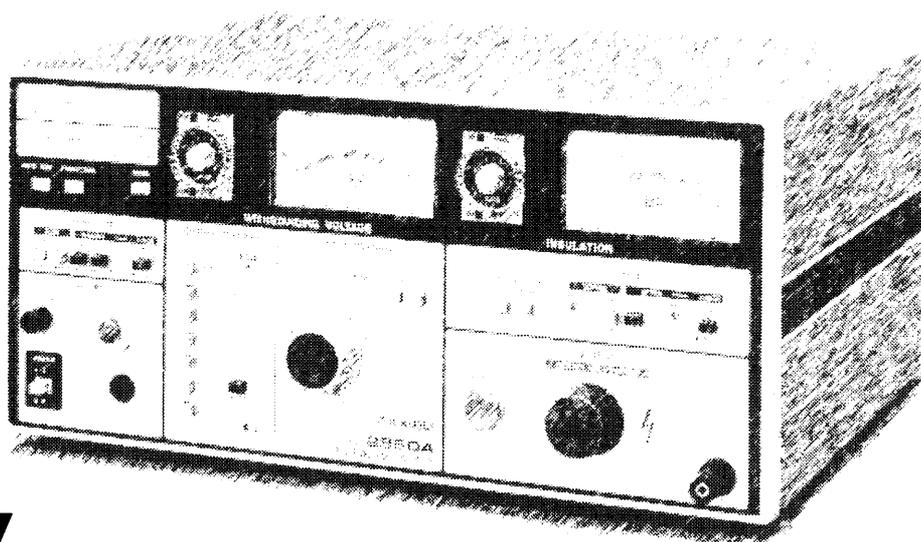


W / I AUTO TESTER

TOS8850A

OPERATION MANUAL



DANGER



HIGH VOLTAGE

- This Tester generates high voltage.
- Any incorrect handling may cause death.
- Read "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.

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 it gets lost or soiled, a new Operation Manual can be purchased. In either case, please contact your Kikusui agent, and provide the "Part No." given on cover.
- This manual has been prepared with the utmost care; however, if you have any questions, or note any errors or omissions, please contact your Kikusui agent.

Reproduction and reprinting of this operation manual, whole or partially, without our permission is prohibited. Both unit specifications and manual contents are subject to change without notice.

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 (How to avoid electrification)

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 lead-wire 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. (in case of insulation resistance test)

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.
- the same action as above immediately after the power of tester has been turned off. (in case of insulation resistance test)

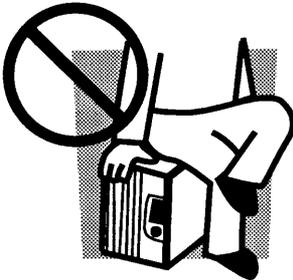
Safety Precautions

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. Kikusui assumes no liability against any damages or problems resulting from negligence of the precautions.



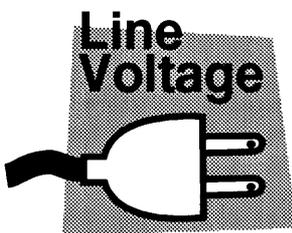
Users

- 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.)



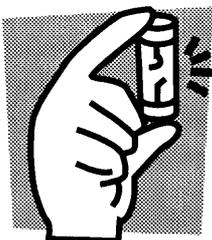
Purposes of use

- If the product is to be used for purposes not described in this manual, contact your Kikusui agent in advance.



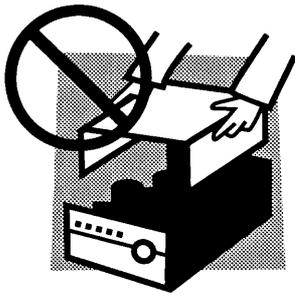
Input power

- Use the product with the specified input power voltage.
- For applying power, use the AC power cable provided. The shape of the plug differs according to the power voltage and areas. Use the cable which is suitable for the line voltage used.



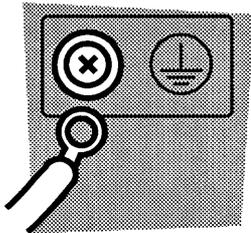
Fuse

- 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. If the cover must be removed, contact your Kikusui agent in advance.



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).



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.



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



Maintenance and checking

- To avoid electrical shock, be absolutely sure to unplug the AC power cable or stop applying power before performing maintenance or checking.
- Do not remove the cover when performing maintenance or checking. If the cover must be removed, contact your Kikusui agent in advance.
- To maintain performance and safe operation of the product, it is recommended that periodic maintenance, checking, cleaning, and calibration be performed.

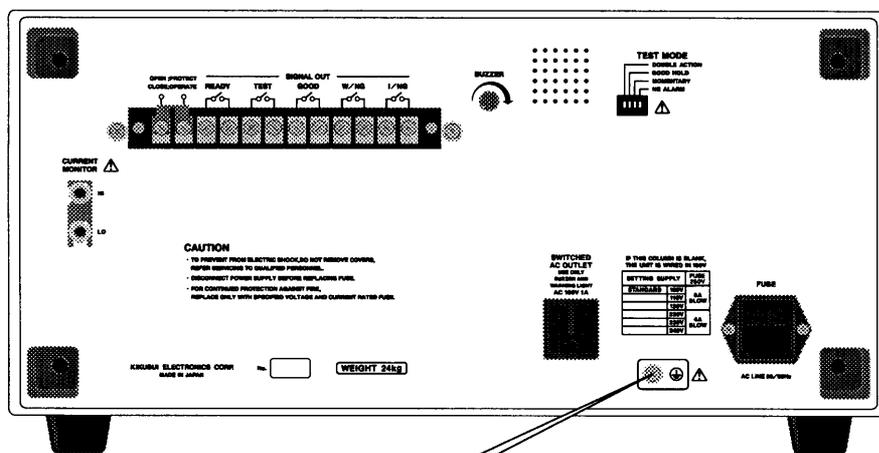
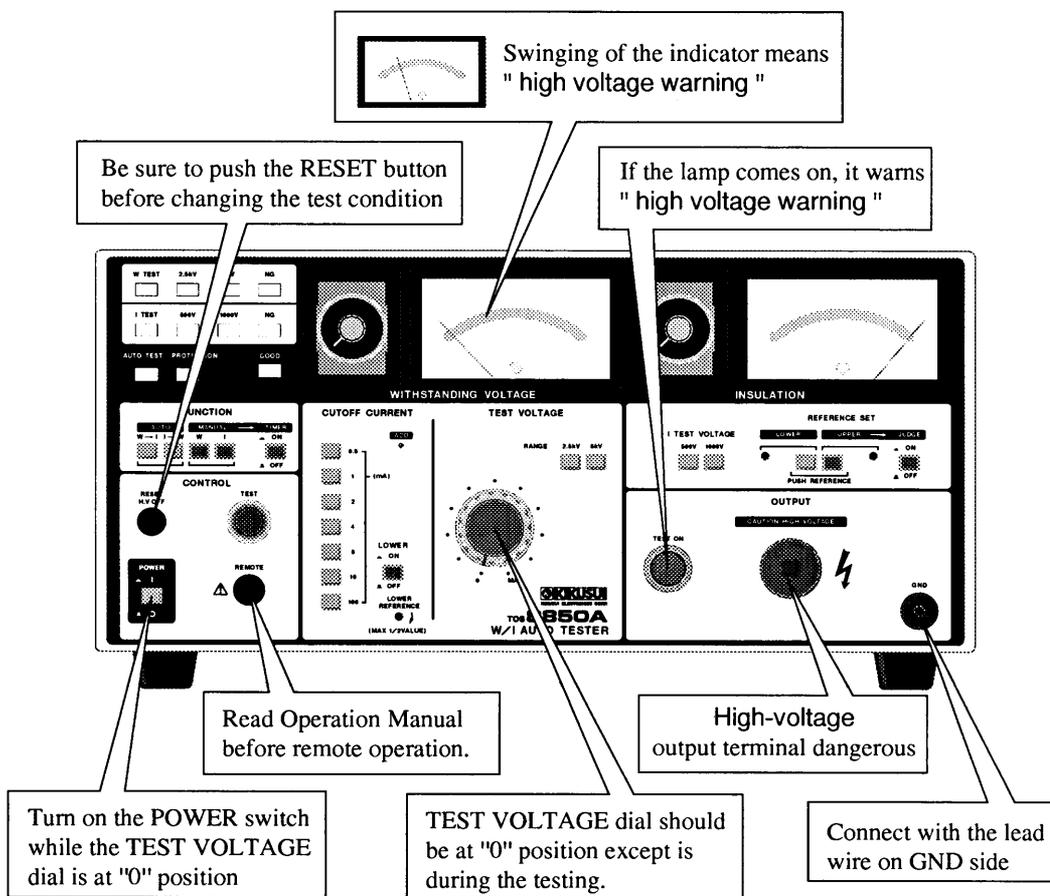


Service

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

Front panel and Rear panel

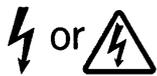
- Be sure to read Chapter 2 " WARNINGS AND CAUTIONS FOR OPERATING THE TESTER."



The rear panel of the tester casing and the protective grounding terminal shall be connected to the earth, using the applicable tool

Safety Symbols

This operation manual and this product use the following safety symbols. Note the meaning of each of the symbols to ensure safe use of the product. (As using symbols depend on the product, all of symbols may not be used.)



Indicates the presence of 1000V or higher.
Never attempt to touch this part when the power switch of the product is turned on.

WARNING

Indicates the possibility of personal injury or death. Never fail to follow the operating procedure.
Do not proceed beyond a WARNING sign until the noted conditions are fully understood and met.

CAUTION

Indicates the existence of damage to the product or connected equipment. Always follow the operating procedure.
Do not proceed beyond a CAUTION sign until the indicted conditions are fully understood and met.

NOTE

Indicates additional information such as operating procedure.

Description

Describes technical terms used in this manual.



Indicates action prohibited.



Indicates general warning, caution, risk of danger.
When this mark is indicated on the product, refer the relevant section of the Operation Manual.



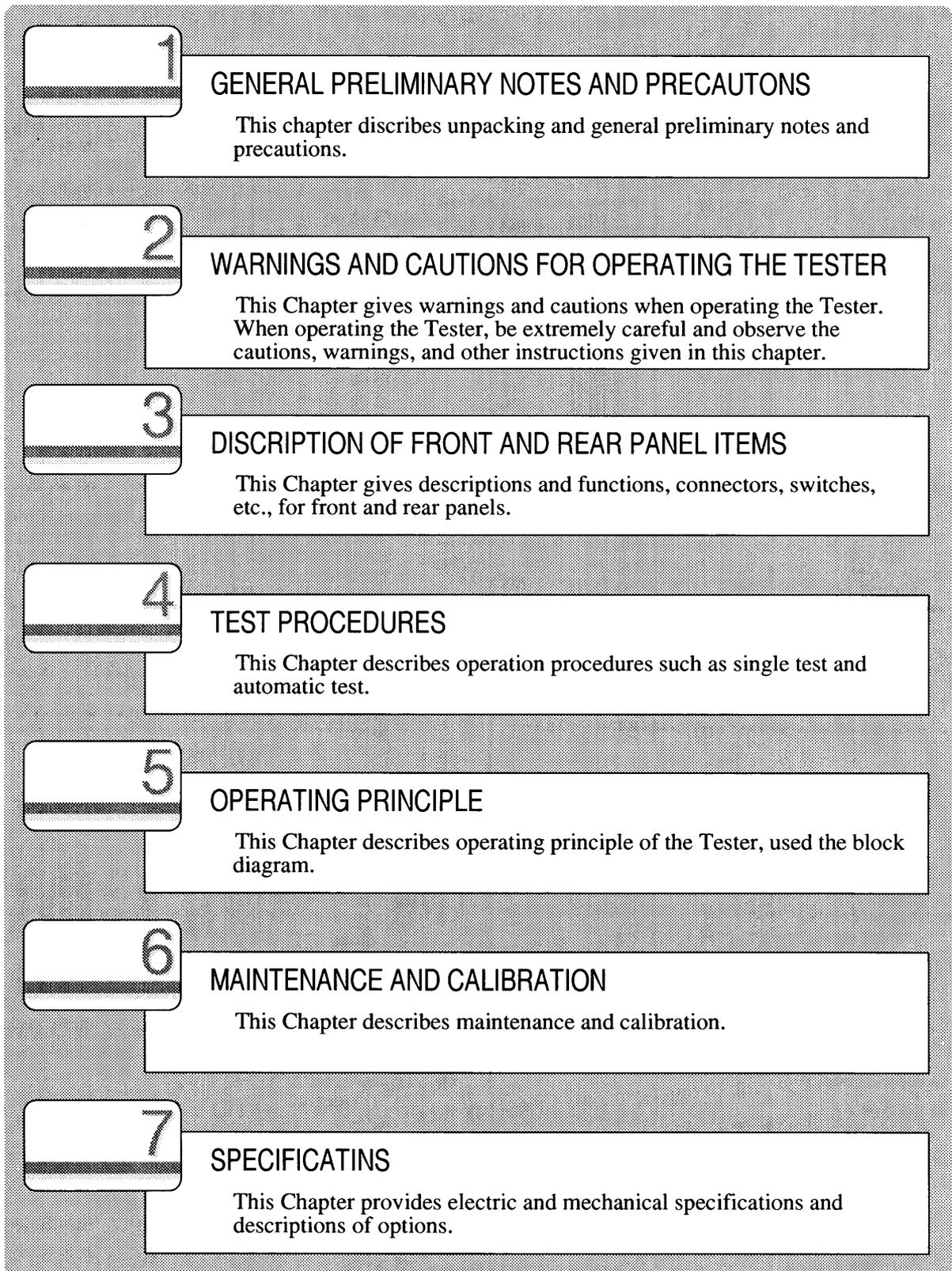
Indicates a grounding (earth) terminal.



Indicates a chassis grounding terminal.

Composition of The Manual

This manual is composed of the following chapters.



CONTENTS

△ Safety Precautions	ii
Safety Symbols	vi
Composition of The Manual	vii
Introduction	xii
General	xii
Chapter 1 GENERAL PRELIMINARY NOTES AND PRECAUTIONS _____	1-1
1.1 Checking for Shipping Damages and Accessories	1-2
1.2 Precautions for Installation	1-3
1.3 Checking the AC power fuse	1-5
1.4 AC Line Requirements	1-6
Chapter 2 WARNINGS AND CAUTIONS FOR OPERATING THE TESTER _____	2-1
2.1 Preparative Procedures	2-2
2.1.1 Wearing Insulation Gloves	2-2
2.1.2 Grounding the Tester	2-2
2.2 Warnings and Cautions when Operating the Tester	2-3
2.2.1 Connecting of test lead-wire on GND side	2-3
2.2.2 Connection of test lead-wire on high-voltage output side	2-3
2.2.3 Power switch	2-4
2.2.4 Change of test condition	2-4
2.2.5 Suspension of testing	2-4
2.2.6 Critical areas of the Tester under operation	2-5
2.3 Warning after the output has been cut off	2-5
2.3.1 Confirmation on completion of testing	2-5
2.3.2 Cautions in electric charging in insulation resistance test	2-6
1) Electric charging	2-6
2) Confirmation on discharge	2-6
2.4 Remote controls of the Tester	2-7
2.5 Inhibitions	2-7
2.5.1 Inhibition of rapid ON/OFF repetitions	2-7
2.5.2 Inhibition of shorting to earth ground	2-7
2.6 Emergency handling	2-8

2.7 Troubleshooting	2-8
2.7.1 In case of trouble	2-8
2.7.2 Fade out of TEST ON lamp	2-8
2.8 Attention for Trouble-Free Operation	2-9
Chapter 3 DESCRIPTION OF FRONT AND REAR PANEL ITEMS	3-1
3.1 Description of Front Panel Items	3-2
3.2 Description of Rear Panel Items	3-6
Chapter 4 OPERATION PROCEDURE	4-1
4.1 Procedure Before Test	4-2
1) Check that the indicator	4-2
2) Confirmation of attention on the handling	4-2
3) Reset the Tester	4-2
4.2 Single Withstanding Voltage Test	4-3
1) Selecting the withstanding voltage test mode	4-3
2) Selecting a test voltage range	4-3
3) Setting the high limit reference value of leakage current	4-3
4) Setting the test time	4-3
5) Setting the test voltage	4-3
6) Connecting the device under test	4-3
7) Test procedure	4-4
8) Single test without using the timer	4-4
9) Reapplication of test voltage (retest)	4-4
10) Setting the GO-NOGO judgement reference values for withstanding voltage test	4-5
11) Setting the LOWER REFERENCE value	4-5
4.3 Single Insulation Resistance Test	4-7
1) Selecting the insulation resistance test mode	4-7
2) Check the Zero-ohm	4-7
3) Selecting a test voltage	4-7
4) Setting the GO-NOGO judgement reference values for Insulation resistance test	4-7
5) Setting the test time	4-8
6) Connecting the device under test	4-8
7) Test procedure	4-8
8) Test without using the timer	4-9
9) Reapplication of test voltage (retest)	4-9
10) Checking discharge from DUT	4-9
Waiting-time for Judgement in Insulation Resistance Test	4-9

4.4 Automatic Test	4-10
1) Selecting a test sequence	4-10
2) Setting the test conditions	4-10
3) Connecting the device under test	4-10
4) Test procedure	4-10
5) To abort the test	4-10
6) Reapplication of test voltage (retest)	4-11
7) Checking discharge from DUT	4-11
4.5 Remote Control	4-12
1) Remote-control with the option	4-12
2) Remote-control by the other control system	4-12
■ REMOTE control connector	4-13
■ PROTECT/OPERATE input terminal	4-15
4.6 Output Signals	4-16
■ Contact signals	4-17
■ Use examples of contact signal	4-18
■ Precaution on using the contact signal	4-19
4.7 4.7 Special Test Modes	4-20
■ DOUBLE ACTION	4-20
■ GOOD HOLD	4-21
■ MOMENTARY	4-21
■ NG ALARM	4-22
4.8 Timer	4-23
Chapter 5 OPERATING PRINCIPLE	5-1
5.1 Block Diagram	5-2
5.2 Description of Individual Circuits	5-3
5.3 Zero-Start Switch	5-5
Chapter 6 MAINTENANCE AND CALIBRATION	6-1
6.1 Cleaning the Outer Surfaces	6-2
6.2 Inspection	6-2
6.3 Maintenance	6-3
6.4 Calibration	6-3

- 7.1 Withstanding Voltage Tester 7-2
 - Test Voltage Waveform 7-3
- 7.2 Insulation Resistance Tester 7-4
- 7.3 Common Specifications 7-5
- 7.4 Options 7-8
 - 1) Model RC01-TOS/RC02-TOS Remote Control Box 7-8
 - 2) Model HP01A-TOS/HP02A-TOS High Voltage Test Probe 7-10
 - 3) Model PL01-TOS Warning Light Unit 7-11
 - 4) Model BZ01-TOS Buzzer Unit 7-11
 - 5) High Voltage Test Leadwires 7-11

Introduction

General

Model TOS8850A W/I Auto Tester is a combination of an withstanding voltage tester and an insulation resistance tester, and it is capable of performing withstanding voltage test and insulation resistance test in one continuous process.

As for the withstanding voltage tester, the Tester can provide a maximum output voltage of 5kV and an output capacity of 500 VA, and can be used for withstanding voltage test in compliance with JIS, UL, CSA, BS and other major electrical standards and ordinances.

As for the insulation resistance tester, the Tester has two ranges of 500V/1000M Ω and 1000V/2000M Ω . The Tester can perform a GO-NOGO judgement function when in either the withstanding voltage or insulation resistance test mode.

A GO-NOGO judgement is with a window comparator type. When in withstanding voltage test, the Tester is capable of generating an NG judgement not only when the detected leakage current is greater than the high limit reference value preset on the front panel of the Tester but also when it is less than the low limit reference value (which is continuously adjustable down to one-half of the high limit reference value), thereby contributing to make GO-NOGO judgement including test of open circuiting of leadwires and imperfect contacting of connections.

The Tester is incorporated with a function to deliver signals representing the result of GO-NOGO judgement and the state of the Tester, and a remote control function. The signals namely are TEST ON, GOOD, READY, and NG alarm (contact signals).

The Tester is incorporated also with a remote control function for test set/reset. These features can be utilized for automatic test with labor economization.

Its sequence circuit is designed with full attention to noise to prevent erroneous operation which could be caused by noise.

WARNING

- Although many safety features are incorporated in the Tester, a deadly accident may occur when the operator touches the device under test (DUT) or the probe.

Safety guards around DUT should be considered for safe operation.

Also, other precaution, which deemed necessary for the tester and the devices, shall be maintained under positive control.

1

Chapter 1

GENERAL PRELIMINARY NOTES AND PRECAUTIONS

This chapter describes unpacking and general preliminary notes and precautions.

- 1.1 Checking for Shipping Damages and Accessories
- 1.2 Precautions for Installation
- 1.3 Checking the AC power fuse
- 1.4 AC Line Requirements

1.1 Checking for Shipping Damages and Accessories

■ Unpacking

The Tester should be checking upon receipt for damage that might have occurred during transportation. Also check that all accessories have been provided. Should the Tester be damaged or accessory missing, notify your Kikusui agent.

ACCESSORIES				
	Item	Q'ty	Remarks	Check
1	Power cable	1		
2	TL01-TOS High Voltage Test Leadwires	1	Approx.. 1.5m	
3	5P DIN Plug	1	Assembly type	
4	AC Power fuse	2	One in present use and the other as spare (in the fuse holder cap)	
5	" HIGH VOLTAGE DANGER " label	1		
6	Operation Manual	1		

■ Packing

CAUTION

- When transporting the Tester, be sure to use the original packing materials. If they are missing, contact your Kikusui agent.
- When packing the Tester, remove the power cable and all other connection cables.

1.2 Precautions for Installation

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

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

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

■ **Avoid locations where the unit is exposed to high temperature or direct sunshine.**

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

Specification temperature range: 5 to 35°C

Operation temperature range: 0 to 40°C

Storage temperature range: -20 to 70°C

■ **Avoid locations of high humidity.**

Do not locate the unit in high-humidity locations, i.e., near a boiler, humidifier, water supply, etc.

Specification humidity range: 20 to 80% RH

Operation humidity range: 20 to 80% RH

Storage humidity range: 80% RH or less

Dew condensation may take place even in the operation humidity range. In such a case, do not use the unit until the dew dries up completely.

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

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

■ **Do not locate the unit in a dusty location.**

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

Leave sufficient space around the unit to allow air to flow through.

■ **Do not install the unit along a tilted section of floor or in a location subject to vibrations.**

-
- Do not use the unit in locations affected by strong magnetic and/or electric fields.

- Do not use the unit in locations near high sensitivity devices.

Do not operate the Tester near highly sensitive measuring instruments such as communication receivers lest the noise generated by the Tester should interfere with such devices.

Above 3kV test voltage the Tester may produce corona discharge between its test leadwire clips which will generate a significant amount of broadband RF emission. To minimize this effect, support the alligator clips and leadwires away from each other and from conducting surfaces, especially from sharp metal edges.

1.3 Checking the AC power fuse

WARNING

- To avoid electric shock, always disconnect the AC power cable when checking or replacing the fuse.
- Select a fuse element of external design, rating and characteristics suitable for the unit. Never attempt to run the unit by shorting the fuse circuit with a wire.

- ① Make sure the POWER switch is turned off (0) and unplug power cable.
- ② Remove fuse holder as shown in Figure 1-2.

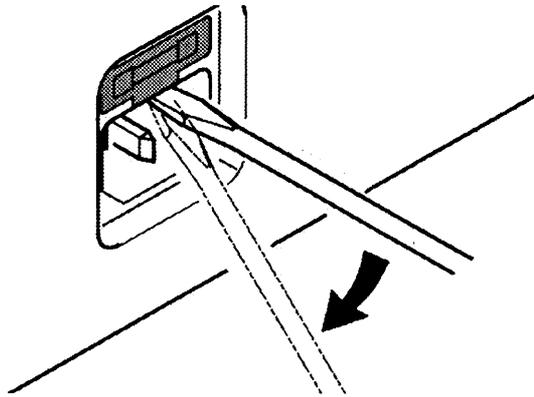


Fig. 1-2 Removing fuse holder

- ③ Check rating and blowing characteristics of mounted fuse. If fuse is blown, or has incorrect ratings, replace it.

Fuse

Nominal AC line voltage	Fuse ratings
100V	250V 8A SLOW
110V	
120V	
220V	250V 4A SLOW
230V	
240V	

1.4 AC Line Requirements

The AC line requirements of the Tester are as follows:

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

The standard nominal AC line voltage of the Tester is 100V. The Tester normally operates on an AC line voltage within ± 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 voltage	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 for the standard nominal voltage (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	8A SLOW
	110V	
	120V	
	220V	4A 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

Chapter 2

WARNINGS AND CAUTIONS FOR OPERATING THE TESTER

This Chapter gives warnings and cautions when operating the Tester. When operating the Tester, be extremely careful and observe the cautions, warnings, and other instructions given in this chapter.

- 2.1 Preparative Procedures
- 2.2 Warnings and Cautions when Operating the Tester
- 2.3 Warnings for Matters After Turning-OFF High Voltages
- 2.4 Warnings for Remote Control
- 2.5 Inhibitions
- 2.6 In Case of Emergency
- 2.7 Dangerous States of Failed Tester
- 2.8 Wattage, Heat and Other Limiting Conditions of Use

WARNING

- The Tester delivers a 5kV test voltage 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.

2.1 Preparative Procedures

2.1.1 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.

2.1.2 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.

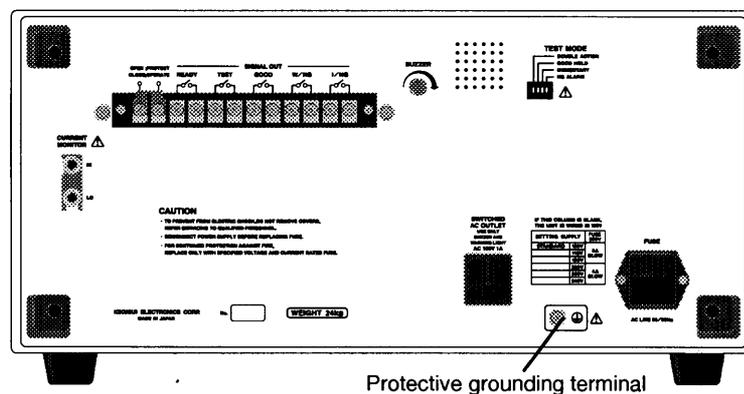


Fig. 2-1 Grounding the Tester

Description

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

2.2 Warnings and Cautions when Operating the Tester

2.2.1 Connecting of test lead-wire on GND side

Figure 2-2 shows the connection of the test lead-wire on GND side. Every time the Tester is used, check if the lead wire is not damaged or disconnected.

The lead-wire connection to the DUT shall be made from GND side. If the connection is in complete, it is hazardous that the entire DUT may be changed with high voltage.

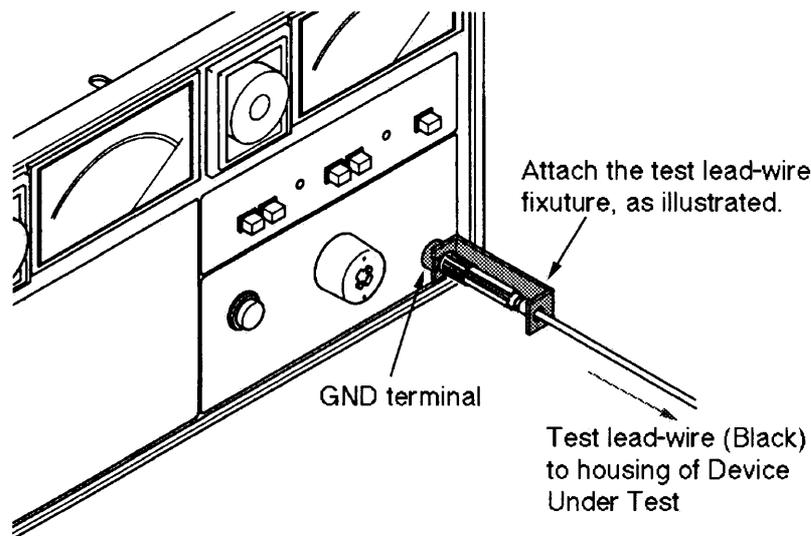


Fig. 2-2 Connecting of test lead-wire on GND side

2.2.2 Connection of test lead-wire on high-voltage output side

After connecting the lead-wire on GND side, take the following procedure.

- ① Push the RESET button.
- ② Confirm if the indicator of the output voltmeter is at "0".
- ③ Confirm if the TEST ON lamp has been off.
- ④ Connect the high-voltage test lead-wire with the high-voltage output terminal.
- ⑤ Short the high-voltage test lead-wire with the GND test lead-wire once, and confirm that no high voltage is output.
- ⑥ Lastly, connect the GND test lead-wire and then the high-voltage output test lead-wire to the DUT.

2.2.3 Power switch

The power switch shall be turned on after confirming that the TEST VOLTAGE dial has been turned to the extreme left ("0" position).

2.2.4 Change of test condition

Change-over of the switches on the panel shall be made after confirming that the RESET button has been pushed in and that the TEST VOLTAGE dial has been turned to the extreme left ("0" position).

2.2.5 Suspension of testing

Except under testing, the TEST VOLTAGE dial shall be turned to the extreme left ("0" position). Also, push the RESET button (H.V OFF) to ensure safety.

The Power switch shall be turned off (0) if the tester is not used for some time or the operator is to leave from the tester.

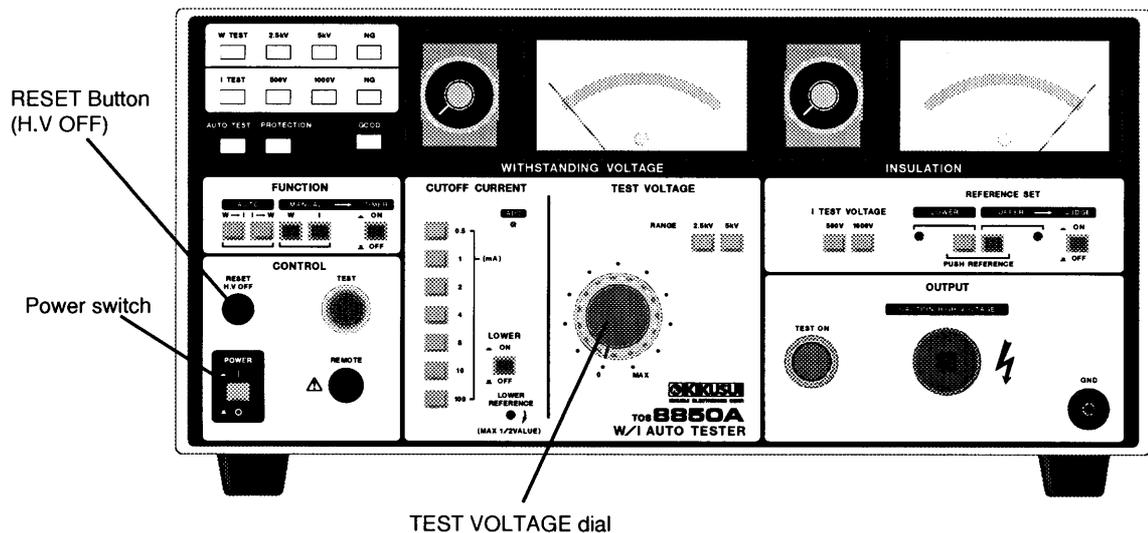
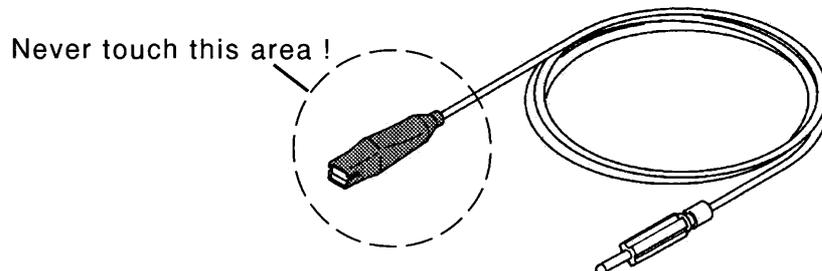


Fig. 2-3

2.2.6 Critical areas of the Tester under operation

It is dangerous to touch such high voltage areas as the DUT, and the test lead-wire, probe and output terminal while the tester is under operation.



WARNING

- NEVER touch the alligator clip of the test lead-wire and the vinyl-cover of the clip because they are NOT insulation proof.

2.3 Warning after the output has been cut off

2.3.1 Confirmation on completion of testing

You may touch the DUT and the high-voltage areas (test lead-wire, probe or output terminal) for correction of the wiring or any other purpose provided that the following confirmation has been made;

- the indication of output voltage is at "0", and
- the TEST ON lamp has been turned off.

In the case of insulation resistance test, DUT is charged after testing.

Be sure to read next Section "2.3.2 Cautions in electric charging in insulation resistance test".

2.3.2 Cautions in electric charging in insulation resistance test

1) Electric charging

WARNING

- Do not touch charged high-voltage areas such as the DUT, test lead-wire, probe and output terminal, etc. to prevent electric shock for a while after the power has been turned off.

In case of insulation resistances test, the DUT, internal capacitor of the Tester, test lead-wire, probe and output terminal, etc. are charged with high voltage.

And it takes some time to discharge after the power has been cut off.

2) Confirmation on discharge

The time required to discharge electric charge depends on the characteristic of the DUT and the test voltage.

Suppose that the high-voltage areas such as the DUT and the test lead-wire are an equivalent circuit and that it can be expressed as a capacity of $0.01 \mu\text{F}$ and a parallel resistance of $100\text{M}\Omega$, then the time required to attenuate the voltage of the DUT down to 30V will be about 3.5 seconds. at the test voltage of 1000V, and about 2.8 seconds at 500V.

If the time constant of the DUT is known, the attenuation time down to 30V, after the power has been cut off, of the DUT can be determined by multiplying the attenuation time given above with such a time constant.

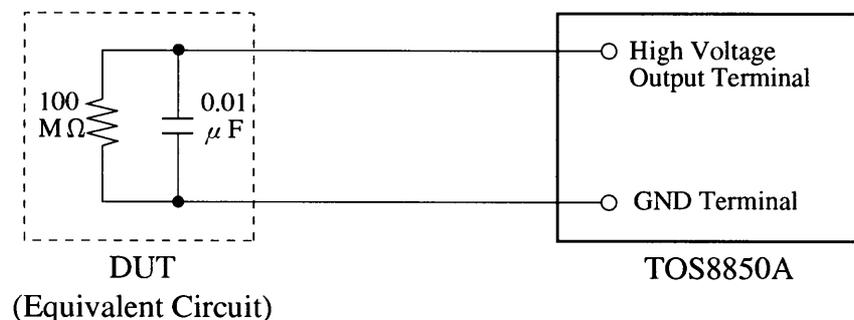


Fig. 2-4 Example of discharge of equivalent circuit

2.4 Remote controls of the Tester

In the case of the Tester is to be remote controlled, the application of high voltage to the Tester will be controlled by an external signal.

Take the following safety precautions to prevent accident. Also, shall be maintained the safety precaution under positive control.

- NOT to permit unexpected output of high voltage from the Tester (that is, to prevent the Tester from being put in TEST ON condition).
- NOT to permit operator and any other come into contact with DUT test lead-wire, probe, output terminal, etc. while the Tester is generating high test voltage.

2.5 Inhibitions

2.5.1 Inhibition of rapid ON/OFF repetitions

Once the Power switch of the Tester has been turned off, leave at least several seconds before it is turned on again. Do not repeat ON-OFF switching of the Power switch particularly when the Tester is generating the output voltage. In such a case, the safety protection of the Tester may not work properly, and the operator is endangered.

The power switch shall not be turned off while the Tester is generating the output voltage except in the case of emergency.

2.5.2 Inhibition of shorting to earth ground

Do not short-circuit the Tester output with the ground or a conveyer or any device connected to the ground, or with the commercial power-line around tester location. Such a short-circuit may cause high-voltage charging on the Tester casing, which is very dangerous.

However, such a risky condition will not arise if only the casing has been grounded, in which case the casing will not be electrically charged nor will cause the damage on the Tester even when the GND terminal has been short-circuited with the high-voltage terminal.

The protective grounding terminal shall be positively grounded using applicable tool.

2.6 Emergency handling

In the case of any accident such as an electric shock or burn-down of the DUT resulting from the failure of the Tester or DUT, take the following actions promptly. It does not make any difference whichever action of the above two is taken first, but be sure to take the two actions.

- Turn off (O) the POWER switch.
- Pull out the plug of AC power cable from the socket of the power source.

2.7 Troubleshooting

2.7.1 In case of trouble

In the following cases of trouble, it is very hazardous that the power of the Tester may not be cut off while the Tester continues to generate high voltage:

- TEST ON lamp keeps on lighting even when the RESET button has been pushed.
- TEST ON lamp is turned off but the indicator of the output voltmeter continues swinging.

The immediate action to take, in the above cases, is to pull out the plug of AC power cable from the socket of the power source, and suspend the operation of the Tester.

If the tester shows any irregular performance, it is possible that a high voltage may be output irrespective of the operator's will.

Suspend the operation of the tester immediately.

WARNING

- Never attempt to repair the Tester for yourself. Please order your Kikusui agent for such service.

2.7.2 Fade out of TEST ON lamp

In the case the TEST ON lamp has been faded out, it may cause erroneous operation of the Tester, which in turn give rise to dangerous electrification.

Please entrust us with the repair of such a defective tester.

2.8 Attention for Trouble-Free Operation

1. The maximum output voltage of the Tester reaches higher than 5kV under no-load condition, and even higher voltage in proportion to the line voltage fluctuation. But be sure to operate the Tester at a lower voltage than the specified 5kV.

2. The heat dissipation capacity of the high-voltage transformer, embodied in the Tester, is designed to be a half of the rated output, taking into consideration of the size, weight and cost.

Accordingly, if the test is to be conducted at the CUTOFF CURRENT of 100 mA, leave a suspension time longer than the test duration.

Incidentally, the maximum allowable test duration is 30 minutes at ambient temperature of 40°C (104°F) or lower.

The above timing is not applicable if the Tester is used at the CUTOFF CURRENT setting of 25.5mA or lower.

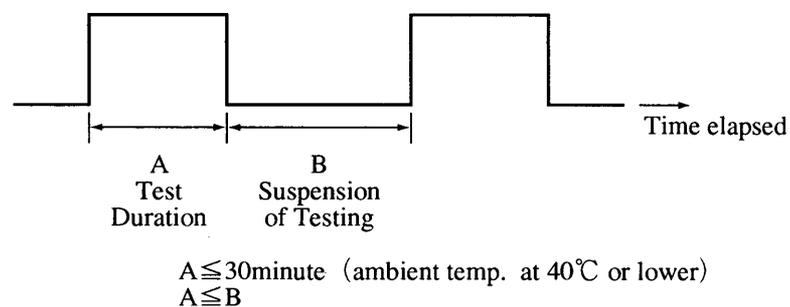


Fig. 2-5 Test Duration and Suspension of Testing

3. The Tester can be properly used with the input voltage range of nominal input voltage $\pm 10\%$, but its operation becomes incomplete outside of this range and leads to possible failures.

It is thus important to adjust the voltage within the range of nominal input voltage $\pm 10\%$ by any proper means.

4. The operation and storage of the Tester under exposure to the direct sunshine, high temperature and humidity or dusty environment should be avoided.

5. The Tester is incorporated with a transformer of high output voltage up to 500VA.

A considerably large current (in scores of amperes) may flow through the commercial power line, which is connected with the Tester in the following two cases:

- In the duration of scores of milli-second, in which the Tester detects that a DUT has failed the testing.
- At an instant when the test is executed.

Also it is important to determine the capacities of the power line and of any electronic device connected to the same line, taking into consideration of such a large current.

3

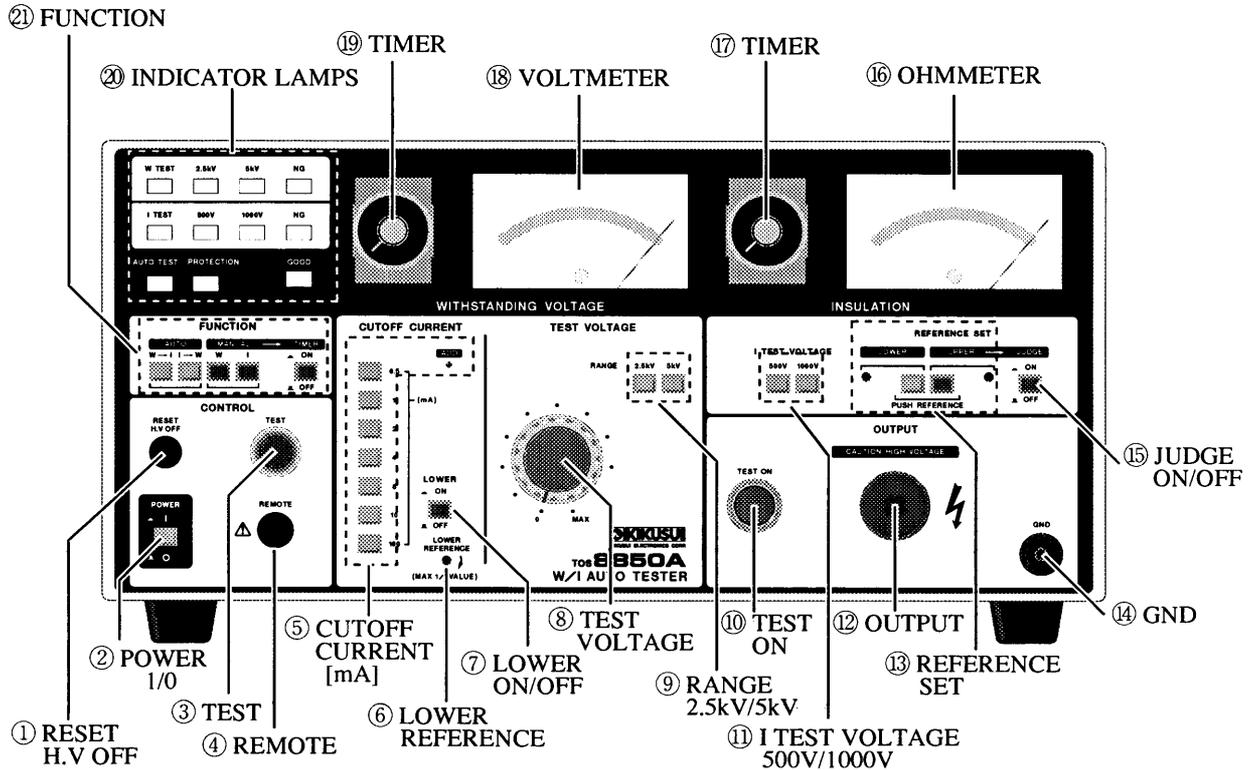
Chapter 3

DESCRIPTION OF FRONT AND REAR PANEL ITEMS

This Chapter gives descriptions and functions, connectors, switches, etc., for front and rear panels.

- 3.1 Description of Front Panel Items
- 3.2 Description of Rear Panel Items

3.1 Description of Front Panel Items



① RESET H.V OFF

Push this button in case of following three.

- To cutoff the H.V output when in test operation.
- Reset from the NG alarm state.
- Reset from the PROTECTION state.

② POWER I/O

Main power switch of Tester. Before turning on the switch, be sure to read Chapter 2 "WARNINGS AND CAUTIONS FOR OPERATING THE TESTER." The state which this button was put is on (1).

③ TEST

As you press the button when the Tester is in the RESET state, the TEST ON lamp illuminates and the test as selected by the FUNCTION selector switch is performed.

④ REMOTE ⚠

When the TEST/RESET operation of the Tester is remote controlled, the connector is used to connect the control signal of the Remote Control Box (RC01-TOS or RC02-TOS) or other devices. Be sure to read Chapter 4 "4.5 Remote Control" (page 4-12) before remote-controlling the Tester.

⑤ CUTOFF CURRENT (mA)

The switches select a high limit reference value (UPPER REFERENCE value) of leakage current for withstanding voltage test. The switch values are 0.5, 1, 2, 4, 8, 10 and 100 mA. By pressing one or more of these switches, values are selectable for a range of 0.5 - 25.5 mA in 0.5mA steps. When two or more switches are pressed, the ADD lamp illuminates to indicate that the set current is the sum of those selected by two or more switches. At the instant the leakage current of the device under test has exceeded the set high limit reference value, an NG judgement is made and the output is cutoff and an NG alarm is generated. Set the high limit reference value as you may require for the device under test.

⑥ LOWER REFERENCE

The potentiometer is used to set the low limit reference value for withstanding voltage test (LOWER REFERENCE value). The adjustable range is from zero to one-half of the high limit reference value set by the CUTOFF CURRENT switches. The fully clockwise position of the potentiometer is for one-half of the high limit reference value.

⑦ LOWER ON/OFF

The Tester is able to make an NG judgement also when the leakage current is less than the low limit reference value (LOWER REFERENCE value), as well as when the leakage current is more than the high limit reference value. The LOWER ON/OFF switch enables or disables this function.

⑧ TEST VOLTAGE

The dial controls the output voltage for withstanding voltage test. The output voltage increases as you turn this dial clockwise.

Be sure to set the dial at the fully counterclockwise position (zero position) whenever no test is being done.

⑨ RANGE 2.5kV/5kV

The switches select either the 2.5 kV or 5 kV range for withstanding voltage test. The switches are linked to the output voltmeter to change its ranges.

⑩ TEST ON

The lamp (red) indicates that the test voltage is ready to be delivered to the output terminal or that it is being delivered.

⑪ I TEST VOLTAGE 500V/1000V

The switches select a test voltage for insulation resistance test.

⑫ OUTPUT

The hot line of the test voltage.

⑬ REFERENCE SET

The switches are for setting a GO-NOGO judgement reference value for insulation resistance test. When neither the UPPER switch nor the LOWER switch is pressed, the ohmmeter indicates the value of measuring resistance. When the LOWER switch is pressed, the ohmmeter indicates the low limit reference value for GO-NOGO judgment; when UPPER switch is pressed, the ohmmeter indicates the high limit reference value. When both switches are pressed, the LOWER switch has a priority. The limit reference values are adjustable with the potentiometers located at right and left of the switches.

- ⑭ GND The ground line of the test voltage. Electrically, the line is connected to the Tester chassis.
- ⑮ JUDGE ON/OFF The switch selects whether the high-limit GO-NOGO judgment in the insulation resistance test is to be done or not.
- ⑯ OHMMETER Indicates the resistance measured in insulation resistance test. The adjustor in the centre of the meter is used to adjust mechanical "0".
- ⑰ TIMER Presets the insulation resistance test period. See Chapter 4 "4.8 Timer" (page 4-23).
- ⑱ VOLTMETER Indicates the output voltage for withstanding voltage test. Directly measures the voltage of the high voltage output terminal. The adjustor in the centre of the meter is used to adjust mechanical "0".
- ⑲ TIMER Presets the withstanding voltage test period. See Chapter 4 "4.8 Timer" (page 4-23).
- ⑳ INDICATOR LAMPS
- AUTO TEST Identifies between automatic test and single test. The lamp illuminates when in the automatic test mode. When in the single test mode, either the W TEST lamp or the I TEST lamp illuminates.
 - W TEST Illuminates when in the withstanding voltage test mode.
 - 2.5kV/5kV Indicate the output voltage range being used for withstanding voltage test.
 - I TEST Illuminates when in the insulation resistance test mode.
 - 500V/1000V Indicate the test voltage being used for insulation resistance test.
 - GOOD/NG Indicate the test result. If the result of GO-NOGO judgement is GOOD, the GOOD lamp illuminates; if it is NG, the NG lamp illuminates. The NG lamp illuminates continuously; the GOOD lamp illuminates only for about 50ms.
- However, at the GOOD HOLD of TEST MODE switch on the rear panel is OFF. For details, refer to Chapter 4 "4.7 Special Test Modes" (Page 4-20).

————— NOTE —————

- When no timer is used in the single test mode, the GOOD judgement is not done.

○ PROTECTION

When in any of the following cases, the protective circuit trips, the output is cutoff and the lamp illuminates. (When this has occurred, remove the cause of the trip and then press the RESET button to reset the Tester.)

- (1) When the RANGE 2.5kV/5kV switches of withstanding voltage tester are changed. When both switches are in the pushed-in state ( ) or pushed-out state ( ).
- (2) When the I TEST VOLTAGE 500V/1000V switches are changed. When both switches are in the pushed-in state ( ) or pushed-out state ( ).
- (3) When the FUNCTION switches are changed. When two or more switches are in the pushed-in state (   ) or all switches are in the pushed-out state (   ).
- (4) When the REMOTE CONTROL connector is disconnected and then connected. (However, the lamp does not light when a connector which meets the requirements of reset condition is connected without the NG ALARM of the SPECIAL TEST MODE switch ON state).
- (5) When the remote protection input terminals are made open.
- (6) When the POWER switch is turned on again immediately after turning it off.
- (7) When all of the CUTOFF CURRENT switches are set in the pushed-out state or set at 108 mA or more.
- (8) When both withstanding voltage tester and insulation resistance tester are operated at the same time due to a failure of the Tester.

WARNING

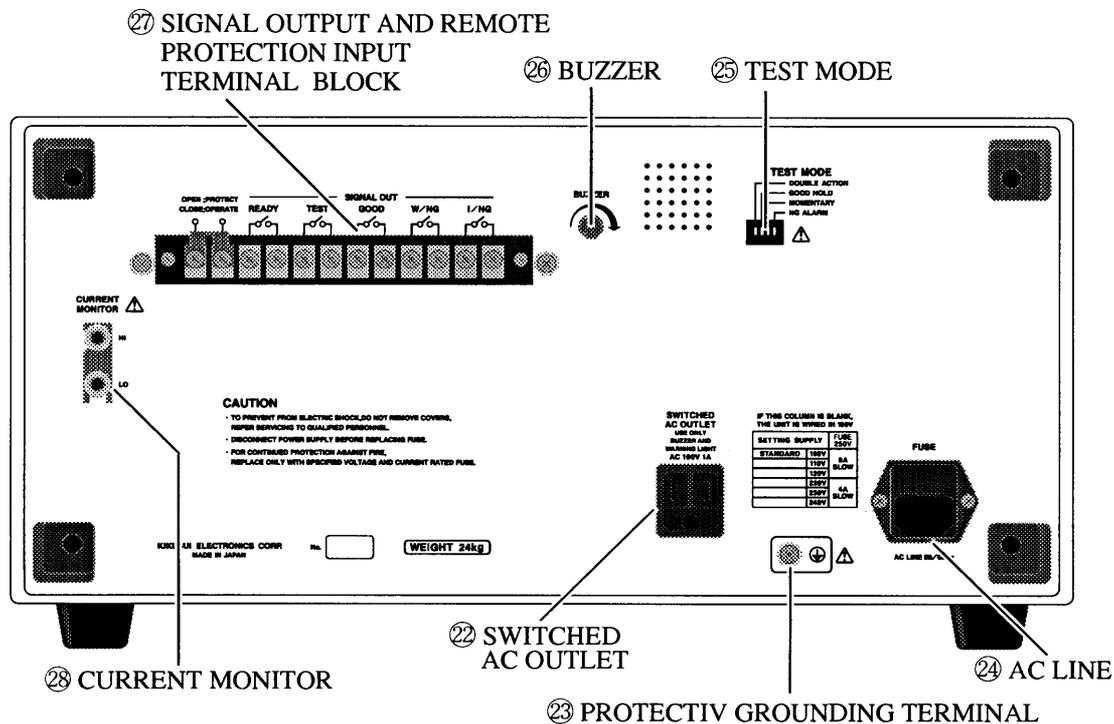
- If the lamp does not go off even when you have eliminated the cause of the trip to the PROTECTION state and have pressed the RESET button, the most probable cause is a failure of (8). Immediately stop using the Tester.

②① FUNCTION

When in the automatic test mode, the switches are used to set the order of withstanding voltage test and insulation resistance test. When in the single test mode, the switches are used to select either one of the two types of tests.

When in the automatic test mode, the test period is as preset by the timer. When in the single test mode, use or unuse of the timer is selectable by the TIMER ON/OFF switch located in the right hand side.

3.2 Description of Rear Panel Items



- ②② SWITCHED AC OUTLET Delivers a 100V AC power for PL01-TOS Warning Light Unit or BZ01-TOS Buzzer Unit (both units are optional). The power is ON/OFF-controlled being linked to the POWER switch on the front panel. The receptacle is dedicated to the above optional units. Do not use it for other purposes.

NOTE

- The receptacle delivers the 100 V AC power even when the AC line voltage of the Tester is modified.

②③ PROTECTIVE GND TERMINAL ⚠

To ground the Tester to an earth line.

WARNING

- Be sure to connect securely (by using a screwdriver) an earth ground line to the Protective grounding terminal. 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 Chapter 2 "2.1.2 Ground the Tester ." (Page 2-2)

②④ AC LINE

The AC line connector is for the AC input power. It is servers also as an input power fuse holder. Use the input power cable which accompanies the Tester.

Rating of a fuse refers to a table shown below.

Nominal AC line voltage	Fuse ratings		
100V	250V	8A	SLOW
110V			
120V			
220V	250V	4A	SLOW
230V			
240V			

WARNING

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

②⑤ TEST MODE ⚠

Select the DOUBLE ACTION, GOOD HOLD, MOMENTARY, or NG ALARM mode. Be sure to turn off the POWER switch before setting the selector switches. For details, refer to Chapter 4 "4.7 Special Test Modes" (page 4-20).

②⑥ BUZZER

Controls the loudness of buzzer of an NG or GOOD judgement.

②⑦ SIGNAL OUTPUT AND REMOTE PROTECTION INPUT TERMINAL BLOCK

SIGNAL OUT

For the READY, TEST ON, GOOD, W/NG, and I/NG output signals (contact signals). For details, refer to Chapter 4 "4.6 Output Signals" (page 4-16).

PROTECT/OPERATE

For REMOTE PROTECTION input signal. Normally the terminals are shorted with a shorting piece. When the terminals are made open, the TEST ON state is inhibited for protection.

②⑧ CURRENT MONITOR ⚠

The leakage current when in withstanding voltage test can be directly monitored by disconnecting the shorting bar from the terminals and connecting a milliammeter between them. The milli-ammeter should be capable of measuring the leakage current. Be sure to connect the shorting bar when the current is not monitored.

A current may flow also when in insulation resistance test and this is not an abnormal indication.

4

Chapter 4

OPERATION PROCEDURE

This Chapter describes operation procedures such as single test and automatic test.

- 4.1 Procedure Before Test
- 4.2 Single Withstanding Voltage Test
- 4.3 Single Insulation Resistance Test
- 4.4 Automatic Test
- 4.5 Remote Control
- 4.6 Output Signals
- 4.7 Special Test Modes
- 4.8 Timer

4.1 Procedure Before Test

1) Check that the indicator

CAUTION

- Check that the indicator after being off with power switch.

Before turning on the POWER switch, check that the voltmeter is indicating the "0" scale position and the ohmmeter is indicating the " ∞ " scale position. If the meters are not indicating these positions, adjust them to these positions with their mechanical zero at their centers.

2) Confirmation of attention on the handling

Before turning on the POWER switch, thoroughly read and note the items of Chapter 2 "WARNINGS AND CAUTIONS FOR OPERATING THE TESTER."

3) Reset the Tester

When the PROTECTION indicator lamp is illuminating, test is disabled and cannot be started by pressing the TEST button. The conditions for illuminating of the lamp are given on Chapter 3 "3.1 Description of Front Panel" (pages 3-4). Eliminate the conditions and then press the RESET button to reset the Tester.

DESCRIPTION

- When the POWER switch is turned on or off, the ohmmeter pointer may deflect irregularly. This is only transient and is not an abnormal indication.

4.2 Single Withstanding Voltage Test

1) Selecting the withstanding voltage test mode

- ① Select the MANUAL W test mode with the FUNCTION selector switches.
- ② The W TEST indicator lamp will illuminate. Letter "W" stand for withstanding voltage test.

2) Selecting a test voltage range

- ① Select the required test voltage range with the RANGE 2.5 kV/5 kV switches.
- ② The corresponding indicator lamp will illuminate.

3) Setting the high limit reference value of leakage current

- ① With the CUTOFF CURRENT switch, set the high limit reference value (upper reference value) of leakage current of the device under test as required of standards, and other.

4) Setting the test time

- ① With the timer, set the test time of the device under test as required of standards, and other. Refer to Section 4.8 "Timer" (Page 4-23).

5) Setting the test voltage

- ① Set both TIMER ON/OFF switch and LOWER ON/OFF switch to the OFF state.
- ② Check that the PROTECTION lamp is not illuminating.
- ③ Check that the TEST VOLTAGE dial is at fully counterclockwise position
- ④ Press the TEST button.
- ⑤ Adjust the test voltage by gradually turning clockwise the TEST VOLTAGE dial and reading the voltage on the voltmeter.
- ⑥ Cutoff the output by pressing the RESET button.
- ⑦ Set the TIMER ON/OFF switch to the ON state.
If the PROTECTION lamp is illuminating, press the RESET button once and then perform the above procedure.

6) Connecting the device under test

- ① Make sure that the output voltmeter indication is zero.
- ② Make sure that the TEST ON lamp is not illuminating.
- ③ Connect the GND test leadwire to the GND terminal of the Tester.
- ④ Connect the high voltage test leadwire (hot line) to the output terminal.
- ⑤ Short the high voltage test leadwire (hot line) to the GND test leadwire to make sure that no high voltage is being delivered to the output terminal.
- ⑥ Connect the GND leadwire to the device under test.
- ⑦ Connect the high voltage test leadwire (hot line) to the device under test.

7) Test procedure

- ① To start test, press the TEST button.
- ② When the period set by the timer has elapsed, the test voltage is cutoff and GOOD judgement is made and the GOOD signal is generated in the forms of lamp and buzzer and make-contact signal for about 50ms.
- ③ When a leakage current larger than the high limit reference value set by the CUTOFF CURRENT switches has flowed, the NG judgement is made and the output is instantaneously cutoff and the NG alarm with the lamp, buzzer and make-contact are generated. Different from the case of the GOOD signal, the NG alarm continue until the Tester is reset or the PROTECTION condition is effected. To reset from the NG state, press the RESET button.
- ④ To abort the test being executed (to cutoff the output) for any reason, press the RESET button.

8) Single test without using the timer

The timer of the Tester is for 10 minutes maximum. When a test time longer than this is needed, perform the test without using the timer. However, note that, when the CUTOFF CURRENT switches are set for 100 mA or more, the continuous operation time rating of the Tester is up to 30 minutes. When the current setting is 25.5 mA or less, the Tester may be operated for a longer period.

- ① Set the TIMER ON/OFF switch to the OFF state.
- ② Connect the device under test to the output terminals of the Tester as described in Step 6).
- ③ Check that the TEST VOLTAGE dial is set at the fully counterclockwise position.
- ④ Press the TEST button. The TEST ON lamp will illuminate to indicate that the test voltage is ready to be applied to the device under test.
- ⑤ Gradually turn clockwise the TEST VOLTAGE dial until the necessary test voltage is obtained.
- ⑥ When the required test time has elapsed or when a condition calling for aborting the test has occurred, press the RESET button to cutoff the output voltage. In this case the GOOD signal is not generated.

When an NG alarm is generated in the above test, operation is identical with that when the test is mode using the timer.

9) Reapplication of test voltage (retest)

If the Tester is in the RESET state, the test voltage as set by the TEST VOLTAGE dial can be delivered again to the output terminal simply by pressing the TEST button. If the Tester is generating an NG alarm or is in the PROTECTION state, press the RESET button to reset the Tester. If a GOOD judgement is made at the end of the test, the auto reset circuit operates and the Tester is automatically reset.

10) Setting the GO-NOGO judgement reference values for withstanding voltage test

The GO-NOGO judgement by the Tester is done in a window comparator system such that the GOOD judgement is made only when the measured leakage current is between the high and low limit reference values. The NG judgement can be made not only when the measured value is larger than the high limit reference value but also when it is smaller than the low limit reference value (0 to one-half of the high limit reference value).

Detection small leakage currents

The window comparator system is especially advantageous when the leakage current values of device under test are not distributed widely and are larger than the minimum detectable current of the Tester. To test such device under test, the low limit reference (LOWER REFERENCE) value may be set at a value slightly smaller than the predicted lowest value, and the test may be done in the window comparator system. When this is done, device under test of exceptionally small leakage currents can be identified and open-circuiting of leadwires and imperfect contacting also can be detected, thereby substantially facilitating the withstanding voltage test.

Tests with low limit judgements for low leakage currents will be inconvenient when setting the test voltage in the no-load state or when the device under test draw almost no current. In such cases, set the LOWER ON/OFF switch to the OFF state to disable the low limit judgement function.

Judgment errors by stray capacitances

When test is made with a high sensitivity using a high AC voltage, it is possible that the current which flows through stray capacitances of the test leadwires and other device under test becomes larger than the low limit reference value and no low limit judgement for low leakage current can be correctly made. That is, when the device under test is disconnected from the test setup, an NG judgement should be made since the current drawn by the device under test is zero and is absolutely smaller than the low limit reference value. Actually, however, since the current which flows through the stray capacitances is larger than the low limit reference value, the Tester erroneously generates a GOOD judgement signal. Refer to Note 2 on Chapter 7 "SPECIFICATIONS" (Page 7-3)

Pay attention to this type of judgement errors. Make it sure that the Tester correctly makes NG judgement when the device under test is disconnected from the test setup.

11) Setting the LOWER REFERENCE value

- ① Set the high limit reference value (CUTOFF CURRENT value).
- ② Set the TIMER ON/OFF switch to the OFF state.
- ③ Set the LOWER ON/OFF switch in the OFF state.
- ④ Turn the LOWER REFERENCE value control to the counterclockwise position.
- ⑤ Connect the device under test as described in Step 6).
- ⑥ Make settings as shown in the flowchart on the next page.

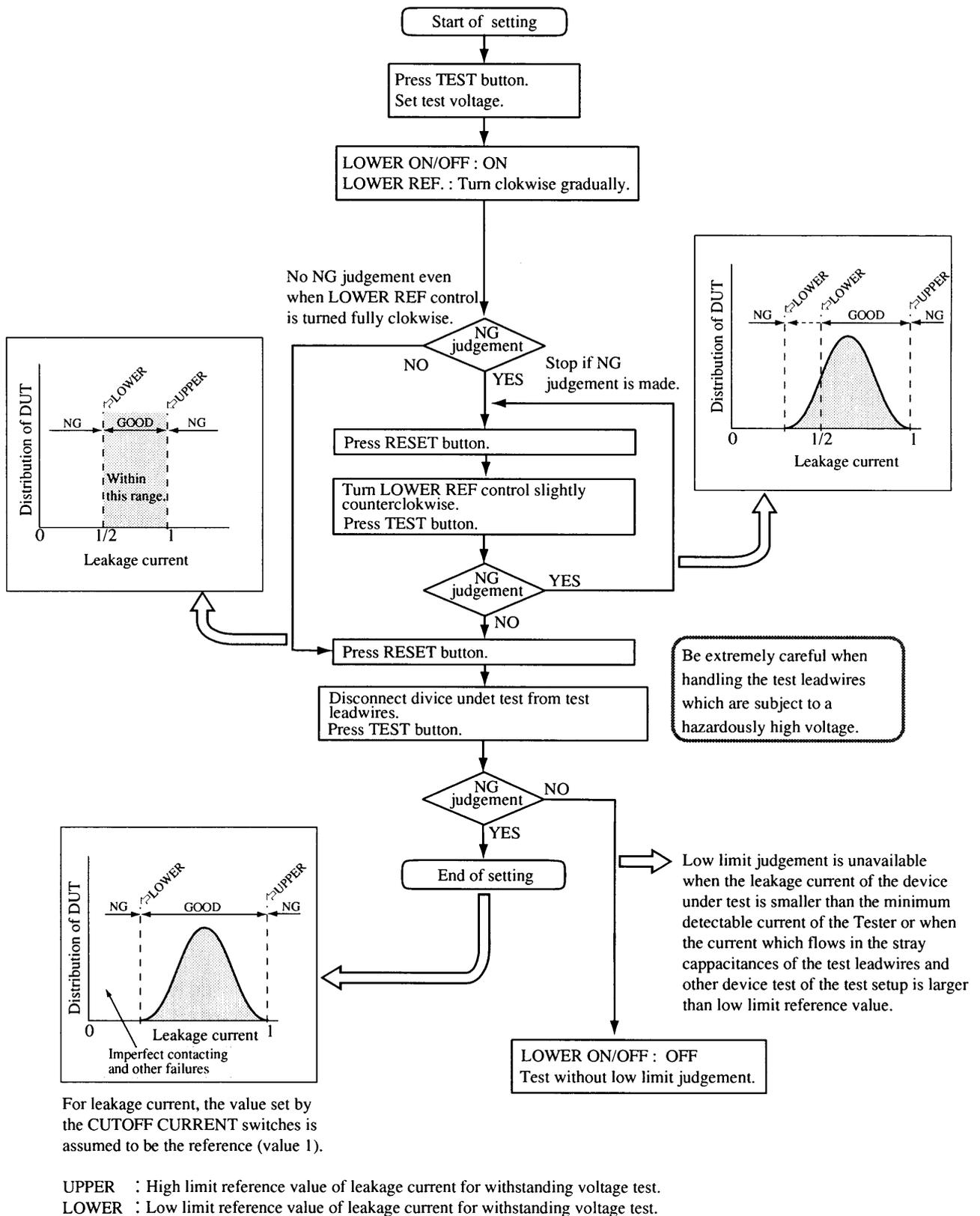


Fig. 4-1 Flowchart of set the LOWER REFERENCE value

4.3 Single Insulation Resistance Test

1) Selecting the insulation resistance test mode

- ① Select the MANUAL I test mode with the FUNCTION selector switches.
- ② The I TEST indicator lamp will illuminate. Letter "I" stand insulation resistance test.

2) Check the Zero-ohm

- ① Check that the TIMER ON/OFF switch is in the OFF state.
- ② Short the high voltage test leadwire (hot line) to the GND test leadwire to make sure that no high voltage is being delivered to the output terminal.
- ③ Press the RESET button with a state of ②.
- ④ Press the TEST button with a state of ②.
- ⑤ Check The ohmmeter will indicate approximately zero ohms.

3) Selecting a test voltage

With the I TEST VOLTAGE 500V/1000V switch, select the test voltage of the device under test as required of standards, and other.

4) Setting the GO-NOGO judgement reference values for Insulation resistance test

The GO-NOGO judgement by the Tester is done in a window comparator system such that the GOOD judgement is made only when the measured insulation resistance is between the high and low limit reference values. The NG judgement is made not only when the measured value is lower than the low limit reference value but also when it is higher than the high limit reference value.

Detection high insulation resistances

The window comparator system is especially advantageous when the distribution of the insulation resistances of device under test can be predicted and the predicted high limit value is in the range of the detectable resistance of the Tester. To test such device under test, the high limit reference value may be set at a value slightly higher than the predicted highest value of the device under test, and the test may be made in the window comparator system. When this is done, device under test of exceptionally high insulation resistances can be identified and open-circuiting of leadwires and imperfect contacting also can be detected, thereby attaining still better insulation resistance test.

With the REFERENCE SET switches set in the regular state ($\begin{matrix} L & U \\ \blacksquare & \blacksquare \end{matrix}$), the ohmmeter indicates the measured resistance when in the insulation resistance test.

When not in the insulation resistance test, the ohmmeter indicates the ∞ position.

A selection and setting of judgment reference value

Press the LOWER REFERENCE SET switch, and the ohmmeter will indicate the low limit reference value. Next, press the UPPER REFERENCE SET switch, and the ohmmeter will indicate the high limit reference value. When the two switches are pressed at the same time, the LOWER REFERENCE SET switch has a priority.

The high and low limit reference values can be set with the potentiometers located at right and left of the switches. Set the values as required by the device under test.

When the low limit judgement is not required, turn the low limit reference value setting potentiometer so that the ohmmeter pointer for the low limit reference value indicates a position lower than the zero ohm scale position.

For some types of tests, it may be undesirable to perform high limit judgement. In such cases, set the UPPER ON/OFF switch in the OFF state.

5) Setting the test time

Set the TIMER ON/OFF switch to the ON state. Set the test time as required by the device under test (within a range of 0.5 seconds to 10 minutes with the timer). Refer to Chapter 4 "4.8 Timer" (page 4-23).

6) Connecting the device under test

- ① Make sure that the output voltmeter indication is zero.
- ② Make sure that the TEST ON lamp is not illuminating.
- ③ Connect the GND test leadwire to the GND terminal of the Tester.
- ④ Connect the high voltage test leadwire (hot line) to the output terminal.
- ⑤ Short the high voltage test leadwire (hot line) to the GND test leadwire to make sure that no high voltage is being delivered to the output terminal.
- ⑥ Connect the GND leadwire to the device under test.
- ⑦ Connect the high voltage test leadwire (hot line) to the device under test.

7) Test procedure

- ① If the PROTECTION indicator lamp is illumination, press the RESET button to reset the Tester. If the Tester is already in the RESET state, test can be immediately started simply by pressing the TEST button.
- ② If the device under test satisfies the conditions of GOOD judgement set for GO-NOGO judgement in Step 4), the ohmmeter will indicates the measured resistance value.
- ③ When the preset time has elapsed, the test voltage is cutoff, the device under test is judged to be good.
- ④ When the GOOD judgment, the Tester will generate GOOD signals with the lamp, buzzer and make-contact for approximately 50ms.

If the device under test does not meet the above-mentioned test conditions, the NG judgement is made and the output is instantaneously cutoff and the NG alarm is generated.

The alarm is with the lamp and make-contact which are different from those for the withstanding voltage test and with the buzzer which is used in common for the withstanding voltage test.

To reset the alarm, press the RESET button.

8) Test without using the timer

Set the TIMER ON/OFF switch to the OFF stage. When this is done, insulation resistance test can be done irrespective of the timer as is the case for withstanding voltage test. If the Tester is in the RESET state, the test will start as you press the TEST button. As you press the RESET button, the output voltage is cutoff and the test ends.

9) Reapplication of test voltage (retest)

If the Tester is in the RESET state, the test voltage as set by the I TEST VOLTAGE dial can be delivered again to the output terminal simply by pressing the TEST button. If the Tester is generating an NG alarm or is in the PROTECTION state, press the RESET button to reset the Tester. If a GOOD judgement is made at the end of the test, the auto reset circuit operates and the Tester is automatically reset.

10) Checking discharge from DUT

WARNING

- In case of this mode (Single Insulation Resistance Test), DUT is charged after testing. Be sure to check discharge from DUT. Refer to Chapter 2 "2.3.2 Cautions in electric charging in insulation resistance test" (page 2-6).

Waiting-time for Judgement in Insulation Resistance Test

When a test voltage is applied to a DUT which has a larger capacitance, a larger charge current will flow at the initial short period and the resistance of the DUT may be indicated lower than the actual value. In order to eliminate such period from the GO-NOGO judgement period, a time delay provision is incorporated. The delay time is set at approximately 0.3 seconds. If the timer is set at a period shorter than 0.3 seconds, the effect of the above provision will be lost and a GOOD judgement may be made erroneously.

Be sure to set the timer for a period longer than 0.5 seconds.

4.4 Automatic Test

1) Selecting a test sequence

The Tester is capable of performing a withstanding voltage test and an insulation resistance test sequentially.

- ① Sequence is selectable for "W → I" or "I → W" with the FUNCTION switches.
- ② When the Tester is set for this mode, the AUTO lamp illuminates. (Letter "W" stands for withstanding voltage test and letter "I" for insulation resistance tests.)

2) Setting the test conditions

Set the test voltages of withstanding voltage test or insulation resistance test, leakage current detection reference values, test time, and insulation resistance judgement reference values as in the case for the single-item tests.

3) Connecting the device under test

- ① Make sure that the output voltmeter indication is zero.
- ② Make sure that the TEST ON lamp is not illuminating.
- ③ Connect the GND test leadwire to the GND terminal of the Tester.
- ④ Connect the high voltage test leadwire (hot line) to the output terminal.
- ⑤ Short the high voltage test leadwire (hot line) to the GND test leadwire to make sure that no high voltage is being delivered to the output terminal.
- ⑥ Connect the GND leadwire to the device under test.
- ⑦ Connect the high voltage test leadwire (hot line) to the device under test.

4) Test procedure

- ① Set the Tester in the RESET state.
- ② Press the TEST button.
- ③ The Tester will automatically perform the two types of tests.
- ④ When the test is over without the NG judgement, the GOOD signals are generated at the end of the test. The signals are the same with those of the single test.

When the withstanding voltage test or insulation resistance test is over with NG judgement, the output voltage is instantaneously cutoff the NG alarm is generated, and the test is end.

The signals are the same with those of the single test.

5) To abort the test

To abort the test being performed, press the RESET button. The output voltage will be instantaneously cutoff and the Tester will be RESET state.

6) Reapplication of test voltage (retest)

When the test is over with the GOOD judgement, the Tester generates the GOOD signals for approximately 50ms and then resets itself.

The next test can be started simply by pressing the TEST button. When the Tester has generated the NG alarms, reset once the Tester and then press the TEST button.

7) Checking discharge from DUT

WARNING

- In case of "W → I" test mode, DUT is charged after testing. Be sure to check discharge from DUT. Refer to Chapter 2 "2.3.2 Cautions in electric charging in insulation resistance test" (page 2-6).

4.5 Remote Control

1) Remote-control with the option

The TEST/RESET operation of the Tester can be remote-controlled with the remote control box (optional). As the plug of the remote control cable is connected to the REMOTE control connector on the Tester front panel, the internal circuit is automatically switched to the remote operation mode. In this case, the TEST button on the Tester front panel is disabled, although the reset operation can be done either at the Tester front panel or at the remote control box.

2) Remote-control by the other control system

The Tester can be remote-controlled by other control system equipment without using the remote control box.

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 lead-wire, probe or output terminal etc.) when the test voltage is being delivered.

When these measures are unavailable, do not use the following remote control method.

■ REMOTE control connector

Because the Tester can operate by remote control, the pin No.2 and No.3 of connector must be externally connected.

By controlling the TEST and RESET contacts shown in Figure 4-2, test voltage can be on-off controlled in the same manner as done at the Tester front panel.

However, when the NG ALARM of TEST MODE switch on the rear panel is OFF. For details, refer to Chapter 4 "4.7 Special Test Modes" (Page 4-20).

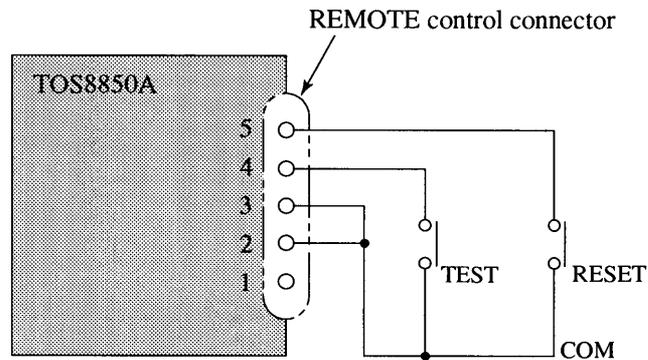


Fig. 4-2

In the case of the setup shown in Figure 4-3, the test voltage is turned on when the switch is thrown to the NO position, and Tester is forcefully reset when the switch is returned to the NC position.

However, when the NG ALARM of TEST MODE switch on the rear panel is OFF. For details, refer to Chapter 4 "4.7 Special Test Modes" (Page 4-20).

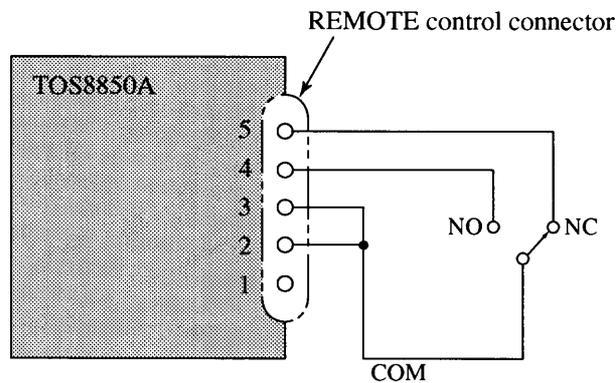


Fig. 4-3

Logical elements, transistors or photocouplers may be used instead of the switches in Figure 4-2.

The example is shown in Figure 4-4. 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 : $\leq 2\text{mA}$
- Input pulse width : 20ms minimum

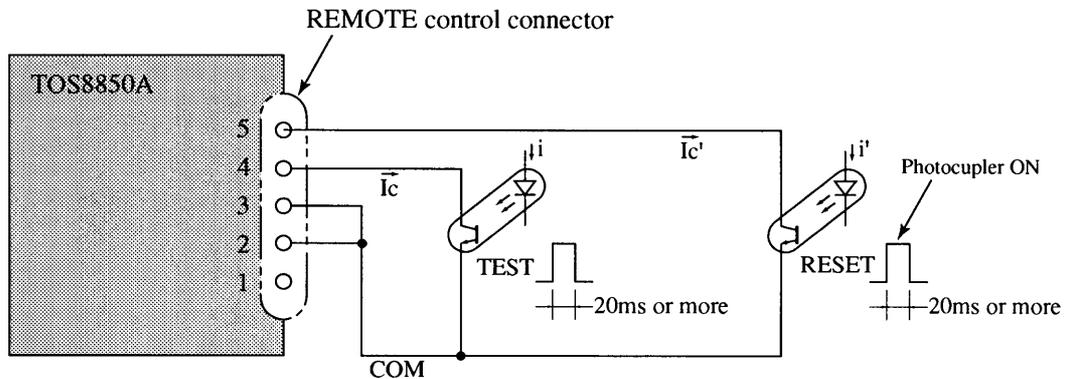


Fig. 4-4

NOTE

- The gates are pulled up to +15V. Opening of the input terminals is equivalent to a high level input.
- Currents i and i' must be sufficient to provide currents I_c and I_c' of 2mA or more.
- When using the CURRENT MONITOR terminals, isolate the common line (line COM in Figure 4-4) of the control circuit from the power line and ground line of the Tester.
- A timing of RESET signal for clearing of NG alarm sends RESET signal more than 20ms after doing 100ms or more after NG signal generated as follows.

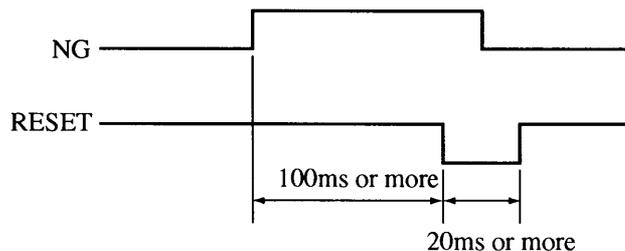


Fig. 4-5

With a view to prevent erroneous operation which could be caused by noise, it is recommendable to use photocouplers as shown in Figure 4-4 or relays as shown in Figure 4-2. The Tester is designed with full attention so that it does not erroneously operate by noise. Pay attention so that the devices connected to the Tester do not erroneously operate by noise.

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 4-6.

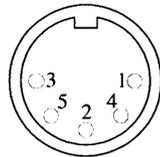


Fig. 4-6 Layout of connector pins as viewed from panel surface

■ PROTECT/OPERATE input terminal

The Tester can be remote-controlled for PROTECTION state with an external signal through the PROTECT/OPERATE input terminals on the rear panel.

If the Tester is in the PROTECTION state, on test voltage is delivered even when a test input signal is applied (or the TEST button is pressed) thereby maintaining the protected state. With this feature, erroneous delivery of the output voltage by an erroneous external condition can be eliminated to protect the operator.

An example of setup for the remote PROTECT/OPERATE control function is shown in Figure 4-7. When the contact shown in Figure 4-7 is open, the Tester is in the PROTECTION state. When the contact is closed and a reset signal is applied (or the RESET button is pressed), the Tester is reset to the state that it is ready to perform the test.

When the Tester is shipped, the PROTECT/OPERATE input terminals are shorted with a shorting piece.

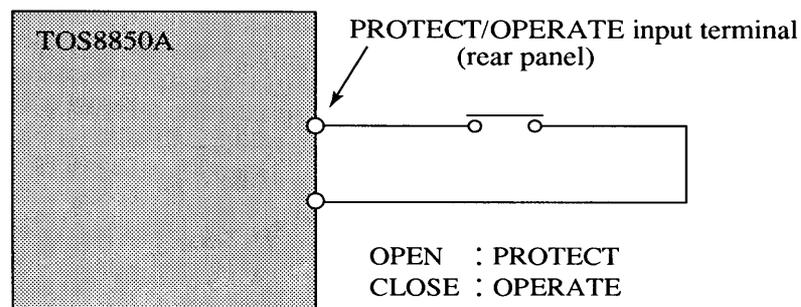


Fig. 4-7

4.6 Output Signals

The Tester delivers the following signals from the SIGNAL OUTPUT terminal on the rear panel other than the lamp and buzzer signals.

No.	Signal	Condition for Delivery	Type and Rating
①	TEST ON	Entire period during test is on	Make-contact signal Ratings : 100VAC/1A 30VDC/1A
②	GOOD	When test is over. Approx. 50ms	
③	W / NG	When NG judgement is made for withstanding voltage test. Continuous	
④	I / NG	When NG judgement is made for insulation resistance test. Continuous	
⑤	READY	When in ready for test.	

① TEST ON signal

This signal is generated and remains on for the entire period of either the single test or the automatic test.

② GOOD signal

This signal is generated when a GOOD judgement is made at the end of a single test with the timer or at the end of the latter one of automatic tests. The signal lasts for approximately 50ms.

③ W/NG signal

This signal is generated when an NG judgment is made for the withstanding voltage test. This signal remains on till the following operation is done.

- The next RESET signal is applied.
- The RESET button is pressed.
- The PROTECTION signal is applied.

④ I/NG signal

This signal is generated when an NG judgment is made for the insulation resistance test.

- The next RESET signal is applied.
- The RESET button is pressed.
- The PROTECTION signal is applied.

⑤ READY signal

NOTE

- When in the MOMENTARY of Special Test Mode, this signal is not generated.

This signal is continuously delivered when the Tester is in the READY state.

The READY state that the Tester is ready to be driven into the TEST ON state. That is, this signal is delivered when the test that all following five conditions are met.

- Power of the Tester is turned on.
- The RESET signal is not applied. (or the RESET button is not pressed.)
- Not in the TEST ON state.
- Not generating the GOOD signal.
- Not generating the NG alarm.
- Not in the PROTECTION state.

As the TEST signal is applied (or the TEST button is pressed) when the READY signal is being delivered, the Tester starts the test operation.

■ Contact signals

The contact signals are only with contacts and without any power sources as Figure 4-8. Therefore, cannot drive any loads which have no power.

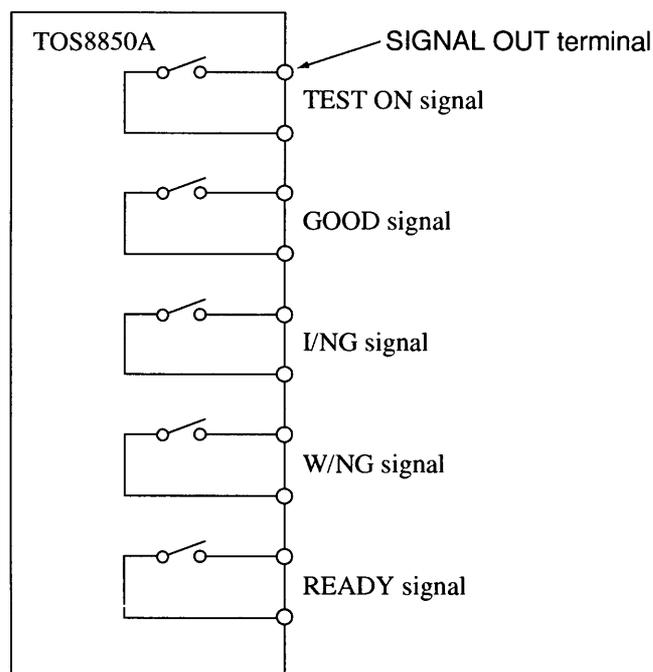


Fig. 4-8

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

The contacts of the Tester are of the make-contact type and their rating is 100V AC, 1A or 30 V DC, 1A.

The withstanding voltage is 500V AC 1 minute between the circuit and chassis.

■ Use examples of contact signal

To drive a DC buzzer with an W/NG or I/NG alarms.

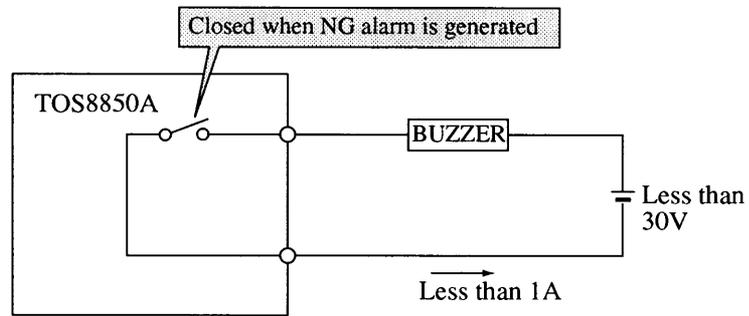


Fig. 4-9

To drive a lamp with the TEST ON signal.

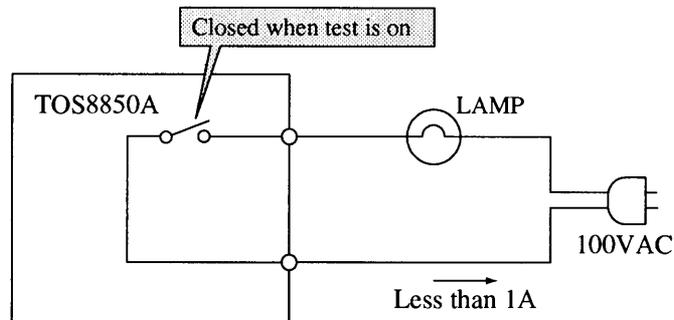


Fig. 4-10

To obtain an "L" level digital signal with the contact signal.

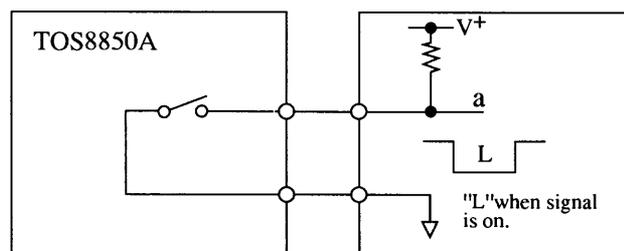


Fig. 4-11

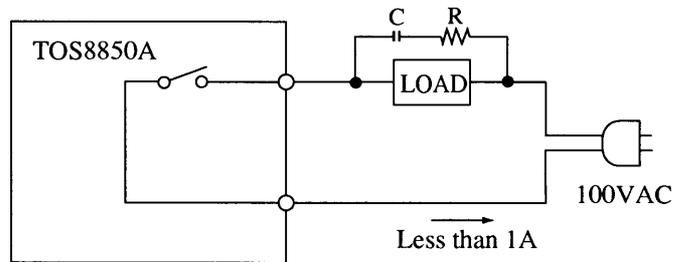
In the Figure 4-11 illustration, an "L" level signal is obtained at point "a" when the contact output signal is on. However, since the signal obtained at point "a" include chattering, an appropriate chattering suppression provision should be incorporated

depending on the nature of the circuit to be driven by this signal. In some cases, a noise suppression provision may be necessary.

■ Precaution on using the contact signal

Before using this contact signal, provide a contact protection measure (to absorb surge) suitable to the using method. Failure can not only cause malfunction of the circuit being connected later but also break the contact of the tester.

The Figure 4-12 and 4-13 are the examples of the contact protection method recommended.

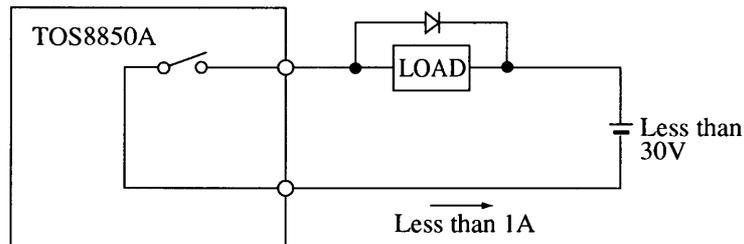


R : Approx. 100Ω 2W or over

C : Approx. $0.1\mu\text{F}$ 250VAC or higher

(The R and C are reference values only. Select proper values in accordance with the actual conditions.)

Fig. 4-12



Diode

Reverse voltage : 200V or higher

Foward current : 1A or more

(The diode ratings are reference value only. Select proper values in accordance with the actual conditions.)

Fig. 4-13

4.7 Special Test Modes

Four types of special modes are selectable with the TEST MODE selector switches on the rear panel. The standard positions of the switches (the positions as the switches are set as the Tester is shipped) are the OFF positions as shown in Figure 4-14.

By throwing the switches to the ON positions, respective modes as described below can be selected. Since mode settings are mutually independent, any combinations of switch settings are possible.

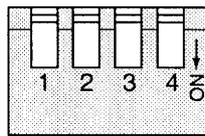


Fig. 4-14 STANDARD POSITIONS

■ DOUBLE ACTION

For the DOUBLE ACTION mode, set the switches as shown in Figure 4-15.

When in the RESET state in the standard mode, as you press the TEST button, the Tester is driven into the TEST ON state. When in the DOUBLE ACTION mode, the Tester is driven into the TEST ON state provided that you press the TEST button within approximately 0.5 seconds after pressing the RESET button. That is, no test is started unless both RESET and TEST buttons are pressed in the correct sequence within a certain period. While the procedure is more complicated due to the double switch actions, a higher safety of test can be attained.

The function is the same as above also when in the remote control mode.

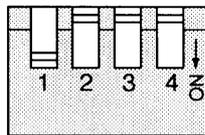


Fig. 4-15 DOUBLE ACTION mode

■ GOOD HOLD

For the GOOD HOLD mode, set the switches as shown in Figure 4-16. When a GOOD judgement is made in the standard mode, the Tester generates a GOOD signal only for approximately 50ms. When in the GOOD HOLD mode, the GOOD signal is continuously held until the RESET signal is applied.

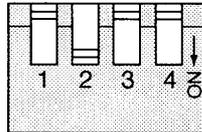


Fig. 4-16 GOOD HOLD mode

■ MOMENTARY

For the MOMENTARY mode, set the switches as shown in Figure 4-17.

When in the standard mode, once the TEST button is pressed, the TEST ON state is maintained until the period set by the timer elapses or the RESET button is pressed. When in the MOMENTARY mode, the TEST ON state is maintained only for the period the TEST button is kept pressed.

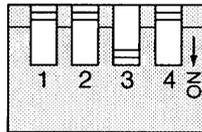


Fig. 4-17 MOMENTARY mode

As you release the TEST button, the test stops instantaneously. Thus, the MOMENTARY mode is advantageous from the viewpoint of operation safety.

Still higher operation safety can be attained by operating the Tester in the MOMENTARY mode and using RC02-TOS Remote Control Box (both-hand type, option) in conjunction.

When test is made with the timer, the Tester generates a GOOD signal for approximately 50ms after the test for the period preset by the timer has elapsed, and then the test ends.

NOTE

- When in this mode, the READY signal is not generated.

■ NG ALARM

For the NG ALARM mode, set the switches as shown in Figure 4-18.

When the Tester is set in the standard mode, as a remote RESET signal is applied, the test voltage is cutoff and the NG alarm and PROTECTION state and GOOD signal are reset as in the case that the RESET button on the front panel is pressed. When in the NG ALARM mode, as a remote RESET signal is applied, although the output is cutoff and the GOOD signal is reset, the NG alarm and the PROTECTION state are not reset. To reset the NG alarm and PROTECTIONS state, press the RESET button on the front panel.

This mode provides an effective means for confirming the NG alarm when HP01A-TOS or HP02A-TOS High Voltage Probe (optional) is used.

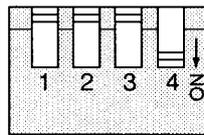


Fig. 4-18 NG ALARM mode

4.8 Timer

The timer has two slide switches to select four time ranges. The units of time and figures on the scale plate also are changed as the switches are changed, allowing you to directly read the set time range.

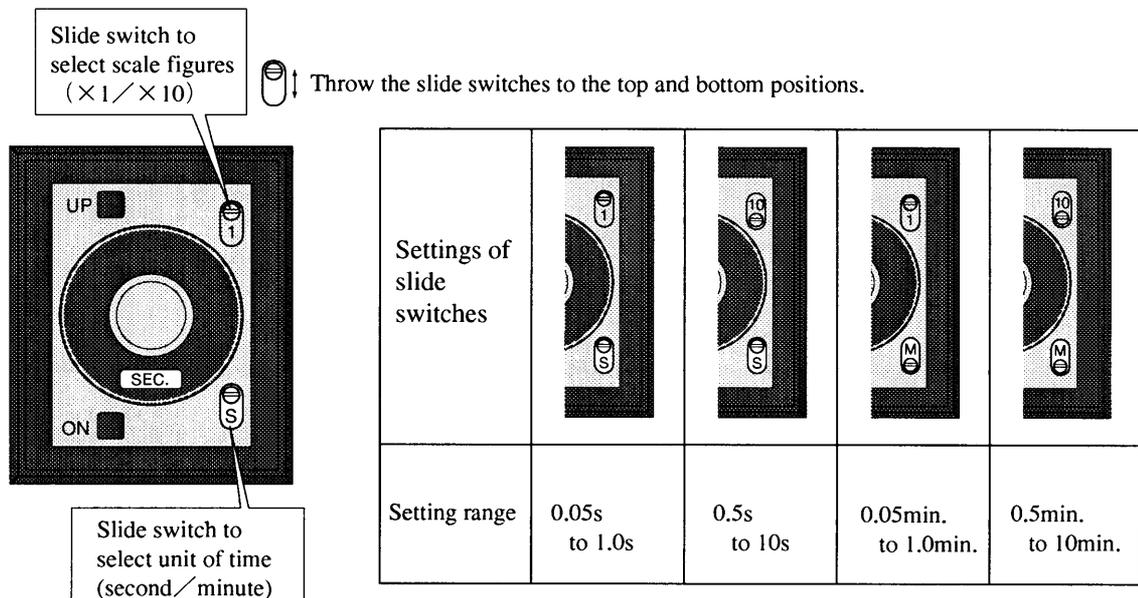


Fig. 4-19 Settings of the timer

NOTE

- When the low limit judgement is used for withstanding voltage test, be sure to set the timer for 0.2 seconds or a longer period.
- For insulation resistance test, be sure to set the timer for 0.5 seconds or a longer period. Refer to Chapter 4 "Waiting-time for Judgement in Insulation Resistance Test." (Page 4-9)

5

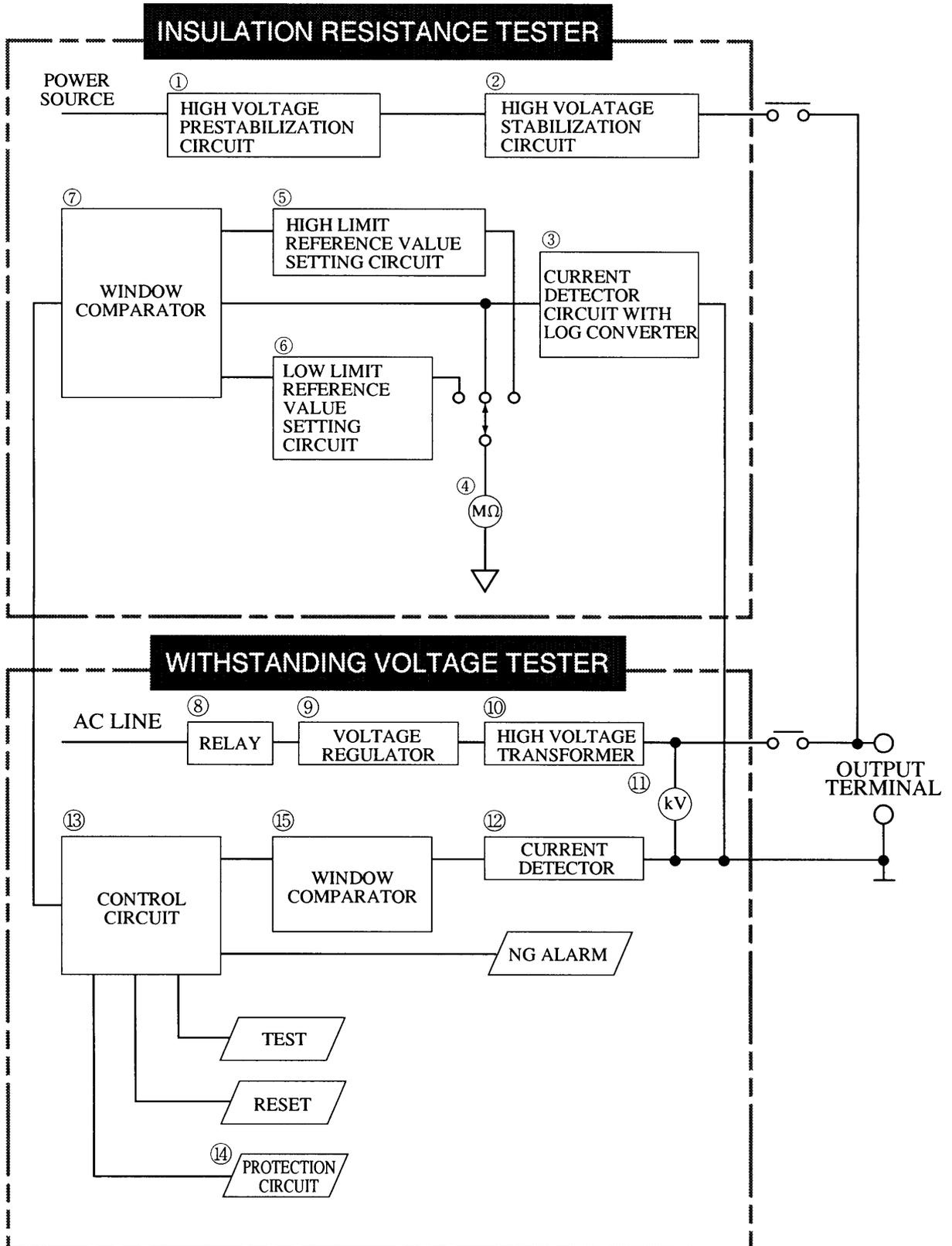
Chapter 5

OPERATING PRINCIPLE

This Chapter describes operating principle of the tester, used the block diagram.

- 5.1 Block Diagram
- 5.2 Description of Individual circuits
- 5.3 Zero-Start Switch

5.1 Block Diagram



5.2 Description of Individual Circuits

① High voltage prestabilization circuit

In order to obtain the high voltage required for insulation resistance test, this circuit triple-voltage rectifies the AC input power and roughly prestabilizes the DC output voltage at approximately 1150V.

② High voltage stabilization circuit

Stabilizes the above DC voltage more finely, in order to be applied as an insulation resistance test voltage to the device under test.

The test voltage is a negative voltage of nominal 1000V or 500V.

③ Current detector circuit with log converter

The current which flows in the device under test varies ranging from less than $1 \mu A$ to approximately 1mA when shorted.

To detect and indicate this wide dynamic range current on the single range scale of the ohmmeter, this circuit has a log converter which converts the detected signal into a logarithmic signal. A highly accurate log converter is used in order to satisfy the specification accuracy.

④ Ohmmeter

This meter is driven by the above logarithmic signal to indicate the insulation resistance of the device under test.

⑤ High limit reference value setting circuit

Sets the high limit reference value for GO-NOGO judgement. The value is adjustable with its potentiometer on the front panel.

⑥ Low limit reference value setting circuit

Sets the low limit reference value for GO-NOGO judgement. The value is adjustable with its potentiometer on the front panel.

⑦ Window comparator

Generates a GOOD signal if the measured value is within the range between high and low limit reference values. If not, generates an NG signal.

⑧ Relay

On-off controls the power applied to the voltage regulator for withstanding voltage test. A solid-state zero-start type relay circuit is employed to minimize transient spike voltages caused when the high voltage output is turned on or off.

⑨ Voltage regulator

A slide transformer is used to control the output voltage.

⑩ High voltage transformer

Boosts the voltage regulator output with a ratio of 1:25 or 1:50 into a high output voltage of 0 to 2.5kV or 0 to 5kV. The rating is 5kV, 100mA (500VA) when the AC line voltage is 100V.

⑪ Voltmeter

Indicates the output voltage for withstanding voltage test.

⑫ Current detection circuit

Consists of a current detecting resistor, a reference voltage generator circuit, and a comparator.

⑬ Control circuit

Controls overall operations of the Tester. Structured in high-reliability logic circuits with CMOS IC.

⑭ Protective circuits

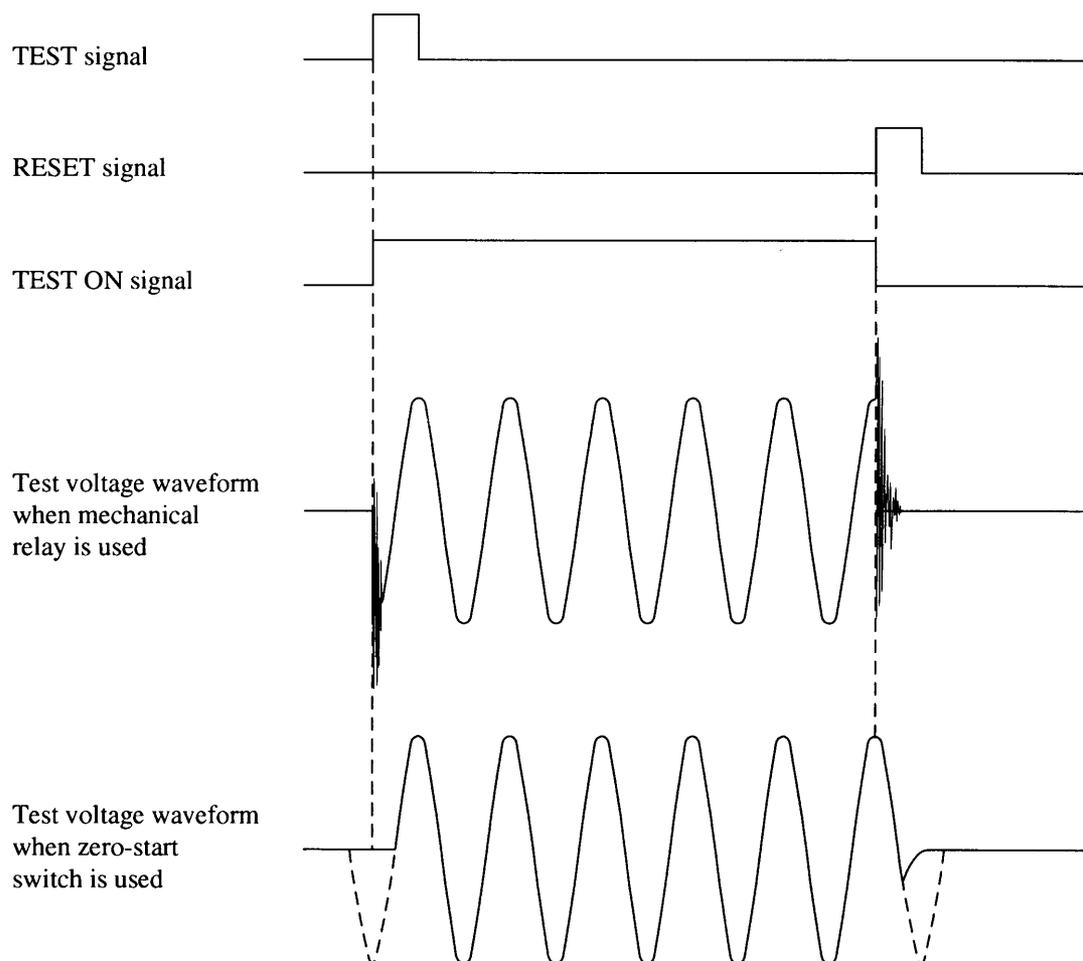
Various protective features are incorporated for the safety of tests. But be careful to operate.

⑮ Window comparator

Generates a GOOD signal only when the leakage current is within the range between the high limit reference value set with the CUTOFF CURRENT switches and the low limit reference value set with the LOWER REFERENCE value control. When the leakage current is not within the above range, the comparator generates an NG judgement.

5.3 Zero-Start Switch

If a regular mechanical contact type relay is used for on-off operation of the primary circuit of the high voltage transformer, transient spike voltages could be produced, thereby applying an unjustifiedly high voltage to the device under test (DUT) and causing a possibility of re-jecting an acceptable DUT. The zero-start switch, which employ a solid-state switching circuit, turns on and off the power line at approximately 0 volt level, thereby reducing transient overshoots.



6

Chapter 6

MAINTENANCE AND CALIBRATION

This Chapter describes maintenance and calibration.

Perform regular maintenance, inspection and calibration to maintain optimum performance for a long time.

- 6.1 Cleaning the Outer Surfaces
- 6.2 Inspection
- 6.3 Maintenance
- 6.4 Calibration

6.1 Cleaning the Outer Surfaces

CAUTION

- Be sure to turn OFF (0) the power of the Tester before start cleaning it.
- Do not use volatile solvents such as thinner and benzine. They may discolor the unit surface coating, erase printing characters.

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

6.2 Inspection

Checking the AC Power Cable

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

Checking the HV Test Leadwires

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

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-circuit), it can be a cause of electric shock hazards. Never use imperfect test leadwires.

To purchase accessories, contact your Kikusui agent.

6.3 Maintenance

■ High Voltage Relay

The high voltage relay of the internal discharge circuit is a wearable component. In this regard, it is recommended to order your Kikusui agent to overhaul the Tester at every approximately 200,000 repetitions of tests (although the service intervals may differ depending on the conditions of use).

WARNING

- The Tester generates a hazardously high voltage of 5kV. Never attempt to overhaul the Tester for yourself. For such service, connect your Kikusui agent.

6.4 Calibration

The Tester was properly calibrated at shipment.

However, the Tester should be calibrated after long-term usage .

WARNING

- The Tester generates a hazardously high voltage of 5kV. Never attempt to calibrate the Tester for yourself. For such service, connect your Kikusui agent.

7

Chapter 7

SPECIFICATIONS

This Chapter provides electric and mechanical specifications and descriptions of options.

- 7.1 Withstanding Voltage Tester
- 7.2 Insulation Resistance Tester
- 7.3 Common Specifications
- 7.4 Options

7.1 Withstanding Voltage Tester

WITHSTANDING VOLTAGE TESTER			
Test Voltage	Applied AC Voltage	0 to 2.5kV/0 to 5kV (two ranges)	
	Output Rating	500VA (5kV, 100mA with 100V line voltage) See Note 1.	
	Waveform	AC line waveform	
	Voltage regulation	Better than 20% (for maximum rated load to no load, with 100V line voltage)	
	Switching	With zero-start type switch	
Output Voltmeter	Scales	2.5kV f.s / 5kV f.s, two ranges linear scales	
	Class of meter	JIS Class 1	
	Accuracy	$\pm 3\%$ f.s or better	
	Indication	Mean-value response, effective-value scale graduation	
Judgment of Test Result GO-NOGO judgment . Output cutoff by leakage current detection	Judgment	<input type="radio"/> Window comparator system <input type="radio"/> NG judgment when leakage current larger than high limit reference value is detected. <input type="radio"/> NG judgment also when leakage current smaller than low limit reference value is detected. <input type="radio"/> When NG judgment is made, output is cutoff and NG alarm is generated. <input type="radio"/> If no NG judgment is made after preset period has elapsed, GOOD signal is generated.	
	High limit reference value (CUTOFF CURRENT)	0.5/1/2/4/8/10/100mA (7 values) By combinations of above values, a range of 0.5 to 25.5mA can be covered in 0.5mA steps.	
	Low limit reference value (LOWER REFERENCE)	0 to one-half of high limit reference values (continuously variable)	
	Accuracy of judgment (See Note 2.)	<input type="radio"/> $\pm 5\%$ of high limit <input type="radio"/> $\pm 20\%$ of low limit reference value (one-half of high limit reference values at maximum counterclockwise) . (Other are non-calibrated.)	
	Judging method	Absolute value of leakage current is integrated and compared with preset limit reference value	
	Calibration	Calibrated with rms value of sine wave, using a pure resistance load.	
	No-load output voltage need for detection (See Note 3.)	2.5kV range	Approx. 450V when set at 100mA
		5kV range	Approx. 550V when set at 100mA
Test time	0.2s to 10min. (with 4-range timer)		
Terminals	Terminals for monitoring of leakage current		

Note 1 : When the Tester is delivering its maximum rated current, its maximum rated continuous operation time is 30 minutes.

Note 2 : The current which flows due to stray capacitances of the output circuit and leadwires causes an error. The overall accuracy of judgement is the above-mentioned accuracy of judgement plus a factor caused by this current. Typical values of this type of currents are shown in the next table. Note that, when a test is made with a high voltage and high sensitivity, the current which flows through the stray capacitances may become larger than the preset low limit reference value and low limit judgement may become unavailable.

Output voltage	1kV	2kV	3kV	4kV	5kV
Test alone (without leadwires)	4 μ A	8 μ A	12 μ A	16 μ A	20 μ A
When 350mm long leadwires are hung in air	6 μ A	12 μ A	18 μ A	24 μ A	30 μ A
When the accessory leadwire (TL01-TOS) are used	20 μ A	40 μ A	60 μ A	80 μ A	100 μ A

Note 3 : When making an NG judgement test with the output terminals shorted, a certain level of no-load output voltage is needed due to the internal resistance of the output circuit. The voltages shown here are this type of output voltages.

Test Voltage Waveform

When an AC output voltage is applied to a capacitive load, it is possible that the voltage becomes higher than that when in the no-load state due to the capacitance of the load. Moreover, when the capacitance of the load is voltage dependent (typical examples are ceramic capacitors), the voltage waveform may be distorted. When the test voltage is 1.5 kV, however, effects caused by a capacitance of 1000 pF or less are negligible.

7.2 Insulation resistance Tester

INSULATION RESISTANCE TESTER		
Measuring Voltage		500V or 1000V DC, negative polarity (two ranges)
Effective Measuring Ranges	500V range	1 to 1000M Ω
	1000V range	2 to 2000M Ω
Values center of scale	500V range	20M Ω
	1000V range	50M Ω
Accuracy		<input type="radio"/> 1st effective measuring range : $\pm 5\%$ of the indicated value <input type="radio"/> 2nd effective measuring range : $\pm 10\%$ of the indicated value (See Note 4 and 5)
Measuring terminal voltage	When output terminals are open	0% to +5% of rated measuring voltage
	When at center of scale	95% or more of rated measuring voltage
Judgment of Test Result <div style="border: 1px dashed black; padding: 2px; display: inline-block;">GO-NOGO judgment</div>	Judgment	<input type="radio"/> Window comparator system (mutually independent settings of high limit and low limit) <input type="radio"/> NG judgment when measured resistance is smaller than low limit reference value. <input type="radio"/> NG judgment when measured resistance is larger than high limit reference value. <input type="radio"/> When NG judgment is made, output is cutoff and NG alarm is generated. <input type="radio"/> If no NG judgment is made after preset period has elapsed, GOOD signal is generated.
	Limit reference value setting range	Low and high limit reference values can be set at any points within the effective measuring range of the Tester.
	Accuracy of judgment	<input type="radio"/> 1st effective measuring range : $\pm 10\%$ of set value <input type="radio"/> 2nd effective measuring range : $\pm 15\%$ of set value (See Note 4 and 5)
	Waiting-time for judgment	Approx. 0.3s
Test time		0.5s to 10min. (with 4-range timer)

Note 4 : At 25°C \pm 10°C

Note 5 : The 1st effective measuring range is from 1/1000 to 1/2 of the maximum effective scale value.
The 2nd effective measuring range is from the above to the maximum effective scale value.

Note 6 : Since the Tester operates on an AC power line, measuring errors may be introduced if the device under test is connected to the AC line.

7.3 Common Specifications

Common Specifications			
Types of test	1.AUTO W→I	Withstanding voltage test first and insulation resistance test next	
	2.AUTO I→W	Insulation resistance test first and withstanding voltage test next	
	3.MANUAL W	Withstanding voltage test alone	
	4.MANUAL I	Insulation resistance test alone	
Remote Control	Test / Reset control	○Low active control ○Input conditions (See Note 7) <ul style="list-style-type: none"> · High level input voltage 11 to 15V · Low level input voltage 0 to 4V · Low level sweep out current 2mA or less · Input pulse width 20ms minimum 	
	Protection	Protection is effected when PROTECTION input terminal is made open (test is disabled).	
Output signals (See Note 8)	Signal Name	Conditions for Signal Generation	Type of Signals
	TEST ON signal	Delivered during entire test-on period.	Make-contact signal and lamp
	GOOD signal	Delivered when GOOD judgment is made, for approximately 50ms.	Make-contact signal, lamp and buzzer
	W/NG alarm	Delivered continuously when NG judgment of withstanding voltage test is made.	Make-contact signal, lamp and buzzer
	I/NG alarm	Delivered continuously when NG judgment of insulation resistance test is made.	Make-contact signal, lamp and buzzer
	READY signal	Delivered when in the READY state.	Make-contact signal
Special Test Mode Selectable with DIP switches at rear of Tester	1.DOUBLE ACTION	Test starts only when the TEST button is pressed within approximately 0.5s after pressing the RESET button.	
	2.GOOD HOLD	The GOOD state is held.	
	3.MOMENTALY	Test is executed only during the period the TEST button is kept pressed.	
	4.NG ALARM	NG alarm and PROTECTION state cannot be reset by the remote-control RESET signal.	

Note 7 : The input terminal is pulled up to +15V supply voltage by resistor. Opening of the input terminals is equivalent to a high level input.

Note 8 : ① The rating of the signal contacts is 100VAC, 1A, or 30VDC, 1A.

② Loudness of the buzzer is adjustable with a knob in common for the GOOD signal and NG alarm.

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 or less	
EMC	<p>Complied with the following standards (See Note 9)</p> <p>IEC61326-1:1997-03/A1:1998-05 Electrical Equipment for Measurement, Control and Laboratory Use - EMC requirements</p> <p>Radiated Emissions Class A Conducted Emissions Class A</p> <p>IEC61000-4-2:1995-01/A1:1998-01 Electrostatic discharge</p> <p>IEC61000-4-3:1995-02 Radiated, radio-frequency, electromagnetic field</p> <p>IEC61000-4-4:1995-01 Electrical fast transient/Burst</p> <p>IEC61000-4-5:1995-02 Surge</p> <p>IEC61000-4-6:1996-04 Conducted disturbances</p> <p>IEC61000-4-11:1994-06 Voltage dips, short interruptions and voltage variations</p> <p>Under following conditions</p> <ol style="list-style-type: none"> 1. Used HV test leadwire TL01-TOS. 2. No discharge in testing. 		
Safety	<p>Complied with the following standards (See Note 9)</p> <p>European Community Requirements (73/23/EEC)</p>		
Power Requirements	Line voltage	100VAC ± 10%, 50/60 Hz (See Note 10)	
	Power consumption	When no load (RESET state) : 15VA or less (See Note 11) When with rated load : Approx. 600VA	
	Insulation resistance	30MΩ or more, 500VDC	
	Withstanding voltage	1000VAC, 1minute	
Dimensions	430W × 199H × 370D mm (16.93W × 7.83H × 14.57D in) Including extrusions : 430W × 214H × 435D mm (16.93W × 8.43H × 17.13D in)		
Weight	Approx. 24kg (53lb) Approx. 28kg (62lb) when in Line Voltage modified.		
Accessories	○ TL01-TOS High Voltage Test Leadwires, approx. 1.5m long.	1	
	○ 5P DIN plug (assembly type)	1	
	○ AC Power cable	1	
	○ "HIGH VOLTAGE DANGER" label	1	
	○ Operation Manual	1	
	○ AC Power Fuse	2	
	One in present use and the other as spare (in the fuse holder cap).		

Note 9 : CE marking are put only on the products sold in Europe.

Note 10 : Can be factory-modified to nominal 110V, 120V, 220V, 230V and 240V.

Options	<input type="radio"/> RC01-TOS Remote Control Box <input type="radio"/> RC02-TOS Remote Control Box <input type="radio"/> HP01A-TOS High Voltage Test Probe, approx. 1.5m (4.9ft) long <input type="radio"/> HP02A-TOS High Voltage Test Probe, approx. 3m (9.8ft) long <input type="radio"/> TL02-TOS High Voltage Test Readwires, approx. 3m (9.8ft) long <input type="radio"/> PL01-TOS Warning Light Unit <input type="radio"/> BZ01-TOS Buzzer Unit <input type="radio"/> BH4M-TOS Rackmount Bracket (for JIS) <input type="radio"/> BH5-TOS Rackmount Bracket (for DIN)
---------	---

Note 11 : Power consumption of the instrument modified to operate on an AC line voltage other than 100 V is as follows.

110V / 120V	: 25 VA or less
220V / 230V / 240V	: 45 VA or less

7.4 Options

The following options are provided to the Tester.

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 on the front panel 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 TEST 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.

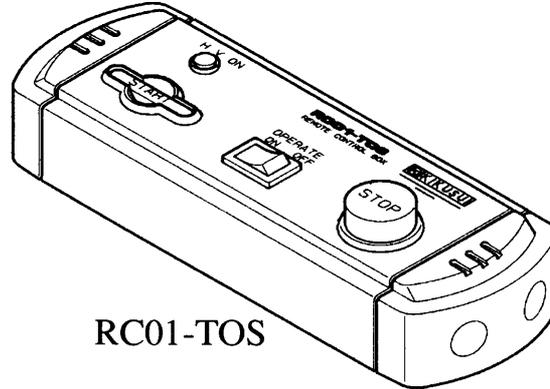
STOP switch

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.)

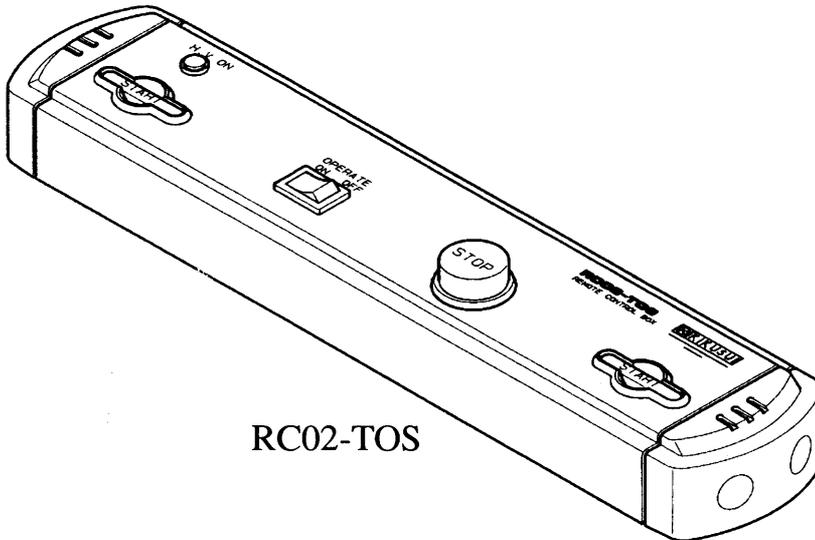
■ Dimensions

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

2) Model HP01A-TOS/HP02A-TOS High Voltage Test Probe

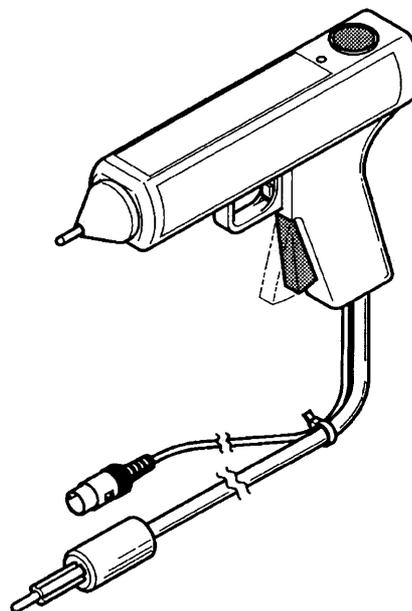
The High Voltage Test Probe renders a threefold operating safety, namely, the test voltage is not delivered unless you squeeze with one hand the slide lever of the grip of the probe and pull the trigger and you press with the other hand the switch on top of the probe, thereby occupying your both hands. 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 AC rms 50/60Hz
5kV DC

Length of cable

HP01A-TOS : Approx. 1.8 m
HP02A-TOS : Approx. 3.5m



WARNING

- The maximum voltage ratings of the probe is 4kV AC rms 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).

CAUTION

- If you need a test in compliance to the UL Standard by using the probe, set the NG ALARM mode switch (DIP switch on the rear panel) of the Tester to ON. If you have set this switch to ON, the Tester is not reset from the NG alarm has gone out even when you have released your hand from the probe. To reset it, you have to press the RESET button of the Tester. Thus, you will be securely informed of the NG alarm. For details, refer to Item "NG ALARM" on Chapter 4 "4.7 Special Test Mode"(Page 4-22).

3) Model PL01-TOS Warning Light Unit

This unit indicates that the Tester is in the TEST-ON status (delivering the test voltage).

4) 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 NG alarm signal of the tester.

5) High Voltage Test Leadwires

Model	Voltage rating	Length
TL01-TOS	5kV AC rms, 50/60Hz 5kV DC	Approx. 1.5m
TL02-TOS		Approx. 3m