OPERATION MANUAL

TOS5000 SERIES
WITHSTANDING VOLTAGE TESTER
TOS5030

WARNINGS Against HIGH VOLTAGE

- *This Tester generates high voltage.*
- *Any incorrect handling may cause death.*
- *Read Chapter 3 "WARNINGS AND CAUTIONS FOR OPERATING THE TESTER" in this manual to prevent accident.*
- *This manual should be placed within the reach of the operator so that he or she may read it whenever necessary.*

KIKUSUI

KIKUSUI PART No. Z1-000-622 IB000965 MAR/2004

– To supervisor in charge of operation –

(1) If the operator does not read the language used in this manual, translate the manual into appropriate language.

(2) Help the operator in understanding this manual before operation.

(3) Keep this manual near the Tester for easy access of the operator.

– For your own safety (How to avoid electrification) –

(1) While the Tester is generating the output, do not touch the following areas, or else, you will be electrified, and run the risk of death by electric shock.

- ☆ the output terminal
- ☆ the test leadwire connected to the output terminal
- ☆ the Device Under Test (DUT)
- ☆ any part of the Tester, which is electrically connected to the output terminal.

(2) Also, electric shock or accident may arise in the following cases:

- ☆ the Tester being operated without grounding.
- ☆ if the gloves for electrical job are not used.
- ☆ approach to any part connected to the output terminal while the power of the Tester is turned on.

On Power Supply Source, it is requested to replace the related places in the operation manual with the following items.

(Please apply the item of ✓ mark.)

☐ Power Supply Voltage: to _ _ _ _ _ V AC

☐ Line Fuse: to _ _ _ _ _ A

☐ Power Cable: to 3-core cable (See Fig. 1 for the colors.)

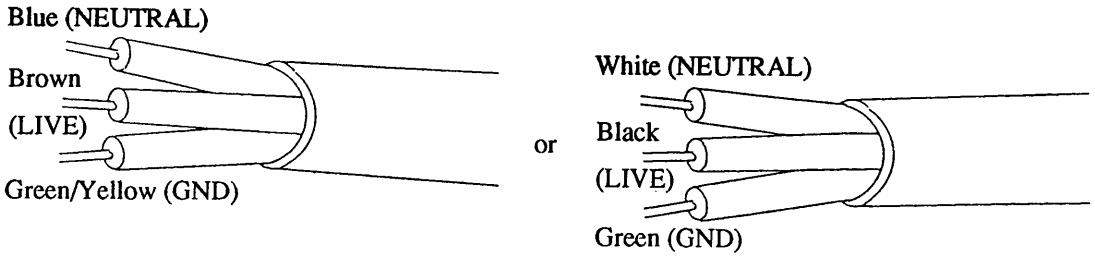

Fig. 1

Please be advised beforehand that the above matter may cause some alteration against explanation in the operation manual.

* AC Plug: In case of Line Voltage 125V AC or more, AC Plug is in principle taken off and delivered, in view of the safety.
(AC Plug on 3-core cable is taken off in regardless of input voltages.)
To connect the AC plug to the AC power cable, connect the respective pins of the AC plug to the respective core-wires (LIVE, NEUTRAL, and GND) of the AC power cable by referring to the color cables shown in Fig. 1.

Before using the instrument, it is requested to fix a suitable plug for the voltage used.

COMPOSITION OF THE MANUAL

This manual is composed of the following chapters.

Chapter 1. GENERAL	Provide basic information about how to use the Tester. Be sure to read these chapters.
Chapter 2. GENERAL PRELIMINARY NOTES AND PRECAUTIONS	
Chapter 3. WARNINGS AND CAUTIONS FOR OPERATING THE TESTER	
Chapter 4. OPERATION METHOD	Describes how to operate the Tester.
Chapter 5. OPERATING PRINCIPLE	Introduces basic operating principles of the Tester.
Chapter 6. MAINTENANCE	Introduces basic maintenance method for the Tester.
Chapter 7. SPECIFICATIONS	Provides electrical and mechanical specifications.
Chapter 8. OPTIONS	Introduces optional devices.
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– Warnings and Cautions –

The Tester generates dangerous high voltage. You must handle it very carefully to avoid electrification to yourself and to prevent damage to peripheral devices. Warnings and cautions in this regard are given in this manual and indicated on the Tester as follows.

Warning and caution instructions given in this manual

WARNING

Gives instructions to avoid electrification to yourself and to prevent damage to the Tester and other devices.

Caution

Gives instructions to prevent damage to the Tester and other devices.

Attention signs indicated on the Tester

"DANGER! HIGH VOLTAGE"

This sign warns you that the area is charged up to a dangerous high voltage and you must never touch it.

"Refer to the Corresponding Section"

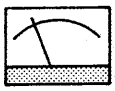
This sign means that you should refer to the operation manual.

CAUTION

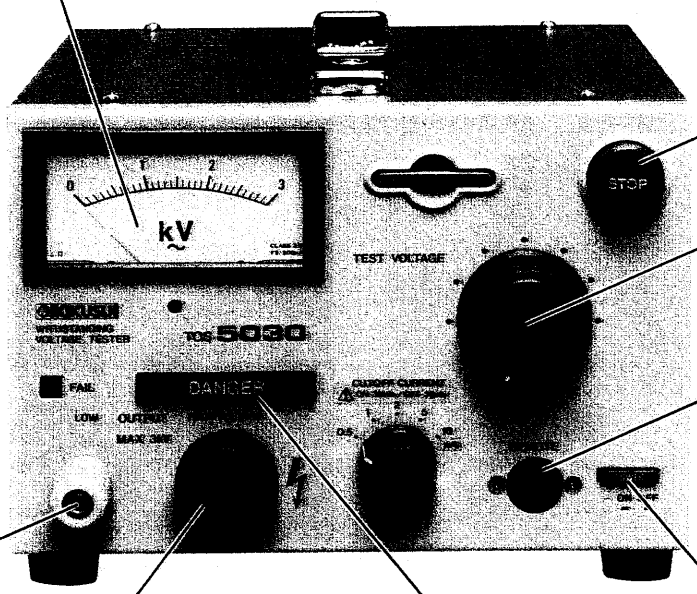
The sign means that the area involves a danger of electrification to yourself or damage to the Tester or other devices.

WARNINGS AND CAUTIONS FOR OPERATING THE TESTER

Caution • Be sure to read Chapter 3 "WARNINGS AND CAUTIONS FOR OPERATING THE TESTER."



Deflected meter pointer means that the Tester is in "DANGER! HIGH VOLTAGE" state.



Be sure to stop the Tester before changing test parameters.

TEST VOLTAGE control should be at "0" position (fully counterclockwise position) except during the testing.

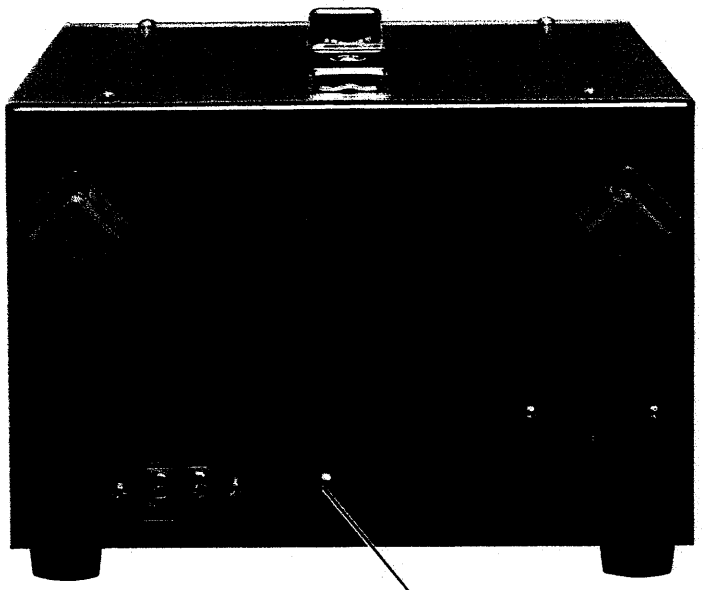
Be sure to read Section 4.3.3 "Remote Control" before controlling the Tester remotely.

Connect the LOW test leadwire first (the HIGH test leadwire next).

Danger! High Voltage Output Terminal

Lighted lamp means that the Tester is in the "DANGER! HIGH VOLTAGE" state.

Before turning-ON the POWER switch, be certain that the TEST VOLTAGE control is in "0" position.



Be sure to connect securely (by using a screwdriver) the protective grounding terminal to an earth line.

- AC line voltage

  Be sure that the AC line voltage is within the specified range.

- AC power cable

  Be sure to use the specified type of power cable.

- AC power fuse

  Be sure to use a power fuse of the correct ratings.

- Cover

  There are parts which are charged up to dangerous high voltages inside the Tester housing. Never attempt to open any panel of the Tester.

Chapter 1
GENERAL

This chapter shows the applicable scope of this manual and major features of the Testers.

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1.1 TOS5000 Series

Kikusui TOS5000 Series Withstanding Voltage Testers are available in four models listed below. This manual is applicable to TOS5030 only. (For TOS5050, TOS5051 and TOS5101, refer to a separate manual dedicated to them.)

Model	Type	AC Output	DC Output	Transformer
TOS5030	AC	3kV/10mA (30VA)	—	30VA
TOS5050	AC	5kV/100mA (500VA)	—	500VA
TOS5051	AC/DC	5kV/100mA (500VA)	5kV/10mA (50W)	500VA
TOS5101	AC/DC	10kV/50mA (500VA)	10kV/5mA (50W)	500VA

WARNING

- *Each of these testers generate hazardous high voltages. Its output terminals, test leadwires, probes, and devices under tests are charged up to these voltages. Be sure to provide full protective measures to guard against electric shock hazard — such as to enclose the test area with rope fences to prevent access by unauthorized persons.*

1.2 Features

The features of Model TOS5030 Tester can be summarized as follows:

■ Compact and light

The Tester is compact and light, and may be conveniently used for test of electronic components and for in-process inspection of products on a manufacturing line.

Model	Dimensions	Weight
TOS5030	200 W × 132 H × 215 W mm (8.16 W × 6.86 H × 8.46 W in.)	4.8 kg (10 lbs.)

■ FAIL judgement function

The Tester gives a FAIL judgement when it has detected a leak current larger than the preset criterion (preset cutoff current).

■ Remote control provision

The tester has provisions for remote start/stop control operation. The remote control function, together with the judgement result output function, will help you conduct efficient automatic labor-saving tests.

■ A FAIL signal output

The Tester delivers a FAIL signal via a connector on the rear panel. The signal, together with the remote control function, will help you conduct efficient automatic labor-saving tests.

■ Zero-turn-on switch

The Tester incorporates a zero-turn-on switching circuit and delivers a quality test voltage with less transients when it is turned on or off, reducing the chances of abnormal voltage to the device under test (DUT).

■ A safer HV output terminal

The leadwire insertion portion of the high voltage output terminal is structured with a restriction for safer connection.

■ A DANGER lamp

The Tester has a large and bright DANGER lamp. This lamp lights up so far as electric charge remains on the output terminal, warning you of a possible electric shock hazard.

■ A START switch for safer operation

The START switch is of a type that reduces chances of inadvertent handling, thereby improving test operation reliability and safety.

■ Noise-resistant circuits

The internal circuits of the Tester are designed to be highly resistant against noise, thereby enhancing the operation reliability.

Chapter 2

GENERAL PRELIMINARY NOTES AND PRECAUTIONS

This chapter gives general notes and precautions you should take heed of, before start using the Tester.

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2.1 Checking for Shipping Damages and Accessories

When you receive the Tester, inspect it for any obvious damages that may have occurred during shipment. Immediately report any damages to the carrier and your Kikusui agent.

You should also find the standard accessories as shown below accompany the Tester in the same package.

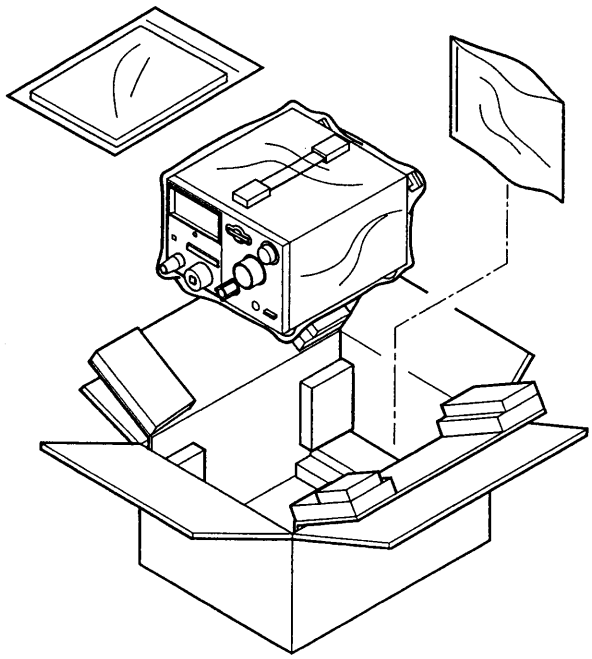
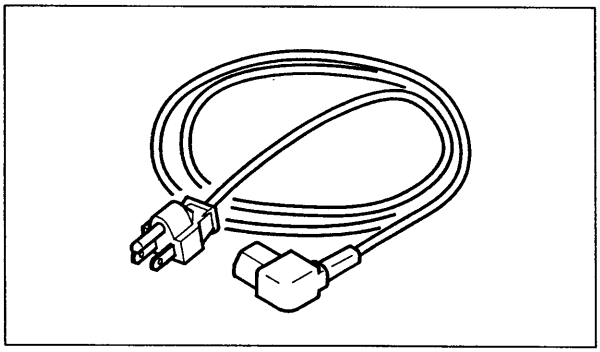
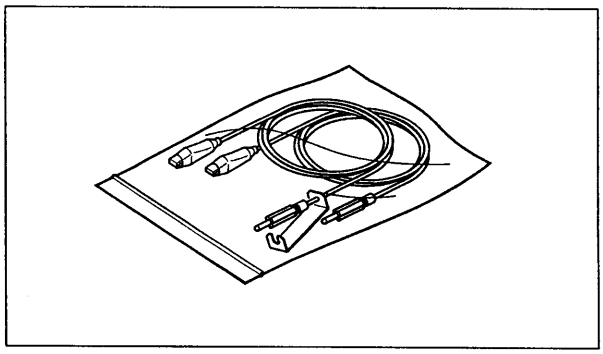


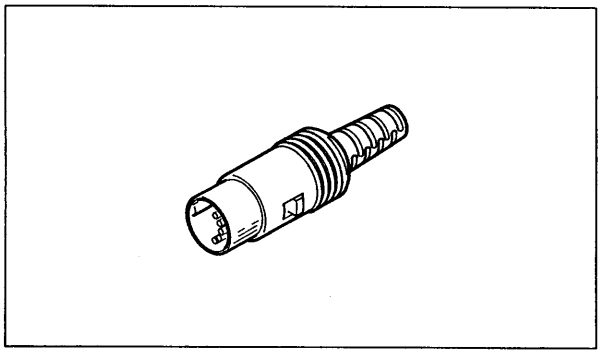
Figure 2.1 Unpacking the Tester



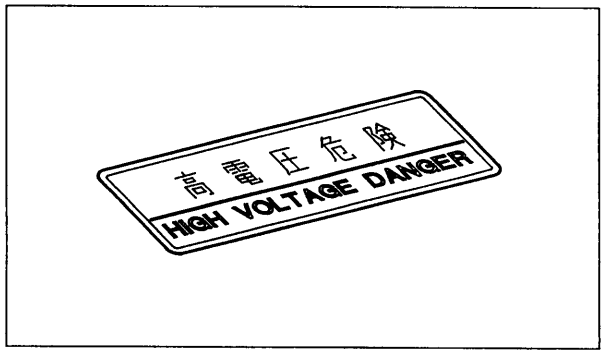
AC power cable



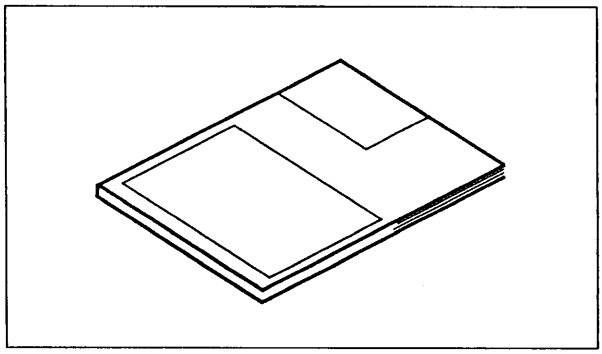
HV Test Leadwires (TL01-TOS)



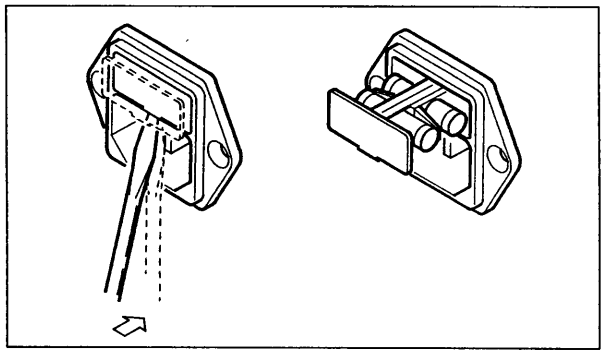
5-pin DIN plug (assembly type)



"DANGER! HIGH VOLTAGE" sticker



Operation manual



AC line power fuse (in fuse holder)

Figure 2.2 Accessories

- Standard accessories of TOS5030

Item	Q'ty	Remarks	Check
AC power cable	1		
High voltage test leadwires TL01-TOS (1.5 meters)	1 set		
5-pin DIN plug	1	Assembly type	
"Danger! High Voltage" sticker	1		
Operation manual	1	(This book)	
Power fuses	2	One in present use and the other as spare (in the fuse holder cap)	

2.2 General Information Before Using the Tester

This section provides general information you should acquire before start using the Tester. Be sure to read this section before start using the Tester.

2.2.1 AC Line Requirements

The AC line requirements of the Tester are as follows:

Nominal voltage	Voltage tolerance	Nominal frequency
100V AC	±10% of nominal voltage	50/60 Hz

The Tester normally operates on an AC line voltage with a tolerance of ±10% of the nominal voltage. If the line voltage is outside of this range, the Tester may not operate normally or may be damaged. If your AC line voltage is outside of this range, be sure to convert it into within this range by using an autotransformer or other appropriate means.

Testers to operate on other AC line voltages as shown below also are available as factory-modification options.

Optional AC line voltages	110V	120V	220V	230V	240V

A sheet that indicates the AC line setting of the Tester as shown below is posted near the AC line power input terminal of the Tester. If no particular indication is made on this indicator sheet, the AC line setting of the Tester is 100V AC. As an option, modification to one of the other nominal voltages is made at the factory before the Tester is shipped from the factory. When this has been done, the modified nominal AC line voltage is indicated by a marking on the indicator sheet. Before turning ON the AC input power of the Tester, be sure that your AC line voltage conforms with the nominal voltage indicated on the indicator sheet.

SETTING SUPPLY		FUSE 250V
STANDARD	100V	1A SLOW
	110V	
	120V	
	220V	0.5A SLOW
	230V	
	240V	

WARNING

- *Do not attempt to convert your Tester for AC line voltage change for yourself. Order your Kikusui agent for conversion of your Tester.*

2.2.2 Fuse Ratings

Be sure to check the ratings of the fuses before connecting the AC power cable to the AC LINE connector of the Tester. The fuse holder is structured in the AC LINE connector. To check the fuse ratings, remove the fuse holder cap by using a screwdriver as illustrated below. There are two fuses in the cap — one for present use and the other for spare. Take out the fuses and check their ratings.

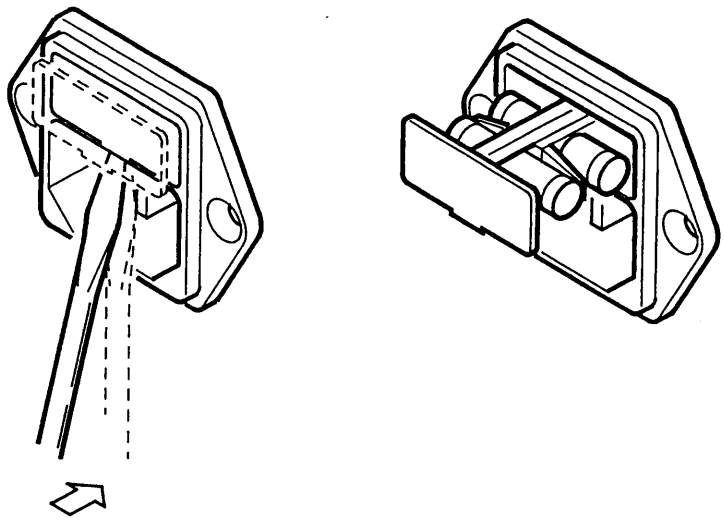


Figure 2.3 Fuse Replacement

Nominal AC line voltage	Fuse ratings
100V	250V, 1A, slow blow
110V	
120V	
220V	250V, 0.5A, slow blow
230V	
240V	

After checking the ratings, put back the fuses into the cap and insert the cap into the fuse holder sufficiently — that is, until the cap clicks.

When the fuse in present use has blown out, replace it with the spare one after eliminating the cause of the fuse blow. When you need further fuses, be sure to use fuses of the correct ratings.

WARNING

- *Do not use a fuse of incorrect ratings. Never attempt to run the Tester by shorting the fuse circuit with a wire.*

2.2.3 Precautions for Installation

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: 0 ˚C to +40 ˚C
Storage temperature range: -20 ˚C to +70 ˚C

■ 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: 80 % 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. At a test voltage exceeding 3 kV, corona discharge may be generated to produce substantial amounts of RF broadband emissions between grips on the test leadwire. To minimize this effect, secure a sufficient distance between alligator clips.
In addition, keep the alligator clips and test leadwire away from the surfaces of conductors (particularly sharp metal ends).

■ 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.

2.2.4 Precautions for Moving

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

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

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

■ 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.

■ 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.

Chapter 3
WARNINGS AND CAUTIONS FOR OPERATING THE TESTER

This chapter gives warnings and cautions you must observe when operating the Tester.

WARNING The Tester delivers a test voltage of up to 3kV, which can cause electric shock hazard. When operating the Tester, be extremely careful and observe the cautions, warnings, and other instructions given in this chapter.

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3.1 Preparative Procedures

3.1.1 Wearing Insulation Gloves

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

3.1.2 Grounding the Tester

Be sure to ground the Tester. To do this, connect securely (by using a tool) an earth line to the protective grounding terminal on the rear panel of the Tester. Unless the Tester is securely grounded, when the Tester output is shorted to an earth line or to a conveyor or other device which is connected to an earth line or when it is shorted to the AC line*, the Tester chassis can be charged up to the high voltage that can cause electric shock hazard.

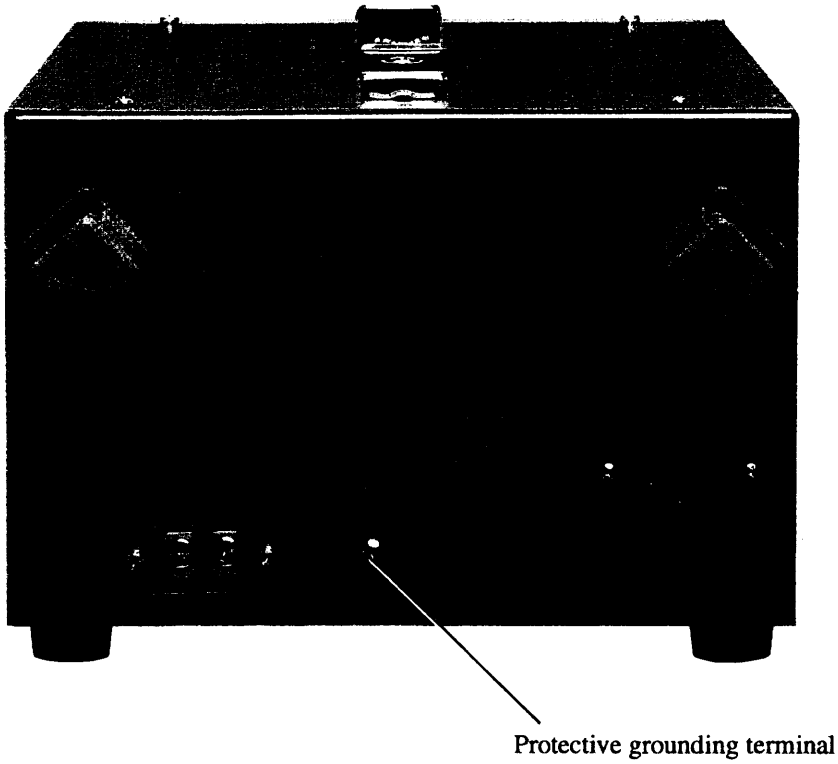

Figure 3.1 Grounding the Tester

*AC line: The term "AC line" here means the line on which the Tester is operating. That is the line to whose outlet the AC power cable of the Tester is connected. It may be of a commercial AC power line or of a private-generator AC power line.

3.2 Warnings and Cautions when Operating the Tester

3.2.1 Connecting the LOW Test Leadwire

For the connection method of the LOW test leadwire to the LOW output terminal of the Tester, see Figure 3.2. Each time before start using the Tester, check that the LOW test leadwire is not broken. When connecting the Tester to a DUT (device under test), connect the LOW test leadwire first (and the HIGH test leadwire next) and be sure that it securely connects the LOW output terminal of the Tester to the corresponding terminal (chassis protective grounding terminal) of the DUT. If the connection is imperfect, overall DUT can be charged up to a hazardous high voltage.

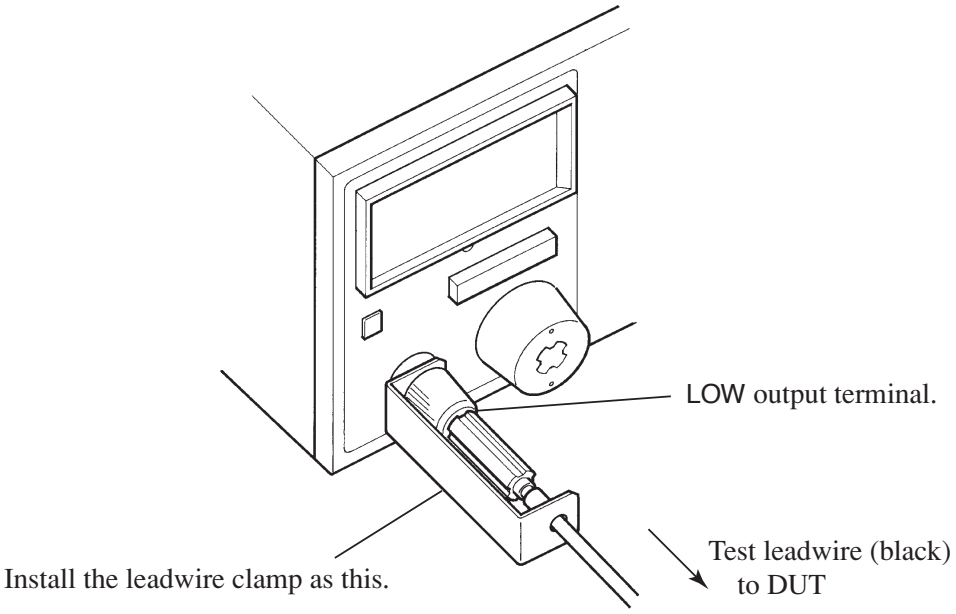

Figure 3.2 Connecting the LOW Test Leadwire

3.2.2 Connecting the HIGH Test Leadwire

Be sure to observe the order of leadwire connections — the LOW test leadwire first and the HIGH test leadwire next. To connect the Tester to a DUT, proceed as follows:

Step 1 Press the **STOP** switch.

Step 2 Check that the output voltmeter reading is zero.

Step 3 Check that the DANGER lamp is OFF.

Step 4 Connect the HIGH test leadwire to the HIGH VOLTAGE output terminal.

Step 5 Short the LOW and HIGH test leadwires, and check that no high voltage is output.

Step 6 Connect the Tester to the DUT, with the LOW output leadwire first and HIGH output leadwire next.

3.2.3 Before Turning-ON AC Input Power

Before turning-on the AC input power, be certain that the TEST VOLTAGE control knob is in the zero position (fully counterclockwise position).

3.2.4 Before Changing Test Parameters

Before changing test parameters, press the [STOP] switch and be certain that the TEST VOLTAGE control knob is in the zero position (fully counterclockwise position).

3.2.5 Precautions for Pausing Tests

When you pause the test, be sure to turn the TEST VOLTAGE control knob to the zero position (fully counterclockwise position) and press the [STOP] switch. 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.

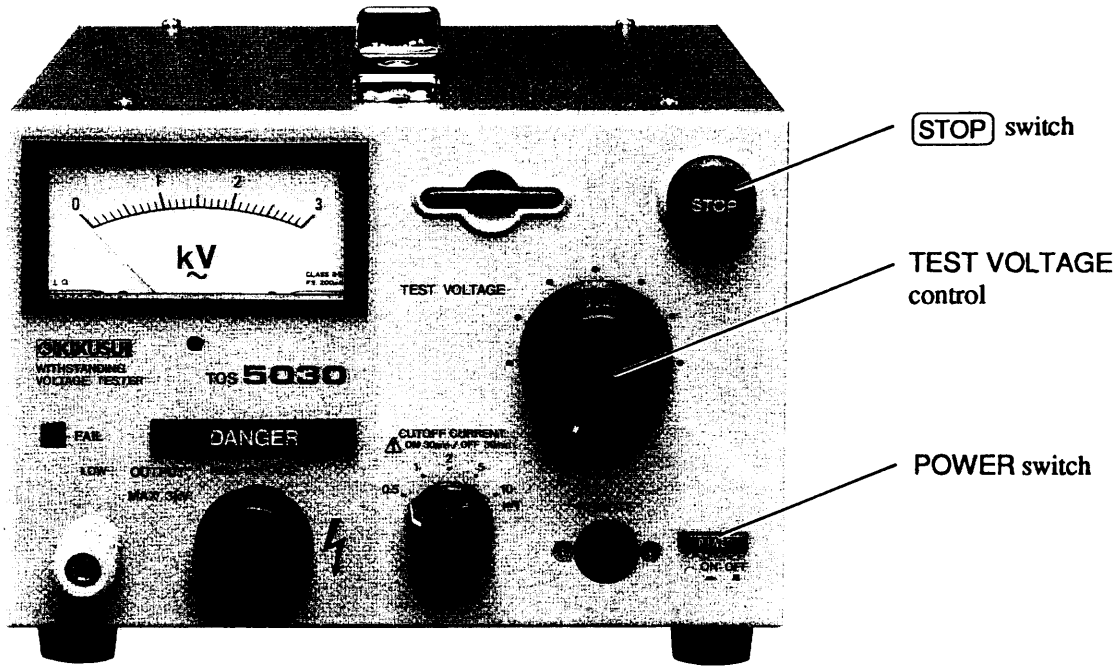

Figure 3.3 Switches and Control on Front Panel

3.2.6 Items Charged Up to Dangerous High Voltages

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

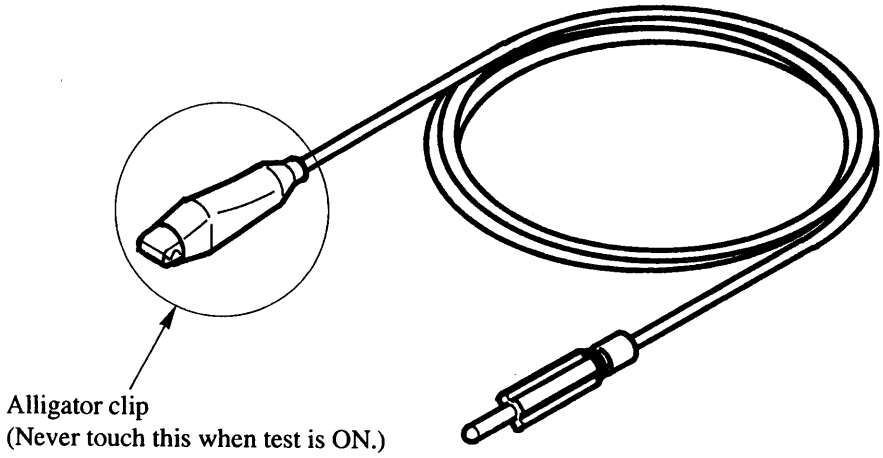

Figure 3.4 Test Leadwire

WARNING

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

3.3 Warnings for Matters After Turning-OFF Power

3.3.1 Matters to be Sure of After Turning-OFF Power

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

(a) The output voltmeter indicates "zero."

(b) The DANGER lamp has gone out.

3.4 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-ON state (state that the test voltage is being delivered) by inadvertent operation.

- Provide means to assure that none can touch the DUT, test leadwires, probes, output terminals and their vicinities when in the TEST-ON state (state that the test voltage is being delivered).

3.5 Inhibitions

3.5.1 Inhibition of Rapid ON/OFF Repetitions

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 without turning OFF the output switch first — you may do this only in case of emergency.

3.5.2 Inhibition of Shorting to Earth Ground

Pay attention so that the high test voltage line is not shorted to a nearby AC line or nearby devices (such as conveyors) which are connected to an earth ground. If it is shorted, the Tester chassis can be charged up to the hazardous high voltage.

Be sure to connect the protective grounding terminal of the Tester to an earth line. If this has been securely done, even when the HIGH output terminal is shorted to the LOW output terminal, the Tester will not be damaged and its chassis will not be charged up to the high voltage.

3.6 In Case of Emergency

3.6.1 Actions When in Emergency

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

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

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

You may do either (a) or (b) first. But be sure to do both.

3.7 Dangerous States of Failed Tester

3.7.1 Inhibition of Use 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. Never attempt to repair the Tester for yourself — please order your Kikusui agent.

- The DANGER lamp does not go out despite you have pressed the [STOP] switch.
- The DANGER lamp does not light up despite the pointer of the output voltmeter is deflected indicating that the output voltage is being delivered.

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

3.7.2 DANGER Lamp

If the DANGER lamp does not light up (due to failure of the lamp itself or other cause) when it should, this situation is very dangerous. Immediately stop using the Tester and order your Kikusui agent for repair.

3.8 Wattage, Heat, and Other Limiting Conditions of Use

1. The maximum output voltage of the Tester when at no load may become higher than 3kV. It may become still higher depending on AC line voltage change. With these in mind, be sure to operate the Tester at output voltage not higher than 3kV.

2. The heat dissipation of the high voltage transformer of the AC test section is one-half of the normal wattage with respect to the rated output from the viewpoint of size, weight, and cost of the Tester. Due to this, when operating the Tester with its UPPER CUTOFF CURRENT higher than 5mA, provide pause periods at least identical with test periods. The allowable maximum continuous test period is 30 minutes (at ambient temperature not higher than 40°C (104°F). If you operate the Tester in the TEST-ON state continuously for a period longer than this, the thermal fuse on the high voltage transformer may blow out.

Ambient temperature t (°C)	Upper cutoff current I (mA)	Pause period	Maximum allowable continuous test period
t ≤ 40°C	5 < I ≤ 10	Not less than test period	≤ 30 min.
(t ≤ 104°F)	I ≤ 5	Not required	Infinite

3. The Tester operates normally on an AC line voltage with an allowance of ±10% of the nominal line voltage. Outside this allowance range, the Tester may not operate normally and may become damaged. If your utility AC line voltage is not within this range, provide an appropriate means to convert it into this range.

4. Do not operate or store the Tester in direct sunlight or in high temperature, high humidity, or dusty atmosphere.

5. The Tester has a high voltage output transformer of 30VA and will draw a large AC input current (several tens Amperes) in the following cases:

   - For several tens milliseconds before the Tester detects a FAIL of the DUT (if the DUT is a failure).

   - For several tens milliseconds of start up period of the Tester.

   Pay due regards to the capacity of the AC line and to other devices connected to the same line. Do not connect the Tester to a regulated AC line which employs a current cut-out type of overcurrent protector. If the current is cut out, the Tester may generate quite a high surge voltage in its output circuit. This is very dangerous.

Chapter 4
OPERATION METHOD

This chapter describes the items on the front and rear panels, test operation method.

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4.1 Description of Front Panel Items

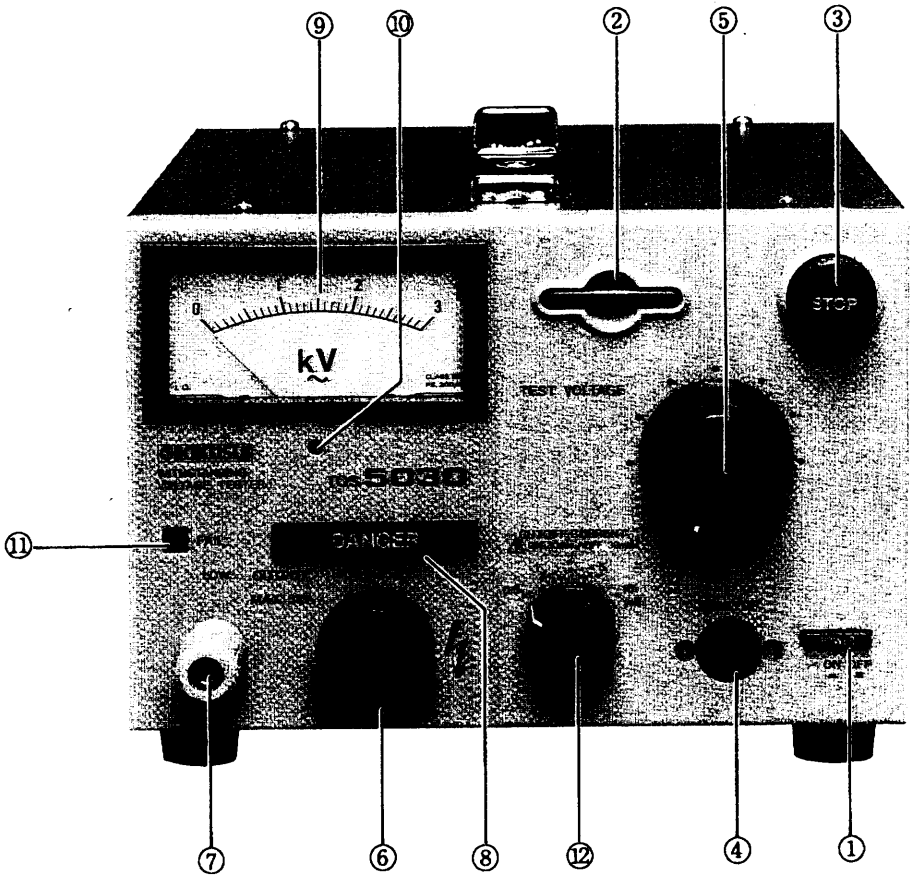


Figure 4.1 Front Panel of TOS5030

① [POWER] Switch — This switch turns ON/OFF the AC input power of the Tester.

Be sure to read Chapter 3 "WARNINGS AND CAUTIONS FOR OPERATING THE TESTER" of this manual before start using the Tester.

② [START] Switch — As you press the [START] switch, Tester delivers the test voltage (adjusted with the TEST VOLTAGE control) to the HV OUTPUT terminal and the DANGER lamp illuminates.

③ [STOP] Switch — The [STOP] switch is to terminate the test operation or to cut off the output voltage while the test is in progress. It also is used to release the FAIL signal.

④ REMOTE CONTROL Connector — This connector is for remote control of start/stop of test operation from a Remote Control Box (RC01-TOS or RC02-TOS). Be sure to read Section 4.4.3 "Remote Control" before remote-controlling the Tester.

⑤ TEST VOLTAGE Control	This control is to adjust the test voltage. As you turn the control clockwise from the "0" position, the test voltage increases. Be sure to keep the TEST VOLTAGE control in the fully counterclockwise position ("0" position) whenever no test is done.
⑥ HIGH VOLTAGE Terminal	This terminal is for the high line of the Tester output voltage which is used as the test voltage.
⑦ LOW Terminal	This terminal is for the low line of the Tester output. This terminal is directly connected to the Tester chassis.
⑧ DANGER Lamp	This red lamp illuminates to indicate that the Tester will deliver the test voltage as you turn the TEST VOLTAGE control or that it is delivering the test voltage.
⑨ Analog Voltmeter	The voltmeter indicates the test voltage. It directly measures the output terminal voltage of the Tester.
⑩ Zero Adjustment of Analog Voltmeter	This is for mechanical zero adjustment of the analog voltmeter. Before making zero adjustment, be sure that the POWER switch is OFF.
⑪ FAIL Lamp	This lamp illuminates to indicate that the test result was a FAIL.
⑫ CUTOFF CURRENT [mA] Switch	This switch selects a cutoff current value — one of 0.5/1/2/5/10mA. If the Tester detects a current larger than the preset cutoff current value, it instantaneously cuts off the output voltage and generates a FAIL signal. Select a value to meet the requirements imposed on the DUT to be tested.

Caution

- *Test time and pause period are limited by setting upper cutoff current. "ON 30min" of the front panel character shows a maximum test time and "OFF 30min" shows a minimum pause period. For details, refer to Section 7.1 "Performance specifications".*

4.2 Description of Rear Panel Items

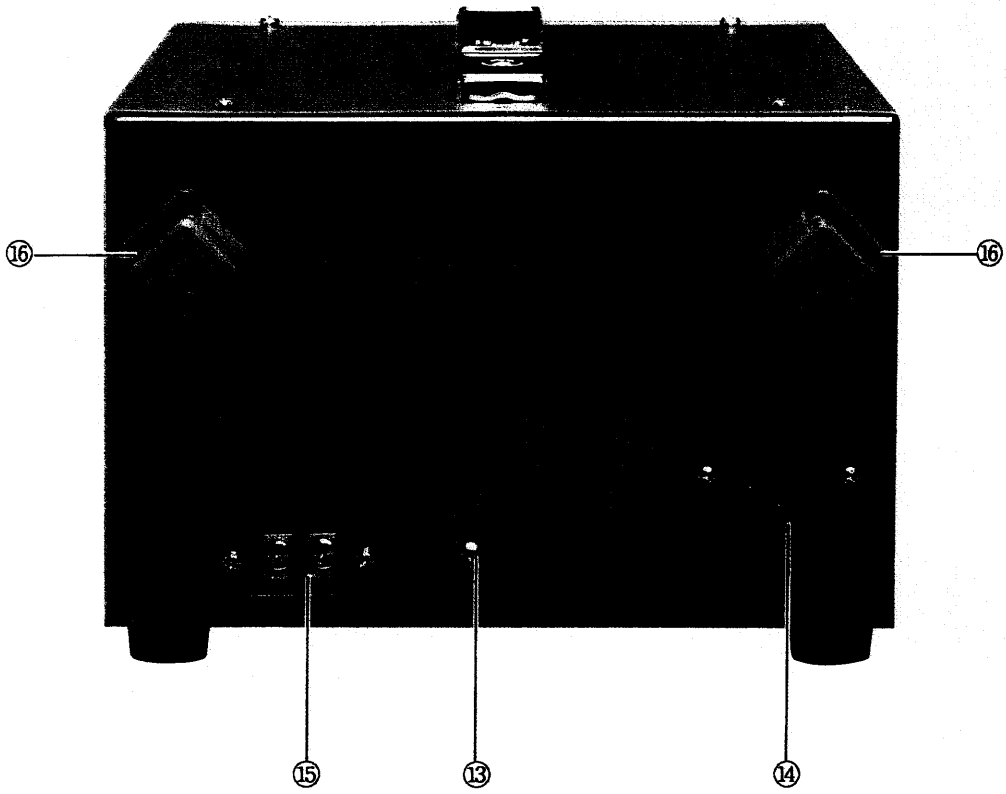


Figure 4.2 Rear Panel of TOS5030

⑬ Protective grounding Terminal — This terminal is for grounding the Tester to an earth ground.

WARNING

- *Be sure to connect securely (by using a screwdriver) an earth ground line to the Protective grounding terminal ⑬. Unless the Tester is securely grounded, when the Tester chassis can be charged up to the high voltage than can cause electric shock hazard. For details, refer to Section 3.1.2* "Grounding the Tester."

⑭ AC LINE [50/60 Hz] Connector — The AC LINE connector is for the AC input power. It serves also as an input power fuse holder.

⑮ FAIL SIGNAL Connector — This connector delivers the fail signal. The signal is of a make-contact signal, whose ratings are 100V 1A AC, or 30V 1A DC. For details, refer to Section 4.3.4 "Contact Signal."

⑯ AC Power Cable Takeups — To take up the AC power cable when the Tester in not in use.

4.3 Test Operation Method

4.3.1 Preliminary Procedure

(1) Before turning-ON the POWER switch, be certain that the voltmeter pointer indicates the "0" scale position. If it does not, adjust it with the zero adjustment located below it. If the Tester power has been ON, turn it OFF once to adjust the zero position.

(2) Be sure to read Chapter 3 "WARNINGS AND CAUTIONS FOR OPERATING THE TESTER" before turning-ON the [POWER] switch. To operate the Tester, observe the instructions given in this chapter.

4.3.2 Test Procedure

(1) Setting the cutoff current

With the CUTOFF CURRENT switch, select a cutoff current value to meet the requirements applicable to the DUT.

Caution

- *Test time and pause period are limited by setting upper cutoff current. "ON 30min" of the front panel character shows a maximum test time and "OFF 30min" shows a minimum pause period. For details, refer to Section 7.1 "Performance specifications".*

(2) Setting the test voltage

Check that the TEST VOLTAGE control is in the fully counterclockwise position and then press the [START] switch. Monitoring the test voltage on the voltmeter, turn gradually the TEST VOLTAGE control clockwise until the required voltage is attained. Then press the [STOP] switch.

(3) Connecting the DUT

After making sure the voltmeter reads "zero" and the DANGER lamp has gone out, connect the LOW test leadwire to the LOW output terminal of the Tester. With the other end of the LOW test leadwire, hit the HIGH VOLTAGE output terminal to check that no high voltage is fed to the HIGH VOLTAGE output terminal. Then, connect the HIGH test leadwire to the HIGH VOLTAGE output terminal.

Next, connect the LOW test leadwire to the DUT and then the HIGH test leadwire to the DUT.

(4) Executing the test

(a) Press the [START] switch and the test will start.

(b) If the Tester detects a leak current larger than the preset cutoff current, it instantaneously cuts off the test voltage, gives a FAIL judgement, and delivers a FAIL signal. The FAIL signal is with a lamp, a buzzer, and a make-contact. To reset the FAIL signal, press the [STOP] switch.

(c) If the required test time elapses without any FAIL judgement, the DUT is judged to be a pass. Press the [STOP] switch to cut off the test voltage.

(d) When the test is over, press the [STOP] switch to cut off the test voltage, turn the TEST VOLTAGE control to the "0" position, and turn OFF the [POWER] switch.

4.3.3 Remote Control

(1) The start/stop of test can be remote-controlled from an optional Remote Control Box. As you connect the plug of the remote control cable to the REMOTE CONTROL connector on the Tester front panel, the internal circuit is automatically switched to the remote mode of operation. In this case, the [START] switch on the Tester front panel is disabled, although the STOP operation can be done both remotely from the Remote Control Box and locally from the Tester front panel.

It also is possible to remote-control the Tester from other control device than the Remote Control Box. This method is explained below.

WARNING

- *Be extremely careful when using this method because the high voltage is on/off-controlled with an external signal. Pay attention so that the high test voltage is not generated inadvertently. Also, provide full measures to ensure that nobody is contacted with the high voltage areas (DUT, test leadwires, probe, output terminal, etc.) when the test voltage is being delivered. When these measures are unavailable, do not use the following remote control method.*

(a) In order to remote-control the Tester, externally connect Pin 2 to Pin 3 of the REMOTE CONTROL connector.

(b) By controlling the START and STOP contacts as shown in Figure 4.3, the test voltage can be remote-controlled in the same manner as done locally on the Tester front panel.

(c) In the case of the setup shown in Figure 4.4, the test voltage is turned on when the switch is thrown to the NO position, and the Tester is forcefully stopped when the switch is thrown to the NC position.

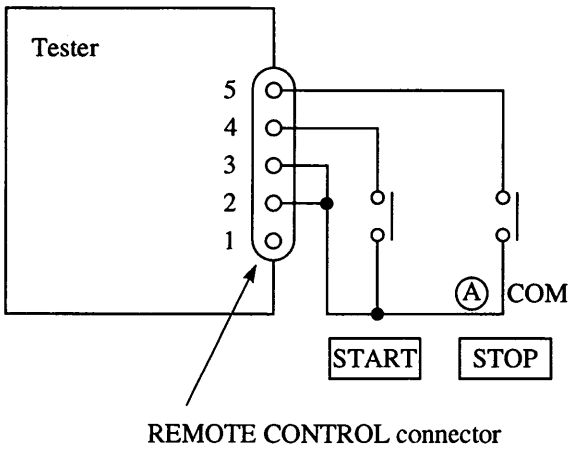


Figure 4.3

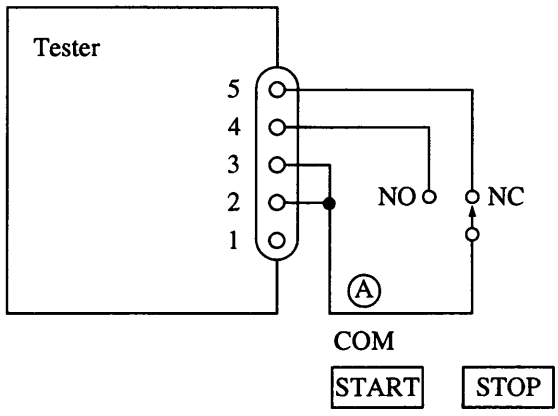


Figure 4.4

(d) Logic elements (transistors, FET's, or photocouplers) may be used instead of the switches in Figure 4.3. The signal status for such operation is shown in Figure 4.7. The input conditions of the Tester for such operation are as follows:

High level input voltage : 11 to 15V
Low level input voltage : 0 to 4V
Low level sweep out current : 7mA or less
Input signal duration needed : 20 ms minimum

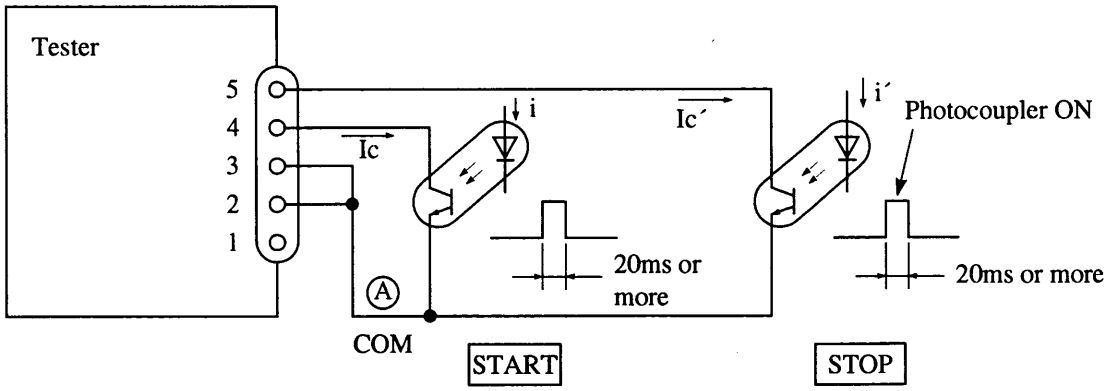


Figure 4.5

Caution

- *Each of the input terminals is pulled up to +15V. If the input terminal is made open, it becomes equivalent to that a high level input is applied.*
- *Pay attention for i and i' so that Ic and Ic' can be pulled by 7mA or more.*
- *An impedance of 5MΩ or more is needed between the common line (point Ⓐ in Figure 4.5) of the control circuit and the power line or the ground line.*
- *The timing of the STOP signal for clearing the FAIL signal is as follows:*

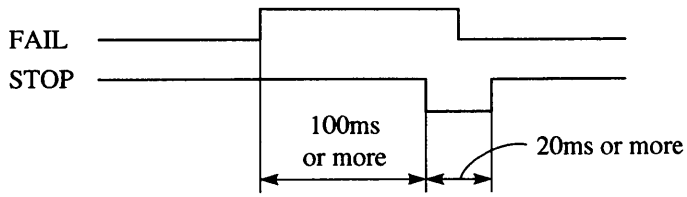
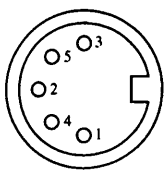


Figure 4.6

(e) As for the elements to be connected to the Tester, the use of photocouplers as shown in Figure 4.5 or relays as shown in Figure 4.3 would be advantageous from the viewpoint of preventing erroneous operations which could be cause by noise. Although the Tester is incorporated with the various provisions to guard it against erroneous operations caused by noise generated by itself or by its related devices, it is most recommendable to take full attention to prevent noise when connecting devices to the Tester.

(f) Note that the layout of pins of the REMOTE CONTROL connector is as per DIN Standard and is not in the due order of number progression, as shown in Figure 4.7.



Layout of connector pins as viewed from panel front

Figure 4.7

4.3.4 Contact Signal Output

(1) The tester delivers a FAIL signal (a make-contact signal) via its rear terminal for external use. The signal lasts until the STOP signal is applied.

(2) The contact signal is only with passive contacts and without any power source. Therefore, it cannot drive any load which has no own power.

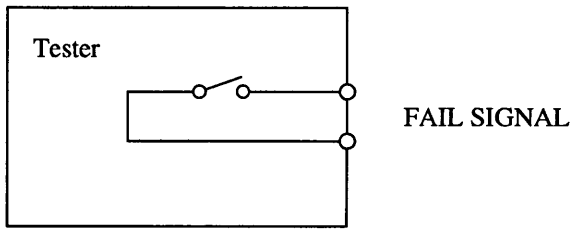


Figure 4.8

A contact which is closed when the signal is applied is called make contact, normally open contact, or form "a" contact. A contact which is made open when the signal is applied is called break contact, normally closed contact, or form "b" contact.

The contacts of the Tester is of a make-contact type and its ratings are 100V AC, 1A or 30V DC, 1A. The withstanding voltage between the signal circuit and the chassis is 500V AC, 1 minute.

(3) Examples of uses of contact signals are shown in the following:

- To drive a DC buzzer with the FAIL signal

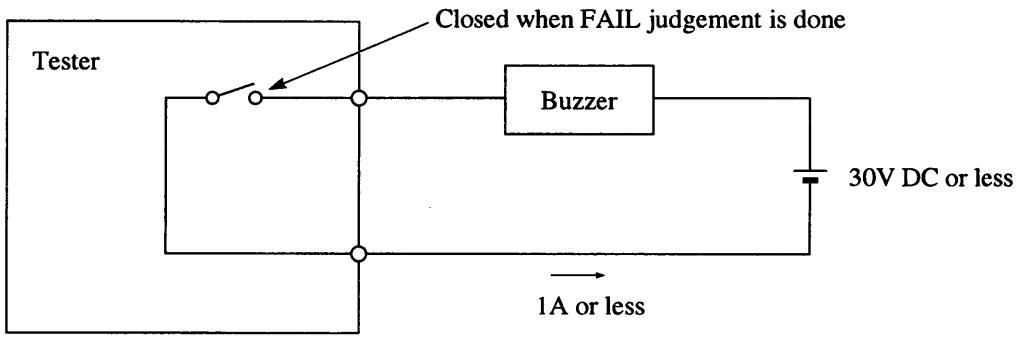


Figure 4.9

- To drive a lamp with the FAIL signal

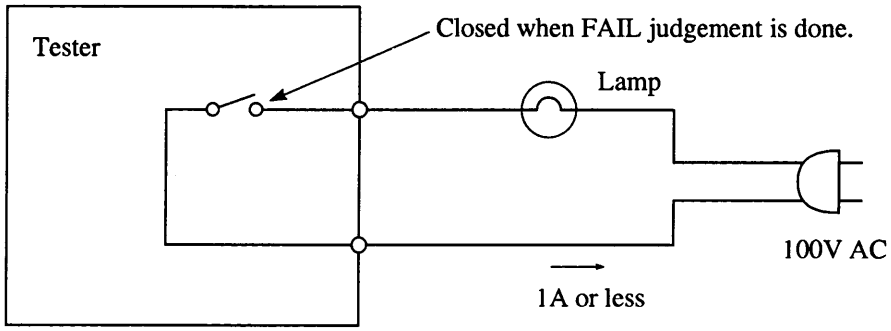


Figure 4.10

- To obtain an "L" level signal with the contact signal

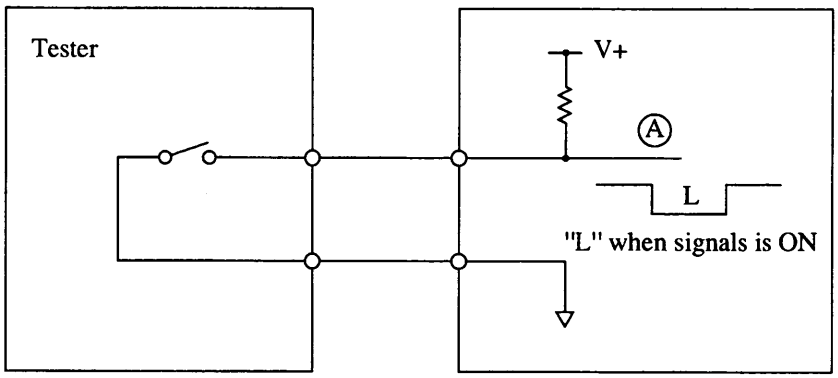


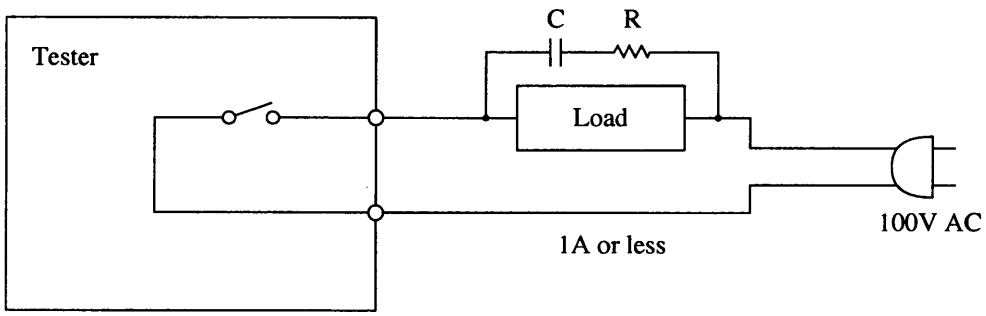
Figure 4.11

In the above illustration, an "L" level signal is obtained at point Ⓐ when the contact output signal is on. However, since the signal obtained at point Ⓐ involves chattering, an appropriate chattering suppression provision should be incorporated depending on the nature of the circuit to be driven by this signal. In some cases, a noise suppression provision may be necessary.

(4) Precautions for using the contact signal

Before using the contact signal, provide a contact protection measure (to absorb surge) suitable for the using method. If no protection is done, operation errors of the circuit connected to the contact may result and, in favorable cases, damage to the contact itself may result.

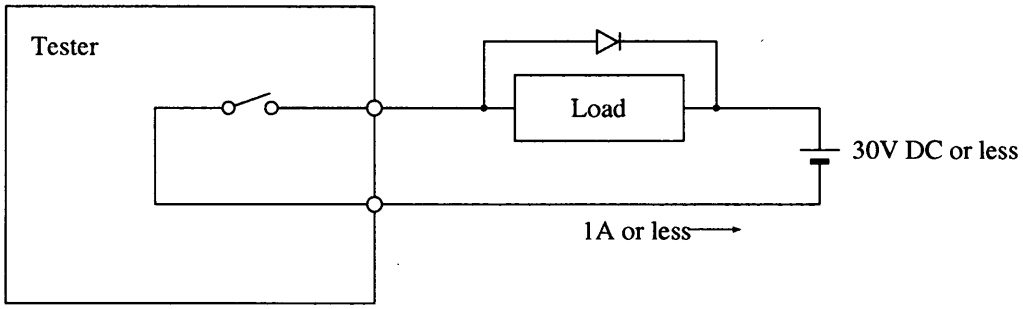
Examples of recommendable protection measures are shown in Figures 4.12 and 4.13.



R: Approx. 100Ω, 2W or more
C: Approx. 0.1μF, 250V AC or more

(The values of R and C are for your reference only. Select appropriate values in accordance with the actual conditions.)

Figure 4.12



Diode
Reverse voltage: 200V or higher
Forward current: 1A or more

(The values of the diode are for your reference only. Select appropriate values in accordance with the actual conditions.)

Figure 4.13

Chapter 5
OPERATING PRINCIPLE

This chapter describes the operating principle of the Tester.

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5.1 Block Diagrams

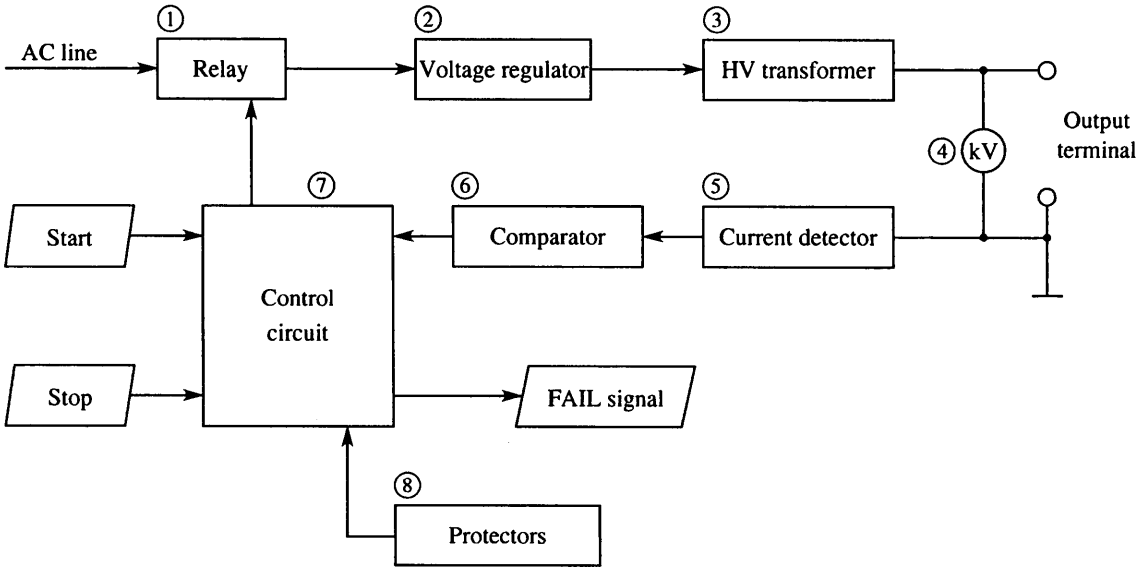


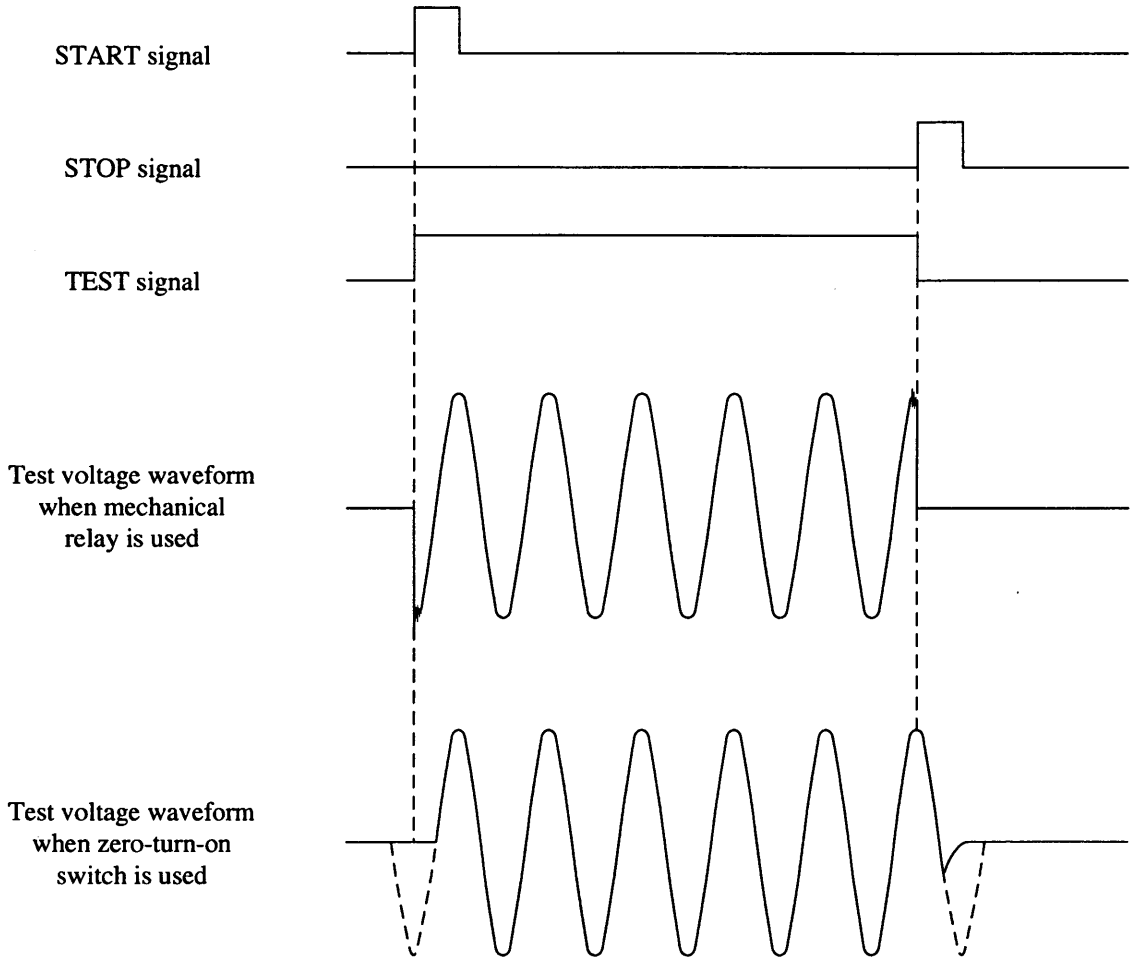
Figure 5.1

5.2 Componential Circuits and Devices

① Relay	The relay turns ON/OFF the line power supplied to the voltage regulator for AC withstanding voltage test. The relay employs a solid-state zero-turn-on circuit to minimize transient spike voltages caused when the relay is turned on or off.
② Voltage regulator	A slide transformer is used to control the output voltage.
③ High voltage transformer	The transformer boosts the voltage regulator output with a ratio of approximately 1:30 into a high output voltage of 0 to 3kV. The rating is 3kV, 10mA.
④ Voltmeter	The voltmeter indicates the output voltage (the voltage of the output terminal).
⑤ Current detector	The current detector measures the output current. It consists of a full-wave rectifier circuit, current shunt resistors, and an integrating circuit.
⑥ Comparator	The comparator circuit is comprised of a reference voltage generator circuit and a comparing circuit, for FAIL judgement.
⑦ Control circuit	The circuit dictates overall operation of the Tester.
⑧ Protectors	Provide various protective features for the Tester.

5.3 Zero-turn-on Switch

If a regular mechanical contact type relay is used for on-off control operation of the primary circuit of the high voltage transformer, transient spike voltages may be produced, thereby applying an abnormal high voltage to the DUT and causing a possibility of rejecting an acceptable DUT or damaging it. The zero-turn-on switch, which employs a solid-state switching circuit, turns on and off the power line at approximately 0 volt level, thereby reducing transient overshoots.



Caution

- *Be sure to observe the following instructions when using a High Voltage Test Probe (HP01A-TOS or HP02A-TOS).*
- *Do not connect the probe to or disconnect it from the DUT while letting it deliver the test voltage. If you do this, the effects of the "zero" switching may be spoiled and the DUT may be damaged. Be sure to turn-on the test voltage after connecting the probe to the DUT and to disconnect the probe from the DUT after turning-off the test voltage.*

Chapter 6
MAINTENANCE

This chapter describes the maintenance procedures for the Tester.

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To make the best use of the Tester, have your Tester subjected to periodical maintenance, inspection and calibration services as described in this chapter.

Caution

- *The Tester generates a dangerous high voltage of 3kV. Never attempt to calibrate the Tester for yourself. For such service, contact your Kikusui agent.*

6.1 Cleaning the Outer Surfaces

When the panels of the Tester has become dirty, clean them by wiping them with a soft cloth moistened with neutral soapsuds.

Caution

- *Be sure to turn OFF the power of the Tester before start cleaning it.*
- *Never use benzine, thinner or other volatile detergent for cleaning the Tester. If you do, the panels may be discolored, letters printed on the panels may be erased, or finishing of the top panel and rear panel may peel off.*

6.2 Checking the Cord and Leadwires

6.2.1 Checking the AC Power Cable

Check the AC input power cable for broken sheath and for loose or cracked plug.

6.2.2 Checking the HV Test Leadwires

The HIGH and LOW test leadwires are wearable parts. Check them each time before using them, in order to be sure of the following:

(a) Visually inspect the leadwires and be sure that they have no indications of broken sheaths or other signs of damage.

(b) Electrically check that the leadwires are not open-circuited (by using a circuit tester or other instrument).

WARNING

- *If the test leadwire is damaged (its sheath is damaged or its core wire is open-circuited), it can be a cause of electric shock hazards. Never use imperfect test leadwires.*

6.3 Calibration

The tester was shipped after factory calibration. However, it should be calibrated at appropriate intervals as the factors may change by aging.

Caution

- *The tester generates a dangerous high voltage (3kV). For the sake of your safety, never attempt to calibrate the Tester for yourself. Please order your Kikusui agent for such service.*

Chapter 7
SPECIFICATIONS

This chapter shows the specifications of Models TOS5030 Tester.

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7.1 Performance specifications

Item		Specification	Remarks
Test voltage	Applied voltage	0 to 3kV	
	Output rating	30VA/3kV, 10mA (with nominal AC line voltage)	See Note 1.
	Waveform	AC line voltage waveform	
	Voltage regulation	With line voltage 100V, 110V, 120V 15% or better (against change from maximum rated to no load)	
		With line voltage 220V, 230V, 240V 20% or better (against change from maximum rated to no load)	
	Switching	With zero-turn-on (zero-start) switch	
Output voltmeter	Scale	3kV full scale	
	Class	JIS* Class 2.5	
	Accuracy	±5% full scale	
	Response, graducation	Mean-value response, rms-value graduation	
FAIL judgement	Type of judgement	• FAIL judgement is given if the measured current is larger than the preset cutoff current. • When a FAIL judgement is given, the Tester cuts off the output voltage and generates an alarm signal.	
	Cutoff current setting values	0.5, 1, 2, 5, or 10mA	
	Judgement accuracy	±5% of preset cutoff current	See Note 2.
	Current detection	The absolute value of the current is integrated and compared with the preset cutoff current.	
	Calibration	Calibrated for r.m.s. value of sine wave, by using a pure-resistive load	
	No-load output voltage required for detection	Approx. 400V, at 10mA setting	See Note 3.
Dimensions	Excluding protrusions	200 W × 132 H × 215 D mm (7.87 W × 5.20 H × 8.46 D in.)	
	Including protrusions	200 W × 160 H × 280 D mm (12.6 W × 6.30 H × 11.0 D in.)	
Weight		Approx. 4.8 kg (11 lbs.)	See Note 4.

* JIS : Japanese Industrial Standards

Note 1: The heat dissipation of the high voltage transformer of the AC test section is one-half of the normal wattage with respect to the rated output from the viewpoint of size, weight, and cost of the Tester. Due to this, when operating the Tester with its UPPER CUTOFF CURRENT higher than 5mA, provide pause periods at least identical with test periods. The allowable maximum continuous test period is 30 minutes (at ambient temperature not higher than 40°C (104°F). If you operate the Tester in the TEST-ON state continuously for a period longer than this, the thermal fuse on the high voltage transformer may blow out.

Ambient temperature t (°C)	Upper cutoff current I (mA)	Pause period	Maximum allowable continuous test period
t ≤ 40°C	5 < I ≤ 10	Not less than test period	≤ 30 min.
(t ≤ 104°F)	I ≤ 5	Not required	Infinite

Note 2: When in the AC mode, the current which flows through the stray capacitances of the test leadwires, test jigs, and other items on the test circuit also causes measuring errors. The total judgement accuracy is the sum of this current and the above-mentioned judgement accuracy. Approximate values of such currents are shown in the following table.

Output voltage	1kV	2kV	3kV
Tester itself (without test leadwires)	4μA	8μA	12μA
When 350-mm-long test leadwires are used being suspended in air	6μA	12μA	18μA
When accessory test leadwires TL01-TOS are used	20μA	40μA	60μA

Note 3: In order to be able to make a FAIL judgement, a certain minimal level of no-load output voltage is necessary due to the internal resistance of the output circuit. This item indicates such minimal output voltage.

Note 4: When the Tester is modified to operate on an optional AC line voltage by factory modification, the Tester will become heavier by approximately 1 kg (2.2 lbs.).

Test voltage waveform:

When an AC test voltage is applied to a capacitive DUT, it is possible that the voltage becomes higher even than that when in the no load state. Furthermore, waveform distortion also may occur if the capacitance of the DUT is voltage-dependent (such as of ceramics capacitors). When the test voltage is not higher than 1.5kV and the capacitance is not larger than 1000 pF, such test voltage changes are only of negligible levels.

Remote control:

The START/STOP operation can be remote-controlled in the following cases.

- When the Remote Control Box (optional) is used.
- When the High Voltage Test Probe (optional) es used.
- When the Tester is controlled with a make-contact of a relay or a switch.
- When the Tester is controlled in a low-active mode with logic elements.

The input conditions of the Tester in this case are as follows:

- HIGH level input voltage : 11 to 15V
- LOW level input voltage : 0 to 4V
- LOW level sweepout current: 7mA or less

Note 5: The input terminals are pulled up to +15V supply voltage by a resistor. If the input terminals are made open, the state is identical with that a HIGH level input is applied.

FAIL signals

For the FAIL signals, the Tester provides a lamp signal, a buzzer signal, and a make-contact signal. The ratings of the make-contact signal is 100V AC, 1A or 30V DC, 1A. The generated FAIL signals are not reset until you press the STOP switch.

Ambient temperature and humidity

Specification range : 5 to 35˚C (41 to 95˚F), 20 to 80% RH
Operable range : 0 to 40˚C (32 to 104˚F), 20 to 80% RH
Storage range : -20 to 70˚C (-4 to 158˚F), ≤ 80% RH

SAFETY (See Notes 6 and 7.)

Conforms to the requirements of the following directive and standard.
Low Voltage Directive 73/23/EEC
EN61010-1
Class I
Pollution degree 2
UL1244
(The UL-approved products with input voltage of 120VAC satisfy the UL1244 standerd.)

Electromagnetic compatibility (EMC) (See Note 6.)

Conforms to the requirements of the following directive and standard.
EMC Directive 89/336/EEC
EN61326
EN61000-3-2
EN61000-3-3
Under following conditions
1. Used HV test leadwires TL01-TOS.
2. No discharge in testing.

AC line requirements

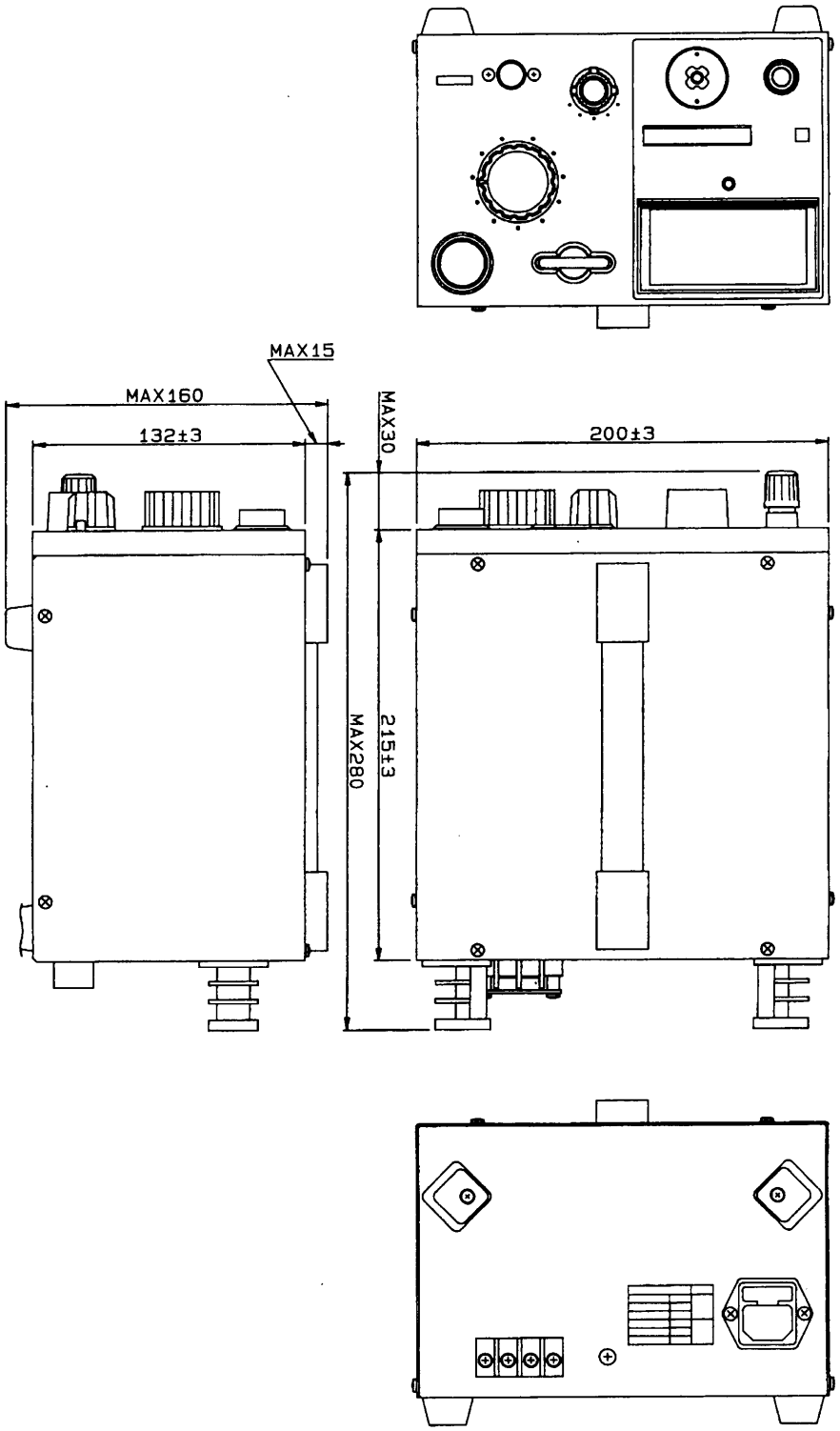
Line voltage : 100V±10%, 50/60 Hz
(Can be factory-modified to nominal 110/120/220/230/240V)
Power consumption : 10VA or less when no load (in READY state)
(See Note 8.)
Approx. 45VA when with rated load
Insulation resistance : ≥ 30 MΩ, with 500V DC
Withstanding voltage : 1390V AC (2 seconds), between AC line and chassis
1200V AC (1 second), UL-approved products only

Note 6: Only on models that have CE marking on the panel.
Not applicable to custom order models.
Note 7: 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.
Note 8: 25VA or less when the Tester is modified to operate on an AC line voltage other than 100V.

Accessories

Item	Q'ty	Remarks
AC power cable	1	
High voltage test leadwires TL01-TOS (1.5 meters)	1 set	
5-pin DIN plug	1	Assembly type
"Danger! High Voltage" sticker	1	
Operation manual	1	(This book)
Power fuses	2	One in present use and the other as spare (in the fuse holder cap)

7.2 Overall Dimensions



Unit: mm

Chapter 8
OPTIONS

This chapter introduces optional devices for the Tester.

Table of contents

8.1 Model RC01-TOS/RC02-TOS Remote Control Box

Model RC01-TOS or RC02-TOS Remote Control Box is for remote control of start/stop of test operation of the Tester. For remote control, connect the Control Box to the REMOTE connector of the Tester. The RC01-TOS has one START switch; RC02-TOS has two START switches and the test starts as you press both switches at the same time with your both hands, thereby enhancing the operating safety.

Functions of switches:

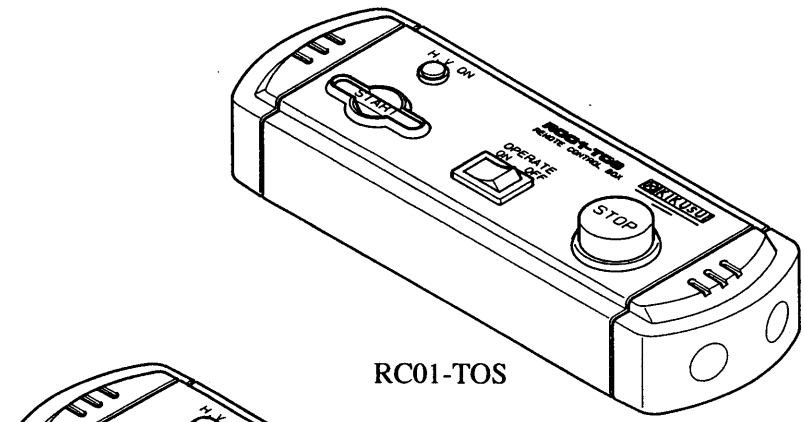
OPERATE switch: This switch enables (when ON) or disables (when OFF) the START switch or switches.

START switch : The test starts as you press this switch (or switches) when the OPERATE switch is ON and the Tester is in the READY status.

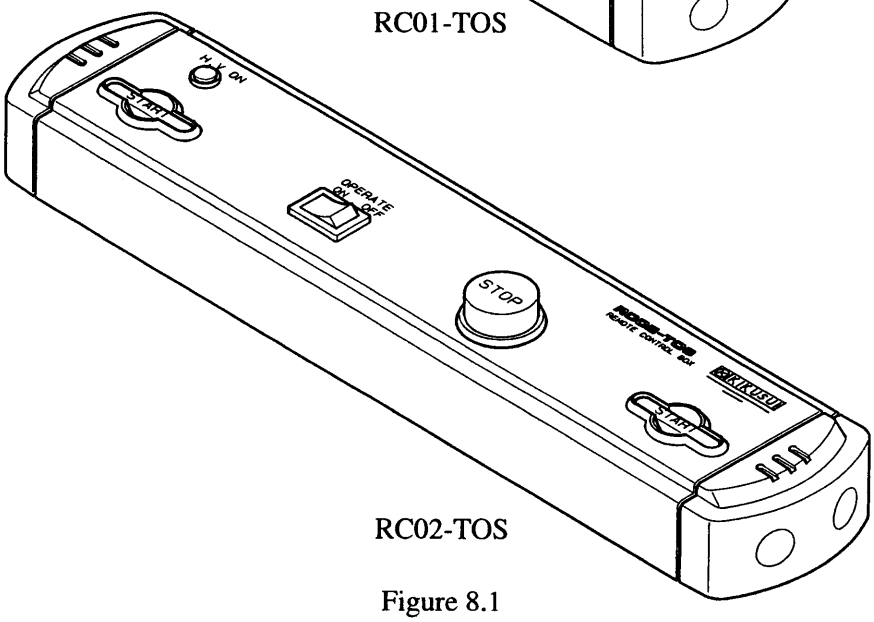
STOP switch : This switch terminates the test (cuts off the test voltage) or resets the Tester from the FAIL or other particular status — its functions are the same with those of the STOP switch on the front panel of the Tester.

Dimensions

RC01-TOS: 200 W × 70 H × 39 D mm (7.9 W × 2.8 H × 1.5 D in.)
RC02-TOS: 330 W × 70 H × 39 D mm (13 W × 2.8 H × 1.5 D in.)



RC01-TOS



RC02-TOS

Figure 8.1

8.2 Model HP01A-TOS/HP02A-TOS High Voltage Test Probe

The High Voltage Test Probe renders a three-fold operating safety, namely, the test voltage is not delivered unless you squeeze with one hand the slide lever of the grip of the probe and pull the trigger and you press with the other hand the switch on top of the probe, thereby occupying your both hands. As you release even a single one of these, the probe immediately and forcefully delivers the STOP signal to cut off the test voltage.

Voltage ratings: 4kV (rms) AC, 50/60 Hz;
5kV DC
Length of cable: Approx. 1.8 m (HP01A-TOS)
Approx. 3.5 m (HP02A-TOS)

WARNING

- *The maximum voltage ratings of the probe is 4kV rms AC or 5kV DC. Never let it subjected to voltages higher than these limits.*
- *Do not connect the probe to or disconnect it from the DUT while letting it deliver the test voltage — if you do this, the DUT may be damaged. If you disconnect the probe from the DUT while letting it deliver the test voltage, the items of the tested circuit may remain charged up to the high test voltage. Before connecting the probe to the DUT, be sure that the test voltage is OFF (the LED on top of the probe is OFF); before disconnecting the probe from the DUT, be sure that the test voltage is OFF (the LED is OFF).*

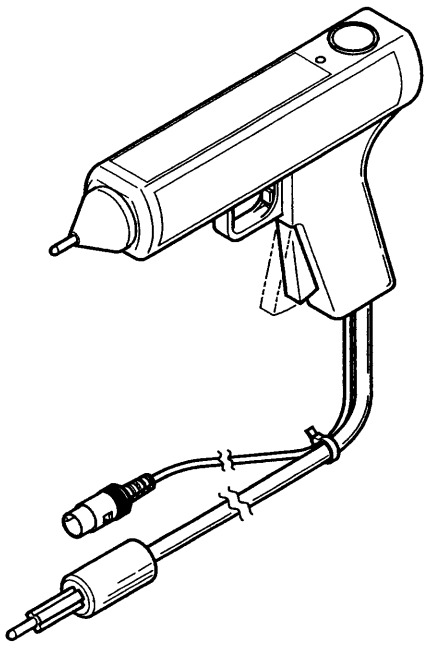


Figure 8.2 HP01A-TOS High Voltage Test Probe

8.3 Model BZ01-TOS Buzzer Unit

This unit may be used when the sound generated by the buzzer housed in the Tester is insufficient. This unit can be driven by the FAIL status signal of the Tester.

8.4 High Voltage Test Leadwires

Model	Voltage rating	Length	Remarks
TL01-TOS	AC: 5kV rms, 50/60 Hz DC: 5kV	Approx. 1.5 m	Accessories of TOS5030
TL02-TOS	AC: 5kV rms, 50/60 Hz DC: 5kV	Approx. 3.0 m	

8.5 Model TOS1200 Withstanding Voltage Tester Current Calibrator

This instrument is used to calibrate the leak current detection sensitivity of the Tester.

Caution

- *The present version of TOS1200 is accompanied by Model TL04-TOS High Voltage Test Leadwires. The elder version of TOS1200 was accompanied by Model HTL-1.5R High Voltage Test Leadwires — which you must not use to connect the TOS1200 to the TOS5000 Series. Be sure to use the TL04-TOS leadwires.*

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WITHSTANDING VOLTAGE TESTER TOS5030 OPERATION MANUAL