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User Manual

ST2692 Insulation Tester

Contents

1 Overview

Thank you for purchasing and using our products, before you use this instrument, first of all, please confirm according to the last chapter of the manual "complete sets and warranty", if there is any discrepancy, please contact us as soon as possible in order to protect your rights and interests.

1.1 Introduction

Model ST2692 Insulation Resistance Tester is an insulation resistance tester with high voltage creepage speed, high accuracy and high stability.

It has high- and low-end contact checking function and upper and lower limit sorting function and is equipped with 37-cell external IO interface, RS232C interface and USB Device interface, which can be widely used in automated testing of production lines. Its own low-voltage short-circuit detection function is very suitable for micro-short-circuit testing of battery cells, thus avoiding the risk of the internal micro-short-circuit portion of the battery being burned off due to the application of high voltage, resulting in the defective product being judged as a good product.

When testing highly insulated DUTs, the current can be calibrated to minimize the deviation caused by ambient temperature and humidity. The instrument has the following main performance characteristics:

- Adjustable test voltage up to 1000V, maximum 2.4mA test current
- 10kΩ ~ 100GΩ Resistance Test Range
- Single measurement speed up to 50ms
- Sorting judgment is possible for both resistance and current.
- Four-end contact check function
- Short-circuit check function (battery micro-short circuit test)
- Noise check function
- Current zero function
- Save up to 16 test files for quick switching between different test conditions
- 7-inch touch screen, 800 × 480 resolution
- Chinese and English operation interface
- Interfaces: USB Device, RS232C, EXT.IO, Analog Output, USB-A

1.2 Conditions of Use

1.2.1 Power Supply

Power Supply Voltage: 220V / 110V (1 ± 10%)

Power Frequency: 50Hz / 60Hz (1 ± 5%)

Power Consumption: < 50VA

1.2.2 Ambient Temperature and Humidity

Normal Operating Temperature: 0°C ~ 40°C, Humidity: < 90% RH

Reference Operating Temperature: 20°C ± 8°C, Humidity: < 80% RH

Transportation Ambient Temperature: 0°C ~ 55°C, Humidity: ≤ 93% RH

1.2.3 Warm Up

Warm-Up Time after Power-On: ≥ 20 minutes

1.2.4 Environment

1) Please do not use in dusty, vibration, direct sunlight, corrosive gases and other adverse environments.
2) If the instrument is not used for a long time, please store it in the original packing box or similar box in a ventilated room with the temperature of 5 °C ~ 40 °C and the relative humidity not more than 85% RH.
3) The air should not contain harmful impurities that corrode the measuring instrument, and it should be avoided from direct sunlight.
4) This instrument has been carefully designed to minimize spurious interference due to inputs from the AC power supply side, however, it should still be used in as low a spurious environment as possible, and if this cannot be avoided, a power supply filter should be installed.
5) Do not switch the instrument on and off frequently as this may cause loss of stored data.

1.3 Dimensions and Weight

Dimensions (W × H × D): 215mm × 89mm × 154mm (without test end, interface and other projections)

Weight: about 1.9kg

1.4 Safety Requirement

This instrument is a Class I safety instrument.

It conforms to the safety requirements of Directive 2006/95/EC:

- EN 61010-1:2010+A1:2019 Safety requirements for electrical equipment for measurement, control and laboratory use

1.4.1 Insulation Resistance

The insulation resistance between the power supply terminals and the housing is **no less than 50MΩ** under reference operating conditions.

Insulation resistance between the power supply terminals and the housing under hot and humid transportation conditions is **no less than 2MΩ**.

1.4.2 Dielectric Strength

Under the reference working conditions, the power supply terminals and the shell can withstand the rated voltage of 1.5kV, frequency of 50Hz AC voltage for 1 minute, without breakdown and flying arc phenomenon.

1.4.3 Leakage Current

Leakage current is **no more than 3.5mA**.

1.5 Electromagnetic Compatibility

Complies with Directive 2004/108/EC on electromagnetic compatibility:

- EN 61326-1:2021 Electromagnetic compatibility requirements for electrical equipment for measurement, control and laboratory use
- CISPR 11:2015+A1:2016+A2:2019 Radioactive and conducted radiation levels, group 1, category A
- EN 61000-4-2:2009 Electrostatic discharge immunity
- EN 61000-4-3:2020 Radiated immunity to RF electromagnetic fields
- EN 61000-4-4:2012 Electrical fast transient impulse group immunity
- EN 61000-4-5:2014+A1:2017 Power line surge impulse immunity
- EN 61000-4-6:2014 Conducted radio frequency immunity
- EN 61000-4-11:2020 Voltage dips and interruptions immunity
- EN 61000-3-2:2019+A1:2021 Harmonic radiation from AC power lines
- EN 61000-3-3:2013+A1:2019+A2:2021 Voltage Changes, Fluctuations and Flicker

2 Panel Description

The content of this chapter is only a general description, the specific operation and detailed explanation of the corresponding content of Chapter 3, Chapter 4 and Chapter 5.

2.1 Front Panel Description

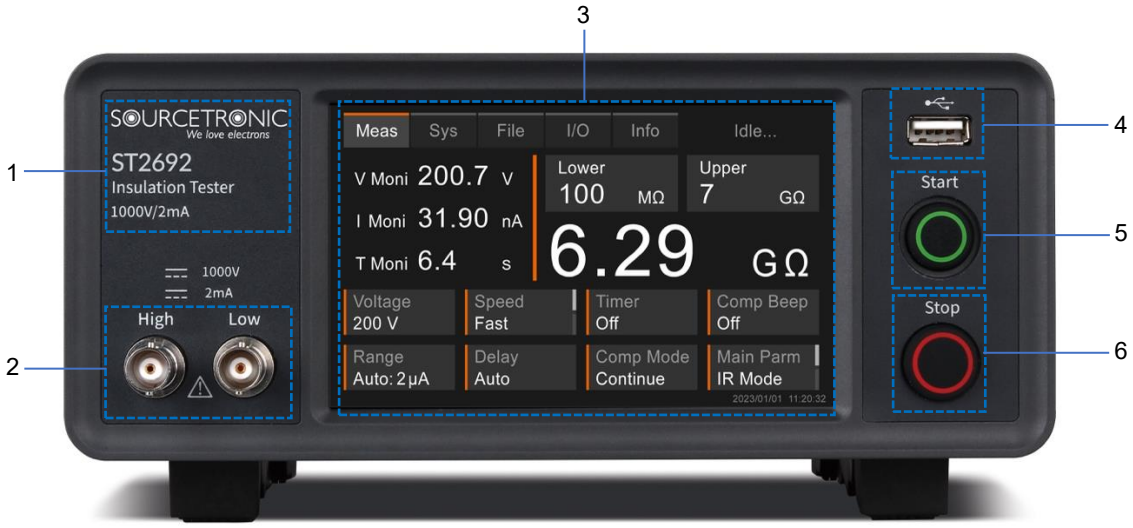


Figure 2-1 Instrument Front Panel

Table 2-1 Instrument Front Panel Description

No.	Name	Description
1	Trademark & Model	
2	Test Port	**High:** Voltage test high end **Low:** Voltage test low side
3	Touch Monitor	800 × 480 pixels, 5-inch touch screen.
4	USB Port	For USB flash drive software upgrades.
5	Start Button	In stop state, press start button to start output.
6	Stop Button	**Function 1:** In output state, press the stop button to stop the output. **Function 2:** In stop state, press the stop button to do the parameter clearing.

2.2 Rear Panel Description

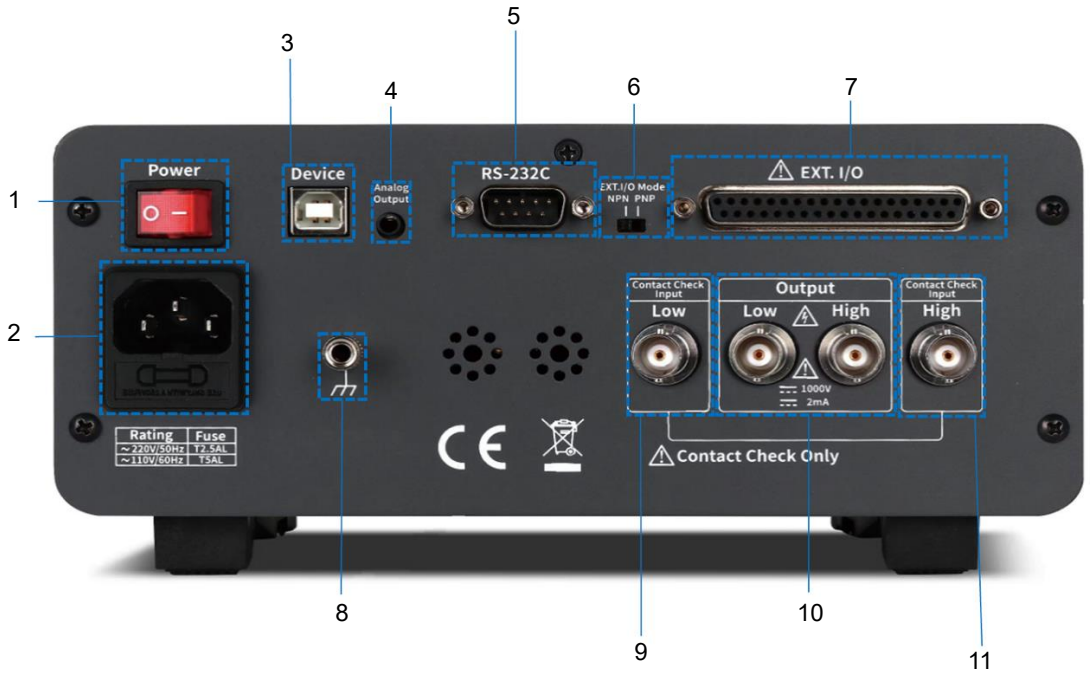


Figure 2-2 Instrument Rear Panel

Table 2-2 Instrument Rear Panel Description

No.	Name	Description
1	Power Switch	Switching the instrument on/off state
2	Three-Wire Power Socket	For connection to 220V / 50Hz or 110V / 60Hz AC power supply
3	USB Device Interface	Serial communications interface
4	Analog Output Interface	0 ~ 4V analog output
5	RS232C Interface	Serial communications interface
6	EXT.I/O Mode Switching Switch	Current Sink (NPN) / Current Pull (PNP) mode switching. The mode is selected according to the external connection, and the switching mode must be under the power-off condition.
7	Ext.I/O External Control Interface	37 pole external control interface
8	Ground Terminal	For grounding
9	Contact Check Low End	For low-end contact check
10	Test Port	**High:** Voltage test high end **Low:** Voltage test low end
11	Contact Check High End	For high-end contact check

2.3 Display Area Description

2.3.1 Measurement Interface

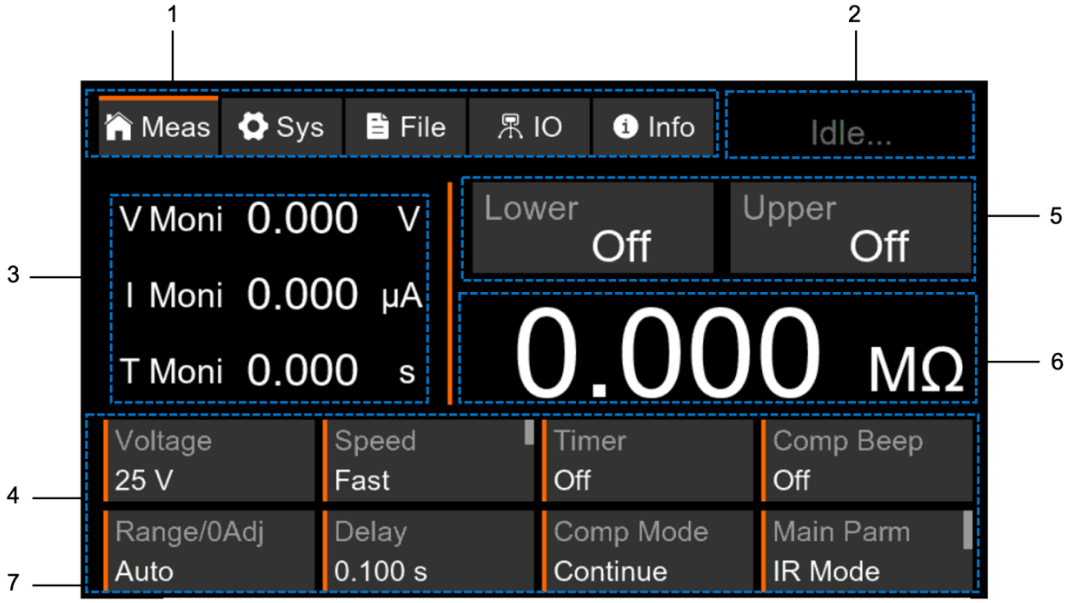


Figure 2-3 Instrument Measurement Interface

Table 2-3 Instrument Measurement Interface Description

No.	Name	Purpose
1	Menu Bar	The menu is fixed at the top of the interface and is used to quickly switch between the five interfaces "Measurement", "System", "File", "Communication" and "Information".
2	Status Bar/ Screenshot Button Area	It is used to show that the instrument is in the six states of "Idle", "Test in Progress", "High Voltage Danger", "Factory Restore", "Language Switching" and "Interlock On". If a USB stick is inserted into the front panel, touch this area to take a screenshot and save the screenshot image in the USB stick.
3	Sub-Parameter Monitoring Area	It is used to display the measured voltage, measured current (measured insulation resistance when the main parameter is in current mode) and test time.
4	Parameter Setting Area	For quick setting of measurement parameters and status display.
5	Upper and Lower Limit Setting and Judgment Display Area	It is used to set the upper and lower limits of the main parameter. When measuring, the bottom color of the key is green to indicate passing, and the bottom color of the key is red to indicate failure.
6	Main Parameter Monitoring and Judgment Display Area	For displaying the test value of the insulation resistance (measured current when the main parameter is in current mode).
7	Information Bar	Unique information bar per page for displaying prompts, e.g. short-circuit checking time when short-circuit measurement is automatic.

2.3.2 System Interface

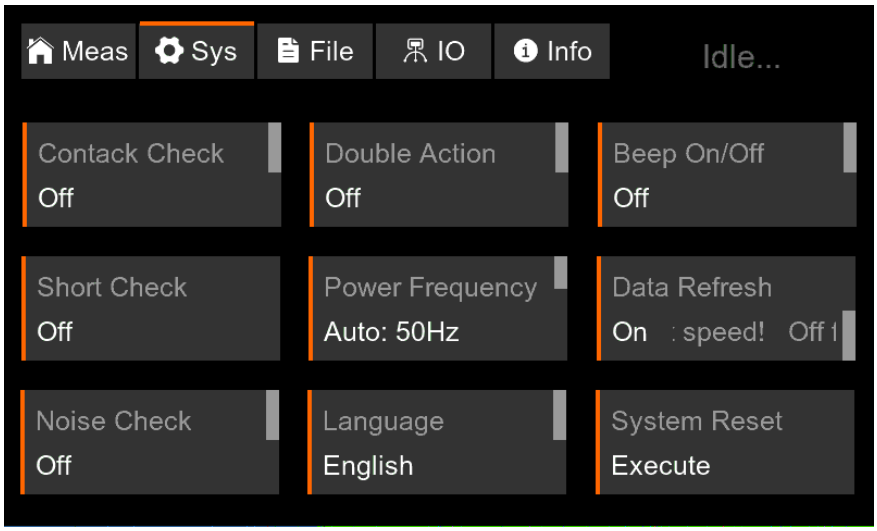


Figure 2-4 Instrument System Interface

2.3.3 File Interface

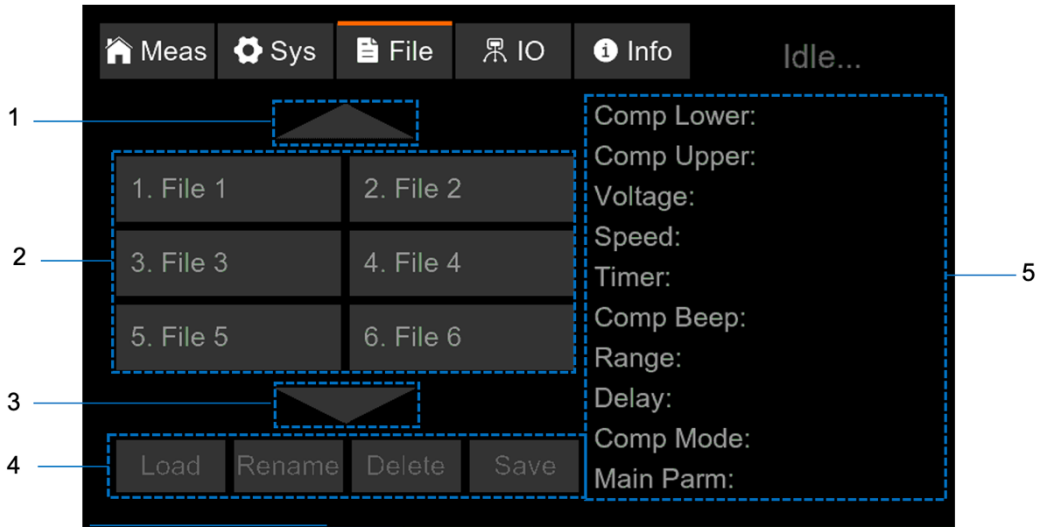


Figure 2-5 Instrument File Interface

Table 2-4 Instrument File Interface Description

No.	Name	Purpose
1	Previous Page	File page up
2	File	Display the 6 files of the current file page
3	Next Page	File page down
4	File Functions	Load, rename, delete, save 4 file functions
5	File Parameters	Display the parameter settings in the selected file

2.3.4 Communication Interface

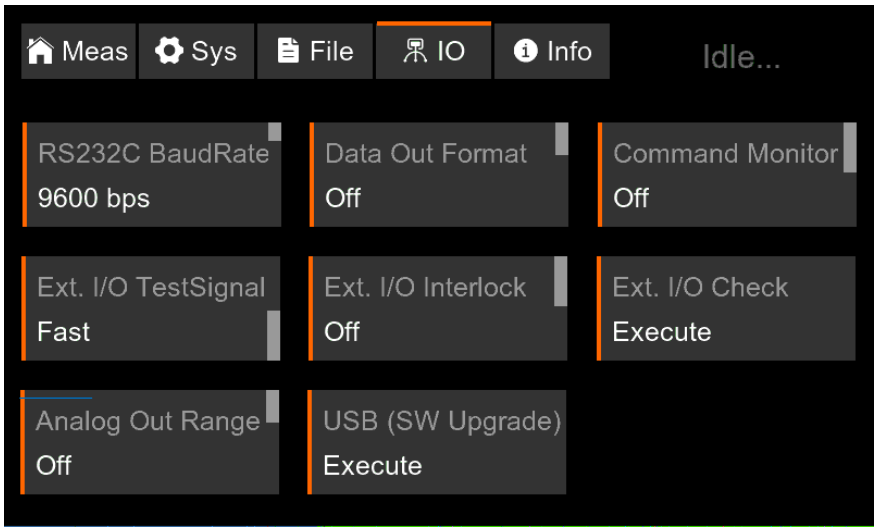


Figure 2-6 Instrument Communication Interface

2.3.5 Information Interface

Figure 2-7 Instrument Information Interface

3 Operating Instructions

3.1 Measurement Page Operating Instructions

Touch the menu bar **Measurement** at the top of the screen to enter the Measurement page, as in Figure 3-1.

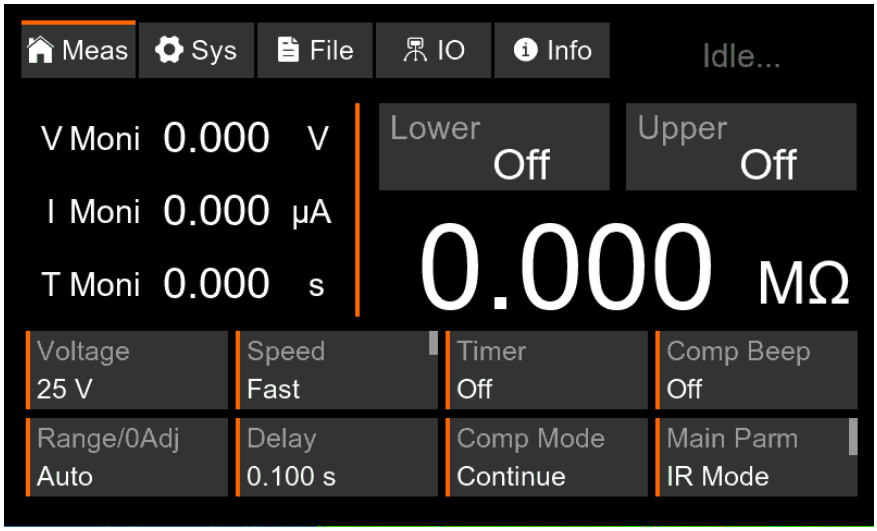


Figure 3-1 Instrument Measurement Interface

3.1.1 Comparator Upper/Lower Limit Setting

Upper and lower limit comparison can be sorted for current or insulation resistance. When the main parameter is insulation resistance mode, the setting range of upper and lower limits is 0.000 ~ 1000GΩ. When the main parameter is current mode, the setting range of upper and lower limits is 0.000 ~ 1000A.

Touch screen to click on the **Main Parameter** in Figure 3-1 to switch between insulation resistance mode or current mode.

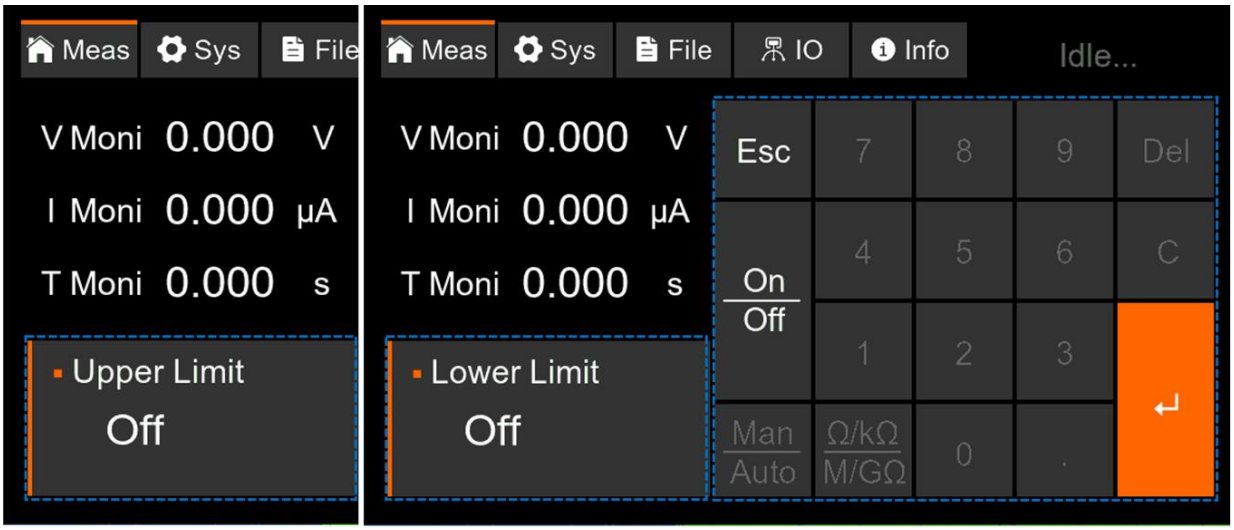


Figure 3-1-1.1 Upper and Lower Limit Setting

Touch screen to click on Figure 3-1 **Upper/Lower Limit**, as Figure 3-1-1.1 pop-up value window, touch screen to open the comparator function, enter the upper/lower limit value with its unit and then ↵ to confirm.

Description of the judgment results:

1) The judgment display area is distinguished by the red/green background color of the upper/lower limit setting keys and the main parameter display area. Red color is judgment failure and green color is judgment pass.
   As shown in Figure 3-3, the upper limit judgment fails, the lower limit judgment passes, and the overall judgment fails.

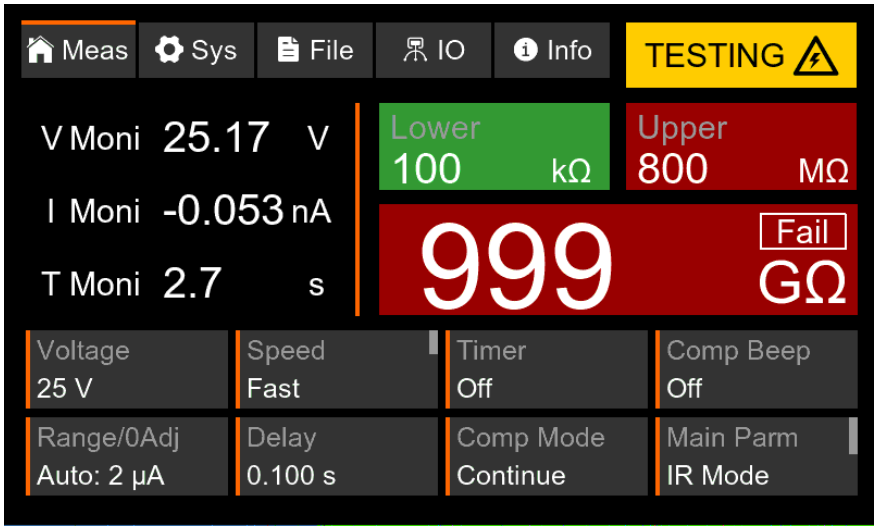


Figure 3-1-1.2 Upper and Lower Limit Judgment

2) Buzzer comparison signal, see 3.1.5 for details.

3) Measured values and judgment results are automatically sent to the PC as data via the RS-232C or USB Device interface, see 3.4.2 Data Output Format for details.

4) Outputs the result of the judgment to the outside, see 4.3 External Interface for details.

Comparison of Functional Determination Methods:

Type	Result	Description
Determination Using Only the Lower Limit Value	PASS	The lower limit value has a set value, and the bottom color of the key is green to indicate that the lower limit is passed. The upper limit is set to off, and the base color is black without change. The main parameter area is bottomed out in green and shows PASS, indicating an overall pass.
	FAIL	The lower limit value has a set value, and the bottom color of the key is red indicating that the lower limit has failed. The upper limit is set to off, and the base color is black without change. The main parameter area is bottomed out in red and displays FAIL, indicating an overall failure.
Determination Using Only the Upper Limit Value	PASS	The upper limit value has a set value, and the bottom color of the key is green to indicate that the upper limit has passed. The lower limit is set to off, and the base color is black without change. The main parameter area is bottomed out in green and shows PASS, indicating an overall pass.
	FAIL	The upper limit value has a set value, and the bottom color of the key is red indicating that the upper limit has failed. The lower limit is set to off, and the base color is black without change. The main parameter area is bottomed out in red and displays FAIL, indicating an overall failure.
	PASS	The upper/lower limit values have set values.

Determination Using Upper/Lower Limit Values		Upper/Lower Limit Setting buttons are both green in color at the bottom to indicate that both upper/lower limits are passed. The main parameter area is colored green at the bottom and shows PASS, indicating an overall pass.
	FAIL	The upper/lower limit values have set values, and the lower limit setting button has a green background color. The bottom color of the upper limit setting button is red, indicating that the lower limit passes and the upper limit fails. The main parameter area is bottomed out in red and displays FAIL, indicating an overall failure.
		The upper/lower limit values have set values, and the upper limit setting button has a green background color. The bottom color of the lower limit setting button is red, indicating that the upper limit passes and the lower limit fails. The main parameter area is bottomed out in red and displays FAIL, indicating an overall failure.

3.1.2 Voltage Setting

Voltage Setting Range: 25V ~ 1000V

Voltage Setting Resolution: 1V

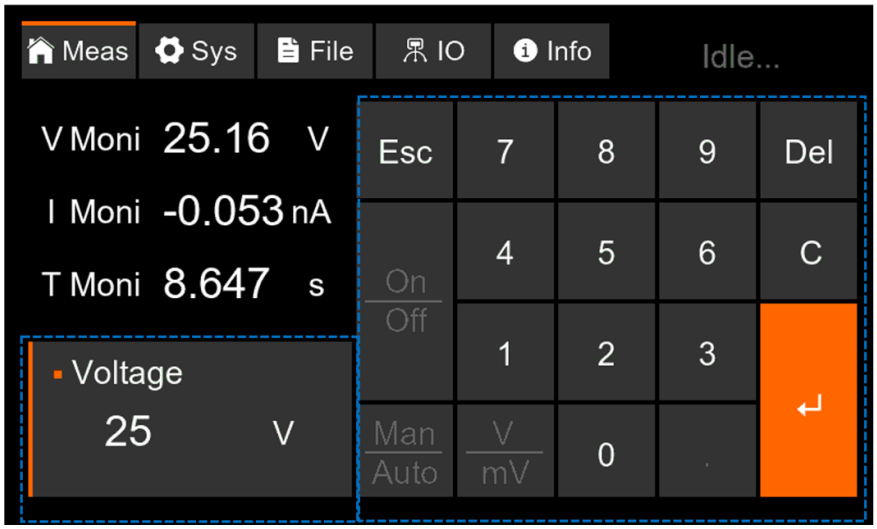


Figure 3-1-2 Voltage Setting

Touch screen to click on Figure 3-1 **Voltage**, such as Figure 3-1-2 pop-up setting window, touch screen to enter the measured voltage value after ↵ to confirm.

3.1.3 Speed Setting

Measurement speeds include 3 speeds: Fast, medium and slow. The fast speed is used to measure at 50ms (80ms for 2μA) (excluding screen refresh time); the medium speed is used to measure at 200ms and display the measured value; and the slow speed is used to measure at 500ms and display the measured value.

Touch screen to click on Figure 3-1 **Speed** to cycle through the 3 choices of Fast, Medium, and Slow.

3.1.4 Timing Control

Timing setting means setting the test time. The test time is the length of time that the test voltage is applied to the DUT. The test time includes the time for the contact check but does not include the time for the short-circuit check.

Note:

1) If the timing setting is too short and the test is stopped before the measurement is completed, the screen does not refresh the test value.

2) Due to environmental and other factors, the measured value may take a certain amount of time to stabilize, and the time required to stabilize the measured part should be fully considered and tested before setting the test time.

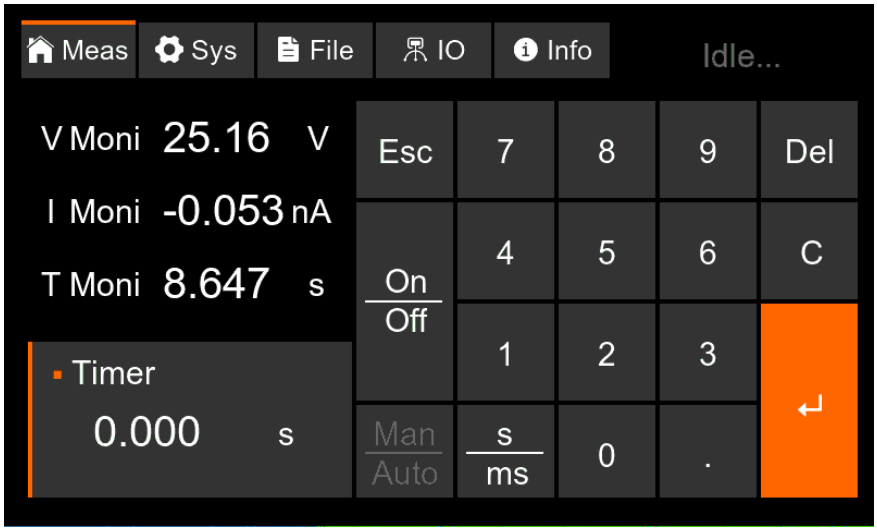


Figure 3-1-4 Timing Setting

Touch screen click Figure 3-1 **Timing**, such as Figure 3-1-4 pop-up value window, touch screen to open and enter the measurement time value with its unit after ↵ to confirm. When the timer function is on, T monitor counts down; when the timer function is off, T monitor counts up.

3.1.5 Compare Beep

The signaling types include 4 modes: OFF, PASS, FAIL and END.

Compare Beep	Description
OFF	The buzzer does not sound when the upper/lower limit determination is completed.
PASS	The buzzer sounds when the upper/lower limit is passed.
FAIL	The buzzer sounds when the upper/lower limit's judgment fails.
END	At the end of the test, the buzzer sounds.

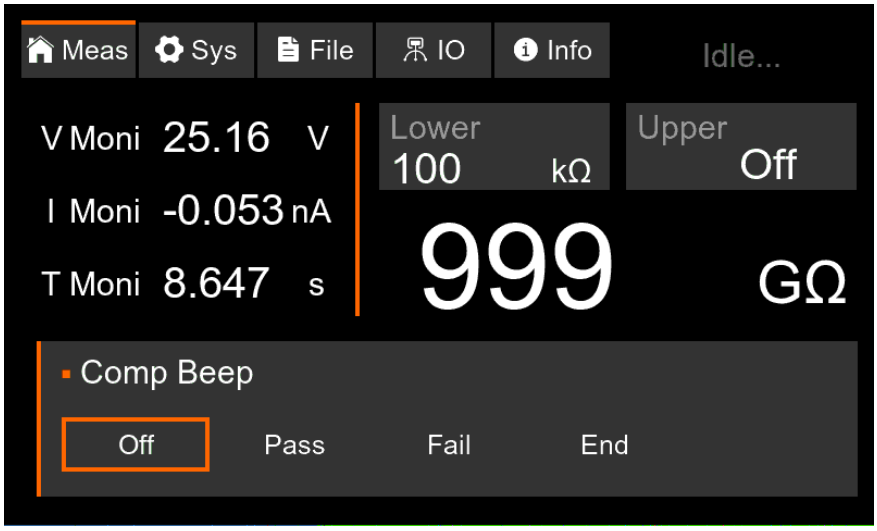


Figure 3-1-5 Compare Beep Setting

Touch screen click Figure 3-1 more swiftly, such as Figure 3-1-5 pop-up options window, touch screen to select the mode automatically return to the measurement page.

Note: For 10nA or less, use the pass-stop or fail-stop mode, and select the medium or slow speed. The specific mode to be used needs to be decided by the user through repeated tests.

3.1.6 Measurement Range Setting

Range Setting: Auto range, manual range.

1) When auto ranging, the instrument automatically judges and selects the appropriate gear. After the range is stabilized, the area where the range is set will display the currently selected range.

2) **Manual Range:** 2mA, 200μA, 20μA, 2μA
Manual range saves time in range judgment (about 2ms or so), but the operator is required to make range selections based on prejudgement. If you are not sure which range to select, it is recommended that you measure the DUT once using the auto range, read the range selected under the auto range, and then set the manual range.

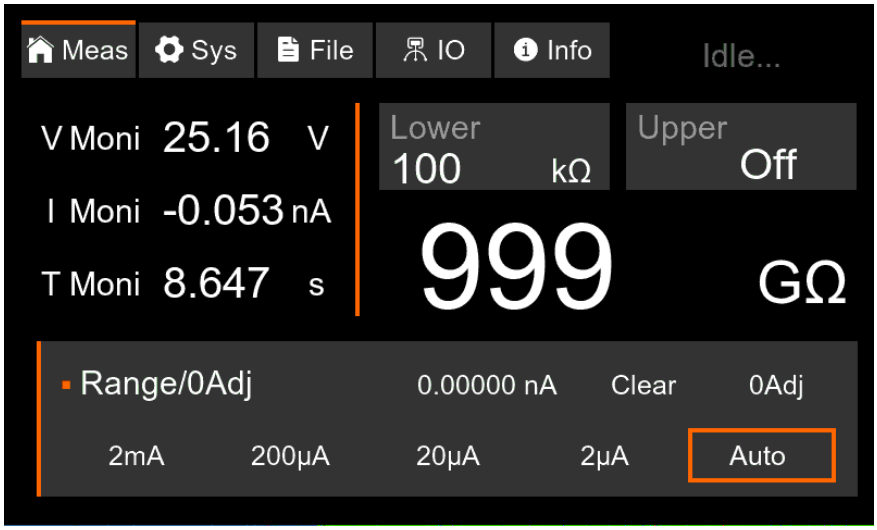


Figure 3-1-6 Range Setting

Touch screen to click on Figure 3-1 **Range**, such as Figure 3-1-6 pop-up range setting options window, touch screen to select the desired range automatically return to the measurement page.

3.1.7 Current Zeroing

Due to the ambient temperature and humidity or some other factors, it may cause the no-load current to have a certain drift, at this time, you can use the current calibration zero function to clear the current bottom.

When using the current zero function, the instrument's high and low outputs can be in the open-circuit state or in the state of being connected to the measured part. There is no need to select a range before zeroing. Touch the screen and click the **Zero** button in Figure 3-1-6, the instrument will read the bottom number of current and display it on the left side of the **Clear** button. At this time, the message bar at the bottom of the screen will also indicate "Zero calibration completed!"

After the current calibration is completed, the output of the instrument will be automatically deducted from the current base. The **Clear** button is used to clear the current base and display 0.00000 nA on the left side.

Note: The current floor is only deducted for the 2μA range output, since the current floor hardly affects the measurement at other ranges.

3.1.8 Delay Setting

The delay time is counted from the start of the applied test voltage and is set to allow the applied test voltage to reach the set value and stabilize. During the delay time, the instrument does not read or display the voltage and current test values. The time monitoring area indicates "Delay".

If the delay time is set manually, please make sure that the timing time is longer than the delay time (the specific setting time is related to the tested parts, please repeat the test to determine the appropriate delay time) to ensure that the test is carried out normally.

Note:

1) If a manual delay time is set, it is possible that the DUT has a large capacitance, and the test voltage is read before charging is completed. This voltage is lower than the voltage when the DUT is fully charged, making the test resistance small.

2) If the automatic delay time is set, the instrument will measure after the test voltage has stabilized.

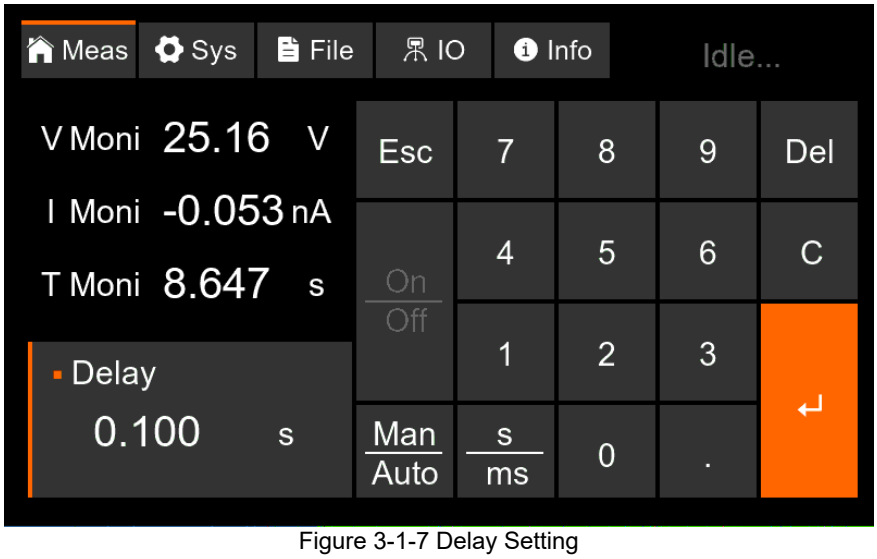


Figure 3-1-7 Delay Setting

Touch screen to click on Figure 3-1 **Delay Time**, such as Figure 3-1-7 pop-up value window, touch screen automatically or manually and enter the delay time value with its unit after ↵ to confirm.

3.1.9 Compare Mode

Mode	Description
Continuous Comparison Mode	Before the end of the test, an upper/lower limit is judged for each measurement.
Pass-Stop Mode	The test ends when the measured value passes the upper/lower limit judgment.
Fail-Stop Mode	When the measured value does not pass the upper/lower limit judgment, the test is terminated.
Terminate Comparison Mode	An upper/lower limit judgment is made when the test is completed.

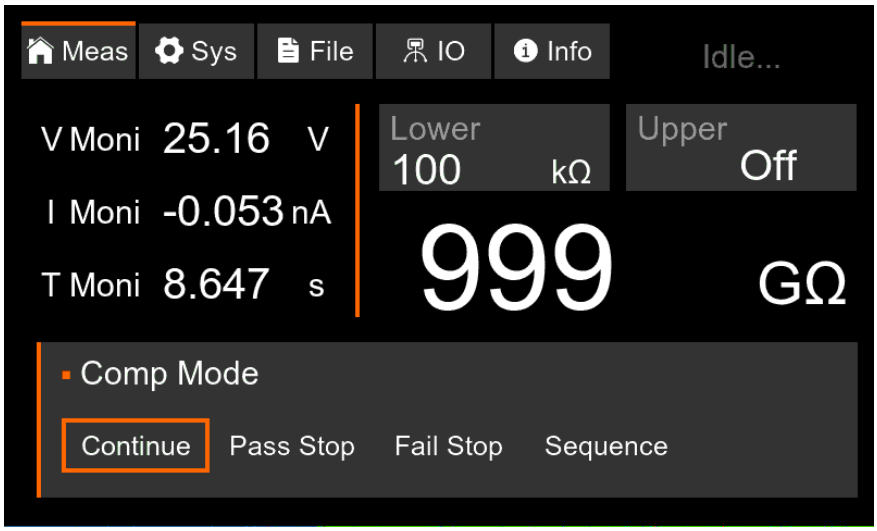


Figure 3-1-8 Comparison Mode Setting

Touch screen to click on Figure 3-1 **Compare Mode**, as in Figure 3-1-8 pop-up options window, touch screen to select the desired compare mode automatically return to the measurement page.

3.1.10 Main Parameter Setting

The main parameter has two modes: Insulation resistance mode and current mode.

When the main parameter is set to insulation resistance (IR), the main parameter display area in the center of the screen shows the insulation resistance value, and the upper and lower limits are set and judged for insulation resistance.

When the main parameter is set to CURRENT, the main parameter display area in the center of the screen displays the current value, and the upper and lower limits are set and judged for current. See Table 2-3-1 for details.

Touch screen to click on the **Main Parameter** in Figure 3-1 to cycle through the 2 items of insulation resistance mode and current mode.

3.2 System Page Operating Instructions

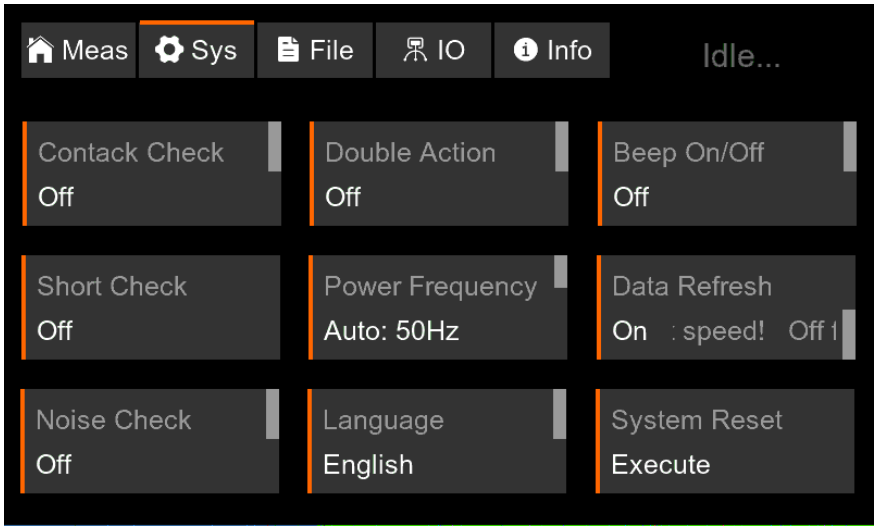


Figure 3-2 System Setting Page

3.2.1 Contact Check

The contact check function is used to check the on-off condition of the test circuit formed by the test object and the instrument and is often used to check the poor contact between the test terminal and the test object or the on-off condition of the test cable.

When the contact check function is turned on, the contact check will be carried out after each reading of the measurement voltage to ensure that the defects can be detected even when the test circuit is suddenly interrupted during the test.

When the instrument determines that the contact is poor, the main parameter area will display High/Low/High/Low end contact is poor and the test will be terminated.

Contact Check Judgment	Description
High-End Contact Failure	The main parameter area displays ContH.
Low-End Contact Failure	The main parameter area displays ContL.
High- And Low-End Contact Failure	The main parameter area displays ContHL.

Touch screen to click on Figure 3-2 **Contact Check** to toggle on and off.

Contact Check Type:

1) **4-Terminal contact check:** To check the 4-terminal contact, you need to turn on the contact check function and wire it as shown in Figure 3-2-1.

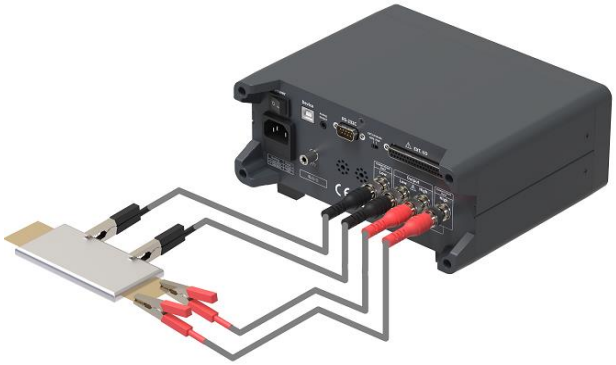


Figure 3-2-1 4-Terminal Wiring Diagram

2) **2-Terminal contact check:** The 2-terminal contact check uses the upper and lower limit judgment function to achieve the purpose of contact check through software judgment of measured values. Therefore, the contact check function should not be turned on, and there is no need to connect the high- and low-test terminals for contact check.

3.2.2 Dual Motion Activation

The dual motion activation function is a function used to prevent the instrument from accidentally starting due to accidental touching of the start button.

When the dual motion function is turned on, the instrument needs to go through two steps to start the output. First, the operator needs to press the **Stop** button, and then press the **Start** button within 1s to start the instrument output.

If the instrument does not detect that the Stop button has been pressed within 1s before the Start button is pressed, the instrument will indicate in the message bar at the bottom of the screen: "Error 4: Dual Motion is on. Please press the Stop button first and press the Start button within 1s to initiate the test."

Touch screen to click on Figure 3-2 **Dual Motion Switch** to toggle the dual motion function on/off.

3.2.3 Beep On/Off

A buzzer switch is used to turn on or off the beeps for the touch screen and keys.

Touch screen to tap on the Figure 3-2 **Beep On/Off** to toggle the buzzer beep on/off.

3.2.4 Short Check

The short-circuit checking function is a function that applies a small voltage of 3 ~ 4V to the DUT first after the instrument starts the test to test whether there is a short-circuit condition. When the measured resistance value of the DUT is less than 100kΩ, the instrument determines that the DUT has a short-circuit condition.

At this point, the main parameter area of the instrument displays Short and ends the test. If the short-circuit check passes, the instrument starts to apply the set voltage for the test, and the information bar at the bottom of the display prompts: "Short-circuit check time X ms, short-circuit check passes! (The test timing sequence is shown in Figure 3-3). (The test sequence is shown in Figure 3-2-4.1.)

In addition, the short-circuit check time indicated in the message bar is not counted in the timer. If a longer short-circuit check duration is set manually, the instrument will indicate "SC" in the time detection area during the short-circuit check.

The short-circuit check function is often used for battery insulation resistance testing, and using DC low voltage for the test can effectively avoid the risk of being judged as a good product due to the application of high voltage inside the battery, which can lead to the burning from small, short-circuited parts.

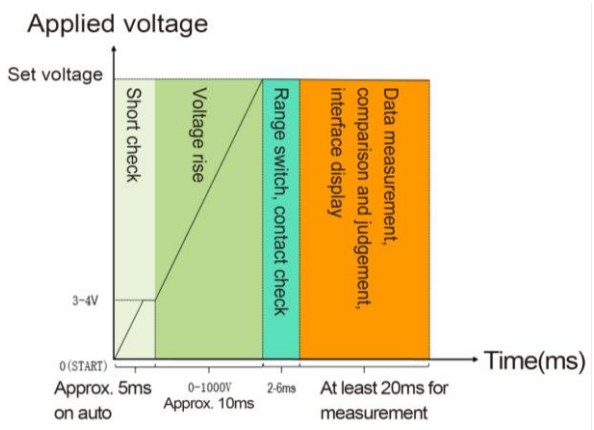


Figure 3-2-4.1 Test Timing Chart

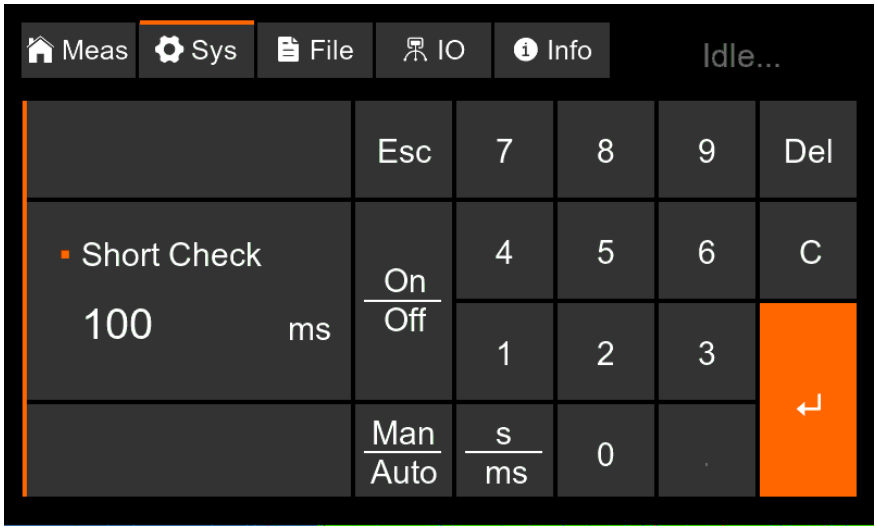


Figure 3-2-4.2 Short Circuit Check Setting

Touch screen to click on Figure 3-2 **Short Circuit Check** to toggle Short Circuit Check on or off (as in Figure 3-2-4.2). When the short circuit check function is in the on state, you can click to switch the automatic or manual option. In the automatic state, the instrument determines the duration automatically. If the manual option is selected, the user can manually set the duration of the short-circuit check according to requirements.

3.2.5 Power Frequency

The setting of the power supply frequency is used to eliminate the industrial frequency interference outside the instrument and make the test values more stable and reliable. The type of power supply frequency can be selected as auto-detection, or 50Hz or 60Hz according to the actual power supply frequency of the instrument. Note: Incorrectly setting the power supply frequency will result in unstable test values.

Touch screen to click on Figure 3-2 **Power Supply Frequency** to switch between Auto, 50Hz, and 60Hz in rounds.f Auto is selected, the instrument will detect the current power supply frequency and display the detected power supply frequency on the Power Supply Frequency Setting button.

3.2.6 Data Refresh

The data refresh function is used to turn on or off the display refresh of the screen during the instrument test. Normally this function is turned on, the instrument will display the current test data and test status in real time during the test.

When the test speed is very high, the data refreshing function can be turned off to save the screen refreshing time to improve the test efficiency. When the screen is not refreshed, the test data can be read through RS232C, USB Device or EXT.I/O interface. When the data refresh function is turned off, even if the instrument does not output, the upper right corner of the screen will indicate "High Voltage Danger".

Touch screen click Figure 3-2 **Data Refresh** to toggle on and off.

3.2.7 Noise Check

Noise can cause the test value to jump when the test terminal is open during the output of the instrument. Turning on noise checking can effectively eliminate the problem of test value jumping, which is suitable for the application scenario of manual meter pen testing.

Note: If the real test value itself has high and low jumps, please turn off this function to avoid misjudgment.

3.2.8 Language

Touch screen to click on Figure 3-2 **Language** to switch between English or Chinese interface. After switching, the page will immediately display the corresponding language and jump to the measurement page.

3.2.9 System Reset

Touch screen to click on Figure 3-2 **System Reset**, the instrument will pop up an inquiry window asking if you want to restore the factory settings. After confirmation, the instrument will be initialized automatically.

3.3 File Page Operating Instructions

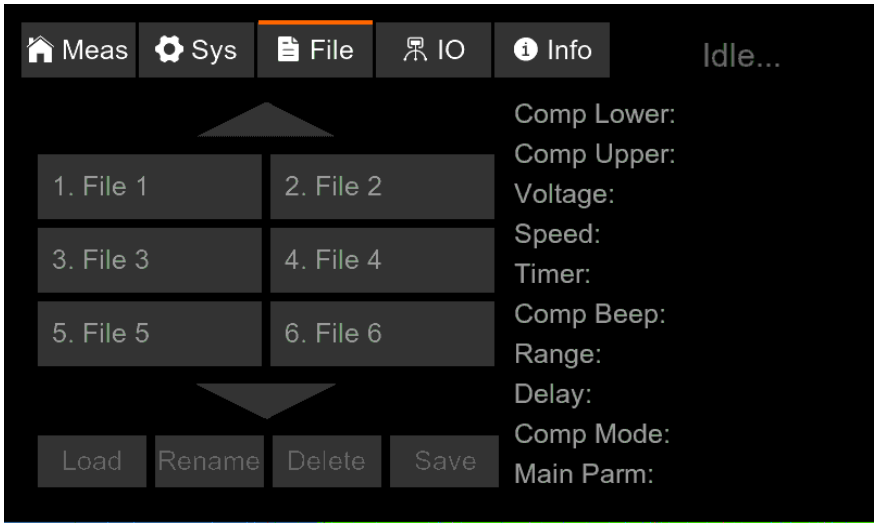


Figure 3-3 File Page

The instrument has 16 built-in files, which can store all the setup parameters of the measurement interface into the files for quick and easy recall by the user.

The up and down page keys on the file page can be used to select the file that needs to be operated.

1) **Save Settings:** Select the file to be deposited, touch screen and click Figure 3-3 **Save**, an inquiry window will pop up, make sure to save the file. After the saving is completed, select the file, the right side of the file interface will display the setting conditions deposited in the file.

2) **Delete Settings:** Select the file to be deleted, touch the screen and click Figure 3-3 **Delete**, an inquiry window will pop up to determine the deletion of the file.

3) **Rename Settings:** Select the file that needs to be renamed, touch the screen and click Figure 3-3 **Rename**, enter the new file name in the pop-up keyboard window and confirm.

4) **Load Settings:** Select the file you need to load, touch screen to click Figure 3-3 **Load**, a pop-up window will ask you to determine the loading of the file. After loading is complete, the message bar prompts: "File loading is complete!"

3.4 Communication Page Operating Instructions

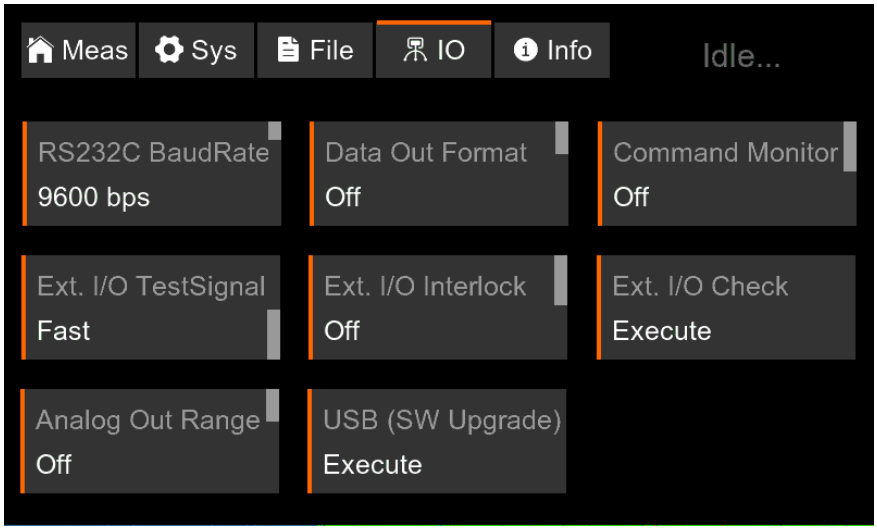


Figure 3-4 Communication Page

3.4.1 RS232C Baud Rate

Communication baud rate options: 9600bps, 19200bps, 38400bps, 57600bps, 115200bps

Touch screen to click on Figure 3-4 **RS232C Baud Rate** to cycle through the 5 items in the order of 9600bps, 19200bps, 38400bps, 57600bps, 115200bps.

3.4.2 Data Output Format

Data output format options: Off, Format 1, Format 2

If the data output format is turned on (Format 1 or Format 2), the instrument will automatically upload the test results to the PC via the RS-232C or USB Device interface after the test has stopped.

Option off does not automatically send data, option Format 1 indicates that the measurement data is sent in the first type of data format, option Format 2 indicates that the measurement data is sent in the second type of data format.

Format 1:

	Serial Number	/	**Test Results**	/	**Unit**	/	**Upper/Lower Limit Judgment**
Description	1. Range: 1 to 65535 2. Returns 1 if the number exceeds 65535. 3. The number is reset to 1 after power-up.		1. No defective, display the main parameter test value. 2. Adverse, show the following results: Short: Bad short circuit C.Hi: Poor high-end contact C.Lo: Poor low-end contact C.HL: Poor high and low ends contact. O.F.: Over upper lmit range U.F.: Over lower limit range --: Not measured		1. The main parameter is insulation resistance: • Mohm: Ω • k Mohm: kΩ • M Mohm: MΩ • G Mohm: GΩ 2. The main parameter is current: • mA • μA • nA • A When the measured value is not a numerical value, it is not displayed.		The following judgment results are displayed when the upper and lower limit judgment function is turned on: PASS: Pass LFAIL: Lower Limit Failure UFAIL: Upper Limit Failure ULFAIL: Unable to judge when range is overrun NOCOMP: Not compared

Example	1						1	.	8	2	9		G		o	h	m			U	L	F	A	I	L
	2						2	5	.	6	2		M		o	h	m			P	A	S	S		
	3						5	2	6	.	8		n	A						U	F	A	I	L	
	4						C	.	H	L										N	o	C	o	M	P
	6	5	5	3	5		S	h	o	r	t									N	o	C	o	M	P

Format 2:

Returns only the test value in scientific notation. If the main parameter is insulation resistance, the unit is "Ω", if the main parameter is current, the unit is "A". "F" is returned when the range is exceeded, and "Under.F" is returned when the range is exceeded.

Example: The main parameter is insulation resistance, the test value is 105.2MΩ, select Format 2, the instrument automatically returns 105.2E+06.

Touch screen to click on Figure 3-4 **Data Output Format** to cycle through the three selections of Off, Format 1 and Format 2.

3.4.3 Command Monitor

The Command Monitor is used to display commands received and sent by the instrument in real time on the Measurement page. Touch screen to tap on the Figure 3-4 **Command Monitor** to toggle the on and off states.

If set to On, the instrument will open the Command Monitor on the Measurement page, as shown in Figure 3-4-3 below:

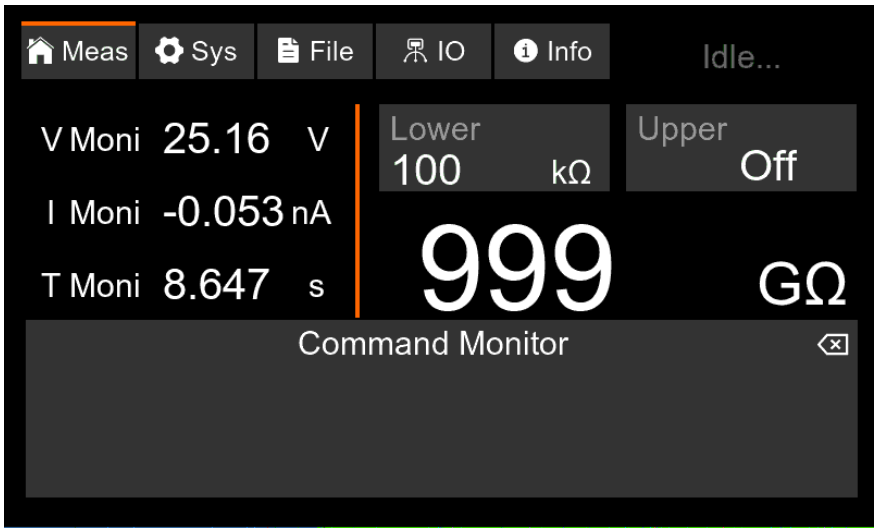


Figure 3-4-3 Command Monitor

3.4.4 External Interface Test Signal

When the instrument is in the test state, after receiving the STOP signal from the external interface (EXT.I/O), the TEST output signal of the external interface will flip high and low. The timing of the high and low flipping of the level of the TEST pin can be selected to be either fast or slow, as shown in Figure 3-4-4.

The following schematic is an example of an NPN connection for the input (as shown in Figure 4-3-3-1.1) and a positive common terminal connection for the output (as shown in Figure 4-3-3-2.1).

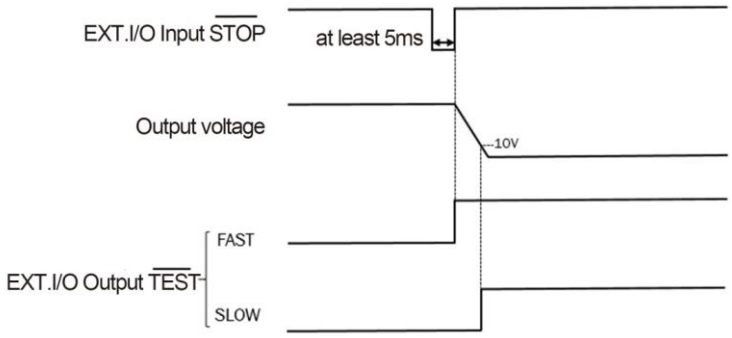


Figure 3-4-4 Test Signal Timing Chart

Touch screen to click on Figure 3-4 **External Interface Test Signal** to toggle between fast and slow options.

3.4.5 External Interface Interlock

The interlock function is used for joint control of the instrument with an external device and can be used to quickly cut off power and prevent misuse.

The interlock function is off by default, if the interlock function is on, the screen jumps to the measurement page and displays "interlock on" status in the upper right corner. At this time, the touch screen function is invalid, the start button is invalid, and the stop button is valid.

Logical Relationships:

(The following table uses the input circuit NPN connection as an example in Figure 4-3-3-1.1)

	EXT.I/O interface INTERLOCK pin level	**EXT.I/O interface input signal can control the instrument or not**	**Is the instrument panel locked?**
INTERLOCK on	1 (INTERLOCK open)	No	Yes
	0	Yes	No
INTERLOCK off	1	Yes	No
	0	Yes	No

Touching screen to click on the Figure 3-4 **External Interface Chain** can be switched from off to on. How to disable the interlock function of the communication interface in case of interface lock?

1) Press and hold the Stop button while turning on the power switch until the instrument completes startup.
2) Send the io:ilock on/off command via RS232C or USB Device interface to turn on/off the interlock function of the communication interface.
3) If the input circuit is NPN connection, pull down the INTERLOCK pin of the EXT.I/O interface (the opposite is true for the PNP connection), and then turn off the interlock function of the communication interface through the instrument panel operation.

3.4.6 External Interface Check

The external interface check function can be used to do the following:

1) View Instrument EXT.I/O Input Circuit Connection Type Current Pour (NPN) or Current Pull (PNP).
2) Manually turn on or off each output pin of EXT.I/O for easy debugging.
3) View the high- and low-level status of the input pins for easy debugging.

Touch screen to click on Figure 3-4 External Interface Check to bring up the test window as shown in Figure 3-4-6. Click on an output signal to toggle its high- and low-level output status.

The high- and low-level status of the input signal will also be monitored and displayed in real time, low level is white on black, high level is black on white. LOAD3 ~ LOAD0 will be converted from binary to decimal, and the corresponding filename will be scrolled in the file area.

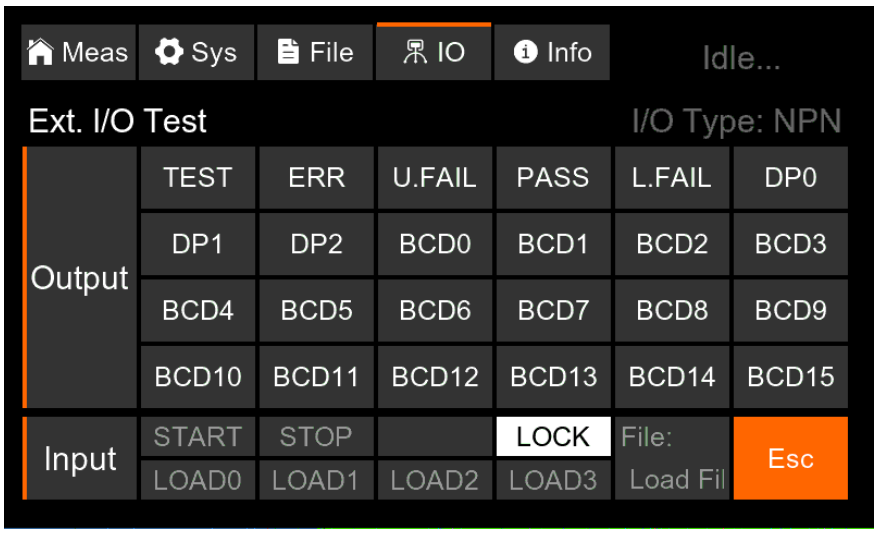


Figure 3-4-6 External Interface Tester

3.4.7 Analog Output Range

The analog output function is used to convert the tested insulation resistance value into the corresponding 0-4V voltage and output it from the analog output port on the rear panel.

At the end of the test, the analog output port will keep the previous test result.

Analog Output Type Selection:

1) **Off:** No analog output

2) **Full Range:** The analog output size is independent of the range selection and is output in the correspondence of the following table. The resistance value is proportional to the voltage value within the specified range: $\frac{\text{measurement resistance value}}{\text{resistance range}} \times 4\text{V}$.

Example: If 200 MΩ is measured at 50V, the analog output is 2V.

Setting Voltage	Resistance Range	Analog Output Voltage
0V ≤ Voltage < 100V	0 ~ 400MΩ	0 ~ 4V
	> 400MΩ	4V
100V ≤ Voltage ≤ 1000V	0 ~ 4GΩ	0 ~ 4V
	> 4GΩ	4V

3) **Range:** The analog output size corresponding to the resistance value is shown in the table below. The resistance value is proportional to the voltage value within the specified range: $\frac{\text{measurement resistance value}}{\text{resistance range}} \times 4\text{V}$.

Example: If 2GΩ is measured in the 2μA range, the analog output is 2V.

Range	Resistance Range	Analog Output Voltage
2mA	0 ~ 4MΩ	0 ~ 4V (analog output 0V when the tested resistance value is less than 0.3125% of the resistance range)
200μA	0 ~ 40MΩ	
20μA	0 ~ 400MΩ	
2μA	0 ~ 4GΩ	

Touch screen to click on Figure 3-4 **Analog Output Range** to rotate through the off, full range, and range options.

3.5 USB Software Upgrade

The USB software upgrade function is used to upgrade the instrument's firmware.

Name the software to be upgraded as "update2692.sec", store it in the outermost directory of the USB flash disk, and insert it into the USB port on the front panel. Touch the screen and click Figure 3-4 to execute the **Software Upgrade**, an inquiry window will pop up, select "Yes" to upgrade automatically.

Note: The USB flash drive used for the upgrade should be set to FAT format and its memory should not exceed 32G.

4 Instrument Interfaces

4.1 RS232C Interface

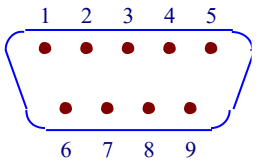
The RS232C interface provided by the instrument can be used to communicate with the computer, the instrument provides a wealth of programmable commands, through the RS232C interface, the computer can implement almost all the functions on the instrument panel operation.

The serial interface of this instrument is not strictly based on the RS-232 standard, but only a minimal subset is provided. The table below:

Code	Notation	Connector Pin Number
Sending data	TXD	3
Receive data	RXD	2
Grounding	GND	5

Note: The serial port pin definitions of this instrument are essentially the same as those of the connector for a standard 9-cell RS232C.

The RS232C connector on this instrument uses a 9-pole pin DB type socket with the pinout sequence shown below:



(Viewed from the outside)

It can be directly connected to it using a standard DB type 9-pole hole plug.

Warning!	
	To avoid electrical shock, turn off power when plugging or unplugging connectors!

Warning!	
	Do not arbitrarily short the output terminals, or short to the chassis to avoid damage to the device!

4.2 USB Device Interface

The instrument provides a USB Device interface for communication with a computer. The instrument provides a wealth of programmable commands, and through the USB Device interface, the computer can implement almost all the functions on the instrument panel.

4.3 External Interface (Ext.I/O)

4.3.1 Pin Function Introduction

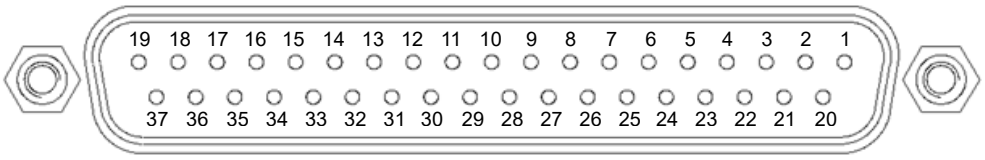


Figure 4-3-1 Schematic Diagram of External Interface (EXT.I/O)

Through the external interface on the rear panel of the instrument (as shown in Figure 4-3-1), external control of the instrument as well as reading of the instrument's test data can be realized.

Pin	Signal Name	Signal Type	Functional Description	Trigger Logic
1	START	Imput	The instrument receives a square wave with a pulse width of at least 5ms to initiate the test.	Fringe
2	non-use			
3	LOCK	Imput	Interlock pin. The instrument will enter the interlock state when the interlock function of the communication interface is turned on during the test and the interlock pin detects a high level (in the case of the input circuit NPN connection).	Power level
4	LOAD1	Imput	File number selection, LOAD3 ~ LOAD0 four binary code composed of decimal file number. (Example: LOAD3 ~ LOAD0 are 0101, corresponding to file 5.) when the file number changes, close the output and load the setup parameters of the file. After the file loading is completed, please set LOAD3 ~ LOAD0 to 0, so that the instrument's touch, key and command can work normally. Note: Load file from external interface only supports file 1 ~ 15, local operation can load file 1 ~ 16.	Power level
5	LOAD3	Imput	File number selection, see pin 4 for details.	Power level
6	non-use			
7	BCD0	Output	BCD15 ~ BCD0 hexadecimal code consists of 4 decimal digits, which is used to output the measured value of the main parameter. (Example: The main parameter is insulation resistance, measured 120.8MΩ. Then BCD15 ~ BCD0, the corresponding binary code is 0001 0010 0000 1000. The corresponding binary code of DP2 ~ DP0 is 110, see Table 4-3-1.2 Decimal Point Output Comparison Table)	Power level
8	ISO_5V	-	±5V power supply. 5V output in NPN mode, -5V output in PNP mode.	-
9	ISO_COM	-	Insulated Power Common Terminal	-
10	ERR	Output	Error message output. Contact check error or short circuit check error or output voltage error (output voltage exceeds the set voltage by 1.02 times +5V).	Power level

11	UPPER FAIL	Output	Comparator judgment. Output when the instrument determines that the upper limit has been exceeded.	Power level
12	LOWER FAIL	Output	Comparator judgment. Outputs when the instrument determines that the lower limit has been exceeded.	Power level
13	BCD1	Output	BCD code, see pin 7 for details.	Power level
14	BCD2	Output	BCD code, see pin 7 for details.	Power level
15	BCD3	Output	BCD code, see pin 7 for details.	Power level
16	BCD4	Output	BCD code, see pin 7 for details.	Power level
17	BCD5	Output	BCD code, see pin 7 for details.	Power level
18	BCD6	Output	BCD code, see pin 7 for details.	Power level
19	BCD7	Output	BCD code, see pin 7 for details.	Power level
20	STOP	Imput	The instrument receives a square wave with a pulse width of at least 5ms to stop the test.	Fringe
21	non-use			
22	LOAD0	Imput	File number selection, see pin 4 for details.	Power level
23	LOAD2	Imput	File number selection, see pin 4 for details.	Power level
24	DP0	Output	Decimal point output, see pin 7 for example.	Power level
25	DP1	Output	Decimal point output, see pin 7 for example.	Power level
26	DP2	Output	Decimal point output, see pin 7 for example.	Power level
27	ISO_COM	-	Insulated Power Common Terminal	
28	TEST	Output	The instrument is outputting during the test, and the discharge period is based on 3.4.4 Test Signal Timing.	Power level
29	BCD8	Output	BCD code, see pin 7 for details.	Power level
30	PASS	Output	Comparator judgment. Output when the instrument determines that it passes.	Power level
31	BCD9	Output	BCD code, see pin 7 for details.	Power level
32	BCD10	Output	BCD code, see pin 7 for details.	Power level
33	BCD11	Output	BCD code, see pin 7 for details.	Power level
34	BCD12	Output	BCD code, see pin 7 for details.	Power level
35	BCD13	Output	BCD code, see pin 7 for details.	Power level
36	BCD14	Output	BCD code, see pin 7 for details.	Power level
37	BCD15	Output	BCD code, see pin 7 for details.	Power level

Table 4-3-1.1 External Interface (EXT.I/O) Pin Description

Main Parameter Range		DP2	DP1	DP0
Insulation Resistance (IR)	**Current (I)**			
0 ≤ IR ≤ 9.999MΩ	0 ≤ I ≤ 9.999μA	0	1	1
10.00MΩ ≤ IR ≤ 99.99MΩ	10.00μA ≤ I ≤ 99.99μA	1	0	1
100.0MΩ ≤ IR ≤ 999.9MΩ	100.0μA ≤ I ≤ 999.9μA	1	1	0
1.000GΩ ≤ IR ≤ 9.999GΩ	1.000mA ≤ I	1	1	1
10.00GΩ ≤ IR ≤ 99.99GΩ		0	1	0
100.0GΩ ≤ IR		0	0	1

Table 4-3-1.2 Decimal Point Output Comparison Table

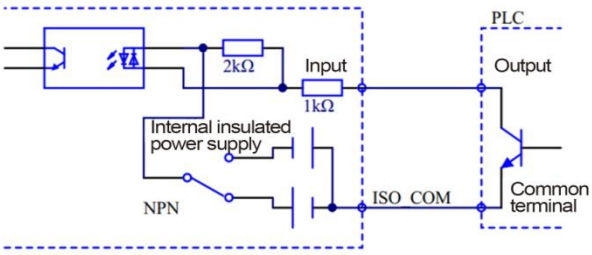
4.3.2 Input Circuit Connection Mode Switch

Use the EXT.I/O MODE (shown in Figure 2-2) switch on the rear panel of the instrument to switch the input circuit connection method of the external interface to either the current-pumping (NPN) mode or the current-pulling (PNP) mode. Note: Ensure that the instrument is powered off when switching the EXT.I/O MODE switch.

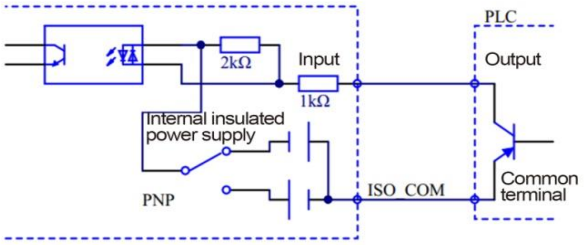
4.3.3 Circuit Connection Description

4.3.3.1 Input Circuit Connection Description

The input pins can be connected to circuits such as switches, relays and PLC control systems as required. The following diagram shows an example of connecting to a PLC.



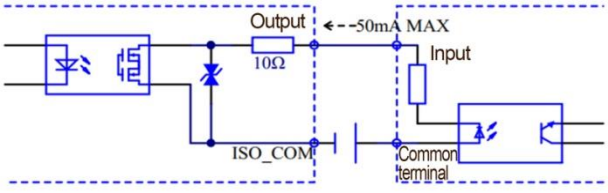
Input Pin NPN Connection Diagram



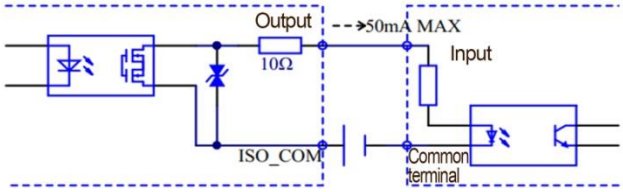
Input Pin PNP Connection Diagram

4.3.3.2 Output Circuit Connection Description

The output pins can be connected to circuits such as light-emitting diodes, relays, PLC control systems, etc. As required. The following figure takes the connection of PLC as an example.



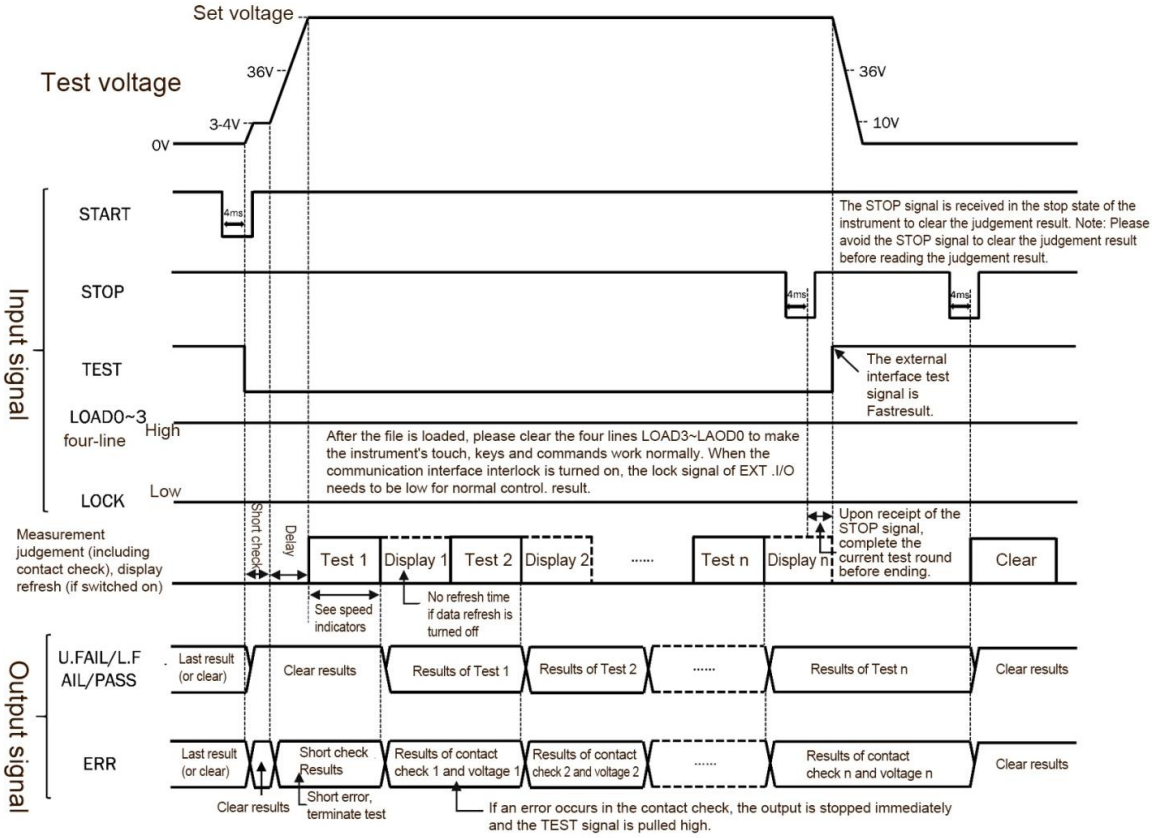
Output Pin Positive Common Connection Diagram



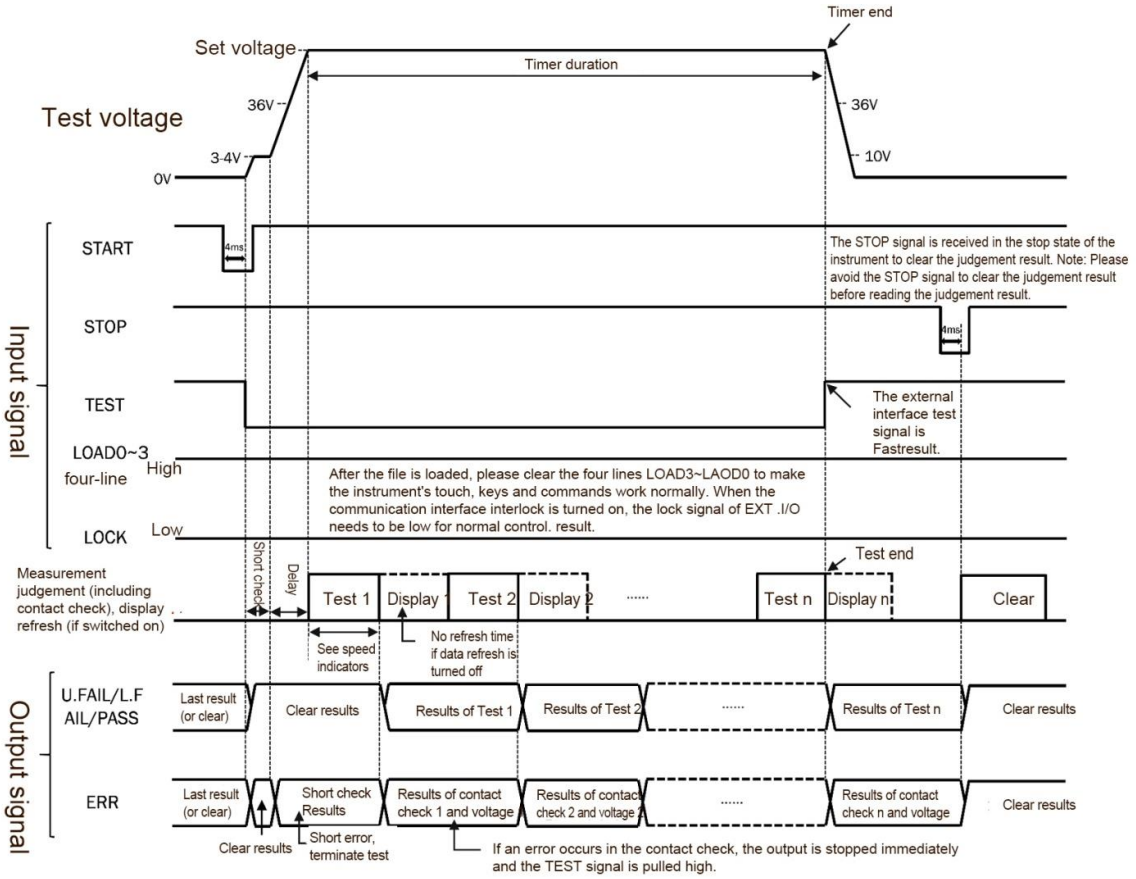
Output Pin Negative Common Connection Diagram

4.3.4 Timing Diagrams

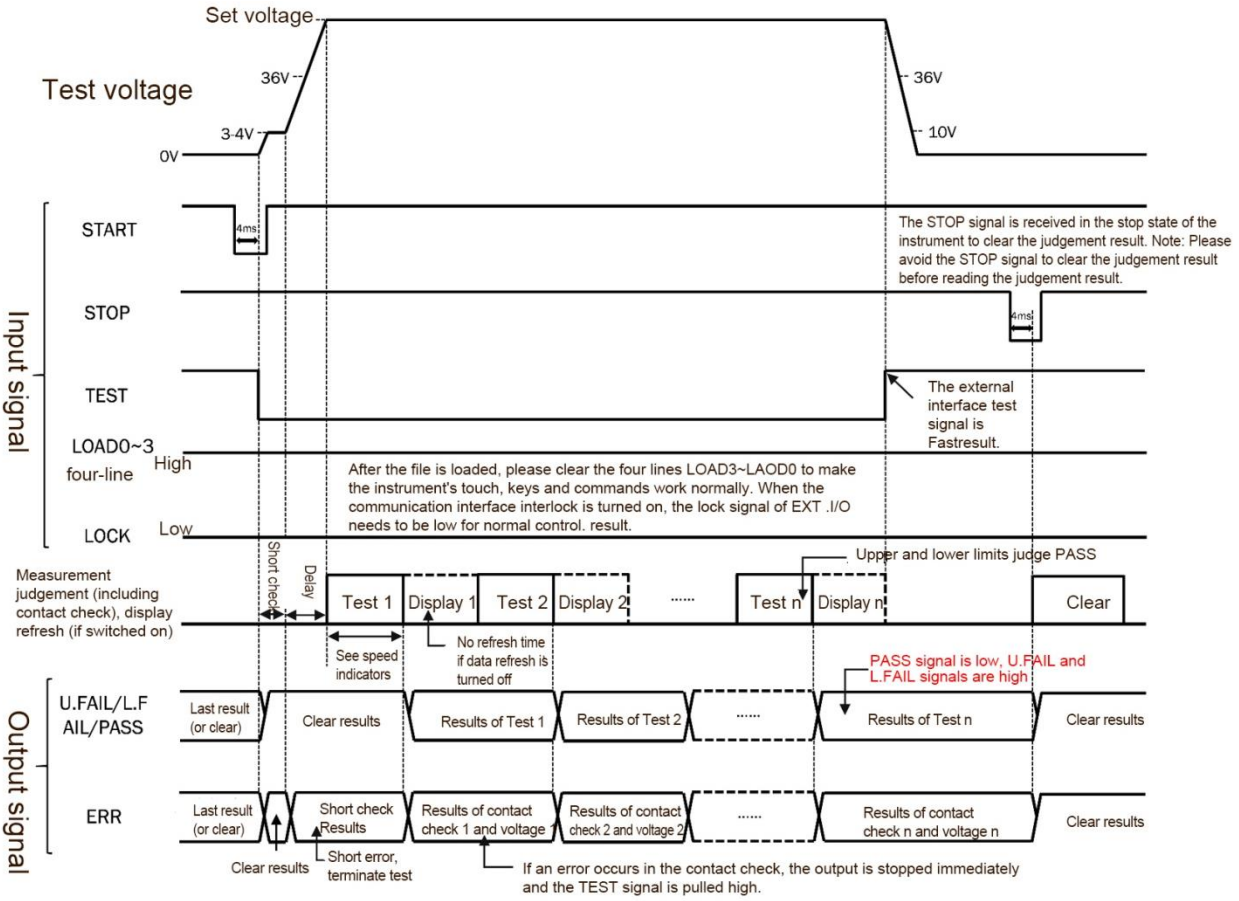
4.3.4.1 Continuous Test Mode with Timer OFF



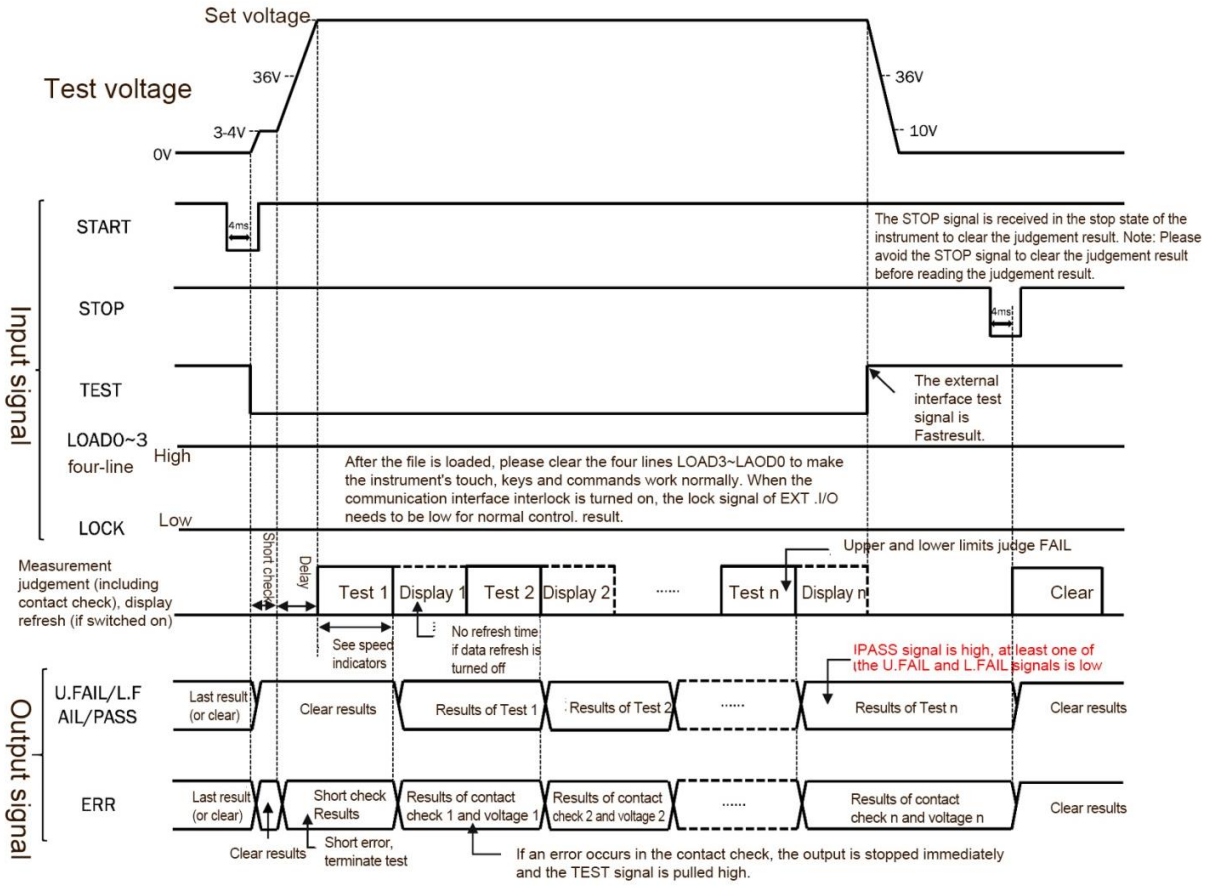
4.3.4.2 Continuous Test Mode with Timer ON



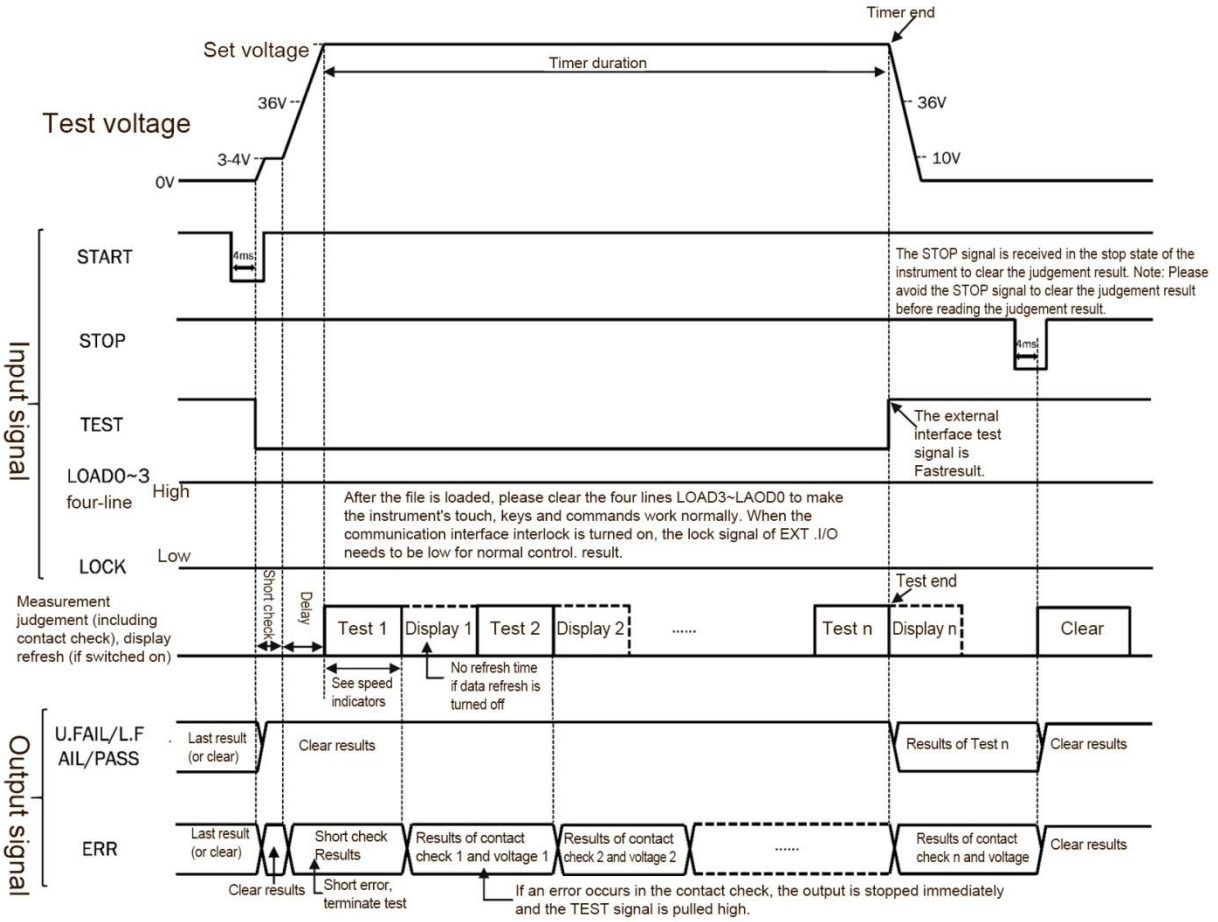
4.3.4.3 Pass Stop Mode with Timer OFF



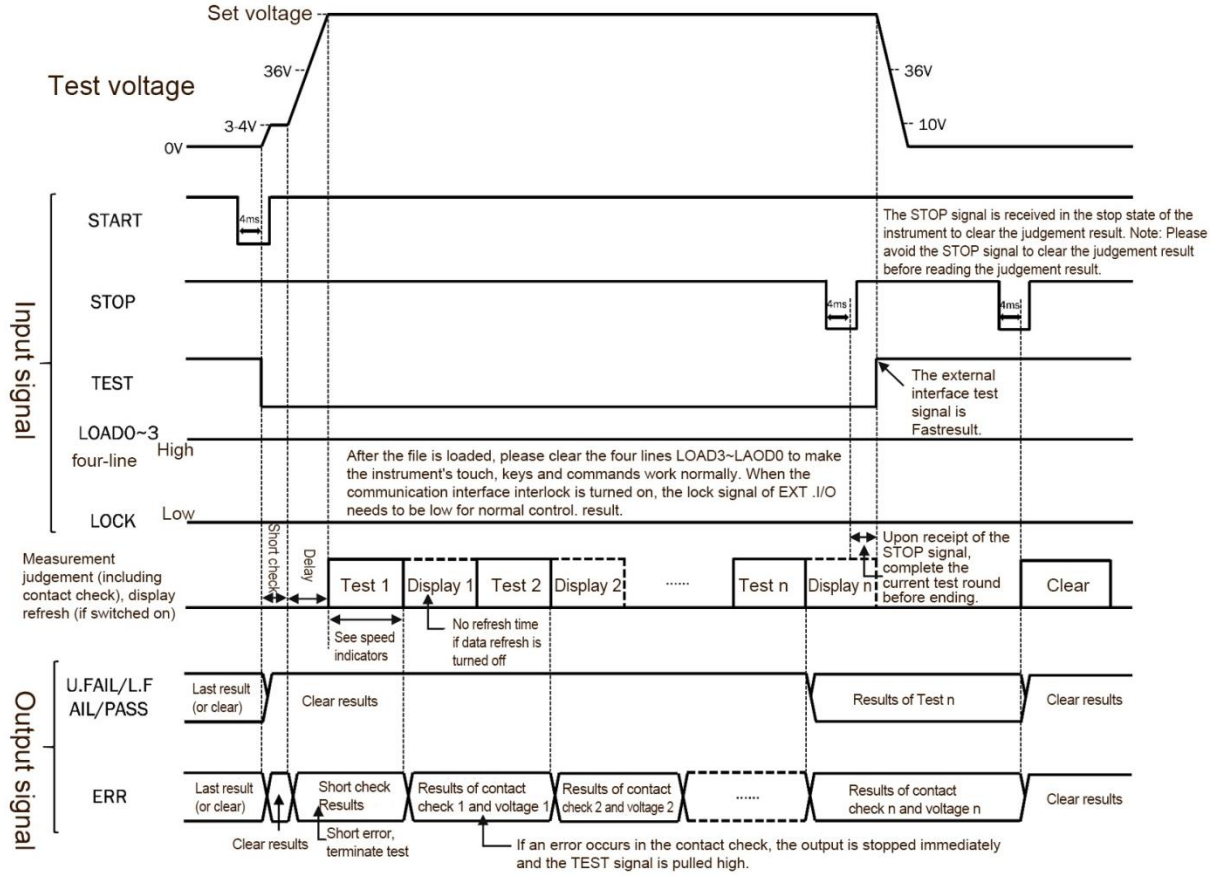
4.3.4.4 Fail Stop Mode with Timer OFF



4.3.4.5 Terminate Compare Mode with Timer ON



4.3.4.6 Terminate Compare Mode with Timer OFF



4.4 USB Port

The USB port on the front panel can be used for software upgrades and screenshots.

4.4.1 Software Upgrade

See Section 3.5 USB Software Upgrade.

4.4.2 Screenshot

Insert the USB flash drive into the USB port on the front panel and click on the **Status Area** in the upper right corner of the screen (as shown in Figure 2-3-1) to automatically save the screenshots into the PIC folder on the outermost layer of the USB flash drive. If there is no PIC folder in the outermost layer of the USB flash drive, the system will create it automatically.

The screenshot image will be named ST2692_000.gif and the serial number will be incremented from 000 to 999, and the counting will start from 0 again on power on.

Note: Screenshots cannot overwrite images with the same filename, to ensure smooth screenshots, please clean up the screenshot images in the PIC directory of the USB flash disk before taking screenshots. The USB flash disk used for taking screenshots should be set to FAT format, and its memory should not exceed 32G.

5 Command Reference

5.1 Command Structure

There are two types of instrument commands: Utility commands and SCPI (Standard Commands for Programmable Instruments) commands. Utility commands apply to all instrument units, but this instrument does not support all utility commands. SCPI commands are tree-structured (as shown in Figure 5-1), where the highest level is called a subsystem command, and the layers under that command are valid only if a subsystem command is selected, using colons to separate the command hierarchy.

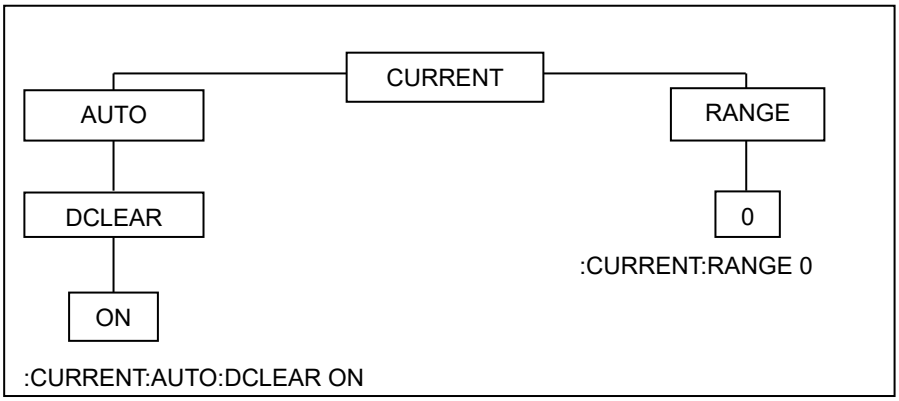


Figure 5-1 Command Tree Example

5.1.1 Basic Rules for Command Structure

- Ignore case.
  Example: SHORTCHECK:TIME AUTO = shortcheck:time auto = Shortcheck:Time Auto
- The space is used to separate the command and the parameter of the command, before the space is the command, after the space is the corresponding parameter of the command.
  Example: In SHORTCHECK:TIME AUTO, SHORTCHECK is the first level command, TIME is the second level command, and AUTO is its parameter.
- Some commands have no parameters.
  Example: Start test START.
- Spaces ("_" indicates a space) cannot be placed before or after a colon.
  Example: ☒ COMPARATOR_:_MODE CONTINUE →☑ COMPARATOR:MODE CONTINUE
- Commands can be abbreviated or spelled out entirely (abbreviated commands are given in subsequent command descriptions)
  Example: COMPARATOR:BEEPER OFF = COMP:BEEP OFF
- The command is immediately followed by a question mark (?). Execute a query corresponding to the command.
  Example: *IDN?

5.1.2 Symbol Conventions and Definitions

1) Syntax symbols used in the command:

: A colon is a command hierarchy, indicating a move to the next level of commands

; Semicolon indicates start of multiple commands (up to 64 bytes for single commands and up to 1024 bytes for multiple commands)

* Commands followed by an asterisk are public commands

? Question marks indicate inquiries

, Comma is a separator for multiple parameters

␣ A space is a separator between commands and arguments

"" Inside the quotation marks is what is being quoted, and the program does not do anything with it.

2) The following symbols will likely be used later in the command explanation:

- NR1: Integer, e.g. 123
- NR2: Floating point number, e.g. 12.3
- NR3: Exponential form of floating-point numbers, e.g. 12.3E+5
- NL: Newline character, integer 10 (0x0A), is the terminator of the string input/output

3) Explanation of the command example:

- "PC>" indicates receipt of a command from the PC
- "ST2692>" indicates a message sent by ST2692
- The actual commands do not have the prefixes in quotes above.

4) Command error description:

When an error occurs in a received command, the instrument will indicate an error message in the message bar at the bottom of the screen. The possible errors are listed below:

- **Commands received via RS232 are too long!**
  More than 1024 bytes of commands are received via RS232.
- **Commands received via USBCDC are too long!**
  More than 1024 bytes of commands are received via USBCDC.
- **The inter-command interval received via RS232C requires a longer delay!**
  The time between commands received via RS232C is too short, and the instrument receives the next command before execution is complete.
- **Longer delays are required between commands received via USBCDC!**
  The time between commands received via USBCDC is too short, and the instrument receives the next command before execution is complete.
- **Instruction error!**
  The instrument received an incorrect command.
- **Wrong command parameters!**
  The instrument received an incorrect command parameter.
- **Instruction execution error!**
  When Interlock is open, the output cannot be manipulated, and an execution error is displayed regardless of the state of the lock read by the EXTI interface.
- **A single command is too long!**
  A single instruction exceeds 64 bytes.

5.2 Command List

Primary Command	Secondary Command	Tertiary Command	Function Name	Function	Example
*IDN?			Query Instrument ID	Check the manufacturer, instrument model, instrument type, and software version of the instrument.	PC>*IDN? ST2692>Sourcetronic, ST2692, Insulation Tester, V1.0.0.
*RST			System initialization	Used to reset the instrument and initialize the system.	PC>*RST
START STAR			Start testing	Start the output and test it.	PC>:START
STOP			End testing	The stop stop output is sent during the test is in progress and the stop clear data is sent during the test is stopped.	PC>:STOP
MAINPARM			Set the main parameters	Character parameters are: IR / CURRENT IR (insulation resistance): When the main parameter is set to IR, the insulation resistance value is displayed in the center area of the screen, and the upper and lower limits are judged against the insulation resistance. CURRENT: When the main parameter is set to CURRENT, the current value is displayed in the center of the screen, and the upper and lower limits are judged against the current.	Set main parameter to insulation resistance: PC>:MAINPARM IR
MAINPARM?			Query the main parameters	The character parameters returned are: IR / CURRENT	When the main parameter of the instrument is insulation resistance (IR), query the status of the main parameter of the instrument: PC>:MAINPARM? ST2692>:MAINPARM IR (HEADER command is ON) ST2692>IR (HEADER command is OFF)
STATE? STAT?			Query test status	Output off returns 0, output on returns 1, output off but voltage has not dropped below 36V returns 2.	The instrument is off, and the instrument status is queried: PC>:STATE? ST2692>0
MEASURE? MEAS?			Query test value	Returns the test value of the main parameter, or Over.F or Under.F if the range is over. Over.F means to switch to a higher current gear; Under.F means to switch to a lower current gear.	When the main parameter is set to insulation resistance mode, the test value is 100.1MΩ: PC>:MEASURE? ST2692>100.1E+06 When the main parameter is set to current mode, the test value is 231.3μA: PC>:MEASURE? ST2692>231.3E-06

MEASURE MEAS	COMPARATOR? COMP?		Query the upper and lower limit judgment results	The judgment results are: OFF / NO-COMP / DELAY / PASS / U.FAIL / L.FAIL / UL.FAIL OFF: Upper and lower limit judgment functions are turned off NOCOMP: No judgment DELAY: During the test delay PASS: Within the judgment range U.FAIL: Measured value > upper limit setting value L.FAIL: Measured value < lower limit setting value UL.FAIL: Measured value error, no judgment.	When the test value is within the upper and lower limits, the query shows the judgment result: PC>:MEASURE:COMPARATOR? ST2692>PASS
	RESULT? RESU? RES?		Query measured values and judgment results	The judgment results are: OFF / NO-COMP / DELAY / PASS / UFAIL / LFAIL / ULFAIL OFF: Upper and lower limit judgment functions are turned off NOCOMP: No judgment DELAY: During the test delay PASS: Within the judgment range UFAIL: Measured value > Upper limit setting value LFAIL: Measured value < Lower limit setting value ULFAIL: Range error, no judgment.	When the main parameter is set to insulation resistance mode and the test value is 1.00GΩ, the judgment result is PASS: PC>:MEASURE:RESULT? ST2692>1.00E+09,PASS When the main parameter is set to current mode, the test value is 98.5nA and the determination result is PASS: PC>:MEASURE:RESULT? ST2692>98.5E-09,PASS
	CLEAR CLEA CLE		Clear measured values and judgment results		PC>:MEASURE:CLEAR
	MONITOR? MONI?		Query voltage monitoring value	Return the voltage test value, numeric only, in voltage (V).	PC>:MEASURE:MONITOR? ST2692>25.12
VOLTAGE VOLT			Set the test voltage	Voltage setting values are integers from 25V ~ 1000V	Set the test voltage to 25V: PC>:VOLTAGE 25
VOLTAGE? VOLT?			Query the voltage setting	Return the voltage setting value, numeric value only, in voltage (V).	The voltage setting value is 25V, and the setting voltage is queried: PC>:VOLTAGE? ST2692>:VOLTAGE 25 (HEADER command is ON) ST2692>25 (HEADER command is OFF)
CURRENT CURR	RANGE RANG		Set the current range	Set the parameters to 0|1|2|3|4, corresponding to auto range, 2mA, 200μA, 20μA, and 2μA, respectively.	PC>:CURRENT:RANGE 0|1|2|3|4
	RANGE? RANG?		Query current range	Return values 0|1|2|3|4, corresponding to auto range, 2mA, 200μA, 20μA, 2μA, respectively.	PC>:CURRENT:RANGE? ST2692>:CURRENT:RANGE 0|1|2|3|4 (HEADER command is ON)

					ST2692>0|1|2|3|4 (HEADER command is OFF)
	AUTO	DCLEAR DCLE DCL	Set the measured value to clear during autorange operation	ON: Instrument is in autorange, last test range changed before end of test, return 0000E+10 if measure? is sent, return 0000E+10 if measure:result? is sent, NOCOMP. OFF: Instrument is in autorange, last test range changed before end of test, instrument returns to previous test data. OFF: The instrument is in autorange, the last range change before the end of the test, the instrument returns the previous test data. This function is used to avoid misjudgment when the range of the DUT changes due to insulation breakdown during the last measurement before the end of the test, but the round of test is ended before the round of test is completed, so that the measured value of the previous test is returned.	PC>:CURRENT:AUTO:DCLEAR ON|OFF
		DECLEAR? DCLE? DCL?	Query the measured value to clear during autorange operation	Query the status of the test value clearing function. Return ON for on and OFF for off.	PC>:CURRENT:AUTO:DCLEAR? ST2692>:CURRENT:AUTO:DCLEAR ON|OFF (HEADER command is ON) ST2692>ON|OFF (HEADER command is OFF)
ZERO			Current zeroing	Start current zero function (see section 3.1.7 for details)	PC>:ZERO
ZERO?			Query current zero base	Query current zero base	PC>:ZERO? ST2692> 0.03615 nA
ZEROCLEAR			Clear current calibration zero base	Clear current calibration zero base	PC>:ZEROCLEAR
SPEED SPED SPE			Set the measuring speed	Character parameters are: FAST / MED / SLOW FAST: Fast MED: Medium SLOW: Slow	Example: Set the test speed to fast. PC>:SPEED FAST
SPEED? SPED? SPE?			Query measurement speed	Return the current test speed setting value.	Example: Test Speed is set to Fast to query the test speed. PC>:SPEED? ST2692>:SPEED FAST (HEADER command is ON) ST2692>FAST (HEADER command is OFF)
TIMER TIME TIM			Set the test time	The test time (unit: S) can be set to 0.001-999.999s, if it is set to 0, the time setting will be turned off.	Example: Set the test time to 50ms. PC>:TIMER 0.05

TIMER? TIME? TIM?			Query the test time	Return the test time (in s) with a value ranging from 0.001 to 999.999. If 0.000 is returned, the time setting is off.	PC>:TIMER? ST2692>:TIMER 0.050 (HEADER command is ON) ST2692>0.050 (HEADER command is OFF)
DELAY DELA DEL			Set the delay time	The delay time (unit: S) can be set to 0.000-999.999 s. Setting it to AUTO means that it is set to automatic delay.	Example: Set the delay time to 50ms. PC>:DELAY 0.05
DELAY? DELA? DEL?			Query the delay time	Return the delay time (unit: S), the value range is 0.000-999.999. If return AUTO, it means the delay time is automatic.	PC>:DELAY? ST2692>:DELAY 0.050 (HEADER command is ON) ST2692>0.050 (HEADER command is OFF)
COMPARATOR COMP	LIMIT LIMI LIM		Set the comparator upper and lower limits values	Set the upper and lower limits in the form of an index, with the previous data as the upper limit and the next data as the lower limit, split by "," in the middle, and the upper limit must be greater than the lower limit. When the main parameter is insulation resistance, set the upper and lower limits of insulation resistance; when the main parameter is current, set the upper and lower limits of current.	Example: 1. Set the upper limit of insulation resistance to 5.281G and the lower limit to 1.678M. PC>:MAINPARM IR PC>:COMPARATOR:LIMIT 5.281E+09, 1.678E+06 2. Set the upper limit of current to 1.581mA and the lower limit to 82.6nA. PC>:MAINPARM CURRENT PC>:COMPARATOR:LIMIT 1.581E-03, 82.6E-09
	LIMIT? LIMI? LIM?		Query the comparator upper and lower limit values	Return the upper and lower limit setting values in the form of an index, with the previous data as the upper limit and the next data as the lower limit, divided by "," in the middle. When the main parameter is insulation resistance, it returns the upper and lower limits of insulation resistance; when the main parameter is current, it returns the upper and lower limits of current. If OFF, returns OFF.	Example: When the upper limit of insulation resistance is 5.281G and the lower limit is 1.678M, query the upper and lower limit setting parameters. PC>:COMPARATOR:LIMIT? ST2692>:COMPARATOR:LIMIT 5.281E+09,1.678E+06(HEADER command is ON) ST2692>5.281E+09,1.678E+06(HEADER command is OFF)
	MODE		Set the comparator test mode	Character parameters are: CONTinue / PASSstop / FAILstop / SEQuence (lower case letters may be omitted) CONTinue (continuous comparison): Upper and lower limits are compared for each test round. PASSstop (Pass stop): Stop the test when the comparison of the upper and lower limits passes. FAILstop (Fail stop): Stop the test when the comparison of the upper and lower limits fails. SEQuence (End comparison): Upper and lower limits are compared when the test is terminated.	Example: Set the compare mode to continuous compare PC>:COMPARATOR:MODE CONTINUE

	MODE?		Query the comparator test mode	Character parameters returned are: CONTINUE / PASSSTOP / FAILSTOP / SEQUENCE	Example: When the comparator test mode is continuous comparison, query the comparator test mode. PC>:COMPARATOR:MODE? ST2692>:COMPARATOR:MODE CONTINUE(HEADER command is ON) ST2692>CONTINUE(HEADER command is OFF)
	BEEPER BEEP		Comparison sound set	The character parameters are: OFF / PASS / FAIL / END OFF: Comparator sound off PASS: Pass sound FAIL: Fail sound END: End sound	Example: Set the compare sound Off PC>:COMPARATOR:BEEPER OFF
	BEEPER? BEEP?		Comparison sound query	The character parameters returned are: OFF / PASS / FAIL / END	Example: Query the compare audio mode when compare audio is off. PC>:COMPARATOR:BEEPER? ST2692>:COMPARATOR:BEEPER OFF (HEADER command is ON) ST2692>OFF (HEADER command is OFF)
CONTACTCHECK CONT			Set the contact check	Character parameters are: ON / OFF	Example: Set contact check to on PC>:CONTACTCHECK ON
	RESULT? RESU? RES?		Query the contact check results	Character parameters returned are: OFF / NOCHK / PASS / HFAIL / LFAIL / HLFAIL OFF: Contact check off NOCHK: No judgment yet PASS: Judgment pass HFAIL: Test high-end poor contact LFAIL: Test low-end poor contact HLFAIL: Both high-end and low-end contacts are poor	Example: When the high end of the contact check has poor contact, query the result of the contact check judgment. PC>:CONTACTCHECK:RESULT? ST2692>:CONTACTCHECKRESULT HFAIL(HEADER command is ON) ST2692>HFAIL(HEADER command is OFF)
CONTACTCHECK? CONT?			Query contact check switch status	The character parameters returned are: ON / OFF	Example: Query the contact check status when the contact check is OFF. PC>:CONTACTCHECK? ST2692>:CONTACTCHECK OFF (HEADER command is ON) ST2692>OFF (HEADER command is OFF)
SHORTCHECK SHOR			Set the short-circuit check switch	Character parameters are: ON / OFF	Example: Set the short check to off PC>:SHORTCHECK OFF
	RESULT? RESU? RES?		Query short-circuit inspection judgment results	Character parameters returned are: OFF / NOCHK / PASS / FAIL OFF: Short circuit check off NOCHK: No judgment yet PASS: Judgment pass FAIL: Judgment fail	Example: When the short-circuit check passes, query the short-circuit check judgment result. PC>:SHORTCHECK:RESULT? ST2692>:SHORTCHECKRESULT PASS(HEADER command is ON) ST2692>PASS(HEADER command is OFF)

	TIME		Set the short-circuit check time	If the parameter is set to AUTO, it means that the short-circuit check time is set to automatic. The short-circuit checking time (unit: S) can be set to 0.010-999.999s.	Example: Set short check to 50ms PC>:SHORTCHECK:TIME 0.050
	TIME	MONITOR? MONI?	Query the short-circuit check execution time	Return the short-circuit check execution time (unit: S)	Example: When the short-circuit check takes 5ms, query the short-circuit check execution time. PC>:SHORTCHECK:TIME:MONITOR? ST2692>0.005
	TIME?		Query the short-circuit check time	Return AUTO, indicating that the short-circuit check time is automatic. The value returned is the short-circuit check setting time (unit: S).	Example: When short-circuit check is set to 50ms, query the short-circuit check time. PC>:SHORTCHECK:TIME? ST2692>:SHORTCHECK:TIME 0.050(HEADER command is ON) ST2692>0.050(HEADER command is OFF)
SHORTCHECK? SHOR?			Query the short-circuit check switch status	The character parameters returned are: ON / OFF	Example: Query the short-circuit check when the short-circuit check is OFF. PC>:SHORTCHECK? ST2692>:SHORTCHECK OFF (HEADER command is ON) ST2692>OFF (HEADER command is OFF)
KEY	BEEPER BEEP		Set the key buzzer switch	Character parameters are: ON / OFF	Example: Set the key buzzer to OFF PC>:KEY:BEEPER OFF
	BEEPER? BEEP?		Query the buzzer switch status	The character parameters returned are: ON / OFF	Example: When the key buzzer is off, query the key buzzer switch status. PC>:KEY:BEEPER? ST2692>:KEY:BEEPER OFF(HEADER command is ON) ST2692>OFF(HEADER command is OFF)
DOUBLEACTION DOUB			Set the double action switch	The character parameters are: ON / OFF	Example: Set the double action to off PC>:DOUBLEACTION OFF
DOUBLEACTION? DOUB?			Query the double action switch status	The character parameters returned are: ON / OFF	Example: When double action is off, query the double action switch status. PC>:DOUBLEACTION? ST2692>:DOUBLEACTION OFF(HEADER command is ON) ST2692>OFF(HEADER command is OFF)
SYSTEM	LFREQUENCY LFRE LFR		Set the power supply frequency	The setting parameters are: AUTO / 50 / 60 AUTO: Auto-detect the power supply frequency 50: The power supply frequency is	Example: Set the power supply frequency to auto-detect. PC>:SYSTEM:LFREQUENCY AUTO

				50Hz 60: The power supply frequency is 60Hz.	
	IFREQUENCY? LFRE? LFR?		Query the power supply frequency	The character parameters returned are AUTO / 50Hz / 60Hz	Example: When the power supply frequency is 50Hz, query the power supply frequency. PC>:SYSTEM:LFREQUENCY? ST2692>:SYSTEM:LFREQUENCY 50Hz (HEADER command is ON) ST2692>50Hz (HEADER command is OFF)
	LOCAL		Remove the remote-control status	The instrument enters the remote-control state after receiving the command from the host computer, and the screen touch and START buttons are disabled. Send this command to unlock.	Example: Remove the instrument from remote control PC>:SYSTEM:LOCAL
	DATAREFRESH		Set the datarefresh	The character parameters are: ON / OFF ON: Normal data refresh when the instrument starts to test OFF: When the instrument starts to test and after turning off the output, the voltage, current, time, insulation resistance, upper and lower limit judgment color blocks will not be refreshed, and the instrument status will always indicate that "high voltage is dangerous (DANGER)", the data can be obtained from the RS232C, USB Device, EXT. Data can be obtained from RS232C, USB Device, EXT. Data can be obtained from RS232C, USB Device, or EXT.IO. Turning off data refresh saves screen refresh time and improves test speed. Note: When data refresh is off, if the instrument is in the local state, the instrument will not enter the remote-control mode even if it receives a command from the host computer (the screen touch and START buttons are still effective). This setting is to avoid affecting the screen refresh speed by refreshing the keys that disengage remote control. If you need to enter the remote-control state, you can send any command to make it enter the remote-control mode when the screen refresh is on, and then turn the screen refresh off by the command.	Example: Set data refresh to on PC>:SYSTEM:DATAREFRESH ON
	DATAREFRESH?		Query the data refresh	The character parameters returned are: ON / OFF	Example: When the data refresh function is turned on, query the data refresh function status.

					PC>:SYSTEM:DATAREFRESH? ST2692>:SYSTEM:DATAREFRESH ON(HEADER command is ON) ST2692>ON(HEADER command is OFF)
	LANGUAGE		Set the system language	Character parameters are: EN / CN EN: English system CN: Chinese system	Example: Set the instrument system interface to English. PC>:SYSTEM:LANGUAGE EN
	LANGUAGE?		Query the system language	Character parameters returned are: EN / CN	Example: When the instrument system interface is in English, query the system language. PC>:SYSTEM:LANGUAGE? ST2692>:SYSTEM:LANGUAGE EN(HEADER command is ON) ST2692>EN(HEADER command is OFF)
PANEL PANE PAN	CLEAR CLEA CLE		Delete file	Set the parameter to an integer from 1 to 16, corresponding to file 1 - file 16, respectively.	Example: Delete file 1. PC>:PANEL:CLEAR 1
	LOAD		Load the test conditions in the file	Set the parameter as an integer from 1 to 16, corresponding to file 1 - file 16, respectively. There must be a parameter in the file, otherwise the information bar at the bottom of the display will indicate an execution error.	Example: Load file 1. PC>:PANEL:LOAD 1
	SAVE		Save the test file	Set the parameter to an integer from 1 to 16, corresponding to file 1 - file 16, respectively.	Example: Save the setting parameters to file 1. PC>:PANEL:SAVE 1
	SAVE?		Query whether the file contains data	Return parameters are: 1 / 0 1: The queried file already contained data 0: The query file does not contain data	Example: File 1 already has the setting parameters, query whether file 1 has the data. PC>:PANEL:SAVE? 1 ST2692>1
	NAME		Set the file name	The file number is an integer from 1 to 16, corresponding to files 1 - 16, with the file name enclosed in double quotes. The file number is separated from the file name by a comma.	Example: Set file name of file 1 to "test file1" PC>:PANEL:NAME 1, "test file1"
	NAME?		Query the file name	Return the name of the queried file	Example: When the file name of file 1 is "test file1", query the file name of file 1. PC>:PANEL:NAME? 1 ST2692>:PANEL:NAME 1, "test file1"(HEADER command is ON) ST2692>test file1(HEADER command is OFF)
AOUT	RANGE RANG		Analog output range selection	Character parameters are: OFF/FULL/EACH OFF (OFF): Turn off the analog output. Full range (FULL): When setting voltage as [0V, 100V], 0 ~ 400MΩ	Example: Set analog output range to full range PC>:AOUT:RANGE FULL

				corresponds to analog output 0 ~ 4V, over 400M also outputs 4V; when setting voltage as [100V, 1000V], 0 ~ 4GΩ corresponds to analog output 0 ~ 4V; over 4GΩ also outputs 4V. Range (EACH): The percentage of insulation resistance measurement value in different ranges corresponds to 0 ~ 4V analog output. The maximum resistance ranges for different ranges are as follows (calculated for analog output only, please refer to the instrument specifications for actual test ranges): 2mA range: 4MΩ 200uA range: 40MΩ 20uA range: 400MΩ 2uA range: 4GΩ	
	RANGE? RANG?		Query analog output range selection	The character parameters returned are: OFF / FULL / EACH	Example: Select FULL for the current analog output range and query the analog output range. PC>:AOUT:RANGE? ST2692>:AOUT:RANGE FULL(HEADER command is ON) ST2692>FULL(HEADER command is OFF)
IO	SIGNAL SIGN		Set the external interface TEST signal timing	The character parameters are: FAST / SLOW FAST (FAST): The output TEST signal is pulled high immediately after the external interface receives the STOP signal. Slow (SLOW): After the external interface receives the STOP signal, the TEST signal is pulled high when the output voltage drops below 10V.	Example: Set the external interface test signal to fast. PC>:IO:SIGNAL FAST
	SIGNAL? SIGN?		Query external interface TEST signal timing	The character parameters returned are: FAST / SLOW	Example: The current external interface TEST signal timing is fast, query the external interface TEST signal timing. PC>:IO:SIGNAL? ST2692>:IO:SIGNAL FAST(HEADER command is ON) ST2692>FAST(HEADER command is OFF)
	ILOCK		Set the interlock	Character parameters are: ON / OFF	Example: Turn ON the interlock function PC>:IO:ILOCK ON
	ILOCK?		Query the interlock	The character parameters returned are: ON / OFF	Example: When the interlock function is turned on, query the status of interlock function. PC>:IO:ILOCK? ST2692>:IO:ILOCK ON(HEADER command is ON)

					ST2692>ON(HEADER command is OFF)
HEADER HEAD			Set the response command header	Character parameters are: ON / OFF	Example: Turn on the header function PC>:HEADER ON
HEADER? HEAD?			Query the response command header	The character parameters returned are: ON / OFF	Example: When the header function is turned on, query the status of the header function. PC>:HEADER? ST2692>:HEADER ON(HEADER command is ON) ST2692>ON(HEADER command is OFF)

6 Technical Specifications

Resistance	**Measurement Range**	10kΩ ~ 100GΩ			
	Measurement Accuracy	**Current > 100nA:** ±2% of reading **10nA < Current ≤ 100nA:** ±5% of reading **1nA < Current ≤ 10nA:** ±10% of reading			
	Display Resolution	**Resistance < 1GΩ:** $3\frac{3}{4}$ Bit display **1GΩ ≤ Resistance < 10GΩ:** 2 decimal digits displayed **Resistance ≥ 10GΩ:** 1 decimal digit display			
Voltage	**Setting Range**	25V ~ 1000V			
	Setting Resolution	1V			
	Output Accuracy	1% set voltage ± 1V			
	Reading Accuracy	1% output voltage ± 1V			
	Display Resolution	**25V ≤ measured voltage < 40V:** 0.01V **40V ≤ measured voltage < 400V:** 0.1V **400V ≤ measured voltage ≤ 1000V:** 1V			
Current	**Test Range**	**2mA range:** 220μA ~ 2.4mA **200μA range:** 22μA ~ 220μA **20μA range:** 2.2μA ~ 22μA **2μA range:** 0 ~ 2.2μA			
	Display Resolution	$3\frac{3}{4}$ bit display			
Test Speed		**2mA range**	**200μA range**	**20μA range**	**2μA range**
	Fast	30 ~ 50ms			80ms
	Medium	200ms			
	Slow	500ms			
Comparator Function		Resistance upper and lower limits, current upper and lower limits			
Range		Auto, 2mA, 200μA, 20μA, 2μA			
Interface		USB, RS232C, USB Device, EXT.I/O, Analog			
Memory		16 sets of test files inside the instrument			
Operating Temperature, Humidity		0°C ~ 40°C, ≤ 80%RH			
Power Requirement		90 ~ 121V AC (60Hz) or 198 ~ 242V AC (50Hz)			
Power		25VA			
Dimension (excluding protrusions such as test ends and interfaces)		W × H × D: 215mm × 89mm × 154mm			
Weight		Approx. 1.9kg			

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