



OPERATION MANUAL

U9053 Series AC/DC Withstanding Voltage/Insulation Resistance Tester

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Chapter 1 Introduction to Instrument, Unpacking and Installing

Thank you for your purchase and use of our products. This chapter describes the procedures from unpacking to installation to operation checking.

1.1 Introduction to Instrument

U9053 series provide 5kVAC/30mA withstanding voltage, 6kVDC/10mA withstanding voltage and insulation resistance tester.

In high voltage modular, there is a AB power amplifier power which can assure the programming of output voltage as well as the isolation of output voltage power and line power. 40~600Hz high voltage transformer can rise voltage, and use high voltage feedback loop to assure the accuracy of output voltage, then the actual voltage adjustment rate is far smaller than that of transformer, which can be used to the product whose VA is larger than the actual power.

In AC output, set the operation in 50 or 60Hz, not being limited by line voltage, the voltage waveform isn't affected by line voltage neither. The instrument also has the real current test, and then the large current generated by distributed capacitance can't affect the judgment of real insulation.

To DC and insulation resistance test, U9053/U9052/U9051 tester use 600Hz AC to form DC voltage to be the power, which can assure the DC power ripple is far less than the formal withstanding voltage tester, thus to assure the stability of 5000V, 10mA test.

Once connecting the load, U9053 not only can perform the independent AC withstanding test, DC withstanding voltage test, insulation resistance test, but also multi-item and multi-products test via the setting of test program.

U9053 series all allocate PLC interface, RS-232C、GPIB(optional), thus the instrument can adapt to the auto test system of different required safety and reliability.

1.1.1 Feature:

- **3 test functions—AC withstanding voltage test, DC withstanding voltage test and insulation resistance test.**

U9053/U9052/U9051 provides AC withstanding voltage test and insulation resistance test. U9051C provides AC withstanding voltage test.

Once connected with load, the tester can perform different tests continually.

- **AC withstanding voltage test 5kV/30mA (U9053/U9052/U9051) 5kV/20mA (U9051B/C)**

In U9053/U9051 high voltage modular, there is a AB power amplifier circuit and a

150VA transformer, which can realize the Max. output of 5kV/30mA (1 min), while **U9051B/C** power amplifier circuit and a 100VA transformer can realize the Max. output of 5kV/20mA (1 min) .

U9053/U9051 has the highest limit current 30mA, Min. voltage 50V, so instrument generates the test voltage corresponding with 50Hz/60Hz, independent power, auto voltage adjusting rate is smaller than $\pm 3\%$. It's not necessary to adjust output voltage after setting test voltage.

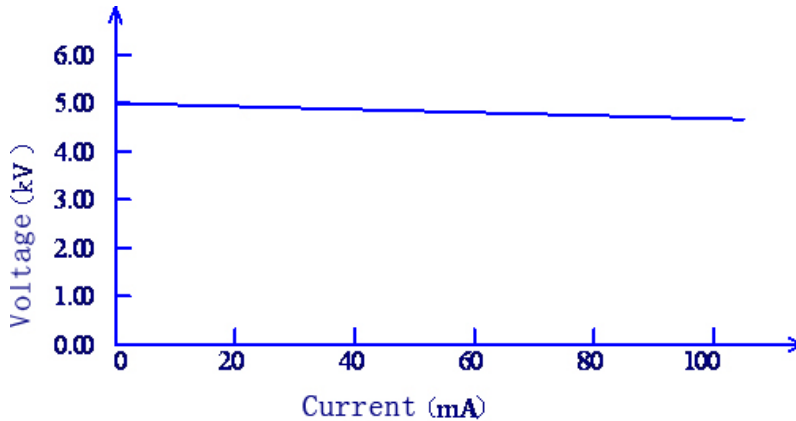


Figure 1-1 AC voltage load adjusting rate

■ **DC withstanding voltage test 6kV (Max. output power is 50W)**

U9053 series can provide DC withstanding voltage test of wide voltage range (Max. output power is 50W, the max. holding time is 1 min) . Instrument allocates a reliable, low ripple DC/AC switch circuit, voltage load adjusting rate $\leq 1\%$.

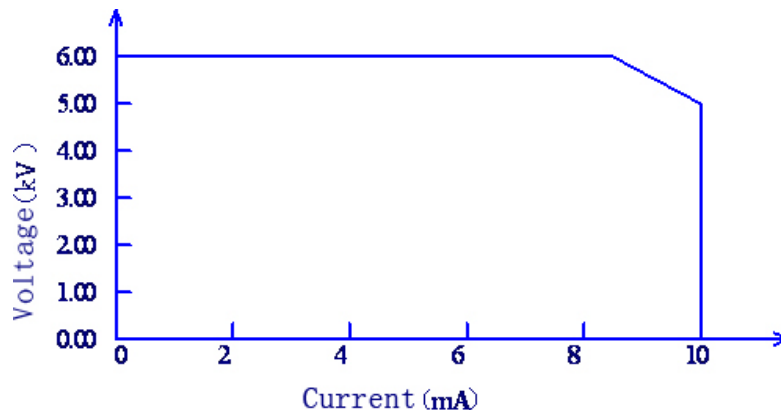


Figure 1-2 DC voltage output range

■ **Insulation resistance test 50V to 1000V (resolution of 1V) /0.1MΩ to 50.0GΩ(Max. rated current range is from 10mA to 50nA)**

■ **Programmable GPIB (optional) and RS-232C interface as the standard**

Except power switch, key lock and execution (auto), other functions can be controlled remotely. In DC withstanding voltage test, AC withstanding voltage test and insulation resistance test, judge and time can be controlled remotely. The test result can also be read via remote control. GPIB and RS-232C interface provides a stable and united standard test interface for PC or other devices.

■ **High voltage scanner can realize the control function flexibly**

U9053/U9052 have internal multi-channels, in withstanding voltage test and insulation resistance, it can control 8 channels to test 8 points. Each channel can be connected to HI/LO/OPEN voltage.

■ **Rising time control function**

In AC withstanding voltage test, DC withstanding voltage test and insulation resistance test, the test voltage can be raised to set value slowly, it can't provide set voltage to DUT instantly after test starts. The resolution is 0.1s from 0.1s to 99.9s, and the resolution is from 100s to 200s. U9053 series meet each UL test standard and IEC withstanding voltage standard (primary voltage is less than the half of test voltage and it can appoint the fixed rising time when reaching the set test voltage.

■ **Fall time control function**

In the pass judge of AC withstanding voltage test, the test voltage can be reduced gradually. The voltage fall time can be set within 0.0s to 99.9s (with the resolution of 0.1s) and 100s to 200s (with the resolution of 1s) .

■ **Discharge function**

In common condition, the DUT reacts the feature of capacitance. At the moment of the cut of DC withstanding voltage and insulation resistance test, the DUT holds the full charge status, so there is a danger of electric shock..U9053 has the enforced rapid discharge function after DC withstanding voltage test and insulation resistance test finish.

■ **Reinforced safety**

In order to improve the safety, U9053 series allocate many devices and safe functions including safe output terminal, discharge function and electric wall. The electric wall means in high voltage test circuit, when return current flowing through

shell is larger than 0.6A, the high voltage output will be cut off, thus there will be no shock current in high voltage to protect the operator's safety.

■ Higher test accuracy

U9053 series is voltage digital display, in withstanding voltage test, the accuracy is \pm (1%reading +30V), in insulation resistance test, is \pm (1% reading +1V) . the digital display of test current is \pm (3% reading +20 μ A) in withstanding voltage test.

■ Current correction function

AC withstanding test needs high sensitivity and voltage, the stray capacitance effects the accuracy of current test.U9053 series has the current correction function to eliminate the moving current.

■ Voltage hold function

In the process of judge, this function allows operator to hold the record of test voltage when the judge result is outputted continuously. The voltage hold function can monitor the breakdown voltage by combining with rising time control function.

■ Easy operation

U9053 series are quite easy to be operated. In the setup interface, the test condition is listed. Set test condition, use direction key to select a topic from LCD display, then input the value using numeric key. Shortcut key can select the set topic. After setting the data, it will back to test interface to perform test.

■ 100 test programs, and each one includes 100 test items, so it can save 500 test items totally.

It can edit 100 test programmes which corresponds to user's different test items; the test item is one of AC withstanding voltage test, DC withstanding voltage, insulation resistance test, open and short judge. Each test condition is noninteractive; the memory can save 500 test steps, and if the stored item is so large that most data have to be transferred to external memory. (U-disk is available) .

■ Signal output function

Via signal output (HANDLER、PLC), START、STOP、INTERLOCK signal can be inputted, and TEST、PASS、FAIL signal can be outputted.

■ High voltage output terminal on the rear panel (Optional)

On the rear panel, there is an optional high voltage output which is used for high voltage output of scanner.

■ Small dimension and light

Used for Max.150VA AC withstanding voltage test, U9053 series are all small and light.

⚠ WARNING: The instrument applies 5kV AC/DC high voltage, so do not touch the DUT and test line, or it will cause the danger of electric shock. The safe measures should be taken around DUT to assure the operator's safety. Otherwise, please be care about the outputted high voltage due to the incorrect connection and operation.

1.1.2 Specification

Model	U9053	U9052	U9051	U9051B	U9051C
Voltage output					
AC	Output voltage range	0.05kV—5kV			
	Voltage frequency	50Hz、60Hz selectable			
	Max. output power	150VA (5kV/30mA)		100VA (5kV/20mA)	
DC	Output voltage range	0.05kV—6kV		0.5kV—6kV	-----
	Max. output power	50VA(5kV/10mA)		25VA(5kV/5mA)	-----
	Discharge function	Auto discharge after test ends		Auto discharge after test ends	-----
IR	Output voltage range	50V – 1000V		-----	-----
	Max. output power	10 VA (1000V/10mA)		-----	-----
	Discharge function	Auto discharge after test ends		-----	-----
8 channels sweep	Available	4 Channels	-----		
Voltage display					
Digit	Test range	0.00kV – 6.00kV AC/DC			
	Accuracy	±(1.0%reading+2V)			

Current display				
Test range	AC	0.1mA – 30mA	0.1mA – 20mA	
	DC	0.01mA – 10mA	0.01mA – 5mA	-----
Accuracy		±(1%reading+10digits) (after correction)		
Arc detection	AC	1mA – 15mA	1mA – 15mA	
	DC	1mA – 10mA	1mA – 5mA	-----
Insulation resistance display				
Resistance test range		0.01MΩ– 49.99GΩ, (current range is from 10nA – 10mA)	-----	-----
Resistance test accuracy		±(5%reading+5digits) (after correction)	-----	-----
Parameter setup				
Voltage rising time		0.1s – 999s		
Voltage down time		0.1s – 999s		
Voltage waiting time		0.1s – 99.9s(only for DC)		
Test time setup		0.3s – 999s		
Other function		Fast discharge, body protection, Handler, RS-232C、GPIB interface		

1.2 Unpacking

Upon receiving the product, confirm that the necessary accessories are included and have not been damaged in transit. Should any damage or shortage be found, please contact Euclid distributor/agent.

Items	Quantity
U9053/U9052/U9051/U9051B/U9051C	1
U26037 withstanding-voltage test clips	1
U26038 withstanding-voltage test lead	1
AC Power cord	1
Operation Manual	1

1.3 Precautions for Installation

Be sure to observe the following precautions when installing the tester.

1.3.1 Do not use the tester in a flammable atmosphere.

To prevent explosion or fire, do not use the tester near alcohol, thinner, or other combustible materials, or in an atmosphere containing such vapors.

1.3.2 Avoid locations where the tester is exposed to high temperatures or direct sunlight.

Do not locate the tester near a heater or in areas subject to drastic temperature changes.

Operating temperature range: 5 °C to +35 °C

Storage temperature range: -20 °C to +60 °C

1.3.3 Avoid humid environments.

Do not locate the tester in a high-humidity environment—near a boiler, humidifier, or water supply.

Operating humidity range: 20 % to 80 % RH (no dew condensation permitted)

Storage humidity range: 90 % RH or less (no dew condensation permitted)

Condensation may occur even within the operating humidity range. In that case, do not start using the tester until the location is completely dry.

1.3.4 Do not place the tester in a corrosive atmosphere.

Do not install the tester in a corrosive atmosphere or one containing sulfuric acid mist or the like. This may cause corrosion of various conductors and imperfect contact with connectors, leading to malfunction and failure, or in the worst case, a fire.

1.3.5 Do not locate the tester in a dusty environment.

Dirt and dust in the tester may cause electrical shock or fire.

1.3.6 Do not use the tester where ventilation is poor.

This tester features a forced-air cooling system. Provide sufficient space for the air inlet on the lateral side and the air outlet on the rear side to allow air to flow.

1.3.7 Do not place the tester on a tilted surface or in a location subject to vibrations.

If placed on a non-level surface or in a location subject to vibration, the tester may fall,

resulting in damage and injury.

1.3.8 Do not use the tester in locations affected by strong magnetic or electric fields.

Operation in a location subject to magnetic or electric fields may cause the tester to malfunction, resulting in electrical shock or fire.

1.3.9 Do not use the tester in locations near a sensitive measuring instrument or receiver.

Operation in a location subject, may cause such equipment may be affected by noise generated by the tester.

At a test voltage exceeding 3 kV, corona discharge may be generated to produce substantial amounts of RF broadband emissions between grips on the test lead wire. To minimize this effect, secure a sufficient distance between alligator clips. In addition, keep the alligator clips and test lead wire away from the surfaces of conductors (particularly sharp metal ends).

1.4 Precautions for Moving


When moving the tester to the installation site or otherwise transporting it, take the following precautions:

1.4.1 Before moving the tester, turn off the power switch.

Transporting the tester with its POWER switch on can lead to electric shock and damage.

1.4.2 When moving the tester, Disconnect all wires from it.

Moving the tester without disconnecting the cables may result in breakage of the wire or injury due to the tester tipping over.

 **WARNING:** This instrument is designed to operate from the overvoltage category II.

Do not operate it from the overvoltage category III or IV.


Before turning on the power, make sure of the fuse and the source voltage agree with the LINE-VOLTAGE RANGE switch on the rear panel.

Nominal voltage range (allowable voltage range):


100 V to 120 V AC (85 V to 132 V AC)

200 V to 240 V AC (170 V to 250 V AC)

Allowable frequency range: 47 Hz to 63 Hz

 **WARNING** To prevent malfunctions, be sure to operate within the line-voltage range.

1.5 Checking and replacing fuse

 **WARNING** To prevent electric shock, before checking or replacing the fuse, be sure to turn off the POWER switch and unplug the AC power cord.

Make sure that the fuse used conforms to the instrument specifications, including shape, rating, and characteristics. Using a fuse with different rating or short-circuiting, the fuse holder will damage the instrument.

1. Turn off the POWER switch, and unplug the AC power cord.
2. On the rear panel, remove the fuse holder, by pushing it inward and unscrewing it counterclockwise using a screwdriver.
3. In accordance with the fuse rating specified below, check the fuse type and replace the fuse.
4. Following the above steps in the reverse order, reinstall the fuse holder.

Voltage range	Frequency	Fuse type	Power
100-120V	47-63Hz	5A(U9053/U9051/U9052) 3A(U9051B/C)	500VA
200-240V		3A(U9053/U9051/U9052) 2A(U9051B/C)	

1.6 Connecting the AC Power Cord

The power cord that is provided varies depending on the destination for the product at the factory-shipment.

Do not use the AC power cord provided with the product as a AC power cord for other instruments.

Connection procedure:

1. Confirm that the supply voltage is within the line voltage range of the tester.
2. Confirm that the POWER switch on the tester is off.
3. Connect the AC power cord to the AC LINE connector on the rear panel.
Use the provided power code or power code that is selected by qualified personnel.
4. Plug in the AC power cord.

1.7 Grounding

⚠ WARNING Be sure to connect the tester to an electrical ground (safety ground). If the output to a conveyor or peripheral device that is connected to an earth ground or a nearby commercial power line is short-circuited without grounding, the tester chassis is charged to an excessively high voltage, resulting in extreme danger.

This tester is designed as a Class I equipment (equipment protected against electric shock with protective grounding in addition to basic insulation). Therefore, electric shock may occur without proper grounding.

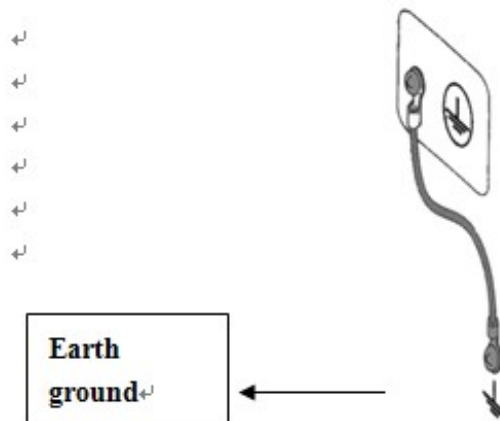
To ensure safety, be sure to ground the tester.

Choose either of the following two available methods of doing so:

1. Connect the AC power cord to a three-contact grounded electrical outlet.
2. Connect the protective conductor terminal on the rear panel to the earth ground.

Have specialized engineers select, manufacture, and install cables.

To ensure secure connection, use proper tools.



1.8 Checking Operations

⚠ WARNING Use the interlock jumper only to quickly cancel the protection status. When using this tester, use the interlock function as much as possible to ensure a safe operating environment. To use jigs in withstanding voltage or insulation resistance testing, provide a cover or other means for the DUT to prevent electric shock by cutting off the output when the cover is opened. It is also recommended that an enclosure be provided around the operating area and that output be cut off every time the door is opened.

Before turning on the power, confirm that the allowable voltage range indicated on the power supply is the same as that indicated on the rear panel of the tester.

When the power is turned on, the tester lights all LEDs on the front panel and self-diagnosis is started.

Before starting up the tester, confirm that all LEDs are on to ensure safety.

It is particularly dangerous to start a test when the DANGER lamp is broken.

Note that, in self-diagnosis, even when the DANGER lamp is lighting, no output or voltage is being generated.

⚠ CAUTION After turning off the POWER switch, wait several seconds before turning it on. Turning the POWER switch on/off repeatedly with insufficient intervals may damage the tester.

Checking procedure:

1. Confirm that the allowable voltage range indicated on the power supply is the same as that indicated on the rear panel.
2. Confirm that the AC power cord is properly connected to the AC LINE connector on the rear panel.
3. Plug in the AC power cord.
4. Turn on the POWER switch. Confirm that all LEDs on the front panel are lit.
5. Following the opening screen, display the <MEAS DISP> screen
6. Turn off the POWER switch.
7. Turn on the POWER switch again.
8. Following the opening screen, display the <MEAS DISP> screen and confirm that the tester is kept in the READY status.

The above steps complete the checking procedure.




Figure 1-3 opening screen

1.9 Other specifications

1. Power: $\leq 500\text{VA}$ (U9053/U9051/U9052)
 $\leq 350\text{VA}$ (U9051/B/C)
2. Dimensions: 340mm*120mm*450mm;
3. Weight: 20kg(U9053)16kg (U9051A/B/C) .

Chapter 2 Precautions on Handling

This chapter describes the precautions to be followed in the handling of this tester. When using the tester, take utmost care to ensure safety.

 **WARNING** The tester delivers a 5 kV test voltage which can cause human injury or death. When operating the tester, be extremely careful and observe the cautions, warnings, and other instructions given in this chapter.

2.1 Prohibited Operations


2.1.1 Do not turn on/off the power repeatedly

After turning OFF the power switch, be sure to allow several seconds or more before turning it ON again. Do not repeat turning ON/OFF the power switch rapidly. If you do this, the protectors of the tester may not be able to render their protective functions properly. Do not turn OFF the power switch when the tester is delivering its test voltage—you may do this only in case of emergency.

2.1.2 Do not short the output to the earth ground

Pay attention so that the high test voltage line is not shorted to a nearby AC line or nearby devices (such as conveyors) which are connected to an earth ground. If it is shorted, the tester chassis can be charged up to the hazardous high voltage. Be sure to connect the protective grounding terminal of the tester to an earth line. If this has been securely done, even when the HIGH VOLTAGE terminal is shorted to the LOW terminal, the tester will not be damaged and its chassis will not be charged up to the high voltage.

Be sure to use a dedicated tool when grounding the protective grounding terminal.

 **CAUTION** The term "AC line" here means the line on which the tester is operating. That is the line to whose outlet the AC power cable of the tester is connected. It may be of a commercial AC power line or of a private-generator AC power line.

2.1.3 Do not apply an External Voltage

Do not apply a voltage from any external device to the output terminals of the tester. The analog voltmeter on the front panel cannot be used as stand-alone voltmeter. They may be damaged if their output terminals are subject to an external voltage.

2.2 Action When in Emergency

In case of an emergency (such as electric shock hazard or burning of DUT), take the following actions. You may do either (a) or (b) first. But be sure to do both.

1. Turn OFF the power switch of the tester.
2. Disconnect the AC power cord of the tester from the AC line receptacle.

2.3 Precautions on Testing

2.3.1 Wearing Insulation Gloves


When handling the tester, be sure to wear insulation gloves in order to protect yourself against high voltages. If no insulation gloves are available on your market, please order Eucoil distributor/agent for them.

2.3.2 Precautions for Pausing Tests

When changing test conditions, press the STOP switch once to take precautions. If you are not going to resume the test soon or if you are leaving the Test area, be sure to turn-OFF the POWER switch.

2.3.3 Items Charged Up to Dangerous High Voltages

When in test, the DUT, test leadwires, probes, and output terminals and their vicinities can be charged up to dangerous high voltages. Never touch them when in test.

 **WARNING** The vinyl sheaths of the alligator clips of the test leadwires which are supplied accompanying the tester have no sufficient insulation for the high test voltages. Never touch them when in test.

2.3.4 Matters to be Sure of After Turning-OFF Power

If you have to touch the DUT, test leadwires, probes, and/or output terminals and their vicinities for re-connections or other reasons, be sure of the following two matters.

1. The analog voltmeter indicates “zero.”
2. The DANGER lamp has gone out.


2.3.5 Warnings for Remote Control

Be extremely careful when operating the tester in the remote control mode in which the dangerous high test voltage is ON/OFF-controlled remotely. Provide protective means as follows:

1. Provide means to assure that the test setup does not become the test voltage is being delivered by inadvertent operation.

2. Provide means to assure that none can touch the DUT, test leadwires, probes, output terminals and their vicinities when the test voltage is being delivered.

2.4 Warning for Residual High Voltages

 **WARNING** In DC withstanding voltage testing and insulation resistance testing, the test lead wire, test probe, and DUT are charged to a high voltage. The tester is equipped with a discharge circuit, but some time is nonetheless required to discharge them after the output is cut off. There is a danger of electric shock during discharge. To avoid electric shock, take the utmost care to ensure that the DUT, test lead wire, probe, and highly charged parts around the output terminal are not touched. If it is necessary to touch them, be sure to confirm both (1) and (2):

(1) The analog voltmeter indicates “zero.”

(2) The DANGER lamp has gone out.

As soon as the output is cut off, the tester’s discharge circuit starts forced discharging. Do not disconnect the DUT during a test or prior to completion of discharging.



Discharge time

The length of the discharge time varies according to the properties of the DUT.

Discharge is conducted at a resistance of approximately 2 k in DC withstanding voltage testing, and at 10 k in insulation resistance testing.

When no DUT is connected, the tester itself requires the following lengths of time to reduce the internal capacitor voltage to 30 V.

If the DUT is disconnected during a test or before the completion of discharging, assuming that the DUT has a capacity of 0.01uF and a parallel resistance of 100 M, approximately 5.3 seconds at 5 kV and approximately 3.5 seconds at 1 kV are required for the DUT to discharge to 30 V.

When the approximate time constant of the DUT is known, the time required for discharging to 30 V after the output is cut off is calculated as the time constant times the value given above.

2.5 Dangerous States of Failed Tester

Typical possible dangerous states of the tester are as shown below and in which cases the most dangerous situation that **“the high test voltage remains delivered and won't be turned off!”** may occur. When this situation has occurred, immediately turn OFF the power switch and disconnect the AC power cable from the AC line receptacle.

•The **DANGER lamp does not go out despite you have pressed the STOP switch.**

•The **DANGER lamp does not light up despite the pointer of the analog voltmeter is deflected indicating that the output voltage is being delivered.**

Also when the tester is in other malfunctioning states than the above, there is a possibility

that the output voltage is delivered irrespective of your proper operating procedure. Never use the tester when it has failed.

⚠ WARNING Keep the tester away of other people until you call our service engineer for help. Immediately call Tonghui distributor/agent. It is hazardous for an unqualified person to attempt to troubleshoot any tester problem.

2.6 To Ensure Long-Term Use without Failures

The withstanding voltage-generating block of the tester is designed to release half the rated amount of heat, in consideration of the size, weight, cost, and other factors of the tester. The tester must therefore be used within the ranges specified below. If you deviate from these ranges, the output block may be heated to excess, activating the internal protection circuit. Should this happen, wait until the temperature returns to the normal level.

Output requirements for withstanding voltage testing

Ambient temperature	Upper current		Pause Time	Output time
T≤40°C	AC	>20mA (U9053/U9051/U9052) >12mA (U9051B/C)	At least as long as the output time	Maximum of 1 minute
		<10mA (U9053/U9051/U9052) <6mA (U9051B/C)	Not necessary	Continuous output possible
	DC	>6mA(U9053/U9051/U9052) >3m (U9051B/C)	At least as long as the output time	Maximum of 1 minute
		<5mA (U9053/U9051/U9052) <2mA(U9051B/C)	At least as long as the judgment wait time (WAIT TIME)	Continuous output possible

(Output time = voltage rise time + test time + voltage fall time)

2.7 Daily Checking

To avoid accidents, confirm at least the following before starting operation:

1. The tester is connected to an earth ground.
2. The coating of the high-voltage test lead wire is free from cracks, fissures, and breakage.
3. The high-voltage test lead wire is not broken.
4. The tester generates FAIL signal when the ends of the low-voltage test lead wire and high-voltage test lead wire are short-circuited.

Chapter 3 Introduction to Front and Rear Panels

This chapter describes the names and functions of components such as switches, displays, and connectors on the front and rear panels.

3.1 Front Panel

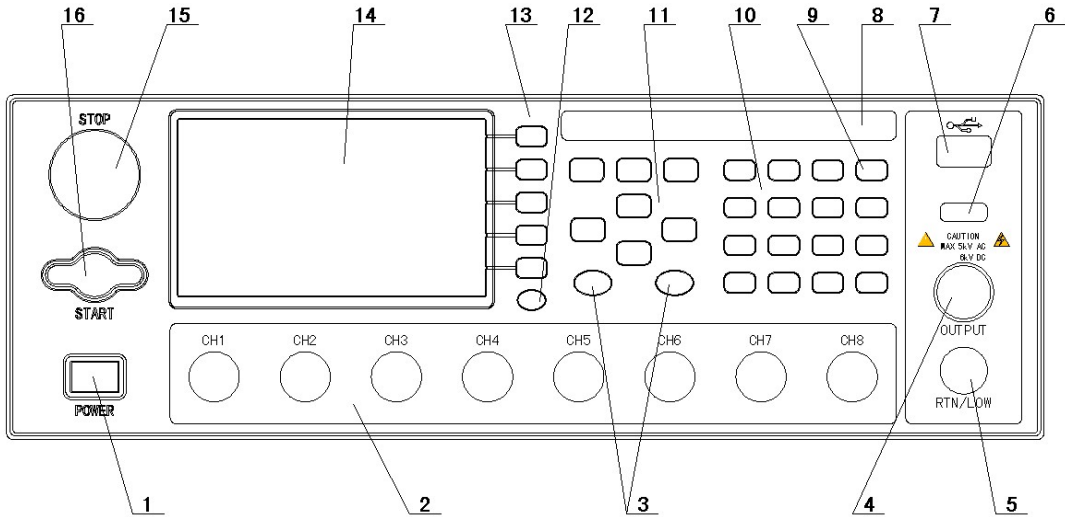


Figure 3-1

Ser.No.	Item	Description
1	POWER	It's the power switch.
2	8 channel sweep interface	Internal 8 channel sweep output interface
3	LED indicator	Indicate a test result of PASS or FAIL
4	Output HIGH voltage terminal	High voltage terminal in test voltage output.
5	Output LOW voltage terminal	Low voltage terminal in test voltage output.
6	TEST indicator	In the process of testing, it lights in output voltage.
7	USB HOST interface	Externally connect to USB storage
8	Brand and Model	Show instrument trademark and model.

9	LOCK/LOCAL	Press this key, the buzzer will beep, which means the function of current panel is locked. Press it again, it will be off, which means discharging the lock status. If the password function is ON, it means correct password is necessary when discharging the key-lock, or the key cannot be unlocked.
10	Numerical Keys	These keys are used to input data to the instrument. The key consists of numerical keys [0] to [9], decimal point [.] and [+/-] key.
11	Function and Arrow keys	MEAS : Press [MEAS] to enter into the MEAS DISP page. SETUP : Press [SETUP] to enter into the MEAS SETUP page. SYST : Press [SYST] to enter into the SYSTEM SETUP page.
12	SAVE	Press SAVE key to save the image file (BMP, GIF, PNG) and waveform file(CSV) to the USB disk
13	SOFT KEY	Corresponding with the function operation on LCD screen
14	LCD screen	480*272 dot-matrix, 24-bit, 4.3-inch TFT LCD is used for measurement setup and result display.
15	STOP key	Used to cancel the test, Or PASS、 FAIL status.
16	START key	Once test starts, TEST indicator lights.

3.2 Instruction of rear panel

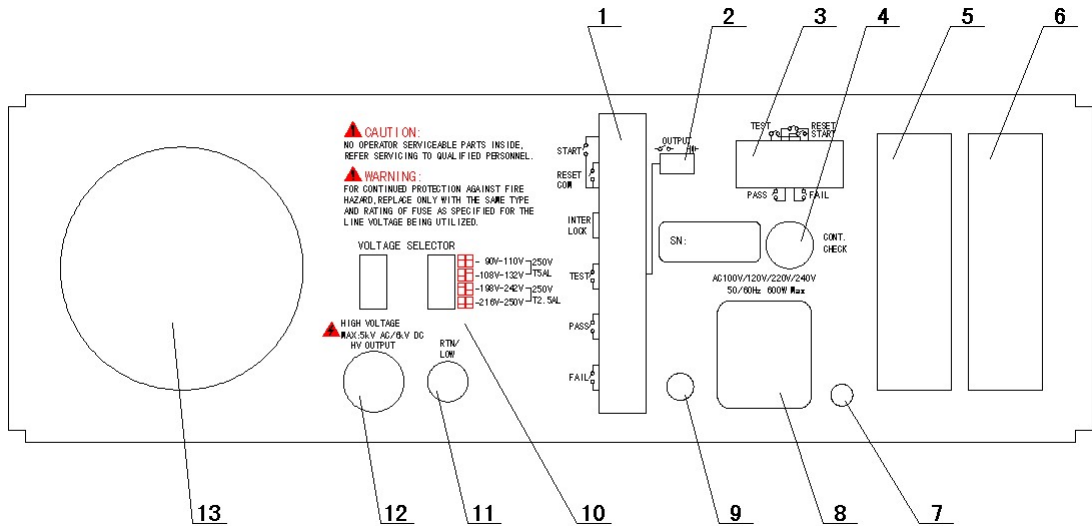


Figure 3-2

1. PLC controller interface

Be used to connect programming controller, where:

- **INTERLOCK:** input the connecting locked signal, if off, starting output is not allowed.
- **TEST:** Output synchronized-signal control when high voltage output is started.
- **START:** Input the starting signal for outputting high voltage, corresponding to START signal on the front panel.
- **RESET:**
- **PASS:**
- **FAIL:**

2. OUTPUT

TEST outputs control, output 24V level or relay switch signal, it is suggested to use switch signal to assure signal separation.

3. HANDEL interface

Use 9 core model D jack to output.

4. Ground break-over test interface

When open ground break-over test function, the terminal has to be connected to the place where DUT is connected with low terminal.

5. RS232C serial interface

Serial communication, realize the communication with computer.

6. IEEE488 (GPIB) parallel communication interface

Provide the general communication interface for instrument and external device.

7. Protective earth terminal

Be used to connect instrument to ground.

8. Power jack

Be used to input AC power; please use the attached power line with fuse. Change the fuse according to input power.

9. Ground break-over calibration

Ground break-over resistance is 1 ohm, use potentiometer to calibrate if there is deviation.

10. Line voltage range

Switch of input voltage range.

11. High voltage output interface (optional)

Stand-by high voltage output interface.

13. Fan

Power amplifier circuit radiator.

3.3 Display Zone

U9053 series adopts 24-bit 4.3-inch LCD screen with a resolution of 480*272. The display screen is divided into the following zones, as shown in figure 2-3.

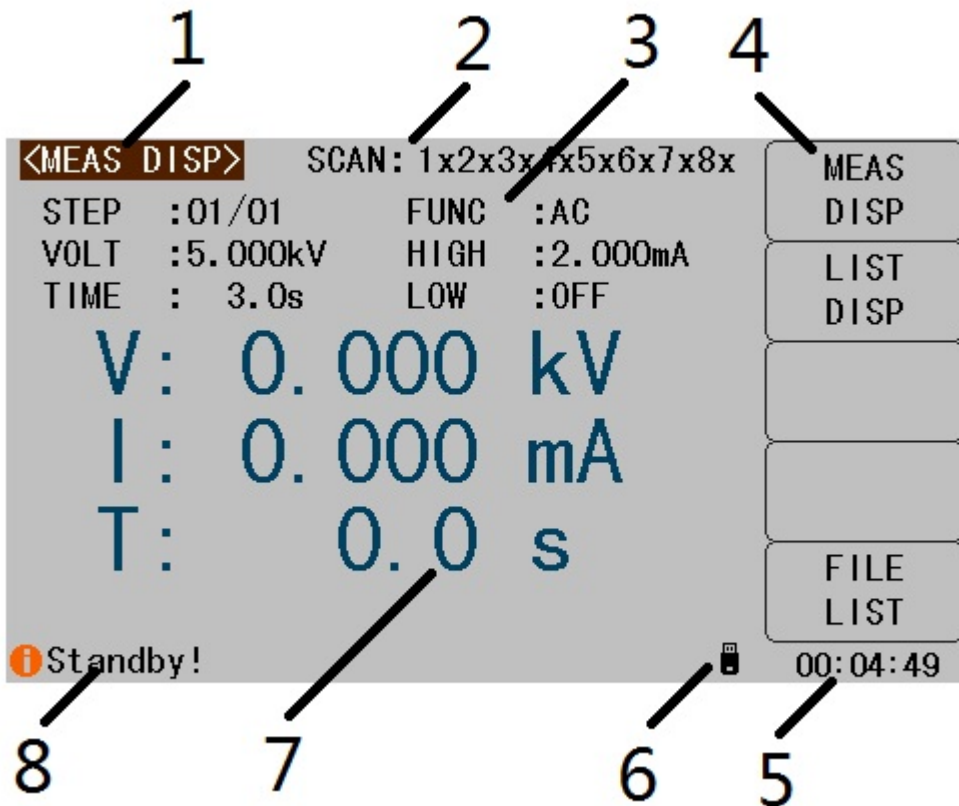


Figure 3-3 Display zone

1. Page name

This zone shows the current page name.

2. Scan channels

This zone can set some short-cut functions.

3. Function zone

This zone is used to change the measurement mode and measurement parameters.

4. Soft keys


This zone displays the function menu corresponding to the cursor-located zone.


5. Time display zone


Display the current time.

6. System icon zone

In this zone, display the system status:

 U disk is connected

 Remot control status.

 Data recording status.

7. Prompt information

This zone displays all prompt information.

8. Result display

This zone displays the measurement result such as voltage and current.

Chapter 4 Basic operation

This chapter describes the operation of withstanding voltage and insulation resistance.

Attention: This chapter takes example for U9053.

4.1 Simple Operation

Simple operation steps for U9053:

- Use [MEAS], [SETUP] or [SYST] or soft keys to enter into the page required to enter. (Refer to figure 3-1)
- Use arrow buttons ([←] [↑] [→] [↓]) to move the cursor to desired zone. When the cursor moves to a specified zone, the zone will become reverse expression.
- The soft key functions corresponding to the current zone of the cursor will be displayed in the soft key zone. Users can select and use the desired key. Numeric keys, [BACKSPACE] and [ENTER] are used to input data.
- When a numeric key is pressed down, the usable unit soft key will be displayed in the soft key zone. You can choose a unit soft key or press [ENTER] to end data inputting. When [ENTER] is used to terminate data inputting, the unit of data will be set to a default unit, such as kV or s.

4.2 Turning on the Power

WARNING

Before turning on the power, be sure to confirm that the allowable voltage range shown on the power supply is the same as that indicated on the tester's rear panel.

To prevent electric shock, be sure to turn off the POWER switch before connecting / disconnecting the GPIB, and RS-232C cables.

As soon as the power is turned on, all LEDs of the tester light up, and self-diagnosis is started. To ensure safety, confirm before starting up the tester that all LEDs are lit. It is particularly dangerous to start a test when the DANGER lamp is broken. Even when the DANGER lamp is lit, no output or voltage is being generated.

CAUTION

When the POWER switch has been turned off, wait several seconds before turning it on again. Turning the POWER switch on/off repeatedly at insufficient intervals may damage the tester.

CAUTION

Even after the power is turned on, the tester does not start a test if the settings are invalid or the tester is in the protection status.

4.2.1 Turning on the power

- 1. Confirm that the allowable voltage range shown on the power supply is the same as that indicated on the tester's rear panel.
- 2. Confirm that the AC power cord is properly connected to the AC LINE connector on the rear panel.
- 3. Plug in the AC power cord.
- 4. Turn on the tester's POWER switch.
- 5. Following the opening screen that displays the firmware version and other information, the LCD displays the last screen displayed when the POWER switch was turned off in the previous test.

4.3 Instruction of interface function

There are mainly 3 function keys which are [MEAS], [SETUP] and [SYST].

4.3.1 <MEAS DISP>

Press down [MEAS] key, the <MEAS DISP> page will be displayed in the screen shown as below:

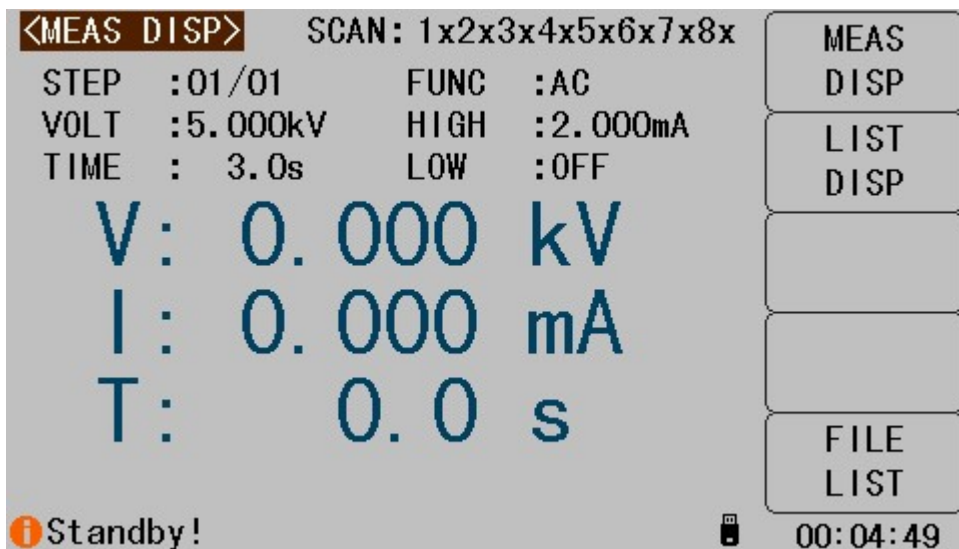


Figure 4-1

Note: The high voltage can only be started on this interface to test high voltage. Other test conditions have to be set on setup interface. The test procedure is as below:

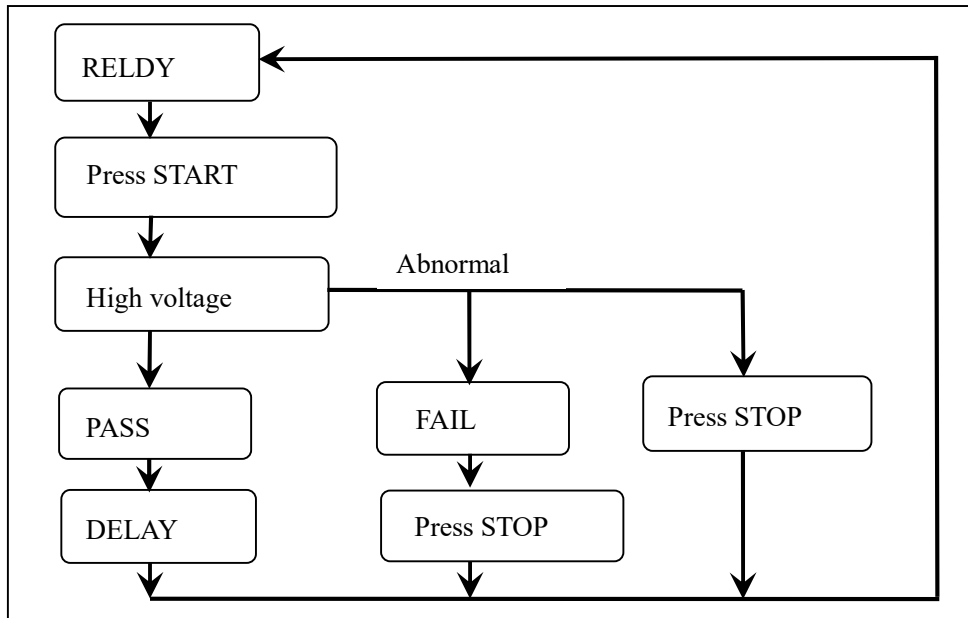


Figure 4-2 Test procedure

The three large font data in the middle of the LCD is the real time test data.

The top one(V) is high voltage output voltage, the unit is (kV) .

The middle one(I) is the tested current of low terminal, the unit is (mA) and (uA) .

The bottom one(T) is the remained time in testing high voltage, if operator turns off the time control, then the test time no less than 999.9S will be displayed, user can analyze the test condition of DUT with the unit of (S) .

Note: operator can't leave if the tester is working, and in the process of testing, not close to the test line or DUT.

4.3.2 <LIST SWEEP>

On the <MEAS DISP> page, press the soft key to enter into <LIST SWEEP> page. In the case of multi steps measurement, the results of each step can be displayed clearly.



Figure 4-3

4.3.3 <MEAS SETUP>

Press down [SETUP] key, the <MEAS SETUP> page will be displayed in the screen shown as below:

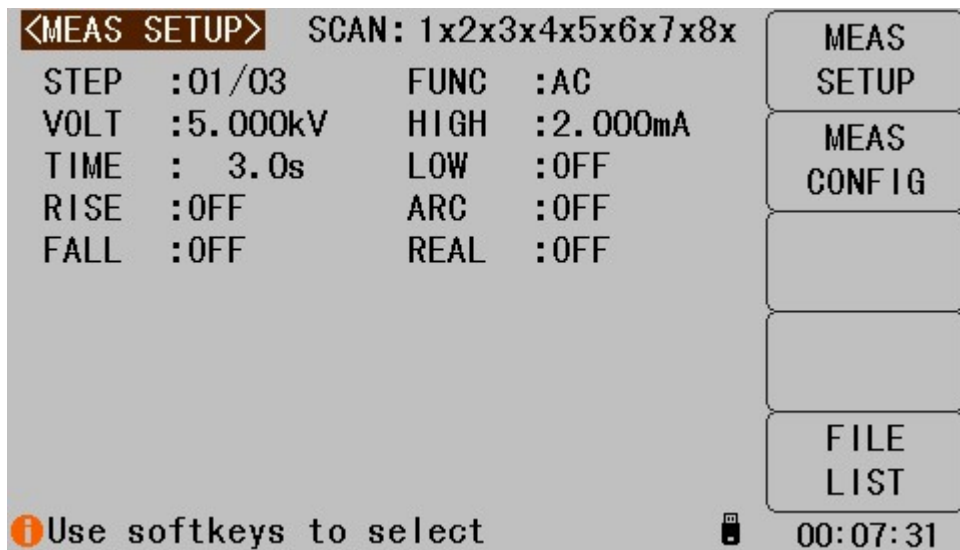


Figure 4-4

On this page, the following parameter can be set:

- Measurement steps(**STEP**)
- Measurement voltage(**VOLT**)
- Measurement time(**TIME**)
- Voltage rising time(**RISE**)
- Voltage fall down time(**FALL**)
- Test items(**FUNC**)
- High Limit(**HIGH**)
- Low limit(**LOW**)

- ARC value(**ARC**)
- REAL value(**REAL**)
- Scanning channels(**SCAN**)

■ **STEP: 01/01** **Test procedure: current setting No. / total items.**

Key	Function	Instruction
F1	INS	Within the current test program (PROG), it adds a new test item.
F2	DEL	Within the current test program (PROG), delete the current test item.
F3	NEW	Create a blank test program (PROG) (including a new test item), which is used to write a new test program.
F4	UP	Check the parameters of the step before the current displayed step
F5	DOWN	Check the parameters of the step after the current displayed step

■ **FUNC: AC** **Current operating mode of test procedure is AC withstanding voltage.**
Cursor in this position can switch to other working items by F1~F3, for instance **DC**、**IR**、**OS**.

■ **SCAN: 1X2X3X4X5X6X7X8X** **Connect multi-channel output and test terminal.**
SCAN channel: for U9053, 8 output channels is connected with test output terminal, there are open(X), high voltage output(H) and ground low terminal(L).

Other data **The test condition of current (AC) item (in 4.3 AC withstanding voltage setup) .**

4.3.4 <MEAS CONFIG>

On the <MEAS SETUP> page, press the soft key to enter into <MEAS CONFIG> page.

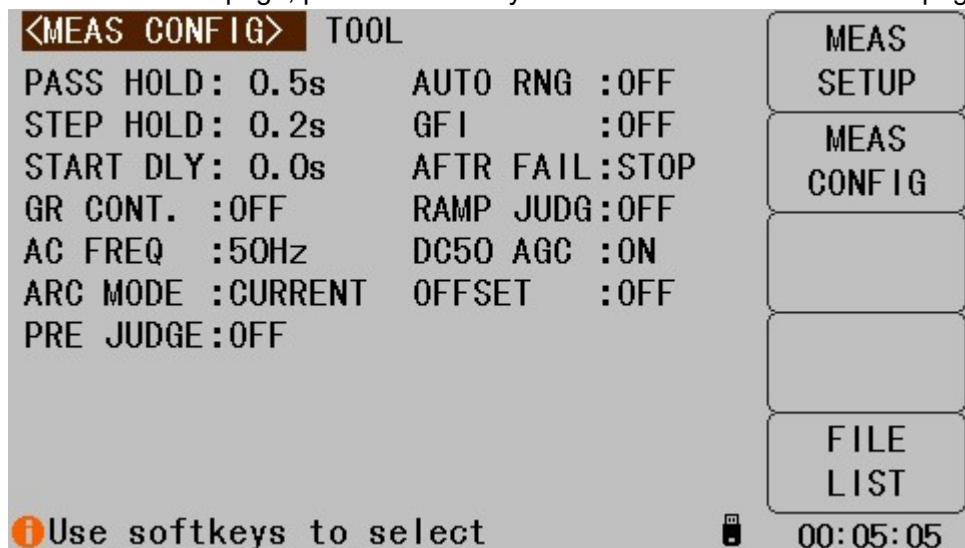
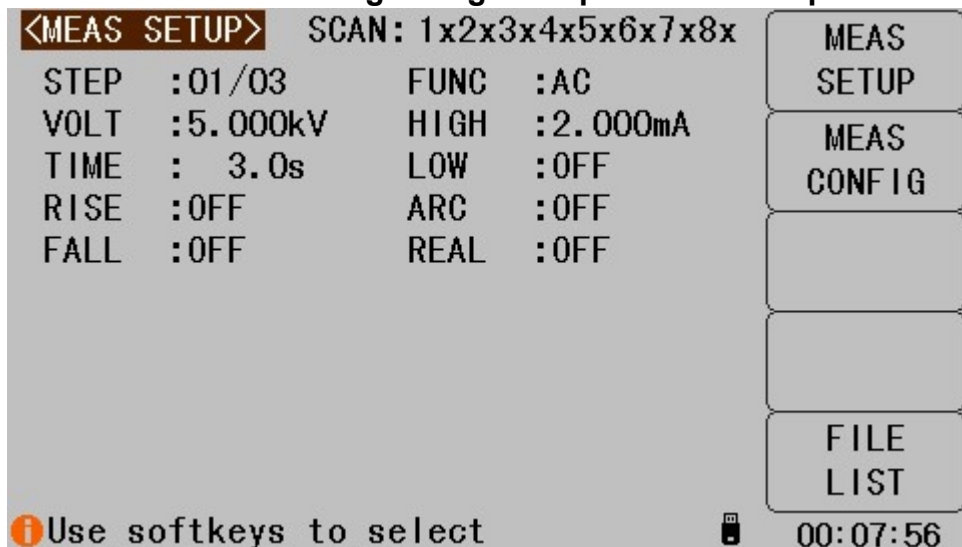


Figure 4-5

Label	Instruction	Definition
PASS HOLD:	0.2S~99.9S	Pass judge hold time.
STEP HOLD:	0.2S~99.9S	Waiting time.
	KEY	Press 'START' to test the next item.
START DLY:	0.1S~99.9S	
GR CONT:	OFF	No contact test in low terminal.
	KEY	Press 'START' to do contact test.
	0.2S~99.9S	Contact time setup.
AC FREQ:	50Hz, 60Hz	AC working frequency
ARC MODE:	CURRENT	
PASSWORD:	ON 、 OFF	Key lock setup.
PRE JUDGE	ON 、 OFF	
AUTO RANG:	ON 、 OFF	Automatically switch range before test end.
GFI:	ON 、 OFF	Discharge wall function.
AFTR FAIL:	STOP	Use 'STOP' to quit in fail result.
	CONTINUE	Continue the next step in fail result.
	RESTART	Retest in fail result.
RAMP JUDG:	ON、 OFF	Low limit judge in rising withstanding voltage.
DC50 AGC:	ON、 OFF	High voltage hardware feedback in DC50V-500V.
OFFSET:	OFF	

4.4 Test item interface and parameter setup

4.4.1 AC withstanding voltage test parameter setup:

**Figure 4-6** AC setup interface

Instruction:

VOLT:	0.005~5.000kV	Voltage value of AC high voltage test
-------	---------------	---------------------------------------

TIME:	OFF~0.2~999.9S	Test time of AC withstanding voltage
RISE:	OFF~0.1~999.9S	Voltage rising time of AC high voltage test
FALL:	OFF~0.1~999.9S	Voltage down time of AC high voltage test
HIGH:	0.01~30.00mA	Current high limit value of AC withstanding voltage
LOW:	OFF~0.001~30.00mA	Low limit current value of AC
ARC:	OFF~0.1~15.0 mA	Current Max. value of AC arc
REAL:	OFF~0.001~30.00mA	Real current high limit value of AC withstanding voltage

4.4.2 DC withstanding voltage test parameter setup (DC):



Figure 4-7 DC setup interface

Instruction:

VOLT:	0.050~6.000kV	Voltage value of DC high voltage test
TIME:	OFF~0.2~999.9S	Test time of DC withstanding voltage
RISE:	OFF~0.1~999.9S	Voltage rising time of DC high voltage
FALL:	OFF~0.1~999.9S	Voltage down time of DC high voltage test
CHEK:	ON OFF	DC capacitance load charge current test.
HIGH:	0.001~10.00mA	Current high limit value of DC high voltage
LOW:	OFF~0.001~10.00mA	Current low limit value of DC withstanding voltage
ARC:	OFF~0.1~10.0 mA	Current Max. value of DC arc
DWELL:	OFF~0.1~999.9S	DC charge waiting time

4.4.3 Insulation resistance (IR) test parameter setup:

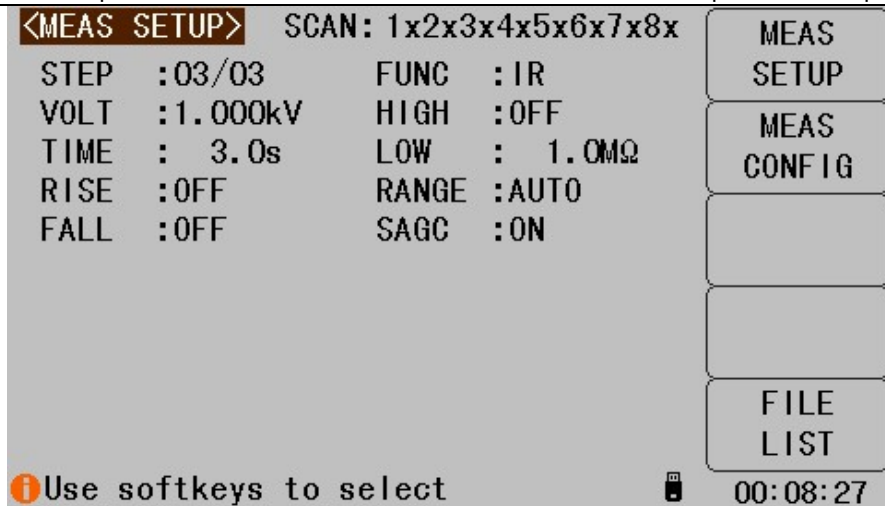


Figure 4-8 IR setup interface

Instruction:

VOLT:	0.050~6.000kV	Voltage value of IR test
TIME:	OFF~0.1~999.9S	Test time of IR.
RISE:	OFF~0.1~999.9S	Rising time of insulation voltage.
FALL:	OFF~0.1~999.9S	Down time of insulation voltage.
HIGH:	0.001~10.00mA	High limit value of IR
LOW:	OFF~0.001~10.00mA	Low limit value of IR.
RANG:	AUTO、300nA、3uA、30uA、300uA、3mA、10mA	Range control of IR.
SAGC:	ON、OFF	Software auto voltage control.

4.4.4 Open detection (OS) parameter setup:

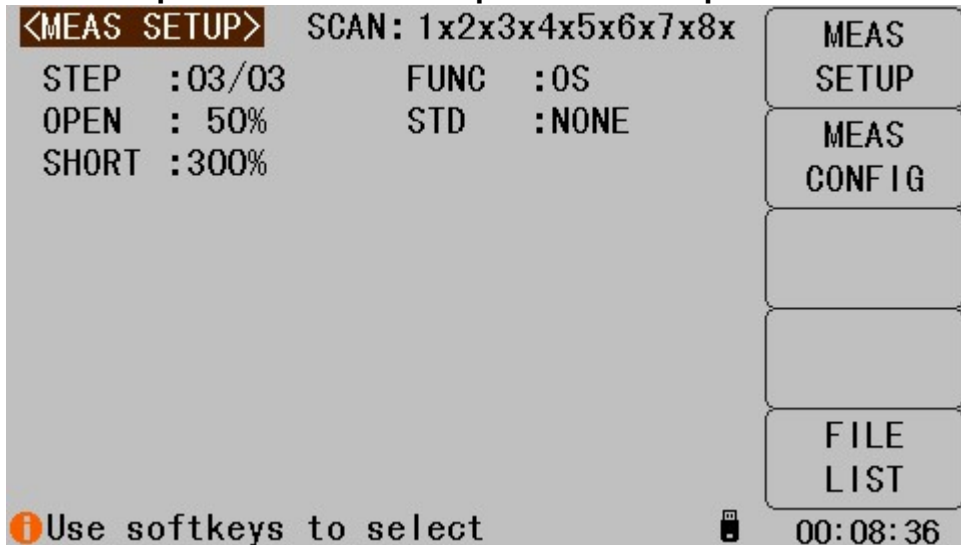


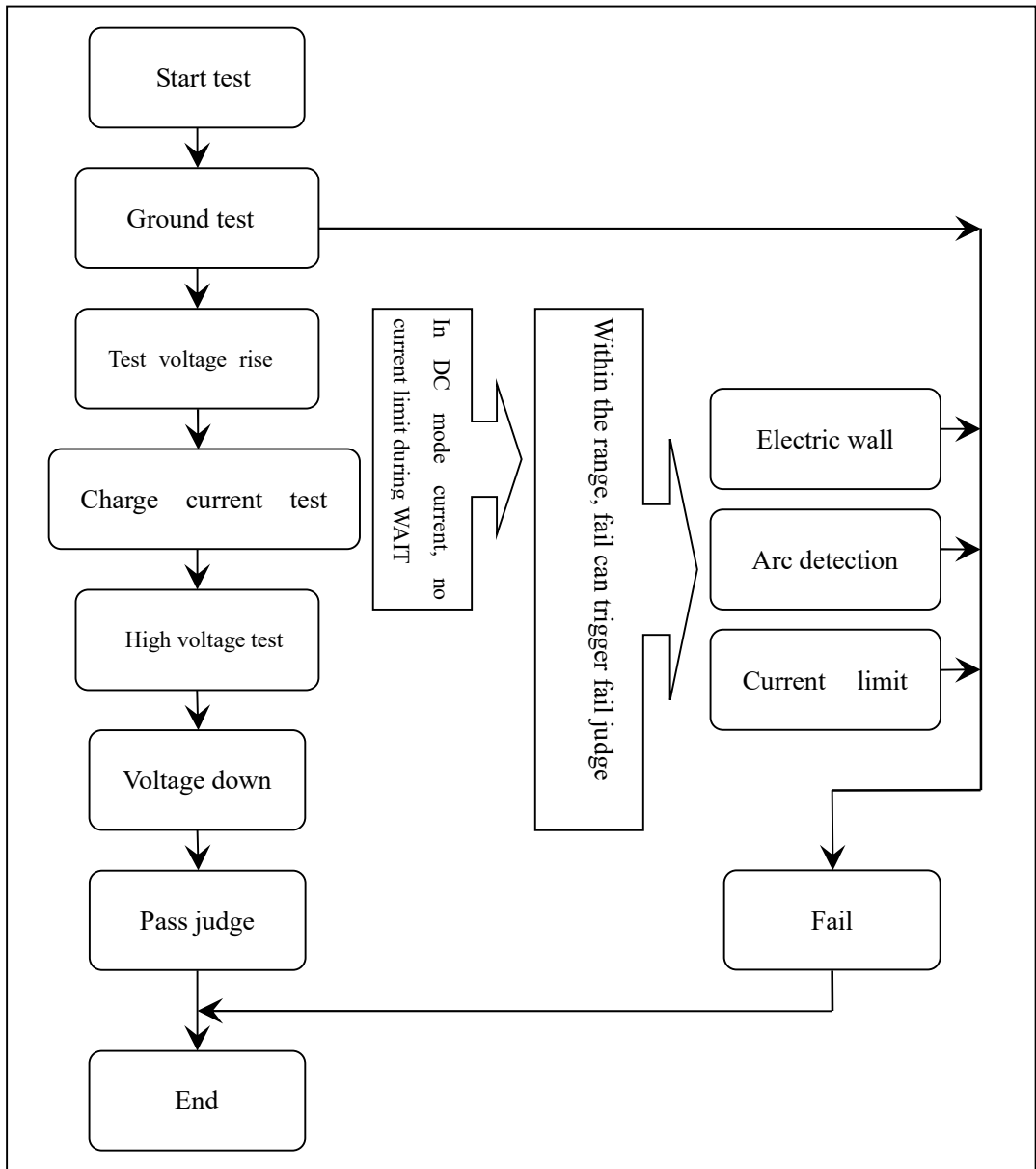
Figure 4-9 OS setup interface

Instruction:

OPEN:	1%~100%	Percentage of open judge value and standard value
SHORT:	OFF~100%~500%	Percentage of short judge value and standard value
STD:		Sampling standard value

- Note: 1. When the cursor is in the position as the table below, (F1) position displays (GET) .
2. Press (F1) function key, the instrument enters standard value sampling status. The instrument outputs 100V voltage in sampling, and the current flowing through the DUT can be obtained within 2 seconds. (**please be attention in voltage output**)
3. The capacitance value here is not the real capacitance value, but the value of the sampled current being transferred via impedance. The value should be close to that of capacitor installed in the test terminal. (The sampling current is not only generated by capacitor)

4.5 Test function theory and instruction



4.5.1 Ground connection test

Ground connection is used in testing device, now the low test terminal is connected to the ground terminal (shell), which is used to judge the reliability of ground connection. If the low terminal connection is not reliable, the shell of DUT takes high voltage in the

process of testing; it will cause the accident shock.

Instruction:

- High voltage test terminal is connected to the ground terminal of DUT.
- Test low terminal is connected to the ground connection terminal of shell.
- Ground check terminal is connected to other terminals of shell (screw) .
- Set ground connection test , test time is set by user.
- Start test, instrument firstly executes ground check: output current from ground check, and flows back to test low terminal shown as the figure.
- If the test circuit connection is normal within the set time (if circle resistance < 1ohm, it is normal), the ground check is passed and test continues.
- If test circuit is not available (if circle resistance > 1ohm, it is abnormal), the instrument will quit testing, and displays connection error (**GR CONT.**) .

Note: Ground breakover parameter is the GR CONT in **MEAS CONFIG** interface.

4.5.2 Electric wall function

Electric wall is used to check the ground current and avoid shocking in the process of testing. When outputting high voltage, the current from voltage output terminal will be back to shell through body, it will cause a serious result.

Instruction:

- When starting electric wall, if ground current is larger than 0.5mA, it judges as shock.
- When electric wall is closed, if ground current is larger than 30mA, it judges as shock.
- When the judge is shock, the instrument will output high voltage within 0.3S, and quit test status, as well as display **GFI FAIL**.

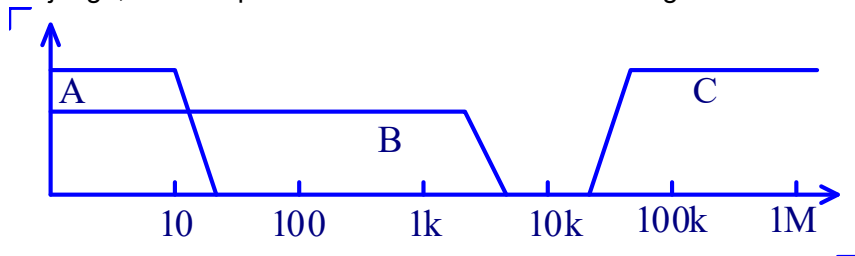
Note: when ground current reaches to 30mA, it is so serious that it will cause the operator coma or death. It is suggested to open electric wall.

4.5.3 Current over limit and arc detection (ARC) function

Current over limit is divided as: current low and high limit, current range over limit, arc detection.

- Current low limit judge (**LOW**): generally for judging low terminal break. When instrument tests device, there must be a certain leakage current, when the leakage current is smaller than the set current value, it means fail, if the leakage current of DUT is quite small, then it is not necessary to turn off the function. It displays (**LOW FAIL**) in over limit.
- Current high limit judge (**HIGH**): When instrument tests device, there must be a certain leakage current, when the leakage current is larger than the set current value, it means fail. It displays (**HIGH FAIL**) in over limit.

- Current range over limit (**RANGE**): current sampling judge is slow, and sometimes the current changes quickly so that sampling circuit can't reflect, otherwise, if current has passed the range of current test, it would trigger the over limit judge. It displays (**RANGE FAIL**) in over limit.
- Real current high limit judge (**REAL**): DUT is considered as capacitive, and the capacitor takes current in AC test. When the capacitive change is big, then the capacitive current has nothing to do with the test result, now you can select real current judge which only judges the current of same voltage phase. It displays (**REAL FAIL**) in over limit.
- (ARC) : It is a practical function in component test, which tests the instant fire in partial circuit of high voltage. Because the speed of partial fire is quite fast, and the filter coefficient of common current detection circuit is so large that it can't make a suitable judge, so use specific circuit to deal with the change of fast current pulse.



Current over limit judge and frequency response contrast of arc detection: (in the figure above)

- Zone A: current response of current sampling display, the power ripple has to be filtered, so the analyze response rate is 0.1S class.
- Zone B: sampling analyze circuit rate is too slow, and long-time over-flow may cause the damage of DUT, as well as effect the output circuit. In circuit, current fast response circuit is added for compensating slow sampling response. It can response the over-flow signal quickly, but if current waveform is big, high accuracy contrast can't be performed, but over range judge.
- Zone C: Arc detection circuit. There is air breakdown in high voltage, which causes the partial high frequency self-motivation. There is low frequency current in current sampling circuit, and the fast signal can't be handled meanwhile. Arc detection circuit only samples the changeable amplitude to find the potential defect in current return circuit.

Chapter 5 System and File

5.1 SYSTEM SETUP

Press [**System**] to enter into the <SYSTEM SETUP> page shown as below.



On this page, most system setup items are displayed, such as instrument skin, language, PASS alarm, FAIL alarm, password, bus mode, GPIB address, baud rate, data/time.

SKIN

The function of this zone is to set the theme of display.

Operation steps for setting the theme of display

- 1) Move the cursor to **SKIN**, the following soft keys will be displayed.
 - GRAY
 - BLACK
 - BLUE
 - CYAN
- 2) Use above soft keys to select the theme of display.

LANGUAGE

This zone is used to control and display the current language mode of the operating instrument.

Operation steps for setting language

1) Move the cursor to Language, the following soft keys will be displayed.

- English

This soft key is used to select English as the operation language.

- 中文

This soft key is used to select Chinese as the operation language.

PASS ALARM

This zone is used to control and display the beep mode when the test result is qualified.

Operation steps for setting PASS ALARM

1) Move the cursor to PASS ALARM, the following soft keys will be displayed.

- CONTINUE

This soft key is used to set the pass beep function as continued.

- GAP

This soft key is used to set the pass beep function as discontinued.

- PASS VOL.OFF

This soft key is used to select the beep sound level.

FAIL ALARM

This zone is used to control and display the beep mode as **FAIL ALARM** when the test result is unqualified.

Operation steps for setting FAIL ALARM

1) Move the cursor to FAIL ALARM, the following soft keys will be displayed.

- CONTINUE

This soft key is used to set the fail beep function as continued.

- GAP

This soft key is used to set the fail beep function as discontinued.

- FAIL VOL.OFF

This soft key is used to select beep sound level.

KEY SOUND

Operation steps for setting key sound

- 1) Move the cursor to **KEY SOUND**, the following soft keys will be displayed.
 - **OFF**
 - **ON**
- 2) Use above soft keys to turn OFF/ON the key sound.

PASS WORD

This zone is used to display the password –protection mode.

Operation steps for setting the password

- 1) Move the cursor to Password, the following soft keys will be displayed.
 - **OFF**
This soft key is used to turn off the password protection mode.
 - **KEYLOCK**
This soft key is used to protect unlock keyboard.
 - **Hold SYSTEM**
This soft key is used to turn on the password protection function including file protection and starting up password.
 - **Hold FILE**
This soft key is used to protect user's file.
 - **MODIFY**
This soft key is used to modify the password. The operation steps are as follows:
Press **MODIFY** to input a new password. After inputting, a prompt information will appear on the screen to prompt you to confirm the new password. Input the new password again till the modification finishes.
-

Note: The default password is 123456.

SAVE TYPE

Operation steps for setting the type of files

- 1) Move the cursor to **SAVE TYPE**, the following soft keys will be displayed.
 - **CSV**

- **TXT**
- **GIF**
- **BMP**
- **PNG**

2) Use above soft keys to select the type of files.

LOAD SET

Operation steps for setting the type of LOAD SET

- 1) Move the cursor to **LOAD SET**, the following soft keys will be displayed.
 - **LAST**
The instrument call the setup settings same as the last shutdown.
 - **FILE**
The instrument call the setup settings from the last used file.
 - **DEFAULT**
The instrument call the default setup settings.
- 2) Use above soft keys to select the type of load set.

BUS MODE

This mode is used to select RS232C, USBTMC or USBCDC.

Operation steps for setting bus mode

- 2) Move the cursor to **BUS MODE**, the following soft keys will be displayed.
 - **RS232C**
 - **USBTMC**
 - **USBCDC**
- 3) Use above soft keys to select the required interface bus.

Note: GPIB optional must be installed before GPIB mode is available.

BUS ADDR

Operation steps for setting the BUS address

- 1) Move the cursor to **BUS ADDR**, the following soft keys will be displayed.
 - **↑(+)**
Press this key the instrument will increase the set value by one.

- ↓(-)

Press this key the instrument will decrease the set value by one.

BAUD RATE

Baud rate is used select the baud rate of the RS232C interface. The available baud rate of this instrument is from 1200 to 115.200k.

Operation steps for setting the baud rate

- 1) Move the cursor to **BAUD RATE**, the following soft keys will be displayed.
 - 1200
 - 9600
 - 19200
 - 38400
 - 57600
 - 115200
- 2) Use above soft key is to set the baud rate.

DATA/TIME

When moving to the time zone, user should input the password to enter.

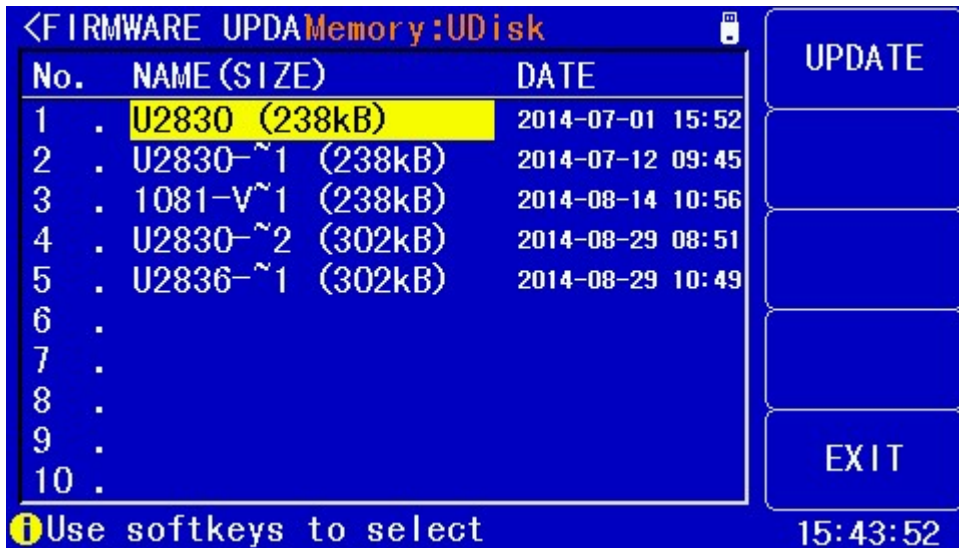
5.2 SYSTEM INFORMATION

Press **SYSTEM INFO** enter into the **<SYSTEM INFO>** page shown as below.



5.3 FIRMWARE UPDATE

- 1) Press **FIRMWARE UPDTE** enter into the **<FIRMWARE UPDATE>** page shown as below.



- 2) Press **UPDTE**, the following soft keys will be displayed.
- **YES**
 - **NO**
- 3) Press **YES** soft key to update the firmware of the instrument.

5.4 SYSTEM TEST

- Press **SYSTEM TEST** enter into the **<SYSTEM TEST>** page shown as below.



5.5 FILE

U9053 instrument can save the user-set parameter to the nonvolatile memory in the form of file, so when use the same setting next time user can load a corresponding file to obtain the parameter set and used last time. By doing so, it can save the time of setting parameter and improve the production efficiency. The file manage function of the transformer scanning will be described in the part of transformer test setting.

Press [FILE] to enter into the file manage page, shown as below.

