

INSTRUCTION MANUAL FOR

DIODE CURVE TRACER

MODEL 5804

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

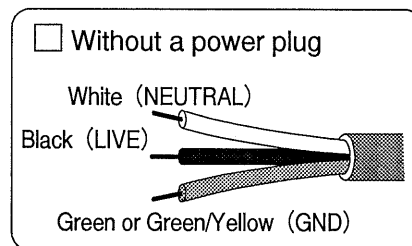
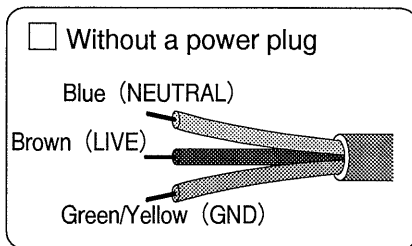
- To avoid electrical shock, always disconnect the AC power cable or turn off the switch on the switchboard before attempting to check or replace the fuse.
- Use a fuse element having a shape, rating, and characteristics suitable for this product. The use of a fuse with a different rating or one that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

AC power cable

The product is provided 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.



1. GENERAL

Kikusui Model 5804 Diode Curve Tracer displays forward characteristics or reverse characteristics of diodes or other devices. It also displays both types of characteristics simultaneously on the 1st quadrant of its oscilloscope which operates as an automatic-beam-switching dual-trace type of instrument.

As for the measuring power sources, the 5804 has a power supply of 0 - 20 V 10 A peak, 0 - 200 V 1 A peak, and 0 - 2 kV 0.1 A peak for each of the forward and reverse characteristics test circuits. Thus, it is capable of simultaneous measurement of characteristics of such thyristors as SSS and TRIAC.

The 5804 incorporates an internal calibration circuit, various protective circuits, and regulated power supplies. Thus, it is capable of continuous, safe, rapid and accurate measurements.

2. SPECIFICATIONS

- General:
- (1) Reverse characteristics of a diode can be displayed on the 1st quadrant of oscilloscope by employing the measuring power supply, voltage and current axis provided specifically for reverse characteristics measurement.
 - (2) Forward characteristics of a diode can be displayed on the 1st quadrant of oscilloscope by employing the measuring power supply, voltage and current axis provided specifically for forward characteristics measurement.
 - (3) Both forward and reverse characteristics of a diode can be simultaneously displayed on the 1st quadrant of the oscilloscope by alternately displaying the characteristics curves of (1) and (2) above, by means of the automatic-beam-switching dual-trace feature of the oscilloscope.

Power requirements: _ _ _ _ V AC, 50/60 Hz
Approx. 50 VA at no load
Approx. 200 VA at full load

Dimensions: 510 W x 410 H x 456 D mm
(Maximum dimensions): (545 W x 445 H x 485 D mm)

Weight: Approx. 50 kg

Accessories: Shorting bars 2
Instruction manual 1

CRT graticule: 10 div x 10 div, 8 mm/div,
white or red illumination

CRT: 5UPIF, acceleration voltage approx. 1500 V

REVERSE (Reverse characteristics measuring circuit)

- o Measuring power supply: Half-wave rectification of line power

Ranges: 3 ranges
0 - 20 V peak, 10 A peak
0 - 200 V peak, 1 A peak
0 - 2 kV peak, 0.1 A peak

Overcurrent protection relay:

Related to current axis; operates at
6 - 8 div above graticule scale center.

Test circuit fuse: Quick blow type, 1 A

- o Dissipation limiting resistors: 19 ranges

0/1/2/5/10/20 - 100k/200k & 500k Ω

Power capacity: 1/2/5/10 - 5k/10k Ω ... 80 or 100 W
20k/50k - 500k Ω ... (2000 V peak)

Accuracy: $\pm 10\%$

- o Voltage axis sensitivity: 11 ranges

0.1/0.2/0.5/1 - 50/100 & 200 V/div

Accuracy: $\pm 3\%$

- o Current axis sensitivity: 19 ranges

0.001/0.002 - 200/500 & 1000 mA/div

Accuracy: $\pm 3\%$

o Parallel capacity compensation: Approx. 100 pF maximum

o Calibration voltage (amplifier sensitivity)

Voltage axis: 1 Vp-p square wave/10 div

Current axis: 0.5 Vp-p square wave/10 div

FORWARD (Forward characteristics measuring circuit)

The specifications are the same with those of the REVERSE characteristics measuring circuit.

ALTER: The REVERSE and FORWARD characteristics of a diode are alternately displayed on the 1st quadrant of oscilloscope in dual-trace mode.

o ALTER frequency: 2.5 Hz and 5 Hz (2 ranges) or
3 Hz and 6 Hz (for 60-Hz line)

The setting of operating point of overcurrent relay and the calibration voltage are used in common for both REVERSE and FORWARD.

Temperature: Ambient temperature 0 - 40°C

Operating temperature 5 to 35°C

3. OPERATING METHOD

3.1 DESCRIPTION OF PANEL

- POWER:** Main power switch of the instrument. As this switch is thrown to the upper position, the power is turned on and the power pilot lamp lights.
- INTENSITY:** Intensity control of CRT spot (trace). Intensity increases as this control is turned clockwise and vice versa.
- FOCUS:** Focus control of CRT. In conjunction with astigmatism control, adjusts the focus (trace) sharpest.
- ASTIGMATISM:** The astigmatism control, in conjunction with the FOCUS control, also is used to obtain a sharp trace. The sharpest positions of both controls slightly vary as INTENSITY control is turned.
- SCALE ILLUM:** Graticule scale illumination control. Illumination increases as this control is turned clockwise. Illumination color can be changed from white to red by turning the scale upside down.
- FUNCTION:** FORWARD/REVERSE/ALTER measuring mode selector switch.
- FORWARD:** Measurement of forward characteristics.
- REVERSE:** Measurement of reverse characteristics.
- ALTER:** FORWARD and REVERSE characteristics are simultaneously measured in a dual-trace display mode at a switching frequency selected by the below-mentioned ALTER FREQ knob.

ALTER FREQ: Selects switching frequency for the above-mentioned alternate dual-trace display of FORWARD and REVERSE characteristics. Selectable switching frequencies are 2.5 Hz and 5 Hz for line frequency 50 Hz (or 3 Hz and 6 Hz for line frequency 60 Hz).

POSITION: Positioning controls for the spot (trace). The ↓ knob is for vertical positioning and the ↔ knob is for horizontal positioning.

PUSH TO CAL and GAIN ADJ: As the PUSH TO CAL button is depressed, a line trace with accentuated spots at both ends is displayed for each of vertical axis (current axis) and horizontal axis (voltage axis). With the GAIN ADJ semi-fixed resistor, adjust the line length equal to the full scale length (10 div).

(The below explanation is common for both FORWARD and REVERSE.)

RANGE: Measuring power supply range selector switch. Figures indicate the maximum voltages and currents (peak values). The waveform is half-wave-rectified line frequency.

TEST VOLTS: Continuously-variable voltage control knob of measuring power supply. For the sake of safety, the knob must be set in the MIN (RESET) position whenever the instrument is not in the measuring operation. (Be careful not to apply abnormally large force to the knob.) The RESET position is for resetting of the overcurrent relay which is explained later.

DISSIPATION
LIMITING
RESISTORS:

Selector switch for dissipation limiting resistors. An appropriate resistance is selected in order to limit the power loss in the specimen diode and to protect the measuring power supply in case of short-circuiting.

CAPACITY BAL:

When tested with a high voltage and a small current, characteristic curve of the specimen may be presented as a loop. In order to prevent such a presentation, the capacitance is balanced out with this knob.

TEST CIRCUIT FUSE:

1-ampere quick-blow fuse for protection of the measuring power supply. One fuse is provided for each of the FORWARD and REVERSE circuits.

TEST ON:

The TEST ON lamp lights when the measuring power supply is in the operating state and the measuring voltage is being applied to the specimen. The lamp goes off when the overcurrent relay (explained later) has acted. The lamp lights again as the TEST VOLTS knob is turned to the RESET position.

VERTICAL CURRENT/DIV:

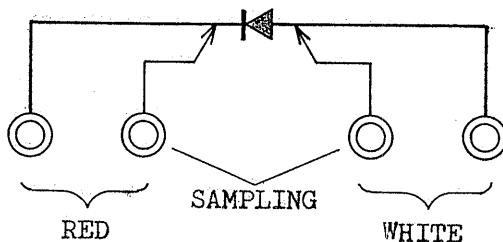
Sensitivity selector switch of the current axis (vertical axis). The figures denote current values per one scale division.

HORIZONTAL VOLTS/DIV:

Sensitivity selector switch of the voltage axis (horizontal axis). The figures denote voltage values per one scale division.

3.2 MEASURING PROCEDURE

- 3.2.1 Turn on the POWER switch. Allow approximately 5 minutes of stabilization period for the oscilloscope. Then, adjust the INTENSITY, FOCUS, ASTIG, and SCALE ILLUM controls.
- 3.2.2 Set the spot in a lower left position on the screen by adjusting the vertical and horizontal POSITION controls.
- 3.2.3 Depress the vertical and horizontal PUSH TO CAL buttons. Adjust respective GAIN ADJ controls so that respective trace lengths are made equal to 10 scale divisions.
- 3.2.4 Set the TEST VOLTS knobs of the FORWARD and REVERSE circuits, and check that the TEST ON lamp lights.
- 3.2.5 Connect the specimen to the specimen terminals, observing the polarity. The SAMPLING terminals are voltage terminals and they must be connected as below.



- 3.2.6 Select the required operation mode with the FUNCTION switch. For measurement of the forward characteristics alone, set the switch in the FORWARD position; for reverse characteristics alone, set the switch in the REVERSE position; for simultaneous measurement of both forward and reverse characteristics, set the switch in the ALTER position.
- 3.2.7 When the ALTER mode is selected by the FUNCTION switch, select the beam switching frequency for 2.5 Hz or 5 Hz (or, 3 Hz or 6 Hz) with the ALTER FREQ switch.

- 3.2.8 Select appropriate values of measuring power ranges and dissipation limiting resistors for both FORWARD and REVERSE circuits. Also select appropriate values for the voltage and current axes in accordance with the diode specimen to be tested.
- 3.2.9 Gradually turn clockwise the TEST VOLTS knob of the FORWARD or REVERSE circuit in order to apply a test voltage to the diode specimen. Observing the characteristic curve displayed on the CRT screen, set the knob in an appropriate position. If static characteristics are displayed as a loop, adjust the CAPACITY BAL knob.
- 3.2.10. If the overcurrent protection relay trips due to such cause as shorting of the diode specimen while in measurement, the TEST ON lamp of the FORWARD or REVERSE circuit goes off. The relay can be reset by turning the TEST VOLTS knob to the MIN (RESET) position.

3.3 PRECAUTIONS IN OPERATION

3.3.1 Operation of Overcurrent Relay

The function of the overcurrent relay is to cut out the primary circuit of the measuring power supply transformer (the TEST ON lamp goes off in consequence) when the characteristic curve is deflected off the CRT screen by several scale divisions from the scale top. Thus, the overcurrent relay operates with respect to the position of the spot on the CRT screen. The operating point (trip point) is adjustable by means of the OVERCURRENT ADJ semi-fixed resistor on the printed board A1-1.

3.3.2 Switch Turning While in Measurement

Before turning the below-mentioned switches while in measurement, turn the TEST VOLTS knob to the MIN (RESET) position. Do not neglect this instruction.

- o RANGE switch of measuring power supply
- o FUNCTION switch
- o ALTER FREQ switch

3.3.3 Horizontal Trace Angle Adjustment

If the horizontal trace is not parallel with the horizontal scale lines of the graticule due to the effect of terrestrial magnetism and positioning of the instrument, loosen the clamp at the neck of the CRT and rotate the CRT so that the horizontal trace is made parallel with the horizontal scale lines. The 10 DIV CAL trace may be used as the horizontal trace for this adjustment.

3.3.4 Replacement of Specimen

In order to prevent electric shock hazards, do not try to replace the diode specimen while the voltage is being applied. Before replacement, turn the TEST VOLTS knob to the MIN position.

4. MAINTENANCE

4.1 ADJUSTMENT OF SUPPLY VOLTAGES

4.1.1 Adjustment of -15 V

Adjust with the -15 V ADJ semi-fixed resistor of printed board A2.

4.1.2 Adjustment of +15 V

Adjust with the +15 V ADJ semi-fixed resistor of printed board A2.

4.1.3 Adjustment of +5 V

Adjust with the +5 V ADJ semi-fixed resistor of printed board A2.

4.1.4 Adjustment of -1500 V

This supply is used as the acceleration voltage of the CRT. Connecting a voltmeter to the cathode (pin #3) of the CRT, so adjust the voltage with the H.V. ADJ semi-fixed resistor on the left hand side circuit board that the voltmeter reads -1500 V.

4.2 ADJUSTMENT OF CAL V ADJ

The CAL V ADJ is for adjustment of the square wave calibration voltage which is used for calibration of the sensitivity of the amplifier. For this adjustment, proceed as follows: Turn the FUNCTION switch to the REVERSE position, set the TEST VOLTS knob of the REVERSE circuit in the MIN position, and set the DISSIPATION LIMITING RESISTORS switch in the 500 k Ω position. Set the voltage and current axes of the REVERSE circuit at 0.1V/DIV and 1A/DIV,

respectively. Apply a DC voltage signal of accurately +1 V to the diode specimen connection terminals (red terminal (positive) and white terminal) and determine the distance of horizontal movement of the spot on the graticule. Depress the PUSH TO CAL button and so adjust the CAL V ADJ semi-fixed resistor of printed board A2 that the trace length is made the same with the above-determined distance.

4.3 ADJUSTMENT OF DC BAL

So adjust the DC BAL semi-fixed resistors of printed boards A1-1 and A1-2 that, when the GAIN ADJ controls of the vertical and horizontal axes are turned, the spot does not shift.

4.4 REPLACEMENT OF REED RELAYS

Check the reed relays, which make switching for the ALTER operation, once a year. If the operation of a reed relay is unstable, replace it. The specifications of the reed relays are as follows:

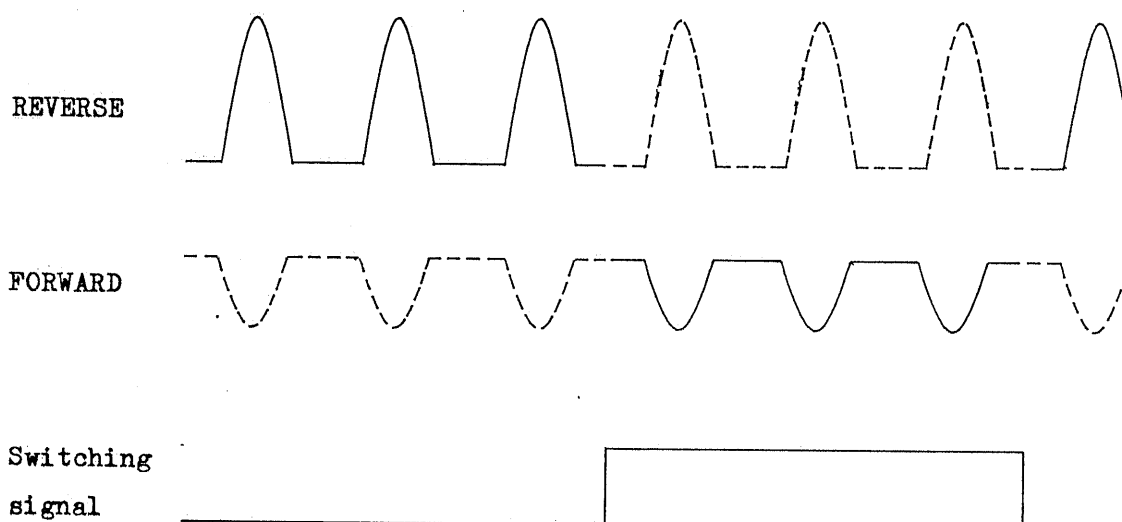
SR-101: 24 V DC, 15 mA or less
(1T) Contact rating 10 VA, 50 V, 0.1 A max.
Dielectric strength 200 V DC or over

LRL-101-15: 24 V DC, 12 mA or less
(1M) Contact rating 50 VA, 3 A max.
Dielectric strength 500 V DC or over

LRL-101-50: 24 V DC, 15 mA or less
(1M) Contact rating 50 VA, 3 A max.
Dielectric strength 500 V DC or over

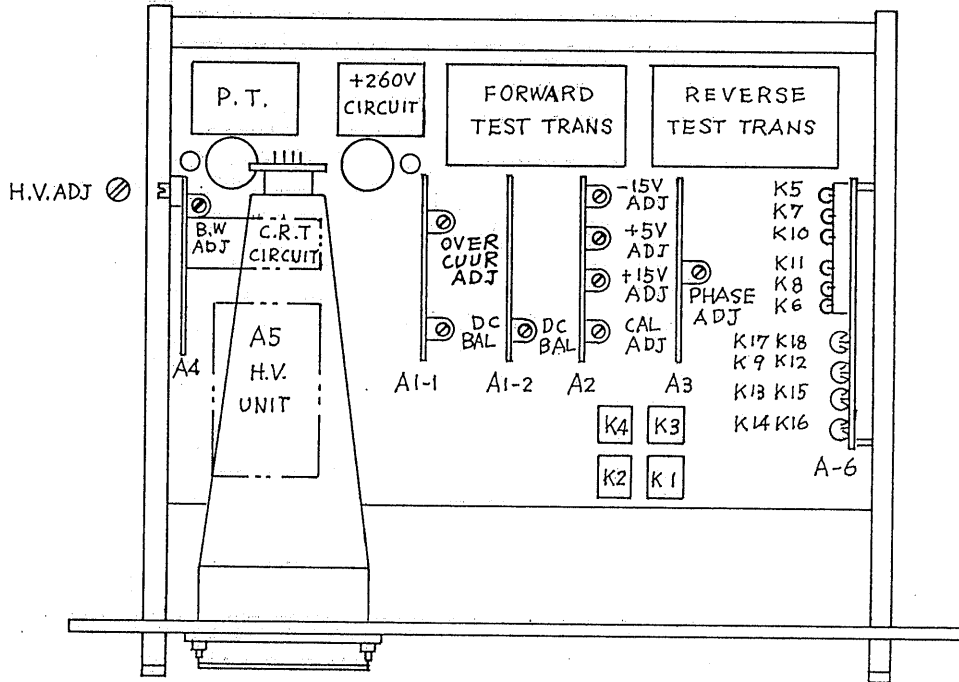
4.5 TEST OF ALTER OPERATION

Under the ALTER operation, the waveform of the voltage applied to the diode specimen and that of the switching signal must be as illustrated below. When the measuring power supply transformer or printed board A3 has been replaced, so adjust the phase of the measuring power supply transformer and the phase of the switching signal that the below-illustrated relationship is obtained. (The phase of the switching signal can be adjusted with the PHASE ADJ semi-fixed resistor on printed board A3.)

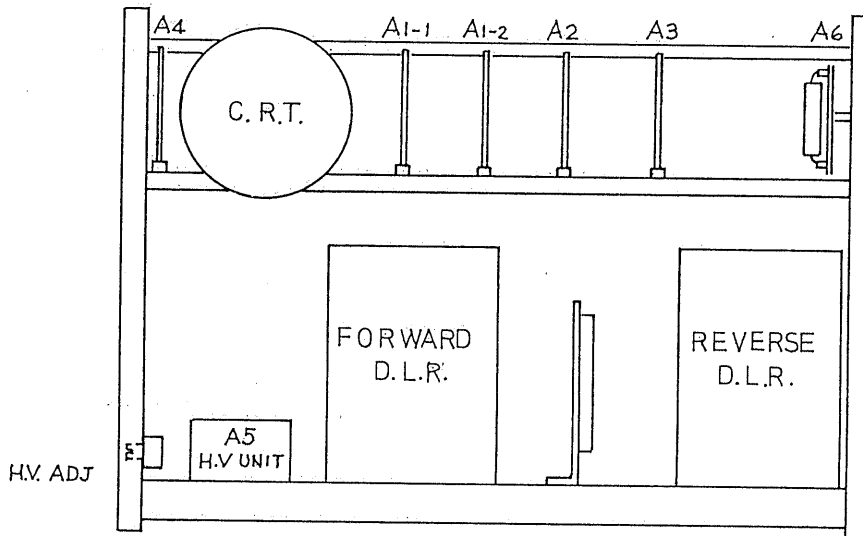


As above-illustrated, the phase of the supply voltages of the REVERSE and FORWARD circuits are mutually reverse. The switching point is in a mid-position of the zero span between two adjoining peaks of half-wave rectified waveform. Thus, switching is made when the half-wave rectified voltage is at the zero-volt level.

5. COMPONENTS LAYOUT OF MODEL 5804 DIODE CURVE TRACER



Top view



Front view