resistance measurement is that a voltage V is generated by the high voltage generator and applied to both ends of the tested resistance. By measuring the current I flowing through the resistance, the resistance value R is calculated according to ohm's law.

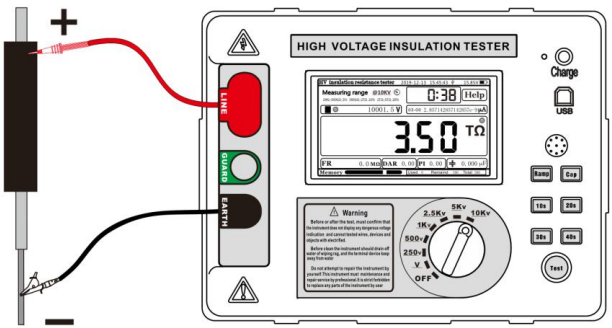


$$R = V / I$$

	Please confirm cutting off breaker of the circuit loop before the test. The insulation resistance test can only be conducted on the uncharged object.
	Before the test, please check whether the test line of the instrument is complete or not. If there is any damage, please replace it before the test.
	During the test, can't change the gear with live electricity. If need to change the gear, it must be stopped the output. Only can change the gear when the voltage drops below the safety voltage.
	Must wear the high voltage insulation gloves to operate.
	After pressing the test button when measuring the insulation resistance, the test line and the tested circuit will produce high voltage. Please pay attention to avoid touching, which may lead to electric shock accident.
	Do not touch the tested circuit immediately after the test. The stored charge may lead to electric shock accident.
	After the test, do not take off the test line immediately, and do not touch the tested circuit until the discharge is completed.

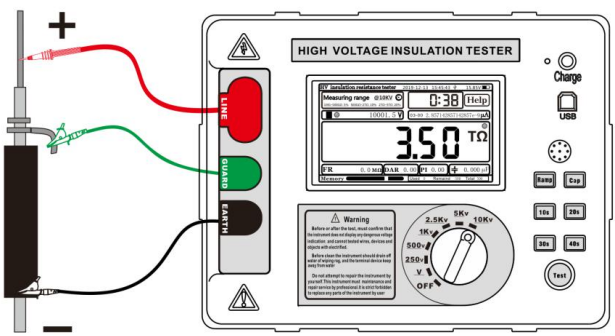
7.3. The Test Line Connection

In normal testing, only use two test lines. The red high voltage test line connect to the LIEN port and the black grounding line connect to the EARTH port. As shown in the figure below.



In the measurement of the high resistance value, In order to achieve the best test accuracy can use three test lines to measurement. The red high voltage test line connect to the **LIEN** port, the black grounding line connect to the **EARTH** port, and the shield line connect to the **GUARD** port.

GUARD shield ports are used to prevent surface leakage current or other external leakage current from reducing measurement accuracy. As shown in the figure below.

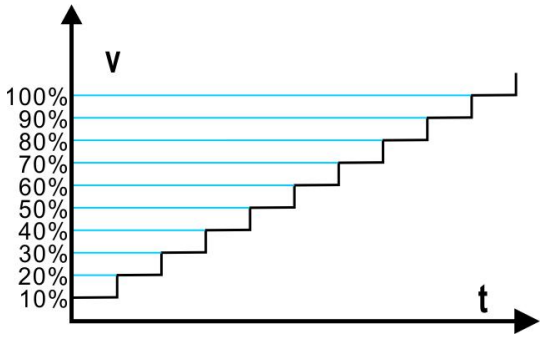


7.4. Normal Test Mode & Ramp Test Mode Selection

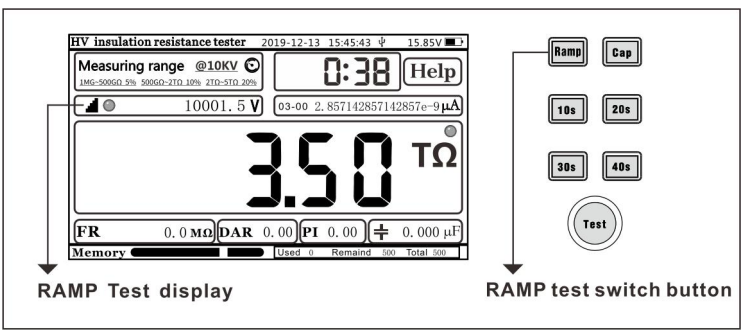
In general case, a fixed voltage is used to measure the insulation resistance of the tested circuit loop. This is called a normal test mode.

The ramp test mode is an automatic test mode which use to check for insulation breakdown. During the ramp test period, the output voltage will start at 10% of the preset voltage and increase in steps of 10% until reach the preset voltage or until a sudden drop in

the measured resistance is detected. Then the ramp test stopped. If not reach the selected preset voltage, will only the completed test point data will be recorded, and all other test results will be invalid.



In the key group of the instrument, the **Ramp** button is the switch button of Ramp test mode, the indicator light is on to indicate that enter into ramp test mode, and the indicator light is not on to indicate that is the normal test mode. Press the **Ramp** button to switch between the two modes. See below figure.



7.5. Dielectric Absorption Ratio (DAR) & Polarization Index (PI)

Since the time length of applying DC voltage to the equipment is different, the influence on the humidity of the insulator is different. Therefore, by comparing the ratio of the two parameters, it can be determined whether the insulation resistance is affected by the humidity of the insulator. Absorption ratio and polarization index are independent of the shape and size of the insulator and vary with the humidity of the insulator. Therefore, the detection of absorption ratio and polarization index is very important in the cable insulation diagnosis.

Dielectric Absorption Ratio refers to the ratio of insulation resistance between 1 minute and 15 seconds. Dielectric absorption ratio need to complete within 1 minute. Therefore, for

all insulation tests less than 1 minute, the measurement data will be stored as invalid data. When the insulation test time is 1 minute or longer, the absorption ratio measurement is included in the results.

Dielectric Absorption Ratio （DAR）	＞1.4	1.25～1.0	＜1.0
Insulation State	Very Good	Good	Bad

Polarization Index (PI) refers to the ratio of insulation resistance between 10 minutes and 1 minute. The polarization index test took 10 minutes to complete. The polarization test will be completed and saved when the insulation test is 10 minutes or longer.

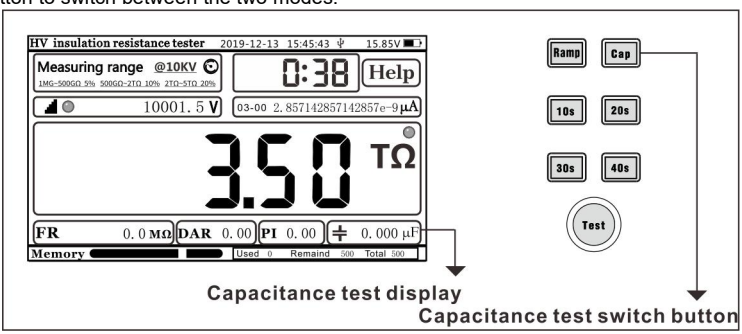
$$PI = \frac{R_{10min}}{R_{1min}}$$

Polarization Index（PI）	＞4	4～2	2.0～1.0	＜1.0
Insulation State	Very Good	Good	Problems	Bad

7.6. Capacitance Test

As part of the insulation test, the instrument has the function of measure and store the capacitance of the tested circuit loop. Select whether to measure capacitance or not in this measurement by pressing the button. When select to measure the capacitance, the instrument calculate the capacitance value by measuring the discharge time. At this time, the rapid discharge function is turned off. Press the test button to waiting for the measurement result. The discharge time is longer than that when capacitance measurement is not selected.

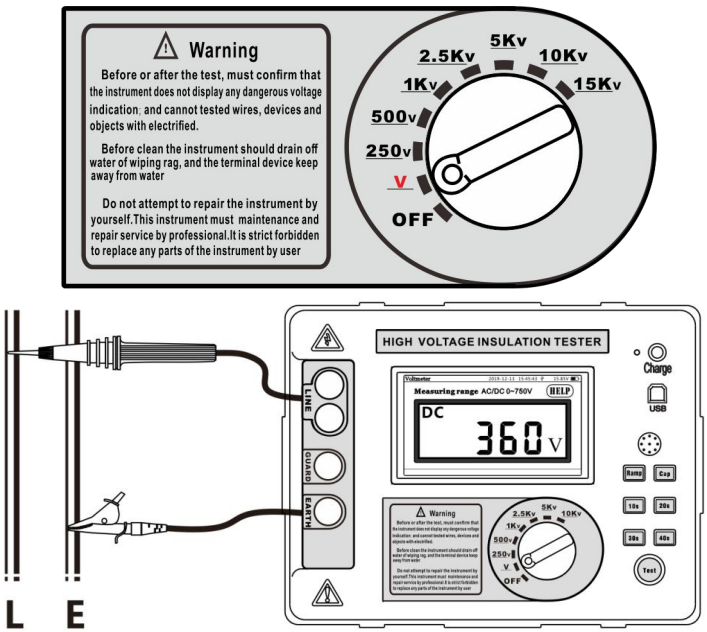
In the instrument key group, **Cap** is the capacitance measurement button. The indicator light of the button is on indicate that enter into the capacitance measurement mode, while the indicator light is not on indicate that exit the capacitance measurement mode. Press the **Cap** button to switch between the two modes.



7.7. Voltage Test

This instrument has the function of measuring AC and DC voltage. This function is only used to help check whether the tested circuit loop is live or not when measuring insulation resistance. Please do not measure AC/DC voltage above 1000KV, which may damage the instrument.

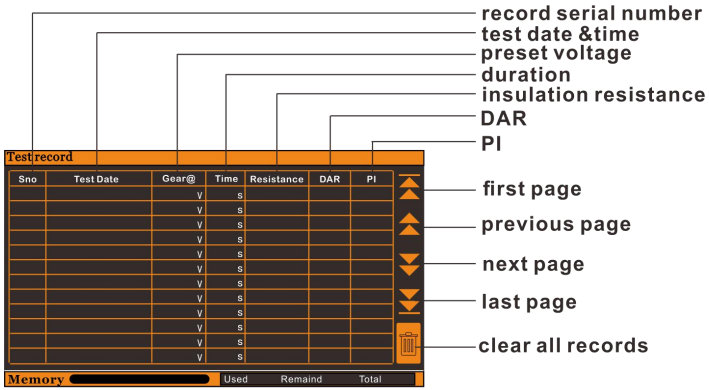
When testing the voltage, rotate the knob to the voltage test gear. The red high voltage test line connect to the LIEN port, and the black grounding line connect to the EARTH port. As shown in the figure below.



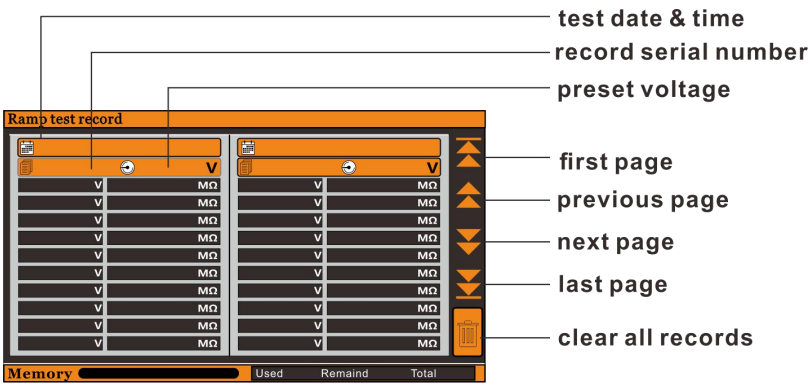
⚠	Before the test, please confirm the maximum withstand voltage value of the tested circuit loop. Exceeding the maximum withstand voltage value may damage the tested circuit.
	Do not measure AC/DC voltage above 1000V to avoid damage to the instrument.
	The actual test voltage may be 10% higher than the selected test voltage.

8. View Test Record

Put the finger on the screen and swipe to the left, the screen switches to the test record browsing page. (The test time not reach 15 seconds, will not save the test record)



Normal Test Record Page



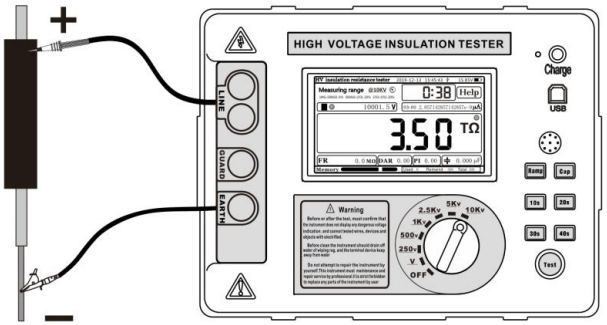
Ramp Test Record Page

9. General Test Line Connection Method

9.1. The Insulation Resistance Test of Cable

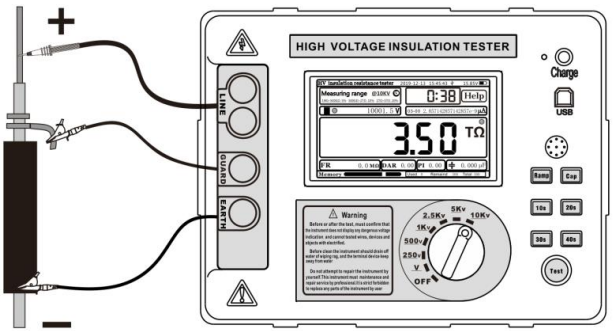
9.1.1. General two wires measurement connection mode

There is leakage current on the surface of the inner insulation layer near the end of the cable. This leakage current is also in the measurement current of the "-" terminal, which will make the measurement resistance reading value lower than the actual insulation resistance value. Non-ultra high resistance values can be measured in this way. (As shown figure below)



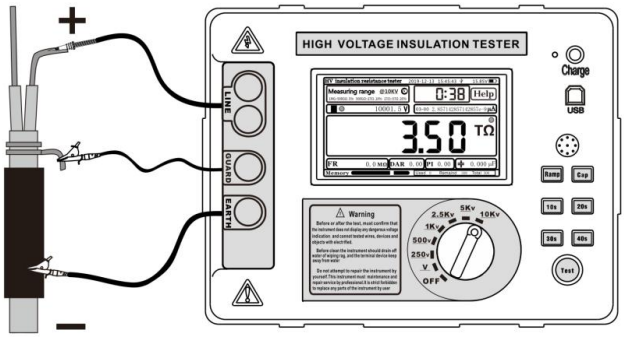
9.1.2. Ultra high resistance value three wire measurement connection mode

A metal bare wire with good conductivity is wound around the outer layer of the internal insulation layer to prevent leakage current from the surface of the measured object by connecting the safety terminal to the outer conductor of the internal insulation layer. Surface leakage will be directed to the safety terminal to eliminate surface leakage in the measurement path between the +/- electrodes and improve the accuracy of the measurement readings. (As shown figure below)



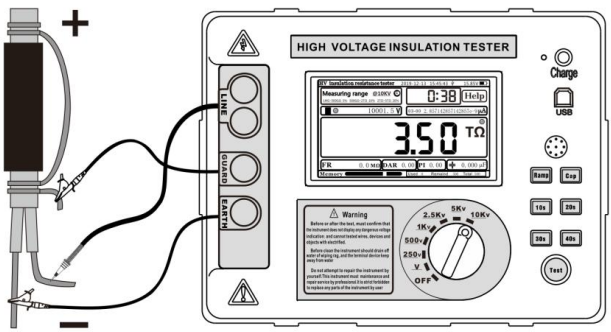
9.1.3. Ultra high resistance value three wire insulation resistance measurement connection mode.

A metal bare wire with good conductivity is wound around the outer layer of the internal insulation layer, connect the safety terminal to the outer conductor of the internal insulation layer and unused cable. Surface leakage will be directed to the safety terminal to eliminate surface leakage in the measurement path between the +/- electrodes，which can ensures that the measured insulation resistance is the insulation resistance between the selected cable and the outer insulator and eliminates the leakage path between the cables at the same time. (As shown figure below)



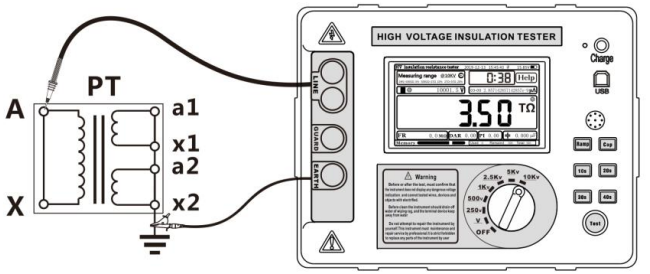
9.1.4. Ultra high resistance value three wire insulation resistance measurement connection mode

A metal bare wire with good conductivity is wound around the outer layer of the internal insulation layer, connect the safety terminal to the outer conductor of the internal insulation layer and unused cable. Surface leakage will be directed to the safety terminal to eliminate surface leakage in the measurement path between the +/- electrodes，which can ensures that the measured insulation resistance is the insulation resistance between the selected cable and the outer insulator and eliminates the leakage path between the cables at the same time. (As shown figure below)

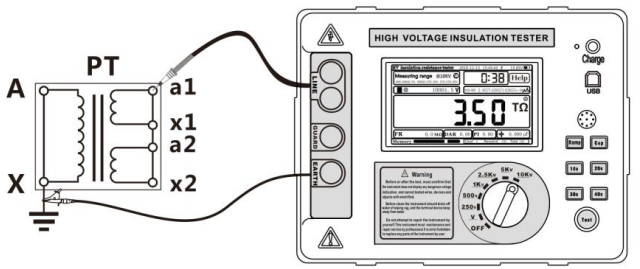


9.2. Transformer Insulation Resistance Test

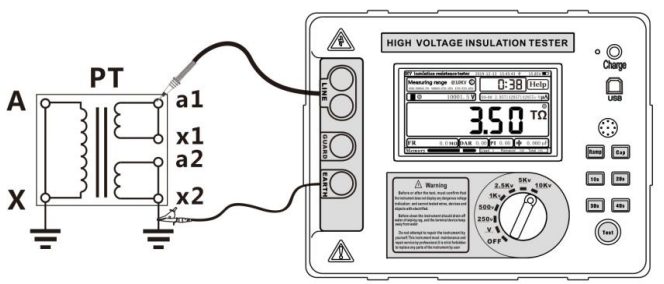
9.2.1. The insulation resistance test between primary winding and secondary winding



9.2.2. The insulation resistance test between the primary winding grounding and the secondary winding



9.2.3. Insulation resistance test between secondary winding



10. Instrument Maintenance

To avoid electric shock or personal injury

- Do not try to repair or maintain the instrument out of scope described in this manual.
- This instrument is for professional maintenance only
- The user shall not replace any part of the instrument without permission.

The accuracy of the instrument can be maintained for 1 year after calibration at operating temperatures from 0°C to 35°C. For operating temperatures outside the range (-20°C to 0°C and 35°C to 50°C), error increase by ±0.25 % per °C.

Clean: In order to avoid the risk of electric shock or personal injury, before cleaning the instrument should wring out the moisture of the cloth, do not let any terminal touch the water. Clean the shell regularly with a mild cleaner. Do not use abrasive or solvent to clean this instrument.

Save: After use, the instrument should be stored in a dry and clean environment.

⚠	Use, disassembly, calibration, and repair of this tester must be performed by authorized personnel

11. Accessories

Tester	1 PCS
High Voltage Rod	1 PCS Red
Alligator Clip Test Wire	2 PCS (each 1 PCS of black and green)
Alligator Clip	1 PCS
Hook	1 PCS
USB Communication Cable	1 PCS
Software CD	1 COPY
Charger	1 PCS
Instrument Bag	1 PCS
Manual/ Warranty Card / Qualification Certificate	1 SET