Usermanual

ST4028 High Voltage Tester

AC/DC Withstanding

Voltage/ Insulation

Resistance Tester

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Announcement

The description of the manual may not cover all contents of the instrument, and our company is subject to change and to improve the performance, function, inner structure, appearance, accessory and package of the instrument without notice. If there is puzzle caused by inconsistency of manual and instrument, then you can contact with our company by the address on the cover.

1 Chapter 1 Setup

This chapter describes the procedures from unpacking to installation to operation checking.

1.1 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 Kust Elektronik GmbH distributor/agent.

Items	Quantity
ST4028	1
Withstanding-voltage test leadwires	1
Withstanding-voltage ground leadwires	1
3A（220V）/5A（11 0 V） Fuse	1
AC Power cord	1
Operation Manual	1
Test Report	1
Servicing card	1
Accessories ordered by customers	1

1.2 Precautions for Installation

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

- **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.

- **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

- **A void 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.

- **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.

- **Do not locate the tester in a dusty environment**.

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

- **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.

■ **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.

■ **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.

■ **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).

1.3 Precautions for Moving

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

■ **Before moving the tester, turn off the power switch.**
Transporting the tester with its POWER switch on can lead to electric shock and damage.

■ **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.

1.4 Checking power source and fuse

■ **Toggle power line voltage**

⚠ **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):
100V：AC（90V to110V AC）
120V：AC（108V to 132V AC）
220V：AC（198V to 242V AC）
240V：AC（216V to 260V AC）
Allowable frequency range: 47 Hz to 63 Hz

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

■ **Checking or 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	500VA
200-240V		3A	

1.5 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 an AC power cord for other instruments.
Connection procedure:

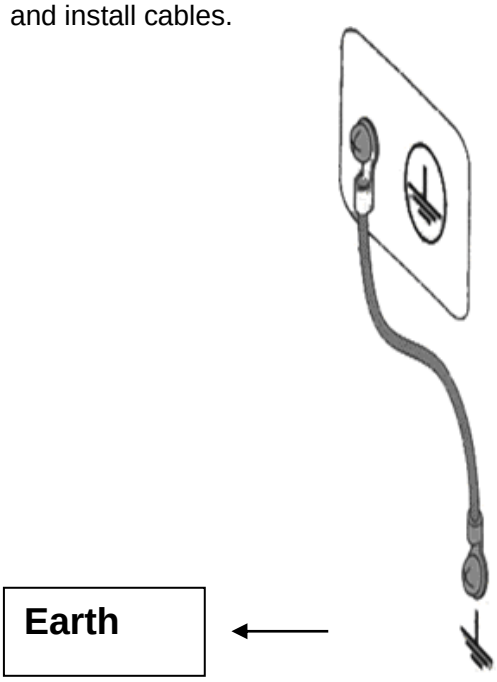
1. Confirm that the supply voltage is within the line voltage range of the tester.
2. Confirm that the line power is correctly selected.
3. Confirm that the POWER switch on the tester is off.
4. Connect the AC power cord to the AC LINE connector on the rear panel.
5. Use the provided power code or power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

1.6 Grounding

WARNING Be sure to connect the tester to an electrical ground (safety ground). If the output to a conveyer 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 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.



1.7 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. Following the opening screen, display the ACW screen
5. Turn off the POWER switch.
6. Turn on the POWER switch again.
7. Following the opening screen, display the ACW screen and confirm that the tester is kept in the READY status. The above steps complete the checking procedure.

1.8 Other specifications

1. Power：≤500VA
2. Dimensions：350mm*130mm*385mm；
3. Weight：16kg.

2 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 derivers, 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

■ 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.

■ 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.

■ 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

■ Wearing Insulation Gloves

When handling the tester, be sure to wear insulation gloves in order to protect yourself against high voltages.

■ 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.

■ Items Charged Up to Dangerous High Voltages

When in test, the DUT, test lead wires, 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 lead wires which are supplied accompanying the tester have no sufficient insulation for the high test voltages. Never touch them when in test.

■ Matters to be Sure of After Turning-OFF Power

If you have to touch the DUT, test lead wires, 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.

■ 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 lead wires, 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 Kust Elektronik GmbH 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 ≤4	AC	>20mA	At least as long as the output time	Maximum of 1 minute
		<10mA	Not necessary	Continuous output possible
	DC	>6mA	At least as long as the output time	Maximum of 1 minute
		<4mA	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 input source complies with the standard and the tester power configuration is correct.
2. The tester is connected to an earth ground.
3. The coating of the high-voltage test lead wire is free from cracks, fissures, and breakage.
4. The low-voltage test lead wire is not broken.
5. The tester generates FAIL signal when the ends of the low-voltage test lead wire and high-voltage test lead wire are short-circuited.

3 Chapter 3 Part names and Functions

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

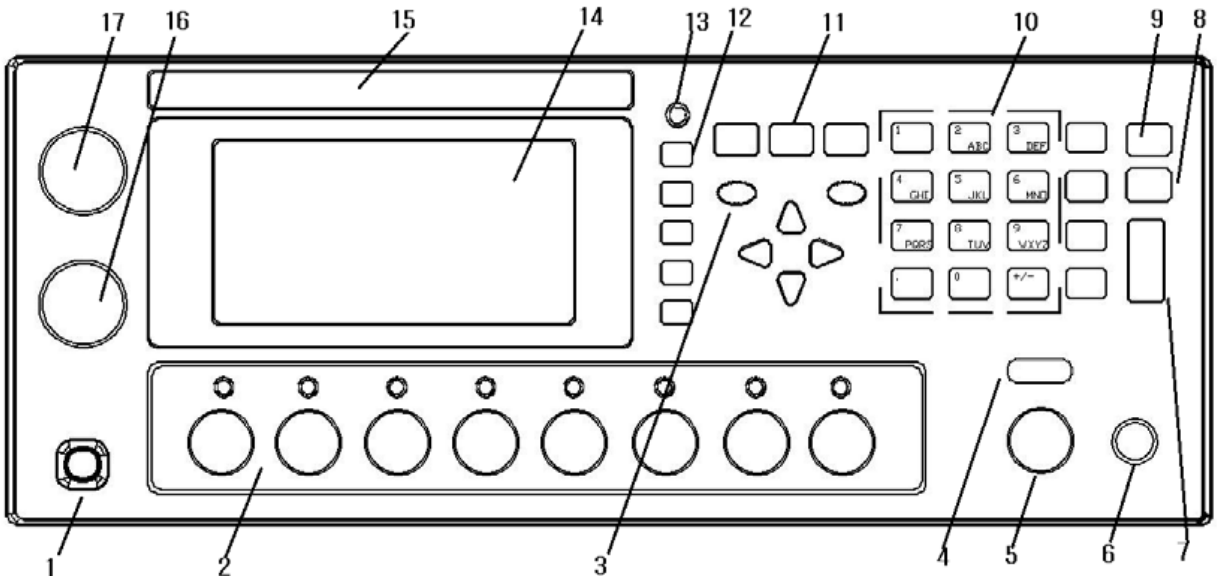


Figure 3-1

1. POWER

Power switch. Operators should check the power types and whether the test line connections are normal.

2. 8 channel sweep interfaces

Internal 8 channel sweep output interface.

3. Indicator

● **PASS**

Indicate a test result, it lights in PASS；

When time function is off,（TIMER OFF）， no PASS judge.

● **FAIL**

Indicate a test result, it lights in FAIL.

4. HV Indicator

*DANGER！！*In the process of testing, it lights in output voltage.

5. Output voltage HIGH terminal

High voltage terminal in test voltage output.

Warning：In the process of testing, don't touch the high terminal

Caution： if external voltage is used in test terminal, it will cause the damage of internal circuit.

6. Test low terminal, test current return terminal (LOW/RET)

High and low voltage terminal in test voltage output.

Warning：In the process of testing don't touch the high terminal

Caution： if external voltage is used in test terminal, it will cause the damage of internal circuit

7. USB interface

Externally connect to USB storage

8. OFFT key and Indicator

Used to open or close the Offset function.

9. KEYLOCK key and Indicator

Used to open or close the key lock function.

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

Select mode, system, interface.

● **TEST**

Press the key, and the corresponding key lights, the instrument is ready to test.

● **SETUP**

Press the key, and the corresponding key lights, the instrument enters parameter setting；

● **SYSTEM**

Press the key, and the corresponding key lights, display system setting interface；

● **MEMORY**

Press the key in the SETUP page, and the corresponding key lights, the SAVE window is used to save the currently edited test program; while the LOAD window is used to retrieve saved data, you can set the selected data as the default scheme.

12. Shortcut key（F1-F5）

Corresponding with the function operation or shortcut key on LCD.

13. FILE

Press the key and the corresponding key lights, the file operation interface will be displayed;

14. LCD screen

480*272 TFT dot- matrix LCD screen, display setting and test interface etc.

15. Brand and model

Brand and model

16. STOP

Stop key, used to cancel the test, or PASS、FAIL status.

17. START

Start up the instrument, once test starts, “TEST” will be displayed on the screen, TEST indicator lights.

3.2 Instruction of rear panel

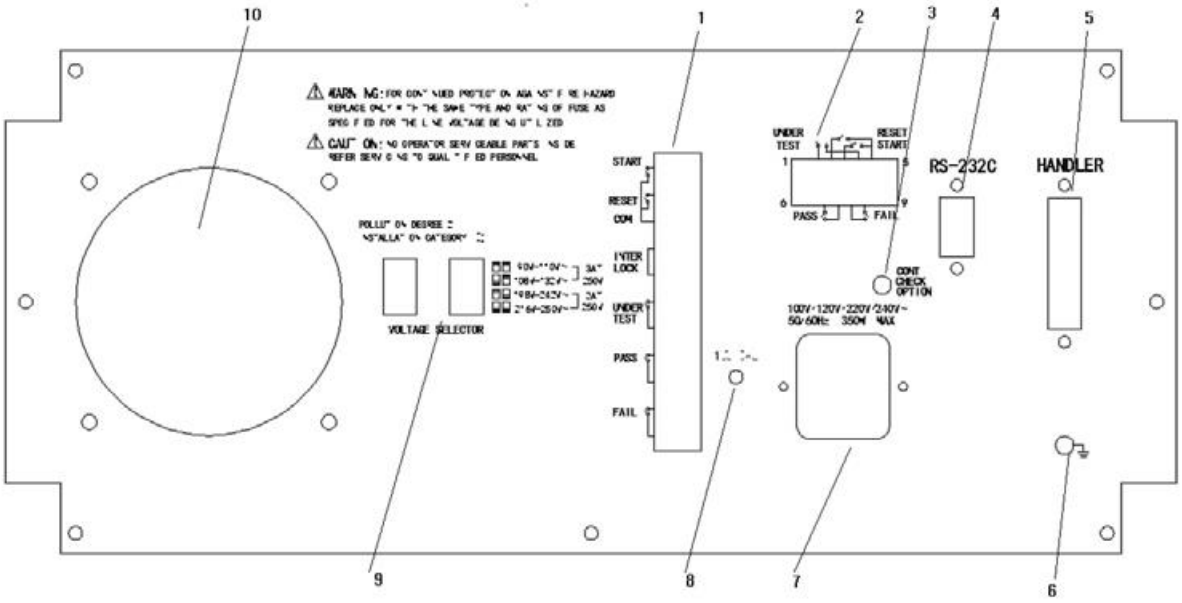


Figure 3-2

i. 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:** Input the reset signal for stopping high voltage output, corresponding to STOP signal on the front panel.
- **PASS:** The output pass signal of the instrument, corresponding to PASS instruction on the front panel.
- **FAIL:** The output fail signal of the instrument, corresponding to FAIL instruction on the front panel.

ii. HANDEL interface

Use 9 core model D jack to output.

iii. 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.

iv. RS232C serial interface

Serial communication, realize the communication with computer.

v. Optional HANDEL interface

Optional hander interface as your requirement.

vi. Protective earth terminal

Be used to connect instrument to ground.

vii. Power jack

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

viii. Ground break-over calibration

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

ix. Line voltage range

Switch of input voltage range.

x. Fan

Power amplifier circuit radiator.

3.3 Description

ST4028 Provide 5kVAC/30mA withstanding voltage, 6kVDC/10mA withstanding voltage and insulation resistance with scanning test.

In high voltage modular, there is an 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, ST4028 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, ST4028 not only can perform the independent AC withstanding test, DC withstanding voltage test, insulation resistance test, but also multi –item test via the setting of test programme. ST4028 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.

Feature：

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

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

- **AC withstanding voltage test 5kV/**30mA

In ST4028 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）.

ST4028 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 ±3%. It's not necessary to adjust output voltage after setting test voltage.

Figure 3-3 AC voltage load adjusting rate

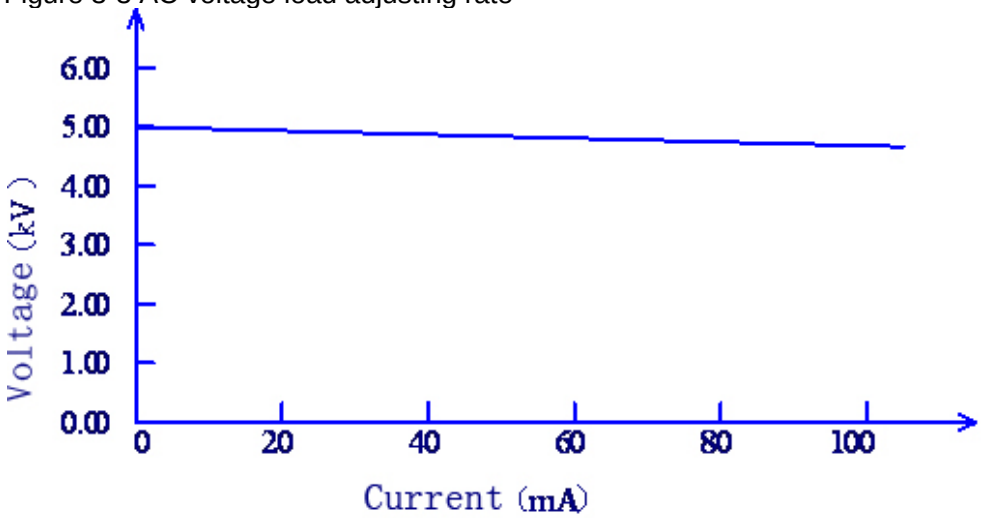


Figure 3-3 AC voltage load adjusting rate

■ DC withstanding voltage test 6kV（Max. output power is 50W）
ST4028 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≤1%.

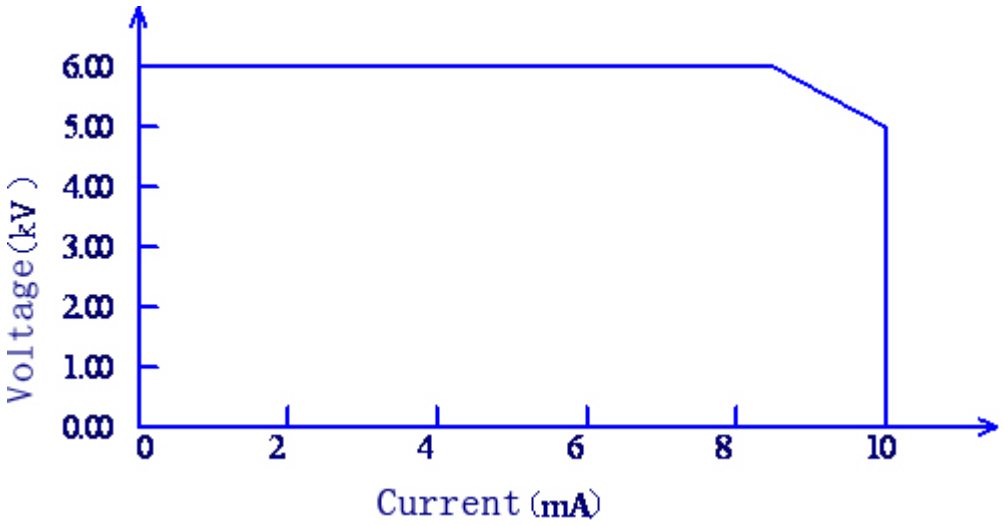


Figure 3-4 DC voltage output range

■ **Insulation resistance test 50V to 1000V（resolution of 1V）/0.1MΩ to 50.0GΩ (Max. rated current range is from 10mA to 50nA)**
Insulation resistance test range: When the voltage is less than 500V: 0.1MΩto 1GΩwith accuracy of ± [10% reading +5 digits].
When the voltage is greater than 500V: 0.1MΩto 1GΩ with accuracy of [5% reading +5 digits], 1GΩto 10GΩ with accuracy of [10% reading +5 digits], 10GΩto 50GΩ with accuracy of [5% reading +5 digits].

■ **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.

■ **PLC and HANDLER interfaces bring convenience for the connection and control**.
PLC and HANDLER interfaces can input START, STOP and INTERLOCK signals and output TEST, PASS and FAIL signals. Connecting with a footswitch, they can construct a foot-control device; while connecting with simple test fixtures, they can realize safety interlock, air controls, test indication, etc.

■ **USB interface for backup**
Through the USB interface equipped by all testers except ST4028, tester programmed test programs and customer's measuring file can be saved to or recalled from an external U disk, which is convenient to set, use and file a batch of testers.

■ **High voltage scanner can realize the control function flexibly**
ST4028 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.

■ **Waiting time setup function**
ST4028 series can set the test waiting time from 0.1s to 99.9s by a resolution of 0.1s. In this period, the tester will output TEST control signals. They are used to control external devices and ensure a reliable connection. After that high voltage measurement will be enabled.

■ **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 999s. ST4028 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 999s（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. ST4028 has the enforced rapid discharge function after DC withstanding voltage test and insulation resistance test finish.

■ **Reinforced safety**
In order to improve the safety, ST4028 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**
ST4028 series is voltage digital display, in withstanding voltage test, the accuracy is ±（1%reading +30V）, in insulation resistance test, is±（1% reading +1V）. the digital display of test current is ±（3% reading +20μA）in withstanding voltage test.

■ **Current correction function**
AC withstanding test needs high sensitivity and voltage, the stray capacitance effects the accuracy of current test. ST4028 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**
ST4028 series are quite easy to be operated. In the setup interface, the test condition is listed. Set test condition, use direction keys to select a topic from the\LCD display, then rotate code switch. 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 10000 test items totally.
It can edit 100 test programs 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 no interactive; the memory can save 10000 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.

■ Small dimension and light
Used for Max.150VA AC withstanding voltage test, ST series are all small and light.

Instruction for options:
■ 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.

⚠ **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.

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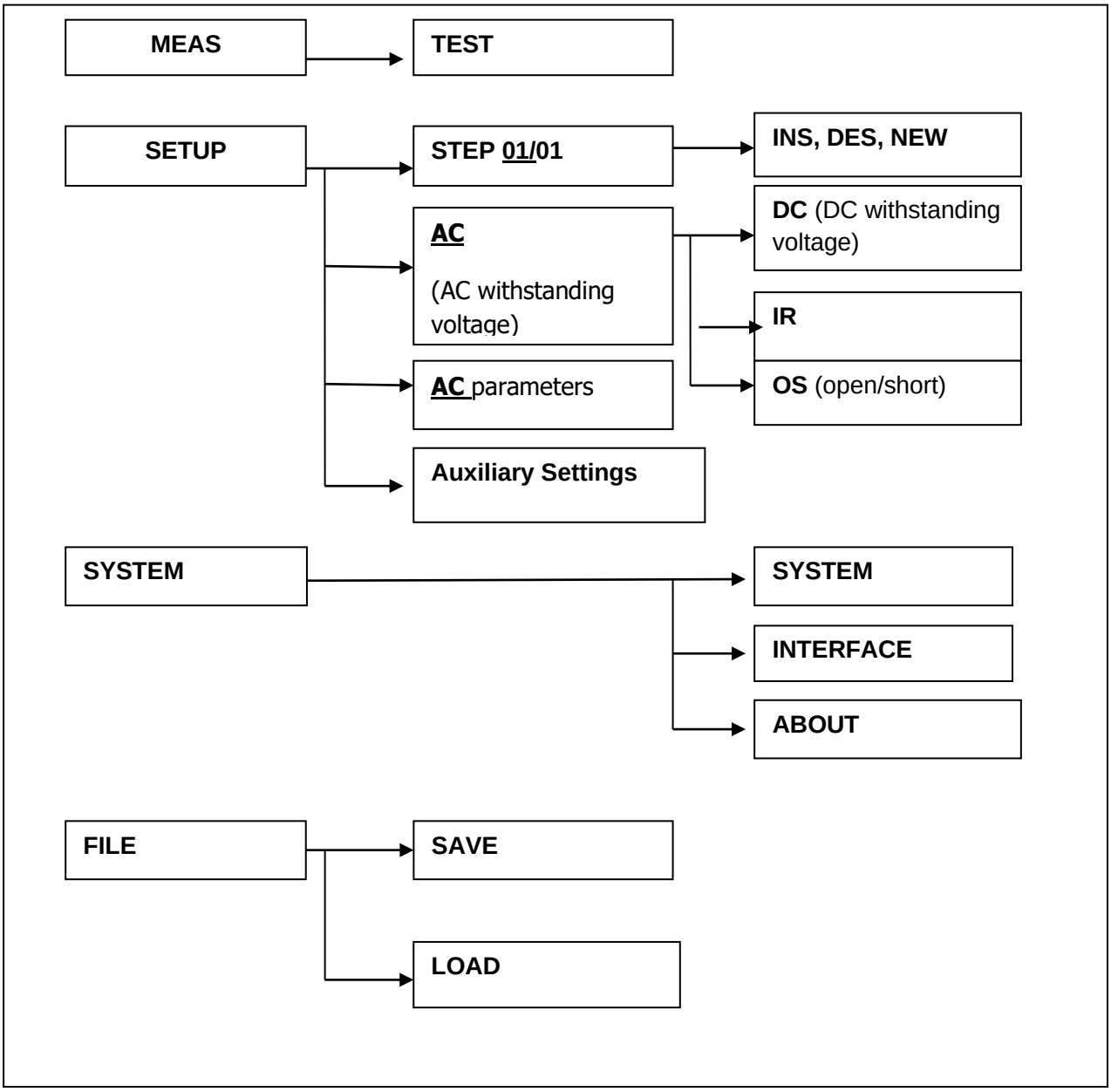
4 Chapter 4 Basic operation

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

4.1 Interface structure overview

The following figure is the interface structure:



Operation Steps

Introduction to the interface:

- The first line in the interface structure shows the initial states corresponding to the function keys on the panel. Because the TEST interface cannot modify parameters, it is not mapped out in above figure.
- The second line in the interface shows the parameter structures of the initial interface. For example: STEP 01/01 in the SETUP interface means that it is the step 1 of the scheme and the total steps is 1; AC: means the AC withstanding voltage test interface; AC parameter means that other parameters are AC withstanding voltage test parameters.
- The third line in the interface is the function toggle interface. When some function labels are selected in the second interface, the corresponding functions can be changed and their relative parameters will also vary. For instance, changing AC to DC, the tester will change from the AC withstanding voltage test mode to the DC withstanding voltage test mode, and the current AC parameter will be changed into DC parameter.

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

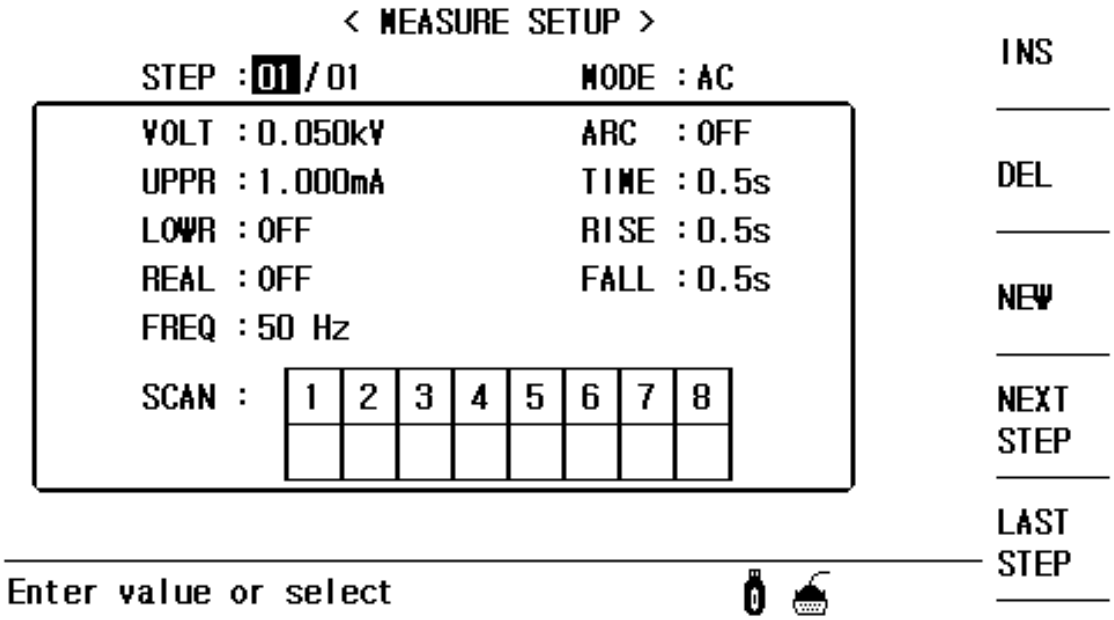
- 1. Confirm that the allowable voltage range shown on the power supply is the same as that indicated on the tester's rear panel.
- 2. Confirm that the AC power cord is properly connected to the AC LINE connector on the rear panel.
- 3. Plug in the AC power cord.
- 4. Turn on the tester's POWER switch.
- 5. Following the opening screen that displays the ROM 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

This section is mainly describe the function interface and relevant parameter in accordance with the order of software process and interface relevance.

- Initial state introduction of the instrument

1. After starting up, the system enters into the last used setup interface before shutdown last time.
2. The default set of the instrument is single step, AC withstanding voltage and default parameters. As shown below.
3. The default cursor of the default interface is the interface switch. Other interface can be chosen directly.



Default interface diagram of the instrument

Four function keys can be directly used to realize the interface switch, namely TEST, SETUP, SYSTEM and FILE. The interface function will be introduced separately below.

- Basic function operation of panel:

MEAS:	Instrument enters waiting status, the high voltage test starts.
SETUP:	Change the previous interface of test program, test item, and test parameter. The change of test program is finished in this interface.
SYSTEM:	Enters the set interface related with test safety and the working mode.
FILE:	Save and load the test program, relating to the data storage.
▼▲◄►:	Cursor can move freely among each parameter.
F1~F5:	Change the selected data by coordinating with the contents in soft key function display zone.

4.3.1 (SETUP）：

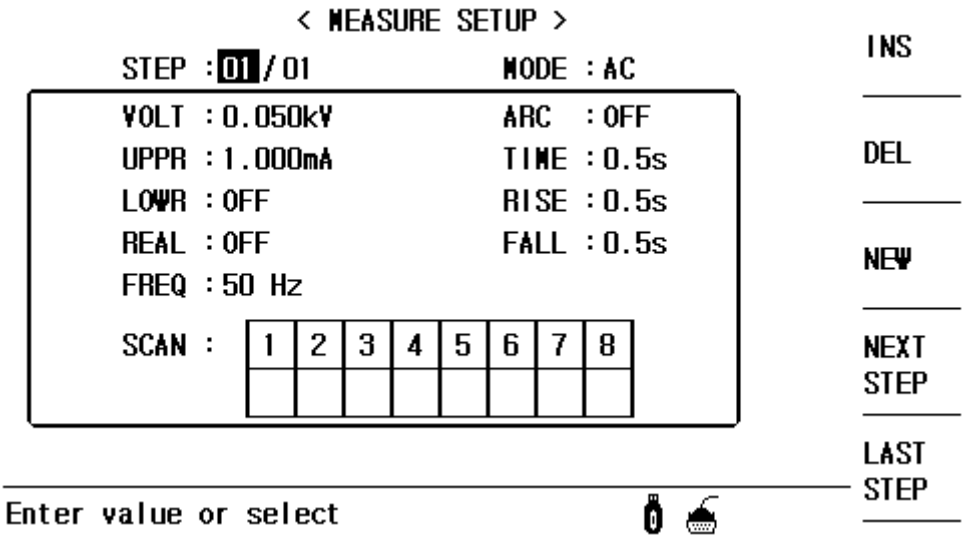


Figure 4.3.1 AC setup interface

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

Key	Function	Instruction
F1	INS	Within the current test programme（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	NET STEP	Visit the parameter of the step after the current displayed step.
F5	LAST STEP	Visit the parameter of the step before the current displayed step.

<u>AC</u> Current operating mode of test procedure is AC withstanding voltage.
The current working mode of the test item is AC withstanding voltage. Cursor in this position can switch to other working items by F1~F4, for instance **DC、IR、OS.**

SCAN: 1 2 3 4 5 6 7 8 Connect multi-channel output and test terminal.
SCAN channel: as for ST4028 with multi-channel, 8 output channels is connected with test output terminal, there are open, high voltage output and ground low terminal.

Other data the test condition of current （AC）item in (AC withstanding voltage setup).

4.3.2 （MEAS） ：（Take AC for example）

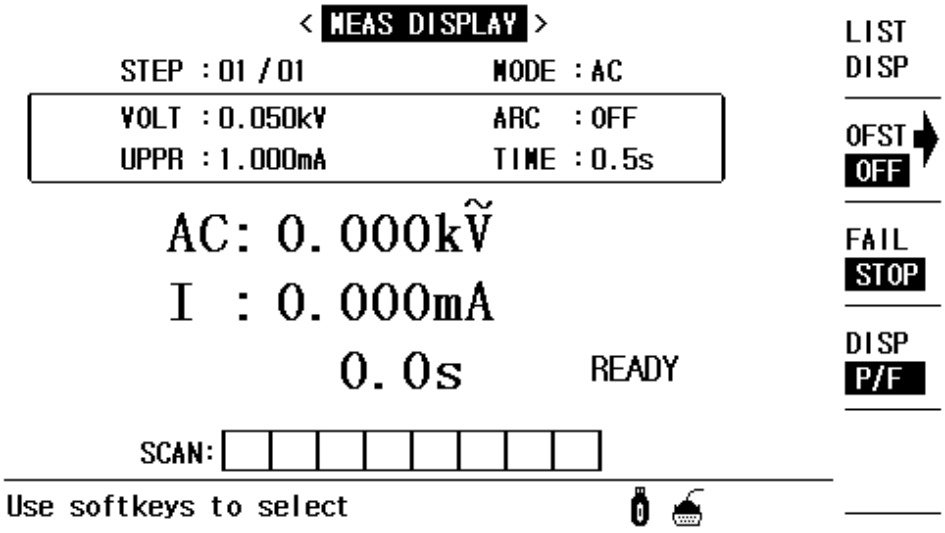


Figure 4.3.2 AC test

Note:

1. **Press TEST to enter set interface**
2. **The high voltage can only be started on this interface to test high voltage. Other test conditions have to been set on setup interface. The test procedure is as below** :

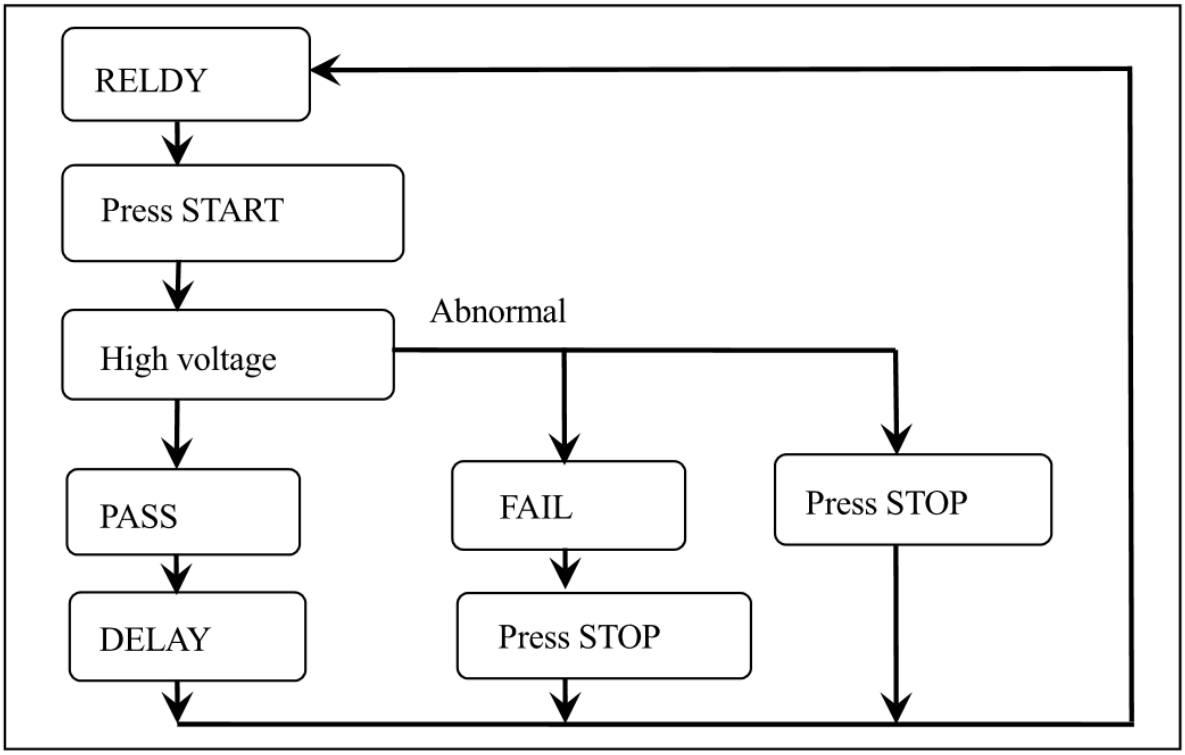
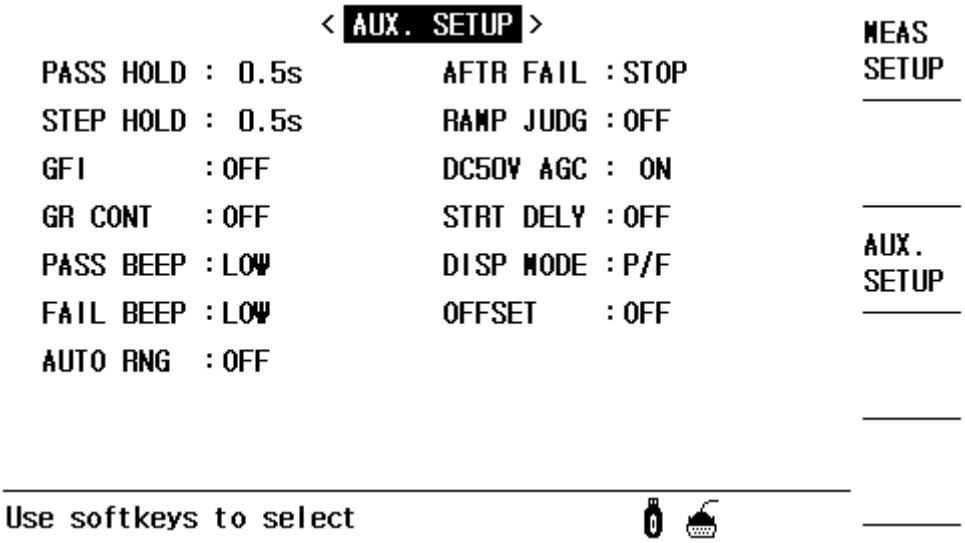


Figure 4.3.3 Test procedure

3. **The function key KLOCK can lock the keyboard. When the keyboard is locked, only three keys: START, STOP and KLOCK are usable. Otherwise, the unlocking operation is also controlled by the PASSWORD function in the SYSTEM interface.**

The three large font data in the middle of the front panel is the real time test data. The top one is high voltage output voltage, the unit is（kV）.
The middle one is the tested current of low terminal, the unit is（mA） and（uA）.
The bottom one 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.

4.3.3 （SETUP2）

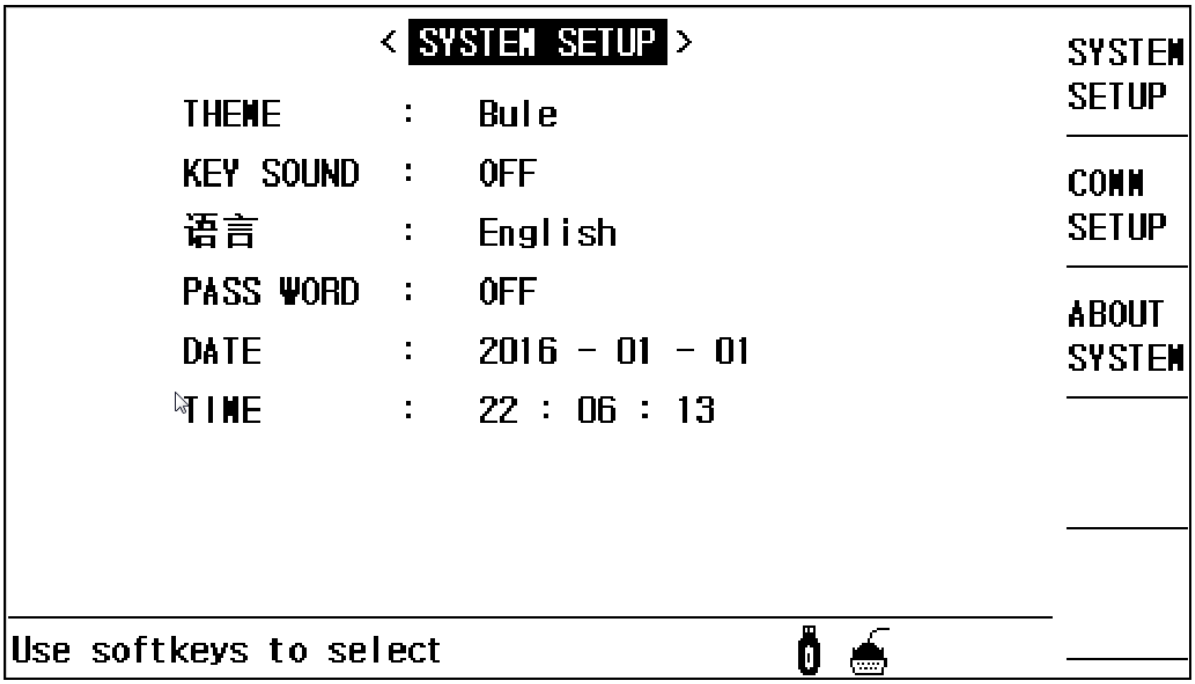


4.3.4 SETUP2

Instruction:

Label	Instruction	Definition
PASS HOLD：	0.2S～99.9S	Pass judge hold time.
STEP HOLD：	0.0S~99.9S	Waiting time.
	KEY	Press ‘ START’ to test the next item.
GFI：	ON ， OFF	Discharge wall function.
GR CONT：	OFF	No contact test in low terminal.
	KEY	Press ‘START’ to do contact test.
	0.2S~99.9S	Contact time setup.
PASS BEEP	OFF	None
	LOW	Low volume
	HIGH	High volume
FAIL BEEP	OFF	None
	LOW	Low volume
	HIGH	High volume
AUTO RANG:	ON ， OFF	Automatically switch range before test end.
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.
STA DELY	OFF~0.1~99.9S	Set the test delay time.
OFFSET	OFF~ON~GET	Set the clear of base number.

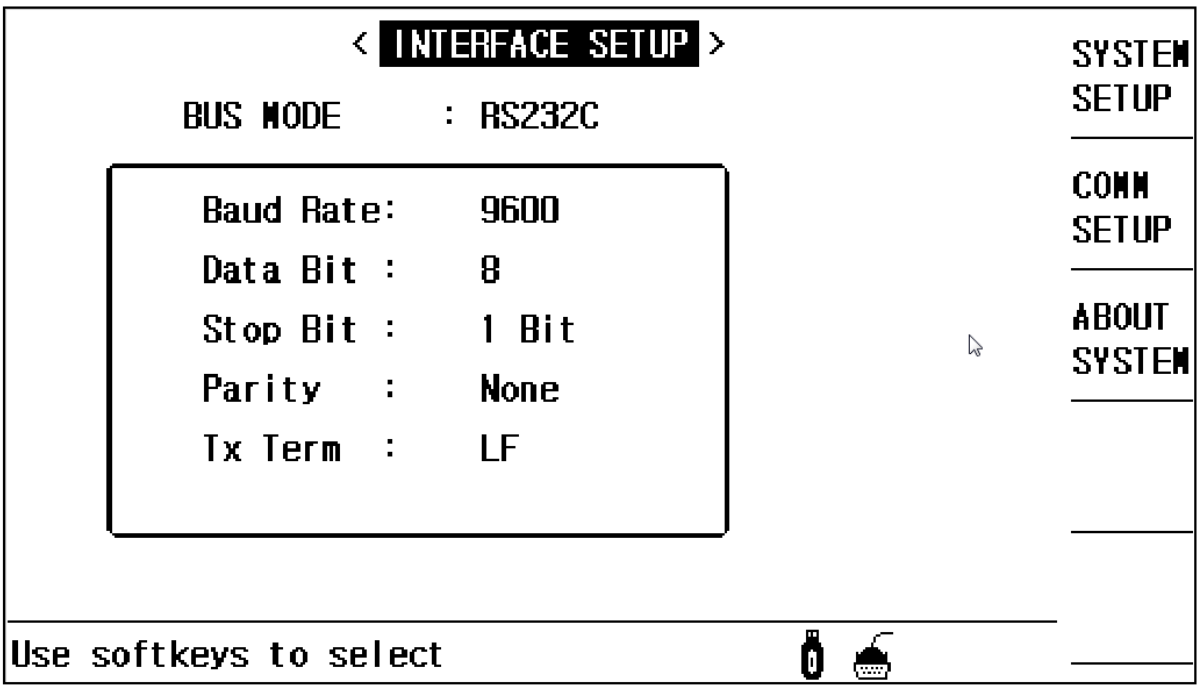
4.3.5 （SYSTEM）



Instruction:

THEME：	BULE/BLACK	This zone is used to alter the display style.
KEY SOUND：		Reserved
LANGUAGE：	Chinese/English	Interface language selection.
PASS WORD：	Off	Turn off the key lock function. The default password is **9908**
	LOCK SYSTEM	Needing the password when entering the system
	LOCK FILE	Needing the password when recalling the file.
	MODIFY	Change the original password for the new password.
DATE：		When moving to the DATE zone, user should input the value directly.
TIME		When moving to the TIME zone, user should input the value directly.

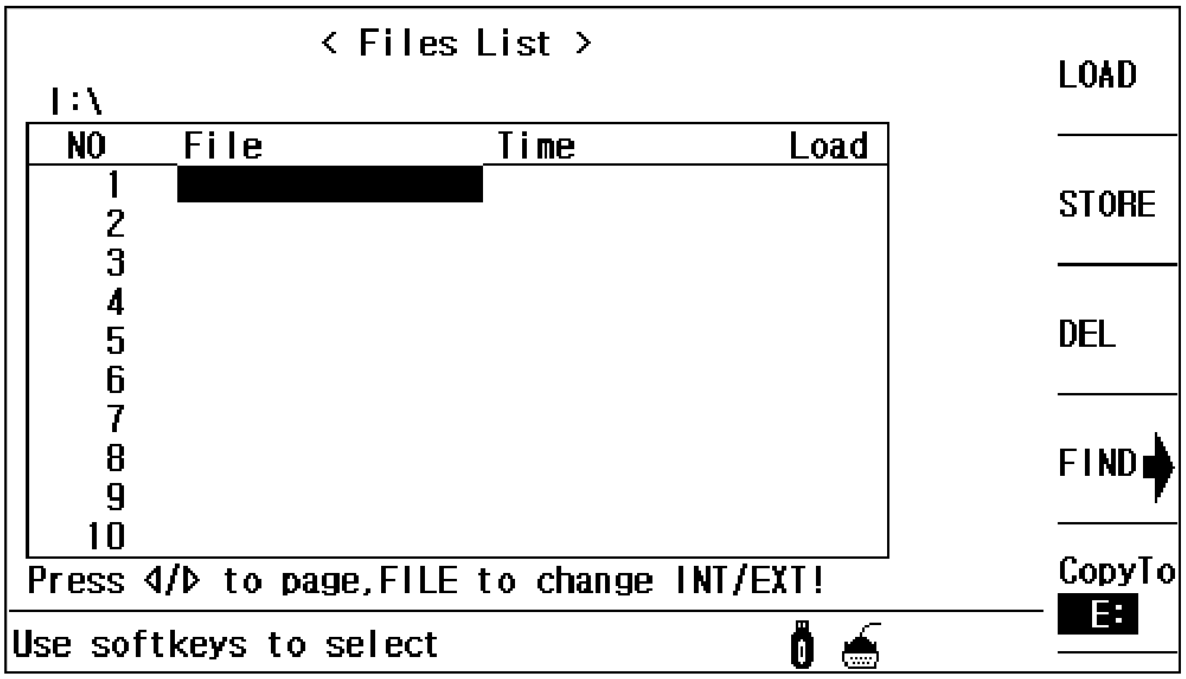
4.3.6 （SYSTEM2）



BUS MODE	RS232C	Serial mode: data format: 8.n. 1
	USBTMC	Standard USB slave mode
	USBVCOM	USB analog serial mode: data format: 8.n. 1
BAUD:	9600	Communication interface baud rate.
DATA:	8	Communication interface data digit.
STOP:	2	Communication interface stop digit.
PARITY	NONE	Communication interface parity digit.
TX TERM:	LF	Communication interface tx term digit.

4.3.7 （FILE）

Press the FILE key to enter into the file manage interface as follows:

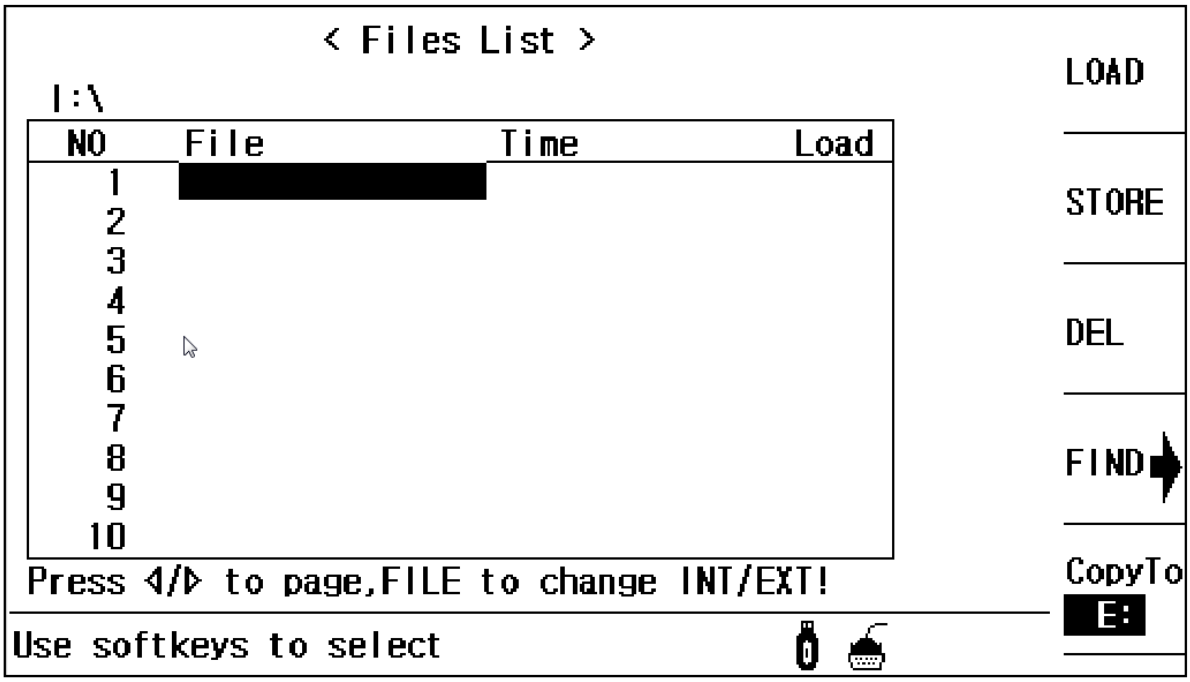


Instruction:

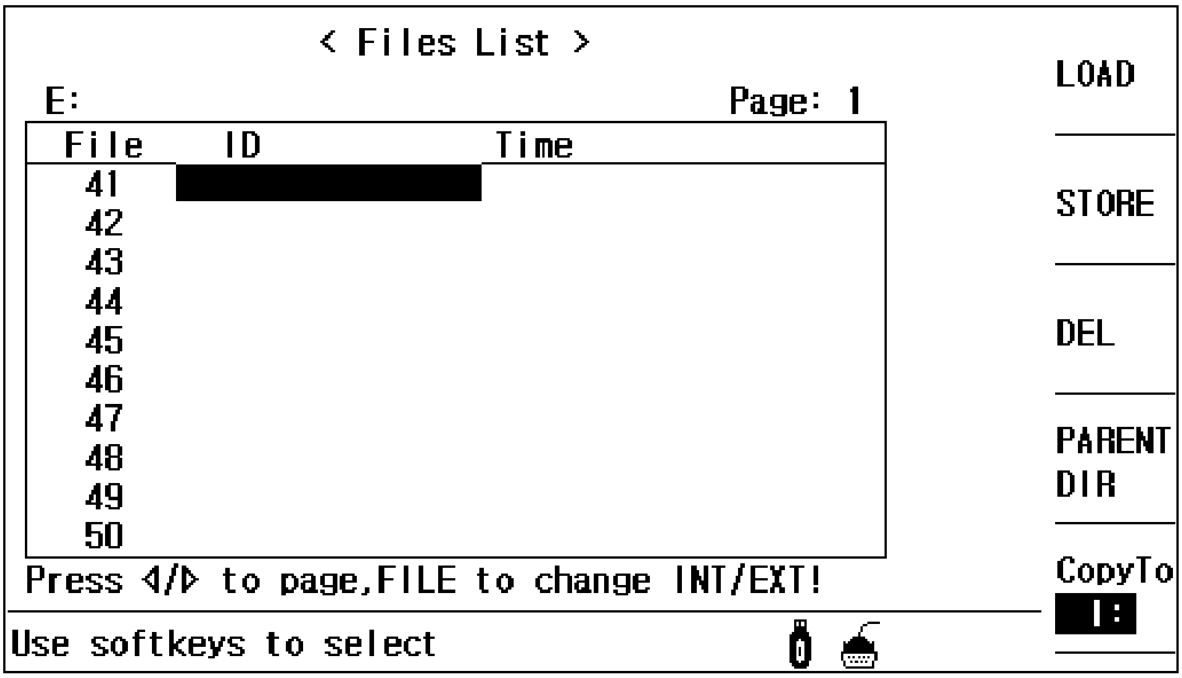
Serial number	Description		Shortcut option	Definition
1	Memory	File	Internal/External	Internal file interface, External file
2	File list	F1	Load	Load the current internal as the use file.
		F2	Save	Save the internal use file to the current file.
		F3	Delect	Delete the current file.
		F4	Find	Search the file
		F5	Copy To E:	Copy the current file to the U-disk (internal file).
			Copy To I:	Copy the current file to the interior instrument
3	Page number		PgUp	Page up the file list.
			PgDn	Page down the file list.

You can press the FILE to change the Operation interface between the internal file or the external file

Operation interface of the internal file:



Operation interface of the external file:



4.4 Test item interface and parameter setup

This section describes each test function parameter and its definition of the setup interface to help the customer set the relevant parameters.

4.4.1 AC withstanding voltage test parameter setup

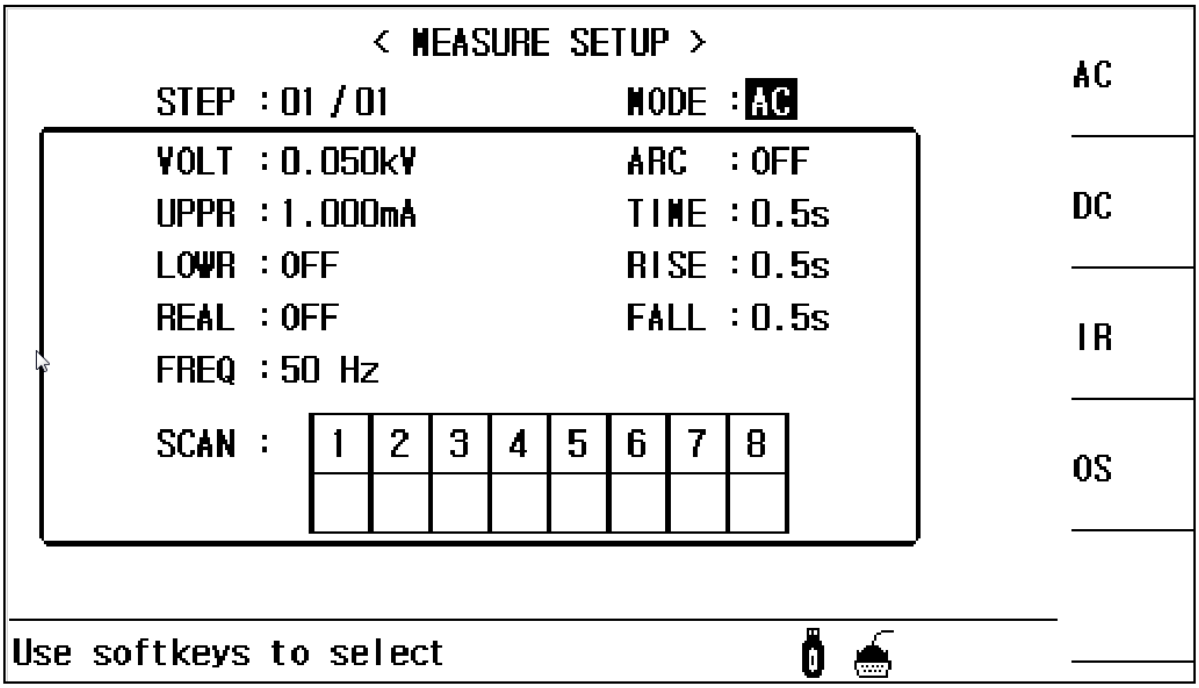


Figure 4.4.1 AC setup interface

VOLT:	0.005~5.000kV	Voltage value of AC high voltage test
UPPER:	0.01~30.00mA	Current high limit value of AC withstanding voltage
ARC:	OFF~0.1~15.0 mA	Current Max. value of AC arc
TIME:	OFF~0.1~999.9S	Test time of AC withstanding voltage
RISE:	OFF~0.1~999.9S	Voltage rising time of AC high voltage test
FAIL:	OFF~0.1~999.9S	Voltage down time of AC high voltage test
LOW:	OFF~0.001~30.00mA	LOW limit current value of AC
REAL:	OFF~0.001~30.00mA	Real current high limit value of AC withstanding voltage
FREQ:	50/60	AC working frequency

4.4.2 DC withstanding voltage test parameter setup（DC）：

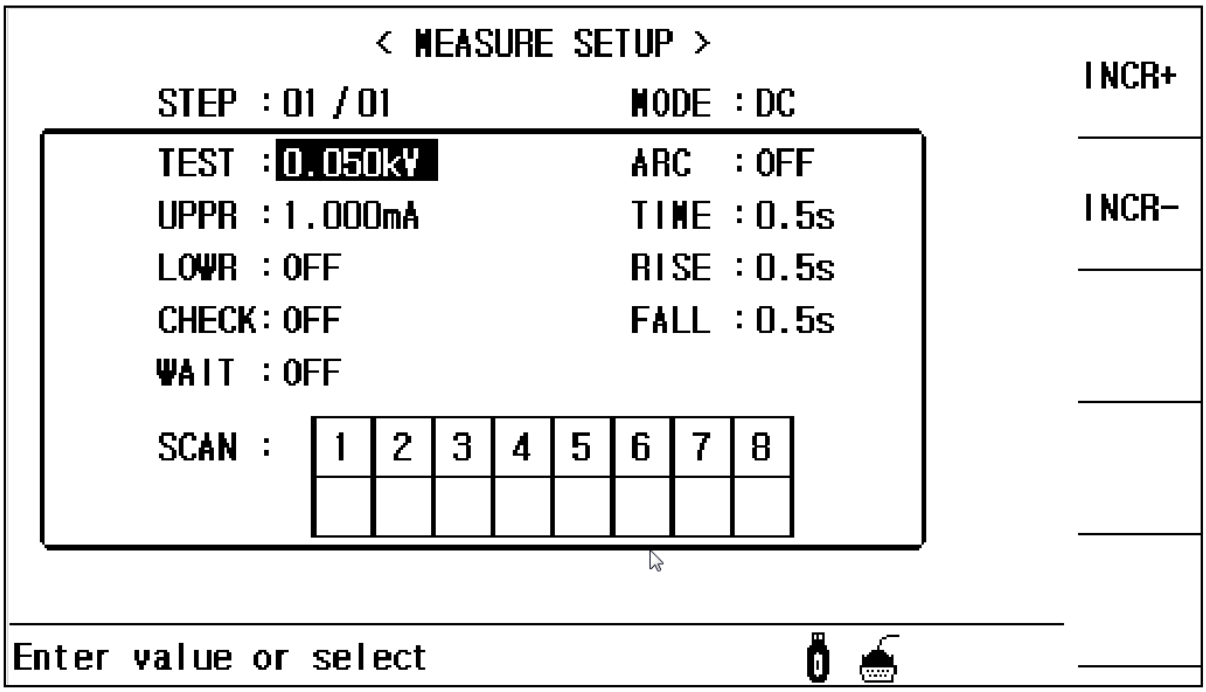


Figure 4.4.2 DC setup interface

Instruction：

VOLT	0.050~6.000kV	Voltage value of DC high voltage test
UPPER:	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
TIME:	OFF~0.1~999.9S	Test time of DC withstanding voltage
ARC:	OFF~0.1~10.0 mA	Current Max. value of DC arc
RISE:	OFF~0.1~999.9S	Voltage rising time of DC high voltage
FAIL:	OFF~0.1~999.9S	Voltage down time of DC high voltage test
W AT:	OFF~0.1~999.9S	DC charge waiting time
CHEK:	ON OFF	DC capacitance load charge current test.

4.4.3 Insulation resistance （IR）test parameter setup：

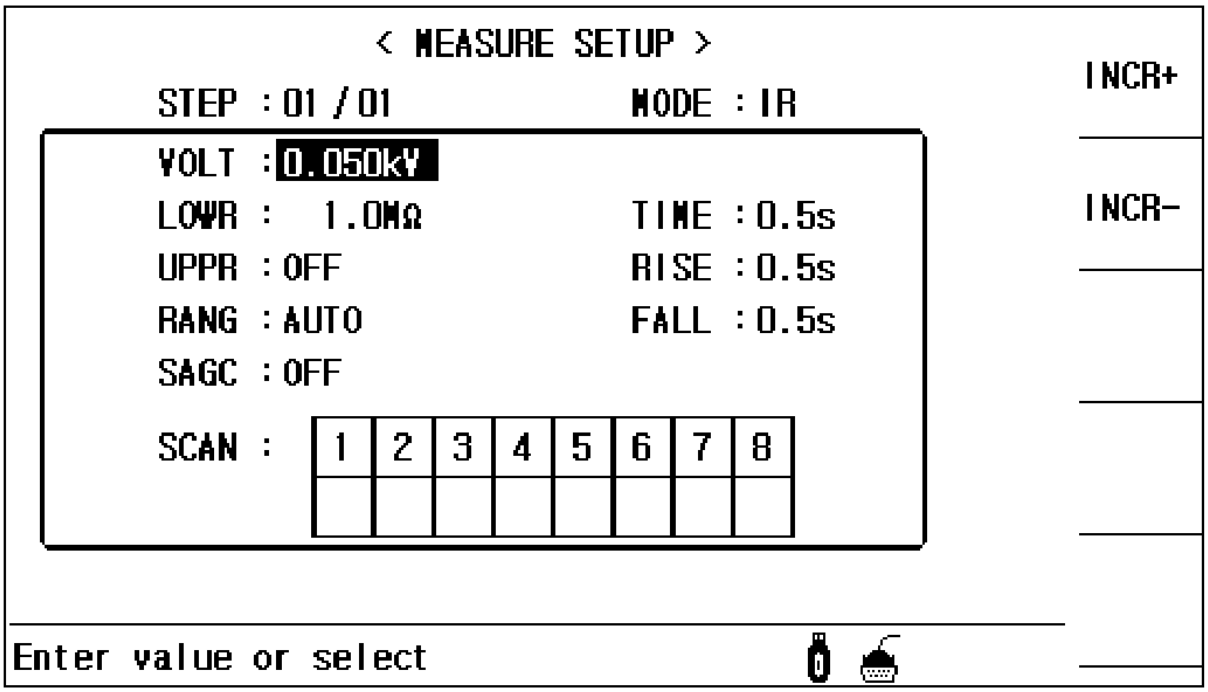


Figure 4.4.3 IR setup interface

Instruction：

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

4.4.4 Open detection（OS）parameter setup：

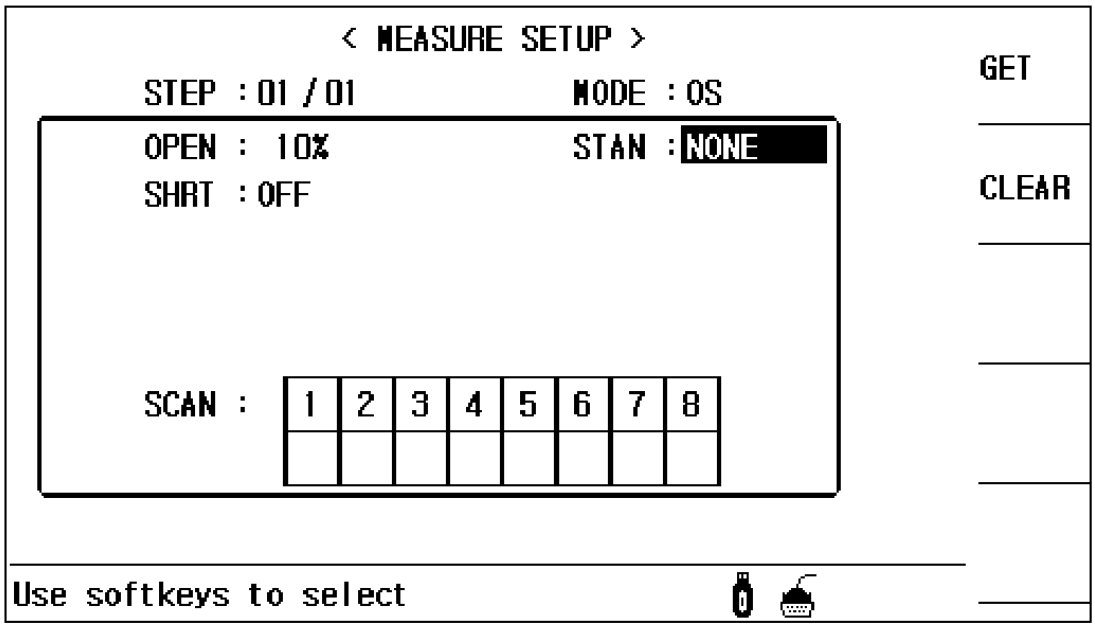


Figure 4.4.4 OS setup interface

Instruction：

OPEN CHK:	10%～100%	Percentage of open judge value and standard value
SHORT CHK:	OFF~100%~500%	Percentage of short judge value and standard value
STAN:	Previous standard value	Sampling standard value (see NOTE)
	GET	Acquisition of the distribution parameter as standard

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）

Setup of OPEN SHORT value:
The OPEN value is larger than the value when there is no connection with the DUT and smaller than the minimum value when there is connection with the DUT.
The SHORT value is larger than the maximum value when there is connection with the DUT and smaller than the value when having other short problems.
Example: take 3-coil inductance for example: the capacitance between 1-2 is 300P, the capacitance between 1-3 is 200P and 2-3 may short-circuit.
1. No connection with the DUT (GET): STAN=100P, confirmation of the OPEN value.

2. Repeated connection with the DUT, the data range of GET: STAN=350P~450P, confirmation of the standard value.
3. Short circuit in 2-3, the data range of GET: STAN=550P~650P, confirmation of the SHORT value.

Calculation of the parameter setting:
1. Supposing STAN=400P
2. OPEN value: lower limit=100P/400P=25%, upper limit=350P/400P=88%. 60% is recommended to take.
3. SHORT value: lower limit=450P/400P=112%, upper limit=550P/400P=138%. 125% is recommended to take.

4.5 Test function theory and instruction

4.5.1 Start up test

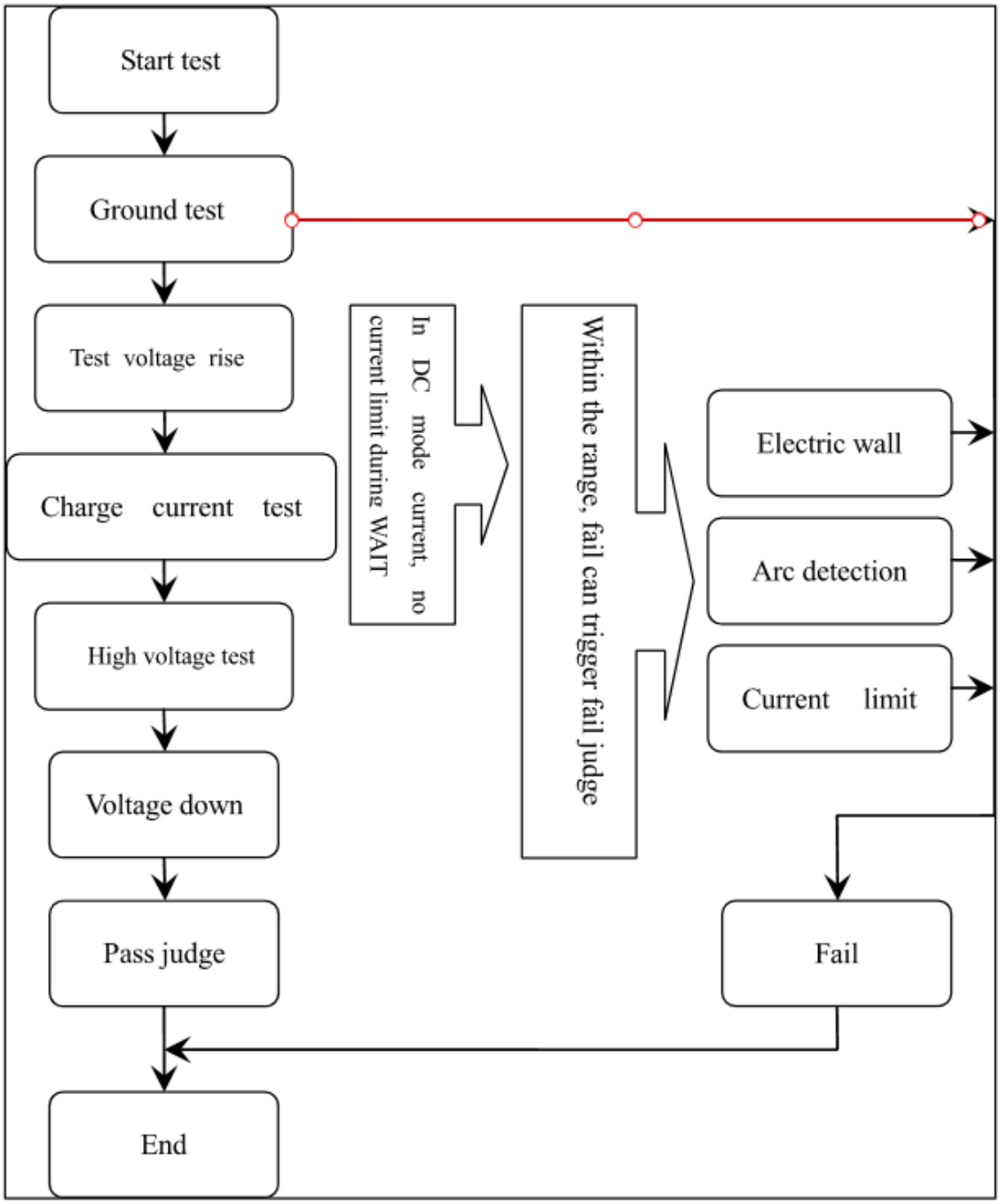
In measurement mode, after the tester check the test conditions and the connection with DUT, press START to start up test. After the delay set by STA DELY, the tester will start measurement.

4.5.2 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 FAIL）

Note1：ground breakover parameter is the GR CONT. Note2: for test convenience, the test low-terminal and the ground detecting terminal can be connected directly. And then they are attached to the DUT to realize the ground breakover test. However, this function will bring many dangers for other operators, because it will give them false safety messages.



4.5.3 Voltage rise

Some DUTs are voltage-sensitive, so this function is useful. The output voltage rises from 0. The resolution of the output voltage, controlled by the instrument, varies in every 0.1S and depends on the test voltage and the voltage rise time（ΔV = V / (10*S)）. If the voltage rise time (RISE OFF) is turned off, the default voltage rise time will be 0.1S.

4.5.4 DC RAMP

Using the current upper limit judge function in the process of the voltage rise is mainly to avoid erroneous judgement. When the test distributed capacitance is small, under the circumstance of no obvious change in current due to small charge current of the capacitance, RAMP can detect the poor performance of the DUT as soon as possible and decrease the discharge damage probability of the components. When the test distributed capacitance is large, there is a charging process of the capacitance in voltage rise process, now, the current may be far greater than the set current upper limit. If RAMP is set as ON, it may cause erroneous judgement of exceeding the upper limit.

4.5.5 High-voltage test

This function is used to make high-voltage test on DUT. The test circuit should be connected correctly. The measurement result will not be affected by special attach parameters and be the real withstanding-voltage current required by the test.

4.5.6 Voltage fall

It is the same as the voltage rise function depending on the characteristics of DUT. The voltage will fall when the high-voltage test ends. The resolution of the output voltage, controlled by the instrument, varies in every 0.1S and depends on the test voltage and the voltage rise time（ΔV = V / (10*S)）. If the voltage fall time (FALL OFF) is turned off, the default voltage rise time will be 0.1S. At this moment, the instrument will not conduct test compare judgement and the data is for reference only.

4.5.7 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.

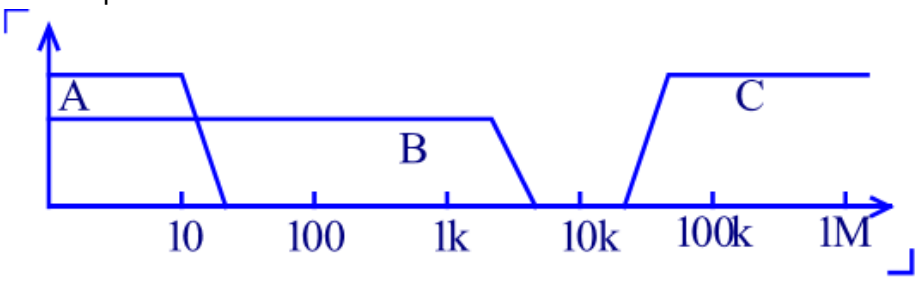
4.5.8 Current over limit and arc detection（ARC）function

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 （**HI FAIL**）in over limit.
- Current range over limit（**RNGE**）： 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（**RNGE 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 affect 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.

4.5.9 Fail judgment

When a setting exceeds its corresponding limit, the instrument will judge the DUT as a failure and the following results are: the current test is stopped, the voltage output is cut off, and the test result will be dealt with.

4.5.10 Deal with test results

If existing over limit in the test process, the instrument will judge the DUT as FAIL. There is mule-test item and the process mode of FAIL judge is controlled by the test mode of the Setup2. Otherwise, FAIL and the fail reason will be displayed and needs processing by the customer. When the test ends, if there is no FAIL mark, the instrument will judge the DUT as PASS and the process mode of PASS judge is controlled by PASS HOLD in Setup2. The instrument will transfer to the next test item or it will exit from the test waiting status.

From the beginning of this status to the next item starts high voltage, the customer can use the software to query the test data and results.

4.5.11 STOP

In any test mode, if you press down the “STOP” button on the instrument, it will automatically end the test. When the test ends, no measurement result will be output. **But in test end status, customer can query the test data before pressing the STOP button by using the software.**

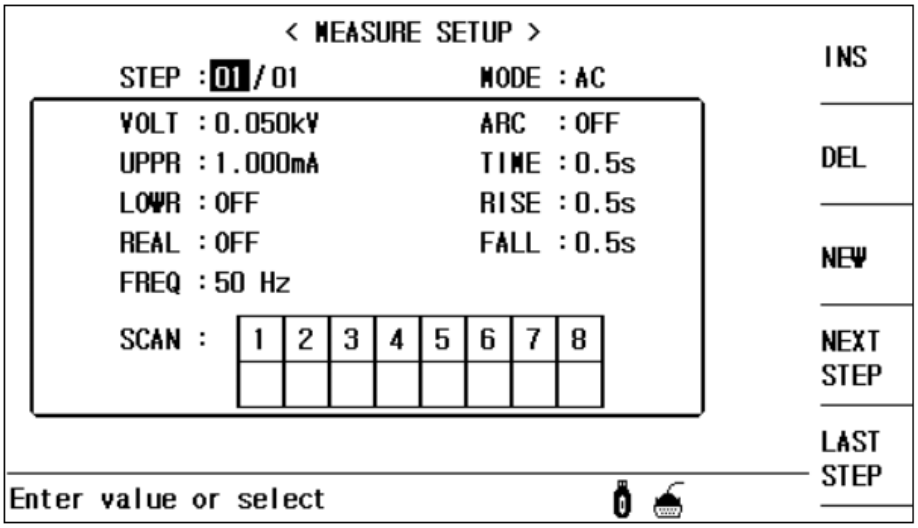
4.5.12 OFFSET

Before testing, due to the change of working environment and position of the test cable, there may be some base numbers when the instrument is in no-load test. For some customers who pursuing accurate measurement can conduct zero clearing in Setup2 interface. The specific steps are as follows:

1. Set the current test condition in SETUP interface.
2. Select OFFSET item in SETUP2 interface and set it as ON.
3. Press GET, the instrument will start high voltage test and treat the current test value as the zero position value.
4. Press “STOP” button to stop the test if the customer has not set the test time. **NOTE: when in GET, do not connect the product with the test terminal.**

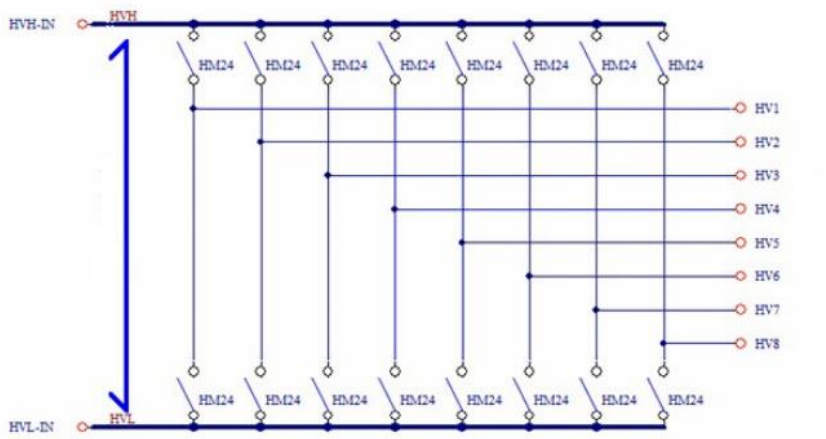
4.6 SCAN multi-channel structure and use

4.6.1 SCAN parameter



The figure in the parameter indicates the corresponding output channel,

4.6.2 Structure principle



4.7 Structure and Use of Interface Circuit

4.7.1 PLC and HANDLER interfaces

PLC interface is a control interface used to connect PLC controllers. Importing and exporting signals on the interface meet the requirements of PLC standard interface. Except INTERLOCK signal, other signals on HANDLER interface are directly interconnected. PLC signals schematic circuit is shown as follows (The output interface on the rear panel of the reference instrument arranges from top to bottom.) :

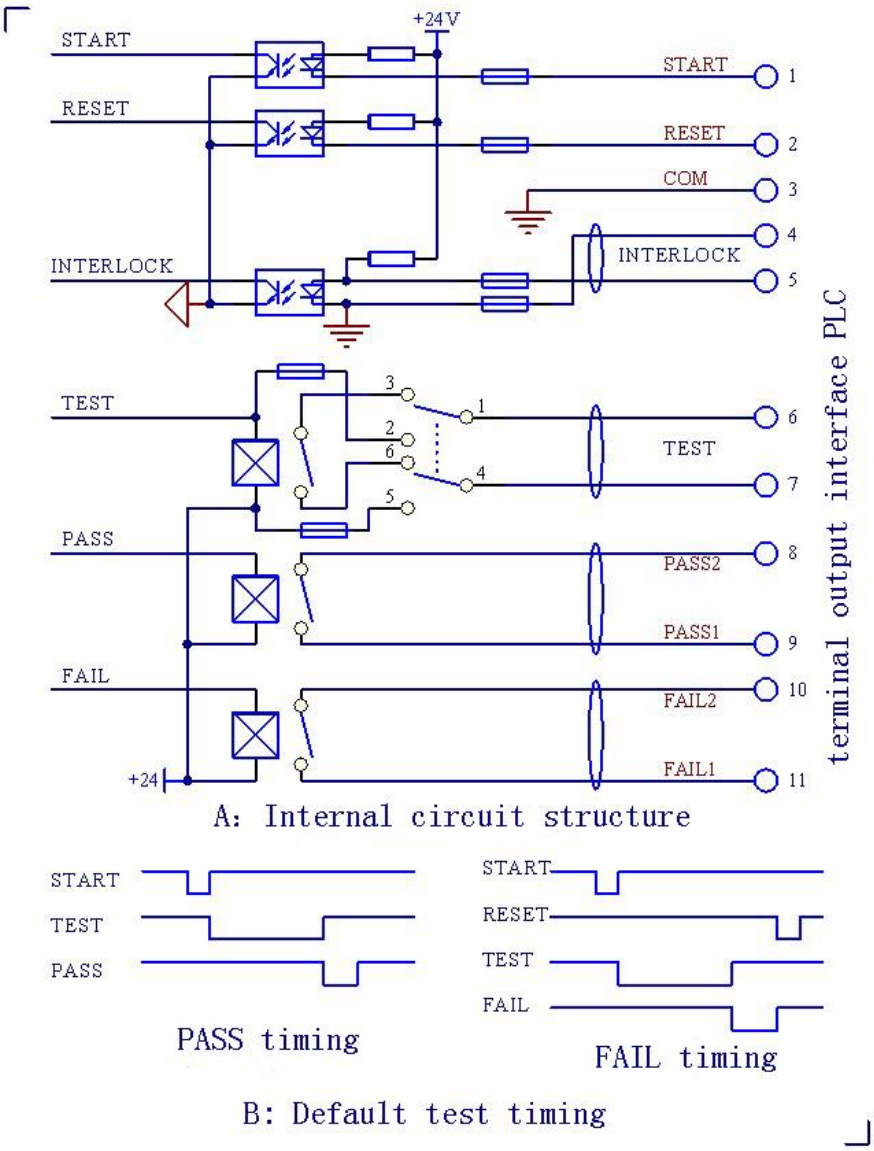


Figure 4.7.1: PLC Interface Structure and Timing

NOTE：1. In the TEST signal power mode, PLC interface can output signals of 24V, at this moment the real internal resistance approptriates to 20Ω and the drive current is less than 30mA. Therefore, above signals can be applied to drive miniwatt components like LED. DO NOT use this signal as a power to drive other charged components so as to avoid damaging the internal electric source.

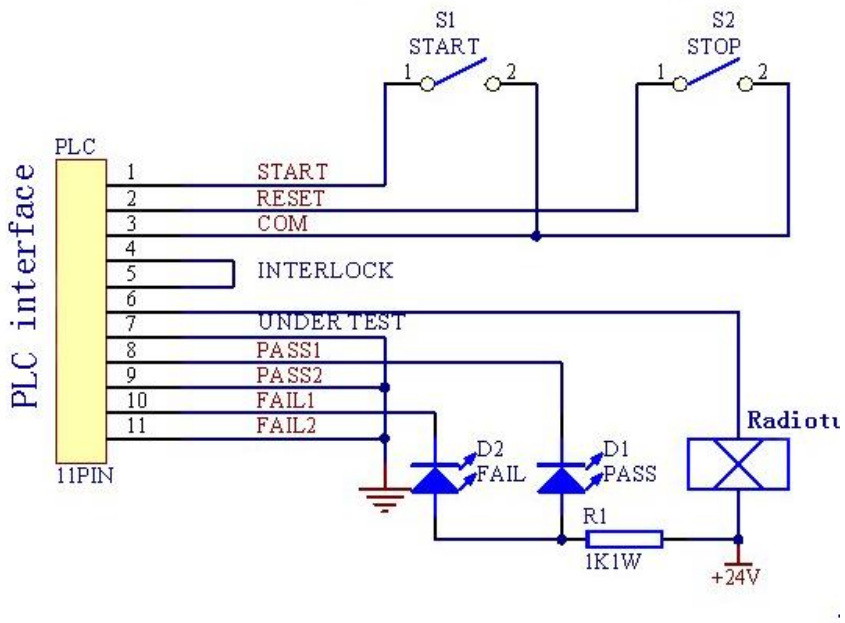


Figure 4.7.2: Connection of PLC External Circuit

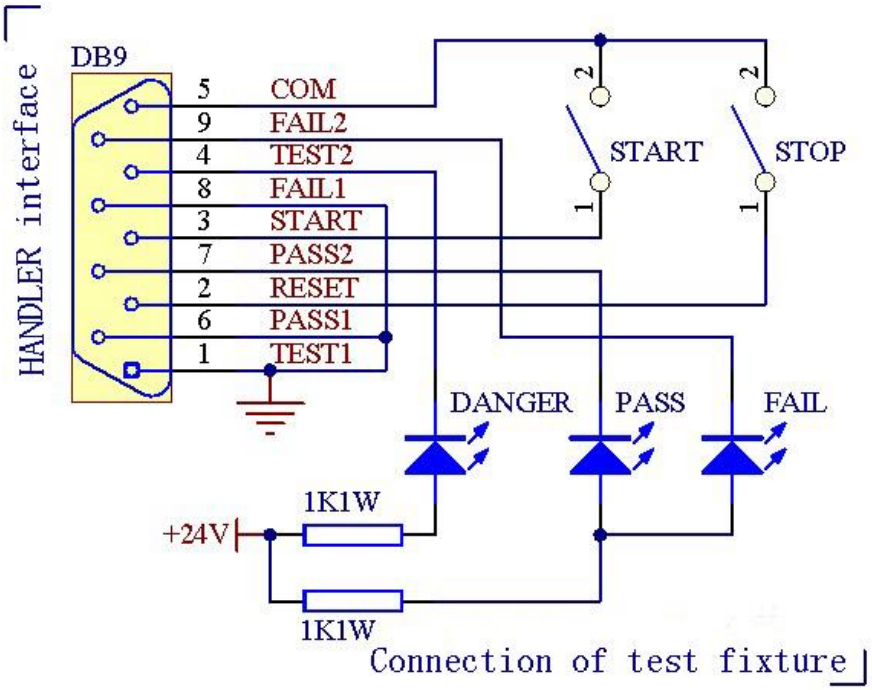


Figure 4.7.3: Connection of HANDLER external Circuit

5 Chapter 5 specification

Model			STXXXX
Withstanding voltage test			
Output voltage	AC	Range	0.050kV—5.000kV
		Waveform	Sinusoidal wave
		Distortion	< 3%
		frequency	50, 60Hzselectable
		Frequency accuracy	±2%
		Max. output power	150VA（5.000kV 30mA
	DC	range	0.050 kV—6.00kV
		Signal source frequency	600Hz
		Max. output power	50VA（5.000kV 10mA）
	Voltage regulation		±（1.0% +10V) （nominal power）
	Voltage resolution		1V
	Voltage display accuracy		±(1.0%reading+5V) (non-load)
	Voltage generating method		DDS signal source +AB power amplifier
Current test range	AC	Range	0.001mA – 30.00 mA
		Short-circuit current	>60 mA (output voltage>500V)
		Resolution	0.001 mA
		Accuracy	±(1% reading +5 digits)
		Effective current	OFF-0.001 mA-30 mA
	DC	Range	0.1uA – 10.00mA
		Accuracy	±(1.0% reading +5 digits)
	Discharge function		Auto discharge after test ends（DCW）
IR test			
Output voltage			0.050V – 1.000V
Voltage resolution			1V
Voltage test accuracy			±(1.0% reading+2V)
Max. output current			10mA
Max. output power			10 VA（1000V/1mA）
Output short current			≥20mA
Load regulation			≥3%（nominal power）
Ripple（1kV)			≥3% (1kV, non-load)
Discharge function			Auto discharge after test ends
Resistance measurement range			0.01MΩ– 50GΩ, (current range: 1nA – 10mA)
Resistance display range (1000V)			10 mA 0.1 MΩ-10 MΩ 3mA 0.3 MΩ-30 MΩ 300uA 3 MΩ -300 MΩ 30uA 30 MΩ -3GΩ 3uA 300 MΩ-30GΩ 300nA > 30GΩ

Resistance measurement accuracy		≥500V 1MΩ– 1GΩ ±(5% reading +5 digits) 1GΩ– 10GΩ±(10% reading +5 10GΩ– 50GΩ±(15% reading +5 digits) digits) < 500V 0.1MΩ– 1GΩ±(10% reading +5 digits)
Resistance display range (1000V)		10 mA 0.1 MΩ-10 MΩ 3mA 0.3 MΩ-30 MΩ 300uA 3 MΩ -300 MΩ 30uA 30 MΩ -3GΩ 3uA 300 MΩ-30GΩ 300nA > 30GΩ
Resistance measurement accuracy		≥500V 1MΩ– 1GΩ ±(5% reading +5 digits) 1GΩ– 10GΩ±(10% reading +5 digits) 10GΩ– 50GΩ±(15% reading +5 digits) < 500V 0.1MΩ– 1GΩ±(10% reading +5 digits)
Current measurement accuracy		±(1.5% reading +5 digits) （after correction）
Arc detection		
Measurement range	**AC**	1mA – 15mA
	DC	1mA – 10mA
Comparator		
Judgement mode		Window comparison mode: I_{lower} ON: at I_{lower}< Ix < I_{upper} , PASS ; at $I_x \le I_{lower}$ or $I_x \ge I_{upper}$, FAIL （condition: I_{lower} < I_{upper}） I_{lower} OFF: at Ix < I_{upper}, PASS ; at $I_x \ge I_{upper}$, FAIL The same judgment mode for insulation resistance judgment.
Current upper limit I_{uppper}	**AC**	0.001mA – 30mA
	DC	0.1uA – 10mA
Current lower limitI_{lower} (LOWER OFF)	**AC**	0.001mA – 30mA
	DC	0.1uA – 10mA
Resistance upper limit		OFF - 0.01MΩ- 50GΩ
Resistance lower limit		0.01MΩ - 50GΩ
Judging output		PASS/FAIL LCD or LED respectively display, sound alarm
Parameter setup		
Voltage rising time		0.1s – 999s
Voltage down time		0 s – 999s, (only after the withstanding voltage test passes）
Voltage waiting time		0.3s – 99.9s(only for DC withstanding voltage and rising time+ test time ＞waiting time)
Test time setup		0.3s – 999s（when TIMER is ON）
Time accuracy		±（0.2% set value + 20ms）

Measurement function	
Keyboard lock	Prevent the test conditions being modified unintentionally.
Base clear function	Clear the current flowing through the IR or distributed capacitor between the output cables.
Start-up waiting display	After the test starts (press START), high-voltage enabling signals will be output. Waiting for a while, high-voltage begins to be output.
Ground connection	Ensure the test low terminals are connected correctly.
Current over-range judging	The hardware will rapidly judge the insulation breakdown. It is more convenient and safer than voltage sampling and can reduce shocks products.
ARC detection	Sample abrupt signals of current and then judge the potential danger and the rough scale of the return circuit.
Electric wall function	Protect personal safety at the moment of accidental electric shock or leakage.
Alarm volume adjustment	OFF, HIGH, LOW
High-voltage indicator	Window indicator or LED indicator
Storage and interface	
file program and storage	100 programmable test files, 100 test steps respectively set for AC, DC and IR in each file.
USB interface	available
Start-up parameters storage	Parameter settings automatically saved, and automatically loaded next time of turning on the tester.
Control interface	PLC, HANDLER
Communication interface	RS232C, GPIB (option)

General Specifications

General specifications	
Working temperature & humidity	0°C －40°C, ≤90%RH
Power supply	90V-110V, 198V-242V 47.5-63Hz
Power consumption	≤500VA
Dimensions	340mm×130mm×450mm
Weight	Approx. 15kg