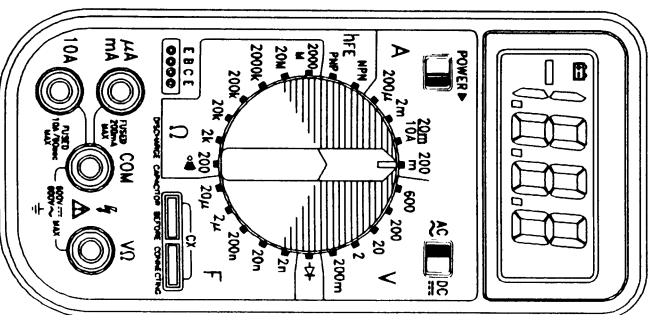


# OPERATING INSTRUCTIONS

## MODEL 123

### DIGITAL MULTIMETER



## SAFETY INFORMATION

The following safety information must be observed to insure maximum personal safety during the operation at this meter:

Do not use the meter if the meter or test leads look damaged, or if you suspect that the meter is not operating properly.

Never ground yourself when taking electrical measurements. Do not touch exposed metal pipes, outlets, fixtures, etc., which might be at ground potential. Keep your body isolated from ground by using dry clothing, rubber shoes, rubber mats, or any approved insulating material.

Turn off power to the circuit under test before cutting, unsoldering, or breaking the circuit. Small amounts of current can be dangerous.

Use caution when working above 60V dc or 30V ac rms. Such voltages pose a shock hazard.

When Using the probes, keep your fingers behind the finger guards on the probes.

Measuring voltage which exceeds the limits of the multimeter may damage the meter and expose the operator to a shock hazard. Always recognize the meter voltage limits as stated on the front of the meter.

## SPECIFICATIONS

**Display:** 3½ digit liquid crystal display (LCD) with a maximum reading of 1999.

**Polarity:** Automatic; positive implied, negative polarity indication.

**Overrange:** (1) or (-1) is displayed.

**Zero:** Automatic.

**Low battery indication:** The " " is displayed when the battery voltage drops below the operating level.

**Measurement rate:** 2.5 times per second, nominal.

**Operating environment:** 0°C to 50°C at < 70% relative humidity.

**Storage temperature:** -20°C to 60°C, 0 to 80% R.H. with battery removed from meter.

**Accuracy:** Stated accuracy at 23°C ± 5°C, < 75% relative humidity.

**Power:** Single standard 9-volt battery, NEDA 1604, JIS 006P, IEC 6F22.

**Battery life:** 200 hours typical with carbon-zinc.

**Dimensions:** 147mm (H) x 70mm (W) x 39mm (D).

**Weight:** Approx. 345g including holster.

**Accessories:** One pair test leads, One spare fuse, 9V battery (installed) and Operating Instructions.

## DC VOLTS

**Ranges:** 200mV, 2V, 20V, 200V, 600V

**Resolution:** 100µV

**Accuracy:** ±(0.8% rdg + 1dgt)

**Input impedance:** 10MΩ

**Overload protection:** 600VDC or AC rms

**AC VOLTS (50Hz - 500Hz)**

**Ranges:** 200mV, 2V, 20V, 200V, 600V

**Resolution:** 100µV

**Accuracy:**

±(1.5% rdg + 3dpts) on 200mV to 20V ranges

±(2.0% rdg + 3dpts) on 200V to 600V ranges

**Input impedance:** 10MΩ

**Overload protection:** 600VDC or AC rms

## DC CURRENT

**Ranges:** 200µA, 2mA, 20mA, 200mA, 10A

**Accuracy:**

±(1.0% rdg + 1dgt) on 200µA to 200mA ranges

±(3.0% rdg + 3dpts) on 10A range

**Input protection:** 0.5A / 250V fast blow fuse

10A/250V fast blow ceramic fuse

**AC CURRENT (50Hz - 500Hz)**

**Ranges:** 200µA, 2mA, 20mA, 200mA, 10A

**Accuracy:**

±(2.0% rdg + 4dpts) on 200µA to 200mA ranges

±(3.5% rdg + 4dpts) on 10A range

**Input protection:** 0.5A / 250V fast blow fuse

10A/250V fast blow ceramic fuse

## RESISTANCE

Ranges: 200 $\Omega$ , 2K $\Omega$ , 20K $\Omega$ , 200K $\Omega$ , 20M $\Omega$ , 2000M $\Omega$

Accuracy:

$\pm(1.0\% \text{ rdg} + 4\text{dgt})$  on 200 $\Omega$  to 2000K $\Omega$  ranges

$\pm(2.0\% \text{ rdg} + 4\text{dgt})$  on 20M $\Omega$  range

$\pm(5.0\% \text{ rdg} - 10\text{dgt}) + 10\text{dgt})$  on 2000M $\Omega$  range

Open circuit volts: 0.3Vdc

(3.0Vdc on 200 $\Omega$ , 2000M $\Omega$  ranges)

Overload protection: 500VDC or AC rms

## CONTINUITY

Audible indication: Less than 100 $\Omega$

Overload protection: 500VDC or AC rms

## DIODE TEST

Test current: 0.8mA  $\pm$  0.3mA

Accuracy:  $\pm(3.0\% \text{ rdg} + 1\text{dgt})$

Open circuit volts: 3.0Vdc typical

Overload protection: 500VDC or AC rms

## CAPACITANCE

Ranges: 2nF, 20nF, 200nF, 2 $\mu$ F, 20 $\mu$ F

Accuracy:  $\pm(4.0\% \text{ rdg} + 10\text{dgt})$  on all ranges

Test frequency: 400Hz

## TRANSISTOR hFE

Ranges: 0 - 1000

Base current: 10 $\mu$ Adc approx. ( $V_{ce}=3.0\text{Vdc}$ )

## OPERATION

### Input Warning Beeper

The meter have a beeper that warns the user when the test lead is in the current jack while the meter is switched to make a voltage measurement. Another safety feature to protect the meter and you.

### Voltage Measurements

1. Connect the red test lead to the "V $\Omega$ " jack and the black test lead to the "COM" jack.
2. Set the Function/Range switch to the desired voltage range and slide the "AC/DC" selector switch to the desired voltage type. If magnitude of voltage is not known, set switch to the highest range and reduce until a satisfactory reading is obtained.
3. Connect the test leads to the device or circuit being measured.

### Current Measurements

1. Set the Function/Range switch to the desired current range and slide the "AC/DC" selector switch to the desired current type.
2. For current measurements less than 200mA, connect the red test lead to the  $\mu$ A/mA jack and the black test lead to the COM jack.
3. For current measurements of 200mA or greater, connect the red test lead to the 10A jack and the black test lead to the COM jack.
4. Remove power from the circuit under test and open the normal circuit path where the measurement is to be taken. Connect the meter in series with the circuit.

### Resistance and Continuity Measurements

1. Set the Function/Range switch to the desired resistance range or continuity position.
  2. Remove power from the equipment under test.
  3. Connect the red test lead to the "V $\Omega$ " jack and the black test lead to the "COM" jack.
  4. Touch the probes to the test points. In ohms, the value indicated in the display is the measured value of resistance. In continuity test, the beeper sounds continuously, if the resistance is less than 100 $\Omega$ .
- Note when using 2000M $\Omega$  Range**  
The 2000M $\Omega$  range has a fixed 10-count offset in the reading. When the test leads are shorted together in this range, the meter will display 010. This residual reading must be subtracted from the reading.

### Diode Tests

1. Connect the red test lead to the "V $\Omega$ " jack and the black test lead to the "COM" jack.
2. Set the Function/Range switch to the "✚" position.
3. Turn off power to the circuit under test.
4. Touch probes to the diode. A forward-voltage drop is about 0.6V (typical for a silicon diode).
5. Reverse probes. If the diode is good, "1" is displayed. If the diode is shorted, ".000" or another number is displayed. If the diode is open, "1" is displayed in both directions.

### Transistor Gain Measurements

1. Set the Function/Range switch to the desired hFE range (PNP or NPN type transistor).

2. Never apply an external voltage to the hFE sockets. Damage to the meter may result.

3. Plug the transistor directly into the hFE sockets. The sockets are labeled E, B, and C for emitter, base, and collector.

4. Read the transistor hFE directly from the display.

### Capacitance Measurements

1. Set the Function/Range switch to the desired Cx (capacitance) range.
2. Never apply an external voltage to the Cx sockets. Damage to the meter may result.
3. Insert the capacitor leads directly into the Cx sockets.
4. Read the capacitance directly from the display.

### Battery Replacement

Power is supplied by a 9 volt "transistor" battery. (NEDA 1604, IEC 6F22). The "☹" appears on the LCD display when replacement is needed. To replace the battery, remove the three screws from the back of the meter and lift off the front case. Remove the battery from case bottom.

### Fuse Replacement

If no current measurements are possible, check for a blown overload protection fuse. There are two fuses: F1 for the  $\mu$ A/mA jack and F2 for the 10A jack. For access to fuses, remove the three screws from the back of the meter and lift off the front case. Replace F1 only with the original type 0.5A/250V, fast acting fuse. Replace F2 only with the original type 10A/250V, fast acting ceramic fuse.

# 123 CALIBRATION PROCEDURES

## EQUIPMENT REQUIREMENTS

Before removing the 123 from service, check that the necessary calibration equipment is available, the equipment requirements listed as following:

- A: DATRON 4700                      AUTOCAL MULTIFUNCTION CALIBRATOR  
B: GENERAL RADIO 1409              STANDARD CAPACITOR

1. Perform calibration at  $23 \pm 2^\circ\text{C}$  at relative humidity of  $< 70\%$ , Allow the meter to stabilize at this temperature for at least 30 minutes prior to performing the calibration procedure.

2. Select the 200mV DC range on the meter. Apply  $190\text{mV} \pm 0.005\%$  ( from DATRON 4700 ) to the V- $\Omega$  and the COM input connectors of the meter.

3. Adjust VR1 ( VR 200 $\Omega$  ) as shown to obtain a reading of 190.0 in the digital display.

4. Select the 200nF capacitance range on the meter. Connect a  $0.1\mu\text{F} \pm 0.05\%$  capacitor ( from GR 1409 ) to the capacitor measurement jacks on the meter.

5. Adjust VR2 ( VR 200 $\Omega$  ) as shown to obtain a reading of 100.0 1 digit in the digital display.

