

User's Manual

Electrical Safety Analyzer TOS93 Series

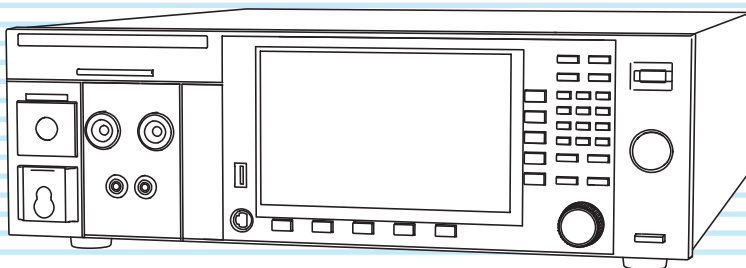
TOS9300

TOS9301

TOS9311

TOS9302

TOS9303



DANGER

**This product generates high voltage!
Improper operation can lead to serious accidents.**

To prevent accidents, be sure to read the section
“Safety Precautions for Testing” in this manual.
Keep this manual close to the product so that the operators
can read the manual at any time.

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Testing is not possible upon opening the package

When you first turn on this product after opening the package, the safety interlock will prevent you from performing tests. Connect the included SIGNAL I/O plug to the SIGNAL I/O connector to temporarily release the interlock ([p. 161](#)).

When you actually perform tests, design a system that uses the interlock for safety ([p. 162](#)).

Notes to the supervisor

- If the operators cannot understand the language used in this manual, translate the manuals into the appropriate language.
- Make sure that the operators understand the information in this manual before they operate this product.
- Keep the Getting Started Guide close to the product so that the operators can read the manual at any time.



DANGER

You will receive a potentially fatal electric shock if:

- You touch an output terminal while output is being generated.
- You touch a test lead that is connected to an output terminal while output is being generated
- You touch the EUT while output is being generated.
- You touch a location that is electrically connected to an output terminal while output is being generated.
- You touch a location that is electrically connected to an output terminal immediately after output is turned off after a DC withstanding voltage test or insulation resistance test has been performed.

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General Description

About Manuals

This manual provides an overview of the product and notes on usage. It also explains how to configure it, operate it, perform maintenance on it, and so on. Read this manual thoroughly before use, and use the product properly.

Intended readers

These manuals are intended for users of this product and their instructors. The manuals assume that the reader has knowledge about electric safety testing.

Manual construction

User's Manual (this manual)

This document is intended for first-time users of this product. It provides an overview of the product, notes on usage, and specifications. It also explains how to connect the product, configure the product, operate the product, perform maintenance on the product, and so on.

Communication Interface Manual

This document contains details about remote control. It is written for readers with sufficient basic knowledge of how to control testers and measuring instruments using SCPI commands.

Getting Started Guide

This document is intended for first-time users of the product. It provides only basic instructions. Please read this manual before you operating the product.

Safety Information

This document contains general safety precautions. Keep them in mind and make sure to observe them.

Manual updates

This manual is subject to be revised due to product improvement and/or specification change. The latest manual (PDF and HTML) is available on our website.



<https://global.kikusui.co.jp/kikusui-manuals/>

Firmware versions that this manual covers

This manual applies to products with firmware versions 2.1X. For information on how to check the firmware version, see "Displaying the Device Information" (p.200).

When contacting us about the product, please provide us with the following information.

Model (marked in the top section of the front panel)

Firmware version (p.200)

Serial number (marked on the rear panel)

Trademarks

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Both unit specifications and manual contents are subject to change without notice.

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Disposal

Dispose of TOS93 series in accordance with your local regulations.

Open Source Software

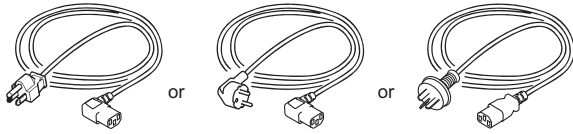
This product contains open source software under the licensing terms of GNU General Public License (GPL), GNU LESSER General Public License (LGPL), and other licenses. For details, see the following URL.

<https://rddocuments.kikusui.co.jp/oss/tos93>

Accessories

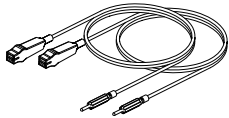
TOS9300, TOS9301, TOS9302, TOS9303

The attached power cord varies depending on the shipment destination.



Plug: NEMA5-15 Rating: 125 Vac/10 A Plug: CEE7/7 Rating: 250 Vac/10 A Plug: GB1002 Rating: 250 Vac/10 A

Power cord (1 pc., length: 2.5 m)

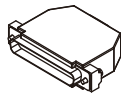


High-voltage test lead TL31-TOS (1 pair)



High-voltage warning sticker (1 pc.)

Cable tie (1 pc.)

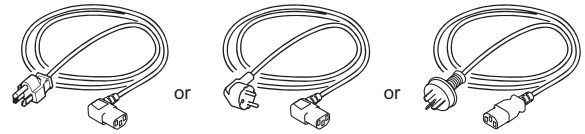


SIGNAL I/O plug (1 set) Assembly type D-sub plug unit

Heavy object warning label (1 pc.)*
When you move TOS93 series, be sure to put this sticker on a position where their contents can be seen. Make sure not to cover the air inlet and outlet with the sticker.
* Not included with the TOS9300

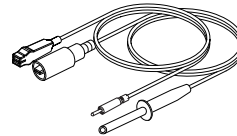
TOS9311

The attached power cord varies depending on the shipment destination.

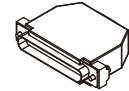


Plug: NEMA5-15 Rating: 125 Vac/10 A Plug: CEE7/7 Rating: 250 Vac/10 A Plug: GB1002 Rating: 250 Vac/10 A

Power cord (1 pc., length: 2.5 m)



High-voltage test lead TL34-TOS (1pair)



SIGNAL I/O plug (1 set) Assembly type D-sub plug unit

Heavy object warning label (1 pc.)
When you move TOS93 series, be sure to put this sticker on a position where their contents can be seen. Make sure not to cover the air inlet and outlet with the sticker.



High-voltage warning sticker (1 pc.)

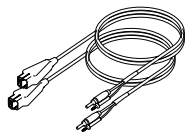
Cable tie (1 pc.)

China RoHS sheet (1 sheet)

Getting Started Guide (1 copy)

Safety Information (1 copy)

TOS9302, TOS9303 only



Test leads for earth continuity test TL13-TOS (1 pair)

Getting Started Guide (1 copy)

Safety Information (1 copy)

China RoHS sheet (1 sheet)

Product Overview

The TOS93 series is a electrical safety analyzer that can perform several types of safety tests on electronic devices and components. The available types of safety tests include withstanding voltage test, insulation resistance test, earth continuity test, partial discharge test, and leakage current test (touch current test, and protective conductor current test, patient leakage current test).

Different models are available according to the combination of tests you require, so a single unit is enough to cover your various safety test needs.

The product is suited to (1) research and development installations, (2) test facilities for quality assurance testing and standard certification, and (3) manufacturing lines.

Model configurations

This document describes TOS9300, TOS9301, TOS9302, TOS9303 and TOS9311.

The full lineup of the TOS93 series is as follows.

Model	Supported tests ¹
TOS9300	ACW, IR
TOS9301	ACW, DCW, IR
TOS9311	ACW, DCW, IR
TOS9301PD	ACW, DCW, IR, PD
TOS9302	ACW, EC
TOS9303	ACW, DCW, IR, EC
TOS9303LC	ACW, DCW, IR, EC, LC

1. ACW: AC withstanding voltage, DCW: DC withstanding voltage, IR: insulation resistance, EC: earth continuity, PD: partial discharge, LC: leakage current

Features

Diverse lineup of products

A diverse lineup of products is available for the various combinations of test required in production lines to accommodate a variety of needs. Tests can be performed in accordance with the requirements of safety and electrical standards and ordinances such as IEC, EN, BS, VDE, UL, CSA, GB, and JIS.

Dielectric breakdown detection sensitivity settings

Safety standards define that corona discharge and partial discharge are not dielectric breakdown. This product allows you to adjust the detection sensitivity of EUT's dielectric breakdown during withstanding voltage testing to support a wide range of settings from those that do not detect corona discharge or partial discharge to those that do. Failure analysis that were not possible with previous Kikusui withstanding voltage testers is now possible.

Support for AC/DC earth continuity test up to 40 A (TOS9302, TOS9303 only)

The newly developed amplifier a broad range of tests from AC earth continuity test of general home electric appliances to DC earth continuity test of EV-PV systems.

LAN, USB, and RS232C


The product is standard equipped with LXI compatible LAN, USB 2.0, USB-TMC compatible USB, and RS232C interface.

Color liquid crystal display

Intuitive display and controls are provided through the 7-inch display that shows various test settings, descriptions, and drawings.

Notations Used in This Manual

In-Text notations

- In this manual, units of Electrical Safety Analyzer TOS9300, TOS9301, TOS9311, TOS9302, and TOS9303 refer to as "TOS93 series"
- "PC" in this manual is a generic term for personal computers and workstations.
- The term "EUT" is used to refer generally to a device under test.
- ">" indicates the hierarchy of items you need to select. The item to the left of this symbol indicates a higher level item.
- Test names may be abbreviated as follows:
AC withstanding voltage: ACW, DC withstanding voltage: DCW, insulation resistance: IR.
- The following icons indicate the TOS93 series model names.

- The screen captures and illustrations used in this manual may differ from the actual items.

Safety information

DANGER

Indicates an imminently hazardous situation which, if ignored, will result in death or serious injury.

WARNING

Indicates a potentially hazardous situation which, if ignored, could result in death or serious injury.

CAUTION

Indicates a potentially hazardous situation which, if ignored, may result in slight injury or damage to the product and other property.

NOTE

Indicates information that you should know.

Safety Precautions

When using this product, be sure to observe the precautions in the Safety Information Manual. Items specific to this product are given below.

When using in general

⚠ DANGER

The TOS93 series generates high voltage, which may cause electric shock. Improper operation can lead to fatal accidents.

- To prevent accidents, be sure to read "Safety Precautions for Testing" (p.21) in this User's Manual.
- Keep the Getting Started Guide close to TOS93 series so that the operators can read the manual at any time.
- Do not touch an output terminal while output is being generated.
- Do not touch a test lead that is connected to an output terminal while output is being generated.
- Do not touch the EUT while output is being generated.
- Do not touch a location that is electrically connected to an output terminal while output is being generated.
- Do not touch a location that is electrically connected to an output terminal immediately after output is turned off after a DC withstanding voltage test or insulation resistance test has been performed.

⚠ WARNING

Risk of electric shock or fire.

- If a break or tear is found, stop using the test leads immediately.

Risk of electric shock.

- Do not operate without grounding the product.
- Wear rubber gloves for electrical work.
- In tests that use test leads, do not touch the tip of test leads.
- If you want to turn the POWER switch back on, wait at least 10 seconds.

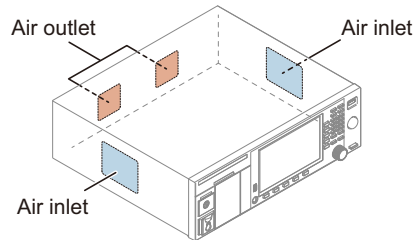
It is dangerous to do otherwise, because the protective functions of the product may not work effectively. This may cause the product to malfunction or reduce the life of the POWER switch and internal parts such as the fuses.

Risk of fire.

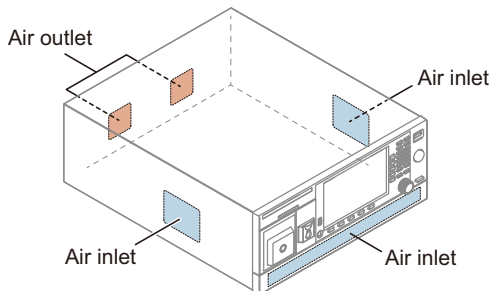
- **Do not use the product where ventilation is poor.**
The TOS93 series uses forced air cooling. It sucks air through the inlet holes on its right and left panels and expels air through its rear panel.
- **Secure adequate space around the product's air inlet and outlet so that they are not blocked.**
Allow at least 20 cm of space between the air inlet/outlet and the wall (or obstacles). Be careful not to block the air inlet and outlet especially when rack mounting the product.

- **Do not place objects that are affected by heat near the air outlet.**

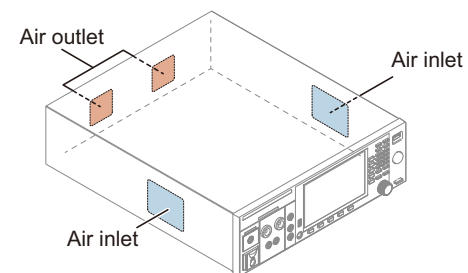
Hot air (approximately 20 °C (68 °F), hotter than the ambient temperature) is expelled from the outlet hole
TOS9300, TOS9301



TOS9311



TOS9302, TOS9303



⚠ CAUTION

Risk of electric shock.

- Install the connector cover or terminal cover when not using the USB port, LAN port, RS232C port, I terminal, or V terminal. (p.21)

Noise generated by this product may affect other devices.

- **Do not use this product near highly sensitive measuring instruments or receivers.**
At a test voltage of 3 kV or greater, the product may produce corona discharge between its test lead clips. This will generate a significant amount of broadband RF emission. To minimize this effect, keep the alligator clips away from each other. Also, keep the alligator clips and test leads away from conducting surfaces, especially sharp metal edges.

Installation

⚠ WARNING

Risk of electric shock.

- **To prevent electric shock, be sure to connect the protective conductor terminal of the product to electrical ground (safety ground).**

This product is IEC Safety Class I equipment (equipment with a protective conductor terminal).

- **Connect the protective conductor terminal to earth ground.**
The product is grounded through the power cord ground wire.

CAUTION

- **Do not install the product in residential environment.**
TOS93 series is not intended for use in residential environments and may not provide adequate protection to radio reception in such environments.

General precautions during test

WARNING

Risk of electric shock.

- **To prevent accidents, strictly follow the precautions and always pay the utmost attention to safety concerns when you operate the product.**
Since the following high voltages are generated, handling the product improperly may lead to a fatal accident.
 - TOS9300, TOS9302: Maximum voltage during an ACW test is 5.0 kVac
 - TOS9301, TOS9303: Maximum voltage during an ACW test is 5.0 kVac, or maximum voltage during a DCW test is 7.2 kVdc.
 - TOS9311: Maximum voltage during an ACW test is 10.0 kVac, or maximum voltage during a DCW test is 10.0 kVdc.
- **While the DANGER LED is lit, do not touch the EUT, test leads, test probes, output terminals, or other peripheral components.**
- **Stay away from the alligator clips on the included test leads while the DANGER LED is lit.**
The alligator clip vinyl insulation of the supplied tests do not have dielectric strength.
- **When performing a withstanding voltage test, be sure to wear rubber gloves for electrical work.**
If obtaining these gloves is difficult, contact your Kikusui agent or distributor.
- **For a while after the output has been turned off, do not touch the EUT, test leads, test probes, output terminals, or other peripheral components.**
- **During testing and before this discharge completes, do not disconnect the tester from the EUT.**
After the output has been turned off, the internal discharge circuit goes into operation and discharges the output voltage.
- **Except in an emergency, do not turn the power off while output is being generated.**

During withstanding voltage test and insulation resistance test

WARNING

Risk of electric shock.

- **Do not touch the EUT, HIGH VOLTAGE terminals, test leads, test probes, output terminals, or other peripheral components while the DANGER LED is lit.**
- **Stay away from the alligator clips on the included test leads while the DANGER LED is lit.**
There are some current-carrying parts protruding from the vinyl coating during wiring.

- **Connect the test leads securely.**
If connections are incomplete, the entire EUT may be charged to a high voltage.
- **Be sure to connect the low-voltage test lead (black) first.**
- **If there is a possibility that the EUT or tools and the like will be grounded or if you are uncertain about it, do not set GND to Guard.**
The ammeter will be short-circuited and will not be able to measure current.
- **If you set GND to Guard, do not connect measuring instruments that are grounded at one end (e.g., Kikusui 149-10A High Voltage Digital Voltmeter, TOS1200 Current Calibrator) to this product.**
The ammeter will be short-circuited and will not be able to measure current.

During earth continuity test

WARNING

There is a risk of burns or injury.

- **Connect the test leads securely.**
The TOS9302 and the TOS9303 produce large current up to 42 A. The OUTPUT terminals or the EUT may get hot if the connection is loose.
- **Do not connect the supplied test leads or the voltage measurement cable (the thinner cable) of the optional test probe to the OUTPUT terminals.**
Because the nominal cross-sectional area for running the current is insufficient, they may burn out.

CAUTION

There is a risk of minor injury or failure.

- **When using the included TL13-TOS test leads for earth continuity test, connect the voltage measurement cables (black and red) even when two-terminal wiring (p.40) is in use.**
Because the test voltage is also applied to the voltage measurement wiring terminals during test, do not let the terminals contact other parts.

A large magnetic field may be generated.

- **Do not bring objects that are easily affected by magnetic fields close to the test leads or the current output cable of the TOS9302 and the TOS9303.**

In case of failure

WARNING

Risk of electric shock.

- **Until you get the product fixed, make sure that nobody can use it.**
- **For repairs, contact your Kikusui agent or distributor.**

Notes on Usage

When using or storing this product, be sure to observe the temperature and humidity ranges. For environmental conditions, see General Specifications (p.220).

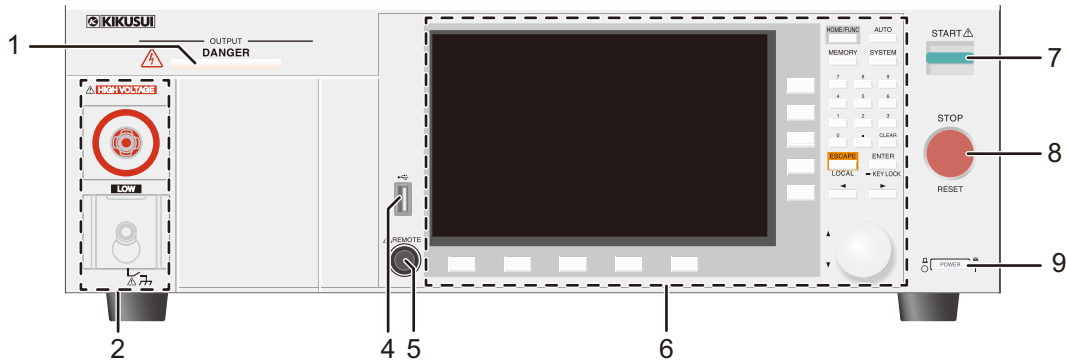
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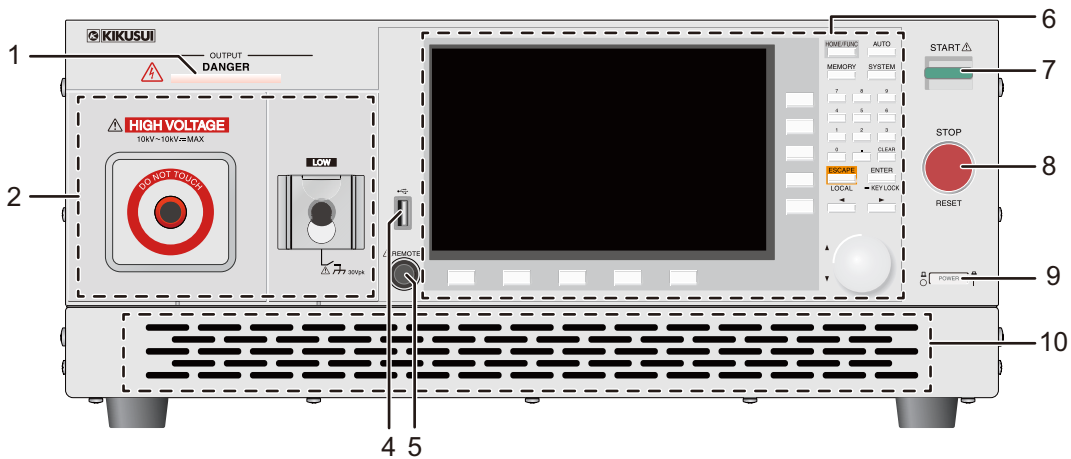
Component Names

Front Panel

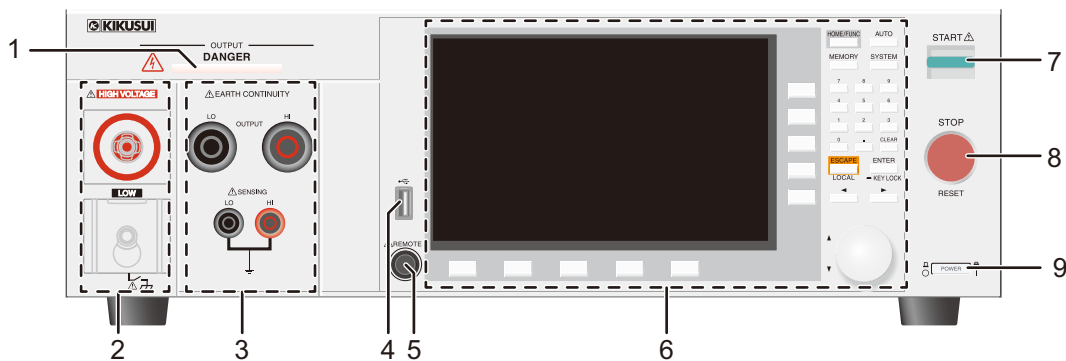
TOS9300, TOS9301



TOS9311

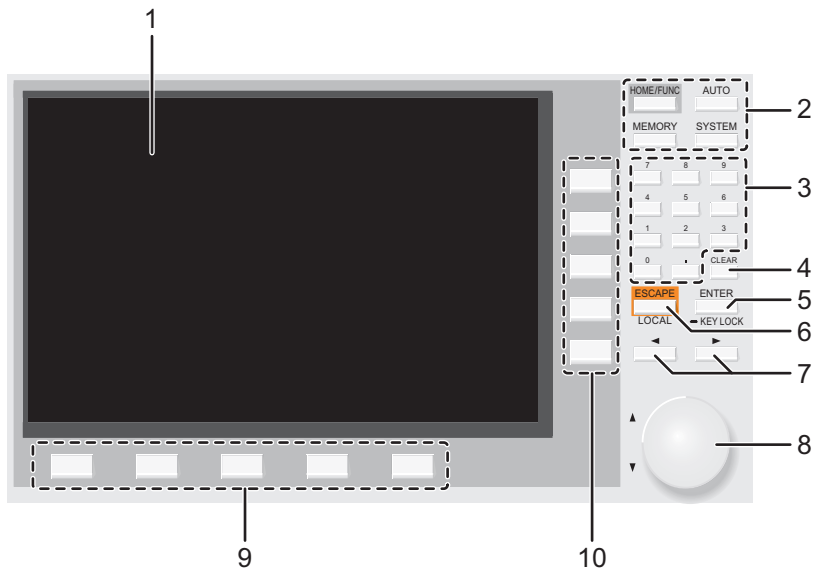


TOS9302, TOS9303



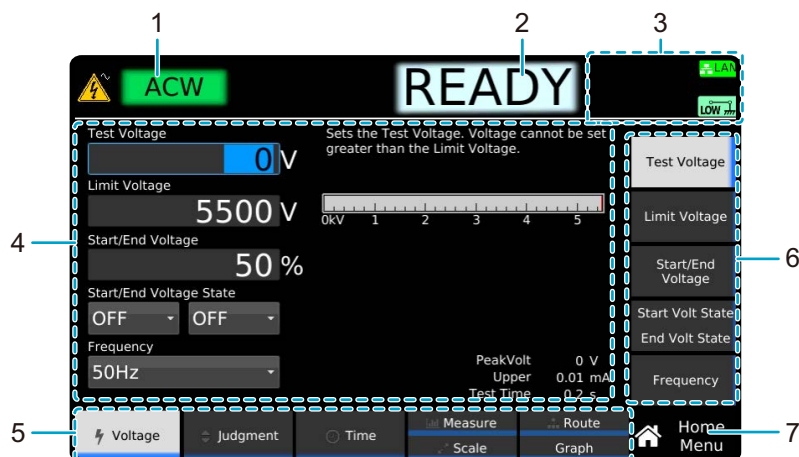
No.	Name	Function	
1	DANGER LED	Lights red when the power is turned on, when a test is in progress, when a high voltage is being output, or when there is residual voltage at the output terminals.	
2	Area for withstanding voltage, and insulation resistance (p.35)	HIGH VOLTAGE terminal	Outputs the test voltage of the high voltage side.
		LOW terminal	Outputs the test voltage of the low voltage side (with cable lock).
3	Area for earth continuity test (p.40)	OUTPUT HI terminal	Outputs the test voltage of the high voltage side.
		OUTPUT LO terminal	Outputs the test voltage of the low voltage side.
		SENSING HI terminal	Detects the voltage at the sensing terminal (of the high voltage side) when four-terminal wiring is in use.
		SENSING LO terminal	Detects the voltage at the sensing terminal (of the low voltage side) when four-terminal wiring is in use.
4	USB port (host)	For connecting an external keyboard (p.46), Saves setup memory and test results (p.170), Exporting and importing AUTO test programs (p.154), and updates the firmware (p.199).	
5	REMOTE connector	For connecting the optional remote control box or test probes. (p.234)	
6	Controls	See Controls (p.16)	
7	START switch	Starts a test.	
8	STOP switch	Stops testing and clears the current status. Returns to the HOME menu screen.	
9	POWER switch	Turns the power on (I) and off (O). (p.30)	
10	Air inlet	Air inlet for cooling.	

Controls



No.	Name	Function	
1	Display	Displays the settings, measured values, and other information. (p.17)	
2	Menu keys	HOME/FUNC key	Switches between the test setup screen (Home menu) and test selection screen (Function menu). (p.43)
		AUTO key	Displays the auto test screen. (p.138)
		MEMORY key	Displays the memory function screen. (p.170)
		SYSTEM key	Displays the system setting screen (System Menu). (p.179)
3	Numeric keypad	Enters values. (p.46)	
4	CLEAR key	Deletes numbers/characters. (p.46)	
5	ENTER key	KEYLOCK key	Confirms numeric keypad input. Confirmation after selection of setting item. (p.46)
		KEYLOCK key	Hold down to lock the keys. Hold down when key lock is enabled to unlock. (p.183)
6	ESCAPE key	LOCAL key	Cancel numeric/character input. Closes windows. (p.46)
		LOCAL key	Returns remote control to panel operation. (p.238)
7	◀/▶ keys	Move the cursor left and right. Select the left or right item. (p.46)	
8	Rotary knob	Selects an item. Enters numbers and characters. (p.46)	
9	Function keys	Executes the item that is displayed above each key (function area). (p.44)	
10	Sub-function keys	Executes the item that is displayed to the left of each key (sub-function area). (p.44)	

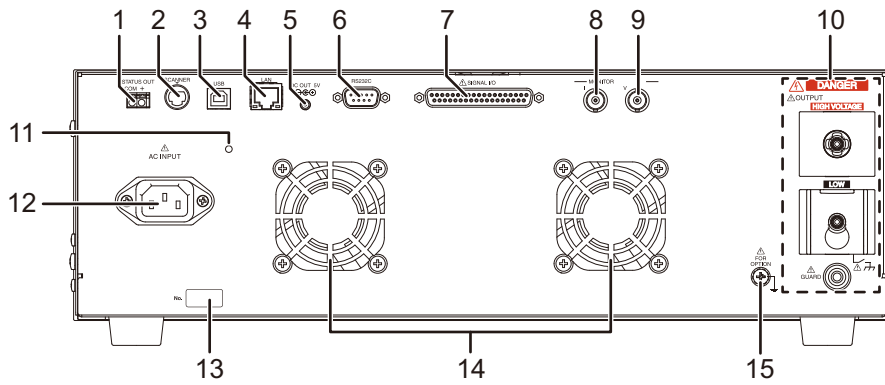
Display



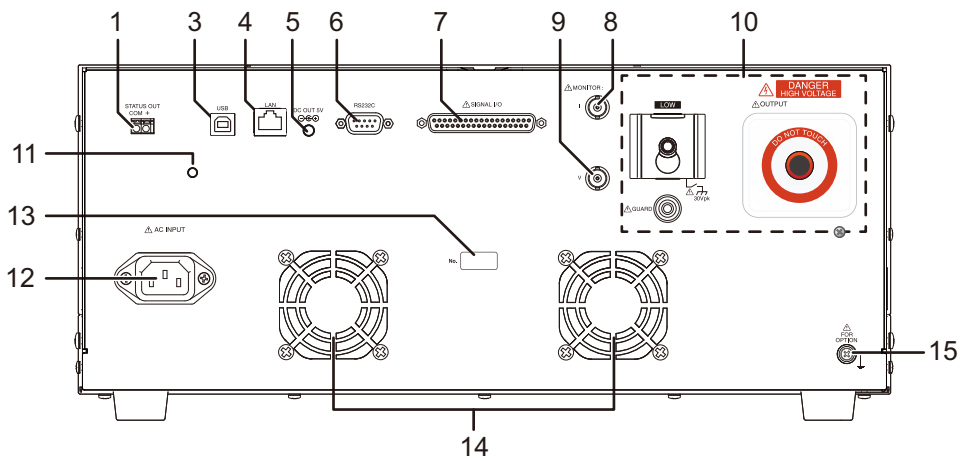
No.	Name	Function	
1	Test mode	Selected test type.	
2	Test status	READY	Ready to start test.
		RISE	Voltage or current rising.
		FALL	Voltage or current falling.
		TEST	Testing.
		PASS	Test successful.
		Upper-FAIL	Test failed because a value greater than or equal to the upper limit was detected.
		Lower-FAIL	Test failed because a value less than or equal to the lower limit was detected.
		Upper-FAIL (dV/dt)	In a DCW test, the voltage rise rate (dV/dt) is less than approximately 1 V/s. (p.86)
		Lower-FAIL (dV/dt)	In an IR test, the voltage rise rate (dV/dt) is less than approximately 1 V/s. (p.86)
	Contact-FAIL	The continuity between the scanner and EUT cannot be verified. (p.74)	
	CHECK	Contact check in progress.	
3	Status display icon area	Displays a product status using icons. (p.20)	
4	Settings area	Displays settings and descriptions. Displays measured values during testing. (p.44)	
5	Function area	Indicates that execution is possible with the keys (function keys) at the bottom of the display. (p.44)	
6	Sub-function area	Indicates that execution is possible with the keys (sub-function keys) in the right side of the display. (p.43)	
7	Menu name	Name of the menu currently displayed. (p.20)	

Rear Panel

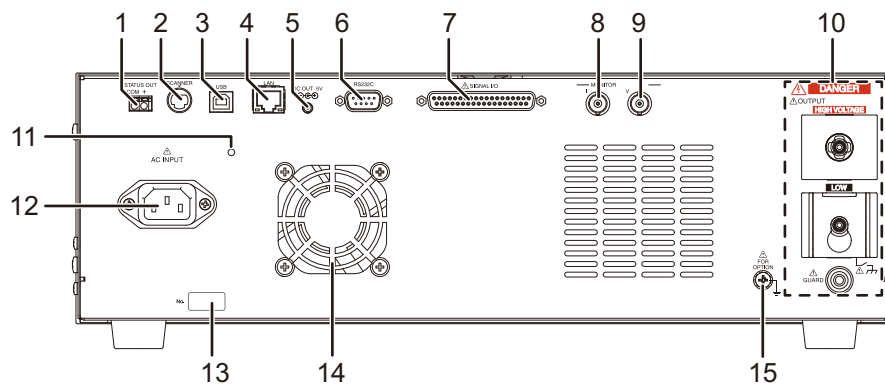
TOS9300, TOS9301



TOS9311



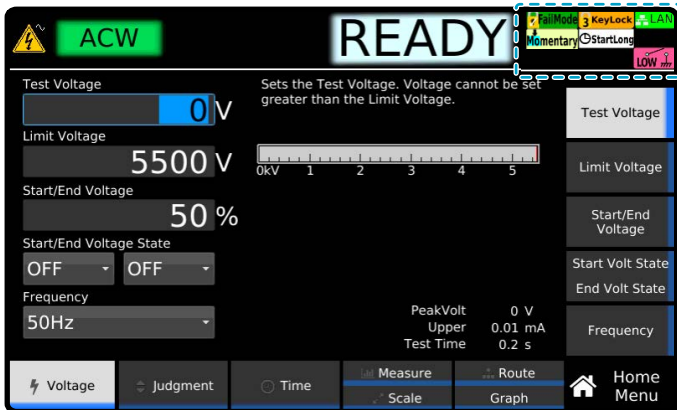
TOS9302, TOS9303



No.	Name	Function	
1	STATUS OUT connector	Connect option products. (p. 169)	
2	SCANNER connector	Connect to the high voltage scanner option. (p. 234) (TOS9311 not supported.)	
3	USB port ¹	USB port for remote control.	
4	LAN port ¹	LAN port for remote control.	
5	DC OUT 5 V terminal	Connect option products.	
6	RS232C port ¹	RS232C port for remote control.	
7	SIGNAL I/O connector	A I/O signal connector for controlling this product from an external device. (p. 157)	
8	I terminal ¹	Signal output terminal for monitoring the current waveforms of withstanding voltage tests. (p. 168)	
9	V terminal ¹	Signal output terminal for monitoring the voltage waveforms of withstanding voltage tests. (p. 168)	
10	Area for withstanding voltage and insulation resistance	HIGH VOLTAGE terminal	Outputs the test voltage of the high voltage side. (p. 35)
		LOW terminal	Outputs the test voltage of the low voltage side (with cable lock).
		GUARD terminal	Connect the chassis connection wire of the shield box when a shield box is used. (p. 38)
11	Cable tie attachment hole	Hole for attaching the included cable tie (for USB cables).	
12	AC INPUT inlet	Connect a power cord for supplying power to this product. (p. 28)	
13	Serial number	Serial number.	
14	Air outlet	Vent for cooling this product.	
15	FOR OPTION terminal	Connect the ground wire of option products.	

1. When the product is shipped from the factory, covers are attached. (p. 21)

Status Display Icons



Icon	Description
	Indicates that key lock is on. The key lock level is displayed numerically. (p.183)
	Under remote control.
	LAN connection status. Green: Communication enabled, Orange: Preparing for communication, Red: Not connected.
	Fail Mode is enabled. (p.188)
	Double Action is enabled. (p.189)
	Start Long is enabled. (p.189)
	Momentary is enabled. (p.189)
	Auto testing/auto test standby. (p.138)
	GND setting (Low, Guard). (p.67)
	While discharging. (p.64) (TOS9302 not supported.)
	SCPI error. The number of error incidents (up to 16) is displayed numerically. (p.195)

Safety Precautions for Testing

Lighting of the DANGER LED

The DANGER LED lights when the product is in any of the following conditions.

- At power on
- When a test is running
- When high voltage is being output
- When voltage remains at the output terminals

Check whether the DANGER LED lights at power on. If it does not, stop using the product, and contact your Kikusui agent or distributor.

Checking the Connectors/Terminal Covers

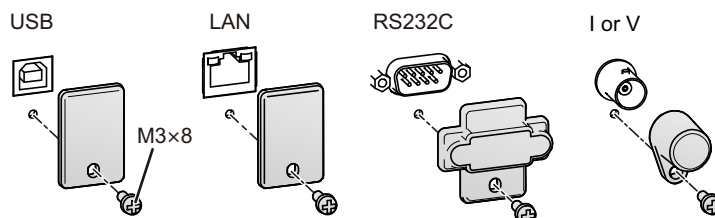
⚠ CAUTION

Risk of electric shock.

- **Install the connector cover or terminal cover when not using the USB port, LAN port, RS232C port, I terminal, or V terminal.**

When the product is shipped from the factory, covers are attached to the USB port, LAN port, RS232C port, I terminal, and V terminal on the rear panel.

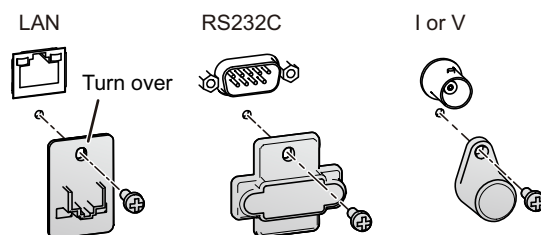
If they are damaged or lost, contact your Kikusui agent or distributor.



■ Holding the Connector/Terminal Covers

The removed cover can be held as shown below.

Keep the USB port cover separately as it will interfere with the cable tie attachment hole.



Test Precautions

Pre-test precautions

WARNING

Risk of electric shock.

- **To prevent accidents, strictly follow the precautions and always pay the utmost attention to safety concerns when you operate the product.**
Since the following high voltages are generated, handling the product improperly may lead to a fatal accident.
 - TOS9300, TOS9302: Maximum voltage during an ACW test is 5.0 kVac
 - TOS9301, TOS9303: Maximum voltage during an ACW test is 5.0 kVac, or maximum voltage during a DCW test is 7.2 kVdc.
 - TOS9311: Maximum voltage during an ACW test is 10.0 kVac, or maximum voltage during a DCW test is 10.0 kVdc.
 - **While the DANGER LED is lit, do not touch the EUT, test leads, test probes, output terminals, or other peripheral components.**
-

Check the following items before you start testing, and always follow the precautions.

- **The power cord is connected to a properly grounded outlet.**
- **There is no damage such as tears or breaks in the test lead insulation.**
- **When the POWER switch is turned on, the DANGER LED lights.**
- **When the DANGER LED is lit, do not turn the POWER switch off except in an emergency.**
- **Test leads connected to the following output terminals of this product must not be connected to the main power supply circuit in the active state.**
 - HIGH VOLTAGE terminal or LOW terminal (all models)
 - OUTPUT HI terminal, OUTPUT LO terminal, SENSING HI terminal, or SENSING LO terminal (for TOS9302, TOS9303)

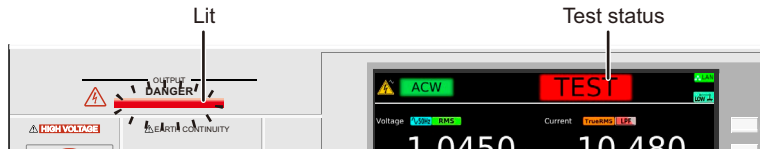
Testing precautions

WARNING

Risk of electric shock.

- While the DANGER LED is lit, do not touch the EUT, test leads, test probes, output terminals, or other peripheral components.
- Stay away from the alligator clips on the included test leads while the DANGER LED is lit. The alligator clip vinyl insulation of the supplied tests do not have dielectric strength.
- When performing a withstanding voltage test, be sure to wear rubber gloves for electrical work.
If obtaining these gloves is difficult, contact your Kikusui agent or distributor.

During testing, the DANGER LED lights, and the display shows "TEST." Be careful because high voltage may be being output when the DANGER LED is lit.



Precautions when setting test conditions

Before changing test conditions, press STOP and check that the DANGER LED is turned off to ensure safety.

Precautions after Output Has Been Turned Off

WARNING

Risk of electric shock.

- For a while after the output has been turned off, do not touch the EUT, test leads, test probes, output terminals, or other peripheral components.
 - During testing and before this discharge completes, do not disconnect the tester from the EUT.
After the output has been turned off, the internal discharge circuit goes into operation and discharges the output voltage.
-

The EUT, test leads, test probes, output terminals, and other peripheral components are charged to a high voltage. After the output has been turned off, be sure to check the following before you touch the items that have been charged to a high voltage.

- The **DANGER LED** is off.
- “RISE,” “TEST,” or “FALL” is not shown on the display.

If you will not use the product for some time or if the operator will be away from the product, be sure to turn the POWER switch off.

Estimated discharge time

The time required to discharge the built-up electrical charge varies according to the test voltage and the properties of the EUT.

The time that this product requires to discharge the voltage from its internal capacitors down to 30 V is as follows:

- When an EUT is not connected: 16 ms for a DCW test, 1.5 ms for an IR test
- When an EUT with a input capacitance of 0.05 μF is connected: 50 ms for a DCW test, 6 ms for an IR test

Remote Control Precautions

If you are performing remote control at a location away from the product, to prevent accidents, follow the safety measures given below.

- **Make sure that high voltages are not generated unintentionally.**
- **Make it impossible to touch the EUT, test leads, test probes, and the areas near the output terminals when high voltages are being generated.**

Malfunction Precautions

WARNING

Risk of electric shock.

- **Until you get the product fixed, make sure that nobody can use it.**
- **For repairs, contact your Kikusui agent or distributor.**

Dangerous malfunctions

If the product is in one of the states explained below, it may be malfunctioning in a very dangerous manner—it may not be possible to turn off the high voltage that is being generated.

- **Even when you press the STOP switch, the DANGER LED remains lit.**
- **Even though a voltage is indicated on the voltmeter, the DANGER LED does not light.**

If the tester is not operating properly, it may be generating a high voltage irrespective of the settings made by the operator. Immediately turn the POWER switch off, and disconnect the power cord from the outlet. Stop using the product immediately, and contact your Kikusui agent or distributor.

Emergency measures

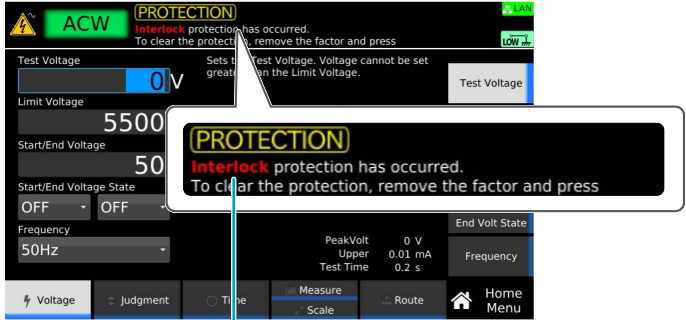
There are two actions that you must carry out if, due to a malfunction in the product or the EUT, there is a possibility of an emergency occurring such as electric shock or damage to the EUT.

- **Turn the POWER switch off.**
- **Remove the power cord plug from the outlet.**

Protection Functions

When one or more protection function activation conditions are met, the protection function will be activated, and you will no longer be able to perform test in this state (PROTECTION mode).

When a protection function is activated, the word “PROTECTION” is indicated on the display along with the type of protection. If a PROTECTION mode occurs during a test, the output is shut off and the test is stopped immediately.



Type of protection

Use the following table to check the type of protection function, activation condition, and remedy, and release PROTECTION mode. The text inside the parentheses in the “Type of protection” column is displayed in the list of test results (p.174).

Type of protection	Activation condition	Remedy
Interlock (ILOCK)	Interlock is activated.	Release the interlock (p.161).
Power Supply (PS)	There is an error in the power supply section.	Pressing STOP releases the PROTECTION mode, but the product needs to be repaired. Contact your Kikusui agent or distributor.
Output Error (OUTERR)	An output voltage outside of the following range is detected. ACW, DCW, IR test: $\pm(10\% \text{ of setting} + 50 \text{ V})$ EC test: $\pm(10\% \text{ of setting} + 2 \text{ A})$ This error may also occur when the output changes suddenly.	Eliminate the cause of the error, and press STOP.
Over Load (OL)	An output power or output current outside of the following range is detected. ACW: 550 VA, DCW: 110 W or 50 mA, IR (7200 V test): 110 W or 25 mA, IR (10 kV test): 110 W or 25 mA, IR (-1000 V test): 2 mA, EC: 240 VA	Eliminate the cause of the error, and press STOP.
Over Heat (OH)	The internal temperature of the product is abnormally high.	Confirm that the internal temperature of the product has decreased, and then press STOP.
Over Rating (OR)	During a withstanding voltage test, an output current is generated for a length of time that exceeds the output time limit (p.80).	Press STOP, and wait the necessary rest time.
Calibration (CAL)	The preset calibration period is exceeded.	Setting Protection Keep under Calibration (p.186) to Disable and pressing STOP releases the PROTECTION mode, but the product needs to be calibrated. To have your product calibrated, contact your Kikusui agent or distributor.
Remote (RMT)	The REMOTE connector is connected or disconnected.	Check the REMOTE connector, and then press STOP.
Signal I/O (SIO)	There is a change in the SIGNAL I/O connector's ENABLE signal.	Press STOP.

Type of protection	Activation condition	Remedy
Communication (COMM)	An internal communication error is occurring.	Repair is necessary. Turn the power off, and contact your Kikusui agent or distributor.
	No SCPI communication took place for more than the specified time when the watchdog (p.181) was enabled.	Check the SCPI communication status.
Earth Fault (EF)	When the grounding mode (GND) is set to Guard, abnormal current flows from the high voltage output of this product to ground.	Set the grounding mode to Low.
Scan I/F (SIF) (TOS9311 not supported)	While scanning, the interface cable is disconnected.	Connect the interface cable, and press STOP.
	The channel-assigned scanner is not detected.	Check the scanner connection, and then press STOP.

■ Tests supported by each model

	TOS9300	TOS9301	TOS9311	TOS9302	TOS9303
ACW	✓	✓	✓	✓	✓
DCW	n/a	✓	✓	n/a	✓
IR	✓	✓	✓	n/a	✓
EC	n/a	n/a	n/a	✓	✓

Preparation

This chapter describes how to prepare this product for use. •

- For information about installing and moving this product, see "Precautions Concerning Installation Location" and "Precautions to Be Taken When Moving the Product" in the Safety Information Manual.
- When using or storing this product, be sure to observe the temperature and humidity ranges. For environmental conditions, see "General Specifications" (p.220).
- If you want to mount the product on a rack, see "Brackets" (p.236).

Connecting the Power Cord

WARNING

Risk of electric shock.

- **To prevent electric shock, be sure to connect the protective conductor terminal of the product to electrical ground (safety ground).**
This product is IEC Safety Class I equipment (equipment with a protective conductor terminal).
- **Connect the protective conductor terminal to earth ground.**
The product is grounded through the power cord ground wire.

NOTE

- Use the supplied power cord to connect to the AC line.
If the supplied power cord cannot be used because the rated voltage or the plug shape is incompatible, have a qualified engineer replace it with an appropriate power cord that is 3 m or less in length. If obtaining a power cord is difficult, contact your Kikusui agent or distributor.
- Do not use the supplied power cord with other instruments.
- The power cord with a plug can be used to disconnect the product from the AC power line in an emergency.
- 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.

This product is designed as an equipment of IEC Overvoltage Category II (energy-consuming equipment supplied from a fixed installation).

- 1 Turn off (O) the POWER switch on the front panel.**
- 2 Check that the AC power line meets the nominal input rating of the product.**
The product can receive a nominal power supply voltage in the range of 100 Vac to 120 Vac or 200 Vac to 240 Vac. The supported frequencies are 50 Hz and 60 Hz. (Frequency range: 47 Hz to 63 Hz)
- 3 Connect the power cord to the AC INPUT inlet on the rear panel.**
- 4 Connect the power cord plug to an outlet with a ground terminal.**
This completes the connections.

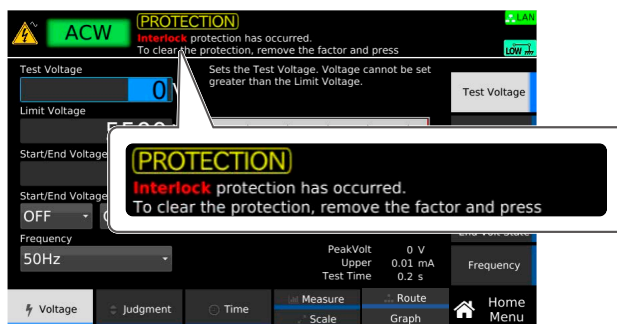
Checking Whether the Power Is On or Off

Checking the interlock operation

When this product is turned on for the first time after purchase, it starts in PROTECTION mode in which the interlock function (p.161) prevents tests from being executed. Check that the interlock is working properly.

- 1 Check that the power cord is connected properly.
- 2 Check that nothing is connected to the SIGNAL I/O connector on the rear panel.
- 3 Turn on (I) the POWER switch on the front panel.
- 4 Check that PROTECTION mode is activated.

After the startup screen, when the product enters PROTECTION mode, the following screen appears.



This completes the checking of the interlock operation.

To release the interlock temporarily, connect the included SIGNAL I/O plug to the SIGNAL I/O connector, and press STOP on the front panel. When you are actually performing tests, construct a system that uses the interlock to ensure safety (p.162).

Turning the power on

NOTE

- When the power is turned on for the first time after purchase, the interlock function sets the product in PROTECTION mode and prevents tests from being performed. Temporarily connect the included SIGNAL I/O plug to the SIGNAL I/O connector to release the PROTECTION mode (p.161).
- When you actually perform tests, design a system that uses the interlock for safety (p.162).

By factory default, the panel settings immediately before the POWER switch is turned off are saved. When you turn the power on, the product starts in the same state as it was in the last time it was turned off. (However, the output is off.)

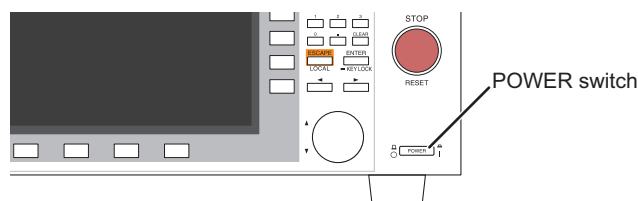
The panel setting state at startup can be changed (p.180).

1 Check that the power cord is connected properly.

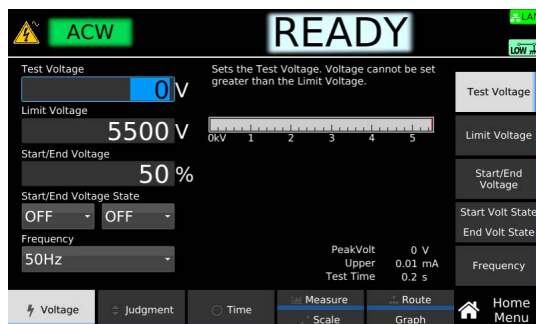
2 Turn the POWER switch (I) on.

The DANGER LED lights, but no voltage is generated. If it does not, stop using the product, and contact your Kikusui agent or distributor.

The following is an example of the TOS9301.



After the startup screen is displayed, the home screen of the test that was in use before the power was turned off the last time appears.



The power is now on.

Turning the power off

WARNING

Risk of electric shock.

- **If you want to turn the POWER switch back on, wait at least 10 seconds.**

It is dangerous to do otherwise, because the protective functions of the product may not work effectively. This may cause the product to malfunction or reduce the life of the POWER switch and internal parts such as the fuses.

- **Except in an emergency, do not turn the power off while output is being generated.**
-

1 Turning the POWER switch off (○)

The power is turned off.

Setting the Date/time and Calibration Date

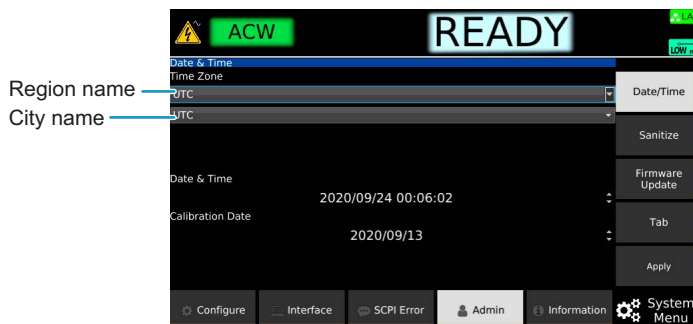
Set the date/time, calibration date, and calibration period.

Setting date

Set the time zone, date, and time. The following settings will be used as an example to explain how to change the date in Japan's time zone.

1 Press **SYSTEM > Admin > Date/Time**.

The date/time setup screen appears.



2 Select Asia using the rotary knob.

3 Press **Tab**, and then turn the rotary knob to select Tokyo.

4 Press **Tab**, Use the numeric keypad or the rotary knob to set the time and date. Press **Tab** to switch between items you can set.

5 Press **Apply**.

A confirmation screen appears. To cancel, press **ESCAPE**.

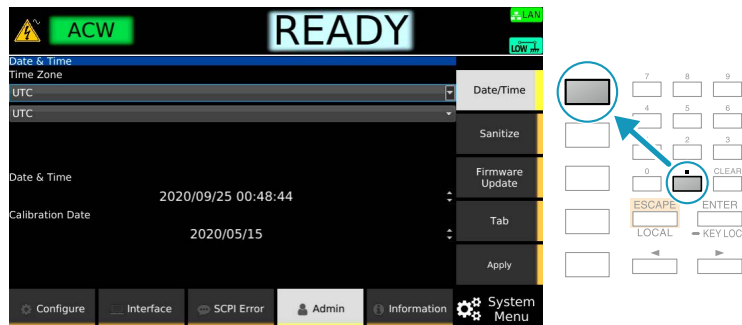
6 Use the arrow (▶) key to select **OK**, and then press **ENTER**.

This completes the setting.

Saving calibration date

Set the date on which calibration was carried out.

- 1 **Press SYSTEM > Admin > Date/Time.**
The currently set calibration date appears in Calibration Date.
- 2 **Press ., then Date/Time.**



A confirmation screen appears.

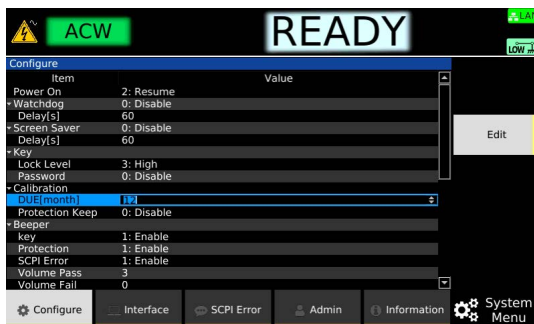
- 3 **Use the arrow (▶) key to select OK, and then press ENTER.**
- 4 **Use the numeric keypad or the rotary knob to enter the data on which calibration was carried out.**
Press Tab to move between entry fields.
- 5 **Press Apply.**
A confirmation screen appears. To cancel, press Escape.
- 6 **Use the arrow (▶) key to select OK, and then press ENTER.**
This completes the setting change.

Set the calibration period

Set the calibration period and the operation performed when the calibration period elapses.

Item	Set value	Description
DUE	1 to 24 (month)	Sets a calibration period of months until the next calibration from the last calibration date.
	Infinity	Calibration period is not monitored.
Protection Keep	Enable	When the calibration period elapses, the protection function is activated, and the product switches to PROTECTION mode (CAL).
	Disable	To release the PROTECTION mode, set Protection Keep to Disable, and press STOP.

- 1 Press SYSTEM > Configure.**
The CONFIG setup screen appears.
- 2 Use the rotary knob to select DUE under Calibration, and then press Edit.**



- 3 Use the rotary knob or numeric keys to enter the calibration period, and then press ENTER.**
The calibration period is set.
- 4 Use the rotary knob to select Protection Keep, and then press Edit.**



- 5 Use the rotary knob to select Enable or Disable, and then press ENTER.**
The operation that is performed when calibration period elapses is set.
This completes the setting.

Connection for Withstanding Voltage and Insulation Resistance Tests

Applicable models for withstanding voltage test: All models

Applicable models for insulation resistance test: **9300**, **9301**, **9311**, **9303**

WARNING

Risk of electric shock.

- **Do not touch the EUT, HIGH VOLTAGE terminals, test leads, test probes, output terminals, or other peripheral components while the DANGER LED is lit.**

Connecting the test leads

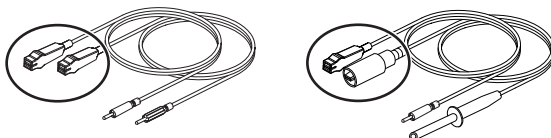
WARNING

Risk of electric shock.

- **Stay away from the alligator clips on the included test leads while the DANGER LED is lit.**

There are some current-carrying parts protruding from the vinyl coating during wiring.

Never touch these while the DANGER LED is lit.



- **Connect the test leads securely.**

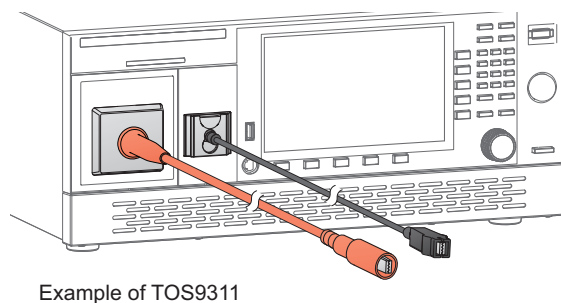
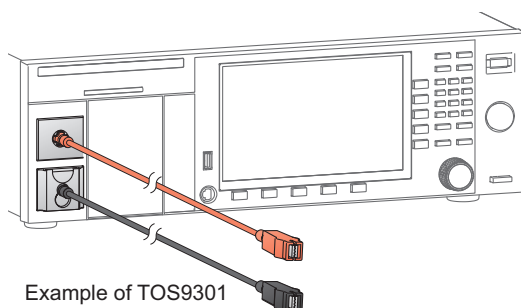
If connections are incomplete, the entire EUT may be charged to a high voltage.

- **Be sure to connect the low-voltage test lead (black) first.**

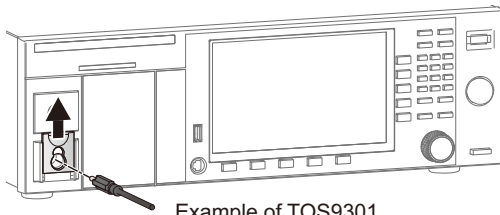
Connect the supplied high voltage test lead to this product.

Before starting work, check that the covering of the test leads are not torn and that the wires are not broken ([p.201](#)).

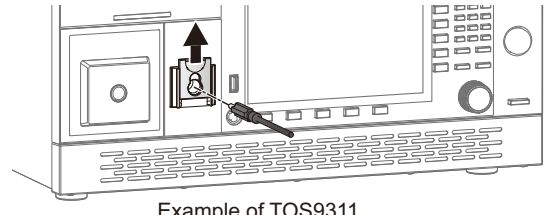
The following procedure uses the TOS9301 and the TOS9311 as an example. The following figure shows the state after connection.



- 1 Check that the **POWER** switch is off and that the **DANGER LED** is off.
- 2 Raise the **LOW** terminal's cable lock, and then connect the low-voltage test lead (black).

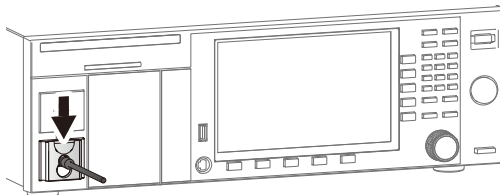


Example of TOS9301

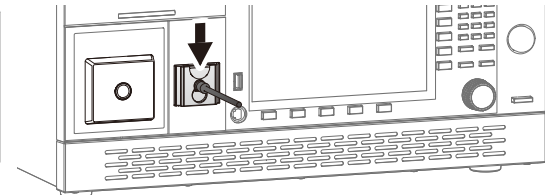


Example of TOS9311

- 3 Lower the cable lock.
Check that the connection is secure.

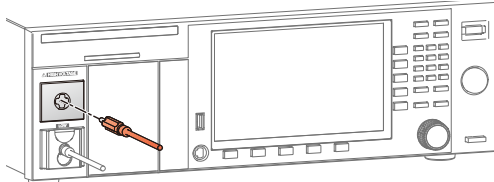


Example of TOS9301

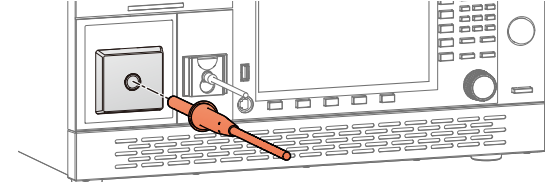


Example of TOS9311

- 4 Connect the low-voltage test lead (black) to the EUT.
- 5 Connect the high-voltage test lead (red) to the EUT.
- 6 Connect the high-voltage test lead (red) to the **HIGH VOLTAGE** terminal.



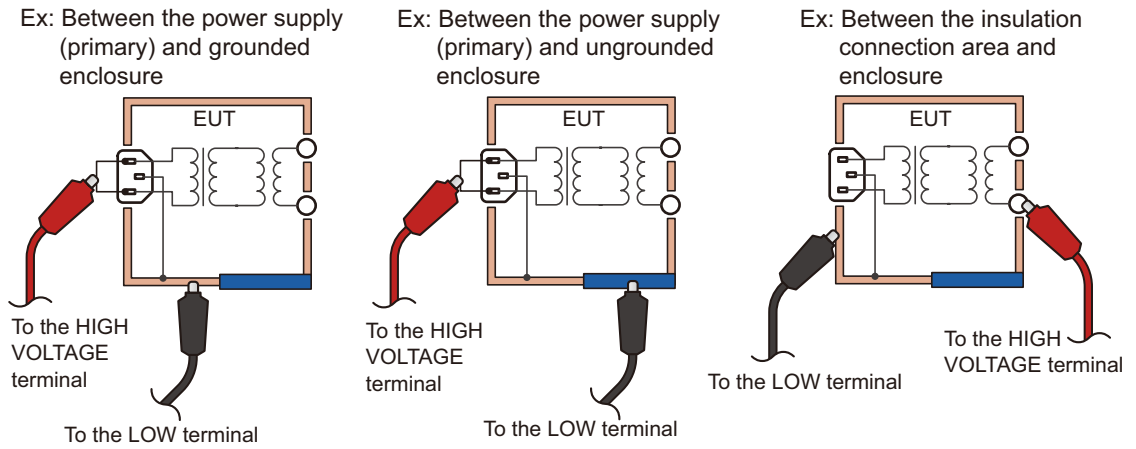
Example of TOS9301



Example of TOS9311

This completes the connections.

Examples of how to connect test leads to the EUT



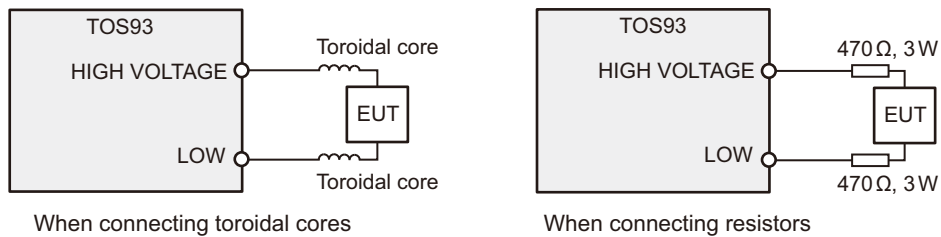
Reducing the effect of noise

Electronic devices in the surrounding area may malfunction due to the effect of noise produced by short circuits across outputs or a dielectric breakdown of the EUT. To reduce the effect of noise, connect a toroidal core or a resistor of approximately $470\ \Omega$ between the tips of the high- and low-voltage test leads and the EUT. Connect the toroidal core or resistor as close to the EUT as possible.

If you are connecting a toroidal core, it is effective to wrap the test leads two to three times around a type of core that can be snapped on and that is often used with power cords. This type of core is usually approximately 20 mm in diameter.

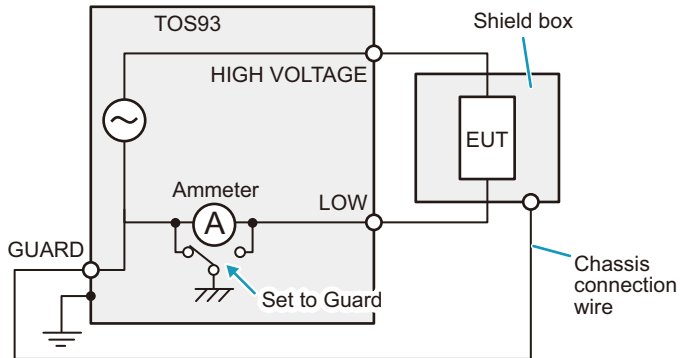
If you are connecting a resistor, pay close attention to the power rating of the resistor. When the upper limit is 10 mA or less, connect a resistor of approximately $470\ \Omega$ (3 W, 30 kV impulse withstanding voltage). Because connecting the resistor causes the voltage to fall, the voltage that is actually applied to the EUT is slightly lower than the voltage that is generated from the product's output terminals (when a 10 mA current flows, the voltage falls approximately 10 V).

These methods are extremely useful in reducing the effect of noise.



Stabilizing measurements

If measurements are unstable due to the effect of noise, such as when making highly sensitive measurements, using a shield box can stabilize the measurements. When using a shield box, set Grounding mode (GND) (p. 67) to Guard and connect the shield box's chassis connection wire to the GUARD terminal on the rear panel.



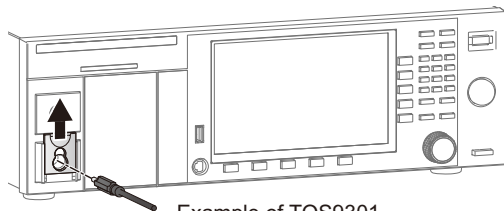
Using the optional high voltage test probe

In withstanding voltage tests, if you use the optional high voltage test probe (HP01A-TOS/HP02A-TOS) (p. 235) instead of the supplied test leads, you can use hands-on control to start tests. For details, see the HP01A-TOS/HP02A-TOS Operation Manual.

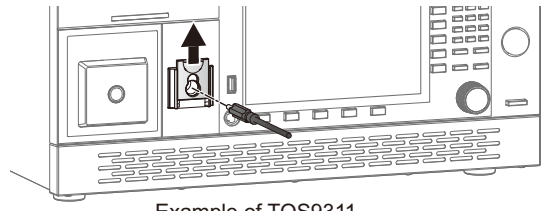
Removing the test leads

This section explains how to remove a test lead that is already connected to the EUT using the TOS9301 and the TOS9311 as an example.

- 1** Check that the **DANGER LED** is turned off.
- 2** Disconnect the high-voltage test lead (red) from the front-panel **HIGH VOLTAGE** terminal.
- 3** Disconnect the high-voltage test lead (red) from the EUT.
- 4** Disconnect the low-voltage test lead (black) from the EUT.
You can disconnect the low-voltage test lead (black) first from either the product or the EUT.
- 5** Raise the **LOW** terminal's cable lock, and then remove the low-voltage test lead (black).

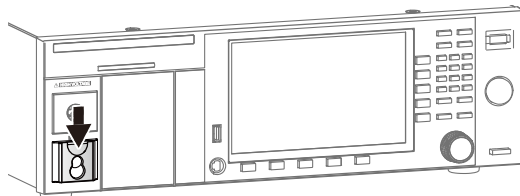


Example of TOS9301

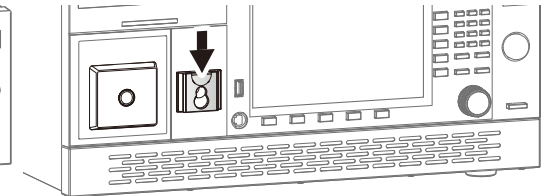


Example of TOS9311

- 6** Lower the cable lock.



Example of TOS9301



Example of TOS9311

This completes the procedure.

Connection for Earth Continuity Tests

Applicable models: **9302**, **9303**

⚠ WARNING

There is a risk of burns or injury.

- **Connect the test leads securely.**

The TOS9302 and the TOS9303 produce large current up to 42 A. The OUTPUT terminals or the EUT may get hot if the connection is loose.

- **Do not connect the supplied test leads or the voltage measurement cable (the thinner cable) of the optional test probe to the OUTPUT terminals.**

Because the nominal cross-sectional area for running the current is insufficient, they may burn out.

⚠ CAUTION

A large magnetic field may be generated.

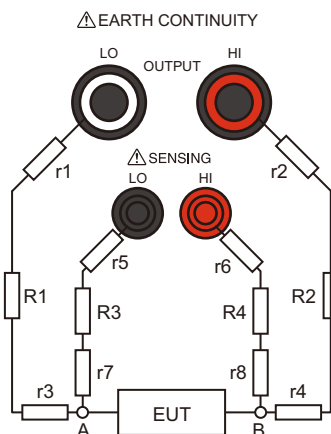
- **Do not bring objects that are easily affected by magnetic fields close to the test leads or the current output cable of the TOS9302 and the TOS9303.**

Four-terminal wiring and two-terminal wiring

There are two methods for wiring test leads to this product. They are the four-terminal wiring and two-terminal wiring. Each method requires the test leads to be connected to different locations.

If you use the supplied test leads for earth continuity testing (TL13-TOS), four-terminal wiring is used. When four-terminal wiring is not possible such as when using test leads other than those supplied with the product, two-terminal wiring is used. After making the connections, set the test conditions by referring to "Terminal wiring method (Terminals Wire)" (p.128).

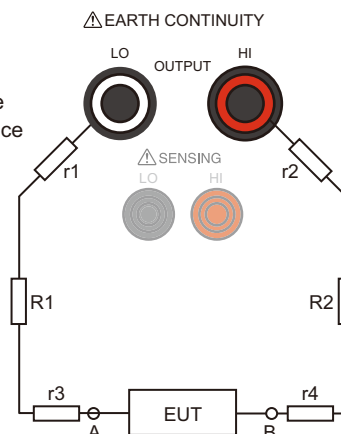
If you use test leads other than those supplied with the product, the product specifications may not be met. Contact your Kikusui agent or distributor for details.



r1 to r8: Contact resistance
R1 to R4: Lead wire resistance

Four-terminal wiring

Connect test leads to the OUTPUT LO and HI terminals and the SENSING LO and HI terminals. The voltage across A and B can be sampled with the SENSING terminals. The measurement is not affected by contact resistance r1 to r8 or the lead wire resistance R1 to R4.



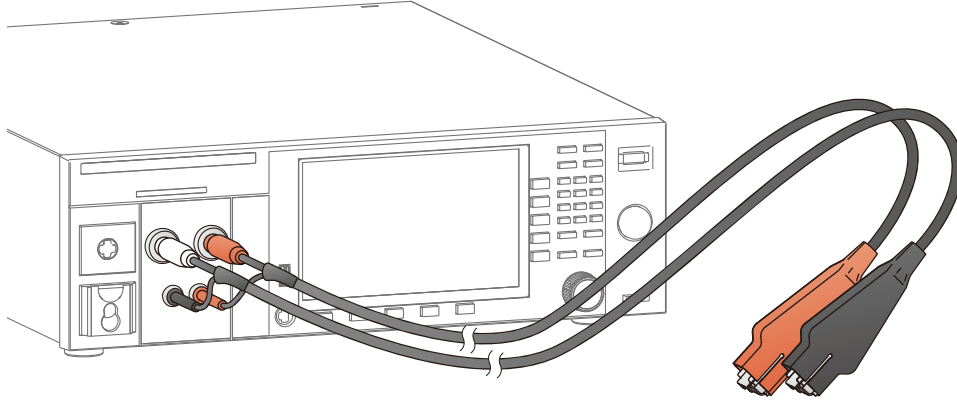
Two-terminal wiring

Connect test leads to the OUTPUT LO and HI terminals. The sum of contact resistance r1 to r4, lead wire resistance R1 and R2, and the resistance across A and B is measured.

Connecting the test leads

Connect the supplied test leads for earth continuity testing (TL13-TOS) to the product.

If you use test leads other than those supplied with the product, the product specifications may not be met. Contact your Kikusui agent or distributor for details. The following figure shows the state after connection.



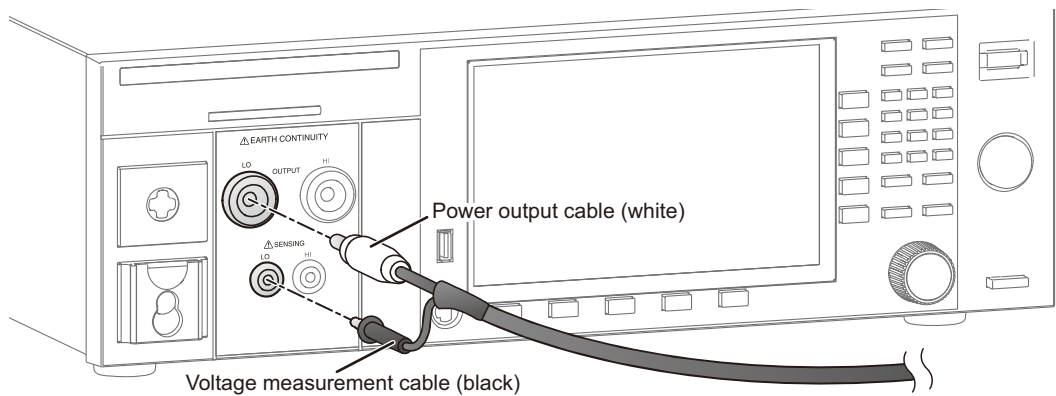
⚠ CAUTION

There is a risk of minor injury or failure.

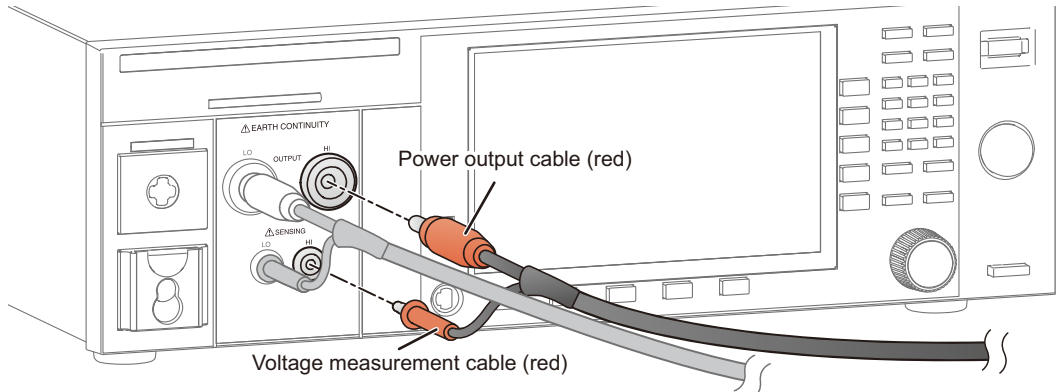
- When using the included TL13-TOS test leads for earth continuity test, connect the voltage measurement cables (black and red) even when two-terminal wiring (p.40) is in use.

Because the test voltage is also applied to the voltage measurement wiring terminals during test, do not let the terminals contact other parts.

- 1 Connect the test lead's current output cable (white) to the EARTH CONTINUITY OUTPUT LO terminal and the voltage measurement cable (black) to the SENSING LO terminal.

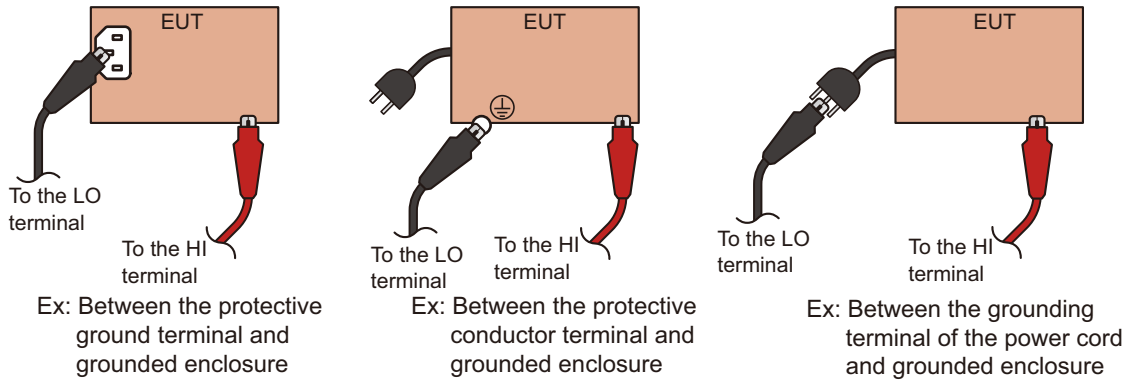


- 2** Connect the test lead's current output cable (red) to the **EARTH CONTINUITY OUTPUT HI** terminal and the voltage measurement cable (red) to the **SENSING HI** terminal.



This completes the connections.

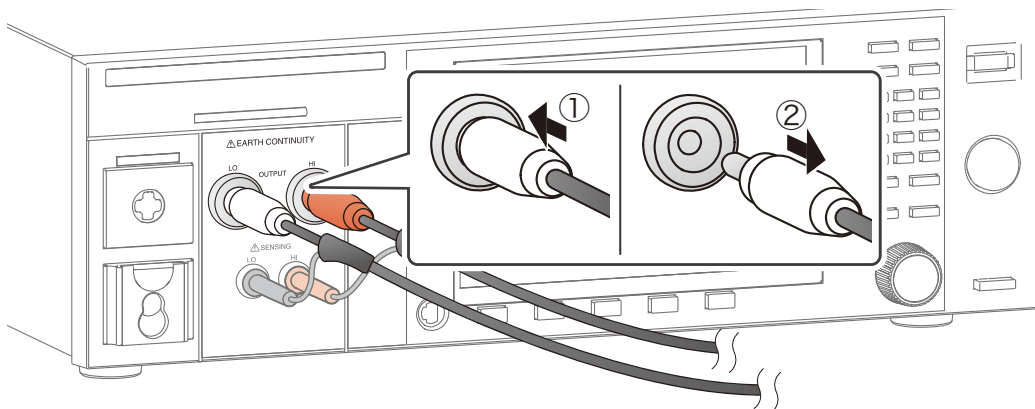
Examples of how to connect test leads to the EUT



Removing the test leads

You can remove the HI and LO test leads in any order. Check that the DANGER LED is turned off before removing the test leads.

To remove the test leads from the OUTPUT HI and LO terminals, push the plugs in once and then pull the terminals out.



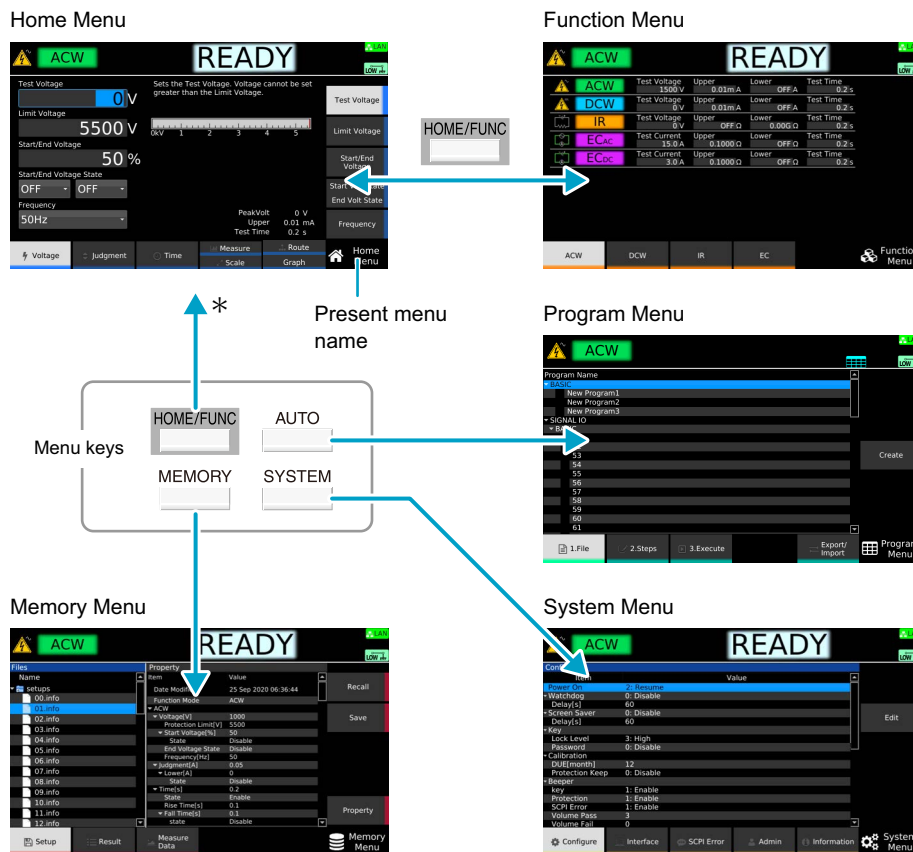
Basic Operation

Basic Panel Operations

Switching menus

The following menus are available. To switch between menus, press the Menu key.

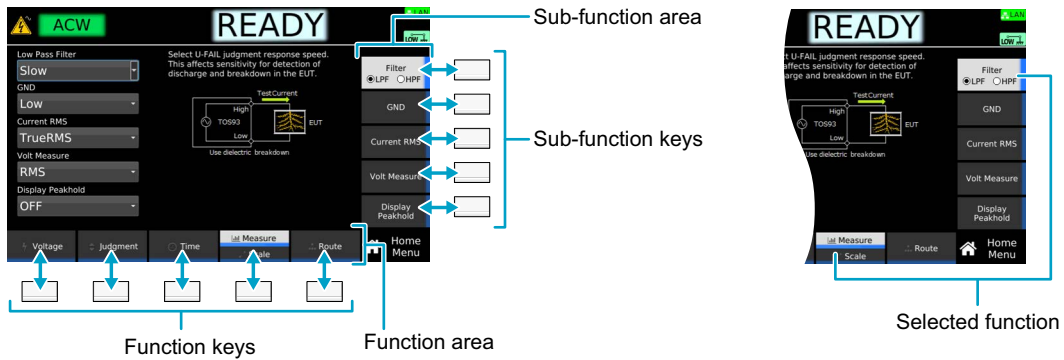
- Home Menu: Set the conditions of each test. Execute tests.
- Function Menu: Display a summary of settings of each test. Switch test modes.
- Memory Menu: Use the memory function.
- System Menu: Display and change system settings.
- Program Menu: Configure and execute auto tests.



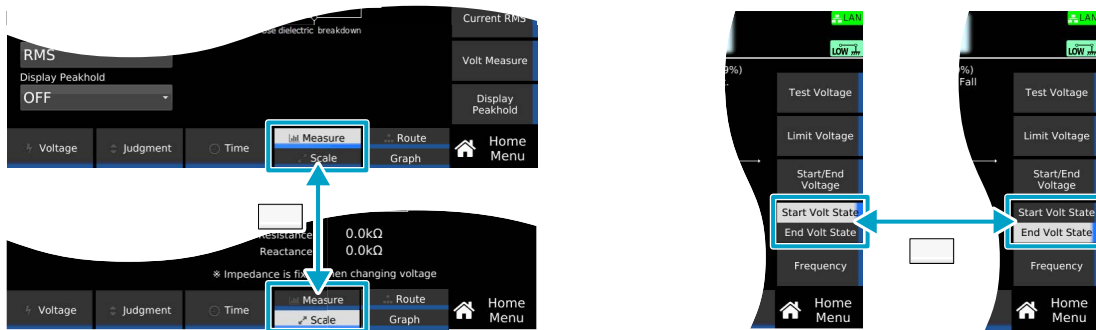
*: If the Home menu is displayed, the screen switches to the Function menu. Otherwise, the screen switches to the Home menu.

Using the function keys

On the display, the available functions are shown in the function area and sub-function area. You can execute or select the functions by pressing the corresponding function key or sub-function key. The selected function is shown with a light gray background.

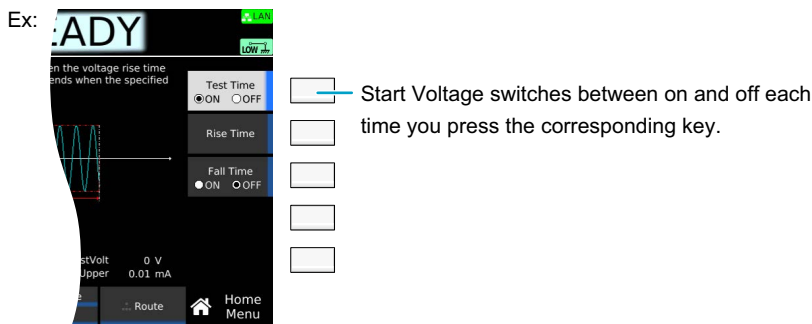


If several functions are displayed for a single key, the function switches each time you press the key.



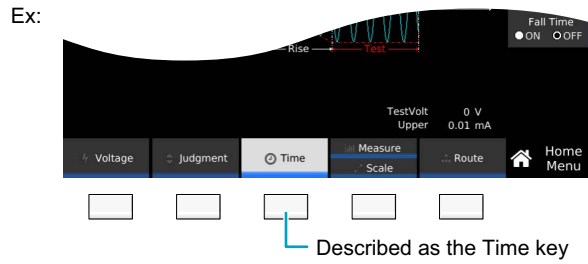
Turning a function on and off

If the function can be turned on and off, the sub-function area may show the function name and settings such as ON and OFF. The function turns on and off each time you press the corresponding sub-function key.



Key names

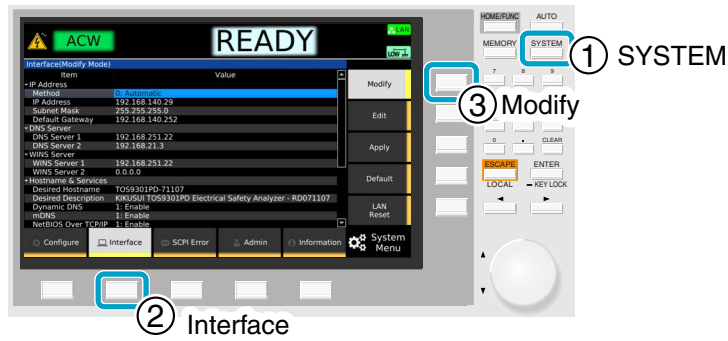
Individual function keys and sub-function keys are distinguished by indicating the function names shown in the function area or sub-function area as the key names.



Operation example (enabling the editing of the interface settings)

1 Press **SYSTEM** > **Interface** > **Modify**.

In the above step example, press the buttons in the following order.



Inputting numbers and characters

You can enter numbers and characters in input areas from the front panel or external keyboard. Number input and character input switch automatically according to the input area.

If numbers or characters are selected in an input area, they can be changed. If only a cursor is shown in an input area, you can enter characters or numbers at the cursor position.



Entering from the front panel

Purpose	Operation	Description
Numeric input	Numeric keypad	You can enter numbers and a decimal point. To confirm a value after input, press the ENTER key.
	Rotary knob	You can enter numbers. Turn clockwise to increase the value and counterclockwise to decrease. The value is confirmed immediately upon input.
Character input	Numeric keypad	You can enter numbers and dots.
	Rotary knob	Turn clockwise to enter characters in the following order: space, uppercase letters, lowercase letters, numbers, and symbols. Turn counterclockwise to enter character in reverse order. To enter the next character, press the arrow (◀ or ▶) key to move the cursor.
Cursor movement	Arrow (◀▶) keys	Moves one digit to the right/left or between entry fields.
Delete	CLEAR key	Deletes the number or character on the left of the cursor or the selected range.
Cancel	ESCAPE key	Cancels numeric/character input.

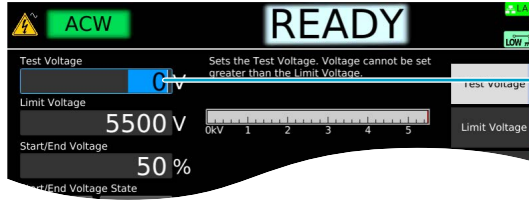
Entering from an external keyboard

If you connect a keyboard to the USB port on the front panel, you will be able to control the product from the keyboard.

Controllable function	Keyboard operation
Number and character input	Keys corresponding to the numbers and characters. (US keyboards are supported.)
Cursor movement	Arrow keys
Number and character deletion	[Backspace], [Delete]
Input canceling	[Escape]
Confirmation	[Enter]
Input item movement	[Tab]
Function keys	(from the left) [F6], [F7], [F8], [F9], [F10]
Sub-function keys	(from the top) [F1], [F2], [F3], [F4], [F5]
START switch	[Alt] + [Ctrl] + [s] (press simultaneously)
STOP switch	[Alt] + [t]
Program Menu display	[Alt] + [p]
Home Menu display	[Alt] + [h]
System Menu display	[Alt] + [y]

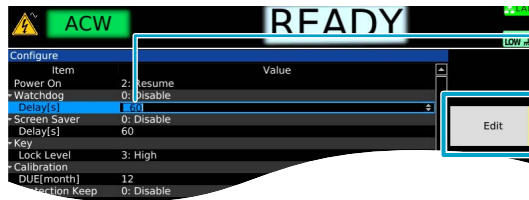
Changing values

To change the test voltage or other values, use the numeric keypad or the rotary knob. If you enter a value with the numeric keypad, following input, press the ENTER key to confirm the value.

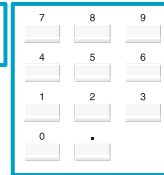


Use the numeric keypad or the rotary knob to change the value.

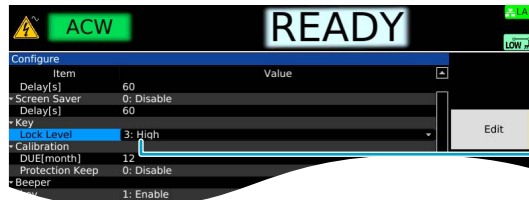
On screens in which "Edit" is shown in the sub-function area, use the rotary knob to select the item you want to change, and then press the Edit key or a numeric key to start changing the value. Procedures using the Edit key are provided in this document.



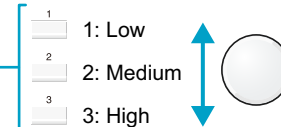
Pressing Edit or a numeric key makes it possible to edit the value.



When changing a setting, if there are multiple items you can choose from, select the item using the rotary knob. If there is a number before the item name, you can also select using the numeric keypad. Procedures using the rotary knob are provided in this document.



Numeric keypad Rotary knob



To confirm a value you entered, press the ENTER or Edit key. Procedures using the ENTER key are provided in this document.



Use ENTER or Edit to confirm the value.



Selecting the Test Mode

The TOS93 series has the following test modes. The tests that can be selected varies depending on the model.

Test mode	Description
AC withstanding voltage (ACW)	This test evaluates whether the electrical insulation section of an electric product or component has enough dielectric strength for the voltage to be handled.
DC withstanding voltage (DCW)	This test evaluates whether the electrical insulation section of an electric product or component has enough dielectric strength for the voltage to be handled. This is used when the EUT's capacitive component is large and judging the dielectric breakdown is difficult using ACW.
Insulation resistance (IR)	This test evaluates whether the electrical insulation section of an electric product or component has enough resistance for the voltage to be handled. The supported tests vary depending on the model. TOS9300: -1000 V test TOS9301 or TOS9303: 7200 V test, -1000 V test TOS9311: 10 kV test, -1000 V test
Earth continuity (EC)	This test evaluates the continuity of the protective connection of devices (Class I devices) that are designed to ensure safety with basic insulation and protective earth grounding. There is a DC test and an AC test.

■ Tests supported by each model

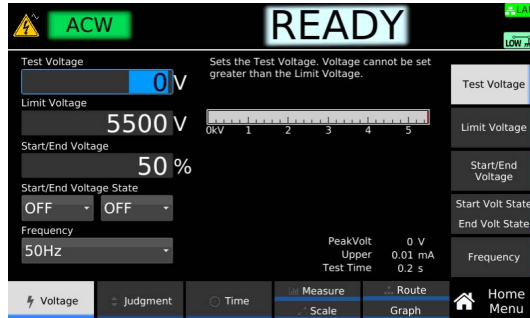
	TOS9300	TOS9301	TOS9311	TOS9302	TOS9303
ACW	✓	✓	✓	✓	✓
DCW	n/a	✓	✓	n/a	✓
IR	✓	✓	✓	n/a	✓
EC	n/a	n/a	n/a	✓	✓

Selecting the test mode

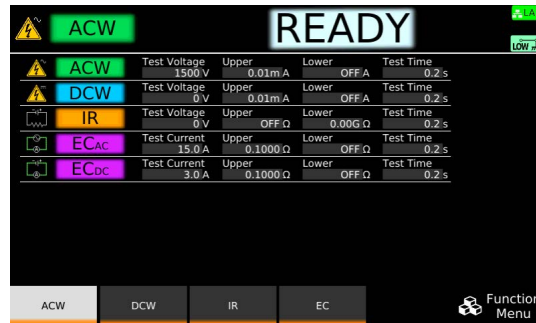
Select the test mode on the Function menu screen. The tests that can be selected varies depending on the model.

1 On the Home menu screen, press HOME/FUNC.

The Function menu screen of ACW appears.



The Function menu screen appears. The following figure shows a screen example of TOS9303.



2 On the Function menu screen, press a function key to select the test mode.

If you select IR, or EC, press a sub-function key to select the sub test mode.

This completes the selection procedure.

Withstanding Voltage Tests

Applicable models for AC withstanding voltage (ACW): All models

Applicable models for DC withstanding voltage (DCW): **9301**, **9311**, **9303**

This chapter describes how to set test conditions, start tests, and view the results for ACW, and DCW tests.

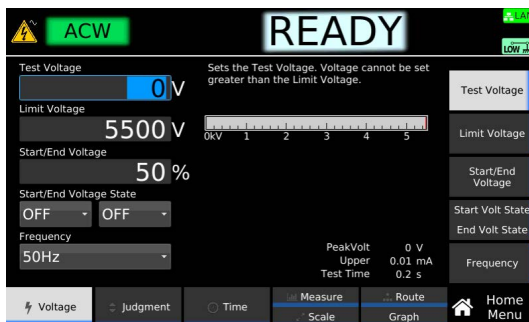
- Setting Test Conditions (p.50)
- Starting a Test (p.80)
- Finishing the Test and Viewing the Judgment (p.85)

Setting Test Conditions

This section describes the test conditions of AC withstanding voltage (ACW), and DC withstanding voltage (DCW) tests and how to set the conditions.

Displaying the setup screen (Home menu)

- 1 On the Function menu screen (p.43), press ACW, or DCW.
The setup screen (Home menu) for the ACW, or DCW test conditions appears.
The following figure shows a screen example during an ACW test.



Set the required conditions by referring to the description of test conditions (p.51).

Description of test conditions

The test conditions you can set vary for ACW, DCW, and IR.

The following test conditions with a check mark can be used with the corresponding test.

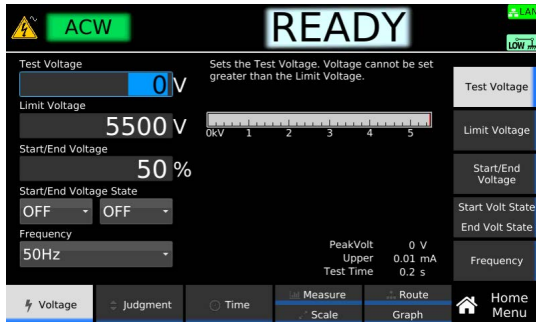
ACW	DCW	Test condition	Description
✓	✓	Test voltage	Voltage to apply to the EUT. (p.52)
✓	✓	Limit voltage	Upper limit of voltage to apply to the EUT. (p.53)
✓	✓	Start voltage	Voltage 0.1 seconds after pressing the START switch. (p.54)
✓	✓	End voltage	Voltage at the end of Fall Time. (p.55)
✓	n/a	Frequency	Test voltage frequency. (p.56)
✓	✓	Upper limit	Current used as a reference for upper limit judgment. (p.57)
✓	✓	Lower limit	Current used as a reference for lower limit judgment. (p.58)
n/a	✓	Auto setting of the judgment delay (Delay Auto)	Select the time (auto or manual) from when the START switch is pressed until the upper limit judgment starts. (p.59)
✓	✓	Test time	Time from when the voltage rise time has passed to the end of the test. (p.61)
✓	✓	Voltage rise time	The time from when the START switch is pressed or from the start voltage to when the test voltage is reached. (p.62)
✓	✓	Voltage fall time	The time from a pass judgment until the voltage falls. (p.63)
n/a	✓	Discharge time	The time for discharging the voltage residing in the high voltage charge area. (p.64)
n/a	✓	Discharge when interlock is activated (Discharge Interlock)	Discharges the voltage when the interlock is activated. (p.65)
✓	✓	Current detection response speed (Filter)	Response speed for detecting current (sensitivity). (p.66)
✓	✓	Grounding mode (GND)	Select whether to include the current running through the stray capacitance of test leads, tools, and the like in measurements. (p.67)
✓	n/a	Current measurement mode (Current RMS)	Select whether to measure current in true rms values or measure by converting the mean-value responses to rms values. (p.69)
✓	✓	Voltage measurement mode (Volt Measure)	Select whether to measure voltage in true rms values or peak values. (p.70)
✓	✓	Peak value display (Display Peakhold)	Select whether to display the maximum value of current for the ACW test and DCW test, or the minimum value of resistance for the IR test, during the test and in the judgment result. (p.71)
✓	n/a	Offset (Offset Real, Offset Imaginary)	Offset the real part and imaginary part of the current running through the stray capacitance of test leads, tools, and the like. (p.72)
n/a	✓	Offset	Applies an offset to the current or resistance of test leads, tools, etc. (p.73)
✓	✓	Checking the scanner contact (Contact Check)	Check the continuity between the test leads connected to the scanner and the EUT. (p.74)
✓	✓	Setting scanner channels (Edit)	Switches the connection (high, low, open) of each channel of the scanner. (p.75)
✓	✓	Opening the scanner (All Open)	Set all channels of the scanner to open. (p.76)
✓	✓	Measurement screen display during the test (Display View)	Select the measurement screen to be displayed during the test from the numerical values or graphs. (p.77)
✓	✓	Graph Scale	Select whether the scale of the voltage-axis is fixed or auto-set. (p.78)
✓	✓	Judgement criteria marker display (Judgement Marker)	Set whether to mark the upper and lower limits on the graph. (p.79)

Test voltage

Set the voltage to apply to the EUT. You cannot specify a voltage that exceeds the limit voltage (p.53).

1 On the Home menu screen, press Voltage > Test Voltage.

The following figure shows a screen example during an ACW test.



2 Use the numeric keypad or the rotary knob to enter the voltage.

ACW setting range: 0 V to 5500 V (0 V to 10.500 kV is only for TOS9311)

DCW setting range: 0 V to 7500 V (0 V to 10.500 kV is only for TOS9311)

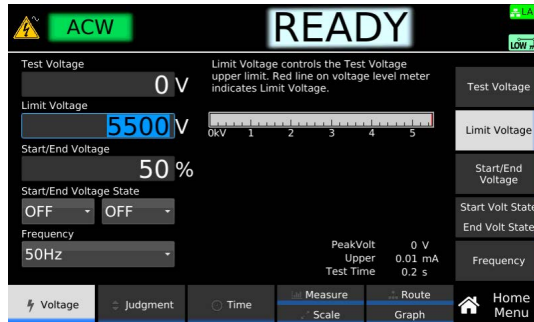
This completes the setting.

Limit voltage

Set the upper limit of the voltage to apply to the EUT. This prevents unnecessarily high voltage from being applied to the EUT by mistake.

1 On the Home menu screen, press **Voltage > Limit Voltage**.

The following figure shows a screen example during an ACW test.



2 Use the numeric keypad or the rotary knob to enter the voltage.

ACW setting range: 0 V to 5500 V (0 V to 10.500 kV is only for TOS9311)

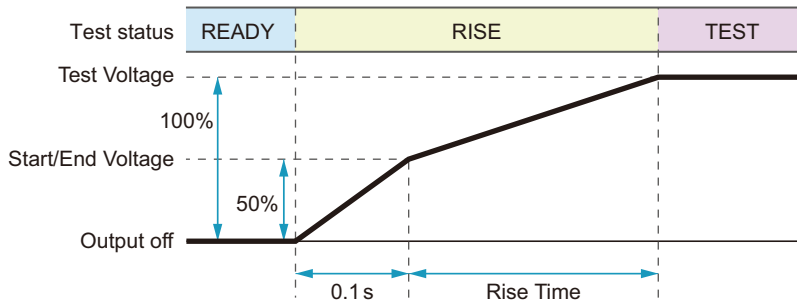
DCW setting range: 0 V to 7500 V (0 V to 10.500 kV is only for TOS9311)

This completes the setting.

Start voltage

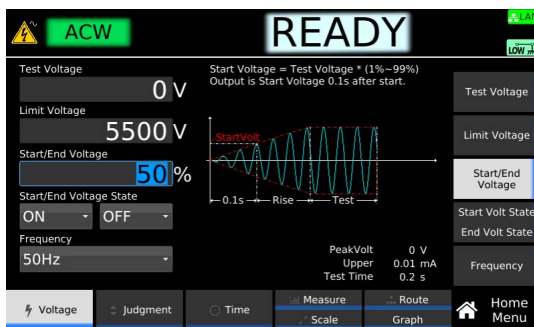
Set the voltage 0.1 seconds after the START switch is pressed as a percentage of the test voltage. If you do not want to set the start voltage, set Start Voltage to off.

■ When the start voltage is 50%



1 On the Home menu screen, press Voltage > Start Voltage.

Each time you press the Start Volt State key, the setting changes between Start Volt State and End Volt State. The following figure shows a screen example during an ACW test.

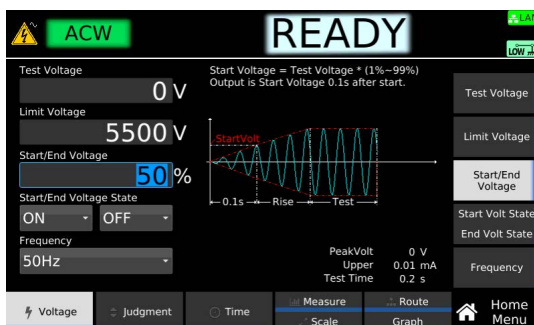


2 Turn the rotary knob to select ON or OFF.

3 If you select ON, press Start/End Voltage, and then use the numeric keypad or the rotary knob to enter a percentage value.

Start/End Voltage is a value commonly applied to Start Voltage and End Voltage (p.55).

Setting range: 1 % to 99 %



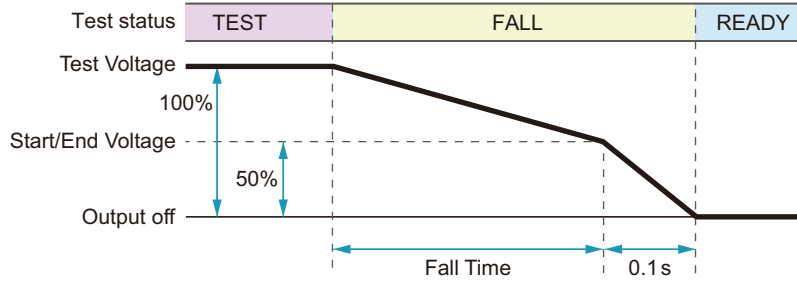
This completes the setting.

End voltage

Set a voltage to finish Fall Time (p.63) in percentage to the Test voltage. Once the voltage has reached End Voltage, it will fall to around 0 V in 0.1 sec.

This command is valid when both Start Volt State (p.54) and Fall Time (p.63) are set to ON. If you do not want to set the end voltage, set End Volt State to off.

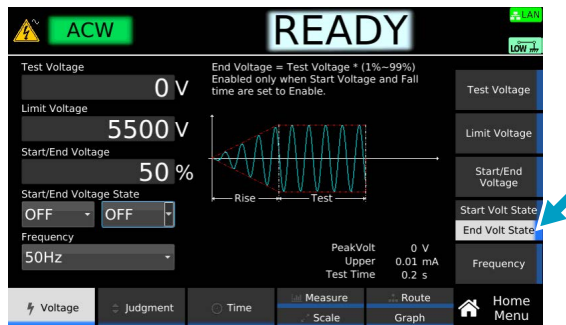
■ When Start/End Voltage is set to 50%



1 On the Home Menu screen, press Voltage.

2 Press End Volt State repeatedly until End Volt State is selected.

Each press of the key switches between Start Volt State and End Volt State. The following figure shows a screen example during an ACW test.

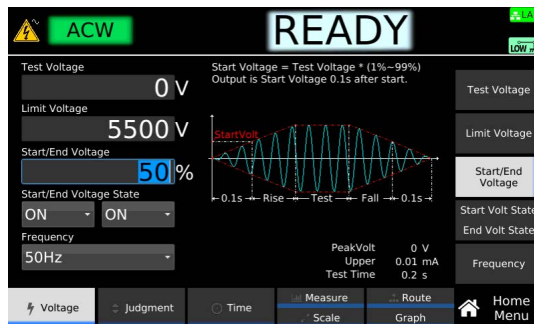


3 Turn the rotary knob to select ON or OFF.

4 If you select ON, press Start/End Voltage, and then use the numeric keypad or the rotary knob to enter a percentage value.

Start/End Voltage is a value commonly applied to Start Voltage (p.54) and End Voltage.

Setting range: 1 % to 99 %



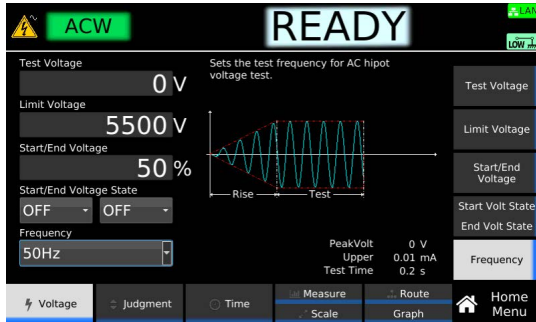
This completes the setting.

Frequency

This can be set only for AC withstanding voltage (ACW) tests.

Set the test voltage frequency to 50 Hz or 60 Hz. **√50Hz/√60Hz** appears during testing according to the setting.

- 1 On the Home menu screen, press Voltage > Frequency.



- 2 Turn the rotary knob to change the value.
This completes the setting.

Upper limit

Set the reference current for upper limit judgment. If current greater than or equal to Upper is measured, upper limit judgment (Upper-FAIL) results.

If a value smaller than Lower (p.58) is set, the Lower setting will change according to the Upper setting.

1 On the Home menu screen, press Judgment > Upper.

The following figure shows a screen example during an ACW test.



2 Use the numeric keypad or the rotary knob to enter the current value.

ACW setting range: 0.01 mA to 110.00 mA (0.01 mA to 55.00 mA is only for TOS9311)

DCW setting range: 0.01 mA to 21.00 mA

This completes the setting.

Lower limit

Set the reference current for lower limit judgment. If current less than or equal to Lower is measured after the voltage reaches the test voltage, lower limit judgment (Lower-FAIL) results. To disable lower limit judgment, set Lower to off.

If a value greater than Upper (p.57) is set, the Upper setting will change according to the Lower setting.

NOTE

Normally, even a good EUT will have a certain degree of leakage current. Setting the limit slightly less than the leakage current of the EUT is useful in detecting EUT errors, breaks in the test leads, and poor connections, enabling you to perform highly reliable testing.

1 On the Home menu screen, press Judgment > Lower.

The following figure shows a screen example during an ACW test.



2 Press Lower to switch between on and off.

Lower switches between on and off each time you press the key.

3 If you select on, use the numeric keypad or the rotary knob to enter the current value.

ACW setting range: 0.00 mA to 109.99 mA (0.00 mA to 54.99 mA is only for TOS9311)

DCW setting range: 0.00 mA to 20.99 mA

This completes the setting.

Auto setting of the judgment delay (Delay Auto)

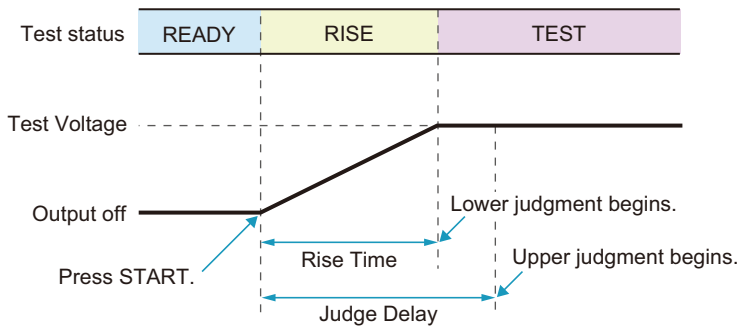
This can be set only in DC withstanding voltage (DCW) tests.

When the test voltage is applied to an EUT with a capacitive component, a large charge current may flow until charging is completed. Judgment errors due to the effects of the charge current can be prevented by setting a delay (Judge Delay) from when the START switch is pressed to when upper limit judgment is started.

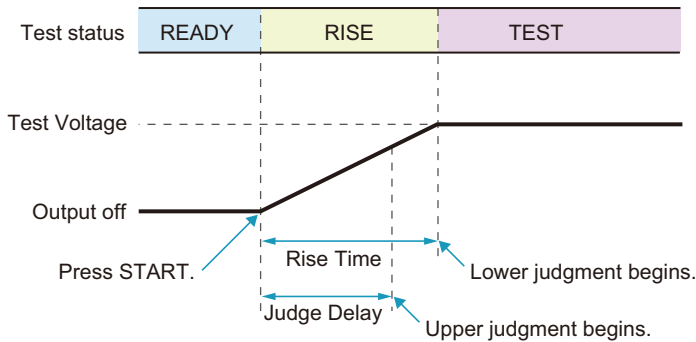
Set Delay Auto to on or off to select auto or manual setting of the judgment delay.

Value	Description
ON	Upper limit judgment will start automatically when the voltage reaches the test voltage and judgment becomes possible. If the output voltage is 200 V or more and the voltage rise rate is less than approximately 1 V/s before the judgment starts, UPPER FAIL (dV/dt) occurs, and the test ends. Problems can be discovered quickly such as when the EUT is shorted.
OFF	Set the judgment delay (Judge Delay) manually. Refer to the following, and set a delay shorter than the sum of Voltage rise time (p.62) and Test voltage (p.52).

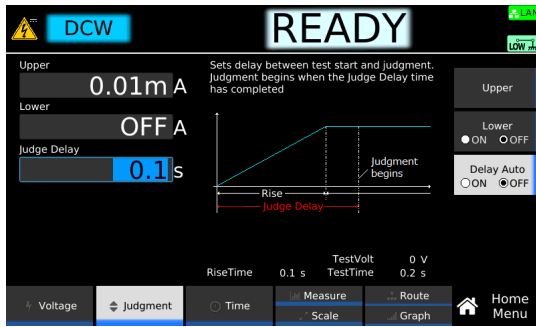
■ When Judge Delay is longer than Rise Time



■ When Judge Delay is shorter than Rise Time



1 On the Home menu screen, press Judgment > Delay Auto.



2 Press Delay Auto to switch between ON and OFF.

Delay Auto switches between on and off each time you press the key.

3 If you select off, use the numeric keypad or the rotary knob to enter the time.

Setting range: 0.1 s to 100.0 s

This completes the setting.

Test time

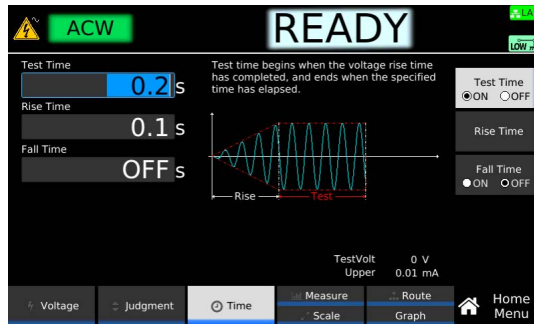
Set the test time to on or off.

Value	Description
ON	Set the time from when the Voltage rise time (p.62) has passed to the end of the test. If upper limit judgment (Upper-FAIL) or lower limit judgment (Lower-FAIL) does not occur during a test, the test will result in PASS.
OFF	The test continues until the STOP switch is pressed. Pass judgments are not made.

If Delay Auto (p.59) is OFF and the sum of the times set for Test Time and Rise Time is shorter than the time set for Judge Delay, the set value of Judge Delay will change according to the sum of Test Time and Rise Time.

1 On the Home menu screen, press Time > Test Time.

The following figure shows a screen example during an ACW test.



2 Press Test Time to switch between on and off.

Test Time switches between on and off each time you press the key.

3 If you select on, use the numeric keypad or the rotary knob to enter the time.

Setting range: 0.1 s to 1000.0 s

This completes the setting.

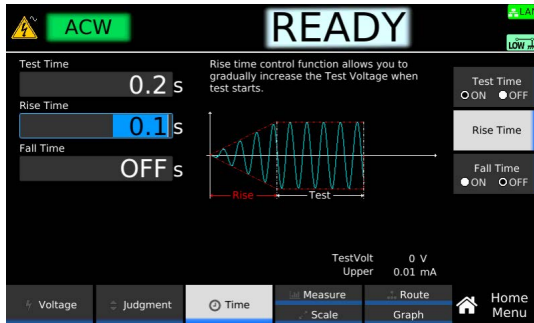
Voltage rise time

Set the time from when the START switch is pressed until the test voltage (p.52) is reached or the time for the voltage to change from the start voltage (p.54) to the test voltage.

If Delay Auto (p.59) is OFF and the sum of the times set for Test Time and Rise Time is shorter than the time set for Judge Delay, the set value of Judge Delay will change according to the sum of Test Time and Rise Time.

1 On the Home menu screen, press Time > Rise Time.

The following figure shows a screen example during an ACW test.



2 Use the numeric keypad or the rotary knob to enter the time.

Setting range: 0.1 s to 200.0 s

This completes the setting.

Voltage fall time

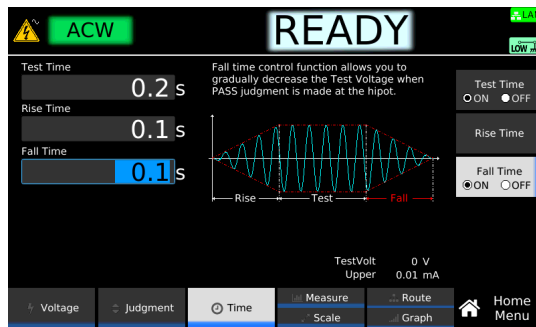
Set the time for the voltage to fall from the test voltage to around 0 V or to End Voltage (p.55) after PASS judgment.

In DCW tests, note the following.

- After Fall Time ends, it will move to Discharge time (p.64). If Fall Time is set to off, a fail judgment occurs or the STOP switch is pressed during the test, discharge starts immediately without transitioning to Fall Time.
- Since the TOS93 series cannot absorb current during output, the voltage may not drop to around 0 V or to Start/End voltage during the Fall Time period, depending on the Fall Time setting time and the connected load.

1 On the Home menu screen, press Time > Fall Time.

The following figure shows a screen example during an ACW test.



2 Press Fall Time to switch between on and off.

Fall Time switches between on and off each time you press the key.

3 If you select on, use the numeric keypad or the rotary knob to enter the time.

Setting range: 0.1 s to 200.0 s

This completes the setting.

Discharge time

This can be set only in DC withstanding voltage (DCW) tests.

During a test, the EUT, test leads, test probes, output terminals, and other peripheral components are charged to a high voltage. Set the time for discharging the voltage remaining in the high voltage charge area after the test ends. If voltage remains even after the set discharge time elapses, discharge continues until the voltage reaches 30 V.

Discharge starts after Voltage fall time (p.63) is finished. If Fall Time is set to off and a fail judgment occurs or the STOP switch is pressed during the test, discharge starts immediately without transitioning to Fall Time.

Estimated discharge time

The time required to discharge the built-up electrical charge varies according to the test voltage and the properties of the EUT.

The time that this product requires to discharge the voltage from its internal capacitors down to 30 V is as follows:

■ TOS9311

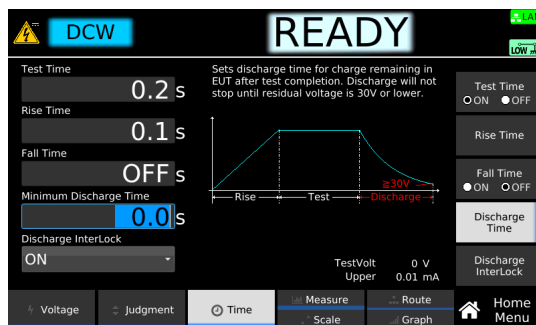
- When an EUT is not connected: 25 ms
- When an EUT with a input capacitance of 0.05 μF is connected: 85 ms

■ Except TOS9311

- When an EUT is not connected: 16 ms
- When an EUT with a input capacitance of 0.05 μF is connected: 50 ms

Setup procedure

1 On the Home menu screen, press Time > Discharge Time.



2 Use the numeric keypad or the rotary knob to enter the time.

Setting range: 0.0 s to 100.0 s

This completes the setting.

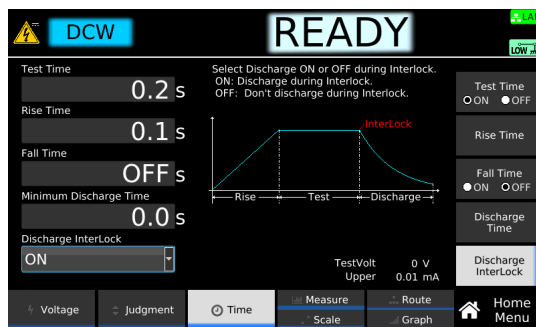
Discharge when interlock is activated (Discharge Interlock)

This can be set only in DC withstanding voltage (DCW) tests.

During a test, the EUT, test leads, test probes, output terminals, and other peripheral components are charged to a high voltage. Set whether to discharge the voltage remaining in the high voltage charge area if the interlock is activated ([p. 161](#)) during a test.

Value	Description
ON	The voltage remaining in the high voltage charge area is discharged if the interlock is activated during a test. Use this when you do not want the voltage to remain if the interlock is activated, such as when a capacitive EUT is connected.
OFF	The output's high voltage relay is opened to shut off the output if the interlock is activated.



1 On the Home menu screen, press Time > Discharge Interlock.



2 Turn the rotary knob to change the value. This completes the setting.

Current detection response speed (Filter)

Set the response speed (sensitivity) for detecting the current when making upper limit judgments. An icon appears during testing according to the setting.

Value	Description	Icon
LPF (Low Pass Filter)	Mean-value response type current detector. This is equivalent to the current detection response of Kikusui's general-purpose AC withstanding voltage testers. This setting is suitable for detecting dielectric breakdown defined in safety standards. It is used for performing withstanding voltage tests on general electronic devices and electronic components. This setting makes it difficult to detect corona discharge and the like, which are not considered to be dielectric breakdown in typical safety standards.	
Medium	With a mean-value response type current detector closer to peak detection, the response is faster than the Slow setting. Because the upper limit judgment detection speed is fast, this setting is suitable for performing withstanding voltage tests on compact electronic components and other EUTs prone to dielectric breakdown. But, because current may be detected for corona discharges and other instantaneous discharges and discharges with high frequency components, this setting may not be suitable for reproducible withstanding voltage tests.	
Fast		
HPF (High Pass Filter)	Extremely small discharges such as corona discharges will be detected but reproducibility will be low.	

- 1 **On the Home menu screen, press Measure repeatedly until Measure is selected.**
Each time you press the key, the setting changes between Measure and Scale. The following figure shows a screen example during an ACW test.





- 2 **Press Filter to switch between LPF and HPF.**
Each time you press the key, the setting changes between LPF and HPF.



- 3 **Turn the rotary knob to change the value.**
This completes the setting.

Grounding mode (GND)

Select whether to include the current running through the stray capacitance (p.229) of test leads, tools, and the like in measurements. An icon is shown in the upper right of the display according to the setting.

Value	Description	Icon
Low	Measures by including the current running through the stray capacitance across test leads or tools and ground and the current running through the insulation resistance. Tests can be performed safely without the risk of shorting the ammeter.	
Guard	High-sensitivity high-precision measurement is possible because the current running through the stray capacitance across test leads or tools and ground and the current running through the insulation resistance are excluded from measurement. Use this mode only when the EUT and tools and the like are completely floating. If one end of the EUT is grounded to earth or if the LOW terminal and chassis are shorted, the ammeter will be shorted. This is extremely dangerous.	

WARNING

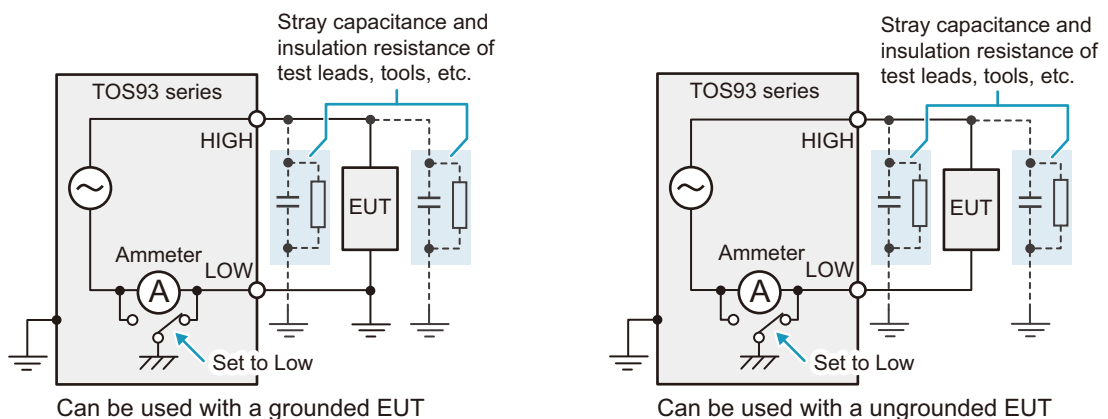
Risk of electric shock.

- **If there is a possibility that the EUT or tools and the like will be grounded or if you are uncertain about it, do not set GND to Guard.**
The ammeter will be short-circuited and will not be able to measure current.
- **If you set GND to Guard, do not connect measuring instruments that are grounded at one end (e.g., Kikusui 149-10A High Voltage Digital Voltmeter, TOS1200 Current Calibrator) to this product.**
The ammeter will be short-circuited and will not be able to measure current.

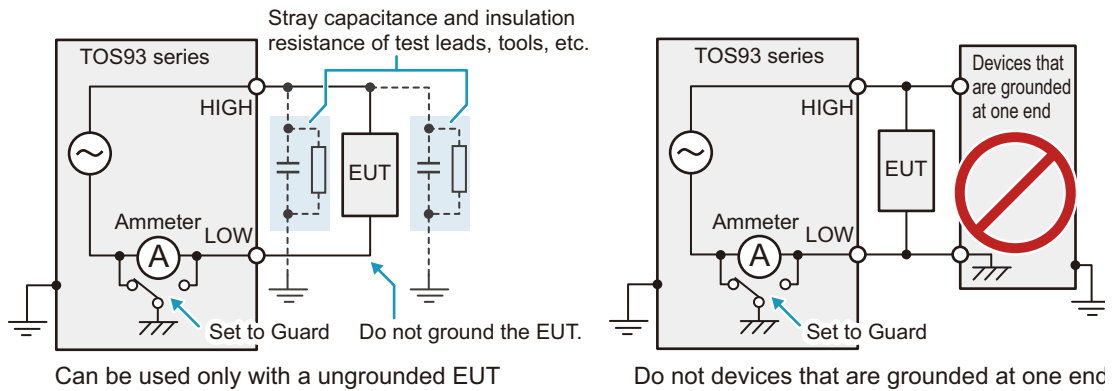
NOTE

Using the product in a high humidity environment when GND is set to low will adversely affect the measurement accuracy in insulation resistance tests. If the grounding mode (GND) is set to low in a high humidity environment, the current will leak to the ground from the high-voltage wiring sections inside the product and the high-voltage wiring sections between the product and the EUT. This leakage current ranges from several nA to several tens of μA depending on the usage and wiring conditions of the optional TOS9320 high voltage scanner. The effects of leakage current can be reduced by making measurements with the offset enabled.

■ When set to Low (example of ACW)



■ When set to Guard (example of ACW)

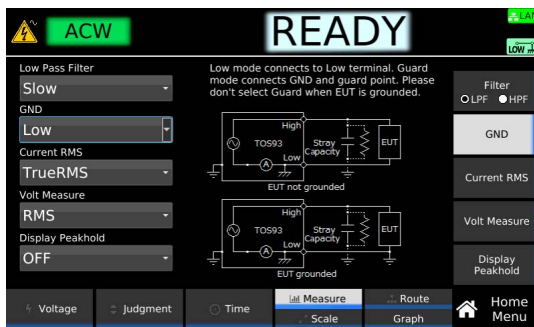


■ Setup procedure

- 1 On the Home menu screen, press Measure repeatedly until Measure is selected. Each time you press the key, the setting changes between Measure and Scale. The following figure shows a screen example during an ACW test.



- 2 Press GND, and then turn the rotary knob to change the value.



This completes the setting.

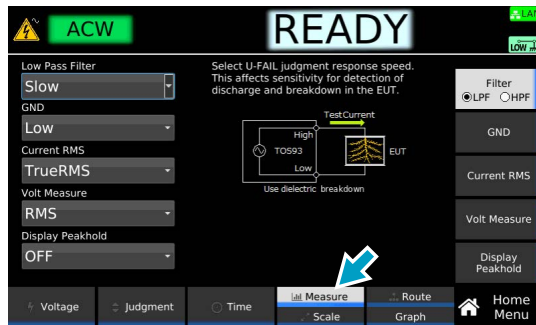
Current measurement mode (Current RMS)

This can be set only for AC withstanding voltage (ACW) tests.

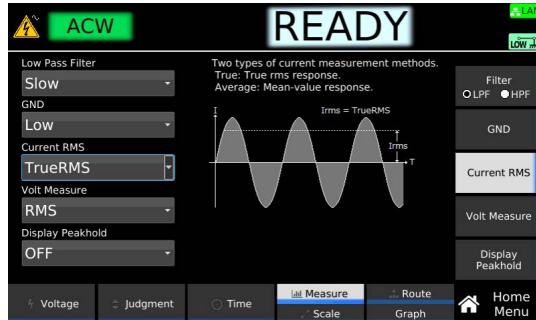
Sets the current measurement mode. An icon appears during testing according to the setting.

Value	Description	Icon
TrueRMS	Measures in true rms values.	TrueRMS
Average	Measures by converting the mean-value responses to rms values.	Average

- 1 On the Home menu screen, press Measure repeatedly until Measure is selected. Each time you press the key, the setting changes between Measure and Scale.



- 2 Press Current RMS, and then turn the rotary knob to change the value.



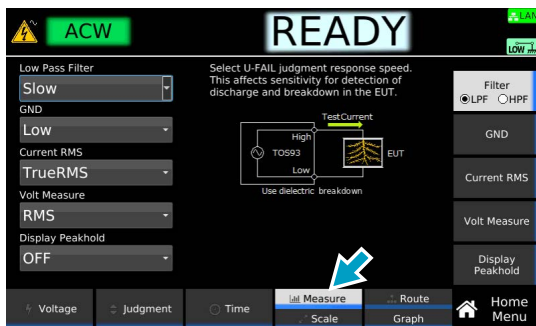
This completes the setting.

Voltage measurement mode (Volt Measure)

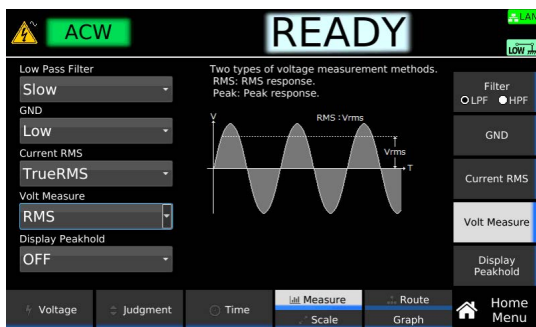
Sets the voltage measurement mode. An icon appears during testing according to the setting.

Value	Description	Icon
RMS (ACW only)	Measures in true rms values.	RMS
Average (DCW only)	Measures in average values.	Average
Peak	Measures in peak values.	Peak

- 1 On the Home menu screen, press **Measure** repeatedly until **Measure** is selected. Each time you press the key, the setting changes between Measure and Scale. The following figure shows a screen example during an ACW test.



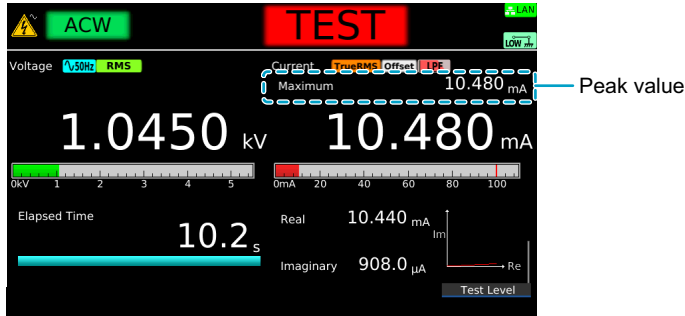
- 2 Press **Volt Measure**, and then turn the rotary knob to change the value.



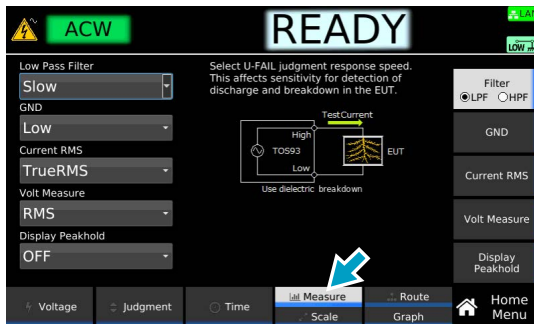
This completes the setting.

Peak value display (Display Peakhold)

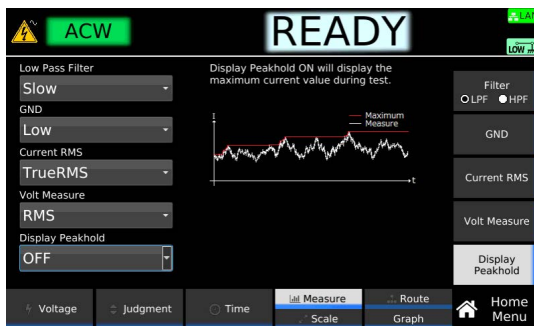
When Display Peakhold is set to on, the maximum value of current is displayed during the test and in the judgment result.



- 1 On the Home menu screen, press Measure repeatedly until Measure is selected. Each time you press the key, the setting changes between Measure and Scale. The following figure shows a screen example during an ACW test.



- 2 Press Display Peakhold, and then turn the rotary knob to select ON or OFF.



This completes the setting.

Offset (Offset Real, Offset Imaginary)

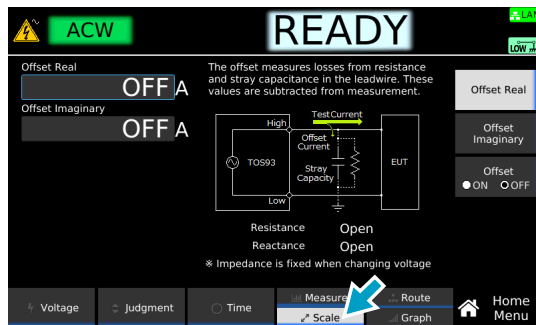
This can be set only for AC withstanding voltage (ACW) tests.

You can set the real part (Offset Real) and imaginary part (Offset Imaginary) of the offset for the current running through the stray capacitance of test leads, tools, and the like. If the offset is set to on, **Offset** appears during testing.

The offset current is recorded in terms of a resistance in the product. The actual offset current is calculated from the resistance and test voltage. Because the resistance resolution is 100 Ω, an error may occur in the measured value.

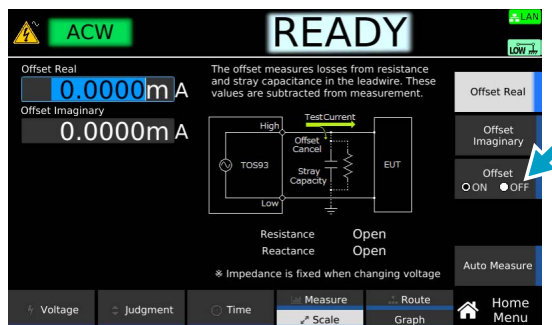
1 On the Home menu screen, press Scale repeatedly until Scale is selected.

Each time you press the key, the setting changes between Measure and Scale.



2 Press Offset to switch between on and off.

Offset switches between on and off each time you press the key.



3 If set to ON, set the Offset Real and Offset Imaginary values according to the following procedure.

Purpose	Operation
Measure the Offset Real and Offset Imaginary values to set them automatically.	Press Auto Measure. Use the rotary knob or numeric keypad to enter the test voltage. Connect test leads to this product, and open the test leads. Press START. When the measurement stabilizes, press STOP. The Offset Real and Offset Imaginary values are set automatically.
Set the Offset Real value manually.	Press Offset Real, and then use the numeric keypad or the rotary knob to enter the value. Setting range: 0.0000 mA to 10.0000 mA
Set the Offset Imaginary value manually.	Press Offset Imaginary, and then use the numeric keypad or the rotary knob to enter the value. Setting range: 0.0000 mA to 10.0000 mA

This completes the setting.

Offset

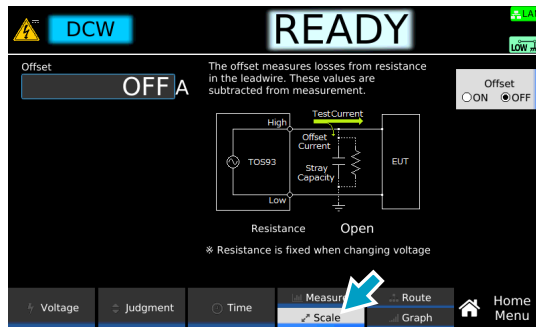
This can be set only in DC withstanding voltage (DCW) tests.

An offset can be applied to the current or resistance of test leads, tools, etc. If the offset is set to on, **Offset** appears during testing.

The offset current is recorded in terms of a resistance in the product. The actual offset current is calculated from the resistance and test voltage. Because the resistance resolution is 100 Ω, an error may occur in the measured value.

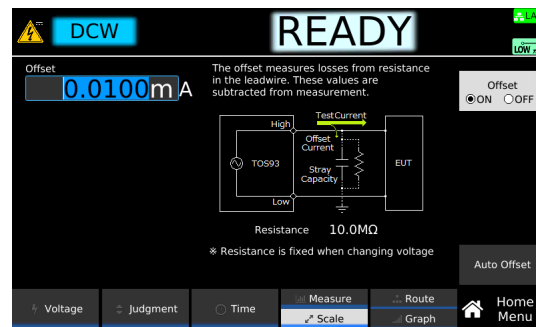
1 On the Home menu screen, press Scale repeatedly until Scale is selected.

Each time you press the key, the setting changes between Measure and Scale.



2 Press Offset to switch between on and off.

Offset switches between on and off each time you press the key.



3 If set to ON, set the Offset value according to the following procedure.

Purpose	Operation
Measure the Offset value to set it automatically.	Press Auto Measure. Use the rotary knob or numeric keypad to enter the test voltage. Connect test leads to this product, and open the test leads. Press START. When the measurement stabilizes, press STOP. The Offset value is set automatically.
Set the Offset value manually.	Use the numeric keypad or the rotary knob to enter the value. For IR tests, the unit of resistance changes each time you press Range. DCW setting range: 0.0000 mA to 10.0000 mA

This completes the setting.

Checking the scanner contact (Contact Check)

Use this function when the TOS9320 high voltage scanner option (p.234) is connected.

You can check the continuity between the test leads connected to the scanner channel set to High or Low and the EUT. When Contact Check is set to ON, "CHECK" will appear on the display, and continuity will be confirmed before the test voltage is applied after the START switch is pressed. When the continuity is confirmed, the test will begin.

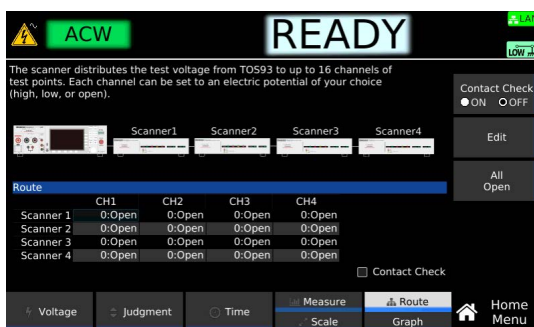
The following equation can be used to calculate the execution time of a contact check.

Execution time = 50 ms + 30 ms × (number of channels set to High or Low)

For information on typical timing charts, see "Contact check operation" (p.230).

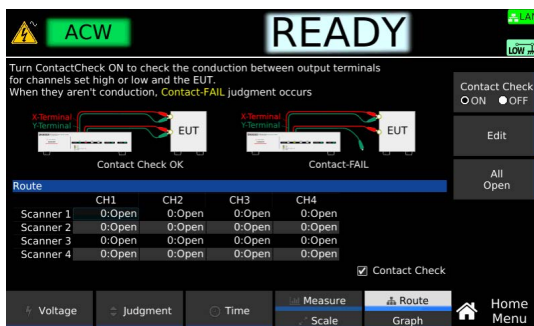
1 On the Home Menu screen, press Route.

The following figure shows a screen example during an ACW test.



2 Press Contact Check to switch between on and off.

Each time you press the key, Contact Check toggles between on and off.



This completes the setting.

If continuity cannot be confirmed

"Contact-FAIL" will appear in the top area of the display. The U FAIL and L FAIL signals of SIGNAL I/O Connector (p.157) will be set to on simultaneously. On the scanner side, the LED of the corresponding channel lights orange. Check that the test leads are connected properly.

Setting scanner channels (Edit)

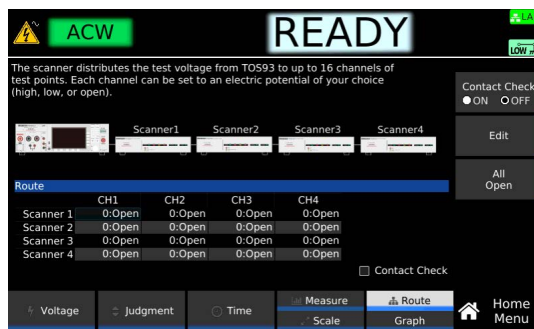
Set the scanner channels when the TOS9320 high voltage scanner option (p.234) is connected.
Set each scanner channel connection to High, Low, or Open.

NOTE

To make the association between the connected test lead and channels clear, affix the channel labels supplied with the scanner to the test leads.

1 On the Home menu screen, press Route.

The following figure shows a screen example during an ACW test.



2 Use the rotary knob and the arrow (◀▶) keys to select a channel, and then press Edit.



3 Use the sub-function keys to select Open, Low, or High and press ENTER.

4 To continue the settings, repeat Step 2 and Step 3 .

This completes the setting.

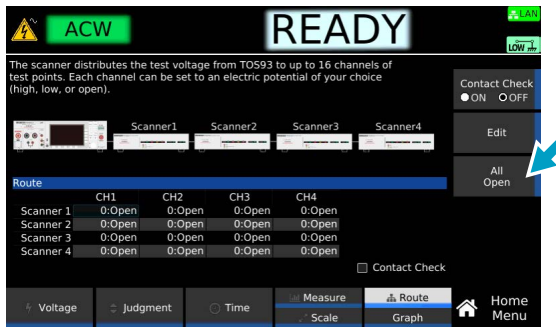
Opening the scanner (All Open)

Applicable models: **9300**, **9301**, **9302**, **9303**

Use this function when the TOS9320 high voltage scanner option (p.234) is connected.

You can set all channels of the scanner to open.

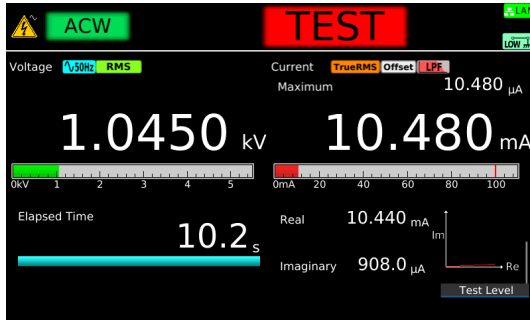
- 1 On the Home menu screen, press Route > All Open.



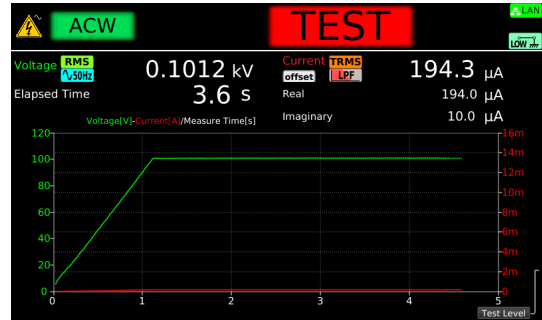
This completes the setting.

Measurement screen display during the test (Display View)

Select the measurement screen to be displayed during the test from the numerical values and graphs.



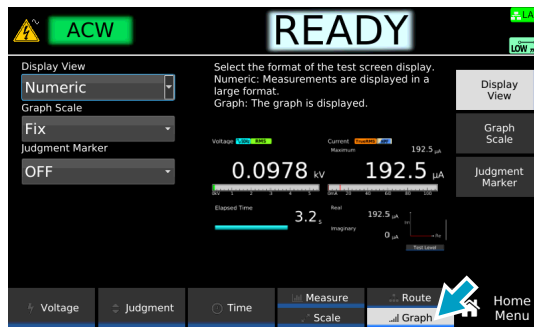
Setting: Numeric



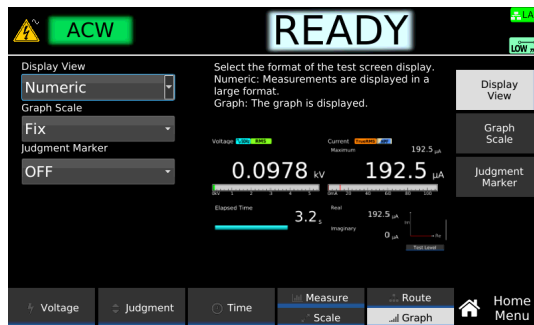
Setting: Graph

- 1 On the Home Menu screen, press Graph repeatedly until Graph is selected. For models other than TOS9311, each time you press the key, it changes between Route and Graph.

The following figure shows a screen example during an ACW test.



- 2 Press Display View, and then turn the rotary knob to change the value.



This completes the setting.

Graph Scale

If Display View (p.77) is set to Graph, select whether the voltage-axis, current-axis and resistance-axis scale should be fixed or automatic.

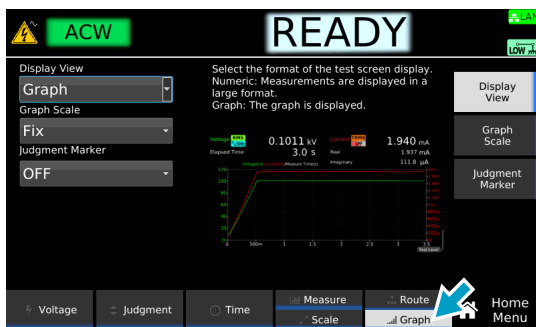
Set value	Description
Fix	Voltage-axis: The minimum value shall be fixed at 0 V, while the maximum value shall be fixed at the TestVoltage +10 % or more. Current-axis: The minimum value shall be fixed at 0 A, while the maximum value shall be fixed at the Upper +10 % or more.
Auto	Both minimum value and maximum value shall be set at auto-scale.

There is no time-axis scale setting. The minimum value of the time-axis is 0 s, and the maximum value is the sum of Test Time, Fall Time, and Rise Time when Test Time is ON and is computed by auto scale when Test Time is OFF.

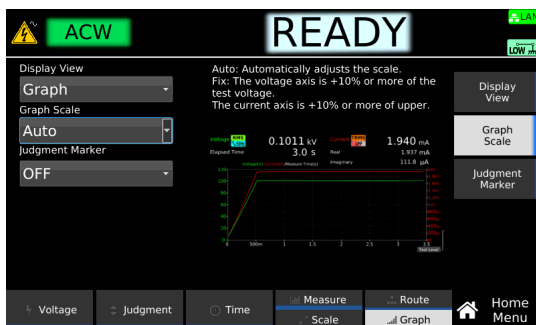
1 On the Home Menu screen, press Graph repeatedly until Graph is selected.

For models other than TOS9311, each time you press the key, it changes between Route and Graph.

The following figure shows a screen example during an ACW test.



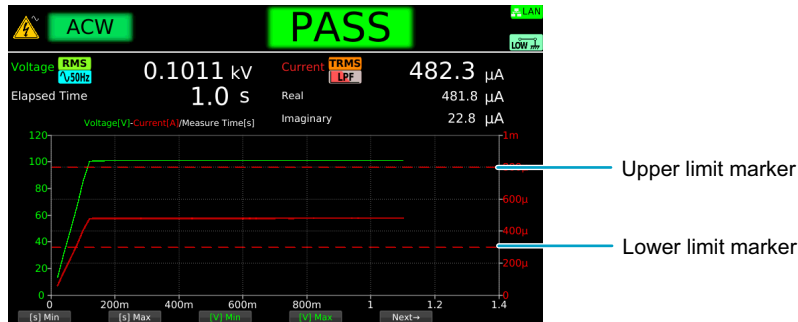
2 Press Graph Scale, and then turn the rotary knob to change the value.



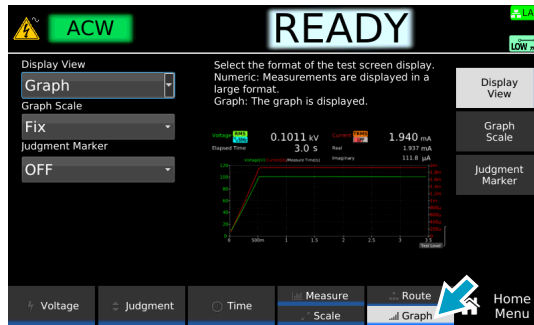
This completes the setting.

Judgement criteria marker display (Judgement Marker)

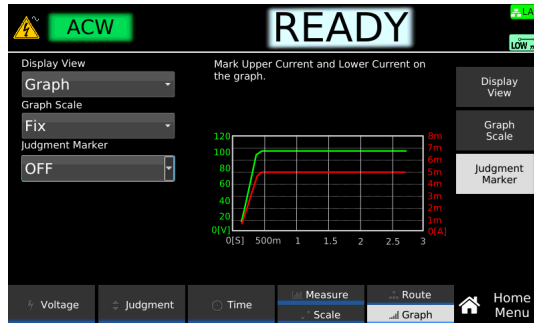
Set whether to mark the upper and lower limits on the graph when Display View (p.77) is set to Graph.



- 1 On the Home Menu screen, press Graph repeatedly until Graph is selected. For models other than TOS9311, each time you press the key, it changes between Route and Graph.



- 2 Press Judgment Marker, and turn the rotary knob to select ON or OFF.



This completes the setting.

Starting a Test

We recommend that you perform a pre-test inspection ([p.201](#)) before executing a test.

Output time limit

When withstanding voltage tests are performed consecutively, output time limit and rest time may become necessary depending on the upper limit.

The following table shows the output time limit and rest time that are necessary when the ambient temperature is 40 °C (104 °F) or less. If you exceed the limit, the temperature of the output section may increase. This may cause the protection function to be activated and “OVER HEAT” to be indicated on the display. If this happens, stop testing and wait for the temperature to return to normal by referring to the rest time. If “READY” is displayed in the upper right of the display when you press the STOP switch, the temperature is back to normal.

■ TOS9300, TOS9301, TOS9302, TOS9303

Test mode	Upper limit (i)	Output time ¹ limit	Rest time
AC withstanding voltage (ACW)	$i \leq 50 \text{ mA}$	No limit	Not necessary
	$50 \text{ mA} < i \leq 110 \text{ mA}$	30 min. max.	At least the length of time the voltage was output
DC withstanding voltage (DCW)	$i \leq 5 \text{ mA}$	No limit	At least judgment delay (Judge Delay) ²
	$5 \text{ mA} < i \leq 20 \text{ mA}$	10 min. max.	At least the length of time the voltage was output

1. Includes the voltage rise time, test time, and voltage fall time.
2. If Delay Auto ([p.59](#)) is set to on, rest time is not necessary.

■ TOS9311

Test mode	Upper limit (i)	Output time ¹ limit	Rest time
AC withstanding voltage (ACW)	$i \leq 10 \text{ mA}$	No limit	Not necessary
	$10 \text{ mA} < i \leq 55 \text{ mA}$	30 min. max.	At least the length of time the voltage was output
DC withstanding voltage (DCW)	$i \leq 2 \text{ mA}$	No limit	At least judgment delay (Judge Delay) ²
	$2 \text{ mA} < i \leq 20 \text{ mA}$	10 min. max.	At least the length of time the voltage was output

1. Includes the voltage rise time, test time, and voltage fall time.
2. If Delay Auto ([p.59](#)) is set to on, rest time is not necessary.

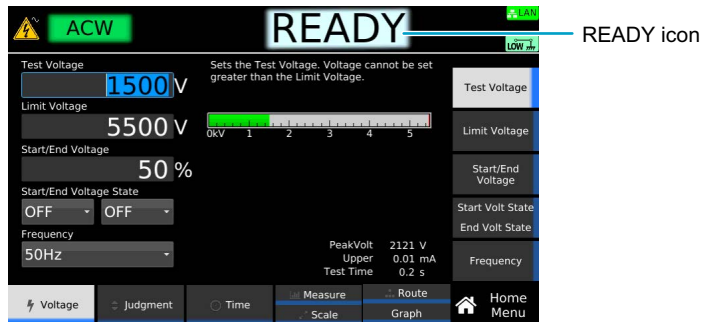
Starting a test

WARNING

Risk of electric shock.

- Do not touch the EUT, HIGH VOLTAGE terminals, test leads, test probes, output terminals, or other peripheral components while the DANGER LED is lit.
- When performing a withstanding voltage test, be sure to wear rubber gloves for electrical work.

- 1 Check that the product is correctly connected to the EUT.
- 2 Check that “READY” is shown on the display, and then press START.
The following figure shows a screen example during an ACW test.



The DANGER LED lights, and the test starts.

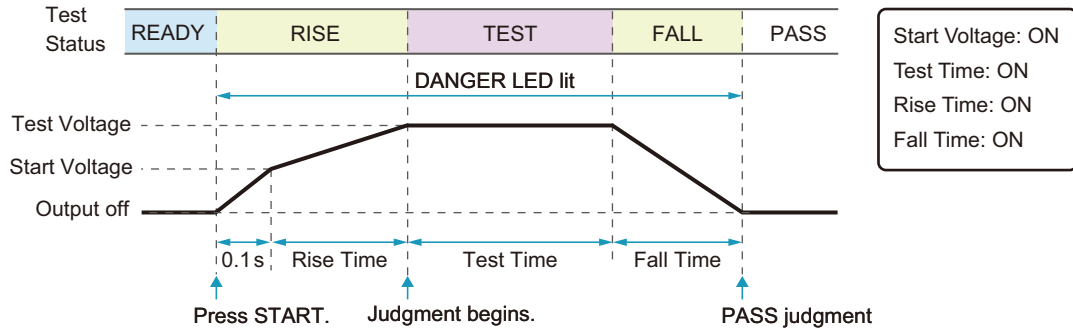
If the test does not start, see "Unable to start a test" (p.239).

If you want to start another test after the test finishes, set a rest time (p.80) between tests as necessary.

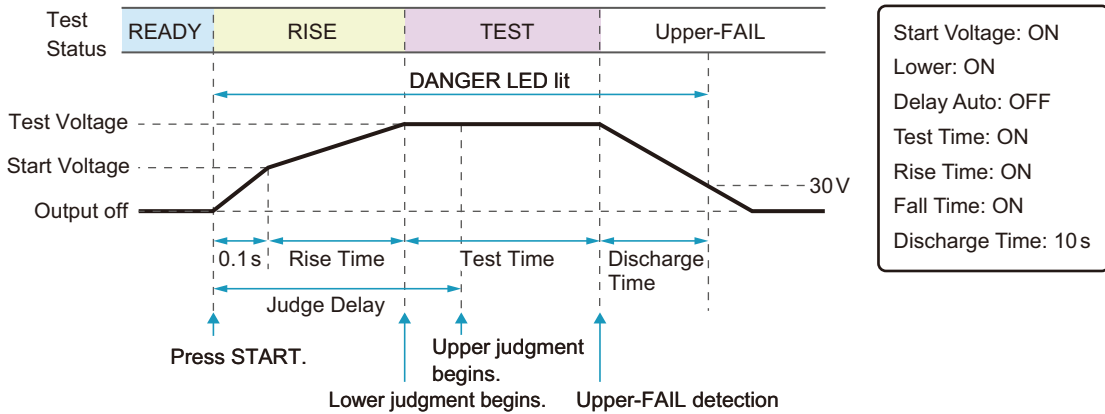
Operation after a test starts

Shown below are examples of operation after a test starts.

■ Example of an ACW test (PASS judgment)

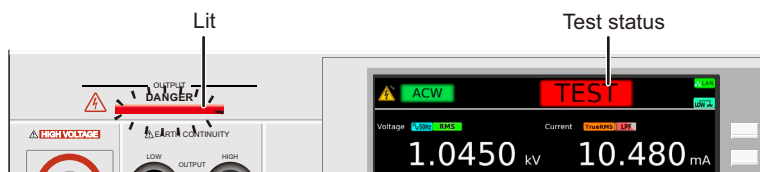


■ Example of a DCW test (FAIL judgment)



■ DANGER LED and test status display

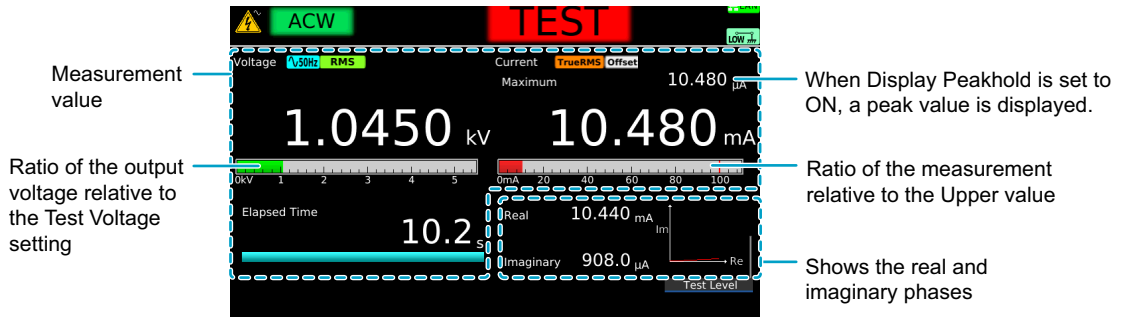
During a test, the DANGER LED lights, and the test status is shown in the upper right of the display. The DANGER LED lights if voltage remains at the output terminals regardless of the test status.



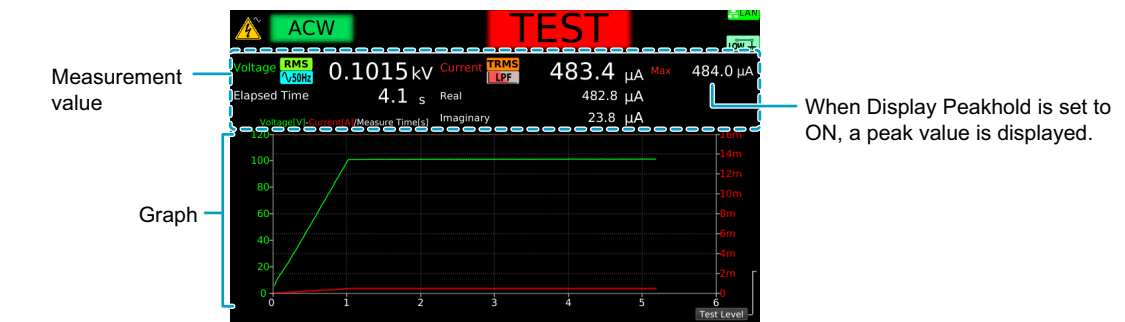
Test status	Description
TEST	Testing
↗RISE	Voltage rising
FALL↘	Voltage falling
CHECK	Performing Contact Check for scanner (TOS9311 not supported.)

Measurement display

The display varies according to the setting of Display View (p.77).



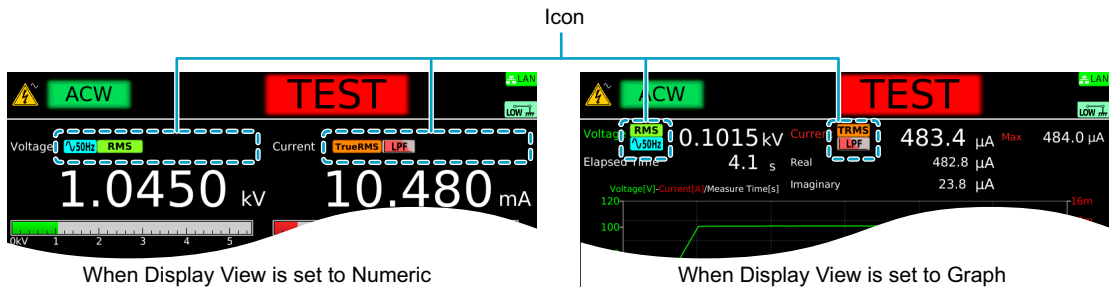
When Display View is set to Numeric



When Display View is set to Graph

Test condition display

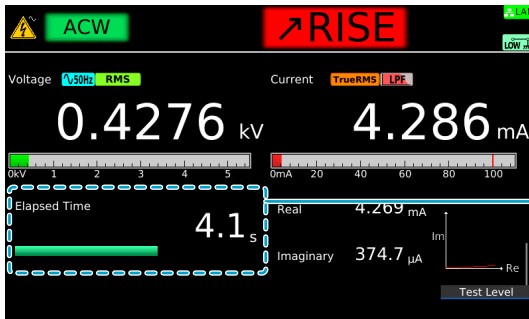
Icons indicating the test conditions appearing during testing.



Icon	Description
	Frequency setting (50 Hz/60 Hz).
	Current RMS setting (TrueRMS/Average).
	Volt Measure setting (RMS/Average/Peak).
	Offsetting.
	Filter setting (LPF/HPF)

Voltage rise time display

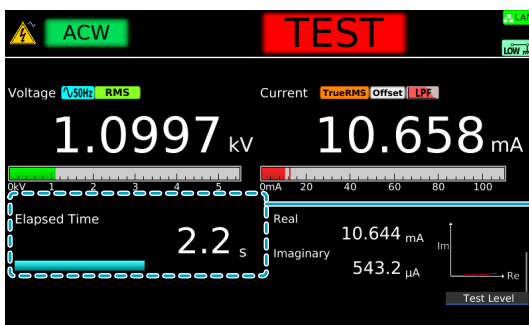
While the voltage is rising, “RISE” is displayed along with the elapsed time. If Display View (p.77) is set to Numeric, the remaining voltage rise time shall be displayed as a bar graph. When the time specified by Rise Time elapses, “TEST” is shown, and the test starts.



Elapsed time. The remaining rise time is displayed with a bar graph.

Test time display

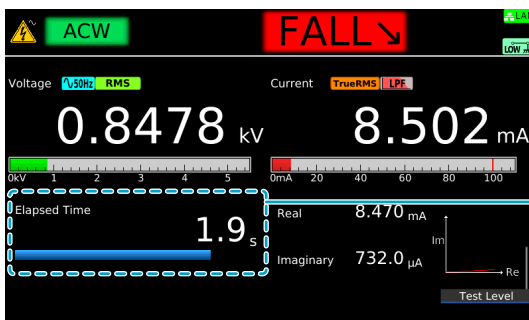
During the test time, “TEST” and the elapsed time are displayed. If Display View (p.77) is set to Numeric, the remaining test time shall be displayed as a bar graph when the Test Time is on. If Test Time is set to off, the elapsed time is displayed up to 3600000.0 seconds. If the elapsed time is greater than 3600000.0, the display is fixed at +Over.



Elapsed time. If Test Time is set to on, the remaining test time is displayed with a bar graph.

Voltage fall time display

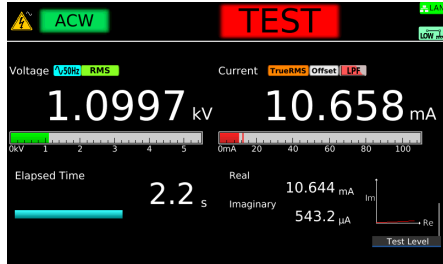
If Fall Time is set to on, “FALL” and the elapsed time are displayed while the voltage is falling. If Display View (p.77) is set to Numeric, the remaining voltage fall time shall be displayed as a bar graph.



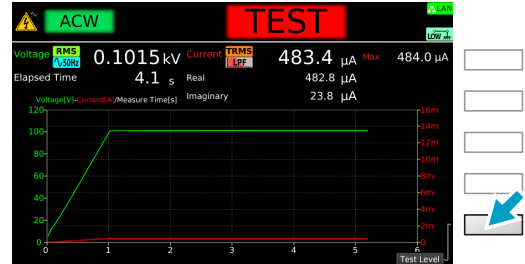
Elapsed time. The remaining fall time is displayed with a bar graph.

Changing the voltage setting during a test

During a test, press Test Level. Then, use the numeric keypad or the rotary knob to change the voltage. The changed voltage is immediately applied to the test, but the voltage value on the display shows the measured value. When “READY” appears in the upper right of the display after the test is finished, the new voltage setting will be displayed. The Output Error may occur when the output changes suddenly.



When Display View is set to Numeric



When Display View is set to Graph

Finishing the Test and Viewing the Judgment

Stopping tests

If you want to stop a test or finish a test when the test time is off, press STOP.



Conditions that cause a test to end

Conditions that cause a test to end are as follows:

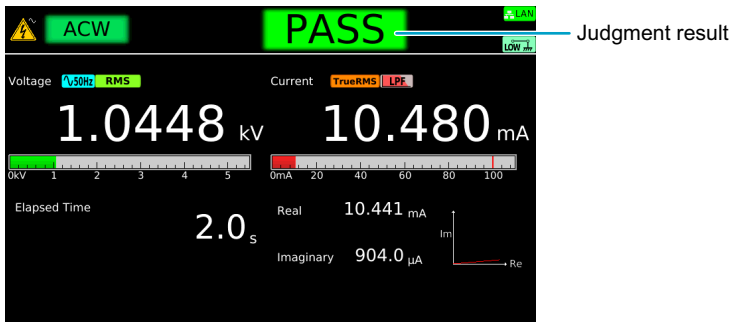
- a. When FAIL judgment is made.
- b. When the test time elapses if Test time is set to on.
- c. When you press STOP.

In any of the cases above, the “TEST” indication on the display disappears when the test ends. When the voltage residing at the output terminals is discharged, the DANGER LED turns off.

If the test finishes under condition a or b given above, the judgment result (p. 86) will be shown on the display.

Judgment types and operation

When a test finishes, the judgment result is shown in the test status.

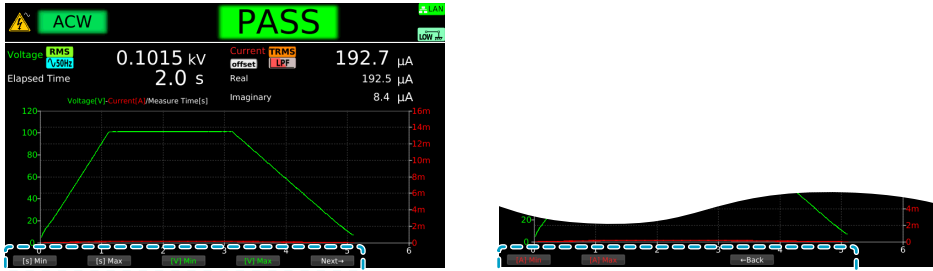


	Upper-FAIL	Lower-FAIL	Upper-FAIL (dV/dt)
Condition	A current greater than or equal to the upper limit was measured.	A current less than or equal to the lower limit was measured.	When Delay Auto is set to on in a DCW test and the output voltage is 200 V or more, the voltage rise rate (dV/dt) is less than approximately 1 V/s before starting a judgment.
Display	The test status shows "Upper-FAIL" until the judgment result is cleared.	The test status shows "Lower-FAIL" until the judgment result is cleared.	The test status shows "Upper-FAIL (dV/dt)" until the judgment result is cleared.
Buzzer	The buzzer continues to sound until the judgment result is cleared.	The buzzer continues to sound until the judgment result is cleared.	The buzzer continues to sound until the judgment result is cleared.
SIGNAL I/O connector	U FAIL signal is output until the judgment result is cleared.	L FAIL signal is output until the judgment result is cleared.	U FAIL signal is output until the judgment result is cleared.

	Contact-FAIL	PASS
Condition	Continuity between the test lead and EUT could not be confirmed when the scanner is used with Contact Check enabled. (TOS9311 not supported.)	A FAIL judgment was not made during the test.
Display	The test status shows "Contact-FAIL" until the judgment result is cleared.	The test status shows "PASS" until the time specified by Pass Hold elapses. Then the judgment result is cleared.
Buzzer	The buzzer continues to sound until the judgment result is cleared.	The buzzer sounds for 50 ms (regardless of the Pass Hold time).
SIGNAL I/O connector	Both U FAIL and L FAIL signals are output simultaneously until the judgment result is cleared.	PASS signal is output until the judgment result is cleared.

Changing the graph scale

If Display View (p.77) is set to Graph, the scale of the graph can be changed after the test.



Select each item using the function keys and enter the maximum/minimum value by using the numeric keypad or the rotary knob.

Item	Description	Resolution
[s] Min	Changes the minimum value of the time-axis.	0.5 s
[s] Max	Changes the maximum value of the time-axis.	
[V] Min	Changes the minimum value of the voltage-axis.	TOS9311: 10 V
[V] Max	Changes the maximum value of the voltage-axis.	Models other than above: 1 V
[A] Min	Changes the minimum value of the current-axis.	0.01 mA
[A] Max	Changes the maximum value of the current-axis.	
Next→	Switches the functions that can be performed with the function key.	none
←Back	Switches the functions that can be performed with the function key.	none

Clearing the judgment result

Press STOP to clear the judgment result. The product is ready to start another test.

Insulation Resistance Tests

Applicable models: **9300**, **9301**, **9311**, **9303**

This chapter describes how to set test conditions, start tests, and view the results for IR tests.

- Setting Test Conditions ([p.88](#))
- Starting a Test ([p.114](#))
- Finishing the Test and Viewing the Judgment ([p.118](#))

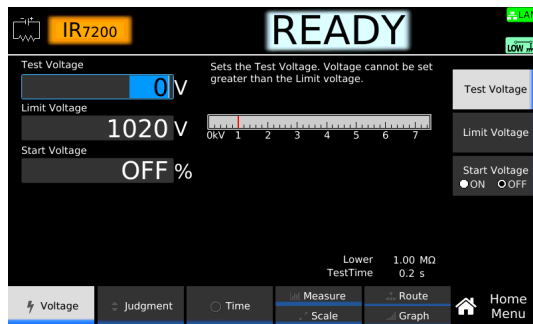
Setting Test Conditions

This section describes the test conditions of insulation resistance (IR) tests and how to set the conditions.

Displaying the setup screen (Home menu)

- 1 On the Function menu screen ([p.43](#)), press IR.
- 2 Select the voltage range with the sub-function keys.
 - TOS9300: -1000 V (fixed)
 - TOS9301 or TOS9303: 7200 V, -1000 V
 - TOS9311: 10 kV, -1000 V

The setup screen (Home menu) for the IR test conditions appears.



Set the required conditions by referring to the description of test conditions ([p.89](#)).

Description of test conditions

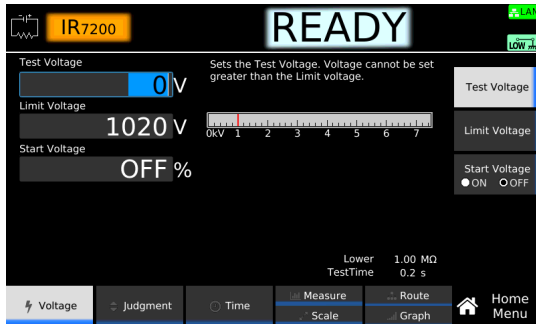
The test conditions you can set vary for ACW, DCW, and IR.
The following test conditions with a check mark can be used with the corresponding test.

Test condition	Description
Test voltage	Voltage to apply to the EUT. (p.90)
Limit voltage	Upper limit of voltage to apply to the EUT. (p.91)
Start voltage	Voltage 0.1 seconds after pressing the START switch. (p.92)
Upper limit	Resistance or current used as a reference for upper limit judgment. (p.93)
Lower limit	Resistance or current used as a reference for lower limit judgment. (p.94)
Unit of criteria (Judge Type)	The unit of upper and lower limits. (p.95)
Auto setting of the judgment delay (Delay Auto)	Select the time (auto or manual) from when the START switch is pressed until the upper limit judgment starts. (p.96)
Test time	Time from when the voltage rise time has passed to the end of the test. (p.98)
Voltage rise time	The time from when the START switch is pressed or from the start voltage to when the test voltage is reached. (p.99)
Discharge time	The time for discharging the voltage residing in the high voltage charge area. (p.100)
Discharge when interlock is activated (Discharge Interlock)	Discharges the voltage when the interlock is activated. (p.101)
Grounding mode (GND)	Select whether to include the current running through the stray capacitance of test leads, tools, and the like in measurements. (p.102)
Using the low-pass filter	Stabilize measurements when measuring at high sensitivity or when the measurements are unstable and hard to read. (p.104)
Peak value display (Display Peakhold)	Select whether to display the maximum value of current for the ACW test and DCW test, or the minimum value of resistance for the IR test, during the test and in the judgment result. (p.105)
Offset	Applies an offset to the current or resistance of test leads, tools, etc. (p.106)
Checking the scanner contact (Contact Check)	Check the continuity between the test leads connected to the scanner and the EUT. (p.107)
Setting scanner channels (Edit)	Switches the connection (high, low, open) of each channel of the scanner. (p.108)
Opening the scanner (All Open)	Set all channels of the scanner to open. (p.109)
Measurement screen display during the test (Display View)	Select the measurement screen to be displayed during the test from the numerical values or graphs. (p.110)
Graph scale	Select whether the scale of the voltage-axis is fixed or auto-set. (p.111)
Graph axis setting (Graph Format)	Sets the value to be displayed on the Y-axis. (p.112)
Judgement criteria marker display (Judgement Marker)	Set whether to mark the upper and lower limits on the graph. (p.113)

Test voltage

Set the voltage to apply to the EUT. You cannot specify a voltage that exceeds the limit voltage (p.91).

- 1 On the Home menu screen, press Voltage > Test Voltage.



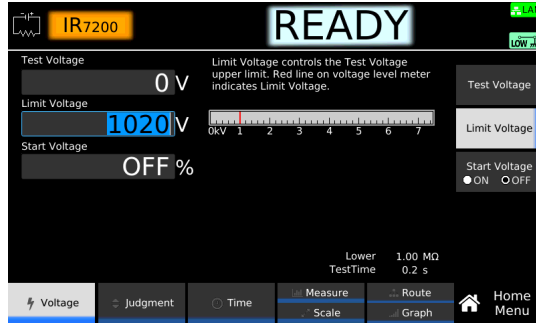
- 2 Use the numeric keypad or the rotary knob to enter the voltage.

Setting range: 0 V to 1020 V (-1000 V test)
 Setting range: 0 V to 7500 V (7200 V test)
 Setting range: 0 V to 10.500 kV (10 kV test)
 This completes the setting.

Limit voltage

Set the upper limit of the voltage to apply to the EUT. This prevents unnecessarily high voltage from being applied to the EUT by mistake.

1 On the Home menu screen, press Voltage > Limit Voltage.



2 Use the numeric keypad or the rotary knob to enter the voltage.

Setting range: 0 V to 1020 V (-1000 V test)

Setting range: 0 V to 7500 V (7200 V test)

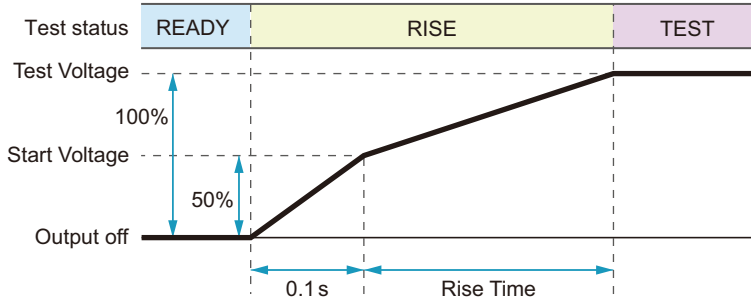
Setting range: 0 V to 10.500 kV (10 kV test)

This completes the setting.

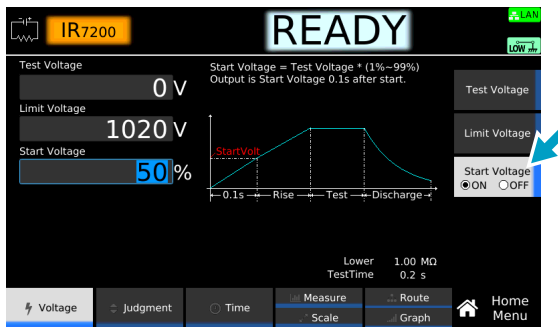
Start voltage

Set the voltage 0.1 seconds after the START switch is pressed as a percentage of the test voltage. If you do not want to set the start voltage, set Start Voltage to off.

■ When the start voltage is 50%



1 On the Home menu screen, press Voltage > Start Voltage.

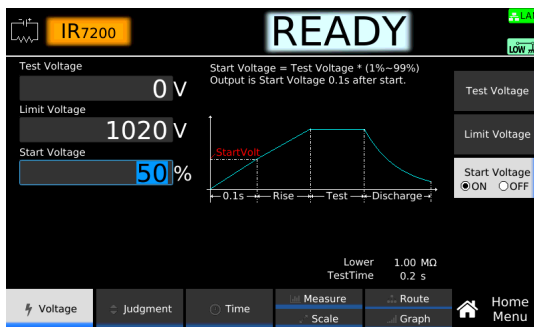


2 Press Start Voltage to switch between on and off.

Start Voltage switches between on and off each time you press the key.

3 If you select ON, press Start/End Voltage, and then use the numeric keypad or the rotary knob to enter a percentage value.

Setting range: 1 % to 99 %



This completes the setting.

Upper limit

Set the reference resistance or current for upper limit judgment. If resistance or current greater than or equal to Upper is measured, upper limit judgment (Upper-FAIL) results. You can set Upper to off if upper limit judgment is not necessary.

If a value smaller than Lower (p.94) is set, the Lower setting will change according to the Upper setting.

NOTE

Normally, even a good EUT will have a certain degree of leakage current. When Unit of criteria (Judge Type) (p.95) is set to resistance, setting Upper slightly greater than the resistance specific to the EUT helps detect EUT errors, breaks in the test leads, and poor connections, enabling you to perform highly reliable testing.

- 1 On the Home menu screen, press Judgment > Upper.



- 2 Press Upper to switch between on and off.
Upper switches between on and off each time you press the key.
- 3 Use the numeric keypad or the rotary knob to enter the resistance or current value.
The setting range varies according to the Judge Type (p.95) and Range settings.

Judge Type	Range	Setting range
[A]	None	0.0001 mA to 1.0100 mA
[Ω]	[GΩ]	0.001 GΩ to 100.000 GΩ
[Ω]	[MΩ]	0.001 MΩ to 999.999 MΩ

This completes the setting.

Lower limit

Set the reference resistance or current for lower limit judgment. If a resistance or current less than or equal to Lower is measured, lower limit judgment (Lower-FAIL) results. To disable lower limit judgment, set Lower to off.

The criteria can be set in terms of resistance or current (p.95).

If a value greater than Upper (p.93) is set, the Upper setting will change according to the Lower setting.

NOTE

Normally, even a good EUT will have a certain degree of leakage current. When Unit of criteria (Judge Type) (p.95) is set to current value, setting Lower slightly less than the leakage current specific to the EUT helps detect EUT errors, breaks in the test leads, and poor connections, enabling you to perform highly reliable testing.

1 On the Home menu screen, press Judgment > Lower.



2 Press Lower to switch between on and off.

Lower switches between on and off each time you press the key.

3 If you select on, use the numeric keypad or the rotary knob to enter the resistance or current value.

The setting range varies according to the Judge Type (p.95) and Range settings.

Judge Type	Range	Setting range
[A]	none	0.0000 mA to 1.0099 mA
[Ω]	[GΩ]	0.000 GΩ to 99.999 GΩ
[Ω]	[MΩ]	0.000 MΩ to 999.999 MΩ

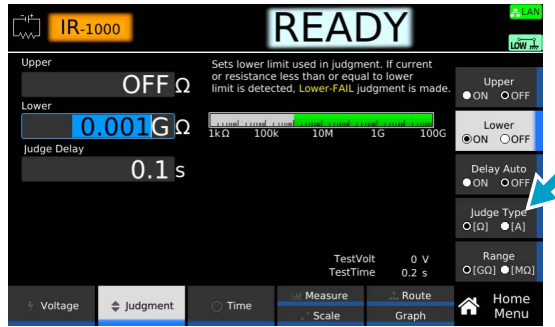
This completes the setting.

Unit of criteria (Judge Type)

Set the unit of the upper limit (p.93) or lower limit (p.94) for insulation resistance (IR) tests to resistance or current.

1 On the Home menu screen, press Judgment > Judge Type.

If the Judge Type key is not displayed, press Upper or Lower to display it. Each time you press Judge Type, the unit of Upper and Lower values switch between Ω and A.



2 If you select resistance (Ω), press Range to select the unit.

If the Range key is not displayed, set Upper or Lower to on to display it. Each time you press the key, the unit of Upper and Lower values switch between G Ω , and M Ω .



This completes the setting.

Auto setting of the judgment delay (Delay Auto)

When the test voltage is applied to an EUT with a capacitive component, a large charge current may flow until charging is completed. Judgment errors due to the effects of the charge current can be prevented by setting a delay (Judge Delay) from when the START switch is pressed to when judgment is started.

Set Delay Auto to on or off to select auto or manual setting of the judgment delay.

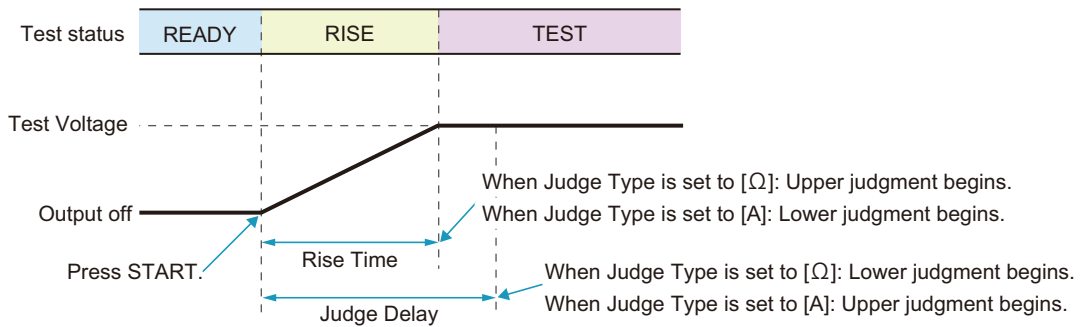
Value	Description
ON	Upper limit judgment or lower limit judgment will start automatically when the voltage reaches the test voltage and judgment becomes possible. ¹ If the output voltage is 200 V or more and the voltage rise rate is less than approximately 1 V/s before the judgment starts, Lower-FAIL (dV/dt) occurs, and the test ends. Problems can be discovered quickly such as when the EUT is shorted.
OFF	Set the judgment delay (Judge Delay) manually. Refer to the following, and set a delay shorter than the sum of Voltage rise time (p.99) and Test time (p.98).

1. When Unit of criteria (Judge Type) (p.95) is set to resistance, it will be lower limit judgment, and when set to current value, it will be upper limit judgment.

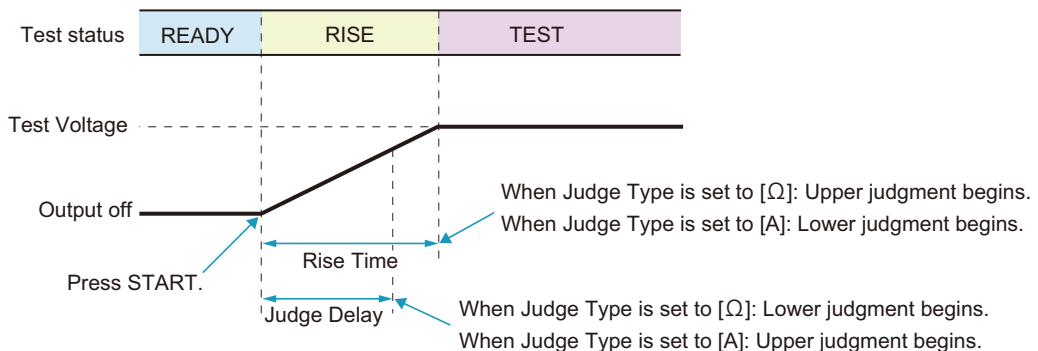
NOTE

- Making judgments on 200 μA or less requires at least 3 seconds after the rise time ends.
- Making judgments when the low pass filter (p.104) is set to on requires at least 10 seconds after the rise time ends.

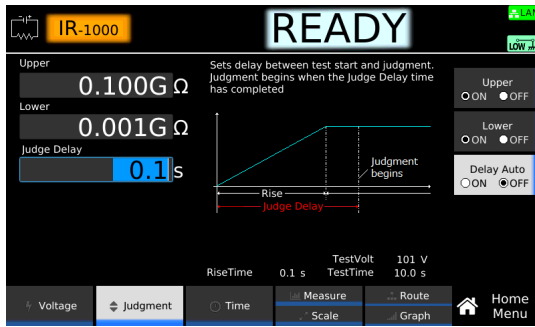
■ When Judge Delay is longer than Rise



■ When Judge Delay is shorter than Rise Time



- 1 On the Home menu screen, press Judgment > Delay Auto.



- 2 Press Delay Auto to switch between ON and OFF.
Delay Auto switches between on and off each time you press the key.
- 3 If you select off, use the numeric keypad or the rotary knob to enter the time.
Setting range: 0.1 s to 100.0 s
This completes the setting.

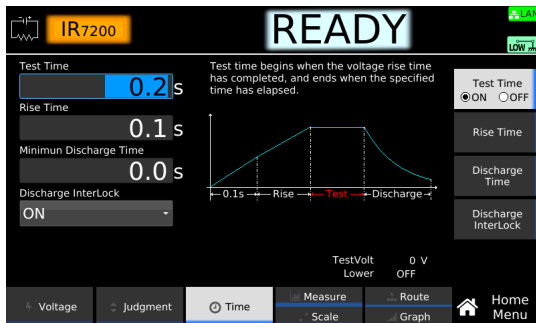
Test time

Set the test time to on or off.

Value	Description
ON	Set the time from when the Voltage rise time (p.99) has passed to the end of the test. If upper limit judgment (Upper-FAIL) or lower limit judgment (Lower-FAIL) does not occur during a test, the test will result in PASS. For insulation resistance (IR) tests, making judgments at 1 μ A or less requires the test time to be at least 1.0 second.
OFF	The test continues until the STOP switch is pressed. Pass judgments are not made.

If Delay Auto (p.96) is OFF and the sum of the times set for Test Time and Rise Time is shorter than the time set for Judge Delay, the set value of Judge Delay will change according to the sum of Test Time and Rise Time.

1 On the Home menu screen, press Time > Test Time.



2 Press Test Time to switch between on and off.

Test Time switches between on and off each time you press the key.

3 If you select on, use the numeric keypad or the rotary knob to enter the time.

Setting range: 0.1 s to 1000.0 s

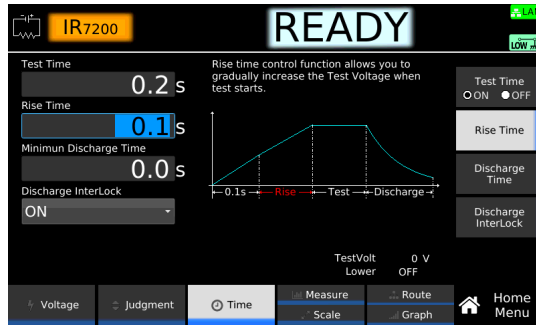
This completes the setting.

Voltage rise time

Set the time from when the START switch is pressed until the test voltage (p.90) is reached or the time for the voltage to change from the start voltage (p.92) to the test voltage.

If Delay Auto (p.96) is OFF and the sum of the times set for Test Time and Rise Time is shorter than the time set for Judge Delay, the set value of Judge Delay will change according to the sum of Test Time and Rise Time.

1 On the Home menu screen, press Time > Rise Time.



2 Use the numeric keypad or the rotary knob to enter the time.

Setting range: 0.1 s to 200.0 s

This completes the setting.

Discharge time

During a test, the EUT, test leads, test probes, output terminals, and other peripheral components are charged to a high voltage. Set the time for discharging the voltage remaining in the high voltage charge area after the test ends. If voltage remains even after the set discharge time elapses, discharge continues until the voltage reaches 30 V.

■ Estimated discharge time

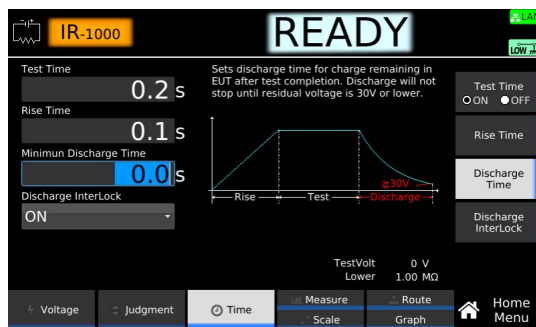
The time required to discharge the built-up electrical charge varies according to the test voltage and the properties of the EUT.

The time that this product requires to discharge the voltage from its internal capacitors down to 30 V is as follows:

- When an EUT is not connected: 1.5 ms
- When an EUT with a input capacitance of 0.05 μF is connected: 6 ms

■ Setup procedure

1 On the Home menu screen, press Time > Discharge Time.



2 Use the numeric keypad or the rotary knob to enter the time.

Setting range: 0.0 s to 100.0 s

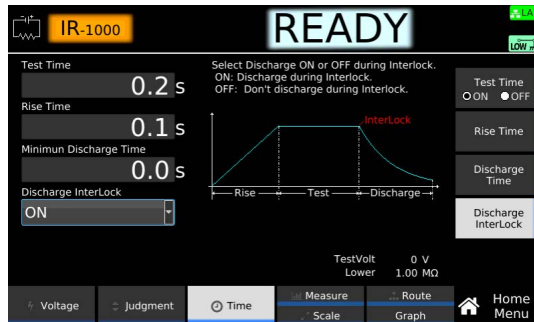
This completes the setting.

Discharge when interlock is activated (Discharge Interlock)

During a test, the EUT, test leads, test probes, output terminals, and other peripheral components are charged to a high voltage. Set whether to discharge the voltage remaining in the high voltage charge area if the interlock is activated ([p. 161](#)) during a test.

Value	Description
ON	The voltage remaining in the high voltage charge area is discharged if the interlock is activated during a test. Use this when you do not want the voltage to remain if the interlock is activated, such as when a capacitive EUT is connected.
OFF	The output's high voltage relay is opened to shut off the output if the interlock is activated.



1 On the Home menu screen, press Time > Discharge Interlock.



2 Turn the rotary knob to change the value. This completes the setting.

Grounding mode (GND)

Select whether to include the current running through the stray capacitance (p.229) of test leads, tools, and the like in measurements. An icon is shown in the upper right of the display according to the setting.

Value	Description	Icon
Low	Measures by including the current running through the stray capacitance across test leads or tools and ground and the current running through the insulation resistance. Tests can be performed safely without the risk of shorting the ammeter.	
Guard	High-sensitivity high-precision measurement is possible because the current running through the stray capacitance across test leads or tools and ground and the current running through the insulation resistance are excluded from measurement. Use this mode only when the EUT and tools and the like are completely floating. If one end of the EUT is grounded to earth or if the LOW terminal and chassis are shorted, the ammeter will be shorted. This is extremely dangerous.	

WARNING

Risk of electric shock.

- **If there is a possibility that the EUT or tools and the like will be grounded or if you are uncertain about it, do not set GND to Guard.**

The ammeter will be short-circuited and will not be able to measure current.

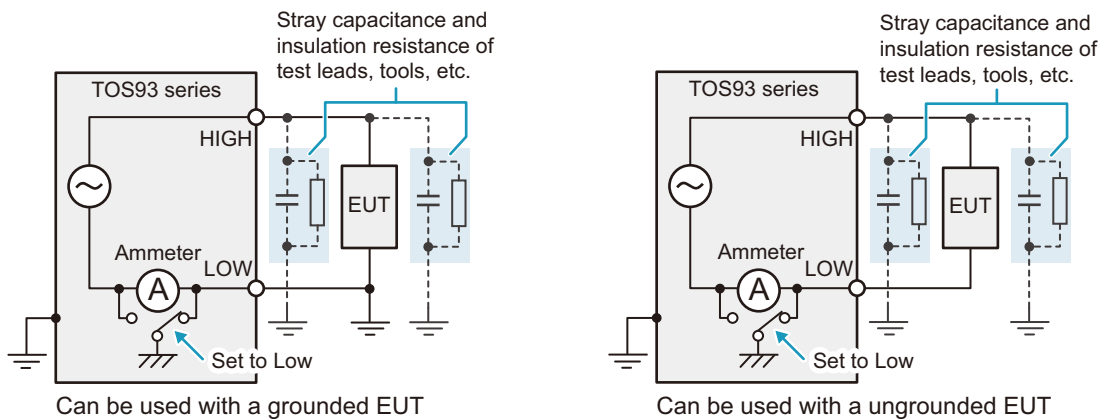
- **If you set GND to Guard, do not connect measuring instruments that are grounded at one end (e.g., Kikusui 149-10A High Voltage Digital Voltmeter, TOS1200 Current Calibrator) to this product.**

The ammeter will be short-circuited and will not be able to measure current.

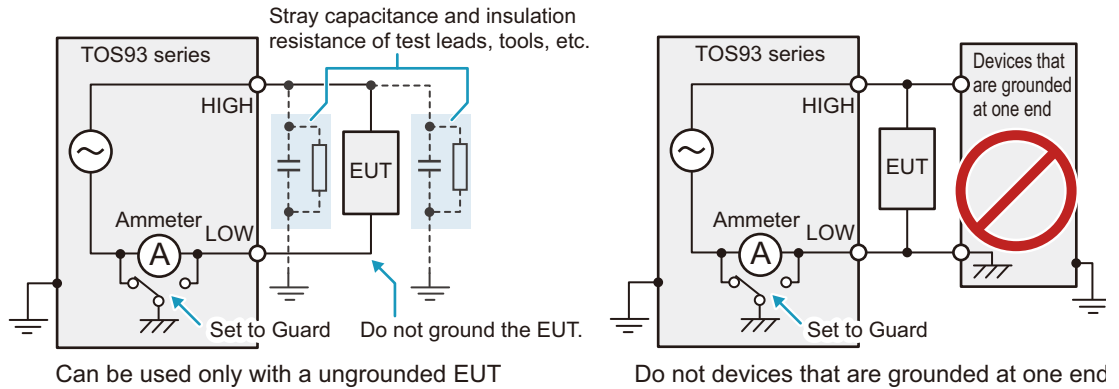
NOTE

Using the product in a high humidity environment when GND is set to low will adversely affect the measurement accuracy in insulation resistance tests. If the grounding mode (GND) is set to low in a high humidity environment, the current will leak to the ground from the high-voltage wiring sections inside the product and the high-voltage wiring sections between the product and the EUT. This leakage current ranges from several nA to several tens of μA depending on the usage and wiring conditions of the optional TOS9320 high voltage scanner. The effects of leakage current can be reduced by making measurements with the offset enabled.

■ When set to Low

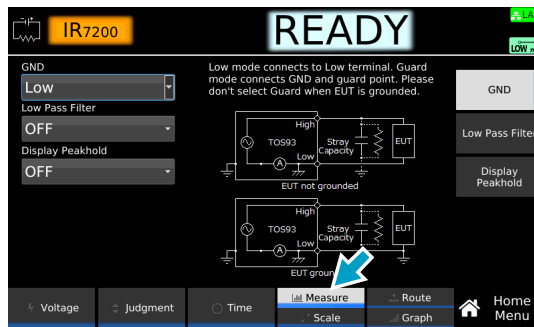


■ When set to Guard

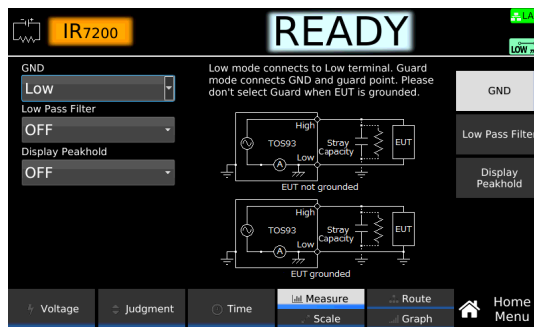


■ Setup procedure

- 1 On the Home menu screen, press Measure repeatedly until Measure is selected. Each time you press the key, the setting changes between Measure and Scale.



- 2 Press GND, and then turn the rotary knob to change the value.



This completes the setting.

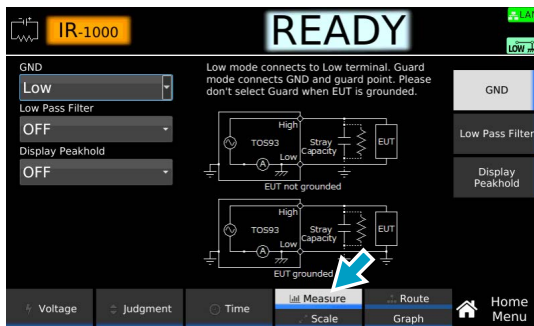
Using the low-pass filter

Turning the low-pass filter on stabilizes measurements when measuring at high sensitivity or when the measurements are unstable and hard to read. If the low pass filter is set to on, **LPF** appears during testing.

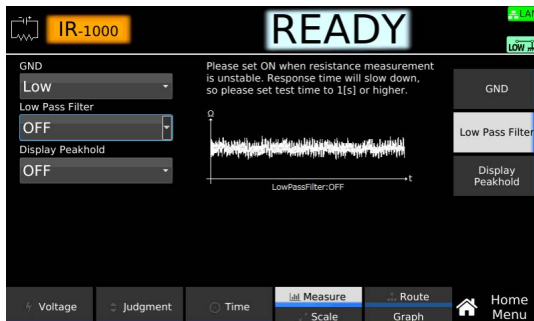
NOTE

Because the response will be slow if the low pass filter is set to on, making judgments will require at least 10 seconds after the rise time ends. Judgments may not be accurate if the time until a judgment is made is short.

- 1 On the Home menu screen, press Measure repeatedly until Measure is selected. Each time you press the key, the setting changes between Measure and Scale.



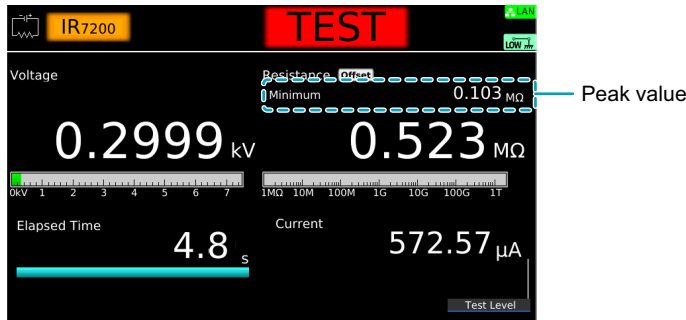
- 2 Press Low Pass Filter, and then turn the rotary knob to select ON or OFF.



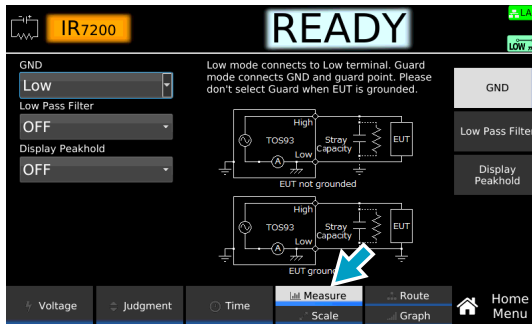
This completes the setting.

Peak value display (Display Peakhold)

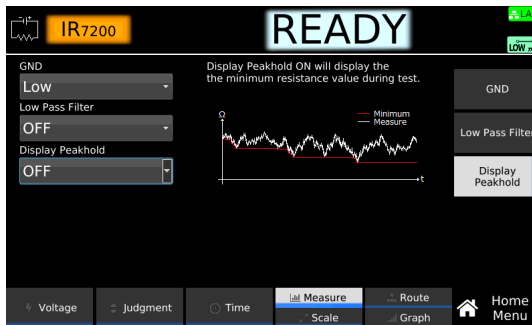
The minimum value of resistance is displayed during the test and in the judgment result.



- 1 On the Home menu screen, press Measure repeatedly until Measure is selected. Each time you press the key, the setting changes between Measure and Scale.



- 2 Press Display Peakhold, and then turn the rotary knob to select ON or OFF.



This completes the setting.

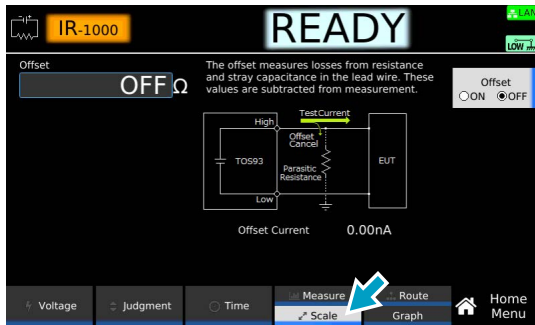
Offset

An offset can be applied to the current or resistance of test leads, tools, etc. If the offset is set to on, **Offset** appears during testing.

The offset current is recorded in terms of a resistance in the product. The actual offset current is calculated from the resistance and test voltage. Because the resistance resolution is 100 Ω, an error may occur in the measured value.

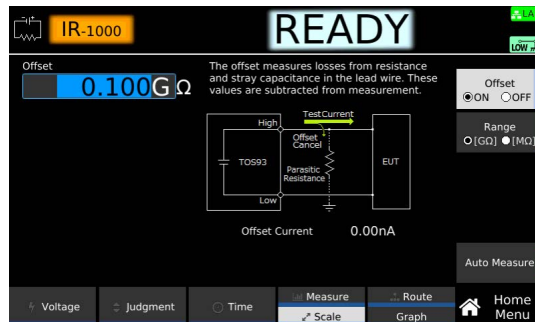
1 On the Home menu screen, press Scale repeatedly until Scale is selected.

Each time you press the key, the setting changes between Measure and Scale.



2 Press Offset to switch between on and off.

Offset switches between on and off each time you press the key.



3 If set to ON, set the Offset value according to the following procedure.

Purpose	Operation
Measure the Offset value to set it automatically.	Press Auto Measure. Use the rotary knob or numeric keypad to enter the test voltage. Connect test leads to this product, and open the test leads. Press START. When the measurement stabilizes, press STOP. The Offset value is set automatically.
Set the Offset value manually.	Use the numeric keypad or the rotary knob to enter the value. For IR tests, the unit of resistance changes each time you press Range. Setting range: 0.001 MΩ to 2000.0 GΩ

This completes the setting.

Checking the scanner contact (Contact Check)

Applicable models: **9300**, **9301**, **9302**, **9303**

Use this function when the TOS9320 high voltage scanner option (p.234) is connected.

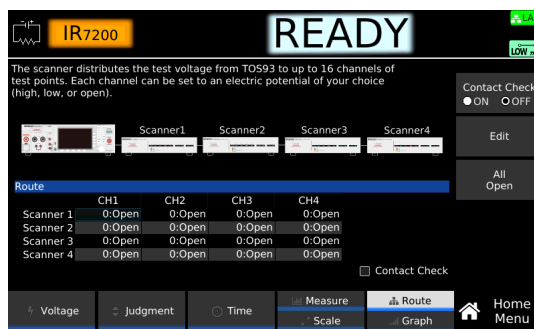
You can check the continuity between the test leads connected to the scanner channel set to High or Low and the EUT. When Contact Check is set to ON, "CHECK" will appear on the display, and continuity will be confirmed before the test voltage is applied after the START switch is pressed. When the continuity is confirmed, the test will begin.

The following equation can be used to calculate the execution time of a contact check.

Execution time = 50 ms + 30 ms × (number of channels set to High or Low)

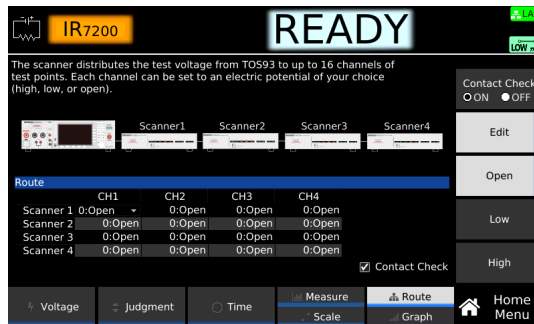
For information on typical timing charts, see "Contact check operation" (p.230).

1 On the Home Menu screen, press Route.



2 Press Contact Check to switch between on and off.

Each time you press the key, Contact Check toggles between on and off.



This completes the setting.

If continuity cannot be confirmed

"Contact-FAIL" will appear in the top area of the display. The U FAIL and L FAIL signals of SIGNAL I/O Connector (p.157) will be set to on simultaneously. On the scanner side, the LED of the corresponding channel lights orange. Check that the test leads are connected properly.

Setting scanner channels (Edit)

Applicable models: **9300**, **9301**, **9302**, **9303**

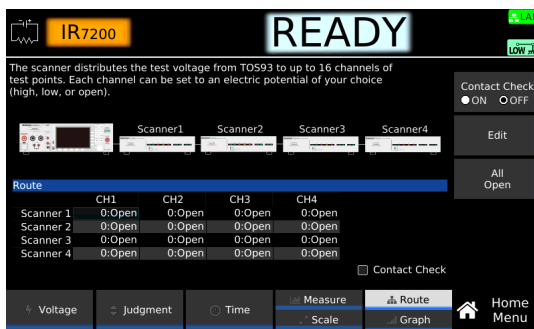
Set the scanner channels when the TOS9320 high voltage scanner option (p.234) is connected.

Set each scanner channel connection to High, Low, or Open.

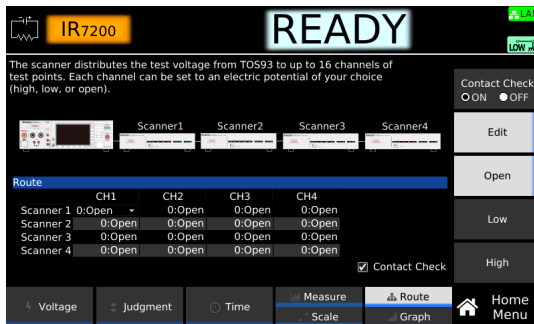
NOTE

To make the association between the connected test lead and channels clear, affix the channel labels supplied with the scanner to the test leads.

- 1 On the Home menu screen, press Route.



- 2 Use the rotary knob and the arrow (◀/▶) keys to select a channel, and then press Edit.



- 3 Use the sub-function keys to select Open, Low, or High and press ENTER.

- 4 To continue the settings, repeat Step 2 and Step 3 .
This completes the setting.

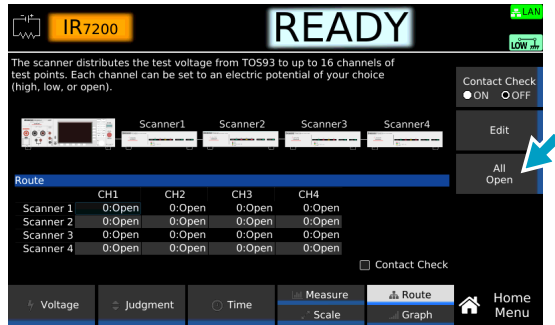
Opening the scanner (All Open)

Applicable models: **9300**, **9301**, **9302**, **9303**

Use this function when the TOS9320 high voltage scanner option (p.234) is connected.

You can set all channels of the scanner to open.

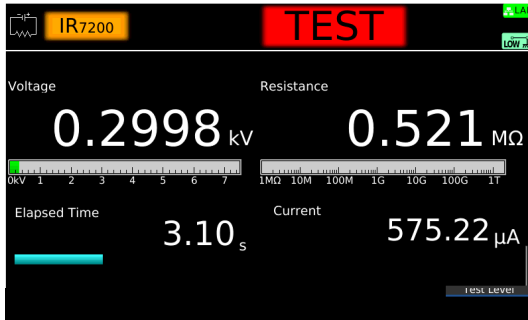
1 On the Home menu screen, press Route > All Open.



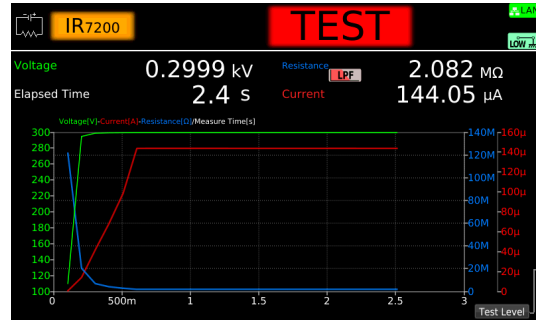
This completes the setting.

Measurement screen display during the test (Display View)

Select the measurement screen to be displayed during the test from the numerical values and graphs.



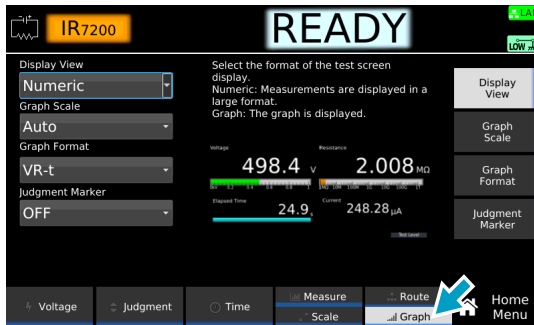
Setting: Numeric



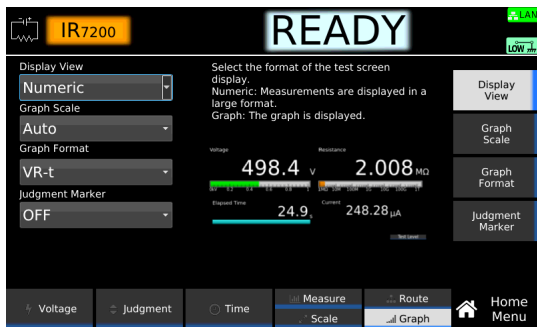
Setting: Graph

1 On the Home Menu screen, press Graph repeatedly until Graph is selected.

For models other than TOS9311, each time you press the key, it changes between Route and Graph.



2 Press Display View, and then turn the rotary knob to change the value.



This completes the setting.

Graph scale

If Display View (p.110) is set to Graph, select whether the voltage-axis, current-axis and resistance-axis scale should be fixed or automatic.

Set value	Description
Fix	Voltage-axis: The minimum value shall be fixed at 0 V, while the maximum value shall be fixed at the Test Voltage +10 % or more. Resistance-axis: The minimum value shall be fixed at Lower -10 %, while the minimum value shall be fixed at the Upper +10 %. When Lower is set to OFF, the minimum value shall be fixed at 0 Ω. Current-axis: Both minimum value and maximum value shall be set at auto-scale.
Auto	Both minimum value and maximum value shall be set at auto-scale.

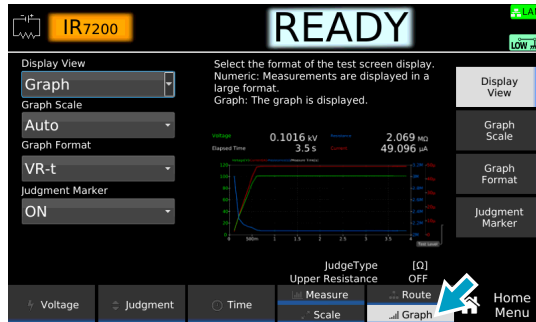
You cannot select Fix in the following conditions.

- Upper (p.93) is set to OFF.
- The unit of setting values is set to [A] in Judge Type (p.95).

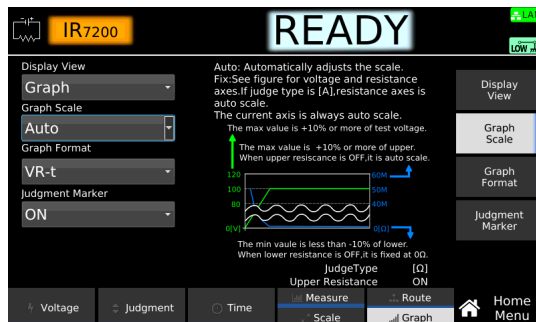
There is no time-axis scale setting. The minimum value of the time-axis is 0 s, and the maximum value is the sum of Test Time, Fall Time, and Rise Time when Test Time is ON and is computed by auto scale when Test Time is OFF.

1 On the Home Menu screen, press Graph repeatedly until Graph is selected.

For models other than TOS9311, each time you press the key, it changes between Route and Graph.



2 Press Graph Scale, and then turn the rotary knob to change the value.



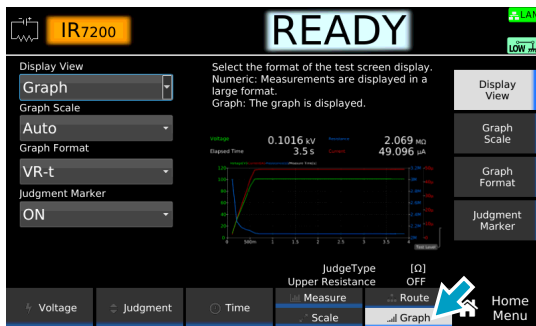
This completes the setting.

Graph axis setting (Graph Format)

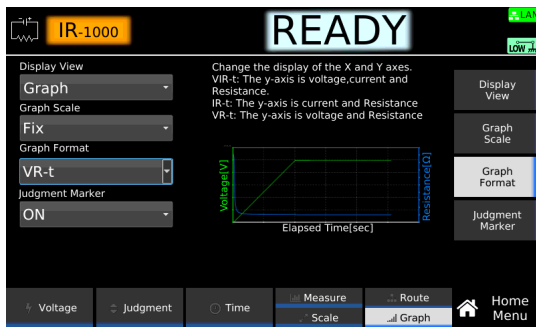
Sets the value to be displayed on the Y-axis of the graph when Display View (p.110) is set to Graph. Always displays time (seconds) on the X-axis.

Set value	Description
VR-t	Displays voltage on the left side of Y-axis, while resistance on the right side.
IR-t	Displays current and resistance on the right side of Y-axis.
VIR-t	Displays voltage on the left side of Y-axis, while current and resistance on the right side.

- 1 On the Home Menu screen, press Graph repeatedly until Graph is selected. For models other than TOS9311, each time you press the key, it changes between Route and Graph.



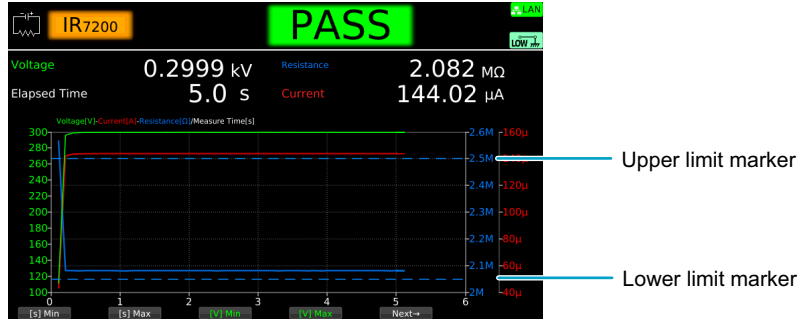
- 2 Press Graph Format, and then turn the rotary knob to change the value.



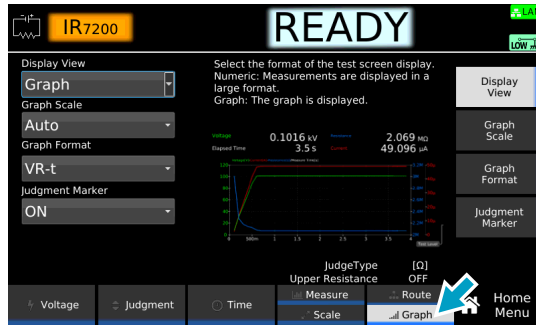
This completes the setting.

Judgement criteria marker display (Judgement Marker)

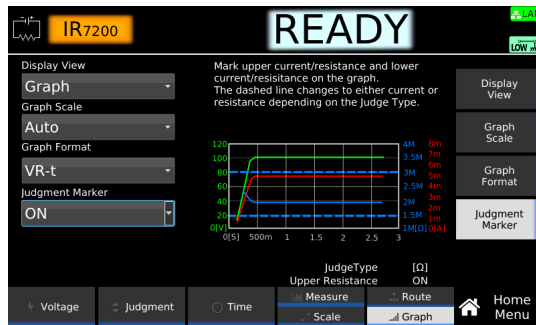
Set whether to mark the upper and lower limits on the graph when Display View (p. 110) is set to Graph. The judgement criteria marker changes to resistance or current value by the Judge Type (p.95) setting.



- 1 On the Home Menu screen, press Graph repeatedly until Graph is selected. For models other than TOS9311, each time you press the key, it changes between Route and Graph.



- 2 Press Judgment Marker, and turn the rotary knob to select ON or OFF.



This completes the setting.

Starting a Test

We recommend that you perform a pre-test inspection ([p.201](#)) before executing a test.

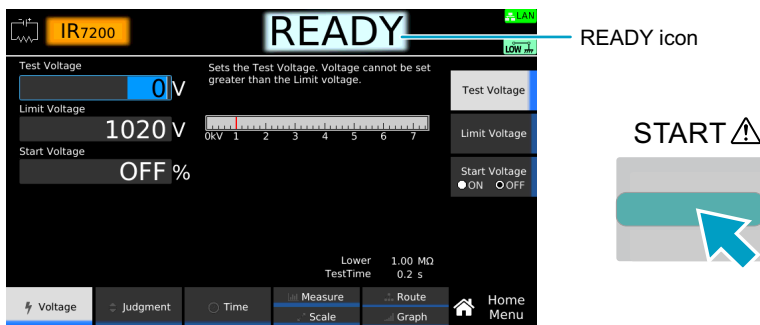
Starting a test

WARNING

Risk of electric shock.

- Do not touch the EUT, HIGH VOLTAGE terminals, test leads, test probes, output terminals, or other peripheral components while the DANGER LED is lit.
- When performing a withstanding voltage test, be sure to wear rubber gloves for electrical work.

- 1 Check that the product is correctly connected to the EUT.
- 2 Check that “READY” is shown on the display, and then press START.



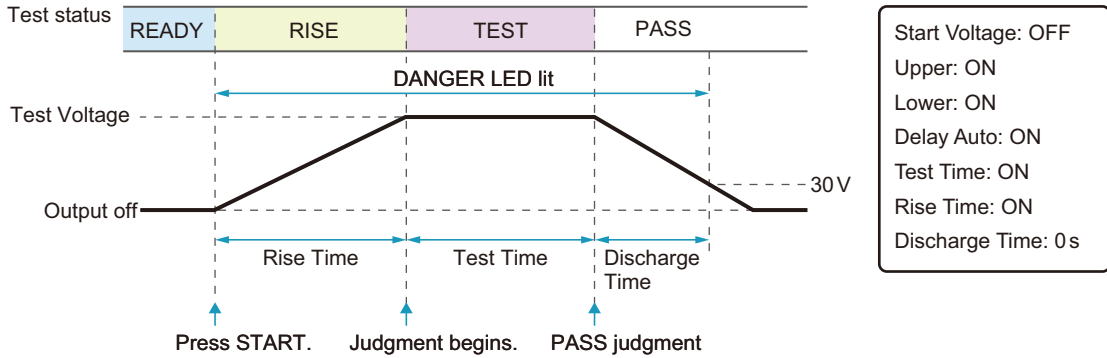
The DANGER LED lights, and the test starts.

If the test does not start, see "Unable to start a test" ([p.239](#)).

Operation after a test starts

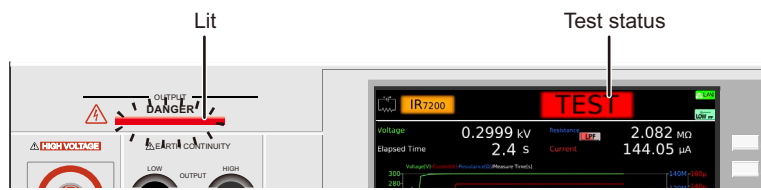
Shown below are examples of operation after a test starts.

■ Example of a PASS judgment



■ DANGER LED and test status display

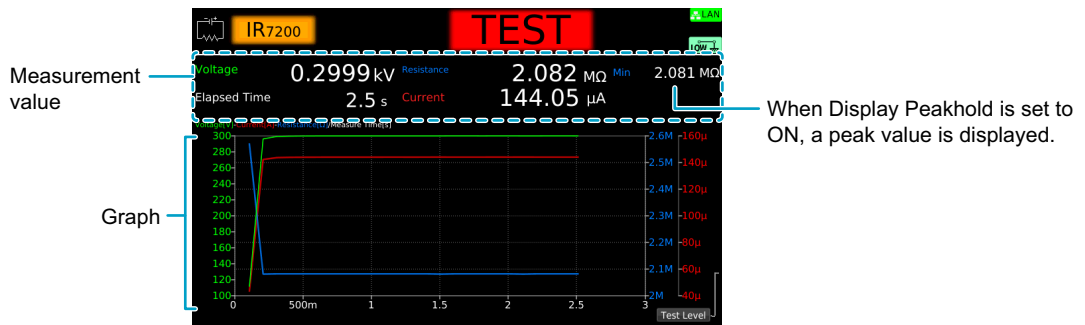
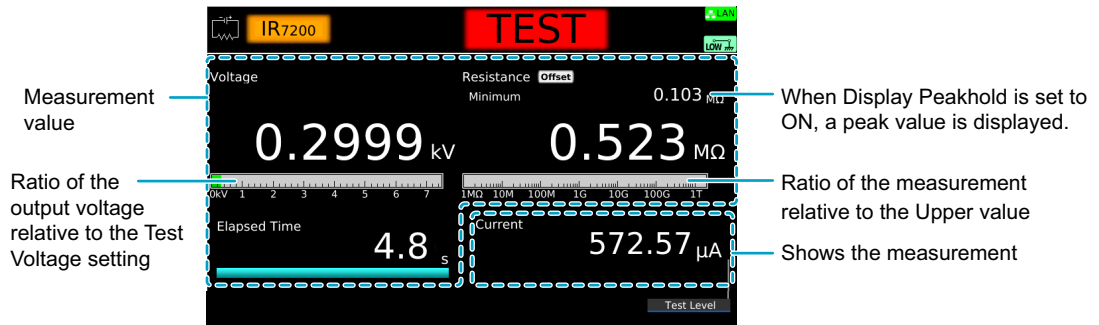
During a test, the DANGER LED lights, and the test status is shown in the upper right of the display. The DANGER LED lights if voltage remains at the output terminals regardless of the test status.



Test status	Description
TEST	Testing
RISE	Voltage rising
FALL	Voltage falling
CHECK	Performing Contact Check for scanner (TOS9311 not supported.)

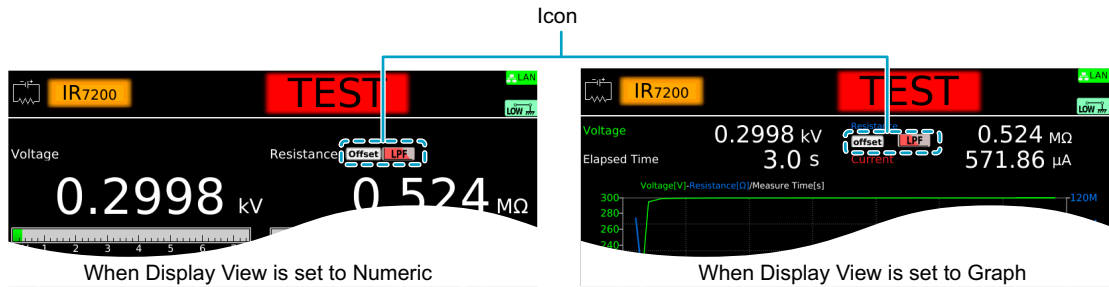
■ Measurement display

During a test, measurements are shown on the display.



Test condition display

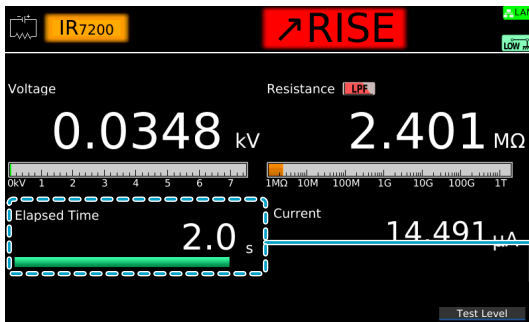
Icons indicating the test conditions appearing during testing.



Icon	Description
	Offsetting.
	Low Pass Filter being set to ON.

Voltage rise time display

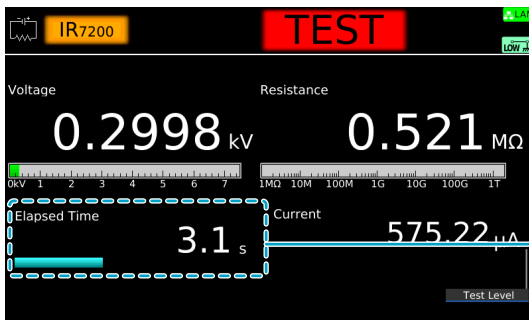
While the voltage is rising, "RISE" is displayed along with the elapsed time. If Display View (p.110) is set to Numeric, the remaining voltage rise time shall be displayed as a bar graph when the Test Time is on. When the time specified by Rise Time elapses, "TEST" is shown, and the test starts.



Elapsed time. The remaining rise time is displayed with a bar graph.

Test time display

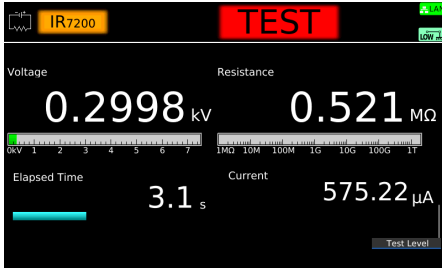
During the test time, "TEST" and the elapsed time are displayed. If Display View (p.110) is set to Numeric, the remaining test time shall be displayed as a bar graph when the Test Time is on. If Test Time is set to off, the elapsed time is displayed up to 3600000.0 seconds. If the elapsed time is greater than 3600000.0, the display is fixed at +Over.



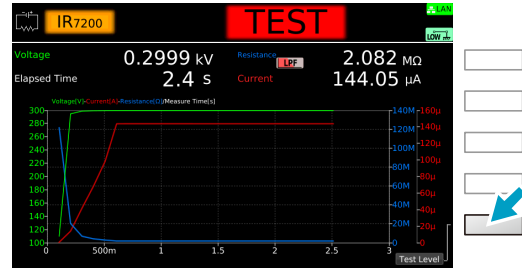
Elapsed time. If Test Time is set to on, the remaining test time is displayed with a bar graph.

Changing the voltage setting during a test

During a test, press Test Level. Then, use the numeric keypad or the rotary knob to change the voltage. The changed voltage is immediately applied to the test, but the voltage value on the display shows the measured value. When “READY” appears in the upper right of the display after the test is finished, the new voltage setting will be displayed. The Output Error may occur when the output changes suddenly.



When Display View is set to Numeric



When Display View is set to Graph

Finishing the Test and Viewing the Judgment

Stopping tests

If you want to stop a test or finish a test when the Test Time is off, press STOP.



Conditions that cause a test to end

Conditions that cause a test to end are as follows:

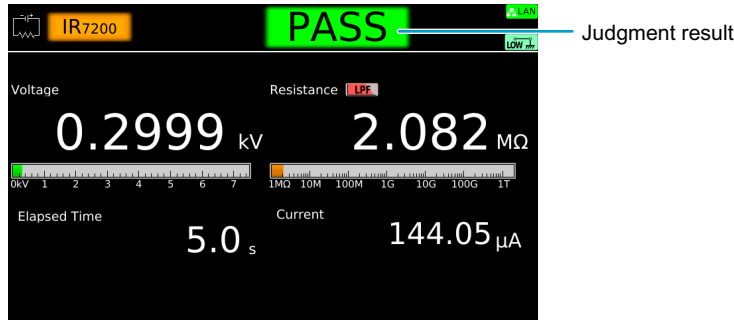
- a. When FAIL judgment is made.
- b. When the test time elapses if Test time is set to on.
- c. When you press STOP.

In any of the cases above, the “TEST” indication on the display disappears when the test ends. When the voltage residing at the output terminals is discharged, the DANGER LED turns off.

If the test finishes under condition a or b given above, the judgment result (p. 119) will be shown on the display.

Judgment types and operation

When a test finishes, the judgment result is shown in the test status.

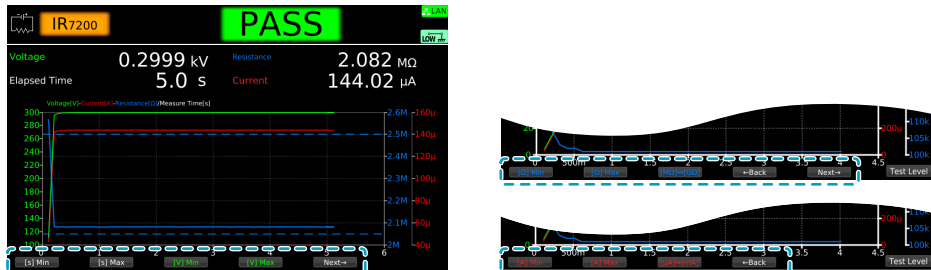


	Upper-FAIL	Lower-FAIL	Lower-FAIL (dV/dt)
Condition	A resistance or current greater than or equal to the upper limit was measured.	A resistance or current less than or equal to the lower limit was measured.	When Delay Auto is set to on in a IR test and the output voltage is 200 V or more, the voltage rise rate (dV/dt) is less than approximately 1 V/s before starting a judgment.
Display	The test status shows "Upper-FAIL" until the judgment result is cleared.	The test status shows "Lower-FAIL" until the judgment result is cleared.	The test status shows "Lower-FAIL (dV/dt)" until the judgment result is cleared.
Buzzer	The buzzer continues to sound until the judgment result is cleared.	The buzzer continues to sound until the judgment result is cleared.	The buzzer continues to sound until the judgment result is cleared.
SIGNAL I/O connector	U FAIL signal is output until the judgment result is cleared.	L FAIL signal is output until the judgment result is cleared.	L FAIL signal is output until the judgment result is cleared.

	Contact-FAIL	PASS
Condition	Continuity between the test lead and EUT could not be confirmed when the scanner is used with Contact Check enabled. (TOS9311 not supported.)	A FAIL judgment was not made during the test.
Display	The test status shows "Contact-FAIL" until the judgment result is cleared.	The test status shows "PASS" until the time specified by Pass Hold elapses. Then the judgment result is cleared.
Buzzer	The buzzer continues to sound until the judgment result is cleared.	The buzzer sounds for 50 ms (regardless of the Pass Hold time).
SIGNAL I/O connector	Both U FAIL and L FAIL signals are output simultaneously until the judgment result is cleared.	PASS signal is output until the judgment result is cleared.

Changing the graph scale

If Display View (p. 110) is set to Graph, the scale of the graph can be changed after the test.



Select each item using the function keys and enter the maximum/minimum value by using the numeric keypad or the rotary knob.

Item	Description	Resolution
[s] Min	Changes the minimum value of the time-axis.	0.5 s
[s] Max	Changes the maximum value of the time-axis.	
[V] Min	Changes the minimum value of the voltage-axis.	TOS9311: 10 V Models other than above: 1 V
[V] Max	Changes the maximum value of the voltage-axis.	
[A] Min	Changes the minimum value of the current-axis.	When the unit is [μA]: 0.01 μA
[A] Max	Changes the maximum value of the current-axis.	When the unit is [mA]: 0.0001 mA
[μA]⇔[mA]	Changes the unit of the current value while the minimum value/maximum value of the current-axis is being changed.	None
[Ω] Min	Changes the minimum value of the resistance-axis.	When the unit is [MΩ]: 0.01 MΩ
[Ω] Max	Changes the maximum value of the resistance-axis.	When the unit is [GΩ]: 0.01 GΩ
[MΩ]⇔[GΩ]	Changes the unit of the resistance while the minimum value/maximum value of the resistance-axis is being changed.	None
Next→	Switches the functions that can be performed with the function key.	None
←Back	Switches the functions that can be performed with the function key.	None

Clearing the judgment result

Press STOP to clear the judgment result. The product is ready to start another test.

Earth Continuity Test

Applicable models: **9302**, **9303**

This chapter describes how to set test conditions, start tests, and view the results for earth continuity (EC) tests.

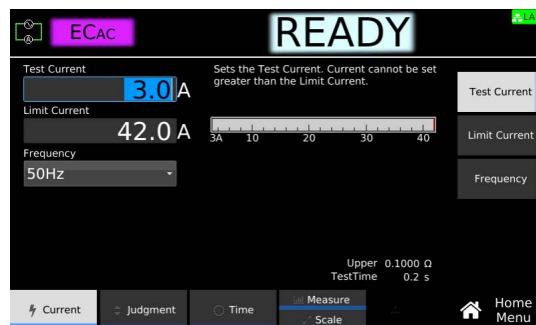
- Setting Test Conditions ([p.121](#))
- Starting a Test ([p.132](#))
- Finishing the Test and Viewing the Judgment ([p.136](#))

Setting Test Conditions

This section describes the test conditions of earth continuity (EC) tests and how to set the conditions.

Displaying the setup screen (Home menu)

- 1 On the Function menu screen ([p.43](#)), press EC.
- 2 Use the sub-function keys to select AC or DC.
The setup screen (Home menu) for the EC test conditions appears.



Set the required conditions by referring to the description of test conditions ([p.122](#)).

Description of test conditions

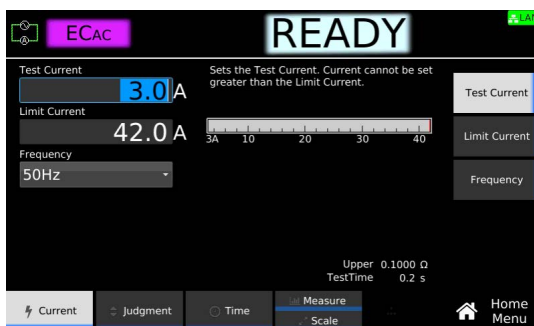
The following table shows the test conditions that you can set for earth continuity (EC) tests. The test conditions you can set are different for AC test and DC test. Test conditions with a check mark can be used with the corresponding test.

AC	DC	Test condition	Description
✓	✓	Test current	Current to run through the EUT. (p.122)
✓	✓	Limit current	Upper limit of current to run through the EUT. (p.123)
✓	n/a	Frequency	Test current frequency. (p.123)
✓	✓	Upper limit	Reference resistance or voltage for upper limit judgment. (p.124)
✓	✓	Lower limit	Reference resistance or voltage for lower limit judgment. (p.125)
✓	✓	Test time	Time from when the current rise time has passed to the end of the test. (p.126)
✓	✓	Current rise time	Time from when the START switch is pressed until the test current is reached. (p.127)
✓	✓	Current fall time	The time from a pass judgment until the current falls. (p.127)
✓	✓	Terminal wiring method (Terminals Wire)	Set the method of wiring test leads to four-terminal wiring or two-terminal wiring. (p.128)
✓	✓	Contact check	Starts testing when the test leads touch the EUT and current starts flowing. (p.129)
✓	✓	Peak value display (Display Peakhold)	Display the maximum resistance during the test. (p.130)
✓	✓	Offset	Cancels the contact resistance of test leads, tools, and the like and the resulting voltage. (p.131)

Test current

Set the current to run through the EUT. You cannot specify a voltage that exceeds the limit voltage Limit current (p.123).

- 1 On the Home menu screen, press **Current > Test Current**.

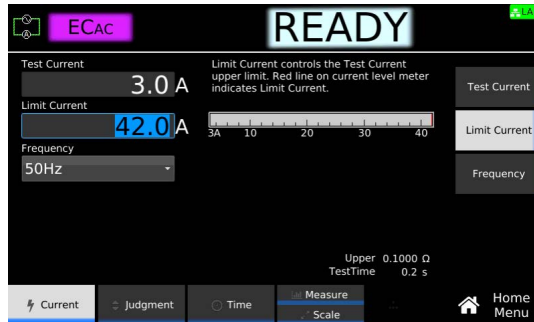


- 2 Use the numeric keypad or the rotary knob to enter the current.
Setting range: 3.0 A to 42.0 A
This completes the setting.

Limit current

Set the upper limit of current to run through the EUT. This prevents unnecessarily high current from being run through the EUT by mistake.

- 1 On the Home menu screen, press **Current > Limit Current**.



- 2 Use the numeric keypad or the rotary knob to enter the current.

Setting range: 3.0 A to 42.0 A

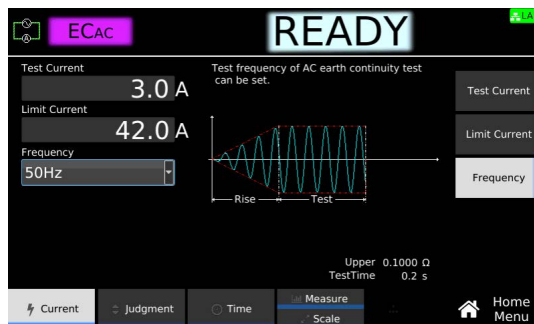
This completes the setting.

Frequency

This can be set only for AC tests.

Set the test current frequency to 50 Hz or 60 Hz. $\sqrt{50\text{Hz}}$ / $\sqrt{60\text{Hz}}$ appears during testing according to the setting.

- 1 On the Home menu screen, press **Current > Frequency**.



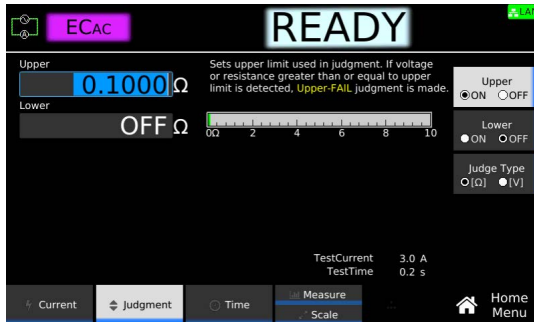
- 2 Turn the rotary knob to change the value.

This completes the setting.

Upper limit

Set the reference resistance or voltage for upper limit judgment. If a value greater than or equal to Upper is measured, upper limit judgment (Upper-FAIL) results. To disable upper limit judgment, set Upper to off. If a value smaller than Lower (p. 125) is set, the Lower setting will change according to the Upper setting.

- 1 On the Home menu screen, press Judgment > Upper.



- 2 Press Upper to switch between on and off.

Upper switches between on and off each time you press the key.

- 3 If you select on, use the numeric keypad or the rotary knob to enter the resistance or voltage.

To change the unit of the value to resistance or voltage, press Judge Type. Each time you press the key, the unit of Upper and Lower values switch between Ω and V.

Setting range: 0.0001 Ω to 10.0000 Ω, 0.001 V to 5.000 V

This completes the setting.

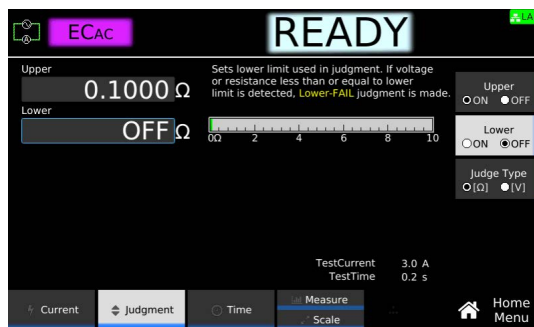
Lower limit

Set the reference resistance or voltage for lower limit judgment. If a value less than or equal to Lower is measured, lower limit judgment (Lower-FAIL) results. To disable lower limit judgment, set Lower to off. If a value greater than Upper (p. 124) is set, the Upper setting will change according to the Lower setting.

NOTE

Normally, even a good EUT will have a certain degree of resistance. Setting the limit slightly less than the resistance of the EUT is useful in detecting problems with the EUT or cables or errors in the probe connection points, enabling you to perform highly reliable testing.

1 On the Home menu screen, press Judgment > Lower.



2 Press Lower to switch between on and off.

Lower switches between on and off each time you press the key.

3 If you select on, use the numeric keypad or the rotary knob to enter the resistance or voltage.

To change the unit of the value to resistance or voltage, press Judge Type. Each time you press the key, the unit of Upper and Lower values switch between Ω and V.

Setting range: 0.0000 Ω to 9.9999 Ω , 0.000 V to 4.999 V

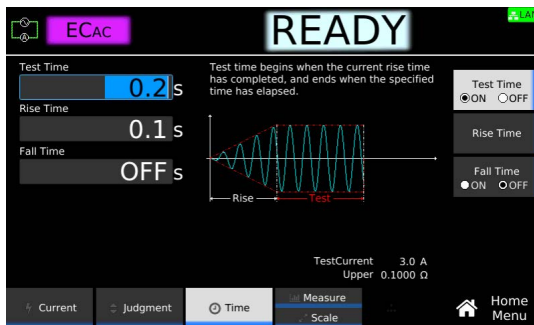
This completes the setting.

Test time

Set the test time to on or off.

Value	Description
ON	Set the time from when the Current rise time (p. 127) has passed to the end of the test. If upper limit judgment (Upper-FAIL) or lower limit judgment (Lower-FAIL) does not occur during a test, the test will result in PASS.
OFF	The test continues until the STOP switch is pressed. Pass judgments are not made.

1 On the Home menu screen, press Time > Test Time.



2 Press Test Time to switch between on and off.

Test Time switches between on and off each time you press the key.

3 If you select on, use the numeric keypad or the rotary knob to enter the time.

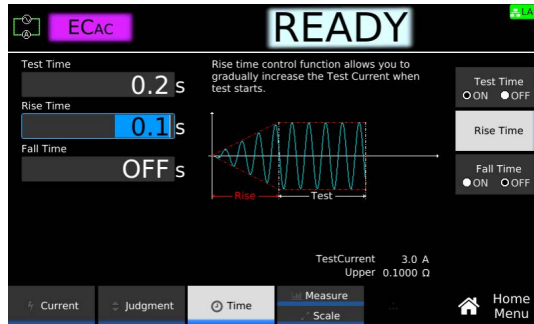
Setting range: 0.1 s to 1000.0 s

This completes the setting.

Current rise time

Set the time from when the START switch is pressed until the Test current (p. 122) is reached.

- 1 On the Home menu screen, press Time > Rise Time.



- 2 Use the numeric keypad or the rotary knob to enter the time.

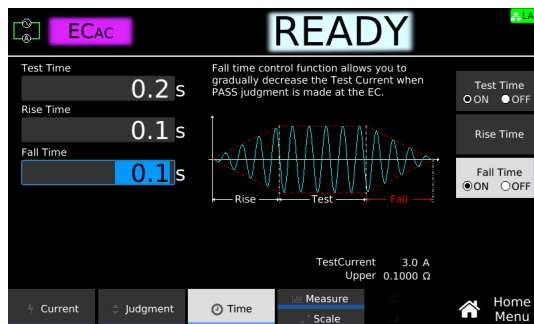
Setting range: 0.1 s to 200.0 s

This completes the setting.

Current fall time

Set the time for the current to fall from the test current when a PASS judgment is made.

- 1 On the Home menu screen, press Time > Fall Time.



- 2 Press Fall Time to switch between on and off.

Fall Time switches between on and off each time you press the key.



- 3 If you select on, use the numeric keypad or the rotary knob to enter the time.

Setting range: 0.1 s to 200.0 s

This completes the setting.

Terminal wiring method (Terminals Wire)

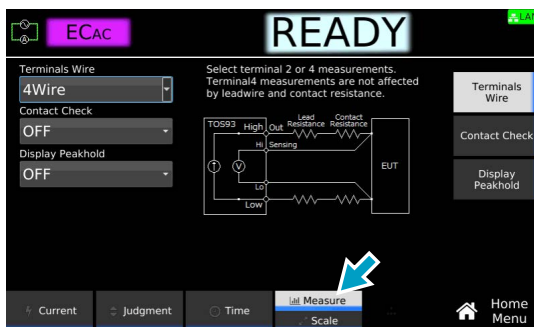
Set the method of wiring test leads to the product to four-terminal wiring (4 Wire) or two-terminal wiring (2 Wire). The locations to connect the test leads to the product are different between the two methods (p.40). Select the appropriate method depending on the type of test leads to be used and whether the minute resistance of lead wires or contact resistance of plugs will be included in the measurement. An icon appears during testing according to the setting.

Value	Description	Icon
2 Wire	The resistance of lead wires and plugs is included in the measurement. Select this method when four-terminal wiring is not possible such as when using test leads other than those supplied with the product. The circuit between OUTPUT and SENSING is shorted inside the product.	
4 Wire	The resistance of lead wires and plugs is not included in the measurement. Select this method when four-terminal wiring can be used such as when you use the supplied test leads for earth continuity testing (TL13-TOS).	

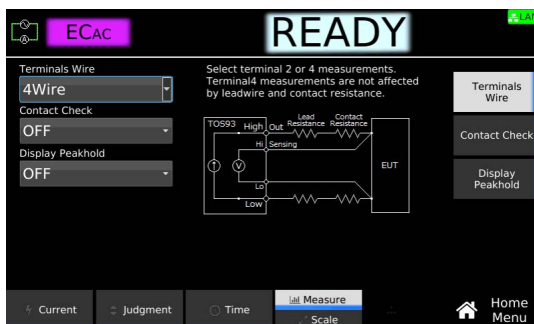
NOTE

If you use test leads other than those supplied with the product, the product specifications may not be met. Contact your Kikusui agent or distributor for details.

- 1 On the Home menu screen, press Measure repeatedly until Measure is selected. Each time you press the key, the setting changes between Measure and Scale.



- 2 Press Terminals Wire, and then turn the rotary knob to change the value.



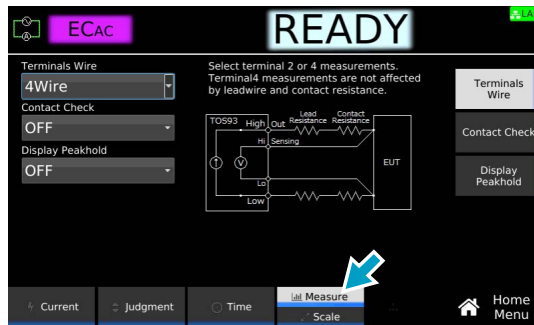
This completes the setting.

Contact check

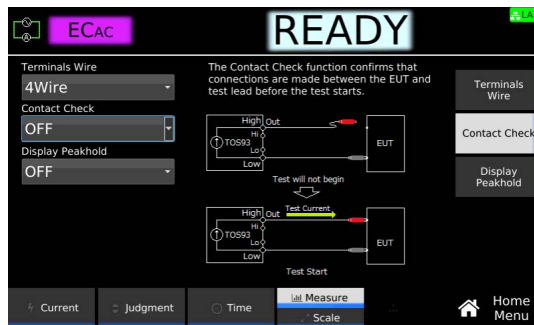
A contact check between the test lead and EUT is checked at the start of tests. If you do not want to check the contact, set Contact Check to off.

To start testing when Contact Check is set to on, press START with the test leads connected to the OUTPUT terminals open. Then, when the test leads make contact with the EUT and current starts flowing through the OUTPUT terminal, the test starts.

- 1 On the Home menu screen, press Measure repeatedly until Measure is selected. Each time you press the key, the setting changes between Measure and Scale.



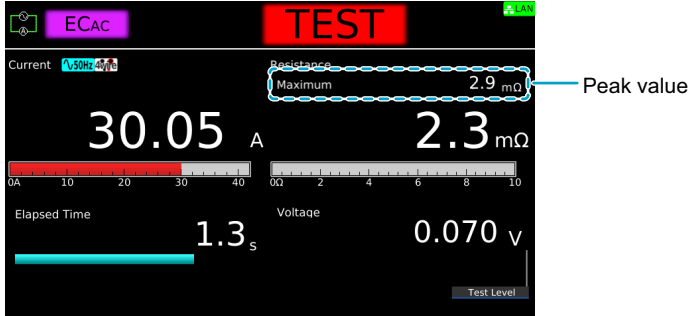
- 2 Press Contact Check, and then turn the rotary knob to select ON or OFF.



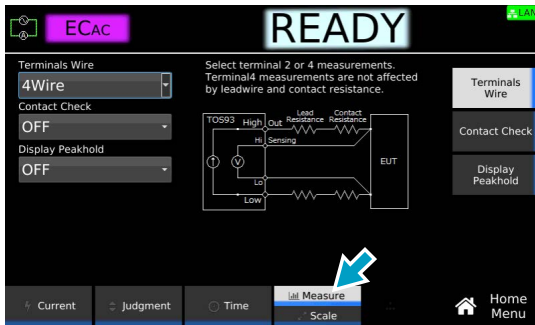
This completes the setting.

Peak value display (Display Peakhold)

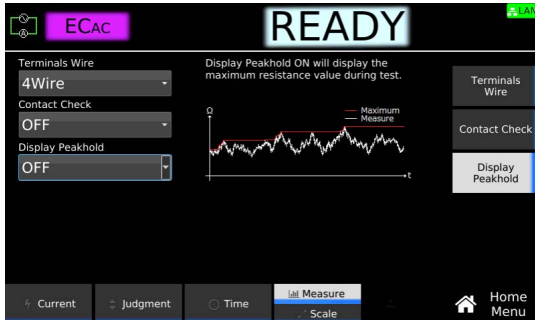
When Display Peakhold is set to on, the peak resistance measured during testing is displayed. Judgment is also performed on the peak value.



- 1 On the Home menu screen, press Measure repeatedly until Measure is selected. Each time you press the key, the setting changes between Measure and Scale.



- 2 Press Display Peakhold, and then turn the rotary knob to select ON or OFF.



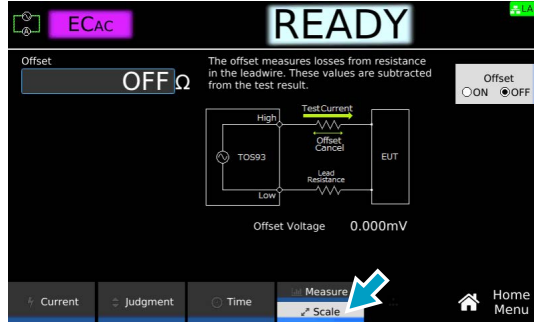
This completes the setting.

Offset

Contact resistance of test leads, tools, and the like and the resulting voltage drop can be canceled. If the offset is set to on, **Offset** appears during testing.

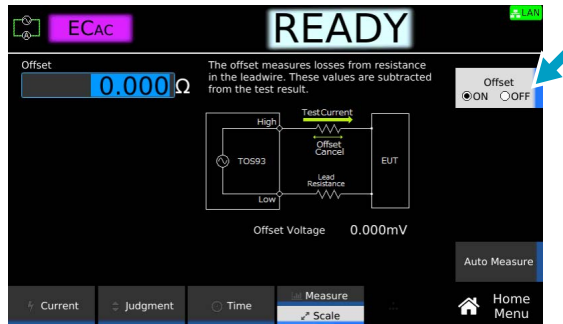
1 On the Home menu screen, press Scale repeatedly until Scale is selected.

Each time you press the key, the setting changes between Measure and Scale.



2 Press Offset to switch between on and off.

Offset switches between on and off each time you press the key.



3 If set to ON, set the Offset value according to the following procedure.

Purpose	Operation
Measure the Offset value to set it automatically.	Press Auto Measure. Use the rotary knob or numeric keypad to enter the test current. Connect test leads to this product, and short the test leads. Press START. When the measurement stabilizes, press STOP. The Offset value is set automatically.
Set the Offset value manually.	Use the numeric keypad or the rotary knob to enter the value. Setting range: 0.000 Ω to 10.000 Ω

This completes the setting.

Starting a Test

We recommend that you perform a pre-test inspection (p.202) before executing a test.

Output time limit

When earth continuity tests are performed consecutively, output time limit and rest time may become necessary depending on the upper limit.

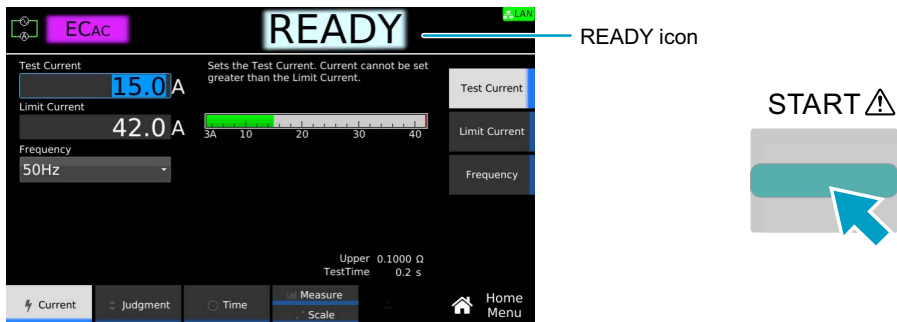
The following table shows the output time limit and rest time that are necessary when the ambient temperature is 40 °C (104 °F) or less. If you exceed the limit, the temperature of the output section may increase. This may cause the protection function to be activated and “OVER HEAT” to be indicated on the display. If this happens, stop testing and wait for the temperature to return to normal by referring to the rest time. If “READY” is displayed in the upper right of the display when you press the STOP switch, the temperature is back to normal.

Upper limit (i)	Output time ¹ limit	Rest time
$i \leq 20 \text{ A}$	No limit	Not necessary
$20 \text{ A} < i \leq 40 \text{ A}$	30 min. max.	At least the length of time the voltage was output

1. Includes the current rise time, test time, and current fall time.

Starting a test

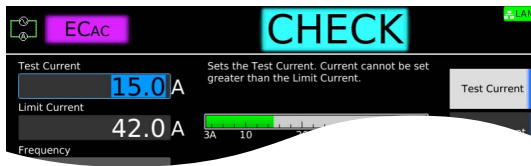
- 1 Check that the product is correctly connected to the EUT.
- 2 Check that “READY” is shown on the display, and then press START.



The DANGER LED lights, and the test starts.
 If the test does not start, see "Unable to start a test" (p.239).

Contact check in progress display

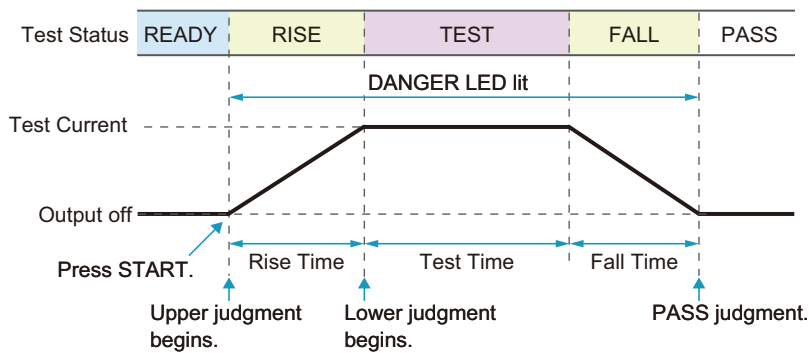
When Contact Check (p. 129) is set to on, "CHECK" appears during the contact check.



Operation after a test starts

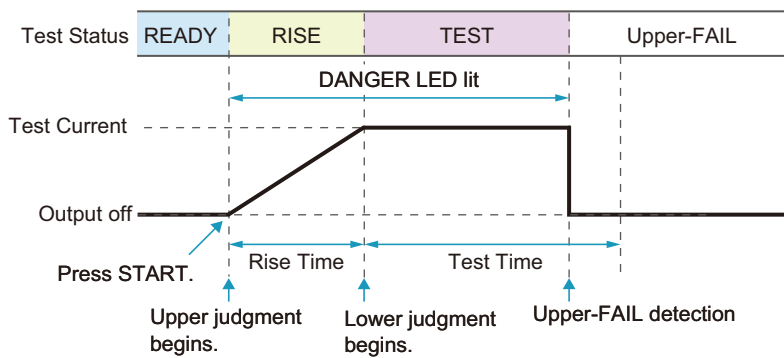
Shown below are examples of operation after a test starts.

Example of a PASS judgment (applies to AC and DC tests)



Test Time: ON
Rise Time: ON
Fall Time: ON

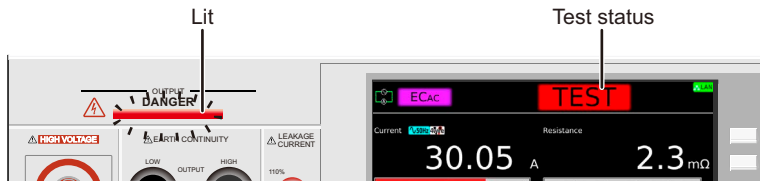
Example of a FAIL judgment (applies to AC and DC tests)



Test Time: ON
Rise Time: ON
Fall Time: ON

DANGER LED and test status display

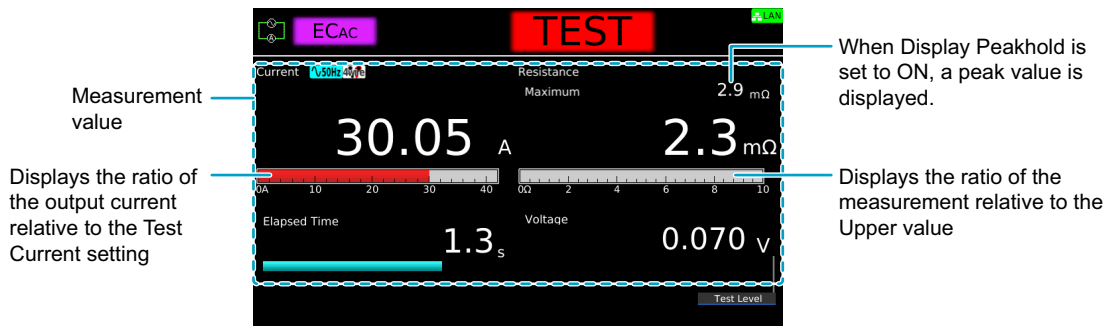
During a test, the DANGER LED lights, and the test status is shown in the upper right of the display. The DANGER LED lights if voltage remains at the output terminals regardless of the test status.



Test status	Description
TEST	Testing
↗RISE	Voltage rising
FALL↘	Voltage falling

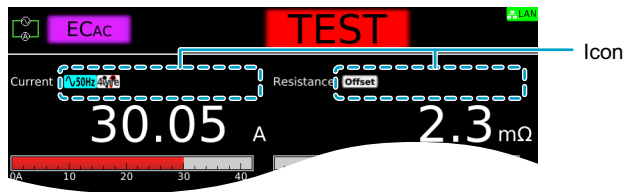
Measurement display

During a test, measurements are shown on the display.



Test condition display

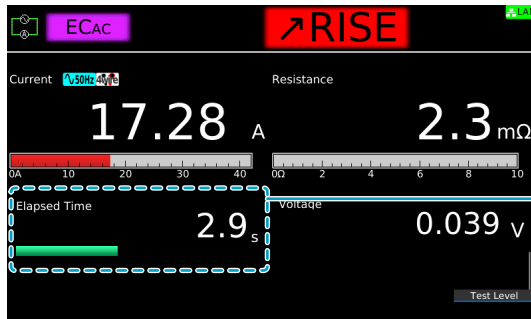
Icons indicating the test conditions appearing during testing.



Icon	Description
	Frequency setting (50 Hz/60 Hz).
	Terminal Wire setting (2Wire/4Wire)
	Offsetting.

Current rise time display

While the current is rising, "RISE" is displayed along with the elapsed time. The remaining rise time is displayed with a bar graph. When the time specified by Rise Time elapses, "TEST" is shown, and the test starts.



Elapsed time. The remaining rise time is displayed with a bar graph.

Test time display

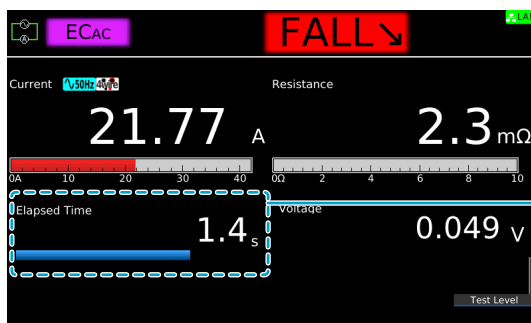
During the test time, "TEST" and the elapsed time are displayed. If Test Time is set to on, the remaining test time is displayed with a bar graph. If Test Time is set to off, the elapsed time is displayed up to 3600000.0 seconds. If the elapsed time is greater than 3600000.0, the display is fixed at +Over.



Elapsed time. If Test Time is set to on, the remaining test time is displayed with a bar graph.

Current fall time display

If Fall Time is set to on, "FALL" and the elapsed time are displayed while the current is falling. The remaining fall time is displayed with a bar graph.



Elapsed time. The remaining fall time is displayed with a bar graph.

Changing the current setting during a test

During a test, press Test Level. Then, use the numeric keypad or the rotary knob to change the voltage. The changed voltage is immediately applied to the test, but the current value on the display shows the measured value. When “READY” appears in the upper right of the display after the test is finished, the new current setting will be displayed. The Output Error may occur when the output changes suddenly.



Finishing the Test and Viewing the Judgment

Stopping tests

If you want to stop a test or finish a test when the Test Time is off, press STOP.



Conditions that cause a test to end

Conditions that cause a test to end are as follows:

- When a resistance or voltage greater than or equal to Upper limit or less than equal to Lower limit is measured.
- When the test time elapses if Test time is set to on.
- When you press STOP.

In any of the cases above, the “TEST” indication on the display disappears when the test ends. When the voltage residing at the output terminals is discharged, the DANGER LED turns off.

If the test finishes under condition a or b given above, the judgment result ([p. 137](#)) will be shown on the display.

Judgment types and operation

When a test finishes, the judgment result is shown in the test status.



	Upper-FAIL	Lower-FAIL	PASS
Condition	A resistance or voltage greater than or equal to the upper limit was measured.	A resistance or voltage less than or equal to the lower limit was measured.	Upper-FAIL or Lower-FAIL judgment did not occur during the test.
Display	The test status shows "Upper-FAIL" until the judgment result is cleared.	The test status shows "Lower-FAIL" until the judgment result is cleared.	The test status shows "PASS" until the time specified by Pass Hold elapses. Then the judgment result is cleared.
Buzzer	The buzzer continues to sound until the judgment result is cleared.	The buzzer continues to sound until the judgment result is cleared.	The buzzer sounds for 50 ms (regardless of the Pass Hold time).
SIGNAL I/O connector	U FAIL signal is output until the judgment result is cleared.	L FAIL signal is output until the judgment result is cleared.	PASS signal is output until the judgment result is cleared.

Clearing the judgment result

Press STOP to clear the judgment result. The product is ready to start another test.

Auto Test

Auto test is a function that executes a sequence of test combinations set in advance. This section provides an overview of the auto test function and how to configure the test, execute the test, and import and export programs.

Auto Test Overview

This section explains the types of tests that auto test can run, overview of programs and steps, and the main functions of auto test.

Tests that auto test can run

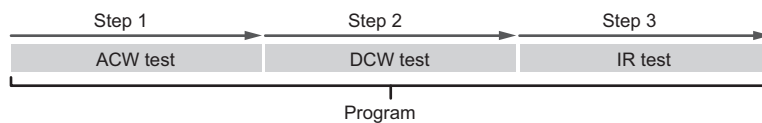
The tests that can be combined for auto tests varies depending on the model you are using.

Model	Tests that auto test can run ¹
TOS9300	ACW, IR
TOS9301	ACW, DCW, IR
TOS9311	ACW, DCW, IR
TOS9302	ACW, EC
TOS9303	ACW, DCW, IR, EC

1. ACW: AC withstanding voltage, DCW: DC withstanding voltage, IR: insulation resistance, EC: Earth continuity

Programs and steps

An auto test consists of programs and steps. A program is a collection of steps. For each step, a single test can be performed. Steps are executed in order from step 1. When the last step is complete, the program is complete. The following is a program schematic.



Main functions

The following types of programs are available. Programs are saved in the product's memory.

Type	Maximum number of programs	Maximum number of steps ¹	Executed under external control ²	Changing the program name	Notes
Program	100	100	n/a	✓	None
Program memory	25	100	✓	n/a	Can be registered in memory numbers 51 to 75

1. Per program
2. See "Recalling from Memory" (p. 163) and "Starting and Stopping Tests" (p. 164).

Settable items

There are functions that can be set for each step, and those that can be set for each program.

Scope	Setting	Description
By step	Test conditions of each test	You can set test conditions that are similar to those that are used when running tests individually, with a few exceptions.
For each program	Step start operation	Set the conditions for starting the test.
	Step interval	Set the step interval time.
	Fail judgment operation	Set whether to stop the auto test or run all steps when a fail judgment occurs.
	EUT power supply	Set whether to cut off the power supply to the EUT or continue the power supply to the EUT after the completion of each step.

Items that cannot be set

You cannot set the following functions.

- Set Test Time to OFF
- Auto Measure when setting the offset
- Functions related to graphs for ACW, DCW, and IR tests
- Set Judgment Lower to OFF when Judge Type is set to Ω (Resistance) in an IR test
- Set Judgment Upper to OFF when Judge Type is set to A (Current) in an IR test
- Set Judgment Upper to OFF when Judge Type is set to Ω (Resistance) in an EC test
- Set Judgment Upper to OFF when Judge Type is set to V (Voltage) in an EC test

Program Configuration

This section explains how to create programs, change program names, and delete programs.

Displaying the program editing screen

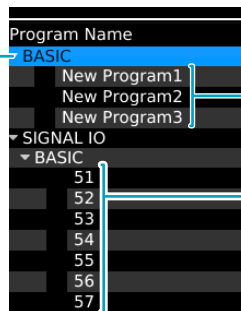
1 Press AUTO > 1.File.

The program editing screen appears. The following figure shows a screen example of TOS9301.



How to view the program editing screen

Use the rotary knob to select the item.
Press arrow (▶) key to open the lower level.
Press arrow (◀) to close the lower level.



A program created with a name of your choice

Program that can be recalled through external control (program memory)

Creating a program

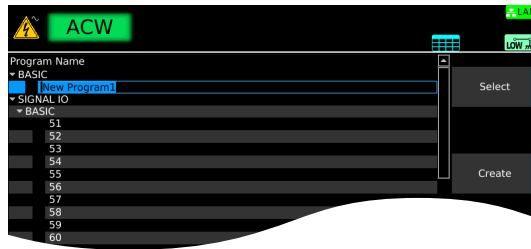
Create an empty program without any steps and assign a name of your choice.

The created program is automatically saved and is not deleted even if the POWER switch is turned off.

- 1 **On the program editing screen, use the rotary knob to select the location to create the program in, and press Create.**

A program is created under the selected row.

If there is a check mark on another program, the Create key will not appear. If this happens, press Select to remove the check mark.



- 2 **Use the numeric keypad or the rotary knob to enter the program name, and then press ENTER.**

You can enter up to 255 characters for the program name.

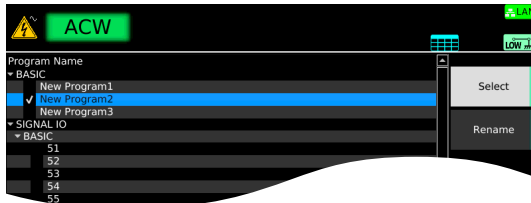
An empty program is created. For information about registering steps to a program, see "Setting Steps" (p.143).

Changing a program name

You can change the name of a program that you created with a name of your choice. Program names (memory numbers) under "SIGNAL I/O" cannot be changed.

- 1 **On the program editing screen, use the rotary knob to select the program in, and press Select.**

A check mark appears to the left of the selected program name.



- 2 **Press Rename.**
- 3 **Use the numeric keypad or the rotary knob to enter the program name, and then press ENTER.**

The program name is changed.

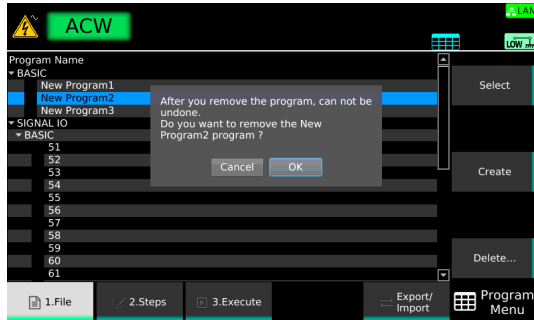
Deleting a program

You can delete a program that you created with a name of your choice. Programs under “SIGNAL I/O” cannot be deleted.

1 On the program editing screen, use the rotary knob to select the program in, and press Delete.

If there is a check mark on another program, the Delete key will not appear. In this situation, use the rotary knob to select the corresponding program, and then press Select to clear the check box.

A confirmation dialog appears. To cancel, press ESCAPE.



2 Press ENTER.

The program is deleted.

Setting Steps

This chapter explains how to edit steps.

Displaying the step editing screen

- 1 **Press AUTO > 1.File.**
The program editing screen appears.
- 2 **Use the rotary knob to select the program, and then press Select.**
A check mark appears to the left of the selected program name.

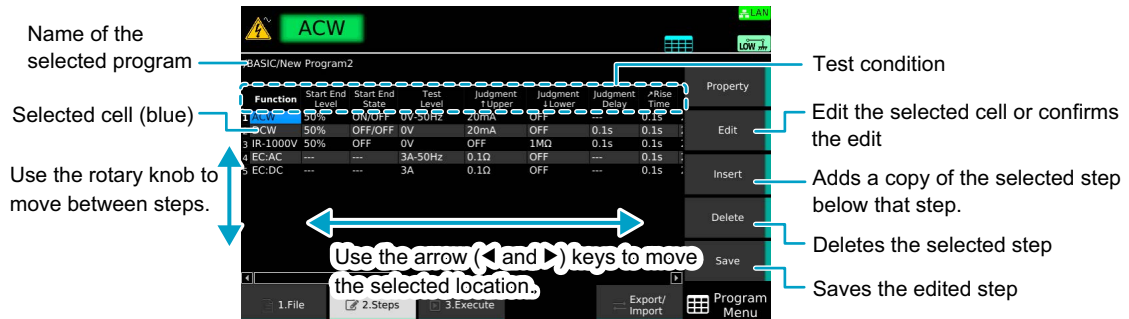


- 3 **Press 2.Steps.**
The step editing screen appears.



Editing steps
















On the step editing screen (p. 143), you can edit, add, delete, and save steps. The basic operation on the step editing screen is provided below.



- 1** On the step editing screen, add and delete steps.
- 2** Use the rotary knob and the arrow (←/→) keys to select the Function column of a step of your choice, and then press Edit.
- 3** Use the sub-function keys to select the test mode, and press Edit. The test mode is set for the selected step.
- 4** Use the arrow (←/→) keys to select a test condition, and press Edit. You can set test conditions similar to those you set when running tests individually, with a few exceptions (p. 139). For test conditions that can be set to on or off or those that have options, items are displayed in a sub-function area. For scanner (Route) settings, refer to "Editing scanner settings" (p. 146).
- 5** Use the numeric keypad, rotary knob, or sub-function keys to set the test conditions of the step, and press ENTER. The test conditions are set for the selected step.
- 6** Repeat Step 1 to Step 5 until all the steps have been registered.
- 7** Press Save. The steps are registered to the program.


Icon list

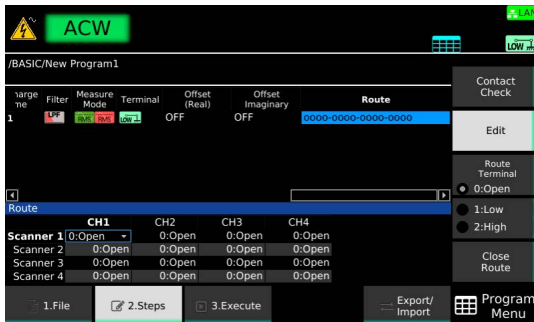
The icons listed below are used to show some of the test condition settings.

 : High Pass Filter (Fast)	 : Volt Measure (RMS)	 : GND (Low)
 : High Pass Filter (Slow)	 : Volt Measure (Peak)	 : GND (Guard)
 : Low Pass Filter (Fast/ON)	 : Current RMS (TrueRMS)	 : Terminals Wire (4Wire)
 : Low Pass Filter (Medium)	 : Current RMS (Average)	 : Terminals Wire (2Wire)
 : Low Pass Filter (Slow)	 : Root Contact Check (ON)	 : EC Contact Check (ON)

Editing scanner settings

Applicable models: **9300**, **9301**, **9302**, **9303**

- 1** On the Step editing screen, select a cell the Route column and then press Edit.
- 2** Press Contact Check to switch between ON and OFF.
The value switches between ON and OFF each time you press the key. When Contact Check is set to ON,  appears in the cell being edited.
- 3** Use the rotary knob and the arrow (◀/▶) keys to select a scanner and a channel, and then press Edit.



- 4** Use the sub-function keys to select a connection, and press ENTER.
The indication of a currently selected cell changes according to the settings.
For example, if you set High to CH1 of Scanner 2, Low to CH3 of Scanner 3, and Open to other channels, "0000-H000-00Lo-0000" appears.
- 5** To continue the settings, repeat Step 3 and Step 4 .
- 6** After you finish the scanner settings, press Close Route.
This completes the setting.

Program Operation Configuration

You can set the program execution operation for each program.

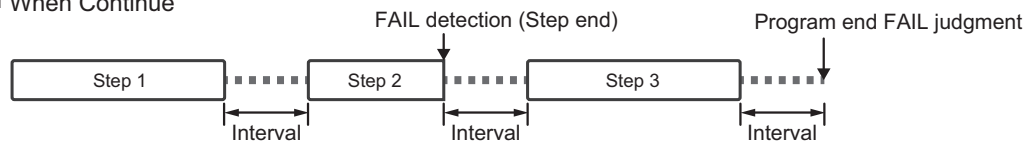
Setup	Description
Fail judgment operation (FAIL Judgment)	Set whether to stop the auto test or run all steps when a fail judgment occurs. (p.147)
Step interval	Set the step interval time. (p.148)
Step start operation (Trigger Source)	Set the conditions for starting the test. (p.149)

Fail judgment operation (FAIL Judgment)

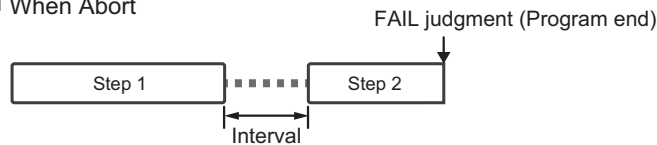
Set whether to stop the auto test or run all steps when a fail judgment occurs.

Value	Description
Continue	A transition is made to the next step when the step running when a failure occurs is completed and the time specified by Interval elapses. A fail judgment is indicated after the completion of all the steps.
Abort	Auto test ends when a failure occurs, and a fail judgment is indicated.

■ When Continue



■ When Abort



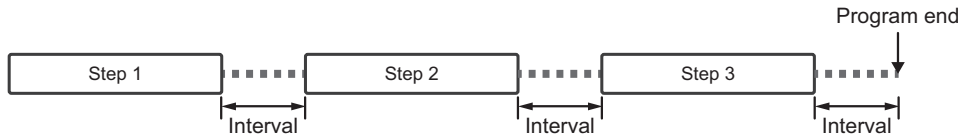
- 1 On the step editing screen (p.143), press Property.
- 2 Press FAIL Judgment to switch between Continue and Abort. Continue switches between Continue and Abort each time you press the key.



This completes the setting.

Step interval

Set the interval from the completion of a step to the next step. For the last step, this is the interval from the completion of the last step to the end of the program.



1 On the step editing screen (p.143), press Property.

2 Press Interval.



3 Use the numeric keypad or the rotary knob to enter the time.

Setting range: 0.1 s to 100.0 s

This completes the setting.

Step start operation (Trigger Source)

You can select the condition for starting the next step when a step is completed.

Value	Description
Immediate	When you press Initiate, all the steps are executed consecutively.
BUS	Pressing Initiate causes the product to enter the auto test trigger wait state. When in the trigger wait state, the step starts when you press START or send a *TRG command from the PC. After a step is completed, the operation is paused. When you press START or send another *TRG, the next step starts.
External	The step starts when you perform a start operation. ¹ After a step is completed, the operation is paused. When you perform another start operation, the next step starts.
Once	When you perform a start operation, ¹ all the steps are executed consecutively.

- Any of the following operations: pressing START on the front panel, pressing the START switch on the device connected to the REMOTE connector, or sending a START signal to the SIGNAL I/O connector.

1 On the step editing screen (p.143), press Property.

2 Press Trigger Source.



3 Turn the rotary knob to select the value.

This completes the setting.

Running Auto Tests

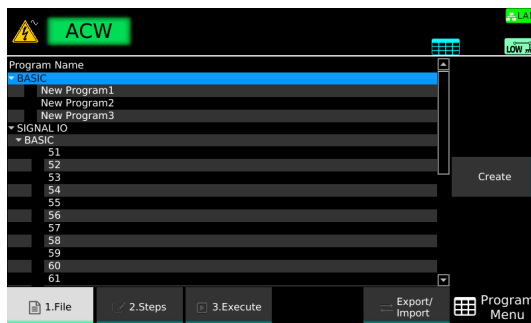
When you finish setting the program and steps, run the auto test.

Running an auto test

The test start operation varies depending on the trigger source ([p.149](#)) setting.

1 Press AUTO > 1.File.

The program editing screen appears.




2 Use the rotary knob to select the program, and then press Select.


A check mark appears to the left of the selected program name.

3 Press 3.Execute.




4 Perform the operation selected with Trigger Source ([p.149](#)).

 is shown in the upper right of the display, and the auto test starts.

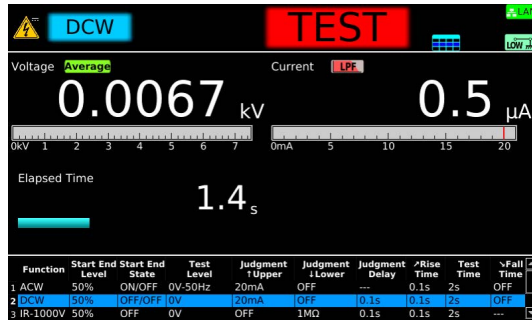
If the trigger source is set to BUS or External, pressing Initiate causes  to appear in the upper right of the display area (trigger wait state). To resume the test from the trigger wait state, send a trigger signal or press Trigger TEST. To cancel the trigger wait state, press Abort.

Behavior during the test

Steps are shown at the bottom of the display area with the step being executed highlighted in blue.

 is shown in the upper right of the display.

Other indications are the same as those when a single test is executed.



Finishing the Test and Viewing the Judgment

Stopping tests

To stop a test, press STOP.



Conditions that cause a test to end

Conditions that cause a test to end are as follows:

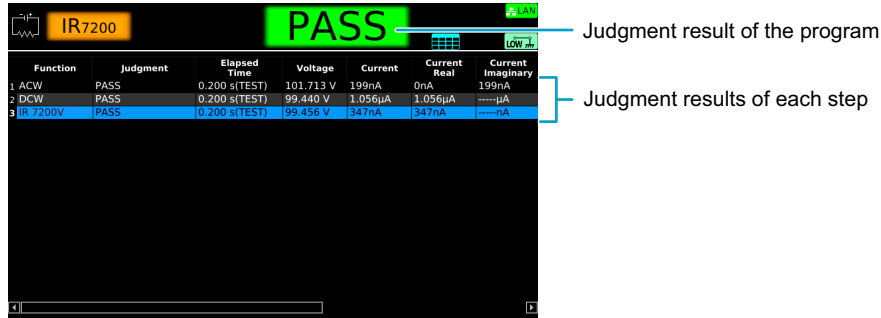
- a. When all steps are completed
- b. When FAIL judgment occurs when FAIL Judgment is set to Abort
- c. When the STOP switch is pressed

In any of the cases above, the "TEST" indication on the display disappears when the test ends. When the voltage residing at the output terminals is discharged, the DANGER LED turns off.

If the test finishes under condition a or b given above, the judgment result (p. 153) will be shown on the display.

Judgment types and operation

When a test finishes, the overall judgment result and each step's judgment results of the executed program appear in the test status. When FAIL Judgment (p.147) is set to Continue, a fail judgment results when a fail judgment occurs in any step.



	Upper-FAIL	Lower-FAIL	PASS
Condition	A value greater than or equal to the upper limit was measured.	A value less than or equal to the lower limit was measured.	A FAIL judgment was not made during the test.
Display	The test status shows "Upper-FAIL" until the judgment result is cleared.	The test status shows "Lower-FAIL" until the judgment result is cleared.	The test status shows "PASS" until the time specified by Pass Hold elapses. Then the judgment result is cleared.
Buzzer	The buzzer continues to sound until the judgment result is cleared.	The buzzer continues to sound until the judgment result is cleared.	The buzzer sounds for 50 ms (regardless of the Pass Hold time).
SIGNAL I/O connector	U FAIL signal is output until the judgment result is cleared.	L FAIL signal is output until the judgment result is cleared.	PASS signal is output until the judgment result is cleared.

	Upper-FAIL (dV/dt)	Lower-FAIL (dV/dt)	Contact-FAIL
Condition	When Delay Auto is set to on in a DCW test and the output voltage is 200 V or more, the voltage rise rate (dV/dt) is less than approximately 1 V/s before starting a judgment.	When Delay Auto is set to on in an IR test and the output voltage is 200 V or more, the voltage rise rate (dV/dt) is less than approximately 1 V/s before starting a judgment.	Continuity between the test lead and EUT could not be confirmed when the scanner is used with Contact Check enabled. (TOS9311 not supported.)
Display	The test status shows "Upper-FAIL (dV/dt)" until the judgment result is cleared.	The test status shows "Lower-FAIL (dV/dt)" until the judgment result is cleared.	The test status shows "Contact-FAIL" until the judgment result is cleared.
Buzzer	The buzzer continues to sound until the judgment result is cleared.	The buzzer continues to sound until the judgment result is cleared.	The buzzer continues to sound until the judgment result is cleared.
SIGNAL I/O connector	U FAIL signal is output until the judgment result is cleared.	L FAIL signal is output until the judgment result is cleared.	Both U FAIL and L FAIL signals are output simultaneously until the judgment result is cleared.

Clearing the judgment result

Press STOP to clear the judgment result. The product is ready to start another test.

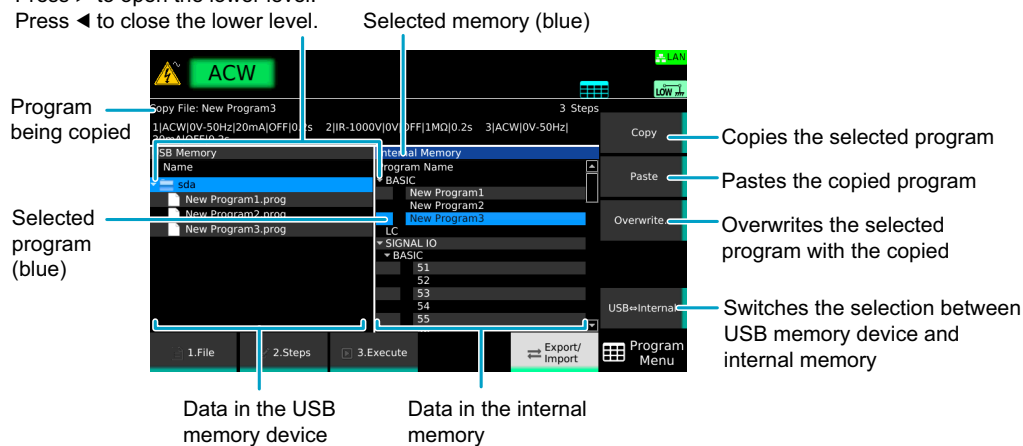
Exporting and Importing Programs

Programs saved in the internal memory can be exported to a USB memory device. Programs exported to a USB memory device can also be imported into the internal memory.

- 1** Insert a USB memory device into the USB port on the front panel.
- 2** Press **AUTO > Export/Import**.
The Export/Import screen appears.

Basic operations on the Export/Import screen

Use the rotary knob to select the item.
Press **▶** to open the lower level.
Press **◀** to close the lower level.



Exporting programs to a USB memory device

- 1** On the Export/Import screen, press **USB↔Internal**, and select “Internal Memory,” which is at the right side of the display area.
Each time you press **USB↔Internal**, the selection toggles between USB Memory and Internal Memory.
- 2** Use the rotary knob to select the program to export, and then press **Copy**.
- 3** Press **USB↔Internal**.
“USB Memory,” which is at the left side of the display area, is selected.
- 4** Use the rotary knob to select the export location, and press **Paste**.
To overwrite the selected file, press **Overwrite**.
A file named “program name”.prog is saved at the specified location.

Importing programs from a USB memory device

- 1** On the Export/Import screen ([p.154](#)), press **USB↔Internal**, and select “**USB Memory**,” which is at the left side of the display area.
Each time you press USB↔Internal, the selection toggles between USB Memory and Internal Memory.
- 2** Use the rotary knob to select the program to import, and then press **Copy**.
- 3** Press **USB↔Internal**.
“Internal Memory,” which is at the right side of the display area, is selected.
- 4** Use the rotary knob to select the import location, and press **Paste**.
To overwrite the selected memory area, press **Overwrite**.
The program is imported into the internal memory.

External Control

The following functions can be controlled and monitored from an external device using the external control connectors. For details on the SIGNAL I/O connector, see "SIGNAL I/O Connector" (p.157).

Functions that can be controlled/monitored	IN/OUT	Connector used
Activate/release interlock (p.161)	IN	SIGNAL I/O
Recall setup memories and programs (p.163)	IN	SIGNAL I/O
Start and stop tests (p.164)	IN	SIGNAL I/O
Monitor the test mode being set (p.165)	OUT	SIGNAL I/O
Monitor during testing/voltage generation status (p.165)	OUT	SIGNAL I/O
Monitor the test status (p.165)	OUT	SIGNAL I/O
Monitor the judgment result (p.166)	OUT	SIGNAL I/O
Monitor the step execution status of auto tests (p.167)	OUT	SIGNAL I/O
Monitor the activation status of protection functions (p.167)	OUT	SIGNAL I/O
Monitor the current waveform (p.168)	OUT	I
Monitor the voltage waveform (p.168)	OUT	V
Monitor the status of a device using optional products (p.169)	OUT	STATUS OUT
Control and monitor the starting and stopping of tests using optional products (p.169)	OUT/IN	REMOTE

■ Precedence between external control and front panel operation

The following precedence applies to the SIGNAL I/O connector, REMOTE connector, and START operation from the front panel. If these are used simultaneously, the one with highest precedence can be used.

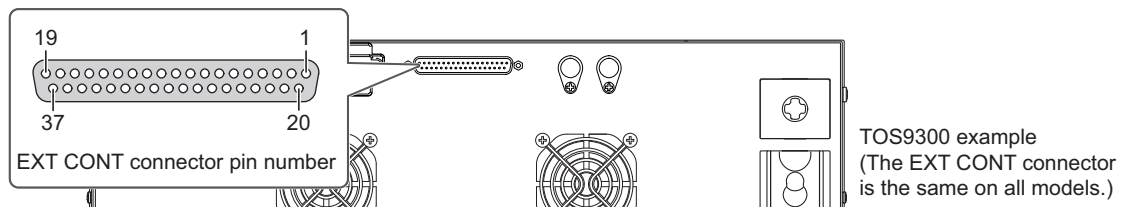
- Highest: SIGNAL I/O connector (when ENABLE is set to ON)
- Medium: REMOTE connector (when a production option is connected)
- Lowest: Front panel (including the keyboard connected to the USB port)

Example: If ENABLE is set to ON for the SIGNAL I/O connector, the REMOTE connector nor the front panel can be used.

SIGNAL I/O Connector

Before using the SIGNAL I/O connector for external control, check the connector specifications, and connect the external device to the SIGNAL I/O connector.

Pin arrangement

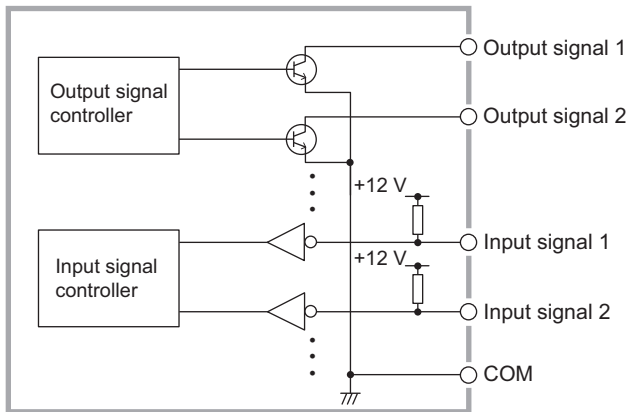


Pin no.	IN/OUT	Signal name	Description
1	IN	INTERLOCK+	Activate/release interlock. (p.161)
2	N/A	COM	Circuit common (chassis potential) shared by input and output.
3	IN	PM0	Select setup memories and auto test program memories. (p.163)
4	IN	PM1	
5	IN	PM2	
6	IN	PM3	
7	IN	PM4	
8	IN	PM5	
9	IN	PM6	
10	IN	PM7	
11	IN	STB	Recall setup memories and programs selected with the PM0 to PM7 signals. (p.163)
12	N/A	Reserved	Not used.
13	N/A	Reserved	
14	N/A	Reserved	
15	IN	START	Start a test. (p.164)
16	IN	STOP	Stop a test. (p.164)
17	IN	ENABLE	Enable the START signal. (p.164)
18	N/A	COM	I/O circuit common (chassis potential).
19	IN	INTERLOCK-	Activate/release interlock. (p.161)
20	N/A	COM	I/O circuit common (chassis potential).
21	N/A	+24V	+24 V internal power supply output terminal. Maximum output current 100 mA.
22	OUT	H.V ON/LINE ON	Set to on in any of the following conditions. Testing. Auto testing. Voltage remaining across the output terminals.
23	OUT	RISE	Set to on when the voltage is rising. (p.165)
24	OUT	TEST	Set to on during test time. (p.165)
25	OUT	PASS	Set to on for the duration of time specified by Pass Hold when a PASS judgment is made. (p.166)
26	OUT	U FAIL	Set to on continuously when a Upper-FAIL judgment is made. Or set to on continuously along with the L FAIL signal when Contact-FAIL judgment is made. (p.166)
27	OUT	L FAIL	Set to on continuously when an Lower-FAIL judgment is made. Or set to on continuously along with the U FAIL signal when Contact-FAIL judgment is made. (p.166)
28	N/A	Reserved	Not used.
29	OUT	READY	Set to on when the product is ready to start a test. (p.165)

Pin no.	IN/OUT	Signal name	Description
30	OUT	PROTECTION	Set to on when a protection function is activated. (p.26)
31	OUT	STEP END	Set to on when each step ends during an auto test. (p.167)
32	OUT	CYCLE END	Set to on when the last step ends during an auto test. (p.167)
33	OUT	ACW	Set to on when the test mode is set to AC withstanding voltage test. (p.165)
34	OUT	DCW	Set to on when the test mode is set to DC withstanding voltage test. (p.165)
35	OUT	IR	Set to on when the test mode is set to insulation resistance test. (p.165)
36	OUT	EC	Set to on when the test mode is set to earth continuity test. (p.165)
37	N/A	Reserved	Not used.

I/O signal circuit

The input signal circuit and the output signal circuit share the same common. The input terminal is pulled up to +12 V by a resistor. The following figure shows the internal construction of the SINGAN I/O.

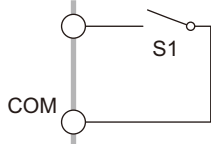


Input signal	Output signal
Opening the input terminals is equivalent to high-level input. <ul style="list-style-type: none"> • Low-active control • High-level input voltage: 11 V to 15 V • Low-level input voltage: 0 V to 4 V • Low-level input current: -5 mA max. • Input time width: 5 ms min. 	<ul style="list-style-type: none"> • Open collector output • Output withstanding voltage: 30 Vdc • Output saturation voltage: Approx. 1.1 V (25 °C, 77 °F) • Maximum output current 400 mA (TOTAL)

Input signal usage example

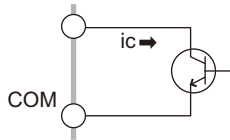
Using a make contact to control input

Use a make contact, such as a relay or switch, to set the input terminal to low level.



Using a logic element to control input

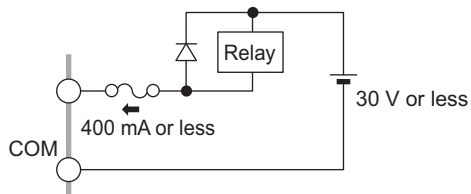
Use a logic element, such as a transistor, in place of the make contact. Design the circuit so that a transistor collector current (i_c) of 5 mA or greater flows.



Output signal usage example

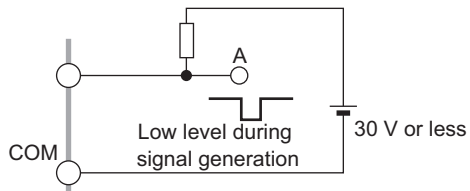
Driving a relay

Use the output signal to drive a relay. To improve the safety of the circuit, we recommend that you insert a protection fuse or connect a diode.



Obtaining a low-level digital signal

Use the output signal to obtain a low-level digital signal.



Connecting to the SIGNAL I/O connector

To connect the signal cable to the SIGNAL I/O connector, create a D-sub37 pin plug by referring to the following information.

SIGNAL I/O connector specifications	D-sub 37-pin female connector (socket), #4-40 UNC inch screws
Compatible plug	D-sub 37-pin male (with #4-40 UNC fixing screws) To prevent malfunction caused by noise, use a shielded plug.
Required cable	Single wire: 0.32 mm (AWG28) to 0.65 mm (AWG22) in diameter Twisted wire: 0.32 mm ² (AWG22) to 0.08 mm ² (AWG28) To prevent malfunction caused by noise, use a cable no longer than 2.5 m.
Required tools	Wire stripper for the above cable

Activating and Releasing Interlock

Interlock links the product to an external device to stop output appropriately. This ensures the safety of the operator.

When the interlock is activated, the product switches to PROTECTION mode, which prevents tests from being started with the START switch on the front panel or an external control START signal. Moreover, you cannot release PROTECTION mode with the STOP switch or the external control STOP signal.

Interlock activation conditions

Open the INTERLOCK+ (1) pin and INTERLOCK- (19) pin of the SIGNAL I/O connector. For the pins to be considered open, any of the following conditions must be met.

- The resistance between pin 1 and pin 19 is at least 1.2 k Ω .
- If you are using transistors or an optical device, the current flowing across pin 1 and pin 19 is no more than 5 mA.

Interlock release conditions

Short the INTERLOCK+ (1) pin and INTERLOCK- (19) pin of the SIGNAL I/O connector, and then press the STOP switch on the front panel or apply an external control STOP signal.

For the pins to be considered shorted, any of the following conditions must be met.

- The resistance between pin 1 and pin 19 is no more than 1 k Ω .
- If you are using transistors or an optical device, the current flowing across pin 1 and pin 19 is at least 6 mA.

Temporarily releasing interlock

Because nothing is connected to the SIGNAL I/O connector in the factory default conditions, interlock will be activated when you turn on the POWER switch. To release this temporarily, connect the included SIGNAL I/O plug to the SIGNAL I/O connector, and then press the STOP switch on the front panel. The included SIGNAL I/O plug has pins 1 and 19 shorted, so this will release the interlock.

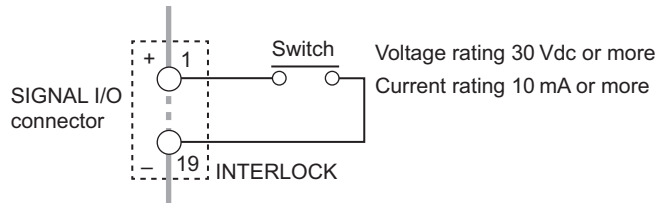
NOTE

When you actually perform tests, do not use this plug. In particular, if you use tools in a withstanding voltage test or insulation resistance test, we recommend that you place a cover over the EUT or install a fence around the EUT to prevent electric shock and devise a system that shuts off the output when the cover or fence is opened.

Examples of how to use interlock

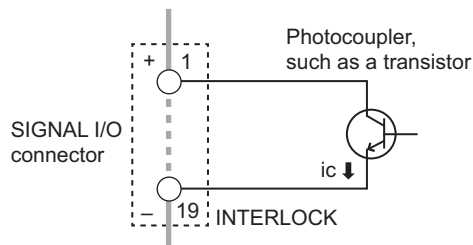
Using an open/close switch

Place a cover over the EUT or install a fence around the EUT, and use a switch to shut off the output when the cover or fence is opened.



Using a transistor or optical device

You can use a transistor or optical device in place of a switch.



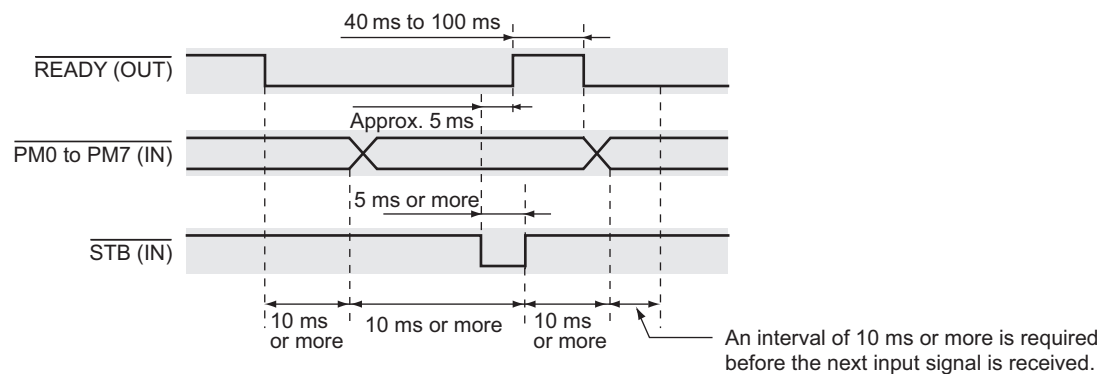
Recalling from Memory

You can recall setup memories and program memories by applying signals to PM0 (pin 3) to PM7 (pin 10), and STB (pin 11) of the SIGNAL I/O connector.

Convert the number (0 to 75) of the memory you want to recall into 8-bit binary notation, and apply high-level (0) or low-level (1) signals to PM7 to PM0.

For example, to recall memory number 74, convert the 74 in decimal notation into 8-bit binary notation, which is 01001010. So apply H, L, H, H, L, H, L, H to PM7 to PM0.

Memory number	MSD				LSD			
	PM7	PM6	PM5	PM4	PM3	PM2	PM1	PM0
0	H	H	H	H	H	H	H	H
1	H	H	H	H	H	H	H	L
2	H	H	H	H	H	H	L	H
⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮
73	H	L	H	H	L	H	H	L
74	H	L	H	H	L	H	L	H
75	H	L	H	H	L	H	L	L

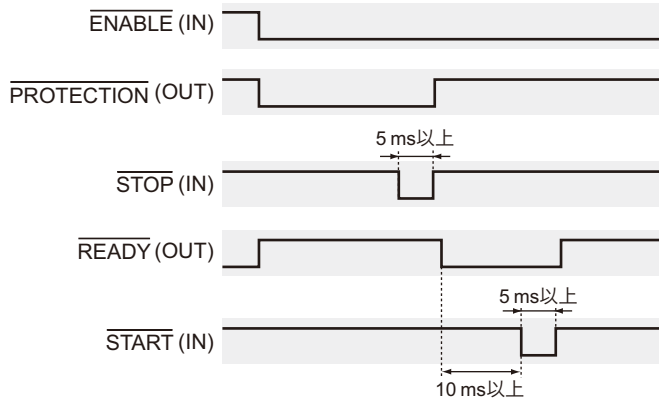


- 1 With “READY” shown in the upper right of the display, apply high-level or low-level signals to PM0 (pin 3) to PM7 (pin 10) of the SIGNAL I/O connector.
- 2 Set STB (pin 11) to low-level for at least 5 ms.
The setup memory or program corresponding to the number specified with the PM0 to PM7 signals is recalled.

Starting and Stopping Tests

You can start and stop tests using the SIGNAL I/O connector.

Starting a test



- 1** Set **ENABLE** (pin 17) of the **SIGNAL I/O** connector to low level.
The product switches to **PROTECTION** mode.
- 2** Set **STOP** (pin 16) to low-level for at least **5 ms** to release **PROTECTION** mode.
The test status shows “**READY**.”
- 3** When at least **10 ms** elapses after the test status becomes “**READY**,” set **START** (pin 15) to low level for at least **5 ms**.
The test starts.

NOTE

- While **ENABLE** is at low level, the **START** switch on the front panel and the **START** signal from the **REMOTE** connector are ignored.
- If you change the **ENABLE** level, the product switches to **PROTECTION** mode. If set to low level, use the **SIGNAL I/O STOP** signal to release **PROTECTION** mode. If set to high level, use the **STOP** switch or **SIGNAL I/O STOP** signal to release **PROTECTION** mode.

Stopping a test

- 1** While a test is in progress, set **STOP** (pin 16) to low-level for at least **5 ms**.

Monitoring the Test Status

Monitoring the test mode

The SIGNAL I/O connector pins are set to low level depending on the set test mode. Monitoring is not possible for auto tests.

Test mode	Pins that are set to low level
AC withstanding voltage test	ACW (pin 33)
DC withstanding voltage test	DCW (pin 34)
Insulation resistance test	IR (pin 35)
Earth continuity test	EC (pin 36)

Monitoring the test and voltage generation status

H.V ON/LINE ON (pin 22) of the SIGNAL I/O connector is set to low level in the following cases:

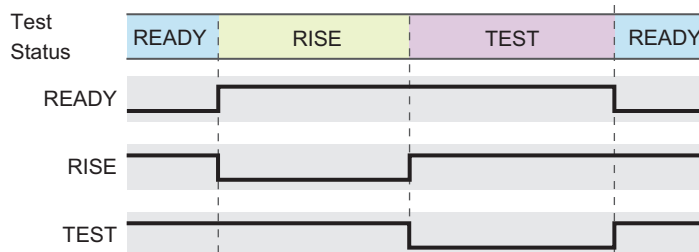
- A test or an auto test is in progress, or voltage is remaining across the output terminals.

Monitoring the test status

SIGNAL I/O RISE (pin 23) is set to low level when the voltage is rising.

SIGNAL I/O TEST (pin 24) is set to low level when a test is in progress.

SIGNAL I/O READY (pin 29) is set to low level when the product is ready to start a test.



Monitoring judgment results

PASS judgment

When the judgment result is PASS, under the following conditions, SIGNAL I/O PASS (pin 25) is set to low level:

- Until the time set by Pass Hold (p. 190) is elapsed or the judgment result is cleared.
- Until the STOP switch is pressed or a STOP signal is received if Pass Hold is set to Infinity.
- During the step interval when PASS judgment is made for a step if Step END Judgment (p. 192) is enabled in an auto test.

UPPER FAIL judgment

When the judgment result is Upper-FAIL, under the following conditions, SIGNAL I/O U FAIL (pin 26) is set to low level:

- Until the judgment result is cleared.
- During the Interval time if a judgment result of a step is Upper-FAIL when Step END Judgment (p. 192) is enabled in an auto test or FAIL Judgment (p. 147) is set to Continue.

LOWER FAIL judgment

When the judgment result is Lower-FAIL, under the following conditions, SIGNAL I/O L FAIL (pin 27) is set to low level:

- Until the judgment result is cleared.
- During the Interval time if a judgment result of a step is FAIL when Step END Judgment (p. 192) is enabled in an auto test or FAIL Judgment (p. 147) is set to Continue.

CONTACT FAIL judgment

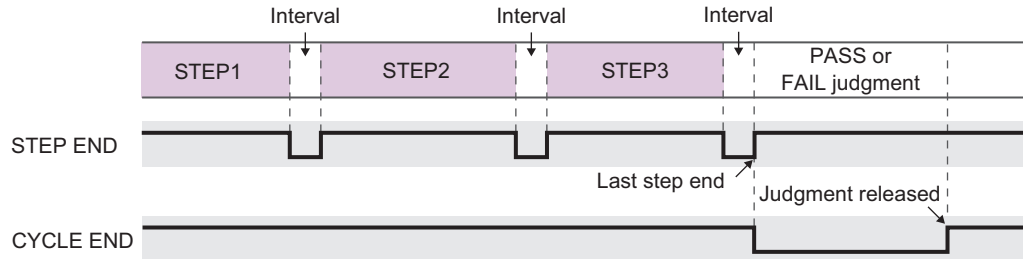
When the judgment result is Contact-FAIL, both U FAIL (pin 26) and L FAIL (pin 27) is set to low level simultaneously.

Monitoring the step execution status of auto tests

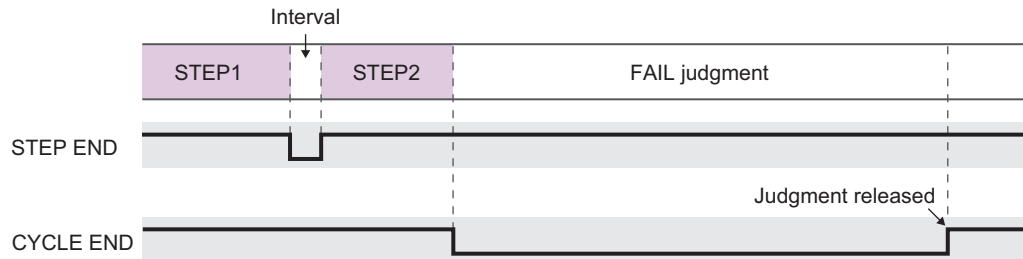
When a step of an auto test ends, SIGNAL I/O STEP END (pin 31) is set to low level.

CYCLE END (pin 32) of SIGNAL I/O is set to low level while a pass or fail judgment is being indicated after the last step is completed or from when a test is completed with a fail judgment until when the judgment is released.

- If a PASS or FAIL judgment is made after the last step ends



- If a FAIL judgment is made in the middle of a step and auto test stops



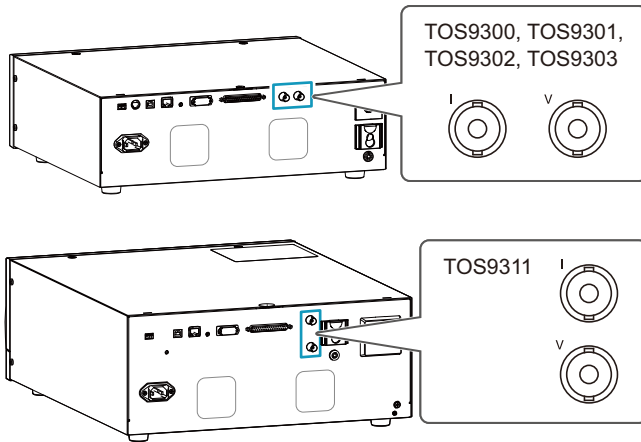
Monitoring the activation status of protection functions

SIGNAL I/O PROTECTION (pin 30) is set to low level when a protection function ([p.26](#)) is activated.

Monitoring Measurements

The current waveform and voltage waveform of the withstanding voltage test can be checked with the signals output from the monitor terminals on the rear panel.

When the product is shipped from the factory, covers are attached. (p.21)

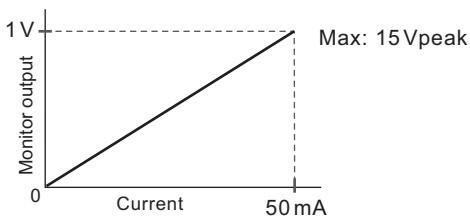


NOTE

Monitor signal output is isolated from the chassis (earth). If you connect an oscilloscope or an external device whose BNC shield is grounded, be sure to set the grounding mode (GND) on the test conditions to Guard.

Monitoring current waveforms

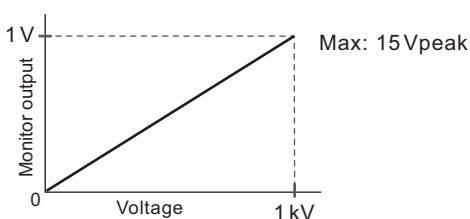
Current waveforms of withstanding voltage tests can be monitored using the signal output from the I terminal on the rear panel.

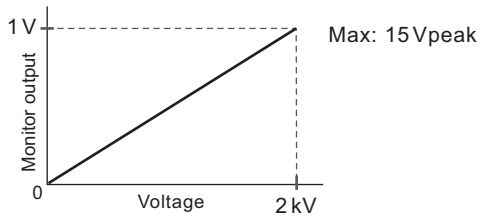


Monitoring voltage waveforms

Voltage waveforms of withstanding voltage tests can be monitored using the signal output from the V terminal on the rear panel.

■ TOS9300, TOS9301, TOS9302, TOS9303



■ TOS9311

Using Option Products

Signal output from the STATUS OUT connector

The STATUS OUT connector on the rear panel outputs signals to the optional warning light unit (PL02-TOS). Use Status Output ([p. 191](#)) of CONFIG settings to set the signal output conditions. For details on the PL02-TOS, see the “Warning Light PL02-TOS Operation Manual.”

Signal I/O of the REMOTE connector

You can control this product from the following option products using the REMOTE connector on the front panel. For details on option products, see the operation manual for the option.

- Remote control box (RC01-TOS/RC02-TOS)
- High voltage test probe (HP01A-TOS/HP02A-TOS)

Memory Function

You can save and recall test conditions, view and save test results, and view and save the values or captured image of the most recent test.

Saving and Recalling Test Conditions

You can save up to 51 test conditions that you specified as you like and the selected test mode type in the product memory (setup memory). Each memory location stores all test conditions of tests supported by the model you are using and the selected test mode type. Test conditions can also be saved in USB memory devices. System settings (p. 179) are not saved.

How to view the setup memory screen

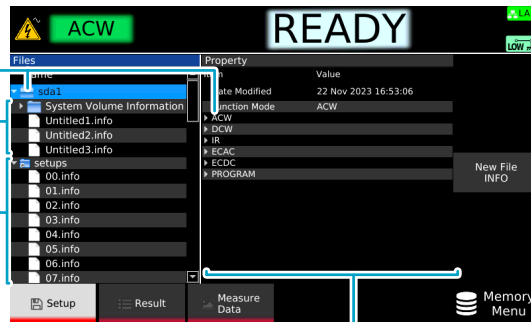
Press MEMORY > Setup to display the setup memory screen. The contents of the internal memory are shown in the setups folder. The internal memory contains setup memories with default values (00 to 50) and the test conditions that were in use when the power was turned off the last time (auto.info).

Connecting a USB memory device to the USB port on the front panel displays an "sdxx" folder (the "xx" changes depending on the USB memory device). You can save test conditions to a file name of your choice in the USB memory device and recall them later.

Select an item and
Press arrow (▶) key to open the lower level.
Press arrow (◀) key to close the lower level.

USB memory device

Internal memory

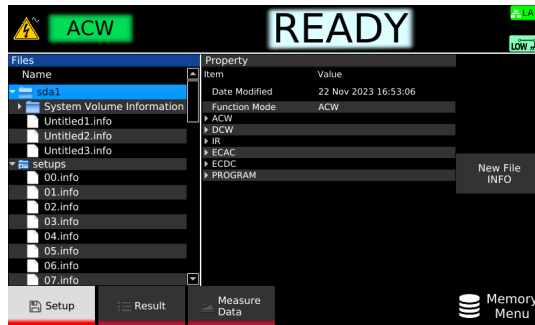


Details of the setup memory (Property)

Saving to the setup memory

Saving over previous settings (internal memory and USB memory)

- 1 Set the test conditions.
- 2 Press MEMORY > Setup.



- 3 Use the rotary knob to select the setup memory.
- 4 Press Save.
The test conditions are saved in the setup memory.

Saving to a new file (USB memory device only)

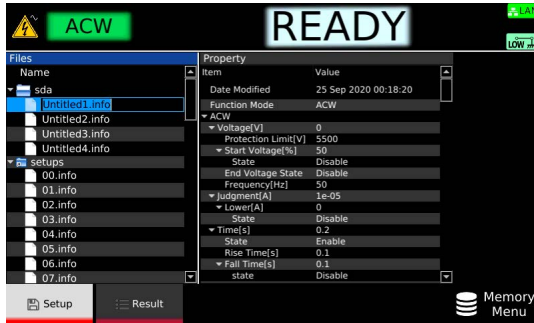
- 1 Set the test conditions.
- 2 Press MEMORY > Setup.
- 3 Insert a USB memory device into the USB port on the front panel.
An "sdx" folder is displayed. The "xx" changes depending on the USB memory device.
- 4 Use the rotary knob to select the sdx folder, and press New File.
A new setup memory is created.



- 5 Use the numeric keypad or the rotary knob to enter a file name of your choice, and then press ENTER.
The setup memory is saved to a new file.

Changing the memory name (USB memory device only)

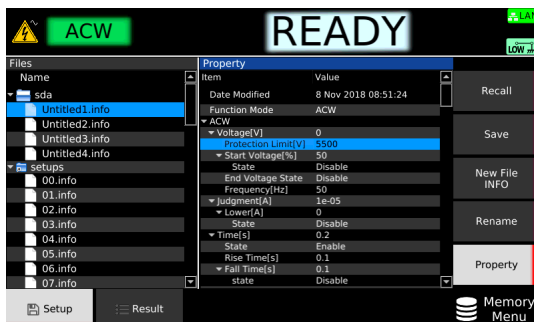
- 1 Press MEMORY > Setup.
- 2 Insert a USB memory device into the USB port on the front panel.
An “sdxx” folder is displayed. The “xx” changes depending on the USB memory device.
- 3 Use the rotary knob to select the setup memory, and press Rename.



- 4 Use the numeric keypad or the rotary knob to enter a file name of your choice, and then press ENTER.
The memory name is saved.

Checking the setup memory details

- 1 Press MEMORY > Setup.
- 2 Use the rotary knob to select the setup memory.
- 3 Press Property.
The detailed information of the setup memory is shown on the right side of the display. The detailed information can be scrolled by using the rotary knob. Press Property again to return to setup memory selection.



Recalling the setup memory

- 1 Press MEMORY > Setup.
- 2 Use the rotary knob to select the setup memory.



Press Property to view the settings of the setup memory on the right side of the display. Press Property again to return to setup memory selection.

- 3 Press Recall.
- The test conditions of each test are overwritten with the content saved in the setup memory.

Viewing and Saving Test Results

Test results are temporarily saved to the internal memory automatically. The 1000 latest test results are saved regardless of the test mode. These are cleared when the power is turned off.

Test results can also be stored in CSV format to a USB memory device.

■ Saved contents

Item	Description
Function	ACW: AC withstanding voltage, DCW: DC withstanding voltage, IR: insulation resistance, ECAC: AC earth continuity, ECDC: DC earth continuity.
Judgment	PASS: A fail judgment was not made. U-FAIL: A value greater than or equal to the upper limit was measured. L-FAIL: A value less than or equal to the lower limit was measured. U-FAIL (dV/dt): In a DCW test, the voltage rise rate (dV/dt) is less than approximately 1 V/s. L-FAIL (dV/dt): In an IR test, the voltage rise rate (dV/dt) is less than approximately 1 V/s. C-FAIL: Continuity between the test lead and the EUT could not be confirmed when the scanner was used. PROT(XXX): A protection function was activated. The type of protection is displayed in "XXX" (p.26). STOP: The test was aborted.
Elapsed Time	The amount of time that has elapsed since the test started (seconds). Test status. When the test status (RISE, TEST, FALL) changes, the elapsed time returns to 0 seconds.
Voltage	Measured voltage
Current	Current measurement
Current Real	Real part of the current
Current Imaginary	Imaginary part of the current
Resistance	Resistance measurement
Test start time	[year] [month] [day] [hour]:[minute]:[second] [timezone] Ex: 4 Oct 2018 17:00:00 +0900

Displaying a list of test results

1 Press MEMORY > Result.

A list of test results is displayed.

Use the rotary knob, arrow (◀/▶) keys, PageUp key, and PageDown key to move between the items you want to view.



Saving test results to a USB memory device

You can save test results in CSV format to a USB memory device.

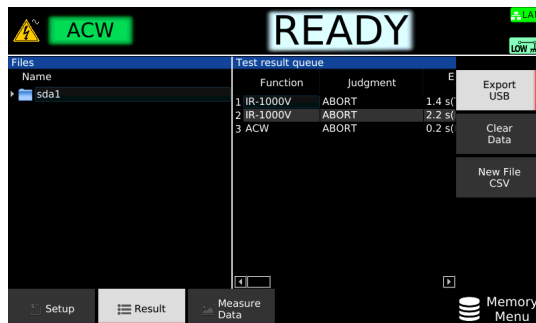
1 Press MEMORY > Result.

A list of test results is displayed.

2 Insert a USB memory device into the USB port on the front panel.

3 Press Export USB, and then turn the rotary knob to select the save destination folder.

The USB memory device folder ("sdxx" folder) appears in the left side of the display area. The "xx" changes depending on the USB memory device. If there are sub folders, you can press arrow (◀/▶) keys to explode or collapse folders.



4 Press New File CSV.

A new file is created.

5 Use the numeric keypad or the rotary knob to enter a file name of your choice, and then press ENTER.

The test results are saved. Press Rename to rename a file.

Clearing the list of test results

- 1** Press **MEMORY > Result**.
- 2** Press **Clear Data**.
A confirmation screen appears. To cancel, press **ESCAPE**.
- 3** Press **ENTER**.
The test results are cleared.

Viewing and Saving Test Data

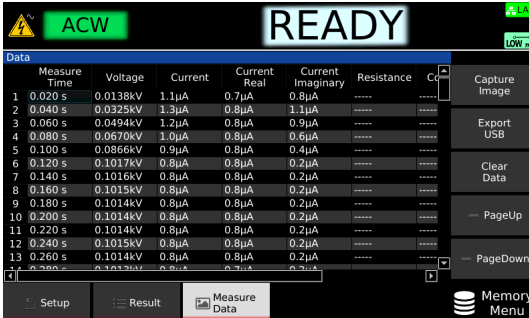
You can save and view the values and the captured image of the most recent test. They are deleted when the power is turned off.

Checking values of the most recent test

1 Press MEMORY > Measure Data.

Displays the values of the most recent test results.

Use the rotary knob, arrow (◀▶) keys, PageUp key, and PageDown key to move between the items you want to view.



Measure Time	Voltage	Current	Current Real	Current Imaginary	Resistance	Capacitance
1 0.020 s	0.0138kV	1.1µA	0.7µA	0.8µA	-----	-----
2 0.040 s	0.0325kV	1.3µA	0.8µA	1.1µA	-----	-----
3 0.060 s	0.0494kV	1.2µA	0.8µA	0.9µA	-----	-----
4 0.080 s	0.0670kV	1.0µA	0.8µA	0.6µA	-----	-----
5 0.100 s	0.0866kV	0.9µA	0.8µA	0.4µA	-----	-----
6 0.120 s	0.1017kV	0.8µA	0.8µA	0.2µA	-----	-----
7 0.140 s	0.1016kV	0.8µA	0.8µA	0.2µA	-----	-----
8 0.160 s	0.1015kV	0.8µA	0.8µA	0.2µA	-----	-----
9 0.180 s	0.1014kV	0.8µA	0.8µA	0.2µA	-----	-----
10 0.200 s	0.1014kV	0.8µA	0.8µA	0.2µA	-----	-----
11 0.220 s	0.1014kV	0.8µA	0.8µA	0.2µA	-----	-----
12 0.240 s	0.1015kV	0.8µA	0.8µA	0.2µA	-----	-----
13 0.260 s	0.1014kV	0.8µA	0.8µA	0.2µA	-----	-----
14 0.280 s	0.1013kV	0.8µA	0.8µA	0.2µA	-----	-----

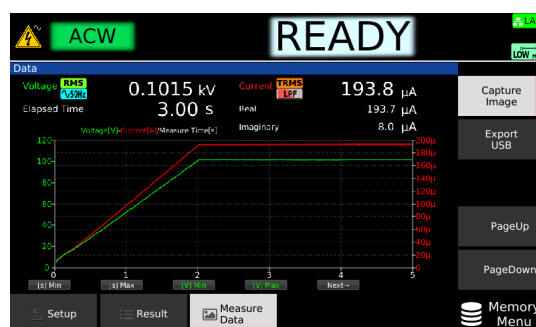
Checking the captured image of the most recent test

1 Press MEMORY > Measure Data.

2 Press Capture Image.

The captured image of the most recent test appears.

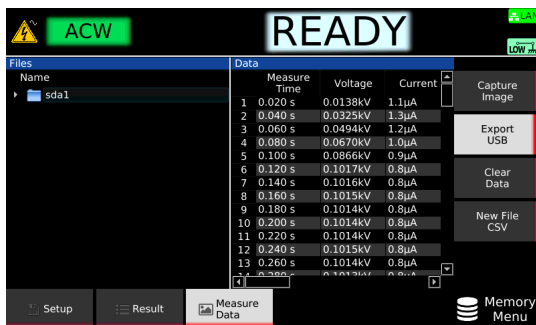
The screen switches between the list of test values and the captured image each time you press Capture Image.



Saving test data to a USB memory device

You can save the values and the captured image of the most recent test to a USB memory device. The values are saved in CVS format, and the image is saved in PNG format.

- 1** Press **MEMORY > Measure Data**.
- 2** Insert a USB memory device into the USB connector on the front panel.
- 3** Press **Capture Image** to display data you want to save.
The screen switches between the list of test values and the captured image each time you press Capture Image.
- 4** Press **Export USB**, and then turn the rotary knob to select a save destination folder.
The USB memory device folder ("sdx" folder) appears in the left side of the display area.
The "xx" changes depending on the USB memory device. If there are subfolders, you can press arrow (◀/▶) keys to open or close the folders.



- 5** Press **New File CSV** or **New File PNG**.
A new file is created.
- 6** Use the numeric keypad or the rotary knob to enter a file name of your choice, and then press **ENTER**.
The test data is saved. Press **Rename** to rename a file.

Deleting test data

- 1** Press **MEMORY > Measure Data**.
- 2** Press **Clear Data**.
A confirmation screen appears. To cancel, press **ESCAPE**.
- 3** Use the arrow (▶) key to select **OK**, and then press **ENTER**.
The test data will be deleted.

System Settings

On the System Menu screen that appears when you press SYSTEM, you can change the CONFIG settings and interface settings, view SCPI errors, set the clock, initialize and update the instrument, and view the instrument information.

Displaying and Changing CONFIG Settings

You can display and change the following settings.

Item	Description
Power On	Panel settings at startup. (p.180)
Watchdog	Turns the product off automatically when no SCPI communication takes place for a given period. (p.181)
Delay	The duration of time until the product decides that there is no SCPI communication when watchdog is enabled.
Screen Saver	Screen saver starts. (p.182)
Delay	Time until the screen saver starts.
Key	Key control lock. (p.183)
Lock Level	Range of key operations to lock.
Password	Sets a password to unlock key operations.
Calibration	Calibration settings. (p.186)
DUE	Sets the next calibration period.
Protection Keep	Sets the operation that is performed when calibration period elapses.
Beeper	Enables/disables the beep sound. (p.187)
Key	Beep sound for invalid operation.
Protection	Beep sound for alarm occurrence.
SCPI Error	Beep sound for SCPI errors.
Volume Pass	Beep volume for pass judgment results.
Volume Fail	Beep volume for fail judgment results.
Fail Mode	Sets the instrument so that fail judgment results and PROTECTION mode cannot be released from a device connected to the SIGNAL I/O connector or REMOTE connector. (p.188)
Double Action	Tests can only be started by pressing and releasing STOP and then pressing START within 0.5 seconds of releasing the STOP switch. (p.189)
Momentary	Tests are only executed while the START switch is held down. (p.189)
Start Long	Starts a test only when the START switch is held down for at least 1 second. (p.189)
Pass Hold	PASS judgment result hold time. (p.190)
Status Output	Conditions for outputting signals from the STATUS OUT connector. (p.191)
Upper Fail	While the test status is Upper-FAIL.
Lower Fail	While the test status is Lower-FAIL.
H.V ON	While there is a residual voltage and during testing.
Pass	While the test status is PASS.
Power ON	While the POWER switch is turned on.
Protection	While in PROTECTION mode.
Ready	While the test status is READY.
Test	While the test voltage is at the specified value.
Signal I/O	Signal I/O settings.
Step END Judgment	Output judgment results for each step from the SIGNAL I/O connector while an auto test is running. (p.192)

Panel settings at startup (Power On)

The panel setting state at power-on can be selected from the following.

Parameter	Description
RST	Start with the reset settings (p.224).
RCL0	Start in setup memory (p.170) number 0 (00.info) condition.
Resume	Start with the same settings as when the power was switched off the previous time.

- 1 Press SYSTEM > Configure.**
The CONFIG setup screen appears.
- 2 Use the rotary knob to select Power On, and then press Edit.**



- 3 Use the rotary knob to select the items, and then press ENTER.**
This completes the setting.

Operation when there is no SCPI communication (Watchdog)

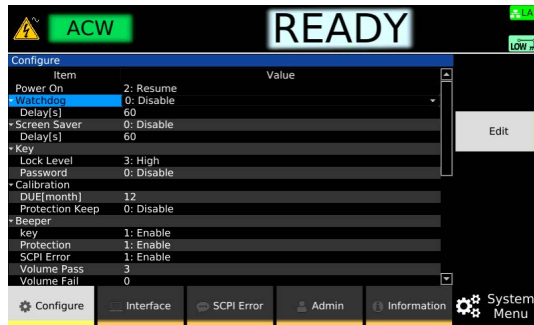
The product switches to PROTECTION mode (p.26) when there is no SCPI communication over a given time period.

Set the duration of time until the product decides that there is no SCPI communication when watchdog is enabled. You can also disable watchdog.

1 Press SYSTEM > Configure.

The CONFIG setup screen appears.

2 Use the rotary knob to select Watchdog, and then press Edit.



3 Use the rotary knob to select Enable or Disable, and then press ENTER.

Watchdog is set to enable or disable.

4 If set to Enable, use the rotary knob to select Delay under Watchdog, and then press Edit.



5 Use the numeric keypad or the rotary knob to enter the duration of time until the product decides that there is no SCPI communication, and then press ENTER.

Setting range: 1 s to 3600 s

This completes the setting.

Screen saver

The display dims when there is no panel activity for a specified length of time.

If screen saver is enabled, set the time until the screen saver starts. You can also disable the screen saver.

1 Press SYSTEM > Configure.

The CONFIG setup screen appears.

2 Use the rotary knob to select Screen Saver, and then press Edit.



3 Use the rotary knob to select Enable or Disable, and then press ENTER.

Screen saver is set to enable or disable.

4 If set to Enable, use the rotary knob to select Delay under Screen Saver, and then press Edit.



5 Use the numeric keypad or the rotary knob to set the time until the screen saver is activated, and press ENTER.

60 s to 59940 s (after setting, rounded to nearest second unit)




This completes the setting.

Key lock

You can lock the operation of the keys to prevent changing the settings or overwriting memory or programs by mistake. You can also set a password to unlock the key lock.

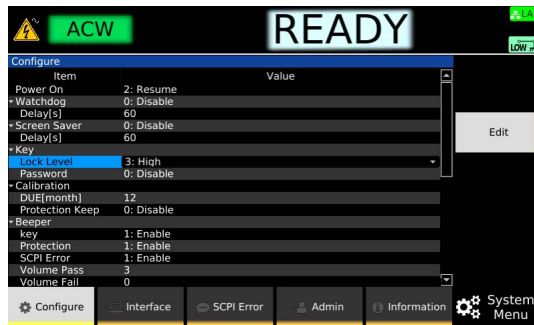
Setting of lock level

The range of key operations that are locked is divided into the following three lock levels. While the keys are locked, an icon indicating the lock level is shown in the upper right of the display.

Parameter	Description	Icon
Low	Locks all operations except the following. <ul style="list-style-type: none"> Release key lock START and STOP switches Memory recall 	
Medium	Locks all operations except the following. <ul style="list-style-type: none"> Release key lock START and STOP switches 	
High	Locks all operations except the following. ¹ <ul style="list-style-type: none"> Release key lock STOP switch 	

1. Only the START switch on the front panel is locked. The START switch on an option product connected to this product is not locked.

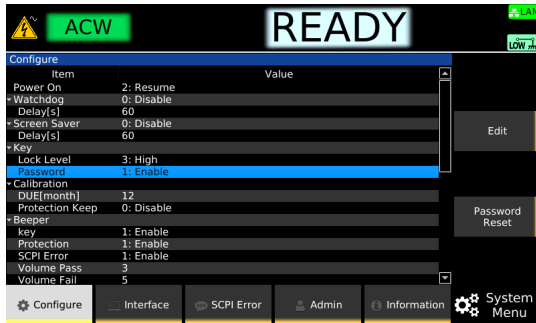
- 1 Press **SYSTEM > Configure**.
The CONFIG setup screen appears.
- 2 Use the rotary knob to select **Lock Level** under **Key**, and then press **Edit**.



- 3 Use the rotary knob to select the level.
- 4 Press **ENTER**.
This completes the setting.

Enabling or disabling the lock password

- 1 Press **SYSTEM > Configure**.
The CONFIG setup screen appears.
- 2 Use the rotary knob to select **Password** under **Key**, and then press **Edit**.



- 3 Use the rotary knob to select **Enable** or **Disable**.
- 4 Press **ENTER**.
This completes the setting.

Changing the lock password

- 1 Press **SYSTEM > Configure**.
The CONFIG setup screen appears.
- 2 Use the rotary knob to select **Password** under **Key**, and then press **Password Reset**.



The Password Input dialog box appears.

- 3 Enter the current password on the display or numeric keypad and then press **ENTER**.
The factory default password is "0000".
- 4 Enter the new password and then press **ENTER**.
You can set a password of 4 to 15 characters.
The password is now changed.

Locking and releasing key operations

1 Hold down KEY LOCK.

Each time the key is held down, key lock switches between lock and unlock.

If Password is set to Enable, enter the current password on the display or numeric keypad and then press ENTER when unlocking.

This completes the setting.

Calibration configuration

You can set the calibration period and the operation performed when the calibration period elapses.

Parameter	Value	Description
DUE	1 to 24 (month)	Sets a calibration period of months until the next calibration from the last calibration date.
	Infinity	Calibration period is not monitored.
Protection Keep	Enable	When the calibration period elapses, the protection function is activated, and the product switches to PROTECTION mode (CAL). To release the PROTECTION mode, set Protection Keep to Disable, and press STOP.
	Disable	When the calibration period elapses, a warning appears on the display when the power is turned on. To clear the warning, press STOP.

1 Press SYSTEM > Configure.

The CONFIG setup screen appears.

2 Use the rotary knob to select DUE under Calibration, and then press Edit.



3 Use the rotary knob or numeric keys to enter the calibration period, and then press ENTER.

The calibration period is set.

4 Use the rotary knob to select Protection Keep, and then press Edit.



5 Use the rotary knob to select Enable or Disable, and then press ENTER.

The operation that is performed when calibration period elapses is set.

This completes the setting.

Beep sound (Beeper)

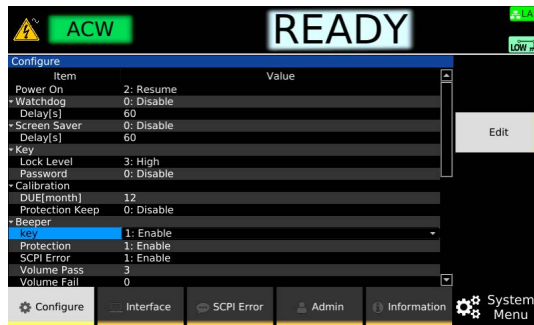
You can enable or disable beep sounds that are emitted in case of invalid operation, alarm occurrence, or SCPI error and the beep volume for pass and fail judgments.

Parameter	Value	Description
Key	Enable/Disable	Beep sound for invalid operation
Protection	Enable/Disable	Beep sound for alarm occurrence
SCPI Error	Enable/Disable	Beep sound for SCPI errors
Volume Pass	0 to 10	Beep volume for pass judgments
Volume Fail	0 to 10	Beep volume for fail judgments

1 Press SYSTEM > Configure.

The CONFIG setup screen appears.

2 Use the rotary knob to select Key, Protection, or SCPI Error under Beeper, and then press Edit.



3 Use the rotary knob to select Enable or Disable, and then press ENTER.

4 Use the rotary knob to select Volume Pass or Volume Fail.


Press Beep Test to generate a beep at the present volume level.

5 Press Edit.

6 Use the rotary knob or numeric keys to enter the volume, and then press ENTER.

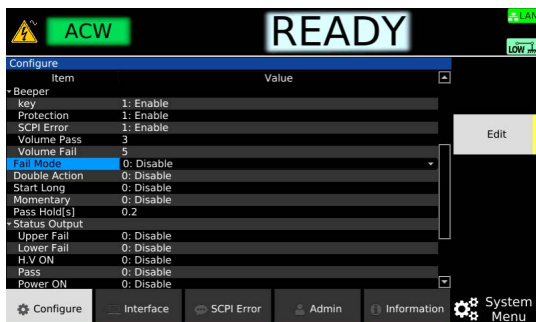
This completes the setting.

Fail mode

Set the instrument so that fail judgment results and PROTECTION mode cannot be released from a device connected to the SIGNAL I/O connector or REMOTE connector. When Fail Mode is enabled,  appears in the upper right of the display.

If you are using the optional high voltage test probe (p.235), enable fail mode. When a test ends with a fail judgment, the fail judgment and PROTECTION mode is not released even if you let go of the probe.




- 1 **Press SYSTEM > Configure.**
The CONFIG setup screen appears.
- 2 **Use the rotary knob to select Fail Mode, and then press Edit.**



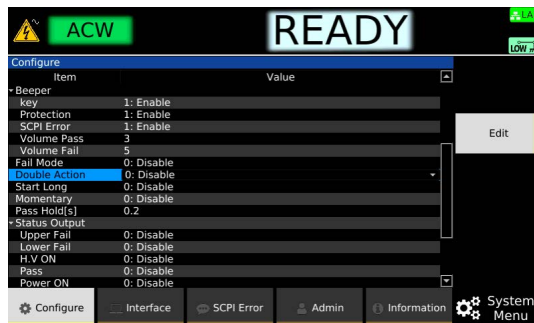
- 3 **Use the rotary knob to select Enable or Disable, and then press ENTER.**
This completes the setting.

Test start settings

The following functions can be used to start tests safely. Either Double Action or Start Long can be enabled, not both.

Parameter	Description	Icon
Double Action	When you press and release STOP, "READY" is shown in the upper right of the display for 0.5 seconds. A test starts only when you press START within this period. This prevents a test from being started by pressing START by mistake.	
Start Long	A test starts only when the START switch is held down for at least 1 second. This prevents a test from being started by pressing START by mistake. The SIGNAL I/O START signal and START signals from the REMOTE connector are not accepted.	
Momentary	A test is executed only while the START switch is held down. If you release START in the middle of a test, the test stops in the same manner as when STOP is pressed. Tests can be performed safely because your hand is fixed on the START switch while the test is in progress. To perform tests more safely, use the remote control box (option) (p.234), which requires you to press the START switch with both hands.	

- 1 Press **SYSTEM > Configure**.
The CONFIG setup screen appears.
- 2 Use the rotary knob to select **Double Action, Momentary, or Start Long**, and then press **Edit**.



- 3 Use the rotary knob to select **Enable or Disable**, and then press **ENTER**.
This completes the setting.
When Double Action is enabled, the screen switches to the test condition setup screen.

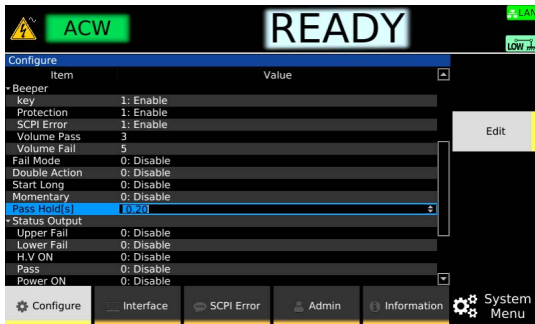
PASS judgment result hold time

Sets the length of time or condition that a PASS judgment result display will be held.

Parameter	Description
0.05 s to 10.00 s	Pass judgment results are displayed until the specified time elapses.
Infinity	Pass judgment results are displayed until you press STOP.

When a FAIL judgment occurs, the FAIL judgment results remain displayed until you press STOP, regardless of the value of the Pass Hold setting.

- 1 Press SYSTEM > Configure.**
The CONFIG setup screen appears.
- 2 Use the rotary knob to select Pass Hold, and then press Edit.**



- 3 Use the rotary knob to select a value, and then press ENTER.**
This completes the setting.

STATUS OUT setting (Status Output)

Set the conditions for outputting 24 Vdc from the STATUS OUT connector. You can use this with the optional warning light unit ([p.235](#)).

- 1 Press **SYSTEM > Configure**.
The CONFIG setup screen appears.
- 2 Use the rotary knob to select the following items under **Status Output**, and then press **Edit**.



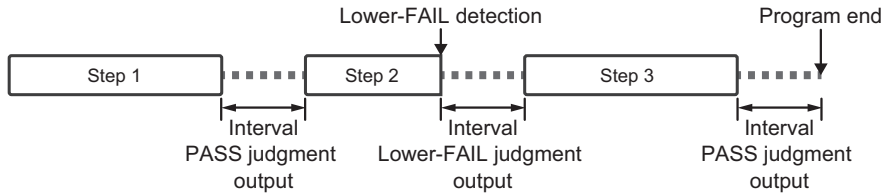
Parameter	Output condition
Upper Fail	While the test status is Upper-FAIL.
Lower Fail	While the test status is Lower-FAIL.
H.V ON	While there is a residual voltage and during testing.
Pass	While the test status is PASS.
Power ON	While the POWER switch is turned on.
Protection	While in PROTECTION mode.
Ready	While the test status is READY.
Test	While the test voltage is at the specified value.

- 3 Use the rotary knob to select **Enable** or **Disable**, and then press **ENTER**.
This completes the setting.

Outputting judgment for each step (Step END Judgment)

If you enable Step END Judgment, the judgment results of each step (PASS, Upper-FAIL, Lower-FAIL) is output from the SIGNAL I/O connector (pins 25 to 27) when an auto test is executed. The results are output at the end of each step over the Interval time (p.148) (the same time as the STEP END signal).

(When FAIL Judgment: Continue)



- 1 Press SYSTEM > Configure.**
The CONFIG setup screen appears.
- 2 Use the rotary knob to select Step END Judgment under Signal I/O, and then press Edit.**



- 3 Use the rotary knob to select Enable or Disable, and then press ENTER.**
This completes the setting.

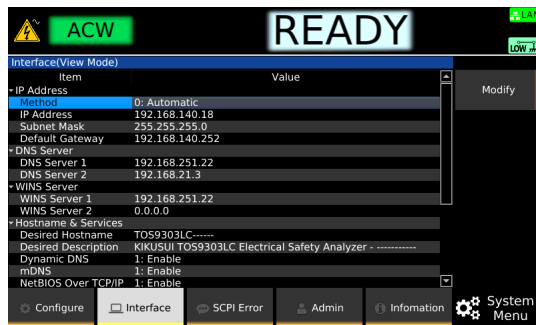
Displaying/Changing the Interface Settings

You can display and change the following settings.

Parameter	Value	Description
IP Address	n/a	IP address
Method	Automatic (auto)/Static (fixed)	IP address assignment method
IP Address	n/a	IP address
Subnet Mask	n/a	Subnet mask
Default Gateway	n/a	Default gateway
DNS Server	n/a	DNS server address
DNS Server 1	n/a	Primary DNS server address
DNS Server 2	n/a	Secondary DNS server address
WINS Server	n/a	WINS server address
WINS Server 1	n/a	Primary WINS server address
WINS Server 2	n/a	Secondary WINS server address
Host name & Services	n/a	Host name and service
Desired Hostname	Enter the host name (up to 15 characters).	Host name setting
Desired Description	Enter the service name (up to 63 characters).	mDNS service name setting
Dynamic DNS	Enable/Disable	Setting of dynamic DNS
mDNS	Enable/Disable	Setting of multicast DNS
NetBIOS Over TCP/IP	Enable/Disable	NetBIOS Over TCP/IP setting
Auto Clock Adjustment	n/a	Auto clock
NTP Server Hostname	ntp.nict.jp	NTP server address
Auto Adjustment	Enable/Disable	Setting of auto clock adjustment
RS232C Settings	n/a	Setting of RS232C
Bitrate	9600/19200/38400/57600/115200	Baud rate [bps]
Data Bits	8 bit	Data length
Stop Bits	1 bit	Stop bits
Flow Control	None/CTS-RTS	Flow control

1 Press SYSTEM > Interface.

The interface setup screen appears.

**2 Press Modify.**

You can now edit the interface settings.

3 Use the rotary knob to select a setting, and then press Edit.**4 Use the numeric keypad or the rotary knob to select or enter a value, and then press ENTER.**

Change the interface settings by repeating Step 3 and Step 4 .
The changes are not applied at this point.

5 Press Apply.

A confirmation screen appears. To cancel, press ESCAPE.

6 Press ENTER.

This completes the setting.

Displaying SCPI Errors

You can check the content of the SCPI error when an SCPI error occurs during remote control.

Up to 16 errors are displayed. If the 17th error occurs, the 16th error changes to “-350 Queue overflow,” and subsequent errors are not displayed.

1 Press **SYSTEM > SCPI Error**.

The SCPI error is displayed. For details on errors, see the Communication Interface Manual. Pressing Clear or restarting the product will clear the error.

Setting the Date/Time

Set the time zone, date, and time.

The date and time are used when saving setup memory.

If you change the time zone, the year, month, and day change accordingly.

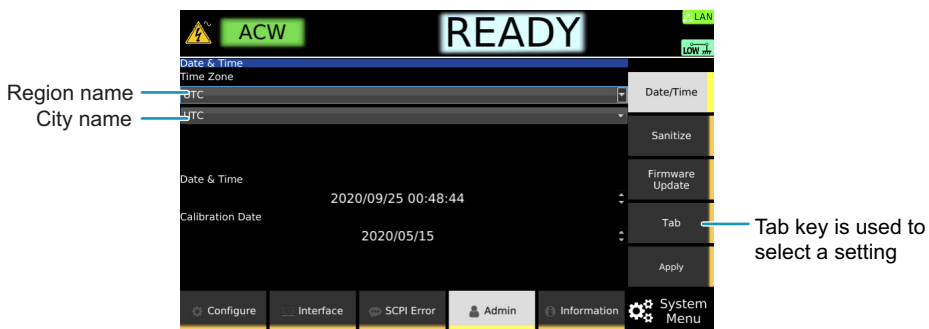
If the product is connected to LAN and can access the Internet, setting Auto Adjustment under Auto Clock Adjustment in the Interface setup (p. 193) to enable will cause the date to be updated automatically according to the time zone.

1 Press SYSTEM > Admin > Date/Time.

The date/time setup screen appears.

2 Set the time zone or the date and time.

Each time you press the Tab key, the item that you can set changes.



Purpose	Operation
Set the time zone (region name)	Press Tab to select the item in the top row of Time Zone, and then use the rotary knob to select the region name.
Set the time zone (city name)	Press Tab to select the item in the bottom row of Time Zone, and then use the rotary knob to select the city name.
Set the year, month, day, and time.	Press Tab to select the year, month, day, or time of Date & Time, and use the numeric keypad or rotary knob to enter the value.

3 Press Apply.

A confirmation screen appears. To cancel, press ESCAPE.

4 Press arrow (▶) key to select OK, and then press ENTER.

This completes the setting.

Initializing the Settings

This product has two sets of default settings: factory default settings and reset settings.

Returning the product to the factory default settings will delete all user data.

Returning the product to the “reset settings” will set some the settings back to the factory default settings.

You can also return only the interface settings to factory default settings or reset settings.

Restoring the factory default settings

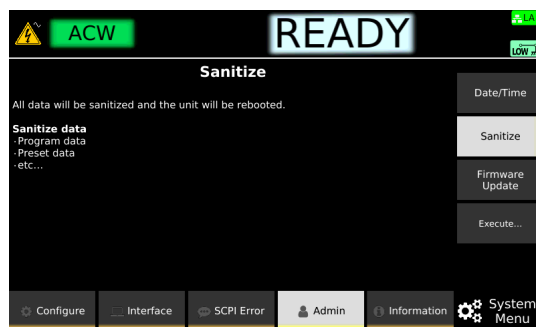
Restoring the factory default settings deletes all the user data*.

For details about the factory default setting, see "Default Settings and Reset Settings" (p.224).

*: The user data is deleted in accordance with the NISPOM (National Industrial Security Program Operating Manual) standard.

You can also return only the interface settings to their factory default values.

1 Press SYSTEM > Admin > Sanitize.



2 Press Execute.

A confirmation screen appears. To cancel, press ESCAPE.

3 Press arrow (▶) key to select OK, and then press ENTER.

The error “-314 Save/recall memory lost” occurs, but this is actually not an error.

4 Turn the product off and then back on.

The product restarts, and the factory default settings are restored.

Returning only the interface settings to the factory default values

1 Press SYSTEM > Interface.

2 Press Modify > Default.

A confirmation screen appears. To cancel, press ESCAPE.

3 Press ENTER.

The interface settings are returned to the factory default values.

Restoring the reset settings

You can reset some of the settings to their factory defaults at power-on.

For the items that are reset, see "Default Settings and Reset Settings" (p.224).

You can also return only the interface settings to the "reset settings."

- 1 Press **SYSTEM > Configure**.
- 2 Use the rotary knob to select **Power On**, and then press **Edit**.
- 3 Use the rotary knob to select **RST**, and then press **ENTER**.



- 4 Turn the product off and then back on.
The product restarts with some of the settings reset to their factory defaults.

Returning only the interface settings to the "reset settings"

Items that have a check mark in the reset column in Interface settings (p.228) of Default Settings and Reset Settings are returned to their factory default settings.

- 1 Press **SYSTEM > Interface**.
- 2 Press **Modify > LAN Reset**.
A confirmation screen appears. To cancel, press **ESCAPE**.
- 3 Press **ENTER**.
The interface setting is reset.

Updating

You can update the product's firmware by using a USB memory device.

If there is an update, you can obtain it from the download service on the Kikusui website (<https://global.kikusui.co.jp/downloads/>).

NOTE

Save the update files (Update.img, CHECKSUM.md5) in the root directory of the USB memory device. Do not change the names of the update files.

1 Press SYSTEM > Admin > Firmware Update.



2 Insert the USB memory device on which the update files have been saved into the USB port on the front panel, and then press Execute.

An update screen appears.

3 Press ENTER.

The update process begins. Do not turn off this instrument while updating is in progress. Do not remove the USB memory device.

4 If "Cycle the unit power..." is displayed, remove the USB memory device, and turn the product off and then back on.

Updating is complete.

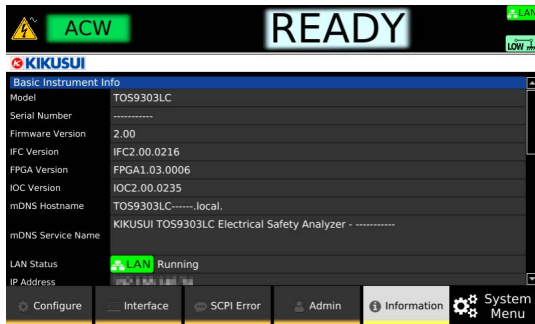
Displaying the Device Information

You can display the model name, serial number, firmware version, IP address, last calibration date, and other device information.

1 Press **SYSTEM** > **Information**.

The device information is displayed. You can scroll the screen by turning the rotary knob.

If a connection is established when IP Address > Method is set to Automatic in the interface settings (p. 193) (the LAN connection status icon in the upper right of the display is green), the automatically assigned IP address is displayed next to IP Address.



Inspection

Pre-inspection for withstanding voltage test and insulation resistance test

Applicable models for AC withstanding voltage (ACW): All models

Applicable models for DC withstanding voltage (DCW): 9301, 9311, 9303

Applicable models for insulation resistance (IR): 9300, 9301, 9311, 9303

Perform ACW, DCW, and IR tests by shorting the test leads, and determine the inspection results from those results. The test leads are consumable parts. Check them periodically for tears and breaks in the insulation.

WARNING

Risk of electric shock or fire.

- If a break or tear is found, stop using the test leads immediately.

1 Connect the low-voltage test lead (black) and high-voltage test lead (red) to the product (p.35).

2 Short the low-voltage test lead (black) and high-voltage test lead (red).

3 Set the test conditions.

For a withstanding voltage test, be sure to set the upper limit (p.57). For an insulation resistance test, set the judgement criteria unit (p.95) to the resistance and set the lower limit (p.94).

4 Press **START**.

The test starts.

5 Check the result.

Test type	Result	Inspection result
Withstanding voltage (ACW, DCW) test	Upper-FAIL or PROTECTION (Output Error or Over Load)	Normal.
	Other than the above	The test leads may be broken. If there are no breaks in the test leads, the product needs to be repaired.
Insulation resistance (IR) test	Lower-FAIL or PROTECTION (Output Error or Over Load)	Normal.
	Other than the above	The test leads may be broken. If there are no breaks in the test leads, the product needs to be repaired.

This completes the inspection.

If the product needs to be repaired, contact your Kikusui agent or distributor.

Pre-testing the earth continuity test

Applicable models: **9302**, **9303**

Perform a test by shorting the test leads for earth continuity testing and a test by opening the test leads, and determine the inspection results from those results. If the product needs to be repaired, contact your Kikusui agent or distributor.

The test leads are consumable parts. Check them periodically for tears and breaks in the insulation.

1 Connect the low-voltage test lead (black) and high-voltage test lead (red) (p.41).

2 Short the low-voltage test lead (black) and high-voltage test lead (red).

3 Set the upper limit (p.124) to on and lower limit (p.125) to off.

4 Press START.

The test starts.

5 Check the test result.

Judgment	Inspection result (when test leads are shorted)
PASS	Normal.
Upper-FAIL	The test leads may be broken. If there are no breaks in the test leads, the product needs to be repaired.

6 Press STOP.

7 Open the low-voltage test lead (black) and high-voltage test lead (red).

8 Press START.

The test starts.

9 Check the test result.

Judgment	Inspection result (when test leads are opened)
PASS	The product needs to be repaired.
Upper-FAIL	Normal.

This completes the pre-inspection.

Replacing Components

Replacing the backup battery

This product uses a lithium battery for memory backup. When the battery is low, the clock may become inaccurate or test conditions and the like may no longer be saved.

Battery life varies depending on the operating environment. As a guideline, we recommend that the battery be replaced once every three years. For information about replacing the battery, contact your Kikusui agent or distributor.

This product comes with an installed CR Coin Lithium Battery which contains Perchlorate Material. Disposal of this battery may be regulated due to environmental considerations.

See www.dtsc.ca.gov/hazardouswaste/perchlorate

Replacing the high voltage relay

The high voltage relay inside the TOS93 series is a consumable item. Though its life depends on usage conditions, we recommend you replace it once in every one million test cycles, along with internal inspection and cleaning. For information about replacing the high voltage relay, contact your Kikusui agent or distributor.

Periodic Calibration

The product is calibrated before shipment. To maintain long-term performance, we recommend the product be calibrated once a year.

You can set a calibration period by the calibration setting (Calibration) ([p. 186](#)).

To have your product calibrated, contact your Kikusui agent or distributor.

Specifications

Unless specified otherwise, the specifications are for the following settings and conditions.

- The product is warmed up for at least 30 minutes.

The used terminology is as follows:

- TYP: These are typical values that are representative of situations where the product operates in an environment with an ambient temperature of 23 °C (73.4 °F). These values do not guarantee the performance of this product.
- setting: Indicates a setting.
- range: Indicates the rated value of each range.
- reading: Indicates a readout value.
- The various tests are abbreviated as follows:
ACW: AC withstanding voltage, DCW: DC withstanding voltage, IR: insulation resistance, EC: earth continuity
- The following table shows which tests are supported by each model.

	ACW	DCW	IR	EC
TOS9300	✓	n/a	✓	n/a
TOS9301	✓	✓	✓	n/a
TOS9311	✓	✓	✓	n/a
TOS9302	✓	n/a	n/a	✓
TOS9303	✓	✓	✓	✓

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<i>Insulation Resistance Test Section</i>	209
<i>Earth Continuity Test Section</i>	216
<i>Interface</i>	218
<i>Other Functions</i>	219
<i>General Specifications</i>	220
<i>External Dimensions</i>	221

Withstanding Voltage Test Section

Applicable models for ACW: All models

Applicable models for DCW: **9301**, **9311**, **9303**,

Output function

Item	TOS9300, TOS9301, TOS9302, TOS9303	TOS9311		
AC output section (ACW only)	Output voltage range	0.050 kV to 5.000 kV	0.050 kV to 10.000 kV	
	Output voltage resolution	1 V	1 V	
	Output voltage setting accuracy (at no load)	$\pm(1.2\% \text{ of setting} + 0.02 \text{ kV})$	$\pm(1.2\% \text{ of setting} + 0.02 \text{ kV})$	
	Max. rated load ¹	500 VA (5 kV/100 mA)	500 VA (10 kV/50 mA)	
	Max. rated current	100 mA (when the output voltage is 0.2 kV or higher)	50 mA (when the output voltage is 0.5 kV or higher)	
	Transformer rating	500 VA	500 VA	
	Output voltage waveform ²	Sine	Sine	
	Output voltage waveform distortion	2 % or less. (when the output voltage is 0.5 kV or higher and no load or a pure resistive load is connected)	2 % or less (when the output voltage is 1.0 kV or more and the pure resistive load is 200 k Ω)	
	Crest factor	$\sqrt{2} \pm 3\%$ (800 V or more)	$\sqrt{2} \pm 3\%$ (1500 V or more)	
	Frequency	50 Hz/60 Hz	50 Hz/60 Hz	
	Frequency accuracy	$\pm 0.1\%$	$\pm 0.1\%$	
	Voltage regulation ³	$\pm 3\%$ or less	$\pm 3\%$ or less	
	Short-circuit current	200 mA or more (output voltage 0.5 kV or higher)	100 mA or more (output voltage 1.0 kV or higher)	
	Output method	PWM switching	PWM switching	
DC output section (DCW only)	Output voltage range	0.050 kV to 7.200 kV	0.100 kV to 10.000 kV	
	Output voltage resolution	1 V	1 V	
	Output voltage setting accuracy	$\pm(1.2\% \text{ of setting} + 0.02 \text{ kV})$	$\pm(1.2\% \text{ of setting} + 0.02 \text{ kV})$	
	Max. rated load ¹	100 W (5 kV/20 mA, 7.2 kV/13.9 mA)	100 W (5 kV/20 mA, 10 kV/10 mA)	
	Max. rated current	20 mA	20 mA	
	Ripple (TYP)	7.2 kV no load	20 Vp-p	N/A
		10 kV no load	N/A	30 Vp-p
		Max. rated load	50 Vp-p	100 Vp-p
	Voltage regulation ³	1 % or less	1 % or less	
Short-circuit current (TYP)	100 mA (200 mA peak)	50 mA (100 mA peak)		
Discharge function	Forced discharge after test completion (discharge resistance: 125 k Ω)			
Start voltage	The voltage at the start of the test can be set.			
End voltage	The voltage at the end of Fall Time can be set.	The voltage at the end of Fall Time can be set.		
Start/End voltage setting range	1 % to 99 % of the test voltage			
Start/End voltage resolution	1 %			
Output voltage monitor function	If the output voltage exceeds $\pm(10\% \text{ of setting} + 0.05 \text{ kV})$, the output is turned off, and the protection function is activated.			

- When tests are performed consecutively, output time limit and rest time may become necessary depending on the upper limit setting (p.57).
- If an AC voltage is applied to a capacitive load, the output voltage may rise higher than at no load depending on the load capacitance. Further, waveform distortions may occur if an EUT whose capacitance is dependent on voltage (for example, an EUT that consists of ceramic capacitors) is connected as the load. However, if the test voltage is 1.5 kV, the effect of a capacitance of 1 000 pF or less can be ignored. Because the product's high-voltage power supply uses the PWM switching method, if the test voltage is 500 V or less, the switching and spike noise proportions are large. The lower the test voltage, the greater the waveform is distorted.
- When changing from maximum rated load to no load.

Measurement function

Item		TOS9300, TOS9301, TOS9302, TOS9303	TOS9311
Voltmeter	Measurement range	0.00 kV to 7.50 kV AC/DC	0.000 kV to 10.500 kV AC/DC
	Resolution	0.1 V	0.1 V
	Accuracy	$\pm(1.2\% \text{ of reading} + 5 \text{ V})$	$\pm(1.2\% \text{ of reading} + 5 \text{ V})$
	Response	Can be switched between true rms and mean-value response rms conversion. Peak-value response in a separate system (the peak-value response is for measuring the dielectric breakdown voltage while rising)	
	Hold function	The voltage measurement after a test is finished is held while the pass/fail judgment is displayed.	
Ammeter ^{1 2}	Measurement range	AC: 0.00 mA to 110 mA (Current including the active component and reactive component) DC: 0.00 mA to 22 mA	AC: 0.00 mA to 55 mA (Current including the active component and reactive component) DC: 0.00 mA to 22 mA
	Accuracy (active component)	$\pm(1\% \text{ of reading} + 2 \mu\text{A})$	$\pm(1\% \text{ of reading} + 2 \mu\text{A})$
	Response	Can be switched between true rms and mean-value response rms conversion.	
	Hold function	The current measurement after a test is finished is held while the pass judgment is displayed.	
	Offset cancel function	Cancels up to 10 mA of the current flowing through the insulation resistance and stray capacitance components across output cables and the like (resistance component only for DC tests). OFF function available.	
	Calibration	Active component: Calibrated with the rms of a sine wave using a pure resistive load. Reactive component: Not calibrated.	

1. During AC voltage tests, current also flows in the stray capacitance of items such as the test leads and tools. For details on stray capacitance, see "Stray Capacitance of AC Withstanding Voltage Tests" ([p.229](#)).
2. When the temperature and humidity are high, erroneous current from the product's internal and external high-voltage wiring sections to ground increases. When the humidity exceeds 70 %, an erroneous current of about 50 μA may be generated.

Judgment function

Item	TOS9300, TOS9301, TOS9302, TOS9303		TOS9311
Current judgment operation	Function		The output is shut off when a judgment is made. Buzzer volume level can be set in the range of 0 (OFF) to 10 for pass and fail separately. In an auto test, the buzzer is valid only for the judgment that takes place at the end of the program.
	UPPER FAIL	Judgment method	UPPER FAIL results when a current greater than or equal to the Upper limit is detected. For DCW, judgment is not made during the judgment delay (Judge Delay).
		Display	"Upper-FAIL" is displayed.
		Buzzer	On
		SIGNAL I/O	The Upper-FAIL signal is generated continuously until a STOP signal is received.
	LOWER FAIL	Judgment method	LOWER FAIL results when a current less than or equal to the Lower limit is detected. Judgment is not made during Voltage rise time or Voltage fall time of an ACW test.
		Display	"Lower-FAIL" is displayed.
		Buzzer	On
		SIGNAL I/O	The Lower-FAIL signal is generated continuously until a STOP signal is received.
	PASS	Judgment method	PASS judgment is made if Upper-FAIL or Lower-FAIL has not occurred when the test time elapses.
		Display	"PASS" is displayed.
		Buzzer	On (fixed to 50 ms)
SIGNAL I/O		The PASS signal is generated for the length of time specified by the Pass Hold setting. If Pass Hold is set to Infinity, the PASS signal is generated continuously until a STOP signal is received.	
Voltage rise rate judgment operation	Function		Monitors the voltage rise rate during Voltage rise time. The output is shut off when a judgment is made. Buzzer volume level can be set in the range of 0 (OFF) to 10 for pass and fail separately. This is valid when Auto setting of the judgment delay (Delay Auto) is set to on and the output voltage is 200 V or more.
	dV/dt FAIL	Judgment method	When the voltage rise rate (dV/dt) is less than approx. 1 V/s.
		Display	"Upper-FAIL (dV/dt)" is displayed.
		Buzzer	ON
		SIGNAL I/O	The U FAIL signal is generated continuously until a STOP signal is received.
	Upper limit setting range		AC: 0.01 mA to 110.00 mA, DC: 0.01 mA to 21.00 mA
Lower limit setting range		AC: 0.00 mA to 109.99 mA, DC: 0.00 mA to 20.99 mA, OFF. Setting 0.00 is equivalent to OFF.	AC: 0.00 mA to 54.99 mA, DC: 0.00 mA to 20.99 mA, OFF. Setting 0.00 is equivalent to OFF.
Judgment accuracy ^{1 2}		±(1 % of setting + 5 μA)	±(1 % of setting + 5 μA)
Current detection method		Compares to the reference value using the following method. Calculate true rms values, convert mean-value responses to rms values	
Response speed (filter) switching		Switches the current detection response speed (sensitivity) used in UPPER FAIL judgment between five levels in ACW and DCW tests.	

1. During AC voltage tests, current also flows in the stray capacitance of items such as the test leads and tools. For details on stray capacitance, see "Stray Capacitance of AC Withstanding Voltage Tests" (p.229).
2. When the temperature and humidity are high, erroneous current from the product's internal and external high-voltage wiring sections to ground increases. When the humidity exceeds 70 %, an erroneous current of about 50 μA may be generated.

Timer function

Item	Specifications
Voltage rise time settings range	0.1 s to 200.0 s
Voltage fall time setting time ¹	0.1 s to 200.0 s, OFF
Test time setting range	0.1 s to 1000.0 s, OFF
Judgment delay (Judge Delay) setting range ²	0.1 s to 100.0 s, AUTO ³ (DCW only)
Accuracy	±(100 ppm of setting + 20 ms) (excluding the fall time)

1. This setting is used only when a PASS judgment occurs in ACW and DCW tests. During a DCW test, the voltage may not drop all the way within the set time because of the electrostatic capacity inside the product and the EUT.
2. Less than the sum of the rise time and fall time.
3. If Delay Auto is set to on, LOWER judgment is not made until the charge time ends.

Other specifications

Item		TOS9300, TOS9301, TOS9302, TOS9303	TOS9311
Analog monitor ¹	Function	Outputs a voltage signal according to the current waveform or voltage waveform	
	I	Current waveform: Scale 50 mA/1 V	Current waveform: Scale 50 mA/1 V
	V	Voltage waveform: Scale 1 kV/1 V	Voltage waveform: Scale 2 kV/1 V
Grounding mode (GND)	Function	Can be switched between Low and Guard.	
	Low	GND is connected to the low terminal. Measures the current flowing across the low terminal and chassis (normal applications).	
	Guard ²	GND is connected to Guard. Measures only the current flowing through the low terminal (current flowing through the chassis is not measured) (high sensitivity, high accuracy measurement applications).	

1. Monitor signal output is isolated from the chassis (earth). If you connect an oscilloscope or an external device whose BNC shield is grounded, be sure to set the grounding mode (GND) to Guard. The value is not calibrated.
2. If there is a possibility that the EUT or tools and the like will be grounded or if you are uncertain, do not set GND to Guard. Doing so is extremely dangerous because the ammeter will be shorted and will not be able to measure current. For normal applications, set GND to Low.

Insulation Resistance Test Section

Applicable models: **9300**, **9301**, **9311**, **9303**

Output function

Item	TOS9300, TOS9301, TOS9303		TOS9311	
Negative polarity	Output voltage range	-25 V to -1000 V		
	Output voltage resolution	1 V		
	Output voltage setting accuracy	$\pm(1.2\% \text{ of setting} + 2 \text{ V})$		
	Max. rated load	1 W (-1000 V/1 mA)		
	Ripple	1 kV no load	2 Vp-p or less	
		Max. rated load	10 Vp-p or less	
	Short-circuit current	12 mA or less		
	Discharge function	Forced discharge after test completion (discharge resistance: 20 k Ω)		
Positive polarity ¹	Output voltage range	+50 V to +7200 V		
	Output voltage resolution	1 V		
	Output voltage setting accuracy	$\pm(1.2\% \text{ of setting} + 0.02 \text{ kV})$		
	Max. rated load	7.2 W (7200 V/1 mA)		
	Ripple	1 kV no load	20 Vp-p or less	
		Max. rated load	50 Vp-p or less	
	Short-circuit current	100 mA (TYP) (200 mA peak)		
	Discharge function	Forced discharge after test completion (discharge resistance: 125 k Ω)		
Max. rated current	1 mA		1 mA	
Voltage regulation	1 % or less (when changing from maximum rated load to no load)			
Output voltage monitor function	If the output voltage exceeds $\pm(10\% \text{ of setting} + 50 \text{ V})$, the output is turned off, and the protection function is activated.			

1. TOS9300 are not supported.

Measurement function

Voltmeter

Item	TOS9300, TOS9301, TOS9303	TOS9311
Measurement range	Negative polarity: 0 Vdc to -1200 Vdc Positive polarity: 0 Vdc to 7500 Vdc	Negative polarity: 0 Vdc to -1200 Vdc Positive polarity: 0 kVdc to 10.500 kVdc
Resolution	0.1 V	
Accuracy	Negative polarity: $\pm(1\% \text{ of reading} + 1 \text{ V})$ Positive polarity: $\pm(1.2\% \text{ of reading} + 5 \text{ V})$	Negative polarity: $\pm(1\% \text{ of reading} + 1 \text{ V})$ Positive polarity: $\pm(1.2\% \text{ of reading} + 5 \text{ V})$

Resistance meter (TOS9300, TOS9301, TOS9303)

Item	TOS9300, TOS9301, TOS9303	
Measurement range	0.001 MΩ to 100.0 GΩ (in the range of maximum rated current of 1 mA to 5 nA)	
Accuracy ^{1 2} (when GND is set to Guard) (i: measured current) (R: measurement resistance)	5 nA ≤ i ≤ 50 nA ³	500.000 MΩ ≤ R < 1.000 GΩ: ±(15 % of reading + 0.5 MΩ) 1.000 GΩ ≤ R < 10.000 GΩ: ±(15 % of reading + 5 MΩ) 10.000 GΩ ≤ R ≤ 100.000 GΩ: ±(20 % of reading + 200 MΩ)
	50 nA < i ≤ 100 nA ³	200.000 MΩ ≤ R < 1.000 GΩ: ±(10 % of reading + 0.5 MΩ) 1.000 GΩ ≤ R < 10.000 GΩ: ±(10 % of reading + 5 MΩ) 10.000 GΩ ≤ R < 50.000 GΩ: ±(10 % of reading + 50 MΩ) 50.000 GΩ ≤ R ≤ 100.000 GΩ: ±(20 % of reading + 200 MΩ)
	100 nA < i ≤ 200 nA ⁴	100.000 MΩ ≤ R < 1.000 GΩ: ±(7 % of reading + 0.5 MΩ) 1.000 GΩ ≤ R < 2.000 GΩ: ±(7 % of reading + 5 MΩ) 2.000 GΩ ≤ R < 10.000 GΩ: ±(7 % of reading + 10 MΩ) 10.000 GΩ ≤ R < 100.000 GΩ: ±(7 % of reading + 100 MΩ)
	200 nA < i ≤ 1 μA ⁴	10.000 MΩ ≤ R < 100.000 MΩ: ±(5 % of reading + 0.05 MΩ) 100.000 MΩ ≤ R < 1.000 GΩ: ±(5 % of reading + 0.5 MΩ) 1.000 GΩ ≤ R < 10.000 GΩ: ±(5 % of reading + 5 MΩ) 10.000 GΩ ≤ R < 50.000 GΩ: ±(5 % of reading + 50 MΩ)
	1 μA < i ≤ 1 mA ⁴	0.001 MΩ ≤ R < 10.000 MΩ: ±(2 % of reading + 0.003 MΩ) 10.000 MΩ ≤ R < 100.000 MΩ: ±(2 % of reading + 0.03 MΩ) 100.000 MΩ ≤ R < 1.000 GΩ: ±(2 % of reading + 0.3 MΩ) 1.000 GΩ ≤ R < 10.000 GΩ: ±(2 % of reading + 3 MΩ)
Accuracy ⁵ (when GND is set to Low) (i: measured current) (R: measurement resistance)	5 nA ≤ i ≤ 50 nA ³	500.000 MΩ ≤ R < 1.000 GΩ: ±(25 % of reading + 0.5 MΩ) 1.000 GΩ ≤ R < 10.000 GΩ: ±(25 % of reading + 5 MΩ) 10.000 GΩ ≤ R ≤ 100.000 GΩ: ±(30 % of reading + 200 MΩ)
	50 nA < i ≤ 100 nA ³	200.000 MΩ ≤ R < 1.000 GΩ: ±(20 % of reading + 0.5 MΩ) 1.000 GΩ ≤ R < 10.000 GΩ: ±(20 % of reading + 5 MΩ) 10.000 GΩ ≤ R < 50.000 GΩ: ±(20 % of reading + 50 MΩ) 50.000 GΩ ≤ R ≤ 100.000 GΩ: ±(30 % of reading + 200 MΩ)
	100 nA < i ≤ 200 nA ⁴	100.000 MΩ ≤ R < 1.000 GΩ: ±(10 % of reading + 0.5 MΩ) 1.000 GΩ ≤ R < 2.000 GΩ: ±(10 % of reading + 5 MΩ) 2.000 GΩ ≤ R < 10.000 GΩ: ±(10 % of reading + 10 MΩ) 10.000 GΩ ≤ R < 100.000 GΩ: ±(10 % of reading + 100 MΩ)
	200 nA < i ≤ 1 μA ⁴	10.000 MΩ ≤ R < 100.000 MΩ: ±(5 % of reading + 0.05 MΩ) 100.000 MΩ ≤ R < 1.000 GΩ: ±(5 % of reading + 0.5 MΩ) 1.000 GΩ ≤ R < 10.000 GΩ: ±(5 % of reading + 5 MΩ) 10.000 GΩ ≤ R < 50.000 GΩ: ±(5 % of reading + 50 MΩ)
	1 μA < i ≤ 1 mA ⁴	0.001 MΩ ≤ R < 10.000 MΩ: ±(2 % of reading + 0.003 MΩ) 10.000 MΩ ≤ R < 100.000 MΩ: ±(2 % of reading + 0.03 MΩ) 100.000 MΩ ≤ R < 1.000 GΩ: ±(2 % of reading + 0.3 MΩ) 1.000 GΩ ≤ R < 10.000 GΩ: ±(2 % of reading + 3 MΩ)
Hold function	The resistance measurement after a test is finished is held while the pass judgment is displayed.	
Offset cancel function	Cancels up to 2000 GΩ of the unnecessary insulation resistance across output cables and the like. OFF function available.	

- Humidity: 70 %rh or less (no condensation), when there is no interference caused by wobbly test leads or other problems.
- If the grounding mode (GND) is set to low in a highly humid environment, leakage current to ground will be generated from the high-voltage wiring sections inside the product and the high-voltage wiring sections between the product and the EUT. This leakage current ranges from several nA to several tens of nA depending on the usage and wiring conditions of the optional TOS9320 high voltage scanner and greatly affects measurement accuracy. The effects of leakage current can be reduced by making measurements with the offset enabled.
- Add 10 % to the accuracy when measuring 100 V or less.
- Add 10 % to the accuracy when measuring 100 V or less.
- When the measured current is limited to 100 nA or more (no condensation) when the humidity is 50 %rh or less, no external disturbance is present such as swinging test leads, and the offset is enabled.

Resistance meter (TOS9311)

Item	TOS9311	
Measurement range	0.001 MΩ to 100.0 GΩ (in the range of maximum rated current of 1 mA to 5 nA)	
Accuracy ^{1 2} (when GND is set to Guard) (i: measured current) (R: measurement resistance)	5 nA ≤ i ≤ 50 nA ³	500.000 MΩ ≤ R < 1.000 GΩ: ±(15 % of reading + 0.5 MΩ) 1.000 GΩ ≤ R < 10.000 GΩ: ±(15 % of reading + 5 MΩ) 10.000 GΩ ≤ R ≤ 100.000 GΩ: ±(20 % of reading + 200 MΩ)
	50 nA < i ≤ 100 nA ³	200.000 MΩ ≤ R < 1.000 GΩ: ±(10 % of reading + 0.5 MΩ) 1.000 GΩ ≤ R < 10.000 GΩ: ±(15 % of reading + 5 MΩ) 10.000 GΩ ≤ R < 50.000 GΩ: ±(10 % of reading + 50 MΩ) 50.000 GΩ ≤ R ≤ 100.000 GΩ: ±(20 % of reading + 200 MΩ)
	100 nA < i ≤ 200 nA ⁴	100.000 MΩ ≤ R < 1.000 GΩ: ±(7 % of reading + 0.5 MΩ) 1.000 GΩ ≤ R < 2.000 GΩ: ±(7 % of reading + 5 MΩ) 2.000 GΩ ≤ R < 10.000 GΩ: ±(7 % of reading + 10 MΩ) 10.000 GΩ ≤ R ≤ 100.000 GΩ: ±(7 % of reading + 100 MΩ)
	200 nA < i ≤ 1 μA ⁴	10.000 MΩ ≤ R < 100.000 MΩ: ±(5 % of reading + 0.05 MΩ) 100.000 MΩ ≤ R < 1.000 GΩ: ±(5 % of reading + 0.5 MΩ) 1.000 GΩ ≤ R < 10.000 GΩ: ±(5 % of reading + 5 MΩ) 10.000 GΩ ≤ R < 50.000 GΩ: ±(5 % of reading + 50 MΩ)
	1 μA < i ≤ 1 mA ⁴	0.001 MΩ ≤ R < 10.000 MΩ: ±(2 % of reading + 0.003 MΩ) 10.000 MΩ ≤ R < 100.000 MΩ: ±(2 % of reading + 0.03 MΩ) 100.000 MΩ ≤ R < 1.000 GΩ: ±(2 % of reading + 0.3 MΩ) 1.000 GΩ ≤ R < 10.000 GΩ: ±(2 % of reading + 3 MΩ)
Accuracy ⁵ (when GND is set to Low) (i: measured current) (R: measurement resistance)	5 nA ≤ i ≤ 50 nA ³	500.000 MΩ ≤ R < 1.000 GΩ: ±(35 % of reading + 0.5 MΩ) 1.000 GΩ ≤ R < 10.000 GΩ: ±(35 % of reading + 5 MΩ) 10.000 GΩ ≤ R ≤ 100.000 GΩ: ±(40 % of reading + 200 MΩ)
	50 nA < i ≤ 100 nA ³	200.000 MΩ ≤ R < 1.000 GΩ: ±(30 % of reading + 0.5 MΩ) 1.000 GΩ ≤ R < 10.000 GΩ: ±(30 % of reading + 5 MΩ) 10.000 GΩ ≤ R < 50.000 GΩ: ±(30 % of reading + 50 MΩ) 50.000 GΩ ≤ R ≤ 100.000 GΩ: ±(40 % of reading + 200 MΩ)
	100 nA < i ≤ 200 nA ⁴	100.000 MΩ ≤ R < 1.000 GΩ: ±(10 % of reading + 0.5 MΩ) 1.000 GΩ ≤ R < 2.000 GΩ: ±(10 % of reading + 5 MΩ) 2.000 GΩ ≤ R < 10.000 GΩ: ±(10 % of reading + 10 MΩ) 10.000 GΩ ≤ R ≤ 100.000 GΩ: ±(10 % of reading + 100 MΩ)
	200 nA < i ≤ 1 μA ⁴	10.000 MΩ ≤ R < 100.000 MΩ: ±(5 % of reading + 0.05 MΩ) 100.000 MΩ ≤ R < 1.000 GΩ: ±(5 % of reading + 0.5 MΩ) 1.000 GΩ ≤ R < 10.000 GΩ: ±(5 % of reading + 5 MΩ) 10.000 GΩ ≤ R < 50.000 GΩ: ±(5 % of reading + 50 MΩ)
	1 μA < i ≤ 1 mA ⁴	0.001 MΩ ≤ R < 10.000 MΩ: ±(2 % of reading + 0.003 MΩ) 10.000 MΩ ≤ R < 100.000 MΩ: ±(2 % of reading + 0.03 MΩ) 100.000 MΩ ≤ R < 1.000 GΩ: ±(2 % of reading + 0.3 MΩ) 1.000 GΩ ≤ R < 10.000 GΩ: ±(2 % of reading + 3 MΩ)
Hold function	The resistance measurement after a test is finished is held while the pass judgment is displayed.	
Offset cancel function	Cancels up to 2000 GΩ of the unnecessary insulation resistance across output cables and the like. OFF function available.	

1. Humidity: 70 %rh or less (no condensation), when there is no interference caused by wobbly test leads or other problems.
2. If the grounding mode (GND) is set to low in a highly humid environment, leakage current to ground will be generated from the high-voltage wiring sections inside the product and the high-voltage wiring sections between the product and the EUT. This leakage current ranges from several nA to several tens of nA depending on the usage and wiring conditions of the optional TOS9320 high voltage scanner and greatly affects measurement accuracy. The effects of leakage current can be reduced by making measurements with the offset enabled.
3. Add 10 % to the accuracy when measuring 100 V or less.
4. Add 5 % to the accuracy when measuring 100 V or less.
5. When the measured current is limited to 100 nA or more (no condensation) when the humidity is 50 %rh or less, no external disturbance is present such as swinging test leads, and the offset is enabled.

Judgment function

Item		TOS9300, TOS9301, TOS9303, TOS9311	
Behavior based on judgment	Function		The output is shut off when a judgment is made. Buzzer volume level can be set in the range of 0 (OFF) to 10 for pass and fail separately. In an auto test, the buzzer is valid only for the judgment that takes place at the end of the program.
	UPPER FAIL	Judgment method	UPPER FAIL results when a resistance greater than or equal to the Upper limit is detected. Judgment is not made during or Voltage rise time.
		Display	"Upper-FAIL" is displayed.
		Buzzer	On
		SIGNAL I/O	The Upper-FAIL signal is generated continuously until a STOP signal is received.
	LOWER FAIL	Judgment method	LOWER FAIL results when a resistance less than or equal to the Lower limit is detected. Judgment is not made during the judgment delay (Judge Delay).
		Display	"Lower-FAIL" is displayed.
		Buzzer	On
		SIGNAL I/O	The Lower-FAIL signal is generated continuously until a STOP signal is received.
	PASS	Judgment method	PASS judgment is made if Upper-FAIL or Lower-FAIL has not occurred when the test time elapses.
		Display	"PASS" is displayed.
		Buzzer	On (fixed to 50 ms)
SIGNAL I/O		The PASS signal is generated for the length of time specified by the Pass Hold setting. If Pass Hold is set to Infinity, the PASS signal is generated continuously until a STOP signal is received.	
Voltage rise rate judgment operation	Function		The output is shut off when a judgment is made. Buzzer volume level can be set in the range of 0 (OFF) to 10 for pass and fail separately. Monitors the voltage rise rate during Voltage rise time. This is valid when Auto setting of the judgment delay (Delay Auto) is set to on and the output voltage is 200 V or more.
	dV/dt FAIL	Judgment method	When the voltage rise rate (dV/dt) is less than approx. 1 V/s.
		Display	"Lower-FAIL (dV/dt)" is displayed.
		Buzzer	ON
		SIGNAL I/O	The L FAIL signals are generated continuously until a STOP signal is received.
Upper limit setting range		0.001 MΩ to 100.000 GΩ (in the range up to the maximum rated current), OFF	
Lower limit setting range		0.000 MΩ to 99.999 GΩ (in the range up to the maximum rated current), OFF. Setting 0.000 is equivalent to OFF.	

Judgment Accuracy (TOS9300, TOS9301, TOS9303)

Item	TOS9300, TOS9301, TOS9303	
Accuracy ^{1 2 3} (when GND is set to Guard) (i: measured current) (R: measurement resistance)	$5 \text{ nA} \leq i \leq 50 \text{ nA}^4$	500.000 MΩ ≤ R < 1.000 GΩ: ±(15 % of setting + 0.51 MΩ) 1.000 GΩ ≤ R < 10.000 GΩ: ±(15 % of setting + 15 MΩ) 10.000 GΩ ≤ R ≤ 100.000 GΩ: ±(20 % of setting + 210 MΩ)
	$50 \text{ nA} < i \leq 100 \text{ nA}^4$	200.000 MΩ ≤ R < 1.000 GΩ: ±(10 % of setting + 0.51 MΩ) 1.000 GΩ ≤ R < 10.000 GΩ: ±(10 % of setting + 15 MΩ) 10.000 GΩ ≤ R < 50.000 GΩ: ±(10 % of setting + 60 MΩ) 50.000 GΩ ≤ R ≤ 100.000 GΩ: ±(20 % of setting + 210 MΩ)
	$100 \text{ nA} < i \leq 200 \text{ nA}^5$	100.000 MΩ ≤ R < 1.000 GΩ: ±(7 % of setting + 0.51 MΩ) 1.000 GΩ ≤ R < 2.000 GΩ: ±(7 % of setting + 15 MΩ) 2.000 GΩ ≤ R < 10.000 GΩ: ±(7 % of setting + 20 MΩ) 10.000 GΩ ≤ R < 100.000 GΩ: ±(7 % of setting + 110 MΩ)
	$200 \text{ nA} < i \leq 1 \text{ μA}^5$	10.000 MΩ ≤ R < 100.000 MΩ: ±(5 % of setting + 0.06 MΩ) 100.000 MΩ ≤ R < 1.000 GΩ: ±(5 % of setting + 0.51 MΩ) 1.000 GΩ ≤ R < 10.000 GΩ: ±(5 % of setting + 15 MΩ) 10.000 GΩ ≤ R < 50.000 GΩ: ±(5 % of setting + 60 MΩ)
	$1 \text{ μA} < i \leq 1 \text{ mA}^5$	0.001 MΩ ≤ R < 10.000 MΩ: ±(2 % of setting + 0.013 MΩ) 10.000 MΩ ≤ R < 100.000 MΩ: ±(2 % of setting + 0.04 MΩ) 100.000 MΩ ≤ R < 1.000 GΩ: ±(2 % of setting + 0.31 MΩ) 1.000 GΩ ≤ R < 10.000 GΩ: ±(2 % of setting + 13 MΩ)
Accuracy ⁶ (when GND is set to Low) (i: measured current) (R: measurement resistance)	$5 \text{ nA} \leq i \leq 50 \text{ nA}^4$	500.000 MΩ ≤ R < 1.000 GΩ: ±(25 % of setting + 0.51 MΩ) 1.000 GΩ ≤ R < 10.000 GΩ: ±(25 % of setting + 15 MΩ) 10.000 GΩ ≤ R ≤ 100.000 GΩ: ±(30 % of setting + 210 MΩ)
	$50 \text{ nA} < i \leq 100 \text{ nA}^4$	200.000 MΩ ≤ R < 1.000 GΩ: ±(20 % of setting + 0.51 MΩ) 1.000 GΩ ≤ R < 10.000 GΩ: ±(20 % of setting + 15 MΩ) 10.000 GΩ ≤ R < 50.000 GΩ: ±(20 % of setting + 60 MΩ) 50.000 GΩ ≤ R ≤ 100.000 GΩ: ±(30 % of setting + 210 MΩ)
	$100 \text{ nA} < i \leq 200 \text{ nA}^5$	100.000 MΩ ≤ R < 1.000 GΩ: ±(10 % of setting + 0.51 MΩ) 1.000 GΩ ≤ R < 2.000 GΩ: ±(10 % of setting + 15 MΩ) 2.000 GΩ ≤ R < 10.000 GΩ: ±(10 % of setting + 20 MΩ) 10.000 GΩ ≤ R < 100.000 GΩ: ±(10 % of setting + 110 MΩ)
	$200 \text{ nA} < i \leq 1 \text{ μA}^5$	10.000 MΩ ≤ R < 100.000 MΩ: ±(5 % of setting + 0.06 MΩ) 100.000 MΩ ≤ R < 1.000 GΩ: ±(5 % of setting + 0.51 MΩ) 1.000 GΩ ≤ R < 10.000 GΩ: ±(5 % of setting + 15 MΩ) 10.000 GΩ ≤ R < 50.000 GΩ: ±(5 % of setting + 60 MΩ)
	$1 \text{ μA} < i \leq 1 \text{ mA}^5$	0.001 MΩ ≤ R < 10.000 MΩ: ±(2 % of setting + 0.013 MΩ) 10.000 MΩ ≤ R < 100.000 MΩ: ±(2 % of setting + 0.04 MΩ) 100.000 MΩ ≤ R < 1.000 GΩ: ±(2 % of setting + 0.31 MΩ) 1.000 GΩ ≤ R < 10.000 GΩ: ±(2 % of setting + 13 MΩ)

1. Making judgments on 200 μA or less requires at least 3 seconds after the rise time ends. Making judgments when the low pass filter is set to on requires at least 10 seconds after the rise time ends.
2. Humidity: 70 %rh or less (no condensation), when there is no interference caused by wobbly test leads or other problems.
3. If the grounding mode (GND) is set to low in a highly humid environment, leakage current to ground will be generated from the high-voltage wiring sections inside the product and the high-voltage wiring sections between the product and the EUT. This leakage current ranges from several nA to several tens of nA depending on the usage and wiring conditions of the optional TOS9320 high voltage scanner and greatly affects measurement accuracy. The effects of leakage current can be reduced by making measurements with the offset enabled.
4. Add 10 % to the accuracy when measuring 100 V or less.
5. Add 5 % to the accuracy when measuring 100 V or less.
6. When the measured current is limited to 100 nA or more (no condensation) when the humidity is 50 %rh or less, no external disturbance is present such as swinging test leads, and the offset is enabled.

Judgment Accuracy (TOS9311)

Item		TOS9311
Accuracy ^{1 2 3} (when GND is set to Guard) (i: measured current) (R: measurement resistance)	$5 \text{ nA} \leq i \leq 50 \text{ nA}^4$	500.000 MΩ ≤ R < 1.000 GΩ: ±(15 % of reading + 0.51 MΩ) 1.000 GΩ ≤ R < 10.000 GΩ: ±(15 % of reading + 15 MΩ) 10.000 GΩ ≤ R < 100.000 GΩ: ±(20 % of reading + 210 MΩ)
	$50 \text{ nA} < i \leq 100 \text{ nA}^4$	200.000 MΩ ≤ R < 1.000 GΩ: ±(10 % of reading + 0.51 MΩ) 1.000 GΩ ≤ R < 10.000 GΩ: ±(10 % of reading + 15 MΩ) 10.000 GΩ ≤ R < 50.000 GΩ: ±(10 % of reading + 60 MΩ) 50.000 GΩ ≤ R ≤ 100.000 GΩ: ±(20 % of reading + 210 MΩ)
	$100 \text{ nA} < i \leq 200 \text{ nA}^5$	100.000 MΩ ≤ R < 1.000 GΩ: ±(7 % of reading + 0.51 MΩ) 1.000 GΩ ≤ R < 2.000 GΩ: ±(7 % of reading + 15 MΩ) 2.000 GΩ ≤ R < 10.000 GΩ: ±(7 % of reading + 20 MΩ) 10.000 GΩ ≤ R ≤ 100.000 GΩ: ±(7 % of reading + 110 MΩ)
	$200 \text{ nA} < i \leq 1 \text{ μA}^5$	10.000 MΩ ≤ R < 100.000 MΩ: ±(5 % of reading + 0.06 MΩ) 100.000 MΩ ≤ R < 1.000 GΩ: ±(5 % of reading + 0.51 MΩ) 1.000 GΩ ≤ R < 10.000 GΩ: ±(5 % of reading + 15 MΩ) 10.000 GΩ ≤ R < 50.000 GΩ: ±(5 % of reading + 60 MΩ)
	$1 \text{ μA} < i \leq 1 \text{ mA}^5$	0.001 MΩ ≤ R < 10.000 MΩ: ±(2 % of reading + 0.013 MΩ) 10.000 MΩ ≤ R < 100.000 MΩ: ±(2 % of reading + 0.04 MΩ) 100.000 MΩ ≤ R < 1.000 GΩ: ±(2 % of reading + 0.31 MΩ) 1.000 GΩ ≤ R < 10.000 GΩ: ±(2 % of reading + 13 MΩ)
Accuracy ⁶ (when GND is set to Low) (i: measured current) (R: measurement resistance)	$5 \text{ nA} \leq i \leq 50 \text{ nA}^4$	500.000 MΩ ≤ R < 1.000 GΩ: ±(35 % of reading + 0.51 MΩ) 1.000 GΩ ≤ R < 10.000 GΩ: ±(35 % of reading + 15 MΩ) 10.000 GΩ ≤ R ≤ 100.000 GΩ: ±(40 % of reading + 210 MΩ)
	$50 \text{ nA} < i \leq 100 \text{ nA}^4$	200.000 MΩ ≤ R < 1.000 GΩ: ±(30 % of reading + 0.51 MΩ) 1.000 GΩ ≤ R < 10.000 GΩ: ±(30 % of reading + 15 MΩ) 10.000 GΩ ≤ R < 50.000 GΩ: ±(30 % of reading + 60 MΩ) 50.000 GΩ ≤ R ≤ 100.000 GΩ: ±(40 % of reading + 210 MΩ)
	$100 \text{ nA} < i \leq 200 \text{ nA}^5$	100.000 MΩ ≤ R < 1.000 GΩ: ±(10 % of reading + 0.51 MΩ) 1.000 GΩ ≤ R < 2.000 GΩ: ±(10 % of reading + 15 MΩ) 2.000 GΩ ≤ R < 10.000 GΩ: ±(10 % of reading + 20 MΩ) 10.000 GΩ ≤ R ≤ 100.000 GΩ: ±(10 % of reading + 110 MΩ)
	$200 \text{ nA} < i \leq 1 \text{ μA}^5$	10.000 MΩ ≤ R < 100.000 MΩ: ±(5 % of reading + 0.06 MΩ) 100.000 MΩ ≤ R < 1.000 GΩ: ±(5 % of reading + 0.51 MΩ) 1.000 GΩ ≤ R < 10.000 GΩ: ±(5 % of reading + 15 MΩ) 10.000 GΩ ≤ R < 50.000 GΩ: ±(5 % of reading + 60 MΩ)
	$1 \text{ μA} < i \leq 1 \text{ mA}^5$	0.001 MΩ ≤ R < 10.000 MΩ: ±(2 % of reading + 0.013 MΩ) 10.000 MΩ ≤ R < 100.000 MΩ: ±(2 % of reading + 0.04 MΩ) 100.000 MΩ ≤ R < 1.000 GΩ: ±(2 % of reading + 0.31 MΩ) 1.000 GΩ ≤ R < 10.000 GΩ: ±(2 % of reading + 13 MΩ)

1. Making judgments on 200 μA or less requires at least 3 seconds after the rise time ends. Making judgments when the low pass filter is set to on requires at least 10 seconds after the rise time ends.
2. Humidity: 70 %rh or less (no condensation), when there is no interference caused by wobbly test leads or other problems.
3. If the grounding mode (GND) is set to low in a highly humid environment, leakage current to ground will be generated from the high-voltage wiring sections inside the product and the high-voltage wiring sections between the product and the EUT. This leakage current ranges from several nA to several tens of nA depending on the usage and wiring conditions of the optional TOS9320 high voltage scanner and greatly affects measurement accuracy. The effects of leakage current can be reduced by making measurements with the offset enabled.
4. Add 10 % to the accuracy when measuring 100 V or less.
5. Add 5 % to the accuracy when measuring 100 V or less.
6. When the measured current is limited to 100 nA or more (no condensation) when the humidity is 50 %rh or less, no external disturbance is present such as swinging test leads, and the offset is enabled.

Timer function

Item	Specifications
Voltage rise time settings range	0.1 s to 200.0 s
Test time setting range	0.1 s to 1000.0 s, OFF
Judgment delay (Judge Delay) setting range ¹	0.1 s to 100.0 s, AUTO ²
Accuracy ³	±(100 ppm of setting + 20 ms)

1. Less than the sum of the rise time and fall time.
2. If Delay Auto is set to on, UPPER judgment is not made until the charge time ends.
3. This excludes fall time.

Other specifications

Item	Specifications	
Grounding mode (GND)	Function	Can be switched between Low and Guard.
	Low	GND is connected to the low terminal. Measures the current flowing across the low terminal and chassis (normal applications).
	Guard ¹	GND is connected to Guard. Measures only the current flowing through the low terminal (current flowing through the chassis is not measured) (high sensitivity, high accuracy measurement applications).
Filter function	A low-pass filter can be inserted into the ammeter measurement circuit. ²	

1. If there is a possibility that the EUT or tools and the like will be grounded or if you are uncertain, do not set GND to Guard. Doing so is extremely dangerous because the ammeter will be shorted and will not be able to measure current. For normal applications, set GND to Low.
2. When the low pass filter is on, a judgment delay of at least 5 seconds and a test time are required.

Earth Continuity Test Section

Applicable models: **9302**, **9303**

Output function

Item		TOS9302, TOS9303
Current setting range ¹		3.0 A to 42.0 AAC/DC
Current setting resolution		0.1 A
Current setting accuracy		±(1 % of setting + 0.4 A)
AC	Maximum rated output ²	220 VA (at the output terminal)
	Distortion	2 % or less (20 A or more, using a 0.1 Ω pure resistive load)
	Frequency	Select 50 Hz or 60 Hz. Sine
	Frequency accuracy	±200 ppm
	Open terminal voltage	6 Vrms or less
	Output method	PWM switching
DC	Maximum rated output	220 W (at the output terminal)
	Ripple	±0.4 Ap-p or less (TYP)
	Open terminal voltage	6.0 V or less

1. No greater than the maximum rated output and resistance no greater than the output terminal voltage 5.4 V.
2. When tests are performed consecutively, output time limit and rest time may become necessary depending on the upper limit setting (p.132).

Measurement function

Item		TOS9302, TOS9303
Output ammeter	Measurement range	0.0 A to 45.0 A AC/DC
	Resolution	0.01 A
	Accuracy	±(1 % of reading + 0.2 A)
	Response	AC: true rms value; DC: mean value
	Hold function	The current measurement after a test is finished is held while the pass or fail judgment is displayed.
Output voltmeter	Measurement range	AC: 0.00 V to 6.00 V, DC: 0.00 V to 8.50 V
	Resolution	0.001 V
	Offset cancel function	Cancels up to 5 V (AC/DC) of the unnecessary voltage from measurements. OFF function available.
	Accuracy	±(1 % of setting + 0.02 V)
	Response	AC: true rms value; DC: mean value
Resistance meter	Measurement range ¹	1 mΩ to 600 mΩ
	Resolution	1 mΩ
	Offset cancel function	Cancels up to 10 Ω of the unnecessary resistance from measurements. OFF function available.
	Accuracy	±(2 % of reading + 3 mΩ)
	Hold function	The resistance measurement after a test is finished is held while the pass judgment is displayed.

1. Calculated from the measured output voltage and measured output current.

Judgment function

Item		TOS9302, TOS9303	
Behavior based on judgment	Function	Judgment based on resistance or sensing voltage can be selected. The output is shut off when a judgment is made. Buzzer volume level can be set in the range of 0 (OFF) to 10 for pass and fail separately. In an auto test, the buzzer is valid only for the judgment that takes place at the end of the program.	
	UPPER FAIL	Judgment method	UPPER FAIL results when a resistance greater than or equal to the Upper limit is detected or when a sensing voltage is detected. Judgment is not made during a contact check.
		Display	"Upper-FAIL" is displayed.
		Buzzer	On
		SIGNAL I/O	The Upper-FAIL signal is generated continuously until a STOP signal is received.
	LOWER FAIL	Judgment method	LOWER FAIL results when a resistance less than or equal to the lower limit (Lower) is detected or when a sensing voltage is detected.
		Display	"Lower-FAIL" is displayed.
		Buzzer	On
		SIGNAL I/O	The Lower-FAIL signal is generated continuously until a STOP signal is received.
	PASS	Judgment method	PASS judgment is made if Upper-FAIL or Lower-FAIL has not occurred when the test time elapses.
		Display	"PASS" is displayed.
		Buzzer	On (fixed to 50 ms)
SIGNAL I/O		The PASS signal is generated for the length of time specified by the Pass Hold setting. If Pass Hold is set to Infinity, the PASS signal is generated continuously until a STOP signal is received.	
Resistance judgment	Upper limit setting range	0.0001 Ω to 10.0000 Ω	
	Lower limit setting range	0.0000 Ω to 9.9999 Ω	
	Judgment accuracy	$\pm(2\%$ of setting + 3 m Ω)	
Voltage judgment	Upper limit setting range	0.001 V to 5.000 V AC/DC	
	Lower limit setting range	0.000 V to 4.999 V AC/DC	
	Judgment accuracy	$\pm(2\%$ of setting + 0.05 V)	
Calibration	Calibrated using a pure resistive load (with the rms of a sine wave for AC)		
Contact check function	Checks that current flows through the test leads and then starts the test. (OFF setting available)		

Timer function

Item	TOS9302, TOS9303
Current rise time settings range	0.1 s to 200.0 s
Current fall time setting time ¹	0.1 s to 200.0 s, OFF
Test time	0.1 s to 1000.0 s, OFF
Accuracy	$\pm(100$ ppm of setting + 20 ms) (excluding the fall time)

- This setting is used only when a PASS judgment occurs. During a DC test, the voltage may not drop all the way within the set time because of the electrostatic capacity inside the product and the EUT.

Interface

Item		Specifications	
REMOTE		MINI DIN 9-pin connector. Connect the following option to remotely control the starting and stopping of tests. <ul style="list-style-type: none"> • Remote control box RC01-TOS, RC02-TOS • High voltage test probe HP01A-TOS, HP02A-TOS (when the test voltage is 4 kVac 5 kVdc or less) (TOS9311 not supported.) 	
SIGNAL I/O	Function	D-sub 37-pin connector. For the pin arrangement, see "SIGNAL I/O Connector" (p.157). Enable/disable interlock, recall setup memories, recall auto test programs, start/stop testing, monitor the test and voltage generation status, monitor the test status, monitor judgment results, monitor the step execution status of auto tests, monitor the activation status of protection functions	
	Input specifications	Control	The input signals are all low-active control. The input terminal is pulled up to +12 V by a resistor. Leaving the input terminal open is equivalent to applying a high level signal.
		High-level input voltage	11 V to 15 V
		Low-level input voltage	0 V to 4 V
		Low-level input current	-5 mA max.
		Input time width	5 ms min.
	Output specifications	Output method	Open collector output (4.5 Vdc to 30 Vdc)
		Output withstanding voltage	30 Vdc
		Output saturation voltage	Approx. 1.1 V (25 °C, 77 °F)
		Maximum output current	400 mA (TOTAL)
STATUS OUT	Function	Output terminal of an option product.	
	Positive terminal (red)	Outputs +24 V. Use Status Out of CONFIG settings to set the output conditions.	
	Negative terminal (black)	+24 V circuit common.	
SCANNER		MINI DIN 8-pin connector. Terminal for the optional TOS9320 high voltage scanner (TOS9311 not supported). The maximum number of connections is 4 devices (16 channels).	
USB (host)		Standard type A socket Complies with the USB 2.0 specifications; data rate: 12 Mbps (Full speed)	
Remote control	Function	All functions except turning on and off the power, key lock, and auto test can be remotely controlled.	
	RS232C		D-sub 9-pin connector (EIA-232D compliant) Baudrate: 9600, 19200, 38400, 57600, 115200 bps
	USB (device)	Hardware	Standard Type B connector Complies with the USB 2.0 specifications; data rate: 480 Mbps (high speed) Complies with the USBTMC-USB488 device class specifications.
	LAN	Hardware	IEEE 802.3 100Base-TX/10Base-T Ethernet Auto-MDIX compliant. IPv4, RJ-45 connector. Complies LXI Class C, Specification 1.5
		Communication protocol	VXI-11, HISLIP, SCPI-RAW
Display		7-inch LCD. Displays settings, measured values, judgment results, etc.	

Other Functions

Item	TOS9300, TOS9301, TOS9302, TOS9303	TOS9311	
Auto test	Auto execution by combining ACW, DCW, IR, and EC.		
Test condition memory	Setup memory	Up to 51 test conditions (ACW, DCW, IR, EC) can be saved.	
	Program	Up to 25 program (ACW, DCW, IR, EC) combinations, each containing 100 steps, can be saved.	
Test result memory	Records up to 1000 latest test result of independent tests and auto tests.		
System clock	Function	For recording the calibration time and test times	
	Recordable time	Up to year 2038	
	Calibration period setting	Displays a warning at power-on when the specified period passes. Select whether to activate a protection function or only display a warning in the display area when a warning occurs.	
Backup battery life	3 years (at 25 °C, 77 °F)		
Peak value display	Function	Shows or hides peak values of current measurements and resistance measurements for each test.	
	OFF	Displays the current measurement during a DCW test or the insulation resistance measurement during an IR test for the duration of the test.	
	ON	Displays the maximum value of current measurement during a DCW test or the minimum value of insulation resistance measurement during an IR test for the duration of a single test.	
Test start method	Double Action	When you press STOP, "READY" is shown for 0.5 seconds. A test starts only when you press START within this period.	
	Momentary	Tests are only executed while the START switch is held down.	
	Start Long	A test starts only when the START switch is held down for at least 1 second.	
PASS judgment display time (Pass Hold)	Set the time to hold the pass judgment result display (0.05 s to 10.00 s) or hold it until STOP is pressed (Infinity).		
STOP signal disable (Fail Mode)	It is possible to set the instrument so that fail judgment results and PROTECTION mode cannot be released from a device connected to the SIGNAL I/O connector or REMOTE connector.		
Key lock	Lock the operation of the keys to prevent changing the settings or overwriting memory or programs by mistake.		
Protection functions	Common actions	If a protection function is activated during a test, the output is shut off and the test is stopped immediately. Conditions that cause a protection function to be activated are as follows.	
	Interlock	Interlock is activated.	
	Power Supply	There is an error in the power supply section.	
	Output Error	An output voltage outside of the following range is detected. ACW, DCW, IR: $\pm(10\% \text{ of setting} + 50 \text{ V})$ EC: $\pm(10\% \text{ of setting} + 2 \text{ A})$	
	Over Load	An output power or output current outside of the following range is detected. ACW: 550 VA DCW: 110 W or 50 mA, IR (7200 V test): 110 W or 25 mA IR (-1000 V test): 2 mA EC: 240 VA	An output power or output current outside of the following range is detected. ACW: 550 VA DCW: 110 W or 50 mA IR (10 kV test): 110 W or 25 mA IR (-1000 V test): 2 mA
	Over Heat	The internal temperature of the product is abnormally high.	
	Over Rating	During a withstanding voltage test, an output current is generated for a length of time that exceeds the output time limit (p.80).	
	Cal	The preset calibration period is exceeded.	
	Remote	The REMOTE connector is connected or disconnected.	
	Signal I/O	There is a change in the SIGNAL I/O connector's ENABLE signal.	
	Communication	An internal communication error is occurring.	
	Earth Fault	When the grounding mode (GND) is set to Guard, abnormal current flows from the high voltage output of this product to ground.	
	Scan I/F	While scanning, the interface cable is disconnected. Or, the channel-assigned scanner is not detected.	n/a

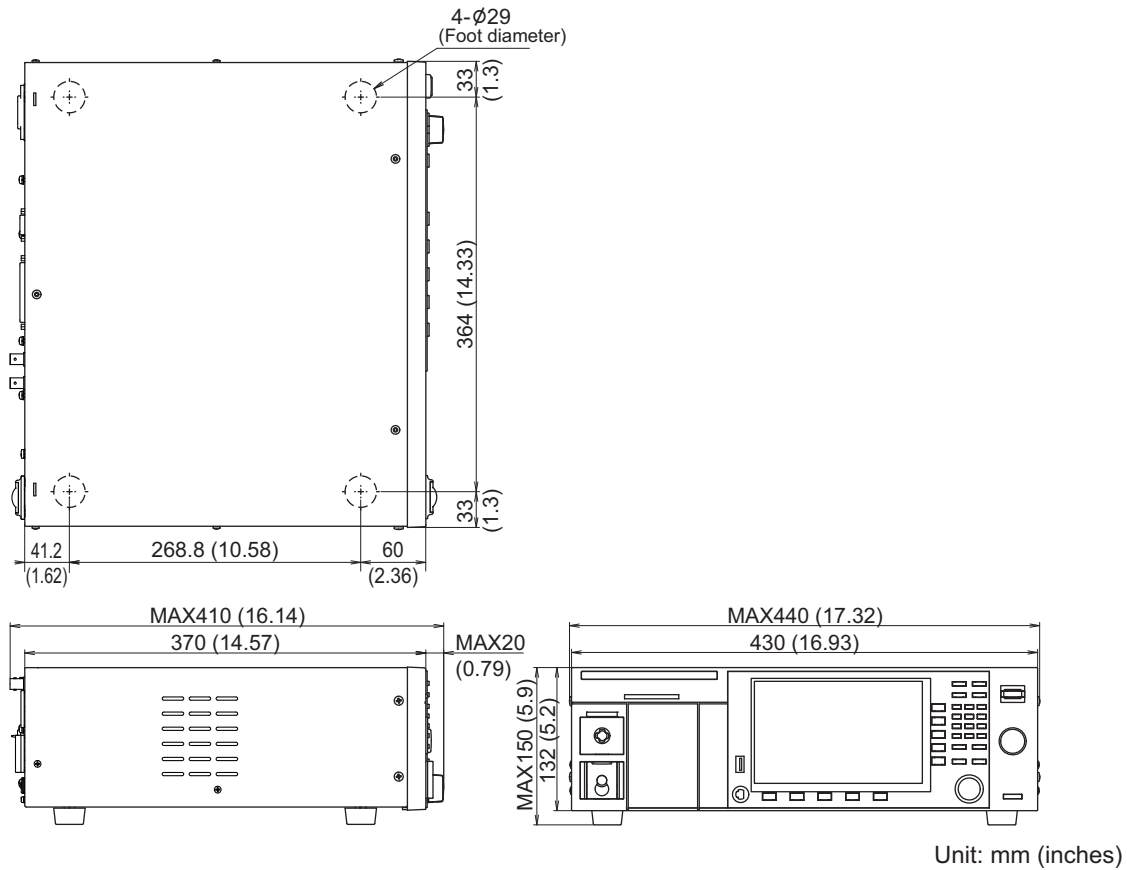
General Specifications

Item	Specifications		
Environment	Installation location		
	Spec guaranteed range	Temperature	5 °C to 35 °C (41 °F to 95 °F)
		Humidity	20 %rh to 80 %rh (no condensation)
	Operating range	Temperature	0 °C to 40 °C (32 °F to 104 °F)
		Humidity	20 %rh to 80 %rh (no condensation)
	Storage range	Temperature	-20 °C to 70 °C (-4 °F to 158 °F)
Humidity		90 %rh or less (no condensation)	
Power supply	Nominal voltage range (allowable voltage range)		
	Power consumption	No load (READY state)	100 VA or less
		Rated load	800 VA max.
	Allowable frequency range		47 Hz to 63 Hz
Insulation resistance (between AC LINE and chassis)		30 MΩ or more (500 Vdc)	
Withstanding voltage (between AC LINE and chassis)		1500 Vac, 1 minute, 20 mA or less	
Earth continuity		25 Aac, 0.1 Ω or less	
Dimensions		See "External Dimensions" (p.221).	
Weight		TOS9300: Approx. 17 kg (37.5 lb.), TOS9301: Approx. 18 kg (39.7 lb.), TOS9311: Approx. 27 kg (59.5 lb.), TOS9302: Approx. 20 kg (44.1 lb.), TOS9303: Approx. 21 kg (46.3 lb.)	
Accessories		See "Accessories" (p.9).	
Electromagnetic compatibility ^{2 3}		Complies with the requirements of the following directive and standards. EMC Directive 2014/30/EU EN 61326-1 (Class A ⁴) EN 55011 (Class A ⁴ , Group 1 ⁵) EN 61000-3-2 EN 61000-3-3 Applicable under the following conditions The maximum length of all cabling and wiring connected to the product must be less than 2.5 m. Shielded cables are being used when using the SIGNAL I/O. Use the included high voltage test leads. Electrical discharges are applied only to the EUT.	
Safety ¹		Complies with the requirements of the following directive and standards. Low Voltage Directive 2014/35/EU ³ EN 61010-1 (Class I ⁶ , Pollution Degree 2 ¹) EN61010-2-030	

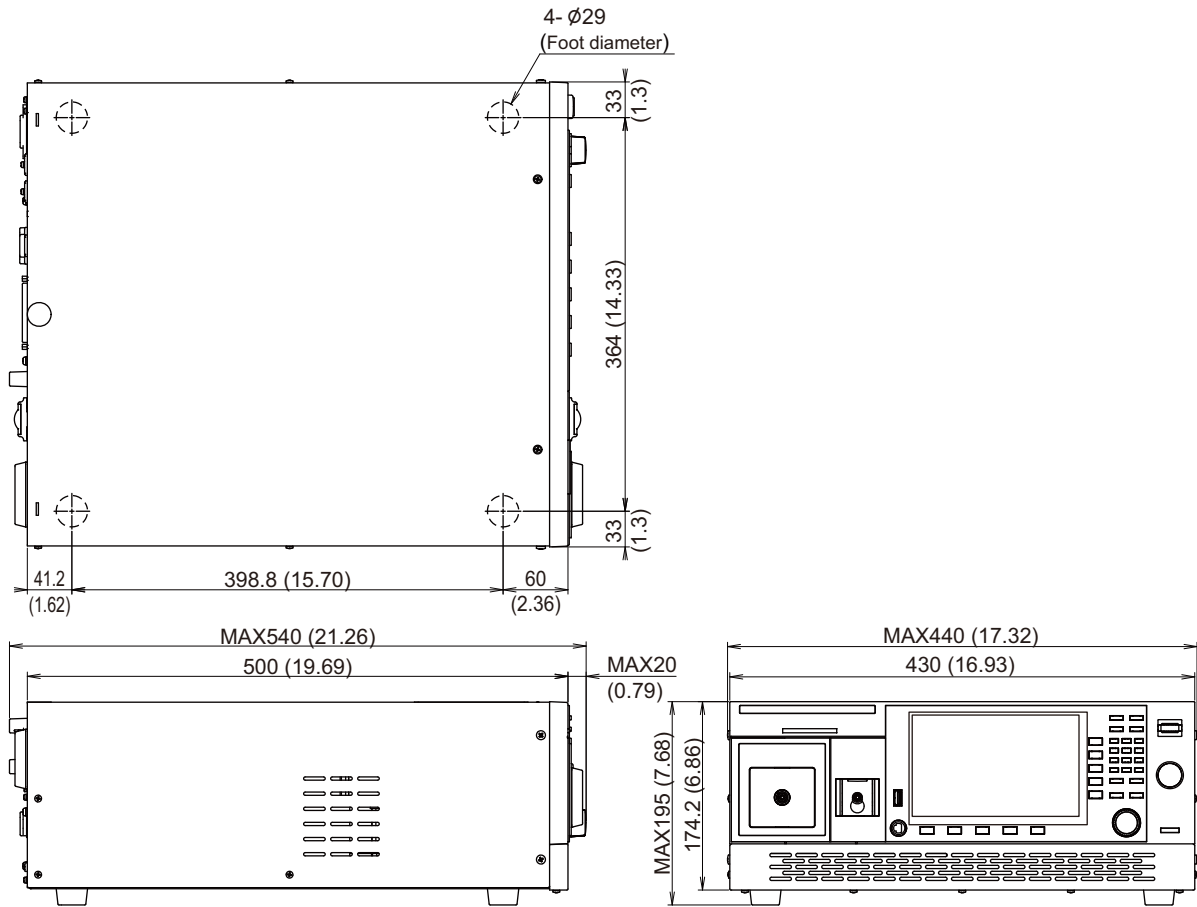
- Pollution is addition of foreign matter (solid, liquid or gaseous) that may produce a reduction of dielectric strength or surface resistivity. Pollution Degree 2 assumes that only non-conductive pollution will occur except for an occasional temporary conductivity caused by condensation.
- Does not apply to specially ordered or modified products.
- Only on models that have CE/UKCA marking on the panel.
- This is a Class A instrument. This product is intended for use in an industrial environment. This product may cause interference if used in residential areas. Such use must be avoided unless the user takes special measures to reduce electromagnetic emissions to prevent interference to the reception of radio and television broadcasts.
- This is a Group 1 instrument. This product does not generate and/or use intentionally radio-frequency energy, in the form of electromagnetic radiation, inductive and/or capacitive coupling, for the treatment of material or inspection/analysis purpose.
- This is a Class I instrument. Be sure to ground this product's protective conductor terminal. The safety of this product is guaranteed only when the product is properly grounded.

External Dimensions

TOS9300, TOS9301

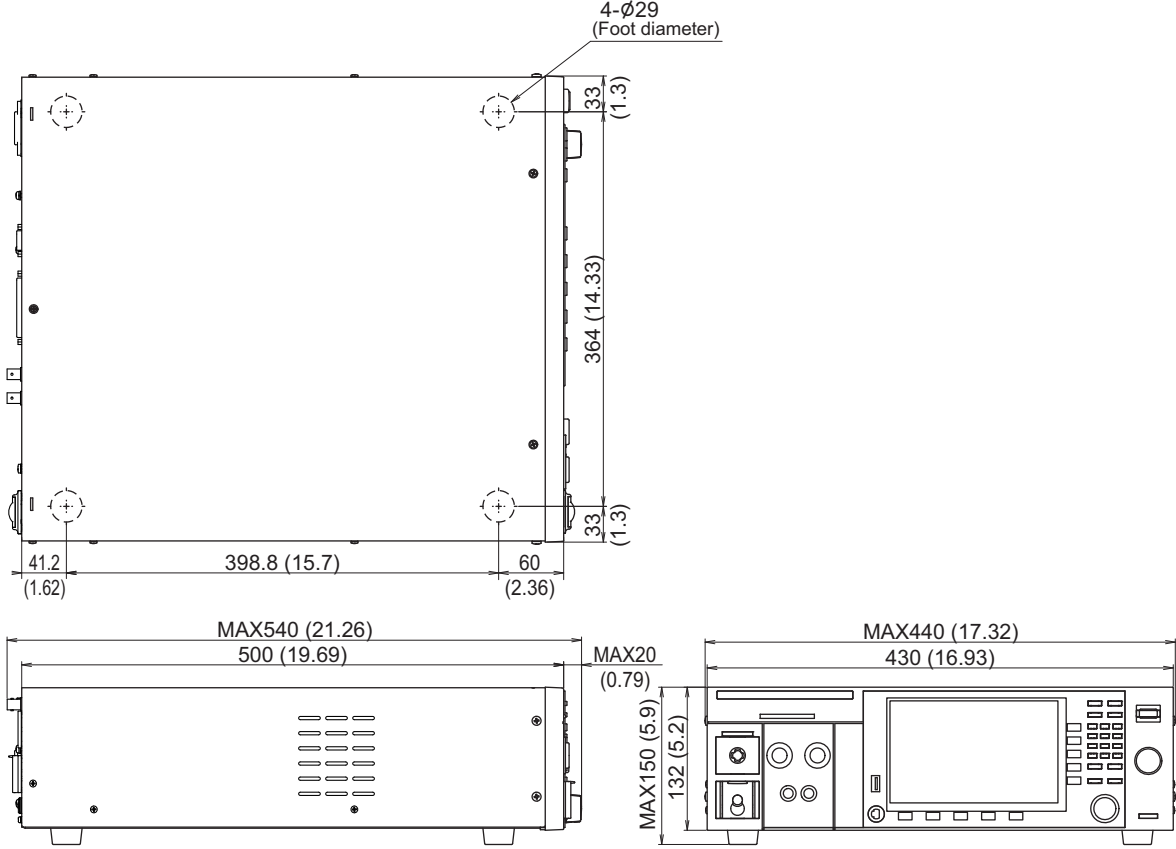


TOS9311



Unit: mm (inches)

TOS9302, TOS9303



Default Settings and Reset Settings

Factory default settings are indicated in the following tables. All items that have the check mark in the "Reset" column are returned to their factory default values upon reset.

Withstanding voltage (ACW/DCW) test conditions

Applicable models for AC withstanding voltage (ACW): All models

Applicable models for DC withstanding voltage (DCW): **9301**, **9311**, **9303**

ACW	DCW	Parameter	Factory default	Reset
✓	✓	Test current	0 V	✓
✓	✓	Limit voltage	For TOS9300, TOS9301, TOS9302, TOS9303: ACW: 5500 V DCW: 7500 V For TOS9311: ACW: 10.500 kV DCW: 10.500 kV	✓
✓	✓	Start/End Voltage	50 %	✓
✓	✓	Start Volt State	OFF	✓
✓	✓	End Volt State	OFF	✓
✓	n/a	Frequency	50 Hz	✓
✓	✓	Upper limit	0.01 mA	✓
✓	✓	Lower limit	OFF	✓
n/a	✓	Auto setting of the judgment delay (Delay Auto)	OFF (Judge Delay: 0.1 s)	✓
✓	✓	Test time	0.2 s	✓
✓	✓	Voltage rise time	0.1 s	✓
✓	✓	Voltage fall time	OFF	✓
n/a	✓	Discharge time	0.0 s	✓
n/a	✓	Discharge when interlock is activated (Discharge Interlock)	ON	✓
✓	✓	Current detection response speed (Filter)	LPF, Slow	✓
✓	✓	Grounding mode (GND)	Low	✓
✓	n/a	Current measurement mode (Current RMS)	TrueRMS	✓
✓	✓	Voltage measurement mode (Volt Measure)	ACW: RMS DCW: Average	✓
✓	✓	Peak value display (Display Peakhold)	OFF	✓
✓	n/a	Offset (Offset Real, Offset Imaginary)	OFF	✓
n/a	✓	Offset	OFF	✓
✓	✓	Setting scanner channels (Edit) (TOS9311 not supported)	All open	✓
✓	✓	Measurement screen display during the test (Display View)	Numeric	✓
✓	✓	Graph Scale	Auto	✓
✓	✓	Judgement criteria marker display (Judgement Marker)	ON	✓

Insulation resistance (IR) test conditions

Applicable models: **9300**, **9301**, **9311**, **9303**

Parameter	Factory default	Reset
Test current	0 V	✓
Limit voltage	1020 V	✓
Start voltage	OFF	✓
Upper limit	OFF	✓
Lower limit	0.001 GΩ	✓
Unit of criteria (Judge Type)	Ω	✓
Auto setting of the judgment delay (Delay Auto)	OFF (Judge Delay: 0.1 s)	✓
Test time	0.2 s	✓
Voltage rise time	0.1 s	✓
Discharge time	0.0 s	✓
Discharge when interlock is activated (Discharge Interlock)	ON	✓
Grounding mode (GND)	Low	✓
Using the low-pass filter	OFF	✓
Peak value display (Display Peakhold)	OFF	✓
Offset	OFF	✓
Setting scanner channels (Edit) (TOS9311 not supported)	All open	✓
Measurement screen display during the test (Display View)	Numeric	✓
Graph scale	Auto	✓
Graph axis setting (Graph Format)	VR-t	✓
Judgement criteria marker display (Judgement Marker)	ON	✓

Earth continuity (EC) test conditions

Applicable models: **9302**, **9303**

AC	DC	Parameter	Factory default	Reset
✓	✓	Test current	3.0 A	✓
✓	✓	Limit current	42.0 A	✓
✓	n/a	Frequency	50 Hz	✓
✓	✓	Upper limit	0.1000 Ω	✓
✓	✓	Lower limit	OFF	✓
✓	✓	Test time	0.2 s	✓
✓	✓	Current rise time	0.1 s	✓
✓	✓	Current fall time	OFF	✓
✓	✓	Terminal wiring method (Terminals Wire)	4Wire	✓
✓	✓	Contact check	OFF	✓
✓	✓	Peak value display (Display Peakhold)	OFF	✓
✓	✓	Offset	OFF	✓

Auto test (AUTO) settings

Parameter	Factory default	Reset
Registered programs	None	n/a
Program selection	No selection	✓

Memory function

Parameter	Factory default	Reset
Setup memory	Empty memory	n/a
Test result	None	✓

CONFIG settings

Parameter	Factory default	Reset
Power On	Resume	n/a
Watch Dog	Disable	n/a
Delay	60 s	n/a
Screen Saver	Disable	n/a
Delay	60 s	n/a
Key	n/a	n/a
Lock Level	High	n/a
Password	0000 (Disable)	n/a
Calibration	n/a	n/a
DUE	12 months	n/a
Protection Keep	Disable	n/a
Beeper	n/a	n/a
Key	Enable	n/a
Protection	Enable	n/a
SCPI Error	Enable	n/a
Volume Pass	3	n/a
Volume Fail	5	n/a
Fail Mode	Disable	n/a
Double Action	Disable	n/a
Start Long	Disable	n/a
Momentary	Disable	n/a
Pass Hold	0.2 s	n/a
Status Output	n/a	n/a
Upper Fail	Disable	n/a
Lower Fail	Disable	n/a
H.V ON	Disable	n/a
Pass	Disable	n/a
Power ON	Disable	n/a
Protection	Disable	n/a
Ready	Disable	n/a
Test	Disable	n/a
Signal I/O	n/a	n/a
Step END Judgment	Disable	n/a

Interface settings

Parameter	Factory default	Reset
IP Address	n/a	n/a
Method	Automatic	✓
IP Address	n/a	n/a
Subnet Mask	n/a	n/a
Default Gateway	n/a	n/a
DNS Server	n/a	n/a
DNS Server 1	0.0.0.0	n/a
DNS Server 2	0.0.0.0	n/a
WINS Server	n/a	n/a
WINS Server 1	0.0.0.0	n/a
WINS Server 2	0.0.0.0	n/a
Host name & Services	N/A	n/a
Desired Hostname	Model name and serial number	n/a
Desired Description	KIKUSUI XXXX Electrical Safety Analyzer (XXXX is the model name) and serial number	n/a
Dynamic DNS	Enable	✓
mDNS	Enable	✓
NetBIOS Over TCP/IP	Enable	✓
Auto Clock Adjustment	n/a	n/a
NTP Server Hostname	ntp.nict.jp	n/a
Auto Adjustment	Enable	n/a
RS232C Settings	n/a	n/a
Bitrate	19200	n/a
Data Bits	8	n/a
Stop Bits	1	n/a
Flow Control	None	n/a

Stray Capacitance of AC Withstanding Voltage Tests

WARNING

- If there is a possibility that the EUT or tools and the like will be grounded or if you are uncertain about it, do not set GND to Guard. (p.67)

The ammeter will be short-circuited and will not be able to measure current.

- If you set GND to Guard, do not connect measuring instruments that are grounded at one end (e.g., Kikusui 149-10A High Voltage Digital Voltmeter, TOS1200 Current Calibrator) to this product. (p.67)

The ammeter will be short-circuited and will not be able to measure current.

During AC withstanding voltage tests, current also flows in the stray capacitance of items such as the test leads and tools. The following table shows a summary of the current running through the stray capacitance due to the output voltage.

■ For TOS9301 or TOS9303

Measurement environment	Output voltage				
	1 kV	2 kV	3 kV	4 kV	5 kV
When a lead wire 350 mm long is hung in air (typical value)	2 μ A	4 μ A	6 μ A	8 μ A	10 μ A
When the supplied high voltage test lead is used (typical value)	16 μ A	32 μ A	48 μ A	64 μ A	80 μ A
Per high voltage scanner (typical value, excluding the test lead)	22 μ A	44 μ A	66 μ A	88 μ A	110 μ A

Particularly when performing high-sensitivity, high-accuracy measurement or when using the optional high voltage scanner (p.234), the effects of current running through the stray capacitance must be removed by referring to the following methods.

- If you set the grounding mode (GND) to low, add the current running through the stray capacitance to the upper and lower limits, or use the offset function.
- Set the grounding mode (GND) to Guard.

■ For TOS9311

Measurement environment	Output voltage				
	2 kV	4 kV	6 kV	8 kV	10 kV
When the supplied high voltage test lead is used (typical value)	32 μ A	64 μ A	96 μ A	128 μ A	160 μ A

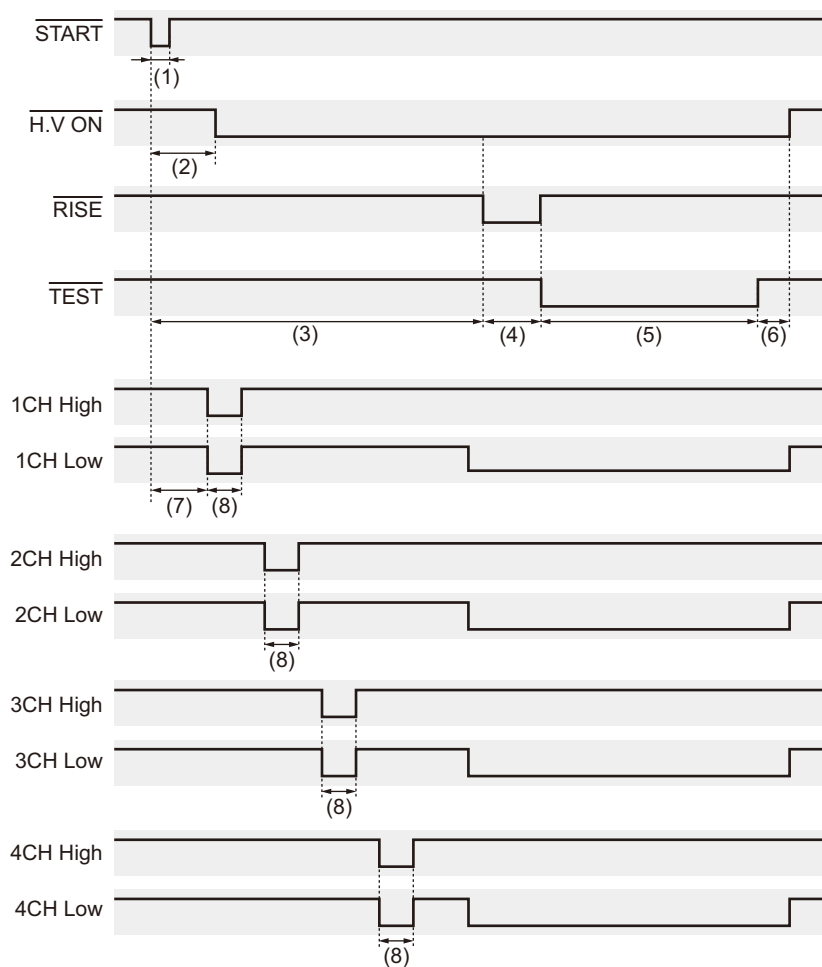
Timing Charts

Typical examples of timing charts are provided below.

Contact check operation

■ Setting conditions

Connect a high voltage scanner
 Contact Check: ON
 CH1 to CH4 of the scanner: Low
 Rise Time: ON
 Test Time: ON
 Start the test with the SIGNAL I/O



- | | |
|---------------------------------|---------------------------------|
| (1) 5 ms min. | (5) Test Time |
| (2) Approx. 18 ms ¹ | (6) Varies depending on the EUT |
| (3) Approx. 185 ms ¹ | (7) Approx. 20 ms ¹ |
| (4) Rise Time | (8) Approx. 30 ms ¹ |

1. TYP (typical value)

ACW test (PASS judgment)

■ Setting conditions

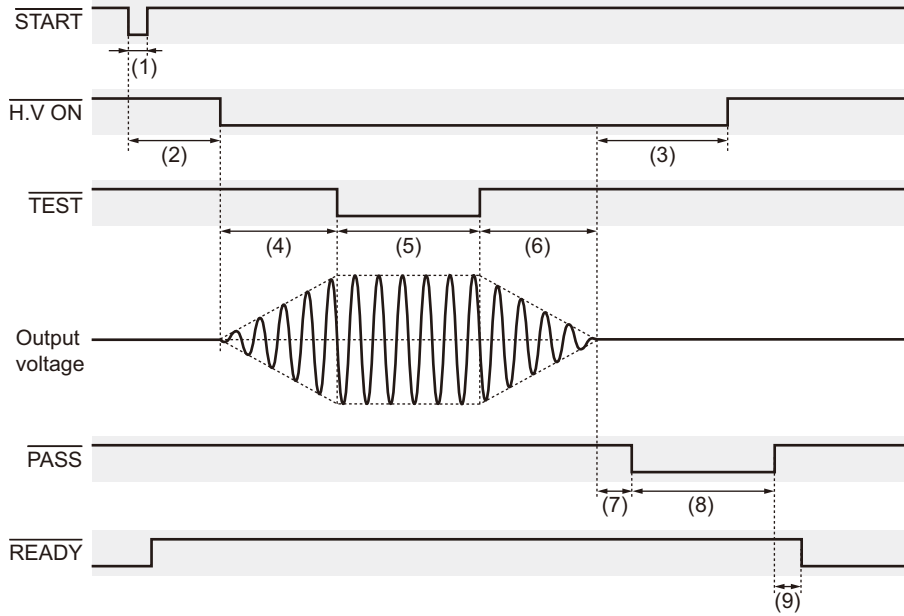
Rise Time: ON

Test Time: ON

Fall Time: ON

Pass Hold: 50 ms

No load (waveform monitoring with a high voltage probe), start the test with the SIGNAL I/O.



- | | |
|--------------------------------|-------------------------------|
| (1) 5 ms min. | (6) Fall Time |
| (2) Approx. 20 ms ¹ | (7) Approx. 5 ms ¹ |
| (3) Approx. 30 ms ¹ | (8) Pass Hold |
| (4) Rise Time | (9) Approx. 2 ms ¹ |
| (5) Test Time | |

1. TYP (typical value)

ACW test (FAIL judgment)

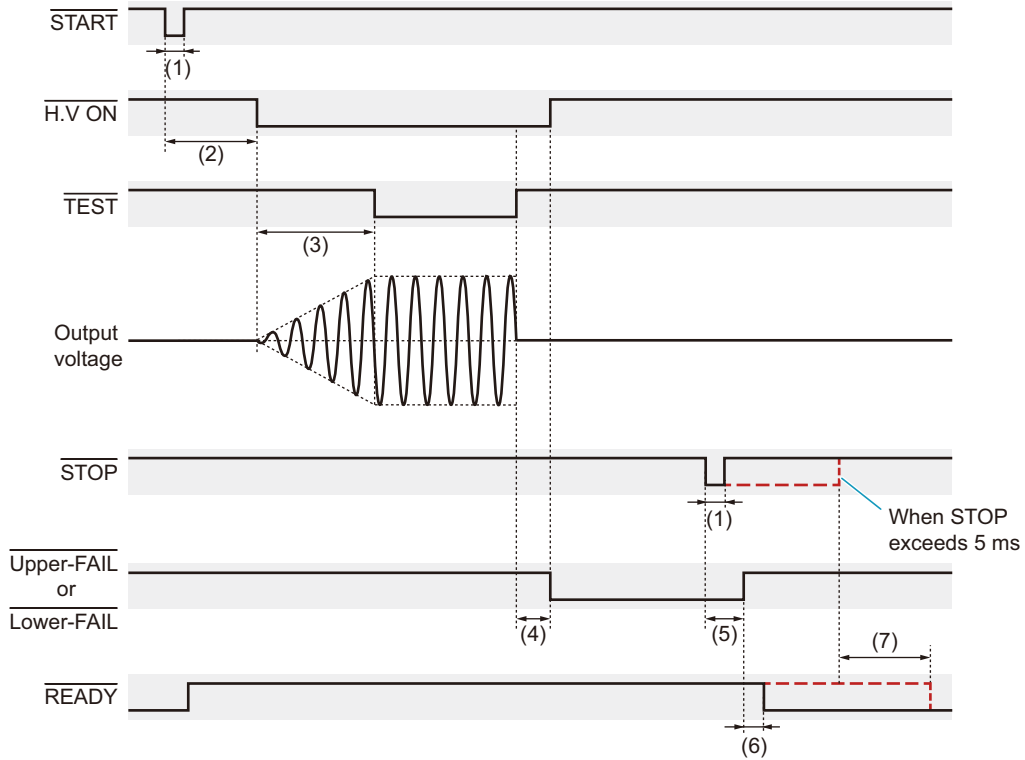
■ Setting conditions

Rise Time: ON

Test Time: OFF

Pass Hold: 50 ms

No load (waveform monitoring with a high voltage probe), start the test with the SIGNAL I/O.



- (1) 5 ms min.
 - (2) Approx. 20 ms¹
 - (3) Rise Time
 - (4) Approx. 5 ms¹
 - (5) Approx. 5 ms¹
 - (6) Approx. 1 ms¹
 - (7) Approx. 20 ms
1. TYP (typical value)

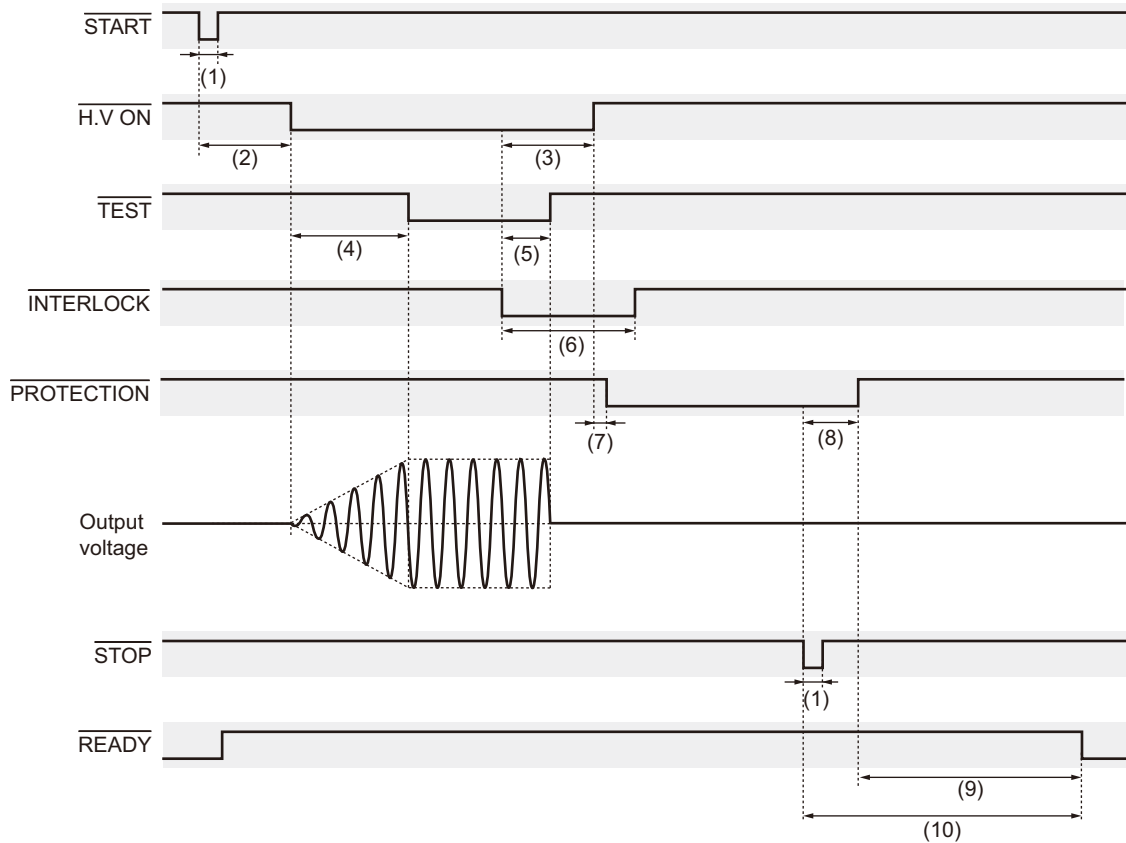
ACW test (interlock)

■ Setting conditions

Rise Time: ON

Test Time: OFF

No load (waveform monitoring with a high voltage probe), start the test with the SIGNAL I/O. Abort test with an interlock operation.



- | | |
|--------------------------------|----------------------------------|
| (1) 5 ms min. | (6) 5 ms min. |
| (2) Approx. 20 ms ¹ | (7) Approx. 0.5 ms ¹ |
| (3) Approx. 20 ms ¹ | (8) Approx. 10 ms ¹ |
| (4) Rise Time | (9) Approx. 90 ms ¹ |
| (5) Approx. 10 ms ¹ | (10) Approx. 100 ms ¹ |

1. TYP (typical value)

Options

This product has the following options.

For information about options, contact your Kikusui agent or distributor.

- High voltage scanner (TOS9320)
- Remote control box (RC01-TOS/RC02-TOS)
- DIN adapter cable (DD-5P/9P)
- High voltage test probe (HP01A-TOS/HP02A-TOS)
- Warning light unit (PL02-TOS)
- Brackets (KRB3-TOS/KRB150-TOS/KRB4/KRB200)

High voltage scanner

Applicable models: **9300**, **9301**, **9302**, **9303**

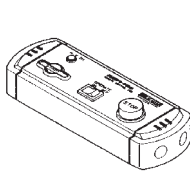
The TOS9320 high voltage scanner distributes the test voltage from this product to up to 16 channels of test points in a ACW, DCW, or IR test. This saves power when testing electric/electronic devices and components that have multiple test points and enables highly reliable tests.

- A single high voltage scanner expands an output to four channels. Each channel can be set to an electric potential of your choice (high, low, or open), and any of the four test points can be tested.
- Up to four high voltage scanners (16 channels) can be connected to a single TOS93 series.
- The output of each channel and the contact between each test point can be verified.

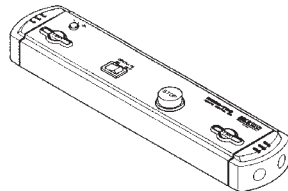


Remote control box

The RC01-TOS/RC02-TOS remote control box can be used to remotely control the starting and stopping of ACW, DCW, or IR tests. One model is for use with one hand, and the other model is for use with two hands. A DIN adapter cable ([p.235](#)) is required to connect to the TOS93.



RC01-TOS (one hand)

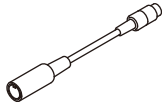


RC02-TOS (two hands)

DIN adapter cable

The DD-5P/9P DIN adapter cable (5 pin to 9 pin) is for connecting the following option products to the TOS93.

- Remote control box(RC01-TOS/RC02-TOS)
- High voltage test probe(HP01A-TOS/HP02A-TOS)



High voltage test probe

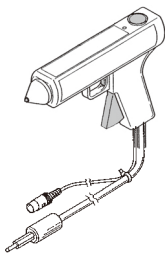
Applicable models: **9300**, **9301**, **9302**, **9303**

The HP01A-TOS/HP02A-TOS high voltage test probe is for outputting test voltages in ACW and DCW tests. The probe has to be operated with both hands to output the test voltage. This prevents the test voltage from being output inadvertently. A DIN adapter cable ([p.235](#)) is required to connect to the TOS93.

WARNING

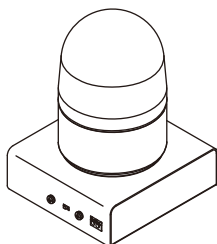
Risk of electric shock.

The maximum rated voltages of the HP01A-TOS/HP02A-TOS are 4 kVac and 5 kVdc. For safety reasons, set the limit voltage of TOS93 series ([p.53](#)) to limit the applied voltage.



Warning light unit

The PL02-TOS warning light unit indicates that a test is in progress or other statuses. You can view the status from a distance.



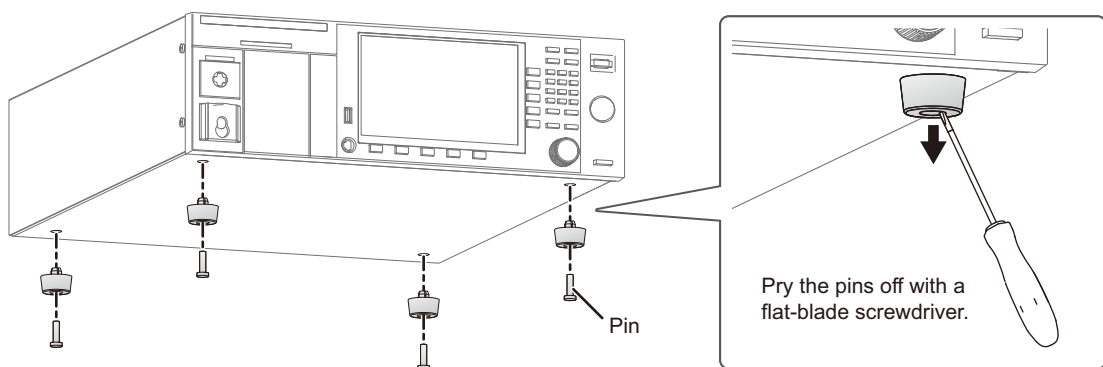
Brackets

Brackets are rack mounting options. There are two types of brackets: EIA standard and JIS standard.

Model	EIA inch rack Standard	JIS millimeter rack standard
TOS9300, TOS9301, TOS9302, TOS9303	KRB3-TOS	KRB150-TOS
TOS9311	KRB4	KRB200

Removing the feet

We recommend that you keep all pieces that you remove from the product. You will need these pieces if you remove the product from the rack.



- 1** Pry off the pins holding the legs (four locations) with a flat-blade screwdriver.
- 2** Remove the legs (four locations).
This completes the removal.

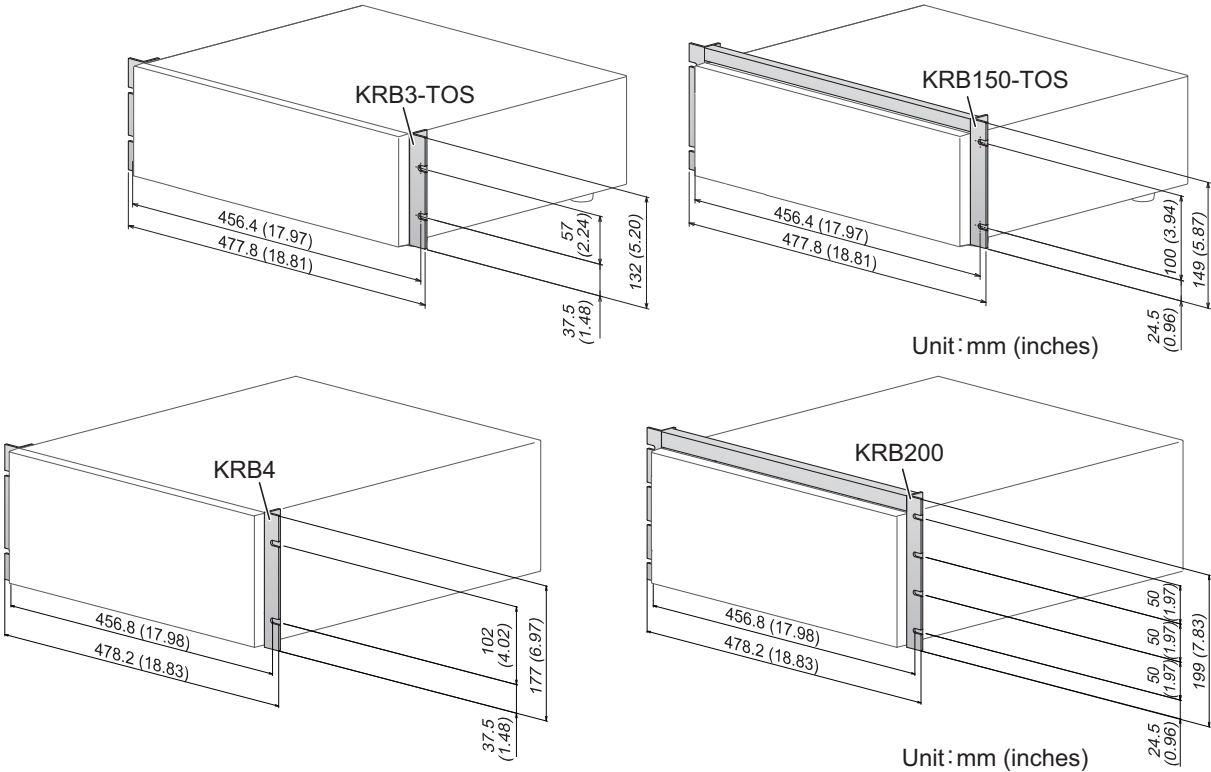
Attaching the rack adapter or bracket.

NOTE

When mounting the product on a rack, be sure to use support angles (auxiliary brackets) to safely support the product.

For information on rack mounting, see the operation manual of the relevant bracket.

External dimensions



Troubleshooting




This section introduces troubleshooting measures. Typical symptoms are listed. Check whether any of the items listed below apply to your case. In some cases, the problem can be solved quite easily.

If none of the items apply to your case, we recommend that you initialize the product to its factory default settings (p.197). If following the remedy does not solve your problem, contact your Kikusui agent or distributor.



■ The power does not turn on.

Symptom	Possible cause	Remedy
The product does not operate when the POWER switch is turned on.	The power cord is disconnected.	Check the power cord connection. (p.28)
	Interlock is activated.	Release the interlock. (p.161)

■ Unable to control from the panel.

Symptom	Check	Remedy
Front panel key operations are not accepted.	 KeyLock /  KeyLock /  KeyLock is displayed in the upper right of the display.	The keys are locked. Hold down KEY LOCK to release the key lock. (p.183)
	"REMOTE" is shown in the display.	The product is being controlled remotely. Press LOCAL to control the product from the front panel.
	The password for the key lock is forgotten.	Enter "9941104" to cancel the password. If the product is returned to factory default settings, the password will be reset to "0000" and the password setting will be invalid. (p.197)
The product does not switch to local mode even when I press the LOCAL key.	A local lockout (LLO) remote control command was sent.	Refer to the Interface Manual and cancel the LLO command with a communication command.

■ Unable to start a test

Symptom	Possible cause	Remedy
"PASS," "Upper-FAIL," or "Lower-FAIL" is displayed.	A judgment result is displayed.	Press STOP to clear the judgment result.
"PROTECTION" is displayed.	A protection function is activated.	Clear the protection mode. (p.26)
"Contact-FAIL" is displayed.	When a scanner was connected with Contact Check set to on, a bad test lead connection was detected.	Connect the test leads properly. (p.35)
Testing does not begin when the START switch is pressed.	A test lead is connected to the REMOTE connector. If  or  appears in the upper right of the display, Double Action or Start Long in set to on in the CONFIG settings.	Remove the test lead, or press the START switch on the test lead. Start the test properly, or set Double Action and Start Long to off. (p.189)
	A STOP signal is applied to SIGNAL I/O.	Turn off the STOP signal. (p.164)
	The SIGNAL I/O ENABLE signal is set to low level.	Set the ENABLE signal to high level. (p.164)

■ Unable to measure

Symptom	Possible cause	Remedy
The measured values are abnormal.	The test leads are connected to the wrong terminals.	Connect the test leads properly.
Test data for pass judgments cannot be saved.	The pass judgment result display is cleared immediately.	Set the Pass Hold time to an appropriate value. (p.190)
Judgments do not begin.	Judgment delay (Judge Delay) is set.	Judgment begins after the Judge Delay elapses. Set Judge Delay to an appropriate value.
Testing does not finish.	The test timer is set to off.	The test continues until the STOP switch is pressed. Turn the test timer on, and set an appropriate timer value.

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Warranty Period

Before delivery, our products have undergone strict testing and inspections and have been found to comply with the specifications. We offer different warranty periods for different product models. If the product should become defective within the specific warranty period applied to the product model after the date of purchase, we will repair the product or replace it with a new one for free. In a case in which the customer concluded a separate agreement with us regarding the warranty period, the conditions of the warranty period are applied based on such agreement.

Scope of Warranty

If the product should become defective within the warranty period, we will repair the product or replace it with a new one. However, the warranty does not cover:

- Failure or damage caused by use that is not in accordance with the Operation Manual, misuse, or neglect.
- Failure or damage during transportation after delivery.
- Failure or damage caused by improper modification, adjustment, or repair.
- Failure or damage caused by an Act of God, fire, or other events beyond our control.
- Failure or damage caused by use in a corrosive atmosphere, a dusty environment, or an environment where salt damage occurs or contamination by liquid or foreign matters is likely to occur.
- Failure or damage due to causes that are not attributable to us.

Disclaimer

Regardless of the warranty period, in no event shall we be liable for loss of opportunity or profit caused by the failure of our product, or initial or secondary damages, accident compensation, damages to products other than our products, or compensation for other operations caused by unavoidable circumstances that we may or may not have foreseen.

If you find any misplaced or missing pages in the manuals, they will be replaced. If the manual gets lost or soiled, a new copy can be provided for a fee. In either case, please contact your Kikusui agent or distributor. At that time, inform your agent or distributor of the "Part No." written on the front cover of this manual.

Every effort has been made to ensure the accuracy of this manual. However, if you have any questions or find any errors or omissions, please contact your Kikusui agent or distributor.

After you have finished reading this manual, store it so that you can use it for reference at any time.

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