

## FEATURES

- 3-1/2 digit extra large (0.8" digits) high contrast LCD display.
- Single function and range control.
- Six resistance ranges: 200 Ω to 20 MΩ.
- Nine capacitance ranges: 200 pF to 200 mF (20,000 μF).
- Two LED test currents.
- Measures  $h_{FE}$  and leakage current for NPN and PNP transistors.
- Tests batteries under load conditions.
- Tests SCR's.
- Measures diode forward voltage.
- Measures diode leakage current.
- External adjustment "zeroes out" effects of test leads in low-value capacitance measurements.
- Non-slip grip.
- Non-skid rubber feet.
- Tilt stand.
- Wall hanger cutout.

### OPTIONAL ACCESSORIES

Carrying case . . . . . LC-29  
Replacement test leads . . . . . FP-30

### ELECTRICAL SPECIFICATIONS

All accuracies are  $\pm$ (reading + number of digits) at 23°C  $\pm$ 5°C, less than 75% R.H.

### CAPACITANCE

Range	Resolution	Accuracy	Test Frequency
200pF	0.1pF	$\pm(0.5\% \text{ rdg} + 1 \text{ dgt} + 0.5\text{pF})$	820 Hz
2nF	1pF	$\pm(0.5\% \text{ rdg} + 1 \text{ dgt})$	
20nF	10pF		
200nF	100pF		82 Hz
2μF	1nF		
20μF	10nF	$\pm(1.0\% \text{ rdg} + 1 \text{ dgt})$	8.2 Hz
200μF	100nF		
2000μF	1μF		
20μF	10μF	$\pm(1.5\% \text{ rdg} + 1 \text{ dgt})$	

**Test Voltage:** 3.2 V maximum from "+" terminal to "-" terminal.

**Input Protection:** protected against damage from charged capacitors (more than 50 Vdc) by fuse (.25 A, 250 V, fast acting).

**Zero Adjustment:** range approximately  $\pm 20$  pF.

### RESISTANCE

Range	Resolution	Accuracy	Max. open circuit voltage	Overload protection
200Ω	0.1Ω	$\pm(0.75\% \text{ rdg} + 4 \text{ dgt})$	3.2V	500V DC/AC max.
2KΩ	1Ω	$\pm(0.5\% \text{ rdg} + 1 \text{ dgt})$	0.5V	
20KΩ	10Ω			
200KΩ	100Ω			
2MΩ	1KΩ	$\pm(0.75\% \text{ rdg} + 1 \text{ dgt})$		
20MΩ	10KΩ	$\pm(2.0\% \text{ rdg} + 1 \text{ dgt})$		

## SPECIFICATIONS

### DIODE CHECK

Range	Resolution	Accuracy	Max. test current	Max. open circuit voltage
→	1mV	$\pm(1.5\% \text{ rdg} + 5 \text{ dgts})$	1.5mA	3.2V

**Overload Protection:** 500 V dc/ac maximum.

### LED TEST

**Test Voltage:** 3.2 V maximum.

**Test Current:** two ranges: 2 mA or 10 mA.

**Display:** reads approximate forward voltage of lit LED.

### TRANSISTOR $h_{FE}$ AND LEAKAGE ( $I_{ceo}$ ) TESTS

**$h_{FE}$  Range:** 0-1000, either PNP or NPN.

**$h_{FE}$  Base Current:** approximately 10 μA.

**$h_{FE}$   $V_{ce}$ :** approximately 3 V.

**$I_{ceo}$ :** 10 nA - 20.00 μA.

### SCR TEST

SCR good/defective test.

### BATTERY TEST

**9 V Battery Load:** approximately 15 mA.

**1.5 V AA, C or D Cell Load:** approximately 150 mA.

**1.55 V Button Cell Load:** approximately 0.8 mA.

**Display:** reads approximate battery voltage.

### GENERAL SPECIFICATIONS

**Display:** 3-1/2 digit liquid crystal display (LCD) with 0.8" digits, automatic decimal point, negative sign, and low battery indicator; maximum reading of 1999.

**Polarity Indication:** Automatic, positive implied, negative indicated.

**Overrange Indication:** "1" or "-1".

**Low Battery Indication:** "  " displayed.

**Measurement Rate:** 2 times per second, nominal.

**Operating Temperature:** 0°C to 50°C, 0-80% R.H.

**Storage Temperature:** -20°C to 60°C, 0-80% R.H. (battery removed).

**Temperature Coefficient:** (0.15 x specified accuracy) per °C, for less than 18°C or greater than 28°C.

**Power Requirements:** Standard 9 V battery, NEDA 1604 or equivalent.

**Battery Life:** Approximately 150 hours (alkaline).

**Dimensions (H x W x D):** 6-7/8" x 3-1/4" x 1-1/2" (175 mm x 83 mm x 38 mm)

**Weight (including battery):** 11.6 oz. (326 g).

**Accessories Supplied:** Test leads (pair), spare fuse, battery, instruction manual.

## OPERATING INSTRUCTIONS

### CAUTION

Never apply a voltage to the test connectors of the meter (except in "battery test" mode).

Fully discharge any capacitor to be measured.

Observe polarity when testing polarized capacitors.

Do not attempt to measure any components in-circuit; the instrument is intended for out-of-circuit testing only.

### RESISTANCE MEASUREMENTS

1. Turn the POWER switch ON. The presence of any character on the LCD display serves as a "power on" indicator.
2. Set the function/range switch to the desired "RESISTORS" range (green settings).
3. Connect the red test lead to the "+ RESISTORS" jack and the black test lead to the "- RESISTORS" jack. The red lead is "+" polarity.
4. Connect the test leads to the resistor to be measured and read the resistance value from the display. If the resistance to be measured is unknown, start with the 200  $\Omega$  range. If an overrange is indicated, keep increasing ranges until a reading is obtained.

### CAPACITANCE MEASUREMENTS

1. Capacitors are measured using the blue "CAPs" settings. Small axial-lead capacitors or PC-mount devices can be plugged directly into the slotted test socket. For larger devices, test leads must be used, plugged into the (+) and (-) banana CAPs jacks. In either case, the meter should first be zeroed, as described in step 2.
2. Select the 200 pF range. Adjust the front panel zero adjustment for a reading as close as possible to "00.0". If test leads are used, connect them to the (+) and (-) capacitor banana jacks before zeroing the meter. The adjustment will then compensate for the capacitance of the test leads. DO NOT short the test leads together.
3. Recheck meter zero each time measurements are started, making sure the reading appears as close to "00.0" as possible. The greatest meter resolution is realized when the meter is zeroed on the 200 pF range.

### DIODE TEST

1. Set the function/range switch to the white "D" position.
2. Connect the red test lead to the "+ DIODES" jack and the black test lead to the "- DIODES" jack. The red lead is "+" polarity. NOTE: this test does NOT use the socket on the meter (with the diode graphic); that is used for measurement of leakage current only.
3. To check forward voltage ( $V_f$ ), connect the red test lead to the anode of the device and the black test lead to the cathode. Diodes and semiconductor junctions with normal  $V_f$  of less than approximately 2.0 V can be checked.
4. The display indicates forward voltage. Normal diode voltages are approximately 0.4 V for germanium diodes and 0.7 V for silicon diodes. An overrange indicates an open diode. A shorted diode reads near 0 V.
5. Reverse the test lead connections to the diode. The reading should be the same as with open test leads (an overrange indication). A lower reading indicates a leaky diode. Diode leakage current,  $I_L$ , can be measured directly, as described in the following section.

### DIODE LEAKAGE CURRENT MEASUREMENT

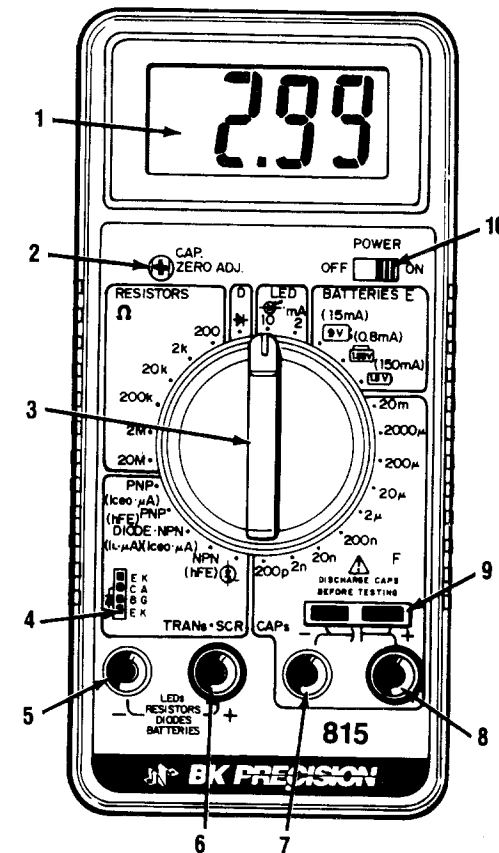
1. Set the function/range switch to "DIODE ( $I_L$ - $\mu$ A)". This setting is located near the transistor/SCR socket, and should not be confused with the "diode test" ("D") setting at the top of the dial.
2. Plug the diode into the "C" and "E" receptacles of the transistor/SCR socket, in the direction shown by the graphic.
3. The display will indicate the leakage current, in microamps ( $\mu$ A).

### LED TEST

1. Connect the red test lead to the "+ LEDs" jack and the black test lead to the "- LEDs" jack. The red lead is "+" polarity.
2. Set the function/range switch to one of the two white "LED" test current settings, either "10 mA" or "2 mA". NOTE: 10 mA is appropriate for most LED's. High-efficiency LED's, however, will light adequately on the 2 mA setting.
3. Connect the red test lead to the anode of the LED and the black test lead to the cathode. A good LED will light, and the meter will read the approximate forward voltage across it. Typical values are 1.7 to 1.9 V on the 2 mA range, and 2.0 to 2.2 V on the 10 mA range. However, these values may vary between device types.

## CONTROLS AND INDICATORS

1. **Display.** 3-1/2 digit display (1999 maximum) with automatic decimal point and (-) sign. Overrange indicated by displaying most significant digit as "1" with all other digits blank. Low battery indicator in lower left corner.
2. **Capacitance Zero Adjustment.** Adjustment zeroes out display in capacitance measurement mode (range approximately  $\pm 20$  pF).
3. **Function/Range Switch.** Selects one of six operating modes: resistance measurement (6 ranges), capacitance measurement (9 ranges), battery test (3 settings), transistor/SCR test (5 settings), LED test (2 settings), or diode test.
4. **Transistor/SCR Input Socket.** Socket for direct plug-in of transistors or SCR's. Also used for measurement of diode leakage current. The "E"/"K" (emitter/cathode) socket hole is placed in two positions for easier device insertion.
5. **"-" Jack - LEDs/RESISTORS/DIODES/BATTERIES.**
6. **"+" Jack - LEDs/RESISTORS/DIODES/BATTERIES.**
7. **"-" Jack - CAPs.** Banana jack connected directly to "-" side of capacitor plug-in socket (9).
8. **"+" Jack - CAPs.** Banana jack connected directly to "+" side of capacitor plug-in socket (9).
9. **Capacitor Socket.** Socket for direct plug-in of capacitor under test.
10. **POWER Switch.** Turns unit on/off.



- Set the function/range switch to the appropriate range, connect the capacitor, and read the value from the display. For unknown capacitances, start with the 200 pF range. If an overrange is indicated, keep increasing ranges until the overrange ceases and a reading is obtained.

#### Considerations

- An open capacitor will read zero on all ranges (possible a few pF on the 200 pF range).
- When using the 200 pF range, it is recommended that the supplied short test leads be used if direct plug-in is not feasible. Long test leads may possess excessive capacitance. If this capacitance exceeds 20 pF, the zero adjust of the meter will not be able to compensate for it. Also, even though a test cable may have been zeroed initially, subsequent movement of the leads may invalidate the previous zero.
- If the test lead capacitance exceeds the limit of the meter zero adjust, note the cable capacitance reading and deduct it from the final meter reading.
- When measuring an assortment of capacitors, where some require test leads and others do not, leave the test leads connected to the meter throughout the measurements. Otherwise, it will be necessary to continually readjust the zero whenever the test leads are inserted and removed.
- The instrument applies a very low voltage to the capacitor being measured. There is no danger of exceeding the voltage rating of most capacitors, or of retaining a dangerous voltage on the capacitor when it is removed from the tester.
- Some capacitors, notably electrolytics, have exceptionally wide tolerances. Measured values of up to 100% greater than the rated value may be observed. However, readings drastically below the rated value are seldom encountered.

#### BATTERY TESTS

- Select the yellow "BATTERIES" setting appropriate for the battery to be tested. The Model 815 can test 9 V "transistor" batteries, 1.5 V cells ("C", "D", and "AA"), and 1.55 V "button" cells.
- Connect the red test lead to the "+ BATTERIES" jack and the black test lead to the "- BATTERIES" jack. The red lead is "+" polarity.
- Touch the test leads to the battery to be tested. NOTE: the reading displayed indicates battery voltage under load conditions as specified on the selected front panel setting.

- Without the test leads connected to an LED, the display will read approximately 3 V. This reading will also be obtained if the device being tested is open, or is connected backwards. Of course, in either case, the LED will not light.

#### TRANSISTOR/SCR TESTS

These tests, which include transistor  $h_{FE}$  and leakage measurements, and SCR good/defective test, are all located in the white "TRANS-SCR" area of the function/range control.

##### Transistor $h_{FE}$ (DC Gain) Measurements

- Set the function/range switch to the appropriate setting, "PNP ( $h_{FE}$ )" or "NPN ( $h_{FE}$ )."
- Plug the transistor directly into the transistor/SCR input socket. The terminals are labeled "E", "B", and "C", for emitter, base, and collector, respectively. The emitter terminal is located in two places for convenience.
- Read the transistor  $h_{FE}$  directly from the display.

##### Transistor Leakage ( $I_{CEO}$ ) Test

- Set the function/range switch to the appropriate setting "PNP ( $I_{CEO}$ )" or "NPN ( $I_{CEO}$ )."
- Plug the transistor directly into the transistor/SCR input socket. The terminals are labeled "E", "B", and "C", for emitter, base, and collector, respectively. The emitter terminal is located in two places for convenience.
- Read the leakage current directly from the display. The measurement is microamps ( $\mu A$ ).

##### SCR Good/Defective Test

- Set the function/range switch to the SCR ( $\oplus$ ) setting.
- Plug the SCR directly into the transistor/SCR input socket. The terminals are labeled "A", "K", and "G", for anode, cathode, and gate, respectively. The cathode terminal is located in two places for convenience.

NOTE: for a thorough SCR test, complete all three steps following.

- For a good SCR, the display should read "000".
- Turn the function/range switch momentarily to "NPN ( $h_{FE}$ )", and then back to  $\oplus$ .
- For a good SCR, the display should now overrange.

## MAINTENANCE

#### BATTERY REPLACEMENT

The low battery symbol first appears when the battery is about 90% depleted. The unit may be operated for a short period but the battery should be replaced soon thereafter. Remove the three screws and the tilt stand/wall holder assembly from the case bottom. Lift the end of the case bottom until it gently un-snaps from the case top at the end nearest the LCD. Replace the battery with a fresh 9 volt "transistor" battery. Make sure the gaskets are properly seated and the two snaps on the case top are engaged when reassembling.

#### FUSE REPLACEMENT

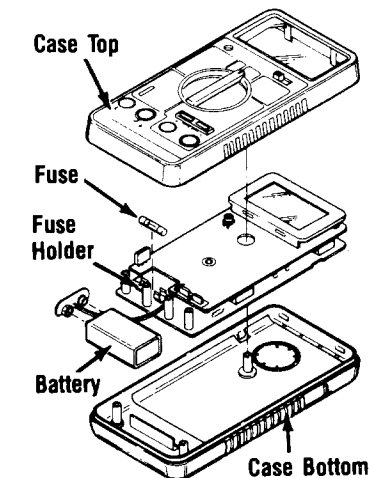
To replace the fuse, set the function/range switch to LED - 10 mA (top position), and remove the case bottom as for battery replacement. Gently pull the circuit board (two-board combination) away from the case top and function/range switch. A gentle wiggling motion will facilitate this removal. Do not remove any circuit board screws. Replace the fuse only with the original type 250 mA, 250 V, 5 x 20 mm fast-acting fuse (B & K part number 196-300-0-250). When reassembling, make sure that the function/range switch is set to LED - 10 mA, and the black arrow on the circuit board rotator (white hexagonal hole) is pointing up. Make sure the gaskets are properly seated and the two snaps on the case top are engaged.

#### TEST LEADS

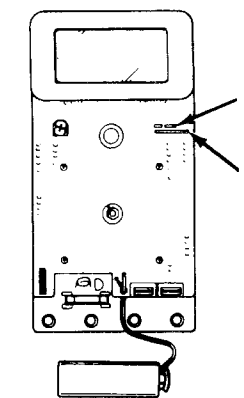
Periodically examine the test leads to ensure that the conductors are not intermittent or broken. Also make sure that good contact pressure exists at the test lead receptacles, and keep these areas free from dirt and corrosion.

#### POWER-ON WITH CASE TOP REMOVED

To power the unit for any reason with the pc board removed from the top case, connect a jumper between points A and B on the board as shown in the figure. A clipped resistor lead works well. The jumper serves as a substitute for the POWER switch, which remains attached to the case top.



Battery and Fuse Replacement



Contacts for Power-On with Case Top Removed