

**FLUKE®**

**12**

Multimeter

**Users Manual**


PN 2063508  
January 2003

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
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## **READ FIRST: SAFETY INFORMATION**

This meter has been designed and tested in accordance with IEC Publication 1010. To ensure that the meter is used safely, follow all safety and operating instructions in this manual. If the meter is not used as described in this manual, the safety features of the meter might be impaired.

### **⚠ Warning**


**To avoid false readings, which could lead to possible electric shock or personal injury, replace the battery as soon as the battery indicator () appears.**

- Do not use the meter if the meter or test leads look damaged, or if you suspect that the meter is not operating properly.
- Turn off power to the circuit under test before cutting, unsoldering, or breaking the circuit. Small amounts of current can be dangerous.
- Do not apply more than 600 V rms between a terminal and earth ground.
- Use caution when working above 60 V dc or 30 V ac rms. Such voltages pose a shock hazard.
- When using the probes, keep your fingers behind the finger guards on the probes.
- Disconnect the live test lead before disconnecting the common test lead.

## **SYMBOLS**

The following international electrical symbols are used in this manual:

 Important Safety Information in Manual

 Not Applicable to Identified Model

 AC

 DC

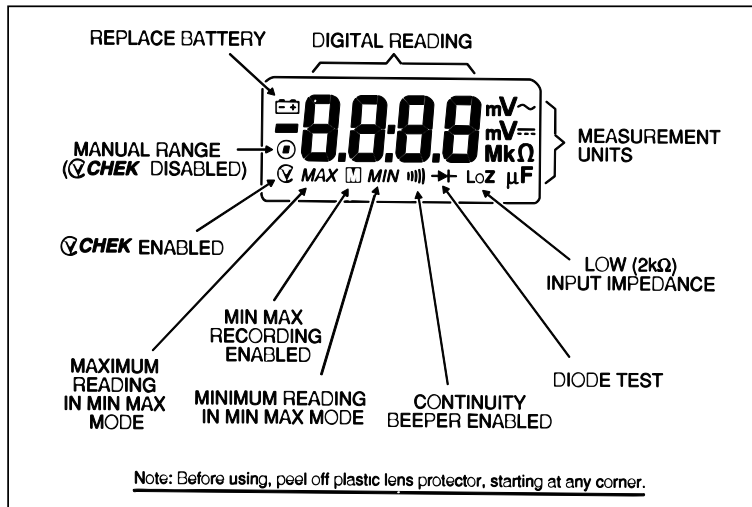
 Diode

 Capacitor

 Ground

 Double Insulation

**DISPLAY**



**Figure 1. Display**

## OPERATING FEATURES

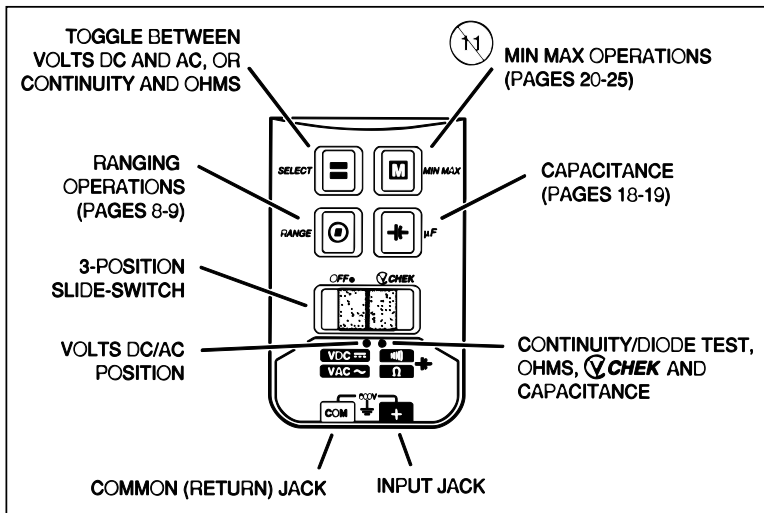


Figure 2. Operating Features



### ***STANDBY MODE***

In standby mode, the display goes blank to preserve battery life. The meter beeps and enters Standby if it is ON but inactive for more than 45 minutes. Press any pushbutton to resume operation. Standby is not allowed if the meter is in the MIN MAX mode.

### ***INPUT RANGES***

The input range determines the highest value the meter will measure. Most functions have more than one range (see SPECIFICATIONS). If the range is too low, the display shows OL (overload). If the range is too high, the display will show fewer digits of resolution.

## **Autoranging**

The meter defaults to autorange when you turn it on. In autorange, the meter selects the range automatically.


## **Manually Selecting a Range**

The meter also has a manual range mode. In manual range, you select and lock the meter in a range. To manually select a range:


1. Press [◻]. The meter is locked in the range it is in, and ◻ is displayed. In manual range, **CHEK** is disabled.
2. Press [◻] to step through the ranges. NOTE: The 4000 mV range, which can only be entered in manual range, is convenient when using accessories.
3. To return to autorange, press [◻] for 2 seconds (until ◻ is no longer displayed), or change the measurement function.

## **MEASURING VOLTAGE**

1. Insert the test leads in the jacks.
2. To select a voltage function, put the slide-switch in the middle position. See Figure 3.

To toggle between dc and ac, press [].

3. Touch the probes to the test points, and read the display. The meter beeps an Overload Alert™ when OL (overload) is displayed.

In manual range, you can toggle the meter between a high or low input impedance mode by moving the slide-switch between the voltage and continuity/ohms positions. (See “ *CHEK* AND HOW TO USE IT”.) In the continuity/ohms position, the input impedance of the meter is 2 k $\Omega$ , and LoZ is displayed to indicate that the meter is in the low input impedance mode. In the volts position, the input impedance is 5 M $\Omega$  in ac and 10 M $\Omega$  in dc.

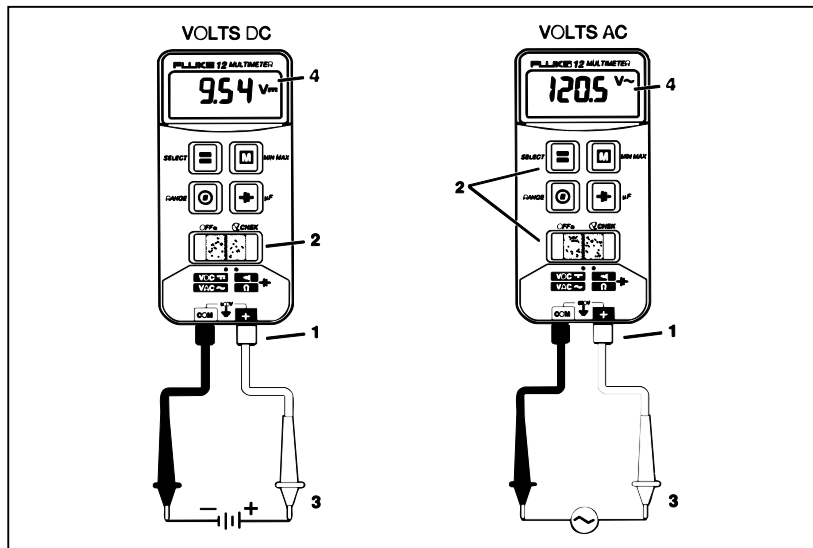


Figure 3. Measuring Voltage

**TESTING CONTINUITY AND MEASURING RESISTANCE**

1. Insert the test leads in the jacks, and turn off power to the circuit under test. External voltage across the components causes invalid readings.
2. Put the slide-switch in the continuity/ohms position (Figure 4).

To toggle between the continuity/diode and ohms functions, press .

3. Touch the probes to the test points.
4. In ohms, read the resistance on the display.

In continuity test, the beeper sounds continuously if continuity exists (resistance < 25  $\Omega$ ). Opens and shorts longer than 250  $\mu$ s are detected. On the Fluke 12, short-to-open and open-to-short transitions can be captured and visually displayed. See “Capturing Continuity Intermittents”.

If the meter detects a voltage greater in magnitude than about 4.5 V and the meter is not in the manual range mode, the meter automatically changes to the voltage measurement function. (See “CHEK AND HOW TO USE IT”.)

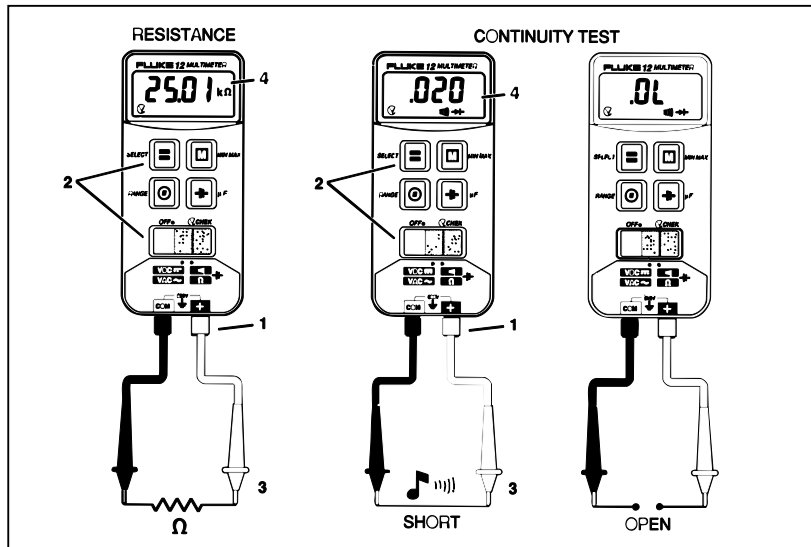


Figure 4. Continuity and Resistance Measurements

## TESTING DIODES

1. Insert the test leads in the jacks.
2. Put the slide-switch in the continuity/ohms position. The meter selects either the continuity/diode (🔊) ➔ or ohms ( $\Omega$ ) function.

If ohms is selected, press [🔊] to toggle to the continuity/diode function. To toggle the beeper on or off in continuity/diode test, press [🔊]. 🔊 is displayed when the beeper is enabled.

3. Touch probes to the diode (Figure 5A). A forward-voltage drop of about 0.6 V (typical for a silicon diode) causes the meter to beep once.
4. Reverse probes (Figure 5B). If the diode is good, OL is displayed. If the diode is shorted (Figure 5C), the beeper sounds continuously in at least one direction.

If the diode is open, OL is displayed in both directions.

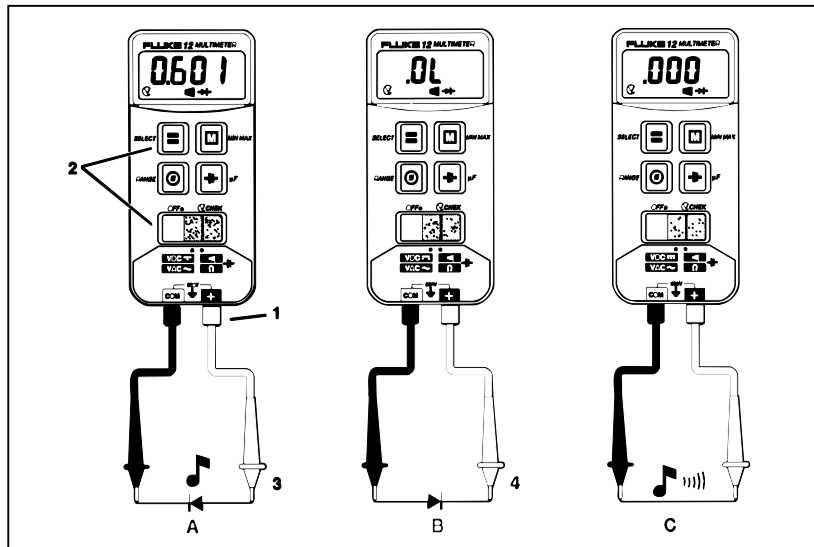








Figure 5. Testing Diodes








## VCHEK AND HOW TO USE IT

 **VCHEK** is a subset of the continuity/ohms function. In  **VCHEK**, the meter is designed to automatically display an ac or dc voltage when the meter detects a voltage greater in magnitude than about 4.5 V and the meter is not in the manual range mode. **THIS WILL NOT HARM THE METER.**  **VCHEK** is always enabled (and  is displayed) when the meter is in the continuity/ohms function unless the meter is in one of the following:

- The manual range mode (i.e.,  is displayed)
- The MIN MAX mode (i.e.,  is displayed)
- The capacitance function (i.e.,  $\mu\text{F}$  is displayed)

### **Warning**

**Repetitive transients on a dc bus will cause  **VCHEK** to select ac volts, even though a hazardous dc voltage may be present. To avoid a misleading display and possible electric shock, manually select the proper volts function for measurements on these circuits.**

In  **VCHEK**, the meter has a low input impedance ( $\sim 2\text{ k}\Omega$ ). When a voltage is displayed, LoZ is also displayed to remind you of this, and the beeper momentarily sounds a  **VCHEK Alert™**. To disable the  **VCHEK** Alert in the ohms function, press and hold down  while turning the meter on.

Use  $\mathcal{V}_{CHEK}$  only on power supplies and other power sources that have a low output impedance. Do not use  $\mathcal{V}_{CHEK}$  to measure voltage in electronic circuitry unless a  $2\text{ k}\Omega$  load will not damage the circuit. See † on page 27.

### **DISABLING $\mathcal{V}_{CHEK}$ WITH FUNCTION LOCK**

To lock the meter in either the continuity/diode or ohms function, and disable  $\mathcal{V}_{CHEK}$ :

1. Put the slide-switch in the continuity/ohms position. The meter selects the continuity/diode or ohms function. Press [F] to toggle between the continuity/diode and ohms functions.
2. Press [L] to put the meter in manual range. L is displayed. The meter is locked in the selected function and  $\mathcal{V}_{CHEK}$  is disabled.

In continuity/diode test, press [L] to toggle the beeper on and off.

In ohms, press [L] to manually select a range.

To remove the function lock and reenable  $\mathcal{V}_{CHEK}$ , press [L] for 2 seconds, press [F], or move the slide-switch.

### **MEASURING CAPACITANCE**

First, turn off power to the circuit, and disconnect and discharge the capacitor.

1. Insert test leads, and move the slide-switch to [⇄]. (See Figure 6.)
2. Press [⇄]. The capacitance function is selected and  $\mu\text{F}$  is displayed.
3. Touch the probes to the capacitor. When measuring polarized capacitors, be sure to connect the positive to [⊕] and the negative to COM. Capacitor dielectric absorption can cause measurement errors. If more discharge is necessary, the meter displays “dISC” while the capacitor is discharging.

To exit capacitance, press [⇄] or [⏏], or move the slide-switch to another position.

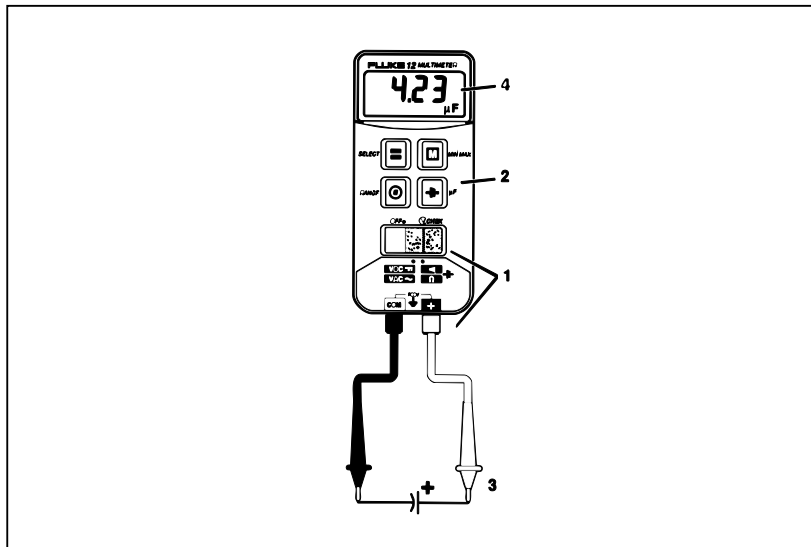


Figure 6. Measuring Capacitance

## **USING MIN MAX FUNCTIONS**

### **Recording Minimum and Maximum Readings**

MIN MAX records the highest and lowest measurements taken. MIN MAX cannot be used when the meter is measuring capacitance. In the MIN MAX mode, autoranging, Standby, and  $\checkmark_{CHEK}$  are disabled.

1. Insert the test leads, and put the meter in volts or ohms.
2. Connect the leads to the circuit.
3. Press  $[M]$  to enter MIN MAX.  $M$  is displayed, and autorange is disabled. When the reading changes more than about 50 digits, the meter beeps a short Input Change Alert™. When a new minimum or maximum is recorded, the meter beeps a longer MIN MAX Alert™.
4. Press  $[M]$  to cycle through maximum, minimum, and present readings (see Figure 7). To exit MIN MAX and erase the stored readings, press  $[M]$  for 2 seconds or change the measurement function.

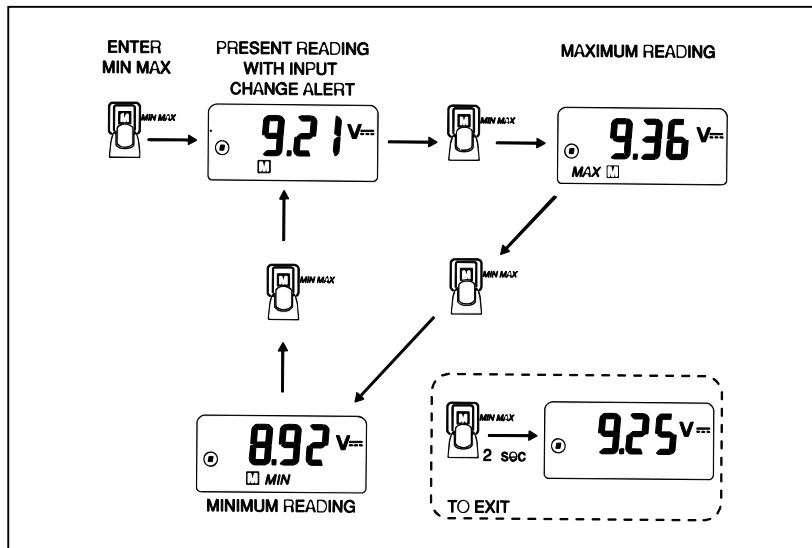


Figure 7. Displaying Minimum and Maximum Reading

### ***Recording Minimum and Maximum Reading with Elapsed Time***

The MIN MAX with elapsed-time mode records the time (in hours and minutes) between when MIN MAX was entered and the last high and low was recorded. Time is kept to 99:59. OL is displayed for longer times.

1. To enable the MIN MAX elapsed-time clock, hold [M] down while moving the slide-switch from OFF to the volts or continuity/ohms position.
2. Insert the test leads, and put the meter in volts or ohms.
3. Connect the leads to the circuit.
4. Press [M] to select MIN MAX. M is displayed, and time is set to 00:00.
5. Press [M] to step through the display sequence shown in Figure 8.
6. To exit, press [M] for 2 seconds, or change the measurement function.

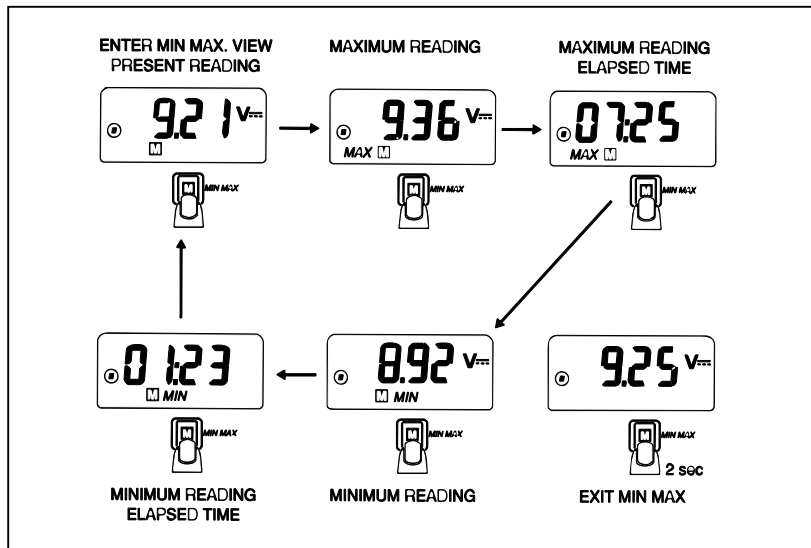


Figure 8. Maximum and Minimum Reading with Elapsed Time



### ***Capturing Continuity Intermittents with Continuity Capture***

When testing continuity, the meter can capture intermittents as short as 250  $\mu$ s, and display them as open-to-short and short-to-open transitions.

1. Put the slide-switch in the continuity/ohms position.
2. Connect the leads to the circuit.
3. Press [M]. The display shows the initial condition (either an open or short) as shown in Figure 9, and M is displayed.

If the meter detects a transition, it beeps and the display captures the transition (see Figure 9). Subsequent transitions cause the meter to beep, but the display does not change.

4. Press [M] to reset the display to the present condition and resume capture mode.
5. To exit, press [M] for 2 seconds or change measurement function.

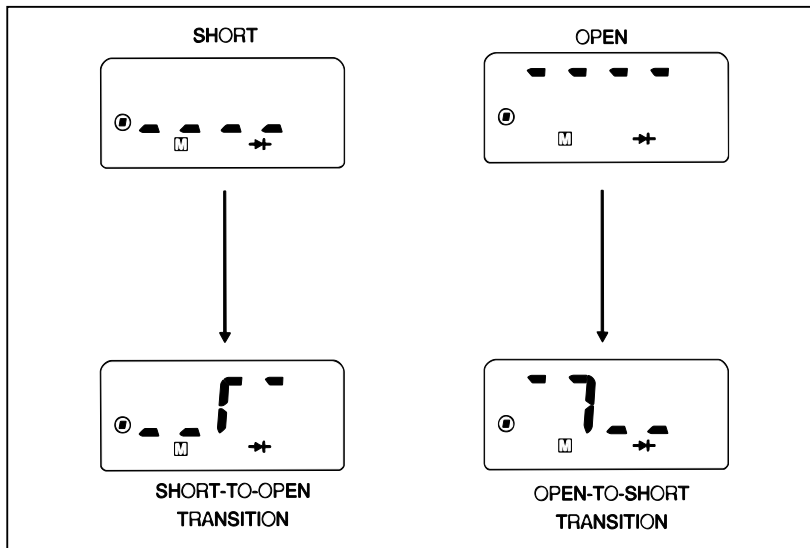


Figure 9. Open-to-Short and Short-to-Open Transitions

## **TURNING BEEPER OFF**

To disable all beeper functions, press and hold down [Ⓞ] for 2 seconds while turning the meter on.

## **MAINTENANCE**

### **⚠ Warning**

**To avoid electrical shock or damage to the meter, do not get water inside the case. Remove the test leads and any input signals before opening the case.**

Periodically wipe the case with a damp cloth and detergent. Do not use abrasives or solvents.

### **🔋 Replacing the Battery**

The meter uses a 9 V battery (NEDA 1604 or IEC 6F22). To replace the battery, remove the four screws from the back of the meter and lift off the front. Remove the battery from case bottom.

### **Replacing the Test Leads**

The meter uses double-insulated test leads. When replacing the test leads, order Fluke PN 855742 only.

## **Service and Parts**

This meter should be serviced only by a qualified service technician. To order the service manual (PN 900824) and other parts or for service information, in the USA call 1-800-825-9810. Outside the USA, contact the nearest Fluke service center.

## **Accessories**

When using accessories, put the slide-switch in the volts position, and manually select the 4000 mV range for ease of reading.

## **SPECIFICATIONS**

This meter complies with Part 15 of FCC Rules. Operation is subject to the following conditions: (1) This meter may not cause harmful interference, and (2) this meter must accept any interference received, including interference that may cause undesired operation.

Accuracy is specified for a period of one year after calibration, at 18 °C to 28 °C (64 °F to 82 °F) with relative humidity to 90 %. AC conversions are ac-coupled, average responding, and calibrated to the rms value of a sine wave input. Accuracy Specifications are given as:

$$\pm([\% \text{ of reading}] + \text{number of least significant digits])$$

<b>Maximum Voltage Between any Terminal and Earth Ground</b>	600 V rms
<b>Display</b>	3 3/4-digits, 4000 counts, updates 4/sec
<b>Operating Temperature</b>	-10 °C to 50 °C
<b>Storage Temperature</b>	-30 °C to 60 °C indefinitely (to -40 °C for 100 hrs)
<b>Temperature Coefficient</b>	0.1 x (specified accuracy)/°C (<18 °C or >28 °C)
<b>Relative Humidity</b>	0 % to 90 % (-10 °C to 35 °C) 0 % to 70 % (35 °C to 50 °C)
<b>Battery Type</b>	9 V, NEDA 1604 or IEC 6F22
<b>Battery Life</b>	650 continuous hours with alkaline 450 continuous hours with carbon-zinc
<b>Shock, Vibration</b>	1 meter shock. Per MIL-T-28800D for a Class 3 Instrument
<b>Size (HxWxL)</b>	1.35 in x 2.75 in x 5.55 in (3.46 cm x 7.05 cm x 14.23 cm)
<b>Weight</b>	10 oz (286 g)
<b>Safety</b>	Designed to Protection Class II requirement of UL 3111, ANSI/ISA-S82, CSA C22.2 No 231, and VDE 0411, and IEC 1010 overvoltage category III.
<b>EMI Regulations</b>	Complies with FCC Part 15, Class B, and VDE 0871B.

## 12 Multimeter Users Manual

Function	Range	Resolution	Accuracy (50 to 400 Hz)
V~	4000 mV*	1 mV	±(1.9 %+3)
	4.000 V	0.001 V	±(1.9 %+3)
	40.00 V	0.01 V	±(1.9 %+3)
	400.0 V	0.1 V	±(1.9 %+3)
	600 V	1 V	±(1.9 %+3)
V---	4000 mV*	1 mV	±(0.9 %+2)
	4.000 V	0.001 V	±(0.9 %+2)
	40.00 V	0.01 V	±(0.9 %+1)
	400.0 V	0.1 V	±(0.9 %+1)
	600 V	1 V	±(0.9 %+1)
Ω	400.0 Ω	0.1 Ω	±(0.9 %+2)
	4.000 kΩ	0.001 kΩ	±(0.9 %+1)
	40.00 kΩ	0.01 kΩ	±(0.9 %+1)
	400.0 kΩ	0.1 kΩ	±(0.9 %+1)
	4.000 MΩ	0.001 MΩ	±(0.9 %+1)
	40.00 MΩ	0.01 MΩ	±(1.5 %+3)
†	1.000 pF	0.001 μF	±(1.9 %+2)
	10.00 μF	0.01 μF	±(1.9 %+2)
	100.0 μF	0.1 pF	±(1.9 %+2)
	10000 pF	1.0 μF	≤1000 μF ±(1.9 %+2) >1000 μF ±(10 % + 90) Typical
))) →†	2.000 V	0.001 V	±(0.9 %+2) †

\* The 4000 mV range can only be entered in manual range mode. Use the 4000 mV range with accessories.

† The beeper is guaranteed to come on at <25 Ω and turn off at >250 Ω. The meter detects opens or shorts of 250 μs or longer.

## 12 Multimeter SPECIFICATIONS

Function	Overload Protection*	Input Impedance (Nominal)	Common Mode Rejection Ratio (1 k $\Omega$ Unbalance)	Normal Mode Rejection	
$V_{DC}$	600 V dc	>10 M $\Omega$ <100 pF † $\varnothing_{CHEK}$ & LoZ = >2 k $\Omega$ <200 pF	>100 dB at dc, 50 Hz or 60 Hz	>50 dB at 50 Hz or 60 Hz	
$V_{AC}$	600 V rms	>5 M $\Omega$ <100 pF † $\varnothing_{CHEK}$ & LoZ = >2 k $\Omega$ <200 pF	>60 dB at dc 50 Hz or 60 Hz		
$\Omega$	600 V rms	<b>Open Circuit</b>	<b>Full Scale Voltage</b>		
		<b>Test Voltage</b>	<b>To 4.0 M<math>\Omega</math></b>	<b>40 M<math>\Omega</math></b>	<b>Short Circuit Current</b>
		<1.5 V dc	<450 mV dc	<1.5 V dc	<500 $\mu$ A
$\rightarrow$	600 V rms	2.4-3.0 V dc	2.400 V dc		0.95 mA (Typical)

\*3 x 10<sup>6</sup> V Hz Maximum

†  $\approx$ 2 k $\Omega$  with input voltage up to 50 V. Impedance will increase with input voltage to >300 k $\Omega$  at 600 V.

### MIN MAX Recording Accuracy and Response Time

Specified accuracy of measurement function  $\pm$  12 digits for changes > 200 ms in duration ( $\pm$ 40 digits in ac).  
Typical 100 ms response to 80 %.

### MIN MAX Recording with Elapsed Time

Elapsed Time	Resolution	Accuracy
0 to 100 hours (99:59)	1 minute	0.3 % Typical

### Continuity Capture

Detects opens or shorts of 250  $\mu$ s or longer

