OPERATION MANUAL

Withstanding Voltage/Insulation Resistance Tester

TH9101
TH9101A
TH9101B
TH9101C

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Chapter 1 Setup

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

1.1 Unpacking

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

Items	Quantity
TH9101/TH9101A/TH9101B/TH9101C	1
TH90001R High-voltage test leadwires	1
TH90001B Low-voltage test leadwires	1
5A（220V）/10A（110V） Fuse （TH9101/A）	2
3A（220V）/5A（110V） Fuse （TH9101B/C）	2
TH90002 withstanding-voltage test stick	1
TH26034 RS232C cable	1
AC Power cord	1
Operation Manual	1
Test Report	1
Servicing card	1
Accessories ordered by custom	1

1.2 Precautions for Installation

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

1.2.1 Do not use the tester in a flammable atmosphere.

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

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

Do not locate the tester near a heater or in areas subject to drastic temperature changes.
Operating temperature range: 5 °C to +35 °C
Storage temperature range: -20 °C to +70 °C

1.2.3 A void humid environments.

Do not locate the tester in a high-humidity environment—near a boiler, humidifier, or water supply.
Operating humidity range: 20 % to 80 % RH (no dew condensation permitted)
Storage humidity range: 90 % RH or less (no dew condensation permitted)
Condensation may occur even within the operating humidity range. In that case, do not start

using the tester until the location is completely dry.

1.2.4 Do not place the tester in a corrosive atmosphere.

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

1.2.5 Do not locate the tester in a dusty environment.

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

1.2.6 Do not use the tester where ventilation is poor.

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

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

If placed on a non-level surface or in a location subject to vibration, the tester may fall, resulting in damage and injury.

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

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

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

Operation in a location subject, may cause such equipment may be affected by noise generated by the tester.
At a test voltage exceeding 3 kV, corona discharge may be generated to produce substantial amounts of RF broadband emissions between grips on the test leadwire. To minimize this effect, secure a sufficient distance between alligator clips. In addition, keep the alligator clips and test leadwire away from the surfaces of conductors (particularly sharp metal ends).

1.2.10 Secure adequate space around the power plug.

Do not insert the power plug to an outlet where accessibility to the plug is poor.
And, do not place objects near the outlet that would result in poor accessibility to the plug.

1.3 Precautions for Moving

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

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

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

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

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

1.4 Checking the Line voltage and Fuse

1.4.1 Switching source voltages

This instrument is designed to operate from the overvoltage category II. Do not operate it from the overvoltage category III or IV.

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

Nominal voltage range (allowable voltage range):

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

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

Allowable frequency range: 47 Hz to 63 Hz

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

1.4.2 Checking and replacing 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.

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

---

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

Voltage range	Frequency	Fuse type	Power
100-120V	47-63Hz	10A(TH9101/A) 5A(TH9101B/C)	800VA
200-240V		5A(TH9101/A) 3A(TH9101B/C)	

1.5 Connecting the AC Power Cord

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

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

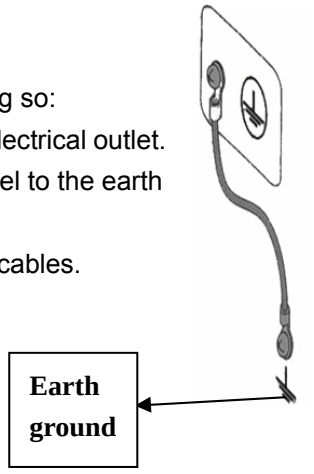
Connection procedure:

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

1.6 Grounding

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

To ensure safety, be sure to ground the tester.
Choose either of the following two available methods of doing so:
1. Connect the AC power cord to a three-contact grounded electrical outlet.
2. Connect the protective conductor terminal on the rear panel to the earth ground.
Have specialized engineers select, manufacture, and install cables.
To ensure secure connection, use proper tools.



1.7 Checking Operations

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

When the power is turned on, the tester lights all LEDs on the front panel and self-diagnosis is started.
Before starting up the tester, confirm that all LEDs are on to ensure safety.
It is particularly dangerous to start a test when the DANGER lamp is broken.
Note that, in self-diagnosis, even when the DANGER lamp is lighting, no output or voltage is being generated.

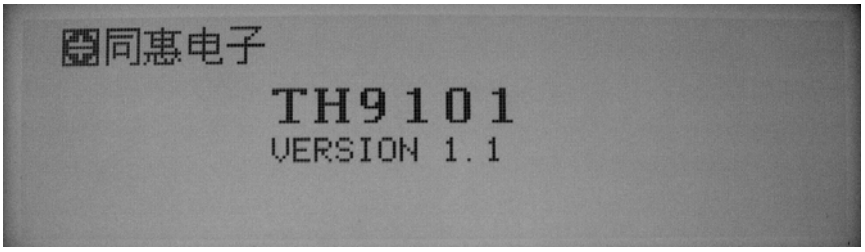
⚠ **CAUTION** After turning off the POWER switch, wait several seconds before turning it on. Turning the POWER switch on/off repeatedly with insufficient intervals may damage the tester.

Checking procedure:

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

The above steps complete the checking procedure.

OPENING SCREEN：



1.8 Other specifications

1. Power：≤700VA（TH9101/A）
   ≤400VA (TH9101B/C)
2. Dimensions：430mm*140mm*385mm；
3. Weight：20kg(TH9101/A)16kg（TH9101B/C）.

Chapter 2 Precautions on Handling

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

⚠ **WARNING** The tester derivers a 5 kVAC/6 kVDC test voltage which can cause human injury or death. When operating the tester, be extremely careful and observe the cautions, warnings, and other instructions given in this chapter.

2.1 Prohibited Operations

2.1.1 Do not turn on/off the power repeatedly

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

2.1.2 Do not short the output to the earth ground

Pay attention so that the high test voltage line is not shorted to a nearby AC line or nearby devices (such as conveyors) which are connected to an earth ground. If it is shorted, the tester chassis can be charged up to the hazardous high voltage. Be sure to connect the protective grounding terminal of the tester to an earth line. If this has been securely done, even when the HIGH VOLTAGE terminal is shorted to the LOW terminal, the tester will not be damaged and its chassis will not be charged up to the high voltage.
Be sure to use a dedicated tool when grounding the protective grounding terminal.
⚠ **CAUTION** The term "AC line" here means the line on which the tester is operating. That is the line to whose outlet the AC power cable of the tester is connected. It may be of a commercial AC power line or of a private-generator AC power line.

2.1.3 Do not apply an External Voltage

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

2.2 Action When in Emergency

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

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

2.3 Precautions on Testing

2.3.1 Wearing Insulation Gloves

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

2.3.2 Precautions for Pausing Tests

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

2.3.3 Items Charged Up to Dangerous High Voltages

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

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

2.3.4 Matters to be Sure of After Turning-OFF Power

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

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

2.3.5 Warnings for Remote Control

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

1. Provide means to assure that the test setup does not become the test voltage is being delivered by inadvertent operation.
2. Provide means to assure that none can touch the DUT, test leadwires, probes, output terminals and their vicinities when the test voltage is being delivered.

2.4 Warning for Residual High Voltages

⚠ **WARNING** In DC withstanding voltage testing and insulation resistance testing, the test lead wire, test probe, and DUT are charged to a high voltage. The tester is equipped with a discharge circuit, but some time is nonetheless required to discharge them after the output is cut off. There is a danger of electric shock during discharge. To avoid electric shock, take the

utmost care to ensure that the DUT, test lead wire, probe, and highly charged parts around the output terminal are not touched. If it is necessary to touch them, be sure to confirm both (1) and (2):
(1) The analog voltmeter indicates “zero.”
(2) The DANGER lamp has gone out.
As soon as the output is cut off, the tester’s discharge circuit starts forced dischargin g. Do not disconnect the DUT during a test or prior to completion of discharging.

 **Discharge time**

The length of the discharge time varies according to the properties of the DUT.
Discharge is conducted at a resistance of approximately 125 k in DC withstanding voltage testing, and at 25 k in insulation resistance testing.
When no DUT is connected, the tester itself requires the following lengths of time to reduce the internal capacitor voltage to 30 V.
Insulation resistance testing at 1000V: 5ms
DC withstanding voltage testing at 6000V: 40ms

If the DUT is disconnected during a test or before the completion of discharging, assuming that the DUT has a capacity of 0.01uF and a parallel resistance of 100 M, approximately 5.3 seconds at 6 kV and approximately 3.5 seconds at 1 kV are required for the DUT to discharge to 30 V.
When the approximate time constant of the DUT is known, the time required for discharging to 30 V after the output is cut off is calculated as the time constant times the value given above.

2.5 Dangerous States of Failed Tester

Typical possible dangerous states of the tester are as shown below and in which cases the most dangerous situation that **“the high test voltage remains delivered and won't be turned off!”** may occur. When this situation has occurred, immediately turn OFF the power switch and disconnect the AC power cable from the AC line receptacle.
•The DANGER lamp does not go out despite you have pressed the STOP switch.
•The DANGER lamp does not light up despite the pointer of the analog voltmeter is deflected indicating that the output voltage is being delivered.
Also when the tester is in other malfunctioning states than the above, there is a possibility that the output voltage is delivered irrespective of your proper operating procedure. Never use the tester when it has failed.

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

2.6 To Ensure Long-Term Use Without Failures

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

Output requirements for withstanding voltage testing

<table>
<tr><th>Ambient temperature</th><th colspan="2">Upper current</th><th>Pause Time</th><th>Output time</th></tr>
<tr><td rowspan="4">T≤40℃</td><td rowspan="2">AC</td><td>50＜i≤110mA
（TH9101/A）
20＜i≤40mA
（TH9101B/C）</td><td>At least as long as the output time</td><td>Maximum of 15minutes</td></tr>
<tr><td>i≤50mA
（TH9101/A）
i≤50mA
（TH9101B/C）</td><td>Not necessary</td><td>Continuous output possible</td></tr>
<tr><td rowspan="2">DC</td><td>5＜i≤11mA</td><td>At least as long as the output time</td><td>Maximum of 1 minute</td></tr>
<tr><td>i≤5mA
（TH9101/B）</td><td>At least as long as the judgment
wait time (WAIT TIME)</td><td>Continuous output possible</td></tr>
</table>

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

2.7 Daily Checking

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

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

Chapter 3 Part names and Functions

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

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3.1 Front Panel

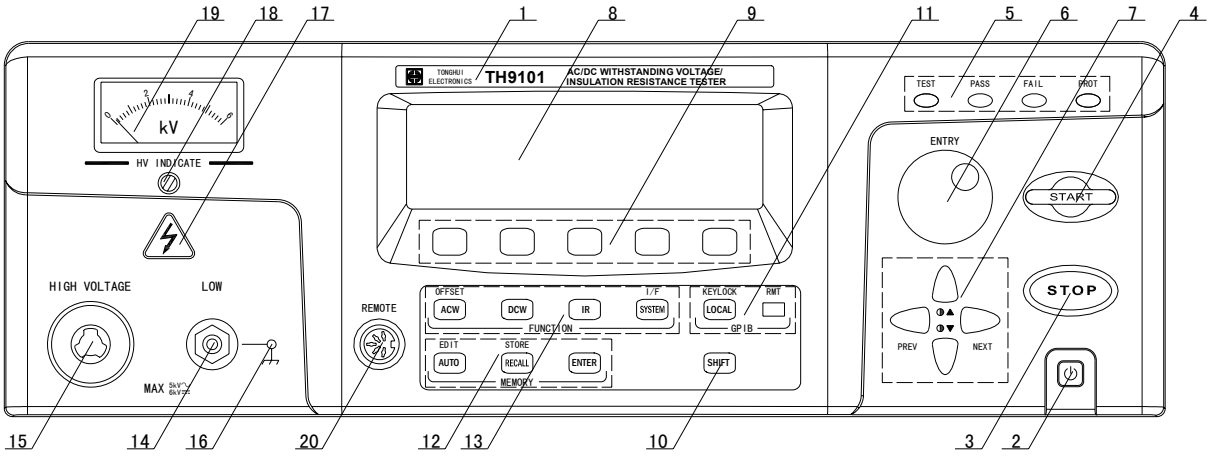


Figure 3-1

1. Mark

This mark describes the instrument's type.

2. POWER Switch

Used to turn the power on/off. To start using the factory settings, press the SHIFT key + the POWER switch to initialize the settings.

3. STOP Key

Used to suspend a test.

Also used to cancel the PASS, FAIL, and PROTECTION statuses.

4.START Key

Used to start a test.

The test starts when this switch is pressed while "READY" is displayed on the LCD.

Once the test starts, the LCD displays "TEST" and the TEST LED flashes on the indicator during a voltage rise.

When the tester reaches the test voltage, the TEST LED remains lit.

5. Indicator

• TEST

LED indicating that a test is under way. The LED flashes during contact checks, voltage rise,

and voltage fall. It lights up while the test voltage is being output.

• PASS

LED indicating the test results.

This LED lights up when a PASS judgment is made.

No PASS judgment is made when the timer function is off.

• FAIL

LED indicating the test results.

This LED lights up when a FAIL judgment is made.

• PROTECTION

LED indicating that the protection function has been activated. The activated protection function is shown at the top right of the LCD. For the protection function,

6. Rotary knob

READY status : Used to set test conditions on the LCD

Test in Progress : Used to change the test voltage

7. CURSOR

Used to move the cursor to set test conditions.

When pressed together with the SHIFT key, it enables screen contrast adjustment and the switching of setting screens.

8. LCD(240*64)

Displays settings and measurements.

9. F1-F5

Functions corresponding to the F1 to F5 keys on the LCD.

10. SHIFT

Used to switch the function menus and expand key functions.

11. LOCAL/KEYLOCK

Used to return to the LOCAL mode during remote control with the GPIB or RS- 232C interface.

In remote control, the LED lights up to the right of the key.

To activate the key-lock function during local control, press this key together with the SHIFT key. In the key-lock mode, the LCD displays “KEYLOCK.”

12. MEMORY

AUTO/EDIT

When this key is pressed, the LED lights up. The LCD displays the program execution screen (AUTO READY).

To display the program edit screen (AUTO EDIT), press this key together with the SHIFT key.

RECALL/STORE

Used to recall the panel memory.

To change the memory number, first press the rotary knob, then press the ENTER key next to the rotary knob to recall the contents.

To store data in memory, press this key together with the SHIFT key.

13. FUNCTION

Used to select the test-mode settings, system settings, or interface settings.

ACW/OFFSET

When this key is pressed, the LED lights up. The LCD displays the AC withstanding voltage testing screen (ACW).

To display the offset screen (OFFSET), press this key together with the SHIFT key.

DCW (TH9101/TH9101B only)

When this key is pressed, the LED lights up. The LCD displays the DC withstanding voltage testing screen (DCW).

IR

When this LED is pressed, the LED lights up. The LCD displays the insulation resistance testing screen (IR).

SYSTEM /I/F

When this key is pressed, the LED lights up. The LCD displays the system settings screen (SYSTEM).

To display the interface settings screen (INTERFACE), press this key together with the SHIFT key.

14. LOW terminal

Low-voltage terminal for outputting the test voltage.

15. HIGH VOLTAGE terminal

High-voltage terminal for outputting the test voltage.

⚠ **WARNING** During a test, never touch the HIGH VOLTAGE terminal.

⚠ **CAUTION** Internal circuit may malfunction if a voltage is applied to it from outside.

---

16. FLOAT/GND

Lights when the LOW/GUARD for the GND is set to LOW for each test.

⚠ **WARNING** When this lamp is off, check the grounding of the DUT, jigs and peripheral devices. Read the relevant sections of "Chapter 3 Basic Operations", and strictly follow the instructions given.

---

17. DANGER lamp

Red lamp indicating that a high voltage is being output.

This lamp lights up during testing and automatic testing, or while an output voltage remains in the output terminal.

⚠ **WARNING** While this lamp is lit, never touch the HIGH VOLTAGE terminal, test lead wire, or DUT.

---

18. Analog-voltmeter zero adjuster

Adjuster used to adjust the analog voltmeter to the zero point.

⚠ **CAUTION** Prior to zero adjustment, be sure to turn off the POWER switch.

---

19. Analog voltmeter

Voltmeter used to display the output voltage. Directly reads the voltage between the HIGH VOLTAGE terminal and the LOW terminal.

⚠ **WARNING** While the pointer of the analog voltmeter is moving, never touch the HIGH VOLTAGE terminal, test lead wire, or DUT.

⚠ **CAUTION** This voltmeter cannot be used as an in dependent voltmeter. It may malfunction if a voltage is applied to the output terminal from outside.

20. REMOTE terminal

Terminal used to connect the optional remote-control box or the exclusive probe.

3.2 Rear Panel

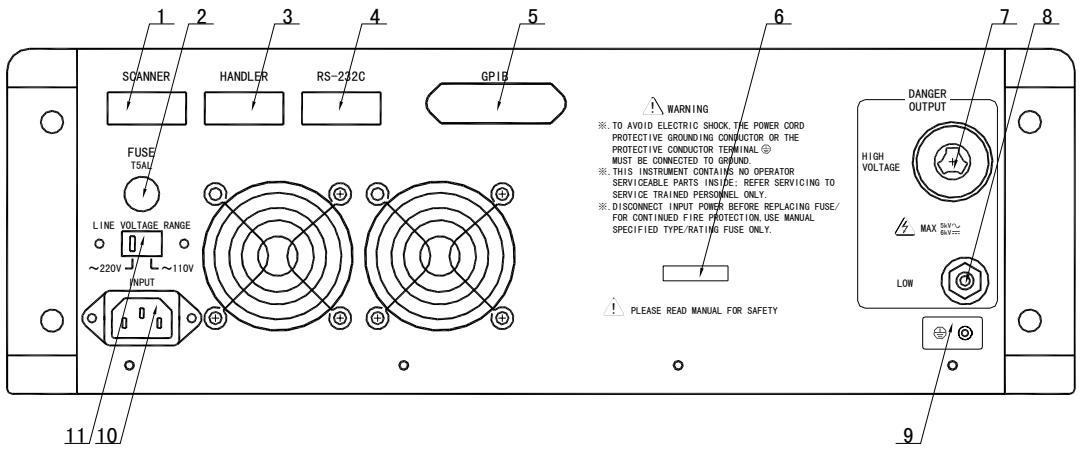


Figure3-2

1. SCANNER
Connector used to connect the optional high-voltage scanner.

2. FUSE
Fuse holder. Contains a fuse for AC input.

⚠ **WARNING** Improper handling of the fuse holder may lead to electric shock.

---

3. HANDLER
Output PASS/FAIL status.

4. RS-232C
Connector used to connect an RS-232C cable in order to remotely control the tester via a PC using the RS-232C interface.

5. GPIB
Connector used to connect a GPIB cable in order to remotely control the tester via a PC using the GPIB interface.

6. Mark
This mark describes the instrument's SN.

7. HIGH VOLTAGE terminal
High-voltage terminal for outputting the test voltage is connected with the front.

⚠ **WARNING** During a test, never touch the HIGH VOLTAGE terminal.
⚠ **CAUTION** Internal circuit may malfunction if a voltage is applied to it from outside.

---

8. LOW terminal
Low-voltage terminal for outputting the test voltage is connected with the front.

9. Protective conductor terminal
Terminal used to ground the tester.

⚠ **WARNING** Before turning on the POWER switch, be sure to confirm that the voltage to be used is consistent with the voltage range selected using the LINE VOLTAGE RANGE switch.

---

10. Cord holder
Holder for the power cord.

11. LINE VOLTAGE RANGE

Switch for selecting an input-voltage range.

⚠ **WARNING** Before turning on the POWER switch, be sure to confirm that the voltage to be used is consistent with the voltage range selected using the LINE VOLTAGE RANGE switch.

Chapter 4 Basic Operations

This chapter describes the procedures for conducting withstanding voltage and insulation resistance tests.

⚠ **NOTE** This chapter takes example for TH9101.

4.1 Turning on the Power

⚠ **WARNING**

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

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

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

⚠ **CAUTION**

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

⚠ **CAUTION**

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

4.1.1 Turning on the power

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

4.2 Pre-Test Zero Adjustment

Before starting a test, perform zero adjustment on the analog voltmeter. Perform the following procedure:

1. Turn off the POWER switch.
2. Confirm that the analog voltmeter indicates “0.” Otherwise, adjust the analog-voltage zero adjuster until the voltmeter indicates “0.”

4.3 Structure of LCD Screen

The tester’s LCD screens are composed of setting screens and execution screens. On the setting screens, settings can be made for the tester and test conditions or automatic testing can be programmed. The execution screens indicate the test status.

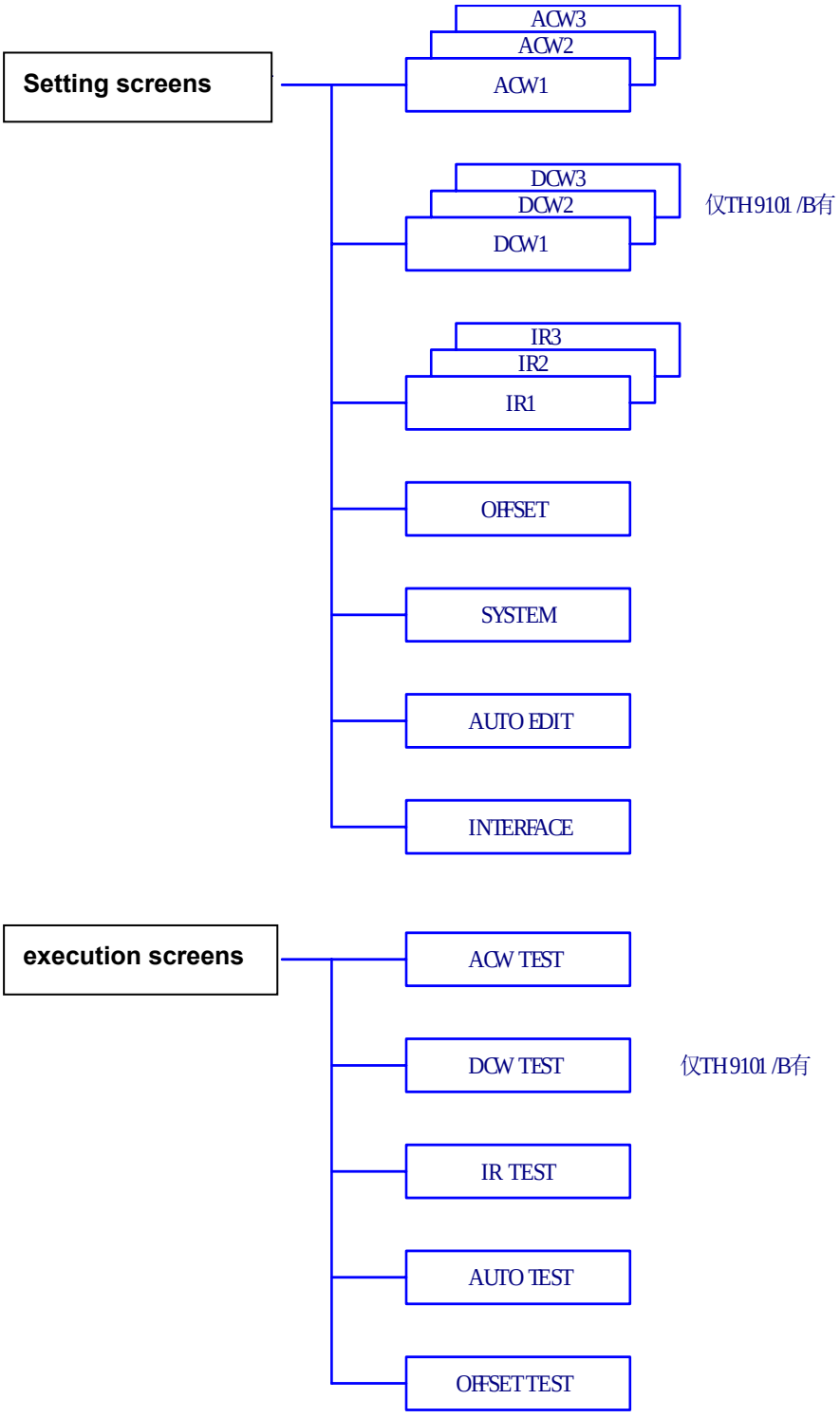


Figure 4-1

4.4 Settings for AC Withstanding Voltage Testing

To make settings for an AC withstanding voltage test, use the AC withstanding voltage test screen (ACW). To jump to this screen (ACW1), press the ACW key. The LED on the ACW lights up.

The AC withstanding voltage test screen has three pages from ACW1 to ACW3. To move between these pages, press the SHIFT key + ◀ ▶keys. To return to ACW1 from ACW2 or ACW3, press the ACW key.

⚠ **CAUTION**
No setting is permitted in the KEYLOCK status.

The three ACW pages allow the following settings to be made:

ACW1

• Test voltage
• Test frequency
• Lower current (LOWER) and ON/OFF of the lower judgment function
• Upper current (UPPER)
• ON/OFF of the offset function
• Test time (TEST TIME) and ON/OFF of the timer function

ACW2

• Start voltage
• Voltage rise time (RISE TIME)
• Voltage fall time (FALL TIME)
• Output-voltage range
• SLOW/MID/FAST settings for the current detection response (RESPONSE)
• GND/FLOAT settings

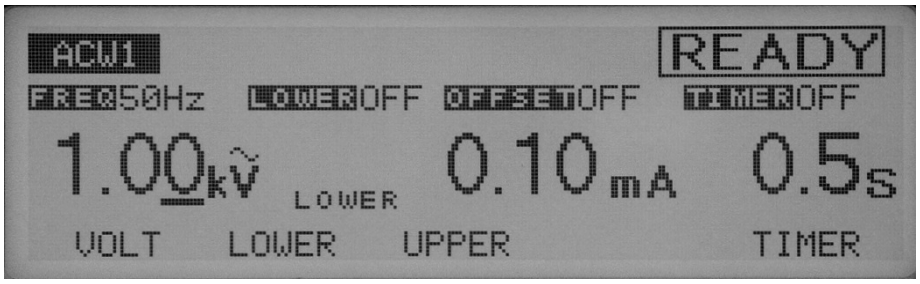
ACW3

• Channel settings for the high-voltage scanner
• ON/OFF of the contact check function

To move the cursor between items, use the ▼▲◀▶ keys.
When a function is shown on keys F1 to F5, they can be used to jump to the target item. To make settings for the items to be displayed on these keys, press the SHIFT key + F1 to F5 keys.]

4.4.1 Settings on the ACW1 Screen

4.4.1.1 Settings for AC withstanding voltage testing



To make a setting, use the rotary knob with the cursor at the test voltage.
1. If the cursor is not at the test voltage, press the F1 key to bring the cursor to the test voltage (the◀▶ keys can also be used).

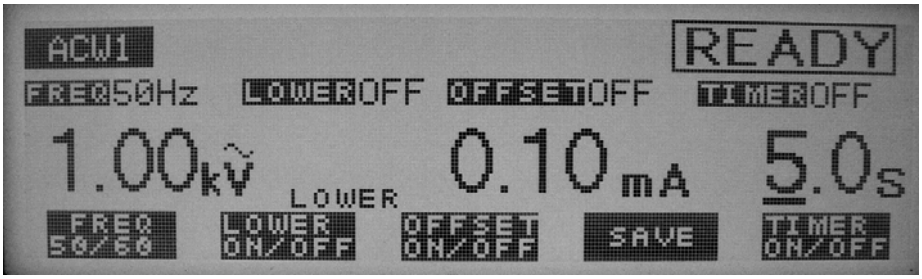
2. Move the cursor to the target digit using the ◀▶keys.
3. Set a test voltage using the rotary knob.

⚠ **CAUTION**

1.When settings are being made, if the test voltage multiplied by the upper current exceeds 550 VA, “READY” disappears and “OVER 550VA” flickers at the top right of the LCD to indicate that testing cannot be performed. In such a case, reduce the test voltage or the upper current.

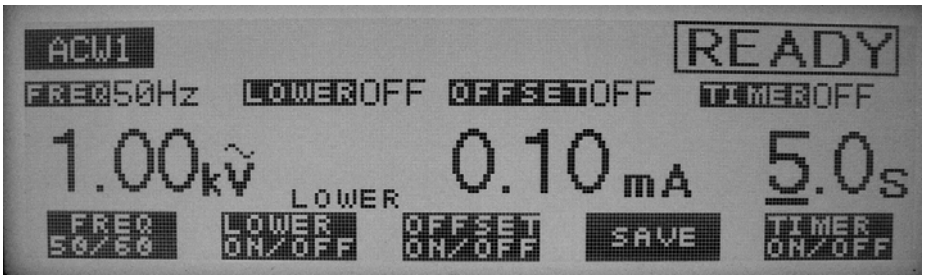
2.If the output voltage range is at AUTO and the test voltage is 2.6 kV or less, the 2.5 kV range is selected automatically. It is therefore impossible to change the voltage to more than 2.6 kV during the test.

4.4.1.2 Setting the frequency



The frequency of the test voltage can be set to either 50 Hz or 60 Hz. The test frequency can be set using the SHIFT + F1 keys (press the F1 key while pressing the SHIFT key), regardless of where the cursor is positioned. Every time the SHIFT + F1 keys are pressed, the setting alternates between 50 Hz and 60 Hz.

4.4.1.3 Turning the lower judgment function ON/OFF



The lower judgment function can be turned on/off. When the lower judgment function is on, the test result is judged to be FAIL if the measured current drops below the lower current, and the test is ended.

The lower current is explained in the following section. The lower judgment function can be set to ON/OFF using the SHIFT + F2 keys, regardless of where the cursor is positioned. Every time the SHIFT + F2 keys are pressed, the setting alternates between ON and OFF.

4.4.1.4 Setting the lower current (LOWER)



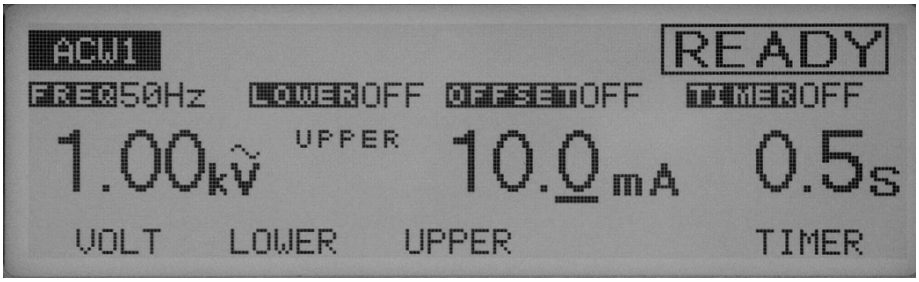
The lower current can be set between 0.01 mA and 110 mA (at a resolution of 0.01 mA for 0.01 mA to 9.99 mA, 0.1 mA for 10.0 mA to 99.9 mA, and 1 mA for 100 mA to 110 mA).
When the cursor is at the lower current, the rotary knob can be used to make settings. When the lower judgment function is set to ON and the measured current is at or below the lower current, the test ends with a FAIL judgment.
When the fluctuations of the leakage current of the DUT are limited and exceed the current by a sufficient amount to permit the tester to make a judgment, set the lower current below the smallest fluctuation. By making such a setting, it is possible to identify a DUT that generates a small leakage current and even detect disconnection and failed contact in the test lead wire, ensuring an accurate withstanding voltage test. If the lower judgment function is not to be used, turn it off.
1. To display the lower current, press the F2 key (LOWER). While the lower current is displayed, the cursor can be moved using the ◀▶ keys.
2. Using the ◀▶ keys, move the cursor to the target digit.
3. Using the rotary knob, set the lower current.

⚠ **CAUTION**

1. If the lower current is set at or above the upper current while the lower judgment function is on, “READY” disappears and “UP<=LOW” flickers at the top right of the LCD to indicate that testing cannot be performed (the lower current is factory set to 0.10 mA). Lower the lower current or raise the upper current.
The invalid settings shown above have the priority specified in "4.15 Invalid Settings". When there are two or more invalid settings, messages with higher priority may be displayed first.
2. As described in "Chapter 5 Specifications", in a high-sensitivity and high-voltage test using an alternating current, a current larger than the lower current may flow into the stray capacity of the test lead wire and other components, making it impossible to conduct lower judgment. No current flows into a DUT if it is not connected to the tester. Thus, the current flowing into the DUT is smaller than the lower current. The test may then be judged as FAIL. Nonetheless, if a current larger than the lower current flows into the stray capacity, the current detection circuit detects the current and makes a PASS judgment. Carefully check combined judgment errors. In addition, disconnect the DUT under preset test conditions
and confirm that a FAIL judgment is possible.
3. No lower judgment is made while the voltage is rising or falling.

4.4.1.5 Setting the upper current (UPPER)

⚠ **CAUTION** If the upper current is set above 50 mA, the protective circuit may be activated. To avoid this, set the output time to 15 minutes or less and provide a pause longer than the output time.



The upper current can be set between 0.01 mA and 110 mA (at a resolution of 0.01 mA for the 0.01 mA to 9.99 mA range, 0.1 mA for the 10.0 mA to 99.9 mA range, and 1 mA for the 100 mA to 110 mA range). When a current exceeding the upper current is detected, the test ends with a FAIL judgment. When the cursor is at the upper current, the rotary knob can be used to make settings.

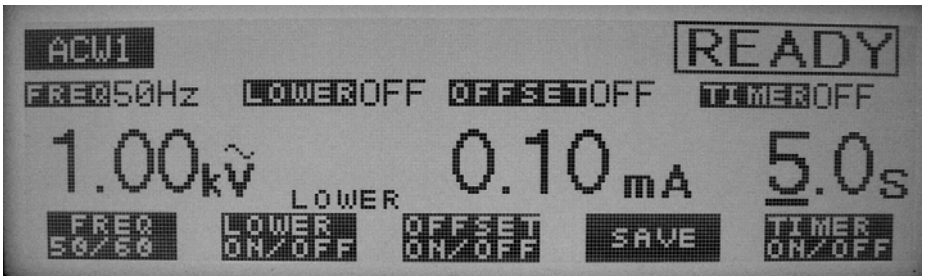
1. To display the upper current, press the F3 key (UPPER). (When the upper current is displayed, the cursor can be moved using the ◀▶ keys.)
2. Using the ◀▶ keys, move the cursor to the target digit.
3. Using the rotary knob, set the upper current.

⚠ **CAUTION**

1. If the upper current is set at or below the lower current while the lower judgment function is on, “READY” disappears and “UP<=LOW” flashes at the top right of the LCD to indicate that testing cannot be performed. (The upper current is factory- set to 0.20 mA.) Lower the lower current, raise the upper current, or turn off the lower judgment function.
2. When settings are being made, if the test voltage multiplied by the upper current exceeds 550 VA, “READY” disappears and “OVER 550 VA” flashes at the top right of the LCD to indicate that testing cannot be performed. In such a case, reduce the test voltage or the upper current.

4.4.1.6 Turning the offset cancel function ON/OFF

The offset cancel function can be turned on/off. When it is on, this function displays the difference calculated by subtracting from the measured value the offset value recorded by the function ("4.9 Offset Cancel Function").

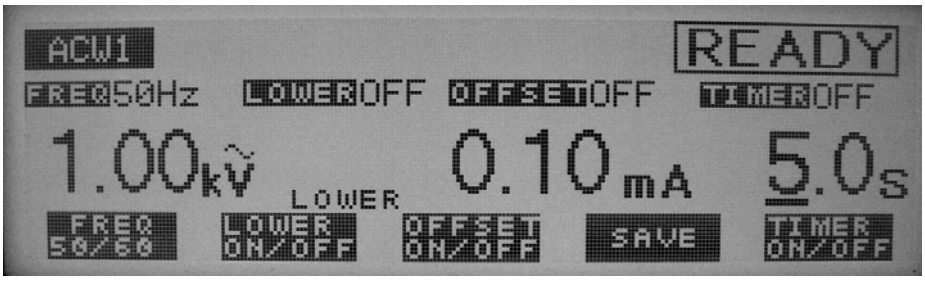


⚠ **CAUTION**

To use the recorded offset value, make the same settings for the frequency, SGND/FLOAT of the LOWTERM, and the scanner as were made for the offset value. Each time the test voltage is changed, the recorded offset value is converted to reflect the change. For details, see "4.9 Offset Cancel Function".

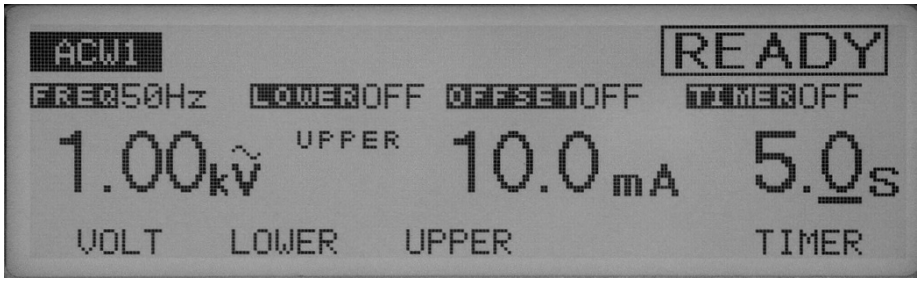
The offset cancel function can be set to ON/OFF using the SHIFT + F3 keys, regardless of the location of the cursor. Each time the SHIFT + F3 keys are pressed, ON and OFF alternate.

4.4.1.7 Turning the timer ON/OFF



Make ON/OFF settings for the timer function.
When the timer function is turned on, the test time can be controlled as shown in “Setting the test time” in the next section. When the preset test time has elapsed with a recorded leakage current between the lower and upper currents, the test ends with a PASS judgment. The timer function can be set to ON/OFF using the SHIFT + F5 keys, regardless of the location of the cursor. Each time the SHIFT + F5 keys are pressed, ON and OFF alternate.

4.4.1.8 Setting the test time (TEST TIME)



⚠ CAUTION

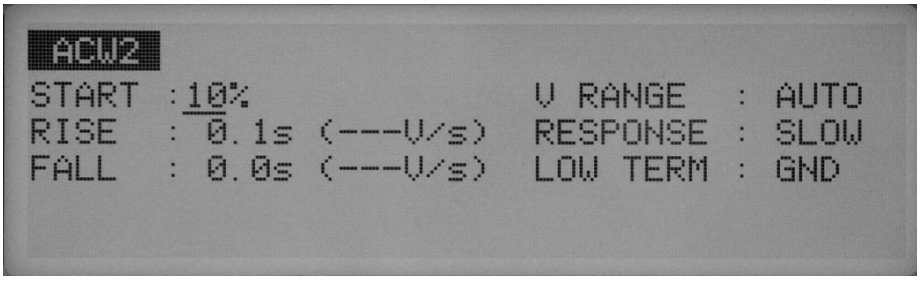
If the upper current is set above 50 mA, the protective circuit may be activated. To avoid this, set the output time to 15 minutes or less and provide a pause longer than the output time.

The time for which a preset voltage is applied to the DUT can be set to 0.3 s through 999 s (at a resolution of 0.1 s for the 0.3 s to 99.9 s range and 1 s for the 100 s to 999 s range).
When the cursor is at the test time, the rotary knob can be used to make settings.

1. To move the cursor to the timer, press the F5 key (TIMER). (The ◀▶ keys can also be used.)
2. Using the ◀▶ keys, move the cursor to the target digit.
3. Using the rotary knob, set the test time.

4.4.2 Settings on the ACW2 screen

4.4.2.1 Setting the start voltage



For an AC withstanding voltage test, set the start voltage as a percentage of the test voltage, to 0% through 99% (at a resolution of 1%). When the cursor is located to the right of START, settings can be made using the rotary knob.

1. To move the cursor to the right of START Using the ▼▲◀▶ keys.
2. Using the rotary knob, set the start voltage.

⚠ CAUTION

When the start voltage is set to 1% or more, approximately 100 ms is required for the tester to reach the start voltage from 0 V.

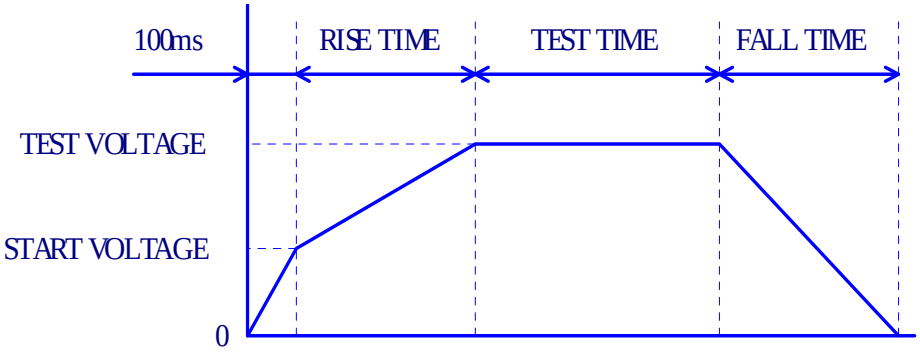
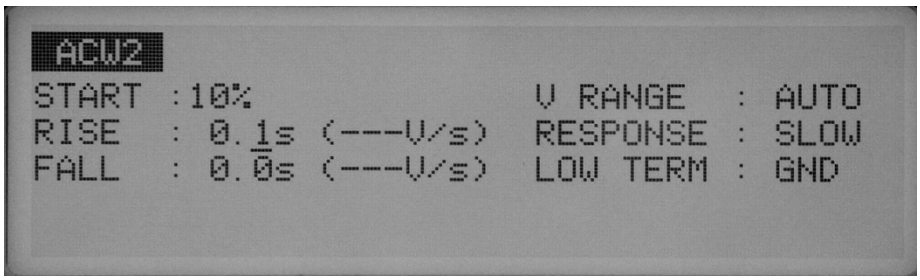


Figure 4-2　Start voltage（ACW）

4.4.2.2 Setting the voltage rise time (RISE TIME)



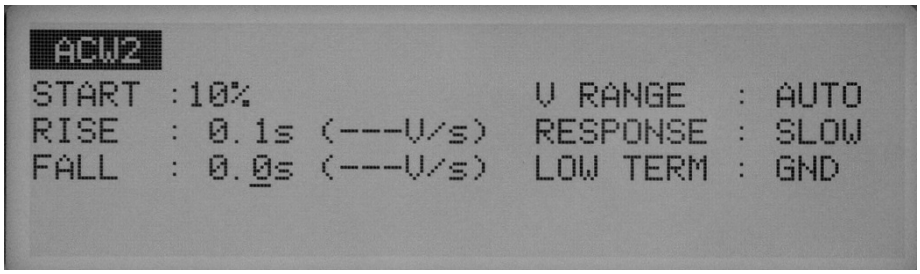
The rise time between the start voltage and the test voltage can be set to 0.1 s through 200 s (at a resolution of 0.1 s for the 0.1 s to 99.9s range and 1 s for the 100
s to 200s range).

When the cursor is to the right of RISE, settings can be made using the rotary knob.

1. Using the ▼▲◀▶ keys, move the cursor to the target digit.
2. Using the rotary knob, set the rise time. The figure (V/s) in parentheses represents the voltage increase per second calculated for reference using the preset value.

If the value cannot be displayed in three digits, “---”is displayed instead.

4.4.2.3 Setting the voltage fall time (FALL TIME)



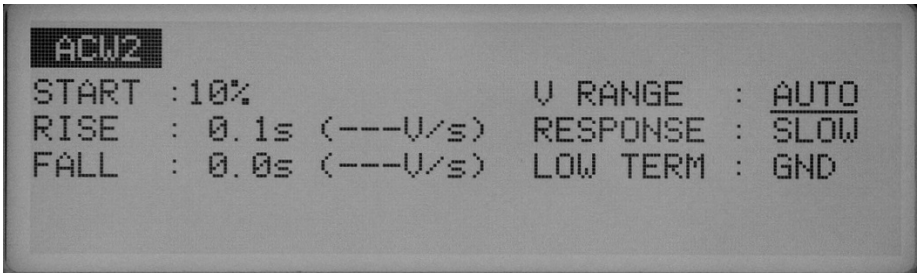
When the test ends with a PASS judgment, the voltage falls to 0 V during the preset voltage fall time. This voltage fall time can be set to 0.0 s through 200 s (at a resolution of 0.1 s for the 0.1 s to 99.9s range and 1 s for the 100 s to 200s range).

When the cursor is to the right of FALL, settings can be made using the rotary knob.

1. Using the ▼▲◀▶ keys, move the cursor to the target digit.
2. Using the rotary knob, set the fall time.

The figure (V/s) in parentheses represents the voltage fall per second calculated for reference using the set value. If the value cannot be displayed in three digits, “---” is displayed instead.

4.4.2.4 setting the output-voltage ranges (V RANGE)



Switch the output-voltage ranges. For the output-voltage range, select between AUTO and 5kV. The 5kV range can be changed at any time up to 5.20kV. the AUTO range automatically selects either the 2.5kV range or the 5kV range, as it is selected in the pre-test settings. If the pre-test setting exceeds 2.6kV, the 5kV range is selected. Otherwise, the 2.5kV range is selected. Once the 2.5kV range has been selected, the voltage cannot be reset above 2.6kV during the test.

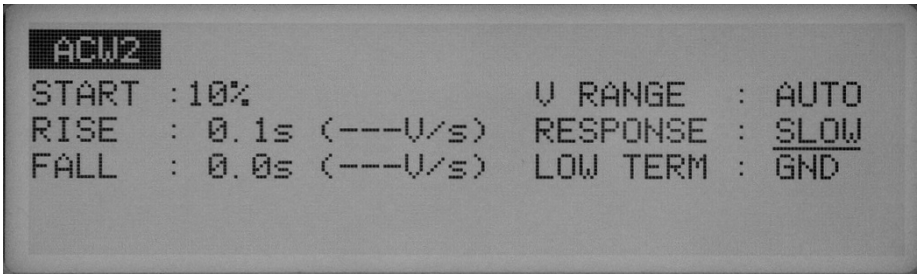
To run a test at or below 2.6kV, it is recommended that the AUTO range be selected to prevent the application of an unnecessarily large voltage.

Using the ▼▲◀▶ keys, move the cursor to the right of the output-voltage range, and make settings using the rotary knob.

Turn the rotary knob clockwise : 5kV

Turn the rotary knob counterclockwise : AUTO

4.4.2.5 Setting the current detection response（RESPONSE）：



By changing the integrated time constant of the current detection circuit, switch the current detection response for UPPER FAIL judgment.

Integrated time constant

- SLOW ： 40ms
- MID ： 4ms
- FAST ： 0.4ms

Using the ▼▲◀▶ keys, move the cursor to the right of the current detection response (RESPONSE), and make settings using the rotary knob.

Turn the rotary knob clockwise : SLOW → MID → FAST

Turn the rotary knob counterclockwise : FAST → MID → SLOW

■ SLOW

In the SLOW mode, a current is detected at an integrated time constant of approximately 40 ms in response to the mean value. This is equivalent to the current-detection response of the AC withstanding voltage tester. This setting complies with the dielectric breakdown detection

defined in the safety standards, and can be used to conduct withstanding voltage testing of ordinary electric devices and electronic components.

⚠ **CAUTION**

According to the safety standard (IEC60950 1999), “dielectric breakdown is regarded to have occurred when, as a result of the application of a test voltage, the flowing current sharply increases beyond control, that is, it becomes impossible to maintain the flowing current below a certain level. Coronal discharge or instantaneous flashover is not regarded as dielectric breakdown.” In accordance with this standard, Kikusui’s general-purpose AC withstanding voltage tester makes a FAIL judgment for a test if the tester, having a mean-value-responsive current-detection circuit, detects a current above the upper current (UPPER) flowing into a DUT.

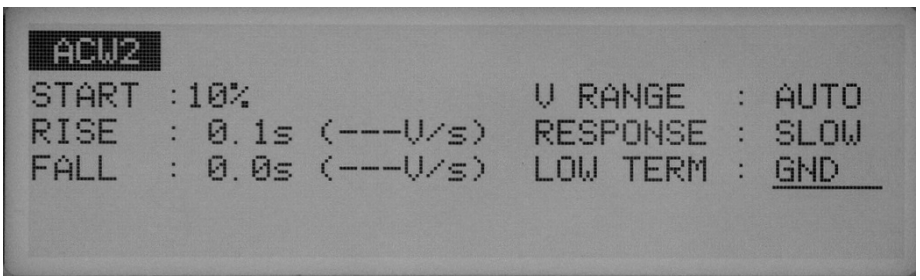
■ MID, FAST

MID and FAST, with integrated time constants of approximately 4 ms and 0.4 ms, respectively, detect currents in response to the mean value, similarly to peak detection.
These two modes respond more quickly than the SLOW mode, making them suitable for the detection of an instantaneous discharge, as well as a discharge containing high-frequency elements. Due to their excellent ability to detect the upper current, they are effective in withstanding voltage tests on DUTs that are prone to dielectric breakdown, such as small electronic devices. However, the two modes are not always useful in repeatable withstanding voltage tests, as they detect even a minimal discharge.

⚠ **CAUTION**

Even in the FAST mode, minimal discharges are sometimes not detected. This tester is designed for conducting withstanding voltage tests on electric devices and electronic components under a safety standard. It has a transformer capacity of 500 VA with a short-circuit current of 200 mA. Therefore, the tester may destroy some types of electronic components such as small relays and semiconductors, even if the tester is capable of detecting dielectric breakdowns by monitoring an over current.

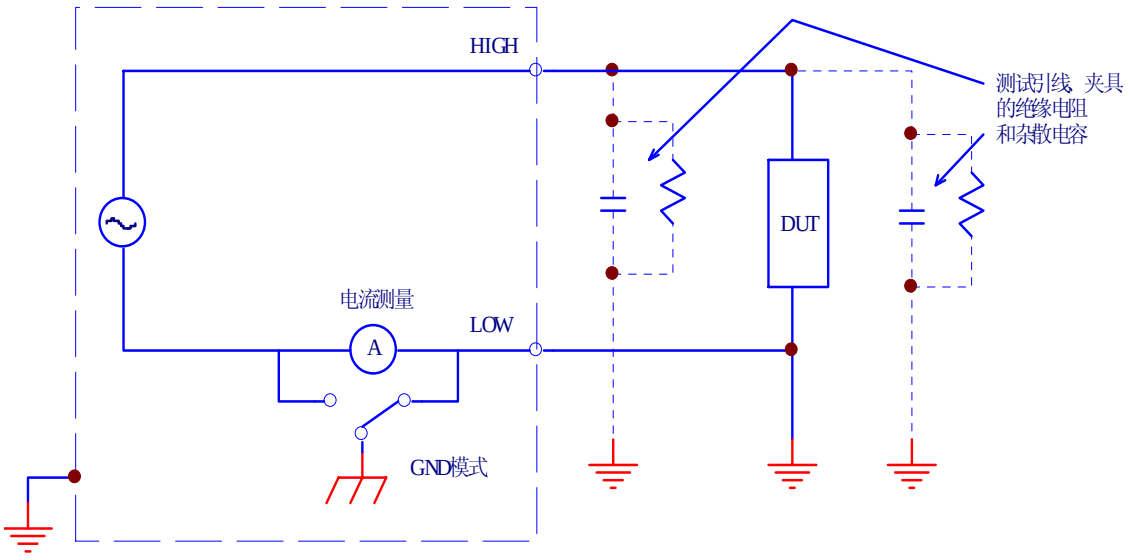
4.4.2.6 Setting GND/FLOAT for the LOWTERM



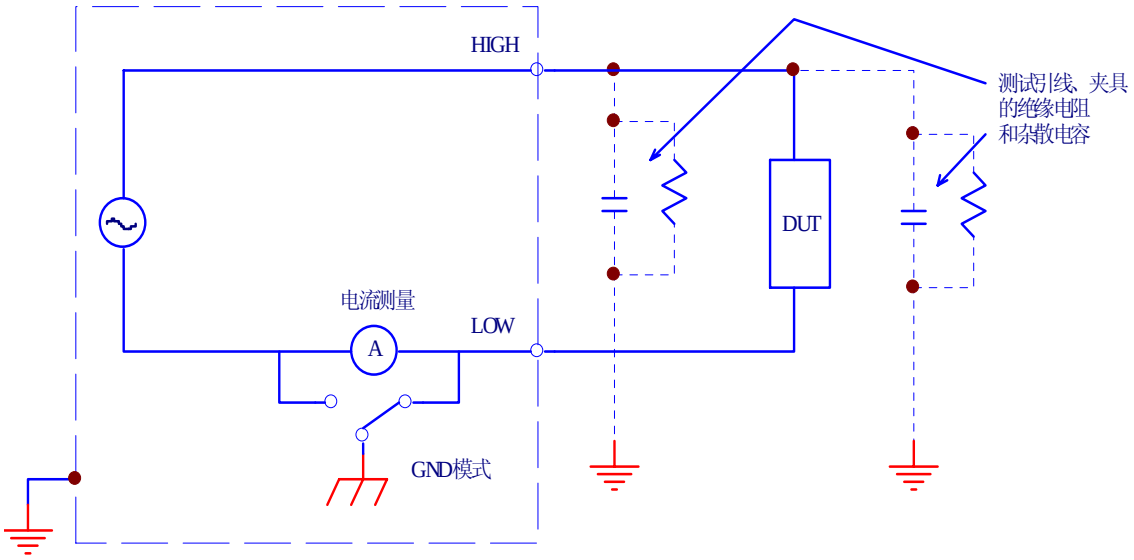
You can select either of the following two measurement modes;
The **GND** mode that the LOWTERM is connected to the tester's LOW terminal,
The **FLOAT** mode that the LOWTERM is used as guard.

In both modes, the tester detects the current flowing into the LOW terminal from the HIGH VOLTAGE terminal via the DUT.
In the GND mode, the LOW terminal is connected to the chassis. This leads to the problem that the stray capacity and insulation resistance existing between the test lead wire or jigs and the earth are included in the measurement. Nonetheless, the GND mode ensures safe testing, as it does not short-circuit the ammeter.
In the FLOAT mode, on the other hand, only the current flowing into the LOW terminal from the HIGH VOLTAGE terminal via the DUT is measured, and the influence of the stray capacity and insulation resistance existing between the test lead wire or jigs and the earth is eliminated. For this reason, the FLOAT mode is effective in measurements that require high sensitivity and high accuracy. At the same time, however, the ammeter can be short-circuited, posing a grave danger if the LOW terminal and the chassis are short-circuited when part of the DUT is connected to an earth ground. If it is possible that the DUTs and jigs are grounded, select the GND mode.
Using the ▼▲◀▶ keys, move the cursor to the right of GND; settings can then be made using the rotary knob.
Turn the rotary knob clockwise: FLOAT
Turn the rotary knob counterclockwise: GND
When GND is selected, the LED to the left of the LOW terminal lights up.

■ GND
In the GND mode, the current which flows through the LOW terminal by stray capacity and insulation resistance of the test lead wire and jigs is included in measurements. However, the ammeter is protected from short-circuiting, thereby ensuring safe testing regardless of whether the DUT is grounded. For this reason, it is recommended that GND be set in ordinary tests.



(A) GND模式，被测件接地



(B) GND模式，被测件不接地

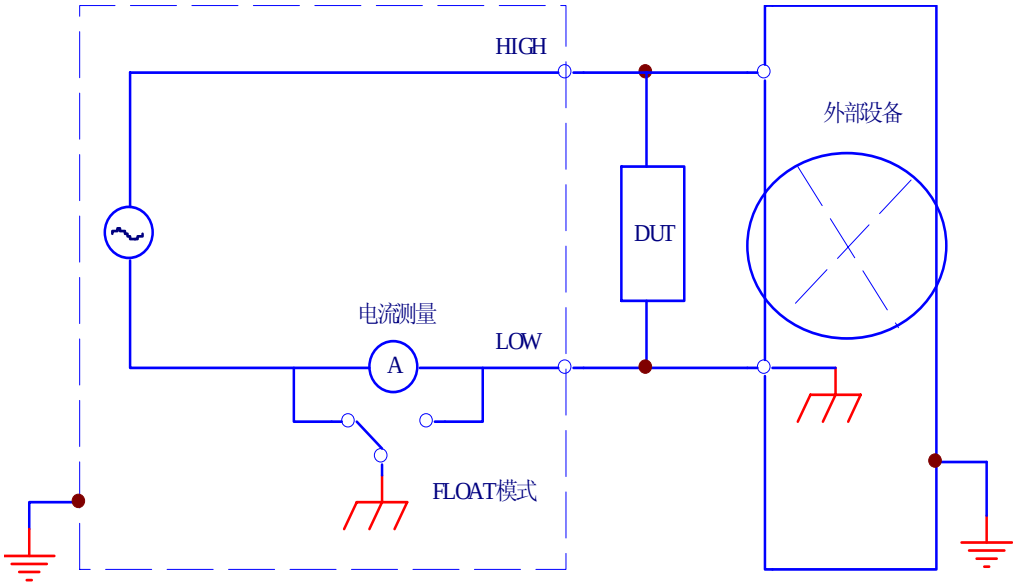
Figure 4-3 GND mode

■ FLOAT

⚠ WARNING:

If it is not known whether the DUT or jig is grounded, never select FLOAT. If FLOAT is selected while the DUT is grounded, the ammeter will be short-circuited, thereby disabling measurement and posing a grave danger.

If FLOAT is selected, do not connect this tester to any measuring instruments or other devices that involve single-side grounding. Otherwise, the ammeter will be short-circuited.



(A) 和外部设备的连接

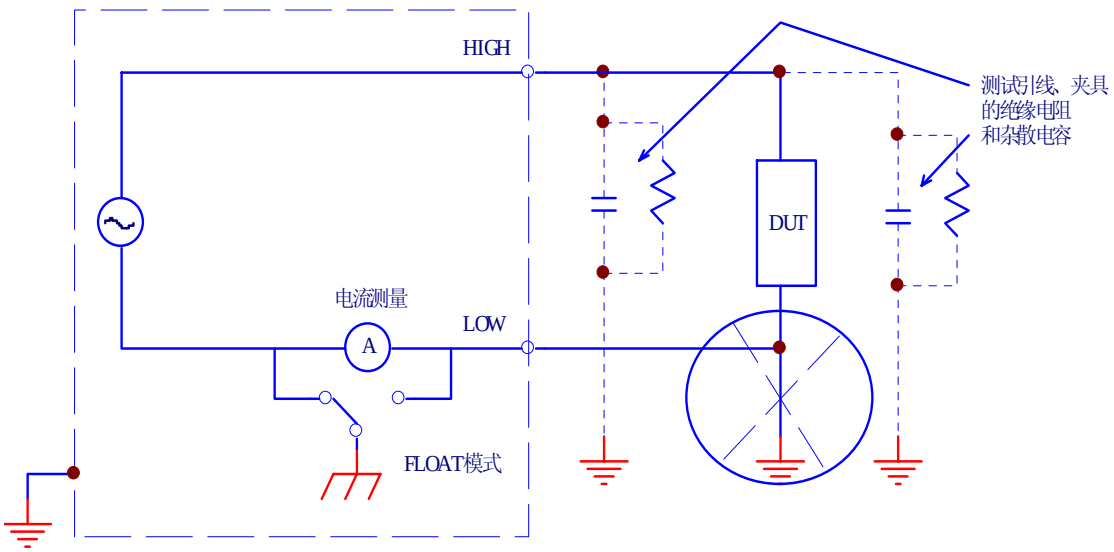


Figure 4-4 Dangerous connection

Select FLOAT only when DUTs such as small electronic components and jigs are completely “floating” electrically.

The FLOAT mode enables high-sensitivity, high accuracy measurements to be made, as it excludes the current by stray capacity and insulation resistance of the test lead wire and jigs.

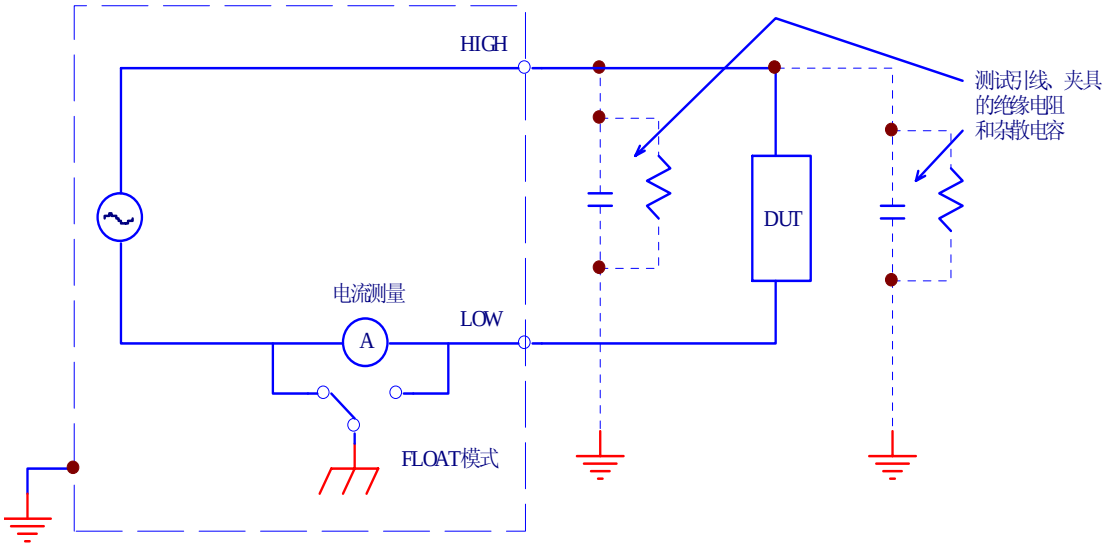
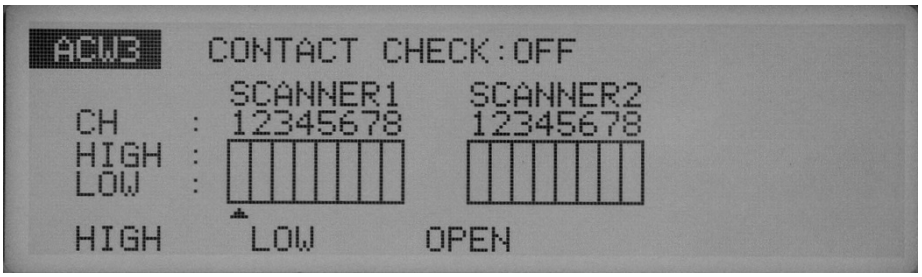


Figure 4-5 FLOAT mode

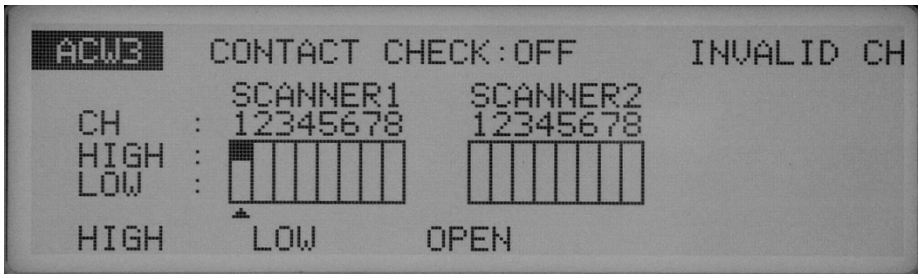
4.4.3 Settings on the ACW3 screen

4.4.3.1 Channel settings for the high-voltage scanner



Make settings with the optional scanner connected.
Each channel can be set to HIGH, LOW, or OPEN.
Use the ◀▶ keys to move the cursor (▲) to a channel, and then use the F1, F2, and F3 keys to make settings.
All channels can be opened using the SHIFT + F1 keys, regardless of the location of the cursor.

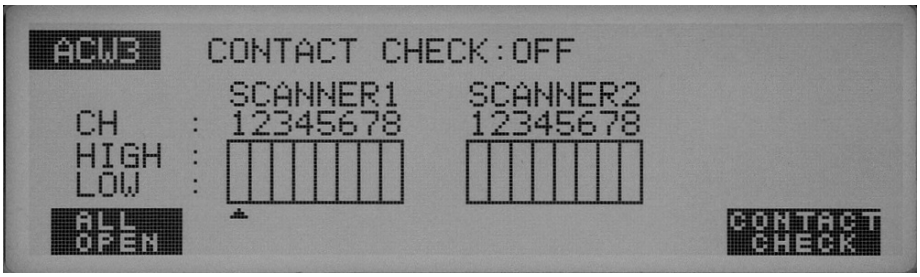
NOTE： If an unconnected channel is selected, “INVALID CH” flashes on the LCD.



⚠ **WARNING**
If the test lead wire is not connected to the DUT, do not leave the test lead wire connected to the scanner’s output terminal.
The TH9121 scanner does not have a contact check function to check connections to the DUT. If the tester is set to the high-voltage (HIGH) level, a test can be started using a channel with the test lead wire not connected to the DUT.

NOTE：
To clearly indicate the relationships between the connected test lead wire and the channel, affix the Channel Display Seal (provided for the scanner) to the test lead wire.

4.4.3.2 Turning the contact check ON/OFF



When the optional high-voltage scanner TH9121 (with a contact check function) is connected to the tester, the continuity between the test lead wire and the DUT can be checked using the HIGH or LOW terminal prior to the application of a test voltage.
To do so, turn on the contact check function.
To turn the contact check function on/off, use the SHIFT + F5 keys.
Each time the SHIFT + F5 keys are pressed, ON and OFF alternate, regardless of the location of the cursor. The cursor moves to CONTACT CHECK.
Press the ACW key to return to the ACW1 screen, and then press the START switch. READY will then disappear from the LCD, and a contact check will start for each channel.
The test starts as soon as the continuity is confirmed, and continues until the test time preset on the timer has elapsed or the STOP switch is pressed.

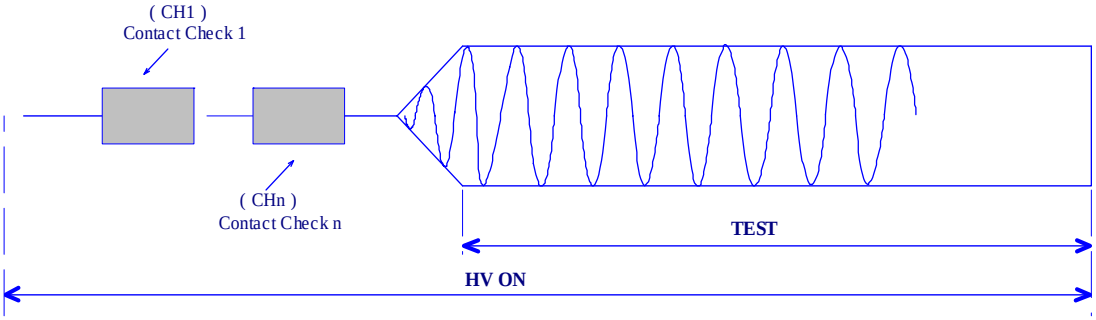
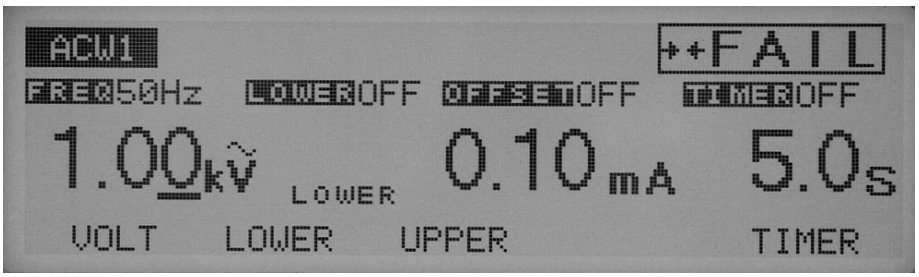


Figure 4-6

The contact check time is calculated using the following formula:
Contact check time = 260 ms + 60 ms x (number of channels set to HIGH or LOW)
When a continuity error is detected in a contact check, "→←FAIL" appears at the top right of the LCD. On the high-voltage scanner, the LED of the failed channel lights up in orange.



4.5 Settings for DC Withstanding Voltage Testing（TH9101/B）

To make settings for a DC withstanding voltage test, use the DC Withstanding Voltage- Test Setting screen (DCW).
To jump to this screen (DCW1), press the DCW key. The LED on the DCW key lights up.
The DC Withstanding Voltage-Test Setting screen has three pages, from DCW1 to DCW3. To move between these pages, press the SHIFT key + keys. To return to DCW1 from DCW2 or DCW3, press the DCW key.

NOTE：
No setting can be made in the KEYLOCK status.

The three DCW pages allow the following settings to be made:
DCW1
• Test voltage
• Lower current (LOWER) and ON/OFF of the lower judgment function
• Upper current (UPPER)
• Test time (TEST TIME) and ON/OFF of the timer function
DCW2
• Start voltage
• Voltage rise time (RISE TIME)
• Judgment wait time (WAIT TIME)
•GND/FLOAT settings for the GND
DCW3
• Channel settings for the high-voltage scanner
• ON/OFF of the contact check function

To move the cursor between items, use the ▼▲◀▶ keys.
When a function is shown on the F1 to F5 keys, they can be used to jump to the target item. To make settings for items displayed on these keys, press the SHIFT key + F1 to F5 keys.

4.5.1 Settings on the DCW1 screen

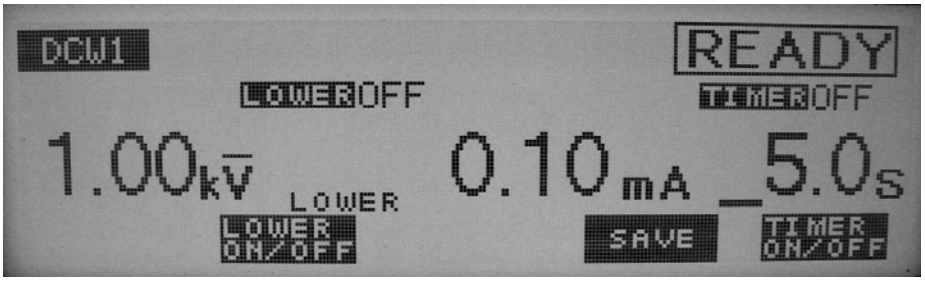
4.5.1.1 Setting the test voltage for DC withstanding voltage testing



The test voltage to be applied to a DUT can be set to DC 0.00 kV through 6.10 kV (at a resolution of 0.01 kV).
To make settings, use the rotary knob with the cursor at the test voltage.
1. To bring the cursor to the test voltage, press the F1 (VOLT) key
2. Using the◀▶ keys, move the cursor to the target digit.
3. Using the rotary knob, set a test voltage.

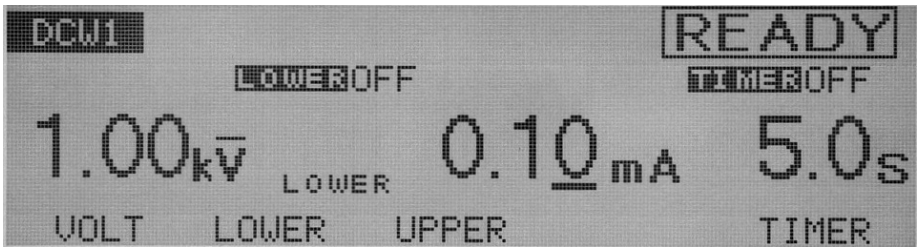
NOTE:
When settings are being made, if the test voltage multiplied by the upper current exceeds 55 W, “READY” disappears and “OVER 55 W” flashes at the top right of the LCD to indicate that testing cannot be performed. In such a case, reduce the test voltage or the upper current.

4.5.1.2 Turning the lower judgment function ON/OFF



The lower judgment function can be turned on/off.
When the lower judgment function is on, the test ends with a FAIL judgment if the measured current drops below the lower current. The lower current is explained in the following section.
The lower judgment function can be set to ON/OFF using the SHIFT + F2 keys, regardless of the location of the cursor. Each time the SHIFT + F2 keys are pressed, ON and OFF alternate.

4.5.1.3 Setting the lower current (LOWER)



The lower current can be set between 0.01 mA and 11.0 mA (at a resolution of 0.01 mA for the 0.01 mA to 9.99 mA range, and 0.1 mA for the 10.0 mA to 11.0 mA range).
When the lower judgment function is set to ON and the measured current is at or below the lower current, the test ends with a FAIL judgment.
If the fluctuation of the leakage current of the DUT is limited and the leakage current is sufficiently high to enable the tester to make a judgment, set the lower current below the smallest fluctuation. Making this setting makes it possible to identify a DUT that contains an

exceptionally small leakage current, and even to detect a disconnection and failed contact in the test lead wire, thus ensuring a high-quality withstanding voltage test. If the lower judgment function is not to be used, turn it off.

If the cursor is at the lower current, the rotary knob can be used to make settings.

1. If the lower current is not displayed, press the F2 key (LOWER) to display it. (When the lower current is displayed, the cursor can be moved using the ◀▶ keys.)
2. Using the ◀▶ keys, move the cursor to the target digit.
3. Using the rotary knob, set the lower current.

NOTE:

1.If the lower current is set at or above the upper current while the lower judgment function is on, “READY” disappears and “UP<=LOW” flashes at the top right of the LCD to indicate that testing cannot be performed (the lower current is factory set to 0.10 mA). Lower the lower current or raise the upper current.

2. No lower judgment is made while the voltage is rising or before the WAIT TIME has elapsed.

4.5.1.4 Setting the upper current (UPPER)



⚠ **CAUTION**:

If the upper current is set to above 5 mA, the protective circuit may be activated. To avoid this, set the output time to 1 minute or less and provide a pause longer than the test time.

The upper current can be set to 0.01 mA through 11.0 mA (at a resolution of 0.01 mA for the 0.01 mA to 9.99 mA range, and 0.1 mA for the 10.0 mA to 11.0 Ma range).

Once a current exceeding the upper current is detected, the test ends with a FAIL judgment.

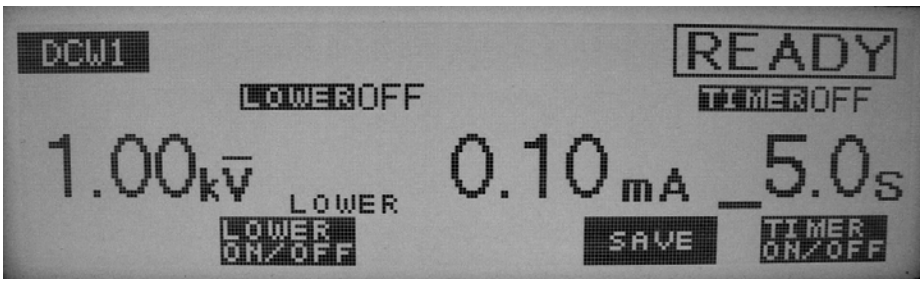
If the cursor is at the upper current, the rotary knob can be used to make settings.

1. If the upper current is not displayed, press the F3 key (UPPER) to display it (while the upper current is displayed, the cursor can be moved using the ◀▶ keys).
2. Using the ◀▶ keys, move the cursor to the target digit.
3. Using the rotary knob, set the upper current.

NOTE：

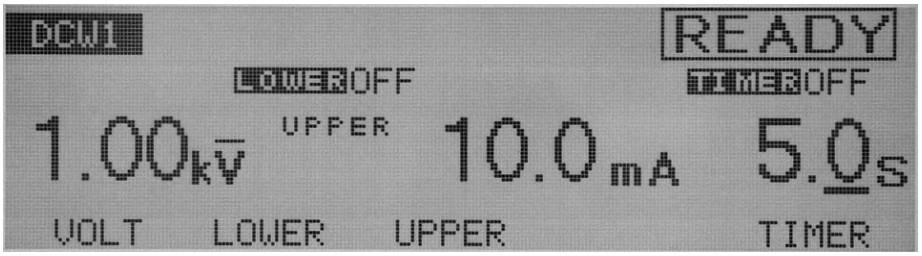
1. With the lower judgment function on, if the upper current is set at or below the lower current, “READY” disappears and “UP<=LOW” flashes at the top right of the LCD to indicate that testing cannot be performed (the lower current is factory set to 0.20 mA). Lower the lower current, raise the upper current, or turn off the lower judgment function.
2. When settings are being made, if the test voltage multiplied by the upper current exceeds 55 W, “READY” disappears and “OVER 55 W” flashes at the top right of the LCD to indicate that testing cannot be performed. In such a case, lower the test voltage or the upper current.

4.5.1.5 Turning the timer ON/OFF



Make ON/OFF settings for the timer function.
When the timer function is turned on, the test time can be controlled, as shown in “Setting the test time” in the next section. When the preset test time has elapsed with a leakage current recorded between the lower and upper currents, the test ends with a PASS judgment.
The timer function can be set to ON/OFF using the SHIFT + F5 keys, regardless of the location of the cursor. Each time the SHIFT + F5 keys are pressed, ON and OFF alternate.

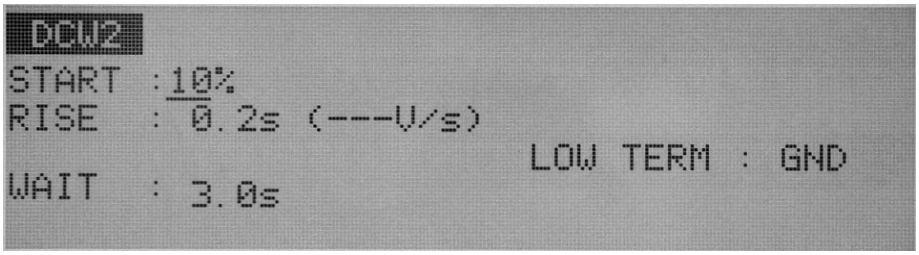
4.5.1.6 Setting the test time (TEST TIME)



The time during which a preset voltage is applied to the DUT can be set to 0.3 s through 999 s (at a resolution of 0.1 s for the 0.3 s to 99.9s range and 1 s for the 100 s to 999s range).
When the cursor is at the timer, the rotary knob can be used to make settings.
1. To move the cursor to the timer, press the F5 key (TIMER). (The ◀▶ keys can also be used.)
2. Using the ◀▶ keys, move the cursor to the target digit.
3. Using the rotary knob, set the test time.

4.5.2 Settings on the DCW2 screen

4.5.2.1 Setting the start voltage



For a DC withstanding voltage test, set the start voltage as a percentage of the test voltage, to 0% through 99% (at a resolution of 1%). When the cursor is located to the right of START, settings can be made using the rotary knob.

1. Using the ▼▲◀▶ keys to move the cursor to the right of START,
2. Using the rotary knob, set the start voltage.

NOTE:

When the start voltage is set to 1% or more, approximately 100 ms is required for the tester to reach the start voltage from 0 V.

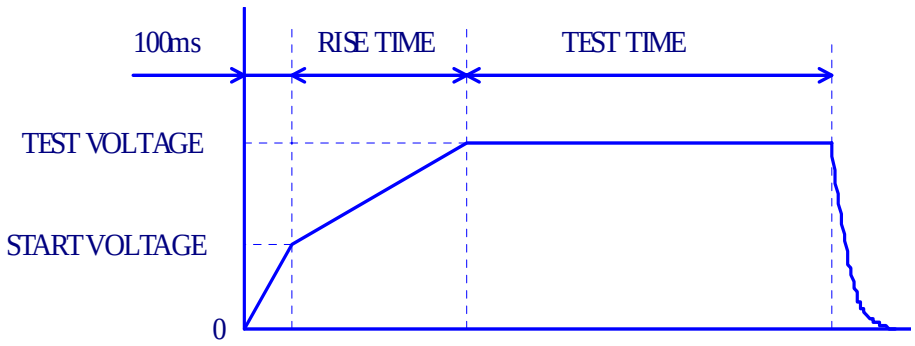
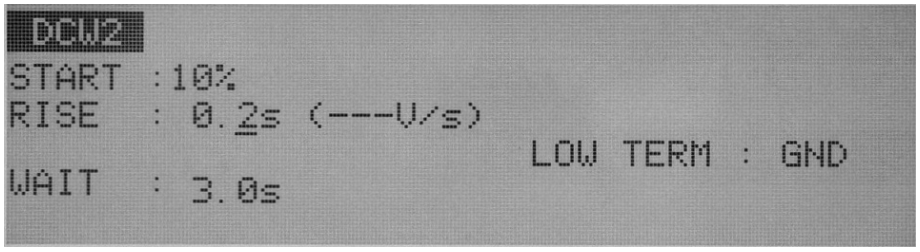


Figure 4-7 start voltage（DCW）

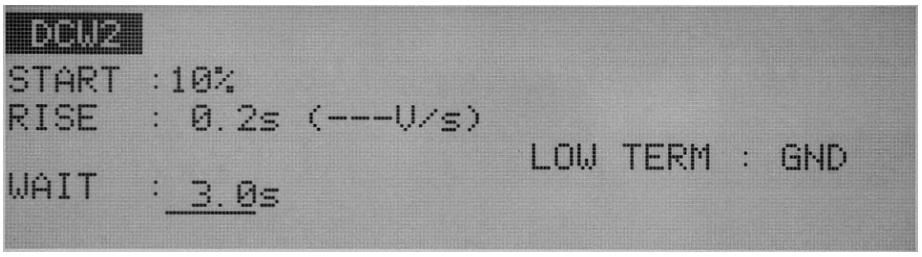
4.5.2.2 Setting the voltage rise time (RISE TIME)



The rise time between the start voltage and the test voltage can be set to 0.1 s through 200 s (at a resolution of 0.1 s for the 0.1 s to 99.9s range and 1 s for the 100 s to 200s range).

When the cursor is to the right of RISE, settings can be made using the rotary knob.
1. Using the ▼▲◀▶ keys, move the cursor to the target digit.
2. Using the rotary knob, set the rise time. The figure (V/s) in parentheses represents the voltage increase per second calculated for reference using the preset value.
If the value cannot be displayed in three digits, "---"is displayed instead.

4.5.2.3 Setting the WAIT TIME



In DC withstanding voltage testing, if a test voltage is applied to a DUT that contains capacitive Elements, a large charge current may flow until charging is completed. TO avoid upper fail judgment by the charge current, a wait time must be provided from the starts of START VOLTAGE, and upper fail judgment will be ignored during wait time.

Set the wait time to 0.3 s through 10.0 s (at a resolution of 0.1 s).
When the cursor is located to the right of WAIT, the rotary knob can be used to make settings.
1. Using the ▼▲◀▶ keys to move the cursor to the right of WAIT.
2. Using the rotary knob, set the wait time.

NOTE

With the timer ON, if the wait time thus set exceeds the sum of the voltage rise time and the test time, "OVER WAIT" flashes on the LCD to indicate that testing cannot be preformed

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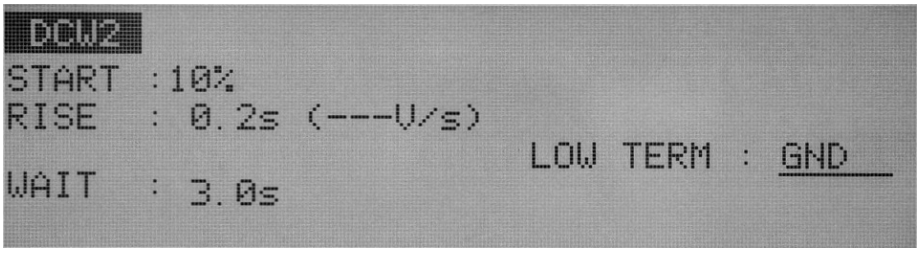
4.5.2.4 Setting GND/FLOAT for the LOWTERM

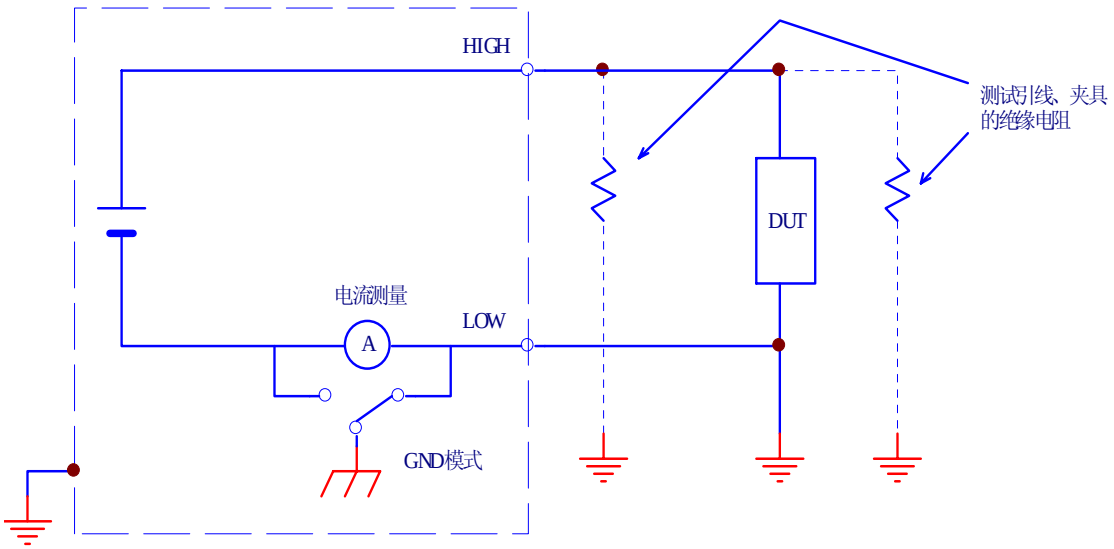


You can select either of the following two measurement modes;
The **GND** mode that the LOWTERM is connected to the tester's LOW terminal,
The **FLOAT** mode that the LOWTERM is used as guard.

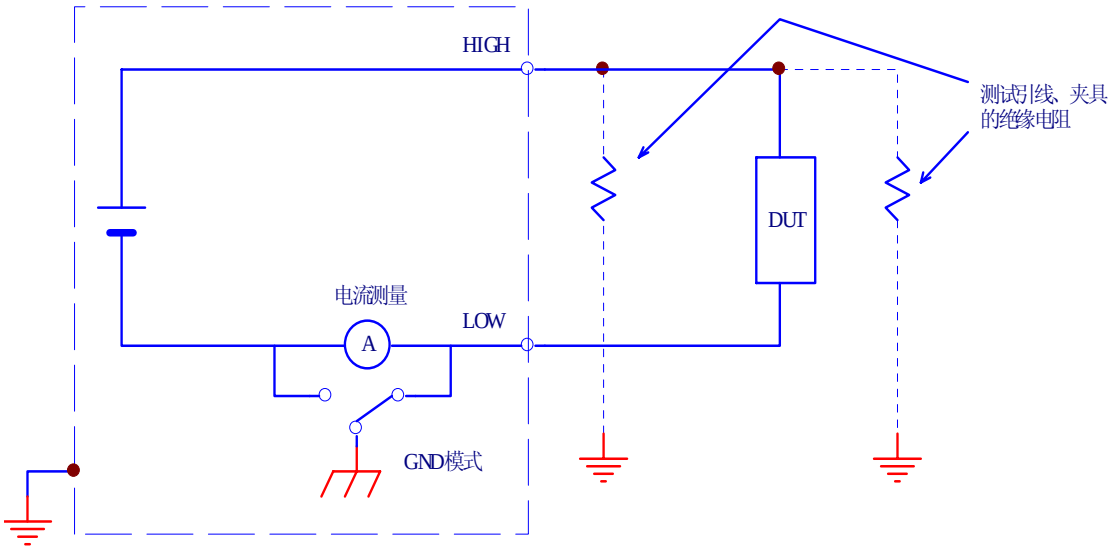
In both modes, the tester detects the current flowing into the LOW terminal from the HIGH VOLTAGE terminal via the DUT.
In the GND mode, the LOW terminal is connected to the chassis. This leads to the problem that the stray capacity and insulation resistance existing between the test lead wire or jigs and the earth are included in the measurement. Nonetheless, the GND mode ensures safe testing, as it does not short-circuit the ammeter.
In the FLOAT mode, on the other hand, only the current flowing into the LOW terminal from the HIGH VOLTAGE terminal via the DUT is measured, and the influence of the stray capacity and insulation resistance existing between the test lead wire or jigs and the earth is eliminated. For this reason, the FLOAT mode is effective in measurements that require high sensitivity and high accuracy. At the same time, however, the ammeter can be short-circuited, posing a grave danger if the LOW terminal and the chassis are short-circuited when part of the DUT is connected to an earth ground. If it is possible that the DUTs and jigs are grounded, select the GND mode.
Using the ▼▲◀▶ keys, move the cursor to the right of GND; settings can then be made using the rotary knob.
Turn the rotary knob clockwise: FLOAT
Turn the rotary knob counterclockwise: GND
When GND is selected, the LED to the left of the LOW terminal lights up.

■ GND

In the GND mode, the current which flows through the LOW terminal by stray capacity and insulation resistance of the test lead wire and jigs is included in measurements. However, the ammeter is protected from short-circuiting, thereby ensuring safe testing regardless of whether the DUT is grounded. For this reason, it is recommended that GND be set in ordinary tests.



(A) GND模式，被测件接地



(B) GND模式，被测件不接地

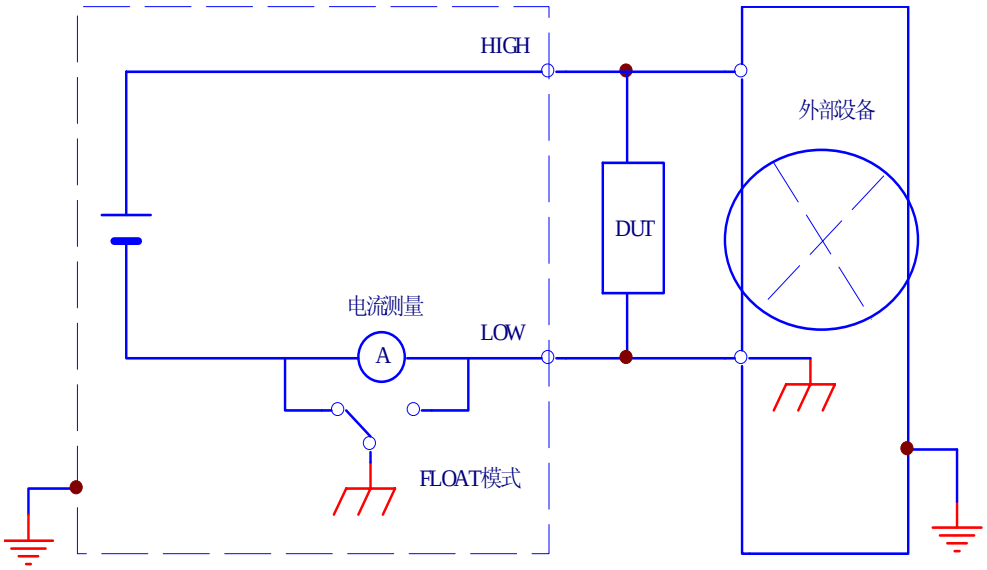
Figure 4-8 GND mode

■ FLOAT

⚠ WARNING:

If it is not known whether the DUT or jig is grounded, never select FLOAT. If FLOAT is selected while the DUT is grounded, the ammeter will be short-circuited, thereby disabling measurement and posing a grave danger.

If FLOAT is selected, do not connect this tester to any measuring instruments or other devices that involve single-side grounding. Otherwise, the ammeter will be short-circuited.



(A) 和外部设备的连接

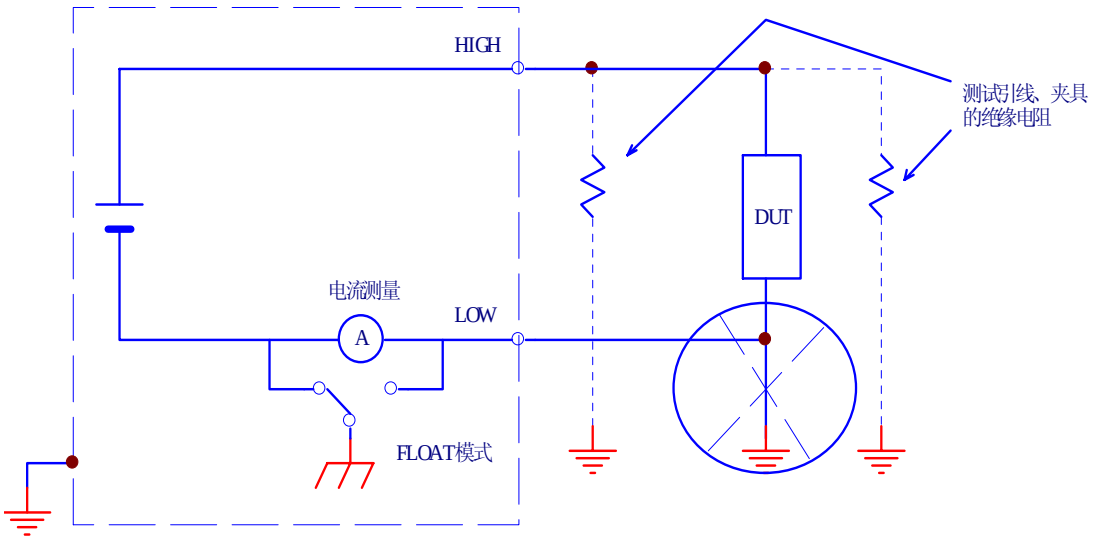


Figure 4-9 Dangerous connection

Select FLOAT only when DUTs such as small electronic components and jigs are completely “floating” electrically.

The FLOAT mode enables high-sensitivity, high accuracy measurements to be made, as it excludes the current by stray capacity and insulation resistance of the test lead wire and jigs.

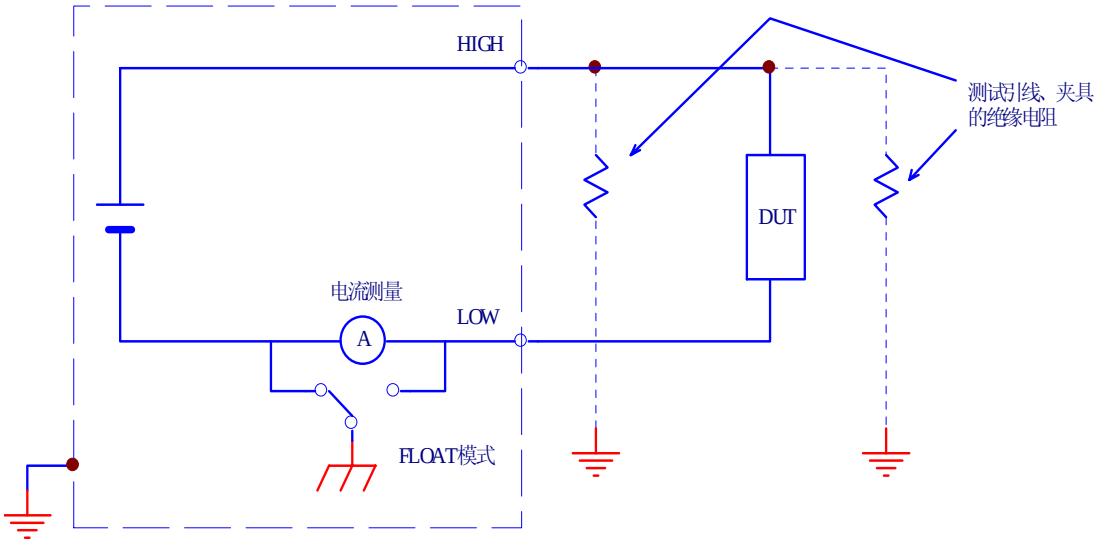
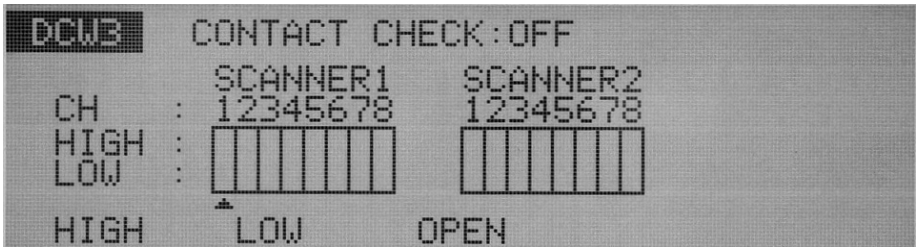


Figure 4-10 FLOAT mode

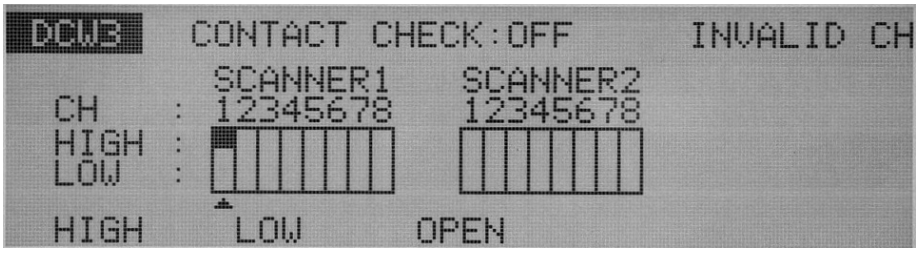
4.5.3 Settings on the DCW3 screen

4.5.3.1 Channel settings for the high-voltage scanner



Make settings with the optional scanner connected.
Each channel can be set to HIGH, LOW, or OPEN.
Use the ◀▶ keys to move the cursor (▲) to a channel, and then use the F1, F2, and F3 keys to make settings.
All channels can be opened using the SHIFT + F1 keys, regardless of the location of the cursor.

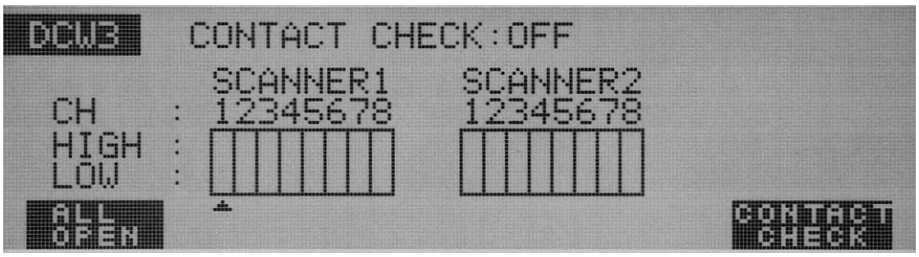
NOTE:
If an unconnected channel is selected, “INVALID CH” flashes on the LCD.



⚠ **WARNING**
If the test lead wire is not connected to the DUT, do not leave the test lead wire connected to the scanner’s output terminal.
The TH9121 scanner does not have a contact check function to check connections to the DUT. If the tester is set to the high-voltage (HIGH) level, a test can be started using a channel with the test lead wire not connected to the DUT.

NOTE:
To clearly indicate the relationships between the connected test lead wire and the channel, affix the Channel Display Seal (provided for the scanner) to the test lead wire.

4.4.5.2 Turning the contact check ON/OFF



When the optional high-voltage scanner TH9121 (with a contact check function) is connected to the tester, the continuity between the test lead wire and the DUT can be checked using the HIGH or LOW terminal prior to the application of a test voltage.
To do so, turn on the contact check function.
To turn the contact check function on/off, use the SHIFT + F5 keys.
Each time the SHIFT + F5 keys are pressed, ON and OFF alternate, regardless of the location of the cursor. The cursor moves to CONTACT CHECK.
Press the ACW key to return to the ACW1 screen, and then press the START switch. READY will then disappear from the LCD, and a contact check will start for each channel.
The test starts as soon as the continuity is confirmed, and continues until the test time preset on the timer has elapsed or the STOP switch is pressed.

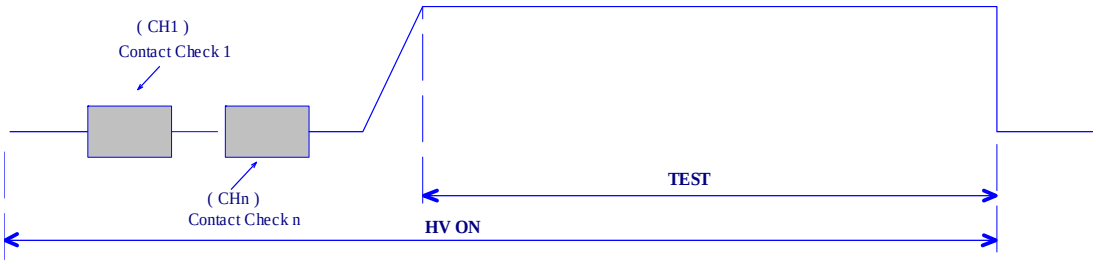
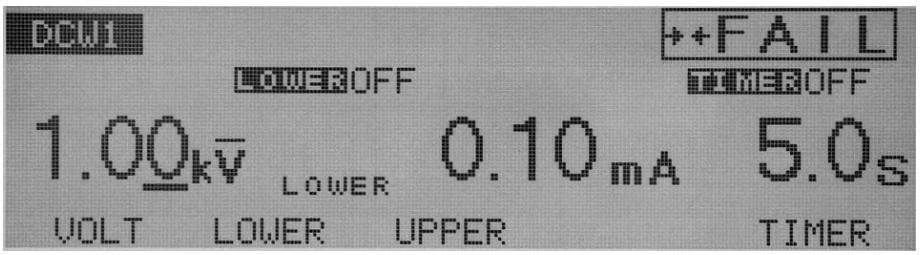


Figure 4-11 Contact Check

The contact check time is calculated using the following formula:
Contact check time = 260 ms + 60 ms x (number of channels set to HIGH or LOW)
When a continuity error is detected in a contact check, "→←FAIL" appears at the top right of the LCD. On the high-voltage scanner, the LED of the failed channel lights up in orange.



4.6 Settings for Insulation Resistance Testing

To make settings for an insulation resistance test, use the Insulation Resistance-Test Setting screen (IR).
To jump to this screen, press the IR key. The LED on the IR key will then light up.
The Insulation Resistance-Test Setting screen has three pages from IR1 to IR3.
To move between these pages, press the SHIFT key + ◀▶keys. To return to IR1 from IR2 or IR3, press the IR key.

NOTE:
No setting can be made in the KEYLOCK status.

The three IR pages allow the following settings to be made:

IR1

• Test voltage
• Lower resistance (LOWER) and ON/OFF of the lower judgment function
• Upper resistance (UPPER) and ON/OFF of the upper judgment function
• Test time (TEST TIME) and ON/OFF of the timer function

IR2

• Voltage rise time (RISE TIME)
• Judgment wait time (WAIT TIME)
• GND/FLOAT settings

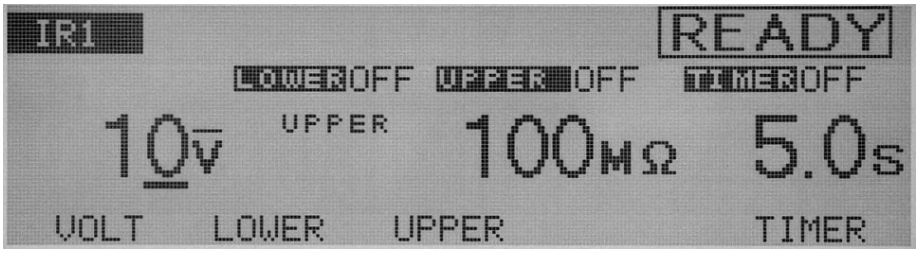
IR3

• Channel settings for the high-voltage scanner
• ON/OFF of the contact check function

To move the cursor between items, use the ▼▲◀▶ keys.
When a function is shown on the F1 to F5 keys, they can be used to jump to the target item. To conduct the operations displayed on these keys, press the SHIFT key + the F1 to F5 keys.

4.6.1 Settings on the IR1 screen

4.6.1.1 Setting the insulation resistance test voltage

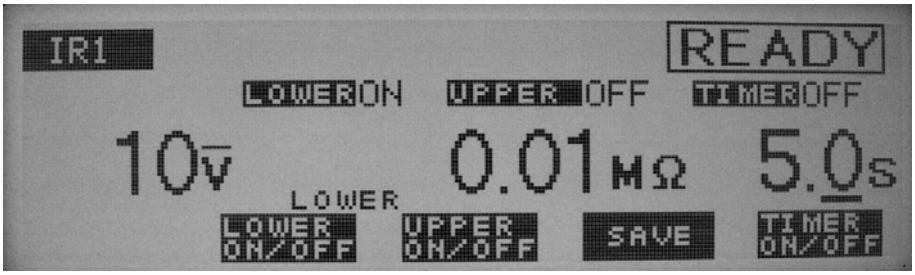


The test voltage to be applied to a DUT can be set to DC –10 V through –1020 V (at a resolution of 1 V). (The negative (-) mark is not displayed.)
To make setting, use the rotary knob with the cursor at the test voltage.

1. To move the cursor to the test voltage, press the F1 key (VOLT). (The ◀▶ keys can also be used.)
2. Using the ◀▶ keys, move the cursor to the target digit.
3. Using the rotary knob, set the test voltage.

NOTE：
With the lower judgment function on, if the test voltage divided by the lower resistance exceeds 1.1 mA, “READY” disappears and “OVER 1.1 mA” flashes at the top right of the LCD to indicate that testing cannot be performed. In such a case, lower the test voltage or raise the lower resistance.

4.6.1.2 Turning the lower judgment function ON/OFF

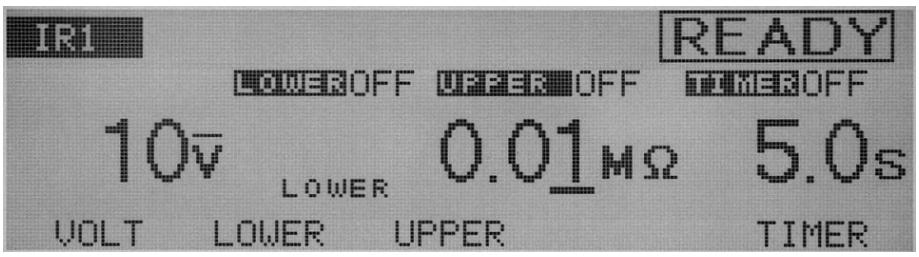


The lower judgment function can be turned on/off.
When the lower judgment function is on, the test ends with a FAIL judgment if the measured insulation resistance drops below the lower resistance. The lower resistance is explained in the following section.

The lower judgment function can be set to ON/OFF using the SHIFT + F2 keys, regardless of the location of the cursor. Each time the SHIFT + F2 keys are pressed,
ON and OFF alternate.

⚠ **CAUTION**：
If the lower and upper judgment function is off, no FAIL judgment is made for that function. Note that a PASS judgment is made when the timer is turned on.

4.6.1. 3 Setting the lower resistance (LOWER)

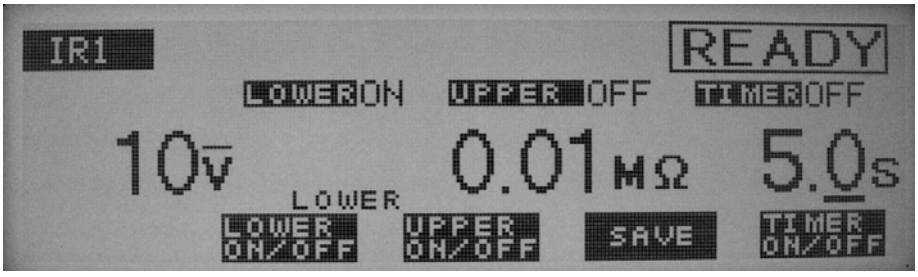


The lower resistance can be set to 0.01 M through 9.99 G (at a resolution of 0.01M for the 0.01-9.99 M range, 0.1 M for the 10.0 M to 99.9 M range, 1 M for the 100 M to 999 M range, and 0.01 G for the 1.00 G to 9.99 G range), but below the maximum rated current. When a resistance value at or below the lower resistance is detected following a wait time, the test ends with a FAIL judgment.

When the cursor is at the lower resistance, the rotary knob can be used to make settings.
1. To display the lower resistance, press the F2 key (LOWER) . (When the lower resistance is displayed, the cursor can be moved using the ◀▶ keys.)
2. Using the ◀▶ keys, move the cursor to the target digit.
3. Using the rotary knob, set the lower resistance.

NOTE:
With both the upper and lower judgment functions on, if the lower resistance is set at or above the upper resistance, “READY” disappears and “UP<=LOW” flashes at the top right of the LCD to indicate that testing cannot be performed. (The lower resistance is factory-set to 1.00 M). Reduce the lower resistance or raise the upper resistance.

4.6.1.4 Turning the upper judgment function ON/OFF

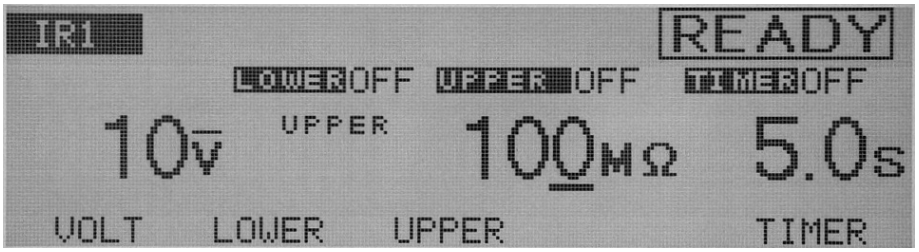


The upper judgment function can be turned on/off.
When the upper judgment function is on, the test ends with a FAIL judgment if the measured resistance exceeds the upper resistance.

The upper resistance is explained in the following section. The upper judgment function can be set to ON/OFF using the SHIFT + F3 keys, regardless of the location of the cursor. Each time the SHIFT + F3 keys are pressed, ON and OFF alternate.

⚠ **CAUTION**:
If the lower and upper judgment functions are off, no FAIL judgment is made. Note that, when the timer is turned on with both functions off, a PASS judgment is made.

4.6.1.5 Setting the upper resistance (UPPER)



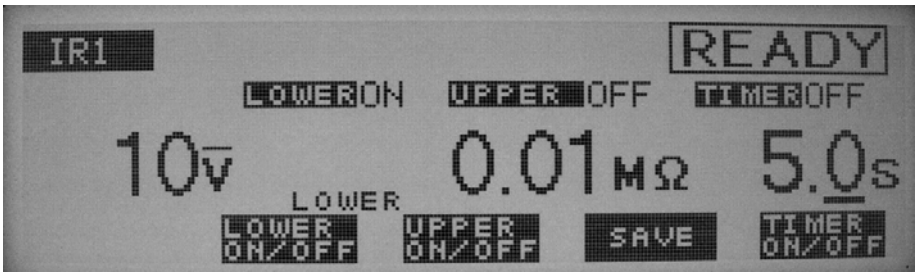
The upper resistance can be set to 0.01 MΩ through 9.99 GΩ (at a resolution of 0.01 MΩ for the 0.01~9.99 MΩ range, 0.1MΩ for the 10.0 MΩ to 99.9 MΩ range, 1MΩ for the 100MΩ to 999MΩ range, and 0.01GΩ for the 1.00GΩ to 99.9GΩ range), but below the maximum rated current.

When the cursor is at the upper resistance, the rotary knob can be used to make settings.
1. To display the upper resistance, press the F3 key UPPER) . (When the upper resistance is displayed, the cursor can be moved using the ◀▶ keys.)
2. Using the ◀▶ keys, move the cursor to the target digit.
3. Using the rotary knob, set the upper resistance.

NOTE:

1. With both the upper and lower judgment functions on, if the upper resistance is set at or below the lower resistance, “READY” disappears and “UP<=LOW” flashes at the top right of the LCD to indicate that testing cannot be performed. (The lower resistance is factory-set to 100 M). Raise the upper resistance or reduce the lower resistance, or turn off the lower judgment function.
2. With the upper judgment function on, if settings are made so that test voltage divided by the upper resistance exceeds 1.1mA, “READY” disappears and “OVER 1.1mA” flashes at the top right of the LCD to indicate that testing cannot be performed. In such a case, lower the test voltage or raise the upper resistance.

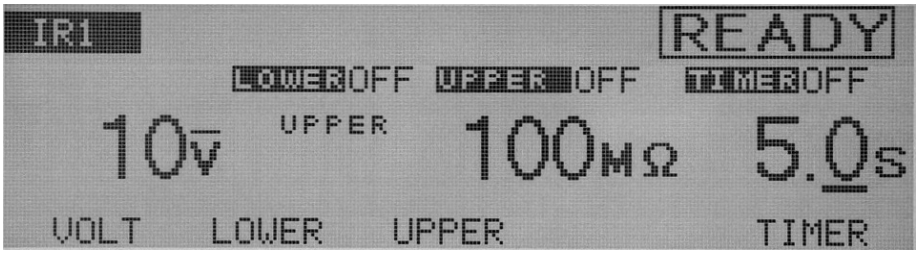
4.6.1.6 Turning the timer ON/OFF



Make ON/OFF settings for the timer function.
When the timer function is turned on, the test time can be controlled as specified in “Setting the test time” in the next section. When the preset test time has elapsed

with the resistance recorded between the lower and upper resistances, the test ends with a PASS judgment.
The timer function can be set to ON/OFF using the SHIFT + F5 keys, regardless of the location of the cursor. Each time the SHIFT + F5 keys are pressed, ON and OFF alternate.

4.6.1.7 Setting the test time (TEST TIME)

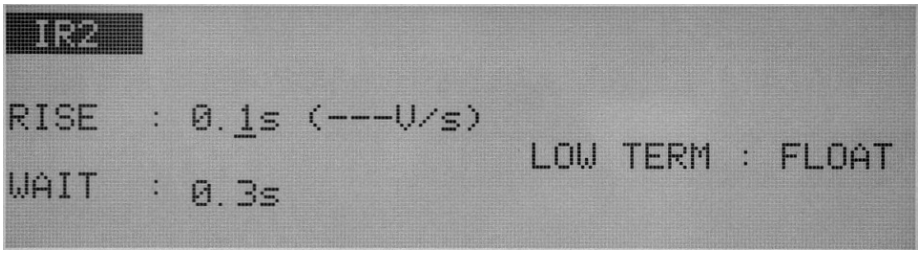


The time during which a preset voltage is applied to the DUT can be set to between 0.5 s and 999 s (at a resolution of 0.1 s for the 0.5 s to 99.9 s range and 1 s for the 100 s to 999 s range).

When the cursor is at TIMER, the rotary knob can be used to make settings.
1. To move the cursor to TIMER, press the F5 key (TIMER). (The ◀▶ keys can also be used.)
2. Using the ◀▶ keys, move the cursor to the target digit.
3. Using the rotary knob, set the test time.

4.6.2 Settings on the IR2 screen

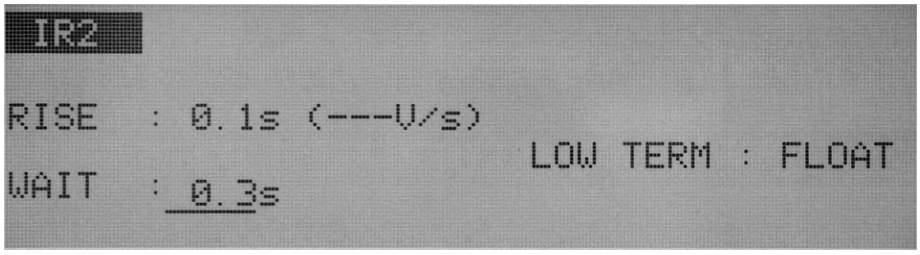
4.6.2.1 Setting the voltage rise time (RISE TIME)



The rise time between the start voltage and the test voltage can be set to 0.1 s through 200 s (at a resolution of 0.1 s for the 0.1 s to 99.9 s range and 1 s for the 100 s to 200 s range).

When the cursor is to the right of RISE, settings can be made using the rotary knob.
1. Using the ▼▲◀▶keys, move the cursor to the target digit.
2. Using the rotary knob, set the rise time.
The figure (V/s) in parentheses represents the voltage increase per second calculated for reference using the set value.
If the value cannot be displayed in three digits, “---” is displayed instead.

4.6.2.2 Setting the WAIT TIME

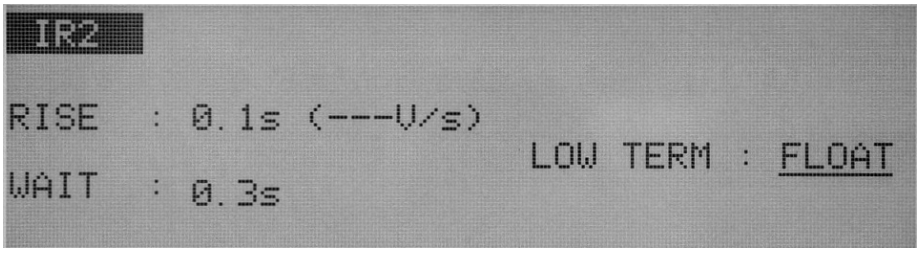


In DC insulation resistance testing, if a test voltage is applied to a DUT that contains capacitive elements, the measured insulation resistance will be below the optimal value due to a charge current, until charging is completed. To avoid upper fail judgment by the charge current, a wait time must be provided from the starts of START VOLTAGE, and upper fail judgment will be ignored during wait time.

Set the wait time to 0.3 s through 10 s (at a resolution of 0.1 s).
When the cursor is located to the right of WAIT, the rotary knob can be used to make settings.
1. Using the ▼▲◀▶keys, move the cursor to the right of WAIT
2. Using the rotary knob, set the wait time.

NOTE：
With the timer ON, if the wait time thus set exceeds the sum of the voltage rise time and the test time, “OVER WAIT” flashes on the LCD to indicate that testing cannot be performed.

4.6.2.3 Setting GND/FLOAT for the LOWTERM



You can select either of the following two measurement modes;
The **GND** mode that the LOWTERM is connected to the tester’s LOW terminal,
The **FLOAT** mode that the LOWTERM is used as guard.

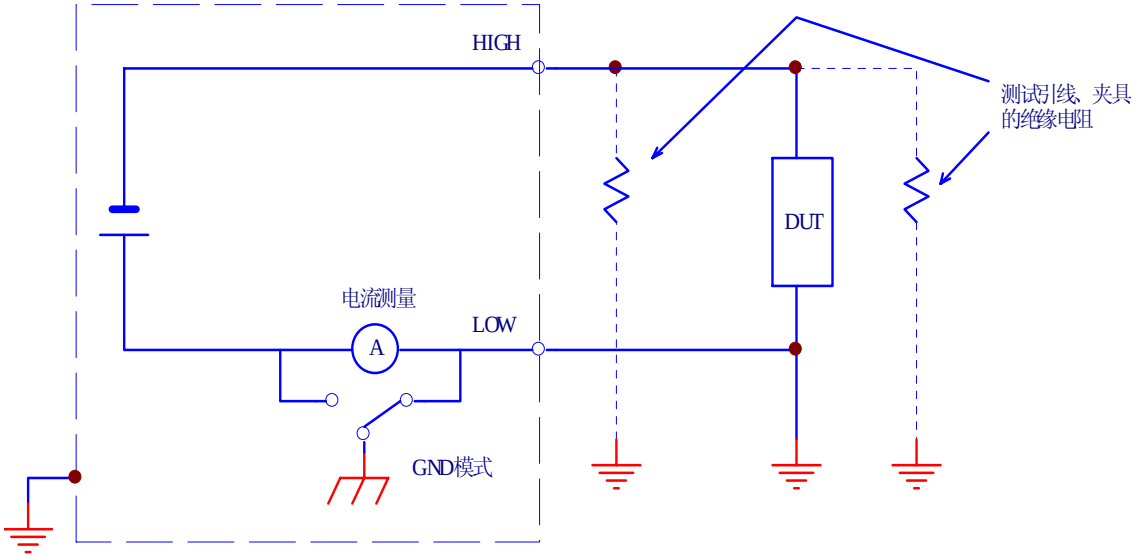
In both modes, the tester detects the current flowing into the LOW terminal from the HIGH VOLTAGE terminal via the DUT.
In the GND mode, the LOW terminal is connected to the chassis. This leads to the problem that the stray capacity and insulation resistance existing between the test lead wire or jigs and the earth are included in the measurement. Nonetheless, the GND mode ensures safe testing,

as it does not short-circuit the ammeter.
In the FLOAT mode, on the other hand, only the current flowing into the LOW terminal from the HIGH VOLTAGE terminal via the DUT is measured, and the influence of the stray capacity and insulation resistance existing between the test lead wire or jigs and the earth is eliminated. For this reason, the FLOAT mode is effective in measurements that require high sensitivity and high accuracy. At the same time, however, the ammeter can be short-circuited, posing a grave danger if the LOW terminal and the chassis are short-circuited when part of the DUT is connected to an earth ground. If it is possible that the DUTs and jigs are grounded, select the GND mode.

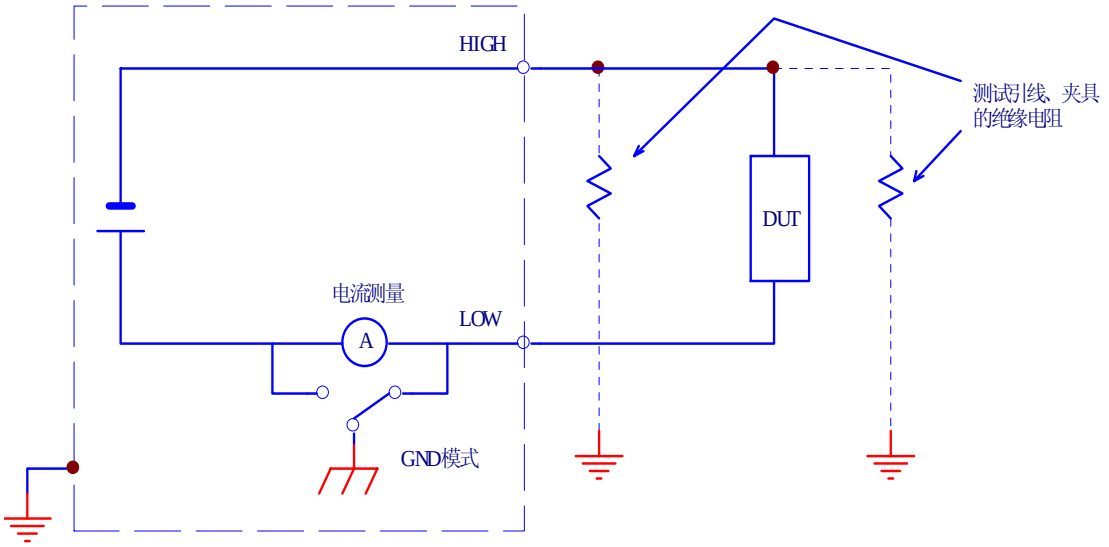
Using the ▼▲◀▶ keys, move the cursor to the right of GND; settings can then be made using the rotary knob.
Turn the rotary knob clockwise: FLOAT
Turn the rotary knob counterclockwise: GND
When GND is selected, the LED to the left of the LOW terminal lights up.

■ GND

In the GND mode, the current which flows through the LOW terminal by stray capacity and insulation resistance of the test lead wire and jigs is included in measurements. However, the ammeter is protected from short-circuiting, thereby ensuring safe testing regardless of whether the DUT is grounded. For this reason, it is recommended that GND be set in ordinary tests.



(A) GND模式，被测件接地



(B) GND模式，被测件不接地

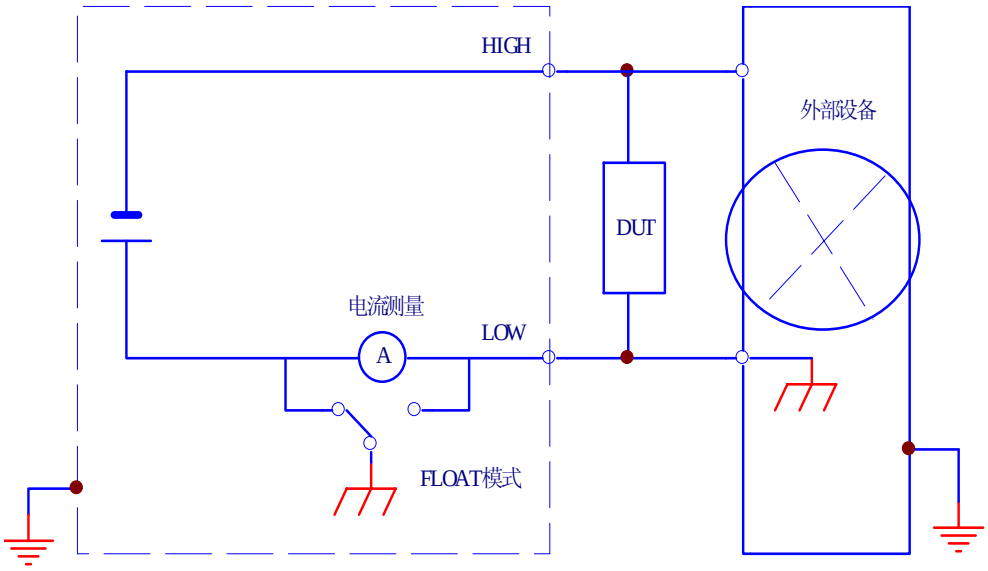
Figure 4-12 GND mode

■ FLOAT

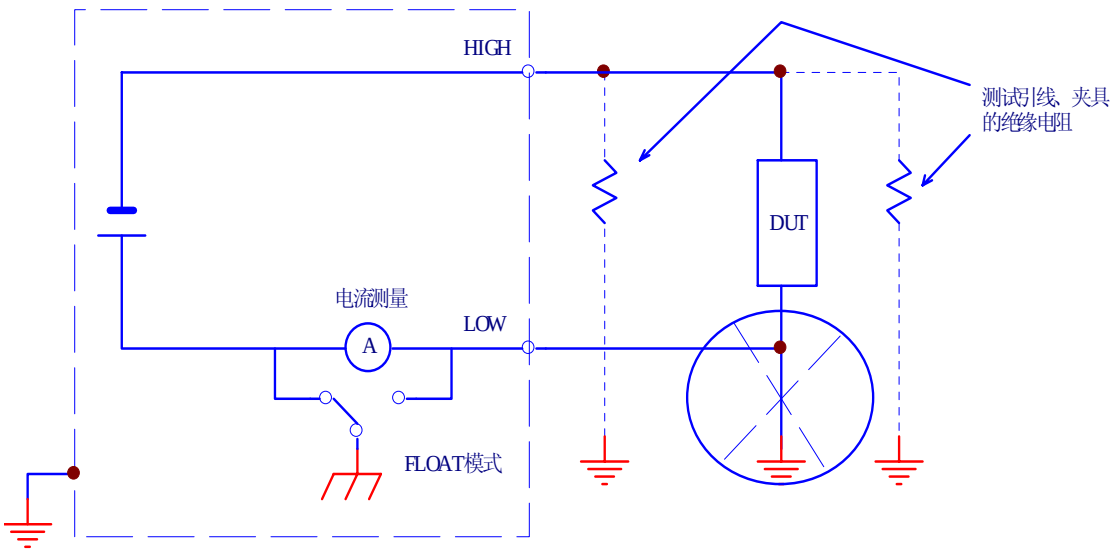
⚠ **WARNING:**

If it is not known whether the DUT or jig is grounded, never select FLOAT. If FLOAT is selected while the DUT is grounded, the ammeter will be short-circuited, thereby disabling measurement and posing a grave danger.

If FLOAT is selected, do not connect this tester to any measuring instruments or other devices that involve single-side grounding. Otherwise, the ammeter will be short-circuited.



(A) 和外部设备的连接



(B) 被测件接地而又选择FLOAT模式

Figure 4-13 Dangerous connection

Select FLOAT only when DUTs such as small electronic components and jigs are completely “floating” electrically.

The FLOAT mode enables high-sensitivity, high accuracy measurements to be made, as it excludes the current by stray capacity and insulation resistance of the test lead wire and jigs

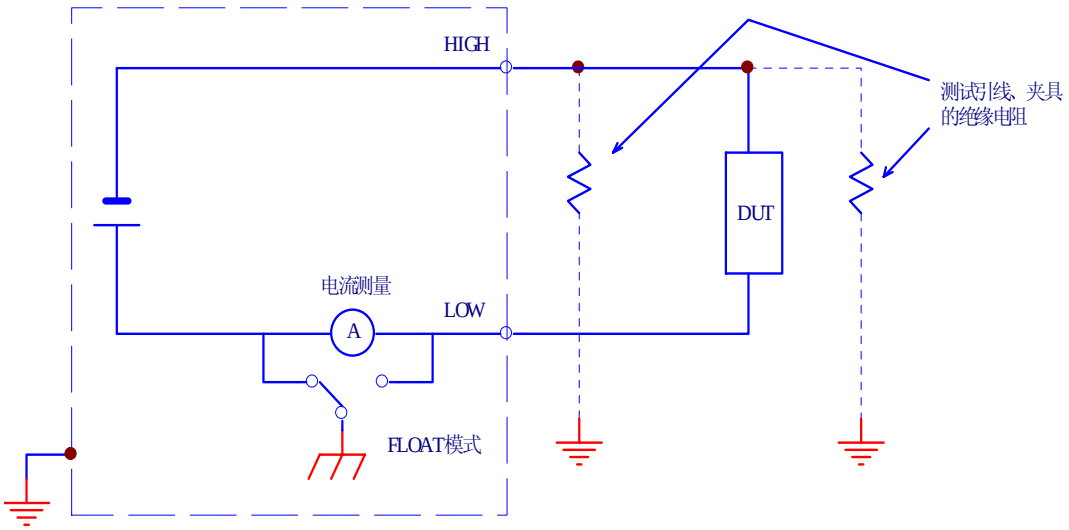
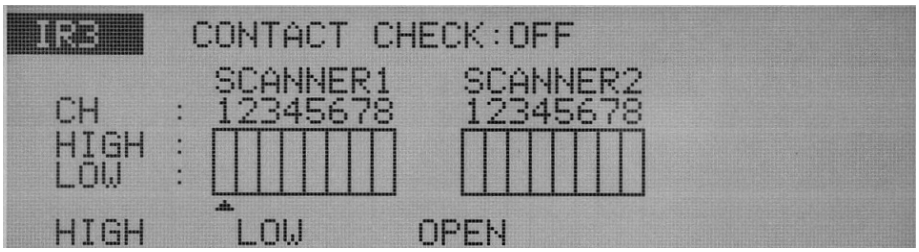


Figure 4-14 FLOAT mode

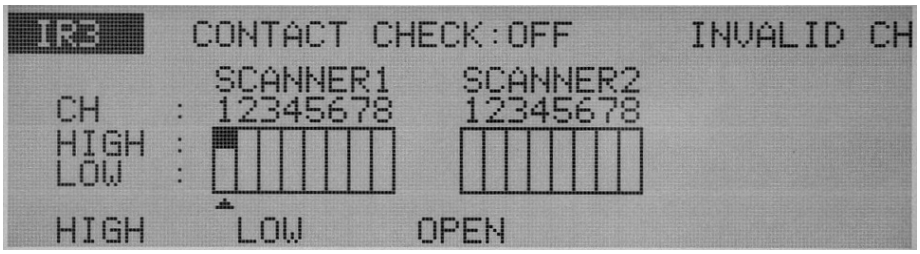
4.6.3 Settings on the IR3 screen

4.6.3.1 Channel settings for the high-voltage scanner



Make settings when the optional scanner is connected.
Each channel can be set to HIGH, LOW, or OPEN.
Use the ◀▶ keys to move the cursor (▲) to a channel, and use the F1, F2 and F3 keys to make settings.
Using the SHIFT + F1 keys, all channels can be opened regardless of the location of the cursor.

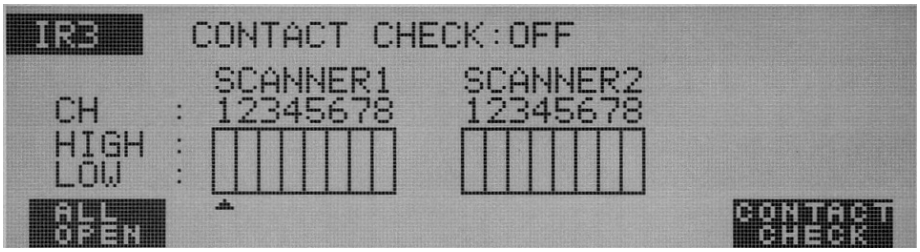
NOTE:
If an unconnected channel is selected, “INVALID CH” flashes on the LCD.



⚠ **WARNING**:
If the test lead wire is not connected to the DUT, do not leave the wire connected to the output terminal on the scanner.
The TH9121 scanner does not have a contact check function to detect connection to the DUT. If the tester is set to the high-voltage (HIGH) level, a test can be started using a channel with the test lead wire not connected to the DUT.

NOTE:
To clearly indicate the relationships between the connected test lead wire and the channel, affix the Channel Display Seal (provided for the scanner) to the test lead wire.

4.6.3.2 Turning the contact check ON/OFF



When the optional high-voltage scanner TH9121 (with the contact check function) is connected to the tester, the continuity between the test lead wire and the DUT with the HIGH or LOW terminal can be checked prior to the application of a test voltage. To do so, turn on the contact check function.

Use the SHIFT + F5 keys to turn the contact check function on/off.

Each time the SHIFT + F5 keys are pressed, ON and OFF alternate, regardless of the location of the cursor.

Press the IR key to return to the IR1 screen, and then press the START switch. READY then disappears on the LCD, and a contact check starts for each channel. The test starts as soon as the continuity is confirmed, and continues until the test time preset on the timer has elapsed or the STOP switch is pressed.

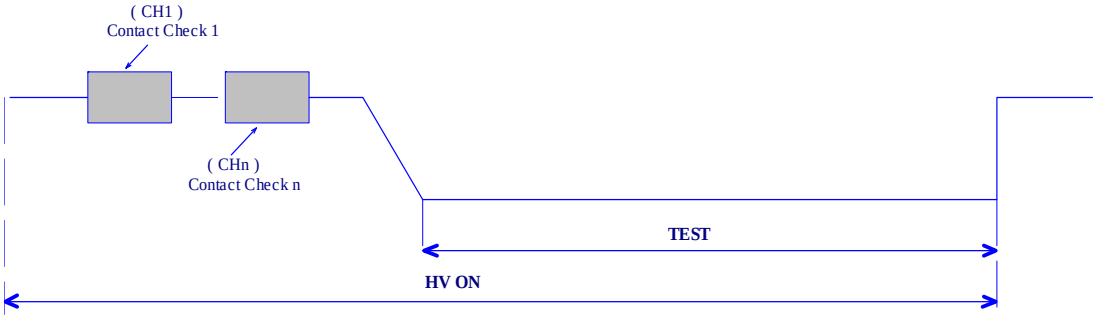
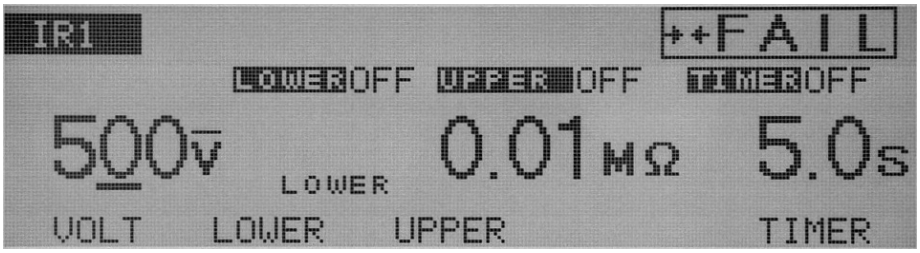


Figure 4-15 Contact check

The contact check time is calculated using the following formula: Contact check time = 260 ms + 60 ms x (number of channels set to HIGH or LOW) When a continuity error is detected in a contact check, " →← FAIL" appears at the top right of the LCD. On the high-voltage scanner, the LED of the failed channel lights up in orange.



4.7Connecting the Test Lead wire

⚠ **WARNING:**
It is extremely dangerous to connect the test lead wire incorrectly, as the DUT may be charged to an excessively high voltage. Be sure to make connections securely.

4.7.1 Connecting the test lead wire to the tester

4.7.1.1 Connecting the low-voltage test leadwire

1. Check for a disconnection in the test leadwire.
2. Connect the low-voltage test leadwire to the tester's LOW terminal.

4.7.1.2 Connecting the high-voltage test leadwire

After connecting the low-voltage test leadwire, follow the procedure specified below.

1. Press the STOP switch.
2. Confirm that the analog voltmeter indicates "0."
3. Confirm that the DANGER lamp is off.
4. Connect the high-voltage test leadwire to the HIGH VOLTAGE terminal.
5. Short-circuit the low-voltage and high-voltage test leadwires, and confirm that no high voltage is output.

4.7.2 Connecting a DUT

After connecting the low-voltage and high-voltage test leadwires, connect a DUT by following the procedure specified below:

1. Press the STOP switch.
2. Confirm that the analog voltmeter indicates "0."
3. Confirm that the DANGER lamp is off.
4. Short-circuit the low-voltage and high-voltage test leadwires, and confirm that no high voltage is applied.
5. Connect the low-voltage test leadwire to the DUT.
6. Connect the high-voltage test leadwire to the DUT.

⚠**WARNING:**
During the test (the TEST lamp or DANGER lamp is lit), never touch the HIGH VOLTAGE terminal, test leadwire, or DUT.

■ Reducing the effects of noise

If a short circuit or breakdown occur, noise generated can lead to the malfunctioning of peripheral electronic components. To reduce the effects of noise, install a toroidal

core or a resistor of approximately 470 Ω between the DUT and the end of the highvoltage test leadwire from the tester, and between the DUT and the end of the lowvoltage test leadwire, as close as possible to the DUT. See Fig. 4-17.

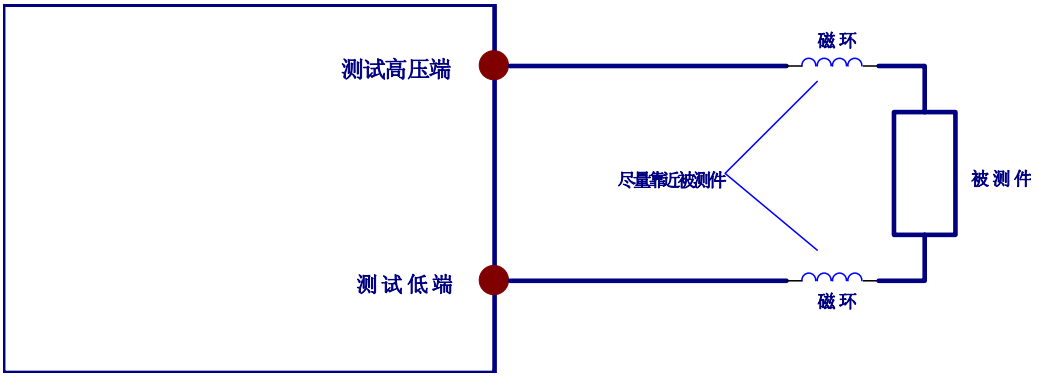


Figure 4-17 Reducing the effects of noise

4.8 Starting and Ending a Test

NOTE：
The test cannot be started with invalid settings or in the protection status. For information on invalid settings and the protection status.

4.8.1 Starting a test

To start a test, press the START switch when the tester is in the READY status on the Test-Condition Settings screen. When the tester is in the READY status, “READY” lights up at the top right of the LCD.

Example of an AC withstanding voltage test (READY)





The time is displayed differently depending on whether the timer function is on or off.
The timer is ON : The remaining test time is displayed.
The timer is OFF : The elapsed test time is displayed. (When 999 seconds have elapsed, “999” flashes.)
If the key is not locked, the test voltage can be changed during the test using the rotary knob.
The cursor moves to the Min. decimal place in ACW, DCW, and IR.

NOTE:
Screens can be switched during the test using the F5 key (DISP). To suspend the test, press the STOP switch.

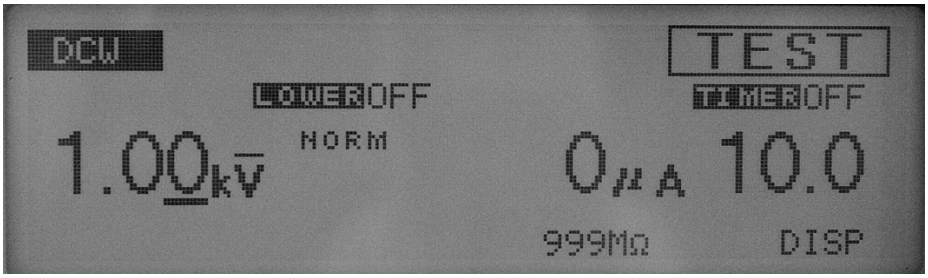
Example of an AC withstanding voltage test



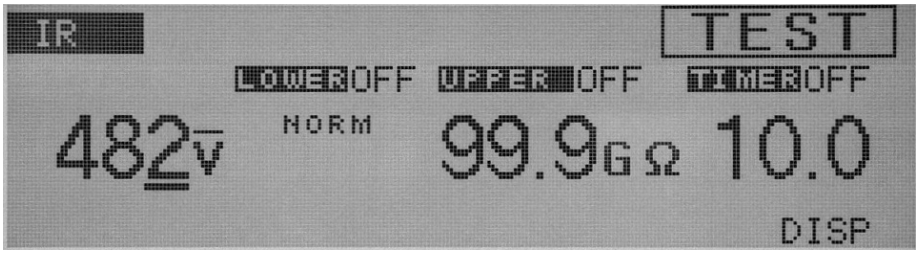


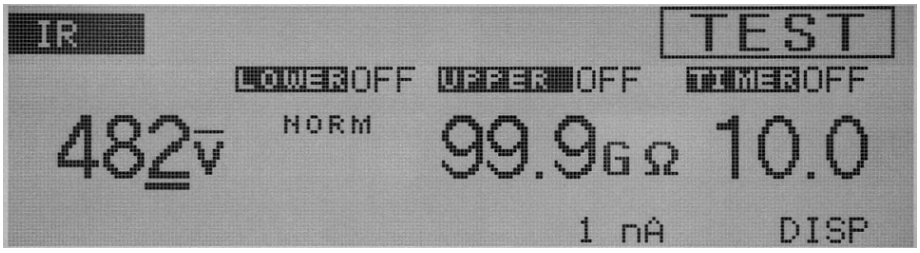
Example of an DC withstanding voltage test





Example of an insulation resistance test





4.8.2 Ending the test

4.8.2.1 PASS judgment

1. When the timer is ON:

When the test time has elapsed without the occurrence of the FAIL status, the test ends with a PASS judgment.

When a PASS judgment is made, “PASS” appears at the top right of the LCD, the PASS LED lights on the indicator, and a buzzer sounds. The PASS judgment is displayed for approximately 0.2 seconds (by default). The display time for the PASS judgment can be set to 0.2 s through 10.0 s or to HOLD. The buzzer action synchronizes with the PASS display time. The measurement results are displayed while “PASS” is displayed.

When “PASS HOLD” is not set to “HOLD,” the tester automatically returns to the READY status after a PASS judgment is made.

2.When the timer is OFF:

The test continues until the FAIL conditions are met.

Press the STOP switch to suspend the test. The test does not make a judgment and “PASS” is

not displayed.

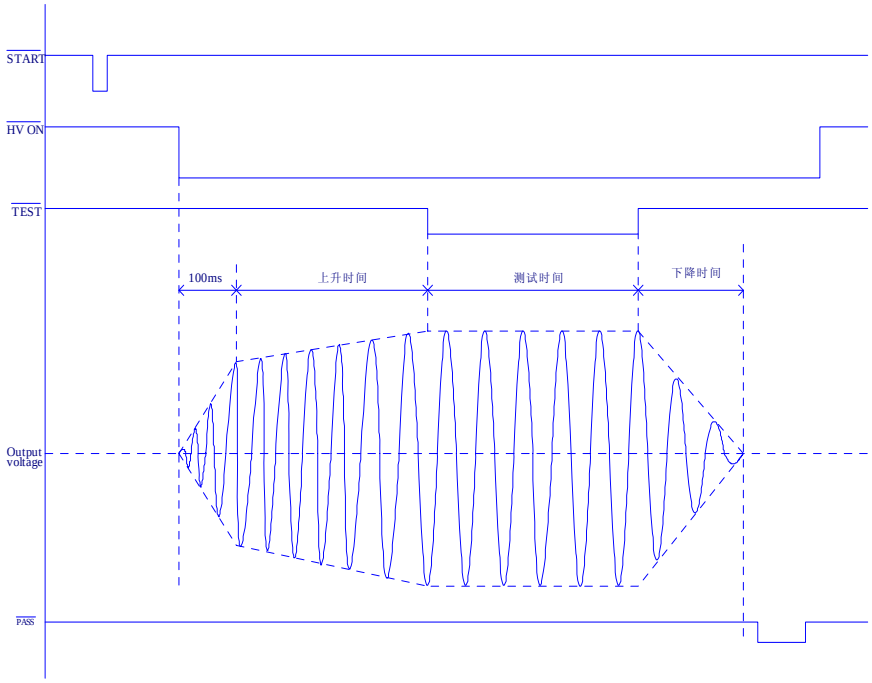


Figure 4-17　Timing chart for PASS judgment（ACW）

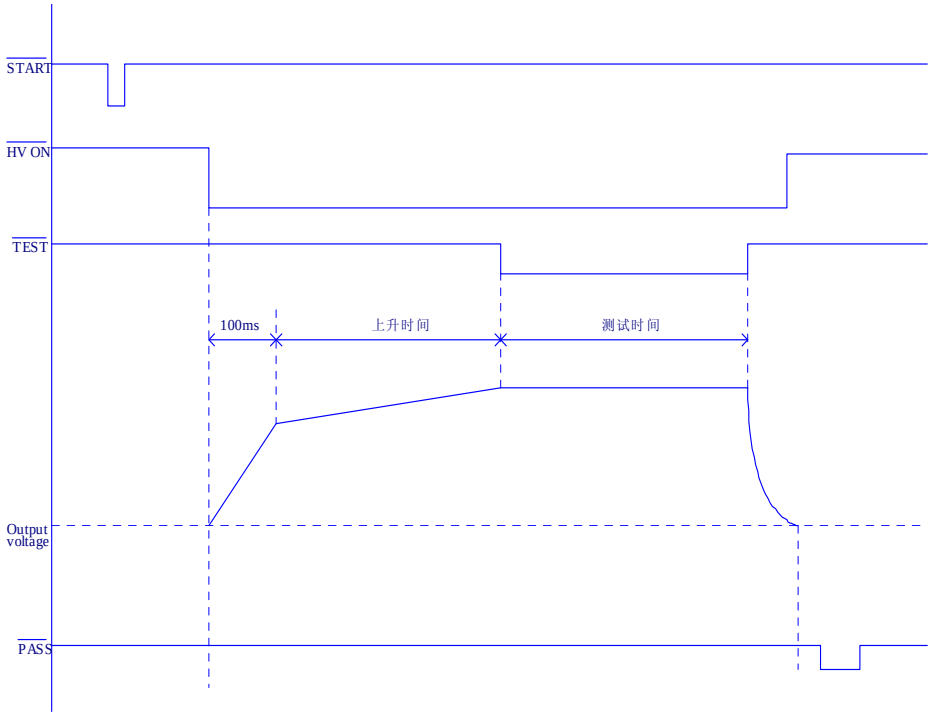


Figure 4-18　Timing chart for PASS judgment（DCW）

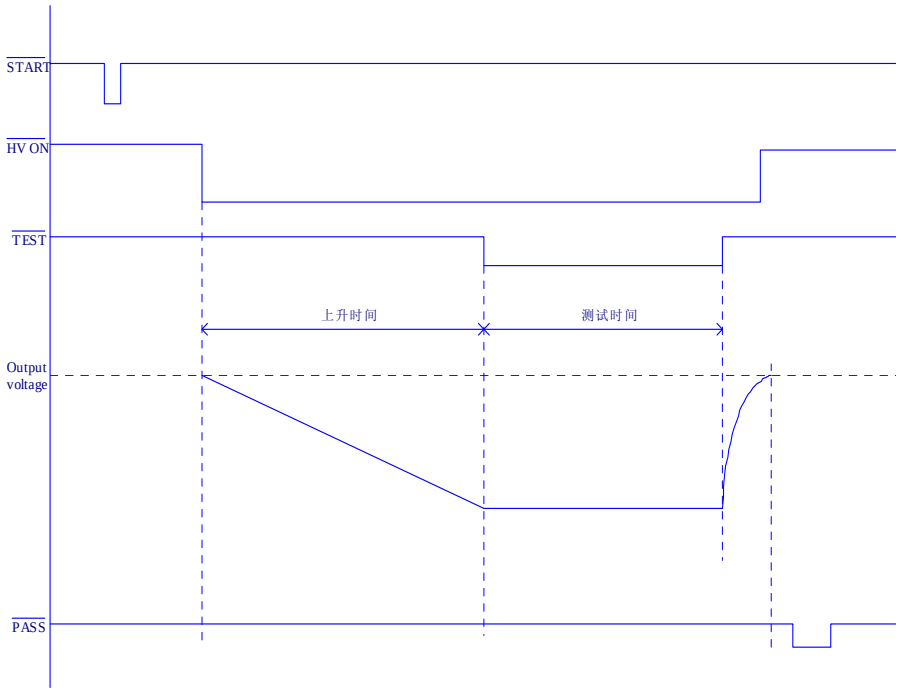


Figure 4-19　Timing chart for PASS judgment（IR）

4.8.2.2 FAIL judgment

1. AC/DC withstanding voltage test

If the lower judgment function is on, the test ends with a FAIL judgment when the tester detects a current larger than the upper current or a current smaller than the lower current. The power is then cut off.
When lower and upper judgments are made, "↓ FAIL" and " ↑FAIL"　appear respectively　at the top right of the LCD.
At the same time, the FAIL LED lights on the indicator and a buzzer sounds. To cancel the FAIL judgment, press the STOP switch (the FAIL judgment is output until the STOP switch is pressed).
The measurement results are displayed until the STOP switch is pressed.
The FAIL judgment other than that described above is a CONTACT FAIL ("→←FAIL") judgment that is made when the contact failure is detected while a scanner is used.

NOTE：
1. In AC withstanding voltage testing, a lower judgment is not made during a voltage rise time (RISE TIME) or a voltage fall time (FALL TIME).
2. In DC withstanding voltage testing, no lower judgment is made during a voltage rise time (RISE TIME).
3.In DC withstanding voltage testing, an upper judgment is not made until the WAIT TIME has elapsed to eliminate the effects of a charge current in capacitive DUTs.

---

2. **Insulation resistance testing**

If the upper judgment function is on, the test ends with a FAIL judgment when a resistance larger than the upper resistance is detected.

If the lower judgment function is on, the test ends with a FAIL judgment when the tester detects a resistance smaller than the lower resistance.

Using a lower and upper judgment, "↓FAIL" and "↑FAIL" appear, respectively, at the top right of the LCD. At the same time, the FAIL LED lights up on the indicator and a buzzer sounds.

To cancel the FAIL judgment, press the STOP switch (the FAIL judgment is output until the STOP switch is pressed).

The measurement results are displayed until the STOP switch is pressed.

The FAIL judgment other than that described above is a CONTACT FAIL ("→← FAIL") judgment that is made when the contact failure is detected while a scanner is used.

NOTE:

1. In insulation resistance testing, an upper judgment is not made during a voltage rise time (RISE TIME).
2. In insulation resistance testing, a lower judgment is not made until the WAIT TIME has elapsed to eliminate the effects of a charge current in capacitive DUTs.

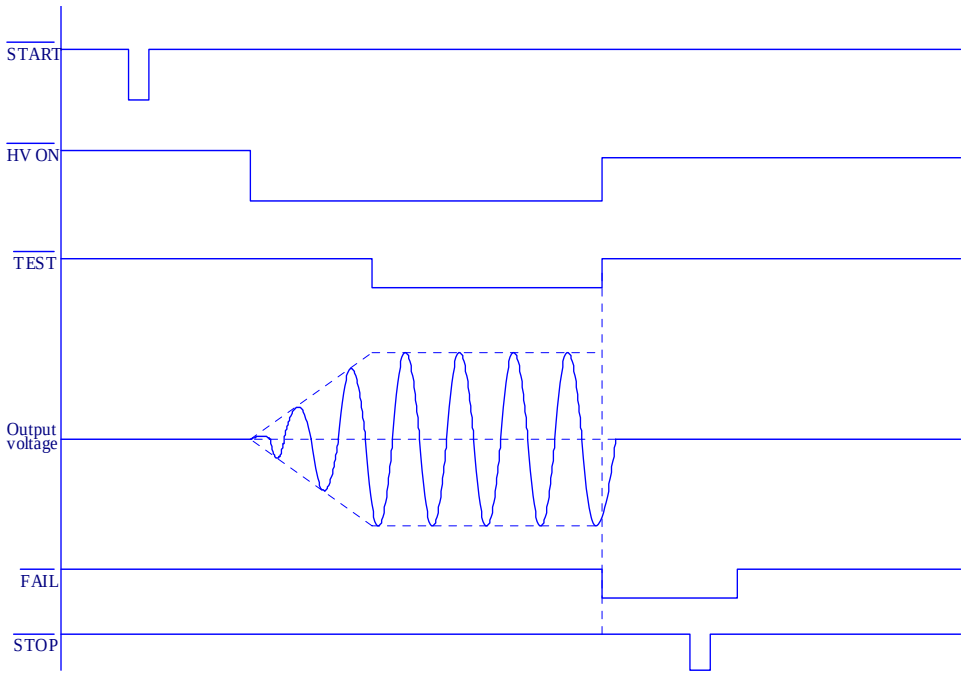


Figure 4-20　Timing chart for the FAIL judgment（ACW）

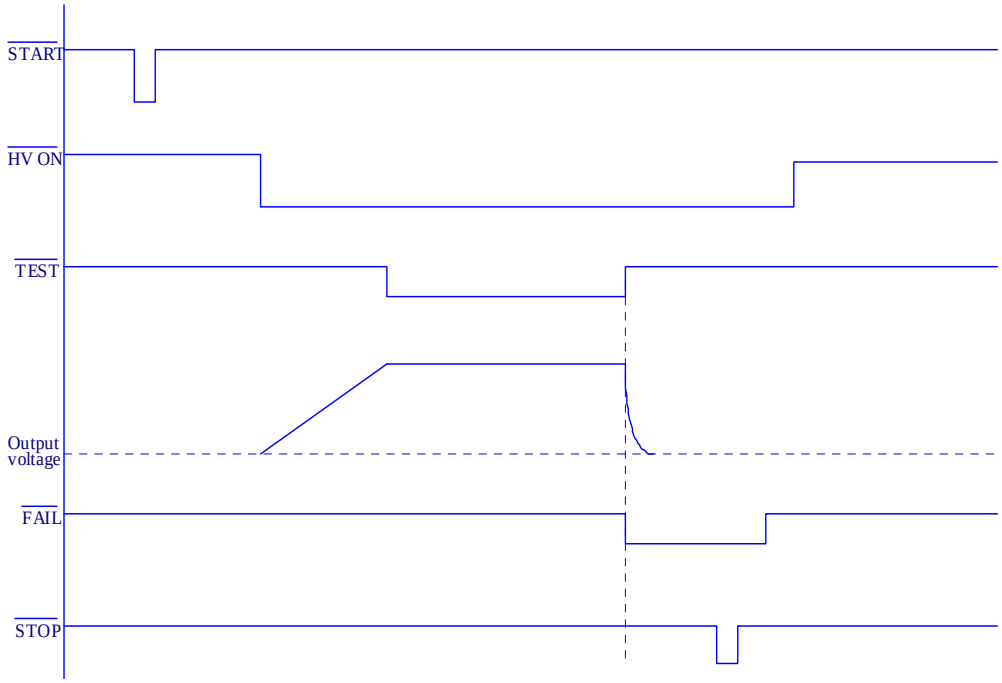


Figure 4-21　FAIL Timing chart for the FAIL judgment（DCW）

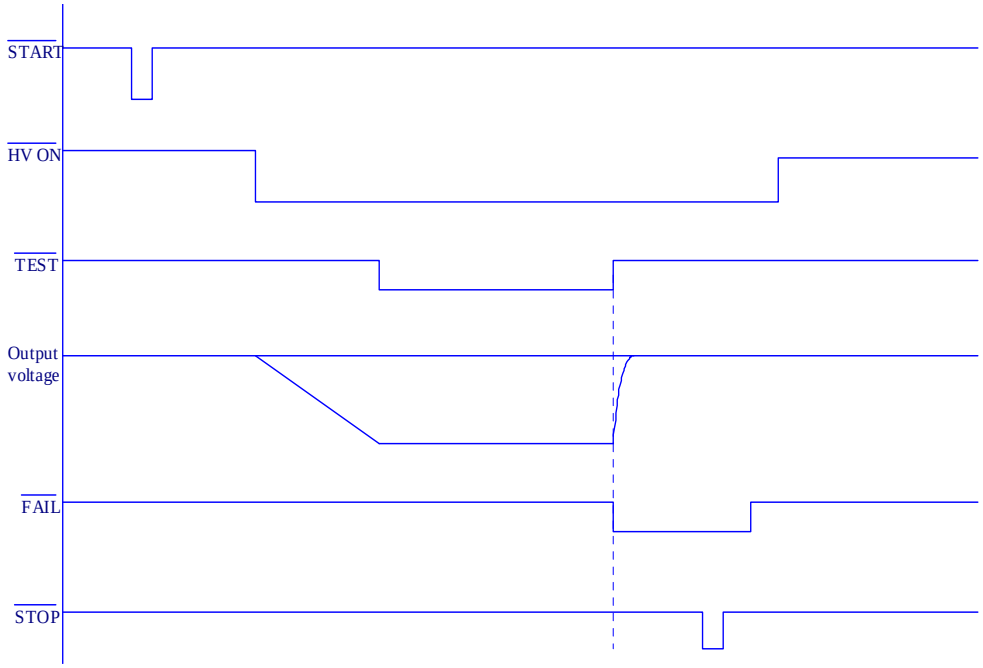


Figure 4-22　Timing chart for the FAIL judgment（IR）

4.9 Offset Cancel Function

The offset cancel function is used to measure the current flowing as insulation resistance, stray capacity in the test lead wire, and jigs in AC withstanding voltage testing. The results are subtracted such current from the measurement results of the testing.

To activate the offset cancel function, open the end of the test lead wire. From the measured current, save the current as offset values.

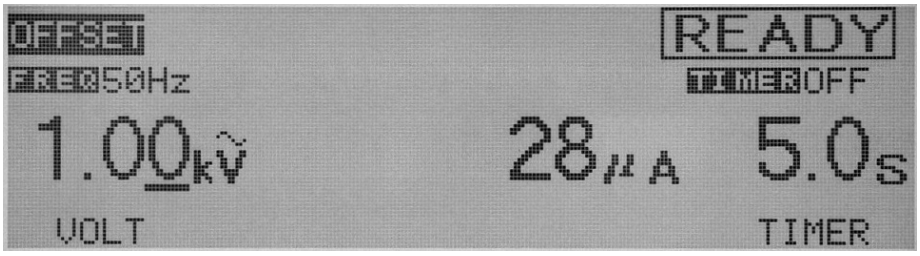
Measure offset values under actual test conditions. If conditions are modified in an actual test, irrelevant offset values would be used for subtraction. Particularly when the frequency, the scanner, or the GND/FLOAT settings for the LOWTERM, which affect the capacitive element, are changed, the offset cancel operation must be repeated. When the test voltage is changed, however, it is not necessary to repeat the offset cancel operation, as the offset value for deduction is converted to suitable value according to test voltage.

NOTE：

1. To ensure high-sensitivity measurement, avoid moving the test lead wire. The stray capacity depends on the status of the test lead wire. To obtain actual offset values, it is recommended that measurements be conducted under actual test conditions.
2. Once the measured current exceed 500Ua at 5 kV and 100uA/kV, the test ends with a FAIL judgment.
When the measured current flashes, recheck the cable connections in order to reduce the stray capacity, and then reactivate the offset cancel function.

Offset cancel procedure

1. Connect cables exactly as they are connected in an actual AC withstanding voltage test, but remove the DUT.
2. On the ACW1 screen, set the lower judgment function to OFF.
3. Using the SHIFT + ACW/OFFSET keys, shift to the offset measurement screen (OFFSET). The screen displays the test voltage, test frequency, test time, and the on/off settings for TIMER exactly as they were on the previous screen.



4. When necessary, set the test voltage, test frequency, and test time. For the setting procedures.
5. When “READY” (READY status) is displayed on the offset measurement screen (OFFSET), press the START switch; offset measurement then starts.



 The tester saves the offset value that is valid when the STOP-switch is pressed or the preset timer time has elapsed. Upon completion of the offset measurement, the tester returns to the READY status.
On the ACW1 screen, if OFFSET is set to ON, the test result is the value obtained by subtracting the offset value measured above from the measured current. To check the offset value, press the SHIFT + ACW/OFFSET keys in order to return to the offset measurement screen (OFFSET).

4.10 System Settings

To display the system setting screen (SYSTEM), press the SYSTEM key. The LED on the SYSTEM key lights up.
The SYSTEM setting screen permits the following settings to be made:

1. MEAS MODE
2. PASS HOLD
3. CONTRAST
4. BUZZ
5. FAIL MODE
6. CONTEST

4.10.1 Setting the measurement mode (MEAS MODE)

A leakage-current measurement mode can be selected.
NORM: Ordinary measurement mode
MIN/MAX: The measurement mode for holding the maximum current in withstanding voltage testing and the minimum resistance recorded after the WAIT TIME has elapsed in insulation resistance testing

1. Using the ▼▲◀▶ keys, move the cursor to MEAS MODE.
2. Using the rotary knob, select NORM or MIN/MAX.

4.10.2 Setting the pass hold time (PASS HOLD)

The hold time can be set to 0.2 s through 10.0 s (at a resolution of 0.1 s) for a PASS judgment.
When HOLD is set, a PASS judgment is held until the STOP switch is pressed.

1. Using the ▼▲◀▶ keys, move the cursor to PASS HOLD.
2. Using the rotary knob, set the pass hold time.

4.10.3 Setting the contrast (CONTRAST)

The LCD screen contrast level can be set to 1 through 10 (at a resolution of 1).

1. Using the F2 key (CONTRAST) or the ▼▲◀▶ keys, move the cursor to CONTRAST.
3. Using the rotary knob, adjust the contrast level.
4. The contrast level can be set using the SHIFT + ▼▲ keys, regardless of the screen displayed.

4.10.4 Setting the buzzer volume (BUZZER)

The buzzer volume can be set to 0 through 2 (at a resolution of 1).

0: Close

1: Low buzzer volume

2: High buzzer volume

1. Using the ▼▲◀▶keys, move the cursor to BUZZ.
2. Using the rotary knob, adjust the buzzer volume

4.10.5 Turning the FAIL mode ON/OFF (FAIL MODE)

When the FAIL mode is on, it is impossible to cancel a FAIL judgment or the protection status using the STOP signal by remote control.

1. Using the ▼▲◀▶keys, move the cursor to FAIL MODE.
2. Using the rotary knob, adjust the FAIL MODE.

Turn the rotary knob clockwise: ON

Turn the rotary knob counterclockwise: OFF

4.10.6 CON TEST

When the CON TEST function is ON, the judgments of per step will be record in a PROGRAM test. When the test ends, a sheet of judgment will be displayed on the LCD. From the sheet, you can inquire about the judgments of per step.

1. Using the ▼▲◀▶keys, move the cursor to CON TEST.
2. Using the rotary knob, adjust the CON TEST.

Turn the rotary knob clockwise: ON

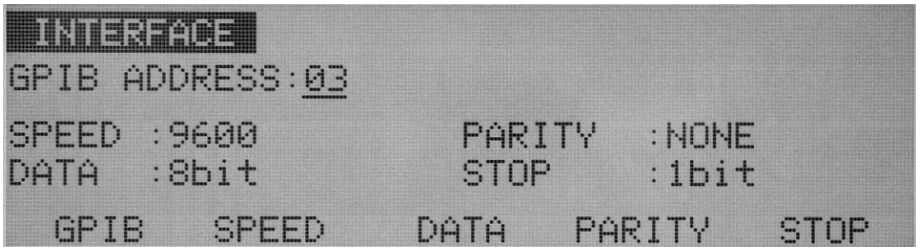
Turn the rotary knob counterclockwise: OFF

4.11 Interface settings

To display the interface setting screen (INTERFACE), press the SHIFT+SYSTEM(I/F) keys. The SHIFT+SYSTEM (I/F) key lights up.

The interface setting screen permits the following settings to be made:

1. GPIB address
2. Baud rate of the RS-232C interface
3. Data length of the RS-232C interface
4. Parity of the RS-232C interface
5. Stop bit of the RS-232C interface



4.11.1 Setting the GPIB address

Set the GPIB address to 0 through 30.

1. Using the F1 key (GPIB) or the ▼▲◀▶ keys, move the cursor to GPIB ADDRESS.
2. Using the rotary knob, set the GPIB address.

4.11.2 Setting the baud rate of the RS-232C interface

For the baud rate of the RS-232C interface, select one of the following three speeds:

38400 bps

19200 bps

9600 bps

1. Using the F2 key (SPEED) or the ▼▲◀▶ keys, move the cursor to SPEED
2. Using the rotary knob, select 38400,19200,9600

4.11.3 Setting the data length of the RS-232C interface

For the data length of the RS-232C interface, select either of the following

7 bits

8 bits

1. Using the F3 key (DATA) or the ▼▲◀▶ keys, move the cursor to DATA
2. Using the rotary knob, select 7 or 8.

4.11.4 Setting the parity of the RS-232C interface

For the parity of the RS-232C interface, select one of the following three parity:

NONE

ODD

EVEN

1. Using the F4 key (PARITY) or the ▼▲◀▶ keys, move the cursor to PARITY
2. Using the rotary knob, select NONE,ODD,EVEN

4.11.5 Setting the stop bit of the RS-232C interface

For the stop bit of the RS-232C interface, select either of the following:

1 bit

2bit

1. Using the F5 key(STOP) or the ▼▲◀▶ keys, move the cursor to STOP
2. Using the rotary knob, select 1 or 2

4.12 Panel Memory

The tester is capable of storing up to 100 preset patterns of test conditions in its internal memory for each AC/DC withstanding voltage test and insulation resistance test.

AC withstanding voltage testing

1. Test voltage
2. Test frequency
3. Lower current (LOWER) and ON/OFF of the lower judgment function

4. Upper current (UPPER)
5. ON/OFF of the offset function
6. Test time (TEST TIME) and ON/OFF of the timer function
7. Start voltage
8. Voltage rise time (RISE TIME)
9. Voltage fall time (FALL TIME)
10. Test-voltage range
11. SLOW/MID/FAST settings for the response filter
12. LOW/GUARD settings for the GND
13. HIGH/LOW/OPEN settings for the scan channel
14. ON/OFF of the contact check function

DC withstanding voltage testing

1. Test voltage
2. Lower current (LOWER) and ON/OFF of the lower judgment function
3. Upper current (UPPER)
4 Test time (TEST TIME) and ON/OFF of the timer function
5. Start voltage
6. Voltage rise time (RISE TIME)
7. Judgment wait time (WAIT TIME)
8. LOW/GUARD settings for the GND
9. HIGH/LOW/OPEN settings for the scan channel
10. ON/OFF of the contact check function

Insulation resistance testing

1. Test voltage
2. Lower resistance (LOWER) and ON/OFF of the lower judgment function
3. Upper resistance (UPPER) and ON/OFF of the upper judgment function
4. Test time (TEST TIME) and ON/OFF of the timer function
5. Voltage rise time (RISE TIME)
6. Judgment wait time (WAIT TIME)
7. LOW/GUARD settings for the GND
8. HIGH/LOW/OPEN settings for the scan channel
9. ON/OFF of the contact check function

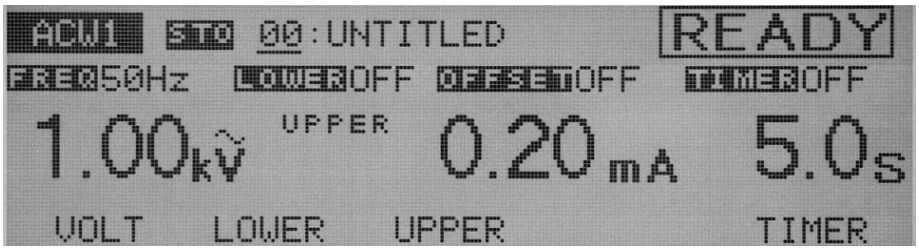
4.12.1 Storage in the panel memory

NOTE：
To store data, first specify a memory number, followed by a memory name. To return to the previous name, move the cursor to the memory number after setting the memory name.

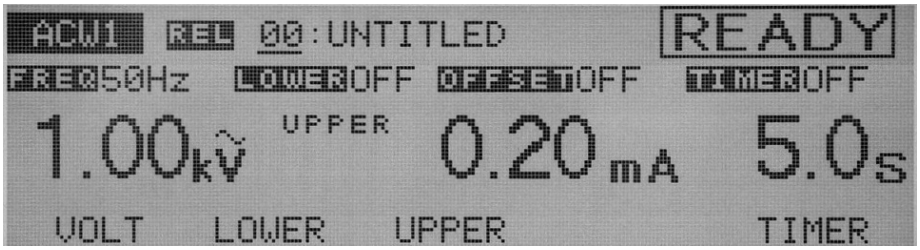
Storing the results of an AC withstanding voltage test in panel memory (example)

1. Press the ACW key to display the AC withstanding voltage test screen (ACW1), and set the

test conditions.
2. Press the SHIFT + RECALL/STORE keys to display “STO 00:UNTITLTED” to the right of the title.
3. Using the rotary knob, set a memory number (00 to 99).
4. Using the ▶ key, move the cursor to “UNTITLTED”.
5. Using the rotary knob, enter a memory name (using up to 8 characters). Use ASCII-code characters from 20H through 7AH.
6. Press the ENTER key to store the test conditions under the set memory number.
Upon completion of the storage procedure, “STO” changes to “MEM.”
7. To cancel the storage operation, use the ACW or ▼ key before pressing the ENTER key.



4.12.2 Recalling panel memory

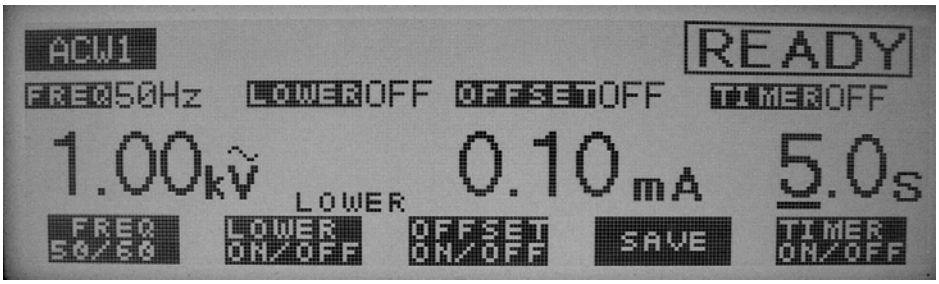


1. Press the RECALL key to display “RCL Memory No.: Memory Name” to the right of the title.
2. Using the rotary knob, specify the memory number to be recalled (00 to 99).
3. Press the ENTER key to recall the test conditions under the memory number. “RCL” changes to “MEM” to the right of the title.

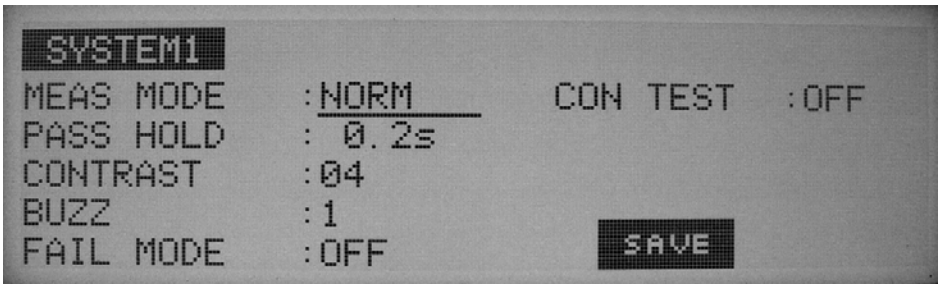
4.12.3 Save the default settings

To save the default settings in the ACW/DCW/IR/SYSTEM screen，press the SHIFT key+F4 key.
When you turn on the tester, the tester will load the default settings automatically.

Example of an ACW1 setting：

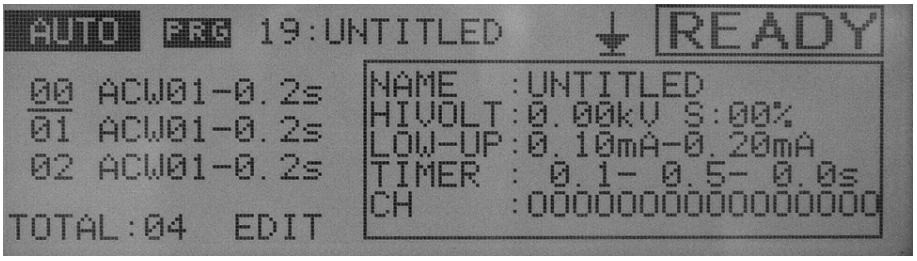


Example of a SYSTEM setting：



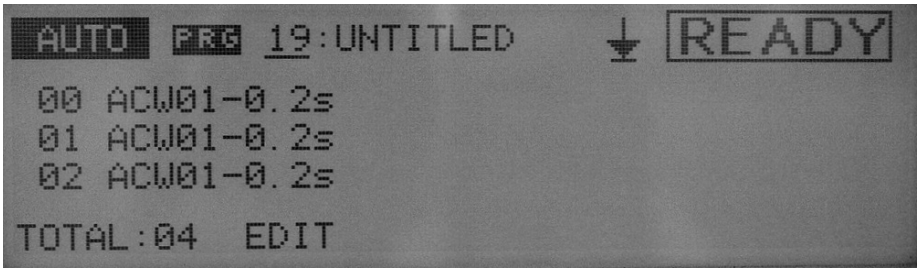
4.13 Program

By combining test conditions stored in internal memory, up to 50 programs composed of a total of 50 steps can be created. Each program can accommodate 50steps.
Press the AUTO key. The LED lights up and the program screen (AUTO) is displayed.



Inquire the steps

1. To jump to the AUTO screen，press the AUTO key. The cursor is at the “STEP **00”**；
2. Using the ▼▲keys, move the cursor to inquire the steps and its basic information.
3. Using the SHIFT key + F1 key or AUTO key, move the cursor to program’s SN.
4. Using the rotary knob, set the SN between 00 and 99 (at a resolution of 1).



Example of a program

Flow of a program test

Step 00 ACW01	Interval 0.5s	Step 01 DCW01	Interval HOLD	Step 02 IR01	Interval 0.5s	RET

To create the above program, make the following settings:

00： ACW01-0.5s

01: DCW01-HOLD

02: IR01-0.5s

RET

At Step 00, Memory ACW01 (AC withstanding voltage test) is conducted. Then, 0.5 second later, at Step 01, DCW01 (DC withstanding voltage test: available with the TOS9201 only) is conducted. The Step-01 interval time is set to HOLD. Thus, Step 02 does not start until the START switch is pressed. When START is pressed, IR01 (insulation resistance test) ends at Step 02 and, 0.5 seconds later, the tester enters the READY status.

When END is set to RET, the test restarts at Step 00.

4.13.1 Creating and editing a program

On the program screen (AUTO), recall the number of the program to be created or edited. Press the SHIFT + AUTO/EDIT keys. The program edit screen will then appear, with “EDIT” displayed at the top right. The program is stored as it is created or edited.

If a program is to be created or edited, the following settings must be made:

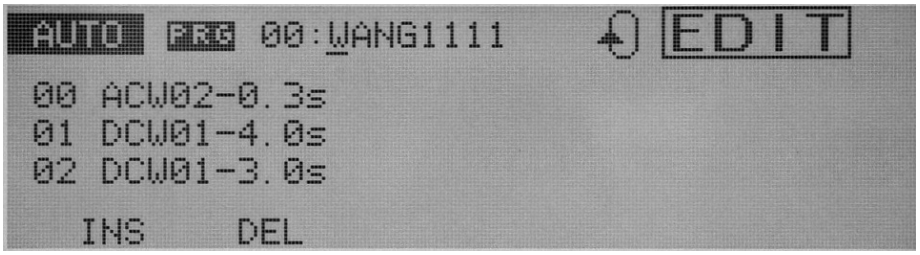
• Program name
• Memory number (step settings)
• Interval time
• Repeat-test settings

4.13.1.1 Setting the program name

Enter the name of the program to be created (using up to 8 characters).

1. Press the SHIFT + F1 keys to move the cursor to the program name.
2. Using the ◀▶ keys, move the cursor to the target character.
3. Using the rotary knob, select characters. Use ASCII characters from 20H to 7AH .

4. Upon completion of editing, press the SHIFT + F1 keys to move the cursor to the step number.



4.13.1.2 Setting the test conditions (Memory No.) and interval time

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NOTE

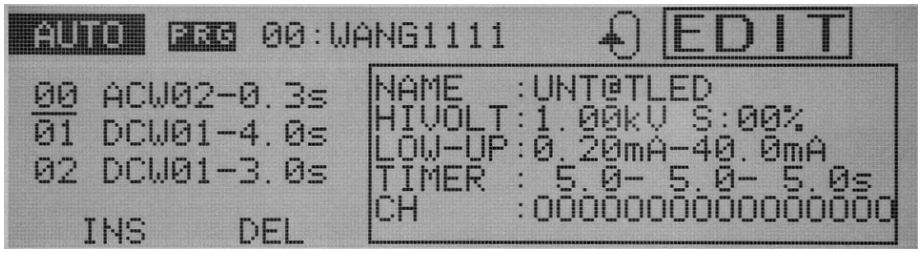
If a test condition under the preset memory number is set to TIMER OFF, a program test ends once the STOP switch is pressed, preventing the next test from being performed.

For each step, set the memory number of the test conditions to be used and the interval between steps. The program executes the test in order of step number.

When the cursor is positioned at the step number, the screen can be scrolled using the rotary knob. The ▼▲ keys can be used to perform scrolling, regardless of the location of the cursor.

Upon completion of each step, “END” or “RET” is displayed.

1. To move the cursor to the step number, press the SHIFT + F1 keys.
2. Move the cursor to the step below the step to be inserted. To add a step to the previous step, move the cursor to END or RET. Press the F1 key (INS). A step (ACW00-0.2s) will be inserted at the cursor.
3. Using the ▶ key, move the cursor to ACW to the right of the step number.
4. Using the rotary knob, set the target test (ACW, DCW, IR).
5. Using the ▶ key, move the cursor to the memory number.
6. Using the rotary knob, set a memory number.
7. Using the ▶key, move the cursor to the interval time to the right of the memory number.
8. Using the rotary knob, set an interval time (from 0.2 s to 9.9 s, HOLD). If the interval time is set to HOLD, the next step starts when the START switch is pressed with the specified step in the HOLD status.
9. To delete a step, move the cursor to the corresponding step number and press the F2 key (DEL).



4.13.1.3 Setting the repeat test

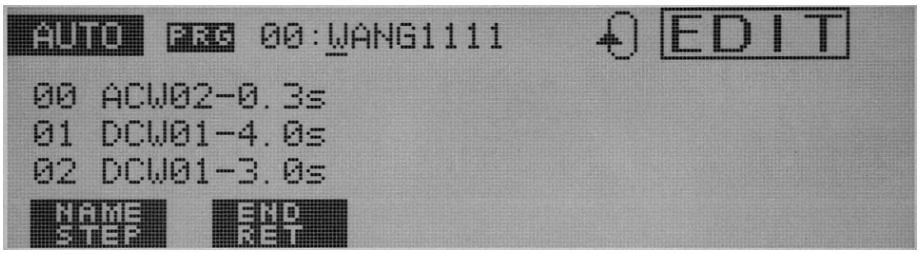
To make settings necessary to repeat a test, use the SHIFT + F2 keys, regardless of the location of the cursor.

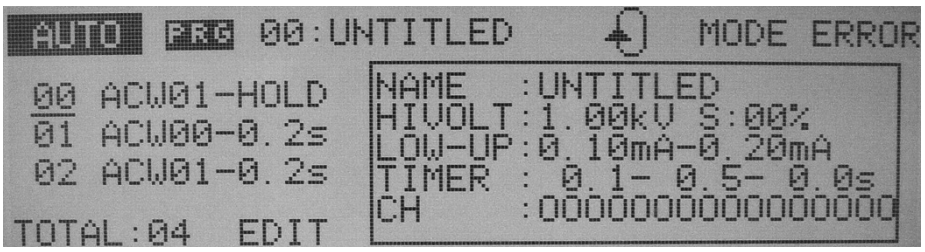
NOTE:

RET mode is unallowable with the CONTEST function on. If you set RET mode with the CONTEST function on, START key function is invalid and “MODE ERROR” is displayed.

END：The program ends, the tester returns to the first step and enters the READY status

RET：The program returns to the first step and starts a new test.





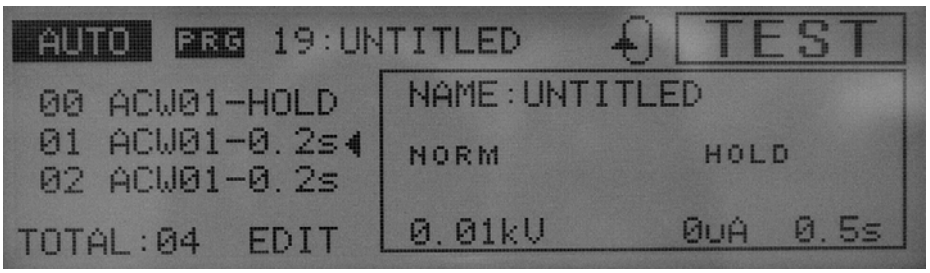
4.13.2 Executing a program

NOTE:

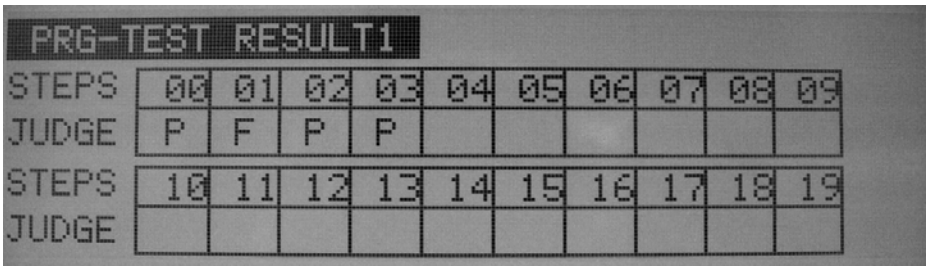
1. If the interval time is set to HOLD, the next step starts when the START switch is pressed with the specified step in the HOLD status.

2. If the test executes a step with the timer function set to OFF, it is unable to proceed to the next step.

To run a program, display the program screen (AUTO).



1. Press the AUTO key to display the program screen (AUTO). Using the rotary knob, specify the number of the program to be recalled. The name of the selected program is displayed to the right of the program number.
2. To check the memory contents, press the SHIFT + F1 keys. The cursor will move to the step number. Using the rotary knob, select a step number. The test conditions for the selected step are displayed.
3. To run the program, press the START switch. During the test, “TEST” is displayed and the TEST LED lights up on the indicator. The step being run is displayed in reverse image.



4.13.3 Suspending the program

To suspend the test while running a program, press the STOP switch.
To start the program from the beginning, press the START switch.

4.13.4 Judgment on the program

PASS judgment

When the interval time for each step is set to other than HOLD, the program makes a PASS judgment if a PASS judgment is made for every step (only if the programmed repeat test is set to END).
A PASS judgment is made after the interval time for the previous step has elapsed. The tester then returns to the READY status. If the interval time for any step is set to HOLD, the test does not proceed to the next step unless the START switch is pressed.

FAIL judgment

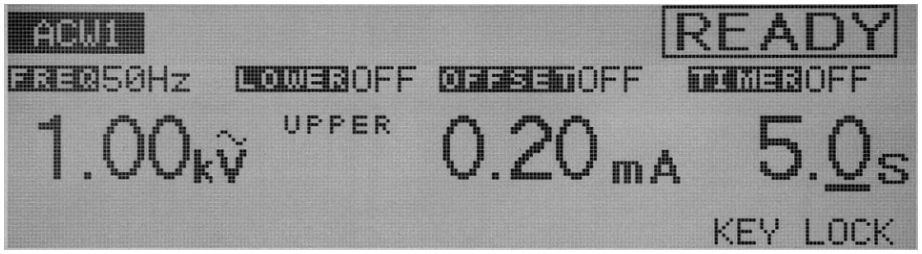
Once a FAIL judgment is made while the program is being run, the test stops at that step. Check the failed step and press the STOP switch. If the START switch is pressed again, the program starts from the beginning.

4.13.5 Exiting the program

To exit the PROGRAM mode in order to return to the normal mode, press the ACW key (or the DCW or IR key). The LED on the AUTO key goes off, and the test-condition setting screen appears.

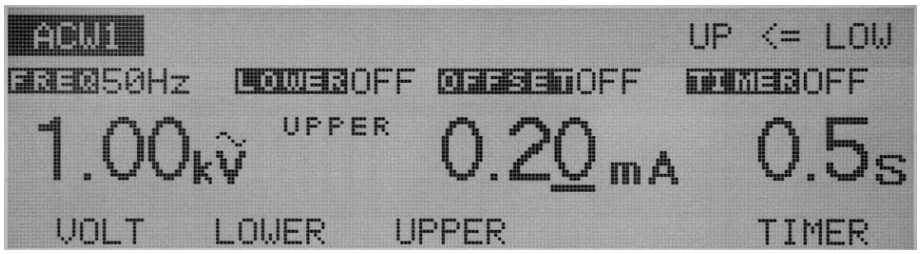
4.14 Key Lock

The key lock function is used to prevent the unintentional alteration of test conditions. To lock the panel settings, press the SHIFT + LOCAL/KEY LOCK keys. On the panel, only the START and STOP switches are operable.
While the key lock function is on, “KEY LOCK” is displayed on the LCD.
To cancel the key lock function, press the SHIFT + LOCAL/KEY LOCK keys.



4.15 Invalid Settings

When an invalid setting is made, the messages shown below flash on the tester. Testing cannot be performed when a message is displayed. The messages below are arranged in order of priority.



1. INVALID CH

“INVALID CH” appears in the scanner channel settings when a channel that is not connected to the tester is specified.

2. OVER WAIT

“OVER WAIT” is displayed when, with the timer on, the preset wait time exceeds the sum of the rise time and the test time.

3. OVER 550 VA

“OVER 550 VA” is displayed when, during settings for an AC withstanding voltage test, the test voltage multiplied by the upper current exceeds 550 VA.

4. OVER 55 W

“OVER 55 W” is displayed when, in settings for a DC withstanding voltage test, the test voltage multiplied by the upper current exceeds 55 VA.

5. OVER 1.1 mA

“OVER 1.1 mA” is displayed when, during settings for an insulation resistance test, the test voltage divided by the lower resistance exceeds 1.1 mA.

6. UP<=LOW

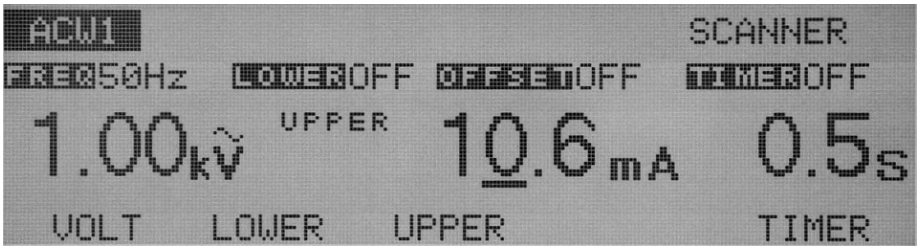
“UP<=LOW” is displayed when, with the lower or upper judgment function on, the upper value is set at or below the lower value.

4.16 Protection

The tester enters the PROTECTION status in the cases specified below, as the internal protective circuit activates.
In the PROTECTION LED lights on the indicator, the output is cut off, and the test stops.
The following events are arranged in order of priority in protection:

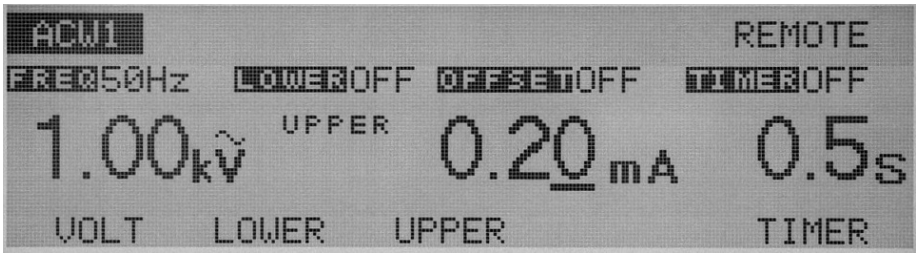
4.16.1 Insertion/extraction of the scanner connector

When a connector is inserted or extracted with the optional in use, the protection function activate and “SCANNER” flashes on the LCD.
To cancel the protection function, press the STOP switch.



4.16.2 REMOTE

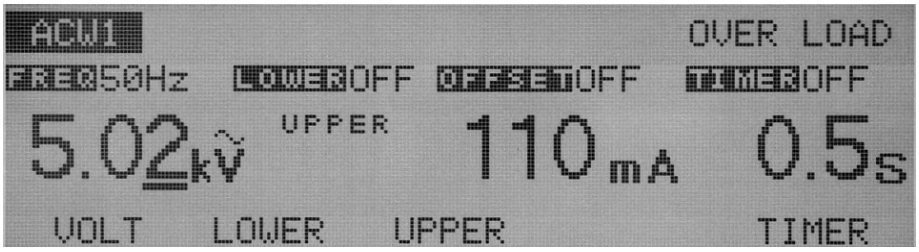
When the remote-control connector on the front panel is inserted or extracted, the protection function activates and “REMOTE” flashes on the LCD.
To cancel the protection function, press the STOP switch.



4.16.3 Output-power limiting function

This is a protection function intended to limit the output power during a test. If the output voltage multiplied by the measured current (including the offset value) exceeds 550 VA and 55 VA in AC and DC withstanding voltage tests, respectively, the protection function activates. “OVERLOAD” flashes on the LCD, and the test stops.

To cancel this function, press the STOP switch.



4.16.4 Overheat protection

When the internal temperature of the tester rises to an abnormal level, the protection function activates. “OVERHEAT” flashes on the LCD, and the test stops. Abnormal temperatures are caused by a reduction in the air flow of the air inlet or outlet, malfunctioning of the fan or other components, and operations at high temperatures.

Usually, the internal temperature falls to a normal level in approximately 10 minutes if there is no malfunctioning of the fan. Once the temperature returns to the normal level, press the STOP switch to cancel the protection function.

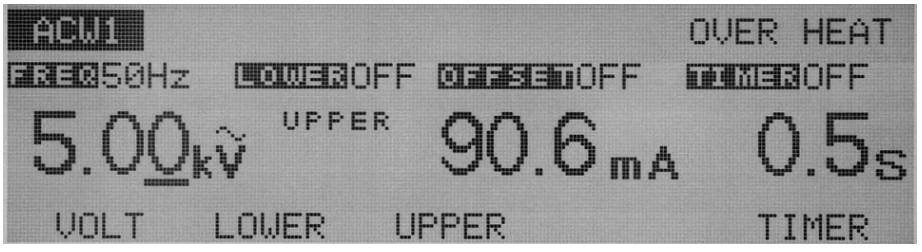
Abnormal temperatures may be caused by the malfunctioning of the fan if the protection function activates frequently.



4.16.5 Time restriction by the output current

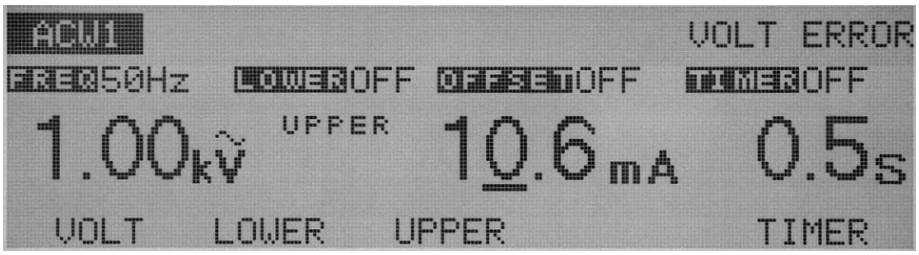
The tester is designed to release heat that is half the rated output in consideration of the tester’s size, weight, cost, and other factors. Therefore, to conduct an AC withstanding voltage test with an upper current of 50 mA, it is necessary to provide a pause longer than the output time. Note that the maximum output time is 15 minutes (at an ambient temperature of 40 °C or below). During a test, if a current of 50 mA or greater is detected for 15 minutes or more, the protection function activates. “OVERHEAT” flickers on the LCD, and the test stops. There is no time restriction when the tester is operated below 50 mA.

To cancel the protection function, turn off the POWER switch.



4.16.6 Output-voltage monitoring function

When the output voltage deviates from ±(10 % of the setting +50 V), the protection function activates. “VOLT ERROR” flashes on the LCD, and the test stops.
To cancel the protection function, press the STOP switch.



4.17 Initialization

NOTE

When the tester is initialized, the contents of panel memory and all programs are cleared. Before initializing the tester, make sure these contents will not be needed.

To initialize the tester, press the SHIFT key + the POWER switch to start it up. Initialization will start. All contents of memory are deleted, and the tester returns to the factory settings. (Hold the SHIFT key down until “TH9101 VERSION 1.1” disappears.)

4.17.1 Factory settings

• Test-Condition Settings screen (ACW)

Test voltage (VOLTAGE) ----------0.00 kV
Frequency (FREQ) ----------50 Hz
Lower judgment (LOWER) ----------OFF
Lower current (LOWER) ----------0.10 mA
Upper current (UPPER) ----------0.20 mA
Offset (OFFSET) ----------OFF
Timer (TIMER) ----------ON
Timer set value (TIMER) ----------0.5 s
Start voltage (START) ----------0 %
Voltage rise time (RISE TIME) ----------0.1 s
Voltage fall time (FALL TIME) ----------0.0 s
Voltage range (V RANGE) ----------AUTO
Response filter (RESPONSE) ----------SLOW
GND/FLOAT of the LOWTERM (GND) ----------GND
Scanner channel ----------ALL OPEN
CONTACT CHECK ----------OFF

• Test-Condition Settings screen (DCW)

Test voltage (VOLTAGE) ----------0.00 kV
Lower judgment (LOWER) ----------OFF

Lower current (LOWER) ----------0.10 mA
Upper current (UPPER) ----------0.20 mA
Timer (TIMER) ----------ON
Timer set value (TIMER) ----------0.5 s
Start voltage (START) ----------0 %
Voltage rise time (RISE TIME) ----------0.1 s
Judgment wait time (WAIT TIME) ----------0.3 s
GND/FLOAT of the LOWTERM (GND) ----------GND
Scanner channel ----------ALL OPEN
CONTACT CHECK ----------OFF

• Test-Condition Settings screen (IR)
Test voltage (VOLTAGE) ----------10 V
Lower judgment (LOWER) ----------ON
Lower resistance (LOWER) ----------1.00 MΩ
Upper judgment (UPPER) ----------OFF
Upper resistance (UPPER) ----------100 MΩ
Timer (TIMER) ----------ON
Timer set value (TIMER) ----------0.5 s
Voltage rise time (RISE TIME) ----------0.1 s
Judgment wait time (WAIT TIME) ----------0.3 s
GND/FLOAT of the LOWTERM (GND) ----------GND
Scanner channel ----------ALL OPEN
CONTACT CHECK ----------OFF

• Offset screen (OFFSET)
Offset value---------- 0uA

• System screen (SYSTEM)
MEAS MODE ----------NORM
PASS HOLD ----------0.2 s
FAIL MODE ----------OFF
BUZZER VOL ----------1
CONTRAST ----------4
CONTEST ----------OFF

• Interface screen (INTERFACE)
GPIB ADDRESS ---------- 4
SPEED ----------19200
DATA ----------8 bits
PARITY ----------NONE
STOP ----------2 bits

Chapter 5 Specifications

This chapter describes the electrical and mechanical specifications for the tester.

5.1 Withstanding Voltage test mode

Item			Specifications			
			TH9101	TH9101A	TH9101B	TH9101C
Output section						
AC	Output-voltage range		0.05kV to 5.00kV			
	Output-voltage accuracy		±(1.5% of setting+20V)（with no load）			
	Output-voltage resolution		10V			
	Max. rated load		500VA（5kV/100mA）		200VA（5kV/40mA）	
	Max. rated current		100mA（output voltage ≥0.2kV）		40mA（output voltage ≥0.2kV）	
	Output-voltage waveform		Sine ware			
	Waveform distortion		≤±3%（with no load or pure resistive load at output voltage of 0.5kV）			
	Short-circuit current		≥200mA（output-voltage≥0.5kV）		≥100mA（output-voltage≥0.5kV）	
	Type of output-voltage		PWM			
DC	Output-voltage range		0.05kV-6.00kV	————	0.05kV-6.00kV	————
	Output-voltage accuracy		±(1.5%of setting+20V)	————	±(1.5%of setting+20V)	————
	Output-voltage resolution		10V	————	10V	————
	Max. rated load		50VA（5kV/10mA）	————	50VA（5kV/10mA）	————
	Max. rated current		10mA	————	10mA	————
	Ripple no load at 5kV		50 Vp-p	————	50 Vp-p	————
	Ripple Max. rated load		150 Vp-p	————	150 Vp-p	————
	Voltage regulation		≤1%（Max. rated load）	————	≤1%（Max. rated load）	————
	Short-circuit current		40mA	————	40mA	————
	Discharge function		Forced discharge at the end of test (via resistance: 125 kΩ)	————	Forced discharge at the end of test (via resistance: 125 kΩ)	————
Volt-meter	Analog	Scale	6kV AC/DC F.S			
		Accuracy	±5% F.S			
		Indicator	Mean-value responsive/root-mean-square value scale			
	Digital	Measurement	0.00kV to 6.00kV			

		range				
		Accuracy	±(1.0%of setting+30V)			
		Resolution	10V			
		Indicator	Mean-value responsive/root-mean-square value scale			
Am-meter	AC	Measurement range	0.00mA to 10mA		0.00mA to 40mA	
	DC		0.00mA to 11mA	————	0.00mA to 11mA	————
	Indicator		0 ~ 999uA； 1.00mA ~ 9.99mA； 10.0mA ~ 99.9mA； 100mA ~ 110mA			
	Accuracy		±(3%of setting+20uA)			
	Response		100ms			
	Offset cancel function		The current flowing to the insulation resistor between the output cables and the stray capacity is cancelled up to 100 uA/kV (in ACW testing only).			
		GND	Connects the GND point to the LOW terminal. Measures the current flowing to the LOW terminal.			
		FLOAT	Sets the GND point as guard. Measures the current flowing to the LOW terminal, but does not measure the current flowing to the chassis (for high-sensitivity, high-accuracy measurements).			
Judg-ment	AC	UPPER setting	0.00mA to110mA		0.00mA to 41mA	
	DC		0.00mA to 11mA	————	0.00mA to -11mA	————
	AC	LOWER setting	0.00mA to 110mA		0.00mA to 1mA	
	DC		0.00mA to 11mA	————	0.00mA to 11mA	————
	Judgment accuracy		±(3%of setting +20uA)			
	DC	Response	FAST/MID/SLOW	————	FAST/MID/SLOW	————
Timer	Rise time		0.1s to 200s			
	Fall time		0s to200s			
	Test time		0.3s to 999s			
	DC	Wait time	0.3s to 10s	————	0.3s to 10s	————
	Time accuracy		±（0.02%of setting + 20ms）			

5.2 Insulation Resistance Testing Mode

Item			Specifications
			TH9101/A/B/C
IR	Output-voltage range		-25V to -1000V
	Output-voltage accuracy		±(1.5% of setting+2V)
	Output-voltage resolution		1V
	Max. rated load		1VA（-1000V/1mA）
	Max. rated current		1mA
	Ripple 1kV no-load		≤2 Vp-p
	Ripple Max. rated load		≤10 Vp-p
	Voltage regulation		≤1%（Max. rated load）
	Short-circuit current		1.1mA
	Discharge function		Forced discharge at the end of test (discharge resistance: 25 kΩ)
Volt-meter	Analog	Scale	6kV AC/DC F.S
		Accuracy	±5% F.S
		Indicator	Mean-value responsive/root-mean-square value scale
	Digital	Measurement range	0V to1200V
		Accuracy	±(1%of setting+1V)
		Resolution	1V
		Indicator	Mean-value responsive/root-mean-square value scale
Resis tance meter	Measurement range		0.01MΩ to9.99GΩ
	Indicator		0.01MΩ~9.99MΩ； 10.0MΩ~ 99.9MΩ； 100MΩ~ 999MΩ； 1.00GΩ~ 9.99GΩ
	Accuracy		±(20%of reading) 50nA≤i＜100nA；±(10% of reading) 100nA≤i＜200nA；±(5% of reading) 200nA≤i＜1uA；±(2% of reading) 1uA≤i≤1mA；(with no disturbance such as swinging of the test lead wire)
	Response		100ms
		GND	Connects the GND point to the LOW terminal. Measures the current flowing to the LOW terminal.
		FLOAT	Sets the GND point as guard. Measures the current flowing to the LOW terminal, but does not measure the current flowing to the chassis (for high-sensitivity, high-accuracy measurements).
Judg-ment	UPPER setting		0.01MΩ to 9.99GΩ
	LOWER setting		0.01MΩ to 9.99GΩ
	LOWER setting	Judgment current	50nA≤i≤100nA / 100nA＜i≤200nA / 200nA＜i≤1uA / 1uA＜i≤1mA
		0.01MΩ≤R＜10.0MΩ	——— / ——— / ——— / ±(2%ofsetting +5digit)

		10.0MΩ≤R＜50.0MΩ			±(5%ofsetting +5digit)	
		50.0MΩ≤R＜100MΩ				
		100MΩ≤R＜200MΩ		±(10%ofsetting+5digit)		
		200MΩ≤R＜500MΩ				
		500MΩ≤R＜1.00GΩ				
		1.00GΩ≤R＜2.00GΩ	±(20%ofsetting+5 digit)			————
		2.00GΩ≤R＜5.00GΩ	±(20%of setting+10 digit)	±(10%of setting+10 digit)		
		5.00GΩ≤R＜10.0GΩ	±(20%of setting+20 digit)		————	
Timer	Rise time	0.1s to 200s				
	Fall time	0s to 200s				
	Test time	0.3s to 999s				
	Wait time	0.3s to 10s				
	Time accuracy	±（0.02%of setting + 20ms）				

Chapter 6 Maintenance

This chapter describes the maintenance, inspection, and calibration of the tester. Regular maintenance and inspection are necessary to maintain the initial performance of the product.

6.1 Cleaning

To clean the surface of the tester, including the panel, wipe it with a soft cloth moistened with water-diluted neutral detergent.

⚠ **WARNING** Before starting cleaning, be sure to turn off the POWER switch and unplug the power cord.
⚠ **CAUTION** Do not use volatile materials such as thinner and benzene. These materials may change surface colors, erase prints, or blur the display.

6.2 Inspection

⚠ **WARNING** Tearing and breakage of the cable coating may lead to electric shock and fire. In such a case, immediately discontinue use of the tester. To purchase accessories, contact TONGHUI distributor/agent.

1. A C Power cord
Check for tears in the cable coating, looseness and fracture of the plug, and breakage of the cable.

2. High-voltage test lead wire
Check the cable coating for tears, fissures, and breakage.

6.3 Maintenance

⚠ **WARNING** To replace components, the tester cover must be opened, but only by our service representative. Contact yourTONGHUI agent/distributor if it is necessary to perform replacement work.

1. High-voltage relay
The high-voltage relays inside the tester are consumable. Although service life depends on the usage environment, we recommend that the high-voltage relays be replaced every one million tests. We also recommend regular internal inspections and cleaning at the same intervals.

2. Cooling fan

The service life of the cooling fan is approximately 60,000 hours. The revolutions per minute of the cooling fan are controlled based on the internal temperature, and its service life depends partly on the conditions under which it is used. Replace the cooling fan after approximately 60,000 hours. In addition, conduct internal inspection and cleaning of the tester at the same time.

6.4 Calibration

To maintain the accuracy of measuring instruments for an extended period, calibration should be performed regularly.

⚠ **WARNING** The tester generates voltages as high as AC 5 kV and DC 6 kV. Calibration is extremely dangerous; contact your TONGHUI agent if calibration services are required.

Chapter 7 RS-232

7.1 RS232 Setup

7.1.1 RS-232C pin assignment

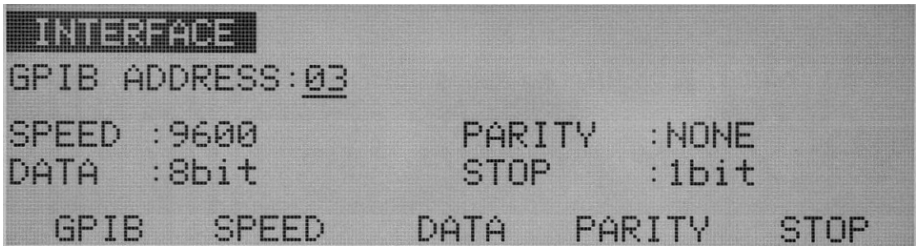
Signal	Code	25-pin connector pin assignment	9-pin connector pin assignment
Request to send	RTS	4	7
Clear to send	CTS	5	8
Data set ready	DSR	6	6
Carrier detection	DCD	8	1
Data terminal ready	DTR	20	4
Transmitted data	TXD	2	3
Received data	RXD	3	2
GND	GND	7	5



Figure 7.1

7.1.2 RS-232C Settings

To display the Interface Settings screen (INTERFACE), press the SHIFT + SYSTEM(I/F) keys. The SYSTEM(I/F) key then lights up.



1. Setting the communication speed of the RS-232C interface

Three communication speeds are available for the RS-232C interface:

38,400 bps

19,200 bps

9,600 bps

a. Using the F2 key (SPEED) or the ▼▲◀▶ keys, move the cursor to SPEED.

b. Using the rotary knob, select 38,400, 19,200, or 9,600 bps.

2.Setting the data length of the RS-232C interface

The following two data lengths are available for the RS-232C interface:

7 bits

8 bits

a. Using the F3 key (DATA) or the ▼▲◀▶ keys, move the cursor to DATA.

b. Using the rotary knob, select 7 or 8.

ERFAC

3.Setting the parity of the RS-232C interface

The following three parities are available for the RS-232C interface:

NONE

ODD

EVEN

a. Using the F4 key (PARITY) or the ▼▲◀▶ keys, move the cursor to PARITY.

b. Using the rotary knob, select NONE, ODD, or EVEN.

4. Setting the stop bit of the RS-232C interface

The following two stop bits are available for the RS-232C interface:

1 bit

2 bits

a. Using the F5 key (STOP) or the ▼▲◀▶ keys, move the cursor to STOP.

b. Using the rotary knob, select 1 or 2.

7.2 Commands

7.2.1 Commands Exclusively Used for AC Withstanding Voltage Testing

ACW:TESTV (A:TES)

Sets the test voltage for an AC withstanding voltage test, or inquires about the set or setting test voltage

--Syntax

Command message:

ACW:TESTV_<voltage>

A:TES_<voltage>

Query message:

ACW:TESTV?

A:TES?

--Program data:

Data format: Real number

Set value : 0.00 to 5.20 E3 (0 to 5200)

Resolution: 10

Unit: V

--Example:

To set the test voltage to 5.00 kV,

A:TES 5.00E3 or A:TES 5000

--Response message

To A:TES?, the currently set test voltage is returned.

If the currently set test voltage is 2.50 kV,

2.50kV is returned.

ACW:FREQUENCY (A:FREQ)

Sets the test frequency for an AC withstanding voltage test, or inquires about the set or setting test frequency.

--Syntax

Command message:

ACW:FREQUENCY_<50/60>

A:FREQ_<50/60>

Query message:

ACW:FREQUENCY?

A:FREQ?

--Program data

Data format: Character

Set value: 50/60

Unit: Hz

--Example

To set the test frequency to 50 Hz,

A:FREQ 50

--Response message

To A:FREQ?, the currently set test frequency is returned.

If the current test frequency is 60 Hz,

60Hz is returned.

ACW:LOWER (A:LOW)

Sets the lower current (LOWER) and ON/OFF of the lower judgment function for an AC withstanding voltage test. Also inquires about the lower current and the ON/ OFF status of the lower judgment function.

--Syntax
Command message:
ACW:LOWER_<lower current>, <ON/OFF>
A:LOW_<lower current>,<ON/OFF>
Query message:
ACW:LOWER?
A:LOW?

--Program data <lower current>
Data format: Real number
Set value : 0.01 E-3 to 110 E-3
Resolution:
0.01 E-3 (0.01 E-3 to 9.99 E-3)
0.1 E-3 (10.0 E-3 to 99.9 E-3)
1 E-3 (100 E-3 to 110 E-3)
Unit: A

--Program data <ON/OFF>
Data format: Character
Set value: OFF/ON

--Example
To set the lower current (LOWER) to 10.0 mA,
A: LOW 10.0E-3,ON

--Response message
To A:LOW?, the currently set lower current and the ON/OFF status of the lower judgment function are returned. If the present lower current is 10.0mA and the lower judgment function is ON, 10mA,ON is returned.

ACW:UPPER (A:UPP)
Sets the upper current (UPPER) for an AC withstanding voltage test. Also inquires about the present upper current.

--Syntax
Command message:
ACW:UPPER_<upper current>
A:UPP_<upper current>
Query message:
ACW:UPPER?

A:UPP?

--Program data

Data format: Real number

Set value: 0.01 E-3 to 110 E-3

Resolution:

0.01 E-3 (0.01 E-3 to 9.99 E-3)

0.1 E-3 (10.0 E-3 to 99.9 E-3)

1 E-3 (100 E-3 to 110 E-3)

Unit: A

--Example

To set the upper current to 10.0 mA,

A:UPP 10.0E-3

--Response message

To A:UPP?, the present upper current is returned.

If the present upper current is 10.0 mA,

10.0mA is returned.

ACW:TIMER (A:TIM)

Sets the test time (TEST TIME) and ON/OFF of the timer function for an AC withstanding voltage test. Also inquires about the current test time and the ON/OFF status of the timer function.

--Syntax

Command message:

ACW:TIMER_<test time>, <ON/OFF>

A:TIM_<test time>, <ON/OFF>

Query message:

ACW:TIMER?

A:TIM?

--Program data <test time>

Data format: Real number

Set value: 0.3 to 999

Resolution:

0.1 for 0.3 to 99.9,

1 for 100 to 999

Unit: s

--Program data <ON/OFF>

Data format: Character

Set value: OFF/ON

--Example

To set the test time to 5 s,

A:TIM 5,ON

--Response message

To A:TIM?, the current test time and the ON/OFF status of the timer function are returned as “test time, ON/OFF.”

If the current test time is 10.0 s and the timer function is set to ON,

10.0,ON is returned.

ACW:OFFSET (A:OFF)

Sets ON/OFF of the offset function for an AC withstanding voltage test. Also inquires about the ON/OFF status of the offset function.

--Command message:

ACW:OFFSET_<0/1>

A:OFF_<0/1>

--Query message:

ACW:OFFSET?

A:OFF?

--Program data

Data format: Character

Set value:

0: OFF

1: ON

--Example

To set the offset function to ON,

A:OFF 1

--Response message

To A:OFF?, the ON/OFF status of the offset function is returned.

If the offset function is currently set to ON,

ON is returned.

ACW:STARTV (A:STAR)

Sets the start voltage for an AC withstanding voltage test. Also inquires about the set or setting start voltage.

--Syntax

Command message:

ACW:STARTV_<start voltage>

A:STAR_<start voltage>

Query message:

ACW:STARTV?
A:STAR?

--Program data
Data format: Integer
Set value: 0 to 99
Resolution: 1
Unit: %

--Example
To set the start voltage to 10% of the test voltage,
A:STAR 10

--Response message
To A:STAR?, the current start voltage is returned.
If the start voltage is currently set to 10%, 10% is returned.

ACW:RISETIME (A:RTIM)
Sets the voltage rise time (RISE TIME) for an AC withstanding voltage test. Also inquires about the set or setting voltage rise time.

--Syntax
Command message:
ACW:RISETIME_<voltage rise time>
A:RTIM_<voltage rise time>
Query message:
ACW:RISETIME?
A:RTIM?

--Program data
Data format: Real number
Set value: 0.1 to 200
Resolution:
0.1 for 0.1 to 99.9
1 for 100 to 200
Unit: s

--Example
To set the voltage rise time to 5 s,
A:RTIM 5

--Response message
To A:RTIM?, the current voltage rise time is returned.
If the voltage rise time is currently set to 5.0 s,

5.0s is returned.

ACW:FALLTIME (A:FTIM)

Sets the voltage fall time (FALL TIME) for an AC withstanding voltage test. Also inquires about the set or setting voltage fall time.

--Syntax

Command message:

ACW:FALLTIME_<voltage fall time>

A:FTIM_<voltage fall time>

Query message:

ACW:FALLTIME?

A:FTIM?

--Program data

Data format: Real number

Set value: 0.0 to 200

Resolution:

0.1 for 0.0 to 99.9

1 for 100 to 200

Unit: s

--Example

To set the voltage fall time to 1 s,

A:FTIM 1

--Response message

To A:FTIM?, the current voltage fall time is returned.

If the voltage fall time is currently set to 2.0 s,

2.0s is returned.

ACW:VRANGE (A:VRAN)

Sets the output-voltage range for an AC withstanding voltage test. Also inquires about the set or setting output range.

--Syntax

Command message:

ACW:VRANGE_<{0|1}>

A:VRAN_<{0|1}>

Query message:

ACW:VRANGE?

A:VRAN?

--Program data

Data format: Integer

Set value:

0: AUTO;

1: 5 kV

--Example

To set the output range to AUTO,

A:VRAN 0

--Response message

To A:VRAN?, the output-voltage range is returned.

If the current output-voltage range is 5 kV,

5Kv is returned.

ACW:RESPONSE (A:RES)

Sets the current detection response speed (RESPONSE) for an AC withstanding voltage test. Also inquires about the set or setting current detection response speed.

--Syntax

Command message:

ACW:RESPONSE_<0/1/2>

A:RES_<0/1/2>

Query message:

ACW:RESPONSE?

A:RES?

--Program data

Data format: Integer

Set value:

0: SLOW;

1: MID;

2: FAST

--Example

To set the current detection response speed to FAST,

A:RES 2

--Response message

To A:RES?, the preset current detection response speed is returned.

If the detection response speed is currently set to MID,

MID is returned.

ACW:LOWTERM (A:LTER)

Sets GND/FLOAT of the LOWTERM for an AC withstanding voltage test. Also inquires about

the set or setting value of the LOWTERM.

--Syntax
Command message:
ACW:LOWTERM_<0/1>
A:LTER_<0/1>
Query message:
ACW:LOWTERM?
A:LTER?

--Program data
Data format: Character
Set value:
0 :GND,
1: FLOAT

--Example
To set the LOWTERM to FLOAT,
A:LTER 1

--Response message
To A:LTER?, the current LOWTERM setting is returned.
If the LOWTER is currently set to GND,
GND is returned.

ACW:SCAN (A:SCAN)
Sets HIGH/LOW/OPEN for the scanner channel for an AC withstanding voltage test.
Also inquires about the set or setting value of the high-voltage scanner channel.

--Syntax
Command message:
ACW:SCAN_<channel>, <H/L/O>
A:SCAN_<channel>, <H/L/O>
Query message:
ACW:SCAN?_<channel>
A:SCAN?_<channel>

--Program data <channel>
Data format: Integer
Set value: 1 to 16
Resolution: 1

--Program data <H/L/O>

Data format: Character

Set value:

O: OPEN;

L: LOW;

H: HIGH

--Example

To set scanner channel 1 to HIGH,

A:SCAN 1,H

--Response message

To A:SCAN?2, the preset value for scanner channel 2 is returned.

If scanner channel 2 is currently set to OPEN,

OPEN is returned.

ACW:CONTACTCHECK (A:CCH)

Sets ON/OFF of the contact check function for an AC withstanding voltage test.
Also inquires about the status of the function.

--Syntax

Command message:

ACW:CONTACTCHECK_<0/1>

A:CCH_<0/1>

Query message:

ACW:CONTACTCHECK?

A:CCH?

--Program data

Data format: Character

Set value:

0: OFF

1: ON

--Example

To set the contact check to ON,

A:CCH 1

--Response message

To A:CCH?, the current setting for the contact check is returned.
If the contact check is currently set to ON,
ON is returned.

ACW:RECALL (A:REC)

Recalls the contents of memory stored in an AC withstanding voltage test

--Syntax
Command message:
ACW:RECALL_<memory number>
A:REC_<memory number>

--Program data
Data format: Integer
Set value: 0 to 99
Resolution: 1

--Example
To recall memory 10 for AC withstanding voltage testing,
A:REC 10

ACW:STORE (A:STOR)
Stores the current settings for an AC withstanding voltage test. Note that the memory name is not stored

--Syntax
Command message:
ACW:STORE_<memory number>
A:STOR_<memory number>

--Program data
Data format: Integer
Set value: 0 to 99
Resolution: 1

--Example
To store the current settings for an AC withstanding voltage test to memory 10,
A:STOR 10

ACW:VDATA (A:VDAT)
Inquires about the monitor voltage for ACW test. During the test, the real-time voltage is returned. After the test, the previous test voltage is returned.

--Syntax
Query message:
ACW:VDATA?
A:VDAT?

--Response message
To VDAT?, the monitor voltage is returned for ACW in an AC withstanding voltage

test.
If the current monitor voltage in an AC withstanding voltage test is 1.5 kV,
1.5 kV is returned.

ACW:IDATA (A:IDAT)
Inquires about the monitor current.
During the test, the measured normal value or the maximum value is returned,
.
--Syntax
Query message:
ACW:IDATA?
A:IDAT?

--Response message
To IDAT?, the monitor current is returned for ACW in an AC withstanding voltage test
If the present monitor current in an AC withstanding voltage test is 10.0 mA,
10.0mA is returned.

7.2.2 Commands Exclusively Used for DC Withstanding Voltage Testing

DCW:TESTV (D:TES)
Sets the test voltage for an DC withstanding voltage test, test, or inquires about the set or setting test voltage

--Syntax
Command message:
DCW:TESTV_<voltage>
D:TES_<voltage>
Query message:
DCW:TESTV?
D:TES?

--Program data:
Data format: Real number
Set value : 0.00 to 6.10 E3 (or 0 to 6100)
Resolution: 10
Unit: V

--Example:
To set the test voltage to 5.00 kV,
D:TES 5.00E3

--Response message
To D:TES?, the currently set test voltage is returned.

If the currently set test voltage is 2.50 kV,
2.50kV is returned.

DCW:LOWER (D:LOW)

Sets the lower current (LOWER) and ON/OFF of the lower judgment function for an DC withstanding voltage test. Also inquires about the lower current and the ON/ OFF status of the lower judgment function.

--Syntax

Command message:

DCW:LOWER_<lower current>, <ON/OFF>

D:LOW_<lower current>,<ON/OFF>

Query message:

DCW:LOWER?

D:LOW?

--Program data <lower current>

Data format: Real number

Set value : 0.01 E-3 to 11 E-3

Resolution:

0.01 E-3 (0.01 E-3 to 9.99 E-3)

0.1 E-3 (10.0 E-3 to 11.0 E-3)

Unit: A

--Program data <ON/OFF>

Data format: Character

Set value: OFF/ON

--Example

To set the lower current (LOWER) to 10.0 mA,

D: LOW 10.0E-3,ON

--Response message

To D:LOW?, the currently set lower current and the ON/OFF status of the lower judgment function are returned. If the present lower current is 10.0mA and the lower judgment function is ON, 10mA,ON is returned.

DCW:UPPER (D:UPP)

Sets the upper current (UPPER) for an DC withstanding voltage test. Also inquires about the present upper current.

--Syntax

Command message:

DCW:UPPER_<upper current>

D:UPP_<upper current>

Query message:

DCW:UPPER?

D:UPP?

--Program data

Data format: Real number

Set value: 0.01 E-3 to 11E-3

Resolution:

0.01 E-3 (0.01 E-3 to 9.99 E-3)

0.1 E-3 (10.0 E-3 to 11 E-3)

Unit: A

--Example

To set the upper current to 10.0 mA,

D:UPP 10.0E-3

--Response message

To D:UPP?, the present upper current is returned.

If the present upper current is 10.0 mA,

10.0mA is returned.

DCW:TIMER (D:TIM)

Sets the test time (TEST TIME) and ON/OFF of the timer function for an DC withstanding voltage test. Also inquires about the current test time and the ON/OFF status of the timer function.

--Syntax

Command message:

DCW:TIMER_<test time>, <ON/OFF>

D:TIM_<test time>, <ON/OFF>

Query message:

DCW:TIMER?

D:TIM?

--Program data <test time>

Data format: Real number

Set value: 0.3 to 999

Resolution:

0.1 for 0.3 to 99.9,

1 for 100 to 999

Unit: s

--Program data <ON/OFF>

Data format: Character

Set value: OFF/ON

--Example

To set the test time to 5 s,

D:TIM 5,ON

--Response message

To D:TIM?, the current test time and the ON/OFF status of the timer function are returned as “test time, ON/OFF.”

If the current test time is 10.0 s and the timer function is set to ON,

10.0,ON is returned.

DCW:STARTV (D:STAR)

Sets the start voltage for an DC withstanding voltage test. Also inquires about the set or setting start voltage.

--Syntax

Command message:

DCW:STARTV_<start voltage>

D:STAR_<start voltage>

Query message:

DCW:STARTV?

D:STAR?

--Program data

Data format: Integer

Set value: 0 to 99

Resolution: 1

Unit: %

--Example

To set the start voltage to 10% of the test voltage,

D:STAR 10

--Response message

To D:STAR?, the current start voltage is returned.

If the start voltage is currently set to 10%, 10% is returned.

DCW:RISETIME (D:RTIM)

Sets the voltage rise time (RISE TIME) for an DC withstanding voltage test. Also inquires about the set or setting voltage rise time.

--Syntax

Command message:

DCW:RISETIME_<voltage rise time>

D:RTIM_<voltage rise time>

Query message:

DCW:RISETIME?

D:RTIM?

--Program data

Data format: Real number

Set value: 0.1 to 200

Resolution:

0.1 for 0.1 to 99.9

1 for 100 to 200

Unit: s

--Example

To set the voltage rise time to 5 s,

D:RTIM 5

--Response message

To D:RTIM?, the current voltage rise time is returned.

If the voltage rise time is currently set to 5.0 s,

5.0s is returned.

DCW:WAITTIME (D:WTIM)

Sets the wait time (WAIT TIME) for an DC withstanding voltage test. Also inquires about the set or setting wait time.

--Syntax

Command message:

DCW: WAITTIME_<wait time>

D:WTIM_<wait time>

Query message:

DCW:WAITTIME?

D:WTIM?

--Program data

Data format: Real number

Set value: 0.0 to 200

Resolution: 0.1

Unit: s

--Example

To set the wait time to 1 s,

D:WTIM 1

--Response message

To D:WTIM?, the current wait time is returned.

If the wait time is currently set to 2.0 s,

2.0s is returned.

DCW:LOWTERM (D:LTER)

Sets GND/FLOAT of the LOWTERM for an DC withstanding voltage test. Also inquires about the set or setting value of the LOWTERM.

--Syntax

Command message:

DCW:LOWTERM_<0/1>

D:LTER_<0/1>

Query message:

DCW:LOWTERM?

D:LTER?

--Program data

Data format: Character

Set value:

0 :GND,

1: FLOAT

--Example

To set the LOWTERM to FLOAT,

D:LTER 1

--Response message

To D:LTER?, the current LOWTERM setting is returned.

If the LOWTERM is currently set to GND,

GND is returned.

DCW:SCAN (D:SCAN)

Sets HIGH/LOW/OPEN for the scanner channel for an DC withstanding voltage test.
Also inquires about the set or setting value of the high-voltage scanner channel.

--Syntax

Command message:

DCW:SCAN_<channel>, <H/L/O>

D:SCAN_<channel>, <H/L/O>

Query message:

DCW:SCAN?_<channel>

D:SCAN?_<channel>

--Program data <channel>

Data format: Integer

Set value: 1 to 16

Resolution: 1

--Program data <H/L/O>

Data format: Character

Set value:

O: OPEN;

L: LOW;

H: HIGH

--Example

To set scanner channel 1 to HIGH,

D:SCAN 1,H

--Response message

To D:SCAN? 2, the preset value for scanner channel 2 is returned.

If scanner channel 2 is currently set to OPEN,

OPEN is returned.

DCW:CONTACTCHECK (D:CCH)

Sets ON/OFF of the contact check function for an DC withstanding voltage test.

Also inquires about the status of the function.

--Syntax

Command message:

DCW:CONTACTCHECK_<0/1>

D:CCH_<0/1>

Query message:

DCW:CONTACTCHECK?

D:CCH?

--Program data

Data format: Character

Set value:

0: OFF

1: ON

--Example

To set the contact check to ON,

D:CCH 1

--Response message

To D:CCH?, the current setting for the contact check is returned.
If the contact check is currently set to ON,
ON is returned.

DCW:RECALL (D:REC)

Recalls the contents of memory stored in an DC withstanding voltage test

--Syntax

Command message:

DCW:RECALL_<memory number>

D:REC_<memory number>

--Program data

Data format: Integer

Set value: 0 to 99

Resolution: 1

--Example

To recall memory 10 for DC withstanding voltage testing,

D:REC 10

DCW:STORE (D:STOR)

Stores the current settings for an DC withstanding voltage test. Note that the memory name is not stored

--Syntax

Command message:

DCW:STORE_<memory number>

D:STOR_<memory number>

--Program data

Data format: Integer

Set value: 0 to 99

Resolution: 1

--Example

To store the current settings for an DC withstanding voltage test to memory 10,

D:STOR 10

DCW:VDATA (D:VDAT)

Inquires about the monitor voltage for DCW test. During the test, the real-time voltage is returned. After the test, the previous test voltage is returned.

--Syntax
Query message:
DCW:VDATA?
D:VDAT?

--Response message
To VDAT?, the monitor voltage is returned for DCW in an DC withstanding voltage test.
If the current monitor voltage in an DC withstanding voltage test is 1.5 kV,
1.5 kV is returned.

DCW:IDATA (D:IDAT)
Inquires about the monitor current.
During the test, the measured normal value or the maximum value is returned,
.
--Syntax
Query message:
DCW:IDATA?
D:IDAT?

--Response message
To IDAT?, the monitor current is returned for DCW in an DC withstanding voltage test
If the present monitor current in an DC withstanding voltage test is 10.0 mA,
10.0mA is returned.

7.2.3 Commands Exclusively Used for Insulation Resistance Testing

IR:TESTV (I:TES)
Sets the test voltage for an insulation resistance test or inquires about the set or setting test voltage

--Syntax
Command message:
IR:TESTV_<voltage>
I:TES_<voltage>
Query message:
IR:TESTV?
I:TES?

--Program data:
Data format: Real number
Set value : 10 to 1020)

Resolution: 1
Unit: V

--Example:
To set the test voltage to 500V,
I:TES 500

--Response message
To I:TES?, the currently set test voltage is returned.
If the currently set test voltage is 500 V,
500V is returned.

IR:LOWER (I:LOW)
Sets the lower resistance (LOWER) and ON/OFF of the lower judgment function for an insulation resistance test. Also inquires about the lower resistance and the ON/OFF status of the lower judgment function.

--Syntax
Command message:
IR:LOWER_<*lower resistance*>, <ON/OFF>
I:LOW_<*lower resistance*>, <ON/OFF>
Query message:
IR:LOWER?
I:LOW?

--Program data
Data format: Real number
Set value: 0.01 E6 to 9.99 E9
Resolution:
0.01 E6 (0.01 E6 to 9.99 E6)
0.1 E6 (10.0 E6 to 99.9 E6)
1 E6 (100 E6 to 999 E6)
0.01 E9 (1.00 E9 to 9.99 E9)
Unit: Ω

--Example
To set the lower resistance to 99.9 MΩ,
I:LOW 99.9E6,OFF

--Response message
To I:LOW?, the currently set lower resistance and the ON/OFF status of the lower judgment function are returned.
If the lower resistance is currently set to 1.00 GΩ and the lower judgment
function to OFF,

“1.00 GΩ,OFF” is returned.

IR:UPPER (I:UPP)

Sets the upper resistance (UPPER) and ON/OFF of the upper judgment function for an insulation resistance test. Also inquires about the set or setting upper resistance and the ON/OFF status of the upper judgment function.

--Syntax

Command message:

IR:UPPER_<*upper resistance*>, <ON/OFF>

I:UPP_<*upper resistance*>, <ON/OFF>

Query message:

IR:UPPER?

I:UPP?

--Program data

Data format: Real number

Set value: 0.01 E6 to 9.99 E9

Resolution:

0.01 E6 (0.01 E6 to 9.99 E6)

0.1 E6 (10.0 E6 to 99.9 E6)

1 E6 (100 E6 to 999 E6)

0.01 E9 (1.00 E9 to 9.99 E9)

Unit: Ω

--Example

To set the upper resistance to 99.9 MΩ,

I:UPP 99.9E6,OFF

--Response message

To I:UPP?, the currently set upper resistance and the ON/OFF status of the upper judgment function are returned.

If the upper resistance is currently set to 1.00 GΩ and the upper judgment function to OFF,

“1.00 GΩ,OFF” is returned.

IR:TIMER (I:TIM)

Sets the test time (TEST TIME) and ON/OFF of the timer function for an insulation resistance test. Also inquires about the current test time and the ON/OFF status of the timer function.

--Syntax

Command message:

IR:TIMER_<test time>, <ON/OFF>

I:TIM_<test time>, <ON/OFF>

Query message:

IR:TIMER?

I:TIM?

--Program data <test time>

Data format: Real number

Set value: 0.3 to 999

Resolution:

0.1 for 0.3 to 99.9,

1 for 100 to 999

Unit: s

--Program data <ON/OFF>

Data format: Character

Set value: OFF/ON

--Example

To set the test time to 5 s,

I:TIM 5,ON

--Response message

To I:TIM?, the current test time and the ON/OFF status of the timer function are returned as “test time, ON/OFF.”

If the current test time is 10.0 s and the timer function is set to ON, 10.0,ON is returned.

IR:RISETIME (I:RTIM)

Sets the voltage rise time (RISE TIME) for an insulation resistance test. Also inquires about the set or setting voltage rise time.

--Syntax

Command message:

IR:RISETIME_<voltage rise time>

I:RTIM_<voltage rise time>

Query message:

IR:RISETIME?

I:RTIM?

--Program data

Data format: Real number

Set value: 0.1 to 200

Resolution:

0.1 for 0.1 to 99.9

1 for 100 to 200

Unit: s

--Example

To set the voltage rise time to 5 s,

I:RTIM 5

--Response message

To I:RTIM?, the current voltage rise time is returned.

If the voltage rise time is currently set to 5.0 s,

5.0s is returned.

IR:WAITTIME (I:WTIM)

Sets the wait time (WAIT TIME) for an insulation resistance test. Also inquires about the set or setting wait time.

--Syntax

Command message:

IR: WAITTIME_<wait time>

I:WTIM_<wait time>

Query message:

IR:WAITTIME?

I:WTIM?

--Program data

Data format: Real number

Set value: 0.0 to 200

Resolution: 0.1

Unit: s

--Example

To set the wait time to 1 s,

I:WTIM 1

--Response message

To I:WTIM?, the current wait time is returned.

If the wait time is currently set to 2.0 s,

2.0s is returned.

IR:LOWTERM (I:LTER)

Sets GND/FLOAT of the LOWTERM for an insulation resistance test. Also inquires about the set or setting value of the LOWTERM.

--Syntax

Command message:

IR:LOWTERM_<0/1>

I:LTER_<0/1>

Query message:

IR:LOWTERM?

I:LTER?

--Program data

Data format: Character

Set value:

0: GND,

1: FLOAT

--Example

To set the LOWTERM to FLOAT,

I:LTER 1

--Response message

To I:LTER?, the current LOWTERM setting is returned.

If the LOWTERM is currently set to GND,

GND is returned.

IR:SCAN (I:SCAN)

Sets HIGH/LOW/OPEN for the scanner channel for an insulation resistance test. Also inquires about the set or setting value of the high-voltage scanner channel.

--Syntax

Command message:

IR:SCAN_<channel>, <H/L/O>

I:SCAN_<channel>, <H/L/O>

Query message:

IR:SCAN?_<channel>

I:SCAN?_<channel>

--Program data <channel>

Data format: Integer

Set value: 1 to 16

Resolution: 1

--Program data <H/L/O>

Data format: Character

Set value:

O: OPEN;

L: LOW;

H: HIGH

--Example

To set scanner channel 1 to HIGH,

I:SCAN 1,H

--Response message

To I:SCAN? 2, the preset value for scanner channel 2 is returned.

If scanner channel 2 is currently set to OPEN,

OPEN is returned.

IR:CONTACTCHECK (I:CCH)

Sets ON/OFF of the contact check function for an insulation resistance test. Also inquires about the status of the function.

--Syntax

Command message:

IR:CONTACTCHECK_<0/1>

I:CCH_<0/1>

Query message:

IR:CONTACTCHECK?

I:CCH?

--Program data

Data format: Character

Set value:

0: OFF

1: ON

--Example

To set the contact check to ON,

I:CCH 1

--Response message

To I:CCH?, the current setting for the contact check is returned.

If the contact check is currently set to ON,

ON is returned.

IR:RECALL (I:REC)

Recalls the contents of memory stored in an insulation resistance test.

--Syntax

Command message:

IR:RECALL_<memory number>

I:REC_<memory number>

--Program data

Data format: Integer

Set value: 0 to 99

Resolution: 1

--Example

To recall memory 10 for insulation resistance test.

I:REC 10

IR:STORE (I:STOR)

Stores the current settings for an insulation resistance test. Note that the memory name is not stored

--Syntax

Command message:

IR:STORE_<memory number>

I:STOR_<memory number>

--Program data

Data format: Integer

Set value: 0 to 99

Resolution: 1

--Example

To store the current settings for an insulation resistance test to memory 10,

I:STOR 10

IR:VDATA (I:VDAT)

Inquires about the monitor voltage for IR test. During the test, the real-time voltage is returned. After the test, the previous test voltage is returned.

--Syntax

Query message:

IR:VDATA?

I:VDAT?

--Response message

To VDAT?, the monitor voltage is returned for IR in an insulation resistance test.

If the current monitor voltage in an insulation resistance test is 1.5 kV,

1.5 kV is returned.

IR:RDATA (I:RDAT)

Inquires about the monitor current.

During the test, the measured normal value or the maximum value is returned,

.

--Syntax

Query message:

IR:RDATA?

I:RDAT?

--Response message

To RDAT?, the monitor current is returned for IR in an insulation resistance test.

If the present monitor resistance in an insulation resistance test is 99.9 MΩ,

99.9 MΩ is returned.

7.2.4 Commands Exclusively Used for System Setting

SYS:MEASMODE (S:MMOD)

Sets the display mode (MEAS MODE) of the measured current (or measured resistance).

Also inquires about the display mode of the measured current (or measured resistance).

• Syntax

Command message:

SYS:MEASMODE_<0/1>

S:MMOD_<0/1>

Query message:

SYS:MEASMODE?

S:MMOD?

--Program data

Data format: Character

Set value:

0: NORM

1: MIN/MAX

--Example

To set the display mode of the measured current to Max Hold,

S:MMOD 1

--Response message

To S:MMOD?, the present display mode of the measured current is returned .

If the display mode of the present measured current is set to NORM,

NORM is returned.

SYS:PASSHOLD (S:PHOL)

Sets the PASS hold time in a PASS judgment. Also inquires about the current PASS hold time.

--Syntax

Command message:

SYS:PASSHOLD_<*set value*>

S:PHOL_<*set value*>

Query message:

SYS:PASSHOLD?

S:PHOL?

--Program data

Data format: Real number, character

Set value: 0.2 to 10.0, HOLD

Unit: s

--Example

To set the PASS hold time to HOLD,

S:PHOL HOLD

--Response message

To S:PHOL?, the current PASS hold time is returned.

If the current PASS hold time is 0.5 s,

0.5 is returned.

SYS:BUZZERVOL (S:BUZZ)

Set the buzzer volume. Also inquires about the current buzzer volume.

--Syntax

Command message:

SYS:BUZZERVOL_<*0/1/2*>

S:BUZZ_<*0/1/2*>

Query message:

SYS:BUZZERVOL?

S:BUZZ?

--Program data

Data format: Integer

Set value:

0: Close

1: Low volume

2: High volume

Resolution: 1

--Example

To set the buzzer volume to High

S:BUZZ 2

--Response message

To S:BUZZ?, the current volume is returned.

If the current buzzer volume is High,

2 is returned.

SYS:CONTRAST (S:CON)

Sets the LCD contrast. Also inquires about the current LCD contrast.

--Syntax

Command message:

SYS:CONTRAST_<*set value*>

S:CON_<*set value*>

Query message:

SYS:CONTRAST?

S:CON?

--Program data

Data format: Integer

Set value: 0 to 10

Resolution: 1

--Example

To set the LCD contrast to 5,

S:CON 5

--Response message

To S:CON?, the current LCD contrast is returned.

If the current LCD contrast is 6,

6 is returned.

SYS:FAILMODE (S:FMOD)

Sets the FAIL mode (FAIL MODE). Also inquires about the current FAIL mode setting.

--Syntax

Command message:

SYS:FAILMODE_<0/1>

S:FMOD_<0/1 >

Query message:

SYS:FAILMODE?

S:FMOD?

--Program data

Data format: Character

Set value:

0: OFF
1: ON

--Example
To set the FAIL mode to OFF,
S:FMOD 0

--Response message
To S:FMOD?, the current FAIL mode setting is returned.
If the FAIL mode function is currently ON,
ON is returned.

SYS:CONTEST (S:CTEST)
Sets the CONTEST status. Also inquires about the current CONTEST setting.

--Syntax
Command message:
SYS:CONTEST_<0/1>
S:CTEST_<0/1 >
Query message:
SYS:CONTEST?
S:CTEST?

--Program data
Data format: Character
Set value:
0: OFF
1: ON

--Example
To set the FAIL mode to OFF,
S:CTEST 0

--Response message
To S:CTEST?, the current CONTEST setting is returned.
If the CONTEST function is currently ON,
ON is returned.

7.2.5 Commands Exclusively Used for Program

PRG:PRGNAME (P:PNAM)

Specifies a program number and names the program. Also inquires about the program name.

--Syntax

Command message:

PRG:PRGNAME_<*program number*>, <*program name*>

P:PNAM_<*program number*>, <*program name*>

Query message:

PRG:PRGNAME?_<*program number*>

P:PNAM?_<*program number*>

--Program data <*program number*>

Data format: Integer

Set value: 0 to 49

Resolution: 1

--Program data <*program name*>

Data format: Character

Set value: ASCII Code 20H to 7AH

--Response message

To P:PNAM?_<*program number*>, the name of the program with the specified number is returned.

If the name of program 10 is ACW1000V,

“ACW100V” is returned.

PRG:PRGSN (P:PSN)

Set/inquire the program ‘s serial number

--Syntax

Command message:

PRG:PRGSN_<*program number*>

P:PSN_<*program number*>

Query message:

PRG:PRGSN?

P:PSN?

--Program data

Data format: Integer

Set value: 0 to 49

Resolution: 1

--Example

To set the current program's SN 10

P:PSN 10

--Response message

To P:PSN?_<*program number*>, the SN of the current program is returned.

If the SN of the current program is 10,

10 is returned.

PRG:PRGRETURN (P:PRET)

Makes the RETURN/END settings for a specified program.

Also inquires about the RETURN/END setting for a specified program.

--Syntax

Command message:

PRG:PRGRETURN_<*program number*>, <ON/OFF>

P:PRET_<*program number*>, <ON/OFF>

Query message:

PRG:PRGRETURN?_<*program number*>

P:PRET?_<*program number*>

--Program data <*program number*>

Data format: Integer

Set value: 0 to 49

Resolution: 1

--Program data <*program name*>

Data format: Character

Set value: OFF/ON

--Example

To set program 10 to RETURN,

P:PRET 10,ON

--Response message

To P:PRET?_<*program number*>, the RETURN setting for the specified program is returned.

If program 10 is set to the END mode,

OFF is returned.

PRG:PRGNEW (P:PNEW)

Deletes a specified program.

--Syntax

Command message:

PRG:PRGNEW_<*program number*>
P:PNEW_<*program number*>

--Program data
Data format: Integer
Set value: 0 to 49
Resolution: 1

--Example
To delete program 10,
P:PNEW 10

PRG:PRGTOTAL (P:PTOT)
Inquires about the total number of steps in a specified program

--Syntax
Query message:
PRG:PRGTORAL?_<*program number*>
P:PTOT?_<*program number*>

--Program data <*program number*>
Data format: Integer
Set value: 0 to 49
Resolution: 1

--Response message
To P:PRET?_<*program number*>, the total number of steps in a specified program is returned. If the total number of step in program 10 is 15,
15 is returned.

PRG:PRGDEL (P:PDEL)
Deletes the specified step of a specified program

--Syntax
Command message:
PRG:PRGDEL_<*program number*>, <*step number*>
P:PDEL_<*program number*>, <*step number*>

--Program data <*program number*>
Data format: Integer
Set value: 0 to 49
Resolution: 1

--Program data <*step number*>

Data format: Integer
Set value: 0 to 49
Resolution: 1

--Example
To delete step 15 from program 10,
P:PDEL 10,15

PRG:PRGINS (P:PIN)
Inserts a memory number into the specified step of a specified program. Following the execution of this message, the tester automatically displays the program edit screen.

--Syntax
Command message:
PRG:PRGINS_<*program number*>, <*step number*>, <0/1/2>, <*memory number* >,<interval time>
P:PIN_<*program number*>, <*step number*>, <0/1/2>, <*memory number* >,<interval time>

--Program data <*program number*>
Data format: Integer
Set value: 0 to 49
Resolution: 1

--Program data <*step number*>
Data format: Integer
Set value: 0 to 49
Resolution: 1

--Program data <*mode selection* {0|1|2}>
Data format: Integer
Set value:
0: ACW;
1: DCW;
2: IR

--Program data <*memory number*>
Data format: Integer
Set value: 0 to 99
Resolution: 1

--Program data < interval time >
Data format: Real number
Set value: 0.2 to 9.9,HOLD
Resolution: 0.1

Unit: s

--Example

To insert memory 3 for AC withstanding voltage testing into step 15 of program 10.Also interval time is 0.5s

PIN 10,15,0,3,0.5

7.2.6 Commands Exclusively Used for Switching PAGE

PAGEACW1

The page is switched to ACW1 function.

--Syntax

Command message: PAGEACW1

PAGEACW2

The page is switched to ACW2 function.

--Syntax

Command message: PAGEACW2

PAGEACW3

The page is switched to ACW3 function.

--Syntax

Command message: PAGEACW3

PAGEDCW1

The page is switched to DCW1 function.

--Syntax

Command message: PAGEDCW1

PAGEDCW2

The page is switched to DCW2 function.

--Syntax

Command message: PAGEDCW2

PAGEDCW3

The page is switched to DCW3 function.

--Syntax

Command message: PAGEDCW3

PAGEIR1

The page is switched to IR1 function.

--Syntax

Command message: PAGEIR1

PAGEIR2

The page is switched to IR2 function.

--Syntax

Command message: PAGEIR2

PAGEIR3

The page is switched to IR3 function.

--Syntax

Command message: PAGEIR3

PAGESYS1

The page is switched toSYS1 function.

--Syntax

Command message: PAGESYS1

INTERFACE

The page is switched to INTERFACE function.

--Syntax

Command message: INTERFACE

PAGEAUTO

The page is switched to AUTO function.

--Syntax

Command message: PAGEAUTO

PAGEEDIT

The page is switched to EDIT function.

--Syntax

Command message: PAGEEDIT

7.2.7 Other Commands

START
Starts testing.

--Syntax
Command message: START

STOP
Stops a test. Also cancels FAIL, PASS (HOLD), and PROTECTION.

--Syntax
Command message: STOP

LOCAL
Return to the LOCAL from the REMOTE state.

--Syntax
Command message: LOCAL

***IDN**
Inquires about the model name and ROM version of the tester

--Syntax
Query message: *IDN?

--Response message
The model name of the tester is returned to *IDN? as follows: TH9101 Ver:1.11

***RST**
Initializes the tester (to original factory-set settings).

--Syntax
Command message: *RST

***CLS**
Resets protection register, invalid-setting register.

--Syntax
Command message: *CLS