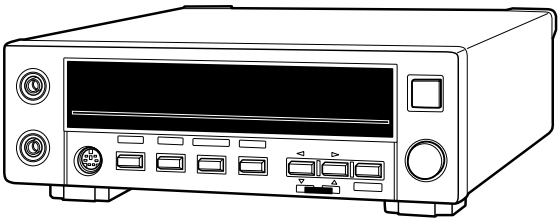
Part No. Z1-002-572, IA002788
Jul. 2009

OPERATION MANUAL

INSULATION RESISTANCE TESTER

TOS7200



⚠ DANGER

This Tester generates high voltage!

- ○ Any incorrect handling may cause death.
- ○ Read Chapter 2 “PRECAUTIONS ON HANDLING” in this manual to prevent accident.
- ○ Keep this manual near the tester for easy access of the operator.

KIKUSUI

Use of Operation Manual

Please read through and understand this Operation Manual before operating the product. After reading, always keep the manual nearby so that you may refer to it as needed. When moving the product to another location, be sure to bring the manual as well.

If you find any incorrectly arranged or missing pages in this manual, 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 Kikusui distributor/agent, and provide the “Kikusui Part No.” given on the cover.

This manual has been prepared with the utmost care; however, if you have any questions, or note any errors or omissions, please contact Kikusui distributor/agent.

Disposing of used Kikusui products in the EU

Under a law adopted by member nations of the European Union (EU), used electric and electronic products carrying the symbol below must be disposed of separately from general household waste.

This includes the power cords and other accessories bundled with the products. When disposing of a product subject to these regulations, please follow the guidance of your local authority, or inquire with your Kikusui distributor/agent where you purchased the product.

The symbol applies only to EU member nations.

Disposal outside the EU

When disposing of an electric or electronic product in a country that is not an EU member, please contact your local authority and ask for the correct method of disposal.

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 when in the DC mode of test.

Power Requirements of this Product

Power requirements of this product have been changed and the relevant sections of the Operation Manual should be revised accordingly. (Revision should be applied to items indicated by a check mark ☑.)

☐ **Input voltage**

The input voltage of this product is _____ VAC,
and the voltage range is _____ to _____ VAC.
Use the product within this range only.

☐ **Input fuse**

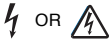
The rating of this product's input fuse is
_____ A, _____ VAC, and _____ .

⚠WARNING

- To avoid electrical shock, always disconnect the AC power cord or turn off the switch on the switchboard before attempting to check or replace the fuse.
- Use a fuse element having a shape, rating, and characteristics suitable for this product. The use of a fuse with a different rating or one that short circuits the fuse holder may result in fire, electric shock, or irreparable damage.

⚠ Safety Symbols

For the safe use and safe maintenance of this product, the following symbols are used throughout this manual and on the product. Understand the meanings of the symbols and observe the instructions they indicate (the choice of symbols used depends on the products).

	Indicates that a high voltage (over 1000 V) is used here. Touching the part causes a possibly fatal electric shock. If physical contact is required by your work, start work only after you make sure that no voltage is output here.
DANGER	Indicates an imminently hazardous situation which, if ignored, will result in death or serious injury.
	Indicates a potentially hazardous situation which, if ignored, could result in death or serious injury.
	Indicates a potentially hazardous situation which, if ignored, may result in damage to the product and other property.
	Shows that the act indicated is prohibited.
	Is placed before the sign “DANGER, ” “WARNING,” or “CAUTION” to emphasize these. When this symbol is marked on the product, see the relevant sections in this manual.
	Indicates a protective conductor terminal.
	Indicates a chassis(frame) terminal.

⚠ Safety Precautions

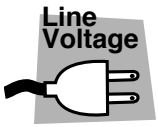
The following safety precautions must be observed to avoid fire hazard, electrical shock, accidents, and other failures. Keep them in mind and make sure that all of them are observed properly.

Users

- This product must be used only by qualified personnel who understand the contents of this operation manual.
- If it is handled by disqualified personnel, personal injury may result. Be sure to handle it under supervision of qualified personnel (those who have electrical knowledge.)
- This product is not designed or produced for home-use or use by general consumers.

Purposes of use

- Do not use the product for purposes other than those described in the operation manual.



Input power

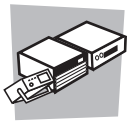
- Use the product with the specified input power voltage.
- For applying power, use the AC power cord provided. Note that the provided power cord is not use with some products that can switch among different input power voltages or use 100 V and 200 V without switching between them. In such a case, use an appropriate power cord.

Fuse

- With products with a fuse holder on the exterior surface, the fuse can be replaced with a new one. When replacing a fuse, use the one which has appropriate shape, ratings, and specifications.

Cover

- There are parts inside the product which may cause physical hazards. Do not remove the external cover.



Installation

- When installing products be sure to observe "Precautions for Installation" described in this manual.
- To avoid electrical shock, connect the protective ground terminal to electrical ground (safety ground).
- When installing products with casters, be sure to lock the casters.

Relocation

- Turn off the power switch and then disconnect all cables when relocating the product.
- Use two or more persons when relocating the product which weights more than 20 kg. The weight of the products can be found on the rear panel of the product and/or in this operation manual.
- Use extra precautions such as using more people when relocating into or out of present locations including inclines or steps. Also handle carefully when relocating tall products as they can fall over easily.
- Be sure the operation manual be included when the product is relocated.

Operation

- Check that the AC input voltage setting and the fuse rating are satisfied and that there is no abnormality on the surface of the AC power cord. Be sure to unplug the AC power cord.
- If any abnormality or failure is detected in the products, stop using it immediately. Unplug the AC power cord. Be careful not to allow the product to be used before it is completely repaired.
- Do not disassemble or modify the product. If it must be modified, contact Kikusui distributor/agent.

Maintenance and checking

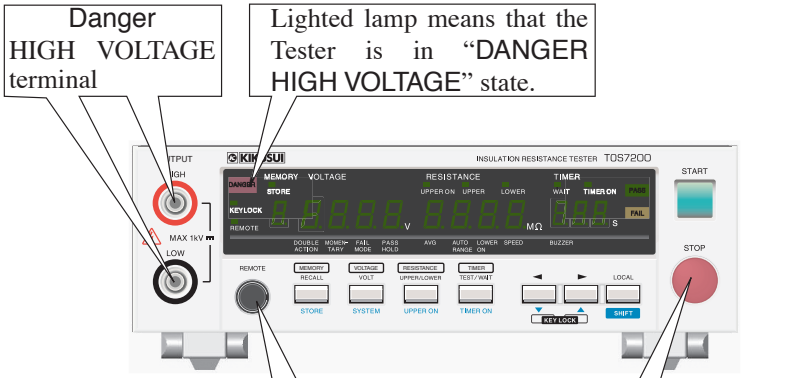
- To avoid electrical shock, be absolutely sure to unplug the AC power cord or stop applying power before performing maintenance or checking.
- Do not remove the cover when performing maintenance or checking.
- To maintain performance and safe operation of the product, it is recommended that periodic maintenance, checking, cleaning, and calibration be performed.

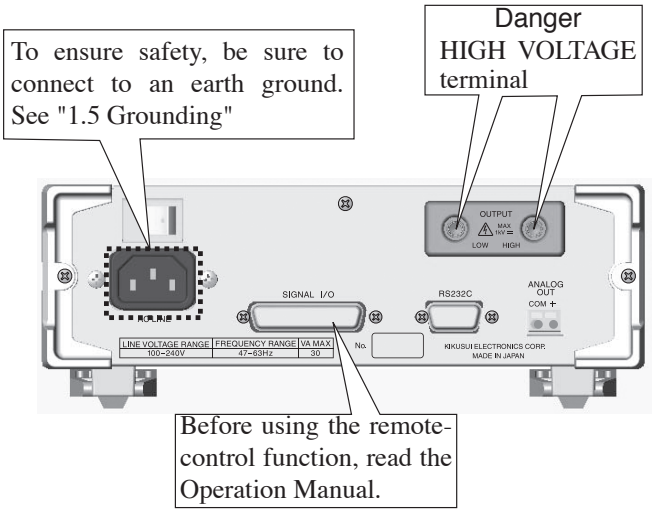
Service

- Internal service is to be done by Kikusui service engineers. If the product must be adjusted or repaired, contact Kikusui distributor/agent.

Front panel and Rear panel

- Be sure to read Chapter 2 "Precautions On Handling".





Contents

Chapter4 Using Terminals and Connectors

Chapter5 RS-232C Control

Chapter6 Part Names and Functions

Chapter7 Maintenance

Chapter8 Specifications

Appendix

Preface

About This Manual

This Operation Manual is for the TOS7200 insulation resistance tester.

This Manual applies to products incorporating ROM of version "1.0x."

The ROM version will be displayed on the voltmeter immediately after power-on.

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 RS-232C 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.

Table P-1

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 being tested. 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.

■ Rear output terminals

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 TOS7200 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 RS-232C interface as standard equipment

The tester features an RS-232C 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

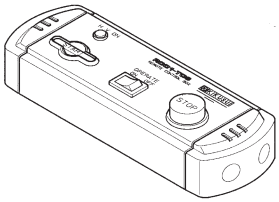
  The TEST switch can be operated only when this switch is set to ON. When it is turned OFF, a test in progress will be stopped forcibly.

- START switch

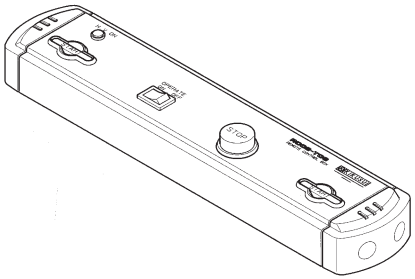
  When the OPERATE switch is ON and the tester is in ready status, pressing this switch starts testing.

- 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) x 70 mm(H) x 39 mm (D)



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

NOTE • Connection of a remote-control box to the tester requires the use of a DIN-Mini DIN adaptor. For DIN-Mini DIN adaptors, contact your Kikusui distributor/agent.

DD-5P/6P DIN-mini DIN adaptor. [84250]

Chapter 1 Setup

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

1.1 Unpacking

Upon receiving the product, confirm that the necessary accessories are included and have not been damaged in transit. Fig. 1-1 shows a list of the accessories.

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

Rated voltage: 125 Vac
PLUG: NEMA5-15
[85-AA-0003]

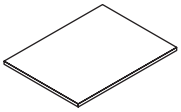
or

Rated voltage: 250 Vac
PLUG: CEE7/7
[85-AA-0005]

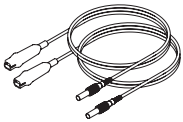
or

Rated voltage: 250 Vac
PLUG: GB1002
[85-10-0790]

☐ Power cord, 1 pc. The power cord that is provided varies depending on the destination for the product at the factory-shipment.



☐ Operation Manual, 1 copy
[Z1-002-572]



☐ TL08-TOS high-voltage test leads (1 set) 1.5 m
[84190]

Fig.1-1 Accessories

NOTE • Retain the packing material for future transport.

1.2 Precautions for installation

Directions for installation locations

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

■ **Do not use the tester in a flammable atmosphere.**

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

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

Do not locate the tester near a heater or in areas subject to drastic temperature changes.

Operating temperature range:+5 °C to +35 °C (+41 °F to +95 °F)
Storage temperature range: -20 °C to +70 °C (-4 °F to +158 °F)

■ **Avoid humid environments.**

Do not locate the tester in a high-humidity environment—near a boiler, humidifier, or water supply.

Operating humidity range:	20 % to 80 % RH (no dew condensation permitted)
Storage humidity range:	90 % RH or less (no dew condensation permitted)

Condensation may occur even within the operating humidity range. In that case, do not start using the tester until the location is completely dry.

■ **Do not place the tester in a corrosive atmosphere.**

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

■ **Do not locate the tester in a dusty environment.**

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

■ **Do not use the tester where ventilation is poor.**

Prepare sufficient space around the tester to allow for air flow.

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

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

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

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

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

Operation in a location subject, may cause such equipment may be affected by noise generated by the tester.

■ **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.

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.

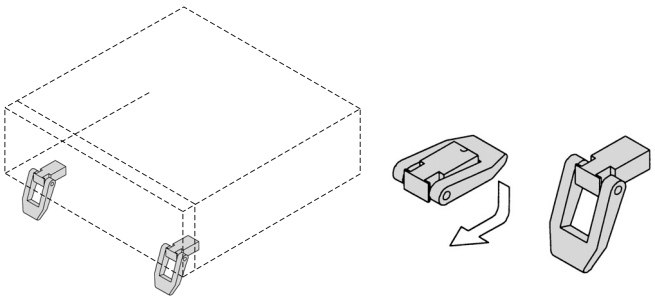


Fig.1-2 Raising the Legs

⚠CAUTION • When the legs are raised and used, do not place any article on the tester or exert force on it.

1.3 Precautions for Moving

When moving or transporting the tester to an installation site, observe the following precautions.

■ **When moving the tester, Disconnect all wires from it.**

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

■ **Retract the legs.**

Moving the tester with the legs raised may result in breakage of the legs.

■ **For transportation, use the special packing material for the tester.**

Transport the tester in its original package to prevent vibration and falls, which may damage the tester. If you require packing material, contact Kikusui distributor/agent.

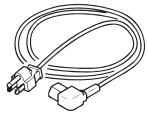
1.4 Connecting the AC Power cord

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

⚠WARNING

- The tester is designed to operate from the overvoltage category II. Do not operate it from the overvoltage category III or IV.
- The AC power cord for 100 V system has a rated voltage of 125 VAC. If this AC power cord is used at the line voltage of a 200 V system, replace the AC power cord with that satisfying that line voltage.
  An appropriate AC power cord must be selected by qualified personnel. If it is difficult to obtain the AC power cord, consult your Kikusui distributor/agent.

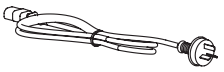
- *Do not use the AC power cord provided with the product as a AC power cord for other instruments.*



[85-AA-0003]
PLUG:NEMA5-15

Power cord for 100 V system
Rated voltage: 125 VAC
Rated current: 10 A

[85-AA-0005]
PLUG:CEE7/7



[85-10-0790]
PLUG:GB1002

Power cord for 200 V system
Rated voltage: 250 VAC
Rated current: 10 A

Fig.1-3 AC power cord

Connection procedure

1. Check that the supply voltage is within the line voltage range of the tester.

   Allowable voltage range: 85 V to 250 VAC

   Frequency range: 47 Hz to 63 Hz
2. Turn OFF the POWER switch.
3. Connect the AC power cord to the AC LINE connector on the rear panel.

   Use the provided power code or power code that is selected by qualified personnel.
4. Plug in the AC power cord.

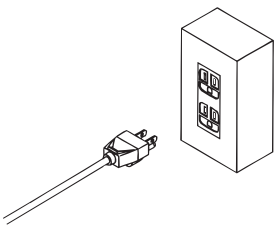
1.5 Grounding

⚠ WARNING

- Be sure to connect the tester to an electrical ground (safety ground).
- This tester is designed as a Class I equipment (equipment protected against electric shock with protective grounding in addition to basic insulation). Therefore, electric shock may occur without proper grounding.

To ensure safety, be sure to ground the tester.

Connect the AC power cord to a three-contact grounded electrical outlet.



Grounded three-contact electrical outlet

Chapter 2 Precautions On Handling

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

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

⚠WARNING • The tester derivers a 1000 V DC test voltage which can cause human injury or death. When operating the tester, be extremely careful and observe the cautions, warnings, and other instructions given in this chapter.

2.1 Prohibited Operations

■ Do not turn on/off the power repeatedly

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

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

2.2 Action When in Emergency

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

(a) Turn OFF the power switch of the Tester.

(b) Disconnect the AC power cord of the Tester from the AC line receptacle.

2.3 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.

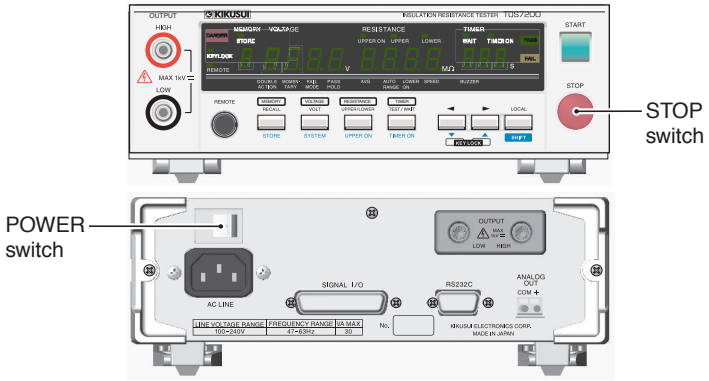


Fig.2-1 Suspending testing and operation

■ Items Charged Up to Dangerous High Voltages

When in test, the DUT, test leadwires, HIGH terminal, and LOW terminal can be charged up to dangerous high voltages. Never touch them when in test.

⚠WARNING

- If the HIGH terminal is short-circuited to ground, high voltage is applied to the LOW terminal, making it dangerous to touch. During testing, do not touch the DUT, test leadwires, HIGH terminal, or LOW terminal.
- 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.

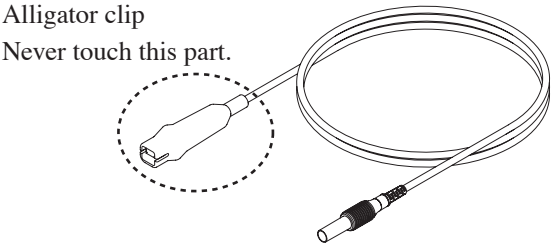


Fig.2-2 Supplied Test leadwires

■ 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.**

2.4 Warning for Residual High Voltages

⚠ WARNING

- In insulation resistance 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 tester's discharge circuit starts forced discharging (discharge function). Do not disconnect the DUT during a test or prior to completion of discharging.

Discharge time

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

Discharge is conducted at a resistance of approximately 25 kΩ in insulation resistance testing.

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

- Insulation resistance testing at 1000 V: Approximately 0.5 ms

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

V is as follows:

- Insulation resistance testing at 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 μF and a parallel resistance of 100 MΩ, 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.

2.5 Dangerous States of Failed Tester

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

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

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

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

2.6 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.

Chapter 3 Basic Operation

This chapter describes the basic operations performed from the front panel, such as setting of the test conditions and system settings.

3.1 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 "1.4 Connecting the AC Power cord".
- To prevent electric shock, be sure to turn OFF the POWER switch before disconnecting the cable for the SIGNAL I/O or RS-232C connector.
- 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 each LED is lit before operating the tester. In particular, conducting a test without checking whether the DANGER lamp is broken is very dangerous. The DANGER lamp lights up during the self-testing, but this does not indicate that the output voltage is being generated.

⚠ CAUTION

- After turning OFF the POWER switch, wait a few seconds, and then turn it on again. Turning the POWER switch on and off repetitively within a short period may damage the tester.

Power-on procedure

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.

   This causes the on-board ROM version number to appear on the voltmeter and "7200", representing the model of the tester, to appear on the resistance meter.

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

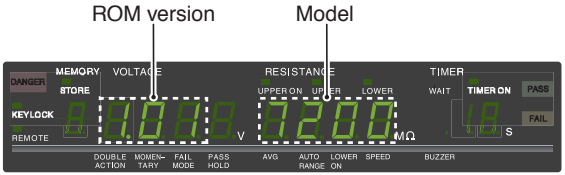


Fig.3-1 Example of Display of the Version Number

3.2 Setting the Test Conditions

NOTE
- If a setting is invalid, the tester cannot start a test. For invalid settings, see "3.8 Invalid Settings".
- A setting is not accepted in the KEYLOCK status (KEYLOCK LED lit), during a test, or during output of a PASS/FAIL judgment result.

The test conditions include the following items:

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

3.2.1 Setting the Test Voltage

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

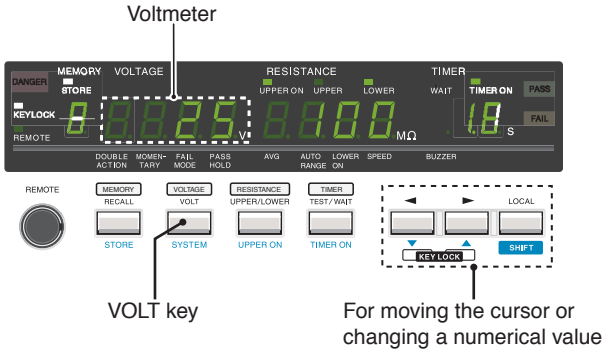


Fig.3-2 Setting the Test Voltage

1. Press the VOLT key to move the cursor to the voltmeter's 7-segment LED.

   This causes the rightmost digit of the 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.

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.

3.2.2 Setting the Lower Judgment

When the lower judgment is set to ON, if the insulation resistance value falls below the lower resistance set in "3.2.3 Setting a Lower Resistance (LOWER)", 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.

ON/OFF of the lower judgment is set after the tester is placed in system mode. For the system mode, see "3.5 System Settings".

1. With the SHIFT key held down, press the VOLT key to enter the system mode.

   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 indicates that “0” is OFF and “1” is ON.
4. Press the STOP switch to exit the system mode.

⚠CAUTION • If the upper or lower judgment function is OFF, no FAIL judgment is made. Note that, if this function is off, PASS judgment is made when the timer is turned on.

3.2.3 Setting a Lower Resistance (LOWER)

The lower resistance can be set in the range of 0.01 MΩ to 5000 MΩ (resolution of 0.01 MΩ for the range of 0.01 MΩ to 9.99 MΩ, of 0.1 MΩ for that of 10.0 MΩ to 99.9 MΩ, and of 1 MΩ for that of 100 MΩ to 5000 MΩ) (provided that the current is within the maximum rated current).

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.

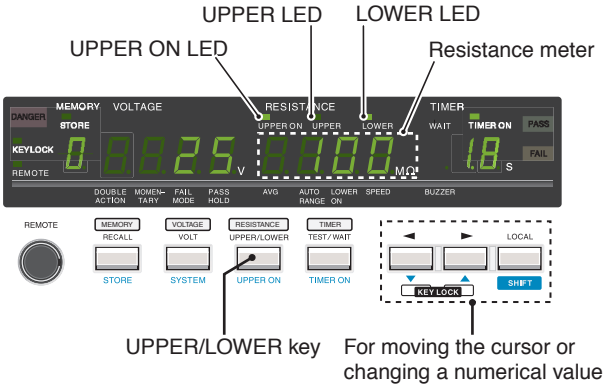


Fig.3-3 Setting a Lower Resistance

1. Press the UPPER/LOWER key to move the cursor to the 7-segment LED of the resistance meter.

   This causes the rightmost digit of the 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.
- 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 ±(2 % of setting + 2 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.

3.2.4 Setting the Upper Judgment

When the upper judgment is set to ON, if the insulation resistance value exceeds the upper resistance set in "3.2.5 Setting the Upper Resistance (UPPER)", the tester returns a FAIL judgment and ends the test.

ON and OFF of the upper judgment can be alternately selected by pressing the UPPER/LOWER (UPPER ON) key with the SHIFT key held down. When the upper judgment has been activated, the UPPER ON LED lights up.

⚠CAUTION • If the upper or lower judgment function is OFF, no FAIL judgment is made. Note that, if this function is off, PASS judgment is made when the timer is turned on.

3.2.5 Setting the Upper Resistance (UPPER)

The upper resistance can be set in the range of 0.01 MΩ to 5000 MΩ (resolution of 0.01 MΩ for the range of 0.01 MΩ to 9.99 MΩ, of 0.1 MΩ for that of 10.0 MΩ to 99.9 MΩ, and of 1 MΩ for that of 100 MΩ to 5000 MΩ) (provided that the current is within the maximum rated current).

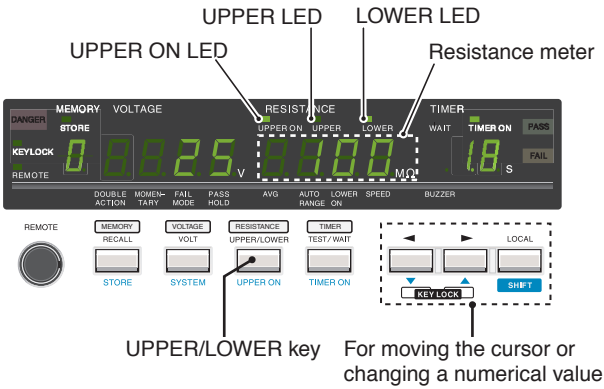


Fig.3-4 Setting the Upper Resistance

1. Press the UPPER/LOWER key to move the cursor to the 7-segment LED of the resistance meter.

   This causes the rightmost digit of the 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.

- When the fixed range has been selected, setting the upper judgment to ON causes the UPPER ON LED to blink, notifying the operator that the test cannot be conducted. In such cases, set the range to auto-range or set the upper judgment to OFF.

3.2.6 Setting the Timer Function

When the timer function is set to ON, the duration of testing can be controlled by following the procedure specified in "3.2.7 Setting the Test Time (TEST TIME)". 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.

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.

3.2.7 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 (resolution of 0.1 s for the range of 0.5 s to 99.9 s and of 1 s for that of 100 s to 999 s).

1. Press the TEST/WAIT key to move the cursor to the timer's 7-segment LED.

   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.

3.2.8 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 to move the cursor to the timer's 7-segment LED.

   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.

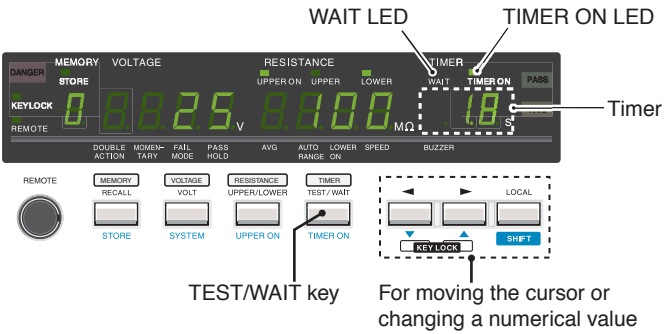


Fig.3-5 Setting the Test Time or Wait Time

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.

3.3 Connecting the Test leadwires

⚠ 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.

3.3.1 Connecting to the Tester

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 of the tester.

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 of the tester.
4. Short-circuit the low voltage side and high voltage side test leadwires to confirm that no high voltage is output.

3.3.2 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.

⚠WARNING • Never touch the HIGH terminal, the LOW terminal, a test leadwire, or the DUT during a test (or while the DANGER lamp is lit).

NOTE • 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. See Fig. 3-6.

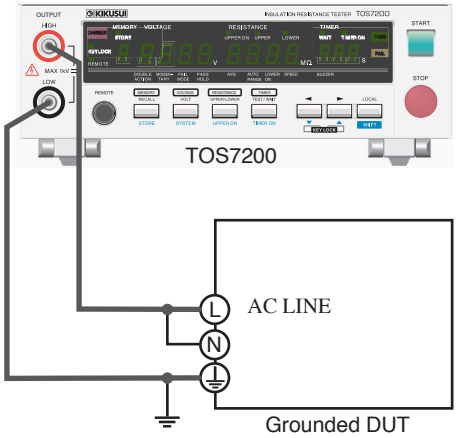


Fig.3-6 Connecting the Tester to a Grounded DUT (insulation resistance test across the AC LINE and chassis of the DUT)

NOTE • 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.

⚠ WARNING • Short-circuiting the HIGH terminal of the tester to ground causes high voltages to be applied to the LOW terminal, making it dangerous to touch. Do not touch the DUT, test leadwires, HIGH terminal, or LOW terminal during a test (or while the DANGER lamp is lit).

■ 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.

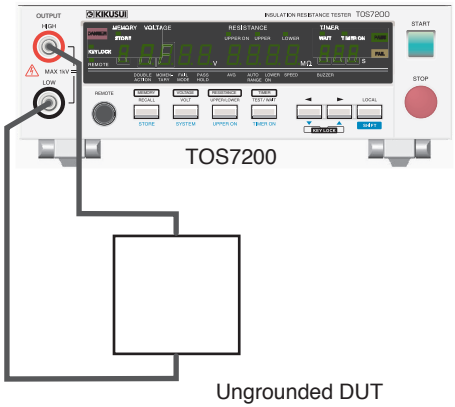


Fig.3-7 Connecting the Tester to an Ungrounded DUT

3.4 Starting and Ending a Test

NOTE

- If a setting is invalid, the tester cannot start a test. For invalid settings, see "3.8 Invalid Settings".
- 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 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. For more information on DOUBLE ACTION, see "3.5 System Settings".
- When MOMENTARY is activated, the tester performs the test only while the START switch is being held down. For more information on MOMENTARY, see "3.5 System Settings".

3.4.1 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.

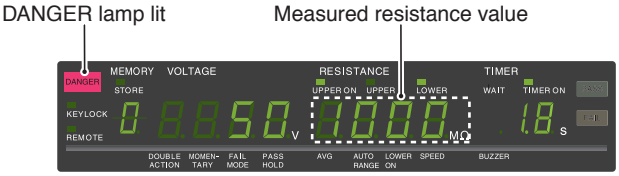


Fig.3-8 Example of Display during a Test

3.4.2 Ending the Test

PASS judgment

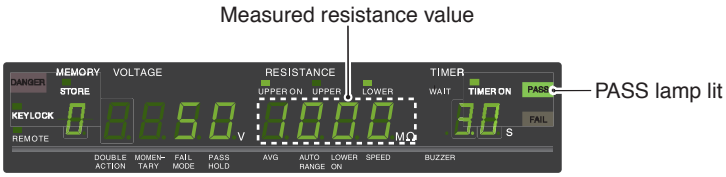


Fig.3-9 Example of Display for PASS Judgment

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. The buzzer is also linked to the “PASS” display time. For information on the procedure for setting the PASS judgment to HOLD, see "3.5 System Settings".
- 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 elapses from the start of a test.
- During the wait time, the WAIT LED blinks.

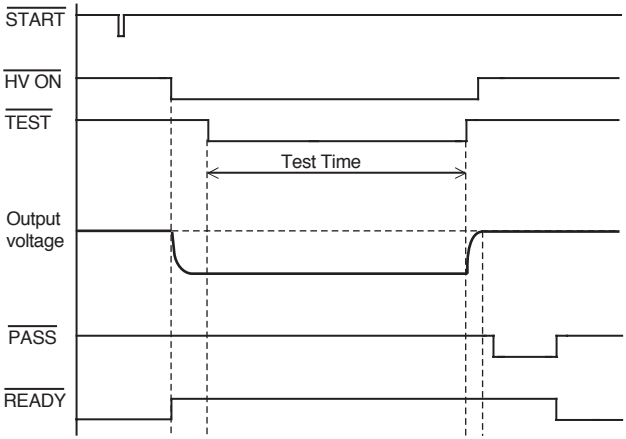


Fig.3-10 Example of the Timing Chart of PASS Judgment

FAIL judgment

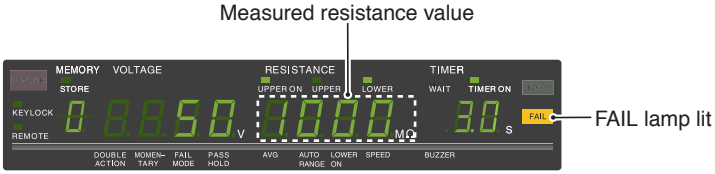


Fig.3-11 Example of the Display for FAIL Judgment

- 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.

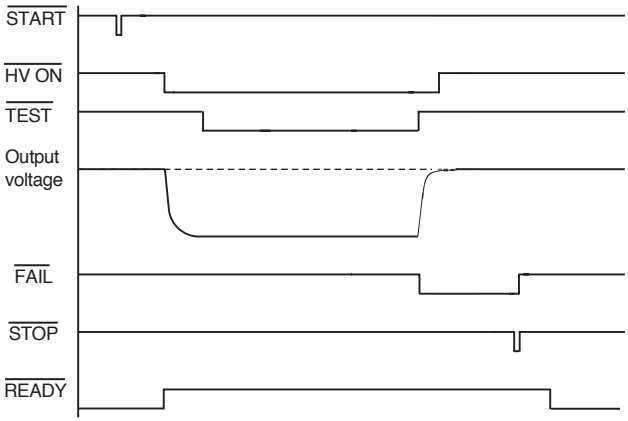


Fig.3-12 Example of a Timing Chart of Output Shutoff Caused by FAIL Judgment

3.5 System Settings

The tester uses the system mode to make system-related settings, in addition to normal mode, which is used to set test conditions, such as test voltage.

In system mode, the following items can be set:

- ON/OFF of double action (DOUBLE ACTION)
- ON/OFF of momentary (MOMENTARY)
- ON/OFF of fail mode (FAIL MODE)
- ON/OFF of pass hold (PASS HOLD)
- Setting of auto-range (AUTO RANGE)
- ON/OFF of lower judgment (LOWER ON)
- Setting of communication rate (SPEED)
- Setting of buzzer volume (BUZZER)

To enter system mode:

1. With the SHIFT key held down, press the SYSTEM key.
   The display of the 7-segment LED changes, and the tester enters system mode.
2. Press the ◀ or ▶ key to move the cursor to the digit at which a value is to be set.
   The indications lower part of the 7-segment LEDs show each setting item.
3. With the SHIFT key held down, press the ▼ or ▲ key to change the value.

To exit system mode:

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

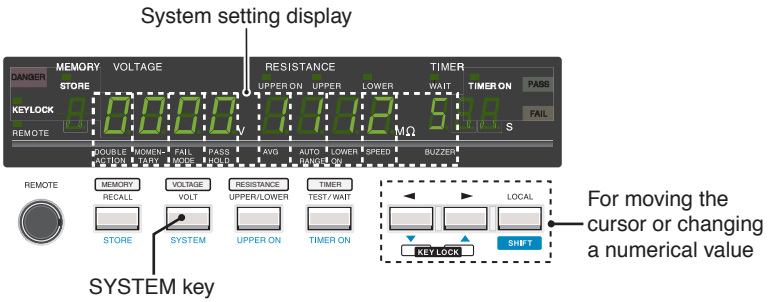


Fig.3-13 Example of Display in the System Mode

Description of each item

■ ON/OFF of 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 RS-232C interface, set this feature to OFF.

Table 3-1

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

■ ON/OFF of 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 START switch 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 RS-232C interface, set this feature to OFF.

Table 3-2

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

■ ON/OFF of 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.

Table 3-3

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

■ ON/OFF of pass hold (PASS HOLD)

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

Table 3-4

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

■ The number of averaging times (AVG)

Indicates the number of a averaging times during measurement.

The number of averaging times is fixed to “100”.

Table 3-5

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

■ Setting of 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.

Table 3-6

7-SEG 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.

■ ON/OFF of lower judgment (LOWER ON)

When the lower judgment function is set to ON, if the insulation 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.

Table 3-7

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

■ Setting the communication rate (SPEED)

This setting selects the RS-232C communication rate. One of 9600 bps, 19200 bps, or 38400 bps may be selected.

Table 3-8

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

■ Setting the 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.

3.6 Panel Memory

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

3.6.1 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.

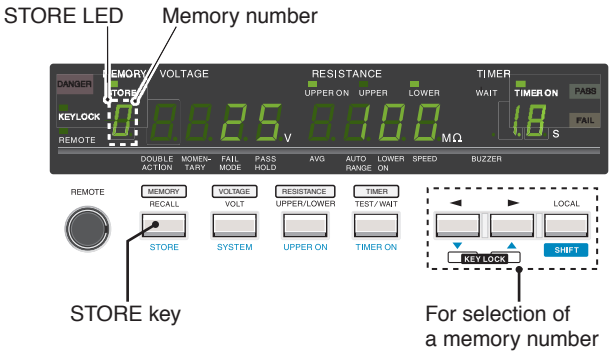


Fig.3-14 Store Mode

3.6.2 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.

3.7 Key Lock

The key lock function 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.

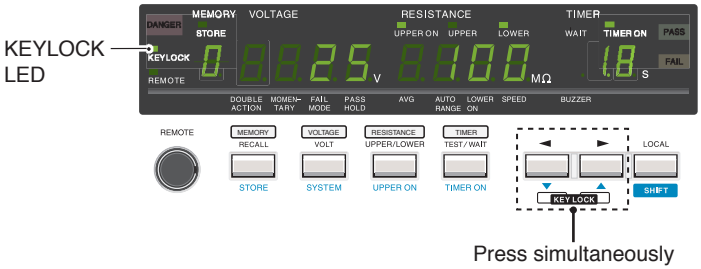


Fig.3-15 Key-Locked Condition

3.8 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.

3.9 Initialize

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 when starting the tester. 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 3-9 to Table 3-11. For settings for test conditions aside from the test-voltage set value, the same value is stored in panel memories 0 to 9.

Table 3-9 Settings for Test Conditions upon Initialization

Item	Set value
Test voltage (VOLTAGE)	See Table 3-10
Lower resistance (LOWER)	1.00 MΩ
Upper judgment (UPPER ON)	ON
Upper resistance (UPPER)	100 MΩ
Timer (TIMER)	ON
Timer set value (TIMER)	0.5 s
Wait time (WAIT TIME)	0.3 s

Table 3-10

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

Table 3-11 System Settings on Initialization

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

Chapter 4 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 or program memory to be recalled. Moreover, output signals through the SIGNAL I/O connector allow the condition of the tester to be checked.

ANALOG OUT connector

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

4.1 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.

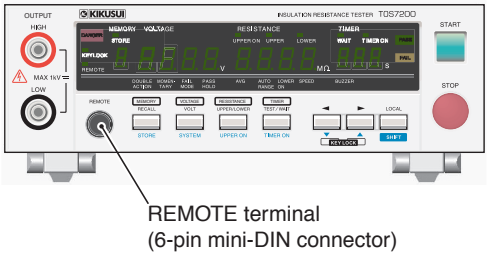


Fig.4-1 REMOTE Terminal

⚠ 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 requires a DIN-mini DIN adaptor. For DIN-mini DIN adaptors, contact your Kikusui distributor/agent.

  DD-5P/6P DIN-mini DIN adaptor.[84250]

■ Performing remote control

1. Turn OFF the POWER switch.
2. Connect the REMOTE connector 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 connector 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 connector with the POWER switch turned ON interrupts high-voltage output.
- When FAIL MODE in the system settings 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. For information on system settings, see “3.5 System Settings”.

4.2 SIGNAL I/O Connector

⚠ WARNING • When connecting or disconnecting a cable, turn off the power supply of each instrument in order to prevent electric shock.

⚠ 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.

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

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

Connector on the tester side

Omron

XM2B-2502 D-SUB 25-pin female connector or equivalent

Connection cable

D-SUB 25-pin male — D-SUB 25-pin male straight cable

Connector compliant with the connection cable

Omron

XM2D-2501 D-SUB 25-pin female connector or equivalent

NOTE • Use a shielded D-SUB 25-pin connector and cable of 3 m in length or less to avoid noise, which may result in malfunctions.

• 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 con-

nector, 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.

4.2.1 Specifications for the SIGNAL I/O Connector

Input signal

Active LOW 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 collector output

Output withstand voltage: 30 V DC
Output saturation voltage: Approx. 1.1 V (25 °C)
Maximum output current: 400 mA (TOTAL)

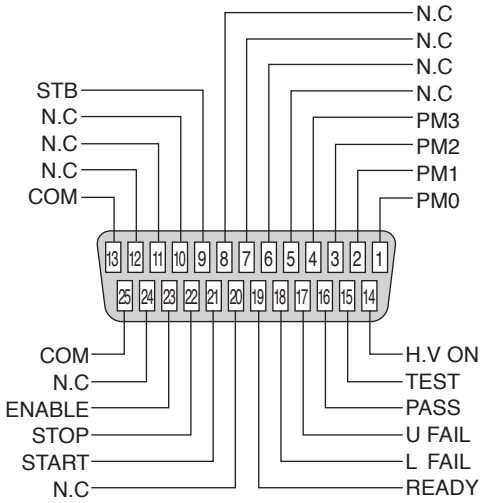


Fig.4-2 Pin Configuration for the SIGNAL I/O Connector

Table 4-1 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 Memory recall by latching this selection signal at the rise of the strobe signal
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)	

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.

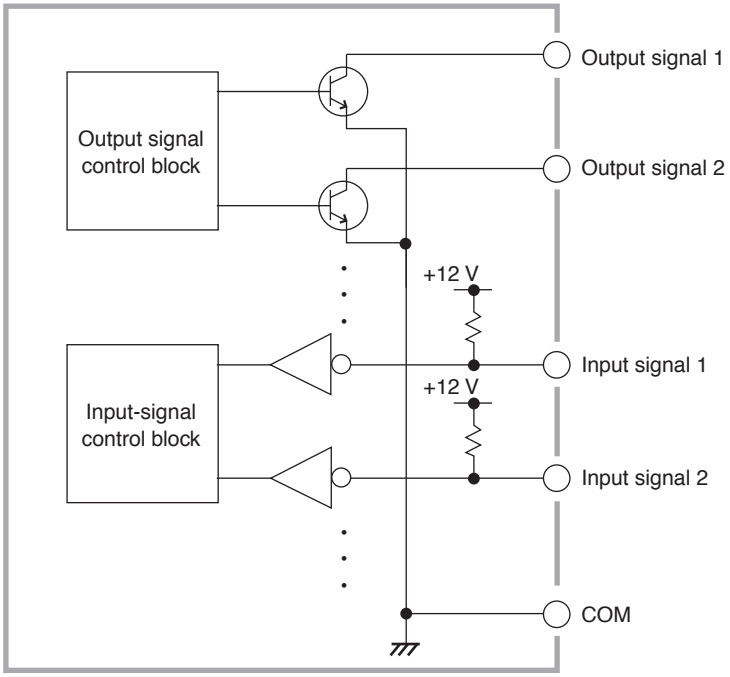
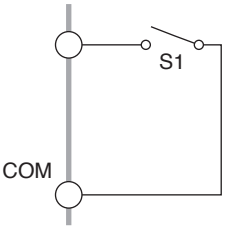


Fig.4-3 Internal Configuration of the SIGNAL I/O Connector

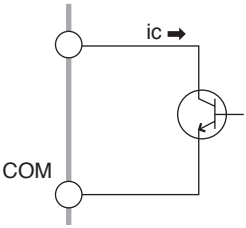
4.2.2 Example of Use

Input signal



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

Fig.4-4 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, ic, by 5 mA or more.

Fig.4-5 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 (do not connect the COM to the shield or to ground.) This isolates the circuits related to the SIGNAL I/O connector from the external environment and reduces noise-induced malfunctions.

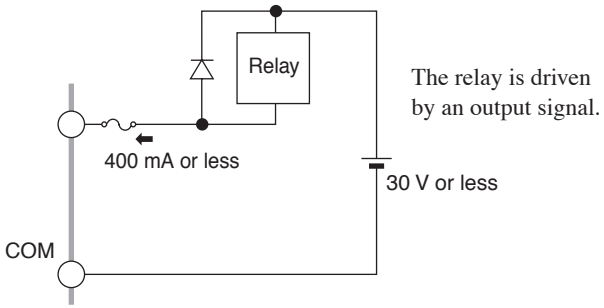


Fig.4-6 Example of Driving the Relay

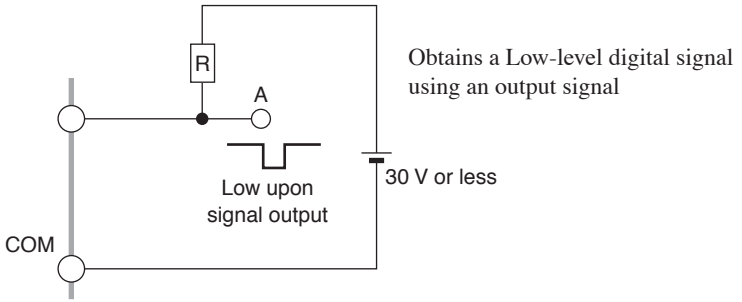


Fig.4-7 Example of Obtaining a Low-level Digital Signal

4.2.3 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 or more from the READY signal has turned to a low level, 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.

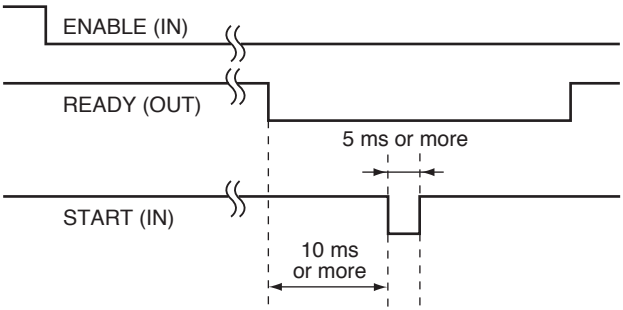


Fig.4-8 START Signal

■ Controlling Signals

1. Short-circuit ENABLE of the start signal from pin 23 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 the START signal from pin 21 to pin 13 or pin 25 (COM) while the READY signal of pin 19 is ON to set that signal to the low level. This starts a test.
3. Short-circuit the STOP signal from pin 22 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, 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. For system settings, see “3.5 System Settings”.
- The input terminal is pulled up to +12 V using a resistor. Opening the input terminal effectively creates a high-level input.

4.2.4 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 4-2.

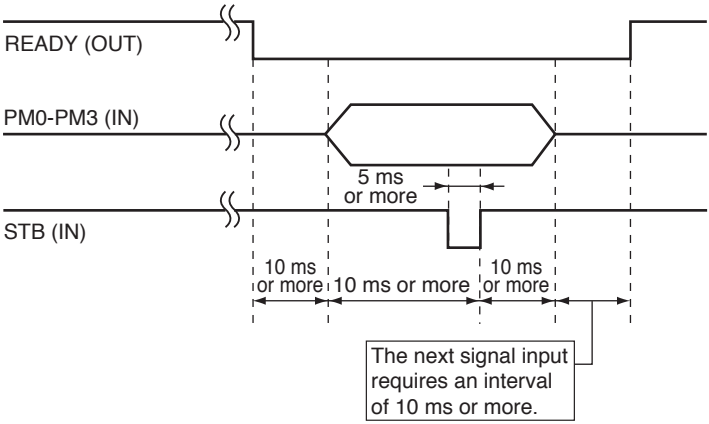


Fig.4-9 Strobe Signal

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

Table 4-2 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

4.3 ANALOG OUT Connector

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

$$\text{ANALOG OUT voltage} = \log\left(1 + \frac{Rx}{1\ M\Omega}\right) \quad \text{Where, Rx = measured resistance value}$$

Table 4-3 Measured Resistance Value and Output Voltage

Measured resistance value	ANALOG OUT voltage
0 Ω	0 V
1 MΩ	0.30 V
10 MΩ	1.04 V
100 MΩ	2.00 V
1000 MΩ	3.00 V
10000 MΩ or more	4.00 V

NOTE • If a test is not conducted, the ANALOG OUT connector outputs a voltage of 4 V.

Compatible wire material:

- Solid wire of ø0.65 mm (AWG22)
- Twisted wire of 0.32 mm^2 (AWG22), single wire diameter of ø0.18 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.

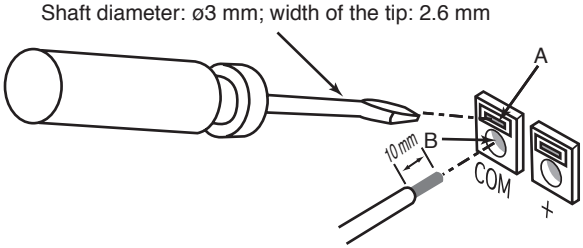


Fig.4-10 Connecting a Signal Wire to the ANALOG OUT Connector

Chapter 5 RS-232C Control

This chapter describes device messages and preparations for remotely controlling the tester via the RS-232C interface.

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

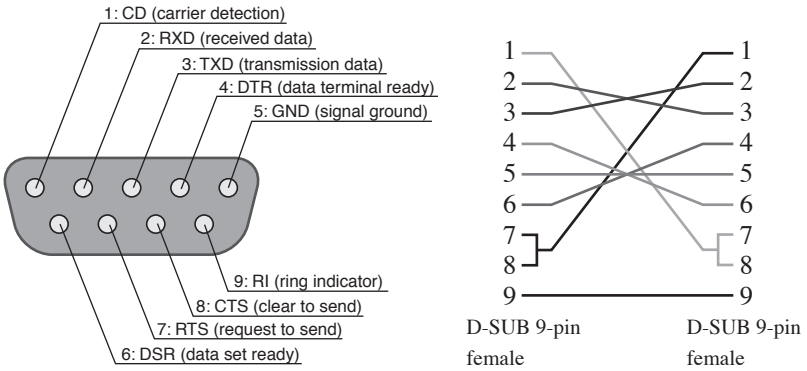
NOTE • Performing remote control through the RS-232C interface causes the REMOTE LED to light up, notifying the operator that no keystroke other than the STOP switch is accepted. To restore local control, press the LOCAL key.

5.1 Preparation

■ Connecting a cable

1. Turn off the POWER switch on the tester and the POWER switch on the controller.
2. Connect an RS-232C cross-cable to the 9-pin RS-232C connector on the rear panel of the tester.

   Fig. 5-1 shows the pin configuration of the connector.



Tester side　　Example of cross cable

Fig.5-1　9-pin AT-type Connector

■ Protocol

As shown in Table 5-1, the RS-232C protocol allows only the communication rate to be selected. Other items are fixed.

Table 5-1 RS-232C Protocol

Item	Set value
Communication rate	9600 bps, 19200 bps, or 38400 bps
Data length	8 bits
Parity bit	None
Stop bit	2-bit setting

Setting the communication rate

The communication rate is set after entering system mode. For information on system mode, see "3.5 System Settings".

1. With the SHIFT key held down, press the VOLT key to enter system mode.

   This causes the leftmost digit (digit indicated as DOUBLE ACTION) of the voltmeter to blink, indicating that the cursor is positioned at this digit.
2. Press the ◀ or ▶ key to move the cursor to the SPEED position.
3. With the SHIFT key held down, press the ▼ or ▲ key to change the communication rate.

   The communication rate can be selected from among 0: 9600 bps; 1: 19200 bps; and 2: 38400 bps.
4. Press the STOP switch to exit system mode.

■ Send and receive via the RS-232C

Sending and receiving via the RS-232C interface should be controlled by flow control or the use of acknowledge messages. One-way transmission may fail to send and receive data properly. For information on acknowledge messages, see " Acknowledge message" in "5.2.1 Messages".

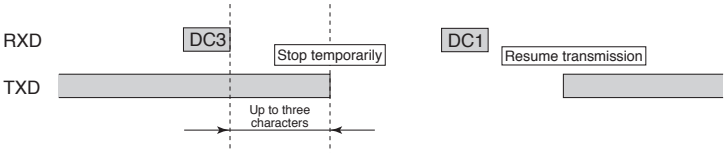
RS-232C flow control

Performing Xon/Xoff control allows sending and receiving of the tester to be controlled. These control codes are executed by DC (device control) codes.

Table 5-2 DC Codes

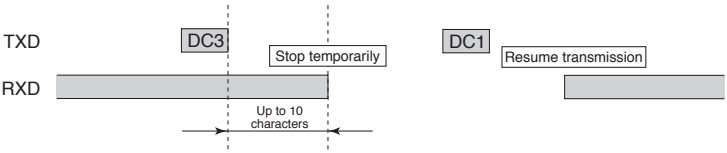
Code	Function	ASCII code
DC1	Request to send	11h
DC3	Request to stop sending	13h

Control of transmission from the RS-232C terminal to the power-supply controller



The tester temporarily stops transmission within three characters after receiving a DC3.

Control of transmission from the power-supply controller to the RS-232C terminal



The RS-232C terminal must temporarily stop transmission within 10 characters after receiving a DC3.

Fig.5-2 Transmission Control between the RS-232C Terminal and Tester

5.2 Messages and Terminator

This section specifies the designations and descriptions used in this manual for communications between a computer (controller) and the tester (device). See Fig. 5-3.

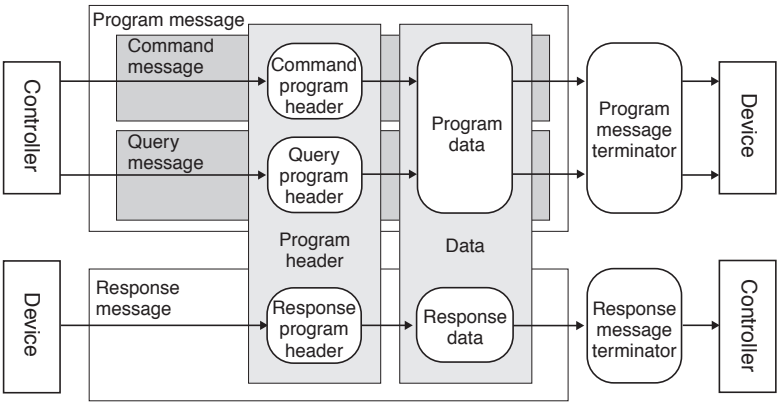


Fig.5-3 Messages and Terminator

5.2.1 Messages

Commands sent from the computer to the tester are designated as program messages. Responses sent from the tester to the computer are designated as response messages.

Each message consists of the program header section and data section.

Program message

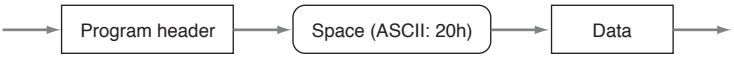
Program messages are further divided into a command message and a query message.

A command message executes a specific function of the tester or modifies settings.

A query message inquires of the setting or status of the tester.

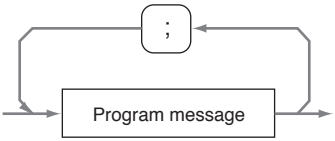
Writing a program message

- A space (ASCII: 20h) is required between the program header section and data section.



- If there are multiple pieces of data, use commas (,) (ASCII: 2Ch) to link them.

- The concatenation of program messages is performed using a semicolon (;) (ASCII: 3Bh).

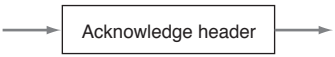


NOTE
- When writing data using hexadecimal numbers, append "#H" to each piece of data.

  Example: To write decimal number 10 in hexadecimal numbers, write "#H0A."

Acknowledge message

An acknowledge message is information sent from the tester to the controller. It informs the controller of the completion of processing of a program message.



The acknowledge message is an ASCII-code character string consisting of the header only. It can be of either of the following two types:

- OK: Normal end
- ERROR: Occurrence of an abnormality such as a syntax error, etc.

The SILENT command message can be used to set whether an acknowledge message is to be returned.

5.2.2 Terminator

A terminator indicating the end of a program message is designated as a program message terminator. A terminator indicating the end of a response message is designated as a response message terminator.

• Program message terminator

Either of the following two program message terminators may be used. This does not need to be preset.

CR, CR+LF

• Response message terminator

Fixed to CR+LF

5.3 Device Messages

The program messages and response messages supported by this tester are designated as device messages.

This section describes each device message supported by the tester.

An item enclosed in parentheses next to a device message indicates the abbreviation of that device message.

Special symbols and characters

The special symbols and characters used in this manual to describe a program message or response message are defined as shown in the table below.

Table 5-3 Definition of Special Symbols and Characters

Symbol and character	Description
< >	These brackets indicate program data. Do not use them in actual programs.
{ }	Characters or numbers enclosed in these brackets and separated by "|" indicate that one in brackets should be selected. In actual programs, do not use the brackets.
_	This character indicates a space.

5.3.1 Register-Related and General Purpose Messages

This subsection describes the device messages used to set, reset, or inquire about each register, and the general purpose device messages used to specify a terminator or other element.

*CLS

Resets the status byte register, event status register, device status register, fail register, invalid setting register, and error register.

For information on each register, see “5.4 Registers”.

Program message

- Syntax

  Comand message: `*CLS`

*ESR

Inquires about the contents of the event status register.

The event status register is reset when it is read by the *ESR? message.

For more information on the event status register, see “5.4 Registers”.

Program message

- Syntax

  Query message: `*ESR?`

Response message

Returns the contents of the event status register in response to *ESR? and resets the register.

(Example)When bit 5 of the event status register has been set,

`32` is returned.

*IDN

Inquires about the model number and ROM version of the tester.

Program message

- Syntax

  Query message: `*IDN?`

Response message

Returns the model number of the tester as shown in the following example, in response to *IDN?.

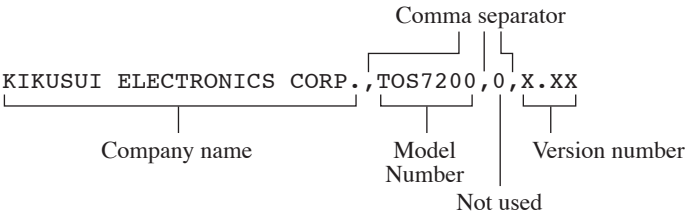


Fig.5-4 *IDN? Response Message

*RST

Initializes the tester (restores factory default settings). Note that the communication rate will not be initialized.

For initialization, see “3.9 Initialize”.

Program message

- Syntax

  Comand message: `*RST`

*SRE

Sets or resets each bit of the service-request enable register, or inquires about the contents of the register.

For more information on the service-request enable register, see “5.4 Registers”.

Program message

- Syntax

  Comand message: `SRE_<value>`

  This command message will be disabled during a test or while a PASS or FAIL judgment is being made.

  Query message: `*SRE?`

- Program data

  Data format: Hexadecimal or decimal numbers

  Set value: 00H to FFH (0 to 255)

  Resolution: 1H (1)

(Example)To set the service-request enable register to #50H,

```
*SRE #H50
```

Response message

Returns the contents of the service-request enable register in response to *SRE?

(Example) When bits 5 and 6 of the service-request enable register are set,

`96` is returned.

*STB

Inquires about the contents of the status byte register.

For more information on the status byte register, see “5.4 Registers”.

Program message

- Syntax

  Query message: `*STB?`

Response message

Returns the contents of the status byte register in response to *STB?

(Example) When bits 5 and 6 of the status byte register are set,

`96` is returned.

CLR

Resets all registers (not including the enable register) to set the STOP flag.

This device message is also used to perform the same processing as DCL from the RS-232C interface.

Program message

- Syntax

  Comand message: `CLR`

DSE

Sets or resets each bit of the device-status enable register. Also inquires about the contents of that register.

For more information on the device-status enable register, see “5.4 Registers”.

Program message

- Syntax

  Comand message: `DSE_<value>`

  This command message will be disabled during a test or while a PASS or FAIL judgment is being made.

  Query message: `DSE?`

- Program data

  Data format: Hexadecimal or decimal numbers

  Set value: 00H to FFH (0 to 255)

  Resolution: 1H (1)

(Example)To set the device-status enable register to 01H,

```
DSE #H01
```

Response message

Returns the contents of the device-status enable register in response to DSE?

(Example)When bit 5 of the device-status enable register is set,

`32` is returned.

DSR

Inquires about the contents of the device status register.

For more information on the device status register, see "5.4 Registers".

Program message

- Syntax

  Query message: `DSR?`

Response message

Returns the contents of the device status register in response to DSR?

(Example)When bit 5 of the device status register is set,

`32` is returned.

ERR

Inquires about the contents of the error register.

The error register will be reset when read by the ERR? message.

For more information on the error register, see “5.4 Registers”.

Program message

- Syntax

  Query message: `ERR?`

Response message

Returns the contents of the error register in response to ERR?, and resets the register

(Example)When bit 3 of the error register is set,

`8` is returned.

FAIL

Inquires about the contents of the fail register.

For more information on the fail register, see “5.4 Registers”.

Program message

- Syntax

  Query message: `FAIL?`

Response message

Returns the contents of the fail register in response to FAIL?

(Example)When bit 4 of the fail register is set,

`16` is returned.

INVALID (INV)

Inquires about the contents of the invalid-setting register.

For more information on the invalid-setting register, see “5.4 Registers”.

Program message

- Syntax

  Query message: `INVALID?`
  `INV?`

Response message

Returns the contents of the invalid-setting register in response to INV?

(Example)When bit 3 of the invalid-setting register is set,

`8` is returned.

SILENT (SIL)

Sets whether an acknowledge message is returned in response to a message delimited by the response-message terminator. Also inquires about the set value indicating whether an acknowledge message is returned by the SILENT? message.

The acknowledge message returns either “OK” or “ERROR.”

To receive the acknowledge message, the RS-232C setting should be full duplex communications.

NOTE • Full duplex communications: A communications system capable of always flowing data in both directions in data transmission between two parties. For setting of full duplex communications, see the operating manual of the PC.

Program message

- Syntax

  Comand message: `SILENT_<{0|1}>`
  `SIL_<{0|1}>`

  Query message: `SILENT?`
  `SIL?`

- Program data

  Data format: Integer

  Set value: 0: Returns an acknowledge message.
  1: Does not return an acknowledge message.

(Example)To makes a setting such that no acknowledge message is returned,

```
SIL 1
```

Response message

Returns the set value of the acknowledge message in response to SIL?

(Example)When the current setting is “Does not to return the acknowledge message”,

`1` is returned.

START

Starts a test

Program message

- Syntax

  Comand message: `START`

  This command message will be disabled during a test or while a PASS or FAIL judgment is being made.

STOP

Stops a test, or cancels a FAIL judgment, a PASS judgment, or the PASS HOLD status.

Program message

- Syntax

  Comand message: `STOP`

5.3.2 Test-Related Messages

This subsection describes the device messages used to set the test conditions or to check settings.

AUTORANGE(AUTOR)

Sets ON/OFF for auto-range or inquires about the current auto-range setting

Program message

- Syntax

  Comand message: `AUTORANGE_<{ON|OFF|1|0}>`
  `AUTOR_<{ON|OFF|1|0}>`

  This command message will be disabled during a test or while a PASS or FAIL judgment is being made.

  Query message: `AUTORANGE?`
  `AUTOR?`

- Program data

  Data format: Character (integer)

  Set value: OFF (0) : Auto-range OFF
  (The fixed range applies.)
  ON (1) : Auto-range `ON`

(Example)To make settings so that measurement is made in auto-range,

```
AUTOR ON
```

Response message

Returns the current setting in response to `AUTOR?`.

(Example)When the current setting is auto-range,

`1` is returned.

LOWER (LOW)

Sets the lower resistance (LOWER) and ON/OFF for lower judgment. Also inquires about the current lower resistance and the setting for lower judgment.

⚠CAUTION • If the upper or lower judgment function is OFF, no FAIL judgment is made. Note that if this function is off, a PASS judgment is made when the timer is turned on.

Program message

- Syntax

  Comand message: `LOWER _`<*lower resistance*`,`
  `{ON|OFF|1|0}>`
  `LOW _`<*lower resistance*`,`
  `{ON|OFF|1|0}>`

  This command message will be disabled during a test or while a PASS or FAIL judgment is being made.

  Query message: `LOWER?`
  `LOW?`

- Program data <*lower resistance*>

  Data format: Real number
  Set value: 0.01E6 to 5000E6
  Resolution: 0.01E6 (0.01E6 to 9.99E6)
  0.1E6 (10.0E6 to 99.9E6)
  1E6 (100E6 to 5000E6)
  Unit: Ω

- Program data <{ON|OFF|1|0}>

  Data format: Character (integer)

  Set value: OFF (0): Lower judgment OFF
  ON (1): Lower judgment ON

(Example)To set the lower resistance to 999 MΩ,

```
LOW 999E6,1
```

Response message

Returns the current lower resistance and ON/OFF for the lower judgment in the form of "lower resistance, 1/0" in response to LOW?.

(Example)When the current lower resistance is 100 MΩ and the lower judgment is OFF,

`100E6,0` is returned.

MON

Inquires about the current monitored values.

Program message

- Syntax

  Query message: `MON?`

Response message

Returns the current monitored values in the form of "monitored voltage, monitored resistance, elapsed (remaining) time" in response to MON?.

Returns the previous test results if a test is not in progress.

(Example)When the monitored voltage is 500 V, the monitored resistance is 500 MΩ, and the remaining time is 2.6 s,

`500,500E6,2.6` is returned.

RDATA (RDAT)

Inquires about a monitored resistance value.

Returns the measured value during a test, and returns the previous resistance value after the test.

Program message

- Syntax

  Query message: `RDATA?`
  `RDAT?`

Response message

Returns the monitored resistance value in response to RDAT?.

(Example)When the current monitored resistance is 10 MΩ,

`10.0E6` is returned.

TIMER

Sets the test duration (TEST TIME) and ON/OFF for the timer function. Also inquires about the current test time and the setting of the timer function.

Program message

- Syntax

  Comand message: `TIMER _<`*test time*`, {ON|OFF|1|0}>`

  This command message will be disabled during a test or while a PASS or FAIL judgment is being made.

  Query message: `TIMER?`

- Program data <*test time*>

  Data format: Real number

  Set value: 0.5 to 999

  Resolution: 0.1 for 0.5 to 99.9, 1 for 100 to 999

  Unit: s

- Program data `<{ON|OFF|1|0}>`

  Data format: Character (integer)

  Set value: OFF (0) : Timer function OFF
  ON (1): Timer function ON

(Example)To set the test time to 5 s,

```
TIMER 5,ON
```

Response message

Returns the current test time and ON/OFF for the timer function in response to TIMER?.

(Example)When the current test time is 2 s and the timer function is disabled,

`2.0,0` is returned.

TESTV (TES)

Sets the test voltage. Also inquires about the current test voltage.

Program message

- Syntax

  Comand message: `TESTV _`<*voltage value*>
  `TES_`<*voltage value*>

  This command message will be disabled during a test or while a PASS or FAIL judgment is being made.

  Query message: `TESTV?`
  `TES?`

- Program data

  Data format: Integer
  Set value: 10 to 1020
  Resolution: 1
  Unit: V

(Example) To set the test voltage to 500 V,

```
TES 500
```

Response message

Returns the current test voltage in response to TES?.

(Example) When the current test voltage is 250 V,

`250` is returned.

TIME

Inquires about the elapsed time (time remaining when the timer function is activated) of testing.

Program message

- Syntax

  Query message: `TIME?`

Response message

Returns the elapsed time (time remaining when the timer function is enabled) in response to TIME?.

(Example) When the current elapsed time (or remaining time) is 7.0 s and a test is underway,

`7.0` is returned.

UPPER (UPP)

Sets the upper resistance and ON/OFF for the upper judgment. Also inquires about the current upper resistance and the setting for upper judgment.

Program message

- Syntax

  Comand message: `UPPER _<`*upper resistance*`,`
  `{ON|OFF|1|0}>`
  `UPP _<`*upper resistance*`,`
  `{ON|OFF|1|0}>`

  This command message will be disabled during a test or while a PASS or FAIL judgment is being made.

  Query message: `UPPER?`
  `UPP?`

- Program data <*upper resistance*>

  Data format: Real number

  Set value: 0.01E6 to 5000E6

  Resolution: 0.01E6 (0.01E6 to 9.99E6)
  0.1E6 (10.0E6 to 99.9E6)
  1E6 (100E6 to 5000E6)

  Unit: Ω

- Program data <`{ON|OFF|1|0}`>

  Data format: Character (integer)

  Set value: OFF (0): Upper judgment `OFF`
  ON (1): Upper judgment `ON`

(Example)To set the upper resistance to 100 MΩ,

```
UPP 100E6,1
```

Response message

Returns the current upper resistance and ON/OFF for upper judgment in the form of "upper resistance, 1/0" in response to UPP?.

(Example)When the current upper resistance is 500 MΩ and upper judgment is inactivated,

`500E6,0` is returned.

VDATA (VDAT)

Inquires about the monitored voltage value for a test. Returns a real-time voltage value during the test, and returns the previous test voltage after the test.

Program message

- Syntax

  Query message: `VDATA?`
  `VDAT?`

Response message

Returns the monitored voltage in response to VDAT?.

(Example) When the current monitored voltage value is 500 V,

`500` is returned.

WAITTIME (WTIM)

Sets the wait time (WAIT TIME) during a test. Also inquires about the value set for current wait time.

Program message

- Syntax

  Comand message: `WAITTIME _`<*wait time*>
  `WTIM_`<*wait time*>

  This command message will be disabled during a test or while a PASS or FAIL judgment is being made.

  Query message: `WAITTIME?`
  `WTIM?`

- Program data

  Data format: Real number
  Set value: 0.3 to 10.0
  Resolution: 0.1
  Unit: s

(Example) To set the wait time to 1 s,

```
WTIM 1
```

Response message

Returns the current wait time in response to WTIM?

(Example) When the current wait time is 2.0 s,

`2.0` is returned.

5.3.3 System-Related Messages

This subsection explains the device messages for items to be set on the System screen.

PASSHOLD (PHOL)

Sets ON/OFF for the pass hold for a PASS judgment. Also inquires about the current setting for pass hold.

Program message

- Syntax

  Comand message: `PASSHOLD_<{ON|OFF|1|0}>`
  `PHOL_<{ON|OFF|1|0}>`

  This command message will be disabled during a test or while a PASS or FAIL judgment is being made.

  Query message: `PASSHOLD?`
  `PHOL?`

- Program data

  Data format: Character (integer)

  Set value: OFF (0): Pass hold `OFF`
  ON (1): Pass hold `ON`

(Example)To set pass hold to ON,

```
PHOL ON
```

Response message

Returns the current pass hold in response to PHOL?.

(Example)When the current pass hold is OFF,

`0` is returned.

BUZZERVOL (BVOL)

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

Program message

- Syntax

  Comand message: `BUZZERVOL _<`*set value*`>`
  `BVOL_<`*set value*`>`

  This command message will be disabled during a test or while a PASS or FAIL judgment is being made.

  Query message: `BUZZERVOL?`
  `BVOL?`

- Program data

  Data format: Integer

  Set value: 0 to 9

  Resolution: 1

(Example)To set the buzzer volume to 5,

```
BVOL 5
```

Response message

Returns the current buzzer volume in response to BVOL?.

(Example)When the current buzzer volume is 3,

```
3
```
is returned.

■ MOMENTARY (MOM)

Sets the start momentary (MOMENTARY). Also inquires about the current setting for start momentary.

NOTE • The start momentary function is useful in operating the tester from the front panel (or locally). For remote control of the tester via the RS-232C interface, the ON/OFF settings for start momentary have no effect.

Program message

- Syntax

  Comand message: `MOMENTARY_<{ON|OFF|1|0}>`
  `MOM_<{ON|OFF|1|0}>`

  This command message will be disabled during a test or while a PASS or FAIL judgment is being made.

Query message: MOMENTARY?
MOM?

- Program data

  Data format: Character (integer)

  Set value: OFF (0): Start momentary OFF
  ON (1): Start momentary ON

(Example)To set the start momentary to OFF,

```
MOM OFF
```

Response message

Returns the current start momentary setting in response to MOM?.

(Example)When the current start momentary is ON,

1 is returned.

FAILMODE (FMOD)

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

Program message

- Syntax

  Comand message: FAILMODE_<{ON|OFF|1|0}>
  FMOD_<{ON|OFF|1|0}>

  This command message will be disabled during a test or while a PASS or FAIL judgment is being made.

  Query message: FAILMODE?
  FMOD?

- Program data

  Data format: Character (integer)

  Set value: OFF (0): Fail mode OFF
  ON (1): Fail mode ON

(Example)To set fail mode to OFF,

```
FMOD OFF
```

Response message

Returns the current fail mode setting in response to FMOD?.

(Example)When the current fail mode is ON,

1 is returned.

DOUBLEACTION (DAC)

Sets the double-action mode (DOUBLE ACTION). Also inquires about the current setting for double-action mode.

NOTE • The double-action mode is useful in operating the tester from the front panel (locally). For remote control of the tester via the RS-232C interface, the ON/OFF settings for double-action mode have no effect.

Program message

- Syntax

  Comand message: `DOUBLEACTION_<{ON|OFF|1|0}>`
  `DAC_<{ON|OFF|1|0}>`

  This command message will be disabled during a test or while a PASS or FAIL judgment is being made.

  Query message: `DOUBLEACTION?`
  `DAC?`

- Program data

  Data format: Character (integer)

  Set value: OFF (0): Double-action mode `OFF`
  ON (1): Double-action mode `ON`

(Example) To set the double-action mode to OFF,

```
DAC OFF
```

Response message

Returns the current setting for double-action mode in response to DAC?.

(Example) When the current double-action mode is ON,

`1` is returned.

5.3.4 Memory-Related Messages

This subsection describes the device messages to be used in relation to memory.

RECALL (REC)

Recalls stored panel settings from memory.

Program message

- Syntax

  Comand message: `RECALL_<`*memory No.*`>`
  `REC_<`*memory No.*`>`

  This command message will be disabled during a test or while a PASS or FAIL judgment is being made.

- Program data

  Data format: Integer

  Set value: 0 to 9

  Resolution: 1

(Example)To recall a panel setting from memory number 9,

```
REC 9
```

STORE (STOR)

Stores the current panel settings.

Program message

- Syntax

  Comand message: `STORE _<`*memory No.*`>`
  `STOR_<`*memory No.*`>`

  This command message will be disabled during a test or while a PASS or FAIL judgment is being made.

- Program data

  Data format: Integer

  Set value: 0 to 9

  Resolution: 1

(Example)To store the current panel settings for an insulation resistance test in memory number 9,

```
STOR 9
```

MEMORY (MEM)

Stores the test conditions in a specified memory number (location). Also inquires about the contents of a specified memory number.

Program message

- Syntax

  Comand message: `MEMORY (MEM)_<`*memory No.*`,` *test voltage*`,` *lower resistance*`,` *upper resistance*`,` *test time*`,` *upper judgment* `{ON|OFF|1|0},` *timer* `{ON|OFF|1|0},` *wait time*`>`

  This command message will be disabled during a test or while a PASS or FAIL judgment is being made.

  Query message: `MEMORY?_<`*memory No.*`>`
  `MEM?_<`*memory No.*`>`

- Program data <*memory No.*>
  Data format: Integer
  Set value: 0 to 9
  Resolution: 1

- Program data <*test voltage*>
  Data format: Real number
  Set value: 10 to 1020
  Resolution: 1
  Unit: V

- Program data <*lower resistance*>
  Data format: Real number
  Set value: 0.01E6 to 5000E6
  Resolution: 0.01E6 (0.01E6 to 9.99E6)
  0.1E6 (10.0E6 to 99.9E6)
  1E6 (100E6 to 5000E6)
  Unit: Ω

- Program data <*upper resistance*>
  Data format: Real number
  Set value: 0.01E6 to 5000E6
  Resolution: 0.01E6 (0.01E6 to 9.99E6)
  0.1E6 (10.0E6 to 99.9E6)
  1E6 (100E6 to 5000E6)
  Unit: Ω

- Program data <*test time*>

  Data format: Real number

  Set value: 0.5 to 999

  Resolution: 0.1 for 0.5 to 99.9, 1 for 100 to 999

  Unit: s

- Program data <*upper judgment* {ON|OFF|1|0}>

  Data format: Character (integer)

  Set value: OFF (0): Upper judgment OFF
  ON (1): Upper judgment ON

- Program data <*timer* {ON|OFF|1|0}>

  Data format: Character (integer)

  Set value: OFF (0): Timer OFF
  ON (1): Timer ON

- Program data <*wait time*>

  Data format: Real number

  Set value: 0.3 to 10.0

  Resolution: 0.1

  Unit: s

Response message

Returns the contents of a specified memory number in response to MEM?_<memory number>.

The memory contents are returned in the same order as for the program message.

(Example) When the program message inquires about the contents of memory number 9 and the memory contents are test voltage: 50 V; lower resistance: 0.01 MΩ; upper resistance: 10.0 MΩ; test time: 2.0 s; upper judgment: OFF; timer: ON; and wait time: 0.5 s,

`50,0.01E6,10.0E6,2.0,0,1,0.5` is returned.

5.4 Registers

NOTE

- For the command messages of each register, the addition of "#H" allows use of hexadecimal data.
- For the query messages of each register, all response data is in decimal format.
- Each bit of each register indicates that it is set when it is "1" and reset when it is "0."
- The contents of enable registers are not backed up.

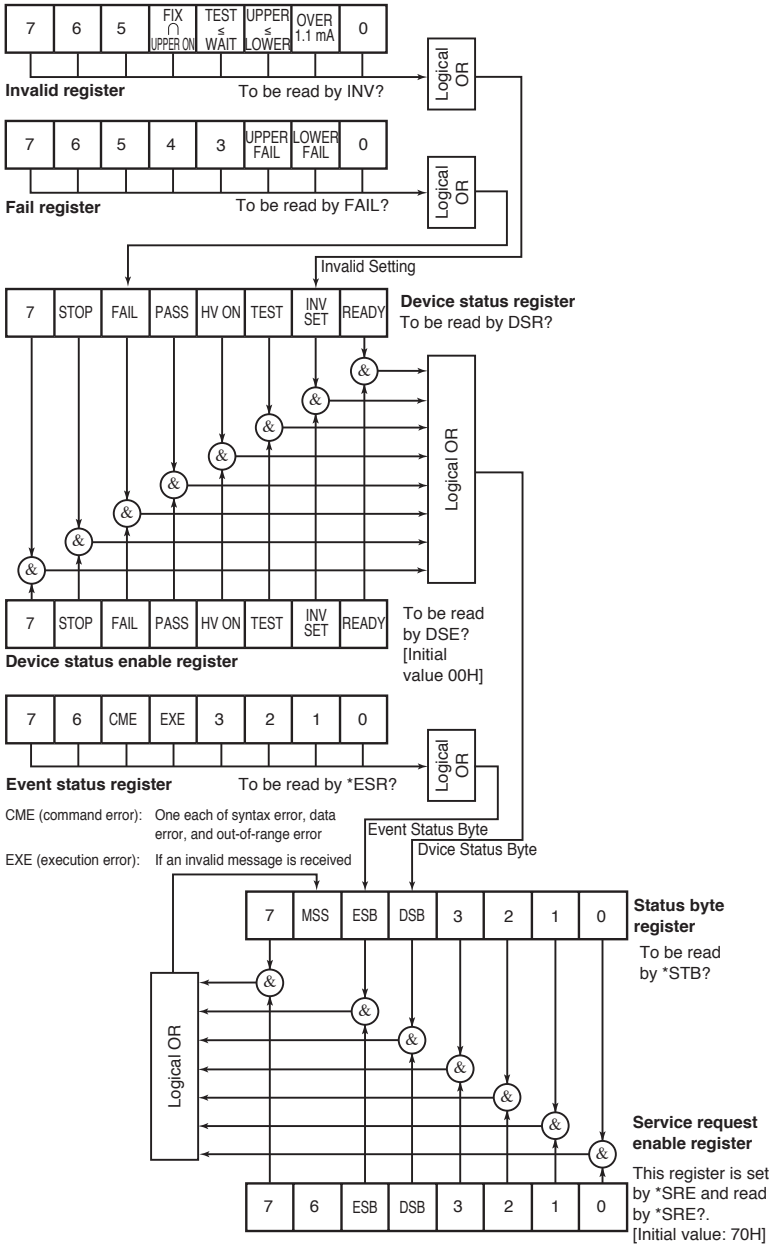


Fig.5-5 Structure of Status Data

Table 5-4 Status Byte Register, Service Request Enable Register

Bit		Description
7		Not used in the tester
6	MSS (Master Summary Status)	This is the logical OR for the status byte register and service-request enable register and is read by *STB?.
5	ESB (Standard Event Status Bit)	Indicates that any of the bits of the event status register has been set.
4	DSB (Device Status Bit)	Indicates that any of the bits of the device status register has been set.
3		Not used in the tester
2		Not used in the tester
1		Not used in the tester
0		Not used in the tester

Table 5-5 Event Status Register

Bit		Description
7		Not used in the tester
6		Not used in the tester
5	CME (Command Error)	Indicates that a syntax error, data error, or out-of-range error has occurred.
4	EXE (Excution Error)	Indicates that this bit has received an invalid message during a test.
3		Not used in the tester
2		Not used in the tester
1		Not used in the tester
0		Not used in the tester

Table 5-6 Device Status Register, Device Status Enable Register

Bit		Description
7		Not used in the tester
6	STOP	A test has stopped.
5	FAIL	FAIL judgment made
4	PASS	PASS judgment made
3	HV ON	State of voltage output
2	TEST	State of test voltage output
1	INV SET (Invalid setting)	Invalid setting state in which the LOWER, UPPER, WAIT, or UPPER ON LED is blinking
0	READY	Ready state

Table 5-7 Fail Register

Bit		Description
7		Not used in the tester
6		Not used in the tester
5		Not used in the tester
4		Not used in the tester
3		Not used in the tester
2	UPPER FAIL	Indicates that a FAIL judgment has been made with respect to the upper resistance.
1	LOWER FAIL	Indicates that a FAIL judgment has been made with respect to the lower resistance.
0		Not used in the tester

Table 5-8 Invalid Register

Bit		Description
7		Not used in the tester
6		Not used in the tester
5		Not used in the tester
4	FIX ∩ UPPER ON	Set if the fixed range is selected with the upper judgment set to ON.
3	TEST ≤ WAIT	Set if the wait time is equal to or greater than the test time with the timer function set to ON.
2	UPPER ≤ LOWER	Set if the lower resistance is equal to or above the upper resistance with the upper and lower judgments set to ON.
1	OVER 1.1 mA	Set if a value obtained by dividing the test voltage by the lower resistance exceeds 1.1 mA.
0		Not used in the tester

Table 5-9 Error Register

Bit		Description
7		Not used in the tester
6		Not used in the tester
5		Not used in the tester
4		Not used in the tester
3	Invalid message	Indicates that an invalid message has been received.
2	Out-of-range error	Indicates that an out-of-range error has occurred.
1	Data Error	Indicates that a data error has occurred.
0	Syntax Error	Indicates that a header error has occurred.

5.5 List of Device Messages

An item in parentheses in the Header column indicates the abbreviation of a device message.

Note 1: A check (✔) is used to indicate available device messages, even during a test or while a PASS or FAIL judgment is being made, while a cross (✘) is used to indicate those not available.

Table 5-10 List of Register-Related and General Purpose Device Messages

Header	Data				Function and response data	Note 1
	Min	Max	Resolution	Unit		
*CLS					Clears the status byte register, event status register, device status register, fail register, invalid setting register, and error register.	✔
*ESR?					Returns the value of the event status register and clears this register.	✔
*IDN?					Returns "KIKUSUI ELECTRONICS CORP., TOS7200, 0, x.xx".	✔
*RST					Initializes the device (to the factory default settings).	✔
*SRE	0	255			Sets the service request enable register.	✔
*SRE?					Returns the value of the service request enable register.	✘
*STB?					Returns the value of the status byte register.	✔
CLR					Clears all registers and sets a stop flag (this message is the same as DCL).	✔
DSE	0	255			Sets the device status enable register.	✘
DSE?					Returns the value of the device status enable register.	✔
DSR?					Returns the value of the device status register.	✔
ERR?					Returns the value of the error register and clears this register.	✔
FAIL?					Returns the value of the fail register.	✔
INVALID? (INV?)					Returns the value of the invalid setting register.	✔
SILENT (SIL)	0	1			Acknowledge message	✔
SILENT? (SIL?)					Returns the value of an acknowledge message.	✔
START (STAR)					Starts a test.	✘
STOP					Stops a test. Also cancels a FAIL or PASS judgment or PASS HOLD status.	✔

Table 5-11 List of Device Messages Relating to Tests

Header	Data				Function and response data	Note 1
	Min	Max	Resolution	Unit		
AUTORANGE (AUTOR)	OFF (0)	ON (1)			Sets ON/OFF for auto-range.	✘
AUTORANGE? (AUTOR?)					Returns ON/OFF for auto-range (ON: 1; OFF: 0).	✔
LOWER (LOW)	0.01 E6	9.99 E6	0.01E6	Ω	Lower resistance	✘
	10.0 E6	99.9 E6	0.1 E6	Ω		
	100 E6	5000 E6	1E6	Ω		
	OFF (0)	ON (1)			Sets ON/OFF for lower judgment.	
LOWER? (LOW?)					Returns the lower resistance and ON/OFF for lower judgment (0.01E6 Ω to 5000E6 Ω; ON: 1; OFF: 0).	✔
MON?					Returns a monitored voltage (0 V to 1020 V), monitored resistance (0.01E6 Ω to 5000E6 Ω), and elapsed (remaining) time (0 s to 999 s), in that order, delimiting them with " , ". Returns the previous test results in any case other than a test in progress.	✔
RDATA? (RDAT?)					Returns a monitored resistance value (0.01E6 Ω to 5000E6 Ω).	✔
TIMER	0.5	99.9	0.1	s	Timer set value	✘
	100	999	1	s		
	OFF (0)	ON (1)			Sets ON/OFF for the timer function.	
TIMER?					Returns the timer set value and ON/OFF for the timer function (0.5 s to 999 s; ON: 1; OFF: 0).	✔
TESTV (TES)	10	1020	1	V	Sets the test voltage.	✘
TESTV? (TES?)					Returns the test-voltage set value (0 V to 1020 V).	✔
TIME?					Returns the elapsed (remaining) time (0 s to 999 s). When TIMER is OFF, the elapsed time is returned. When TIMER is ON, the remaining test time is returned.	✔

Header	Data				Function and response data	Note 1
	Min	Max	Resolution	Unit		
UPPER (UPP)	0.01 E6	9.99 E6	0.01E6	Ω	Upper resistance	✘
	10.0 E6	99.9 E6	0.1 E6	Ω		
	100 E6	5000 E6	1E6	Ω		
	OFF (0)	ON (1)			Sets ON/OFF for upper judgment.	
UPPER? (UPP?)					Returns the upper resistance and ON/OFF for upper judgment (0.01E6 Ω to 5000E6 Ω; ON: 1; OFF: 0).	✔
VDATA? (VDAT?)					Monitored voltage (0 V to 1020 V)	✔
WAITTIME (WTIM)	0.3	10	0.1	s	Sets the wait time.	✘
WAITTIME? (WTIM?)					Returns the set value for the wait time (0.3 s to 10.0 s).	✔

Table 5-12 List of System-Related Device Messages

Header	Data				Function and response data	Note 1
	Min	Max	Resolution	Unit		
PASSHOLD (PHOL)	OFF (0)	ON (1)			Sets ON/OFF for pass hold.	✘
PASSHOLD? (PHOL?)					Returns ON/OFF for pass hold (ON: 1; OFF: 0).	✔
BUZZERVOL (BVOL)	0	9	1		Sets the buzzer volume.	✘
BUZZERVOL? (BVOL?)					Sets the set value of the buzzer volume (0 to 9).	✔
MOMENTARY (MOM)	OFF (0)	ON (1)			Sets ON/OFF for start momentary.	✘
MOMENTARY? (MOM?)					Returns ON/OFF for start momentary (ON: 1; OFF: 0).	✔
FAILMODE (FMOD)	OFF (0)	ON (1)			Sets ON/OFF for fail mode .	✘
FAILMODE? (FMOD?)					Returns ON/OFF for fail mode (ON: 1; OFF: 0).	✔
DOUBLEACTION (DAC)	OFF (0)	ON (1)			Sets ON/OFF for start double action.	✘
DOUBLEACTION? (DAC?)					Returns ON/OFF for start double action (ON: 1; OFF: 0).	✔

Table 5-13 List of Memory-Related Device Messages

Header	Data				Function and response data	Note 1
	Min	Max	Resolution	Unit		
RECALL (REC)	0	9	1		Recalls memory.	✘
STORE (STOR)	0	9	1		Stores the current panel settings in memory.	✘
MEMORY (MEM)	0	9	1		Stores the following data in a specified memory number.	✘
	10	1 020	1	V	Test voltage	
	0.01 E6	9.99 E6	0.01E6	Ω	Lower resistance	
	10.0 E6	99.9 E6	0.1 E6	Ω		
	100 E6	5000 E6	1E6	Ω		
	0.01 E6	9.99 E6	0.01E6	Ω	Upper resistance	
	10.0 E6	99.9 E6	0.1 E6	Ω		
	100 E6	5000 E6	1E6	Ω		
	0.5	99.9	0.1	s	Test time	
	100	999	1	s		
	OFF (0)	ON (1)			Sets ON/OFF for upper judgment.	
	OFF (0)	ON (1)			Timer ON/OFF	
	0.3	10	0.1	s	Wait time	
MEMORY? (MEM?)	0	9	1		Returns the contents of a specified memory number (test voltage, lower resistance, upper resistance, test time, ON/OFF for upper judgment, timer ON/OFF, and wait time) (ON: 1; OFF: 0).	✔

Chapter 6 Part Names and Functions

This chapter gives the names of the switches, indicators, connectors, and other parts on the front and rear panels, and describes their functions.

6.1 Front Panel

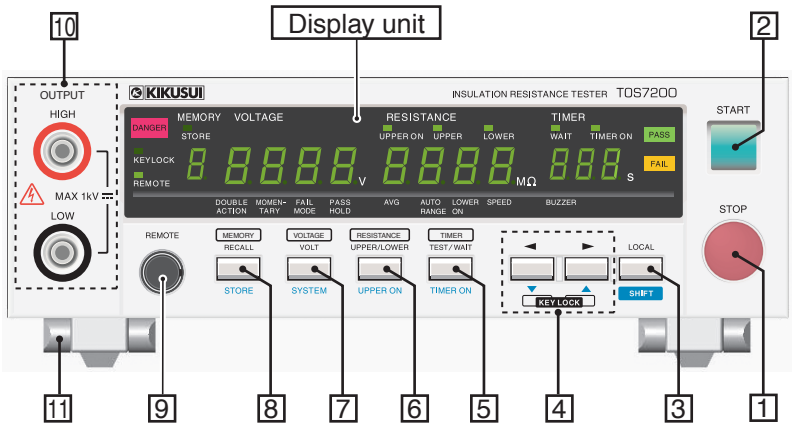


Fig.6-1 TOS7200 Front Panel

[1] STOP switch

This key switch is pressed to stop a test.

It is also pressed to cancel a PASS or FAIL judgment.

Pressing this key switch with the [3] LOCAL (SHIFT) key held down is equivalent to pressing the ENTER key, which is used to store panel settings in panel memory.

[2] START switch

This key switch is pressed to start a test. During a test, the [12] DANGER lamp remains lit.

[3] LOCAL (SHIFT) key

When the tester is remotely controlled via the RS-232C interface, pressing this key switch returns operations to local control. In local control, this key functions as the SHIFT key and is used to apply the extended functions of a key.

Pressing the [27] POWER switch ON with this key switch held down restores tester settings to the factory default settings.

NOTE • Initializing clears the contents of panel memory. Confirm that the memory does not contain important data before initializing.

[4] ◀ and ▶ keys (▼ and ▲ keys)

Used to move the cursor when setting test conditions and other parameters. (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.)

Pressing this key switch with the [3] LOCAL (SHIFT) key held down increases or decreases the numerical value of the digit at which the cursor is located.

Moreover, pressing the ◀ and ▶ keys at the same time invokes the key-locked status and causes the [14] KEYLOCK LED to light. To cancel key-locked status, press the ◀ and ▶ keys together once again.

[5] TEST/WAIT (TIMER ON) key

This key switch is pressed when setting a test duration or wait time.

Pressing this key with the cursor located at the 7-segment LED of the [24] Timer switches between the test time display ([22] WAIT LED OFF) and wait time display ([22] WAIT LED ON).

Pressing this key switch with the [3] LOCAL (SHIFT) key held down switches between ON and OFF for the test-duration timer function ([23] TIMER ON LED).

[6] UPPER/LOWER (UPPER ON) key

This key switch is pressed when the upper or lower resistance is set.

Pressing this key with the cursor located at the 7-segment LED of the [21] Resistance meter switches between the lower resistance display ([20] LOWER LED ON) and the upper resistance display ([19] UPPER LED ON).

Pressing the key switch with the [3] LOCAL (SHIFT) key held down switches between ON and OFF for the upper judgment ([18] UPPER ON LED).

[7] VOLT (SYSTEM) key

This key switch is pressed when the test voltage is set.

Pressing this key switch with the [3] LOCAL (SHIFT) key held down changes the screen to the System Setting screen used to set DOUBLE ACTION and other functions.

[8] RECALL (STORE) key

This key switch is pressed when panel settings are recalled from memory.

Pressing this key switch with the [3] LOCAL (SHIFT) key held down causes the tester to enter store mode ([15] STORE LED ON), which allows panel settings to be stored in memory.

[9] REMOTE terminal

This dedicated terminal is used to connect the optional remote control box RC01-TOS or RC02-TOS.

Connection of the remote control box requires a DIN-mini DIN adaptor.

[10]OUTPUT terminals

These terminals output the test voltage. The negative-polarity side of the power source of the tester is connected to the HIGH terminal, while the positive-polarity side of the power source is connected to the LOW terminal. These are connected in parallel to the OUTPUT terminals on the rear panel.

⚠WARNING • Never touch the HIGH or LOW OUTPUT terminal during a test.

[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.

Display Unit

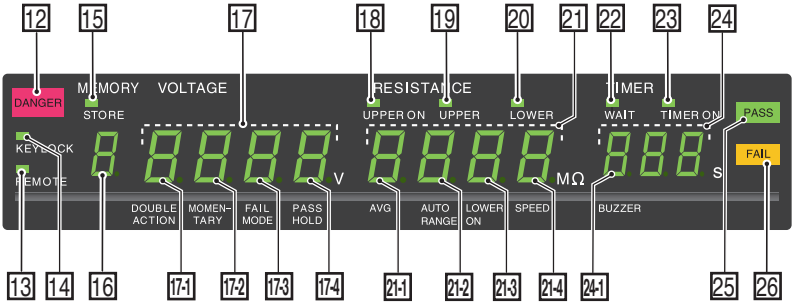


Fig.6-2 TOS7200 Display Unit

[12]DANGER lamp

This red lamp indicates that high voltage is being output.

It lights up while a test is in progress or an output voltage is present at the output terminals.

⚠WARNING • Never touch the HIGH terminal, LOW terminal, test leadwires, or DUT while this lamp is on.

[13]REMOTE LED

Lights up when the tester is remotely controlled through the RS-232C interface, indicating that no keystroke other than the STOP switch is valid. To return operations to local control, press the [3] LOCAL (SHIFT) key.

[14]KEYLOCK LED

Lights up when the tester is in KEYLOCK state.

When this LED is lit, all key switches other than the [1] STOP switch and [2] START switch are disabled.

Pressing the [4] ◀ and ▶ keys simultaneously, switches between ON and OFF for the KEYLOCK state.

[15]STORE LED

Lights when the tester is in store mode, from which panel settings can be stored in memory.

When this LED is lit, pressing the [1] STOP switch with the [3]

LOCAL (SHIFT) key held down enables the current panel settings to be stored in the displayed [16] Memory number.

[16]Memory number

Indicates the number of a memory into or from which panel settings are stored or recalled

[17]Voltmeter

Displays the output voltage during a test, or the test-voltage set value in any case other than a test in progress. For voltage measurements during a test, if the output voltage exceeds the range of ±(2% of setting + 2 V), the measured value on the voltmeter blinks to notify the operator of a drop in the test voltage. However, the following indications apply if the tester has been switched to system mode by pressing the [7] VOLT (SYSTEM) key with the [3] LOCAL (SHIFT) key held down.

[17-1] DOUBLE ACTION

This item indicates the setting for the DOUBLE ACTION function in system mode. When “1” is displayed, DOUBLE ACTION is enabled; when “0” is displayed, the function is disabled.

[17-2] MOMENTARY

This item indicates the setting for the MOMENTARY function in system mode. When “1” is displayed, MOMENTARY is enabled; when “0” is displayed, the function is disabled.

[17-3] FAIL MODE

This item indicates the setting for the FAIL MODE function in system mode. When “1” is displayed, FAIL MODE is enabled; when “0” is displayed, the function is disabled.

[17-4] PASS HOLD

This item indicates the setting for the PASS HOLD function in system mode. When “1” is displayed, the PASS HOLD is enabled; when “0” is displayed, the function is disabled.

[18]UPPER ON LED

Lights when the upper judgment is set to ON.

If this LED is blinking, the fixed range has been selected for the range with the upper judgment enabled. This indicates that the test cannot be started.

[19]UPPER LED

Lights when the set value of the upper resistance is displayed.

If this LED is blinking, the lower resistance has been set to a value equal to or greater than the upper resistance. This indicates that the test cannot be started.

[20]LOWER LED

Lights when the set value of the lower resistance is displayed.

If this LED is blinking, the value obtained by dividing the test voltage by the lower resistance has exceeded 1.1 mA. This indicates that the test cannot be started.

[21]Resistance meter

Displays a measured value during a test or the set value of the upper or lower resistance in any case other than a test in progress. For resistance measurements during the test, if the measurement range has been exceeded, the resistance value on the resistance meter blinks to notify the operator that the resistance is beyond the measurement range. However, the following indications apply when the tester has been switched to system mode by pressing the [7] VOLT (SYSTEM) key with the [3] LOCAL (SHIFT) key held down.

[21-1] AVG

This item shows the number of averaging times. The number of averaging times is fixed to “100”.

[21-2] AUTO RANGE

This item shows the measurement range mode. Set this item to “1” to select auto-range, or “0” to select fixed range.

When auto-range is selected, the tester automatically selects the optimum range for measurements. When the fixed range is selected, the range is selected based on the output voltage and lower resistance (in UPPER OFF condition).

[21-3] LOWER ON

This item shows the setting for the lower judgment. Set this to “1” to enable lower judgment, or to “0” to disable lower judgment.

[21-4] SPEED

This item shows the communication rate for RS-232C communications. The communications rate can be selected from among 0: 9600 bps; 1: 19200 bps; and 2: 38400 bps.

[22]WAIT LED

Lights when the 7-segment LED of the [24] Timer displays the wait time. If this LED is not lit, the test duration is displayed. When this LED is blinking during a test, it is within the wait time.

[23]TIMER ON LED

Lights when the timer function is activated. If this LED is blinking, the wait time has been set to a value equal to or greater than the test time. This indicates that the test cannot be started.

[24]Timer

Displays the test time during a test, and the wait time set value or test-time set value in any case other than a test in progress. However, the following indication applies when the tester has been switched to system mode by pressing the [7] VOLT (SYSTEM) key with the [3] LOCAL (SHIFT) key held down.

[24-1] BUZZER

This item shows the current buzzer volume in 10 steps of 0 to 9 in system mode.

[25]PASS lamp

This LED indicates the test result.

When the result of a pass/fail judgment is PASS, this lamp lights.

For tests conducted with the timer function set to OFF, the tester does not make a PASS judgment regardless of the result of a pass/fail judgment.

[26]FAIL lamp

This LED displays the test result.

When the result of a pass/fail judgment is FAIL, this lamp lights.

6.2 Rear Panel

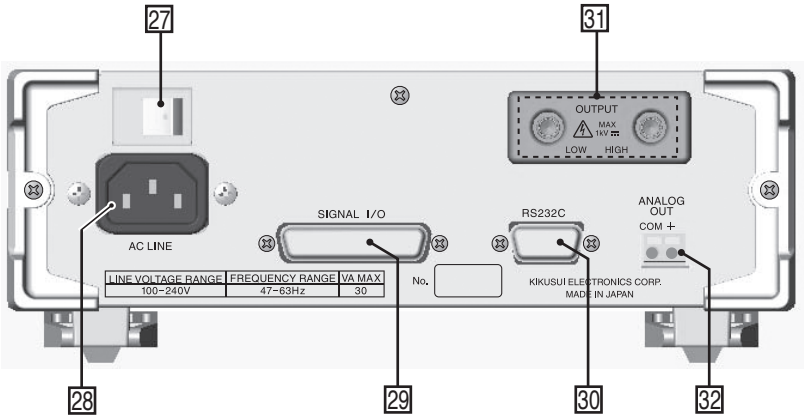


Fig.6-3 TOS7200 Rear Panel

[27]POWER switch

Turns the tester power ON/OFF. When the power is turned ON (|), the tester starts under the test conditions set when power was turned OFF (□) previously.

[28]AC LINE connector

This is the connector for the AC power cord that supplies power to the tester.

⚠WARNING • Improper handling of the AC LINE connector may result in electric shock. Be sure to follow the instructions given in "1.4 Connecting the AC Power cord".

[29]SIGNAL I/O connector

This D-SUB 25-pin connector is used to remotely control the starting and stopping of a test, or to check the tester status based on an output signal.

For more information, see"4.2 SIGNAL I/O Connector".

[30]RS-232C connector

This connector is used to connect an RS-232C cable for remote control of the tester from a PC or other device via the RS-232C interface.

[31]OUTPUT terminals

These terminals output the test voltage. The negative-polarity side of the power source of the tester is connected to the HIGH terminal, while the positive-polarity side of the power source is connected to the LOW terminal. They are connected in parallel to the OUTPUT terminals on the front panel.

⚠WARNING • Never touch the HIGH or LOW OUTPUT terminal during a test.

[32]ANALOG OUT terminal

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

Chapter 7 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.

7.1 Cleaning

If the panel surface or another part becomes soiled, moisten a soft cloth with a water-diluted neutral detergent and gently wipe the panel or other part.

⚠WARNING • Before cleaning, always turn off the POWER switch and unplug the AC power cord from the outlet.

⚠CAUTION • Do not use volatile solvents such as thinner or benzine, as they may discolor the tester's surface covering, remove printed characters, or cause other problems.

7.2 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.

⚠WARNING • 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.

7.3 Maintenance

⚠WARNING • The tester generates voltages as high as 1000 V DC. 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.

7.4 Calibration

Regular calibration is required to maintain the accuracy of measuring instruments over extended periods.

For calibration, contact your Kikusui distributor/agent.

⚠WARNING • The tester generates voltages as high as 1000 V DC. Never attempt to calibrate the Tester for yourself, as such tasks entail great danger. For such service, contact your Kikusui distributor/agent.

7.5 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.

Table 7-1

Symptom	Check Item	Description
• The tester does not start when the POWER switch is pressed.	• Confirm that the AC power cord is connected.	See “1.4 Connecting the AC Power cord”, on page 1-5.
• The keys on the front panel do not work.	• Confirm that the KEYLOCK function is off.	See “3.7 Key Lock”, on page 3-26.
	• Confirm that the tester is not being remotely controlled via the REMOTE terminal or SIGNAL I/O connector.	See “4.1 REMOTE Terminal”, on page 4-2. See “4.2 SIGNAL I/O Connector”, on page 4-4.
	• Confirm that the tester is not being remotely controlled via the RS-232C interface.	See "LOCAL (SHIFT) key" on page 6-2.
• The START switch does not work.	• Confirm that no stop signal is being input.	See “Chapter Using Terminals and Connectors” on page 4-1.
	• 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.	See “3.6 Panel Memory”, on page 3-25.
	• Confirm that the double-action function is off.	See "ON/OFF of double action (DOUBLE ACTION)" on page 3-21.
	• Confirm that the ENABLE terminal of the SIGNAL I/O connector is at the high level.	See “4.2 SIGNAL I/O Connector”, on page 4-4.
	• Confirm that the tester is not in the midst of making system settings.	See “3.5 System Settings”, on page 3-20.
	• Confirm that the LOWER LED is not blinking.	See “3.8 Invalid Settings”, on page 3-26.
	• 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.	

Chapter 8 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 (1000 V/1 mA)
	Maximum rated current		1 mA
	Output terminals	Output type	Floating
		Isolation voltage	±1000 V DC
	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 -1200 V
	Resolution		1 V
	Accuracy		±(1 % of reading +1 V)
Resistance meter			
	Measurement range		0.01 MΩ to 5000 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 < 1000 MΩ] ££££MΩ [1000 MΩ ≤ R ≤ 5000 MΩ] (R = measured insulation resistance)

Resistance meter (continued)			
	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)
	Measurement range		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 5000 MΩ [In the range of the maximum rated current or less]
	Setting range for the lower resistance (LOWER)		0.01 MΩ to 5000 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 % to 70 % R.H (no condensation permitted), with no disturbance such as swinging of the test leadwires

Separate 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 LED 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 LED 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 LED 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.

Separate Table 2 Judgment Accuracy of the Upper/Lower Judgment Function

UPPER, LOWER	f/ 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 < 1000 MΩ	±(10% of setting +5 digits)	±(5% of setting +5 digits)	±(2% of setting +3 digits)
1000 MΩ ≤ R < 2000 MΩ	±(10% of setting +50 digits)	±(5% of setting +50 digits)	—
2000 MΩ ≤ R ≤ 5000 MΩ	±(10% of setting +100 digits)	±(5% of setting +50 digits)	—

- The humidity must be in the range of 20 % to 70 % R.H (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 specifications	High-level input voltage	11 V to 15 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 specifications	Output method	Open collector output (4.5 V to 30 V DC)	
		Output withstand voltage	30 V DC	
		Output saturation voltage	Approx. 1.1 V (at 25°C)	
		Maximum output current	400 mA (TOTAL)	
ANALOG OUT			Outputs a logarithmically compressed voltage corresponding to the measured resistance value	
	+		$Vo = \log\left(1 + \frac{Rx}{1M\Omega}\right)$ where Rx = measured resistance value (1 MΩ: 0.30 V; 10 MΩ: 1.04 V; 100 MΩ: 2.00 V; 1000 MΩ: 3.00 V; 10000 MΩ or more: 4.00 V). Output impedance: 1 kΩ	
	COM		Analog output-circuit common	
	Accuracy		±(2 % of full scale)	
RS-232C			D-SUB 9-pin connector on the rear panel (compliant with EIA-232-D) All functions other than the POWER switch and KEY-LOCK function are remotely controllable.	
		Baud rate	9600 bps/19200 bps/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.

Separate Table 3 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 Memory recall by latching this selection signal at the rise of the strobe signal
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 % to 80 % R.H (no condensation)
	Operating range	Temperature	0 °C to 40 °C (32 °F to 104 °F)
		Humidity	20 % to 80 % R.H (no condensation)
	Storage range	Temperature	-20 °C to 70 °C (-4 °F to 158 °F)
		Humidity	90 % or less R.H (no condensation)
Power requirements			
	Nominal voltage range (allowable voltage range)		100 V to 240 V AC (85 V to 250 V AC)
	Power consumption	At rated load	30 VA maximum
	Allowable frequency range		47 Hz to 63 Hz
Insulation resistance			30 MΩ or more (500 V DC) [AC LINE to chassis]
Withstand voltage			1390 V AC for 2 seconds, 10 mA or less [AC LINE to chassis]
Earth continuity			25 A AC/0.1 Ω or less

Safety (*2, *3)		Conforms to the requirements of the following directive and standard. Low Voltage Directive 2006/95/EC EN 61010-1 Class I Pollution degree 2
Electromagnetic compatibility (EMC) (*2)		Conforms to the requirements of the following directive and standard. EMC Directive 2004/108/EC EN 61326-1 EN 61000-3-2 EN 61000-3-3 Under following conditions 1. Used HV test leadwires TL08-TOS which is supplied. 2. No discharge occurs at outside of the tester. 3. Used the shielded cable which length is less than three meters when the SIGNAL I/O is used.
Dimensions		See Fig. 8-1 Dimensions.
Weight		Approx. 2 kg (4.41 lb)
Accessories		
	AC power cord	1 pc.
	TL08-TOS high-voltage test leadwires (1.5 m)	1 set
	Operation Manual	1 copy

*2: Only on models that have CE marking on the panel.
Not applicable to custom order models.

*3: 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.

Dimensions

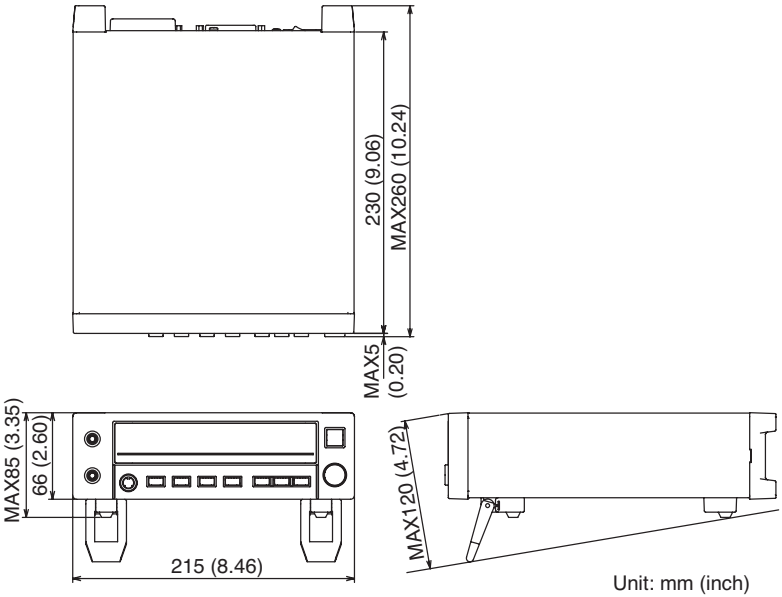


Fig.8-1 Dimensions

Appendix

Sample programs

This Appendix introduces samples of remote-control programs using the RS-232C interface. The sample programs introduced here use Microsoft Visual Basic (version 4.0 or later), which runs under Windows 95, Windows 98, Windows NT, or Windows 2000, and the VISA (Virtual Instrument Software Architecture) library.

Follow the procedures given below to use the VISA library in Visual Basic.

1. Obtain the VISA library.

   It may be included with the latest GPIB/HP-IB boards, as standard or optional equipment. It may also be provided with LabVIEW.

   In addition, it can be downloaded from http://www.ni.com/visa/.

2. Install the VISA library.
3. Add VISA32.BAS and VPPTYPE.BAS to the Visual Basic project.

   These files are generally stored in c:\vxipnp\winnt\incrude (the \winnt part varies, depending on the operating system).

■ Sample program 1

This program sets test conditions when the Command button is clicked, conducts a test by acquiring the contents of the device status register, and displays the test results in the message box.

When a Form is loaded, it initializes the VISA library, opens the COM port, and sets the baud rate and other parameters. When the form is unloaded, it releases the COM port and exits the VISA library.

```
Option Explicit

Dim Tos As Long
Dim vi As Long
Dim vs As Long
Dim r As Long, c As Long
Dim strCommand As String
Dim strRdBack As String

Private Sub Command1_Click()

    Const DSR_READY = 1: Const DSR_INVSET = 2: Const DSR_TEST = 4: Const DSR_HVON = 8    'Definition of the device status register
    Const DSR_PASS = 16: Const DSR_FAIL = 32: Const DSR_STOP = 64
    Const LOWER_FAIL = 2: Const UPPER_FAIL = 4                                           'Definition of the fail register

    Dim DSR As Integer, strResult As String

    strCommand = "TES 500" + vbCrLf: vs = viWrite(Tos, strCommand, Len(strCommand), r)  'Test voltage: 500 V
    strCommand = "LOW 1.00E6,ON" + vbCrLf: vs = viWrite(Tos, strCommand, Len(strCommand), r)
                                                                                         'LOWER 1 Mohm, ON
```

```
strCommand = "UPP 100E6,ON" + vbCrLf: vs = viWrite(Tos, strCommand, Len(strCommand), r)
                                                                    'UPPER 100 Mohm, ON
strCommand = "WTIM 0.5" + vbCrLf: vs = viWrite(Tos, strCommand, Len(strCommand), r) 'WAIT 0.5 sec
strCommand = "TIMER 10,ON" + vbCrLf: vs = viWrite(Tos, strCommand, Len(strCommand), r)
                                                                    'TIMER 10 sec, ON
strCommand = "PHOL ON" + vbCrLf: vs = viWrite(Tos, strCommand, Len(strCommand), r)  'PASS HOLD

Do                                                                  'Waits until READY state is entered.
    strRdBack = Space(25)
    strCommand = "DSR?" + vbCrLf: vs = viWrite(Tos, strCommand, Len(strCommand), r) 'Acquires the contents of the device'
                                                                     'status register.
    vs = viRead(Tos, strRdBack, 25, c)
    If Val(strRdBack) = DSR_READY Then Exit Do                      'Exits the loop if the state is READY.
    strCommand = "STOP" + vbCrLf: vs = viWrite(Tos, strCommand, Len(strCommand), r)
Loop

strCommand = "START" + vbCrLf: vs = viWrite(Tos, strCommand, Len(strCommand), r)    'Test start

Do
    strRdBack = Space(25)
    strCommand = "DSR?" + vbCrLf: vs = viWrite(Tos, strCommand, Len(strCommand), r) 'Acquires the contents of the device
                                                                    'status register.
    vs = viRead(Tos, strRdBack, 25, c)
    DSR = Val(strRdBack)
    If Not (DSR = DSR_TEST Or DSR = DSR_HVON Or DSR = DSR_TEST + DSR_HVON) Then Exit Do
```

```
                                                                    'Exits the loop if the test is not in progress.
Loop

strRdBack = Space(25)
strCommand = "MON?" + vbCrLf: vs = viWrite(Tos, strCommand, Len(strCommand), r)     'Acquires the voltage value, resistance
                                                                                    'value, and test time.
vs = viRead(Tos, strRdBack, 25, c)
strResult = strRdBack

Select Case DSR                                     'Displays the cause of ending the test and the result data in the message box.
    Case DSR_STOP
        MsgBox ("STOP! " + Chr(&HA) + strResult)
    Case DSR_READY
        MsgBox ("STOP! " + Chr(&HA) + strResult)
    Case DSR_PASS
        MsgBox ("PASS! " + Chr(&HA) + strResult)
        strCommand = "STOP" + vbCrLf: vs = viWrite(Tos, strCommand, Len(strCommand), r)
    Case DSR_FAIL
        strRdBack = Space(25)
        strCommand = "FAIL?" + vbCrLf: vs = viWrite(Tos, strCommand, Len(strCommand), r)
        vs = viRead(Tos, strRdBack, 25, c)

        If (Val(strRdBack) = LOWER_FAIL) Then MsgBox ("LOWER FAIL! " + Chr(&HA) + strResult)
        If (Val(strRdBack) = UPPER_FAIL) Then MsgBox ("UPPER FAIL! " + Chr(&HA) + strResult)
```

```
            strCommand = "STOP" + vbCrLf: vs = viWrite(Tos, strCommand, Len(strCommand), r)
    End Select

End Sub

Private Sub Form_Load()

    vs = viOpenDefaultRM(vi)                                                    'Initializes the VISA library.

    vs = viOpen(vi, "ASRL2", vbNull, 10, Tos)                                   'Opens the COM port COM1:ASRL1, COM2:ASRL2

    vs = viSetAttribute(Tos, VI_ATTR_ASRL_BAUD, 19200)                          'Sets the baud rate.
    vs = viSetAttribute(Tos, VI_ATTR_ASRL_PARITY, VI_ASRL_PAR_NONE)             'Parity: None
    vs = viSetAttribute(Tos, VI_ATTR_ASRL_DATA_BITS, 8)                         'Data length: 8 bits
    vs = viSetAttribute(Tos, VI_ATTR_ASRL_STOP_BITS, VI_ASRL_STOP_TWO)          'Stop bits:2
    vs = viSetAttribute(Tos, VI_ATTR_ASRL_FLOW_CNTRL, VI_ASRL_FLOW_XON_XOFF)    'Xon/Xoff

    strCommand = "SIL 1" + vbCrLf: vs = viWrite(Tos, strCommand, Len(strCommand), r)    'Does not return an acknowledge
                                                                                        'message if SILENT is ON.
End Sub

Private Sub Form_Unload(Cancel As Integer)
    strCommand = "STOP" + vbCrLf: vs = viWrite(Tos, strCommand, Len(strCommand), r)
    vs = viClose(Tos)                                                           'Releases the COM port.
    vs = viClose(vi)                                                            'Exits the VISA library.
End Sub
```

■ Sample program 2

This program uses Universal Driver, which can be downloaded from the Kikusui homepage (http://www.kikusui.co.jp/). Using Universal Driver simplifies program creation. For information on using Universal Driver, download the "Using ActiveX Instrument Driver Objects".

This sample program stores test conditions in memories 1 and 2 when the Command button is clicked, recalls them to provide different test conditions, and conducts a test twice continuously under those test conditions. It displays measured data in Label during the test.

Moreover, when a Form is loaded, it connects the tester to the COM port. When the Form is unloaded, it disconnects the tester from the COM port. Baud rates and other parameters are set in the At-Design Property.

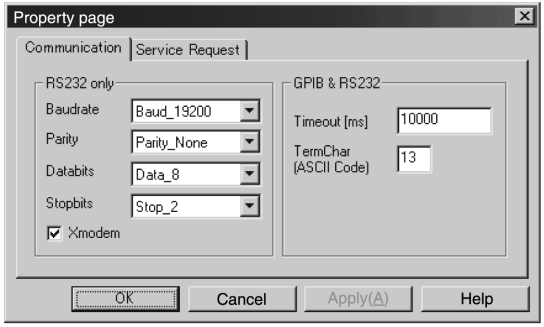


Fig.A-1 At-Design Property

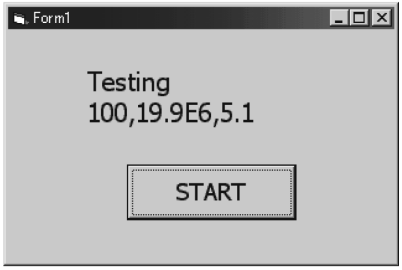


Fig.A-2 Sample Program 2

```
Option Explicit

Private Sub Command1_Click()
    Const DSR_READY = 1: Const DSR_INVSET = 2: Const DSR_TEST = 4: Const DSR_HVON = 8   'Definition of the device status register
    Const DSR_PASS = 16: Const DSR_FAIL = 32: Const DSR_STOP = 64
    Const LOWER_FAIL = 2: Const UPPER_FAIL = 4                                          'Definition of the fail register

    Dim strRdBack As String
    Dim strResult As String
    Dim DSR As Integer
    Dim FAIL As Integer
    Dim Num As Integer

    Tos.SetString "PHOL ON"                                 'Sets PASS HOLD to ON to make it easier to obtain a PASS judgment.
    Tos.SetString "MEM 1,100,1.00E6,1000E6,10,ON,ON,0.5"    'Stores "100 V, Lower: 1 Mohm, Upper: 1000 Mohm, 10 sec.,
                                                            'Upper ON, Timer ON, Wait 0.5 sec." in memory number 1.
    Tos.SetString "MEM 2,200,1.00E6,1000E6,10,ON,ON,0.5"    'Stores "200 V, Lower: 1 Mohm, Upper: 1000 Mohm, 10 sec.,
                                                            'Upper ON, Timer ON, Wait 0.5 sec." in memory number 2.

    For Num = 1 To 2 Step 1
        If Num = 1 Then Tos.SetString "REC 1"               'Recalls memory number 1 for the first For loop.
        If Num = 2 Then Tos.SetString "REC 2"               'Recalls memory number 2 for the second For loop.

        Do                                                  'Waits until READY state is entered.
            Tos.SetString "DSR?"                            'Acquires the contents of the device status register.
```

```
    strRdBack = Tos.GetString
    DSR = Val(strRdBack)
    If DSR = DSR_READY Then Exit Do                    'Exits the loop if the state is READY.
    Tos.SetString "STOP"
Loop

Tos.SetString "START"                                  'Test start

Do
    strRdBack = Space(25)
    Tos.SetString "DSR?"                               'Acquires the contents of the device status register.
    strRdBack = Tos.GetString
    DSR = Val(strRdBack)

    strResult = Space(25)
    Tos.SetString "MON?"                               'Acquires the current voltage value, resistance value, and remaining time.
    strResult = Tos.GetString
    Label1.Caption = "Testing" + strResult             'Displays the acquired voltage value, resistance value, and
                                                       'remaining time in Label1.

    DoEvents                                           'Enables display processing for Label1.

    If Not (DSR = DSR_TEST Or DSR = DSR_HVON Or DSR = DSR_TEST + DSR_HVON) Then Exit Do
                                                       'Exits the loop if the test is not in progress or high voltage is not being output.
Loop
```

```
    strResult = Space(25)
    Tos.SetString "MON?"                          'Acquires the results of the voltage value, resistance value, and test time.
    strResult = Tos.GetString
    Label1.Caption = "End" + strResult            'Displays the acquired voltage value, resistance value, and test time in Label1.

    Select Case DSR
       Case DSR_STOP
       MsgBox ("STOP! ")                          'Displays "STOP!" in the message box if the status is STOP.
       Case DSR_READY
       MsgBox ("STOP! ")      'Displays "STOP!" in the message box if the status has already been changed from STOP to READY.
       Case DSR_PASS
       MsgBox ("PASS! ")                          'Displays "PASS" in the message box if a PASS judgment has been made.
       Tos.SetString "STOP"                                    'Cancels the PASS judgment.
       Case DSR_FAIL
       strRdBack = Space(25)
       Tos.SetString "FAIL?"                      'In the case of a FAIL judgment, the program detects UPPER FAIL or
                                                  'LOWER FAIL, based on the contents of the fail register.
       strRdBack = Tos.GetString
       FAIL = Val(strRdBack)
       If FAIL = LOWER_FAIL Then MsgBox ("LOWER FAIL! ")
       If FAIL = UPPER_FAIL Then MsgBox ("UPPER FAIL! ")
       Tos.SetString "STOP"                                    'Cancels the FAIL judgment.
    End Select
Next Num
```

```
End Sub

Private Sub Form_Load()
    Tos.Connect "ASRL2"                    'Connects to the COM port  COM1:ASRL1, COM2:ASRL2
    Tos.SetString "SIL 1"                  'Does not return an acknowledge message if SILENT is ON.
    Tos.SetString "STOP"
End Sub

Private Sub Form_Unload(Cancel As Integer)
    Tos.SetString "STOP"
    Tos.Disconnect                         'Disconnects from the COM port.
End Sub
```

Index

Massages

A

B

C

D

E

F

T

U

V

W