INSTRUCTION MANUAL FOR

DIODE CURVE TRACER

MODEL 5805

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.

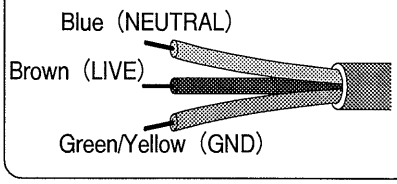
☐ AC power cable

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.

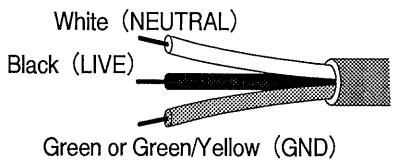
WARNING

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

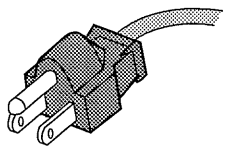
☐ Without a power plug



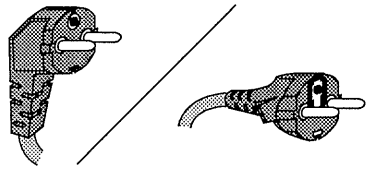
☐ Without a power plug



☐ 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 instrument has been designed primarily for measurements of PIV (PRV) characteristics of high voltage rectifiers (including SCR's) employing an oscilloscope. For measurements of PIV (PRV) characteristics, voltages up to 5000 V peak can be applied and the tested device is housed in a cabinet to protect the operator from electric shock hazards.

2. SPECIFICATIONS

Power requirements:	100 V AC, 50/60 Hz, approx. 330 VA
Dimensions:	510 W x 507 H x 456 D mm
(Maximum dimensions:	540 W x 530 H x 590 D mm)
Weight:	Approx. 50 kg
CRT and graticule:	5UP1F, 10 div x 10 div, 8 mm/div, white illumination
Test voltage source:	Half-wave-rectification and sine wave of line power
Ranges:	
REVERSE:	0 ~ 5 kV peak, half-wave-rectification, maximum 100 mA* peak
SINE:	0 ~ 5 kV peak, sine wave, maximum 100 mA* peak
	(* Short period 200 mA peak is allowable.)
Dissipation limiting resistors:	Six ranges of 0/10k/30k/100k/300k/1MΩ

Voltage axis sensitivity (horizontal):	Five ranges of 50/100/200/500/1000V/div
Current axis sensitivity (vertical):	14 ranges of 1/2/5/10/20/50/100/200/500μA 1/2/5/10/20mA/div
Calibration voltage (amplifier sensitivity):	0.5 Vp-p/10 div, square wave, both voltage axis and current axis
Accessories:	Blind panel ..... 1 Instruction manual 1

3. CONSTRUCTION

The Model 5805 Diode Curve Tracer consists of the below-mentioned two major componential units housed in a single case. Individual units can be readily removed.

(1) SPEC 73510 OSCILLOSCOPE

The deflection sensitivities of both horizontal (voltage) axis and vertical (current axis) are 50 mV/div. The sensitivities are easily adjustable with the internal calibration voltage. A voltage divider and a selector switch for current detection resistors are provided in the input circuit of each amplifier.

(2) SPEC 73511 HIGH VOLTAGE TEST UNIT

This unit generates the measuring voltage. By setting the panel switches as required, characteristics of the tested sample in the reverse direction and both directions (for measurements of the reverse voltage and forward blocking voltage characteristics of SCR's, for example) can be measured.

4. DESCRIPTIONS OF PANELS

4.1 SPEC 73510 OSCILLOSCOPE

POWER (ON-OFF): Power switch of the oscilloscope. As the switch is thrown to the upper position, the power is turned on and the power pilot lamp lights.

INTENSITY: Adjusts the brightness of the spot or trace displayed on the CRT screen. Brightness increases as this control is turned clockwise, and vice versa.

FOCUS: This control should be so adjusted that the image displayed on the CRT screen is made sharpest.

ASTIG: In conjunction with FOCUS control, this ASTIGMATISM control also should be so adjusted that the image displayed on the CRT screen is made sharpest.

ILLUM: For adjustment of illumination of CRT graticule. Illumination increases as this control is turned clockwise, and vice versa.

POSITION: One in the left hand side as faced to the panel is for vertical positioning of the spot or trace displayed on the CRT screen, and the other in the right hand side is for vertical positioning. The spot or trace moves upward or rightward as the vertical or horizontal POSITION controls, respectively, are turned clockwise, and vice versa.

VERTICAL: Selects the sensitivity of the vertical (current) axis. The figure of each position of the switch indicates the current value (peak) corresponding to one division vertical deflection on CRT.

HORIZONTAL: Selects the sensitivity of the horizontal (voltage) axis. The figure of each position of the switch indicates the voltage value (peak) corresponding to one division horizontal deflection on CRT.

INPUT (A, B): The input terminal in the left hand side is for the vertical (current) axis amplifier and that in the right hand side is for the horizontal (voltage) axis amplifier. These terminals are connected to terminals A and B of CURRENT SAMPLING OUTPUT and terminal A of VOLTAGE SAMPLING OUTPUT of SPEC 73511 TEST UNIT, respectively, using the cords supplied as accessories.

10 DIV CALIBRATION: Two self calibration controls, one for vertical (current) axis and the other for horizontal (voltage) axis, are provided. When the PUSH TO CAL button is depressed, either the vertical or the horizontal trace is displayed on the CRT. The trace amplitude should be adjusted to 10 div on the graticule by turning the GAIN ADJ control (semi-fixed resistor) using a screwdriver. This calibration can be made irrespective of setting of the VERTICAL or HORIZONTAL SENSITIVITY selector switch and even can be made when measurement is being done. The pushbutton is locked as it is depressed and twisted clockwise. If both vertical and horizontal buttons are simultaneously depressed, a trace inclined by approximately 45° is displayed.

4.2 SPEC 73511 HIGH VOLTAGE TEST UNIT

POWER (ON-OFF): Power switch of the High Voltage Test Unit. As the switch is thrown to the upper position, the power is turned on and the power pilot lamp lights.

FUNCTION: Selects measuring functions as tabulated below:

	REVERSE	SINE
Measured item	Reverse-direction characteristics	Both-direction blocking characteristics
Variable voltage range	0 ~ 5000 V peak	0 ~ 5000 V peak
Voltage waveform	Half-wave rectification	Sine wave
Maximum current (continuous)	100 mA peak*	100 mA peak

(* Short period 200 mA)

TEST VOLTS: This control is for continuous variation of the test voltage from zero to the maximum voltage (with an allowance to compensate for output voltage drop caused by load current and by line voltage drop). The operator is requested to make it a habit to turn this control to the ZERO position immediately after the measurement is over. The knob must not be turned with an abnormally large force.

DISSIPATION LIMITING RESISTOR SELECTOR:

This switch selects the dissipation limiting resistor connected series to the tested device, in order to protect the measuring power source from damage in case the tested device is shorted.

CAPACITY BALANCE, FINE:

High-voltage small-current devices present loop characteristics due to their parallel capacitances. These knobs are used to compensate for parallel capacitance (the inner red knob is for fine adjustment).

CURRENT SAMPLING OUTPUT (A, B):

OUTPUT A terminal is for measurement of the current of the tested sample and OUTPUT B terminal is for CAPACITY BALANCE. These terminals are connected to VERTICAL INPUT A and B terminals of SPEC 73510 OSCILLOSCOPE with the cords supplied as accessories. The measuring current flows in the cord of terminal A. Note that, if this cable is disconnected while measurement with a high voltage is being made, the high voltage will appear at the output terminal and could cause hazards.

VOLTAGE SAMPLING OUTPUT (A):

This output terminal is for measurement of the voltage being applied across the sample. As (A) is the case for the above terminals, this terminal also is connected to the HORIZONTAL INPUT A terminal of SPEC 73510 OSCILLOSCOPE with the cord supplied as an accessory. The voltage across the sample is divided into 1/1000 before being applied to this output terminal and, therefore, it is not dangerous to disconnect the cord while measurement is being made.

TEST VOLTS UNIT: To use the sliding auto-transformer of the instrument as an external transformer, remove the four clamping-screws of the transformer and pull out the transformer together with cords connected to the transformer. Install the blind panel (supplied) in the position from where the transformer has been removed.

TEST BOX and MEASURING TERMINALS: The measuring terminals are housed in the test box to prevent electric shock hazards. To connect the sample diode, slowly remove the cover of the test box and, then, connect the diode to the high voltage (H.V.) and low voltage sample connection terminals observing the polarity marked on the cover of the test box. The low voltage terminal (left hand side) can be slided horizontally by approximately 4 ~ 8 cm to meet the dimensions of the sample.

The cover of the test box is interlocked with a protective circuit which automatically cuts off the test voltage if the cover is opened while the voltage is being applied. However, before replacing sample diodes, the TEST VOLTS knob must be turned to the ZERO position.

If it is required to extend the sample connection terminals to outside of the test box, cover the extension lead wires with insulation tubes and pass them through the two holes drilled in the front panel of the test box. Be extremely careful to prevent electric shock hazards and discharge. Observe the instructions given in Par. "SAFETY FEATURES" of Section 5 "OPERATION METHOD AND PRECAUTIONS."

5. OPERATION METHOD AND PRECAUTIONS

5.1 SPEC 73510 OSCILLOSCOPE

CHECK OF REFERENCE POINT; STATIONARY SPOT

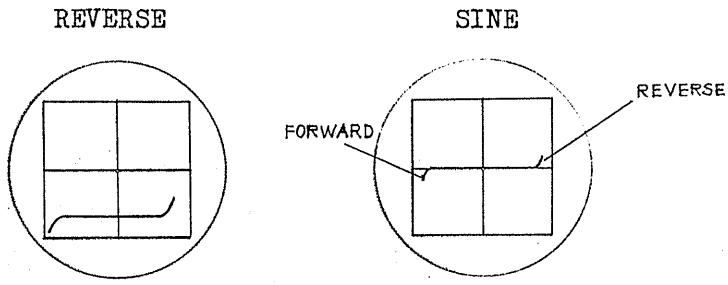
The reference point of the characteristics curve is stabilized in approximately 5 minutes after starting the instrument operation. After this period also, however, the reference point is slightly shifted due to aging and AC line voltage variation and, therefore, the reference point must be adjusted to the true position by means of the POSITION knobs. Note that fluorescent screen is subjected to spot-burning if the beam spot at a high intensity is kept stationary in one point for long periods. In order to prevent this, either reduce the intensity with the INTENSITY control or dim the spot by the FOCUS control.

Due to the residual voltage of the sliding auto-transformer, the image displayed on the CRT screen may have a minor amplitude even when the TEST VOLTS knob of the test unit is turned to the ZERO position (especially for sine waveform). In such a case, check the reference point after turning the POWER switch of the test unit to the OFF position.

POLARITY OF CHARACTERISTICS CURVES

When a positive signal is applied to the VERTICAL or HORIZONTAL INPUT A terminal, the spot deflects upward or rightward, respectively; when a negative signal is applied, the spot deflects downward or leftward, respectively. The input resistance of the HORIZONTAL INPUT terminal is constant at 100 kΩ; that of the VERTICAL INPUT A, B terminal varies according to setting of the VERTICAL SENSITIVITY selector switch.

Typical characteristics curves displayed on the OSCILLOSCOPE which is used in conjunction with the SPEC 73511 HIGH VOLTAGE TEST UNIT are as shown below.



When tested under the SINE mode, if the sample is connected as indicated by the polarity indication mark on the test box cover, the polarity of the characteristics is as shown in the SINE pattern in the above illustration. If the sample is connected in the reverse, the polarity of the characteristics also is reversed.

VERTICAL AND HORIZONTAL INCLINATION OF TRACE

The trace may become inclined with respect to the vertical and horizontal scale lines of the graticule as affected by the position and direction of installation of the oscilloscope. In such a case, pull out the chassis from the case, loosen the front clamp section of the CRT, and turn the CRT by holding its handles so that the trace is made parallel with the graticule scale lines. The 10 DIV CALIBRATION signal may be used for adjustment of the parallelism of the displayed trace with the graticule scale lines.

OVERCURRENT RELAY

The overcurrent relay cuts out the primary circuit of the measuring power supply transformer when the CRT beam spot is deflected off the graticule scale range by several divisions. That is, if the

reference point of the trace is set at the bottom of the graticule, the relay trips when the current is increased to 12 ~ 15 times of the value indicated by the vertical (current) sensitivity selector switch. The sensitivity of the relay is adjustable with a semi-fixed resistor on printed board A1-1 in the oscilloscope. (Refer to the layout drawing.)

5.2 SPEC 73511 HIGH VOLTAGE TEST UNIT

PRECAUTIONS FOR HIGH VOLTAGE

The instrument deals with maximum 5 kV. Although it is incorporated with various safety features, it must be handled very carefully.

(1) The panel should be grounded to the earth.

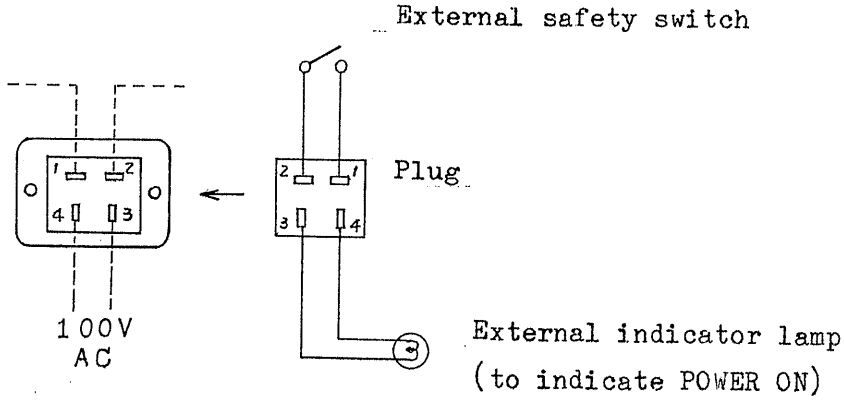
(2) Whenever the instrument is not in use, the TEST VOLTS knob must be set in the ZERO position and the POWER switch in the OFF position.

SAFETY FEATURES

If the FUNCTION selector switch on the front panel is turned while the measuring voltage is being applied, the primary circuit of the measuring power supply is cut out in order to protect the internal measuring power supply and the sample being tested.

When the MEASURING TERMINALS (red terminal and white terminal) of the test box are required to be extended to outside the test box using high-voltage extension lead wires, make use of the EXTERNAL SAFETY CONTROL located on the rear panel. The connections for the control must be made as illustrated below. Terminals 1 and 2 are connected in series to the primary circuit of the sliding auto-transformer of the instrument and these terminals normally are

shorted. (Terminals 1 and 2 of the accessory plug are shorted within the plug.) If terminals 1 and 2 are open-circuited, the relay of the instrument trips and the circuit is not reset even if the terminals are immediately shorted, unless the TEST VOLTS knob on the instrument panel is turned to the ZERO position. Therefore, by connecting a door switch of the test stand or other interlocking device between these two terminals, a safety circuit for the high voltage can be obtained. Terminals 3 and 4 are connected in parallel with the primary circuit of the sliding auto-transformer (as is the case for the internal red lamp) and the line voltage (100 V AC) appears at these terminals while the measuring power supply is in operation and, therefore, these terminals may be used to drive an external indicator lamp, etc.



External Safety Control

DISSIPATION LIMITING RESISTOR

An appropriate resistance should be selected taking the power rating of the sample and other factors into consideration. From the viewpoints of protecting the sample and the internal power supply of the instrument, it is recommendable to select a larger resistance.

TEST VOLTAGE FUSE

This fuse is connected in series in the primary power supply line in order to protect the internal measuring power supply against damage which could be caused by shortening or overcurrent while the high voltage is being applied. The fuse is 2-ampere rating and is located in the center of the rear panel.

CAPACITY BALANCE

This knob is used to balance out the loop caused by parallel capacitance of the sample. The knob is effective for the μA ranges (1 μA/div ~ 500 μA/div) of the oscilloscope (SPEC 73510). When the measuring terminals of the instrument are extended using extension lead wires in order to bring the measuring voltage out of the test box, the parallel capacitance between the terminals must be made as small as possible in order that it does not exceed the capacitance compensatable with the balancing capacitor.

6. MAINTENANCE

6.1 SPEC 73510 OSCILLOSCOPE

DC BALANCE

Unless DC balance is correctly maintained, adjustment with the 10 DIV CALIBRATION GAIN ADJ knob of the front panel can hardly be successfully made because the reference point shifts as the knob is turned. The DC BAL control (semi-fixed resistor) is located on printed board A1. (Refer to the layout diagram.) Turn the GAIN ADJ knob for various positions of the DC BAL control, determine the turning direction of the DC BAL control in which the shift of the reference point as the GAIN ADJ knob is turned is reduced, and finally find the position where the reference point is not shifted at all when the GAIN ADJ knob is turned.

CAL V ADJ

This control (semi-fixed resistor) is for adjustment of the square wave voltage signal used for 10 DIV CALIBRATION. The control is located on printed board A_2. (Refer to the layout diagram.) The same square wave voltage signal (0.5 Vp-p) is used for both vertical and horizontal axes. The control must be so adjusted that the deflection of the spot caused by application of an external voltage of accurately 5 V is made equal with the deflection amplitude of the 10 DIV CALIBRATION signal. Actual procedure may be made as follows: Position the spot on the left end vertical graticule scale line. (Set the VERTICAL SENSITIVITY selector switch in the position of maximum sensitivity 50 V/div.) Apply to the HORIZONTAL INPUT A terminal a positive DC voltage (or positive square wave) of accurately 0.5 V. The spot will be deflected rightward on the horizontal line by approximately 10 divisions (or become a trace with an amplitude of 10 divisions). Now, depress the 10 DIV CALIBRATION button of the horizontal axis so that the spot is deflected with the internal square wave voltage signal. So adjust the CAL V ADJ control that the two deflection amplitudes are made equal. Another method is to measure directly the internal calibration voltage with a sensitivity-calibrated oscilloscope and so adjust the CAL V ADJ control that the voltage is made 0.5 Vp-p. (Refer to the layout diagram.)

-HV ADJ

The -HV ADJ control (semi-fixed resistor) is for adjustment of the regulated high voltage supply of the CRT. It is located in the case (refer to the layout diagram) and is turned with a screwdriver. This control must be so adjusted that the voltage of the CRT cathode (pin 3) is made -1500 V as measured with a vacuum tube voltmeter (for example, Kikusui Model 107A VTVM).

6.2 SPEC 73511 HIGH VOLTAGE TEST UNIT

The test unit, which include the high voltage transformer, must be handled very carefully. The power cord must be disconnected before pulling out the test unit from the case for inspection or repair.

Although the red lamp of the test unit lights while the power is being supplied to the primary circuit of the measuring power supply transformer, the lamp could fail. For the sake of safety, therefore, the POWER switch must be set in the OFF state and the power cord must be disconnected before starting such procedure as connection of the high voltage lead wires, replacement of T.V. fuse, etc.

The operations of the safety devices such as the door switch of the test box, the reset switch of the test voltage, and the red indicator lamp must be routinely checked. Any mal-functioning component must be immediately replaced.

DIVIDE ADJ

The DIVIDE ADJ control (semi-fixed resistor) is used to adjust the voltage dividing ratio of the high voltage supply. This control must be adjusted after the sensitivity of the oscilloscope has been calibrated. The adjusting procedure is as follows: Set the sensitivity of the oscilloscope at 500 V/div. Set the POWER switch of the HIGH VOLTAGE TEST UNIT in the OFF state, the FUNCTION selector switch in the REVERSE position, and the D.L.R. in the 1 M position. Apply a DC voltage of accurately 5 kV between the measuring terminal and the GND terminal located at lower right of the panel, ensuring that the positive line is connected to the high voltage (H.V.) terminal. So adjust the DIVIDER ADJ control that the spot on the CRT is deflected by 10 divisions.

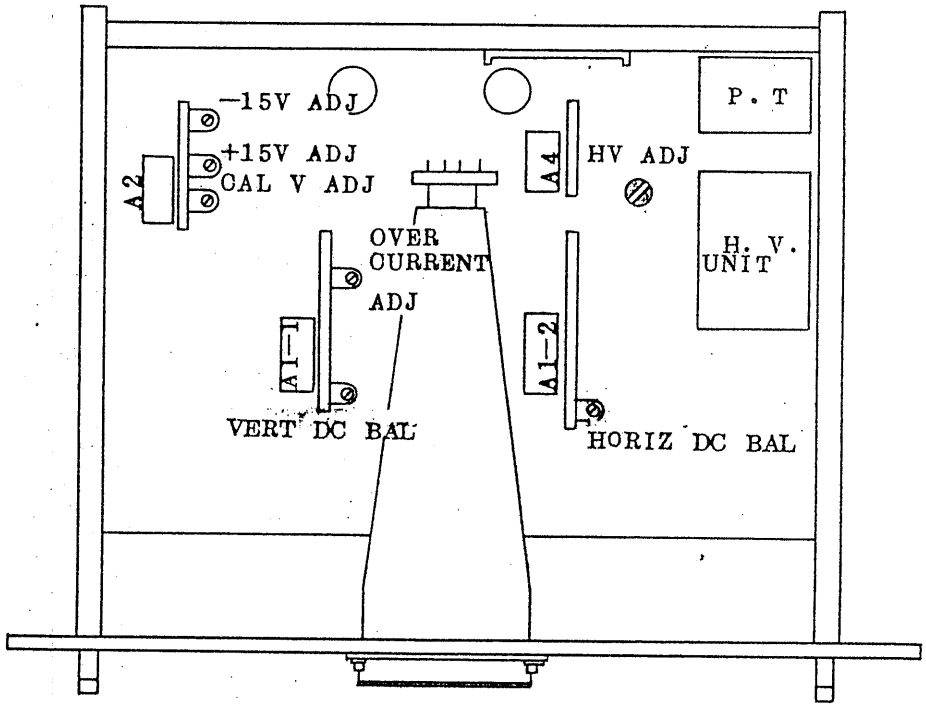
DUTY CONTROL ADAPTOR (SPEC 90503)

By employing an external Duty Control Adaptor, repetition rate of test voltage can be reduced and loss of samples can be reduced. Repetition rates are tabulated below.

Line frequency	Repetition rates
50 Hz	50 25 10 5 2 1 pps
60 Hz	60 30 12 6 2 1 pps

LAYOUT DIAGRAM

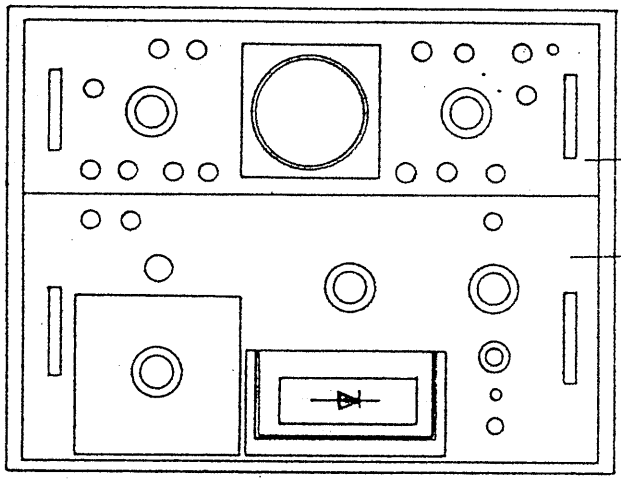
SPEC 73510 OSCILLOSCOPE



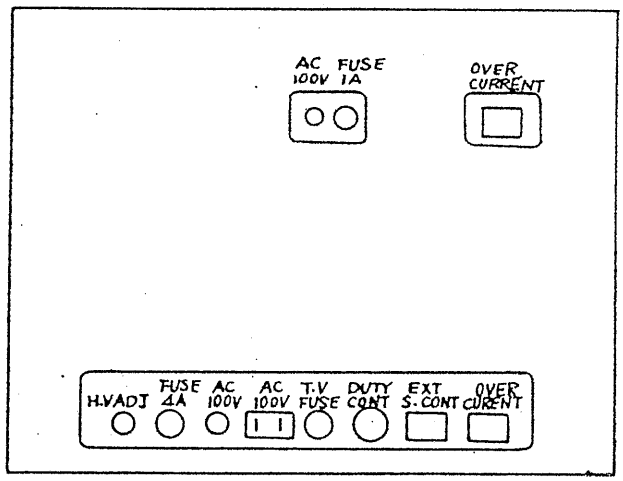
LAYOUT DIAGRAM

SPEC 73511 TEST VOLTAGE UNIT

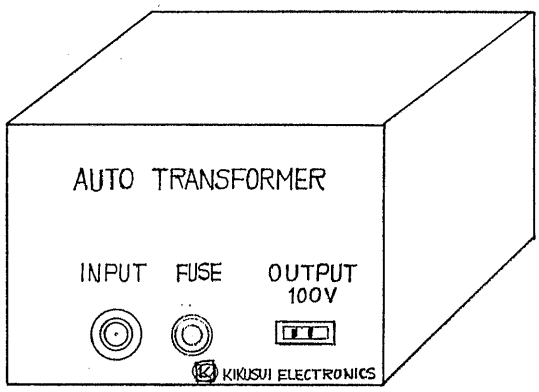
PANEL FRONT

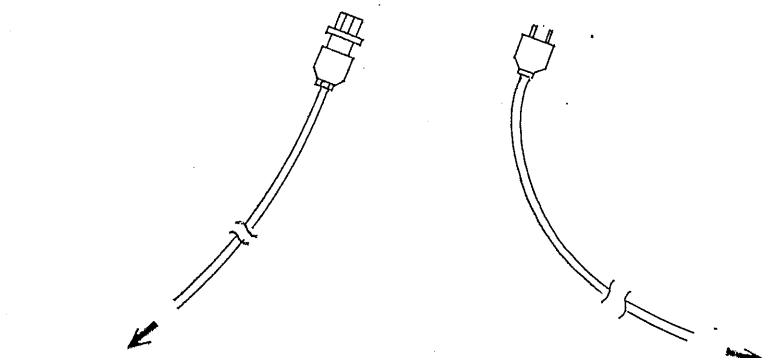


PANEL REAR



How to connect AUTO TRANSFORMER





To AC POWER LINE
220V 50/60 Hz

To MODEL 5805
AC POWER LINE

Red
Black } AC 220V
Green :: GND

FUSE 1 A