INSULATION TESTERS

TOS7000 SERIES

INSTRUCTION MANUAL

TOS7010L
TOS7100L
TOS7100M

KIKUSUI

Part No. Z1-210-820, IB002423

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

(Please apply the item of ☐ mark.)

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

☐ Line Fuse: to _ _ _ _ _ A

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

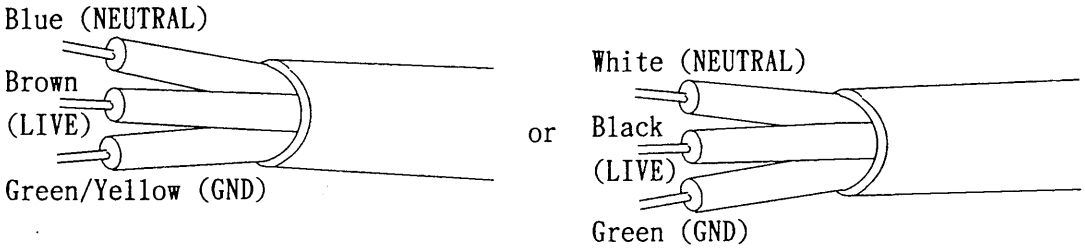

Fig. 1

Please be advised beforehand that the above matter may cause some alteration against explanation or circuit diagram in the instruction manual.

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

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

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1. GENERAL

This instruction manual is applicable in common to Models TOS7010L, TOS7100L, and TOS7100M Insulation Testers. These Testers are identical except their rated test voltages, effective measuring ranges and a few other items which are mentioned discriminately for individual models in respective cases in this manual. The major differences among the models are as shown in the following table.

Model	Rated test voltage	Effective measuring range
TOS7010L	50 V and 100 V (2 ranges)	50 V range: 0.1 MΩ - 100 MΩ
		100 V range: 0.2 MΩ - 200 MΩ
TOS7100L	500 V and 1000 V (2 ranges)	500 V range: 0.1 MΩ - 100 MΩ
		1000 V range: 0.2 MΩ - 200 MΩ
TOS7100M	500 V and 1000 V (2 ranges)	500 V range: 1 MΩ - 1000 MΩ
		1000 V range: 2 MΩ - 2000 MΩ

Models TOS7100L and TOS7100M, which have two rated test voltage ranges of 500 V and 1000 V, can be used for insulation test of electronic devices and components in compliance with the requirements of the Electrical Equipment & Appliance Control Ordinances and JIS (Japanese Industrial Standards), CEE, BS, VDE, CSA and other overseas standards as well. The maximum resistance measuring range values of the former model are 100 MΩ and 200 MΩ; those of the latter model are 1000 MΩ and 2000 MΩ.

Model TOS7010L, which has two lower rated test voltage ranges of 50 V and 100 V, can be used for insulation test of electronic devices and components which have lower dielectrics strengths and to which such higher test voltage as 500 V or 1000 V cannot be applied.

The Tester (the term "Tester" or "instrument" hereafter is used to denote any one of the three models of Insulation Testers) has an automatic GO-NOGO judgement function on the test result. The indicating meter has two pointers -- one for the measured resistance and the other for the reference resistance for GO-NOGO judgement. When the instrument has made an NG judgement, it generates an NG alarm in the forms of a lamp, a buzzer and a relay contact (make contact).

The tester has two output voltage modes which are selectable to best suit the type of test. One mode is the NORMAL mode in which case the test voltage is cut off and the NG alarm is generated at the instant an NG judgement is made. The other mode is the CONTINUOUS mode in which case the measuring voltage is not cut off even when an NG judgement is made and an alarm signal is generated while indicating the measured resistance on the meter. The alarm is automatically reset when the tested object is disconnected from the Tester, and the next object to be tested can be connected to the Tester. Thus, in the latter mode, tests can be accomplished continuedly and rapidly.

The Tester is incorporated also with a remote control function for its test/reset operations. When this function is employed in conjunction with the GO-NOGO judgement function, an automatic labor-saving insulation test system can be realized.

2. SPECIFICATIONS

Model	TOS7010L	TOS7100L	TOS7100M
Rated test voltages (nominal)	50 V, 100 V	500 V, 1000 V	
	DC (negative polarity), two ranges		
Effective measuring range	50V range: 0.1 MΩ - 100 MΩ 100V range: 0.2 MΩ - 200 MΩ	500V range: 0.1 MΩ - 100 MΩ 1000V range: 0.2 MΩ - 200 MΩ	500V range: 1 MΩ - 1000 MΩ 1000V range: 2 MΩ - 2000 MΩ
Scale centers	50V range: 2 MΩ 100V range: 5 MΩ	500V range: 2 MΩ 1000V range: 5 MΩ	500V range: 20 MΩ 1000V range: 50 MΩ

Common Specifications

Accuracy of resistance measurement	o 1st effective measuring range: ±5% of reading o 2nd effective measuring range: ±10% of reading Note 1: At 25°C ±10°C (77°F ±18°F) Note 2: The 1st effective measuring range is a resistance measuring range of 1/1000 to 1/2 of the maximum effective scale value of each scale selected. Other ranges which are not within the 1st effective measuring range are 2nd effective measuring ranges.	
Accuracy of test voltage (at measuring terminal)	When output terminals are open	Within +5% and -0% of nominal test voltage
	At scale center	95% or over of nominal measuring voltage
Indicating meter	Dual pointer type, with mirror. Black pointer: For measured resistance indication Red pointer: For reference resistance indication for GO/NOGO judgement	
Test result judgement (GO-NOGO judgement)	Type of judgement	NG judgement is made when measured resistance is smaller than the reference value.
	Setting range of reference resistance	Can be set at any point within the effective measuring range.

	Accuracy of judgement	o 1st effective measuring range: ±15% of set reference value o 2nd effective measuring range: ±20% of set reference value Note 3: At 25°C ±10°C (77°F ±18°F)
	Wait time for judgement	Approx. 0.3 sec.
	NG alarm	Lamp, buzzer, and contact signal ("make" contact, 100 V AC, 1 A or 30 V DC, 1 A)
Output mode selection	o NORMAL: When an NG judgement is made, the test voltage output is instantaneously cut off and an NG alarm is generated. o CONTINUE: Even when an NG judgement is made, the test voltage output is delivered continuously, although an NG alarm is generated. When the tested object is disconnected from the Tester, the alarm is reset and the Tester remains in the TEST ON state.	
Power line requirements	Line voltage	100 V ±10%, 50/60 Hz AC
	Power consumption	o Reset state: 10 VA or less o With output terminals shorted: 20 VA or less
	Insulation resistance	30 MΩ or over, with 500 V DC
	Withstanding voltage	1000 V AC, 1 minute
Ambient conditions	Operating temperature range	0°C to 40°C (32°F to 104°F)
	Operating humidity range	20 to 80% RH
Dimensions (Maximum dimensions)	200 W × 140 H × 270 D mm (7.87 W × 5.51 H × 315 D in.) 205 W × 170 H × 315 D mm (8.07 W × 6.69 H × 12.40 D in.)	
Weight	Approx. 3.7 kg (8.2 lb)	

Accessories	∘ High Voltage Test Leadwires (HTL-1.5I, approx. 1.5m (4.9 ft) long)	1 set
	∘ AC Power cable	1
	∘ Instruction Manual	1
Options	∘ Model 913A: Remote Control Box	
	∘ Model 914A: Remote Control Box	
	∘ Model 929-1M: Standard Calibration Resistor (1MΩ)	
	∘ Model 929-10M: Standard Calibration Resistor (10MΩ)	
	∘ Model 929-100M: Standard Calibration Resistor (100MΩ)	
	∘ Model 9203: Buzzer Unit	

Note 4: As the Tester operates on an AC line power, measurement errors may be introduced if an object which is connected to the AC line is measured.

3. PRECAUTIONS BEFORE USE

3.1 Unpacking and Inspection

The Tester is shipped after being fully adjusted and inspected at the factory. Upon receiving the instrument, immediately unpack it and check for any sign of damage which might have been caused when in transportation. If any damage is found, immediately notify the bearer and, if malfunctioning is found, notify your Kikusui agent.

3.2 Precautions for Operation

The Tester has been designed with full attention to safety because this instrument generates a high voltage. Yet, as the instrument (TOS7100L/TOS7100M) provides as high voltage as 1 kV to the external circuit, serious hazards are unavoidable unless the instrument is handled correctly. Be sure to observe the following when operating the instrument.

(1) Be sure to connect securely the GND terminal to a good grounding earth line. If grounding is imperfect, the instrument casing can be charged to the high voltage of the instrument when the output is shorted to the ground line or power line and hazards can be caused to the operator when he touches the instrument.

(2) The connection method of the test leadwire of the GND side is shown in Figure 3.1. Be sure to check for that this leadwire is not open, each time the instrument is used. Also be sure to connect at first the GND terminal to the ground line of the measured object. If it is not securely connected, the measured object becomes a floated state and a dangerously high voltage may be built up in the measured object.

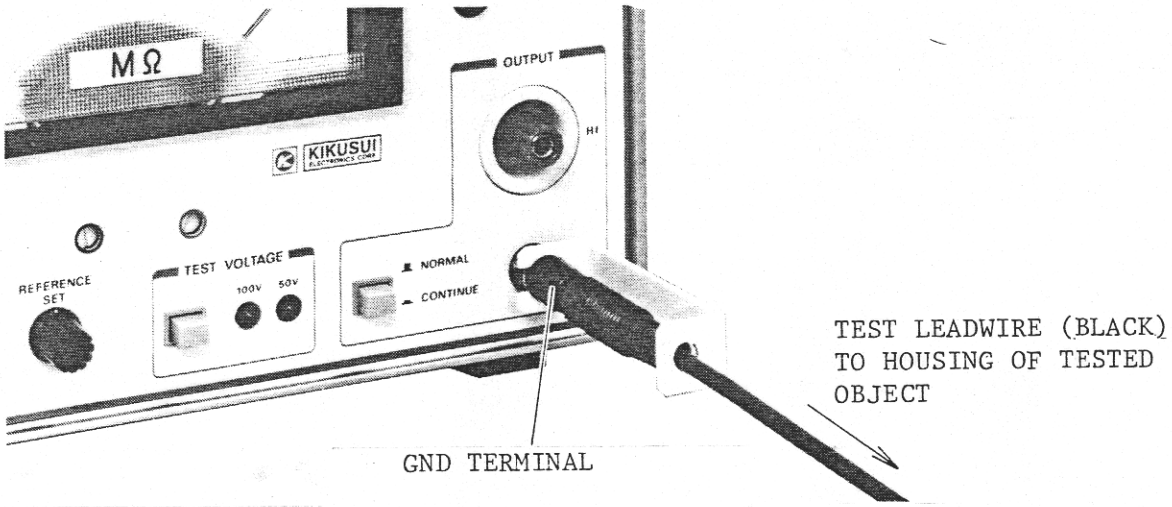


Figure 3.1

(3) Never touch the tested object, leadwires or the output terminals when the instrument is in the TEST ON state and the test voltage is being delivered. The vinyl coating of the alligator clips of the test leadwires supplied do not provide sufficient insulation against the high voltage. Never touch the alligator clip when the power is on.

Before touching the output terminals or the tested object, be sure to press the RESET button and confirm that the TEST ON lamp is OFF.

(4) Do not short the output to the ground line or AC power line, lest the instrument housing should be charged up to a hazardously high voltage. It is permissible, however, to short the high voltage OUTPUT terminal to the GND terminal when the instrument housing is grounded to an earth line.

(5) When the instrument is remote-controlled, the high voltage output is turned on and off with an external signal. When operated in this mode, be extremely careful so that the high measuring voltage output is not turned on inadvertently.

(6) In case of an emergency, immediately turn off the POWER switch and disconnect the AC power cord from the AC line receptacle.

(7) If the TEST ON lamp does not go off even when the RESET button is pressed, it is possible that the output is delivered regardless of the TEST ON/OFF control signal. When this state has occurred, immediately stop using the Tester and contact your Kikusui agent for repair.

Also when the TEST ON lamp has failed and does not turn on, immediately take the same step as above.

To operate the instrument in good conditions for a long time, pay attention to the following:

(1) This instrument operates normally with an AC power line voltage range of 100 V ±10%. If the AC line voltage is not within this range, the instrument operation becomes unstable and damage may be caused to the instrument. When the AC line voltage in your area is not within this range, step it up or down into this range using an appropriate device.

(2) Do not use or store the instrument in direct sunlight, in high temperature or humidity, or in dusty atmosphere.

Note 4: As the Tester operates on an AC line power, measurement errors may be introduced if an object which is connected to the AC line is measured.

4. OPERATION INSTRUCTIONS

4.1 Description of Front Panel

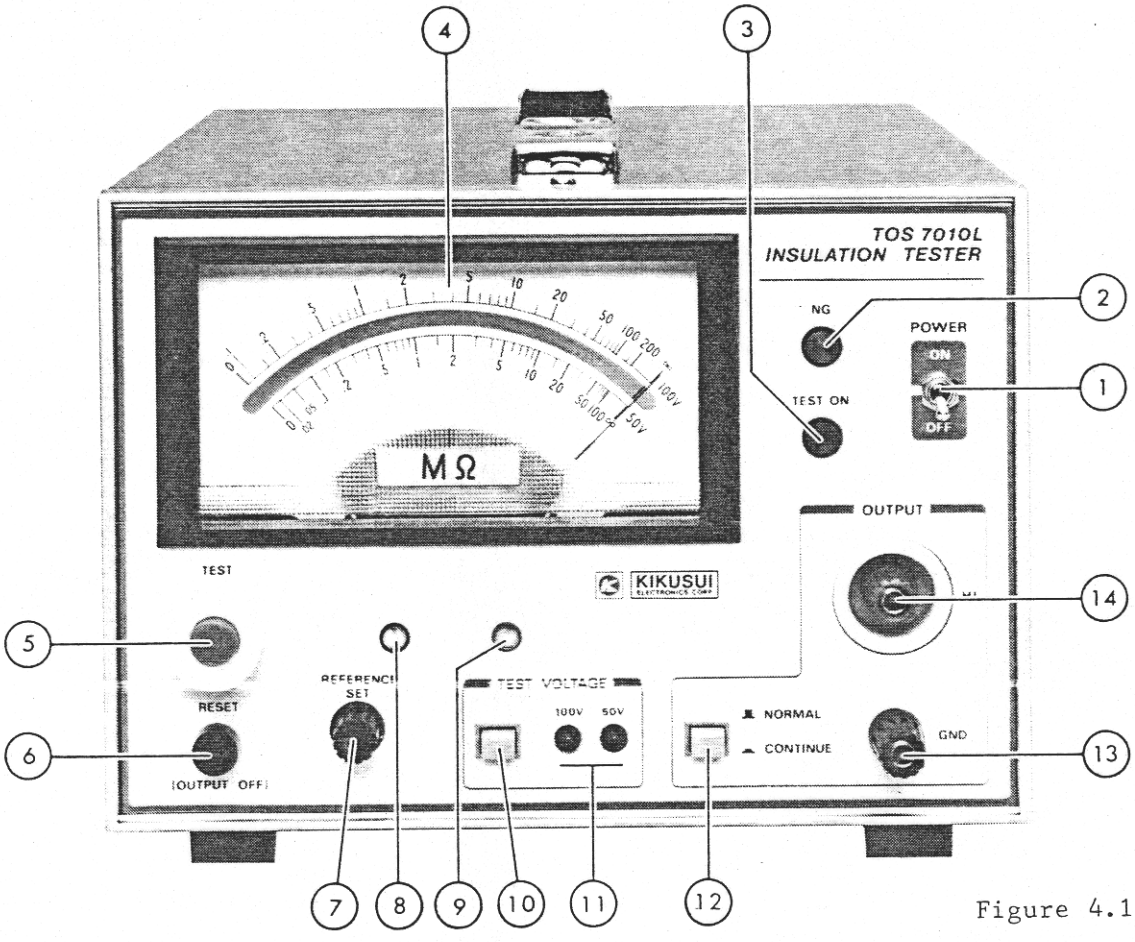


Figure 4.1

Note: Figure 4.1 shows the front panel of the TOS7010L. TOS7100L/ TOS7100M have TEST VOLTAGE lamps for 500V/1000V and indicating meters as shown below.

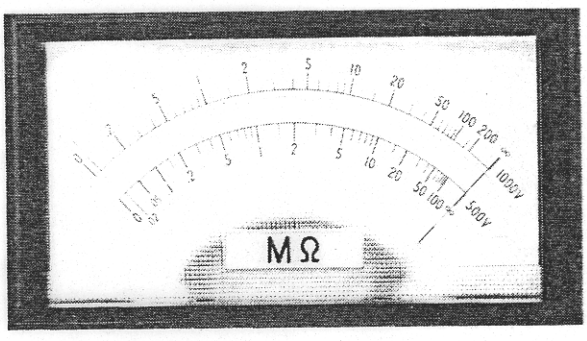


Figure 4.2 Indicating Meter of TOS7100L

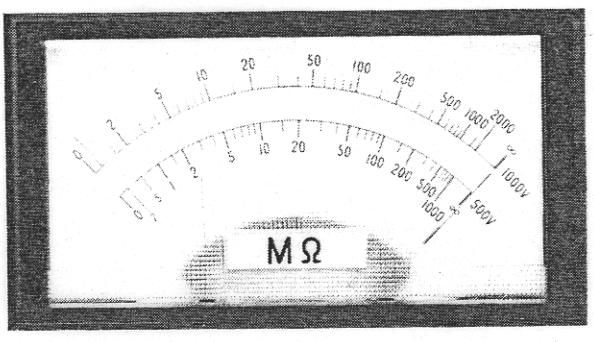


Figure 4.3 Indicating Meter of TOS7100M

① POWER (ON/OFF) switch:

Main power switch of instrument. Before turning on this switch, be sure to read Section 3.2 "Precautions for Operation."

② NG lamp:

This lamp lights to indicate the NG judgement.

③ TEST ON lamp:

This red lamp lights to indicate that the test is being done.

④ Ohmmeter:

Dual-pointer type indicating meter. The black pointer indicates the measured resistance; the red pointer indicates the reference value set for GO-NOGO judgment.

⑤ TEST button:

As you press this button, the TEST ON lamp turns on and the test voltage selected by the TEST VOLTAGE button is delivered to the OUTPUT terminal. That is, the test operation starts as you press this button.

⑥ RESET (OUTPUT OFF) button:

As you press this button, the test voltage is cut off and the instrument is reset. The NG alarm also is reset.

⑦ REFERENCE SET knob:

This knob is for setting the reference value for GO-NOGO judgment. The set reference value is indicated by the red pointer of the meter.

⑧, ⑨ ZERO controls:

For mechanical zero adjustment of the meter pointers.

⑩ TEST VOLTAGE button:

To select a test voltage.

⑪ 1000V/500V (100V/50V for TOS7010L):

To indicate the selected test voltage.

⑫ OUTPUT mode button

- o NORMAL: At the instant an NG judgement is made, the test voltage is cut off and an NG alarm is generated. As you press the RESET button, the instrument is reset and the NG alarm is cleared.
- o CONTINUE: Even when an NG judgement is made, the instrument remains in the TEST ON state (measuring state), the meter indicates the measured value, and the NG alarm continues. When the tested object is disconnected, the NG alarm is reset but the instrument remains in the TEST ON state and the next test can be made continuedly.

⑬ GND terminal:

The ground line of the test voltage. Electrically, this line is connected to the instrument chassis.

⑭ OUTPUT Hl terminal:

The hot line of the test voltage.

4.2 Description of Rear Panel

⑮ Takeups (two) for the power cord

⑯ REMOTE CONTROL connector:

When the instrument test/reset is remote controlled, the cable of the remote control box (Model 913A or other device) is connected to this connector. Be sure to read "Remote Control" of Section 4.3 before operating the Tester in the remote control mode.

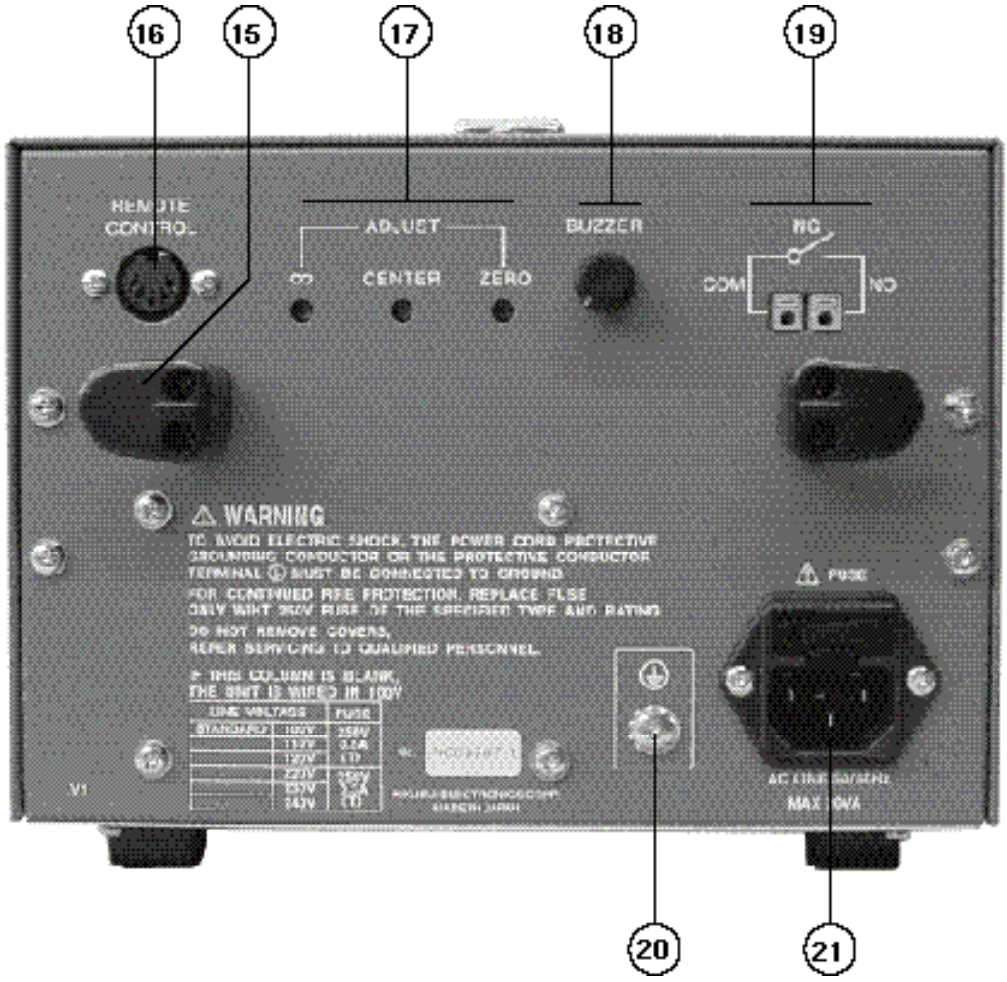


Figure 4.4

⑰ ADJUST ∞/CENTER/ZERO:

Semi-fixed potentiometers for infinitive point, center point, and zero point of the meter.

⑱ BUZZER control:

To control the loudness of the buzzer sound.

⑲ NG output terminals:

The NG alarm signal (contact signal) is deliyered.

⑳ GND terminal:

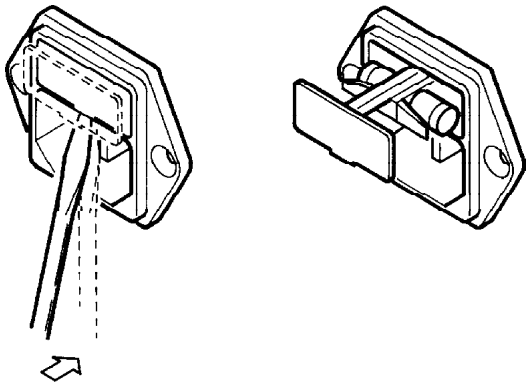
To ground the instrument to an earth ground. Be sure to ground the instrument to the earth via this terminal.

㉑ AC LINE Connector:

The AC LINE connector ㉑ is for the AC input power. It serves also as an input power fuse holder.

Exchange of fuse

(1) Be sure to check the ratings of the fuses, before connecting the AC power cable to the AC LINE connector of the Tester. The fuse holder is structured in the AC LINE connector. To check the fuse ratings, remove the fuse holder cap by using a screwdriver as illustrated below. Take out the fuses and check their ratings.



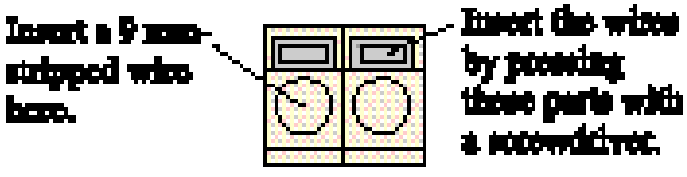
(2) After checking the ratings, put back the fuses into the cap and insert the cap into the fuse holder sufficiently — that is, until the cap clicks.
When the fuse in present use has blown out, replace it with the spare one after eliminating the cause of the fuse blow. When you need further fuses, be sure to use fuses of the correct ratings.

Nominal AC line voltage	Fuse ratings
100V	250V 0.5A S.B. 5.2 x 20
200V	250V 0.3A S.B. 5.2 x 20

WARNING

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

Connect to NG terminal



Applicable wires Single wire : φ0.4 to φ1.2 (AWG26 to 16)
Twisted wire : 0.3mm^2 to 1.25mm^2 (AWG22 to 16)
(Bare wire diameter : φ0.18 or more)

4.3 Operating Procedure

Procedure Before Test

(1) Before turning on the instrument power switch, check that both pointers of the meter are indicating the "0" scale position. If they are not indicating the "0" positions, adjust them to this position with their mechanical zero controls. If the instrument power has been on, turn it off and wait for several minutes and then check the meter.

(2) After thoroughly reading and noting the items of Section 3.2 "Precautions for Operation, " turn on the POWER switch and proceed as explained in this section.

(3) At the instant the power switch is turned on or off, the meter pointer may deflect irregularly. This is not an abnormal indication.

(4) Allow approximately 10 minutes of heat-run period so that the instrument operation is stabilized.

(5) Perform "zero adjustment" and "infinitive adjustment" as follows:

① Without connecting any item between the OUTPUT terminals (OUTPUT and GND terminals), press the TEST ON button to set the instrument to the TEST ON state, and adjust the black pointer to the center of the "∞" scale position with the "∞ ADJUST" semi-fixed potentiometer at the rear panel.

② Short between the OUTPUT terminals, turn the REFERENCE SET knob to the counterclockwise extreme position, and press the TEST ON button to set the instrument into the TEST ON state. Ajust the black pointer to the center of the "0" scale position with the "ZERO ADJUST" semi-fixed potentiometer at the rear panel.

③ To calibrate the meter for its mid-position indication, a standard resistor is needed. Never distrub the set position of the "CENTER ADJUST" semi-fixed potentiometer when no standard resistor is available.

Test Procedure

(1) Setting the test voltage:

Set the required test voltage with the TEST VOLTAGE button.

(2) Clearing of GO-NOGO judgement function:

Move the red pointer of the meter to a position more leftward than the "0" scale position with the REFERENCE SET knob.

(3) Connecting the tested object:

Press the RESET (OUTPUT OFF) button and make it double sure that the TEST ON lamp is OFF. Connect the test leadwires between the Tester and the tested object, especially carefully the leadwire of the ground line. Unless this leadwire is securely connected, the tested object may be charged up to the hazardously high test voltage.

(4) Test operation:

Press the TEST button so that the resistance of the tested object is measured and indicated by the black pointer of the meter. After reading the resistance, press the RESET button so that the output is cut off and the Tester is reset.

(5) Test for GO-NOGO judgement alone (when the resistance of the measured object is not required to be read if judgement is NG)

① Set the OUTPUT button to the NORM (⊓) state and select the required test voltage with the TEST VOLTAGE button.

② Set the red pointer of the meter to the required GO-NOGO judgement reference value with the REFERENCE SET knob.

③ Connect the tested object in the same manner as in (3). Press the TEST button.

④ If the measured resistance of the tested object is higher than the set GO-NOGO reference value, the GOOD judgement is made and the measured resistance is indicated by the black pointer although no GOOD signal is generated. When the test is over, press the RESET button so that the test voltage is cut off and the Tester is reset.

⑤ If the measured resistance is lower than the set reference value, the test voltage is cut off to protect the tested object and an NG alarm is generated. The NG alarm is in the forms of a lamp, a buzzer, and a make-contact. As you press the RESET button, the alarm is cleared and the Tester is reset.

(6) Test to make GO-NOGO judgement and to read the measured resistance in the case of NG judgement

① Set the OUTPUT button to the CONTINUE (⊓) state and select the required test voltage with the TEST VOLTAGE button.

② Set the red pointer of the meter to the required GO-NOGO judgement reference value with the REFERENCE SET knob.

③ Connect the tested object in the same manner as in (3). Press the TEST button. The black pointer will indicate the measured resistance.

④ If the measured resistance is lower than the set GO-NOGO reference value, an NG alarm in the forms of a lamp, a buzzer, and a make-contact will be generated. Different from the case of the NORMAL OUTPUT test mode of (5), even if an NG judgement is made, the test voltage is not cut off and the meter indicates the measured resistance continuously.

⑤ After reading the measured resistance, press the RESET button so that the test voltage is cut off, the NG alarm is cleared and the Tester is reset.

⑥ If you disconnect the tested object without pressing the RESET button in the above step of procedure, although the NG alarm is reset, the Tester remains in the TEST ON state. The next test can be conducted simply by connecting the next object to be tested. Note, however, you must not touch the output terminals, the alligator clips of the test leadwires, or the tested object which are charged up to the hazardously high test voltage.

⑦ If the measured resistance is larger than the GO-NOGO reference value, the operations are identical regardless of whether the OUTPUT mode is NORMAL or CONTINUE.

GO-NOGO Judgement, NG Alarm, and Contact Signal

(1) GO-NOGO judgement:

The Tester is capable of making GO-NOGO judgement by comparing the measured resistance with the preset reference value.
If the measured resistance is lower than the reference value, the instrument makes an NG judgement and generates an NG alarm.
If the measured resistance is higher than the reference value, the Tester makes a GOOD judgement although no alarm signal is generated in this case.

(2) Judgement wait time:

If the tested object has a larger capacitive component, a larger current will flow into the tested object until its

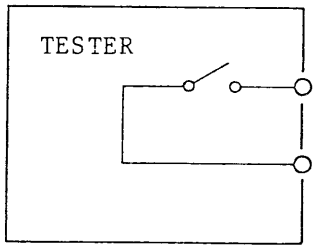
capacitive component is charged up, thereby causing a phenomenon as if the insulation resistance of the tested object is low. In order to avoid making any GO-NOGO judgement during this initial charging period, a wait time of approximately 0.3 seconds is provided.

If the test voltage application period is shorter than 0.3 seconds, the Tester does not make any NG judgement even though the measured resistance may be lower than the reference value. When operating the Tester with its GO-NOGO function, apply the test voltage for a period of approximately 0.5 seconds or over.

(3) NG alarm (lamp, buzzer, contact):

① The Tester generates an NG alarm in the forms of a lamp, a buzzer and a contact signal. The loudness of the buzzer sound is adjustable with the BUZZER loudness control on the rear panel.

The contact signal is only with a pair of contacts and without any power source as shown in Figure 4.5. Therefore, it cannot drive any load which does not have its own power source.



Note: The rating of the contact is 100 V AC, 1 A, or 30 V DC, 1A.

Figure 4.5

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 contact of the Tester is of the make-contact type and their rating is 100 V AC, 1 A or 30 V DC, 1 A. The withstanding voltage between the circuit and the chassis is 500 V AC, 1 minute.

② Examples of uses of contact signals are shown in the following:

o To drive a DC buzzer with the NG signal

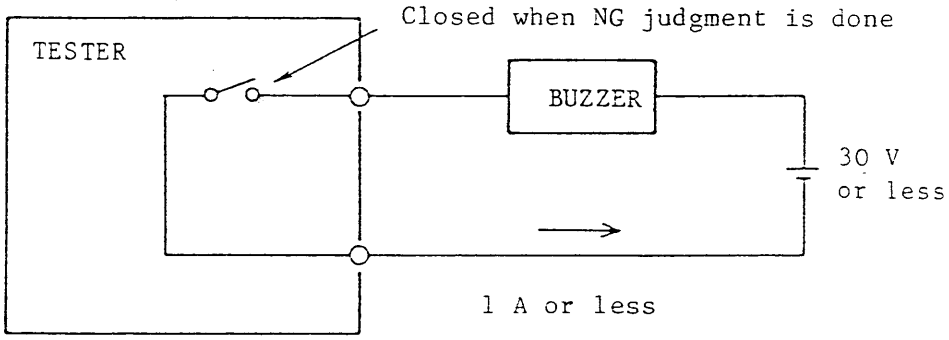


Figure 4.6

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

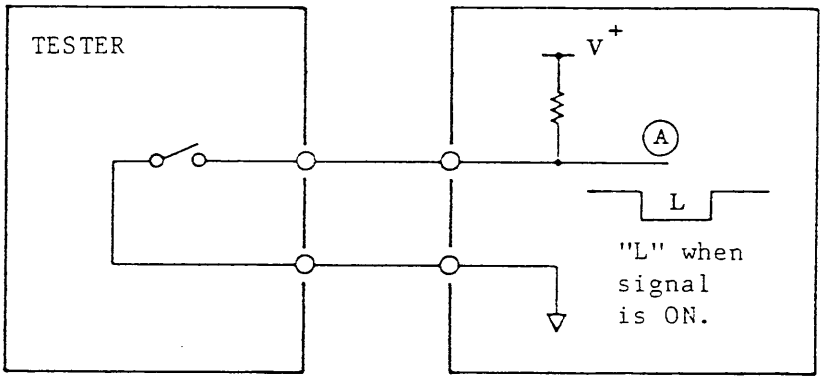


Figure 4.7

In the above 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) involves chattering, an appropriate chattering suppression provision should be incorporated depending on the nature of the circuit to be driven by this signal. In some cases, a noise suppression provision may be necessary.

Remote Control

The test/reset operation of this instrument can be remote-controlled with the remote control box (option). As the plug of the remote control cable is connected to the REMOTE CONTROL connector on the instrument front panel, the internal circuit is automatically switched to the remote operation mode. In this case, the TEST button on the instrument front panel becomes idle, although the reset operation can be done either locally on the instrument front panel or remotely from the remote control box.

It also is possible to remote-control the instrument without using the remote control box but by using other control device. This method is explained below. 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 the operator's body is not contacted with the output terminal or the test leadwires when the test voltage is being delivered. When these measures are unavailable, do not use the following remote control method.

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

(2) By controlling the TEST and RESET contacts shown in Figure 4.8, the test voltage can be on/off-controlled in the same manner as done locally at the instrument front panel.

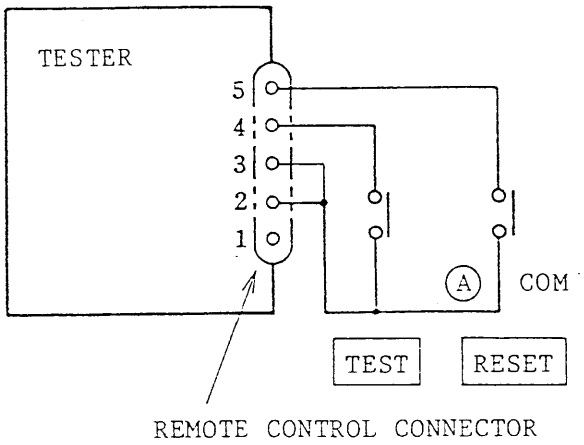


Figure 4.8

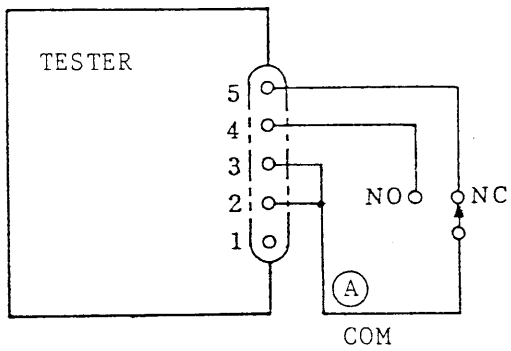


Figure 4.9

(3) In the case of the setup shown in Figure 4.9, the test voltage is turned on when the switch is thrown to the NO Position, and the instrument is forcibly reset when the switch is thrown to the NC position.

(4) Logic elements (transistors, FET's, or photocouplers) may be used instead of the switches in Figure 4.8. The signal status for such operation is shown in Figure 4.10. The input conditions of this instrument for such operation are as follows:

- o High level input voltage: 11 - 15 V
- o Low level input voltage: 0 - 4 V
- o Low level sweep out current: .2 mA or less
- o Input signal duration needed: 20 msec or less

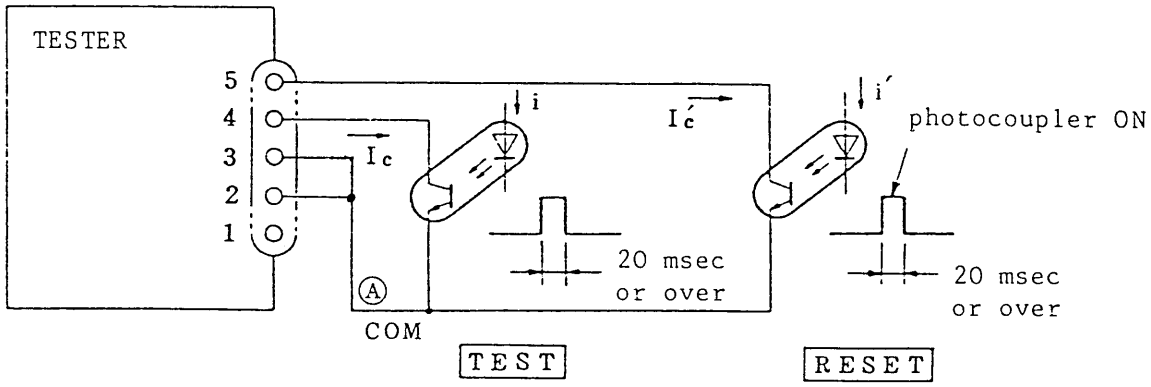


Figure 4.10

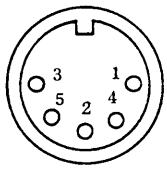
Notes: 1. Each of the gates is pulled up to +15V. If the input terminal is made open, it becomes equivalent with that a high level input is applied.

2. Pay attention for i and i' so that Ic and Ic' can be pulled by 2 mA or over.

(5) As for the elements to be connected to the Tester, the use of photocouplers as shown in Figure 4.10 or relays as shown in Figure 4.8 would be advantageous from the viewpoint of preventing erroneous system operations which could be caused by noise. Although the Tester is incorporated with the various provisions to guard it against erroneous operations caused by noise generated

by itself or its related devices, it is most recommendable to take full attention to prevent noise when setting up the measuring system.

(6) Note that the layout of pins of the REMOTE CONTROL connector is as per DIN Standard as shown in Figure 4.11 and is not in the due order of number progression.



Layout of connector pins as viewed from instrument rear.

Figure 4.11

5. OPERATING PRINCIPLE

5.1 Block Diagram

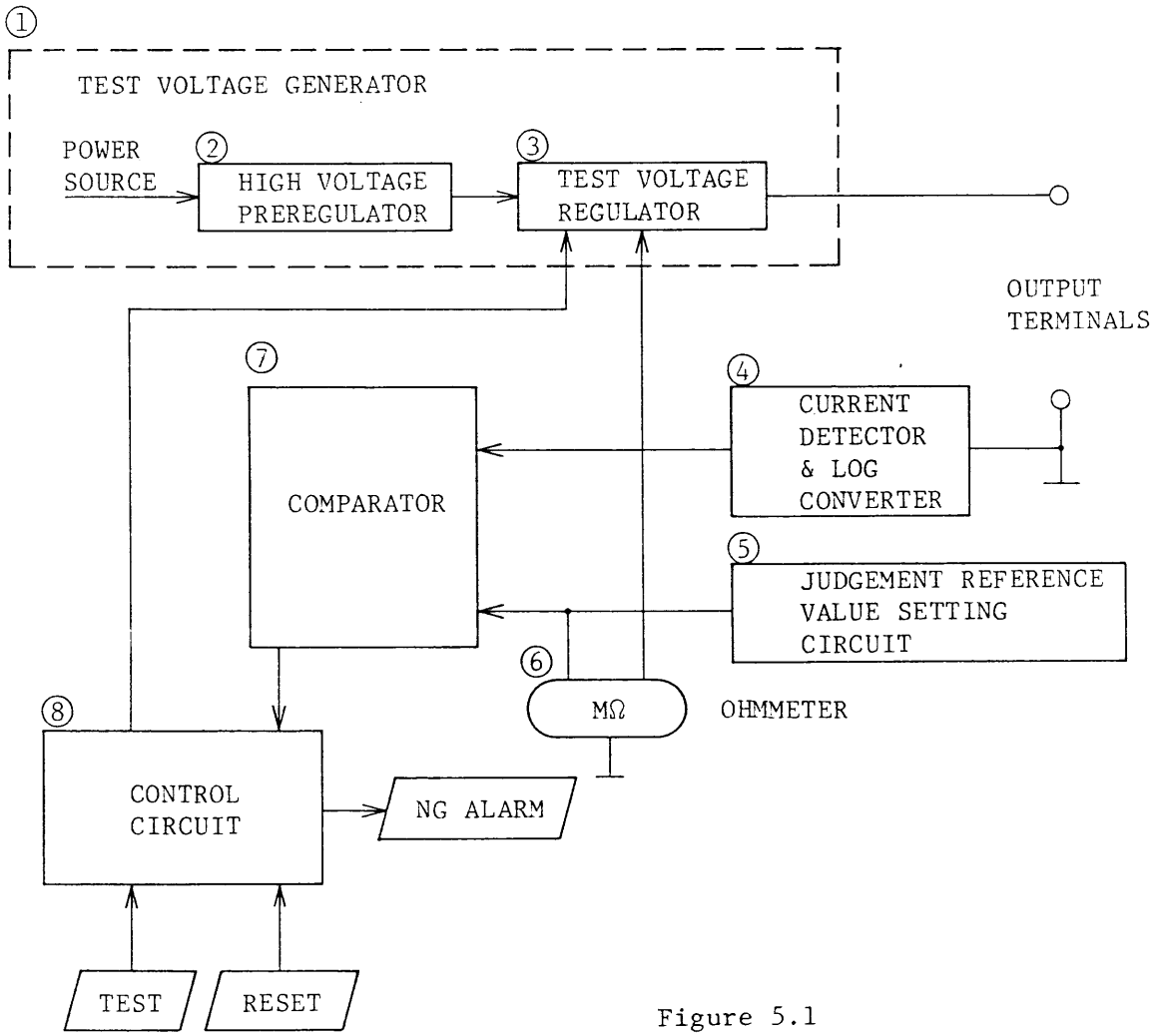


Figure 5.1

5.2 Descriptions of Individual Circuits and Components

① Test voltage generator:

This generator produces a regulated voltage for insulation resistance measurement. The generator of the TOS7100L or TOS7100M consists of ② high voltage preregulator and ③ test voltage regulator; that of the TOS7010L consists of ③ test voltage regulator alone.

② High voltage preregulator:

This circuit tripple-voltage-rectifies the input AC voltage in order to produce a high DC voltage for insulation resistance measurement. The circuit also regulates the rectified voltage in order to reduce voltage loading to the elements of the subsequent regulator circuit. The produced voltage is approximately 1150 V.

③ Test voltage regulator:

This circuit produces a regulated output voltage to be applied to the measured object. The circuit performs series control actions with its base-grounded transistors and operational amplifier.

④ Current detector and log converter:

The current which flows in the tested object varies very widely from levels of less than 1 μA to levels of several milliamperes. This circuit reliably detects such widely varying current and converts it into a log-scale signal in order to be indicated on a single scale range of the indicating meter.

⑤ Judgement reference value setting circuit:

This circuit is to set the GO-NOGO judgement reference value by means of the semi-fixed potentiometer on the panel.

⑥ Ohmmeter (indicating meter):

This meter is a dual-pointer meter. The black pointer indicates the measured resistance and the red pointer indicates the set GO-NOGO judgement reference value.

⑦ Comparator:

This circuit compares the measured resistance with the GO-NOGO judgement reference value, and generates an NG signal if the former is lower than the latter.

⑧ Control circuit:

This circuit controls the overall instrument operation. It consists of simple logic circuits with CMOS IC.

6. MAINTENANCE

6.1 Calibration

This section covers calibration of the ohmmeter externally with the semi-fixed potentiometers on the rear panel of the Tester.

Caution: The TOS7100L and TOS7100M generate a hazardously high voltage of 1.5 kV and some of their internal components are floated. Never attempt to service the Testers for yourself. For such service, please contact your Kikusui agent.

Notes for Calibration

(1) The Tester has two scale ranges for the two test voltages. For calibration, select the range which is used more frequently. When one range is calibrated, the other range also is calibrated automatically to the specifications.

(2) For calibration, prepare a standard resistor of 10 MΩ ±1% (100 MΩ ±1% for the TOS7100M) and of a voltage rating of the test voltage to be applied.

(3) Perform zero adjustment of the meter as mentioned in Step (1) of Procedure Before Test of Section 4.3 "Operating Procedure." Then, heat-run the Tester for 15 minutes or more of stabilization period.

Calibration Procedure

(1) Perform "zero adjustment" and "infinitive adjustment" as explained in Step (5) of Procedure Before Test of Section 4.3 "Operating Procedure."

(2) Connect the 10-MΩ resistor (100-MΩ resistor to the TOS7100M) between the OUTPUT terminals and press the TEST button. Adjust the black pointer of the meter accurately to the center of the 10-MΩ (100-MΩ) scale position with the CENTER ADJUST semi-fixed potentiometer on the rear panel.

(3) Repeat "zero adjustment" and "10-MΩ (100-MΩ) adjustment" alternately for a few times. And, as required, repeat "infinitive adjustment" again.

7. OPTIONS

The following options are available for this instrument.

☐ Model 913A Remote Control Box

For remote control of test and reset operations.

Specifications

Functions

OPERATE switch:

The TEST button is effective only when this switch is ON. By turning OFF this switch, the output voltage is forcefully reset.

TEST button:

The test voltage is delivered as this button is pressed when the OPERATE switch is ON and the instrument is in the reset state.

RESET button:

This button is used to cut off the test voltage or to reset the NG alarm.

Dimensions: 150 (W) × 70 (H) × 40 (D) mm
(5.9 (W) × 2.8 (H) × 1.6 (D) in.)

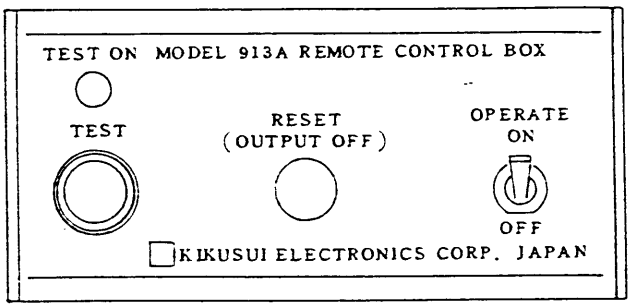


Figure 7.1

☐ Model 914A Remote Control Box

With this control box, the test voltage is delivered only when the two test buttons are pressed simultaneously.

Specifications

Functions:

Has two TEST buttons and the output voltage is delivered only when the two buttons are pressed concurrently.
Other functions are the same as those of Model 913A.

Dimensions: 280 (W) × 70 (H) × 40 (D) mm
(11.0 (W) × 2.6 (H) × 1.6 (D) in.)

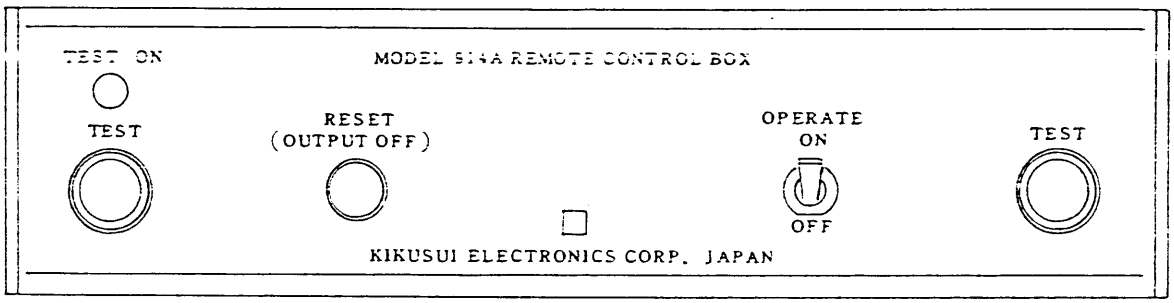


Figure 7.2

929 Series Standard Resistors

(1) These resistors are for calibration of the Insulation Testers.

- o Select a resistor of a resistance as close to the center value of the scale as possible.
- o The standard resistors can be readily connected to the OUTPUT terminals of the Testers.
- o The resistors are available with resistances of 1 MΩ, 10 MΩ, and 100 MΩ.

(2) Specifications

Model	929-1M	929-10M	929-100M
Nominal resistance	1 MΩ	10 MΩ	100 MΩ
Accuracy of resistance	1%, at 25°C ±10°C (77°F ±18°F)		
Temperature coefficient	100 ppm/°C or better		
Voltage coefficient	1 ppm/ V or better		
Working voltage rating	1.2 kV		

(3) External view and dimensions

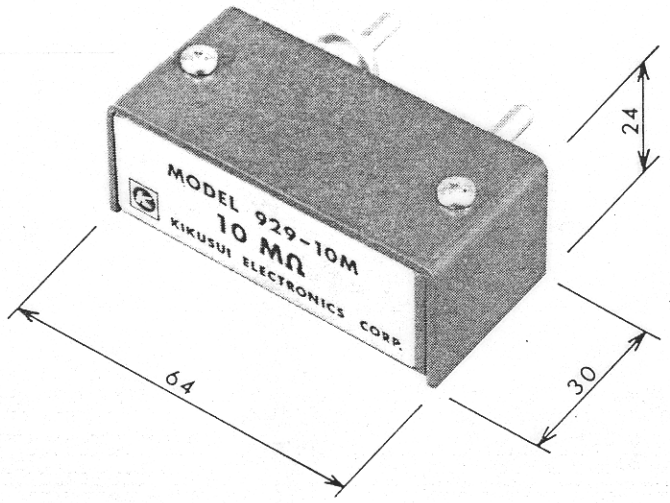


Figure 7.3

☐ Model 9203 Buzzer Unit

The Buzzer Unit may be used when the loudness of the internal buzzer of the Tester is insufficient. The Buzzer Unit can be controlled with the NG signal (contact signal) of the Tester.

INSULATION TESTERS **TOS7000 SERIES** **INSTRUCTION MANUAL**