

FLUKE®

Model 81438

True RMS Multimeter

Users Manual

PN 2125063 December 2003

© 2003 Fluke Corporation. All rights reserved. Printed in USA

All product names are trademarks of their respective companies.

Limited Warranty and Limitation of Liability

Each Fluke product is warranted to be free from defects in material and workmanship under normal use and service. The warranty period is three years and begins on the date of shipment. Parts, product repairs, and services are warranted for 90 days. This warranty extends only to the original buyer or end-user customer of a Fluke authorized reseller, and does not apply to fuses, disposable batteries, or to any product which, in Fluke's opinion, has been misused, altered, neglected, contaminated, or damaged by accident or abnormal conditions of operation or handling. Fluke warrants that software will operate substantially in accordance with its functional specifications for 90 days and that it has been properly recorded on non-defective media. Fluke does not warrant that software will be error free or operate without interruption.

Fluke authorized resellers shall extend this warranty on new and unused products to end-user customers only but have no authority to extend a greater or different warranty on behalf of Fluke. Warranty support is available only if product is purchased through a Fluke authorized sales outlet or Buyer has paid the applicable international price. Fluke reserves the right to invoice Buyer for importation costs of repair/replacement parts when product purchased in one country is submitted for repair in another country.

Fluke's warranty obligation is limited, at Fluke's option, to refund of the purchase price, free of charge repair, or replacement of a defective product which is returned to a Fluke authorized service center within the warranty period.

To obtain warranty service, contact your nearest Fluke authorized service center to obtain return authorization information, then send the product to that service center, with a description of the difficulty, postage and insurance prepaid (FOB Destination). Fluke assumes no risk for damage in transit. Following warranty repair, the product will be returned to Buyer, transportation prepaid (FOB Destination). If Fluke determines that failure was caused by neglect, misuse, contamination, alteration, accident, or abnormal condition of operation or handling, including overvoltage failures caused by use outside the product's specified rating, or normal wear and tear of mechanical components, Fluke will provide an estimate of repair costs and obtain authorization before commencing the work. Following repair, the product will be returned to the Buyer, transportation prepaid, and the Buyer will be billed for the repair and return transportation charges (FOB Shipping Point).

THIS WARRANTY IS BUYER'S SOLE AND EXCLUSIVE REMEDY AND IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. FLUKE SHALL NOT BE LIABLE FOR ANY SPECIAL, INDIRECT, INCIDENTAL OR CONSEQUENTIAL DAMAGES OR LOSSES, INCLUDING LOSS OF DATA, ARISING FROM ANY CAUSE OR THEORY.

Since some countries or states do not allow limitation of the term of an implied warranty, or exclusion or limitation of incidental or consequential damages, the limitations and exclusions of this warranty may not apply to every buyer. If any provision of this Warranty is held invalid or unenforceable by a court or other decision-maker of competent jurisdiction, such holding will not affect the validity or enforceability of any other provision.

Fluke Corporation
P.O. Box 9090
Everett, WA 98206-9090
U.S.A.

Fluke Europe B.V.
P.O. Box 1186
5602 BD Eindhoven
The Netherlands

Table of Contents

Title	Page
Read Before Using the Meter: Warnings and Precautions	ii
Introduction	1
Contacting Fluke	1
"Warning" and "Caution" Statements.....	1
Unsafe Voltage.....	1
Test Lead Alert.....	1
Battery Saver ("Sleep Mode")	2
Terminals	2
Rotary Switch Positions.....	2
Display	3
MIN MAX AVG Recording Mode	4
Display HOLD	4
Manual Ranging and Auto Ranging.....	5
Power-Up Options.....	5
Making Basic Measurements	6
Measuring AC and DC Voltage	6
Measuring Resistance.....	7
Measuring Capacitance.....	7
Testing for Continuity	7
Testing Diodes	8
Measuring AC or DC Current	8
Measuring Frequency	9
Using the Bar Graph	9
Cleaning.....	9
Testing the Fuse	10
Replacing the Battery and Fuse	10
Specifications.....	11

⚠ Read Before Using the Meter: Warnings and Precautions

To avoid possible electric shock or personal injury, follow these guidelines:

- Use the Meter only as specified in this manual or the protection provided by the Meter might be impaired.
- Do not use the Meter or test leads if they appear damaged, or if the Meter is not operating properly.
- Always use proper terminals, switch position, and range for measurements.
- Verify the Meter's operation by measuring a known voltage. If in doubt, have the Meter serviced.
- Do not apply more than the rated voltage, as marked on Meter, between terminals or between any terminal and earth ground.
- Use caution with voltages above 30 V ac rms, 42 V ac peak, or 60 V dc. These voltages pose a shock hazard.
- To avoid false readings that can lead to electric shock and injury, replace the battery as soon as the low battery indicator (🔋) appears.
- Disconnect circuit power and discharge all high-voltage capacitors before testing resistance, continuity, diodes, or capacitance.
- Do not use the Meter around explosive gas or vapor.
- When using test leads or probes, keep your fingers behind the finger guards.
- Remove test leads from Meter before opening the battery door or Meter case.

Symbols

	AC (Alternating Current)		Fuse
	DC (Direct Current)		Conforms to European Union directives
	AC or DC		Canadian Standards Association
	Earth ground		Double insulated
	Important information; Refer to manual	 950 Z Listed	Underwriters Laboratories, Inc.
	Battery (Low battery when shown on display)	 N10140	Conforms to relevant Australian standards
	Inspected and licensed by TÜV Product Services		

Model 81438

True RMS Multimeter

Introduction

The Fluke Model 81438 is a battery-powered, true-rms multimeter (hereafter "the Meter") with a 6000-count display and a bar graph.

The Meter measures or tests the following:

- AC / DC voltage and current
- Resistance
- Continuity
- Diodes
- Voltage and current frequency
- Capacitance

This meter meets CAT III IEC 61010-1-95 standards. The IEC 61010-1-95 safety standard defines four overvoltage categories (CAT I to IV) based on the magnitude of danger from transient impulses. CAT III meters are designed to protect against transients in fixed-equipment installations at the distribution level.

Contacting Fluke

To contact Fluke, call:

1-888-993-5853 in USA and Canada

Visit Fluke's web site at: www.fluke.com.

Register your Meter at: register.fluke.com.

"Warning" and "Caution" Statements

A "**⚠ Warning**" statement identifies hazardous conditions and actions that could cause bodily harm or death.

A "**Caution**" statement identifies conditions and actions that could damage the Meter or the equipment under test.

Unsafe Voltage

To alert you to the presence of a potentially hazardous voltage, the **V** symbol is displayed when the Meter detects a voltage ≥ 30 V or a voltage overload (**OL**) condition.

Test Lead Alert

⚠ Warning

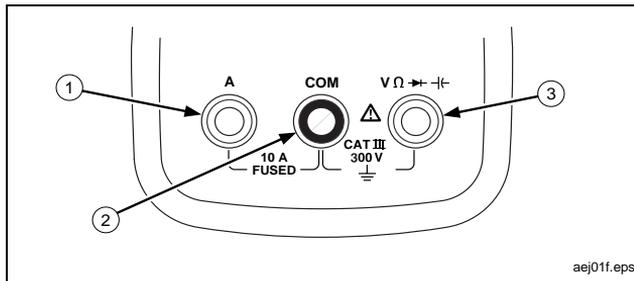
Personal injury or damage to the Meter can occur if you attempt to make a measurement with a lead in an incorrect terminal.

To remind you to check that the test leads are in the correct terminals, **LEAD** is displayed briefly when you move the rotary switch to to or from any **A** position.

Battery Saver ("Sleep Mode")

The Meter automatically enters "Sleep mode" and blanks the display if the Meter is not used for 20 minutes. To disable the Sleep mode, hold down the **Hz** button while turning the Meter on. The Sleep mode is always disabled in the MIN MAX AVG mode.

Terminals



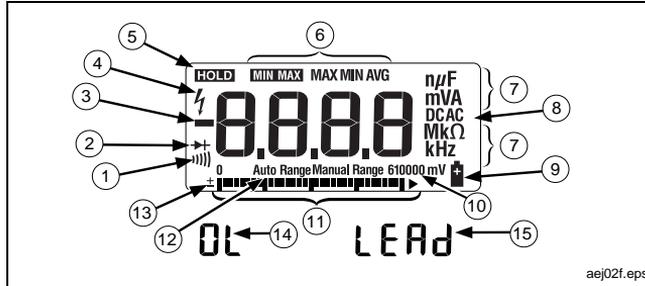
Item	Description
1	Input terminal for AC and DC current measurements to 10 A, or to 20 A overload for 30 seconds maximum, and for frequency of current.
2	Common (return) terminal for all measurements.
3	Input terminal for voltage, continuity, resistance, diode test, capacitance, and voltage frequency measurements.

Rotary Switch Positions

Switch Position	Measurement Function
\tilde{V} Hz (button)	AC voltage from 300 mV to 600 V. Frequency from 5 Hz to 50 kHz.
\bar{V} Hz (button)	DC voltage from 1 mV to 600 V. Frequency from 5 Hz to 50 kHz.
)))	Beeper turns on at < 20 Ω and turns off at > 250 Ω .
Ω	Ohms from 0.1 Ω to 40 M Ω .
$\rightarrow $	Diode test. Displays OL above 2.4 V.
$ \leftarrow$	Farads from 1 nF to 9999 μ F.
\tilde{A} Hz (button)	AC current from 3 A to 10 A. (20 A overload for 30 seconds maximum.) >10.00 display flashes. >20 A, OL is displayed. Frequency from 50 Hz to 5 kHz.
\bar{A} Hz (button)	DC current from 0.001 A to 10 A. (20 A overload for 30 seconds maximum.) >10.00 display flashes. >20 A, OL is displayed. Frequency from 50 Hz to 5 kHz.

Notes: AC voltage and current AC-coupled, True RMS, up to 500 Hz.

Display



aej02f.eps

No.	Symbol	Meaning
1)	Meter is set to continuity function.
2	→	Diode test.
3	-	Negative readings.
4	⚡	Unsafe voltage. Voltage ≥ 30 V, or voltage overload condition (OL).
5	HOLD	Display HOLD is enabled. Display freezes present reading. In MIN MAX AVG mode, MIN MAX AVG recording is paused.
6	MIN MAX MAX MIN AVG	MIN MAX AVG mode enabled. Maximum, minimum, or average reading displayed.

No.	Symbol	Meaning
7	nμF mVA MkΩ kHz	Measurement units.
8	DC AC	Direct current, alternating current.
9	🔋	Replace battery immediately.
10	610000 mV	All possible segments of the range annunciator.
11	(Bar graph)	Analog display.
12	Auto Range Manual Range	The Meter selects the range with the best resolution. The user selects the range.
13	±	Bar graph polarity.
14	OL	The input is too large for the range.
15	LEAD	⚠️ Test lead alert. Displayed briefly when rotary switch is moved <u>to</u> or <u>from</u> any A position.

Error Messages	
diSC	Displayed while the capacitor discharges. In Capacitance function only.
EEPr	Cannot read data from EEPROM. Turn power off, then on. If message remains, service Meter.
EEPr Err	Invalid EEPROM data. Have Meter serviced.
CAL Err	Invalid calibration data. Calibrate Meter.

MIN MAX AVG Recording Mode

The MIN MAX AVG recording mode captures the minimum and maximum input values, and calculates a running average of all readings. When a new high or low is detected, the Meter beeps.

Put the Meter in the desired measurement function and range.

⇒ Press **MIN MAX** to enter MIN MAX AVG mode.

MIN MAX and **MAX** are displayed and the highest reading detected since entering MIN MAX AVG is displayed.

⇒ Press **MIN MAX** to step through the low (**MIN**), average (**AVG**), and present readings.

⇒ To pause MIN MAX AVG recording without erasing stored values, press **HOLD**. **HOLD** is displayed.

⇒ To resume MIN MAX AVG recording, press **HOLD** again.

⇒ To exit and erase stored readings, press **MIN MAX** for at least one second or turn the rotary switch.

Display HOLD

⚠ Warning

To avoid electric shock, when Display HOLD is activated, be aware that the display will not change when you apply a different voltage.

In the Display HOLD mode, the Meter freezes the display.

⇒ Press **HOLD** to activate Display HOLD. (**HOLD** is displayed.)

⇒ To exit and return to normal operation, press **HOLD** or turn the rotary switch.

Manual Ranging and Auto Ranging

The Meter has both Manual Range and Auto Range modes.

- ⇒ In the Auto Range mode, the Meter selects the range with the best resolution.
- ⇒ In the Manual Range mode, you override Auto Range and select the range yourself.

When you turn the Meter on, it defaults to Auto Range and **Auto Range** is displayed.

1. To enter the Manual Range mode, press **RANGE**. **Manual Range** is displayed.
2. In the Manual Range mode, press **RANGE** to increment the range. After the highest range, the Meter wraps to the lowest range.

Note

You cannot manually change the range in the MIN MAX AVG or Display HOLD modes.

*If you press **RANGE** while in MIN MAX AVG or Display Hold, the Meter beeps, indicating an invalid operation, and the range does not change.*

3. To exit Manual Range, press **RANGE** for at least 1 second or turn the rotary switch.

The Meter returns to Auto Range and **Auto Range** is displayed.

Power-Up Options

To select a Power-Up Option, hold down the button indicated for at least 1 second while turning the Meter on.

Power-Up Options are canceled when you turn the Meter off.

Button	Power-Up Options
HOLD	Turns on all display segments. Release HOLD to continue; the software version number is displayed briefly and the Meter resumes normal operation.
MIN MAX	Disables beeper.
Hz	Disables automatic power-down ("Sleep mode").

Making Basic Measurements

The figures on the following pages show how to make basic measurements.

When connecting the test leads to the circuit or device, connect the common (**COM**) test lead before connecting the live lead; when removing the test leads, remove the live lead before removing the common test lead.

⚠ Warning

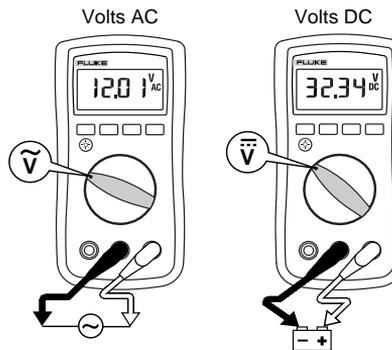
To avoid electric shock, injury, or damage to the Meter, disconnect circuit power and discharge all high-voltage capacitors before testing resistance, continuity, diodes, or capacitance.

Note

In reading AC voltage or current, for the integrated RMS converter to correctly measure distorted waveforms, reading settling time increases to several seconds at the low end of AC voltage and current ranges.

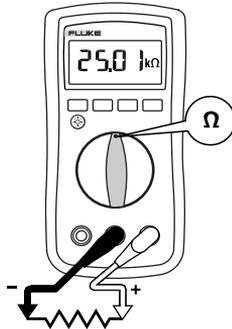
The Meter is not specified for use with current clamp accessories.

Measuring AC and DC Voltage



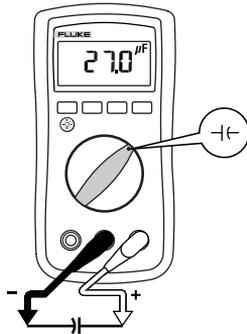
aej03f.eps

Measuring Resistance



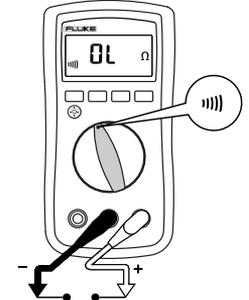
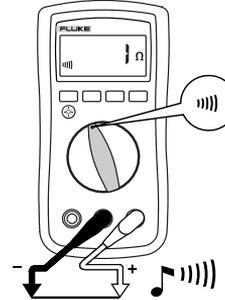
aej04f.eps

Measuring Capacitance



aej05f.eps

Testing for Continuity

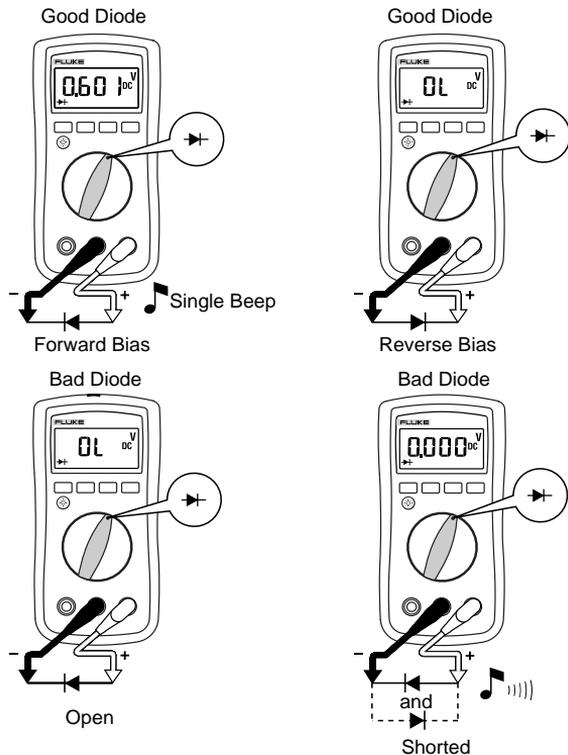


aej06f.eps

Note

The continuity function works best as a fast, convenient method to check for opens and shorts. For maximum accuracy in making resistance measurements, use the Meter's resistance (Ω) function.

Testing Diodes



aej07f.eps

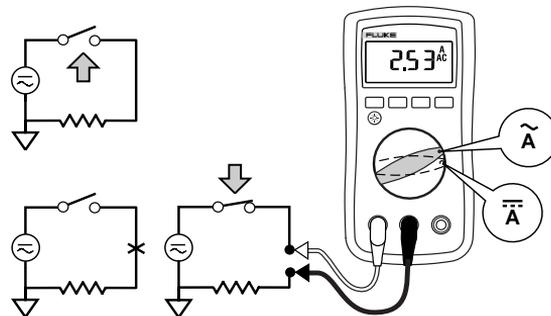
Measuring AC or DC Current

⚠ Warning

To avoid personal injury or damage to the Meter:

- Never attempt to make an in-circuit current measurement when the open-circuit potential to earth is > 600 V.
- Check the Meter's fuse before testing. (See "Testing the Fuse")
- Use the proper terminals, switch position, and range for your measurement.
- Never place the probes in parallel with a circuit or component when the leads are plugged into the current terminals.

Turn power OFF, break circuit, insert Meter in series, turn power on.



aej08f.eps

Measuring Frequency

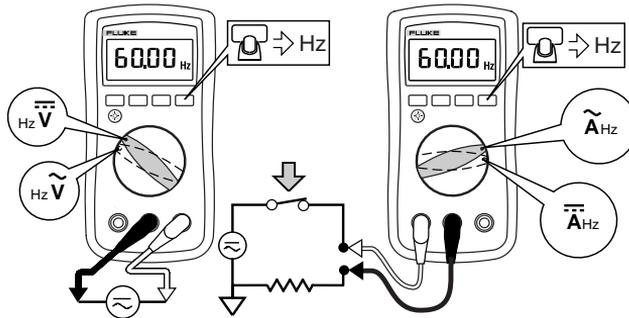
⚠ Warning

To avoid electrical shock, disregard the bar graph for frequencies > 500 Hz. If the frequency of the measured signal is > 500 Hz, the bar graph is unspecified.

The Meter measures the frequency of a signal by counting the number of times the signal crosses a trigger level each second. The trigger level is 0 V, 0 A for all ranges.

AC/DC Voltage Frequency

AC/DC Current Frequency



aej09f.eps

- ⇒ Press **Hz** to turn the frequency measurement function on and off.
- ⇒ In frequency, the bar graph and range annunciator indicate the AC or DC voltage or current present.
- ⇒ Select progressively lower ranges using manual ranging for a stable reading.

Using the Bar Graph

The bar graph is like the needle on an analog meter. It has an overload indicator (▶) to the right and a polarity indicator (±) to the left.

Because the bar graph updates about 40 times per second, which is ten times faster than the digital display, the bar graph is useful for making peak and null adjustments.

The bar graph is disabled when measuring capacitance. In frequency, the bar graph and range annunciator indicate the underlying voltage or current.

The number of segments indicates the measured value and is relative to the full-scale value of the selected range, except on the 10 A ranges.

In the 60 V range, for example (see below), the major divisions on the scale represent 0, 30, and 60 V. An input of -30 V turns on the negative sign and the segments up to the middle of the scale.



aej11f.eps

Cleaning

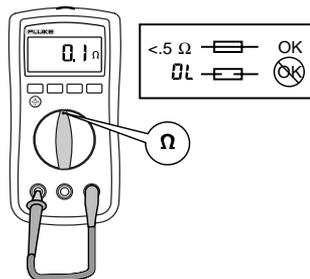
Wipe the case with a damp cloth and mild detergent. Do not use abrasives or solvents. Dirt or moisture in the terminals can affect readings.

Testing the Fuse

⚠ Warning

To avoid electrical shock or injury, remove the test leads and any input signals before replacing the fuse.

Test fuse as shown below.



aej12f.eps

Replacing the Battery and Fuse

⚠ Warning

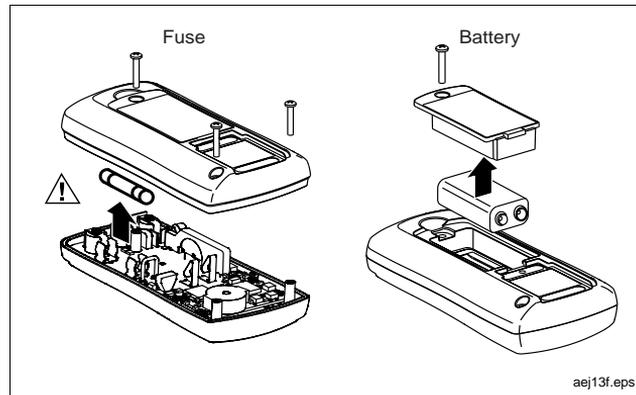
To avoid shock, injury, or damage to the Meter:

- Remove test leads from the Meter before opening the case or battery door.
- Use **ONLY** a fuse with the amperage, interrupt, voltage, and speed ratings specified.
- Replace the battery as soon as the low battery indicator () appears to avoid false readings.

To remove the battery door:

1. Remove screw from battery door.
2. Use the finger recess to lift door slightly.
3. Pull door toward bottom of Meter to release the latch.
4. Lift the door straight up to separate from case.

The battery fits inside the battery door, which is then inserted straight into the case until it clicks into place. Do not attempt to install the battery directly into the case.



aej13f.eps

F1 Fuse 11 A, 1000 V, FAST.
Minimum Interrupt Rating 17000 A.
Use only Fluke Part Number 803293.

Battery, 9 V Alkaline, NEDA 1604A / IEC 6LR61

Specifications

Accuracy is specified for 1 year after calibration, at operating temperatures of 18 °C to 28 °C, with relative humidity at 0 % to 95 %. The accuracy specifications take the form of: \pm ([% of Reading] + [Counts])	
Maximum voltage between any terminal and earth ground:	600 V
Surge Protection	6 kV peak per IEC 61010-1-95
⚠ Fuse for A input:	11 A, 1000 V FAST Fuse
Display:	Digital: 6,000 counts, updates 4/sec Bar Graph: 33 segments, updates 40/sec Frequency: 9,999 counts Capacitance: 9,999 counts
Temperature:	Operating: -10 °C to +50 °C Storage: -30 °C to +60 °C
Temperature Coefficient:	0.1 x (specified accuracy) / °C for < 18 °C or > 28 °C
Electromagnetic Compatibility:	Performance \geq 3 V/m is not specified.
Relative Humidity:	Noncondensing < 10 °C 0 % to 95 % @ 10 °C to 30 °C 0 % to 75 % @ 30 °C to 40 °C 0 % to 45 % @ 40 °C to 50 °C
Battery Life:	Alkaline: 300 hours typical, without backlight
Size, with Holster (H x W x L):	4.6 cm x 9.6 cm x 16.0 cm
Weight:	350 g
Safety Compliances:	ANSI/ISA-S82.01-1988, CSA C22.2 No 231 and IEC 61010-1-95 Overvoltage Category III (CAT III), 300 V
Certifications:	UL (3111), CE, CSA, TÜV,  (N10140)

Model 81438*Users Manual*

Function	Range	Resolution	Accuracy \pm ([% of Reading] + [Counts])
AC Volts ^{1,2} -- True RMS (50 Hz to 500 Hz)	6000 mV ³ 6.000 V 60.00 V 600.0 V	1 mV 0.001 V 0.01 V 0.1 V	1.0 % + 3
DC Volts	6000 mV ³ 6.000 V 60.00 V 600.0 V	1 mV 0.001 V 0.01 V 0.1 V	0.7 % + 2
Continuity	600 Ω	1 Ω	Beeper guaranteed on < 20 Ω , guaranteed off > 250 Ω ; detects opens or shorts of 250 μ s or longer.
Ohms	600.0 Ω 6.000 k Ω 60.00 k Ω 600.0 k Ω 6.000 M Ω 40.00 M Ω	0.1 Ω 0.001 k Ω 0.01 k Ω 0.1 k Ω 0.001 M Ω 0.01 M Ω	0.9 % + 2 0.9 % + 1 0.9 % + 1 0.9 % + 1 0.9 % + 1 1.5 % + 3
Diode test	2.200 V	0.001 V	
Capacitance ⁴	1000 nF 10.00 μ F 100.0 μ F	1 nF 0.01 μ F 0.1 μ F	1.9 % + 2 1.9 % + 2 1.9 % + 2
	10000 μ F	1 μ F	100 μ F - 1000 μ F: 1.9% + 2 > 1000 μ F: 10% + 90 typical
AC Amps ⁵ -- True RMS (50 Hz to 500 Hz)	10.00 A continuous or 20 A overload for 30 seconds maximum	0.01 A	1.5 % + 3

Function	Range	Resolution	Accuracy ± ([% of Reading] + [Counts])
DC Amps (Models 111 and 112)	6.000 A 10.00 A continuous or 20 A overload for 30 seconds maximum	0.001 A 0.01 A	1.0 % + 3
Hz ⁶ (V or A input)	99.99 Hz 999.9 Hz 9.999 kHz 50.00 kHz	0.01 Hz 0.1 Hz 0.001 kHz 0.01 kHz	0.1 % + 2
MIN MAX AVG Accuracy and Response Time	Accuracy is the specified accuracy of the measurement function ± 12 digits for changes >275 ms in duration (± 40 digits in AC). Typical response time: 100 ms to 80 % of signal, except V AC and A AC.		
<ol style="list-style-type: none"> 1. AC voltage ranges are specified from 5% of range to 100% of range. 2. Crest factor of ≤ 3 at full scale up to 300 V, decreasing linearly to crest factor ≤ 1.5 at 600 V. 3. The 6000 mV range can only be entered in Manual Range mode. 4. For film capacitors. 5. Crest factor of ≤ 3. AC current is not specified below 3A. 6. Hz is specified from 5 Hz to 50 kHz in volts, from 50 Hz to 5 kHz in amps. 			

Function	Input Impedance (Nominal)	Common Mode Rejection Ratio		Normal Mode Rejection
Volts AC	> 5 MΩ < 100 pF	> 60 dB at DC, 50 Hz or 60 Hz		
Volts DC	> 10 MΩ < 100 pF	> 100 dB at DC, 50 Hz or 60 Hz		> 50 dB at 50 Hz or 60 Hz
		Full Scale Voltage		
	Open Circuit Test Voltage	To 6 MΩ	40 MΩ	Short Circuit Current
Ohms	< 1.5 V DC	< 600 mV DC	< 1.5V DC	< 500 μA
Diode test	2.4 to 3.0 V DC	2.400 V DC		1.2 mA typical

