FLUKE®

Model 77 Series IV

Digital Multimeter

Users Manual

Model 77 Series IV
Digital Multimeter

Safety Information

A **Warning** identifies conditions and procedures that are dangerous to the user. A **Caution** identifies conditions and procedures that can cause damage to the Product or the equipment under test.

⚠⚠ Warning

To prevent possible electrical shock, fire, or personal injury.

- **Use the Product only as specified, or the protection supplied by the Product can be compromised.**
- **Comply with local and national safety codes. Use personal protective equipment (approved rubber gloves, face protection, and flame-resistant clothes) to prevent shock and arc blast injury where hazardous live conductors are exposed.**
- **Use Product-approved measurement category (CAT), voltage, and amperage rated accessories (probes, test leads, and adapters) for all measurements.**
- **Remove all probes, test leads, and accessories that are not necessary for the measurement.**
- **Do not use test leads if they are damaged. Examine the test leads for damaged insulation and measure a known voltage.**

- **Do not use a current measurement as an indication that a circuit is safe to touch. A voltage measurement is necessary to know if a circuit is hazardous.**
- **Do not use the Product if it is damaged.**
- **Disable the Product if it is damaged.**
- **Do not use the Product above its rated frequency.**
- **Do not use in CAT III or CAT IV environments without the protective cap installed on test probe. The protective cap decreases the exposed probe metal to <4 mm. This decreases the possibility of arc flash from short circuits.**
- **Replace a blown fuse with exact replacement only for continued protection against arc flash.**
- **Do not use the HOLD function to measure unknown potentials. When HOLD is turned on, the display does not change when a different potential is measured.**
- **Attempting to make a measurement with a test lead in an incorrect terminal might blow a fuse, damage the Meter, and cause serious personal injury.**

Symbols

Symbol	Description	Symbol	Description
~	AC (Alternating Current)		Fuse
⎓	DC (Direct Current)	CE	Conforms to European Union directives
⎓ ~	DC/AC	C SP US	Certified by CSA Group to North American safety standards.
⏚	Earth	⧈	Double insulated
⚠	WARNING. RISK OF DANGER.	⚠	WARNING. HAZARDOUS VOLTAGE. Risk of electric shock.

Symbol	Description	Symbol	Description
	Battery (Low battery when shown on display)		Consult user documentation.
	Certified by TÜV SÜD Product Service.		Conforms to relevant South Korean EMC Standards
	Conforms to relevant Australian EMC standards		
CAT II	Measurement Category II is applicable to test and measuring circuits connected directly to utilization points (socket outlets and similar points) of the low-voltage MAINS installation.		
CAT III	Measurement Category III is applicable to test and measuring circuits connected to the distribution part of the building's low-voltage MAINS installation.		
CAT IV	Measurement Category IV is applicable to test and measuring circuits connected at the source of the building's low-voltage MAINS installation.		

Unsafe Voltage

During a voltage measurement, the Meter alerts you to the presence of a potentially hazardous voltage. When the Meter detects a voltage ≥30 V or a voltage overload (**OL**), the ϟ symbol is displayed.

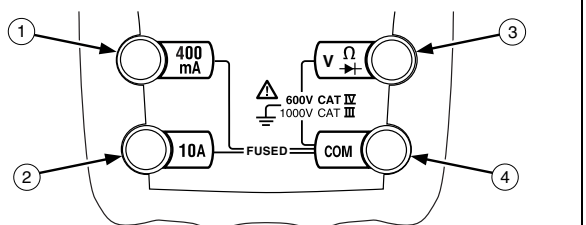
Test Lead Alert

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

Battery Saver (Sleep Mode)

The Meter enters the "Sleep" mode and blanks out the display if there is no function change or button press for 20 minutes. To disable the Sleep mode, hold down the yellow button while turning the Meter on. The Sleep mode is always disabled in the MIN MAX AVG mode and the AutoHOLD mode.

Terminals

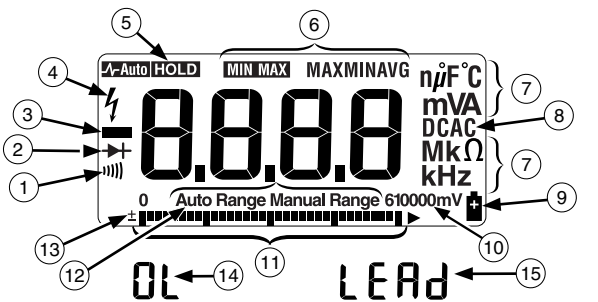


Item	Description
1	Input terminal for AC and DC milliamp measurements to 400 mA.
2	Input terminal for AC and DC current measurements to 10 A.
3	Input terminal for voltage, continuity, resistance, diode test, capacitance, and frequency measurements.
4	Common (return) terminal for all measurements.

Rotary Switch Positions

Switch Position	Measurement Function
Ṽ Hz	AC voltage from 0.001 to 1000 V. Frequency from 2 Hz to 99.99 kHz.
V̿	DC voltage from 1 mV to 1000 V.
mV̿	DC mV from 0.1 mV to 600 mV.
Ω ⊣⊢	Ohms from 0.1 Ω to 50 MΩ. Farads from 1 nF to 9999 µF.
)))) ⊣▸	Beeper turns on at <25 Ω and turns off at >250 Ω. Diode test. Displays OL above 2.4 V.
⎓~ mA	AC mA from 0.01 mA to 400 mA. DC mA from 0.01 mA to 400 mA.
⎓ ~A	AC A from 0.001 A to 10 A. DC A from 0.001 A to 10 A >10.00 display flashes. >20 A, **OL** is displayed.

Display



No.	Symbol	Meaning
1	)))	Continuity test.
2	→|	Diode test.
3	−	Negative readings.
4	ϟ	Unsafe voltage. Voltage ≥30 V, or voltage overload (**OL**)
5	HOLD	AutoHOLD is enabled. Display holds present reading until it detects new stable input. Then the Meter beeps and displays new reading.
6	MIN MAX **MAX , MIN, AVG**	MIN MAX AVG enabled. Maximum, minimum, average, or present reading.
7	**nμ F, mVA, MkΩ, kHz**	Measurement units.
8	**DC, AC**	Direct current, alternating current.
9		Low battery. Replace battery.
10	**610000mV**	All possible ranges.
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 out of range.
15	LEAd	⚠Test lead alert. Displayed when the rotary switch is moved *to* or *from* the **mA** or **A** position.

Error Messages	
bAtt	Replace the battery immediately.
d iSC	In the capacitance function, too much electrical charge is present on the capacitor being tested.
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.

Note

For dc functions, accuracy is the specified accuracy of the measurement function ±12 counts for changes longer than 350 ms in duration.

For ac functions, accuracy is the specified accuracy of the measurement function ±40 counts for changes longer than 350 ms in duration.

To use MIN MAX AVG recording:

- Make sure that the Meter is in the desired measurement function and range. (Autoranging is disabled in the MIN MAX AVG mode.)
- Press **MIN MAX** to activate MIN MAX AVG mode.

  MIN MAX and **MAX** light, 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. HOLD turns off.
- To exit and erase stored readings, press MIN MAX for 1 second or turn the rotary switch.

AutoHOLD Modes

⚠⚠Warning

To avoid electric shock, do not use the AutoHOLD mode to determine if a circuit is live. Unstable or noisy readings will not be captured.

In the AutoHOLD mode, the Meter holds the reading on the display *until* it detects a new stable reading. Then the Meter beeps, and displays the new reading.

- Press **HOLD** to activate AutoHOLD. HOLD lights.
- Press **HOLD** again or turn the rotary switch to resume normal operation.

YELLOW Button

Press the yellow button to select alternate measurement functions on a rotary switch setting, e.g., to select DC mA, DC A, Hz, capacitance, or diode test.

Display Backlight

Press ☼ to toggle the backlight on and off. The backlight automatically turns off after 2 minutes.

Manual Ranging and Autoranging

The Meter has both Manual range and Autorange modes.

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

When you turn the Meter on, it defaults to Autorange 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 mode.

   If you press **RANGE** *while in MIN MAX AVG, the Meter beeps twice, indicating an invalid operation, and the range does not change.*
3. To exit Manual Range, press **RANGE** for 1 second or turn the rotary switch.
   The Meter returns to Autorange and **Auto Range** is displayed.

Power-Up Options

To select a Power-Up Option, hold down the button indicated while turning the Meter on.

Power-Up Options are cancelled when the Meter is turned OFF.

Button	Power-Up Options
HOLD	Turns on all display segments when in VAC switch position.
MIN MAX	Disables beeper. bEEP is diplayed when enabled.
RANGE	Enables "Smoothing" mode. S--- is displayed when enabled. Dampens display fluctuations of rapidly changing inputs by digital filtering.
(YELLOW)	Disables automatic power-down ("Sleep mode"). PoFF is displayed when enabled Sleep mode is also disabled while the Meter is in a MIN MAX AVG Recording mode, or the AutoHOLD mode.
☼	Disables automatic 2-minute backlight timeout. LoFF is displayed when enabled.

Making Basic Measurements

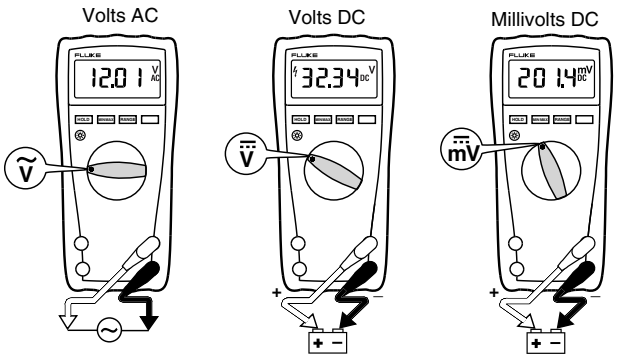
The figures on the following pages show how to make basic measurements.

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.

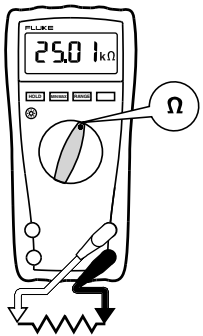
⚠⚠Warning

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

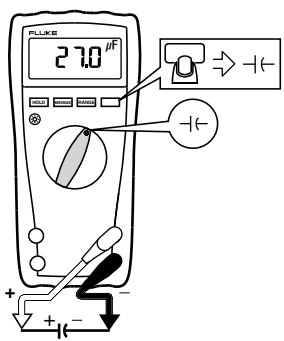
Measuring AC and DC Voltage



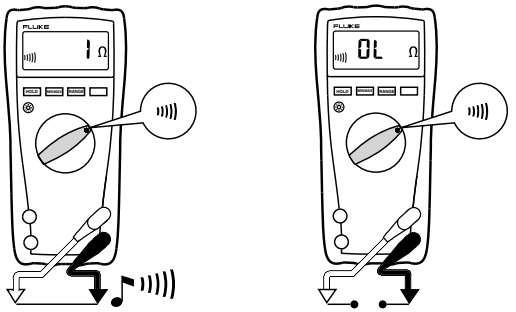
Measuring Resistance



Measuring Capacitance



Testing for Continuity



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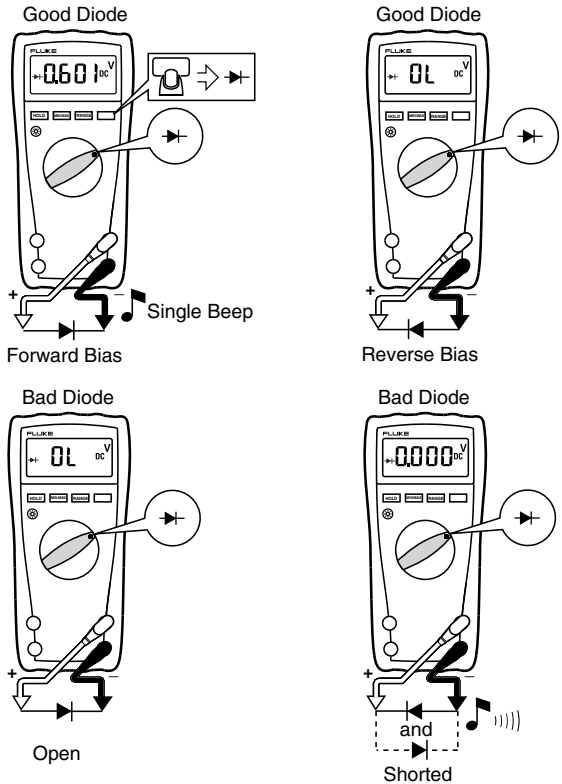
Testing Diodes



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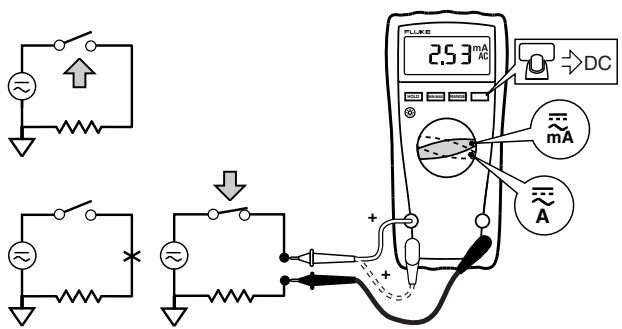
Measuring AC or DC Current

⚠⚠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 ground is >1000 V.**
- **Check the Meter's fuses before testing. (See "Testing the Fuses".)**
- **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.



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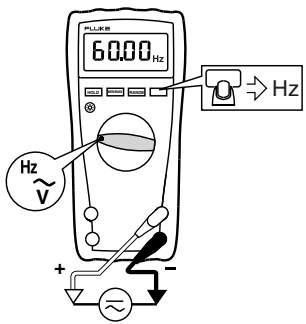
Measuring Frequency

⚠⚠Warning

To avoid electrical shock, disregard the bar graph for frequencies >1 kHz. If the frequency of the measured signal is >1 kHz, the bar graph is unspecified.

The Meter measures the frequency of a signal. The trigger level is 0 V ac for all ranges.

AC Voltage Frequency



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- To exit frequency, press yellow button or turn the rotary switch.
- In frequency, the bar graph shows the ac voltage accurately up to 1 kHz.
- Select progressively lower ranges using manual ranging for a stable reading.

Using the Bar Graph

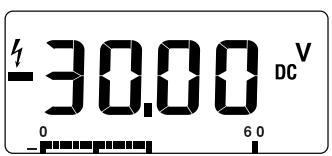
The bar graph is like the needle on an analog Meter. There is an overload indicator (►) to the right, and a polarity indicator (±) to the left.

Because the bar graph is much faster than the digital display, the bar graph is useful for making peak and null adjustments, and for observing rapidly changing inputs.

The bar graph is disabled when measuring capacitance. In frequency, the bar graph accurately indicates the voltage or current up to 1 kHz.

The number of lit segments indicates the measured value and is relative to the full-scale value of the selected range.

For example, in the 60 V range (see below), the major divisions on the scale represent 0, 15, 30, 45, and 60 V. An input of –30 V lights the negative sign and the segments up to the middle of the scale.



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Cleaning

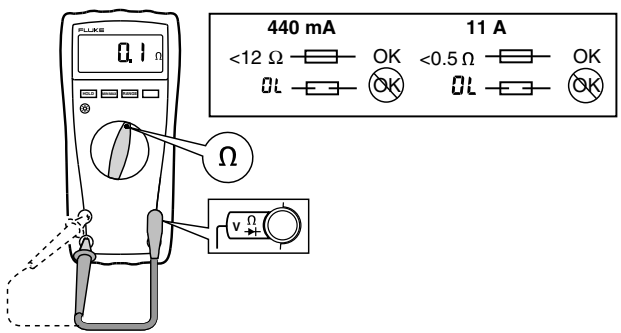
Wipe the case with a damp cloth and mild detergent. Do not use abrasives or solvents. Dirt or moisture in the terminals can affect readings.

Testing the Fuses

⚠⚠Warning

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

Test fuses as shown below.



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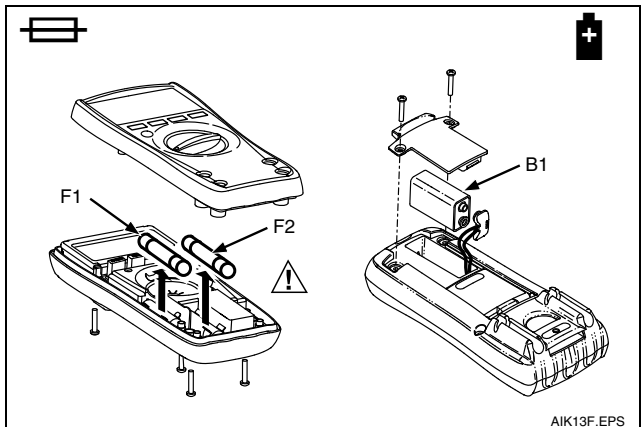
Replacing the Battery and Fuses

⚠⚠Warning

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

- **Use ONLY fuses with the amperage, interrupt, voltage, and speed ratings specified. Disconnect test leads before opening case.**



F1 Fuse, 440 mA, 1000 V, FAST	Fluke PN 943121
F2 Fuse, 11 A, 1000 V, FAST	Fluke PN 803293
B1 Battery, 9 V Alkaline, NEDA 1604 / 1604A	Fluke PN 614487

General Specifications

Accuracy is specified for 1 yr after calibration, at operating temperatures of 18 °C to 28 °C, with relative humidity at 0 % to 90 %. Accuracy specifications take the form of ±([% of Reading] + [Counts]).

Maximum voltage between any terminal and earth ground ..... 1000 V

Fuse protection for mA inputs ..... 0.44 A, 1000 V, IR 10 kA

Fuse protection for A inputs ..... 11 A, 1000 V, IR 17 kA FAST Fuse

Display

Digital ..... 6000 counts, updates 4/sec

Bar Graph ..... 33 segments; Updates 32/sec

Frequency ..... 10,000 counts

Capacitance ..... 1,000 counts

Altitude

Operating ..... 2,000 meters

Storage ..... 12,000 meters

Temperature

Operating ..... -10 °C to +50 °C

Storage ..... -40 °C to +60 °C

Temperature coefficient ..... 0.1 X (specified accuracy) / °C (< 18 °C or > 28 °C)

Safety

General ..... IEC 61010-1: Pollution Degree 2

Measurement ..... IEC 61010-2-033: CAT IV 600 V / CAT III 1000 V

Relative Humidity (Maximum Non-condensing) ..... 90 % to 35 °C
75 % to 40 °C
45 % to 50 °C

Battery Life ..... 400 hrs typical (Alkaline)

Size (H x W x L) ..... 4.3 cm x 9 cm x 18.5 cm

Weight ..... 420 g

Electromagnetic Compatibility (EMC)

International ..... IEC 61326-1: Portable Electromagnetic Environment, IEC 61326-2-2.

CISPR 11: Group 1, Class A

Group 1: Equipment has intentionally generated and/or uses conductively-coupled radio frequency energy that is necessary for the internal function of the equipment itself.

Class A: Equipment is suitable for use in all establishments other than domestic and those directly connected to a low-voltage power supply network that supplies buildings used for domestic purposes. There may be potential difficulties in ensuring electromagnetic compatibility in other environments due to conducted and radiated disturbances.

Emissions that exceed the levels required by CISPR 11 can occur when the equipment is connected to a test object.

Korea (KCC) ..... Class A Equipment (Industrial Broadcasting & Communication Equipment)

Class A: Equipment meets requirements for industrial electromagnetic wave equipment and the seller or user should take notice of it. This equipment is intended for use in business environments and not to be used in homes.

USA (FCC)..... 47 CFR 15 subpart B. This product is considered an exempt device per clause 15.103.

Function	Range	Resolution	Accuracy ± ([% of Reading] + [Counts])
AC Volts (Average responding)	6.000 V 60.00 V 600.0 V 1000 V	0.001 V 0.01 V 0.1 V 1 V	2.0 % + 2 (45 Hz to 1 kHz)
DC mV	600.0 mV	0.1 mV	0.3 % + 1
DC Volts	6.000 V 60.00 V 600.0 V 1000 V	0.001 V 0.01 V 0.1 V 1 V	0.3 % + 1
Continuity	600 Ω	1 Ω	Meter beeps at <25 Ω, beeper turns off at >250 Ω; detects opens or shorts of 250 µs or longer.
Ohms	600.0 Ω 6.000 kΩ 60.00 kΩ 600.0 kΩ 6.000 MΩ 50.00 MΩ	0.1 Ω 0.001 kΩ 0.01 kΩ 0.1 kΩ 0.001 MΩ 0.01 MΩ	0.5 % + 2 0.5 % + 1 0.5 % + 1 0.5 % + 1 0.5 % + 1 2.0 % + 1
Diode test	2.400 V	0.001 V	1 % + 2
Capacitance	1000 nF 10.00 µF 100.0 µF 9999 µF[1]	1 nF 0.01 µF 0.1 µF 1 µF	1.2 % + 2 1.2 % + 2 1.2 % + 2 10 % typical
AC Amps (Average responding)[2]	60.00 mA 400.0 mA[3] 6.000 A 10.00 A[4]	0.01 mA 0.1 mA 0.001 A 0.01 A	2.5 % + 2 (45 Hz to 1 kHz)

[1] In the 9999 µF range for measurements to 1000 µF, the measurement accuracy is 1.2 % + 2.
[2] Amps input burden voltage (typical): 400 mA input 2 mV/mA, 10 A input 37 mV/A.
[3] 400.0 mA accuracy specified up to 600 mA overload.
[4] >10 A unspecified.

Function	Range	Resolution	Accuracy ± ([% of Reading] + [Counts])
DC Amps[3]	60.00 mA 400.0 mA[4] 6.000 A 10.00 A[5]	0.01 mA 0.1 mA 0.001 A 0.01 A	1.5 % + 2
Hz [1][2] (ac voltage input)	99.99 Hz 999.9 Hz 9.999 kHz 99.99 kHz	0.01 Hz 0.1 Hz 0.001 kHz 0.01 kHz	0.1 % + 1
MIN MAX AVG	For dc functions, accuracy is the specified accuracy of the measurement function ±12 counts for changes longer than 350 ms in duration. For ac functions, accuracy is the specified accuracy of the measurement function ±40 counts for changes longer than 350 ms in duration.		

[1] Frequency is specified from 2 Hz to 99.99 kHz.
[2] Below 2 Hz, the display shows zero Hz.
[3] Amps input burden voltage (typical): 400 mA input 2 mV/mA, 10 A input 37 mV/A.
[4] 400.0 mA accuracy specified up to 600 mA overload.
[5] >10 A unspecified.

Function	Overload Protection[1]	Input Impedance (Nominal)	Common Mode Rejection Ratio (1 kΩ Unbalanced)		Normal Mode Rejection
Volts AC	1000 V	>10 MΩ <100 pF	>60 dB @ dc, 50 Hz or 60 Hz		
Volts DC	1000 V	>10 MΩ <100 pF	>120 dB @ dc, 50 Hz or 60 Hz		>60 dB @ 50 Hz or 60 Hz
mV	1000 V[2]	>10 MΩ <100 pF	>120 dB @ dc, 50 Hz or 60 Hz		>60 dB @ 50 Hz or 60 Hz
		Open Circuit Test Voltage	**Full Scale Voltage To:** **6.0 MΩ**	**50 MΩ**	**Short Circuit Current**
Ohms/Capacitance	1000 V[2]	<8.0 V dc	<660 mV dc	<4.6 V dc	<1.1 mA
Continuity/Diode test	1000 V[2]	<8.0 V dc	2.4 V dc		<1.1 mA

[1] 10^7 V-Hz maximum.
[2] For circuits <0.3 A short circuit. 660 V for high energy circuits.

Function	Overload Protection	Overload
mA	Fused, 440 mA, 1000 V FAST Fuse	600 mA overload for 2 minutes maximum, 10 minutes rest.
A	Fused, 11 A, 1000 V FAST Fuse	20 A overload for 30 seconds maximum, 10 minutes rest.