

INSTRUCTION MANUAL FOR

50kV DIODE CURVE TRACER

MODEL 5850

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.

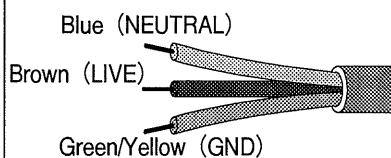
☐ AC power cable

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.

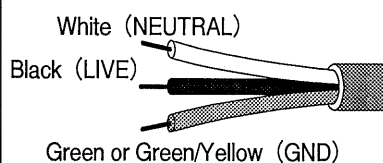
WARNING

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

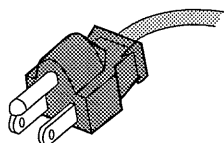
☐ Without a power plug



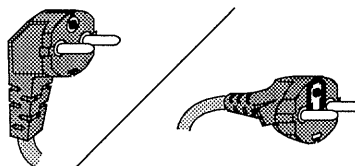
☐ Without a power plug



☐ 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 _____

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1. GENERAL DESCRIPTION

The 5850 is designed primarily for testing PIV (PRV) characteristics of high voltage rectifier diodes employing an oscilloscope as its display. It generates a continuously variable test voltage of 0 to 50 kV (to approximately 75 kV at no load) through half-wave-rectification of the line frequency power.

To ensure operator's safety, the High Voltage Unit and Control Unit are separately constructed and connected with a cable. Several other protective features also are incorporated to protect the operator against electric shocks.

The current measuring sensitivity is as high as $1 \mu\text{A}/\text{DIV}$ as displayed on the oscilloscope graticule. Since a motor-driven slide transformer is employed, the test voltage is easily and rapidly adjustable in a simple pushbutton system.

2. SPECIFICATIONS

- * SPEC 710251 OSCILLOSCOPE
- * SPEC 710261 TEST VOLTAGE CONTROL UNIT
- * SPEC 710271 TEST VOLTAGE SUPPLY &
SAMPLE TEST UNIT

Power requirements:	100 V, 50/60 Hz, approx. 300 VA at full load
Dimensions (max.):	SPEC 710251, SPEC 710261 ... 524 (714) W x 100 (1010) H x 660 (660) D mm SPEC 710271 ... 700 (714) W x 1026 (1126) H x 720 (743) D mm
Weight:	SPEC 710251, SPEC 710261 ... approx. 54 kg SPEC 710271 ... approx. 220 kg
Accessories:	Instruction manual 1 copy Hex wrenches 1 set
Graticule:	10 DIV x 10 DIV, 8 mm/DIV, white or red illumination
CRT:	5UP1F, acceleration voltage approx. 1500 V
Test voltage source:	Half-wave-rectification of line power
Test voltage:	0 ~ 50 kV peak, 5 mA peak max. 0 ~ 75 kV peak at no load.
Overcurrent protector:	Trips when current exceeds 12 ~ 14 DIV as displayed on graticule.
Test circuit fuse:	5 A
Dissipation limiting resistor:	5 M Ω (25 W)
Looping compensation:	Junction capacitance 12 pF max.
Horizontal voltage ranges:	500/1k/2k/5k/10kV/DIV, accuracy $\pm 3\%$
Vertical current ranges:	1/2/5/10/50/100/200/500 μ A/DIV, accuracy $\pm 3\%$
Calibration voltages (for display amplifier)	Horizontal: 0.5 V _{p-p} square wave/10 DIV Vertical: 0.1 V _{p-p} square wave/10 DIV

Housing construction:

The 5850 consists of two separate housings -- one containing the high voltage generator and test terminals and the other the control unit and oscilloscope. The two housings are connected with a cable approximately 4 meters long.





Test terminals:

Both high and low voltage test terminals have leaf springs which securely hold the lead wires of the sample. The distance between two terminals is adjustable for a range of 50 ~ 130 mm to suit the dimension of the sample.

Door interlock for safety:

When the door of the test box is opened to connect a sample device to the test terminals, the primary power supply is automatically cut off and the TEST ON lamp goes off indicating that the sample can be safely connected to the terminals. After connecting the sample, the test state can be restored by closing the test box door and making the test voltage minimum.

Test voltage:

The test voltage is adjustable with two pushbuttons -- one  for voltage increase and the other  for decrease. The test voltage increases or decreases during the period the  or  button is kept depressed as during which period the motor-driven slide transformer turns in the required direction. The drive speed is adjustable with the speed control knob on the front panel. It also is possible to make the voltage rise speed slow and the fall speed fast by means of a selector switch.

3. EXPLANATION OF FRONT PANELS

< SPEC 710251 OSCILLOSCOPE >

- POWER ON-OFF:** The main power switch of the oscilloscope. When this switch is thrown to the upper position, the power is turned on and the power pilot lamp lights.
- INTENSITY:** CRT trace intensity increases as this control is turned clockwise. It is recommended to keep the trace at a subdued intensity when no measurement is done, in order to make the CRT screen life longest.
- FOCUS:** This control, in conjunction with the ASTIG control, is used to obtain a sharp trace on the screen.
- ASTIG:** The astigmatism control, in conjunction with the FOCUS control, also is used to obtain a sharp trace.
- SCALE ILLUM:** Control for graticule illumination. Illumination color can be changed from white to red by turning the graticule upside down.
- VERTICAL:** $\mu\text{A}/\text{DIV}$
Selects vertical (current) sensitivity from 1 $\mu\text{A}/\text{DIV}$ to 500 $\mu\text{A}/\text{DIV}$ in nine ranges.
- HORIZONTAL:** Volts/DIV
Selects ~~horizotal~~ (voltage) sensitivity from 500 V/DIV to 10 kV/DIV in five ranges.
- POSITION (VERT and HORIZ):** For vertical and horizontal positioning of the trace. The trace moves upward or rightward as the VERT or HORIZ control, respectively, is turned clockwise.


10 DIV CALIBRATION






PUSH TO CAL and GAIN ADJ: For calibration of the vertical and horizontal amplifiers. When the PUSH TO CAL button is depressed, a vertical or horizontal trace with an amplitude of approximately 10 DIV is displayed. Under this state, remove the cap (threaded) of the GAIN ADJ (semi-fixed resistor) and turn it so that the amplitude is made accurately 10 DIV. The PUSH TO CAL button can be locked by twisting it clockwise under the depressed state.





< SPEC 710261 TEST VOLTAGE CONTROL UNIT >

POWER ON-OFF: The main power switch of the control unit. When this switch is thrown to the upper position, the power is turned on and the green pilot lamp lights.

TEST ON: This red pilot lamp lights when the test voltage circuit is on. When the overcurrent circuit is tripped or the test box door interlock switch is opened, the test voltage circuit is turned off and the lamp goes off. A lamp of the same function is provided also on the SPEC 710271 TEST VOLTAGE SUPPLY & SAMPLE TEST UNIT.

The test voltage is restored and the above lamps are turned on by closing the test box door and depressing the TEST VOLTAGE  button until the voltage falls to zero.

TEST VOLTAGE: These buttons are for remote control of the motor-driven slide transformer. The test voltage increases or decreases during the period the  or  button, respectively, is kept depressed. To restore the test voltage after the protective circuit is tripped, depress the  button until the voltage is reduced to zero. The test voltage variation speed is adjustable by means of the   SPEED switch.

  SPEED: The test voltage is varied fast or slow as this knob is thrown to the "S" or "F" position, respectively. When the internal selector switch is set in the NORMAL position, both rising and falling speeds are controlled with the SPEED knob. When the internal switch is set in the  HIGH SPEED position, the test voltage falling speed is rapid while the rising speed is adjustable with the SPEED knob on the front panel. Therefore, to increase and decrease the test voltage at the same speed, the internal switch must be set in the NORMAL position; to make rapid the falling speed alone, the internal switch must be set in the  HIGH SPEED position.

CAPACITY BAL: Used to reduce the trace loop through compensation for
FINE parallel capacitance of the sample device. If the sample
device is of such a nature that its parallel capacitance
varies depending on the applied voltage, complete compensation cannot be successfully made. The red knob is for fine adjustment.

<SPEC 710271 TEST VOLTAGE SUPPLY & SAMPLE TEST UNIT>

TEST TERMINALS: The high voltage terminal is colored red to indicate that it is positive with respect to the low voltage terminal. Both terminals are movable to suit the dimension of the sample device.

The test voltage is cut off from the test terminals and the TEST ON lamp (red) goes off when the test box door is opened.


TEST ON: The function of this lamp is the same with that of SPEC 710261, or the lamp lights when the test voltage circuit is ON and the lamp goes off when the circuit is OFF.

4. PRECAUTIONS IN OPERATION

- 1) Be especially careful against electric shocks in operating this instrument which employs a very high voltage. Whenever the instrument is not in use, turn off the POWER switch of the TEST VOLTAGE CONTROL UNIT. Before inspecting the internal components of the instrument, make sure that the power plug is disconnected.
- 2) Before operating the instrument, ensure that the GND terminals on the rear panels of SPEC 710261 and SPEC 710271 are securely grounded to the earth.
- 3) Check that the cable connection between High Voltage Unit and Control Unit is secure.
- 4) Although the interlock switch to turn off the test voltage when the test box door is opened is incorporated as a safety feature, the TEST VOLTAGE control should be turned to its minimum position before opening the test box door for sample replacement. This recommendation should be strictly observed from the viewpoint of protecting both the instrument and the tested sample. Note also that the overcurrent circuit must not be used as a means to turn off purposely the test voltage supply.
- 5) The test voltage is a half-wave-rectified positive voltage, with the high voltage applied to the high voltage terminal. The low voltage terminal is grounded through the current measuring resistor (one of the resistors selected by the VERTICAL RANGE switch). Never try to obtain a half-wave-rectified negative test voltage by floating the instrument chassis from the earth and grounding the high voltage terminal.
- 6) The distance between high and low terminals is adjustable. Note, however, that arcing discharge may be caused between two terminals if they are unreasonably closely positioned.

Samples which have such a short surface distance that will cause surface discharge cannot be tested as they are. They should be treated to prevent surface discharge by soaking in oil or other appropriate means.

5. TEST PROCEDURE

- 1) Connect securely the power plug of the SPEC 710251 Oscilloscope, the vertical and horizontal input cables, and the connecting cord of the overcurrent circuit. Also connect the power plug of the SPEC 710261 Test Voltage Control Unit and the cable connecting it to the SPEC 710271 Test Voltage Supply Unit.
- 2) Connect the GND terminals of the units to the earth.
- 3) Set the POWER switches of the units in the OFF positions, and connect their main power cords to 100 V AC line receptacles.
- 4) At first, turn on the POWER switch of the SPEC 710251 Oscilloscope. Display a sharp spot on the screen by adjusting the required controls and set the vertical and horizontal range selectors in appropriate positions to suit the sample.
- 5) Before connecting the sample, adjust the distance between the terminals in accordance with the sample dimension. Without connecting the sample to the terminals, turn on the POWER switch of the SPEC 710261 Test Voltage Control Unit. When this is done, the TEST ON lamp should turn on. If it does not turn on, close the test box door. If it still does not turn on, depress the  TEST VOLTAGE button until the test voltage is made minimum.
- 6) Without connecting the sample, gradually increase the test voltage and check that the trace on the screen extends rightward. Turn the CAPACITY BAL knob to check its function.
- 7) Again reduce the test voltage to the minimum voltage. Open the test box door and connect the sample diode observing the polarity as indicated on the panel.

- 8) Gradually increase the test voltage. If the trace is drawing a loop on the screen, adjust the CAPACITY BAL knob for compensation. (Note, however, that complete compensation is not to be expected for a sample of which capacitance varies depending on the applied voltage when the test is made with a high voltage and a low current.)
- 9) After the test is over and before replacing the tested sample with another one, the test voltage must be reduced to minimum.
- 10) When the current flowing in the sample has exceeded a value corresponding to ± 7 DIV or over in the vertical direction from the graticule center, the overcurrent circuit operates and the test voltage turns off. The test voltage can be restored by setting the TEST VOLTAGE in the minimum state.

It also is possible to the trip point of the overcurrent circuit by means of the OVERCURRENT ADJ (semi-fixed resistor) located in the oscilloscope.

6. MAINTENANCE

< SPEC 710251 OSCILLOSCOPE >

(For locations of adjusting semi-fixed resistors, refer to the layout diagram)

1) DC BALANCE

Unless the amplifier circuits are correctly DC balanced, the 10 DIV calibration with the GAIN ADJ cannot be successfully made because the reference point shifts. For DC balancing, of both vertical and horizontal axes, adjust the DC BALANCE control (semi-fixed resistors) so that the shift caused by turning of the GAIN ADJ control is made minimum.

2) 10 DIV CALIBRATION

Calibration is made with a square wave calibration signal of 0.5 V_{p-p} for the horizontal axis and that of 0.1 V_{p-p} for the vertical axis. These calibration signals themselves are calibrated by applying an accurately-known external DC voltage to the horizontal amplifier and comparing the resultant movement of the spot with the trace deflection amplitude produced by the internal calibration signal. For actual calibration, proceed as follows: Set the horizontal range switch in the maximum sensitivity position (500 V/DIV), apply an external voltage of accurately 0.5 V between the input terminal J₂ of printed board A1-2 and the chassis, and determine the resultant trace deflection amplitude on the graticule and memorized the determined value. Next, depress the PUSH TO CAL button so that the horizontal trace is produced, and adjust the CAL ADJ control so that the trace amplitude is made the same with that above-determined value.

To calibrate the sensitivity of the oscilloscope with the above calibration voltage, depress the PUSH TO CAL button so that the trace is displayed and then adjust the GAIN ADJ control so that the trace amplitude is made 10 DIV.

3) HV ADJ

The HV ADJ control (semi-fixed resistor) is for adjustment of the CRT acceleration voltage. This control must be so adjusted that the voltage between CRT cathode (pin #3) and chassis is made -1500 V as measured with a voltmeter of a high input resistance (10 M Ω or over). As the deflection sensitivity depends on this voltage, the above-mentioned 10 DIV CALIBRATION (GAIN ADJ) adjustment must be made whenever after this voltage is varied.

<SPEC 710261 TEST VOLTAGE CONTROL UNIT >

1) TEST ON LAMP

Indicates the ON-OFF state of the test voltage supply. When this lamp has failed, it must be immediately replaced. (110 V, T-10, E-10)

2) TEST VOLTAGE, SPEED CONTROL

The speed of the motor which drives the slide transformer to vary the test voltage is controlled by varying the DC drive voltage of the motor. The DC drive voltage is set at approximately 7.5 V for the lowest speed (when the SPEED **knob** is thrown to the "S" position) and at approximately 24 V for the highest speed (when the **knob** is thrown to the "F" position). Check these voltages whenever after this circuit has been repaired. The relay drive voltage of this circuit is 24 V.

<SPEC 710271 TEST VOLTAGE SUPPLY & SAMPLE TEST UNIT >

1) TEST TERMINALS

The test terminals must be always kept clean in order to prevent leakage current and arcing discharge. When test terminals are modified, thorough attention must be paid so that no arcing discharge or other undesirable phenomena are caused.

2) TEST ON LAMP

This lamp, which is connected in parallel with that of the SPEC 710261, indicates the ON-OFF state of the test voltage supply. When the lamp has failed, it must be immediately replaced. (Type: 100 V, T-13, E-12)

3) TEST BOX DOOR SWITCH

The door is opened for connection and replacement of the sample, for terminal distance adjustment, and for maintenance. Check for that the door interlock switch (microswitch) which cuts out the test voltage operates positively.

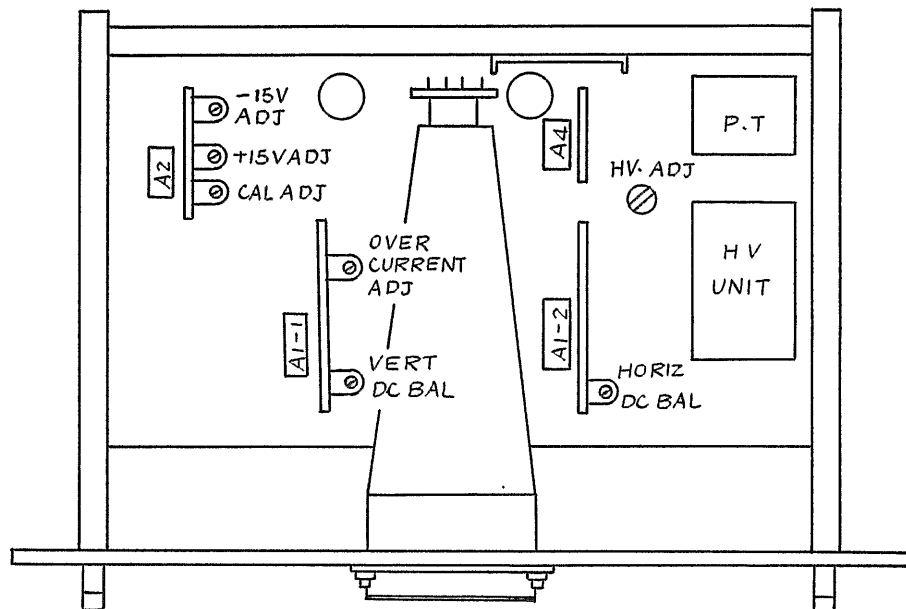
4) DIVIDER ADJ

The voltage dividing ratio of the high voltage divider is adjusted with this DIVIDER ADJ control (semi-fixed resistor). For ratio adjustment, set the POWER switch of the Control Unit in the OFF state, and calibrate the sensitivity of the oscilloscope as described in Section "MAINTENANCE." Next, to gain access to the DIVIDER ADJ, remove the cover which is located below the name plate of the SPEC 710271.

Set the voltage range of the oscilloscope at 5 kV/DIV, apply an external DC voltage of 30 kV $\pm 0.2\%$ between HIGH voltage terminal and GND terminal (with the positive polarity connected to the HIGH voltage terminal), and, under this state, adjust the DIVIDER ADJ so that the spot on the screen deflects by exactly 6 DIV.

7. LAYOUT DIAGRAM

SPEC 710251 OSCILLOSCOPE



SPEC 710261 TEST VOLTAGE CONTROL UNIT

