

MODEL 589
DIODE CURVE TRACER
INSTRUCTION MANUAL

This instrument, designed mainly for measuring on a cathode ray tube screen the blocking characteristics of high voltage rectifiers (including SCR) and the performance characteristics thereof at the time of small current flowing, enables to impress up to 5000V peak as for the blocking characteristics, and the safety of the operator against electric shock is considered in the manner of containing samples in a box.

KIKUSUI ELECTRONICS CORPORATION

MODEL 589 CURVE TRACER SPECIFICATIONS

Power Supply 50/60 Hz ----- V

Dimensions (maximum) 510(540)W x 488(510)H x 457(655)D mm

Weight Approx. 60 kg
 (with SPEC 40631 TEST FIXTURE attached)

Scale on CRT 10div x 10div, 8mm/div, white or
 red illumination.

Cathode Ray Tube 5UP1 F

Test Voltage Supply Line frequency rectified wave and sine wave

 FORWARD : 0~10V peak, 10A peak max. half-wave rectified

 REVERSE : 0~5kV peak, 100mA peak max. half-wave rectified

 SINE : 0~5kV peak, 100mA peak max. sine wave

Dissipation Limiting Resistor

 For high voltage range 6 ranges 0/10k/30k/100k/300k/1M ohms

 For low voltage range 6 ranges 0/1/3/10/30/100 ohms

Voltage (HORIZONTAL) Sensitivity

 High voltage range (REVERSE, SINE) 50/100/200/500/1000V /div

 Low voltage range (FORWARD) 0.05/0.1/0.2/0.5/1V /div

Current (VERTICAL) Sensitivity 19 ranges

 1/2/5/10/20/50/100/200/500 A

 1/2/5/10/20/50/100/200/500/A and 1A /div

Calibrating Voltage (Amplifier gain)

 0.5 Vp-p square wave / 10 div, both the
 voltage and current axis.

* Short time, 200mA peak is possible.

C O N S T I T U T I O N

MODEL 589 DIODE CURVE TRACER consists of the following three units contained in one case, each unit of which can be taken off readily.

1 SPEC 40581 OSCILLOSCOPE

This is an oscilloscope of 50mV/Div deflection sensitivity both the horizontal (voltage) and vertical (current), and the sensitivity can be adjusted easily by the calibrating voltage contained therein. Each amplifier input is provided respectively with a voltage divider and current detecting resistor selecting switch.

2 SPEC 40591 HIGH VOLTAGE TEST UNIT

This is the unit to generate the measuring voltage, and the selection of the switch provided on the panel enables to measure the characteristics of the test piece in the forward, reverse and both directions (such as the blocking characteristics of SCR).

3 TEST FIXTURE

This is an unit to attach at the center of the above TEST UNIT, to connect the test piece thereto, and to perform the test, and is designed to enable to perform safe and certain tests and is furthermore prepared with various types so as to meet with the purposes of use.

Example SPEC 40791 : designed for taking out the measuring voltage externally by high voltage wire.

SPEC 40631 : of drawer type that enables to test with the test piece housed.

DESCRIPTIONS OF PANEL FURNISHINGS

(SPEC 40581 OSCILLOSCOPE)

POWER (ON OFF)

is the power switch for the OSCILLOSCOPE, and when turned upwards, the power is supplied and the pilot lamp is lighted.

INTENSITY

is the CRT (cathode ray tube) intensity adjusting knob, and when rotated clockwise, the intensity is increased.

FOCUS

is the CRT focus adjusting knob and is to be adjusted so as to obtain a sharp bright line.

ASTIG

is the CRT ASTIGMATISM adjusting knob, and is to be adjusted as well as the FOCUS knob so as to obtain the best bright line.

ILLUM

is the illumination adjusting knob for the CRT scale lighting lamp, and when rotated clockwise, the illumination is increased. If the scale is taken off and turned the upper side down, the illumination can be changed from white to red color.

POSITION

is the CRT bright spot position adjusting knob, and the left one, facing to the panel, is for vertical direction and the right one for horizontal direction, and the respective clockwise rotations move the bright spot upwards and rightwards.

VERTICAL

is the vertical (current) sensitivity selector switch, and the numerical figures at the respective points indicate the current values (Peak) corresponding with one division of the CRT vertical direction.

HORIZONTAL

is the horizontal (voltage) sensitivity selector switch, and the numerical figures at the respective points indicate the voltage values (Peak) corresponding with one division of the CRT horizontal direction.

INPUT (A, B)

are the amplifier input terminals, and the left one is for the vertical (current) and the right one is for the horizontal (voltage), which are to be connected respectively by means of the accessory cords to the CURRENT SAMPLING OUTPUT terminal A and B of SPEC 40591 TEST UNIT and to the VOLTAGE SAMPLING OUTPUT terminal A and B thereof.

10 DIV CALIBRATION

are furnished in two sets on the left and right for self-calibrating the vertical (current) and horizontal (voltage) amplifier respectively, and when the push button (PUSH TO CAL) is pushed, a vertical or horizontal bright line appears on the CRT fluorescent screen. If the semi-fixed resistor (GAIN ADJ) is rotated by means of a screwdriver so that the length of the bright line becomes as long as 10 divisions, the amplifier gain is calibrated. This calibration can be performed in no relation to the setting position of the sen-

sitivity selector switch of VERTICAL, HORIZONTAL and even during the time of operation. The push button is locked by rotating clockwise in the state of being pushed in, and if the vertical and horizontal one are pushed in simultaneously, a bright line inclined by approx. 45 degrees appears.

SPEC 40591 HIGH VOLTAGE TEST UNIT

POWER (ON, OFF)

is the power switch for the HIGH VOLTAGE TEST UNIT, and turned upwards, the power is supplied and one of the three lamps (FORWARD, REVERSE and SINE) provided in the center part of the panel is lighted.

FORWARD (green) REVERSE (yellow) SINE (red)

are the indicating lamps of the measuring item that also serve as pilot lamps, and are lighted corresponding with the position of FUNCTION selector switch.

FUNCTION

is the selector switch for the measuring item and the functions at each position are as mentioned below.

This switch shall not be turned except the time when the below-mentioned TEST VOLTS knob is set to ZERO position.

(As is locked, this cannot be turned.)

	FORWARD	REVERSE	SINE
Measuring Item	Forward characteristics	Reverse characteristics	Blocking characteristics of both directions
Voltage	0 ~ 10 V peak	0 ~ 5000 V peak	0 ~ 5000 V peak
Waveform	Half-wave rectified	Half-wave rectified	Sine wave
Max. current	10 A peak	100 mA peak	100 mA peak
		Short time : 200 mA	

TEST VOLTS

is the knob for continuous control of the test voltage, and it is necessary to make it habitual to put this knob back to the zero position for the sake of safety except the test operating time (an excess force should not be given thereto)

The variable range of voltage is approximately from 0 up to the maximum voltage indicated by the above FUNCTION knob, but there is some excess voltage in consideration of line voltage drop and load regulation.

HIGH VOLTAGE DISSIPATION LIMITING RESISTOR

is the switch for selecting the dissipation limiting resistor of the high voltage ranges (REVERSE and SINE), and enables to prevent the test voltage supply from damage at the time of the test piece short-circuited.

LOW VOLTAGE

DISSIPATION LIMITING RESISTOR

is the switch for selecting the dissipation limiting resistor of the low voltage range (FORWARD).

CAPACITY BALANCE, FINE

The characteristics of high voltage and small current may trace a loop because of the parallel capacity of the test piece, and this knob is for compensating the foregoing. The inner red knob is for the fine adjustment.

TO EXT SAFETY CONTROL

is the external connecting terminal of the safety switch for high voltage, and when not in use, the accessory plug shall be inserted therein. The method of use will be described in the section 「PRECAUTIONS FOR OPERATION」.

CURRENT SAMPLING OUTPUT (A, B)

A is the output terminal for measuring the current that flows through the test piece, B is the output terminal for the said CAPACITY BALANCE, and the both shall be connected by means of the accessory cords to the vertical INPUT A and B of the SPEC 40581 Oscilloscope. The A cord is the passage of the measuring current, and if this is disconnected during the time of measuring high voltage, the high voltage may come out to the output terminal thus causing a dangerous state. When the cord is not connected, the resistance between the terminal A and earth is $100K\Omega$.

VOLTAGE SAMPLING OUTPUT (A, B)

are the output terminals for measuring the voltage at the both ends of the test piece, and shall be connected by means of the accessory cords to the horizontal INPUT A, B of the SPEC 40581 Oscilloscope in like manner as the above. In case of the high voltage ranges (REVERSE SINE), the voltage to be impressed upon the test piece is given to the output terminal being previously divided into 1/1000, so that it is not dangerous to remove the cord during the measuring operation.

SPEC 40581 OSCILLOSCOPE PRECAUTIONS OF OPERATION

THE ORIGINAL POINT OF THE TRACE ON THE SCREEN

The original point of the characteristic curve is almost stabilized at some 5 minutes after starting, but even after that time, it may somewhat move by time-passing and power voltage fluctuation due to the drift of the vertical and horizontal amplifier, so that [POSITION] knob shall be adjusted at each time of movement. If the original point is stopped in a high intensity for a long time, the part on the fluorescent screen is burnt, so that [INTENSITY] shall be lowered or [FOCUS] be lost for avoiding the foregoing.

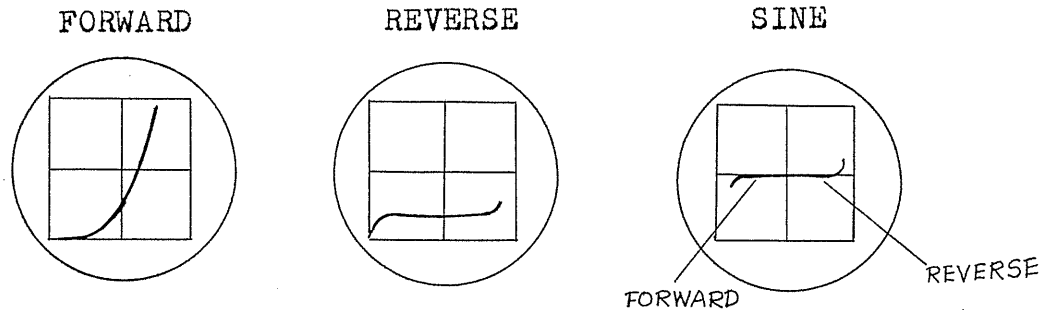
If the bright spot has a width due to the residual voltage of the slide type auto-transformer even when [TEST VOLTS] knob of the test unit (particularly, when the waveform is SINE), the original point shall be confirmed by turning OFF the [POWER] switch of the test unit.

Polarity of characteristic curve

When a signal of plus polarity is given to the vertical INPUT A, the bright spot moves upwards, and likewise a plus signal is given to the horizontal INPUT A, it moves rightwards, and as for the INPUT B, the states become reverse. The input resistance of

each terminal is $100K\Omega$ constant at the horizontal INPUT A, B and ~~vertical INPUT B~~, and it differs at the vertical INPUT A^B, depending upon the position of the VERTICAL sensitivity selector knob.

The polarity of the characteristic curve when connected to the SPEC 40591 High Voltage Test Unit becomes as shown below.



If the test piece is connected contrary to the polarity indication mark provided on the test fixture, the characteristics contrary to the above are traced, but the direction to which the bright line is extended is not altered. That is to say, they become FORWARD \rightarrow REVERSE REVERSE \rightarrow FORWARD, and at the time of SINE, the rightward and upward direction from the original point show the FORWARD characteristics.

Inclination of CRT vertical and horizontal bright line

The CRT vertical and horizontal bright line are inclined depending upon the setting position and direction and become not to be parallel with the scale lines. On such an occasion, pull the chassis out of the case, loosen the CRT socket part, and make adjustment by rotating the CRT. At this time, utilize 10 DIV CALIBRATION for obtaining the vertical and horizontal bright line.

Operation of overcurrent relay

The overcurrent relay operates depending upon the position of the CRT bright point, and when the characteristic curve comes

out of the scale lines by several DIV upwards, it opens the primary side of the test voltage transformer. Accordingly, it operates when the current reached to approximately 12 ~ 15 times as much as the value indicated by the current (vertical) sensitivity selector switch with the original point of the bright line put on the lowest horizontal scale line. The sensitivity of the relay circuit can be adjusted by the semi-fixed resistor provided on the left side of the chassis inside the oscilloscope. (see the Fig at page 17.)

SPEC 40581 OSCILLOSCOPE MAINTENANCE

DC BALANCE

If this balance is lost, the original point inconveniently moves at the time of adjusting the GAIN ADJ of the 10DIV CALIBRATION on the panel. The semi-fixed resistor of DC BALANCE is inside the case (see the Fig at P.17). The adjustment shall be performed by rotating the GAIN ADJ with the DC BAL semi-fixed resistor set to various positions, confirming the direction in which the movement of the original point is lessened and finding out the point where no movement is made.

CAL V ADJ

is the internal square wave voltage adjusting semi-fixed resistor to be used at the time [10DIV CALIBRATION], and is equipped at the ^{left side} of the chassis (see the Fig at p.17). The voltage is 0.5V P-P, utilizing the same square wave both the vertical and horizontal. Accordingly, give a correct 0.5V thereto from the outside, and perform the adjustment so that the movement

of the bright spot at this time and the bright line length at LODIV CALIBRATION become equal. For example, put the bright spot on the most leftward of the vertical scale lines of the CRT in the first place, give a correct 0.5V +DC voltage (or the rectangular wave** of plus polarity) to the horizontal INPUT terminal A, and the bright spot will move on the horizontal line rightwards by some LODIV. (or will be the bright line in length of LODIV) If the push button of the horizontal LODIV CALIBRATION is pushed at this time, a bright spot by the internal square wave voltage appears this time, so that the adjustment can be attained by putting the positions of the both together. Also, the semi-fixed resistor can be adjusted to be 0.5V P-P by observing the internal calibrating voltage directly by means of the oscilloscope of which sensitivity is calibrated. (see the Fig. at P.17)

* Horizontal sensitivity selector switch: Max. sensitivity
in the position of 0.05V/DIV

** For example, the output of MODEL 494 Calibrating Square
Wave Oscillator by our firm

- HV ADJ

is the voltage adjusting semi-fixed resistor for the regulated high voltage power supply for the CRT, and is provided inside the case (see the Fig. at P.17), and is to be adjusted by a screwdriver. Measure the cathode (pin 3) of the CRT by means of a vacuum tube voltmeter (our MODEL 107 VTVM) and set to -1100V.
For example,

SPEC 40591 HIGH VOLTAGE TEST UNIT PRECAUTIONS OF OPERATION

Precautions against high voltage

This instrument deals with more than 5KV maximum, and sufficient care shall be taken to handling in consideration of an emergency, though this is provided with various safety devices.

- 1) It is preferred to use with the panel grounded.
- 2) Except the time of operation, keep TEST VOLTS knob set to zero, FUNCTION knob to FORWARD and POWER switch to OFF.
- 3) TEST FIXTURE shall be handled after reading the instruction manual carefully.

Safety devices

Unless the TEST VOLTS knob is returned to zero, the FUNCTION selector switch on the panel is locked not to be rotated in order to protect the internal test voltage source and test piece.

When the test piece connecting terminals (red and white) are connected with high voltage lead wires and to be used by drawing out to the outside, the connector (TO EXT SAFETY CONTROL) for the external protection circuit on the panel shall be utilized for sake of safety. The connector is connected as shown in Fig at P.14 and is inserted between their terminals 1~2 on the primary side of the slide transformer of the measuring power inside this instrument, and is to be used by short-circuiting at all the times. (The short circuit is attained in the plug between the terminals 1 ~ 2 of the accessory plug) If once 1 ~ 2 is cut off, the internal relay operates, but when they are short-circuited again, they are not reset immediately unless the TEST VOLTS knob on the

panel is returned to zero. Accordingly, if a point between these terminals is connected to the door switch of an external test board or the like, it can be a safety device against high voltage. A point between the terminals 3 ~ 4 is connected in parallel to the primary side of the above slide transformer (in like manner as the internal red lamp), and since AC 100V appears during the operation of the test voltage supply, it can be used as a power supply for the external indicating lamp or the like.

Duty Control Adaptor

To decrease the dissipation in the sample under test, repetition of test voltage may be reduced by using DUTY CONTROL ADAPTOR (Spec 60131) connected externally. In this case, repetition are as follows.

Line Freq.	Repetitions
50 Hz	50, 25, 10, 5, 2, 1 PPS
60 Hz	60, 30, 12, 6, 2, 1 PPS

Dissipation limiting resistor

is to be used by selecting an adequate value from the allowable loss or the like of the test piece, but it is preferred to select a large value as much as possible in order to protect the test piece and internal test voltage supply. This instrument is provided with the limit resistors separately for high voltage (REVERSE SINE) and low voltage (FORWARD) respectively.

High voltage fuse

In order to prevent the internal test voltage supply from damage that may be caused by shortcircuit or overcurrent in the high voltage range, the test piece connecting terminal is provided with the vacuum fuse of 0.1A RMS rating in series. When blown, take off the lid on the right side of the case and change it. And the fuse to be replaced shall be of the rated current as small as the purpose of use permits.

CAPACITY BALANCE

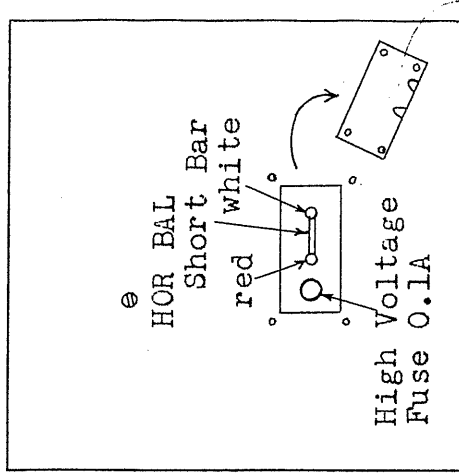
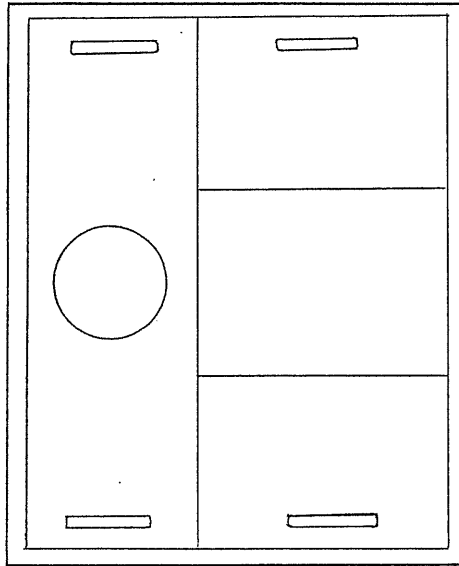
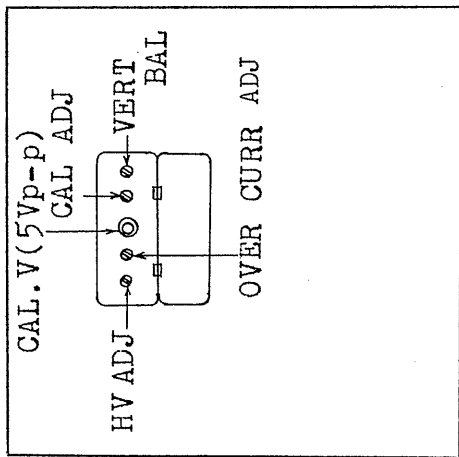
is the knob for erasing the loop in trace due to the parallel capacity of the test piece, and operates in the μA range ($1\mu\text{A}/\text{DIV} \sim 500\mu\text{A}/\text{DIV}$) of the oscilloscope (SPEC 40581). When the test voltage is taken out to the outside by connecting a lead wire the test connecting terminal of this instrument, the parallel capacity between the terminals shall be lessened as much as possible. Otherwise, the compensation may be insufficient.

SPEC 40591 HIGH VOLTAGE TEST UNIT MAINTENANCE

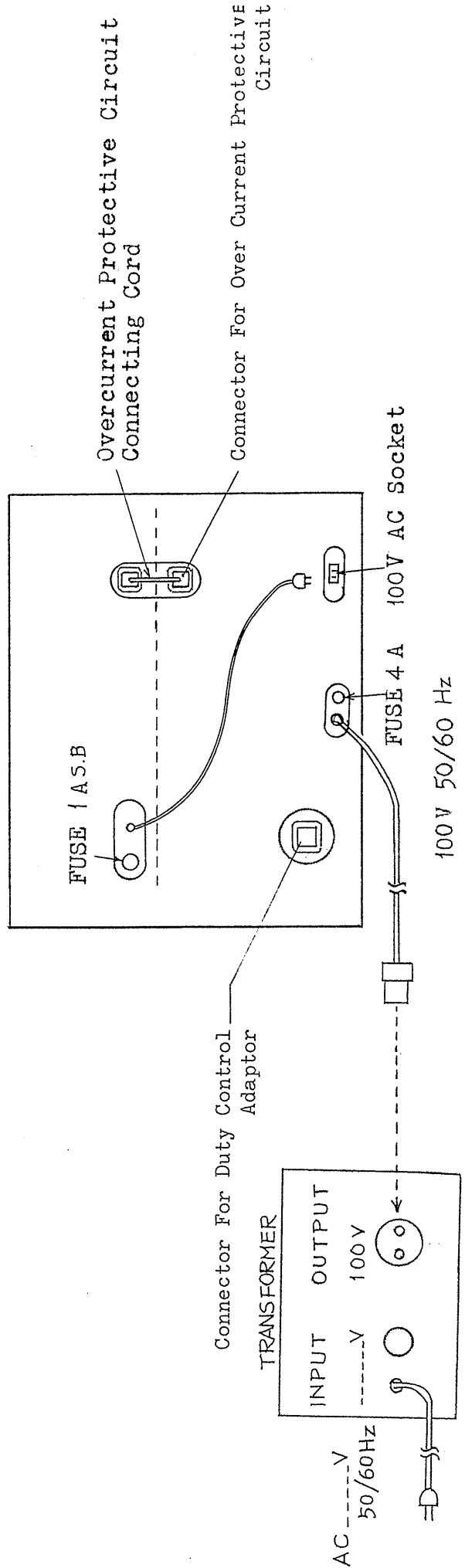
Since this instrument contains a high voltage transformer, sufficient care should be taken in handling, and in case of pulling it out of the case for inspection, repair or the like, the power supply cord shall certainly be pulled off beforehand.

When the primary side of the test voltage transformer is electrified, the internal red lamp is lighted, but in consideration of emergency of lamp disconnection, it is safer to turn the POWER switch OFF and pull off the line cord for such works as connecting a high voltage lead wire and changing the high voltage fuse, etc.

Always check the operating state of such safety devices as the door switch of the TEST FIXTURE, the switch for resetting the TEST VOLTS, the above red lamps, etc., and if any be found uncertain, repair it immediately for avoiding the danger.



HIGH VOLTAGE
DANGER



SPEC 40631

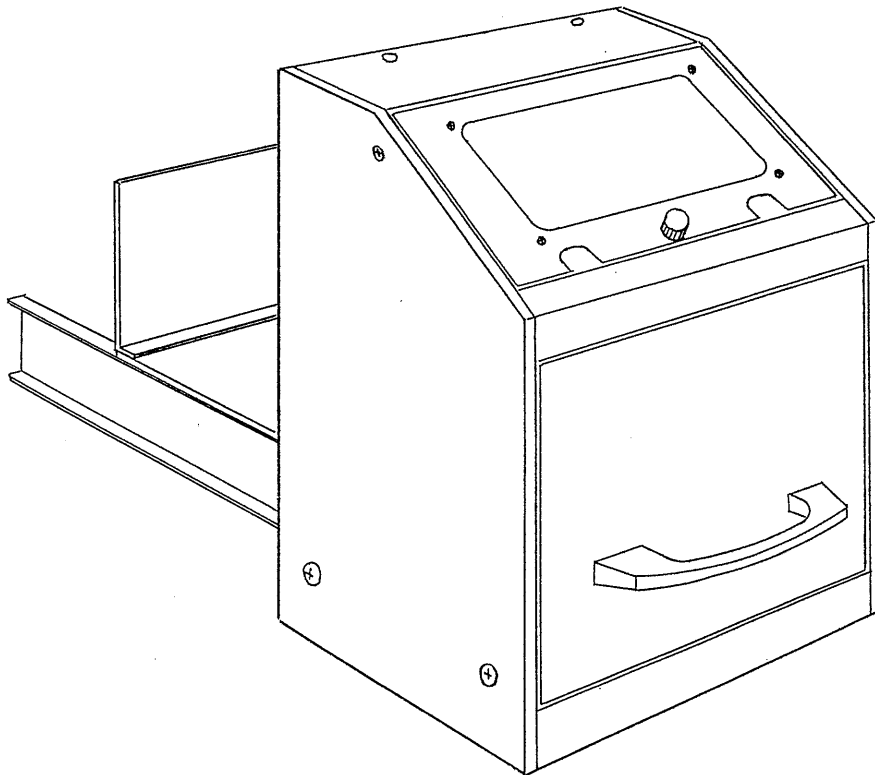
TEST FIXTURE

INSTRUCTION MANUAL

KIKUSUI ELECTRONICS CORPORATION

J a p a n

SPEC 40631 is an universal diode test fixture designed for conveniently testing the various types of diodes, in which both the drawer type test board and the test piece connecting terminals inside the door are connected to the testing circuit of [HIGH VOLTAGE TEST UNIT] when this fixture is connected to the test piece connecting terminals (white and red) of [HIGH VOLTAGE TEST UNIT] by means of the banana plugs.



SPECIFICATION

Dimensions (Case part)	225H x 150W x 150D mm
(Maximum)	240H x 155W x 420D mm
Weight	Approx. 3 Kg

Test piece connecting terminals Spaced by 50mm between the white
and red binding post terminals

Door switch Interlocked with the microswitch of HIGH VOLTAGE
TEST UNIT

Drawer type test board To be pulled out to this side by approx.
240mm when a diode is to be set.

Suitable to 12mm~24mm diode screw diameter.

Suitable to 140mm~200mm diode lead length.

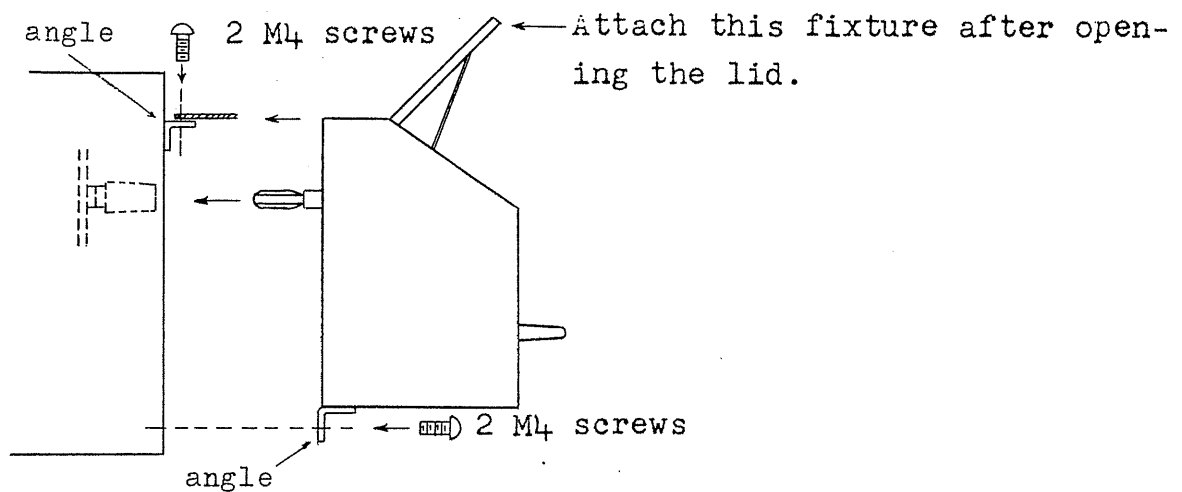
Diode polarity selection Changeable by the banana plug switch
(direction as indicated by the polarity marking)

Drawer test board switch When the drawer is pulled out more than
10mm, the microswitch operates so that the primary
side of the test voltage source is turned off.
When the drawer is pulled out more than 25mm, the
test piece setting clip bolt and banana plug switch
provided on the test board are cut off from the test
voltage source by the action of the knife switch.

DESCRIPTION OF OPERATION

Method of attaching this fixture :

To attach this fixture to HIGH VOLTAGE TEST UNIT, open the door,
then insert the two banana plugs of this fixture into the test
piece connectig terminals (white and red color) of HIGH VOLTAGE
TEST UNIT, push the fixture, as it is, slowly to HIGH VOLTAGE TEST
UNIT so that the top board of this fixture comes on the overhung
angle of the unit, fasten the board to the angle by means of two
4mm screws, and also fix the angle furnished at the bottom of this
fixture to HIGH VOLTAGE TEST UNIT in like manner by means of two
4mm screws. This can be removed by taking the reverse steps of the
above procedure.



Test piece connecting terminals

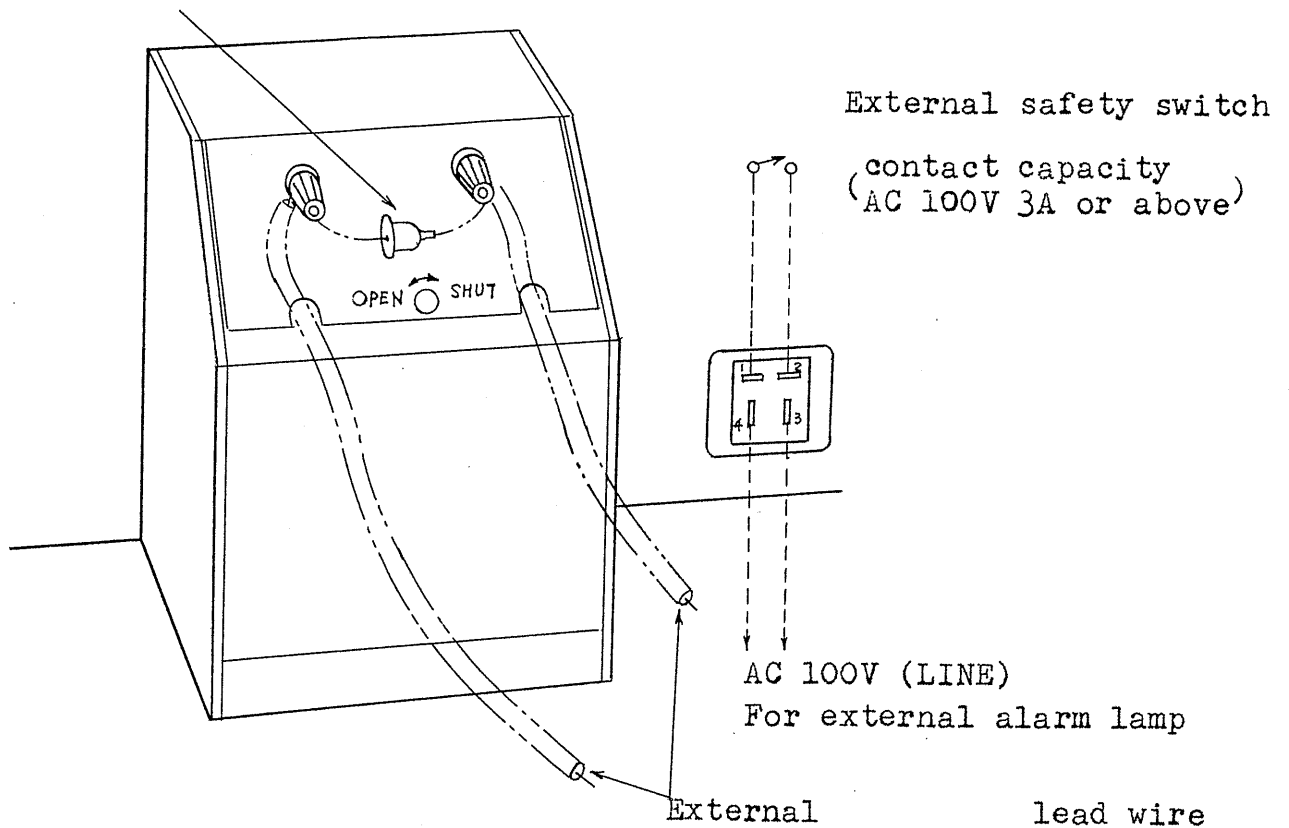
The white and red terminals viewed through the glass of this fixture are the test piece measuring binding posts connected with [HIGH VOLTAGE TEST UNIT], and used for connecting with the diodes of small size or lead wires.

Door

The test piece connecting terminals can be dealt with by rotating ^{counter,} clockwise the center metal knob and opening the door upwards. As soon as the door is opened, the microswitch having been set to the primary side of the test voltage source of [HIGH VOLTAGE TEST UNIT] operates to turn to the OFF side.

When the door is shut, the red lamp inside [HIGH VOLTAGE TEST UNIT] lights and indicates that the primary side of the test voltage source is turned ON. The two holes provided along the front edge of the door are for drawing out the lead wires, but, in this case, the handling of the high voltage shall be sufficiently cautious by attaching a safety switch outside.

Example of a small size
test piece connected



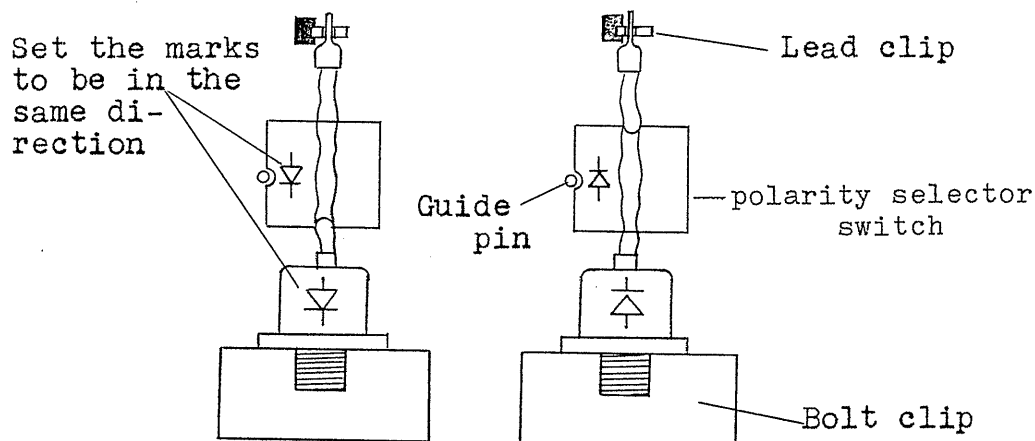
Drawer type test board

When the handle of the panel is pulled this side horizontally, there appear two test piece setting clips, and between these clips the banana plug switch for selecting the diode polarity is provided. The drawer is adhered by the magnet-catch, so that the pulling is somewhat stiff in the beginning. And the drawer is stopped by a stopper when it is pulled out to the full extent approx. 240mm, and the pushing-in and pulling-out of the drawer shall be slowly conducted carefully. When the drawer is pulled out by more than 25mm, the test piece setting clip and banana plug switch is cut off from the test

voltage source, that is to say the test piece measuring terminals, by means of the knife switch. Although the primary side of test voltage transformer is also turned OFF by the micro switch operation at this time, it is preferred that [TEST VOLTAGE] knob is set to ZERO position prior to the pulling-out and pushing-in operation of the drawer.

Setting a test piece

Set the diode polarity selector switch to the polarity of the test piece. The switch shall be pulled up and inserted down vertically.

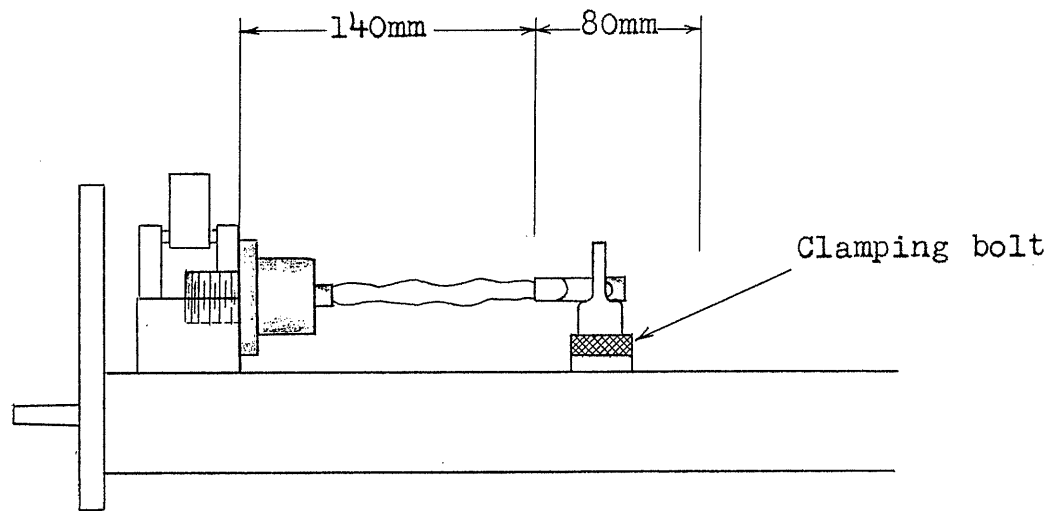


Open the upper jaw of the clip.

Place the stud bolt of the diode on the receiving metal of the clip (this side) and close the clip.

Insert into the other clip the pipe-lug of the diode turned to the vertical direction. The position of this clip can be moved corresponding with the size of the test piece, since the clip is loosened by rotating the bolt part counterclockwise.

After determining the position, fix the bolt by rotating it clockwise.



After finishing this setting, push the drawer in slowly and stop where it is adhered by the magnet catch.

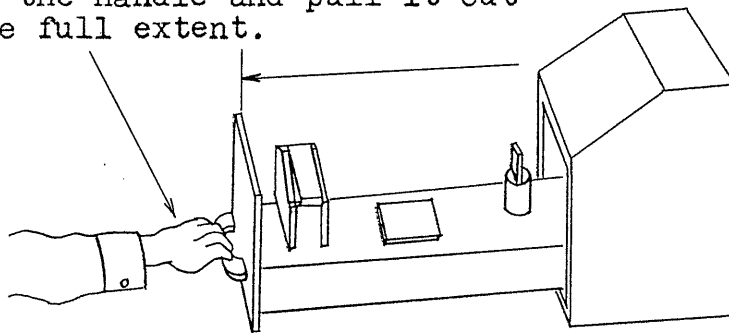
PRECAUTIONS FOR OPERATION

Since high voltage is impressed upon the test piece connecting terminals of this fixture, the clips, bolt and plug switch of the drawer type test board, [TEST VOLTAGE] knob of [HIGH VOLTAGE TEST UNIT] shall surely be set to ZERO and [POWER] switch be to OFF, during the time of operating these parts.

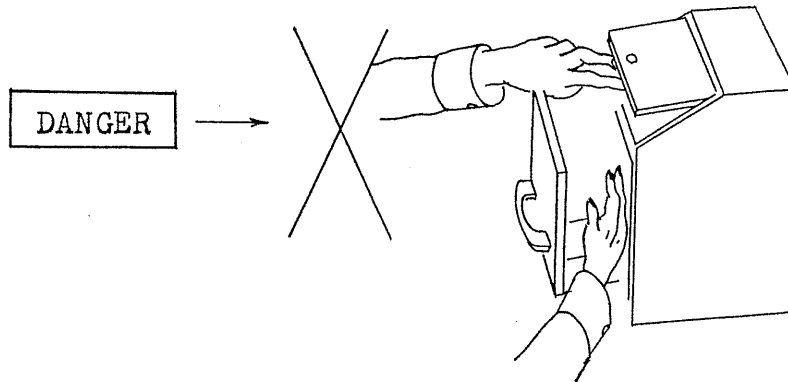
Also, handle the drawer test board with the drawer pulled to the full extent to this side.

The drawer should be pulled out or pushed in by grasping the handle.

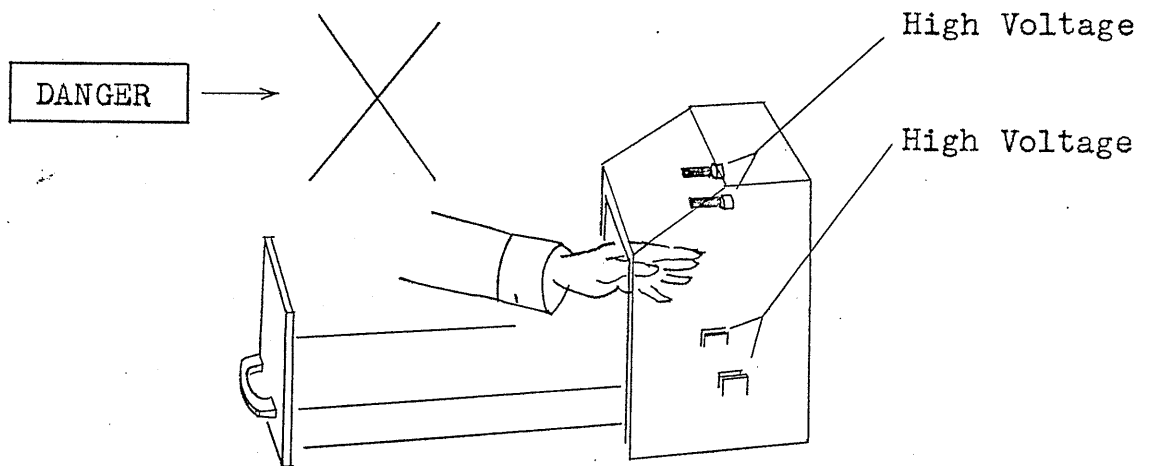
Grasp the handle and pull it out to the full extent.



Never put your hand or the like inside the drawer when the door is partially opened and the drawer is pulled out to some extent. It is dangerous.



Never put your hand or the like inside through the opened space of the drawer panel. Particularly, the knife switch and test piece connecting terminals are dangerous.



The operation shall be conducted with a good care for the above points.

