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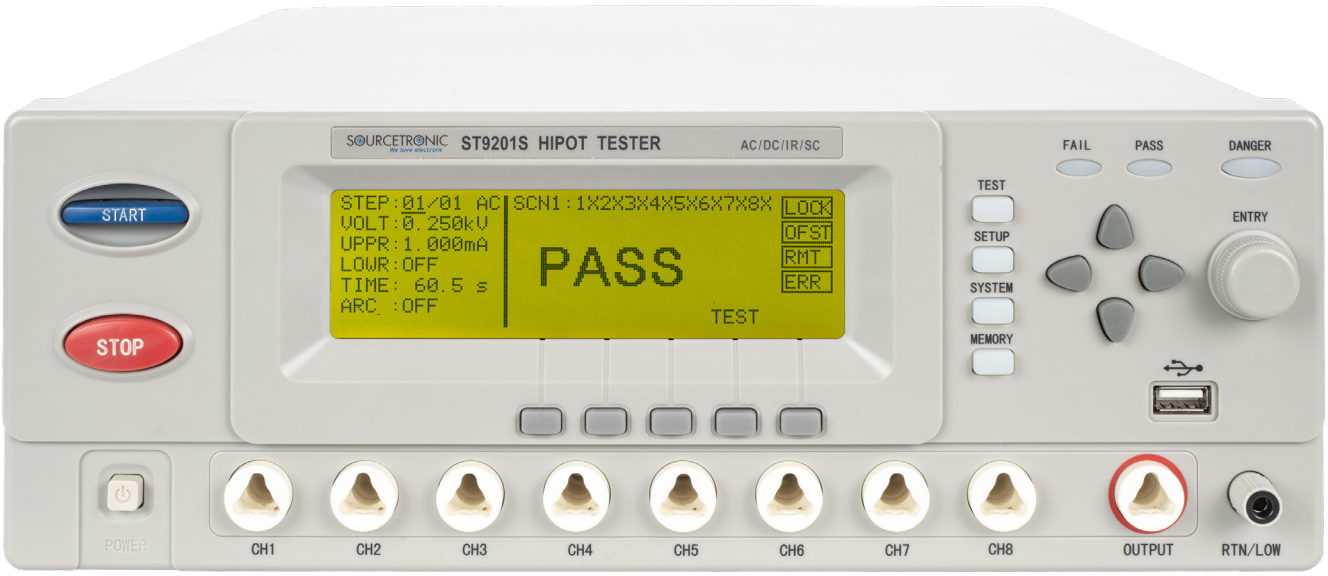
User Manual

AC/DC Hipot / IR Meter ST9201 Series



Contents

1 Setup

This chapter describes some of the checks you must make when you receive the instrument and what you must know and have before you can install and use the instrument.

1.1 Unpacking

Upon receiving the product, confirm that the necessary accessories are included and have not been damaged in transit. Should any damage or shortage be found, please contact your Sourcetronic distributor/agent. Please do not power up the instrument if it appears damaged.

Items	Quantity
ST9201/S/B/C AC/DC withstanding-voltage insulation resistance tester	1
ST90003R withstanding-voltage test leadwires	1
ST90003B withstanding-voltage ground leadwires	1
3A (220V, 240V) / 5A (100V, 120V) Fuse (ST9201/S)	2
2A (220V, 240V) / 3A (100V, 120V) Fuse (ST9201B/C)	2
ST90004 withstanding-voltage test stick	1
ST26034 RS232C cable	1
AC power cord	1
User manual	1

1.2 Power Supply

1.2.1 Range

Toggle Power Line Voltage:

WARNING!	
	This instrument is designed to be used with Class II overvoltages. **Do not** operate it with Class III or IV overvoltages!

Before starting the power supply, make sure that the supply voltage and fuse match the voltage selected by the LINE VOLTAGE RANGE switch on the rear panel of the instrument.

Nominal Voltage Range (Permissible Voltage Range):

- 100V: AC (90V to110V AC)
- 120V: AC (108V to 132V AC)
- 220V: AC (198V to 242V AC)
- 240V: AC (216V to 260V AC)

Permissible Frequency Range: 47 Hz to 63 Hz

WARNING!	
⚠	To prevent malfunctions, be sure to operate within the line-voltage range! Do not use power cords from other devices on this instrument.

1.2.2 Connection

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

Do not use the AC power cord provided with the product as an AC power cord for other instruments!

Connection Procedure:

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

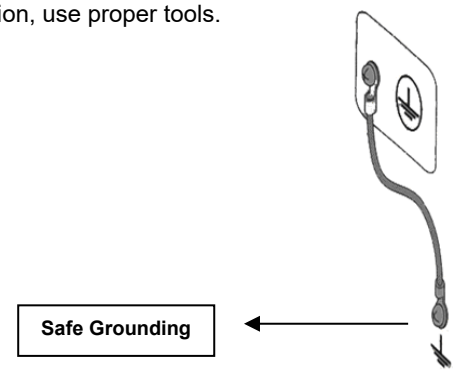
1.3 Grounding

WARNING!	
⚠	Be sure to connect the tester to an electrical ground (safety ground). If the output to a conveyer or peripheral device that is connected to an earth ground or a nearby commercial power line is short-circuited without grounding, the tester chassis is charged to an excessively high voltage, resulting in **extreme danger**! This tester is designed as a Class I equipment (equipment protected against electric shock with protective grounding in addition to basic insulation). Therefore, electric shock may occur without proper grounding.

To ensure safety, be sure to ground the tester.

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

1) Connect the AC power cord to a three-contact grounded electrical outlet.
2) Connect the protective conductor terminal on the rear panel to the earth ground. Have specialized engineers select, manufacture, and install cables.To ensure secure connection, use proper tools.



All work with and on test devices may only be carried out by authorized electricians or electrically trained persons who have carefully read and understood these operating instructions!

1.4 Fuses

WARNING!	
	To prevent electric shock, before checking or replacing the fuse, be sure to turn off the POWER switch and unplug the AC power cord. The instrument is equipped with a fuse from the factory, and you should use the fuse provided by our company. Make sure that the fuse used conforms to the instrument specifications, including shape, rating, and characteristics. Using a fuse that does not conform to one or more of these specifications may damage the instrument!

Voltage Range	Frequency	Fuse Type	Power
100V, 120V	47~63Hz	5A (ST9201/S)	500VA
		3A (ST9201B/C)	
220V, 240V		3A (ST9201/S)	
		2A (ST9201B/C)	

Checking or Replacing the Fuse:

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

1.5 Precautions

1.5.1 For Use

- **Do not use the instrument in combustible air.**

  Prevent the instrument from burning or exploding.

- **Do not place the instrument in a place where it is hot or where the temperature changes drastically.**

  Operating Temperature: 5°C to +35°C

  Storage Temperature: -20°C to +60°C

- **Do not leave the instrument in a humid environment.**

  Operating Humidity: 20% to 80% RH (dew condensation is not allowed)

  Storage Humidity: less than 90% RH (no dew condensation allowed)

  When condensation can cause humidity to exceed the operating range, wait until the environment is completely dry before using the instrument.

- **Do not place the instrument in an environment with corrosive gases.**

  Corrosive gas environments may corrode wires and connectors, creating hidden hazards or connection defects that can lead to malfunction, failure or even fire.

- **Do not use the instrument in dusty environments.**

  Dirt and dust can cause short circuits or fires in electronics.

- **Do not use the instrument in poorly ventilated areas**

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

- **Do not use the instrument on an inclined surface or in a shaky area.**

  When placed on an unlevel surface or in a shaky place, the instrument may slip and damage the instrument.

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

  Electromagnetic pulses can cause instrument malfunctions resulting in fires.

- **Do not use the instrument in the vicinity of sensitive test equipment and receiving equipment.**

  Noise generated by this instrument may affect these devices if they are used in the vicinity of this instrument. Test voltages in excess of 3kV can generate corona, which produces a large amount of interference in the RF (Radio Frequency) bandwidth between the test clips and the test line. To minimize this effect, ensure that the distance from the alligator clips is sufficient. Also, keep alligator clips and test leads away from conductive surfaces (especially pointed metal ends)!

1.5.2 For Moving

- **Turn off the power switch before moving.**

  Moving the instrument with the power switch on can cause electric shock and damage.

- **Disconnect all cables before moving.**

  Moving the instrument without disconnecting the cable may result in damage to the connecting cable, or the instrument may tip over.

1.6 Other Specifications

Power: ≤500VA (ST9201/S)

≤350VA (ST9201B/C)

Dimensions: 340mm × 120mm × 450mm

Weight: 15kg (ST9201/S)

13kg (ST9201B/C)

2 Operational Norms

This chapter describes the precautions to be followed in the handling of this tester.

When using the tester, take utmost care to ensure safety.

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

2.1 Daily Inspections

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

1) The input source meets specifications and the tester power configuration is correct.
2) The instrument is connected to an earth ground.
3) The coating of the high-voltage test lead wire is free from breaks, cracks, and tears.
4) The low-voltage test lead wire is not broken.
5) Do not make contact between the low voltage end of the test lead and the high voltage end of the test lead under normal test conditions.

2.2 Pre-Testing Inspections

WARNING!	
	Use the interlock contact to monitor the safety status. You can ensure safe operation if you use the interlock function continuously. Using a test fixture (test cage) during a voltage or insulation resistance test prevents electric shocks. The test cage is connected to the interlock connection of the test device and the test can only be started when the protective cover of the test device and thus the interlock contact is closed. The test is therefore interrupted immediately as soon as the protective cover of the test device is opened. Before switching on the device, make sure that the voltage range of the mains supply corresponds to that set on the back of the device. As soon as the device is switched on, all LEDs on the front of the device light up and a self-test is carried out. To ensure the highest possible level of safety, check that all LEDs are working before commissioning. There is an increased risk if you carry out a test procedure and the warning light does not work. Please note that the warning light lights up during the self-test without voltage being generated.

CAUTION!	
	After you have switched the device off, wait a few seconds before switching it on again. Repeatedly switching the high voltage live line tester on and off too quickly can cause considerable damage to the device..

Checking Procedure:

1) Make sure the supply voltage matches the voltage control range marked on the rear panel.
2) Make sure that the power outlet is reliably grounded, or that the instrument case is reliably grounded.
3) Connect the AC power cord to the AC LINE (AC Power Cord) terminal on the rear panel.

4) Insert the power plug into an AC outlet.

5) Turn on the power switch and make sure that the indicator lights on the front panel are fully illuminated and the panel displays the power-on screen.

6) The next screen displays the AC Withstand Voltage Test (AC) screen of the SETUP screen.

7) Turn off the power switch.

2.3 Protective Measures

- **Wear insulated gloves**

  Wearing insulated gloves when using the instrument will protect you from touching high voltage electricity, but still try not to touch live conductors with your hands during high voltage testing.

- **Suspension (pause) of testing**

  When it is time to change the test conditions, press the STOP switch once first as a precautionary safety measure. Turn off the power switch if you need to test after a while or will be leaving the place where you are testing.

- **Keep away from energized objects during high voltage testing**

  During testing, DUT, test leads, probes, outputs and their surroundings are charged with dangerous high voltage.

  The sheaths on the alligator clips supplied with the instrument are not adequately insulated against the high voltage of the test and should likewise not be touched during the test.

WARNING!	
	The rubber sheaths of the crocodile clips are not suitable as the sole insulation against high voltage. They must not be touched during a measurement!

- **Shut down high voltage output**

  If the DUT, test leads, probes, or outputs have to be touched and the surrounding area for reconnection or other reasons, make sure the following conditions are met:

  a) Voltage indication is "0".

  b) The DANGER light goes out.

- **Remote Control Warning**

  Because the on/off of the hazardous high voltage is remotely controlled, take special care when operating the use of the instrument in remote control mode.

  a) To avoid injury from electric shock, make sure that the high voltage is not switched on inadvertently.

  b) Make sure that the remote control is deactivated while work is being carried out on the measuring setup.

  c) Never touch the DUT, test leads, probes, outputs and their surroundings while testing voltage outputs.

2.4 Emergency Treatment

In case of an emergency (such as electric shock hazard or burning of DUT), take the following actions:

1) Immediately turn OFF the instrument's power switch.

2) Immediately unplug the instrument's power cord from the power source.

2.5 Residual Voltage

WARNING!	
	During a DC high voltage test or an insulation resistance test, the test object and the test leads are charged with the high voltages. The ST9201 high voltage tester has a discharge function to prevent accidents or electric shock. Nevertheless, in some cases residual voltages or residual charges may occur that have not been completely eliminated by the discharge function. To prevent electric shock and injury, ensure that the following measures are taken before touching the device under test or the test leads: 1) The voltmeter displays a voltage of 0V. 2) The “Danger” warning light is no longer illuminated. **As soon as the high voltage is switched off, the discharge function of the device discharges the DUT. Therefore, do not disconnect the DUT from the device during the test or during the discharging process!**

2.5.1 Discharge Time

The duration of the discharge process varies depending on the type and properties of the test specimen. The discharge after a DC high voltage test takes place via a 2kΩ resistor and that of the insulation test via a 10kΩ resistor.

If no DUT is connected to the high voltage tester, the tester needs less than 1 second to reduce the internal capacitive voltage to approx. 30V.

If the device under test is disconnected from the tester during a running test or before complete discharge, and if the device under test has a capacitance of 0.01μF and a parallel resistance of 100MΩ, for example, the discharge takes approx. 5.3 seconds at 5kV and approx. 3.5 seconds at 1kV.

2.6 Prohibited Operations

- **Do not turn on/off the power repeatedly.**

  After turning OFF the power switch, be sure to allow several seconds or more before turning it ON again. Do not repeatedly turn the power switch ON/OFF, as the instrument's protection may not be fully operational if this is done. Do not turn off the power switch while the instrument is generating test voltage, except in special or emergency situations.

- **Do not short the output to the ground.**

  Be careful not to short-circuit the instrument's high-voltage test leads to a nearby AC LINE (AC power line) that is already connected to ground, or to other nearby equipment (such as transmission equipment). If short-circuited, the instrument's enclosure can be filled with dangerously high voltage.

  Make sure that the protective ground terminal of the instrument is connected to the ground. In this way, even if the HIGH VOLTAGE terminal and the ground terminal are short-circuited, the instrument case will not be charged with high voltage and will not be dangerous.

  When grounding the protective earth terminal, make sure that it is correct and reliable. See Chapter 1.3 Grounding.

CAUTION!	
⚠	The term "AC LINE" is used here to refer to the power cord used for the instrument. It is the wire that connects the power generated by commercial alternating current or electricity generation to the power supply of the instrument.

- **Do not connect external voltage to the test terminal.**

  Do not connect any external voltage to the output of the instrument. In the non-discharged state, the instrument does not have an external discharge function, and connecting the output to an external voltage may damage the instrument.

2.7 Error State

Improper use or a manufacturing error can sometimes lead to malfunctions of the high voltage tester. In the worst-case scenario, high voltage may still be present at the output terminals despite the tester being switched off and this voltage may not be switched off. If this situation occurs, switch off the tester immediately and disconnect the mains cable immediately!

The following indicators point to such a malfunction:

- The "Danger" warning LED **does not go out** after pressing the STOP button.
- The "Danger" warning LED **does not light up** although the voltmeter indicates dangerous voltage at the output terminals.

The instrument must no longer be used after such an error!

WARNING!	
⚠	In the event of a malfunction, keep the tester under lock and key and report the case to Sourcetronic GmbH immediately. Unauthorized repairs or structural modifications can lead to **injuries due to electric shock!** It will also invalidate the warranty.

2.8 Ensuring Long-Term Use Without Failures

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

Table 2-1 Output Requirements for Withstanding Voltage Testing

Ambient Temperature	Upper Current		Pause Time	Output Time
T≤40°C	AC	> 20mA (ST9201/S) > 12mA (ST9201B/C)	At least as long as the output time	Maximum of 1 minute
		< 10mA (ST9201/S) < 6mA (ST9201B/C)	Not necessary	Continuous output possible
	DC	> 6mA(ST9201/S) > 3m (ST9201B/C)	At least as long as the output time	Maximum of 1 minute
		< 4mA (ST9201/B) < 2mA(ST9201B/C)	At least as long as the judgment wait time (WAIT TIME)	Continuous output possible

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

3 Instrument Panel Overview

This chapter describes the basic operating characteristics of the ST9201 series instruments. Before using the ST9201 series instruments, please read this chapter in detail so that you can quickly learn the operation of the ST9201.

3.1 Front Panel

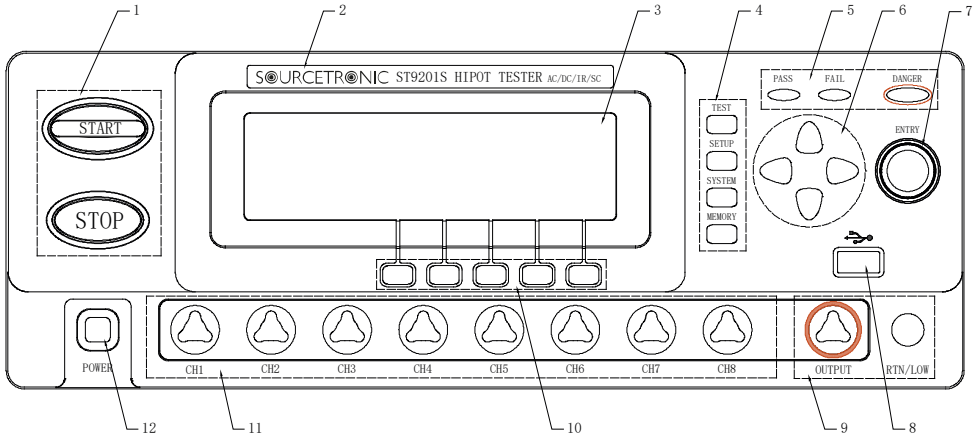


Figure 3-1 Front Panel

1) START and STOP

- **START**
  Initiate the test; once the test has started, TEST is displayed in the upper right corner of the LCD and the DANGER indicator is flashing.
- **STOP**
  Stop key, used to abort the test or cancel the PASS/FAIL status.

2) Brand and Model

3) LCD Screen

240×64 dot matrix LCD screen, display setting and test interface .etc.

4) Function Buttons

- **TEST**
  Press the key; the key lights up and the instrument enters the ready-to-test state.
- **SETUP**
  The instrument enters the parameter setting interface.
- **SYSTEM**
  Press the key; the key lights up and the instrument displays SYSTEM1 setting interface. It can be switched to SYSTEM2, SYSTEM3 and INTERFACE.
- **MEMORY**
  Press the key from the SETUP interface; the key lights up and the interface pops up a window for SAVE, LOAD, or file operations within the USB.

5) Indicators

- **PASS**
  A test result that lights up in the presence of a PASS judgment.

- **FAIL**
  A test result that lights up in the presence of a FAIL judgment.
- **DANGER**
  In the process of testing, indicator lights up with output voltage.

6) Arrow Keys

Move the cursor position on the page.

7) Rotary Knob

Parameter values can be changed using the rotary knob.

8) USB Port

Connect external USB memory. (ST9201, ST9201S, ST9201B with USB memory, ST9201C without USB memory).

9) Output Voltage HIGH and RTN/LOW Terminal

High and low voltage/return terminal in test voltage output.

WARNING!	
⚠	In the process of testing, don't touch the high terminal! **<u>Caution:</u> If external voltage is used in test terminal, it will cause damage to internal circuit!**

10) Shortcut Key (F1~F5)

Corresponding with the function operation or shortcut key on the LCD display.

11) Scanning Interface (only for ST9201S/SX)

Built-in 8-channel scanning output.

12) POWER Switch

3.2 Instruction of Rear Panel

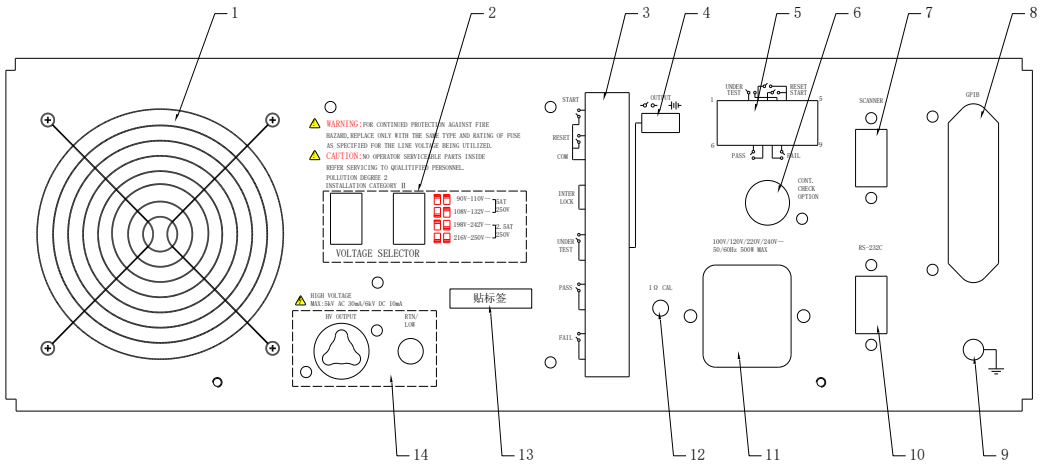


Figure 3-2 Rear Panel

1) Fan

Amplifier circuit cooling vents; take care to preserve space for air circulation.

2) Line Voltage Range

Selection of the input voltage range (the selected voltage range must be adapted to the input voltage, otherwise the instrument will be damaged).

3) PLC Controller Interface

Connect the programmable controller.

- **INTERLOCK**
  Input the connecting locked signal; when disconnected, the machine is not allowed to start the output.
- **TEST**
  Synchronization control signal of the machine output when the instrument starts the high-voltage output.
- **START**
  Input the start signal of the machine, used to start the high-voltage output, which is equivalent to the START signal on the front panel.
- **RESET**
  Input the reset signal of the instrument to stop the high-voltage output, equivalent to the STOP signal of the front panel.
- **PASS**
  The PASS signal output by the instrument, equivalent to the PASS indicator of the front panel.
- **FAIL**
  The FAIL signal output by the instrument, equivalent to the FAIL indicator of the front panel.

4) OUTPUT

TEST signal output mode control, can output 24V level or relay switch signal, it is recommended to use switch signal to ensure signal isolation.

5) HANDLER Interface

9 core model D jack; contains all signals of the control interface (see above) except interlock.

6) Ground Conductivity Test Interface

When turning on the ground conductivity test function, this port must be connected to the DUT with a connecting cable, and the resistance of the connection to the low end of the test is less than 1Ω.

7) SCAN Interface

8) IEEE488 (GBIP) Parallel Communication Interface (optional)

9) Protective Earth Terminal

Connect the instrument to earth.

10) RS232C Serial Interface

Serial communication interface to realize communication with the computer.

11) Electric Socket

For inputting AC power; please use the power cord that comes with the instrument, which has a power fuse inside, and replace the corresponding fuse for the input power.

12) Potentiometer for Ground Conductivity Calibration

Ground resistance must be less than 1Ω. This potentiometer can be used to compensate for measurement deviations caused by unavoidable resistances in the measurement setup.

13) Nameplate

Instrument factory number record.

14) High Voltage Output Interface (optional)

Spare high-voltage output connector, which can be added in case of special customer requirements.

3.3 Instrument Performance

- **ST9201:** Withstanding voltage testing 5kV AC (30mA), 6kV DC (10mA) / insulation resistance testing.
- **ST9201S:** Withstanding voltage testing 5kV AC (30mA), 6kV DC (10mA) / insulation resistance testing / 8-channel matrix.
- **ST9201B:** Withstanding voltage testing 5kV AC (20mA), 6kV DC (5mA) / insulation resistance testing.
- **ST9201C:** Withstanding voltage testing 5kV AC (20mA).

For each model, there is a safety current-limited X variant in the AC range to 3mA:

- **ST9201X:** Withstanding voltage testing 5kV AC (3mA), 6kV DC (10mA) / insulation resistance testing.
- **ST9201SX:** Withstanding voltage testing 5kV AC (3mA), 6kV DC (10mA) / insulation resistance testing / 8-channel matrix.
- **ST9201BX:** Withstanding voltage testing 5kV AC (3mA), 6kV DC (5mA) / insulation resistance testing.
- **ST9201CX:** Withstanding voltage testing 5kV AC (3mA).

When generating the AC test voltage, the selection of the output frequency is not dependent on the mains frequency.

The DC high voltage is generated using a 600Hz AC voltage, which results in very little residual ripple to ensure a stable DC voltage.

After adapting the test object, not only can an AC/DC high-voltage test and an insulation test be carried out separately, but the device also allows the generation of test steps and test programs.

The ST9201 series are equipped with PLC, HANDLER, GPIB (optional) for industrial control, RS-232C for connecting to a PC, and USB (not available for the ST9201C) for backing up data, which makes the instruments adaptable to a wide range of different automatic test systems that require high safety and reliability.

3.3.1 Features

Test Functions—AC Withstanding Voltage Test, DC Withstanding Voltage Test, Insulation Resistance Test and Open & Short Detection

- ST9201/S/B(X) provides AC withstanding voltage test and insulation resistance test.
- ST9201C(X) provides AC withstanding voltage test only.

When connected to a load, the instrument can continuously perform multi-parameter tests by editing the test program.

- **AC Withstanding Voltage Test 5kV/30mA (ST9201/S) or 20mA (ST9201B/C) or 3mA (X)**

  The high voltage generator of the ST9201/S has an AB power amplifier with a 150VA transformer with a maximum output voltage of 5kV and 30mA, while the ST9201B/C has a transformer with 100VA power that allows an output voltage of 5kV and 20mA.

  The maximum continuous test time is 1 minute. The minimum selectable output voltage is 50V with an accuracy of +-3% with automatic adjustment. The X variants have a 15VA transformer that can deliver 5kV 3mA.

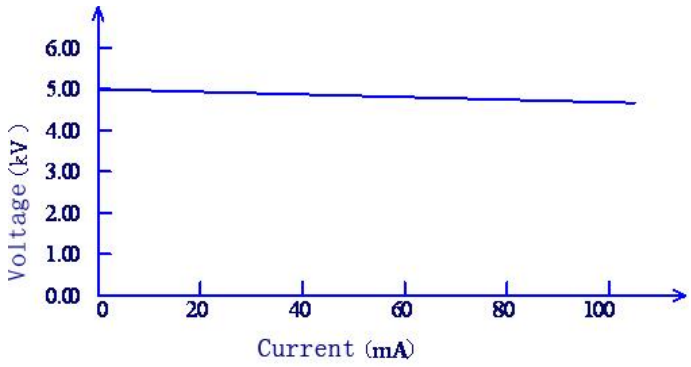


Figure 3-3 AC Voltage Load Adjustment Ratio

- **DC Withstanding Voltage Test 6kV/10mA(ST9201/S) or 5mA(ST9201B/C)**

  The DC high voltage test can be carried out with a maximum voltage of up to 6kV and a maximum output power of 50W (ST9201B/BX: 25W). The maximum continuous test time is 1 minute. Between 50V and 500V, a low load impedance can lead to an unstable output voltage; in this case, switch off the automatic readjustment.

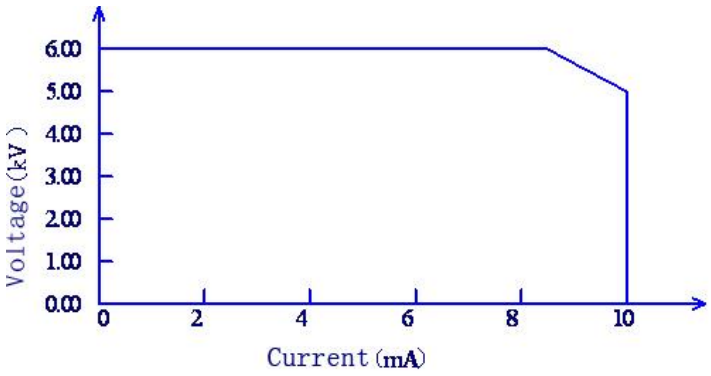


Figure 3-4 DC Voltage Output Range

- **Insulation Resistance Test 50V to 1500V up to 50.0GΩ**

  The insulation resistance test can be performed with a voltage of 50V to 1500V at a resolution of 1V. The resistance measurement range is 0.1MΩ to 50GΩ. The maximum output current is between 50nA and 10mA (5mA for ST9201B/BX), depending on the load.

- **Open and Short Detection**

  If the test object is not correctly contacted, a significantly lower current flows than would be expected; correspondingly, a significantly higher current flows if there is a short circuit. A threshold value can be configured for both cases, which triggers an error if it is not met.

- **Fully Programmable RS-232C and (optional) GPIB Interface**

  Various functions and parameters of the tester can be controlled and changed via the interfaces mentioned above. For example, the test time, ramp times, test results and measured voltage and current can be read out via the interface. The commands for remote control can be found in chapter 5 of these operating instructions.

- **PLC and HANDLER Interfaces for Easy Connection and Control**

  PLC and HANDLER interfaces can input START, STOP and INTERLOCK signals and output TEST, PASS and FAIL signals. It can be easily connected with a foot switch to offer foot control, and with a simple test fixture to realize safety interlock, pneumatic control, test instructions and so on.

- **USB Interface for Backup**

  Instruments except ST9201C are equipped with a USB interface, which can save test programs and customer metrology files prepared by the instrument to an external USB flash drive or transfer them into the instrument from the USB flash drive, facilitating the setup and use of batch instruments and the archiving of programs.

- **Eight-Channel Matrix**

  The ST9201S has an internal 8-channel switching matrix. Each channel can be connected to different points on the DUT and the device switches the channels as a voltage output or return conductor, depending on the setting.

- **Wait Time Control Function**

  The test wait time can be set from 0.1s to 999.9s with a resolution of 0.1s. During this time the instrument outputs the TEST control signal, which is used to control external equipment to ensure that the test connection is reliable before starting the high voltage test process.

- **Rise/Fall Time Control Function**

  For a DC/AC high voltage test and an insulation resistance test, the ramp times for voltage rise and voltage drop can be programmed between 0.1 and 999.9 seconds. The ST9201 series complies with both UL and IEC standards for high-voltage tests.

- **Discharge Function**

  Normally, the DUT is capacitive. When the DC withstand voltage test and insulation resistance test are cut off, the DUT remains fully charged and there is a risk of electric shock. The ST9201 series has a forced rapid discharge function for the DUT after the completion of the DC withstand voltage test and insulation resistance test.

- **Enhanced Safety**

  In order to improve safety, the ST9201 series is equipped with many facilities and safety features, including safety outputs, discharge function and ground current detection. The so-called ground current detection is to cut off the high voltage output when the return current of the local high voltage test circuit through the enclosure is greater than 0.5mA, and even if the user turns off this function, the ground current will trigger this protection when the ground current reaches 70mA or more.

- **Higher Test Accuracy**

  ST9201 series has a digital voltage display.

  In withstand voltage test, the voltage accuracy is ± (1% reading + 5V) and the current accuracy is ± (1% reading + 10 digits). In insulation resistance test, the voltage accuracy is ± (1% reading + 2V).

- **Current Correction Function**

  AC and DC withstand voltage tests require high sensitivity and high voltage, and current flowing through stray capacitance of test leads and fixtures can make the test inaccurate. The ST9201 series has a current clearing function as a means of counteracting current offsets.

- **Easy Operation**

  The ST9201 series is easy to operate, ensuring that users have no difficulty getting started. The instrument lists the test conditions on the setup screen. To set the test conditions, use the arrow keys to select one of the subjects from the LCD display and turn the code switch. The shortcut keys can jump to select the subject being set. The customer sets the data and returns to the measurement screen to perform the measurement.

- **50 Test Programs of up to 100 Test Items Each**

  The test programs contain individual test steps that are to be programmed by the user. The memory can store up to 500 test steps. These can be transferred to an external USB stick.

WARNING!	
	In addition to these operating instructions, the **generally applicable legal regulations** and other binding guidelines on occupational safety and accident prevention – especially regarding working with dangerous high voltage and environmental protection – **must be observed**!

4 Basic Operation

WARNING!	
	Examples in this chapter are based on the ST9201S. Not all of the settings shown here are available for other models.

4.1 Turning on the Instrument

WARNING!	
	Before commissioning the tester, make sure that the fuse is in good condition and that the input voltage corresponds to the input voltage set on the back of the device. Make sure that the tester is switched off. As soon as you switch the tester on, the self-diagnosis starts and all LEDs on the front of the device light up. Make sure that all LEDs are lit. Check the "DANGER" LED in particular, as this is especially important for a safe test procedure!

CAUTION!	
	Wait a few seconds after switching off the tester before switching it on again. Repeatedly switching it on and off too quickly can damage the device.

CAUTION!	
	Even if the tester is switched on, it is possible that the high voltage test will not start when the "START" button is pressed. Reasons for such behavior may be incorrect parameter settings or the tester is in protection status.

1) Check whether the mains voltage matches the voltage range of the tester.
2) Check that the power cable is correctly connected to the tester.
3) Switch on the device.
4) The start screen, which displays the tester's current firmware, is automatically followed by the screen that was active before the tester was switched off.

4.2 Interface Structure Overview

This chapter describes the operational procedures for voltage withstand and insulation resistance testing.

The interface structure of the instrument is illustrated below:

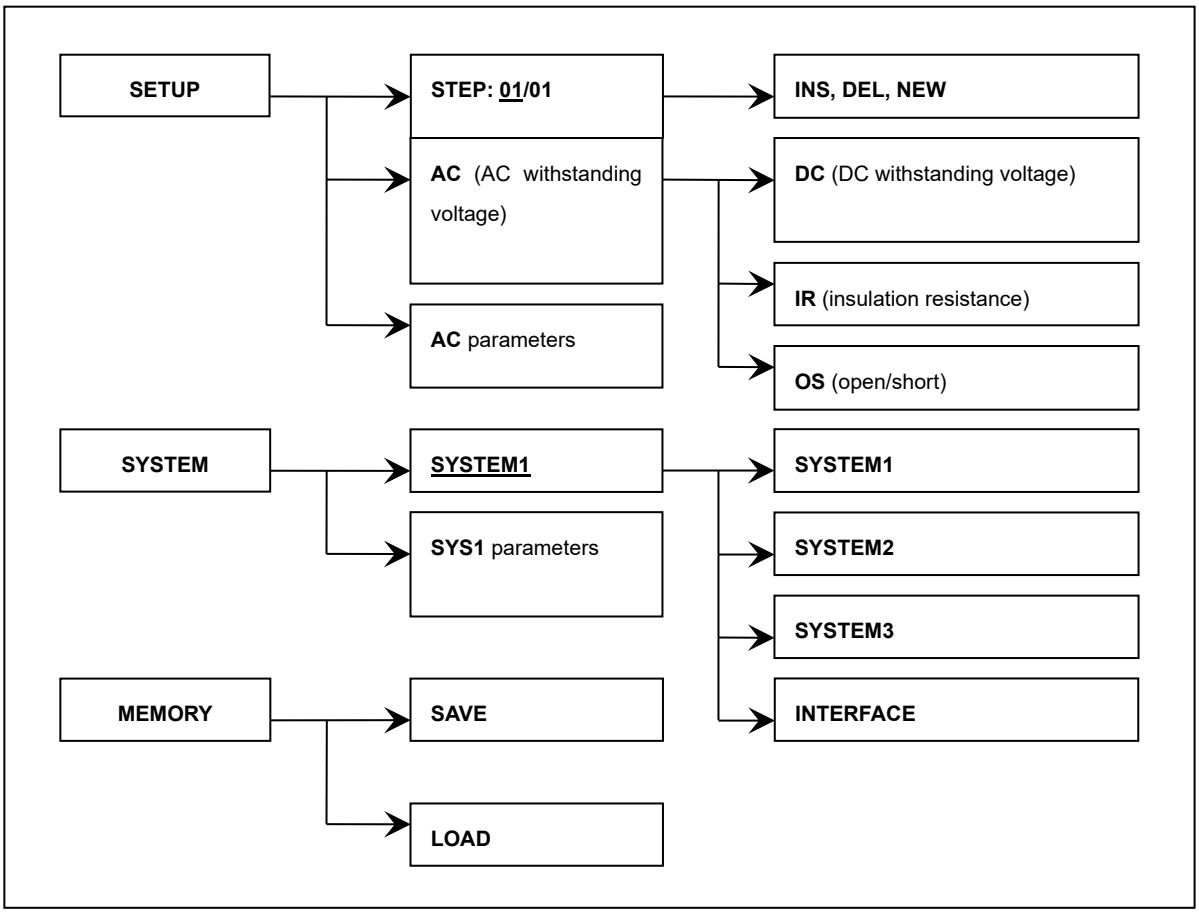


Figure 4-1 Operation Steps

Introduction to the Interface:

1) The first column of the menu structure shows the initial pages corresponding to the function buttons on the control panel. As no settings can be changed on the TEST page, it is not shown in the above image.

2) The second column shows the initial parameters of the corresponding pages. STEP 01/01 means that step 1 of 1 program steps is currently displayed, AC means that the current program step contains an AC high voltage test, the AC parameters are its detailed settings.

3) The third column shows the changes that can be made in the fields in the second column. Here, for example, program steps can be added, changed or a completely new program can be started and the test method to be carried out can be changed to DC, insulation resistance or open/short. If the test method is changed, the corresponding parameters in the second column also change, e.g. from AC to DC parameters.

4.3 Instruction of Interface Function

This section introduces the instrument's functional interfaces and related parameters, mainly based on the software flow and interface relevance as a sequence. In order to guide the user to understand the function and use of the instrument.

Basic Functions of the Panel Keys

- **TEST**
  Allows the instrument to enter the test wait state, which allows the high voltage test to begin.
- **SETUP**
  The interface for modifying the current test program, test items, and test parameters. Modifications to the test content are done in this interface.
- **SYSTEM**
  Allows you to enter the setting interface related to the instrument's test environment.
- **MEMORY**
  The interface for saving and recalling test scenarios, related to memory.
- **▼▲◀▶**
  Allows the cursor to move freely between parameters.
- **F1~F5**
  The shortcut keys allow you to directly change selected data and special function settings.
- **ENTRY (knob)**
  Changes the selected data.

Brief Instruction of Operation

To switch an existing test program from the default AC Withstand **(AC)** to Open Short Circuit Detection **(OS**), proceed as follows:

1) Press the arrow key **'▶'** to bring the cursor (underline) to **"AC"** (see below);
2) The prompts shown below will appear in F1~F5;
3) At this time, you can press **'F4'**, the position of **"AC"** in the following figure will be changed to **"OS"**; the following item parameters will also be changed to the default parameters and interface of the open and short circuit detection.
4) Alternatively, turn the knob **'ENTRY'** clockwise to change **"AC"** → **"DC"** → **"IR "** → **"OS"**, the final effect is the same as that of step 3.

Note: Function keys F1~F5 can be considered shortcuts for knob 'ENTRY' operation, and supplementary functions.

STEP:	01/01	**AC**					
VOLT:	0.050	kV	**RISE:**	0.5	s		**LCK**
UPPR:	1.000	mA	**FALL:**	0.5	s		**OFT**
LOWR:	OFF		**FREQ:**	50	Hz		**RMD**
TIME:	0.5	s					**ERR**
ARC:	OFF						
			AC	**DC**	**IR**	**OS**	
			F1	F2	F3	F4	F5

Figure 4-2 SETUP Page

The interface of the instrument is mainly arranged according to four function keys, which are **TEST**, **SETUP**, **SYSTEM**, and **MEMORY**. The following describes the functions of the interface respectively.

4.3.1 TEST

Press the key [TEST] to enter the <TEST> page:

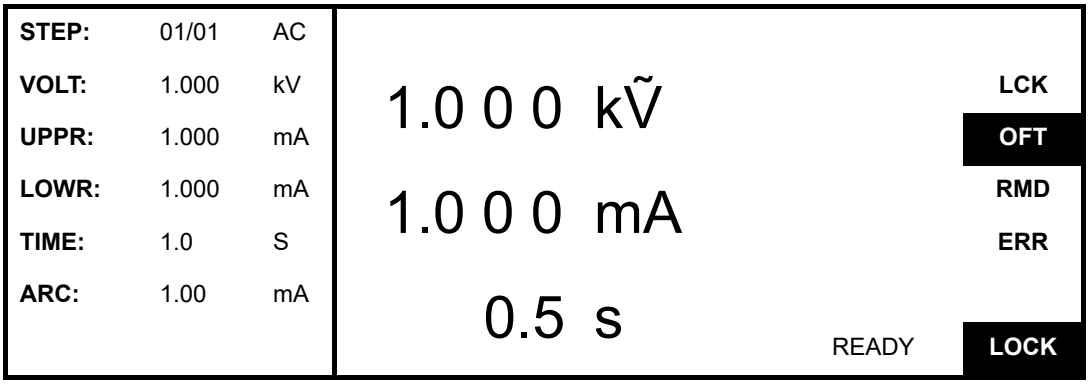


Figure 4-3 AC Test Interface

In the center of the page are three real-time measurements:

- The top one is high voltage output voltage, the unit is (kV).
- The middle one is the tested current of low terminal, the unit is (mA) and (μA).
- The bottom one is the remaining time of the high-voltage test, if the user turns off the test time control, it will display the test time not greater than 999.9s. The user can visually analyze the test in seconds (s).

Note: Only in this interface can the high voltage be activated for high voltage measurement of the component under test, and its test conditions must be set correctly and in detail in the setting interface.

The F5 function key can lock the keyboard. When the keyboard is locked, the **LOCK** in the lower right corner of the page changes to **ULCK**, and the **LCK** on the right side of the page changes to **LCK**. The instrument only responds to the START, STOP, and F5 (unlock) keys, and in addition, the unlock operation is controlled by the PASSWORD setting in the SYSTEM interface.

REMINDER: The operator can't leave while the tester is working and can't approach the test line or DUT during the test!

4.3.2 SETUP

Press the key [SETUP] to enter the <SETUP> page. Or in the <TEST> page, press the key ▼ , to enter the <SETUP> page. Example is the system default parameters:

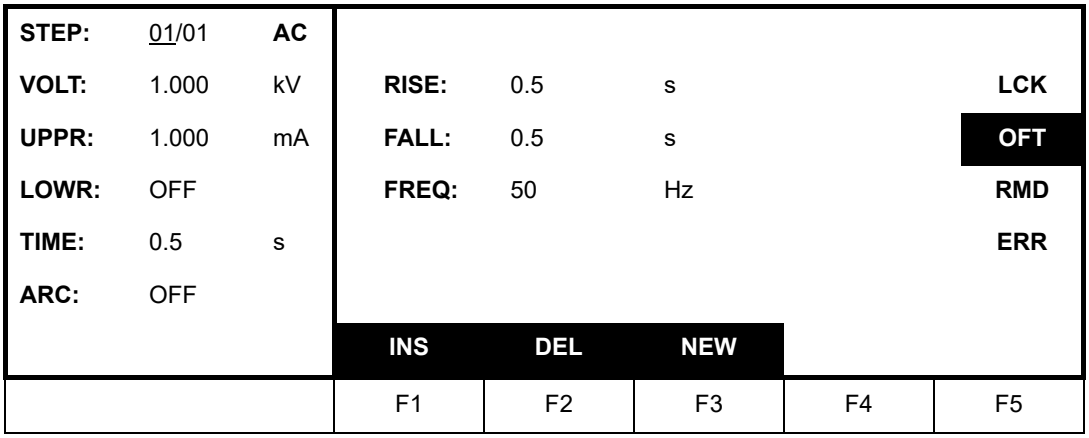


Figure 4-4 SETUP Interface Schematic

4.3.2.1 Test Items

STEP: 01/03 (Current test item no. / total test items)

Table 4-1 Function Key Description

Key	Function	Description
F1	INS	Adds a new test item after this item.
F2	DEL	Delete the current test item.
F3	NEW	Create a new empty test scenario (STEP); contains a default new test item.
ENTRY	—	Modify the currently selected parameter item.
START	—	The SETUP interface allows you to use this key to go directly to the TEST screen and start the high voltage test.

4.3.2.2 Channel Control

The output interface of the multi-channel controller (Figure 3-2) can be set to connect to the high-voltage output, test terminal, and hanging open. The connection of the 8 output channels of the multi-channel and the test output port of the instrument, the channel values are open (X), connected to the high-voltage output terminal (■), and connected to the test low end (□).

SCN1: 1X2X3X4X5X6X7X8X Built-in multichannel output and test terminal

SCN1 channel: Built-in multichannel circuits

4.3.2.3 AC Withstanding Voltage Test Parameters

STEP:	01/03	**AC**							
VOLT:	1.000	kV	**RISE:**	0.5	s				**LCK**
UPPR:	1.000	mA	**FALL:**	0.5	s				**OFT**
LOWR:	0.001	mA	**FREQ:**	50	Hz				**RMD**
TIME:	1.0	s							**ERR**
ARC:	5.00	mA							
			–	**+**					
			F1	F2	F3	F4	F5		

Figure 4-5 AC Setting Interface Schematic

Table 4-2 Description of AC Withstanding Voltage Test Parameters

Label	Instruction	Definition
VOLT	0.050~5.000kV	Voltage value of AC high voltage test.
UPPR	OFF; 0.001~30.00mA	Upper current limit.
LOWR	OFF; 0.001~30.00mA	Lower current limit, must be lower than the upper limit.
TIME	OFF; 0.1~999.9s	Test time of AC withstanding voltage test.
ARC	OFF; 0.1~15.0mA	Current max. value of AC arc.
RISE	OFF; 0.1~999.9s	Voltage rise time of AC high voltage test.
FALL	OFF; 0.1~999.9s	Voltage fall time of AC high voltage test.
FREQ	50/60Hz	AC operating frequency.

4.3.2.4 DC Withstanding Voltage Test Parameters

STEP:	01/01	DC							
VOLT:	1.000	kV	**RISE:**	0.5	s				**LCK**
UPPR:	1.000	mA	**FALL:**	0.5	s				**OFT**
LOWR:	1.000	mA	**WAIT:**	0.2	s				**RMD**
TIME:	1.0	s							**ERR**
ARC:	5.00	mA							
			–	**+**					
			F1	F2	F3	F4	F5		

Figure 4-6 DC Setting Interface Schematic

Table 4-3 Description of DC Withstanding Voltage Test Parameters

Label	Instruction	Description
VOLT	0.050~6.000kV	Voltage value of DC high voltage test.
UPPR	OFF; 0.001~10.00mA	Upper current limit.
LOWR	OFF; 0.001~10.00mA	Lower current limit; must be lower than the upper limit.
TIME	OFF; 0.1~999.9s	Test time of DC withstanding voltage.
ARC	OFF; 0.1~10.0mA	Current max. value of DC arc.
RISE	OFF; 0.1~999.9s	Voltage rising time of DC high voltage.
FALL	OFF; 0.1~999.9s	Voltage falling time of DC high voltage test.
WAIT	OFF; 0.1~999.9s	DC charge waiting time. The voltage rise starts timing, and the upper current limit is not judged during the waiting time (RNG FAIL responds). Waiting time < rise time + test time.

4.3.2.5 IR Insulation Resistance Test Parameters

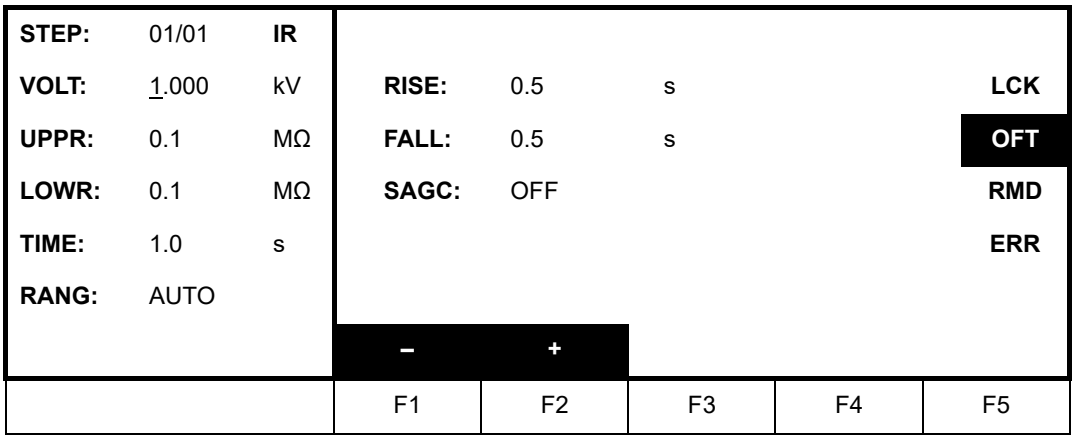


Figure 4-7 IR Setting Interface Schematic

Table 4-4 Description of IR Test Parameters

Label	Instruction	Description
VOLT	0.050~1.500kV	Voltage value of IR test
UPPR	OFF; 0.1MΩ~50.0GΩ	Upper resistance limit of IR test.
LOWR	OFF; 0.1MΩ~50.0GΩ	Lower resistance limit of IR test.
TIME	OFF; 0.1~999.9s	Test time of IR.
RANG	AUTO	Auto range mode. Variable range with test value.
	300nA, 3μA, 30μA, 300μA, 3mA, 10mA	Fixed range mode. Ranges can be estimated using I = U/R to speed up testing and improve accuracy
RISE	OFF; 0.1~999.9s	Rising time of insulation voltage.
FALL	OFF; 0.1~999.9s	Falling time of insulation voltage.
SAGC	ON, OFF	Software auto voltage control.

4.3.2.6 OS Open/Short Circuit Detection Test Parameters

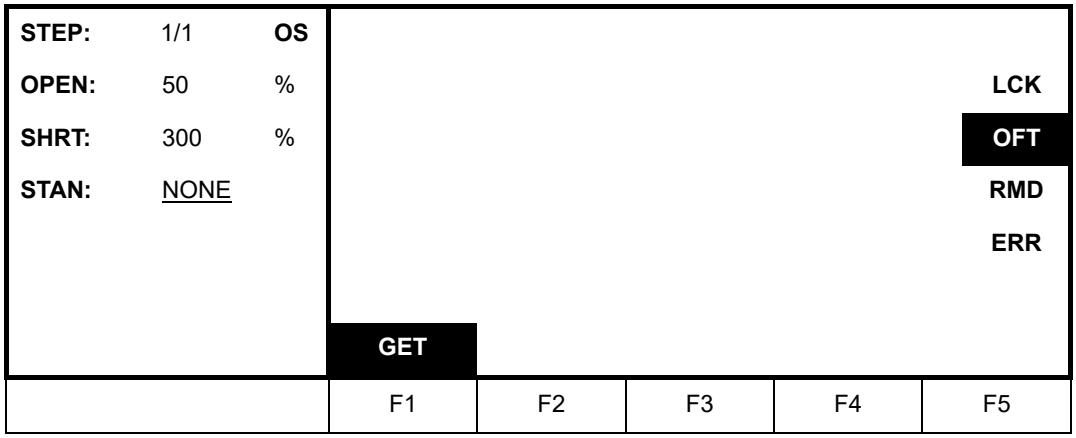


Figure 4-8 OS Setting Interface Schematic

Table 4-5 OS Test Parameter Description

Label	Instruction	Description
OPEN	10%~100%	Open circuit determination threshold; percentage of standard value.
SHRT	OFF; 100%~500%	Short circuit determination threshold; percentage of standard value.
STAN	Previous Standard Value	Standard values for sampling (see note).
	GET	Get the current distribution parameters as a standard.

Note:

1) When the cursor is at the standard value position, the [F1] function key position shows GET.
2) At this time press [F1] function key, the instrument into the standard value sampling state. Sampling the instrument will output 100V voltage in 100 milliseconds to automatically obtain the current flowing through the measured parts. (Please pay attention to the safety of voltage output when using GET!)
3) At this time the capacitance value displayed by the instrument is not the actual capacitance value, but the sampled current by the impedance conversion of the value should be approximated with the actual capacitance installed between the test terminals. (Sampled current is not only generated by the capacitance)

OS Value:

Setting the OPEN SHORT Value. The OS function can be set by satisfying the following necessary conditions:

1) The maximum value of the test impedance when the instrument is not connected to the measured part and the maximum value of the test impedance when it is connected to the measured part have a clear boundary, and this boundary is the OPEN value.
2) The minimum value of impedance when the measured part is excellent and the value of impedance when the measured part is short-circuited have obvious boundaries, and this boundary is the SHORT value.

   Example: Take a 3-coil inductor as an example: the capacitance between 1~2 is about 300P, the capacitance between 1~3 is about 200P, and 2~3 may be in short-circuit. The capacitance after the short circuit is the upper capacitance in parallel.

   - Do not connect the DUT. GET: e.g. STAN = 100P, confirm the open circuit value.
   - Multiple good DUT test standard values, e.g. record GET data range: STAN=350P~450P, confirm standard values.
   - Short circuit 2-3 and GET data range, e.g.: STAN = 550P~650P, confirm the short circuit value.

Parameter Setting Calculation

Assuming STAN = 400P (center of known-good range):

1) OPEN: Lower limit of separation zone = 100P / 400P = 25%, OPEN upper limit = 350P / 400P = 88%. It is recommended to take 40~60%.

2) SHORT: Lower limit of separation zone = 450P / 400P = 112%, upper limit = 550P / 400P = 138%. It is recommended to take 120~130%.

4.3.2.7 MF Multi-Channel Auxiliary Control Setting

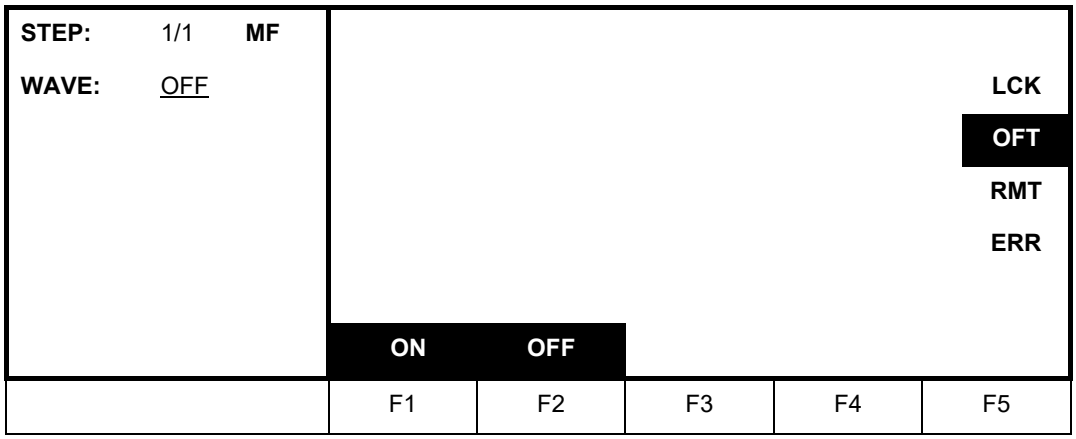


Figure 4-9 MF Setting Interface Schematic

Table 4-6 Multi-Channel Auxiliary Control Parameter Description

Label	Instruction	Description
SCAN	1X2X3X4X5X6X7X8X	Controllable 8 output channels
	X	X : This channel is open circuit
	■	Full frame: This channel is connecting with high voltage terminal
	□	Empty frame: This channel is connecting with test low terminal
WAVE	ON	Turn on multiple channels according to the current SCAN value. Convenient for external devices to do performance testing.
	OFF	Disconnect multiple channels.

This function is required by the ST90010 test system, consisting of a high voltage tester and a winding tester, to switch between the two measuring devices. More detailed explanations can be found in the manual for this test system.

4.3.3 SYSTEM

The system interface is used to configure settings that are not related to the parameters of the specific test item, but rather to the program for which the instrument is performing the test.

4.3.3.1 SYSTEM1 Interface

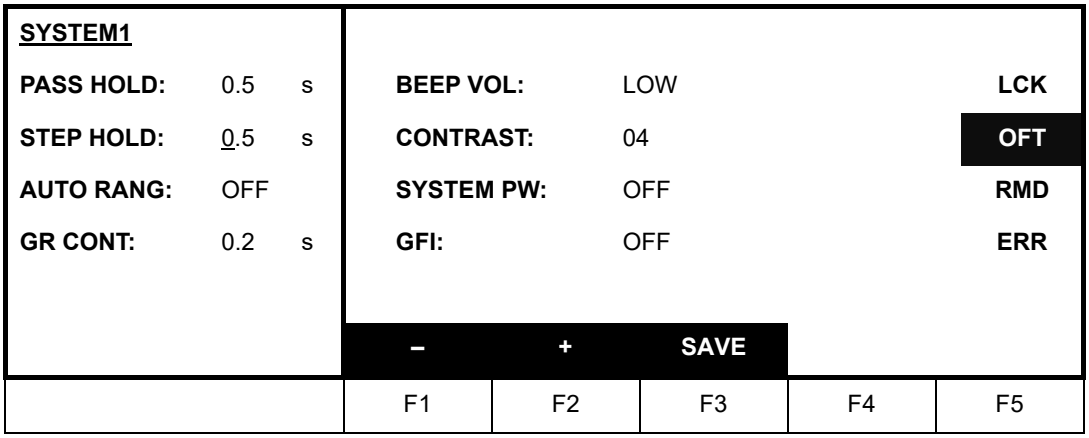


Figure 4-10 SYSTEM1 Interface Schematic

Note: The F3 key saves the system interface parameters as the system interface default parameters when the current options are as above. The interface parameters are saved (including SYS1, SYS2, SYS3, and INTERFACE).

Table 4-7 SYSTEM1 Interface Parameter Description

Label	Instruction	Definition
PASS HOLD	OFF; 0.1~99.9s	Holding time for PASS judgement when test is passed.
	KEY	Stop with STOP key.
STEP HOLD	OFF; 0.1~99.9s	Inter-project wait time.
	KEY	Press ‘START’ to start the next item measurement.
AUTO RANG	ON, OFF	Automatically switches ranges 0.6s before the test ends.
GR CONT	OFF	Do not test the low end of the contact test.
	KEY	Do a contact test while pressing the 'START' button.
	0.2~99.9s	Contact test time setting.
BEEP VOL	OFF, LOW, HIGH	Alarm volume.
CONTRAST	01~10	LCD contrast setting.
SYSTEM PW	ON, OFF	Enable password protection of the keypad. The default password is **90000000**.
GFI	ON, OFF	Ground current detection function (see chapter 4.4.7 GFI (Ground Fault Interruptor) Protective Function)

4.3.3.2 SYSTEM 2 Interface

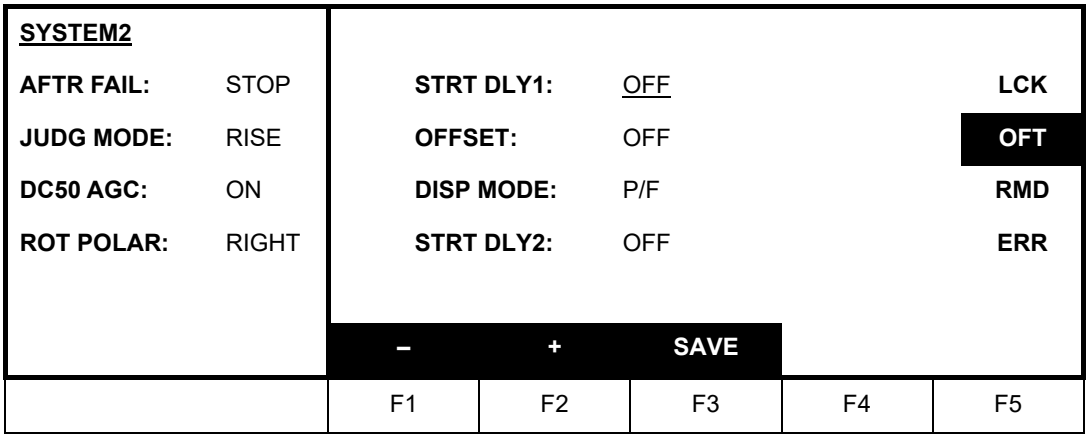


Figure 4-11 SYSTEM2 Interface Schematic

Table 4-8 SYSTEM2 Interface Parameter Description

Label	Instruction	Definition
AFTR FAIL	STOP	Exit with 'STOP' upon FAIL result.
	CONTINUE	Continue the test upon FAIL result.
	RESTART	Restart the test upon FAIL result.
	NEXT	Proceed to next test step upon FAIL result.
JDG MODE	RISE	Evaluation during the rise ramp.
	TEST	Evaluation during the test itself.
	END	Evaluation during the stop ramp.
DC50 AGC	ON, OFF	Voltage hardware feedback loop; enable at DC50V-500V.
ROT POLAR	RIGHT, LEFT	Changes the direction of rotation of the adjusting wheel. RIGHT: Clockwise increase LEFT: Anti-clockwise increase.
STRT DLY1	OFF; 0.1~99.9s	Set the first test delay time.
OFFSET	OFF, ON	Activate the deduction of offset from the test data.
	GET	Obtain the current test data of the current test condition and set it as offset.
DISP MODE	P/F	Large letters display PASS and FAIL.
	DATA	Small letters display PASS and FAIL, without covering the display of the test results.
STRT DLY2	OFF; 0.1~99.9s	Set the second test delay time.

4.3.3.3 SYSTEM 3 Interface

On the SYSTEM3 page you will find (with the exception of PART NO.) individual customer applications that are not supported in the standard system and whose function cannot generally be guaranteed. The functions listed on this page may be different in each firmware version. Please **do not make any changes here** without express agreement.

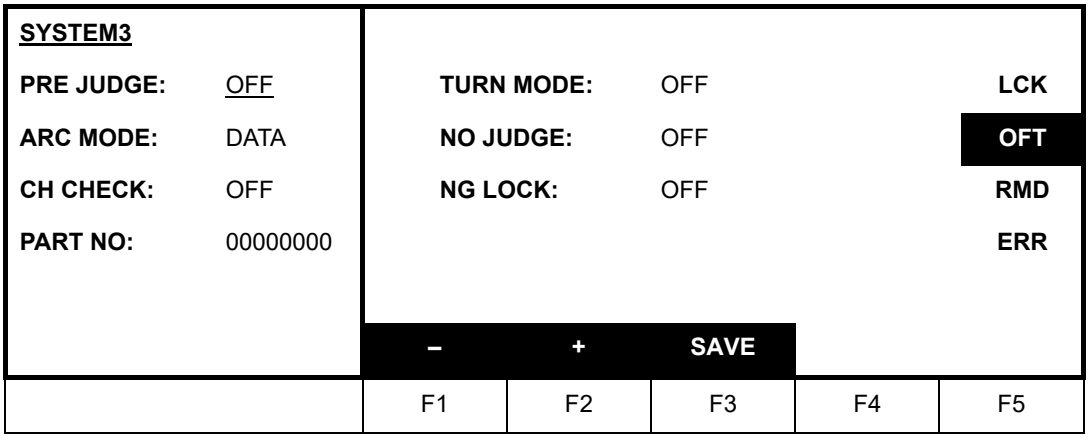


Figure 4-12 SYSTEM3 Interface Schematic

Table 4-9 SYSTEM3 Interface Parameter Description

Label	Instruction	Description
PRE JUDGE	OFF	No differentiation between primary/secondary test.
	1~50	Number of the last step of the primary test. The primary test steps are sufficient but not necessary for a pass, so if the primary test is successful, PASS is output and the process stops after this step; the secondary (detailed) test is therefore not executed if the primary test ran without errors.
ARC MODE	DATA	Evaluation based on ARC current.
	LEVL	Evaluation based on ARC level.
CH CHECK	ON, OFF	Channel detection (customized function), to determine whether the channel is available, no short breaks, etc. ST9201S/SX only.
PART NO	8-bit character	Test program number.
TURN MODE	OFF	End the test when all items in the current file have been tested.
	ON	Automatically start the test from the beginning when the test is finished. Stop condition is set in the test; or press "STOP" to stop.
NO JUDGE	ON, OFF	No judgment (customized function); whether to perform PASS and FAIL judgment.
NG LOCK	ON, OFF	NG lock function (customized function); whether to turn on the function of locking the instrument when detecting NG parts. If it is locked, you need to wait for the staff to unlock it before you can continue the test.

4.3.3.4 INTERFACE

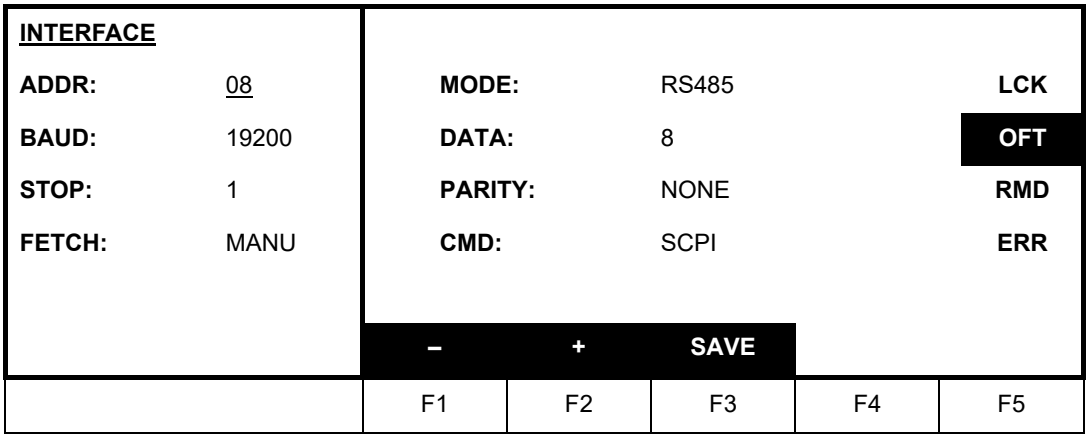


Figure 4-13 INTERFACE Schematic

Table 4-10 INTERFACE Parameter Description

Label	Instruction	Description
ADDR	01~32	IEEE488/GPIB/HPIB/Modbus address of the device.
MODE	R232, GPIB, R485	Select RS232, GPIB (IEEE488) or RS485 as the control interface.
BAUD	9600, 19200, 38400	Communication interface transmission rate.
DATA	7~8	Communication interface number of data bits.
STOP	1~2	Communication interface number of stop bits.
PARITY	ODD, EVEN, NONE	Communication interface parity bit.
FETCH	AUTO, MANU	Automatic/manual data acquisition.
CMD	SCPI, MBUS	Selection of the command set.

4.3.4 MEMORY

In the parameter setting state, press the [MEMORY] key to bring up the MEMORY window as follows (take the AC interface as an example):

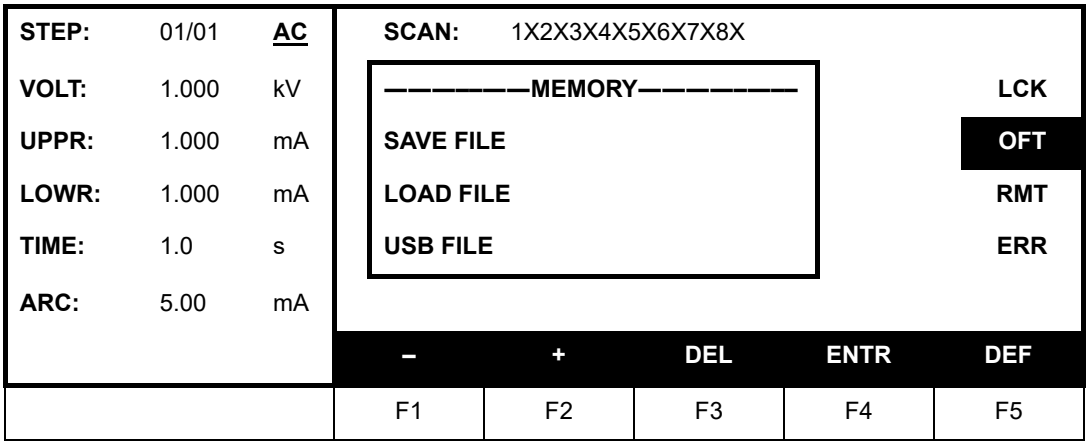


Figure 4-14 MEMORY Interface Schematic

Table 4-11 MEMORY Interface Parameter Description

Label	Definition
SAVE FILE	Enter into the SAVE interface.
LOAD FILE	Enter into the LOAD interface.
USB FILE	Enter into the USB interface.

Use the arrow keys (▼▲) to select SAVE or LOAD and press **F4 (ENTR)** to enter the file management interfaces.

4.3.4.1 SAVE Interface

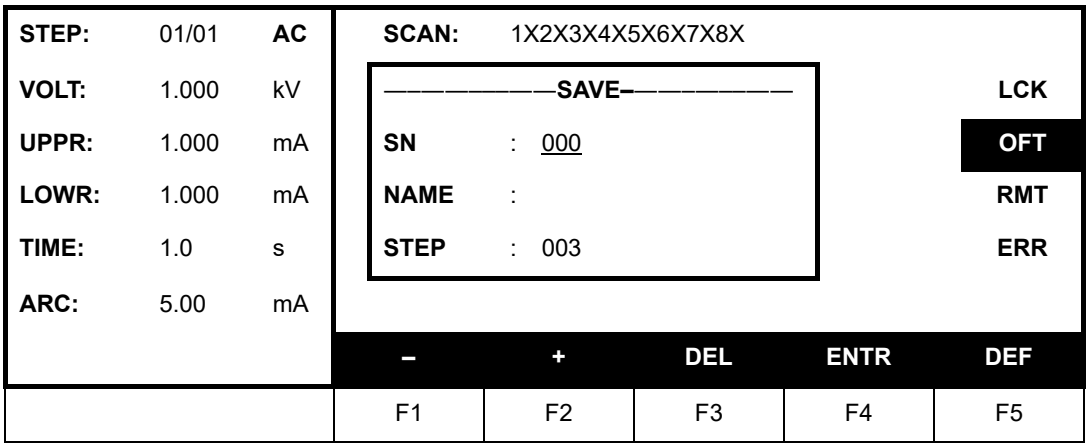


Figure 4-15 SAVE Interface Schematic

Table 4-12 SAVE Interface Parameter Description

Label	Instruction	Definition
SN	00~49	Program storage number.
	Default	This screen is the default scren at start-up.
NAME	8 characters	The name of the program; can be changed only in this screen.
STEP	Black	The current storage area is not in use.
	00~99	The number of items in the previous storage program.

After selecting the storage area and filling in the file name, press **F4 (ENTR)** to enter the confirmation dialog box and confirm again to save the data.

4.3.4.2 LOAD Interface

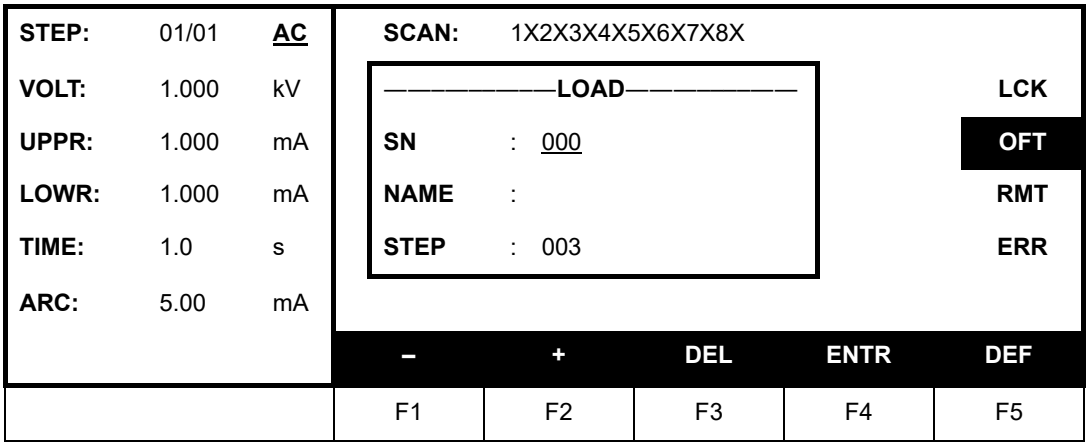


Figure 4-16 LOAD Interface Schematic

The customer cannot change the file name but can only confirm the reading by changing the storage area number according to the file name and the length of the item after confirming the program.

4.3.4.3 USB Storage Function Interface

Press [MEMORY] to enter the storage selection menu, then select the USB FILE option and press ENTR to confirm to enter the USB operation interface as shown below:

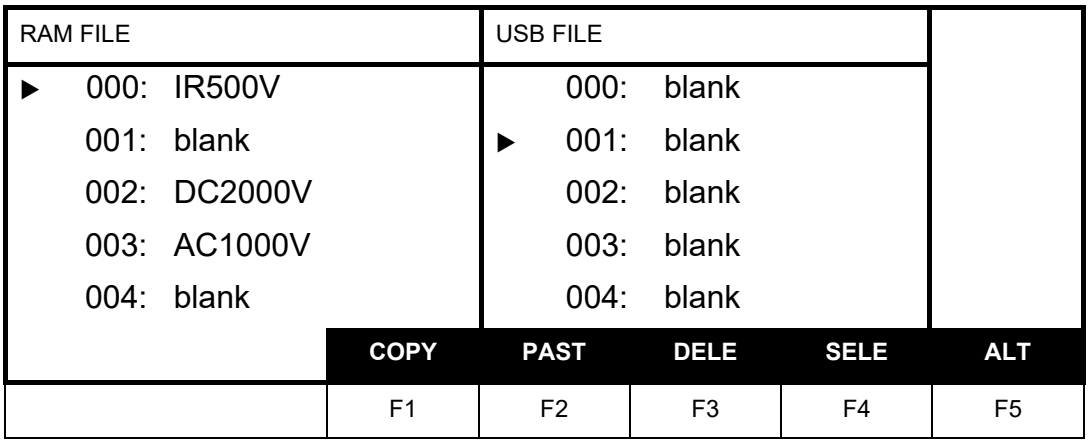


Figure 4-17 USB Storage Interface Schematic

Browse Files:

- The left column is for browsing the internal storage files of the instrument, which can be navigated by using the arrow keys or the knob.
- The right column is for browsing of USB storage files, again with the arrow keys or knob.

If there is no USB disk inserted, No USB Disk will be prompted as shown below:

RAM FILE	USB FILE	
▶ 000: IR500V 001: blank 002: DC2000V 003: AC1000V 004: blank	**No USB DISK**	

	COPY	PAST	DELE	SELE	ALT
	F1	F2	F3	F4	F5

Figure 4-18 No USB Disk Inserted Schematic

Select Files:

Move the cursor to the file you want to select and press **F4 (SELE)**, a tick will be placed after the file to mark it. If you want to cancel the selected file, just move the cursor to the file and press **F4 (SELE)** again to cancel as shown below.

RAM FILE		USB FILE	
000: IR500V		000: blank	
001: blank		001: blank	
▶ 002: DC2000V	√	002: blank	
003: AC1000V		003: blank	
004: blank		004: blank	

	COPY	PAST	DELE	SELE	ALT
	F1	F2	F3	F4	F5

Figure 4-19 Single File Selection Schematic

It is also possible to select several files at the same time, as shown below:

RAM FILE		USB FILE	
000: IR500V	√	000: blank	
001: blank		001: blank	
▶ 002: DC2000V	√	002: blank	
003: AC1000V		003: blank	
004: blank		004: blank	

	COPY	PAST	DELE	SELE	ALT
	F1	F2	F3	F4	F5

Figure 4-20 Selecting Multiple Files Schematic

You can also press **F5 (ALT)** to select all or none. If the cursor is in the RAM FILE area, press **F5** to select or unselect all non-empty files in the RAM FILE area. As shown in the following figure:

RAM FILE		USB FILE		
▶ 000: IR500V √		000: blank		
001: blank		001: blank		
002: DC2000V √		002: blank		
003: AC1000V √		003: blank		
004: blank		004: blank		
	COPY	**PAST**	**DELE**	**SELE**	**ALT**
	F1	F2	F3	F4	F5

Figure 4-21 Selecting All Files Schematic

Copy Files:

Once you have selected one or more of your files, press **F1 (COPY)** to copy the selected files to the instrument's BUFF.

Paste Files:

After copying the files, move the cursor to the place where you want to paste and press F2 (PAST) to paste.

Example: If you want to paste the three files in the RAM FILE in the previous figure into the USB…

1) Select and copy the three files.
2) Move the cursor to the USB FILE area.
3) Press **F2 (PAST)** to paste.

As shown in the figure below:

RAM FILE		USB FILE		
000: IR500V		▶ 000: IR500V		
001: blank		001: blank		
002: DC2000V		002: DC2000V		
003: AC1000V		003: AC1000V		
004: blank		004: blank		
	COPY	**PAST**	**DELE**	**SELE**	**ALT**
	F1	F2	F3	F4	F5

Figure 4-22 File Paste Schematic

Note: When dumping stored records, they can only be stored to the corresponding item. Example: The 000 archive can only be stored to the 000 file.

Delete Files:

This operation is only for the USB FILE area. Move the cursor to the file you want to delete and press **F4 (DELE)** to delete it.

4.4 Test Function Principles and Instructions for Use

This section describes the principles and instrumentation of tests related to ground connection, ground current detection, and arc detection in the order of the test process.

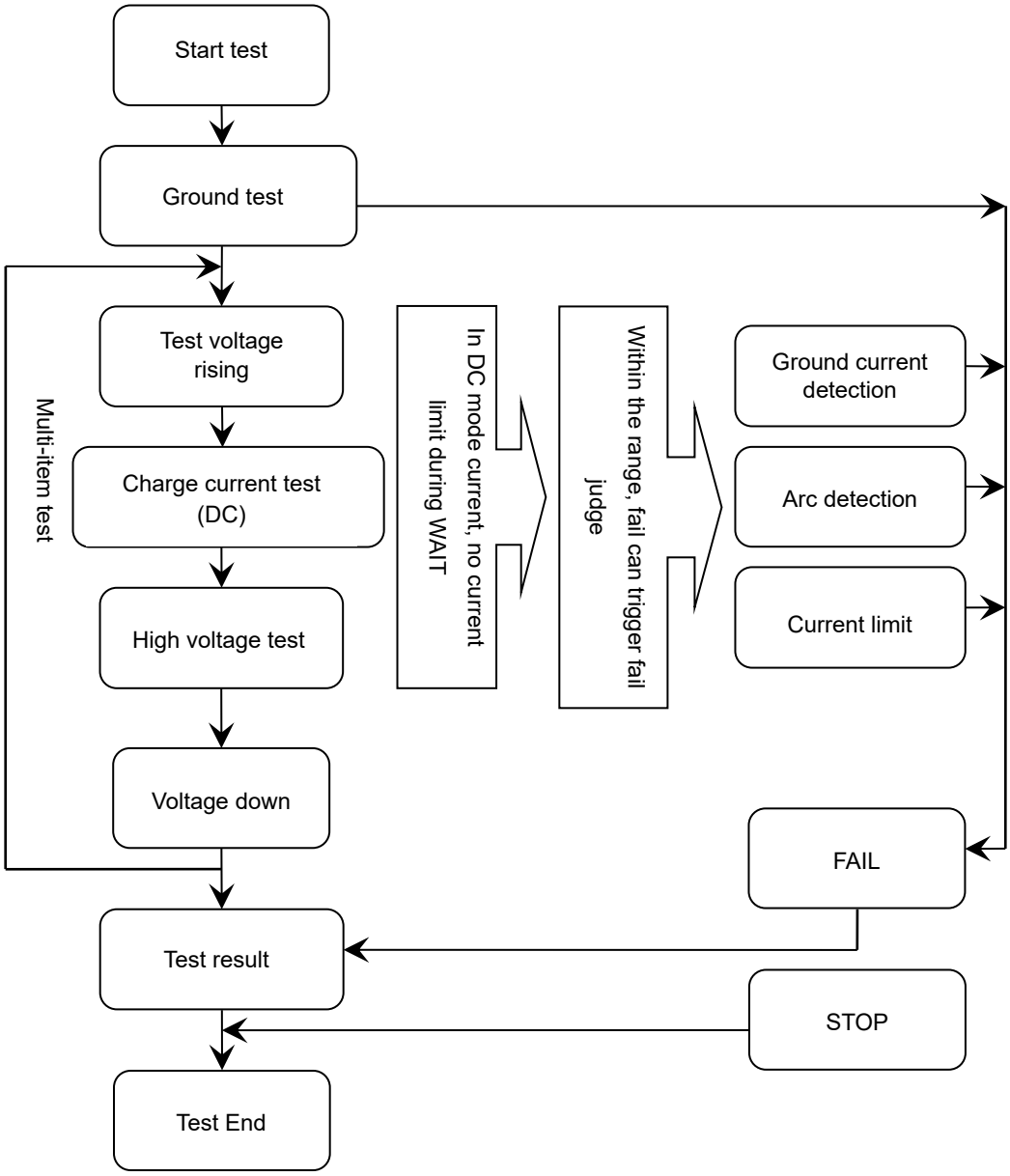


Figure 4-23 Test Procedure

4.4.1 Start Up Test

Procedure:

1) Check test conditions, settings and correct connection of the test sample

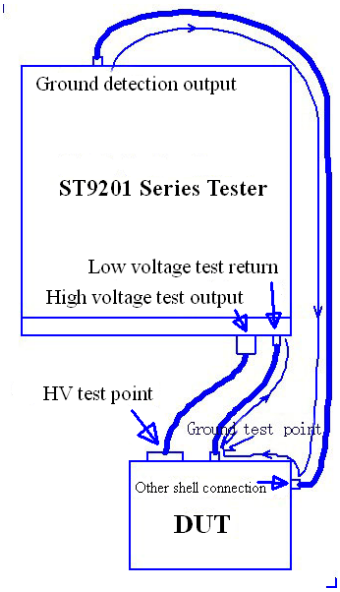
2) Press the START button

After the waiting times configured on the SYSTEM2 page with STRT DLY1 and STRT DLY2, the device starts the measurement.

If the measurement cannot be started as a result, a new program must first be created on the SETUP page using the NEW button and saved and reloaded for the next device start..

4.4.2 Ground Connection Test

The ground connection is generally used when testing equipment, when the low end of the test generally needs to be connected to the equipment's ground terminal (shell). The purpose is to determine whether the test low end to ground connection is reliable. If the test low end is not connected reliably, during the test process, the shell of the equipment under test will be charged with high voltage, which is likely to cause accidental electric shock to the operator.



Instructions (see diagram):

- High voltage test terminal is connected to the test terminal of DUT.
- Low test terminal is connected to the ground connection terminal of device shell.
- Ground detection terminal is connected to another terminal of the shell (e.g. screw).
- Set ground connection test, test time is set by user.
- When the test is initiated, the instrument will first perform a ground detection: the current from the ground detection output will flow through the line as indicated by the arrow in the icon back to the low side of the test.
- If the test circuit is connected normally within the set time (with loop resistance <1Ω as normal), the instrument will consider the grounding test passed and can continue the test.
- If the test circuit is not available (defined as not available with a loop resistance > 1Ω), the instrument will exit the test and display Ground Connection Error (GR FAIL).

Note:

1) Ground connection test is enabled with GR CONT in SYSTEM1 interface.
2) For test convenience, the test low-terminal and the ground detecting terminal could be connected directly and then attached to the DUT to forcibly pass the ground breakover test. However, this setup will bring many dangers for other operators, because it will give them false safety messages.

4.4.3 Voltage Rise

Some of the characteristics of the measured parts are sensitive to the sudden change of voltage and need to use this function. The output voltage is zero when the instrument starts to output, when it starts to output voltage, the instrument will control the output voltage in steps of 0.1s, and the step-up value is determined according to the test voltage and the voltage rise time ($\Delta V = V / (10 \times t_{rise})$). If the voltage rise time is turned off (RISE OFF) the default voltage rise time is 0.1s.

4.4.4 DC Charging Current Detection

This function is used to judge the connection of DUT. DUTs are generally capacitive components. In DC mode, the distributed capacitor will be charged at the voltage rise time (when the measurement starts) and its current will be much larger than the tested current being set. The charging current will fall quickly when the capacitor is fully charged. The presence or the absence of the charging current can judge the connection of DUT. When using this function, the test waiting time should be set longer than the charging time so as to avoid wrong judgment.

4.4.5 High-Voltage Test

Perform high voltage testing on the part under test. At this point it should be possible to ensure that the test circuit is correct and that the test results are not affected by some special incidental parameters and are the actual withstanding voltage current required for the test.

4.4.6 Voltage Drop

The same as the test voltage rise, is the characteristics of the test piece to determine. When the voltage drops at the end of the high voltage test, the instrument will control the output voltage drop in steps of 0.1s, the step-down value is determined according to the test voltage and voltage rise time ($\Delta V = V / (10 \times t_{fall})$).

If the voltage drop time is turned off (FALL OFF) the default voltage drop time is 0.1s.

4.4.7 GFI (Ground Fault Interruptor) Protective Function

The GFI body protection function monitors the current that flows back to the high voltage tester via earth instead of via the return conductor RTN during a running test. The function has the following effects:

When the GFI function is switched on, the high voltage is interrupted immediately (< 0.3s) if the current exceeds **0.5mA** and the error message GFI FAIL appears on the display.

If the GFI function is switched off, the high voltage test is only interrupted at **30mA** earth current and the error message GFI FAIL appears.

WARNING!	
	Even a current of less than 30mA can lead to **serious, if not fatal, injuries due to electric shock**. Therefore, always leave the GFI function switched on unless you have taken other measures, e.g. a test cage with interlock function, to ensure contact safety!

WARNING!	
	The GFI function **only protects against fault currents flowing via earth**, but not if the current flows from the HV connection via the body to the return conductor RTN! (Just as a standard household RCD or RCD does not trip if two monitored phases or a phase and neutral conductor are touched, as the resulting current cannot be distinguished from the current flow intended for normal operation).

WARNING!	
	If a test object contains large capacitances, the charge stored in these can be life-threatening, especially during a prolonged DC test. Although the GFI function interrupts further supply by the high voltage tester, it cannot prevent the discharge of directly touched external capacitances.

4.4.8 Current Overrun and Arc Detection (ARC) Function

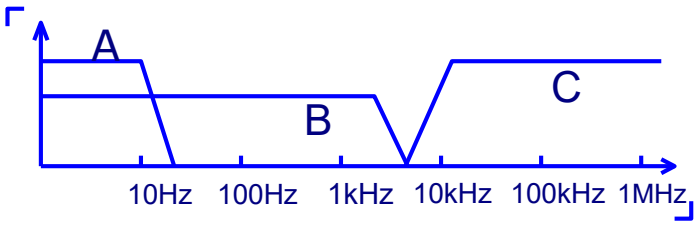
Current overrun is divided into current low and high limit, current range overrun, arc detection.

- **Current Low Limit Judge (LOW)**
  Generally used as a test of the low end of the disconnection judgment. When the instrument test equipment, equipment will certainly have a certain leakage current, when the instrument test leakage current is less than the lower limit of the set current value is considered to be a test failure (not connected to the device), if the component under test itself is very small leakage current must be turned off this function. Displays **(LOW FAIL)** when the limit is exceeded.

- **Current High Limit Judge (HIGH)**
  The most commonly used test current overrun judgment. When the instrument test equipment, equipment will certainly have a certain leakage current, when the instrument test leakage current is greater than the upper limit of the set current value, that the equipment voltage withstanding is not enough test failure. Display **(HI FAIL)** when the limit is exceeded.

- **Current Range Overrun (RANG)**
  The current sampling judgment is slow. Insulation collapse when the current changes faster sampling circuit can not reflect in time, and the current peak has exceeded the upper limit current where the current range of the test range, will trigger such overrun judgment. Displays **(RANG FAIL)** when the limit is exceeded.

- **Arc Detection (ARC)**
  This is a very practical function for component measurement, which tests the sudden change of current caused by the instantaneous firing of local circuits in the high-voltage test circuit. Due to the superimposed on the normal test current, the sudden change in time is relatively short, the above ordinary current detection circuit cannot respond to the current changes to make appropriate judgments. The arc detection circuit filters out normal current values and handles only high-speed current pulse changes. Due to the low pass filtering and the randomness of the arc size itself, this function can only approximate the degree of localized ignition. Displays **(ARC FAIL)** when the limit is exceeded.



- **Figure Area A**
  The current change occurs within a time period of more than 0.05s (corresponds to less than 20Hz). At this frequency, the high-voltage tester can easily detect the current change and provide a qualitative PASS or FAIL evaluation.

- **Figure Area B**
  The sampling rate of the current check is too slow. The current change occurs in this range within a time of at least 0.125ms (corresponds to less than 8kHz). In this range, the high voltage tester can detect the change in current using the current measurement range check and thus prevent damage to the device under test. The PASS or FAIL result depends only on the set current range.

- **Figure Area C**
  The ARC function can only detect very fast current changes that are within 0.05ms to 0.001ms. These short current pulses are caused by partial discharges. Corona discharges (electron sprays) occur particularly at sharp corners. The other two test functions can no longer detect these fluctuations as their sampling rate is too low.

Note: The test frequency for AC is 50/60Hz.

4.4.9 FAIL Judgment

If the test result exceeds the conditions set by the customer, the instrument will judge that the tested part is unqualified and immediately stop the current test, cut off the voltage output, and enter the test results processing program.

4.4.10 Processing of Test Results

If there is no overrun on the right side of the figure during the above process, the instrument will judge that the measured part meets the set requirements, and display the pass judgment (PASS), and the pass indicator will light up (the pass judgment processing mode is controlled by PASS HOLD of SYSTEM1). Otherwise, the instrument will display the failure judgment (FAIL) and the category (see the following figure to HI as an example), failure indicator light (failure judgment processing mode controlled by SYSTEM2 AFTR FAIL). After outputting the result, the instrument will automatically transfer to the next test item if there are more test items, otherwise it will return to the test waiting state.

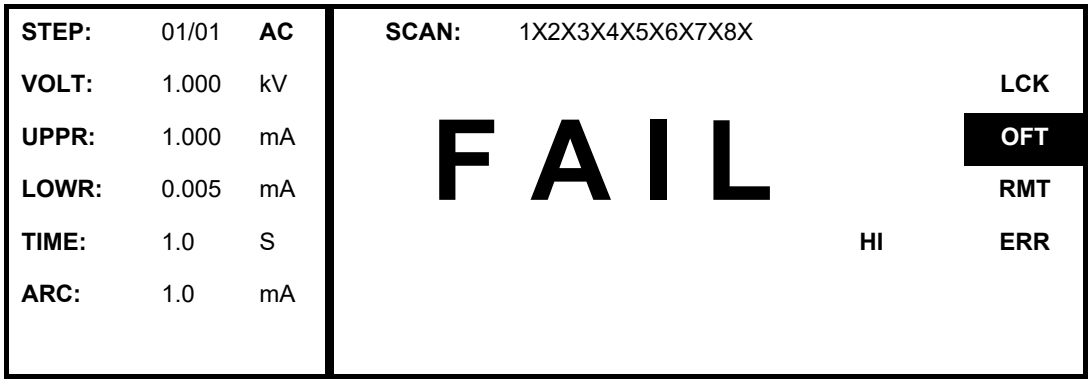


Figure 4-24 Test FAIL Judgement Schematic

4.4.11 STOP

Pressing the STOP key at any state during the whole testing process, the instrument will automatically end the test, and there will not be any test result output.

4.4.12 OFFSET

Before the test, due to the working environment of the instrument and the change of the placement of the test cable, the instrument may have some bottom numbers during the no-load test. For customers who require accurate measurement, you can zero the SYSTEM2 interface. The specific operation steps are as follows:

1) Set the current test conditions in the SETUP interface.
2) Select the OFFSET item in the SYSTEM2 interface and set it to ON.
3) Press GET – the instrument will now automatically start the high voltage test and use the test value of the current as its offset value, adjusting the display to zero.
4) If the customer has not set the test time, the STOP key can be used to stop the test.

4.5 Interface Circuit Structure and Use

4.5.1 PLC and HANDLER Interfaces

PLC interface is a control interface used to connect PLC controllers. Importing and exporting signals on the interface meet the requirements of PLC standard interface.

Except INTERLOCK signal, other signals on HANDLER interface are directly interconnected.

PLC signals schematic circuit is shown as follows in Figure 4-25 PLC Interface Structure and Timing. The output interface on the rear panel of the reference instrument arranges from top to bottom.

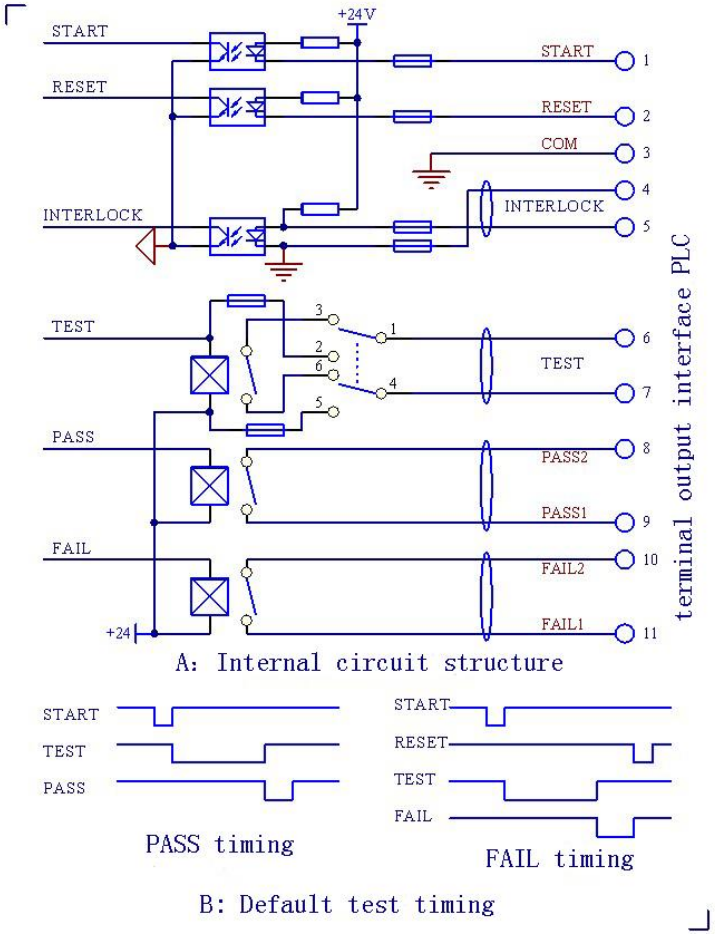


Figure 4-25 PLC Interface Structure and Timing

Note: The behavior of the TEST signal, which indicates a running test, can be switched using the OUTPUT switch on the rear panel of the device (item 4 in the description of the rear panel).

- When the switch is in the right position (battery symbol), the TEST+ connection is connected to the internal 24V source and the TEST – connection is connected to the optocoupler's o.c. output. The internal resistance is about 20Ω, the source can supply a maximum of 30mA in total. Therefore, the connection in this configuration is only suitable for operating potential-free small-signal components, for example a signal LED or a relay coil. **Never** connect components that have their own power supply or are not electrically isolated, as this could damage the internal power supply.
- In the left position (switch symbol), the TEST+ and TEST- contacts are connected to the relay driven by the optocoupler. Use this position if you require a current of more than 10mA or a potential-free contact.

The relays at the TEST+/TEST-, PASS1/PASS2 and FAIL1/FAIL2 connections can switch a maximum of one signal with 230V AC and 1A.

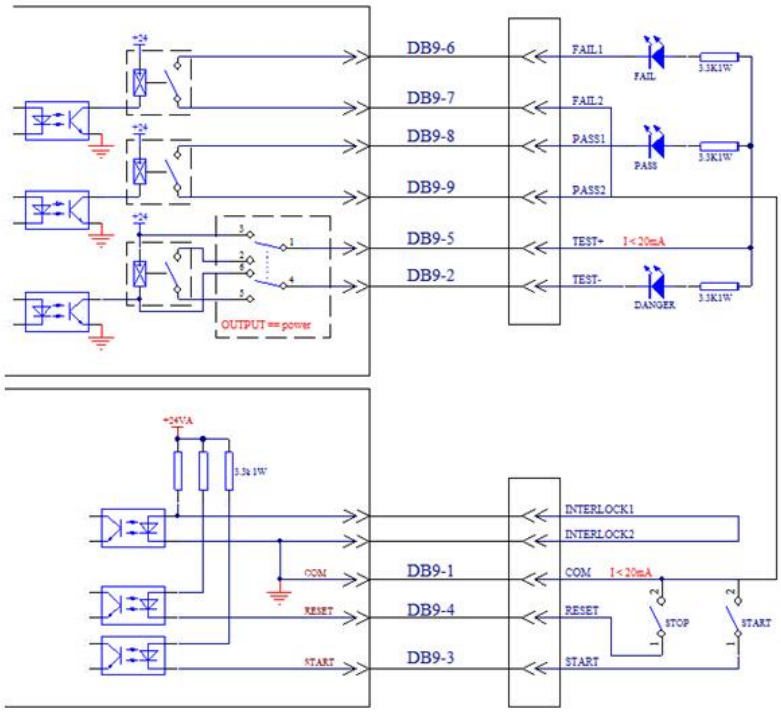


Figure 4-26 HANDLER Connection Circuit

Note: The connections DB9-1 to DB9-9 of the HANDLER connection are directly connected to the terminal with the same designation on the PLC terminal block, e.g. COM is on DB9-1 and terminal 3 . In the above example, the current consumption of all components connected to the 24V source must not exceed 20mA, so this wiring variant is only suitable for LEDs, relay control coils and similar components.

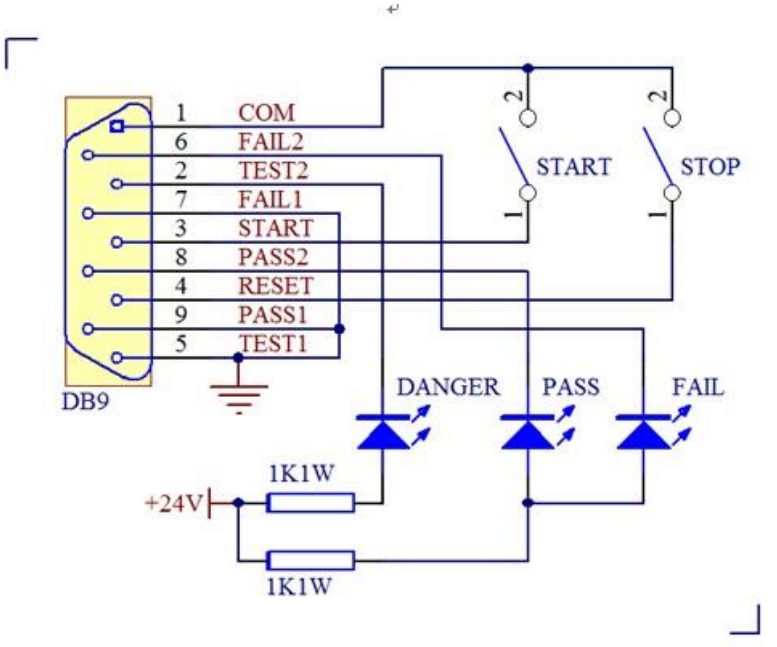


Figure 4-27 HANDLER Connection Circuit with External Source

Note: The above figure shows the use of the HANDLER connection with an external +24V source. In this configuration, the OUTPUT switch must be set to the left position (switch symbol), otherwise the device may be severely damaged. In this operating mode, a higher load current of max. 1A at 230V AC is allowed to flow. However, since the terminals are not protected against contact, it is not recommended to use an operating voltage higher than 24V.

5 ST9201 RS232 Commands

5.1 Commands for System Settings

5.1.1 :SYSTem:TIME:PASS

Sets/queries the time when the PASS beep should sound.

Syntax:

Command Message: :SYST:TIME:PASS<time value>

Query Message: :SYST:TIME:PASS?

Program Data <time value>:

Data Format: Float

Data Range: 0~99.9 (0 is OFF)

Resolution: 0.1

Unit: s

Example:

To set the PASS hold time to 1.0s…

Command: :SYST:TIME:PASS 1.0

Example:

Query: :SYST:TIME:PASS?

Return: If the current PASS hold time is 1.0s, 1.0 is returned.

5.1.2 :SYSTem:TIME:STEP

Sets/queries the STEP interval.

Syntax:

Command Message: :SYST:TIME:STEP<time value>

Query Message: :SYST:TIME:STEP?

Program Data <time value>:

Data Format: Float

Data Range: 0~99.9 (0 is OFF)

Resolution: 0.1

Unit: s

Example:

To set the step hold time to 1.0s…

Command: :SYST:TIME:STEP 1.0.

Example:

Query: :SYST:TIME:STEP?

Return: If the current step hold time is 1.0, 1.0 is returned.

5.1.3 :SYSTem:WRAN

Sets/queries the AUTO RANGE's status.

Syntax:

Command Message: :SYST:WRAN<ON/OFF> or <1/0>

Query Message: :SYST:WRAN?

Program Data <ON/OFF>:

Data Format: Character

Data Range: 0 (OFF)
1 (ON)

Example:

To set the AUTO RANGE's status to ON…

Command: :SYST:WARN ON or :SYST:WRAN 1

Example:

Query: :SYST:WRAN?

Return: If the current AUTO RANGE's status is ON, ON is returned.

5.1.4 :SYSTem:GCON

Sets/queries the status of GR CONTinuity.

Syntax:

Command Message: :SYST:GCON<OFF/KEY/time>

Query Message: :SYST:GCON?

Program Data <OFF/KEY/time>:

Data Format: Character, Float

Data Range: OFF
KEY
Time value (float)

Example:

To set the GR CONT's status to OFF…

Command: :SYST:GCON OFF

Example:

Query: :SYST:GCON?

Return: If the current GR CONT's status is OFF, OFF is returned.

5.1.5 :SYSTem:BEEP

Sets/queries the buzzer volume.

Syntax:

Command Message: :SYST:BEEP<volume value>

Query Message: :SYST:BEEP?

Program Data <volume value>:

Data Format: Enum

Data Range: OFF
LOW
HIGH

Example:

To set the buzzer volume to LOW…

Command: :SYST:BEEP LOW

Example:

Query: :SYST:BEEP?

Return: If the current buzzer volume is LOW, LOW is returned.

5.1.6 :SYSTem:CR

Sets/queries the LCD contrast.

Syntax:

Command Message: :SYST:CR<contrast value>
:SYSTEM:CONTRAST<contrast value>

Query Message: :SYST:CR?
:SYSTEM:CONTRAST?

Program Data <contrast value>:

Data Format: Integer

Data Range: 1~10

Resolution: 1

Example:

To set the LCD contrast to 4…

Command: :SYST:CR 4

Example:

Query: :SYST:CR?

Return: If the current LCD contrast is 4, 4 is returned.

5.1.7 :SYSTem:LOCK

Sets the KEY LOCK's status. Also inquires about the current KEY LOCK's status.

Syntax:

Command Message: :SYST:LOCK<ON/OFF> or <1/0>

Query Message: :SYST:LOCK?

Program Data<ON/OFF>:

Data Format: Character

Data Range: 0 (OFF)
1 (ON)

Example:

To set the KEY LOCK's status to ON…

Command: :SYST:LOCK ON or :SYST:LOCK 1

Example:

Query: :SYST:LOCK?

Return: If the current KEY LOCK's status is ON, ON is returned.

5.1.8 :SYSTem:GFI

Sets/queries the GFI's status.

Syntax:

Command Message: :SYST:GFI<ON/OFF> or <1/0>

Query Message: :SYST:GFI?

Program Data <ON/OFF>:

Data Format: Character

Data Range: 0 (OFF)
1 (ON)

Example:

To set the GFI's status to ON…

Command: :SYST:GFI ON or :SYST:GFI 1

Example:

Query: :SYST:GFI?

Return: If the current GFI's status is ON, ON is returned.

5.1.9 :SYSTem:FAIL

Sets/queries the AFTR FAIL's status.

Syntax:

Command Message: :SYST:FAIL<STOP/CONT/REST/NEXT>

Query Message: :SYST:FAIL?

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

Data Format: Enum

Data Range: STOP
CONTinue
RESTart
NEXT

Example:

To set the AFTR FAIL's status to STOP…

Command: :SYST:FAIL STOP

Example:

Query: :SYST:FAIL?

Return: If the current AFTR FAIL's status is STOP, STOP is returned.

5.1.10 :SYSTem:JUDM

Sets/queries the RAMP JUDGEMENT's status.

Syntax:

Command Message: :SYST:JUDM<RISE/TEST/END>

Query Message: :SYST:JUDM?

Program Data <ON/OFF>:

Data Format: Character

Data Range: 0 (RISE)
1 (TEST)
2 (END)

Example:

To set the JUDM's status to ON…

Command: :SYST:JUDM ON or :SYST:JUDM 1

Example:

Query: :SYST:JUDM?

Return: If the current ramp JUDM is ON, ON is returned.

5.1.11 :SYSTem:DAGC

Sets/queries the DC50 AGC's status.

Syntax:

Command Message: :SYST:DAGC<ON/OFF> or <1/0>

Query Message: :SYST:DAGC?

Program Data <ON/OFF>:

Data Format: Character

Data Range: 0 (OFF)
1 (ON)

Example:

To set the DC50 AGC's status to ON…

Command: :SYST:DAGC ON or :SYST:DAGC 1

Example:

Query: :SYST:DAGC?

Return: If the current DC50 AGC's status is ON, ON is returned.

5.1.12 :SYSTem:PART

Sets/queries the product number.

Syntax:

Command Message: :SYST:PART<number value>

Query Message: :SYST:PART?

Program Data <number value>:

Data Format: Integer

Data Range: 8 bits

Example:

To set the part number to 20090501…

Command: :SYST:PART 20090501

Example:

Query: :SYST:PART?

Return: If the current product number is 20090501, 20090501 is returned.

5.1.13 :SYSTem:SDLY1

Sets/queries the value of STRT DLY1.

Syntax:

Command Message: :SYST:SDLY1<time value>

Query Message: :SYST:SDLY1?

Program Data <time value>:

Data Format: Float

Data Range: 0~99.9 (where 0 is OFF)

Resolution: 0.1

Data Unit: s

Example:

To set the value of STRT DLY1 to 1s…

Command: :SYST:SDLY1 1

Example:

Query: :SYST:SDLY1 1?

Return: If the current value of STRT DLY1 is 1.0, 1.0 is returned.

5.1.14 :SYSTem:OFFSET

Sets/queries the OFFSET's status.

Syntax:

Command Message: :SYST:OFFSET<ON/OFF> or <1/0>

Query Message: :SYST:OFFSET?

Program Data <ON/OFF>:

Data Format: Character

Data Range: 0 (OFF)
1 (ON)

Example:

To set the OFFSET's status to ON…

Command: :SYST:OFFSET ON or :SYST: OFFSET 1

Example:

Query: :SYST:OFFSET?

Return: If the current OFFSET's status is ON, ON is returned.

5.1.15 :SYSTem:DMODE

Sets/queries the DISP MODE's status.

Syntax:

Command Message: :SYST:DMODE<PF/DATA>

Query Message: :SYST:DMODE?

Program Data <PF/DATA>:

Data Format: Enum

Data Range: PF
DATA

Example:

To set the DISP MODE's status to PF…

Command: :SYST:DMODEPF

Example:

Query: :SYST:DMODEPF?

Return: If the current DISP MODE's status is PF, PF is returned.

5.1.16 :SYSTem:SDLY2

Sets/queries the value of STRT DLY2.

Syntax:

Command Message: :SYST:SDLY2<time value>

Query Message: :SYST: SDLY2?

Program Data <time value>:

Data Format: Float

Data Range: 0~99.9 (where 0 is OFF)

Resolution: 0.1

Data Unit: s

Example:

To set the value of STRT DLY2 to 1s…

Command: :SYST:SDLY2 1

Example:

Query: :SYST:SDLY2 1?

Return: If the current value of STRT DLY2 is 1.0, 1.0 is returned.

5.1.17 :SYSTem:PJDG

Sets/queries the PRE JUDGE's status.

Syntax:

Command Message: :SYST:PJDG<sn>

Query Message: :SYST:PJDG?

Program Data <sn>:

Data Format: Integer

Data Range: 0~20 (0 is OFF)

Resolution: 1

Example:

To set the PRE JUDGE's status to OFF…

Command: :SYST:PJDG 0

Example:

Query: :SYST:PJDG?

Return: If the current PRE JUDGE is OFF, 0 is returned.

5.1.18 :SYSTem:TURN

Sets/queries the TURN MODE's status.

Syntax:

Command Message: :SYST:TURN<ON/OFF> or <1/0>

Query Message: :SYST:TURN?

Program Data <ON/OFF>:

Data Format: Character

Data Range: 0 (OFF)
1 (ON)

Example:

To set the TURN MODE's status to ON…

Command: :SYST:TURN ON or :SYST:TURN 1

Example:

Query: :SYST: TURN?

Return: If the current TURN MODE's status is ON, ON is returned.

5.1.19 :SYSTem:NJDG

Sets/queries the NO JUDGE's status.

Syntax:

Command Message: :SYST:NJDG<ON/OFF> or <1/0>

Query Message: :SYST:NJDG?

Program Data <ON/OFF>:

Data Format: Character

Data Range: 0 (OFF)
1 (ON)

Example:

To set the NO JUDGE's status to ON…

Command: :SYST:NJDG ON or :SYST:NJDG 1

Example:

Query: :SYST: NJDG?

Return: If the current NO JUDGE's status is ON, ON is returned.

5.1.20 :SYSTem:CCHK

Sets/queries the status of the CHANNEL CHECK (self-test).

Syntax:

Command Message: :SYST:CCHK<ON/OFF> or <1/0>

Query Message: :SYST:CCHK?

Program Data <ON/OFF>:

Data Format: Character

Data Range: 0 (OFF)
1 (ON)

Example:

To set the CH CHECK's status to ON…

Command: :SYST:CCHK ON or :SYST:CCHK 1

Example:

Query: :SYST: CCHK?

Return: If the current CH CHECK's status is ON, ON is returned.

5.1.21 :SYSTem:FETCH

Sets/queries the mode for fetching the test data.

Syntax:

Command Message: :SYST:FETCH<AUTO/MANU>

Query Message: :SYST:FETCH?

Program Data <AUTO/MANU>:

Data Format: Enum

Data Range: AUTO
MANU

Example:

To set the FETCH status to AUTO…

Command: :SYST:FETCH AUTO

Example:

Query: :SYST:FETCH?

Return: If the current FETCH status is AUTO, AUTO is returned.

5.2 Commands for AC Settings

5.2.1 :SOURce:SAFEty:STEP:AC:LEV

Sets/queries the test voltage for ACW test.

Syntax:

Command Message: :SOUR:SAFE:STEP<step number>:AC:LEV<voltage value>

Query Message: :SOUR:SAFE:STEP<step number>:AC:LEV?

Program Data <step number>:

Data Format: Integer

Data Range: 1~49

Resolution: 1

Program Data <voltage value>:

Data Format: Float

Data Range: 50~5000

Resolution: 1

Data Unit: V

Example:

To set the test voltage in STEP 1 to 1000V…

Command: :SOUR:SAFE:STEP 1:AC:LEV 1000

Example:

Query: :SOUR:SAFE:STEP 1:AC:LEV?

Return: If the test voltage for STEP 1 is 1000V, 1000 is returned.

5.2.2 :SOURce:SAFEty:STEP:AC:LIMit:LOW

Sets/queries the LOWER current limit for ACW test.

Syntax:

Command Message: :SOUR:SAFE:STEP<step number>:AC:LIM:LOW<current value>

Query Message: :SOUR:SAFE:STEP<step number>:AC:LIM:LOW?

Program Data <step number>:

Data Format: Integer

Data Range: 1~49

Resolution: 1

Program Data <current value>:

Data Format: Float

Data Range: 0~30.000E-3 (0 is OFF)

Resolution: 1.000E-6

Data Unit: A

Example:

To set the LOWER current limit for STEP 1 to 1mA…

Command: :SOUR:SAFE:STEP 1:AC:LIM:LOW 0.001

Example:

Query: :SOUR:SAFE:STEP 1:AC:LIM:LOW?

Return: If the LOWER current limit for STEP 1 is 1mA, 0.001 is returned.

5.2.3 :SOURce:SAFEty:STEP:AC:LIMit:HIGH

Sets/queries the UPPER current for ACW test.

Syntax:

Command Message: :SOUR:SAFE:STEP<step number>:AC:LIM:HIGH<current value>

Query Message: :SOUR:SAFE:STEP<step number>:AC:LIM:HIGH?

Program Data <step number>:

Data Format: Integer

Data Range: 1~49

Resolution: 1

Program Data <current value>:

Data Format: Float

Data Range: 1.00E-6~30.000E-3

Resolution: 1.000E-6

Data Unit: A

Example:

To set the UPPER current limit for STEP 1 to 1mA…

Command: :SOUR:SAFE:STEP 1:AC:LIM:HIGH 0.001

Example:

Query: :SOUR:SAFE:STEP 1:AC:LIM:HIGH?

Return: If the UPPER current limit for STEP 1 is 1mA, 0.001 is returned.

5.2.4 :SOURce:SAFEty:STEP:AC:LIMit:ARC

Sets/queries the ARC current limit for ACW test.

Syntax:

Command Message: :SOUR:SAFE:STEP<step number>:AC:LIM:ARC<current value>

Query Message: :SOUR:SAFE:STEP<step number>:AC:LIM:ARC?

Program Data <step number>:

Data Format: Integer

Data Range: 1~49

Resolution: 1

Program Data <current value>:

Data Format: Float

Data Range: 0~15.0E-3 (0 is OFF)

Resolution: 1.000E-4

Data Unit: A

Example:

To set the ARC current for STEP 1 to 1mA…

Command: :SOUR:SAFE:STEP 1:AC:LIM:ARC 0.001

Example:

Query: :SOUR:SAFE:STEP 1:AC:LIM:ARC?

Return: If the current ARC current for STEP 1 is 1mA, 0.001 is returned.

5.2.5 :SOURce:SAFEty:STEP:AC:TIME:RAMP

Sets/queries the RAMP (rise) time for ACW test.

Syntax:

Command Message: :SOUR:SAFE:STEP<step number>:AC:TIME:RAMP<time value>

Query Message: :SOUR:SAFE:STEP<step number>:AC:TIME:RAMP?

Program Data <step number>:

Data Format: Integer

Data Range: 1~49

Resolution: 1

Program Data <time value>:

Data Format: Float

Data Range: 0~999.9 (0 is OFF)

Resolution: 0.1

Data Unit: s

Example:

To set the RAMP time for STEP 1 to 1s…

Command: :SOUR:SAFE:STEP 1:AC:TIME:RAMP 1

Example:

Query: :SOUR:SAFE:STEP 1:AC:TIME:RAMP?

Return: If the current RAMP time for STEP 1 is 1s, 1 is returned.

5.2.6 :SOURce:SAFEty:STEP:AC:TIME:FALL

Sets/queries the FALL time for ACW test.

Syntax:

Command Message: :SOUR:SAFE:STEP<step number>:AC:TIME:FALL<time value>

Query Message: :SOUR:SAFE:STEP<step number>:AC:TIME:FALL?

Program Data <step number>:

Data Format: Integer

Data Range: 1~49

Resolution: 1

Program Data <time value>:

Data Format: Float

Data Range: 0~999.9 (0 is OFF)

Resolution: 0.1

Data Unit: s

Example:

To set the FALL time for STEP 1 to 1s,

Command: :SOUR:SAFE:STEP 1:AC:TIME:FALL 1

Example:

Query: :SOUR:SAFE:STEP 1:AC:TIME:FALL?

Return: If the current FALL time for STEP 1 is 1s, 1 is returned.

5.2.7 :SOURce:SAFEty:STEP:AC:TIME:TEST

Sets/queries the TEST time for ACW test.

Syntax:

Command Message: :SOUR:SAFE:STEP<step number>:AC:TIME:TEST<time value>

Query Message: :SOUR:SAFE:STEP<sn>:AC:TIME:TEST?

Program Data <step number>:

Data Format: Integer

Data Range: 1~49

Resolution: 1

Program Data <time value>:

Data Format: Float

Data Range: 0~999.9 (0 is OFF)

Resolution: 0.1

Data Unit: s

Example:

To set the TEST time for STEP 1 to 1s,

Command: :SOUR:SAFE:STEP 1:AC:TIME:TEST 1

Example:

Query: :SOUR:SAFE:STEP 1:AC:TIME:TEST?

Return: If the current TEST time for STEP 1 is 1s, 1 is returned.

5.2.8 :SOURce:SAFEty:STEP:AC:FREQ

Sets/queries the test frequency for ACW test.

Syntax:

Command Message: :SOUR:SAFE:STEP<step number>:AC:FREQ<frequency value>

Query Message: :SOUR:SAFE:STEP<step number>:AC:FREQ?

Program Data <step number>:

Data Format: Integer

Data Range: 1~49

Resolution: 1

Program Data <frequency value>:

Data Format: Character

Data Range: 50
60

Data Unit: Hz

Example:

To set the test frequency for STEP 1 to 50Hz,

Command: :SOUR:SAFE:STEP 1:AC:FREQ 50

Example:

Query: :SOUR:SAFE:STEP 1:AC:FREQ?

Return: If the current test frequency for STEP 1 is 50Hz, 50 is returned.

5.2.9 :SOURce:SAFEty:STEP:AC:CHAN

Sets/queries the status of the scanning port of the ACW.

Syntax:

Command Message: :SOUR:SAFE:STEP<step number>:AC:CHAN<channel number>:<HIGH/LOW/OPEN>

Query Message: :SOUR:SAFE:STEP<step number>:AC: CHAN<channel number>?

Program Data <sn>:

Data Format: Integer

Data Range: 1~49

Resolution: 1

Program Data <channel number>:

Data Format: Integer

Data Range: 1~8

Resolution: 1

Program Data <HIGH/LOW/OPEN>:

Data Format: Character

Data Range: HIGH
LOW
OPEN

Example:

To set the scanner channel 1 for STEP 1 to HIGH…

Command: :SOUR:SAFE:STEP 1:AC:CHAN 1:HIGH

Example:

Query: :SOUR:SAFE:STEP 1:AC:CHAN 1?

Return: If the scanner channel 1 for STEP 1 is HIGH, HIGH is returned.

5.3 Commands for DC Settings

5.3.1 :SOURce:SAFEty:STEP:DC:LEV

Sets/queries the test voltage for DCW test.

Syntax:

Command Message: :SOUR:SAFE:STEP<step number>:DC:LEV<voltage value>

Query Message: :SOUR:SAFE:STEP<step number>:DC:LEV?

Program Data <step number>:

Data Format: Integer

Data Range: 1~49

Resolution: 1

Program Data <voltage value>:

Data Format: Float

Data Range: 50~6000

Resolution: 1

Data Unit: V

Example:

To set the test voltage for STEP 1 to 1000V…

Command: :SOUR:SAFE:STEP 1:DC:LEV 1000

Example:

Query: :SOUR:SAFE:STEP 1:DC:LEV?

Return: If the current test voltage for STEP 1 is 1000V, 1000 is returned.

5.3.2 :SOURce:SAFEty:STEP:DC:LIMit:LOW

Sets/queries the LOWER current limit for DCW test.

Syntax:

Command Message: :SOUR:SAFE:STEP<step number>:DC:LIM:LOW<current value>

Query Message: :SOUR:SAFE:STEP<step number>:DC:LIM:LOW?

Program Data <step number>:

Data Format: Integer

Data Range: 1~49

Resolution: 1

Program Data <current value>:

Data Format: Float

Data Range: 0~10.000E-3 (0 is OFF)

Resolution: 1.000E-6

Data Unit: A

Example:

To set the LOWER current limit for STEP 1 to 1mA…

Command: :SOUR:SAFE:STEP 1:DC:LIM:LOW 0.001

Example:

Query: :SOUR:SAFE:STEP 1:DC:LIM:LOW?

Return: If the LOWER current limit for step 1 is 1mA, 0.001 is returned.

5.3.3 :SOURce:SAFEty:STEP:DC:LIMit:HIGH

Sets/queries the UPPER current limit for DCW test.

Syntax:

Command Message: :SOUR:SAFE:STEP<step number>:DC:LIM:HIGH<current value>

Query Message: :SOUR:SAFE:STEP<step number>:DC:LIM:HIGH?

Program Data <step number>:

Data Format: Integer

Data Range: 1~49

Resolution: 1

Program Data <current value>:

Data Format: Float

Data Range: 1.00E-6~10.000E-3

Resolution: 1.000E-6

Data Unit: A

Example:

To set the UPPER current limit for STEP 1 to 1mA…

Command: :SOUR:SAFE:STEP 1:DC:LIM:HIGH 0.001

Example:

Query: :SOUR:SAFE:STEP 1:DC:LIM:HIGH?

Return: If the UPPER current limit for STEP 1 is 1mA, 0.001 is returned.

5.3.4 :SOURce:SAFEty:STEP:DC:LIMit:ARC

Sets/queries the ARC current limit for DCW test.

Syntax:

Command Message: :SOUR:SAFE:STEP<step number>:DC:LIM:ARC<current value>

Query Message: :SOUR:SAFE:STEP<step number>:DC:LIM:ARC?

Program Data <step number>:

Data Format: Integer

Data Range: 1~49

Resolution: 1

Program Data <current value>:

Data Format: Float

Data Range: 0~10.0E-3 (0 is OFF)

Resolution: 1.000E-4

Data Unit: A

Example:

To set the ARC current limit for STEP 1 to 1mA…

Command: :SOUR:SAFE:STEP 1:DC:LIM:ARC 0.001

Example:

Query: :SOUR:SAFE:STEP 1:DC:LIM:ARC?

Return: If the ARC current limit for STEP 1 is 1mA, 0.001 is returned.

5.3.5 :SOURce:SAFEty:STEP:DC:TIME:RAMP

Sets/queries the RAMP (rise) time for DCW test.

Syntax:

Command Message: :SOUR:SAFE:STEP<step number>:DC:TIME:RAMP<time value>

Query Message: :SOUR:SAFE:STEP<step number>:DC:TIME:RAMP?

Program Data <step number>:

Data Format: Integer

Data Range: 1~49

Resolution: 1

Program Data <time value>:

Data Format: Float

Data Range: 0~999.9 (0 is OFF)

Resolution: 0.1

Data Unit: s

Example:

To set the RAMP time for STEP 1 to 1s…

Command: :SOUR:SAFE:STEP 1:DC:TIME:RAMP 1

Example:

Query: :SOUR:SAFE:STEP 1:DC:TIME:RAMP?

Return: If the current RAMP time for STEP 1 is 1s, 1 is returned.

5.3.6 :SOURce:SAFEty:STEP:DC:TIME:FALL

Sets/queries the FALL time for DCW test.

Syntax:

Command Message: :SOUR:SAFE:STEP<step number>:DC:TIME:FALL<time value>

Query Message: :SOUR:SAFE:STEP<step number>:DC:TIME:FALL?

Program Data <step number>:

Data Format: Integer

Data Range: 1~49

Resolution: 1

Program Data <time value>:

Data Format: Float

Data Range: 0~999.9 (0 is OFF)

Resolution: 0.1

Data Unit: s

Example:

To set the FALL time for STEP 1 to 1s…

Command: :SOUR:SAFE:STEP 1:DC:TIME:FALL 1

Example:

Query: :SOUR:SAFE:STEP 1:DC:TIME:FALL?

Return: If the current FALL time for STEP 1 is 1s, 1 is returned.

5.3.7 :SOURce:SAFEty:STEP:DC:TIME:TEST

Sets/queries the TEST time for DCW test.

Syntax:

Command Message: :SOUR:SAFE:STEP<step number>:DC:TIME:TEST<time value>

Query Message: :SOUR:SAFE:STEP<step number>:DC:TIME:TEST?

Program Data <step number>:

Data Format: Integer

Data Range: 1~49

Resolution: 1

Program Data <time value>:

Data Format: Float

Data Range: 0~999.9 (0 is OFF)

Resolution: 0.1

Data Unit: s

Example:

To set the TEST time for STEP 1 to 1s…

Command: :SOUR:SAFE:STEP 1:DC:TIME:TEST 1

Example:

Query: :SOUR:SAFE:STEP 1:DC:TIME:TEST?

Return: If the current TEST time for STEP 1 is 1s, 1 is returned.

5.3.8 :SOURce:SAFEty:STEP:DC:TIME:DWEL

Sets/queries the wait time for DCW test.

Syntax:

Command Message: :SOUR:SAFE:STEP<step number>:DC:TIME:DWEL<time value>

Query Message: :SOUR:SAFE:STEP<step number>:DC:TIME:DWEL?

Program Data <step number>:

Data Format: Integer

Data Range: 1~49

Resolution: 1

Program Data <time value>:

Data Format: Float

Data Range: 0~999.9 (0 is OFF)

Resolution: 0.1

Data Unit: s

Example:

To set the wait time for STEP 1 to 1s…

Command: :SOUR:SAFE:STEP 1:DC:TIME:DWEL 1

Example:

Query: :SOUR:SAFE:STEP 1:DC:TIME:DWEL?

Return: If the current wait time for STEP 1 is 1s, 1 is returned.

5.3.9 :SOURce:SAFEty:STEP:DC:CLOW

Sets/queries the CHECK LOW's status for DCW test.

Syntax:

Command Message: :SOUR:SAFE:STEP<step number>:DC:CLOW<ON/OFF> or <1/0>

Query Message: :SOUR:SAFE:STEP<step number>:DC: CLOW?

Program Data <step number>:

Data Format: Integer

Data Range: 1~49

Resolution: 1

Program Data <ON/OFF>:

Data Format: Character

Data Range: OFF(0)
ON(1)

Example:

To set the CHECK LOW's status for STEP 1 to ON…

Command: :SOUR:SAFE:STEP 1:DC:CLOW ON or :SOUR:SAFE:STEP 1:DC:CLOW 1

Example:

Query: :SOUR:SAFE:STEP 1:DC:CLOW?

Return: If the current CHECK LOW's status for STEP 1 is ON, ON is returned.

5.3.10 :SOURce:SAFEty:STEP:DC:CHAN

Sets/queries the status of the scanning port of the DCW.

Syntax:

Command Message: :SOUR:SAFE:STEP<step number>:DC:CHAN<channel number>:<HIGH/LOW/OPEN>

Query Message: :SOUR:SAFE:STEP<step number>:DC: CHAN<channel number>?

Program Data <step number>:

Data Format: Integer

Data Range: 1~49

Resolution: 1

Program Data <channel number>:

Data Format: Integer

Data Range: 1~8

Resolution: 1

Program Data <HIGH/LOW/OPEN>:

Data Format: Character

Data Range: HIGH
LOW
OPEN

Example:

To set the scanner channel 1 for STEP 1 to HIGH…

Command: :SOUR:SAFE:STEP 1:DC:CHAN 1:HIGH

Example:

Query: :SOUR:SAFE:STEP 1:DC:CHAN 1?

Return: If the scanner channel 1 for STEP 1 is HIGH, HIGH is returned.

5.4 Commands for IR Settings

5.4.1 :SOURce:SAFEty:STEP:IR:LEV

Sets/queries the test voltage for IR test.

Syntax:

Command Message: :SOUR:SAFE:STEP<step number>:IR:LEV<voltage value>

Query Message: :SOUR:SAFE:STEP<step number>:IR:LEV?

Program Data <step number>:

Data Format: Integer

Data Range: 1~49

Resolution: 1

Program Data <voltage value>:

Data Format: Float

Data Range: 50~1500

Resolution: 1

Data Unit: V

Example:

To set the test voltage for STEP 1 to 1000V…

Command: :SOUR:SAFE:STEP 1:IR:LEV 1000

Example:

Query: :SOUR:SAFE:STEP 1:IR:LEV?

Return: If the current test voltage for STEP 1 is 1000V, 1000 is returned.

5.4.2 :SOURce:SAFEty:STEP:IR:LIMit:LOW

Sets/queries the LOWER resistance limit for IR test.

Syntax:

Command Message: :SOUR:SAFE:STEP<step number>:IR:LIM:LOW<resistance value>

Query Message: :SOUR:SAFE:STEP<step number>:IR:LIM:LOW?

Program Data <step number>:

Data Format: Integer

Data Range: 1~49

Resolution: 1

Program Data <resistance value>:

Data Format: Float

Data Range: 0~5.0E10 (0 is OFF)

Resolution: 1.0E5

Data Unit: Ω

Example:

To set the LOWER resistance limit for STEP 1 to 1MΩ…

Command: :SOUR:SAFE:STEP 1:IR:LIM:LOW 1000000

Example:

Query: :SOUR:SAFE:STEP 1:IR:LIM:LOW?

Return: If the current LOWER resistance limit for STEP 1 is 1MΩ, 1000000 is returned.

5.4.3 :SOURce:SAFEty:STEP:IR:LIMit:HIGH

Sets/queries the UPPER resistance limit for IR test.

Syntax:

Command Message: :SOUR:SAFE:STEP<step number>:IR:LIM:HIGH<resistance value>

Query Message: :SOUR:SAFE:STEP<step number>:IR:LIM:HIGH?

Program Data <step number>:

Data Format: Integer

Data Range: 1~49

Resolution: 1

Program Data <resistance value>:

Data Format: Float

Data Range: 0~5E10 (0 is OFF)

Resolution: 1.0E5

Data Unit: Ω

Example:

To set the UPPER resistance limit for STEP 1 to 1MΩ…

Command: :SOUR:SAFE:STEP 1:IR:LIM:HIGH 1000000

Example:

Query: :SOUR:SAFE:STEP 1:IR:LIM:HIGH?

Return: If the current UPPER resistance limit for STEP 1 is 1MΩ, 1000000 is returned.

5.4.4 :SOURce:SAFEty:STEP:IR:TIME:RAMP

Sets/queries the RAMP (rise) time for IR test.

Syntax:

Command Message: :SOUR:SAFE:STEP<step number>:IR:TIME:RAMP<time value>

Query Message: :SOUR:SAFE:STEP<step number>:IR:TIME:RAMP?

Program Data <step number>:

Data Format: Integer

Data Range: 1~49

Resolution: 1

Program Data <time value>:

Data Format: Float

Data Range: 0~999.9 (0 is OFF)

Resolution: 0.1

Data Unit: s

Example:

To set the RAMP time for STEP 1 to 1s…

Command: :SOUR:SAFE:STEP 1:IR:TIME:RAMP 1

Example:

Query: :SOUR:SAFE:STEP 1:IR:TIME:RAMP?

Return: If the current RAMP time for STEP 1 is 1s, 1 is returned.

5.4.5 :SOURce:SAFEty:STEP:IR:TIME:FALL

Sets/queries the FALL time for IR test.

Syntax:

Command Message: :SOUR:SAFE:STEP<step number>:IR:TIME:FALL<time value>

Query Message: :SOUR:SAFE:STEP<step number>:IR:TIME:FALL?

Program Data <step number>:

Data Format: Integer

Data Range: 1~49

Resolution: 1

Program Data <time value>:

Data Format: Float

Data Range: 0~999.9 (0 is OFF)

Resolution: 0.1

Data Unit: s

Example:

To set the FALL time for STEP 1 to 1s…

Command: :SOUR:SAFE:STEP 1:IR:TIME:FALL 1

Example:

Query: :SOUR:SAFE:STEP 1:IR:TIME:FALL?

Return: If the current FALL time for STEP 1 is 1s, 1 is returned.

5.4.6 :SOURce:SAFEty:STEP:IR:TIME:TEST

Sets/queries the TEST time for IR test.

Syntax:

Command Message: :SOUR:SAFE:STEP<step number>:IR:TIME:TEST<time value>

Query Message: :SOUR:SAFE:STEP<step number>:IR:TIME:TEST?

Program Data <step number>:

Data Format: Integer

Data Range: 1~49

Resolution: 1

Program Data <time value>:

Data Format: Float

Data Range: 0~999.9 (0 is OFF)

Resolution: 0.1

Data Unit: s

Example:

To set the TEST time for STEP 1 to 1s…

Command: :SOUR:SAFE:STEP 1:IR:TIME:TEST 1

Example:

Query: :SOUR:SAFE:STEP 1:IR:TIME:TEST?

Return: If the current TEST time for STEP 1 is 1s, 1 is returned.

5.4.7 :SOURce:SAFEty:STEP:IR:AGC

Sets/queries the SOFT AGC status for IR test.

Syntax:

Command Message: :SOUR:SAFE:STEP<step number>:IR:AGC<ON/OFF> or <1/0>

Query Message: :SOUR:SAFE:STEP<step number>:IR: AGC?

Program Data <step number>:

Data Format: Integer

Data Range: 1~49

Resolution: 1

Program Data <ON/OFF>:

Data Format: Character

Data Range: OFF(0)
ON(1)

Example:

To set the SOFT AGC's status for STEP 1 to ON…

Command: :SOUR:SAFE:STEP 1:IR:AGC ON or :SOUR:SAFE:STEP 1:IR:AGC 1

Example:

Query: :SOUR:SAFE:STEP :IR:AGC?

Return: If the current SOFT AGC's status for STEP 1 is ON, ON is returned.

5.4.8 :SOURce:SAFEty:STEP:IR:CHAN

Sets/queries the status of the scanning port of the IR.

Syntax:

Command Message: :SOUR:SAFE:STEP<step number>:IR:CHAN<channel number>:<HIGH/LOW/OPEN>

Query Message: :SOUR:SAFE:STEP<step number>:IR: CHAN<channel number>?

Program Data <step number>:

Data Format: Integer

Data Range: 1~49

Resolution: 1

Program Data <channel number>:

Data Format: Integer

Data Range: 1~8

Resolution: 1

Program Data <HIGH/LOW/OPEN>:

Data Format: Character

Data Range: HIGH
LOW
OPEN

Example:

To set the scanner channel 1 for STEP 1 to HIGH…

Command: :SOUR:SAFE:STEP 1:IR:CHAN 1:HIGH

Example:

Query: :SOUR:SAFE:STEP 1:IR:CHAN 1?

Return: If the scanner channel 1 for STEP 1 is HIGH, HIGH is returned.

5.5 Commands for OS Settings

5.5.1 :SOURce:SAFEty:STEP:OSC:OPEN

Sets/queries the OPEN ratio for OS test.

Syntax:

Command Message: :SOUR:SAFE:STEP<step number>:OSC:OPEN<ratio value>

Query Message: :SOUR:SAFE:STEP<step number>:OSC:OPEN?

Program Data <step number>:

Data Format: Integer

Data Range: 1~49

Resolution: 1

Program Data <ratio value>:

Data Format: Float

Data Range: 0.1~1.0

Resolution: 0.1

Example:

To set the OPEN ratio for STEP 1 to 50%…

Command: :SOUR:SAFE:STEP 1:OS:OPEN 0.5

Example:

Query: :SOUR:SAFE:STEP 1:OS:OPEN?

Return: If the OPEN ratio for STEP 1 is 50%, 0.5 is returned.

5.5.2 :SOURce:SAFEty:STEP:OSC:SHORt

Sets/queries the SHORt ratio for OS test.

Syntax:

Command Message: :SOUR:SAFE:STEP<step number>:OSC:SHOR<ratio value>

Query Message: :SOUR:SAFE:STEP<step number>:OSC:SHOR?

Program Data <step number>:

Data Format: Integer

Data Range: 1~49

Resolution: 1

Program Data <ratio value>:

Data Format: Integer

Data Range: 0~5 (0 is OFF)

Resolution: 1

Example:

To set the SHORT ratio for STEP 1 to 200%…

Command: :SOUR:SAFE:STEP 1:OS:SHOR 2

Example:

Query: :SOUR:SAFE:STEP 1:OS:SHOR?

Return: If the SHORT ratio for STEP 1 is 200%, 2 is returned.

5.5.3 :SOURce:SAFEty:STEP:OS:CHAN

Sets/queries the status of the scanning port of the OS.

Syntax:

Command Message: :SOUR:SAFE:STEP<step number>:OS:CHAN<channel number>:<HIGH/LOW/OPEN>

Query Message: :SOUR:SAFE:STEP<step number>:OS:CHAN<channel number>?

Program Data <step number>:

Data Format: Integer

Data Range: 1~49

Resolution: 1

Program Data <channel number>:

Data Format: Integer

Data Range: 1~8

Resolution: 1

Program Data <HIGH/LOW/OPEN>:

Data Format:	Character
Data Range:	HIGH LOW OPEN

Example:

To set the scanner channel 1 for STEP 1 to HIGH…

Command:	:SOUR:SAFE:STEP 1:OS:CHAN 1:HIGH

Example:

Query:	:SOUR:SAFE:STEP 1:OS:CHAN 1?
Return:	If the scanner channel 1 for STEP 1 is HIGH, HIGH is returned.

5.6 Other Commands

5.6.1 *IDN

Queries the instrument model and version information.

Syntax:

Query Message:	*IDN?

Example:

Query:	*IDN?
Return:	ST9201 Ver:1.0 is returned.

5.6.2 :SOURce:SAFEty:START

Start test, functionally equivalent to the START button.

Syntax:

Command Message:	:SOUR:SAFE:START

Example:

Command:	:SOUR:SAFE:START

5.6.3 :SOURce:SAFEty:STOP

Stop test, functionally equivalent to the STOP button.

Syntax:

Command Message:	:SOUR:SAFE:STOP

Example:

Command:	:SOUR:SAFE:STOP

If you are in the middle of an ACW test, you can stop and exit the ACW test.

5.6.4 :SOURce:SAFEty:NEW

Create a new document with the number of steps <n>.

Syntax:

Command Message: :SOUR:SAFE:NEW<n>

Program Data <n>:

Denotes a step, e.g. 2 means that this new document has 2 steps.

Example:

To create a new document with a step count of 1, i.e., a single test document…

Command: SOUR:SAFE:NEW 1

5.6.5 :SOURce:SAFEty:STEP:FUNC

Sets the test function for a specific STEP.

Syntax:

Command Message: :SOUR:SAFE:STEP<step number>:FUNC<function value>

Program Data <step number>:

Data Format: Integer

Data Range: 1~49

Resolution: 1

Program Data <function value>:

Data Format: Character

Data Range: 0 (No function)
1 (AC withstanding voltage test)
2 (DC withstanding voltage test)
3 (Insulation resistance test)
4 (Short-circuit OS)

Example:

To set the test function in STEP 1 to AC withstanding voltage test…

Command: SOUR:SAFE:STEP 1:FUNC 1

5.6.6 :SOURce:SAFEty:FUNC?

Queries test functions of all steps.

Syntax:

Query Message: :SOUR:SAFE:FUNC?

5.6.7 :SOURce:SAFEty:LOAD

Reads a stored file.

Syntax:

Command Message: :SOUR:SAFE:LOAD<sn>

Program Data <sn>:

Data Format: Integer

Data Range: 1~49

Resolution: 1

Example:

To read from storage file 1…

Command: SOUR:SAFE:LOAD 1

5.7 New Commands

5.7.1 :TEST:DATAI?

Queries instantaneous current value during the ACW/DCW test.

Syntax:

Query Message: :TEST:DATAI?

Data Unit: mA

Example:

Query: :TEST:DATAI?

Return: If the present current in an ACW test is 1.00mA, 1.00 is returned.

5.7.2 :TEST:DATAR?

Queries instantaneous resistance value during the IR test.

Syntax:

Query Message: :TEST:DATAR?

Data Unit: MΩ

Example:

Query: :TEST:DATAR?

Return: If the present resistance in an IR test is 1.00MΩ, 1.00 is returned.

5.7.3 :TEST:FETCH?

Queries the test results of all steps.

Syntax:

Query Message: :TEST:FETCH?

Response Message: <judgement>, <judgement$_1$>, <judgement$_2$>,...<judgement$_n$>, <data$_1$>, <data $_2$>,...,<data$_n$>

Program Data<judgement>:

Data Format: Character

Judgement$_1$~Judgement$_n$: 1 (PASS)
2 (FAIL)

Program Data<data>:

Data Format: Float

Data Units: mA for current
MΩ for resistance

Example:

Query: :TEST:FETCH?

Return: If the return message is 1,1,1,1.00,1.00, this indicates:

- Total judgement is PASS
- Judgement of STEP 1 is PASS
- Judgement of STEP 2 is PASS
- Data of STEP 1 is 1.00
- Data of STEP 2 is 1.00

This command can be set to both AUTO/MANU (automatic/manual) modes. Press the SYSTEM key, then use the knob to enter the INTERFACE setup interface, use the cursor to move to the FETCH option to select the AUTO/MANU mode. When set to AUTO, the test results are automatically returned when the test is finished.

5.7.4 :TEST:FETCH2?

Queries the test voltage, current (for ACW or DCW test) or resistance (for IR test), and status of the current step.

Syntax:

Query Message: :TEST:FETCH2?

Response Message: <status value>, <voltage value>, <current or resistance value>

Program Data <status value>:

Data Format: Character

Data Range: 0 (READY)
1 (TEST)
2 (PASS)
3 (FAIL)
4 (STOP)
5 (ARC FAIL)

Program Data <voltage value>:

Data Format:	Integer
Resolution:	1
Data Unit:	V

Program Data <current or resistance value>:

Data Format:	Float
Data Unit:	mA MΩ

Example:

Respone Message:	0, 0, 0 Indicates that the instrument is currently in the READY state.

Example:

Respone Message:	1, 1000, 1.0 Indicates that the instrument is currently under test with a voltage of 1000V and a current of 1.0mA.

5.7.5 :TEST:FETCH4?

Queries the test function settings and test results of all steps.

Syntax:

Query Message:	:TEST:FETCH4?
Response Message:	<function$_1$>, <judgement$_1$>, <data$_1$>…<function$_n$>, <judgement$_n$>, <data$_n$>

Program Data <function>:

Data Format:	Character
Data Range:	1 (ACW) 2 (DCW) 3 (IR) 4 (OS)

Program Data <judgement>:

Data Format:	Character
Data Range:	1 (PASS) 2 (FAIL)

Program Data <data>:

Data Format:	Float
Data Unit:	mA MΩ

Example:

Respone Message: If the return message is 1,1,1.00e-6, this indicates that the test results are:

- Function is ACW
- Sorting judgment is PASS
- Test data is 1uA

This command can be set to both AUTO/MANU (automatic/manual) modes.

Press the SYSTEM key, then use the knob to enter the INTERFACE setup interface, use the cursor to move to the FETCH option to select the AUTO/MANU mode. When set to AUTO, the test results are automatically returned when the test is finished.

5.7.6 :FETCH:JUDGE?

Queries the current test judgement results.

Syntax:

Query Message: :FETCH:JUDGE?

Response Message: <judgement>

Program Data <judgement>:

Data Format: Character

Data Range: 0 (None)
1 (PASS)
2 (HIGH FAIL)
3 (LOW FAIL)
4 (ARC FAIL)
5 (RANGE FAIL)

Example:

Respone Message: If the current test result is PASS, 1 is returned.

5.7.7 :SOURce:SAFEty:STEPSN?

Inquires the current STEP NUMBER during a test.

Syntax:

Query Message: :SOUR:SAFE:STEPSN?

Example:

Query: :SOUR:SAFE:STEPSN?

Return: If the current STEP during a test is 2, 2 is returned.

5.7.8 :SYSTem:FETCH:MODE

Sets the FETCH mode (return message format).

Syntax:

Command Message: :SYST:FETCH:MODE<mode>

Program Data <mode>:

Data Format: Character

Data Range: 0 (:TEST:FETCH?)
1 (:TEST:FETCH4?)

Example:

To set the FETCH mode to :TEST:FETCH4? format…

Command: :SYST:FETCH:MODE 1

5.7.9 :ALLSET3

Sets all setup parameters at once.

WARNING!	
	Please **take great care** when using this command! This function allows you to change settings very freely, including in ways that may cause your device to no longer function as intended, e.g. by exceeding limit values. The device will **not** give explicit warnings of this! Therefore, please use this function carefully.

Syntax:

1) Setup ACW Parameters: :ALLSET3
<func>, <scan>, <volt>, <upper>, <lower>, <time>, <arc>, <*reserved*>, <freq>, <rise>, <fall>, <offset>
12 items, see parameters list below

2) Setup DCW Parameters: :ALLSET3
<func>, <scan>, <volt>, <upper>, <lower>, <time>, <arc>, <rise>, <fall>, <wait>, <check>, <offset>
12 items, see parameters list below

3) Setup IR Parameters: :ALLSET3
<func>, <scan>, <volt>, <upper>, <lower>, <time>, <rise>, <fall>, <sagc>, <range>, <offset>
11 items, see parameters list below

4) Setup OS Parameters: :ALLSET3
<func>, <scan>, <open>, <shrt>, <stan>
5 items, see parameters list below

5) Setup STEP Parameters: :ALLSET3
<func>, <step_enab>, <step_t1>, <step_t2>, <step_t3>, <step_t4>, <step_vsta>, <step_vmax>, <step_stp>
9 items, see parameters list below

Parameters List:

Items	Type	Function	Detail
func	enum	Setup Functions	0: None 1: AC 2: DC 3: IR 4: OS
scan	int	Setup Channel	Bit mask for channel selection; see the **Note** below.
volt	float	Setup Voltage	AC: 50~5000 DC: 50~6000 IR: 50~1000
upper	float	Setup Upper Limit	Unit: μA
lower	float	Setup Lower Limit	Unit: μA
time	float	Setup Test Time	0.1~999.9s
arc	float	Setup Arc Level	Unit: 0.1mA
freq	enum	Setup Frequency	0: 50Hz 1: 60Hz
rise	float	Setup Rise Time	0~999.9s
fall	float	Setup Fall Time	0~999.9s
wait	float	Setup Wait Time	0~999.9s
sagc	enum	Setup Soft AGC	0: OFF 1: ON
check	enum	Setup Ground Check	0: OFF 1: ON
range	enum	Setup IR Range	0: Auto 1~6 are fixed range.
open	enum	Setup OS Open Level	0: OFF 1: 1% 2: 2% 255: 255%
shrt	enum	Setup OS Short Level	0: OFF 1: 100% 2: 200% 5: 500%
stan	float	Setup Standard Value	Unit: nF
offset	float	Setup Offset Value	Unit: μA

Note: The scan value is defined as follows:

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
CH1_L	CH2_L	CH3_L	CH4_L	CH5_L	CH6_L	CH7_L	CH8_L	CH1_H	CH2_H	CH3_H	CH4_H	CH5_H	CH6_H	CH7_H	CH8_H

CHn_L	0	1	0	1
CHn_H	0	0	1	1
Meaning	Open	High	Low	Error

To set CH1 to high, the value of scan is 0000 0000 1000 0000 (0x0080).

To set CH8 to low, the value of scan is 0000 0001 0000 0000 (0x0100).

Example:

:ALLSET3 1, 0, 50, 10, 0, 5, 0, 0, 50, 1, 1, 0

…is equal to…

- :ALLSET3 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0
- :SOUR:SAFE:STEP 1:AC:LEV 50
- :SOUR:SAFE:STEP 1:AC:LIM:HIGH 10
- :SOUR:SAFE:STEP 1:AC:LIM:LOW 0
- :SOUR:SAFE:STEP 1:AC:TIME:TEST 5
- :SOUR:SAFE:STEP 1:AC:FREQ 50
- :SOUR:SAFE:STEP 1:AC:TIME:RAMP 1
- :SOUR:SAFE:STEP 1:AC:TIME:FALL 1

Appendix A Specifications and Accessories

A.1 Technical Specifications of ST9201 Series

Model		ST9201	ST9201S	ST9201B	ST9201C
Output Voltage					
AC	Voltage	0.050kV~5.000kV			
	Frequency	50Hz; 60Hz selectable, accuracy of ±2%			
	Output Power	150VA (5.000kV; 30mA)		100VA (5.000kV ; 20mA)	
DC	Voltage	0.050kV~6.000kV			---
	Output Power	50VA (5.000kV; 10mA)		25VA (5.000kV; 5mA)	---
	Discharge Function	Automatically after the test ends			---
IR	Voltage	50V~1500V			---
	Output Power	10VA (1.000kV; 10mA)		5VA (1.000kV; 5mA)	---
	Short-Circuit Current	≥20mA		≥10mA	
	Discharge Function	Automatically after the test ends			---
8 Channel Matrix		---	Available	---	
Voltage Display					
Range	Voltage Range	0.00kV~6.00kV AC/DC			
	Accuracy	± (1.0% of reading +5V)			
Current Display					
Range	AC	0.001mA~30.0mA		0.001mA~20.0mA	
	DC	0.1μA~10.00mA		0.1μA~5.00mA	
Accuracy		± (1% of reading +10 digits) after OFFSET correction			
ARC	AC	1mA~15mA			
	DC	1mA~10mA		1mA~5mA	
Insulation Resistance Display					
Resistance Measurement Range		0.01MΩ~9.99GΩ, (current: 10nA~10mA)			
Accuracy		≥500V: 1MΩ~1GΩ ± (5% of reading + 5 digits) 1GΩ~10GΩ ± (10% of reading + 5 digits) 10GΩ~50GΩ ± (15% of reading + 5 digits) <500V: 0.1MΩ~1GΩ ± (10% of reading + 5 digits) Voltage: ± (1.0% of reading +2V)			

Parameter Settings	
Voltage Rise Time	0.1s~999.9s
Voltage Fall Time	0.1s~999.9s
Voltage Wait Time	0.3s~999.9s (DC only; rise time + test time > wait time)
Test Duration	0.1s~999.9s
Accuracy	± (0.2% of set value + 20ms)
Other Functions	Rapid discharge, GFI protective function, comparator, handler, RS-232C, GPIB interface (optional), USB host for memory sticks

A.2 Technical Specifications of ST9201X Series

Model		ST9201X	ST9201SX	ST9201BX	ST9201CX
Output Voltage					
AC	Voltage	0.050kV~5.000kV			
	Frequency	50Hz; 60Hz selectable, accuracy of ±2%			
	Output Power	15VA (5.000kV; 3mA)			
DC	Voltage	0.050kV~6.000kV			---
	Output Power	50VA (5.000kV; 10mA)		25VA (5.000kV; 5mA)	---
	Discharge Function	Automatically after the test ends			---
IR	Voltage	50V~1500V			---
	Output Power	10VA (1.000kV; 10mA)		5VA (1.000kV; 5mA)	---
	Discharge Function	Automatically after the test ends			---
8 Channel Matrix		---	Available	---	
Voltage Display					
Range	Voltage Range	0.00kV~6.00kV AC/DC			
	Accuracy	± (1.0% of reading +5V)			
Current Display					
Range	AC	0.1mA~3.0mA			
	DC	0.01mA~10.00mA		0.01mA~5.00mA	
Accuracy		± (1% of reading +10 digits) after OFFSET correction			
ARC	AC	1mA~15mA			
	DC	1mA~10mA		1mA~5mA	
Insulation Resistance Display					
Resistance Measurement Range		0.01MΩ~9.99GΩ, (current: 10nA~10mA)			

Accuracy	≥500V: 1MΩ~1GΩ ± (5% of reading + 5 digits) 1GΩ~10GΩ ± (10% of reading + 5 digits) 10GΩ~50GΩ ± (15% of reading + 5 digits) <500V: 0.1MΩ~1GΩ ± (10% of reading + 5 digits) Voltage: ± (1.0% of reading +2V)	
Parameter Settings		
Voltage Rise Time	0.1s~999.9s	
Voltage Fall Time	0.1s~999.9s	
Voltage Wait Time	0.3s~999.9s (DC only; rise time + test time > wait time)	
Test Duration	0.3s~999.9s	
Other Functions	Rapid discharge, GFI protective function, comparator, handler, RS-232C, GPIB interface (optional), USB host for memory sticks	

A.3 Included Accessories

- ST90003R Pressure resistant test clip 1x
- ST90003B Voltage resistant grounding clip 1x
- ST90004 Pressure resistant test rod 1x
- Connection cable 1x

Further Options:

- ST9200-GPIB Interface board
- ST®Meter Basic RS232C communication control software
- ST®Meter Plus Extended RS232C communication control software
- WL20 Warn lamp set
- DOCAB, SICAB Test cages
- Calibration Hipot Tester

A.4 Software Upgrade

If the software of the instrument is to be updated due to customer requirements, then the customer needs to provide the detailed model number of the instrument **(providing the wrong model number will cause the instrument to be unusable or even damaged after the upgrade)**; we will modify the software and provide the customer with a ST9201.bin file, and the customer needs to upgrade the instrument through the serial port. The following is a brief description of the upgrade:

For manual software updates of the device, you must use WINXP, which is supplied with the Hyper Terminal tool to create a program for sending tools.

1) Click Start Menu → Accessories → Communications → Hyper Terminal.
2) Fill in the name as well as choose the icon, any will do.
3) Select the COM port, whichever serial port number is connected to this instrument.
4) Set from top to bottom: 38400 / 8 / None / 2 / None.
5) Once the above is set, click OK and save as ST9201 to complete Hyper Terminal

Instrument Upgrade Procedure:

1) First connect the ST9201 to the PC with an RS232 interface cable.
2) Start Menu → Accessories → Communications → Hyper Terminal → ST9201.
3) Press and hold the key lowercase "d", then turn on the power of the voltage withstand meter ST9201, which appears in the communication serial port.
   - Type `'d'download`. Other run app.
   - `CCCCC_`
   - If "C" displays "OK", please make sure that "d" is lowercase; there is no effect of input method.
4) Click "Transfer" → Send File.
5) Select the file ST9201.bin you want to send and the protocol Xmodem.
6) After clicking Send, the file was sent.
7) Once the burn is complete, turn off the power. Then press and hold the F5 key of the instrument, and then starts the power for initialization.

Note: The file burned via RS232 is in binary file (instrument model .bin) format and cannot be recovered if burned incorrectly.

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