MATRIX, SINCE 2003

MST-8101/8103 Series

Safety Gauge Tester

User Manual

MATRIX TECHNOLOGY INC.

Catalog

Chapter 1 Installation and Use

This chapter describes some of the checks that must be performed when you receive the instrument, and the conditions that must be known and met before you install and use the instrument.

1.1 Precautions

Rules to follow:

- **Do not use in flammable atmosphere.**

Avoid the vicinity of alcohol, thinner and other flammable materials to prevent combustion or explosion.

- **Avoid dusty environment**

Mud and dust can cause electronic short circuits or fires.

- **Do not use in poorly ventilated areas.**

The instrument has a forced air cooling system. Sufficient space shall be provided for side and rear air vents to ensure air circulation.

- **Do not use it in an unstable place.**

If the instrument is placed in an unstable place, it may slip and damage the instrument.

- **Do not use in areas with strong magnetic or electric field effects.**

If the instrument is used in a place with a strong magnetic field or electric field, the electromagnetic pulse will cause the instrument to malfunction and cause a fire.

- **Avoid high temperature and direct sunlight**

Use temperature: 5 ℃ to + 35 ℃

Storage temperature: -20 ℃ to + 60 ℃

- **Avoid wet conditions.**

Operating humidity: 20% to 80% RH (no dew condensation allowed) Storage humidity: less than 90% RH (no dew condensation allowed)

- **Avoid environment with corrosive gas**

Do not use in the presence of corrosive gases, sulfuric acid, mist, or the like. This may corrode wires, connectors, and form hidden dangers or defects, which can lead to serious failure, failure or even fire.

- **Do not use near sensitive equipment and receiving equipment**

In use, these devices may be affected by noise generated by the breakdown of the DUT. When the output exceeds 3 kV, the electric field between the test lines will ionize the air to produce a corona, resulting in a large amount of RF (radio frequency) bandwidth interference. So make sure that the distance between the test lines is far enough.

Also, keep the test line away from conductive surfaces (especially sharp metal ends).

△ **Warning:**

Before moving the device, turn off the power switch and disconnect all the cables

Movement in the power-on state may cause electric shock and damage, and movement without disconnecting the cable may cause damage to the connecting wire or drop the instrument.

1.2 Connect the AC power cord (use the AC power cord that comes standard with the instrument)

1. Determine the power supply range of the instrument.
2. Determine the nominal fuse value.
3. Determine that the instrument is in the off state.
4. Connect to the AC LINE end of the rear panel.
5. Plug into an AC outlet.

1.3 Grounding

Warning: Make sure that the instrument is connected to an electrical ground (safety ground, earth ground).

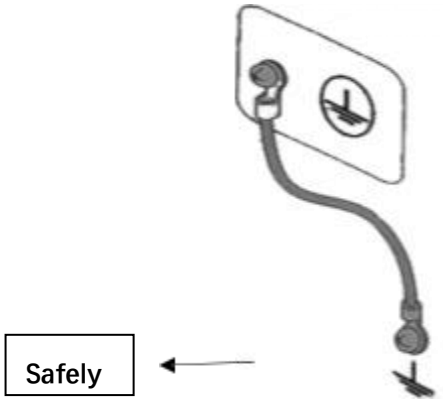
If there is no direct connection to the earth, the housing of the instrument may carry very high voltage and become very dangerous.

The instrument is Class II equipment (the equipment has the function of electric shock protection in addition to basic insulation). However, there is still the possibility of electric shock if the grounding is not correct.

Optional grounding method:

1.Connect to a single-phase, three-wire power outlet. (Make sure that the socket ground wire is reliably grounded) 2. Connect the protective terminal of the rear panel to the grounding bar (reliably connected to the ground provided by the production line

Copper wire or copper bar) to the ground.



1.4 Operation check

△ **Warning:**

Working space hours: a box structure can be made to place the tested part;

Test large tested items: there are warning signs or guardrail in the test area.

In normal use, use INTERLOCK as much as possible to ensure safety.

When the electric shock protection is turned on, the (INTERLOCK) signal circuit is disconnected to ensure the safety of the workplace. During startup, the instrument performs self-check and lights up all lights on the front panel. Please pay attention to the check.

Testing with a damaged DANGER (high pressure warning) lamp is particularly dangerous.

△ Caution: For the second power-on, wait a few seconds for the next power-on. Continuous switching on and off may cause damage to the instrument. Check the sequence

1. Make sure that the power supply voltage is consistent with the set voltage of the instrument.
2. Connect the power cord to the AC LINE end of the rear panel and plug it into an outlet.
3. Turn on the machine, check the indicator light on the front panel, and display the startup screen.
4. The SETUP screen is displayed.
5. Shutdown.

1.5 Other characteristics of the instrument

（1） Power consumption: power consumption < 500VA.

（2） Dimension (W * H * D): 210mm * 125mm * 410mm;

（3） Weight: approx. 13-15 kg depending on model.

Input voltage	Frequency range	Fuse (slow blow)	Instrument series	Rated power
110V	47-63Hz	5A	MST-8101/8103	400VA
220V		3A		

Chapter 2 Operation Specifications and Measures

This chapter describes the specifications and measures to be observed during the use of the instrument.

⚠ ***Warning: This instrument generates a test high voltage of 5kV, which may cause personal injury or even death. When operating the instrument, be very careful and follow the cautions, warnings, and other instructions given in this chapter.***

2.1 Prohibited Operation

■ Do not short the output to ground

If the high voltage test line is connected to the AC LINE; Or other devices to earth conductors. When the grounding terminal of the instrument is not reliable, there may be high voltage at the low end of the high voltage (that is, the housing of the instrument) after the high voltage terminal is grounded.

The grounding terminal of the instrument shall be connected to the ground correctly and reliably. See "1.5 Grounding".

■ Do not switch the power supply on and off continuously

The interval between the second startup should be at least one minute to ensure that the circuit is normally powered off and then started.

In case of repeated on/off, the control circuit may be out of control. The protection function cannot be performed. Except in exceptional or urgent circumstances. Do not turn off the power switch when the instrument is working.

■ Do not connect an external voltage to the test terminal

In the non-discharge state, the instrument does not have the function of external discharge. Do not connect an external voltage to the output of the instrument, or the instrument will be damaged.

2.2 Emergency Management

In case of emergency (such as electric shock and burning of the tested part), the instrument does not disconnect the high voltage output.

(1) Turn off the power switch of the instrument;

(2) Unplug the instrument's power cord from the power cord plug.

2.3 Precautions during testing

■ **Abort (Suspend) Test Precautions**

When it is necessary to touch the test conductor or change the test connection, press the STOP switch once to ensure that the instrument is out of the test preparation state. When the operator leaves, please turn off the power switch to prevent safety hazards caused by accidental touch.

■ **Electrified articles during high voltage test**

During the test, the high voltage output end, the high voltage test line, the high voltage probe, the tested piece and the exposed conductors around them all have high voltage.

No touching.

■ **Wear insulating gloves**

Wear insulating gloves to protect against contact with high voltage, but do not touch live conductors during high voltage testing.

■ **Remote control warning**

When using the remote control mode, please pay special attention to check the reliable connection of remote control.

(1). The "STOP" button must be reliably connected. Press the "STOP" button before replacing the DUT.

(2). The remote control switch must be equipped with an "INTLOCK" interlock switch and a high voltage indicator. Replace the DUT

Disconnect the "INTLOCK" interlock switch before.

■ **Precautions after turning off the high voltage output**

If it is necessary to touch the DUT, the test line, the probe, or the output terminal and the surrounding area, make sure of the following two items: (1). Verify that the instrument is not in the test state.

(2). Danger lamp is off.

2.4 High pressure test warning

2.5 Handling of dangerous state of faulty instrument

2.6 Daily inspection

Warning: During the high voltage test and discharge, the test line, test probe, and the DUT all have high voltage, and there is still a risk of electric shock. Do not touch the above. In case of contact with these, make sure that the DANGER lamp goes out and leave it for one minute before removing the hazard.

When the capacitance of the tested part is too large or the special structure of the tested part will cause incomplete discharge, the test method must be changed by the technician.

■ Discharge time:

$T = -\ln(30/U) \times R \times C$

t: discharge time

30: Discharge remaining safe voltage

30 V U: Test set voltage

R: the discharge impedance of the DUT.

Instrument discharge impedance 10 K C:

the capacitance of the DUT.

Generally, DC high voltage needs to be discharged, and the length of discharge time depends on the nature of the tested part.

At the end of the test, the voltage will drop to zero. If the test fails, the DUT is discharged through the secondary side of the transformer (about 10 K resistance), and the 1uF capacitor with 6000 V high voltage is discharged to 30 V in about 0.05 S.

The fixed discharge time of the instrument is 0.2 S, which can ensure that the device is discharged completely.

When "high voltage is output and the instrument is out of control",

1. Immediately turn off the power switch and unplug the power cord.

2. Stay away from the instrument immediately, and ask relevant technical personnel to check and confirm that there is no danger; Or let the instrument stand for more than one hour to confirm that there is no output voltage at the test end.

3. Remove relevant connecting lines and send them back to the manufacturer.

Precautions before use:

1. The input power supply meets the specifications and is configured correctly.
2. The instrument is reliably connected to the ground.
3. The instrument can successfully complete the test without connecting the test line.
4. The material of the test line shall be in good condition without fracture, crack or damage.
5. Connect the test lines and keep the test lines separated before starting the test.

Chapter 3 Instrument Panel Overview

This chapter describes the basic operating features of the MST-8101/8103 instruments.

3.1 Front panel description

Figure 3-1 provides a brief description of the MST-8101/8103 front panel.

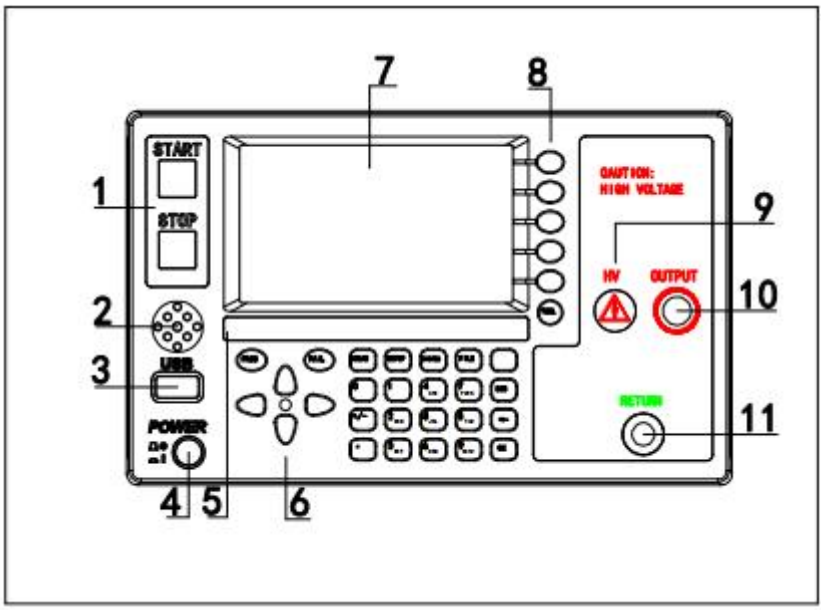


Figure 3-1 Front Panel Description

3.1.1 START key, STOP key

Start key (green): start the test, and the DANGER indicator is on.

STOP key (red): stop key, which can also be used to cancel PASS, FAIL and other prompt States.

3.1.2 Buzzer

Make a sound.

3.1.3 USB interface

Connect an external USB.

3.1.4 Power switch (POWER)

Power switch. Power on for the first time, please check the power supply type.

3.1.5 Trademark and model

Instrument trademark and model

3.1.6 Move key

Used to move the cursor across the screen.

3.1.7 LCD liquid crystal display

480 × 272 TFT dot matrix liquid crystal display, display setting interface, measurement interface, etc.

3.1.8 Shortcut function keys

F1-F5 correspond to the function operation area on the right side of the LCD to realize shortcut operation.

3.1.9 HV

DANGER!! The high voltage start red light starts to light.

3.1.10 Output Voltage High Side (HV)

High voltage output

3.1.11 Test low side, test current return (LOW/RET)

Voltage output low end, current sampling end.

3.2 Rear panel description

Figure 3-2 provides a brief description of the MST8101/8103 rear panel.

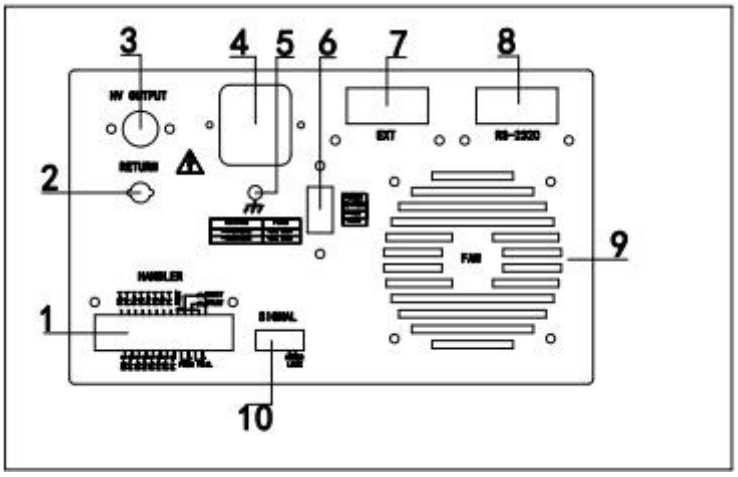


Figure 3-2 Rear Panel Description

3.2.1 HANDLER interface

The comparison PLC lacks the INTERLOCK function, and the others are exactly the same. Convenient control with 9/25 core D-type socket.

- **TEST**：When the high-voltage output is started, the synchronous control signal is output by the machine.
- **START:** start signal, start high voltage output, equivalent to the START signal on the front panel.

- **RESET:** reset signal, stop high voltage output, equivalent to the STOP signal on the front panel.
- **PASS：** Qualified signal, equivalent to PASS indication on the front panel.
- **FAIL：** Fail signal, equivalent to FAIL indication on the front panel.

3.2.2 Test low side, test current return (option)

The spare port can be modified when the customer needs it.

3.2.3 High voltage output (option)

The spare port can be modified when the customer needs it.

3.2.4 Power socket: with fuse box.

Input rated AC power, please use the power cord provided. Built-in power fuse, select the appropriate configuration.

3.2.5 Protective earth terminal

When the three-pin power socket for power insertion cannot be reliably connected to the ground, the grounding bar must be connected from here. Note: It must be reliably grounded, otherwise the shell may have high voltage, and there is a risk of electric shock.

3.2.6 Voltage switch (110V/220V).

Toggle up and down to switch the input voltage.

Note: The instrument only supports 110 and 220 line voltage modes. Other modes are not connected inside the instrument. Pay attention when using it.

3.2.7 EXT

Reserved port

3.2.8 RS232C serial interface

Realize communication with the computer.

3.2.9 Power amplifier fan cooling port

Power amplifier circuit cooling port to maintain air circulation.

3.2.10 SINGLE interface

On-line protection and internal 24V output interface.

- **DC24V power supply:**

(Port: (1, 2) 24V -- (3, 4) GND).

The output voltage is 18.5 VAC rectifier output, without voltage regulation function, and the total current is recommended to be < 500ma.

- **INTERLOCK：**

(Port: (5) INTERLOCK + -- (6) COM) Short circuit active. On-line lock signal, default short circuit. It cannot be

tested when disconnected.

3.3 Multi-channel module description

The multichannel output is a built-in high voltage adapter module added inside the instrument. A plurality of points to be tested of the component can be connected with a plurality of channels of the instrument at one time.

In that t process, the correspond port is connected to the withstand voltage test end by controlling the channel switch to realize the controllable test.

3.4 Overview of instrument performance

8103 can provide 5kVAC/20mA withstand voltage, 6kVDC/10mA withstand voltage, and 1kV IR insulation resistance testing.
8101 can provide 5kVAC/20mA withstand voltage testing.

Principle structure of the instrument:

(1) DA reference: ensure that the output voltage amplitude is controllable.

(2) Controllable sine generator: can be set to 50 or 60Hz.

(3) Linear power amplifier: the distortion of voltage waveform is small, and the control is simple and reliable.

(5) 40 ~ 600Hz high voltage transformer: 600Hz AC power supply is generated and rectified to form DC voltage, which reduces the ripple of DC power supply. (6) Closed-loop control of output voltage: the load regulation is small and the test data is reliable.

Related software of the instrument: multi-parameter continuous test and various host computer control functions.

MST-8101/8103 are equipped with HANDLER and RS-232C, which can adapt to different places.

MST-8101/8103 can be used for AC withstand voltage test, DC withstand voltage test, insulation resistance test, and multi-step test.

Characteristic

- **Four test functions — AC withstand voltage test, DC withstand voltage test, insulation resistance test, open/short circuit test**

MST-8103, provide AC and DC withstand voltage test and insulation resistance test.

MST-8101 provides AC withstand voltage testing. All instruments have an open short detection function. The instrument can perform multi-step tests.

■ **Two options for test power**

Some models have a Class AB power amplifier circuit and a 100 VA high voltage transformer to achieve (AC5kV/20 mA)/ (5.5 kV/20 mA) output; (DC6kV/10 mA)/ (7.2 kV/10 mA) output. The distortion of the waveform is less than 3%.

Some models have a Class AB power amplifier circuit and a 50VA high voltage transformer for AC (5kV/10 mA)/ (5.5 kV/10 mA)

The output of; Output of DC (6kV/5mA)/ (7.2 kV/5mA). The distortion of the waveform is less than 3%.

For continuous current output, the maximum time is 60 seconds above 60% of the rated output current. It can work continuously within 60% ~ 40% of the rated output current. Continuous operation can be guaranteed below 40% of rated output current.

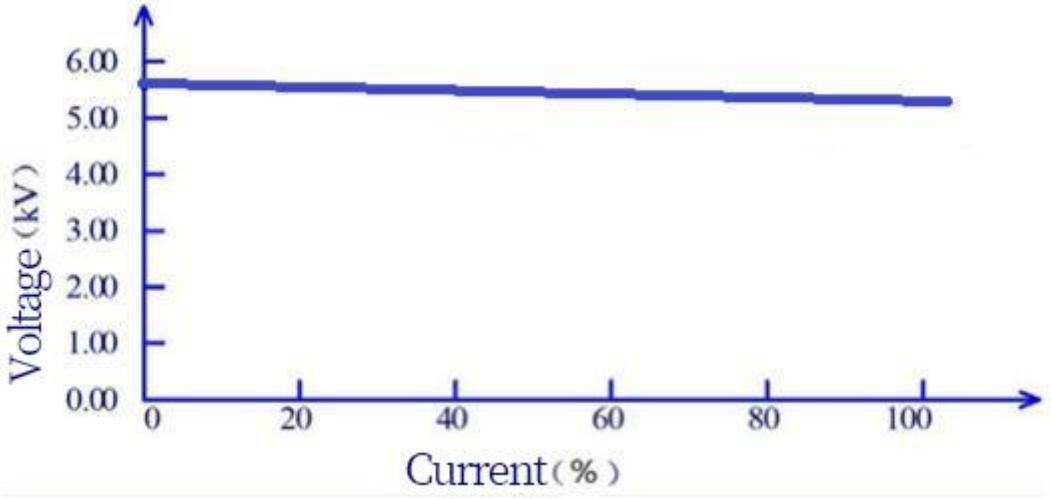


Figure 3-3 AC voltage

■ **DC withstand voltage test 6 kV/10 mA (some models),**

DC withstand voltage test for some models (maximum output DC 7.2 kV). 600Hz frequency automatic voltage regulation, voltage load regulation≤1%+10V.

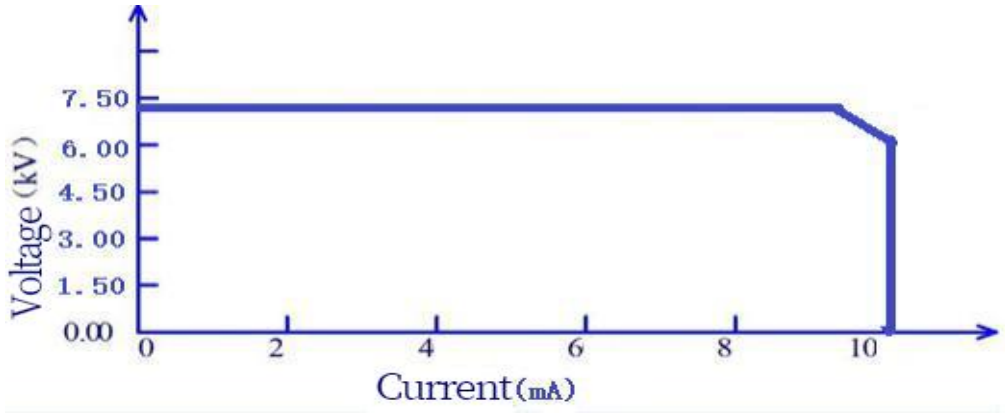


Figure 3-4 DC voltage output range of some models

■ **Insulation resistance test 0.050 kV to 2.500 kV (1V resolution)/0.2 MΩ to 100.0 GΩ, maximum rated current is 10ma for some models and 5ma for some models.**

Insulation resistance test range:

For voltages less than 500 V: 0.2 MΩ ~ 1 GΩ accuracy ± 10% + 5 words,
1GΩ ~ 10GΩ range accuracy of ±
20% + 5 words. When the voltage is greater than 500V, the
accuracy is ± 3% + 5 words in the range of 0.2 MΩ ~ 1GΩ.
± 7% + 5 words in 1GΩ ~ 10GΩ range,
± 20% + 5 words accuracy from 10GΩ to 100GΩ

■ **RS-232C interface as standard**

In addition to power conversion, key lock, the other can be remotely controlled. Test voltage, judgment function, test time and other test conditions can be remotely controlled. Test results can also be read from the rear via remote control. RS-232C for communication.

■ **Test Wait Time Settings**

The latency 0.1 s is set to the 999.9 s and the resolution 0.1 s. The instrument will output the TEST control signal to make the test connection reliable, and then start the high voltage.

■ **Open and short circuit test: the tested parts are reliably connected to ensure the accuracy and safety of the high voltage test.**

Open/short circuit detection can identify the distributed impedance current above 100 PF. When it is less than this value, the instrument can not accurately distinguish the connection between the open circuit and the test element.

■ **Current zero clearing function**

The MST--8101/8103 have a current clearing function to counteract stray capacitive current excursions.

■ **HANDLER interface and input signal interface for convenient connection and control**

HANDLER interface: it can input START and STOP signals and output TEST, PASS and FAIL signals. And is connecte with a test fixture to realize safety interlock, pneumatic control, t indication and that like.

Input signal interface: it can input INTERLOCK signal and provide 24V, 0.5 A power output.

■ **Enhanced security**

In order to improve safety, safety output, discharge function and ground current detection are configured. Ground current detection means that the high voltage output is cut off when the return current through the enclosure is greater than 0.45 mA.

■ **Rise time control function**

During the AC withstand voltage test, DC withstand voltage test and insulation resistance test, the test voltage can rise slowly in stages instead of rising directly to the set value. Rise time maximum

999.9 s resolution 0.1 s. The MST-8103 complies with UL test standards and IEC withstand voltage test standards (the initial voltage is less than half of the test voltage and the rise time can be specified when the set test voltage is reached).

■ **Drop time control function**

The voltage can be gradually reduced in the judgment of the qualification of the AC withstand voltage test. The fall time can be set from a 0.1 s to a 999.9 s with a resolution 0.1 s.

■ **USB interface for backup**

It is equipped with USB interface to realize the conversion or loading of parameters.

■ **Discharge function**

When the DC withstand voltage and insulation resistance test is cut off, the capacitive DUT remains fully charged, and there is a risk of electric shock. The MST-8103 has the function of forcing fast discharge to the tested parts after the completion of DC withstand voltage and insulation resistance test. Series voltage digital display, voltage test accuracy of ± 2%. The accuracy is ± (2% of reading + 2 words) during the current test.

■ **Simple operability**

Use the direction key to select a parameter from the LCD display interface, and then use the function button to modify the parameter. The customer can directly measure after setting the data.

■ **Each of the 105 test files can have 25 test items, and a total of 2625 test items can be saved**

105 test files can be edited, and each test file has 25 test items at most. The test items are any one of AC withstand voltage test, DC withstand voltage test, insulation resistance test and open/short circuit judgment.

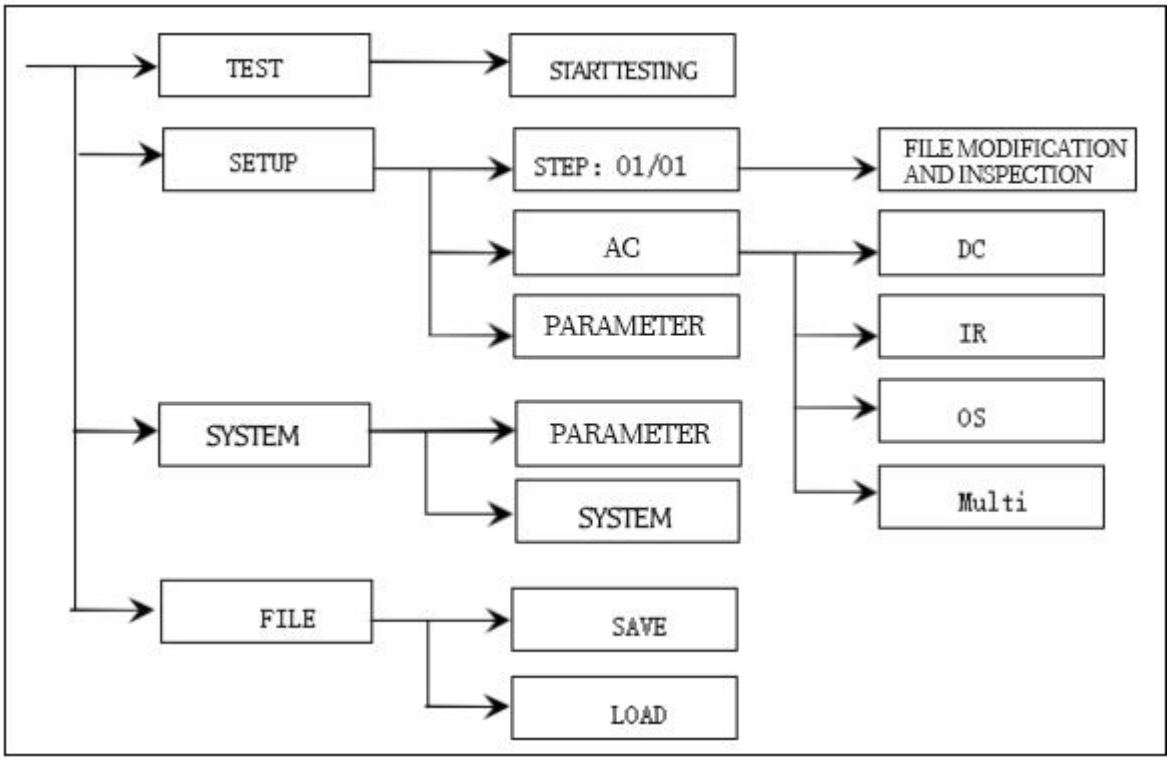
Description of option functions:

■ High voltage output on rear panel (optional) The rear panel includes an optional high voltage output.

Chapter 4 Basic Operation

4.1 Overview of Instrument Interface Structure

This chapter describes the procedures for the withstand voltage and insulation resistance tests. The interface is shown as follows:



Schematic diagram of test operation flow

Interface description:

4.1.1 The first column of the interface structure is the initial state called by the panel function key, and the parameters cannot be modified in the TEST interface.

4.1.2 Interface structure The second column is the parameter structure of the initial interface.

4.1.3 The third column of the interface structure is the function switching interface.

4.2 Description of panel function interface and parameters

- **Initial state of instrument**

1. After startup, the system enters the last modified setting interface by default.

2. The factory setting of the instrument is single step, AC withstand voltage and default parameter status. As shown in the figure below.

3. The default cursor of the default interface is interface switching, and other interfaces can be selected directly.

Schematic diagram of instrument default interface

The interface can be switched by four function keys, including measurement display (TEST), measurement setting (SETUP) and system interface (SYSTEM), FILE.

- **Basic functions of the panel keys:**

TEST: Enter the test waiting state and prepare to start the high voltage test. SETUP: the interface for modifying the current test scheme, test items and test parameters. SYSTEM: Test the settings related to the safety and the operating mode of the instrument.

FILE (file key): saving and calling interface of the test plan, related to the data storage.

↑ ↓ ←→ (direction key): The cursor can move freely between parameters. F1 ~ F5 (soft key): Modify the object selected by the cursor.

4. 2. 1 SETUP measurement setup. The interface is shown as follows:

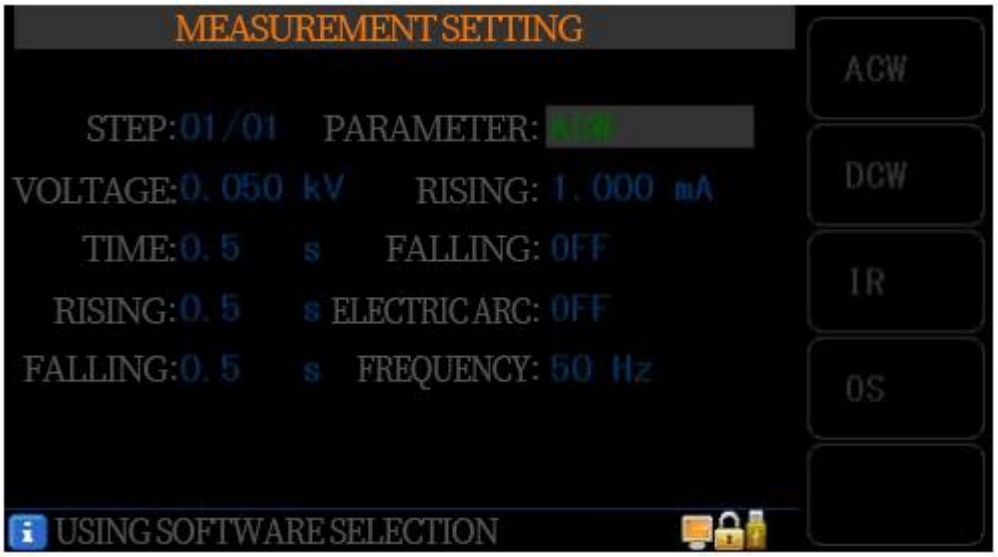


Fig. 1 Schematic diagram of AC setting interface of 4.2 1

Test scheme modification description

STEP：01/01

Test step: currently set item serial number/total number of test items.

Function	Chinese	Explain
INS	Insert	Add a new item after this item. The current item and the following item will be moved one place after the meeting.
DEL	Delete	Deletes the current project. The following items will be moved one place before the meeting.
NEW	New	Create an empty test scheme (STEP), and the system will automatically create a default test item. Save your test plan after you write it.
+	Step up	Access the parameters of the step following the currently displayed step.
-	Next step	Access the parameters of the step preceding the currently displayed step.

The ACW current test step operating mode is AC withstand voltage.

When the cursor is in this position, it can switch to DC, IR and OS items through F1 ~ F4.

4. 2. 2 TEST test interface. The interface diagram is as follows: (take AC as an example)

Figure 4.2 2 AC Test Interface

Note: 1. High voltage measurement can be performed in this interface, and parameters must be set in the setting interface.

2. Press ↑ ↓ ← → (direction key) in this interface to quickly switch to the SETUP interface.

3. The F5 function key can lock the keyboard. After the keyboard is locked, the instrument only responds to the START, STOP and F5 (unlock) keys.

Three data are displayed in large font in the middle of the instrument panel after the measurement is started. Display the real-time test data during the test, and display the result of the last test before pressing the STOP key after the test.

(1) Above is the output voltage in kilovolts (kV).

(2) In the middle is the measured current in milliamperes (mA) and microamperes (uA).

(3) The lower part is time. If the test time is turned off, the displayed test time of the DUT will not be accumulated if it is greater than the 999.9, and the unit is second (S). If the first hand is "FAIL", the test status must be exited with "STOP".

! Special Reminder:

When the machine is switched on, the operator must not leave the station!!!

During the test, no one is allowed to approach the test area of the instrument!!!

Persons other than the operator must not approach the withstand voltage meter with the power supply turned on to avoid danger!!!

4. 2. 3 Control setting interface. The schematic diagram of the interface is as follows:

1. Control setting interface

Fig. Interface of 4.2 and 3.1 control settings

Description of interface parameters:

Chinese	Set the mark	Parameter value description	Chinese meaning
Control mode	CTRL MODE	FILE	After the test, the HANDLER interface outputs the test result.
		STEP	At the end of each step, the HANDLER interface outputs the test result of the current step.
Failure mode	FAIL MODE：	STOP	Quit directly if it is not qualified.
		CONTINUE	If it is not qualified, continue the test, and the result will be output by the table.
		RESTART	If it is not qualified, press START to retest. Secondary current nonconforming step.
		NEXT	If it is not qualified, press START to continue the test One step.
Qualified maintenance	PASS HOLD：	0.2S～99.9S	When the test is passed, the holding time of the pass judgment.
		KEY	Pause and press the 'STOP' key to end.
Delay time	STRT DLY	0.1~99.9S	Set the delay time from the start key press to the start of the first item test.
		OFF	By default, the test starts as soon as the instrument is ready.
Test protection	TEST SAFE	ON	The FAIL state must be returned to the wait state with STOP, To start the next test with START.
		OFF	The FAIL state automatically returns to the wait state, using START Directly start the next test.

Short circuit threshold	SHORT	LOW	Short circuit response sensitivity: low
		HIGH	Short circuit response sensitivity: high
Step mode	STEPMODE	NORMAL	Normal mode: test step by step.
		REPPEAT	Automatic cycle test.
Adjustable mode	TURE MODE	OFF	The output voltage is not adjustable during the test.
		ON	Voltage output allows fine adjustment of the output voltage. Note: This mode turns on ARC with false positives.
Keep between items	STEP HOLD	0.2S～99.9S	The time spent waiting between items in a multi-item test.
		OFF	No waiting between items
		KEY	Pause and press the'START 'key to start the next item.
Discharge hold	DISCHG	200ms	Hold for 200ms after the test is completed
		500ms	Hold 500ms after the test is completed
		1s	Hold for 1 s after the test is completed
		2s	Hold for 2 seconds after the test is completed
		Close	Do not hold after test completes
Electric shock protection	I:	ON 、 OFF	Ground current sense, enabled.
Clear settings	OFFSET	OFF~ON	Base clear setting.
		GET	Obtain the test base under the current test conditions.

2. Communication setting interface

Figure Communication setting interface of 4.2 and 3.2.

Description of interface parameters:

Chinese	Set the mark	Parameter value description
Bus mode	BUS MODE	RS232C
Baud rate	BAUD	4800~115200
Data bit	Data Bit	6--8
Stop Bit	Stop Bit	1,2
Parity check	Parity	Odd parity, even parity, none
Terminator	Tx Term	LF 0X0A ,CR 0X0D, CRLF
MODBUS address	MODBUSAddr	0-31
Command format	CMD Type	SCPI,2512

4. 2. 4 FILE file storage interface.

Press the (FILE) key to enter the file management interface as follows:

4.2.4.1 FILE 1 interface

4.2.4.2 FILE2 interface

Serial number	Description in Chinese	Shortcut options	Chinese meaning
1	Memory Select	Internal	Internal file interface
		External	External file interface
2	File list	Load	Call the current file as the internal use file
		Save	Internal use files are saved to the current file
		Delect	Delete the current file
		Copy To E:	Copy the current file to the USB flash disk (Internal file)
		Copy To I:	The current file is copied inside the instrument (External file)
		Select	Select the current file
3	Page number	PgUp	Page up
		PgDn	Page down

4.3 Test item interface and parameter description

This section describes the test function parameters of the setting interface and their meanings.

4.3.1 AC Setting of AC withstand voltage test parameters. The setting interface is as follows:

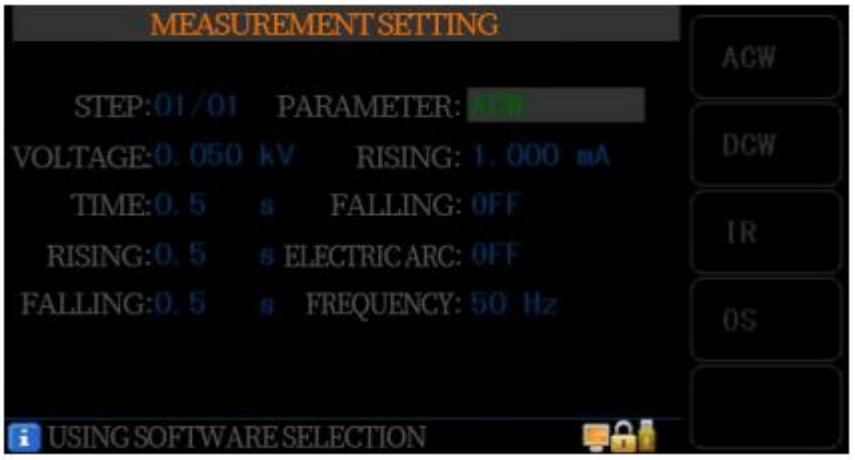


Fig. 1 Schematic diagram of AC setting interface of 4.3 1

Description of AC withstand voltage test parameters:

VOLT：	Voltage	0.010～5.500kV	AC high voltage test voltage value
UPPER：	Upper limit	0.001～20.00mA	MST-8103 Upper Current Limit
		0.001～10.00mA	MST-8103 Upper Current Limit
LOWR：	Lower limit	0.001～20.00mA	MST-8103 Lower Current Value, Must be less than the UPPER value.
		0.001～10.00mA	Series 8101/8103 Lower Current Value, Must be less than the UPPER value.
		OFF	The lower limit is not required
ARC：	Arc	1.0～20.0 mA	Maximum allowable AC arc current
		OFF	Arc is not required
TIME：	Time	0.1~999.9S	Test time of AC withstand voltage, and the test will end when the time is up. RISE≠OFF
		OFF	Test time is not limited
RISE：	Rise	0.1～999.9S	AC High Voltage Test Voltage Rise Time
		OFF	Default = 0.1 S, test time > 0.2 S.
FALL：	Descend	0.1～999.9S	AC High Voltage Test Voltage Fall Time
		OFF	Cut off the voltage output directly after the test. (The DUT may Live)
FREQ：	Frequency	50/60	AC operating frequency

4. 3. 2 DC withstand voltage test parameter setting. The setting interface is as follows:

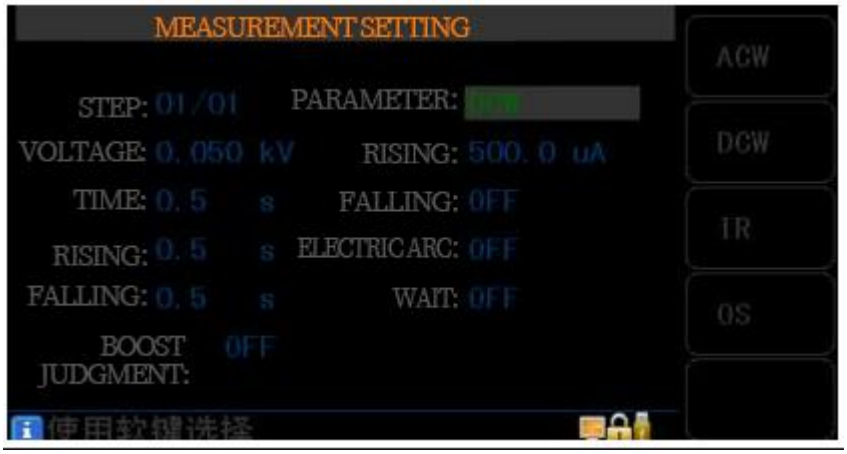


Fig. 4.3. 2 Schematic diagram of DC setting interface

The DC withstand voltage (DC) test parameters are described as follows:

Voltage	VOLT：	0.010～7.200kV	DC high voltage test voltage value
Upper limit	UPPER：	0.1uA～10.00mA	MST-8103 Upper Current Limit
		0.1uA～5.00mA	MST-8103 Upper Current Limit
Lower limit	LOWR：	0.1uA～10.00mA	MST-8103 Lower Current Limit, Is less than the UPPER value.
		0.1uA～5.00mA	8103 current lower limit, Is less than the UPPER value.
		OFF	The lower limit is not required
Time	TIME：	0.1～999.9S	DC withstand voltage test time, and the test ends when the time is up Try, RISE RISEOFF
		OFF	Test time is not limited
Rise	RISE：	0.1～999.9S	DC High Voltage Test Voltage Rise Time
		OFF	Default = 0.1 S, test time > 0.2 s
Descend	FALL：	0.1～999.9S	DC High Voltage Test Voltage Fall Time
		OFF	Directly cut off the voltage output at the end of the test, and enter 0.2 S Fast discharge.
Wait	WAIT：	0.1～999.9S	DC charge waiting time.
		OFF	The element does not need to be charged
Arc	ARC：	1.0～20.0 mA	Maximum DC arc current
		OFF	Arc is not required
Boost determination	RAMP：	ON	Voltage rise time and current upper limit judgment are allowed.
		OFF	Voltage rise time, current upper limit is not detected, but The current limit determination is still judgmental.

* Note: The data below the current upper and lower limit of 1uA must be input by using the soft data keyboard mode.

4. 3. 3 IR insulation resistance test parameter setting. The setting interface is as follows: (schematic diagram 4.3. 3):

Figure 4.3 IR setting interface diagram

The insulation resistance (IR) test parameters are described as follows:

Voltage	0.010～2.500kV	Insulation test voltage value.
Upper limit	0.2M～100.00G	Upper limit value of insulation resistance.
	OFF	Do not judge the upper limit value of insulation resistance.
Lower limit	0.2M～100.0G	Lower limit value of insulation resistance, less than UPPER value.
Time	0.1～999.9S	Insulation resistance test time. (RISE≠OFF)
	OFF	The test time is not limited.
Rise	0.1～999.9S	Insulation voltage rise time.
	OFF	Default = 0.1 S, test time > 0.2 s.
Descend	0.1～999.9S	Insulation voltage fall time.
	OFF	Directly cut off the voltage output at the end of the test, and enter 0.2 S fast discharge.
Range	AUTO	Autoranging mode: improves test accuracy.
8103	2uA 、 20uA 、 200uA 、 2mA、 10mA	Fixed range mode: I = U/R can be used to estimate the range to speed up the test.
8103	1uA 、 10uA 、 100uA 、 1mA、 5mA	

Notice

1. **When RANGAUTO, due to range switching, the minimum test time is 0.6 S,!!!**
2. **Because the current acquisition lags behind the voltage acquisition by about 20 mS, the voltage rise time shows that the resistance value is smaller, and the voltage fall time shows that the resistance value is larger.**
3. **Only SHORTFAIL will respond during the charging and testing process, and the lower limit of the test will be judged at the end of the test!!!**

4. 3. 4 OS open/short circuit detection test parameter setting. The setting interface is as follows:

Fig. 4.3. 4 Schematic diagram of OS

setting interface The test parameters of open/short circuit detection (OS) are described as follows:

Open the way	OPEN：	10%～100% STEP：1%	Percentage of open circuit decision threshold and standard value
Short circuit	SHRT：	OFF～100%～500% STEP：10%	Percentage of threshold value and standard value for short circuit determination
Standard	STAN：	Previous standard values	The standard value of the sample
		GET	Obtain the current distribution parameters as the standard

Note: 1. When the cursor is at the standard value (as shown in the figure above), the (F1) function key position displays (GET).

2. At this time, press the (F1) function key, and the instrument enters the standard value sampling state. When sampling, the instrument will output a voltage of 100 V and automatically obtain the current flowing through the tested part within 100 milliseconds. (Please pay attention to safety if there is voltage output during GET)

3. The capacitance value displayed by the instrument here is not the actual capacitance value, but the value of the sampled current after impedance conversion, which should be similar to the actual capacitance installed between the test terminals. (The sampled current is not just due to capacitance.)

OPEN SHORT value setting:

The OPEN value is greater than the value when the instrument is not connected to the DUT, and is less than the minimum value when the DUT is connected. The short value is greater than the maximum value of the connected DUT, and is less than the value with other short-circuit problems.

Example: Take 3-coil inductance as an example: the capacitance between 1-2 is about 300 P, the capacitance between 1-3 is about 200 P, and the capacitance between 2-3 may be short-circuited. 1. Do not connect the DUT GET: STAN = 100P, and confirm the open circuit value.

2. Record the GET data range by connecting the tested part for many times: STAN = 350P ~ 450P, and confirm the standard value.

3. Short circuit 2-3, GET data range: STAN = 550P ~ 650P,

confirm the short circuit value. Parameter setting calculation:

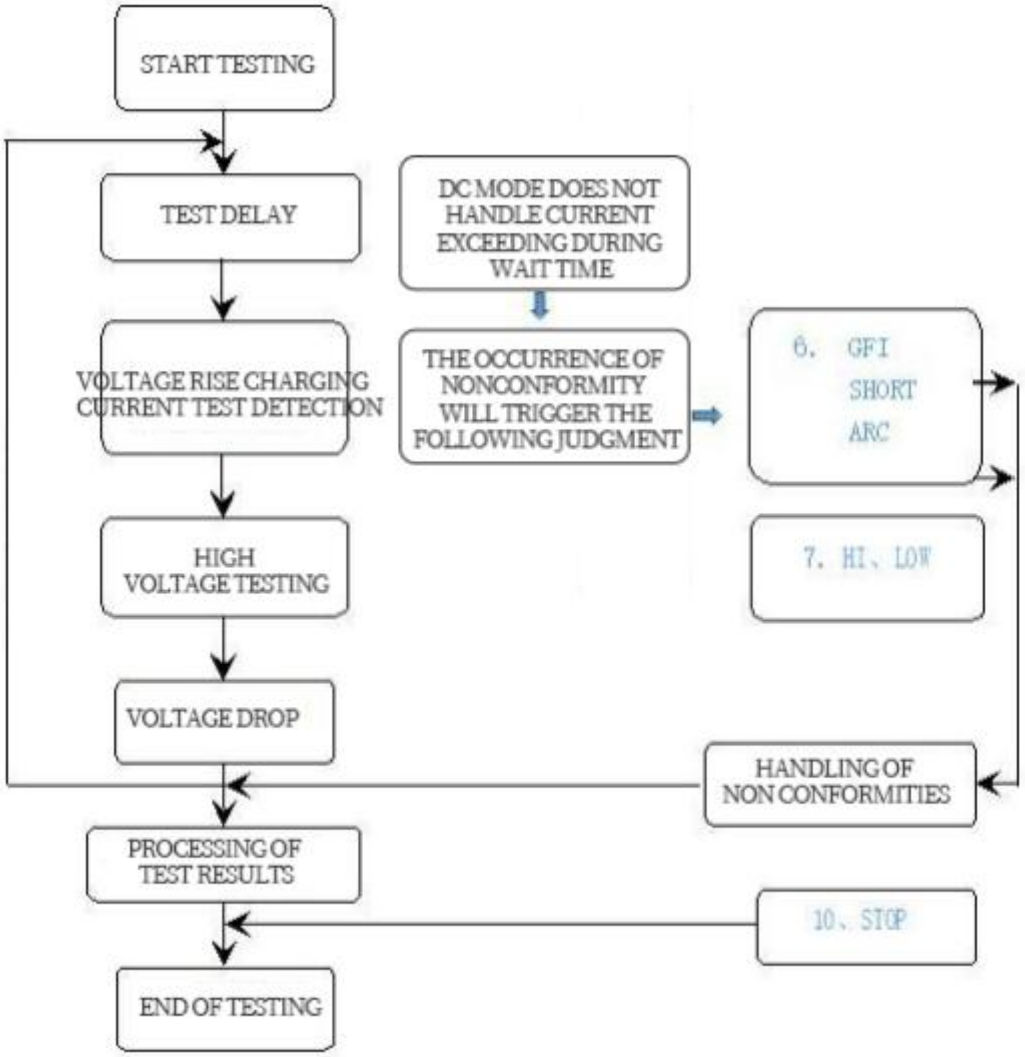
1. Assume STAN = 400P

2. OPEN value: lower limit = 100P/400P = 25%, upper limit = 350P/400P = 88%. 60% is recommended

3. SHORT: Lower limit = 450P/400P = 112%, Upper limit = 550P/400P = 138%, 125% is recommended.

4.4 Principle and instructions of test function

This section describes the principle and use of tests such as ground connection, ground current detection, and arc detection in the order of the test process.



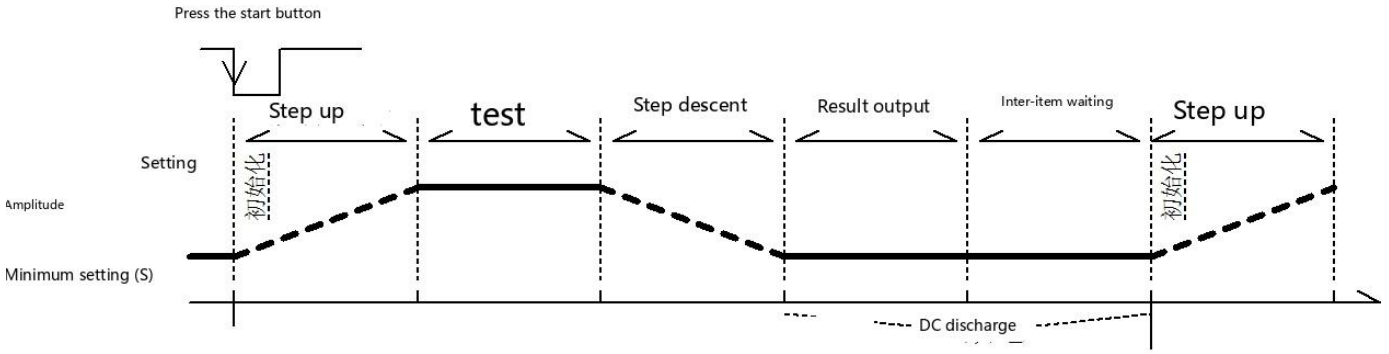
Test flow chart of the instrument

4.4.1 Start the test

After the test conditions are verified and the DUT is connected correctly, press the START key to start the test

4.4.2 Test time delay

After the test is started, the time delay before the first step is delayed according to the setting. The delay between multiple steps is delayed according to the inter-term hold.



Instrument test timing diagram

4. 4. 3 Voltage rise

For devices that are sensitive to abrupt voltage changes. The output starts at zero, and the instrument steps up the voltage in units of 0.1 S, as determined by the test voltage and the voltage rise time (Δ V = V/ (10 * S)). If the voltage rise time (RISE OFF) is turned off, the default time of 0.1 seconds is automatically added to the test time, making the test time a minimum of 0.2 seconds. Note that too small a value may cause an error in the ARC or DC boost determination.

4. 4. 4 DC boost decision

Current upper limit judgment is mainly used to avoid misjudgment.

When the distributed capacitance is small, the charging current is relatively small, which will not cause significant changes in the current. Opening the boost judgment can find the poor performance of the tested part as early as possible, and reduce the probability of overcurrent damage.

When the distributed capacitance is large, the capacitor will have a charging process, and the current at this time may be greater than the upper limit of the set current. If the boost judgment is turned on, it will cause a misjudgment of exceeding the upper limit. The short circuit threshold can be opened to reduce the short circuit sensitivity and increase the charging current.

4. 4. 5 High voltage test

At this time, it is necessary to ensure that the test circuit is correct, the test results are not affected by the attached parameters, and the display value is the actual withstand voltage and current.

4. 4. 6 Test voltage drop

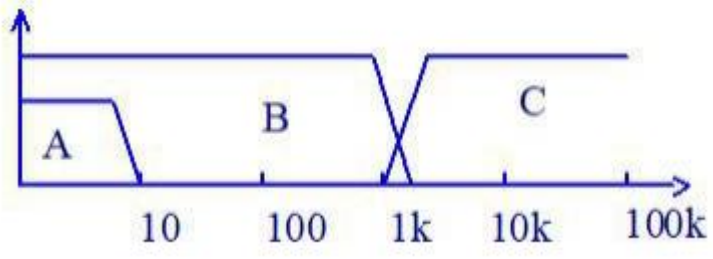
Determined by the characteristics of the DUT. When the voltage drops at the end of the test, the instrument controls the voltage drop in units of 0.1 S (the DC voltage does not drop with the control voltage), and the step drop value is determined according to the test voltage and the voltage rise time (Δ V = -V/ (10 * S)). If this feature is turned off, the default time is 0.1 seconds. At this time, no comparison and judgment will be made, and the data is for reference only. At the end of the voltage drop, the test circuit is in the AC withstand voltage mode. At this time, if there is a DC voltage drop

in the DUT, it will discharge through the AC circuit.

4.4.7 Current Overrun and Arc Detection (ARC) Function

Current overrun classification: current lower limit, current upper limit, current overrun, arc detection.

- Current lower limit judgment (LOW): used to judge the disconnection of the low end of the test. When testing the equipment, there will be a certain leakage current. When the leakage current is less than the lower limit of the current, the test is considered to be a failure (no equipment is connected). This function must be turned off if the leakage current of the DUT itself is very small. Valid when the mode is opened, and displayed when it exceeds the limit (LOWFAIL). Timed sampling at a rate of 100mS each time.
- Current upper limit judgment (HIGH): judge whether the test current exceeds the limit. When testing the equipment, there will be a certain amount of leakage current. When the leakage current tested by the instrument is greater than the upper limit, it is considered that the withstand voltage impedance is not enough, and the test fails. (HI FAIL) is displayed. Timed sampling at a rate of 100mS each time.
- Current limit judgment (SHORT): The current sampling is slow, and the current changes quickly when the insulation collapses. The sampling circuit cannot respond in time, and the current peak value exceeds the allowable range, which will trigger the over-limit judgment display (SHORTFAIL). Since the data cannot be collected after exceeding the limit, the output result is the test result within 100mS before exceeding the limit. The limit value is twice the allowable output current (1.5 times the AC peak value). The fall time is invalid. This decision cannot be masked.
- Arc detection (ARC): The function of measuring coil type components. In the high voltage circuit, there is a partial transient discharge that causes current oscillation. Because it is superimposed on the normal test current, the mutation time is short, and the ordinary current detection circuit can not quickly judge. The arc detection circuit filters out the normal current value and only deals with the high-speed current pulse change, and can only roughly estimate the degree of local ignition. As the data cannot be collected after the current exceeds the limit, the output result is the last test result when it is qualified, and (ARCFAIL) is displayed. The ARC current is a qualitative analysis, and the size of the quantity, the environment, and the line distribution have great randomness, so attention should be paid when using it.



Frequency response comparison of current overrun judgment and arc detection: (see the figure above)

- Area A in the figure: frequency response of current sampling. Because the ripple of the power supply frequency is to be filtered → AD sampling → calculation of the test result

  → Analyze whether the current exceeds the set limit. Within the test current range, the pulse width is greater than 100mS.
- Area B in the figure: current fast response circuit. It only filters the signal of high frequency interference, compares the voltage peak value, locks the overcurrent peak value signal, and only makes the limit judgment. It is greater than the output current of the instrument, and the pulse width is greater than 1mS.
- Area C in the figure: arc detection circuit. The arc detection circuit only samples the amplitude of the sudden change in the current, and the signal is high-pass filtered to remove the low frequency, compared with the voltage peak value, and locked by the pulse. Sudden change of current near the set value, with a pulse width of about 1 uS-1mS.

4.4.8 Ground wire current detection function

Detect the current flowing through the instrument housing to prevent electric shock. When the high voltage is output, the current flows back to the instrument shell from the output end through the human body, which may cause very serious consequences.

- When the ground wire current detection is enabled, if the ground wire current is greater than the 0.45, it is judged that the ground wire is out of limit.
- When the electric shock is judged, the high-voltage output is ended within the 0.3 S, and the test state is exited. And show (I FAIL).

Note: The instantaneous output current of the instrument may be greater than 30 mA, which may cause coma or death in case of electric shock. Therefore, it is recommended to turn on the ground wire current detection.

4.4.9 Test result processing

There are multiple test items, and FAIL judges and handles the failure mode control. Otherwise, the instrument will display the FAIL judgment and category and wait for the user to process. The test ends normally, and the result is (PASS).

The PASS judgment is controlled by the PASS HOLD of SYSTEM, and then it is ready to start the next measurement or return to the test waiting state. If FILE mode is selected, the test results will not be output until the entire file is tested.

The STEP mode controls the interface to output the corresponding signal in each step.

4.4.10 STOP (Stop Measurement)

During the test, press the 'STOP' key, and the instrument automatically ends the test. Press the 'STOP' key again to return to the test wait state. At the end of the test, the customer can use the software to query the last test data obtained before the 'STOP'.

4.4.11 Unqualified judgment

1. If the current exceeds the maximum output current during the test, or if any potential safety hazard is found, the circuit voltage will be cut off immediately, and it will be judged as unqualified after the software queries the cause of the error.
2. If the test result exceeds the set limit, the instrument will judge that the tested part is unqualified. And the current test is stopped, the voltage output is cut off, and the unqualified processing program is entered.

2. Multi-step test. There is a step of FAIL, and the total test result is FAIL.

4.4.12 FFSET (Base Clear)

Due to changes in the working environment of the instrument and the placement of the test cable, there may be some floor numbers during the no-load test. For customers who require accurate measurement, it can be cleared in the SYSTEM interface.

- Set the current test conditions on the SETUP interface.
- Select the OFFSET item in the SYSTEM interface and set it to ON.
- Pressing GET will automatically start the high voltage test with the current test value as the zero value.
- If the customer has not set the test time, you can use the STOP key to stop the test.

Notice

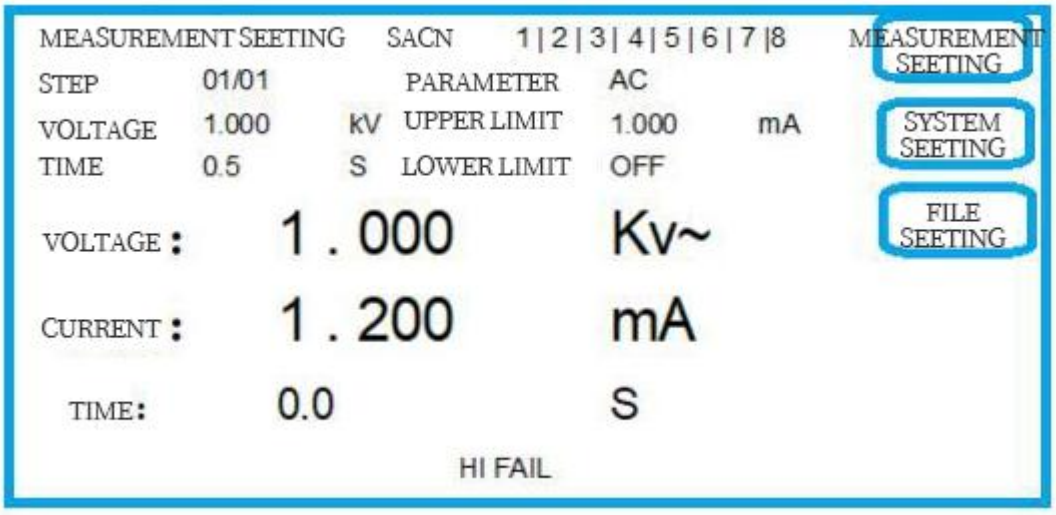
Do not connect the product to the test end during GET. Clearing the product cannot improve the actual test range of the instrument. OFFSET will clear all steps. Please confirm that the setting data is correct.

To change the test condition, you must redo the OFFSET.

4.5 SCAN Multichannel Architecture and Usage

Multi-channel structure means that the instrument can switch the connection between the test terminal and the output terminal through the high-voltage relay. The test fixture is connected once and tested many times, and the position of the test fixture does not need to be manually changed in the test process, so that the test speed is improved, and the potential safety hazard in the test is avoided.

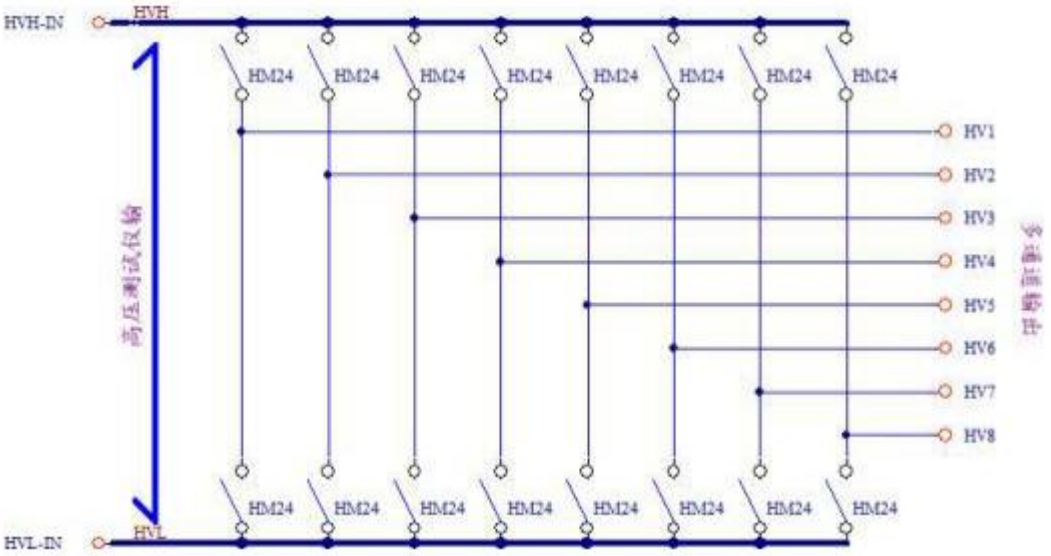
4.5.1 **After adding multiple channels, the instrument adds the SCAN parameter**



The number in the parameter indicates the corresponding output channel, and the color indicates the internal connection:

Scan	SCAN:	1|2|3|4|5|6|7|8	8 controllable output channels
		Black	This circuit is open.
		Red	This circuit is connected to the high voltage end
		Green	This circuit is connected to the test terminal

4.5.2 **The construction principle is as follows**



Notice

1. **In the multi-channel state, the output port of the original withstand voltage instrument**

still has

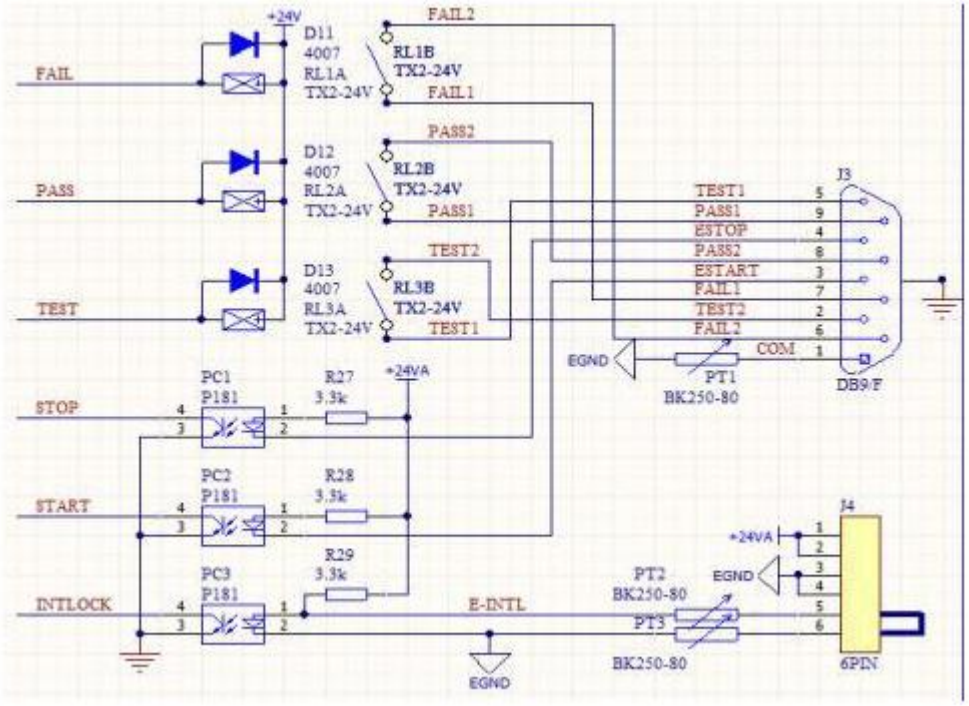
2. the original function. Can be used as a common port.
3. The output port connection of multiple channels is set by the user at will. Pay special attention when using: do not connect redundant high-voltage wiring to avoid danger.

4. 6 Circuit structure and application of HANDLER interface and SINGAL interface

4. 6. 1 Control interface principle

Internal principle of HANDLER interface and SINGAL interface instrument. As follows:

Explain



4.6.1: HANDLER, SIGNAL interface structure and timing

1. HANDLER interface: START, STOP and COM signals constitute remote input control, and the switch input is closed and effective.

2. HANDLER interface: remote output control composed of TEST, PASS and FAIL signals. The switch output is active closed. TEST can be used as a high voltage start signal or a pulse signal for normal operation of the instrument.

3. The SIGNAL interface is mainly (INTLOCK). This signal is short-circuited by default. When it is open-circuited, it is forbidden to start the high-voltage output.

4. The SIGNAL interface also provides a power supply with an output voltage of about + 24 V and an output current of less than 0.5 A. With the control signal of the HANDLER interface, it can be used to drive indicator lights, photoelectric switches, low-power solenoid valves, etc. (See figure below)

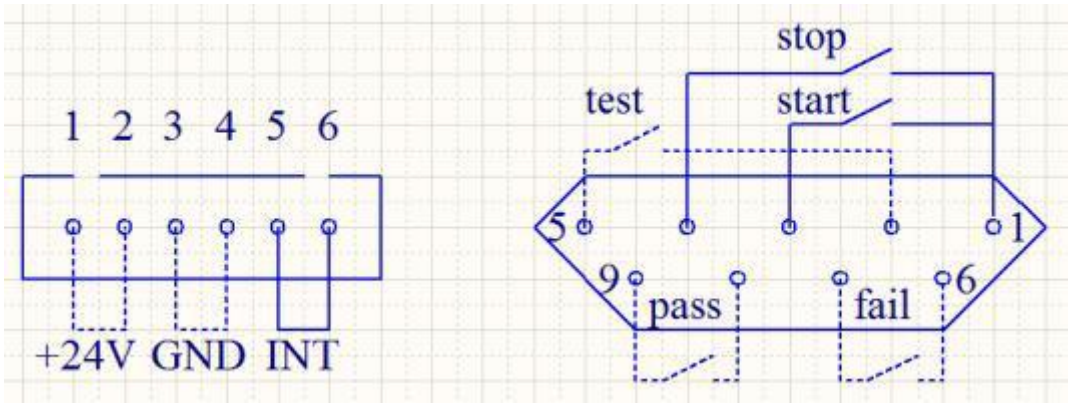


Figure 4.6. 1: Panel view behind the HANDLER SIGNAL interface (schematic)

4. 6. 2 Control interface usage

The control interface is typically used for remote control and test synchronization or indication. The interface external connections are as follows:

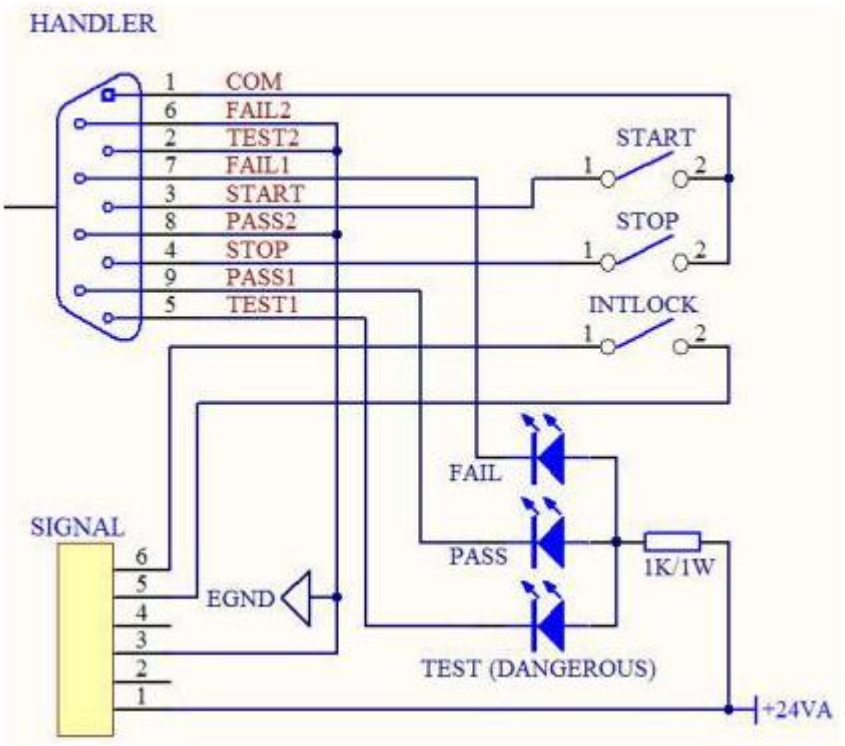


Figure 4.6. 2: Schematic

Explain

1. The switch can be replaced by isolated switch elements such as the secondary side of the optocoupler. Refer to the principle in the figure above for the current direction (the COM end is the low end).

2. The indicator light here can be replaced with other drive control components, and the current direction depends on the power supply.

3. Internal power supply performance of the instrument

a) It is the rectified and filtered output of the AC power supply, and the unregulated output is about 24 V.

b) The instantaneous maximum current shall not be greater than 0.5 A, and the long-time working current shall be less than 0.2 A. If more current is required, please provide your own power supply.

c) The external control signal needs more than 220V voltage or 2A current, and the internal relay of the instrument will not be able to bear it. Please transfer it by yourself.

4. 7 Other interfaces and functions of the instrument

1. USB DEV on the front panel is used to export and import customer setting files and upgrade instrument software.

2. RS232 is used to connect with the computer. See the system setting item for the baud rate.

Chapter 5 Serial Command Set Description

Brief description of the instruction format:

1. The instrument instruction set only describes the actual characters that the instrument accepts or sends.
2. The command characters are ASCII characters.
3. Data of instruction "<??"? > "are ASCII strings.". The default format of the system is integer or floating point number, and the unit of the data is the default value, which does not appear in the instruction.
4. There must be an instruction end mark at the end of the instruction: the identifier of the end of an instruction. Without this identifier, the instrument will not parse the instruction.

The a) default end tags are: Carriage Return (NL), Print Control (n), Decimal (10), Hexadecimal (0x0a). End of UNK1IEEE-488 bus: keyword (^ END), signal (EOI).

Multiple instructions can simplify sending examples as follows: Note: In the example, "_" is a space mark.

FUNC：SOUR：STEP_1：AC：VOLT_1000；UPPC_1；TTIM_9.9；CH1_HIGH；CH2_LOW (NL^END)

FUNC：SOUR：STEP_INS (NL^END) FUNC：SOUR：STEP_2：DC：VOLT_1000；UPPC_1；TTIM_9.9；CH1_HIGH；CH2_LOW (NL^END)

5.1 SCPI instruction set

Instrumentation Subsystem Commands for Serial

- DISPlay ●FUNCtion
- SYSTem ●MMEM●FETC

5.2 DISPlay Subsystem Command Set

The DISPlay subsystem command set is mainly used to set the display page of the instrument? You can query the current page.

DISPlay：PAGE

Command syntax: DISPlay: PAGE < pagename >

< page name > is as follows:

MEAS	Set display page to: Measurement display page
MSET	Set Display Page to: Measurement Setup Page
MSCT	Set display page to: Control setting page
SYST	Set display page to: System setting page
FLIS	Set the display page to: (Internal) File

List Character? You can query the current page.

-- Example: Set the display page to: Measurement display page.

Set Command: DISP: PAGE MEAS

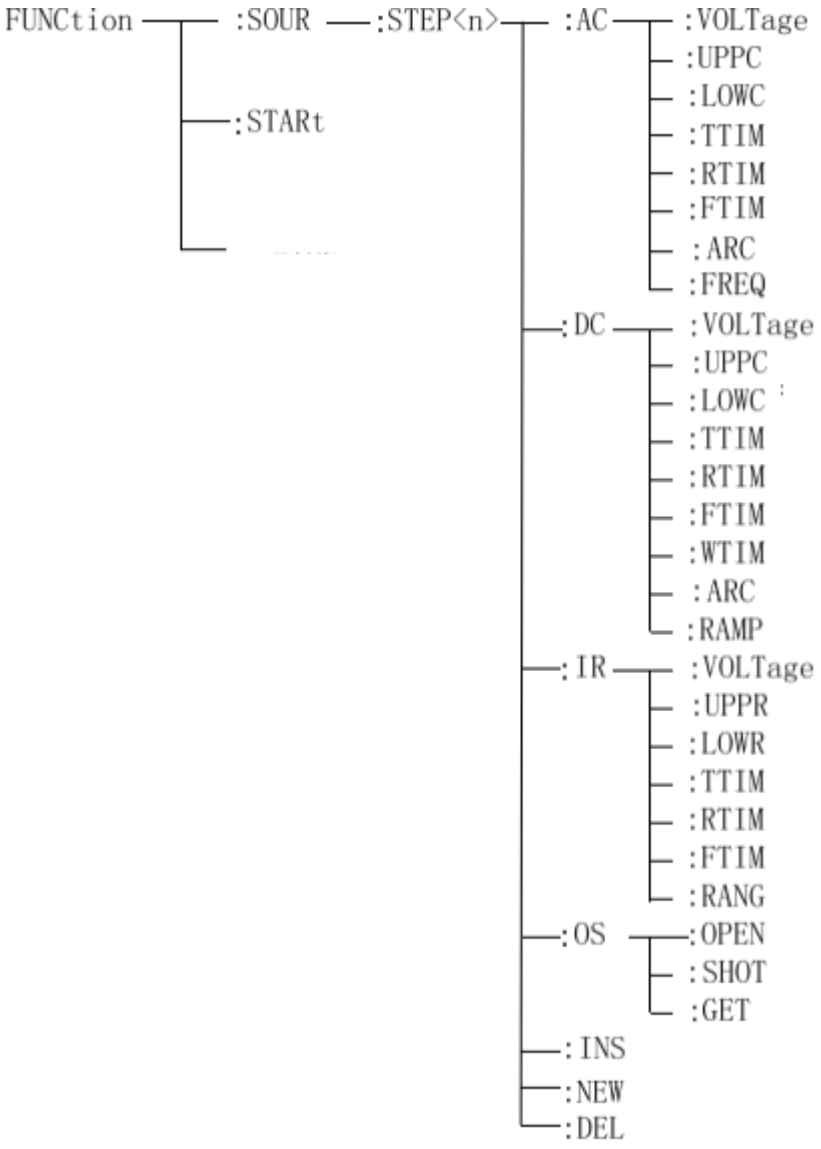
Query instruction: DISPlay: PAGE?

Return value: MEAS

5.3 The FUNCtion subsystem command set

5.3.1 The command set of FUNCtion subsystem is mainly used to set the test parameters of the instrument test function.

Command tree:



5.3.2 PROG function command set

FUNC: STARt starts the test when the instrument is in the test interface.

FUNC: Stop the test when the STOP instrument is on the test interface.

FUNC: SOURce: STEP INS Add a new test item in the existing test plan (STEP) FUNC: SOURce: STEP DEL Delete the current test item in the existing test plan (STEP). FUNC: SOURce: STEP NEW Create an empty test plan to write a new test plan. FUNC: SOURce: STEP < Sn > Edit the < Sn > th step of the current test scenario, < Sn > = 1 ~ 25.

5.3.3 AC Setup function command set (8103 series as an example).

FUNC: SOURce: STEP < Sn >: AC: VOLT Sets/Queries ACW's voltage

-- Format:

Format: FUNC：SOUR：STEP < Sn >: AC: VOLT < voltage value >

Query format: FUNC：SOUR：STEP <sn>：AC：VOLT?

-- Data < Sn >

Data Type:

Integer

Data range: 1 ~ 25

Data precision: 1

-- Data < voltage

value >: data type:

floating point

number

Data range: 10 ~ 5500 (MST-8103: 50 ~ 5000)

Data accuracy: 1

Data unit: V

-- Example:

Set the voltage of ACW in STEP 1 to 1000 V

Set command: FUNC: SOUR: STEP 1: AC: VOLT 1000

Query command: FUNC: SOUR: STEP 1: AC: VOLT?,

return value: 1000.

FUNC: SOURce: STEP < Sn >: AC: UPPC set/query the upper current limit of ACW

-- Format:

Format: FUNC：SOUR：STEP < Sn >: AC: UPPC < current value >

Query format: FUNC：SOUR：STEP <sn>：AC：UPPC?

-- Data < voltage

value >: data type:

floating point

number

Data range: 0.001 ~ 20.000 mA

Data accuracy: 0.001 mA

Data unit: mA

-- Example:

Set the upper current limit of ACW in STEP 1 to 1mA

Set Command: FUNC: SOUR: STEP 1: AC: UPPC 1

Query Command: FUNC: SOUR: STEP 1: AC: UPPC?

Return value: 1.000

FUNC: SOURce: STEP < Sn >: AC: LOWC sets/queries the lower current limit of ACW

-- Format:

Set format: FUNC: SOUR: STEP < Sn >: AC: LOWC < current value >

Query format: FUNC: SOUR: STEP < Sn >: AC: LOWC?

-- Data < current

value > Data type:

floating point

number

Data range: 0 to 20.000 mA (where 0 is OFF) 0 to 10.000 mA (where 0 is OFF)

Data accuracy: 0.001

mA Data unit: mA

-- Example:

Set the current lower limit of ACW in STEP 1 to 1mA

Set Command: FUNC: SOUR: STEP1: AC: LOWC1

Query Command: FUNC: SOUR: STEP1: AC: LOWC?

Return value: 1.000

FUNC: SOURce: STEP < Sn >: AC: TTIM Set/Query Test Time for ACW

-- Format:

Format: FUNC：SOUR：STEP < Sn >: AC: TTIM < time value >

Query format: FUNC：SOUR：STEP <sn>：AC：TTIM?

-- Data < Time

Value >: Data Type:

Float

Data range: 0 ~ 999.9 (0 is OFF)

Data precision:

0.1 data unit: s

-- Example:

Set the test time of ACW in STEP 1 as 1s.

Set Command: FUNC: SOUR: STEP1: AC: TTIM1

Query Command: FUNC: SOUR: STEP1: AC: TTIM?

Return value: 1.

FUNC: SOURce: STEP < Sn >: AC: RTIM set/query rise time of ACW

-- Format:

Format: FUNC: SOUR: STEP < Sn >: AC: RTIM < time value >

Query format: FUNC：SOUR：STEP<sn>：AC：RTIM?

-- Data < Time

Value >: Data

Type: Float

Data range: 0 ~ 999.9 (0 is OFF)

Data precision:

0.1 data unit: s

-- Example:

Set the rise time of ACW in STEP 1 to 1s

Set Command: FUNC: SOUR: STEP 1: AC: RTIM1

Query Command: FUNC: SOUR: STEP 1: AC: RTIM?

Return value: 1.0.

FUNC：SOURce：STEP<sn>：AC：FTIM

Set/Query ACW Fall Time

-- Format:

Format: FUNC: SOUR: STEP < Sn >: AC: FTIM < time value >

Query format: FUNC: SOUR: STEP **<sn>：AC：FTIM?**

-- Data < Time

Value >: Data

Type: Float

Data range: 0 ~ 999.9 (0 is OFF)

Data precision:

0.1 data unit: s

-- Example:

Set the fall time of ACW in STEP 1 to 1s

Set Command: FUNC: SOUR: STEP 1: AC: FTIM1

Query Command: FUNC: SOUR: STEP 1: AC: FTIM?

Return value: 1.0

FUNC: SOURce: STEP < Sn >: AC: ARC Sets/Queries ARC current upper limit for ACW

-- Format:

Set format: FUNC: SOUR: STEP 1: AC: ARC < current value >

Query format: FUNC: SOUR: STEP 1: AC: ARC?

-- Data < current

value >: data type:

floating point

number

Data range: 0 ~ 20.0 mA (where 0 ~ 0.9 is OFF)

Data accuracy: 0.1 mA

Data unit: mA

-- Example:

Set the ARC current upper limit of ACW in STEP1 to:

1mA Set command: FUNC: SOUR: STEP1: AC: ARC1

Query command: FUNC: SOUR: STEP1: AC: ARC?

Return value: 1.0

FUNC: SOURce: STEP < Sn >: AC: FREQ Set/query test frequency for ACW

-- Format:

Format: FUNC: SOUR: STEP1: AC: FREQ

Query format: FUNC：SOUR：STEP 1：AC：FREQ?

-- Data <

Frequency >:

Data Type:

Character Data

Range: 50/60

Data Precision:

Data unit: Hz

-- Example:

Set the test frequency of ACW in STEP 1 as 50Hz

Set command: FUNC: SOUR: STEP 1: AC: FREQ: 50

Query command: FUNC: SOUR: STEP 1: AC: FREQ?

Return value: 50.

FUNC：SOURce：STEP：AC：CH1

Set/Query Multichannel Value for ACW

-- Format:

Format: FUNC: SOUR: STEP1: AC: CH1

Query format: FUNC：SOUR：STEP1：AC：CH1?

--data < channel

value >: data type:

character

Data range: HIHG/LOW/OPEN

-- Example:

Set CH1 of ACW in STEP 1 to High

Set command: FUNC: SOUR: STEP 1: AC: CH1 HIGH

Query command: FUNC: SOUR: STEP 1: AC: CH1?

Return value: HIGH

Note: Other channels are equivalent, for example:

-- Example:

Set CH2 of ACW in STEP 1 to Low

Set command: FUNC: SOUR: STEP 1: AC: CH2 LOW

Query command: FUNC: SOUR: STEP 1: AC: CH2?

Return value: LOW

5.3.4 DCSetup function command set.

Note: Refer to the AC Setup function command set for the basic format.

FUNC: SOURce: STEP < Sn >: DC: VOLT Set/query voltage of DCW

-- Data < voltage

value >: data type:

floating point

number

Data range: 10 ~ 7200 (MST-8103: 50 ~ 6000)

Data precision: 1

Data unit: V

FUNC: SOURce: STEP < Sn >: DC: UPPC set/query the upper current limit of DCW

-- Data < current

value >: data type:

floating point

number

Data range: 0.001~10.000 mA
0.001~5.000mA

Data accuracy: 0.001 mA

Data unit: mA

FUNC: SOURce: STEP < Sn >: DC: LOWC set/query lower current limit of DCW

-- Data < current

value >: data type:

floating point

number

Data range: 0 ~ 10.0 mA (where 0 is OFF)
0 ~ 5.0 mA (where 0 is OFF)

Data accuracy: 0.001

mA Data unit: mA

FUNC: SOURce: STEP < Sn >: DC: TTIM set/query test time for DCW

-- Data < Time

Value >: Data

Type: Float

Data range: 0 ~ 999.9 (0 is OFF)

Data precision:

0.1 data unit: s

FUNC: SOURce: STEP < Sn >: DC: RTIM set/query rise time of DCW

-- Data < Time

Value >: Data

Type: Float

Data range: 0 ~ 999.9 (0 is OFF)

Data precision:

0.1 data unit: s

FUNC: SOURce: STEP < Sn >: DC: FTIM set/query the fall time of DCW

-- Data < Time

Value >: Data

Type: Float

Data range: 0 ~ 999.9 (0 is OFF)

Data precision:

0.1 data unit: s

FUNC: SOURce: STEP < Sn >: DC: ARC Set/Query ARC current upper limit of DCW

-- Data < current

value >: data type:

floating point

number

Data range: 0 ~ 20.0 mA (0 ~ 0.9 is OFF)

Data accuracy: 0.1 mA

Data unit: mA

FUNC: SOURce: STEP < Sn >: DC: WTIM Wait time to set/query DCW

-- Format:

Format: FUNC：SOUR：STEP < Sn >: DC: WTIM < time value >

Query format: FUNC: SOUR: STEP < Sn >: DC: WTIM?

-- Data < time value >: Data type:

floating point number Data range: 0 ~

999.9 (where 0 is OFF) Data precision:

0.1

Data unit: s

-- Example:

Set the waiting time of DCW in STEP 1 to 1s

Set command: FUNC: SOUR: STEP 1: DC: WTIM 1

Query command: FUNC: SOUR: STEP 1: DC: WTIM?

Return value: 1.0

FUNC: SOURce: STEP < Sn >: DC: RAMP Sets/Queries the boost status of the DCW

-- Format:

Format: FUNC：SOUR：STEP <sn>：DC：RAMP：<ON/OFF> or<1/0>

Query format: FUNC: SOUR: STEP < Sn >: DC: RAMP?

-- data <

voltage >: data

type: character

Data range: OFF (0), ON (1)

Data

precision:

Data unit:

-- Example:

Set the RAMP status of DCW in STEP 1 to ON

Set command: FUNC: SOUR: STEP 1: DC: RAMP ON

Query command: FUNC: SOUR: STEP 1: DC: RAMP?

Return value: 1.

FUNC: SOURce: STEP < Sn >: DC: CH1 Set/query the multi-channel value of the DCW

--data < channel

value >: data type:

character

Data range: HIHG/LOW/OPEN

-- Example:

Set CH1 of DCW in STEP 1 to High

Set command: FUNC: SOUR: STEP 1: DC: CH1 HIGH

5.3.5 IR Setup function command set.

Note: Refer to the AC Setup function command set for the basic format.

FUNC: SOURce: STEP < Sn >: IR: VOLT Set/query IR's voltage

-- Data < voltage

value >: Data type:

floating point

number Data range:

10 ~ 2500 Data

precision: 1

Data unit: V

FUNC: SOURce: STEP < Sn >: IR: UPPC sets/queries the upper resistance limit of IR

-- Data <

Resistance

Value >: Data

Type: Float
Data range: 0 ~ 1E5 (0 is OFF) MΩ (MST-8103 range: 0 ~ 1E4) Data

accuracy: 0.1 MΩ

Data unit: MΩ

FUNC: SOURce: STEP < Sn >: IR: LOWC sets/queries the resistance lower limit of IR

-- Data <

Resistance

Value >: Data

Type: Float
Data range: 0 ~ 1E5 MΩ (minimum 0.2 MΩ; MST-8103 up to 1E4 MΩ)

Data accuracy: 0.1 MΩ

Data unit: MΩ

FUNC: SOURce: STEP < Sn >: IR: TTIM Set/Query test time for IR

-- Data < Time

Value >: Data

Type: Float

Data range: 0 ~ 999.9 (0 is OFF)

Data precision:

0.1 data unit: s

FUNC: SOURce: STEP < Sn >: IR: RTIM set/query rise time of IR

-- Data < Time

Value >: Data

Type: Float

Data range: 0 ~ 999.9 (0 is OFF)

Data precision:

0.1 data unit: s

FUNC: SOURce: STEP < Sn >: IR: FTIM Set/Query IR's fall time

-- Data < Time

Value >: Data

Type: Float

Data range: 0 ~ 999.9 (0 is OFF)

Data precision:

0.1 data unit: s

FUNC: SOURce: STEP < Sn >: IR: RANG Set/query IR range

-- data < quantum

value >: data type:

integer

Data range: 0 ~ 5 UNK120mA series: 0 is AUTO, 1 is 10mA, 2 is 2mA, 3 is 200uA, 4 is 20uA, 5 is 2uA.) UNK 310mA series: 0 is AUTO, 1 is 5mA, 2 is 1mA. 3 is 100 uA, 4 is 10 uA, and 5 is 1 uA.)

FUNC：SOURce：STEP<sn>：IR：CH1

--data < channel

value >: data type:

character

Data range: HIHG/LOW/OPEN

5.3.6 OSSetup feature command set

Note: Refer to the AC Setup function command set for the basic format.

FUNC: SOURce: STEP < Sn >: OS: OPEN Set/Query OS's OPEN ratio

-- Format:

Format: FUNC：SOUR：STEP < Sn >: OS: OPEN < ratio >

Query format: FUNC：SOUR：STEP <sn>：OS：OPEN?

-- Data <

Ratio >: Data

Type: Integer

Data range: 10 ~

100 Data precision:

1

Data unit:

-- Example:

OPEN ratio of OS in STEP 1:50%

Set command: FUNC: SOUR: STEP 1: OS: OPEN 50

-- Return information

Query command: FUNC: SOUR: STEP1: OS: OPEN?,

Return value: the OPEN ratio of OS in STEP 1, for example, the return value of 50% is [space] 50, a total of 3 bits, if it is 100%, the return value is 100

FUNC: SOURce: STEP < Sn >: OS: SHOT Set/Query SHOT rate for OS

-- Format:

Format: FUNC：SOUR：STEP < Sn >: OS: SHOT < ratio >

Query format: FUNC：SOUR：STEP <sn>：OS：SHOT?

-- Data <

Ratio >: Data

Type: Integer

Data range: 0 ~ 500 (0 is off, 10 ~ 500 is ratio)

Data accuracy: 10

Data unit:

-- Example:

Set the SHOT ratio of OS in STEP 1 as: 100%

Set command: FUNC: SOUR: STEP 1: OS: SHOT100

-- Return information

Query command: FUNC: SOUR: STEP1: OS: SHOT?

Return value: SHOT ratio of OS in STEP 1, such as

100.

FUNC: SOURce: STEP < Sn >: OS: GET Get Capacitance

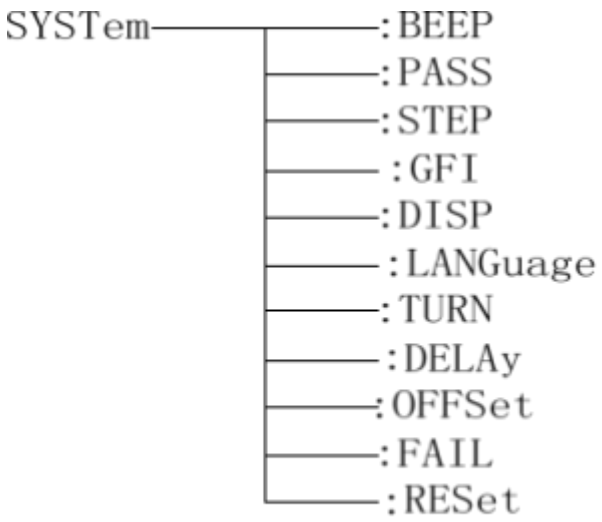
Value Setting Format:

FUNC：SOUR：STEP<sn>：OS：GET

The instrument will automatically sample the capacitance standard value of the current after impedance conversion.

5.4 The SYSTem subsystem command set

Command tree:



SYSTem：PASS **Set/query the time for the PASS beep response (qualified hold time).**

-- Format:

Set Format: SYST: PASS < Time

Value > Query Format: SYST: PASS?

-- Data:

Data type: float

Data range: 0 ~ 99.9 (0: OFF, 0.1: KEY) Data

precision: 0.1

Data unit: s

-- Example:

Set PASSHOLD to 1.0 s

Set command: SYST: PASS 1

-- Return information

Query command: SYST: PASS?

Return value: set value of PASSHOLD, such as 1.0

SYSTem：STEP **Set/query the interval time of STEP (hold between items).**

-- Format:

Format: SYST: STEP < time value >

Query format: SYST: STEP?

-- Data:

Data type: float

Data range: 0 ~ 99.9 UNK20: OFF; 0.1:KEY;

Accuracy of) data: 0.1

Data unit: s

-- Example:

Set STEPHOLD to 1.0 s

Set command: SYST: STEP1

-- Return information

Query command: SYST: STEP?

Return value: set value of STEPHOLD, such as 1.0

SYSTem：DISC **Set/query discharge hold time.**

-- Format:

Format: SYST: DISC < 0/1/2/3/4 >

Query format: SYST: DISC?

-- Data < OFF/0.2 S/0.5 S/1 S/2 S >:

Data type:

character Data

range: 0 ~ 4

-- Example:

Set discharge hold time to OFF Close

state setting command: SYST: DISC 0

-- Return information

Query command: SYST: DISC?

Return value: the state of the discharge hold, such as 0.

SYSTem：GFI Set/query the status of the GFI.

-- Format:

Format: SYST：GFI <ON/OFF> or<1/0>

Query format: SYST：GFI?

-- Data < ON/OFF >:

Data Type: Character

Data range: 0 (OFF), 1 (ON)

-- Example:

Set GFI to ON

Set command: SYST: GFI ON or: SYST: GFI: 1

-- Return information

Query command: SYST: GFI?

Return value: the state of the GFI, such as 1.

SYSTem：FAIL Set/query the status of FAIL MODE (failure mode).

-- Format:

Format: SYST: FAIL < 0/1/2/3 >

Query Format: SYST: FAIL?

-- Data < STOP/CONT/REST/NEXT >:

Data type:

character Data

range: 0 ~ 3

-- Example:

Set FAIL MODE to STOP

Set command: SYST: FAIL0

-- Return information

Query command: SYST: FAIL?

Return value: status of FAIL MODE, such as 0.

SYSTem: Status of the LANGuage setup/query language.

-- Format:

Set format: SYST: LANG < 0/1 >

Query format: SYST: LANG?

-- Data:

Data type: character

Data range: 0 (Chinese), 1 (English)

-- Example:

Set LANG to 0 (Chinese) Set

command: SYST: LANG 0

-- Return information

Query command: SYST: LANG?

Return value: Status of LANG, such as 0.

SYSTem：BEEP　　Set/query the status of the key tone switch

-- Format:

Format:　　SYST：BEEP <off(0)/on(1)>

Query format: SYST：BEEP?

-- Data:

<OFF/ON>

Data type: character

Data range: 0 ~ 1 (where 0 is OFF and 1 is ON)

-- Example:

Set BEEP to 1

Set command: SYST: BEEP 1

-- Return information

Query command: SYST: BEEP?

Return value: the status of the buzzer's key tone, such as 1.

SYSTem: DELAy sets/queries the time of DELAy test delay.

-- Format:

Format:　　SYST: DELA < time value >

Query format: SYST：DELA?

-- Data:

Data type: float

Data range: 0 ~ 99.9 (0 is OFF)

Data precision:

0.1 data unit: s

-- Example:

Set DELA to 1.0 s

Set command: SYST: DELA1

-- Return information

Query command: SYST: DELA?

Return value: setting value of DELA, such as 1.0.

SYSTem: OFFSet sets/queries the status of the zeroing setting.

-- Format:

Format: SYST：OFFS<ON/OFF/GET> or<1/0/GET>

Query format: SYST：OFFS?

-- Data < ON/OFF/GET >:

Data type: character

Data range: 0 (OFF), 1 (ON), GET (get clear value)

-- Example:

Set OFFS to ON

Set command: SYST: OFFS ON or: SYST: OFFS 1

-- Return information

Query command: SYST: OFFS?

Return value: status of OFFS, such as 1.

-- Get the current value directly

Set command: SYST: OFFS GET

SYSTem：TURN

Set/query the status of the voltage adjustment.

-- Format:

Format: SYST：TURN<ON/OFF> or <1/0>

Query format: SYST：TURN?

-- Data < ON/OFF >:

Data Type: Character

Data range: 0 (OFF), 1 (ON)

-- Example:

Set the adjustable voltage to ON

Set command: SYST: TURN ON or: SYST: I: 1

-- Return information

Query command: SYST: TURN?

Return value: the status of GR TURN, such as 1.

SYSTem：RESet

Restore all settings to the default state.

-- Format:

Formatting: SYST: RES

5.5 MMEM Subsystem Command Set

MMEM: Saves the current file to file number.

-- Format:

Formatting: MMEM: STOR: STAT < file number > [, < file name >]

-- Data < file number >:

Data Type:

Integer Data

Range: 1-105

Data Precision:

1

-- Data < file

name >: Note: can

be ignored

Data type:

Character data

range: 1-105

MMEM: LOAD Exports the file specified by the file number to the current.

-- Format:

Format: MMEM: LOAD: STAT < file number >

-- Data < File

No. >: Data Type:

Integer Data Range:

1-105 Data

Precision: 1

5.6 FETCh subsystem command set

FETCh is used to obtain the measurement results of the meter.

-- Format:

Format: FETCh: AUTO < ON/OFF > or < 1/0 >

Query format: FETCh?

-- Data < ON/OFF > or < 1/0 >

Data type: character

Data range: 0 (OFF), 1 (ON)

-- Example:

Automatically return the setup test data to ON

The command is: FETCh: AUTO ON or: FETCh: AUTO 1

-- Return information

The query command: FETCh? Returns the result of

the current measurement of the instrument.

Command syntax: FETCh?

After the instrument receives this command, the instrument will

automatically send out the test results until the test is finished.

Command syntax: FETCh?

After the instrument receives this command, the instrument will automatically send out the test results until the test is finished.

Return format:

Steps: Test items: test voltage (V), test current (mA), sorting

results; Notice

1. All data are in integer or floating point format, ASCII string.

2. The value of IR insulation resistance does not have the unit of ohm.

5.7 Other control command sets

*IDN Inquire about instrument model and version information

The query returns: < manufacturer >, < model >, <

firmware > < NL ^ END > Here: < manufacturer > gives the

manufacturer name (i.e. MATRIX)

< model > gives the machine model

< firmware > gives the software version number (e.g. Version 1.0). For example: WrtCmd (— *

IDN? ||);

Chapter 6 Appendices

6.1 MST-8101/8103 Models and Specification

1. Specific parameters

Model			MST-8101/8103
Withstand voltage test			
Output voltage	**AC**	Voltage range	0.050kV—5.000kV
		Voltage waveform	Sine wave
		Distortion	< 3%
		Operating frequency	50, 60Hz optional
		Frequency accuracy	±1%
		Output Power	100VA（ 20mA）
		Voltage regulation	± (1.0% + 50V) (rated power)
	DC (MST-8101 None)	Voltage range	0.050 kV—6.00kV
		Signal source frequency	600Hz
		Output Power	50VA（ 10mA）
		Voltage regulation	± (1.0% + 100V) (rated power)
	Voltage resolution		1V
	Voltage test accuracy		±2%
	Voltage generation mode		DDS signal source plus class AB power amplifier
Current test range	**AC**	Current range	0.001mA – 20.00 mA
		Short circuit current (Instantaneous)	>40 mA (Set output voltage > 500V)
		Current resolution	0.001 mA
		Current accuracy	± (2% of reading + 2 words)
		Actual current	OFF-0.001 mA-20 mA
	DC (MST-8101 None)	Current range	0.1uA – 10.00mA
		Current accuracy	± (2% of reading + 2 words)
	Discharge function		Automatic discharge after test (DCW)
Insulation resistance test (MST-8101 None)			
Output voltage			0.010V – 1.000V
Voltage resolution			1V
Voltage test accuracy			±2%
Maximum output current			10mA
Maximum output power			10VA（1000V/10mA）
Output instantaneous short-circuit current			>20mA (Set output voltage > 500V)
Load regulation			≤ 1% (rated power)
Ripple (1 kV)			≤ 3% (1 kV, no load)

Discharge function		Automatic discharge after test
Resistance measurement range		0.1MΩ– 10GΩ
Resistance measurement accuracy		Voltage ＜ 500V: 0.2MΩ to 1GΩ Accuracy: [± 10% reading + 5 words] 1GΩ to 10GΩ Accuracy: [± 20% reading + 5 words] Voltage ＞ 500V: 0.2 MΩ --1GΩ accuracy: ± [3% reading + 5 words] 1GΩ -- 10GΩ Precision: ± [7% reading + 5 words]
Arc detection (9 gears optional)		
Measuring range	**AC**	1mA – 20mA
	DC	1mA – 20mA
Comparator		
Discrimination mode		Window comparison method ON under I: when I < Ix < I, PASS; When Ix ⩽ I down or Ix ⩾ I up, FAIL (condition I down < I up) I Down OFF: When Ix < I Up, PASS; When Ix ⩾ I, FAIL Discrimination method of insulation resistance is the same as above
Current upper limit setting I	AC	0.001mA – 20mA
	DC	0.1uA – 10mA
Under current lower limit setting I **(LOWER OFF)**	AC	0.001mA – 20mA
	DC	0.1uA – 10mA
Upper resistance limit setting		OFF - 0.2MΩ - 10GΩ
Resistance lower limit setting		0.2MΩ– 10GΩ
Parameter setting		
Voltage rise time		0.1s – 999.9s
Voltage sag time		0 s – 999.9 s, (only after withstand voltage PASS)
Voltage waiting time		0.3 s – 999.9 s UNK3 DC withstand voltage only and satisfies rise time + test time > etc. Waiting time)
Test time setting		0.3 s – 999.9 s (at TIMER ON)
Time accuracy		± (0.2% of set value ± 0.1 s)
Measurement function		
Keypad lock		Prevent accidental modification of test conditions, or prohibit test conditions from being modified
Base number clearing function		The current flowing through the insulation resistance and the distributed capacitance between the output lines can be cleared.
Start wait delay		When the test is started (START is pressed), first output the high voltage start signal and wait. High voltage output after a certain time

Current overrange judgment	Hardware can quickly judge the insulation breakdown, which is faster and safer than voltage sampling, and reduces the impact damage to the product.
ARC arc detection	Sample the sudden change signal of the current to judge the potential hidden danger and the approximate scale of the circuit
Ground wire current detection	Protect personal safety in case of accidental electric shock or leakage of high voltage to the shell
Alarm volume adjustment	Off, High, Low
High pressure indication	Window indication and LED indication
Storage and interface	
File programming and storage	Programmable 105 test files, each file AC, DC, insulation resistance can be divided into Do not set 25 test steps
USB interface	Have
Boot parameters are saved	The set parameters are saved as default parameters, which can be automatically restored at the next boot
Control interface	HANDLER，SINGAL
Communication interface	RS232C（SCPI / MODBUS）

2. Corresponding table of model and function

	Power	ACW	DCW	IR	OS	SCAN
MST-8103		*	*	*	*	
MST-8101		*			*	

4.General technical indicators

General technical indicators		
Operating temperature and humidity		0°C－40°C, ≤80%RH
Power source		100V-121V，198V-242V47.5-63Hz
Power consumption		≤400VA
Shape and volume		215mm wide * 143mm high (including foot support) * 405mm deep (excluding terminal)
Weight	MST8101,MST8103	About 12 kg

5. Accompanying accessories

MST-8000	Withstand voltage test clip	Pay 1
	Power cord	1

Warranty Card

What the warranty covered:
If the machine break down due to its defectiveness, MATRIX will provide free maintenance during warranty period. If the machine break down due to wrong operation or carelessness, then Matrix provide paid service within warranty period.

How long does this warranty last:
This warranty lasts for 3 years from the date of original purchase of all MATRIX branded products.

Who is covered:
This warranty covers only the original purchaser of this product. This warranty is not transferable to subsequent owners or purchasers of this product.

What do customers need to do to get repairs/service under the warranty policy?
If the machine get problem, please contact our local distributor. If you cannot find the local distributor, you can contact us directly, our email is service@szmatrix.com, our telephone No. is 0086 755 2836 4276.

What information do customers need to supply?

Model No.	
Serial No.	
Problem description	
Picture	
Video if necessary	