OPERATION MANUAL

WITHSTANDING VOLTAGE TESTER

MODELS 865A & 865AZ

KIKUSUI ELECTRONICS CORPORATION

Power Requirements of this Product

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

☐ Input voltage

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

☐ Input fuse

The rating of this product's input fuse is _____A, _____VAC, and _____.

WARNING

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

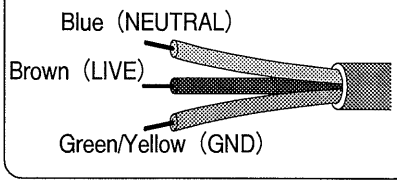
☐ AC power cable

The product is porvided with AC power cables described below. If the cable has no power plug, attach a power plug or crimp-style terminals to the cable in accordance with the wire colors specified in the drawing.

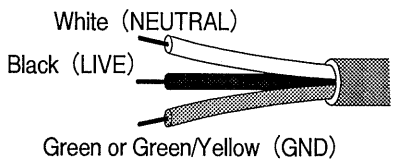
WARNING

- The attachment of a power plug or crimp-style terminals must be carried out by qualified personnel.

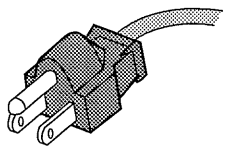
☐ Without a power plug



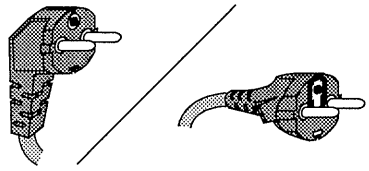
☐ Without a power plug



☐ Plugs for USA



☐ Plugs for Europe



☐ Provided by Kikusui agents

Kikusui agents can provide you with suitable AC power cable.
For further information, contact your Kikusui agent.

☐ Another Cable _____

 Kikusui Part No. Z9-000-027 IB001681

KIKUSUI

TABLE OF CONTENTS

1. GENERAL

This instruments is a withstanding voltage tester with maximum output voltage 5 kV and output rating 500 VA. The instrument can be used for withstanding voltage test (dielectric strength test) of electronic equipment and components complying with the requirements of JIS (Japanese Industrial Standards) and the Electric Appliance Control Ordinance. The instruments has a GO-NOGO judgement function, a remote control function and other auxiliary functions, which facilitate efficient withstanding voltage test realizing labor economization.

The instrument, which deals with a high voltage, has been designed with full attention to the safety of the operator.

2. SPECIFICATIONS

Power requirements: 100 V ±10%, 50/60 Hz AC

Power consumption

No load (reset state): Approx. 2 VA

Full load (5 kV, 100 mA): Approx. 600 VA

Insulation resistance: 30 MΩ or over (500 V DC)

Withstanding voltage: 1000 V AC, 1 minute

Dimensions: 300 W × 235 H × 290 D mm
(11.8 W 9.3 H 11.4 D in.)
(Maximum dimensions): (305 W × 260 H × 340 D mm)
(12.0 W 10.2 H 13.4 D in.)

Weight: Approx. 15 kg (33 lb.)

Accessories: High voltage test leads (HTL-1.5W, approx. 1.5 m (4.9 ft.)) ..... 1 set
Operation manual ..... 1 copy

Test voltage

Applied voltage: 0 - 1.5 kV/0 - 5 kV AC (2 ranges)

Output: 500 VA (5 kV, 100 mA, continuous operation up to 30 minutes), (at line voltage 100 V)

Waveform: Commercial line power waveform

Voltage regulation: 20% or less at 5 kV (at line voltage 100 V, maximum rated load → no load)

Output voltmeter

Meter: JIS Class 1.5

Scales: 1.5 kV/5 kV FS (2 ranges), even scale

Accuracy: ±3% FS

Type of indication: Average-value response, rms-value graduation

Output cutoff by leak current detection

Ranges:	0.5/1/2/5/10/100 mA (6 ranges)
Setting accuracy:	±5%
Detecting method:	Current is integrated, compared with reference value, and calibrated with rms value of sinusoidal wave.

Test method and test time

Manual and with timer

Timer set time 2 - 60 sec

Judgement of test result

When a leak current larger than the set value is detected, the output is instantaneously cut off and NG alarm is given.

NG alarm:
- o Lamp
- o Buzzer
- o Make contact signal 100 V AC, 1A
  30 V DC, 1A

Remote control

The test and reset operations can be remote controlled in the following cases:

- o When the remote control box (option) is used.
- o When the high voltage test probe (option) is used.
- o When controlled with the make contact signal of an external relay, etc.
- o When low active control is done with logical elements, etc. The input conditions of this instrument are as follows:

High level input voltage: 11 - 15 V

Low level input voltage: 0 - 5 V

Low level sweep out current: 1 mA

Note: As the internal gate is subjected to level-up with a resistor, it becomes the high level input state when the input terminal is made open.

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

Note: Model 865AZ employs a zero turn-on switch. This is the only difference from Model 865A.

Options:

- o Model 913 Remote Control Box

  Used being connected to the instrument rear connector, for remote control of test and reset operations.

- o Model 914 Remote Control Box

  The test is turned on only when test buttons are pressed with both hands. Used when extra high safe operation is required.

- o HTL-3W High Voltage Test Lead

  Test lead wire, approx. 3 m (9.8 ft.) long

- o HTP-1.5 High Voltage Test Probe

  High voltage test probe designed for high operating safety and operability. Cable length approx. 1.5 m. (4.9 ft.).

3. PRECAUTIONS BEFORE USE

3.1 Unpacking and Inspection

The instrument 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 caused while in transportation. If any damage is found, immediately notify the bearer or, if malfunctioning is found, notify the dealer.

3.2 Precautions for Operation

Model 863 Withstanding Voltage Tester has been designed with full attention to safety because this instrument handles a high voltage. Yet, as the instrument provides as high voltage as 5 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 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.

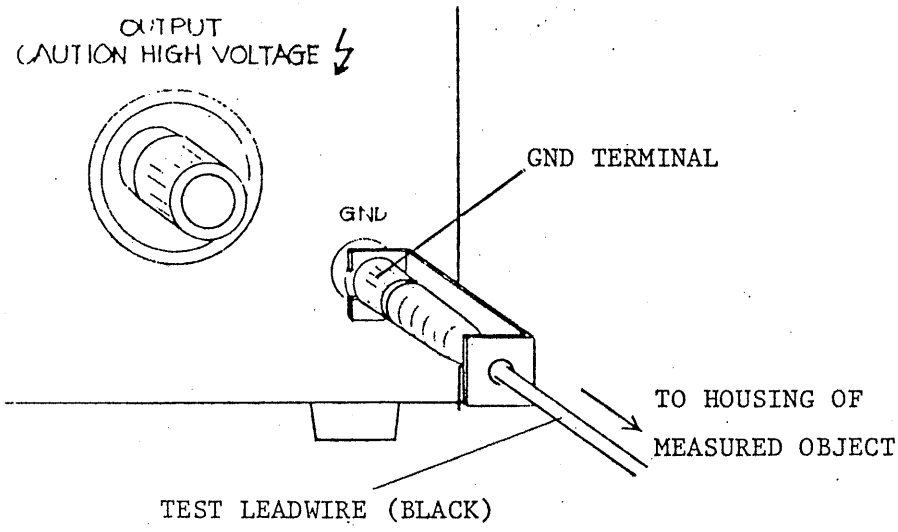


Figure 3.1

(3) Be sure to wear gloves whenever operating this instrument in order to guard against electric shock hazards.

(4) Before turning-on the power switch, make sure that the TEST VOLTAGE dial is in the extremely counterclockwise position ("0" position).

(5) Except when test is being done, turn the TEST VOLTAGE dial to the extremely counterclockwise position ("0" position). Also, press the RESET (HV OFF) button for the sake of safety. Be sure to turn-off the power switch each time the instrument is not used for a short period of time or when the operator leaves the instrument.

(6) Before changing the voltage RANGE switch, make sure that the instrument is in the reset state and the TEST VOLTAGE dial is turned to the extremely counterclockwise position ("0" position).

(7) Never try to connect or disconnect the leadwires to or from the measured objected under the state that the test voltage is applied. Never touch the tested object or leadwires when the test voltage is delivered.

(8) Before touching the test leadwires or output terminal, be sure to check the following:

(a) The output voltmeter indication is zero.

(b) The TEST ON lamp has gone off.

Also short the high voltage OUTPUT terminal to the GND terminal with the test leadwire of the GND terminal.

(9) 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.

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

(11) When the TEST ON lamp has failed and does not turn on, immediately replace it or contact Kikusui's agent in your area.

(12) 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 voltage output is not turned on inadvertently.

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

(1) When in the no-load state, the maximum output voltage of the instrument becomes higher than 5 kV. An output voltage higher than 5 kV may be produced also when the AC line voltage has surged up. Operate the instrument with an output voltage not higher than 5 kV, whenever possible.

(2) The heat dissipation capacity of the transformer of this instrument is for one-half of the rated output, from the viewpoints of size, weight and cost. Therefore, continuous operation when set at the 100-mA leak current range must not exceed 30 minutes (at ambient temperature 40°C (104°F)). If more test time is required, pause the instrument for the same period that it has been used and, then, resume operation. This requirement does not apply when the leak current range is 10 mA or smaller.

(3) 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 is not within this range, step it up or down into this range using an appropriate device.

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

This instrument employs a high voltage output transformer of 500 VA. Therefore, a large input power current (several tens amperes) may flow for several tens milliseconds before the NG signal is detected and the output current is cut off when an overcurrent has flowed in the load being tested. Pay attention to the AC line capacity and to that this large transiential current might affect other instruments connected on the same AC power line.

4. OPERATION INSTRUCTIONS

4.1 Description of Front Panel

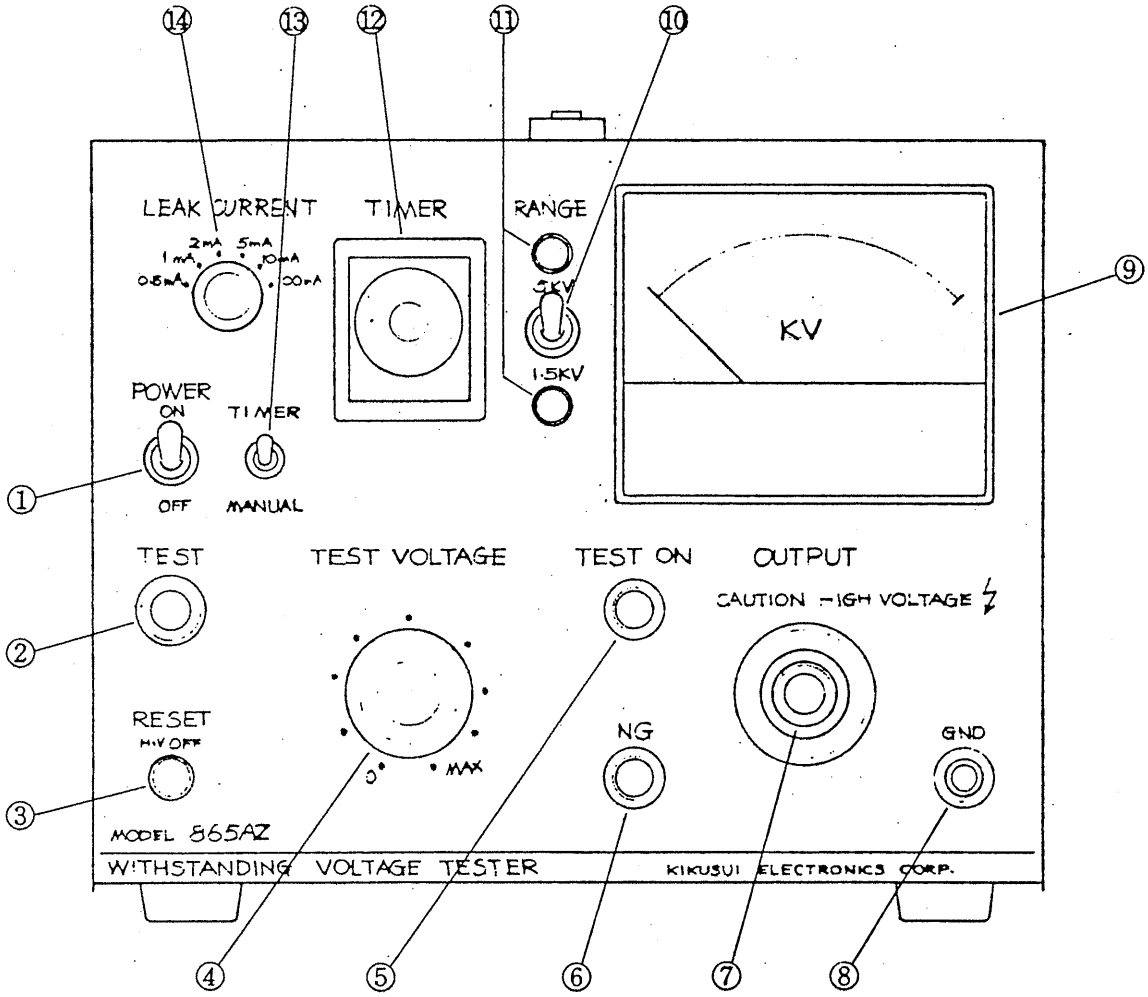


Figure 4.1

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) TEST button:

As you press this button when the instrument is not in the NG state, (5) TEST ON lamp lights and the voltage set by (4) TEST VOLTAGE dial is delivered to (7) OUTPUT terminal.

(3) RESET button (HV OFF):

To be pressed to reset the output voltage when test is over or to reset the NG state.

(4) TEST VOLTAGE dial:

For setting the test voltage. The "0" position is for the minimum output and the output increases as this dial is turned clockwise.

(5) TEST ON lamp:

This red lamp indicates that the test voltage is being delivered to the OUTPUT terminal or the test voltage is being applied.

(6) NG lamp:

This lamp turns on when the current in the tested object has become larger than the value set by (14) LEAK current knob.

(7) OUTPUT terminal:

The hot line of the test voltage.

(8) GND terminal:

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

(9) Indicating meter (output voltmeter):

Indicates the output voltage of the instrument.

⑩ RANGE switch:

Selects the test voltage range (5 kV range or 1.5 kV range).

⑪ 5kV/1.5kV lamp

Indicates the range selected by the above switch.

⑫ TIMER:

Sets the test time, with the center knob.

⑬ TIMER/MANUAL switch:

Selects the test mode (TIMER or MANUAL). When thrown to the TIMER position, the test is performed for the period set by ⑫ TIMER. When thrown to the MANUAL position, the output is applied continuously.

⑭ LEAK CURRENT dial:

Sets the reference value for leak current detection. The value can be set at 0.5, 1, 2, 5, 10 or 100 mA. If a leak current larger than the reference value flows in the tested object, judgement is done to be NG and the output is instantaneously cut off. The dial should be set at a value in conformity with the requirement of the tested object.

4.2 Description of Rear Panel

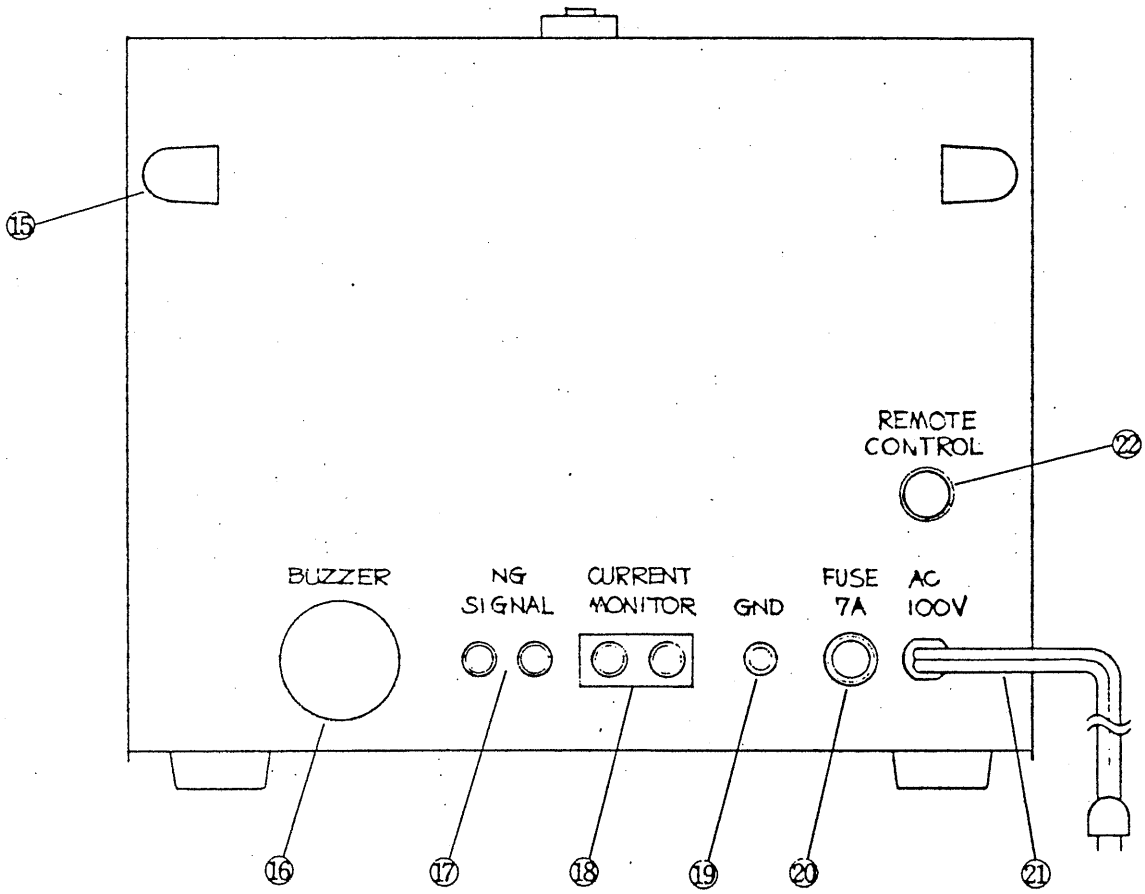


Figure 4.2

⑮ Cord take-up:

To take-up the AC power cord when not in use.

⑯ NG buzzer:

Sounds when NG state is detected. Loudness is adjustable by opening/closing its window.

⑰ NG SIGNAL terminals:

When an NG alarm state is detected, these terminals provide a contact signal ("make" when an alarm is

detected and "break" when the circuit is reset).
The contact rating is 100 V AC, 1 A; or 30 V DC, 1 A.

⑱ CURRENT MONITOR terminals:

The leak current can be directly monitored by disconnecting the shorting bar from these terminals and connecting an ammeter to them. The ammeter should be capable of measuring the current set by ⑭ LEAK CURRENT dial. The right-hand terminal is connected to the instrument chassis. Be sure to connect the shorting bar when the current is not measured.

⑲ GND terminal:

Terminal for connecting the instrument chassis (housing) to the earth ground.

⑳ FUSE:

Fuse of the AC power line (7 amperes)

㉑ AC power cord

㉒ REMOTE CONTROL connector:

When the instrument is remote controlled, the cable of the remote control box is connected to this connector.

4.3 Operating Procedures

Observing the instructions of 3.2 "Precautions for Operation," operate the instrument as follows:

(1) Turning-on the power:

After making sure that ④ TEST VOLTAGE dial is set in the extremely counterclockwise position, turn-on ① POWER switch.

(2) Setting the test voltage range:

Select the required test voltage range with ⑩ RANGE switch.

(3) Setting the leak current reference value:

With ⑭ LEAK CURRENT dial, set the leak current reference value as required by the tested object.

(4) Connecting the tested object:

After making sure that the output voltmeter and the TEST ON lamp are in the following states, short the high voltage OUTPUT terminal to the GND terminal with the test leadwire of the GND terminal, and connect the test leadwire of the GND terminal. Next, connect the test leadwire of the GND terminal to the tested object. Then, connect the test leadwire of the high voltage side to the tested object.

- o The output voltmeter indication is "0".
- o ⑤ TEST ON lamp has gone off.

(5) MANUAL test

(a) Set (13) TIMER/MANUAL switch in the MANUAL state. Press (2) TEST button. (5) TEST ON lamp will light, indicating that the test voltage is ready to be applied. Then, turn clockwise (4) TEST VOLTAGE dial so that the test voltage is applied to the tested object.

(b) When the test is over, press (3) RESET button to cut off the output voltage.

(c) If a current larger than that set by (14) LEAK CURRENT dial flows in the tested object, the instrument judges that the tested object is NG, cuts off its output voltage, and generates an NG alarm. Alarm signals are with a lamp, a buzzer and a contact signal. Alarm signals can be reset by pressing (3) RESET button.

(6) TIMER test

(a) Before connecting the tested object, press (2) TEST button and set the test voltage with (4) TEST VOLTAGE dial. Then, press (3) RESET button to cut off the output.

(b) Set (13) TIMER/MANUAL switch in the TIMER state. Set the required test time with (12) TIMER knob.

(c) Connect the tested object as Item (4) above.

(d) Press again (2) TEST button to start the test. When the period set by the timer has elapsed, the test voltage is cut off and the tested object passes the test. In this case, the instrument generates no signal.

(e) If the NG signal is generated when in the test, the operations and procedures are the same with those explained in Item (5) "MANUAL test."

(7) Re-application of test voltage:

Note that the test voltage is delivered through the OUTPUT terminal only by pressing (2) TEST button regardless of either in the MANUAL or TIMER test mode except when the NG alarm is being generated.

(8) To apply the test voltage only during the period the TEST button is depressed:

Turn (12) TIMER knob to the extremely counterclockwise position ("0" position). Depress (2) TEST button and keep depressed the button for the period the test voltage is required to be applied. As you release (2) TEST button, the test voltage is cut off. To apply the test voltage again, press (2) TEST button again. The voltage setting method is the same as the case of (6) TIMER test mode.

(9) Remote control:

This instrument can be remote controlled with the remote control box (option). As the plug of the remote control cable is connected to (22) REMOTE CONTROL connector at the instrument rear, the internal circuit is automatically switched to the remote circuit. In this case, (2) TEST button on the instrument front panel becomes idle, although the reset operation can be done either at the instrument front panel or at the remote control box.

It also is possible to remote control the instrument without using the remote control box. 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 leadwire when the test

voltage is being delivered. When these measures are unavailable, do not use the following remote control method.

(a) By controlling the TEST and RESET contacts shown in Figure 4.3, the test voltage can be on-off controlled in the same manner as done at the instrument front panel.

(b) In the case of the setup shown in Figure 4.4, the test voltage is turned on when the switch is thrown to the NO position and it is forcefully turned off when the switch is returned to the NC position.

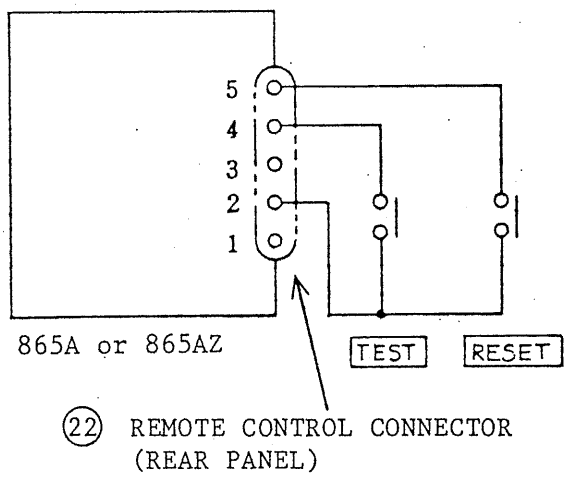


Figure 4.3

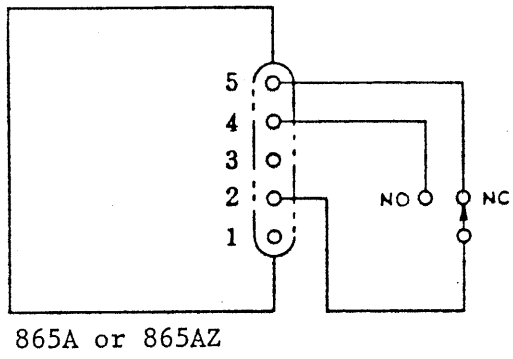


Figure 4.4

(c) Logical elements or transistors may be used instead of the switches in Figure 4.3. The signal status for such operation is shown in Figure 4.5. 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 - 5 V
- o Low level sweep out current: 1 mA

The internal gate is pulled up to +15 V with resistors. Pay attention to the withstanding voltage rating of the transistors used. The impedance between the common line of the controlling circuit and the power line or ground must be greater than 5 MΩ.

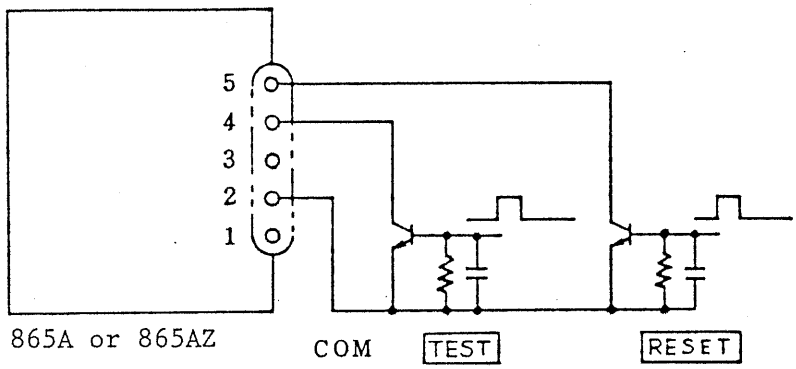
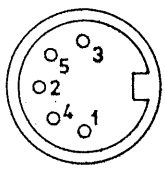


Figure 4.5

(d) 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.



Layout of connector pins as viewed from panel surface

Figure 4.6

5. OPERATING PRINCIPLE

5.1 Block Diagram

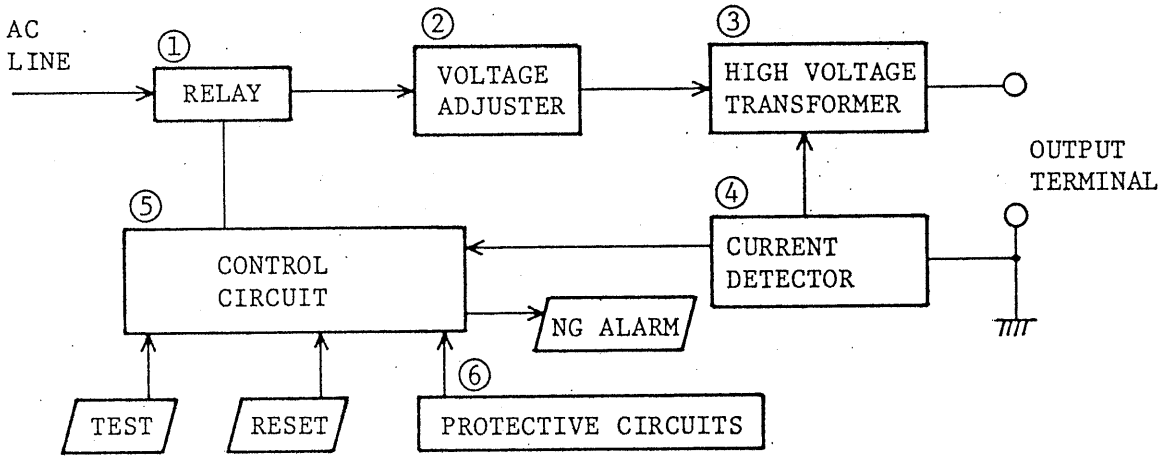


Figure 5.1

5.2 Descriptions of Individual Circuits

① Relay:

The 865A employs a regular mechanical relay for on-off control of the AC line. The 865AZ employs a semi-conductor zero-turn-on switch.

② Voltage adjuster:

A slide-transformer is used.

③ High voltage transformer:

Boosts up the output voltage of the voltage adjuster with a ratio of approximately 1:50 to obtain an output voltage of 0 - 1.5/0 - 5 kV. The rating is 500 VA (5 kV, 100 mA).

④ Current detector circuit:

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

⑤ Control circuit:

Logic circuits consisting of CMOS IC, ensuring a high operation reliability.

⑥ Protective circuits:

Provide various protective features for high voltage test safety.

5.3 Zero-turn-on Switch

The 865AZ employs a zero-turn-on switch. (This is the only difference of the 865AZ from the 865A.) The features of the zero-turn-on switch are as follows: When a regular mechanical contact type relay is used for on-off operation of the primary circuit of the high voltage transformer, transiential spike voltages are produced, thereby applying unjustified high voltages to the tested object and there is a possibility of rejecting an acceptable tested object. The zero-turn-on switch, which employ a semiconductor switching circuit, turns on and off the power line at approximately 0 level, thereby reducing transiential overshoots.

However, if the tested object is connected under the state that the test voltage is being delivered, spikes are produced at the instant of contacting and the effect of the use of the zero-turn-on switch is lost. It also is dangerous. Be sure to turn on and off the test voltage using the TEST and RESET buttons after the tested object is securely connected.

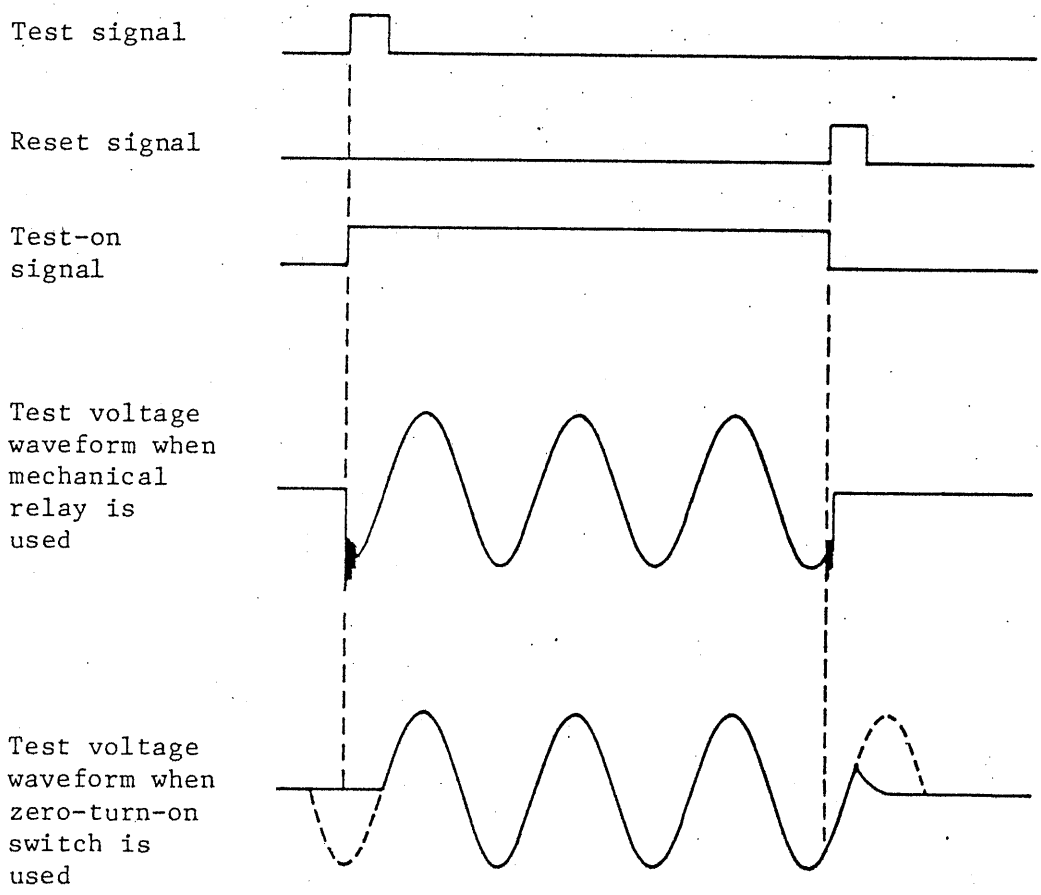


Figure 5.2

6. MAINTENANCE

This instrument generates a dangerously high voltage of 5 kV. Do not carelessly touch the instrument inside. Whenever servicing or calibrating the instrument, be sure to provide full safety measures. If such safety measures are unavailable, do not touch the inside of the instrument. Never bring your hand near the high voltage transformer and output terminal when the instrument power is on.

6.1 Calibration

(1) Devices required for calibration

(a) Voltmeter which is capable of measuring 1.5 kV/5 kV AC with an accuracy of approximately 1%. (e.g. Kikusui 149-10A Voltmeter)

(b) Ammeter which is capable of measuring 0.5/1/2/5/10/100 mA AC with an accuracy of approximately 1%.

(c) Load resistors 5k/50k/100k/250k/500k/1MΩ, with voltage rating of 500 V AC.

(2) Locations of semi-fixed resistors for calibration.

Layout of calibrating semi-fixed resistors on printed circuit board

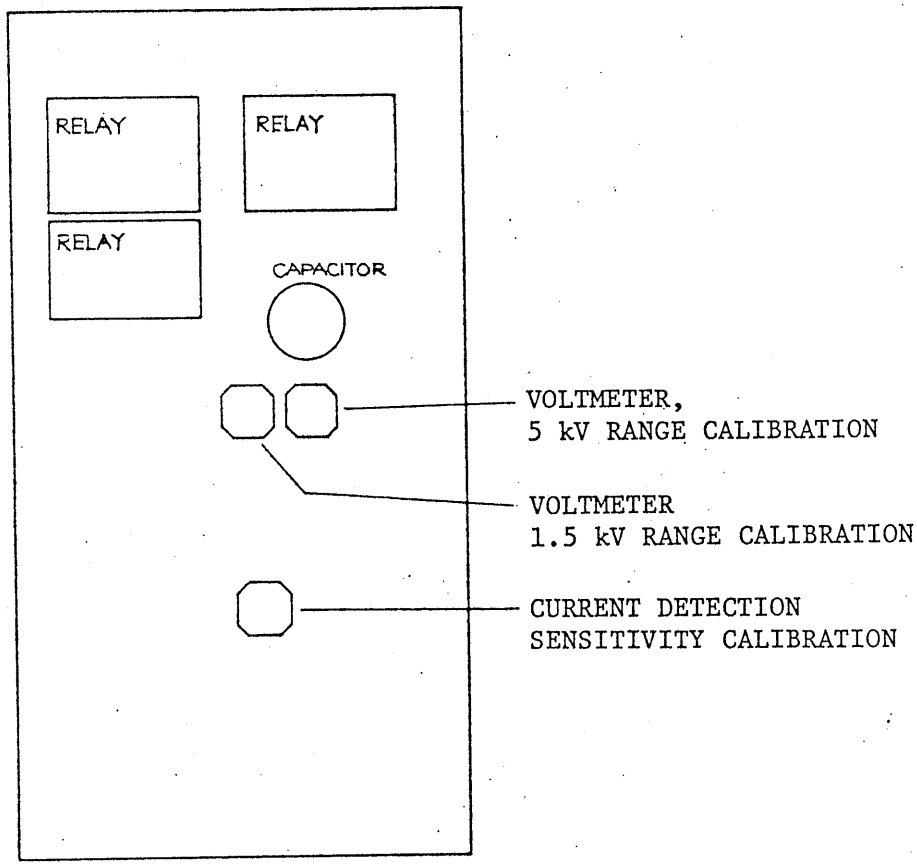


Figure 6.1

(3) Procedures before calibration

Before turning on the instrument power, check that the meter pointer is indicating the "0" scale position. If not at this position, adjust to this position with the mechanical adjuster. Then, turn on the instrument power (throw (1) POWER switch to the upper position).

(4) Voltmeter calibration

(a) Throw (10) RANGE switch on the front panel to the 1.5 kV position.

(b) Connect a calibrating voltmeter to the OUTPUT terminal of the instrument and press (2) TEST button. So adjust (4) TEST VOLTAGE dial that the calibrating voltmeter reads 1.5 kV.

(c) So adjust the VOLTMETER 1.5 kV RANGE CALIBRATION semi-fixed resistor that the voltmeter of the instrument front panel reads 1.5 kV.

(d) Press (3) RESET button, turn (4) TEST VOLTAGE dial to the extremely counterclockwise position ("0" position), and throw (10) RANGE switch to the 5 kV position.

(e) Press (2) TEST button and so adjust (4) TEST VOLTAGE dial that the calibrating voltmeter reads 5 kV.

(f) So adjust VOLTMETER 5 kV RANGE CALIBRATION semi-fixed resistor that the instrument voltmeter reads 5 kV.

(g) Press (3) RESET button to cut off the output.

(5) Leak current detection sensitivity calibration

(a) From (18) CURRENT MONITOR terminals at the instrument rear, remove the shorting bar and connect a 10-mA milliammeter in its place.

(b) Throw (10) RANGE switch to the 1.5 kV position and set (14) LEAK CURRENT dial at 10 mA.

(c) Press (2) TEST button. Gradually raise the output voltage by turning (4) TEST VOLTAGE dial, observing the milliammeter reading. The NG signal will be generated at approximately 10 mA. Read the milliammeter at this point.

(d) Repeating once more or twice the procedure of (c) above, so adjust CURRENT SENSITIVITY CALIBRATION semi-fixed resistor that the NG alarm is generated just at 10 mA.

(6) Checking the leak current detection value

At each of 0.5 - 100 mA ranges, measure the current at which the NG alarm is generated, at 500 V. The milliammeter ranges and load registors for respective ranges are as shown in the following table:

Range [mA]	Milliammeter full scale [mA]	Load resistor [Ω]
0.5	0.5	1 M
1	1	500 k
2	2	250 k
5	5	100 k
10	10	50 k
100	100	5 k

7. OPTIONS

The following options are available for this instrument.

7.1 Model 913 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
(5.90 (W) × 2.56 (H) × 1.58 (D) in.)

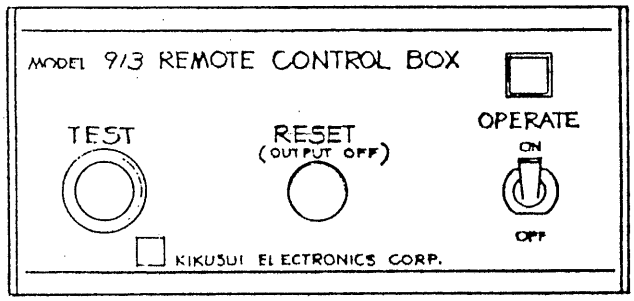


Figure 7.1

7.2 Model 914 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 913.

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

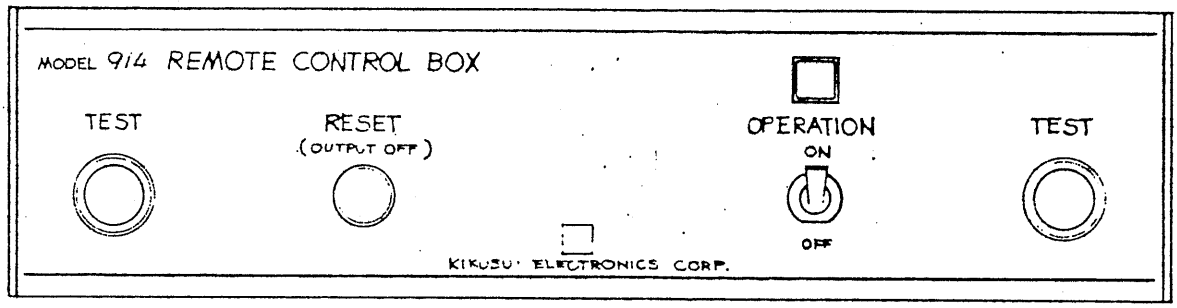


Figure 7.2

7.3 HTL-3W High Voltage Test Leadwire

A high voltage test leadwire approximately 3 m (4.9 ft.) long

7.4 HTP-1.5 High Voltage Test Probe

The HTP-1.5 is designed for high operation safety, yet maintaining good operability. The test switch can be pressed only after holding the grip, thereby preventing inadvertent turning on of the test voltage. When the test switch is released, the test voltage is reset forcefully.

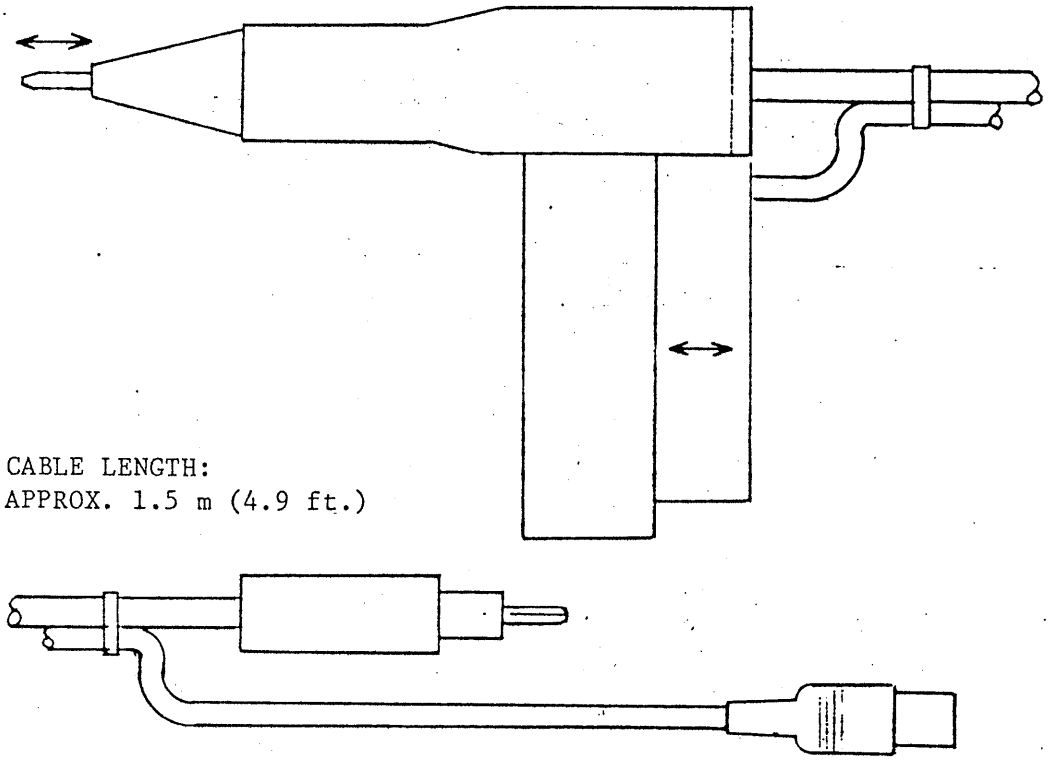


Figure 7.3