



KIKUSUI

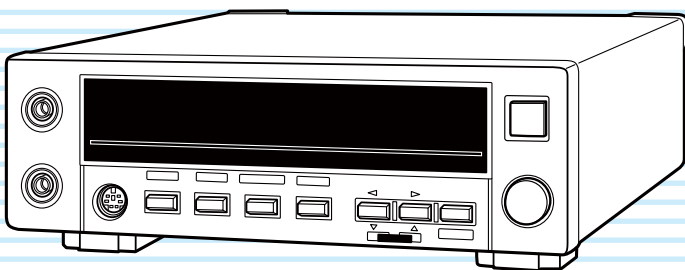
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Jul 2021

User's Manual

Insulation Resistance Tester

TOS7200

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DANGER

This Tester generates high voltage!

- Any incorrect handling may cause death.
- Read Chapter 3 "Safety Precautions during Testing" in this manual to prevent accident.
- Keep this manual near the tester for easy access of the operator.

About the TOS7200 Manuals

There are five TOS7200 Manuals listed as follows.

- **Setup Guide**
Setup Guide is intended for first-time users of this product. It provides an overview of the product and notes on usage. It also explains how to set up the product for testing the DUT. Always read this manual before using the product.
- **Quick Reference**
Quick Reference explains Panel description and operation briefly.
- **Safety Information**
Safety information contains general safety precautions for this product. Keep them in mind and make sure to observe them.
- **User's Manual (this manual)**
This manual is intended for first-time users of this product. It provides an overview of the product and notes on usage. It also explains how to configure the product, operate the product, perform maintenance on the product, and so on.
- **Communication Interface Manual**
Interface Manual contains details about remote control. The manual is provided on the accompanying CD-ROM. Interface manual is written for readers with sufficient basic knowledge of how to control instruments using a personal computer.

TOS7200 Manuals are intended for users of the Insulation Resistance Tester and their instructors. Explanations are given under the presumption that the reader has knowledge about the electrical aspects of electrical safety testing.

Firmware version of the product to which this manual applies

This manual applies to TOS7200 with firmware version 1.0x.

When making an inquiry about the product, please provide us with the following information.

Model (indicated at the top section on the front panel)

Firmware version ([p.15](#))

Serial number (indicated at the bottom section on the rear panel)

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Notations Used in the Manual

- Device under test is also referred to as DUT.
- The term "PC" is used to refer generally to both personal computers and workstations.
- The following markings are used in the explanations in the manual.

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 damage to the product or other property.

NOTE

Indicates information that you should know.

DESCRIPTION

Explanation of terminology or operation principle.

Unpacking

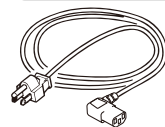
Upon receiving the product, confirm that the necessary accessories are included and have not been damaged in transit.

Should any damage or shortage be found, please contact Kikusui distributor/agent.

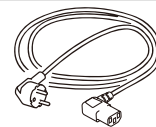
Retain the packing material for future transport.

Accessory

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



or



or

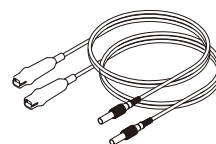


Plug: NEMA5-15
Rating: 125 Vac/10 A
[85-AA-0003]

Plug: CEE7/7
Rating: 250 Vac/10 A
[85-10-1070]

Plug: GB1002
Rating: 250 Vac/10 A
[85-10-0791]

Power cord (1 pc., Approx. 2.5 m)



TL08-TOS High-voltage test lead
(1 set, 1.5 m)

Quick Reference
(English: 1 pc., Japanese: 1 pc.)

Safety information
(1 pc.)

Setup guide (1 pc.)

CD-ROM (1 pc.)

To supervisor in charge of operation

- If the operator does not read the language used in this manual, translate the manual into appropriate language.
- Help the operator in understanding this manual before operation.
- Keep this manual near the Tester for easy access of the operator.

For your own safety (to avoid electrification)

While the Tester is delivering its test voltage, never touch the following areas, or else, you will be electrified, and run the risk of death by electric shock.

- the output terminal
- the test leadwires connected to the output terminal
- the Device Under Test (DUT)
- any part of the Tester, which is electrically connected to the output terminal, and
- the same part as above immediately after the output has been cut off.

Safety Precautions

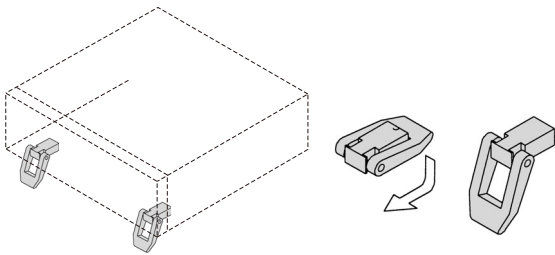
When using this product, be sure to observe the “Safety Precautions” in the Safety information manual.

Precautions Concerning Installation Location

When installing this product, be sure to observe the “Precautions Concerning Installation Location” in the Safety information manual.

Items specific to this product are given below.

- When you install the product, be sure to observe the temperature and humidity ranges indicated below.
Operating temperature range: 0 °C to 40 °C (32 °F to 104 °F)
Operating humidity range: 20 %rh to 80 %rh (no condensation)
- When you store the product, be sure to observe the temperature and humidity ranges indicated below.
Storage temperature range: -20 °C to 70 °C (-4 °F to 158 °F)
Storage humidity range: 90 %rh or less (no condensation)
- Use the product in an industrial environment.
Use the product 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
- Use of the legs
These legs are used to raise the front part of the tester so that the screen on the front panel is easier to see and the keys are easier to operate.
To use the legs, pull them toward the front until you hear a click.



Moving the Product

When moving or transporting the product to the installation location, be sure to observe the “Precautions to Be Taken When Moving the Product” in the Safety information manual.

Item specific to this product are given below.

- Retract the legs.

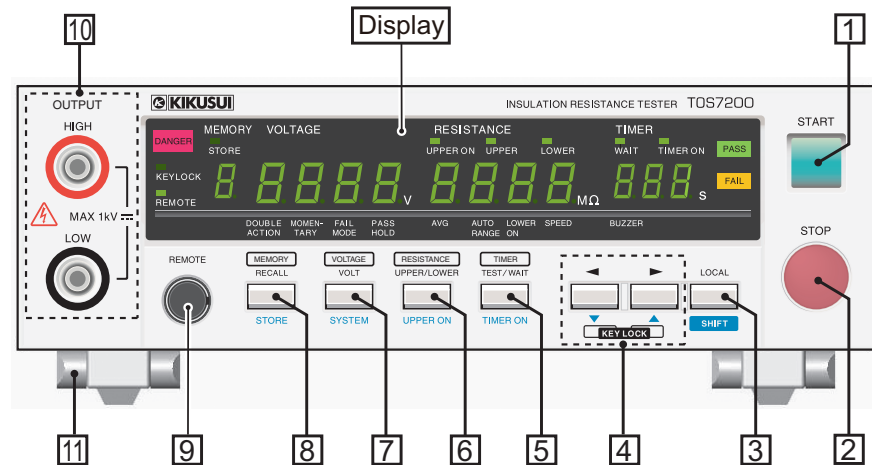
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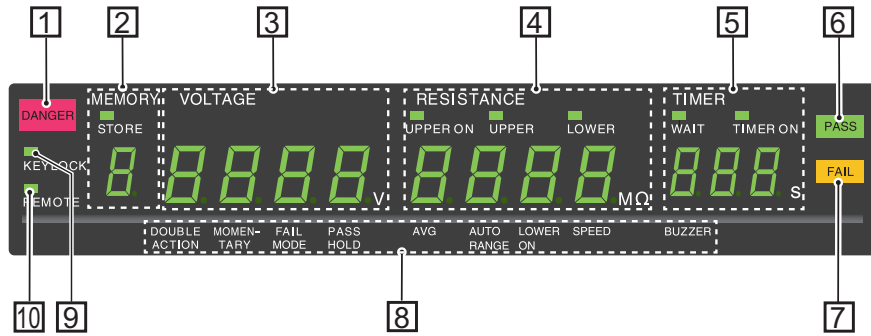
Front Panel



No.	Name	Description	See
1	START switch	Starts testing.	p. 30
2	STOP switch	Stops testing and clears the current status. Cancels a PASS or FAIL judgment.	p. 31
3	LOCAL key	Switches RS232C remote mode (REMOTE LED lit) to local mode.	—
	SHIFT key	Used to access the features that are written in blue.	—
4	◀ and ▶ keys	Moves the cursor when setting test conditions or the like. ^{*1} Pressing them both at the same time locks the keys and turns on the KEYLOCK LED.	—
	▼ and ▲ keys	Increases or decreases the numerical value of the digit at which the cursor is located.	—
5	TEST/WAIT key	Sets the test duration or wait time.	p. 28
	TIMER ON key	Switches between ON and OFF for the test-duration timer function (TIMER ON LED).	p. 28
6	UPPER/LOWER key	Sets the upper or lower resistance	p. 24
	UPPER ON key	Switches between ON and OFF for the upper judgment	p. 27
7	VOLT key	Sets the test voltage	p. 23
	SYSTEM key	Switches to the system setting display.	p. 33
8	RECALL key	Recalls panel settings from memory	p. 36
	STORE key	Stores panel settings to memory	p. 36
9	REMOTE terminal	This dedicated terminal is used to connect the optional remote control box RC01-TOS or RC02-TOS.	p. 40
10	OUTPUT terminal	Test voltage output terminals Connected in parallel with the OUTPUT terminals on the rear panel.	p. 16
11	Legs	These legs are provided to raise the front part of the tester to make it easier to view the front panel screen and operate the keys.	p. 4

*1. The location of the cursor is indicated by a blinking 7-segment LED on the display unit. This blinking will stop if no keystroke is entered for 5 seconds or more.

Display

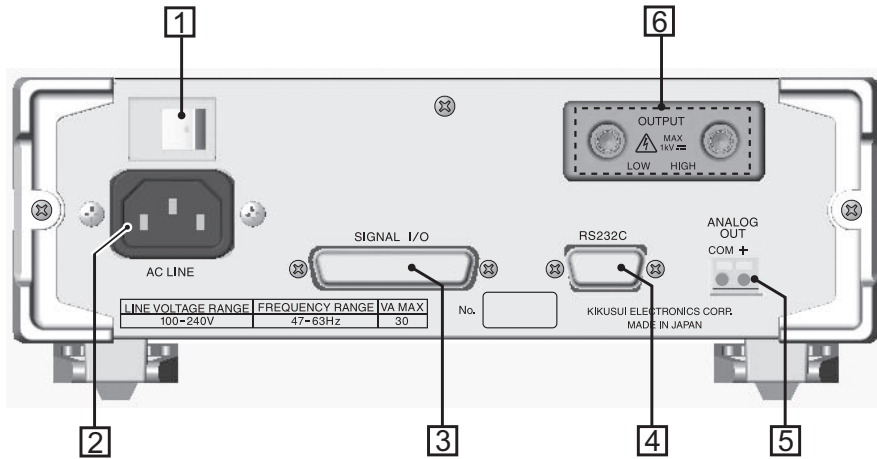


No.	Name	Description	See
1	DANGER lamp	On (red) during testing and while voltage resides across the output terminals.	p. 30
2	MEMORY	Indicates panel memory settings.	p. 36
	STORE LED	Lights when settings can be stored to panel memory.	—
	7-segment LED	Indicates the number of a memory into or from which panel settings are stored or recalled	—
3	VOLTAGE	Indicates the test voltage.	p. 23
	7-segment LED	Indicates the output voltage (during testing). Indicates the test voltage setting (not during testing).	—
4	RESISTANCE	Indicates the resistance (during testing). Indicates the upper limit or lower limit setting (not during testing).	p. 24
	UPPER ON LED	Lights when the upper judgment is enabled.	p. 27
	UPPER LED	Lights when the upper limit setting is displayed or when the judgment result is UPPER FAIL.	p. 25
	LOWER LED	Lights when the lower limit setting is displayed or when the judgment result is LOWER FAIL.	p. 24
	7-segment LED	Indicates the resistance measurement during testing (blinks when the measurement range is exceeded) or indicates the upper or lower limit setting otherwise.	—
5	TIMER	Indicates the test time (during testing). Indicates the judgment wait time or test time setting (not during testing).	p. 28
	WAIT LED	Lit: The 7-segment LED displays the judgment wait time. Not lit: The 7-segment LED displays the test time.	p. 29
	TIMER ON LED	Lights when the timer function is on. Blinks when the judgment wait time is set longer than the test time.	p. 28
	7-segment LED	Indicates the countdown time when the timer is on and the elapsed time when the timer is off (during testing).	—
6	PASS lamp	When the result of a pass/fail judgment is PASS, this LED lights.	p. 31
7	FAIL lamp	When the result of a pass/fail judgment is FAIL, this LED lights.	p. 32

No.	Name	Description	See
8	System setting display	Indicates the selected function when system settings are being configured.	p. 33
	DOUBLE ACTION	Indicates the setting for the DOUBLE ACTION function. 1: ON, 0: OFF	p. 34
	MOMENTARY	Indicates the setting for the MOMENTARY function. 1: ON, 0: OFF	p. 34
	FAIL MODE	Indicates the setting for the FAIL MODE function. 1: ON, 0: OFF	p. 34
	PASS HOLD	Indicates the setting for the PASS HOLD function. 1: ON, 0: OFF	p. 34
	AVG	Shows the number of averaging times.	p. 34
	AUTO RANGE	Shows the measurement range mode. 1: auto-range, 0:fixed range	p. 35
	LOWER ON	Indicates the lower judgment function 1: ON, 0: OFF	p. 35
	SPEED	Shows the communication rate for RS232C communications. 0: 9600 bps, 1: 19200 bps, 2: 38400 bps	p. 35
	BUZZER	Indicates the buzzer volume level (10 levels from 0 to 9)	p. 35
9	KEYLOCK LED	Lights up when the tester is in KEYLOCK state.	p. 37
10	REMOTE LED ^{*1}	Lights up when the tester is remotely controlled through the RS232C interface.	—

*1. When lit, all inputs except the STOP switch are not accepted. To return to local mode, press LOCAL (SHIFT).

Rear Panel



No.	Name	Description	See
1	POWER switch	Turns the power on [I] and off [O].	p. 15
2	AC LINE connector	AC inlet.	p. 14
3	SIGNAL I/O connector	External control signal connector.	p. 42
4	RS232C connector *1	This is the RS232C interface.	—
5	ANALOG OUT terminals	Analog output terminal This terminal outputs the voltage that corresponds to the measured resistance value.	p. 48
6	OUTPUT terminals	These terminals output the test voltage. They are connected in parallel to the OUTPUT terminals on the front panel.	p. 16

*1. For details, see the communication interface manual.

1 Preface

Outline of the TOS7200

The TOS7200 is an insulation resistance tester that is available in a wide range of electric and electronic components and equipment, and allows any test voltage to be set. Because it features the window comparator and timer function, the tester is capable of efficiently conducting insulation resistance tests based on various safety standards. Moreover, with the panel memory, which can be recalled externally and the RS232C interface provided as standard equipment, the tester can flexibly handle automated systems.

Features

■ Arbitrary setting of the output voltage

The output voltage may be set to between 25 V and 1000 V. Thus, insulation resistance tests can be conducted on a wide range of electric and electronic components and equipment.

Test voltage	Resistance measurement range
25 V	0.03 MΩ to 250 MΩ
50 V	0.05 MΩ to 500 MΩ
100 V	0.10 MΩ to 1000 MΩ
125 V	0.13 MΩ to 1250 MΩ
250 V	0.25 MΩ to 2500 MΩ
500 V	0.50 MΩ to 5000 MΩ
1000 V	1.00 MΩ to 5000 MΩ

■ Equipped with a discharge function

The tester features a discharge function, which discharges the electric charge in the device under test (DUT.) This allows tests to be conducted more safely.

■ Equipped with a window comparator

The tester has adopted a window comparator system capable of making judgments on both the upper and lower limits. This prevents non-contact-caused judgment errors and other errors.

■ Equipped with a timer function

The tester features a timer function that allows the test time to be set. It also enables setting of the wait time, allowing more secure measurements and evaluation.

■ **Output terminals on the rear panel**

Output terminals on the rear panel improve wiring workability in an automated production line or other workshops.

■ **Analog output**

The rear panel is provided with an analog output section for measured resistance values.

■ **Equipped with a panel memory**

As the TOS7210A can store up to 10 types of panel settings, settings complying with various standards can easily be invoked to conduct tests.

■ **Provided with a SIGNAL I/O connector and remote-control terminal**

Equipped with a SIGNAL I/O connector as standard equipment, to output the test status as an external I/O and handle starting/stopping of tests and recalling of panel memory. In addition, the front panel has a remote-control terminal that allows tests to be started/stopped remotely.

■ **Incorporating the RS232C interface as standard equipment**

The tester features an RS232C interface as standard equipment for easy connection to a PC, allowing measured data to be obtained.

Option

This Tester features the following options:

RC01-TOS/RC02-TOS remote-control boxes

These remote-control boxes remotely control starting/stopping of the tester when connected to the REMOTE terminal on the front panel.

The RC01-TOS has one START switch, while the RC02-TOS has two.

For the RC02-TOS, a test starts only when both switches are pressed simultaneously.

■ **Functions**

- OPERATE switch

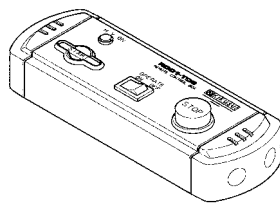
The TEST switch can be operated only when this switch is set to ON. When it is turned OFF, a test in progress will be stopped forcibly.

- START switch

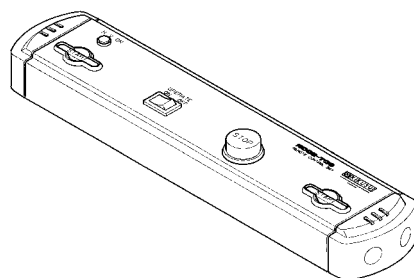
When the OPERATE switch is ON and the tester is in ready status, pressing this switch starts testing.

- STOP switch

This switch is used to shut off the output voltage or cancel a FAIL judgment. It serves the same function as the STOP switch on the front panel of the tester.



RC01-TOS: 200 mm (W)×70 mm(H)×39 mm (D)



RC02-TOS: 330 mm (W)×70 mm (H)×39 mm (D)

NOTE

Connection of a remote-control box to the tester requires the use of a DIN-Mini DIN adapter. For DD-5P/6P DIN-Mini DIN adapter [84250], contact your Kikusui distributor/agent.

2 Preparation

This chapter describes the procedures from installation to operation checking.

Connecting the Power Cord



WARNING

- **This product is a piece of equipment that conforms to IEC Safety Class I (equipment that has a protective conductor terminal). Be sure to earth ground the product to prevent electric shock.**
- **The product is grounded through the power cord ground wire. Connect the protective conductor terminal to earth ground.**

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.
- The power cord with a plug can be used to disconnect the product from the AC line in an emergency. Connect the plug to an easily accessible power outlet so that the plug can be removed from the outlet at any time. Be sure to provide adequate clearance around the power outlet.
- Do not use the supplied power cord for other devices.

This product is a piece of equipment that conforms to IEC Overvoltage Category II (energy-consuming equipment that is supplied from a fixed installation).

- 1 Check that the POWER switch is turned off.**
- 2 Check whether the AC power line is compatible with the input rating of the product.**

The product can receive a nominal power supply voltage in the range of 100 Vac to 240 Vac (85 Vac to 250 Vac) that has a frequency in the range of 47 Hz to 63 Hz.
- 3 Connect the power cord to the rear-panel AC inlet, and then connect the power plug to an outlet that has a ground terminal.**

Turning ON the Power



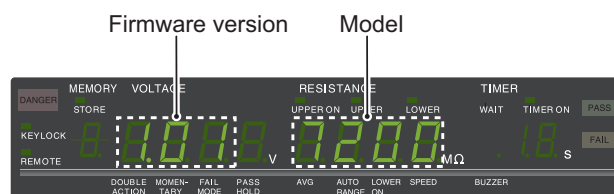
WARNING

- Before turning ON the power, always confirm that the AC power is within the allowable line-voltage range indicated on the rear panel of the tester. For more information, see “Connecting the Power Cord” (p.14).
- To prevent electric shock, be sure to turn OFF the POWER switch before disconnecting the cable for the SIGNAL I/O or RS232C connector.

- 1 Confirm that the AC power is within the allowable line voltage range indicated on the rear panel of the tester.
- 2 Confirm that the AC power cord is properly connected to the AC LINE connector on the rear panel of the tester.
- 3 Connect the other plug of the AC power cord to an electrical outlet.
- 4 Turn ON the POWER switch of the tester.

The voltmeter displays the installed firmware version number, and the resistance meter displays “7200,” which is the product model.

Following these displays, the voltmeter and resistance/current meter change to the displays status when the POWER switch was last turned off.



NOTE

When the power is turned on, the tester lights up all LEDs on the front panel to perform self-testing. To ensure safety, be sure to confirm that all LEDs is lit before operating the tester. It is especially dangerous to use the tester if its DANGER lamp is broken.

When the power is turned on, the DANGER lamp lights, but no voltage is generated.

Turning the POWER switch off.

The POWER switch to turn the TOS7200 off.

The panel settings that were in use immediately before the POWER switch was turned off are saved. If the POWER switch is turned off immediately after the settings have been changed, the last settings may not be stored.



WARNING

Possible electric shock.

- After you turn the POWER switch off, wait at least 10 seconds before you turn the POWER switch back on. It is dangerous to do otherwise, because the protective features of the product may not work effectively. This may cause the product to malfunction, and it may reduce the life of the POWER switch and internal parts such as the fuses.
- Except in an emergency, do not turn the POWER switch off while output is being generated.

Connecting the Test leadwires

Test leadwires connect the product to the DUT.



WARNING Insecure connection of a test leadwire may cause the entire DUT to be charged to high voltage, posing a danger. Take care to connect the test leadwires securely.

Connecting to the OUTPUT terminals

■ Connecting the low voltage side test leadwire

- 1** Press the STOP switch.
- 2** Check that the DANGER lamp is off.
- 3** Check that there is no breakage in the test leadwires.
- 4** Connect the low voltage side test leadwire to the LOW terminal.

■ Connecting the high voltage side test leadwire

Perform the following procedure after connecting the low voltage side test leadwire:

- 1** Press the STOP switch.
- 2** Confirm that the DANGER lamp is off.
- 3** Connect the high voltage side test leadwire to the HIGH terminal.
- 4** Short-circuit the low voltage side and high voltage side test leadwires to confirm that no high voltage is output.

Connecting to the DUT

Connect the test leadwires to the DUT after connecting the low voltage side and high voltage side test leadwires to the tester.

- 1 Press the **STOP** switch.
- 2 Confirm that the **DANGER** lamp is off.
- 3 Short-circuit the high voltage side test leadwire using the low voltage side test leadwire to confirm that no high voltage is applied.
- 4 Connect the low voltage side test leadwire to the DUT.
- 5 Connect the high voltage side test leadwire to the DUT.



Risk of electric shock. Never touch a test leadwire, the DUT, the HIGH terminal, or the LOW terminal during a test (or while the DANGER lamp is lit).

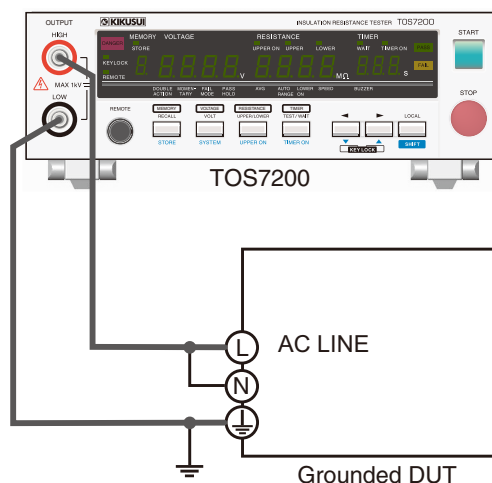


The polarity of the output terminal of the tester is negative. The HIGH terminal has negative (-) polarity, while the LOW terminal has positive (+) polarity.

Connecting to a grounded DUT

When conducting an insulation resistance test on a DUT with one terminal grounded, connect the LOW terminal of the tester to the grounding terminal of the DUT.

For example, to conduct an insulation resistance test across the AC LINE and grounding terminal of the grounded DUT, connect the LOW terminal of the tester to the grounding terminal of the DUT and the HIGH terminal of the tester to the AC LINE of the DUT.



Insulation resistance test across the AC LINE and chassis of the DUT



Risk of electric shock. Never touch a test leadwire, the DUT, the HIGH terminal, or the LOW terminal during a test (or while the DANGER lamp is lit).

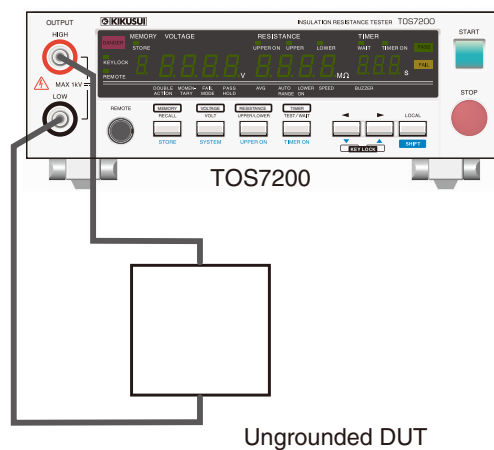
DESCRIPTION ● Reason that the **LOW** terminal of the tester is connected to the grounding terminal of the DUT that has been grounded:

It is appropriate to connect the line terminal (LINE) to the negative (-) side of the power source and the grounding terminal (EARTH) to the positive (+) side. When testing the insulation of insulation wires or cables with respect to ground for direct current, connecting the negative polarity of the power source to the core and the positive polarity to ground will generally provide smaller measured values than when the reverse polarities are connected. Thus, the above-noted connection is considered appropriate for the detection of insulation failures.

For the above reason, the tester connects the negative polarity of the power source to the HIGH terminal and the positive polarity of the power source to the LOW terminal. Thus, for insulation resistance testing involving a DUT with one grounded terminal, it is appropriate to connect the LOW terminal of the tester to the grounding terminal of the DUT, and the HIGH terminal of the tester to the LIVE terminal of the DUT.

Connecting to an ungrounded DUT

When conducting insulation resistance testing on a DUT that has not been grounded, connect the HIGH and LOW terminals of the tester to any two points of the DUT.



Disconnecting Test Leads from the DUT

- 1 Check that the **DANGER** lamp is off.
- 2 Remove the high voltage side test leadwire from the TOS7200 **HIGH** terminal.
- 3 Remove the high voltage side test leadwire from the **DUT**.
- 4 Remove the low voltage side test leadwire.
You can remove either end of this test leadwire first: the DUT end or the OUTPUT terminal end.

3

Safety Precautions during Testing

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



The tester derives a 1000 Vdc test voltage which can cause human injury or death. When operating the tester, be extremely careful and observe the cautions, warnings, and other instructions given in this chapter.

Daily Checking

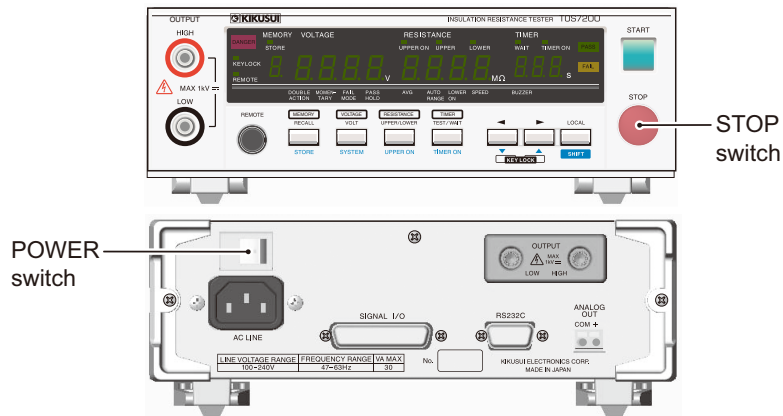
To avoid accidents, confirm at least the following before starting operation:

- The tester is connected to an earth ground.
- The coating of the test leadwires are free from cracks, fissures, and breakage.
- The test leadwires are not broken.
- When a test is started without the test leadwires connected to each other in the UPPER OFF condition, a FAIL judgment must not be made.
- When a test is started with the test leadwires short-circuited in a LOWER ON condition, a FAIL judgment must be made.

Precautions on Testing

Precautions for pausing tests

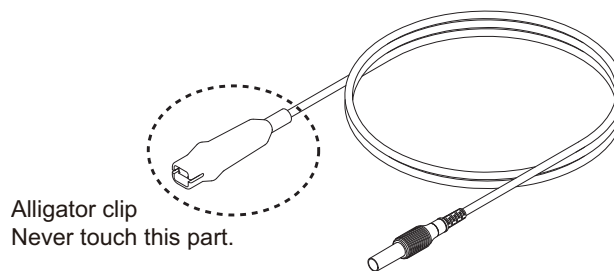
When changing test conditions, press the STOP switch once to take precautions. If you are not going to resume the test soon or if you are leaving the Test area, be sure to turn-OFF the POWER switch.



Items charged up to dangerous high voltages



- **Possible electric shock. Never touch a test leadwire, the DUT, the HIGH terminal, or the LOW terminal during a test.**
- **The vinyl sheaths of the alligator clips of the test leadwires which are supplied accompanying the Tester have no sufficient insulation for the high test voltages. Never touch them when in test.**



Matters to be sure of after turning-off power

If you have to touch the DUT, test leadwires, HIGH terminal, and/or LOW terminal for re-connections or other reasons, be sure of the following matter.

The DANGER lamp has gone out.

Warnings for remote control

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

- Provide means to assure that the test setup does not become the test voltage is being delivered by inadvertent operation.
- Provide means to assure that none can touch the DUT, test leadwires, HIGH terminal, and LOW terminal when the test voltage is being delivered.

Warning for Residual High Voltages



WARNING

- In Testing, the test leadwire, and DUT are charged to a high voltage. The tester is equipped with a discharge circuit, but some time is nonetheless required to discharge them after the output is cut off. There is a danger of electric shock during discharge. To avoid electric shock, take the utmost care to ensure that the DUT, test leadwire, and highly charged parts around the output terminal are not touched. If it is necessary to touch them, be sure to confirm the following:
The DANGER lamp has gone out.
- As soon as the output is cut off the testers discharge circuit starts to discharge (discharge function). Do not disconnect the DUT during a test or prior to completion of discharging.



NOTE

The discharger function operates until the DUT voltage (or output terminal voltage) becomes approximately 30 V.

Discharge time

The length of the discharge time varies according to the properties of the DUT and the test voltage.

Discharge is conducted at a resistance of approximately 25 k Ω in testing.

When no DUT is connected, the tester itself requires this following lengths of time to reduce the internal capacitor voltage to 30 V.

Test voltage 1000 V: Approximately 0.5 ms

Assuming that a 0.05 μ F capacitor is tested, the following lengths of time are required to reduce the charge to 30 V.

Test voltage 1000 V: Approximately 5 ms

If the DUT is disconnected during a test or before the completion of discharging, assuming that the DUT has a capacity of 0.01 μ F and a parallel resistance of 100 M Ω , approximately 3.5 seconds at 1000 V is required for the DUT to discharge to 30 V.

When the approximate time constant of the DUT is known, the time required for discharging to 30 V after the output is cut off is calculated as the time constant times the value given above.

Action When in Emergency

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

- (a) Turn OFF the power switch of the Tester.
- (b) Disconnect the AC power cord of the Tester from the AC line receptacle.

Prohibited Operations

■ Do not turn on/off the power repeatedly

After turning OFF the power switch, be sure to allow 10 seconds or more before turning it ON again. Do not repeat turning ON/OFF the power switch rapidly –if you do this, the protectors of the Tester may not be able to render their protective functions properly.

Do not turn OFF the power switch when the tester is delivering its test voltage—you may do this only in case of emergency.

Dangerous States of Failed Tester

Typical possible dangerous states of the Tester are as shown below and in which cases the most dangerous situation that *"the high test voltage remains delivered and won't be turned off!"* may occur. When this situation has occurred, immediately turn OFF the power switch and disconnect the AC power cable from the AC line receptacle.

The DANGER lamp does not go out despite you have pressed the STOP switch.

Also when the Tester is in other malfunctioning states than the above, there is a possibility that the output voltage is delivered irrespective of your proper operating procedure. Never use the Tester when it has failed.



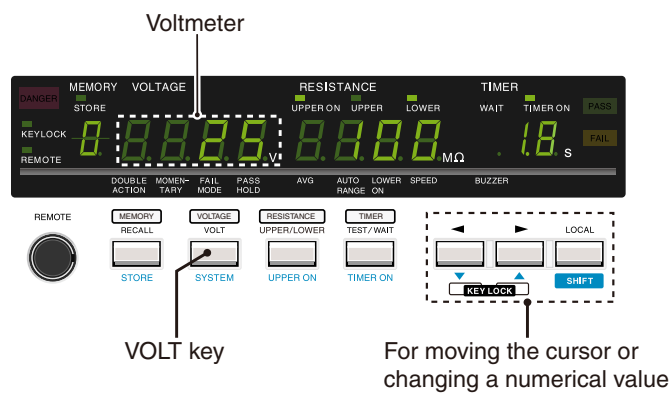
- **Keep the Tester away of other people until you call our service engineer for help.**
 - **Immediately call your Kikusui distributor/agent. It is hazardous for an unqualified person to attempt to troubleshoot any Tester problem.**
-

4 Basic Operation

This chapter describes basic panel operations such as how to set test conditions and system settings.

Setting the Test Voltage

The tester enables setting of the test voltage to be applied to the DUT in the range of -10 Vdc to -1020 Vdc (resolution: 1 V). (Note that the minus sign “-” is not indicated.)



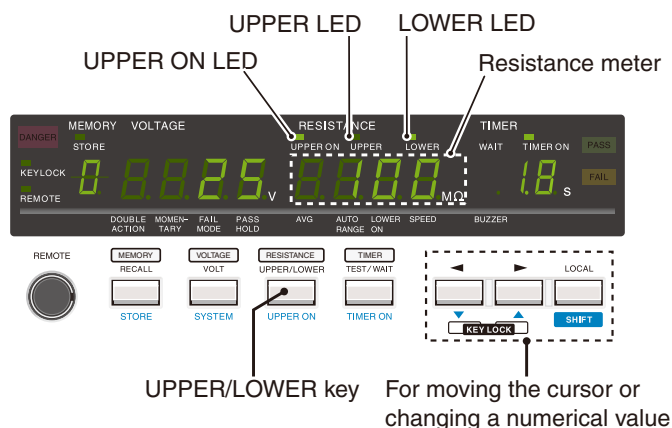
- 1 Press the VOLT key.**
This causes the rightmost digit of the voltmeter LED to blink, indicating that the cursor is positioned at this digit.
- 2 Press the ◀ or ▶ key to move the cursor to the digit at which a value is to be set.**
- 3 With the SHIFT key held down, press the ▼ or ▲ key to change the value.**
If necessary, change the value at another digit to reach the desired test-voltage value. When the blinking of the changed value stops, the setting takes effect.

NOTE

When the lower judgment is activated, making settings such that the value obtained by dividing the test voltage by the lower resistance exceeds 1.1 mA causes the LOWER LED to blink, notifying the operator that a test cannot be conducted. In such cases, lower the test voltage or raise the lower resistance. (p.24)

Setting Limits

Set the limits for making pass/fail judgments on the DUT. There is a lower limit (LOWER) and an upper limit (UPPER).



Setting a lower resistance (LOWER)

The lower resistance can be set in the range of 0.01 MΩ to 5000 MΩ (provided that the current is within the maximum rated current).

Lower Resistance	Resolution
0.01 MΩ to 9.99 MΩ	0.01 MΩ
10.0 MΩ to 99.9 MΩ	0.1 MΩ
100 MΩ to 5000 MΩ	1 MΩ

When the wait time elapses following the start of a test, if an insulation resistance value below the lower resistance is detected, the tester makes a FAIL judgment and ends the test.

- 1 Press the UPPER/LOWER key.**
This causes the rightmost digit of the resistance meter LED to blink, indicating that the cursor is positioned at this digit.
- 2 Check whether the LOWER LED is lit.**
If it is, the lower resistance is displayed. If the UPPER LED is lit, the value displayed is the upper resistance. In such cases, press the UPPER/LOWER key again to light up the LOWER LED.
- 3 Press the ◀ or ▶ key to move the cursor to the digit at which a value is to be set.**
- 4 With the SHIFT key held down, press the ▼ or ▲ key to change the value.**
If necessary, change the value at another digit to achieve the desired lower resistance.

NOTE

- When both the upper and lower judgments are activated, setting the lower resistance to a value higher than the upper resistance causes the UPPER LED to blink, notifying the operator that a test cannot be conducted. (The lower resistance is set to 1.00 MΩ at factory shipment.) In such cases, lower the lower resistance or raise the upper resistance.
- When the lower judgment is activated, making settings such that the value obtained by dividing the test voltage by the lower resistance exceeds 1.1 mA causes the LOWER LED to blink, notifying the operator that a test cannot be conducted. In such a case, lower the test voltage or raise the lower resistance.

Setting the upper resistance (UPPER)

The upper resistance can be set in the range of 0.01 MΩ to 5 000 MΩ (provided that the current is within the maximum rated current).

Upper Resistance	Resolution
0.01 MΩ to 9.99 MΩ	0.01 MΩ
10.0 MΩ to 99.9 MΩ	0.1 MΩ
100 MΩ to 5 000 MΩ	1 MΩ

1 Press the UPPER/LOWER key.

This causes the rightmost digit of the resistance meter LED to blink, indicating that the cursor is positioned at this digit.

2 Check whether the UPPER LED is lit.

If it is, the upper resistance is displayed. If the LOWER LED is lit, the value displayed is the lower resistance. In such a case, press the UPPER/LOWER key again to light up the UPPER LED.

3 Press the ◀ or ▶ key to move the cursor to the digit at which a value is to be set.

4 With the SHIFT key held down, press the ▼ or ▲ key to change the value.

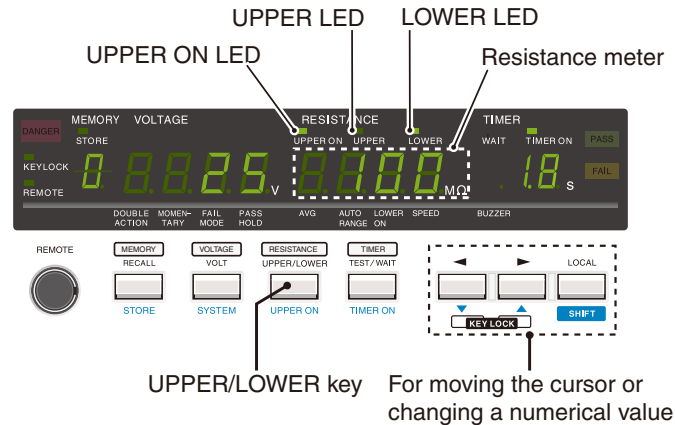
If necessary, change the value at another digit to reach the desired upper resistance.

NOTE

When both the upper and lower judgments are activated, setting the upper resistance to a value below the lower resistance causes the UPPER LED to blink, notifying the operator that the test cannot be conducted. (The upper resistance is set to 100 MΩ at factory shipment.) In such cases, raise the upper resistance, lower the lower resistance, or set the lower judgment to OFF.

Turning the Judgment Function On and Off

The lower limit (LOWER) and upper limit (UPPER) are used to make pass/fail judgment on the DUT. You can set the lower and upper judgment functions separately. If both judgment functions are ON, they function as a window comparator.



NOTE

If the upper or lower judgment function is OFF, no FAIL judgment is made. However, if the timer is on, a PASS judgment will be made after the test time elapses, so you need to be careful.

Turning the lower judgment function on and off

When the lower judgment is set to ON, if the resistance value falls below the lower resistance, the tester makes a FAIL judgment and ends the test.

Setting the lower judgment to OFF causes the tester not to return a FAIL judgment, even if the insulation resistance falls below the lower resistance.

You can turn on or off the lower judgment function with judgment mode (LOWER ON) (p.35) in the system settings.

- 1 With the SHIFT key held down, press the VOLT key to enter the system setting.**
This causes the leftmost digit of the voltmeter (digit indicated as DOUBLE ACTION) to blink, indicating that the cursor is positioned at this digit.
- 2 Press the ◀ or ▶ key to move the cursor to the LOWER ON position.**
- 3 With the SHIFT key held down, press the ▼ or ▲ key to change the setting.**
The display shows 0 when the lower judgment function is off and 1 when it is on.
- 4 Press the STOP switch to exit the system setting.**

NOTE

- To measure the resistance value despite the fact that it causes a drop in the test voltage, use a tester with the lower judgment set to OFF. In such a case, if the output voltage exceeds the range of $\pm(2\% \text{ of setting} + 2\text{ V})$, the measured voltage value displayed on the voltmeter blinks, notifying the operator of a drop in the test voltage.
- A lower judgment cannot be made until the wait time has elapsed since the start of a test.

Turning the upper judgment function on and off

If the upper judgment is set to ON, when the resistance reaches or exceeds the upper limit, a FAIL judgment is made, and the test is ended.

To turn on the upper judgment function, hold down SHIFT and press UPPER/LOWER (UPPER ON). The function toggles between ON and OFF each time you press the key. When set to ON, the UPPER ON LED lights.

Window comparator function

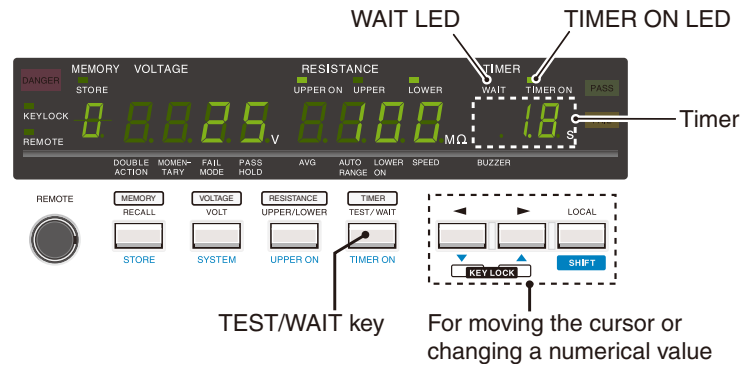
If both the lower and upper judgment functions are ON, they function as a window comparator. When the resistance reaches or exceeds the upper limit or reaches or goes lower than the lower limit, a FAIL judgment is made, and the test is ended.

NOTE

If you turn on the upper judgment function when a fixed range is selected, the UPPER ON LED blinks to indicate that you cannot start the test. Set the range to auto, or turn off the upper judgment function.

Setting the Timer Function

When the timer function is set to ON, the duration of testing can be controlled. When the set test time elapses with the resistance value within the upper and lower resistances during testing, the tester makes a PASS judgment and ends the test.



Turning the timer function on and off

ON and OFF of the timer function can be alternately selected by pressing the TEST/WAIT (TIMER ON) key with the SHIFT key held down. When the timer function has been activated, the TIMER ON LED lights up.

NOTE

If the upper or lower judgment function is OFF, no FAIL judgment is made. However, if the timer is on, a PASS judgment will be made after the test time elapses, so you need to be careful.

Setting the test time (TEST TIME)

The test duration during which the set test voltage is applied to the DUT can be set in the range of 0.5 s to 999 s.

Test Time	Resolution
0.5 s to 99.9 s	0.1 s
100 s to 999 s	1 s

- 1 Press the TEST/WAIT key.**
This causes the rightmost digit of the LED to blink, indicating that the cursor is positioned at this digit.
- 2 Check whether the WAIT LED is lit.**
If it is not lit, the test time is displayed. If it is lit, the value displayed is the wait time. In such a case, press the TEST/WAIT key again to turn off the WAIT LED.
- 3 Press the ◀ or ▶ key to move the cursor to the digit at which a value is to be set.**

- 4 **With the SHIFT key held down, press the ▼ or ▲ key to change the value.**
If necessary, change the value at another digit to reach the desired test time.

NOTE

Setting the test time shorter than the wait time with the timer function set to ON causes the TIMER ON LED to blink, notifying the operator that the test cannot be conducted.

Setting the wait time (WAIT TIME)

In insulation resistance testing, application of the test voltage to the DUT, including a capacitive DUT, results in a lower insulation resistance measurement than expected until completion of charge, due to the charge current. To eliminate the effects of the charge current during lower judgment, the tester provides a wait time extending from the application of the test voltage to the start of lower judgment.

The wait time can be set in the range of 0.3 s to 10 s (resolution of 0.1 s).

- 1 **Press the TEST/WAIT key.**
This causes the rightmost digit of the LED to blink, indicating that the cursor is positioned at this digit.
- 2 **Check whether the WAIT LED is lit.**
If it is, the wait time is displayed. If the WAIT LED is not lit, the value displayed is the test time. In such cases, press the TEST/WAIT key again to make the WAIT LED light.
- 3 **Press the ◀ or ▶ key to move the cursor to the digit at which a value is to be set.**
- 4 **With the SHIFT key held down, press the ▼ or ▲ key to change the value.**
If necessary, change the value of another digit to set the desired wait time.

NOTE

Setting the test time shorter than the wait time with the timer function set to ON causes the TIMER ON LED to blink, notifying the operator that the test cannot be conducted.

Starting and Ending a Test

NOTE

- If a setting is invalid (p.37), the tester cannot start a test.
- When a PASS/FAIL judgment result is being output, the tester cannot start a test.
- If the STOP switch has been pressed, the tester cannot start a test. (This includes a stop signal from the remote control.)
- When DOUBLE ACTION in the system setting (p.33) is activated, the test can be started by pressing the STOP switch, then pressing the START switch within approximately a half-second. Otherwise, the test cannot be started.
- When MOMENTARY in the system setting (p.33) is activated, the tester performs the test only while the START switch is being held down.

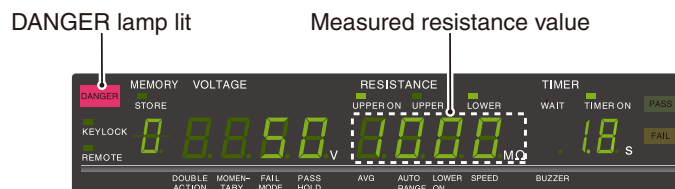
Starting the test

- To start the test, press the START switch.
- When the test starts, the DANGER lamp lights up, the voltmeter and resistance meter indicate the measured values, and the timer indicates the time.
- The time indicated after the start of the test differs depending on whether the timer function is set to ON or OFF.

When the timer is ON: The time remaining of the set time is indicated.

When the timer is OFF: The elapsed test duration is indicated.
(Note that if the test time exceeds 999 seconds, "999" blinks.)

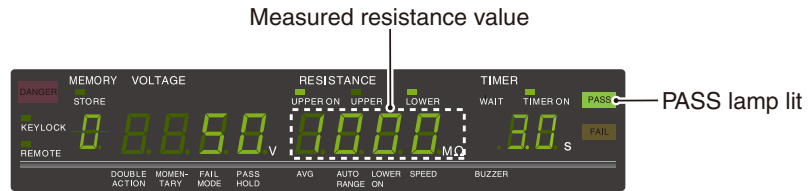
- The WAIT LED blinks during the wait time.



Example of Display during a Test

Ending the test

PASS judgment



■ When the timer is ON:

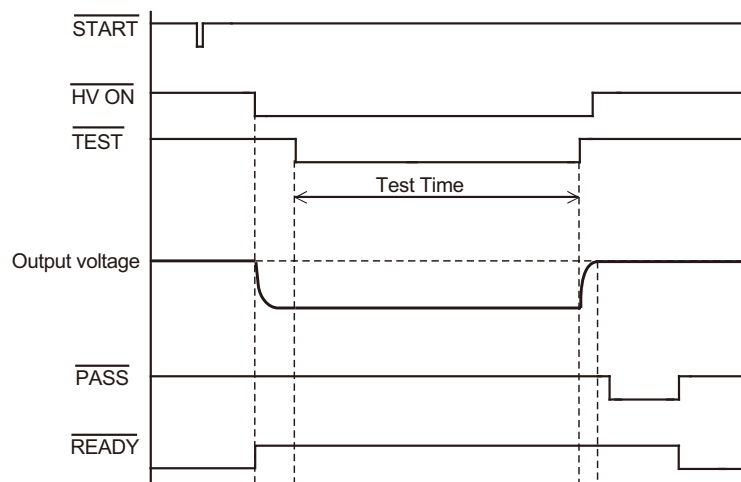
- When the test time elapses without a FAIL judgment during testing, the tester makes a PASS judgment and ends the test.
- When a PASS judgment is made, the PASS lamp lights up and the buzzer sounds. The PASS judgment is indicated for approx. 0.2 seconds. The display of a PASS judgment may be set to HOLD. (p.33) The buzzer is also linked to the "PASS" display time.
- The measurement results will be displayed while the PASS lamp is lit.

■ When the timer is OFF:

- If the FAIL conditions are not met, the test will continue.
- To interrupt the test, press the STOP switch. When the STOP switch has been pressed to stop the test, no judgment is made and "PASS" is not displayed.

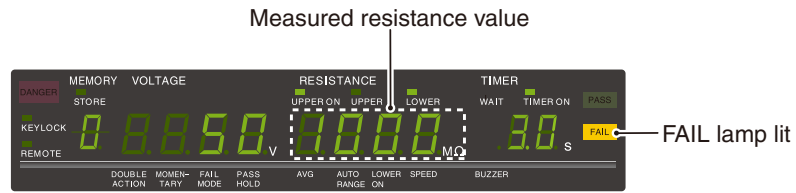
NOTE

- To eliminate the effects of the charge current of a capacitive DUT, a lower judgment will not be made until the wait time (p.29) elapses from the start of a test.
- During the wait time, the WAIT LED blinks.

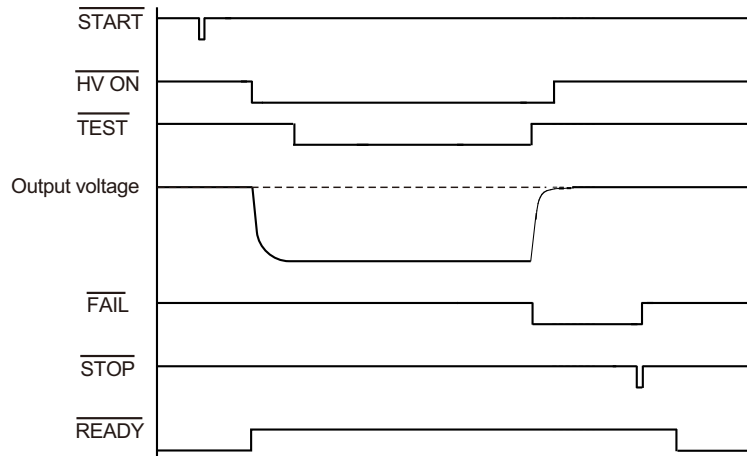


Example of the Timing Chart of PASS Judgment

FAIL judgment



- When the upper judgment is activated, detection of a resistance value greater than the upper resistance during a test causes the tester to make a FAIL judgment, shut off the output, and end the test.
- When the lower judgment is activated, detection of a resistance value below the lower resistance during a test causes the tester to make a FAIL judgment, shut off the output, and end the test.
- The tester lights up the LOWER LED for lower judgment or the UPPER LED for upper judgment, lights up the FAIL lamp, and sounds the buzzer.
- To stop a FAIL judgment, press the STOP switch. (The tester continues to output a FAIL judgment indication until the STOP switch is pressed.)
- The measurement results will be displayed until the STOP switch is pressed.



Example of a Timing Chart of Output Shutoff Caused by FAIL Judgment

System Setting

In addition to test conditions such as the test voltage, this product has settings related to the system.

In system setting, the following items can be set:

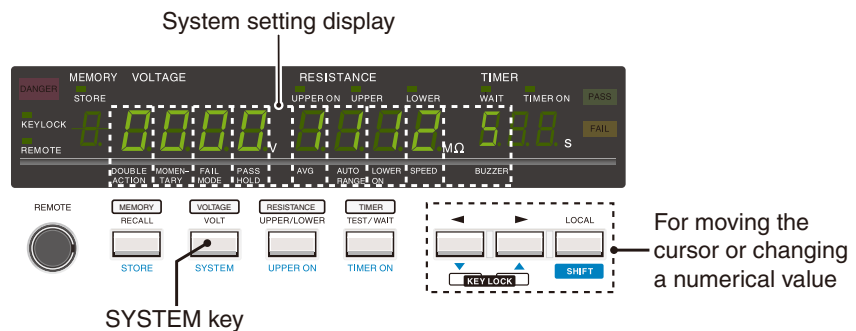
- Double action
- Momentary
- Fail mode
- Pass hold
- Average count (AVG)
- Auto-range
- Lower judgment (LOWER ON)
- Communication rate (SPEED)
- Buzzer volume (BUZZER)

Controlling the system settings

- 1 Press the STOP switch.**
- 2 Check that the DANGER lamp is turned off.**
- 3 With the SHIFT key held down, press the SYSTEM key.**
The TOS7200 enters system setting mode.
- 4 Press the ◀ or ▶ key to move the cursor to the digit at which a value is to be set.**
The 7-segment LED corresponding to the system setting function display turns on to indicate that a system setting item has been selected.
- 5 With the SHIFT key held down, press the ▼ or ▲ key to change the value.**

To exit system setting

- 1 Press the STOP switch.**
The display returns to the previous status before the tester entered system setting.



Description of each item

■ Double action (DOUBLE ACTION)

When DOUBLE ACTION is set to ON, the START switch must be pressed within approximately a half-second after the STOP switch is pressed to start testing. Pressing only the START switch does not start a test; this function requires pressing both the STOP and START switches, making the procedure more complicated. Nevertheless, this method offers greater safety.

When operating the tester through the RS232C interface, set this feature to OFF.

7-segment LED	Setting	
0	DOUBLE ACTION is OFF	← At initialization
1	DOUBLE ACTION is ON	

■ Momentary (MOMENTARY)

When MOMENTARY is set to ON, the tester performs a test only for as long as the START switch remains pressed.

Since this operation keeps the operator's hands confined to the front panel of the tester or the optional remote control box during a test, it increases the safety of operations. Use of this function together with the optional RC02-TOS (a remote control box operated using both hands) further increases safety.

When controlling the tester via the RS232C interface, set this feature to OFF.

7-segment LED	Setting	
0	MOMENTARY is OFF	← At initialization
1	MOMENTARY is ON	

■ Fail mode (FAIL MODE)

With FAIL MODE set to ON, a FAIL judgment can only be canceled using the STOP switch on the front panel. It cannot be cancelled by a stop signal from the remote control.

7-segment LED	Setting	
0	FAIL MODE is OFF	← At initialization
1	FAIL MODE is ON	

■ Pass hold (PASS HOLD)

When PASS HOLD is set to ON, a PASS judgment is held until the STOP switch is pressed.

7-segment LED	Setting	
0	PASS HOLD is OFF	← At initialization
1	PASS HOLD is ON	

■ Average count (AVG)

The number of averaging times is fixed to "100".

7-segment LED	Setting	
1	Number of averaging times: 100	(Fixed)

■ Auto-range (AUTO RANGE)

This setting selects auto-range or fixed range for measurements.

When AUTO RANGE is selected, the tester automatically selects the optimum range for measurements. When fixed range is selected, the range is selected based on output voltage and lower resistance.

7-segment LED	Setting	
0	Fixed range	
1	Auto-range	← At initialization

NOTE

When the fixed range is selected with the upper judgment set to ON, the UPPER ON LED blinks, notifying the operator that a test cannot be performed. In such cases, select auto-range or set the upper judgment to OFF.

■ Lower judgment (LOWER ON)

When the lower judgment function is set to ON, if the resistance value falls below the lower resistance, the tester returns a FAIL judgment and ends the test.

When the lower judgment function is set to OFF, the tester does not return a FAIL judgment, even if the insulation resistance falls below the lower resistance.

7-segment LED	Setting	
0	Lower judgment is OFF	
1	Lower judgment is ON	← At initialization

■ Communication rate (SPEED)

This setting selects the RS232C communication rate.

7-segment LED	Setting	
0	9600 bps	
1	19200 bps	← At initialization
2	38400 bps	

■ Buzzer volume (BUZZER)

The system mode allows the volume of the buzzer sounded in the event of a FAIL judgment to be set in 10 steps of 0 to 9. The buzzer volume is set to "5" at initialization.

The volume of the buzzer sounded in the event of a PASS judgment is approximately half of that sounded in the event of a FAIL judgment.

Panel Memory

This tester allows a maximum of 10 types of panel settings to be stored in internal memory and recalled if necessary.

Storing in panel memory

- 1 With the SHIFT key held down, press the STORE key to enter the store mode.**

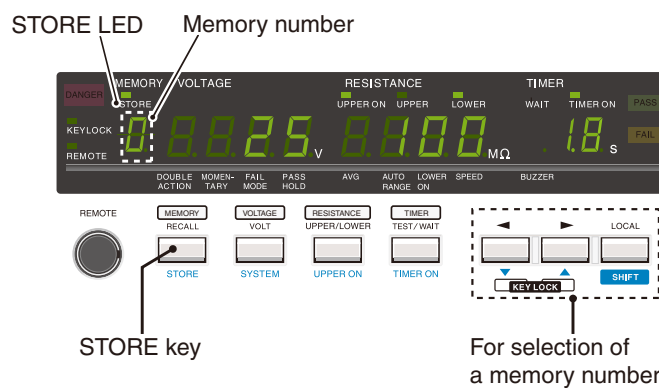
The STORE LED lights up and the memory number's 7-segment LED blinks.

- 2 With the SHIFT key held down, press the ▼ or ▲ key to select the memory number at which the panel settings are to be stored.**

- 3 With the SHIFT key held down, press the STOP switch.**

The STORE LED goes off and the tester exits store mode.

If only the STOP switch is pressed, the STORE LED goes off and the tester exits store mode, but panel settings are not stored.



Recalling a panel memory

- 1 Press the RECALL key to move the cursor to the memory number's 7-segment LED.**

The memory number LED blinks, indicating that the cursor is positioned at that LED.

- 2 With the SHIFT key held down, press the ▼ or ▲ key to select a memory number.**

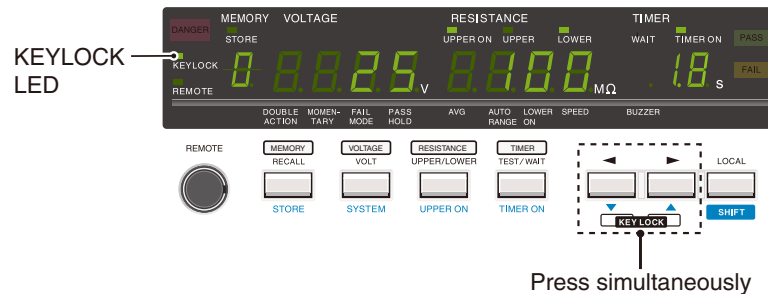
The panel settings stored in that memory location will then appear.

Key Lock

The key lock prevents accidental changing of the test conditions.

Press the ◀ and ▶ keys simultaneously to involve key-locked status, causing the KEYLOCK LED to light up. In the key-locked status, only the START and STOP switches are valid.

To cancel key lock, press the ◀ and ▶ keys simultaneously once again.



Invalid Settings

If any of the invalid settings specified below are made, the tester causes the associated LED to blink, notifying the operator that an invalid setting has been made. While that LED is blinking, a test cannot be conducted.

■ OVER 1.1 mA

If the value obtained by dividing the test voltage by the lower resistance exceeds 1.1 mA, the LOWER LED blinks.

■ UPPER ≤ LOWER

When both the upper and lower judgments are set to ON, setting the upper resistance to a value equal to or less than the lower resistance causes the UPPER LED to blink.

■ TEST ≤ WAIT

When the timer function is activated, setting the test duration to a value equal to or less than the wait time causes the TIMER ON LED to blink.

■ FIX ∩ UPPER ON

If the fixed range is selected with upper judgment is activated, the UPPER ON LED blinks.

NOTE

Initializing clears the contents of the panel settings stored in memory. Before initializing, make sure no data still required is contained in memory.

To initialize, turn ON the POWER switch with the SHIFT key held down. This clears the contents of memory and restores tester settings to the factory default settings. (Press the SHIFT key until the timer's 7-segment LED starts to blink.)

The panel settings restored following initialization are given in Table below. For settings for test conditions aside from the test-voltage set value, the same value is stored in panel memories 0 to 9.

Settings for test conditions

Item	Set value
Test voltage (VOLTAGE)	See 「Test voltage settings」 in the following table.
Lower resistance (LOWER)	1.00 MΩ
Upper judgment (UPPER ON)	ON
Upper resistance (UPPER)	100 MΩ
Timer (TIMER ON)	ON
Timer set value (TIMER)	0.5 s
Wait time (WAIT TIME)	0.3 s

■ Test voltage settings

Panel memory number	Test voltage set value
0	10 V
1	25 V
2	50 V
3	100 V
4	125 V
5	250 V
6	500 V
7 to 9	1000 V

System setting

Item	Set value
Double action (DOUBLE ACTION)	OFF
Momentary (MOMENTARY)	OFF
Fail mode (FAIL MODE)	OFF
Pass hold (PASS HOLD)	OFF
Average count (AVG)	1 (fixed)
Auto-range (AUTO RANGE)	ON
Lower judgment function (LOWER ON)	ON
Communications rate (SPEED)	19200 bps
Buzzer volume (BUZZER)	5

5

Using Terminals and Connectors

This chapter describes use of the terminals and connectors on the front and rear panels of the tester.



WARNING

The remote control uses an external signal to turn ON/OFF the high voltage, which may involve great danger. Therefore, thorough safety measures must be taken to ensure that a high voltage is not accidentally generated and that no one touches the DUT, high-voltage test leadwire, output terminals, or other parts while high voltage is being generated. If such measures cannot be taken, do not perform remote control.



NOTE

When a START signal at the SIGNAL I/O connector is enabled, the START signal has priority over a START signal at the REMOTE terminal. A STOP signal through the SIGNAL I/O connector and that through the REMOTE terminal are accepted equally.

■ REMOTE terminal on the front panel

This terminal allows the starting and stopping of a test to be controlled using the optional remote-control box RC01-TOS or RC02-TOS.

■ SIGNAL I/O connector on the rear panel

Inputting a signal to this connector allows a test to be started or stopped and the panel memory to be recalled. Moreover, output signals through the SIGNAL I/O connector allow the condition of the tester to be checked.

■ ANALOG OUT terminals

This connector outputs a voltage compressed logarithmically that corresponds to the measured resistance value, in the range of 0 V to 4 V.

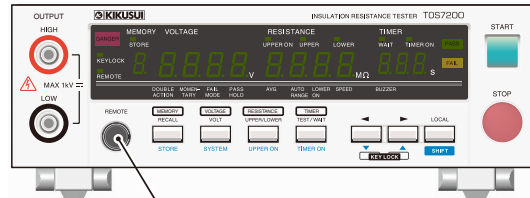
■ RS232C communication interface connector

You can remotely control the TOS7200 through the RS232C interface. For details, see the communication interface manual on the included CD-ROM.

REMOTE Terminal

The REMOTE terminal is a 6-pin mini-DIN connector on the front panel designed to allow connection of an optional remote control box RC01-TOS or RC02-TOS.

Connecting a remote control box disables the START switch on the front panel.



REMOTE terminal
(6-pin mini-DIN connector)

CAUTION

- To prevent damage to the tester, do not connect any component other than the dedicated remote control boxes to the REMOTE terminal.
- Install signal wires more than 50 cm from the high voltage test leadwire or DUT. Avoid short-circuiting the test voltage to a signal wire. If the test voltage is short-circuited to a signal wire, the entire internal circuit may be destroyed.

NOTE

Connection of a remote-control box to the tester requires the use of a DIN-Mini DIN adapter. For DD-5P/6P DIN-Mini DIN adapters [84250], contact your Kikusui distributor/agent.

Performing remote control

- 1 Turn OFF the POWER switch.**
- 2 Connect the REMOTE terminal and the remote-control box using the dedicated connection cable (5-pin DIN cable) via the DIN-mini DIN adaptor.**
- 3 Turn ON the POWER switch.**

This allows the input of a start signal from the remote control box and disables the START switch on the front panel. Note that stop operations may be performed both by using the STOP switch on the front panel and by transmitting a stop signal from the remote control box. For more information, see the operation manual for the optional remote control box.
- 4 To restore control from the front panel, turn OFF the POWER switch.**
- 5 Remove the dedicated connection cable (6-pin DIN cable) from the REMOTE terminal on the front panel.**
- 6 Turn ON the POWER switch.**

This enables the START switch on the front panel.

NOTE

- When a START signal at the SIGNAL I/O connector is enabled, the START signal has priority over a START signal at the REMOTE terminal. A STOP signal through the SIGNAL I/O connector and that through the REMOTE terminal are accepted equally.
 - Connecting or disconnecting a remote control box to or from the REMOTE terminal with the POWER switch turned ON interrupts high-voltage output.
 - When FAIL MODE in the system setting ([p.33](#)) has been activated, a FAIL judgment cannot be canceled by the input of a stop signal via the REMOTE terminal. In such cases, use the STOP switch on the front panel to cancel the judgment.
-

SIGNAL I/O Connector



Possible electric shock. Ensure that all devices are off before you connect or disconnect cables between them.



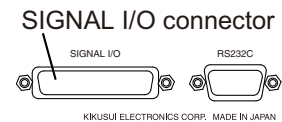
Possible damage to the internal circuitry.

- Keep the signal wire at least 50 cm away from the high-voltage test lead and the DUT.
- Do not short the output voltage circuit.
- If you use the TOS7200 with incomplete connections, burn outs caused by heating may occur when the output is turned on.
- Do not touch the contacts or attach insulators to them. Doing so may reduce the quality of the contacts or cause other problems.

The SIGNAL I/O connector is a D-SUB 25-pin connector on the rear panel.

This connector is used to start and stop tests, recall panel memory entries, and monitor the status of the TOS7200.

- Connector on the tester side
XM3B-2522 D-sub 25-pin female connector (socket) ;
manufactured by OMRON Corporation, Screw M2.6 x 0.45
- Complies connector (plug)
D-sub 25-pin male (with fix screw M2.6)



To avoid malfunctions caused by noise, use shielded-type D-sub 25-pin connectors and a cable that is 2.5 m or less in length.

For information about how to obtain replacement parts, contact your Kikusui agent or distributor.

For information about how to use these components, see the OMRON Corporation catalogs.

Wire and tool that are necessary to make the connection

Wire	Single wire: $\Phi 0.32$ mm (AWG28) to 0.65 mm (AWG22) in diameter
	Twisted wire: $\Phi 0.32$ mm ² (AWG22) to 0.08 mm ² (AWG28)
Wire stripper	A wire stripper that matches the wires listed above

Specifications for the SIGNAL I/O connector

Input signal

Low-active control input

High-level input voltage: 11 V to 15 V

Low-level input voltage: 0 V to 4 V

Low-level input current: -5 mA maximum

Input time width: 5 ms minimum

Output signal

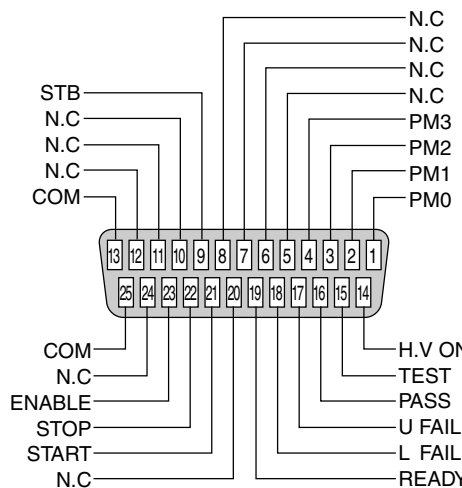
Open drain output

Output withstand voltage: 30 Vdc

Output saturation voltage: Approx. 0.7 V (25 °C)

Maximum output current: 400 mA (TOTAL)

Pin assignment



Pin Configuration for the SIGNAL I/O Connector

No.	Signal name	I/O	Description of signal
1	PM0	I	LSB 1-digit BCD active LOW input
2	PM1	I	Panel memory's selection signal input terminal
3	PM2	I	
4	PM3	I	MSB
5	N.C.		
6	N.C.		
7	N.C.		
8	N.C.		
9	STB	I	Input terminal for the strobe signal of the panel memory
10	N.C.		
11	N.C.		
12	N.C.		
13	COM		Circuit common (chassis potential)
14	HV ON	O	ON during a test or while a voltage remains between the output terminals
15	TEST	O	ON during a test
16	PASS	O	ON for approx. 0.2 seconds when PASS judgment is made, or continuously ON while PASS HOLD is activated
17	U FAIL	O	Continuously ON if an insulation resistance equal to or exceeding the upper resistance is detected, resulting in FAIL judgment
18	L FAIL	O	Continuously ON if an insulation resistance equal to or falling below the lower resistance is detected, resulting in FAIL judgment
19	READY	O	ON during standby
20	N.C.		
21	START	I	Input terminal for the START signal
22	STOP	I	Input terminal for the STOP signal
23	ENABLE	I	Remote control enable signal input terminal
24	N.C.		
25	COM		Circuit common (chassis potential)

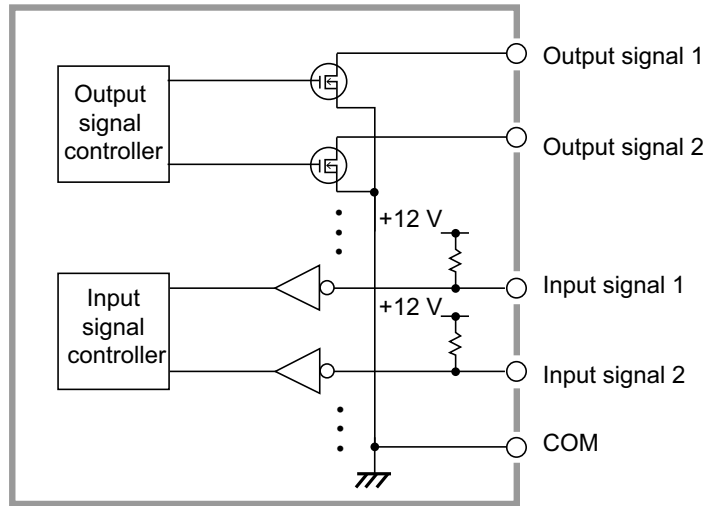
NOTE

Input signals cannot be directly controlled using logic IC such as HC.

■ Internal configuration

Common of the input signal control block is connected to common of the output signal control block.

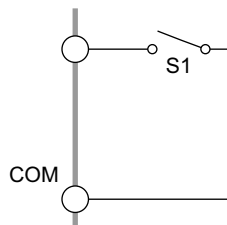
Because the input signal circuit is pulled up to +12 V, opening the input terminal effectively creates a high-level input.



Internal Configuration of the SIGNAL I/O Connector

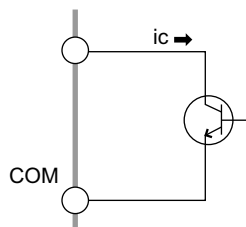
Example of use

■ Input signal



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

Example of Control Using a Make Contact



Use a logic element such as a transistor in place of a switch in the above example. Consideration should be given to pulling up the transistor's collector current, i_c , by 5 mA or more.

Example of Control Using a Logic Element

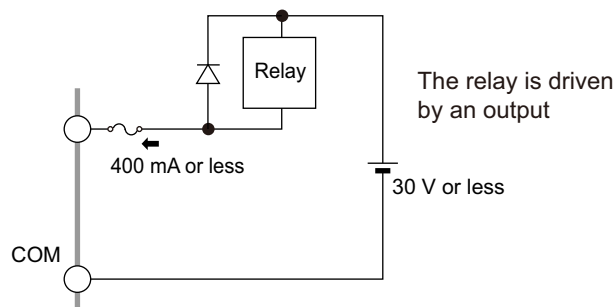
■ Output signal

CAUTION

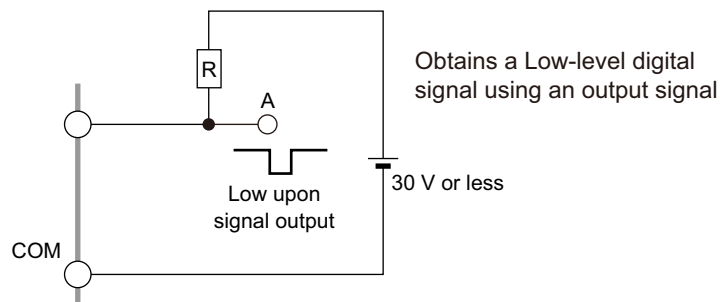
Install signal wires more than 50 cm from the high voltage test leadwire, DUT, and the like. Avoid short-circuiting the test voltage to a signal wire. If the test voltage is short-circuited to a signal wire, the entire internal circuit may be destroyed.

NOTE

- When a load is short-circuited, the open-collector output causes the burning of an output element or printed circuit board. We recommend inserting a protection fuse into the output.
- When driving an inductive load such as a relay, be sure to connect a diode in parallel with the coil.
- The tester's internal control circuit is designed to prevent malfunctions caused by noise generated by the tester or peripheral equipment. However, connected equipments may malfunction if bare (unshielded) cables are connected to SIGNAL I/O terminals, because such cables would make a sort of "antenna" to pick up external noise. Therefore, for connectors, cables, and the external circuit, use a shielded metal connector, a shielded cable, and an external circuit provided in a shielded enclosure, respectively. Moreover, connect each to the cabinet of the tester. This isolates the circuits related to the SIGNAL I/O connector from the external environment and reduces noise-induced malfunctions.



Example of Driving the Relay

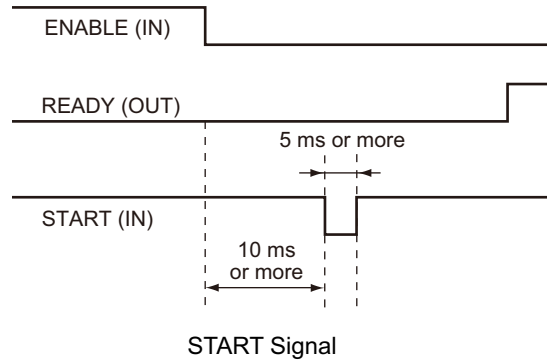


Example of Obtaining a Low-level Digital Signal

Starting a test

To start a test by using the SIGNAL I/O connector, set the ENABLE signal to a low level first. After a lapse of 10 ms, set the START signal to a low level for 5 ms or more. The READY signal turns to a high level after the effective START signal has been detected.

When the ENABLE signal is the low level, the START signal of the SIGNAL I/O connector is enabled. This disables START input via the REMOTE terminal and the START switch on the front panel. But, stopping is possible using any of the available methods: the STOP switch on the panel, STOP input via the REMOTE terminal, or the STOP signal.



Controlling signals

1 Short-circuit from pin 23 (ENABLE) to pin 13 or pin 25 (COM) to set that signal to the low level.

This disables the START switch on the front panel and START input via the REMOTE terminal. Note that stop operations may be performed via the STOP switch on the front panel, the STOP input from the remote control, or the STOP signal via the SIGNAL I/O connector.

2 Short-circuit from pin 21 (START) to pin 13 or pin 25 (COM) to set that signal to the low level.

This starts a test.

3 Short-circuit pin 22 (STOP) to pin 13 or pin 25 (COM) to set that signal to the low level.

This stops a test.

4 To cancel remote control, set ENABLE of the start signal to the high level.

This enables the START switch on the front panel and disables the START signal of the SIGNAL I/O connector.

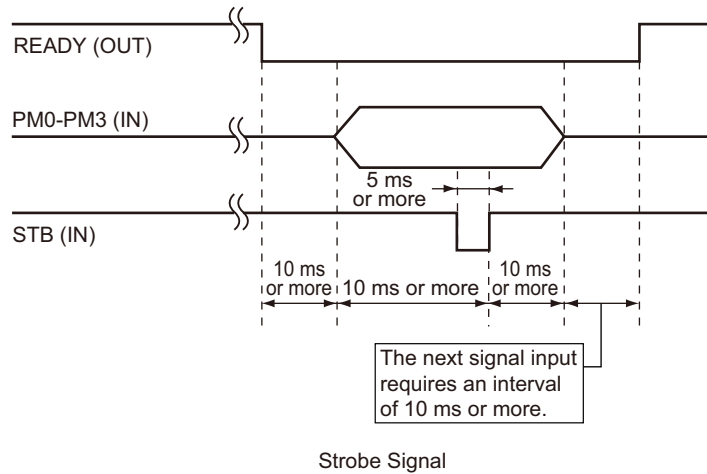
NOTE

- Changing the ENABLE level of a start signal shuts off high-voltage output.
- When FAIL MODE is activated in the system settings (p.33), a FAIL judgment cannot be canceled by stop input from the remote control. In such cases, use the STOP switch on the front panel to cancel judgment.
- The input terminal is pulled up to +12 V using a resistor. Opening the input terminal effectively creates a high-level input.

Recalling the panel memory

A PM signal and STB signal are processed with the timing specified below (make sure the READY signal is at the Low level).

The relationship between the PM0 to PM3 signals and the memory numbers actually to be recalled is as shown in Table below.



NOTE

The input terminal is pulled up to +12 V using a resistor. Opening the input terminal effectively creates a high-level input.

■ PM signals and memory numbers to be recalled

PM3	PM2	PM1	PM0	Memory number to be recalled
H	H	H	H	0
H	H	H	L	1
H	H	L	H	2
H	H	L	L	3
H	L	H	H	4
H	L	H	L	5
H	L	L	H	6
H	L	L	L	7
L	H	H	H	8
L	H	H	L	9

ANALOG OUT Terminals

As shown below, the ANALOG OUT terminals output a logarithmically compressed voltage corresponding to a measured resistance value, in the range of 0 V to 4 V.

$$V_o = \log \left(1 + \frac{R_x}{1M\Omega} \right) \quad \text{Rx: Resistance measurement}$$

Resistance measurement	Output voltage (Vo)*1
0 Ω	0 V
1 MΩ	0.30 V
10 MΩ	1.04 V
100 MΩ	2.00 V
1 000 MΩ	3.00 V
10 000 MΩ or more	4.00 V

*1. Full scale is 5 V.

NOTE

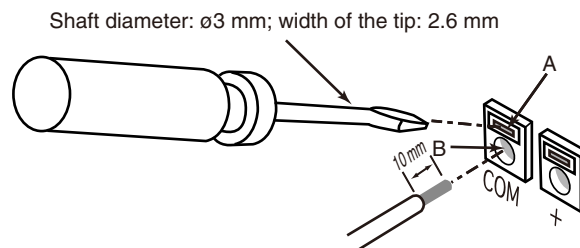
J1 outputs 4 V when a test is not in progress.

Compatible wire material:

- Solid wire of $\Phi 0.65$ mm (AWG22)
- Twisted wire of 0.32 mm² (AWG22), single wire diameter of $\Phi 0.18$ mm or more

■ Connection to the connector

- 1 Strip approx. 10 mm of the covering from the end of each wire.**
- 2 Insert the end of a flat-head screw driver into opening A to open port B.**
- 3 Insert the signal wire into B, making sure the covering is not caught in port B.**
- 4 Gently pull the wire to confirm that it does not come off easily.**



6 Maintenance

This chapter describes the maintenance and inspection of the tester. To maintain the tester's original performance for as long as possible, conduct periodic inspection and maintenance.

Inspection

■ AC power cord

Confirm that the covering is free of breaks and cracks, that the plug is free of looseness and cracks, and that the cord does not contain a broken wire.

■ High-voltage test leadwires

Confirm that the covering is free of breaks and cracks and that there is no break in the leads.



Any break or crack in the covering greatly increases the risk of electric shock or fire. If you find any breaks or cracks, immediately discontinue use of the tester.

To purchase accessories, contact your Kikusui distributor/agent.

Maintenance



The tester generates voltages as high as 1 000 Vdc. Never attempt to maintain the Tester including overhauls for yourself, as such tasks entail great danger. For such service, contact your Kikusui distributor/agent.

■ Backup battery

The tester uses a lithium battery for memory backup.

If the battery is exhausted, the memory will not retain stored test conditions or other data.

Although the service life depends on the usage environment, we generally recommend that the battery be replaced every three years. We also recommend that regular internal inspections and cleaning be conducted at the same intervals.

Calibration

Regular calibration is required to maintain the accuracy of measuring instruments over extended periods. For calibration, contact your Kikusui distributor/agent.



The tester generates voltages as high as 1 000 Vdc. Never attempt to calibrate the Tester for yourself, as such tasks entail great danger. For such service, contact your Kikusui distributor/agent.

Troubleshooting

The problems specified below do not necessarily indicate failures. Please perform the following checks before requesting repairs. If the remedy does not solve the problem or if your case does not match any of the items, contact your Kikusui distributor/agent.

Symptom	Check Item	Reference, Description
The tester does not start when the POWER switch is pressed.	Confirm that the AC power cord is connected.	"Connecting the Power Cord" (p.14)
The keys on the front panel do not work.	Confirm that the KEYLOCK function is off.	"Key Lock" (p.37)
	Confirm that the tester is not being remotely controlled via the REMOTE terminal or SIGNAL I/O connector.	"REMOTE Terminal" (p.40) "SIGNAL I/O Connector" (p.42)
	Confirm that the tester is not being remotely controlled via the RS232C interface.	"LOCAL key" (p.7)
The START switch or START signal of the SIGNAL I/O does not work.	Confirm that no STOP signal of the SIGNAL I/O is being input.	"Using Terminals and Connectors" (p.39)
	Confirm that the tester is not in PASS or FAIL status.	The START switch does not function during output of a judgment result. Press the STOP switch to cancel output.
	Confirm that the tester is not currently storing panel settings to or recalling panel settings from panel memory.	"Panel Memory" (p.36)
	Confirm that the double-action function is off.	"Double action (DOUBLE ACTION)" (p.34)
	Confirm that the ENABLE signal of the SIGNAL I/O is at the high level.	"SIGNAL I/O Connector" (p.42)
	Confirm that the tester is not in the midst of making system settings.	"System Setting" (p.33)
	Confirm that the LOWER LED is not blinking.	"Invalid Settings" (p.37)
	Confirm that the UPPER LED is not blinking.	
	Confirm that the TIMER ON LED is not blinking.	
	Confirm that the UPPER ON LED is not blinking.	
	Confirm that the tester is not being remotely controlled via the RS232C interface.	"LOCAL key" (p.7)

7 Specifications

Basic performance

Output section		
Output voltage range		-25 V to -1000 V
	Resolution	1 V
	Accuracy	±(1.5 % of setting +2 V)
Maximum rated output		1 W (1 000 V/1 mA)
Maximum rated current		1 mA
Output terminals	Output type	Floating
	Isolation voltage	±1 000 Vdc
Ripple	1000 V under no load	2 Vp-p or less
	Maximum rated load	10 Vp-p or less
Voltage regulation		1 % or less (maximum rated load → no load)
Short-circuiting current		12 mA or less
Output rise time		50 ms or less (10 % to 90 %, no load)
Discharge function		Forced discharge at the end of test (discharge resistance: 25 kΩ)
Voltmeter		
Measurement range		0 V to -1 200 V
Resolution		1 V
Accuracy		±(1 % of reading +1 V)
Resistance meter		
Measurement range		0.01 MΩ to 5 000 MΩ (In the range of over 100 nA to a maximum rated current of 1 mA)
Display		□ . □□ MΩ [R < 10.0 MΩ] □□ . □ MΩ [10.0 MΩ ≤ R < 100.0 MΩ] □□□ MΩ [100.0 MΩ ≤ R < 1 000 MΩ] □□□□ MΩ [1000 MΩ ≤ R ≤ 5 000 MΩ] (R = measured insulation resistance)
Accuracy *1		±(10 % of reading) [100 nA < i ≤ 200 nA] ±(5 % of reading) [200 nA < i ≤ 1 μA] ±(2 % of reading) [1 μA < i ≤ 1 mA] (i = measured output-voltage value/measured resistance value)
Range selection		The current measurement range is selectable between AUTO and FIX.
AUTO		Automatically changes the current measurement range according to the measured current value.
FIX		Fixes the current measurement range based on the output voltage set value and LOWER set value (in UPPER OFF status)
Holding function		Holds the resistance value obtained at the end of testing while a PASS judgment is being output.

Judgment function	
Judgment method/action	See Separate Table 1.
Setting range for the upper resistance (UPPER)	0.01 MΩ to 5 000 MΩ [In the range of the maximum rated current or less]
Setting range for the lower resistance (LOWER)	0.01 MΩ to 5 000 MΩ [In the range of the maximum rated current or less]
Judgment accuracy	See Separate Table 2.
Time	
Setting range for the test duration (TEST TIME)	0.5 s to 999 s (TIMER OFF function provided)
Setting range for the wait time (WAIT TIME)	0.3 s to 10 s (TEST TIME > WAIT TIME)
Accuracy	±(100 ppm +20 ms)

*1. In the humidity range of 20 %rh to 70 % rh (no condensation permitted), with no disturbance such as swinging of the test leadwires

■Table.1 Judgment method/action of the judgment function

Judgment	Judgment method	Indication	Buzzer	SIGNAL I/O
UPPER FAIL	If a resistance value equal or higher than the upper resistance is detected, the tester shuts off the output and returns an UPPER FAIL judgment.	FAIL lamp lights. UPPER LED lights.	ON	Outputs an UPPER FAIL signal.
LOWER FAIL	If a resistance value equal or less than the lower resistance is detected, the tester shuts off the output and returns a LOWER FAIL judgment. Note that no judgment is made within the judgment wait time (WAIT TIME) after the start of the test.	FAIL lamp lights. LOWER LED lights.	ON	Outputs a LOWER FAIL signal.
PASS	If no abnormality is found when the set test time has elapsed, the tester shuts off the output and returns a PASS judgment.	PASS lamp lights.	ON	Outputs a PASS signal.

- A PASS signal is output for approx. 200 ms. However, if the PASS HOLD function is set to “HOLD,” the signal is continuously output until a STOP signal is input.
- An UPPER FAIL or LOWER FAIL signal is continuously output until a STOP signal is input.
- The buzzer volume for FAIL or PASS judgment is adjustable. However, it cannot be individually adjusted for PASS and FAIL judgments, as they use common settings.

■Table.2 Judgment accuracy of the upper/lower judgment function

UPPER, LOWER	i = test/(UPPER, LOWER)		
	100 nA < i ≤ 200 nA	200 nA < i ≤ 1 μA	1 μA < i ≤ 1 mA
0.01 MΩ ≤ R < 10.0 MΩ	–	–	±(2 % of setting+3 digits)
10.0 MΩ ≤ R < 50.0 MΩ	–	±(5 % of setting+5 digits)	±(2 % of setting+3 digits)
50.0 MΩ ≤ R < 100 MΩ	–	±(5 % of setting+5 digits)	±(2 % of setting+3 digits)
100 MΩ ≤ R < 200 MΩ	±(10 % of setting+5 digits)	±(5 % of setting+5 digits)	±(2 % of setting+3 digits)
200 MΩ ≤ R < 500 MΩ	±(10 % of setting+5 digits)	±(5 % of setting+5 digits)	±(2 % of setting+3 digits)
500 MΩ ≤ R < 1 000 MΩ	±(10 % of setting+5 digits)	±(5 % of setting+5 digits)	±(2 % of setting+3 digits)
1 000 MΩ ≤ R < 2 000 MΩ	±(10 % of setting+50 digits)	±(5 % of setting+50 digits)	–
2 000 MΩ ≤ R ≤ 5 000 MΩ	±(10 % of setting +100 digits)	±(5 % of setting+50 digits)	–

- The humidity must be in the range of 20 % to 70 %rh (no condensation permitted), and there must be no disturbance such as swinging of the test leadwires.
- The lower judgment requires a test duration of 0.5 s or more after the wait time has expired. It also requires a wait time of 1.0 s or more for a lower judgment of 200 nA or less.

Interface and other functions

REMOTE		6-pin mini-DIN connector on the front panel The optional remote controller RC01-TOS or RC02-TOS is connected to remotely control starting/stopping of a test (note that a DIN-mini DIN adapter is required).	
SIGNAL I/O		D-SUB 25-pin connector on the rear panel For names and descriptions of connector signals, see Separate Table 3.	
Input	High-level input voltage	11 V to 5 V	All input signals are active Low controlled. The input terminal is pulled up to +12 V using a resistor. Opening the input terminal is equivalent to inputting a high-level signal.
	Low-level input voltage	0 V to 4 V	
	Low-level input current	-5 mA maximum	
	Input time width	5 ms minimum	
Output	Output method	Open drain output (4.5 Vdc to 30 Vdc)	
	Output withstand voltage	30 Vdc	
	Output saturation voltage	Approx. 0.7 V (25 °C)	
	Maximum output current	400 mA (TOTAL)	
ANALOG OUT		Outputs a logarithmically compressed voltage corresponding to the measured resistance value	
+		$V_o = \log \left(1 + \frac{R_x}{1M\Omega} \right)$ Rx: Resistance measurement Rx (1 MΩ: 0.30 V, 10 MΩ: 1.04 V, 100 MΩ: 2.00 V, 1 000 MΩ: 3.00 V, 10 000 MΩ or more: 4.00 V) Output impedance: 1 kΩ	
COM		Analog output-circuit common	
Accuracy		± (2% of full scale)	
RS232C		D-SUB 9-pin connector on the rear panel (compliant with EIA-232-D) All functions other than the POWER switch and KEYLOCK function are remotely controllable.	
		Baud rate	9600/19200/38400 bps (data: 8 bits; parity: none; stop bit: 2 bits fixed)
Display		7-segment LED, 4-digit voltage display, 4-digit insulation resistance display, and 3-digit time display	
Memory function		A maximum of 10 types of test conditions can be stored in memory.	
Backup battery life		3 years or more (at 25 °C)	
TEST MODE	MOMENTARY	A test is conducted only when the START switch is pressed.	
	FAIL MODE	Disables cancellation of FAIL judgment using a stop signal via remote control.	
	DOUBLE ACTION	Starts a test only when the STOP switch is pressed and the START switch is pressed within approximately a half-second.	
	PASS HOLD	Allows the time of holding PASS judgment to be set to 0.2 s or HOLD.	
KEYLOCK		Places the tester in a state in which no keystroke other than the START/STOP switch is accepted.	

■ Table.3 SIGNAL I/O pin assignment

No.	Signal name	I/O	Description of signal	
1	PM0	I	LSB	1-digit BCD active LOW input Panel memory's selection signal input terminal
2	PM1	I		
3	PM2	I		
4	PM3	I	MSB	
5	N.C			
6	N.C			
7	N.C			
8	N.C			
9	STB	I	Input terminal for the strobe signal of the panel memory	
10	N.C			
11	N.C			
12	N.C			
13	COM		Circuit common (chassis potential)	
14	HV ON	O	ON during a test or while a voltage remains between the output terminals	
15	TEST	O	ON during a test	
16	PASS	O	ON for approx. 0.2 seconds when PASS judgment is made, or continuously ON while PASS HOLD is activated	
17	U FAIL	O	Continuously ON if an insulation resistance equal to or exceeding the upper resistance is detected, resulting in FAIL judgment	
18	L FAIL	O	Continuously ON if an insulation resistance equal to or falling below the lower resistance is detected, resulting in FAIL judgment	
19	READY	O	ON during standby	
20	N.C			
21	START	I	Input terminal for the START signal	
22	STOP	I	Input terminal for the STOP signal	
23	ENABLE	I	Remote control enable signal input terminal	
24	N.C			
25	COM		Circuit common (chassis potential)	

General specifications

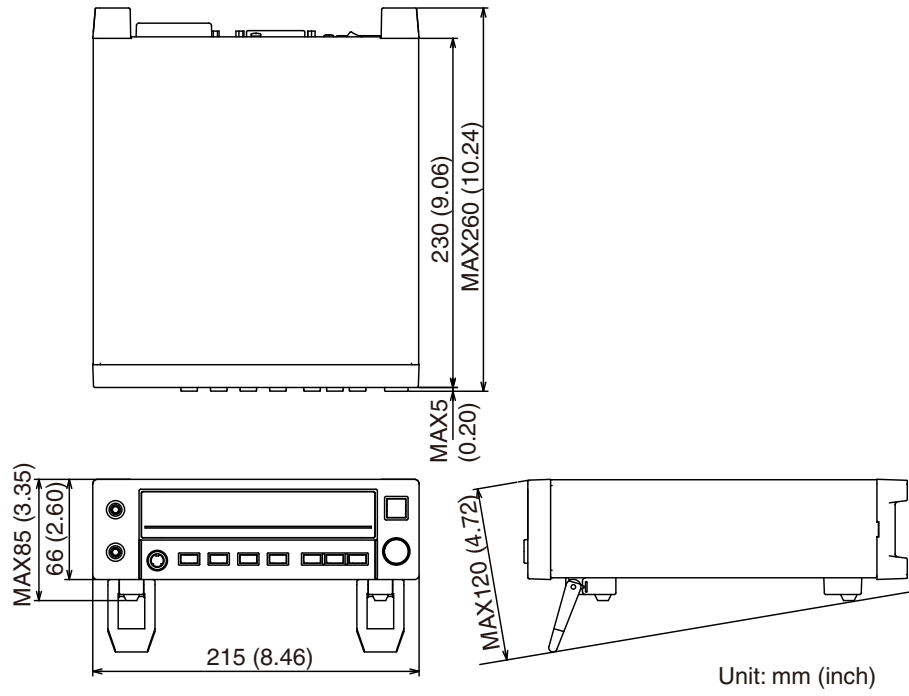
Environment		
Installation location		Indoors and at altitudes up to 2000 m
Warranty range	Temperature	5 °C to 35 °C (41 °F to 95 °F)
	Humidity	20 %rh to 80 %rh (no condensation)
Operating range	Temperature	0 °C to 40 °C (32 °F to 104 °F)
	Humidity	20 %rh to 80 %rh (no condensation)
Storage range	Temperature	-20 °C to 70 °C (-4 °F to 158 °F)
	Humidity	90 %rh or less (no condensation)
Power requirements		
Nominal voltage range (allowable voltage range)		100 Vac to 240 Vac (85 Vac to 250 Vac)
Power consumption	At rated load	30 VA maximum
Allowable frequency range		47 Hz to 63 Hz
Insulation resistance		30 MΩ or more (500 Vdc) [between AC LINE and the chassis]
Withstand voltage		1 390 V AC for 2 seconds, 10 mA or less [AC LINE to chassis]
Earth continuity		25 Aac/0.1 Ω or less
Safety *1		Conforms to the requirements of the following standard. EN 61010-1 (Class I*2, Pollution degree 2*3)
Dimensions		See Dimensions.
Weight		Approx. 2 kg (4.4 lb)
Accessories		
AC power cord		1 pc.
TL08-TOS high-voltage test leadwires		1 set
Setup guide		1 pc.
Quick reference		English: 1pc., Japanese: 1pc.
Safety information		1 pc.
CD-ROM		1 pc.

*1. Not applicable to custom order models.

*2. This instrument is a Class I equipment. Be sure to ground the protective conductor terminal of the instrument. The safety of the instrument is not guaranteed unless the instrument is grounded properly.

*3. 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

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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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