

Physical Specifications

Display (LCD)	Digital: 50000/5000 counts primary display, 5000 counts secondary display; updates 4/second. Analog: 51 segments, updates 40/second.
Operating Temperature	– 20 °C to + 55 °C
Storage Temperature	– 40 °C to +60 °C
Temperature Coefficient	0.05 x (specified accuracy) / °C (<18 °C or >28 °C)
Relative Humidity	0 % to 90 % (0 °C to 28 °C) 0 % to 70 % (28 °C to 55 °C)
Altitude	Operating: 0-2000 meters per EN61010 CAT III, 1000V 0-3000 meters per EN61010 CAT II, 1000V, EN61010 CAT III, 600V Storage: 10000 meters
Battery Type	4 AA Alkaline, NEDA 15A or LR6
Battery Life	72 Hours typical (with backlight off)
Shock Vibration	Per MIL-T-PRF 28800 for Class II instruments
Electromagnetic Compatibility (EMC)	Susceptibility and Emissions: Commercial Limits per EN61326-1 (see notes for DC mV, DC μ A, and Resistance.)
Size	10.0 cm x 20.3 cm x 5.0 cm (3.94 in x 8.00 in x 1.97 in) (Not Including Accessory Mount)
Weight	545 grams (1.2 lbs.)
Case Sealing	IP-42 per IEC 529, Section 3
Warranty	Lifetime
Calibration Interval	1 year

Feature Summary

Feature	Description
Dual Digital Displays	Primary: 50,000 counts Secondary: 5,000 count
Analog Bar Graph	Bar graph: 51 segments, updates 40 times/second
Backlight with 2 brightness adjustment	Bright white backlight for clear readings in poorly lighted areas
Fast Autorange	Meter automatically selects best range - instantly
AC+DC true rms, ac rms specified to 100 kHz	Choices for AC only, AC and DC dual display, or AC+DC readings
dBm, dBV	User selectable impedance references for dBm
AutoHOLD	Holds readings on display
Continuity / Open test	Beeper sounds for resistance readings below threshold, or to indicate a momentary open circuit
Fast Bar Graph	51 segments for peaking and nulling
Duty cycle / Pulse width	Measure the time signal is on or off in % or milliseconds
MIN MAX Mode	Record maximum, minimum, and average values. 24-hour clock for MAX or MIN, elapsed time for AVG.
FAST MN MX with 24-hour time stamp	FAST MN MX captures peaks to 250 μ sec.
Close-Case Calibration	No internal adjustments needed
Battery / Fuse Access Door	Battery or fuse replaceable without voiding calibration
Hi-Impact Overmolded Case	Protective holster features

Basic Specifications

Function	Ranges/Description
DC Voltage	0 to 1000 V
AC Voltage, true RMS	15 mV to 1000 V – 100 kHz bandwidth
Basic Accuracy	DC voltage: 0.025 % AC voltage: 0.4 %
DC Current	0 to 10 A (20 A for 30 seconds)
AC Current, true RMS	25 μ A to 10 A (20 A for 30 seconds)
Resistance	0 to 30 M Ω
Conductance	0 to 50 nS
Capacitance	0.001 nF to 50 mF
Diode Test	3.1 V
Temperature	–200 °C to 1350 °C (–328 °F to 2462 °F)
Frequency	0.5 Hz to 1000 kHz
LOGGING Intervals (Model 89 only)	At least 288 intervals may be stored. Up to 700 unstable event values (see AutoHold) are automatically added to LOGGING memory for viewing only through optional PC software. Additional intervals will be logged up to 988 if the signal is stable.
SAVE Readings (Model 89 only)	Up to 100 readings may be saved by the user in a memory separate from LOGGING memory. These readings may be viewed using VIEW MEM.

Detailed Accuracy Specifications

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 %. Accuracy specifications are given as:

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

AC mV, AC V, AC μ A, AC mA, and AC A specifications are ac coupled, true rms and are valid from 5% of range to 100 % of range. AC crest factor can be up to 3.0 at full-scale, 6.0 at half-scale except the 3000 mV and 1000 V ranges where it is 1.5 at full scale, 3.0 at half-scale.

			Accuracy				
Function	Range	Resolution	45 Hz-1 kHz	20-45 Hz	1 kHz-10 kHz	10 kHz-20 kHz	20 kHz-100 kHz
AC mV ^{1, 2}	50.000 mV	0.001 mV	0.4 % + 40	2 % + 80	5 % + 40	5 % + 40	15 % + 40
	500.00 mV	0.01 mV	0.4 % + 40	2 % + 80	5 % + 40	5 % + 40	6 % + 40
	3000.0 mV	0.1 mV	0.4 % + 40	2 % + 80	0.4 % + 40	1.5 % + 40	6 % + 40
AC V ^{1, 2}	5.0000 V	0.0001 V	0.4 % + 40	2 % + 80	0.4 % + 40	1.5 % + 40	6 % + 40
	50.000 V	0.001 V	0.4 % + 40	2 % + 80	0.4 % + 40	1.5 % + 40	6 % + 40
	500.00 V	0.01 V	0.4 % + 40	2 % + 80	0.4 % + 40	Not specified	Not specified
	1000.0 V	0.1 V	0.4 % + 40	2 % + 80	0.4 % + 40	Not specified	Not specified
dBV	-52 to -6	0.01 dB	0.1 dB	0.2 dB	0.5 dB	0.5 dB	2.0 dB
	-6 to +34	0.01 dB	0.1 dB	0.2 dB	0.1 dB	0.2 dB	0.5 dB
	+34 to +60	0.01 dB	0.1 dB	0.2 dB	0.1 dB	Not specified	Not specified

1. For the 5,000 count mode, divide the number of least significant digits (counts) by 10.

2. A residual reading of 8 to 80 digits with leads shorted, will not affect stated accuracy above 5 % of range.

			Accuracy			
Function	Range	Resolution	45-1 kHz	20-45 Hz	1-20 kHz	20 kHz-100 kHz
AC μ A	500.00 μ A	0.01 μ A	0.75 % + 20	1 % + 20	0.75 % + 20	6 % + 40
	5,000.0 μ A	0.1 μ A	0.75 % + 5	1% + 5	0.75 % + 10	2 % + 40
AC mA	50.000 mA	0.001 mA	0.75 % + 20	1% + 20	0.75 % + 20	9 % + 40
	400.00 mA ¹	0.01 mA	0.75 % + 5	1% + 5	1.5 % + 10	4 % + 40
AC A	5.0000 A	0.0001 A	1.5 % + 20	1.5% + 20	6 % + 40	Not specified
	10.000 A ²	0.001 A	1.5 % + 5	1.5% + 5	5 % + 10	Not specified
1. 500.00 mA overload for 30 seconds maximum. 2. 10 A continuous up to 35 °C, less than 10 minutes -35 °C to 55 °C. 20 A overload for 30 seconds maximum.						

Function	Range	Resolution	Accuracy	Accuracy Dual Display AC or AC+DC ⁶		
			DC	20 - 45 Hz	45 Hz - 1 kHz	1 kHz- 20 kHz
DC mV	50.000 mV	0.001 mV	0.1% + 20			
	500.00 mV	0.01 mV	0.03 % + 2 ⁴	2 % + 80	0.6 % + 40	6 % + 40 ³
	3000.0 mV ⁷	0.1 mV	0.025 % + 5 (89-IV) 0.025 % + 10 (87-IV)	2 % + 80	0.6 % + 40	
DC V	5.0000 V	0.0001 V	0.025 % + 10	2 % + 80	0.5 % + 40	
	50.000 V	0.001 V	0.03 % + 3	2 % + 80	0.5 % + 40	
	500.00 V	0.01 V	0.1 % + 2	2 % + 80	0.5 % + 40	Not specified
	1000.0 V	0.1 V	0.1 % + 2	2 % + 80	0.5 % + 40	Not specified
DC μ A	500.00 μ A	0.01 μ A	0.25 % + 20 ⁵	7 % + 10	7 % + 10	9 % + 40
	5,000 μ A	0.1 μ A	0.25 % + 2	1 % + 10	0.75 % + 10	2 % + 40
DC mA	50.000 mA	0.001 mA	0.15 % + 10	1 % + 10	0.75 % + 10	2 % + 40
	400.00 mA ¹	0.01 mA	0.15 % + 2	1.5 % + 10	1.5 % + 10	3 % + 40
DC A	5.0000 A	0.0001 A	0.5 %+ 10	7 % + 20	7 % + 20	12 % + 40
	10.000 A ²	0.001 A	0.5 %+ 2	1.5 % + 10	1.5 % + 10	3 % + 40

1. 500.00 mA for 30 seconds maximum.
2. 10 A continuous up to 35 °C, less than 10 minutes -35 °C to 55 °C. 20 A overload for 30 seconds maximum.
3. DC 5 V range, -3 dB typical @ 10 kHz.
4. In RF field of 3 V/m, add 100 counts from 100 to 120 MHz, 60 counts from 270 to 300 MHz, 40 counts from 320 to 335 MHz.
5. In RF field of 3 V/m, add 200 counts from 80 to 95 MHz.
6. See AC conversions notes for AC mV and V.
7. 1100.0 mV AC or AC+DC.

Function	Range	Resolution	Accuracy
Resistance ¹	500.00 Ω	0.01 Ω	0.05 % + 10 ^{3,4}
	5.0000 k Ω	0.0001 k Ω	0.05 % + 2
	50.000 k Ω	0.001 k Ω	0.05 % + 2
	500.00 k Ω	0.01 k Ω	0.05 % + 2
	5.0000 M Ω	0.0001 M Ω	0.15 % + 4 ²
	30.000 M Ω	0.001 M Ω	1 % + 4 ²
Conductance	50.00 nS	0.01 nS	1 % + 10
1. For the 5,000 count mode, divide the number of least significant digits (counts) by 10. 2. For relative humidity greater than 70 %, resistance accuracy is 0.5 % over 1 M Ω and 2.5 % over 10 M Ω . 3. In RF field of 3 V/m, add 45 counts from 470 to 1000 MHz. 4. Using relative mode (REL Δ) to zero residual reading.			

Function	Ranges	Resolution	Accuracy
Capacitance ²	1.100 nF	0.001 nF	2% + 5
	11.00 nF	0.01 nF	1 % + 5
	110.0 nF	0.1 nF	
	1.100 μF	0.001 μF	
	11.00 μF	0.01 μF	
	110.0 μF	0.1 μF	
	1,100 μF	1 μF	
	11.0 mF	0.01 mF ³	
	50.00 mF	0.10 mF ³	1% + 50
Diode Test ¹	3.1000 V	0.0001 V	2 % + 2

1. For the 5,000 count mode, divide the number of least significant digits (counts) by 10.

2. For film capacitor or better, using Relative mode (**REL Δ**) to zero residual on 1.1 nF range.

3. The small range annunciator above the AUTO/MANUAL messages will show 50, and the display will show xx.xx throughout these two measurement ranges.

Function	Range	Resolution	Accuracy
Frequency	500.00 Hz	0.01 Hz ¹	± (0.005 % + 1)
	5.0000 kHz	0.0001 kHz	
	50.000 kHz	0.001 kHz	
	999.99 kHz	0.01 kHz	
Duty Cycle ²	10 to 90 %	0.1 %	± (0.12 x voltage range / input voltage x 100 %)
Pulse Width ²	50.000 ms	0.001 ms	± (0.001 ms +1)
Temperature	–200 to +1350 °C	0.1 °C	± (1% of reading + 1 °C) ^{3,4}
	–328 to +2462 °F	0.1 °F	± (1% of reading + 1.8 °F) ^{3,4}
MIN MAX AVG	Response: 100 ms to 80 %		Specified accuracy ± 12 counts for changes > 200 ms in duration. (± 40 counts in AC for changes > 350 ms and inputs > 25 % of range)
FAST MN MX	250 µs		Specified accuracy ±100 counts for changes >250 µs in duration ⁵
1. Reading will be 0.00 for signals below 0.5 Hz. 2. Duty cycle and pulse width operate on repetitive waveforms at 14.5 Hz or greater. 3. Accuracy specification is relative to the user-adjustable temperature offset, and assumes ambient temperature stable to ± 1 °C. 4. For ambient temperature changes of ± 5 °C, rated accuracy applies after 1 hour. 5. For repetitive peaks; 2.5 ms for single events.			

Frequency Counter Sensitivity

Input Range	Minimum Sensitivity (RMS Sine Wave) ¹			Approximate Trigger Levels (DC Voltage Function)
	40 Hz to 20 kHz ²	15 to 40 Hz ³	20 to 500 kHz ³	
50 mV (dB only)	15 mV to 3 mV	15 mV	15 mV	± 25 mV
500 mV	50 mV to 30 mV	50 mV	30 mV	35 mV ± 6 mV
3000 mV	1500 mV to 300 mV	2000 mV	2000 mV	170 mV ± 6 mV
5 V	1.5 V to 0.3 V	2 V	2.2 V	1.7 V ± 0.25 V
50 V	15 V to 3 V	15 V	5 V	3.5 V ± 2.5 V
500 V	50 V to 20 V	50 V	50 V	35 V ± 25 V
1000 V	250 V to 100 V	250 V	50 V	35 V ± 25 V

1. Maximum input for specified accuracy = 10 x Range or 1000 V, ac-coupled only. Accuracy: add 1 count.

2. Sensitivity improves linearly from 40 Hz to 20 kHz.

3. Useable at reduced sensitivity to 0.5 Hz and 1000 kHz.

Burden Voltage (A, mA, μ A)

Function	Range	Burden Voltage (typical)
mA - μ A	500.00 μ A	102 μ V / μ A
	5,000 μ A	102 μ V / μ A
	50.000 mA	1.8 mV / mA
	400.00 mA	1.8 mV / mA
A	5.0000 A	0.04 V / A
	10.000 A	0.04 V / A

Input Characteristics

Function	Input Impedance (Nominal)					
Volts, mV	10 MΩ, < 100 pF					
	Common Mode Rejection Ratio			Normal Mode Rejection		
DC Volts, mV	>100 dB -dc, 50 Hz, or 60 Hz ±0.1%			>90 dB at 50 Hz, or 60 Hz ± 0.1%		
AC Volts, mV	> 90 dB dc to 60 Hz					
	Open Circuit Test Voltage			Full-Scale Voltage		
				To 5 MΩ		30 MΩ + nS
Ohms	< 5 V			500 mV	3.1 V	
Diode Test	< 5 V			3.1000 V		
	Typical Short-Circuit Current					
	500 Ω	5 kΩ	50 kΩ	500 kΩ	5 MΩ	30 MΩ
Ohms	100 μA	100 μA	10 μA	1 μA	0.1 μA	0.1 μA
Diode Test	0.8 mA typical					