FLUKE®

80 Series V

Multimeters

Getting Started Manual

PN 2101973
May 2004 Rev.2, 11/08

Lifetime Limited Warranty

Each Fluke 20, 70, 80, 170 and 180 Series DMM will be free from defects in material and workmanship for its lifetime. As used herein, “lifetime” is defined as seven years after Fluke discontinues manufacturing the product, but the warranty period shall be at least ten years from the date of purchase. This warranty does not cover fuses, disposable batteries, damage from neglect, misuse, contamination, alteration, accident or abnormal conditions of operation or handling, including failures caused by use outside of the product’s specifications, or normal wear and tear of mechanical components. This warranty covers the original purchaser only and is not transferable.

For ten years from the date of purchase, this warranty also covers the LCD. Thereafter, for the lifetime of the DMM, Fluke will replace the LCD for a fee based on then current component acquisition costs.

To establish original ownership and prove date of purchase, please complete and return the registration card accompanying the product, or register your product on http://www.fluke.com. Fluke will, at its option, repair at no charge, replace or refund the purchase price of a defective product purchased through a Fluke authorized sales outlet and at the applicable international price. Fluke reserves the right to charge for importation costs of repair/replacement parts if the product purchased in one country is sent for repair elsewhere.

If the product is defective, 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. Fluke will pay return transportation for product repaired or replaced in-warranty. Before making any non-warranty repair, Fluke will estimate cost and obtain authorization, then invoice you for repair and return transportation.

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Introduction

⚠⚠ Warning

Read "Safety Information" before you use the Meter.

Except where noted, the descriptions and instructions in this manual apply to Series V Models 83 and 87 multimeters (hereafter referred to as "the Meter").
Model 87 appears in all illustrations.

Contacting Fluke

To contact Fluke, call one of the following telephone numbers:

USA: 1-888-44-FLUKE (1-888-443-5853)
Canada: 1-800-36-FLUKE (1-800-363-5853)
Europe: +31 402-675-200
Japan: +81-3-3434-0181
Singapore: +65-738-5655
Anywhere in the world: +1-425-446-5500
USA Service: 1-888-99-FLUKE (1-888-993-5853)

Or, visit Fluke's Web site at www.fluke.com.
To register your product, visit register.fluke.com

Safety Information

The Meter complies with:

- EN61010-1:2001
- ANSI/ISA S82.01-2004
- CAN/CSA C22.2 No. 1010.1:2004
- UL610101-1
- Measurement Category III, 1000V, Pollution Degree 2
- Measurement Category IV, 600V, Pollution Degree 2

In this manual, a **Warning** identifies conditions and actions that pose hazards to the user. A **Caution** identifies conditions and actions that may damage the Meter or the equipment under test.

Electrical symbols used on the Meter and in this manual are explained in Table 1.

⚠⚠Warning

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

- **Use this Meter only as specified in this manual or the protection provided by the Meter might be impaired.**
- **Do not use the Meter if it is damaged. Before you use the Meter, inspect the case. Look for cracks or missing plastic. Pay particular attention to the insulation surrounding the connectors.**
- **Make sure the battery door is closed and latched before operating the Meter.**
- **Replace the battery as soon as the battery indicator (⊟) appears.**
- **Remove test leads from the Meter before opening the battery door.**
- **Inspect the test leads for damaged insulation or exposed metal. Check the test leads for continuity. Replace damaged test leads before you use the Meter.**
- **Do not apply more than the rated voltage, as marked on the Meter, between the terminals or between any terminal and earth ground.**

- **Never operate the Meter with the cover removed or the case open.**
- **Use caution when working with voltages above 30 V ac rms, 42 V ac peak, or 60 V dc. These voltages pose a shock hazard.**
- **Use only the replacement fuses specified by the manual.**
- **Use the proper terminals, function, and range for measurements.**
- **Avoid working alone.**
- **When measuring current, turn off circuit power before connecting the Meter in the circuit. Remember to place the Meter in series with the circuit.**
- **When making electrical connections, connect the common test lead before connecting the live test lead; when disconnecting, disconnect the live test lead before disconnecting the common test lead.**
- **Do not use the Meter if it operates abnormally. Protection may be impaired. When in doubt, have the Meter serviced.**
- **Do not operate the Meter around explosive gas, vapor, or dust.**
- **Use only a single 9 V battery, properly installed in the Meter case, to power the Meter.**
- **When servicing the Meter, use only specified replacement parts.**
- **When using probes, keep fingers behind the finger guards on the probes.**
- **Do not use the Low Pass Filter option to verify the presence of hazardous voltages. Voltages greater than what is indicated may be present. First, make a voltage measurement without the filter to detect the possible presence of hazardous voltage. Then select the filter function.**

⚠Caution

To avoid possible damage to the Meter or to the equipment under test, follow these guidelines:

- **Disconnect circuit power and discharge all high-voltage capacitors before testing resistance, continuity, diodes, or capacitance.**
- **Use the proper terminals, function, and range for all measurements.**
- **Before measuring current, check the Meter's fuses. (See "Fuse Test" in the Users Manual on the *80 Series V User Manual CD*.)**

Table 1. Electrical Symbols

~	AC (Alternating Current)	⏚	Earth ground
⎓	DC (Direct Current)		Fuse
	Hazardous voltage	CE	Conforms to European Union directives.
	Risk of Danger. Important information. See Manual.		Conforms to relevant Canadian Standards Association directives.
	Battery. Low battery when displayed.		Double insulated
	Continuity test or continuity beeper tone.		Capacitance
CAT III	IEC Overvoltage Category III CAT III equipment is designed to protect against transients in equipment in fixed-equipment installations, such as distribution panels, feeders and short branch circuits, and lighting systems in large buildings.	CAT IV	IEC Overvoltage Category IV CAT IV equipment is designed to protect against transients from the primary supply level, such as an electricity meter or an overhead or underground utility service.
	Underwriters Laboratories		Diode
	Inspected and licensed by TÜV Product Services.		

The Meter's Features

Tables 2 through 5 briefly describe the Meter's features.

Table 2. Inputs

Terminal	Description
A	Input for 0 A to 10.00 A current (20 A overload for 30 seconds maximum), current frequency, and duty cycle measurements.
mA μA	Input for 0 μA to 400 mA current measurements (600 mA for 18 hrs.) and current frequency and duty cycle.
COM	Return terminal for all measurements
V Ω →|–	Input for voltage, continuity, resistance, diode, capacitance, frequency, temperature (87), and duty cycle measurements.

Table 3. Rotary Switch Positions

Switch Position	Function
Any Position	When the Meter is turned on, the Meter model number briefly appears on the display.
LO V~	AC voltage measurement Press ( ) for low pass filter (LO) (87 only).
V⎓	DC voltage measurement
mV⎓	600 mV dc voltage range Press ( ) for temperature (🌡) (87 only).
))) Ω ⊣⊢	Press ( )))) for continuity test. Ω Resistance measurement Press ( ) for Capacitance measurement.
→|	Diode test
mA~ / A⎓	AC current measurements from 0 mA to 10.00 A Press ( ) for dc current measurements, from 0 mA to 10.00 A.
μA~⎓	AC current measurements from 0 μA to 6000 μA Press ( ) for dc current measurements from 0 μA to 6000 μA.

Table 4. Pushbuttons

Button	Switch Position	Function
(Yellow)	Ω ⊣⊢	Selects capacitance
	mV	Selects temperature (87 only)
	LO Ṽ	Selects ac low pass filter function (87 only)
	mA A	Switches between dc and ac current
	μA	Switches between dc and ac current
	Power-up	Disables automatic power-off feature (Meter normally powers off in 30 minutes). The Meter reads "PoFF" until (Yellow) is released.
MIN MAX	Any switch position	Starts recording of minimum and maximum values. Steps the display through MAX, MIN, AVG (average), and present readings. Cancels MIN MAX (hold for 1 second).
	Power-up	Enables the Meter's calibration mode and prompts for a password. The Meter reads "CAL " and enters calibration mode. See the *80 Series V Service Information*.
RANGE	Any switch position	Switches between the ranges available for the selected function. To return to autoranging, hold the button down for 1 second.
	mV	Switches between °C and °F.
	Power-up	Enables the Meter's smoothing feature. The Meter reads "S---" until RANGE is released.

Table 4. Pushbuttons (cont.)

Button	Switch Position	Function
AutoHOLD	Any switch position	AutoHOLD (formerly TouchHold) captures the present reading on the display. When a new, stable reading is detected, the Meter beeps and displays the new reading.
	MIN MAX recording	Stops and starts recording without erasing recorded values.
	Frequency counter	Stops and starts the frequency counter.
	Power-up	Turns on all LCD segments.
☼	Any switch position	Turns the backlight on, makes it brighter, and turns it off. For Model 87, hold ☼ down for one second to enter the HiRes digit mode. The "HiRes" icon appears on the display. To return to the 3-1/2 digit mode, hold ☼ down for one second. HiRes =19,999
)))))	Continuity))))Ω⊣⊢	Turns the continuity beeper on and off
	MIN MAX recording	Switches between Peak (250 µs) and Normal (100 ms) response times.
	Hz, Duty Cycle	Toggles the meter to trigger on positive or negative slope.
	Power-up	Disables the beeper for all functions. The Meter reads "bEEP" until))))) is released.

Table 4. Pushbuttons (cont)

Button	Switch Position	Function
REL Δ (Relative mode)	Any switch position **Power-up**	Stores the present reading as a reference for subsequent readings. The display is zeroed, and the stored reading is subtracted from all subsequent readings. Enables zoom mode for the bar graph. Refer to Zoom Mode in the Users Manual located on the 80 Series V User Manuals CD. The Meter reads "2rEL" until REL Δ is released.
Hz %	Any switch position except diode test **Power-up**	Press Hz % for frequency measurements. Starts the frequency counter. Press again to enter duty cycle mode. Enables the Meter's high impedance mode when the mV dc function is used. The Meter reads "Hi Z" until Hz % is released.

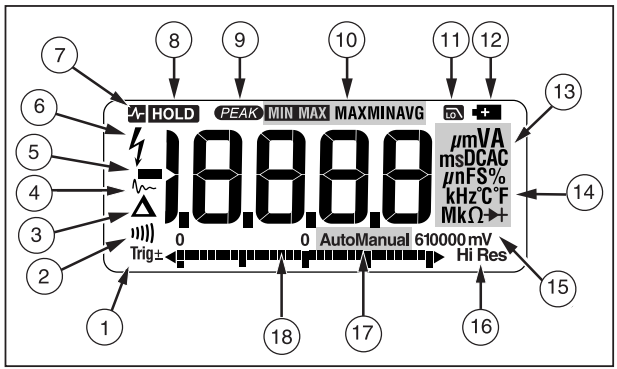

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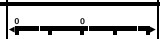
Figure 1. Display Features (Model 87)

Table 5. Display Features

Number	Feature	Indication
①	±	Polarity indicator for the analog bar graph.
	Trig±	Positive or negative slope indicator for Hz/duty cycle triggering.
②	)))	The continuity beeper is on.
③	Δ	Relative (REL) mode is active.
④	∿	Smoothing is active.
⑤	−	Indicates negative readings. In relative mode, this sign indicates that the present input is less than the stored reference.
⑥	ϟ	Indicates the presence of a high voltage input. Appears if the input voltage is 30 V or greater (ac or dc). Also appears in low pass filter mode. Also appears in cal, Hz, and duty cycle modes.
⑦	HOLD	AutoHOLD is active.
⑧	HOLD	Display Hold is active.
⑨	PEAK	Indicates the Meter is in Peak Min Max mode and the response time is 250 µs (87 only).
⑩	MIN MAX MAX MIN AVG	Indicators for minimum-maximum recording mode.
⑪	LO	Low pass filter mode (87 only). See "Low Pass Filter (87).
⑫	+	The battery is low. ⚠⚠**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.**

Table 5. Display Features (cont.)

Number	Feature	Indication
⑬	**A, µA, mA**	Amperes (amps), Microamp, Milliamp
	V, mV	Volts, Millivolts
	µF, nF	Microfarad, Nanofarad
	nS	Nanosiemens
	%	Percent. Used for duty cycle measurements.
	Ω, MΩ, kΩ	Ohm, Megohm, Kilohm
	Hz, kHz	Hertz, Kilohertz
	AC DC	Alternating current, direct current
⑭	**°C, °F**	Degrees Celsius, Degrees Fahrenheit
⑮	**610000 mV**	Displays selected range
⑯	**HiRes**	The Meter is in high resolution (Hi Res) mode. HiRes=19,999
⑰	**Auto**	The Meter is in autorange mode and automatically selects the range with the best resolution.
	Manual	The Meter is in manual range mode.

Number	Feature	Indication
⑱		The number of segments is relative to the full-scale value of the selected range. In normal operation 0 (zero) is on the left. The polarity indicator at the left of the graph indicates the polarity of the input. The graph does not operate with the capacitance, frequency counter functions, temperature, or peak min max. For more information, See "Bar Graph" in the Users Manual located on the *80 Series V User Manual CD*. The bar graph also has a zoom function, as described under "Zoom Mode".
--	OL	Overload condition is detected.

Display 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.
LEAd	⚠Test lead alert. Displayed when the test leads are in the **A** or **mA/µA** terminal and the selected rotary switch position does not correspond to the terminal being used.
FB-Err	Invalid model. Have Meter serviced.
OPEn	Open thermocouple is detected.

Power-Up Options

Holding a button down while turning the Meter on activates a power-up option. Table 4 includes the power-up options.

Automatic Power-Off

The Meter automatically turns off if you do not turn the rotary switch or press a button for 30 minutes. If MIN MAX Recording is enabled, the Meter will not power off. To disable automatic power-off, refer to Table 4.

Input Alert™ Feature

If a test lead is plugged into the **mA/µA** or **A** terminal, but the rotary switch is not set to the correct current position, the beeper warns you by making a chirping sound and the display flashes "LEAd". This warning is intended to stop you from attempting to measure voltage, continuity, resistance, capacitance, or diode values when the leads are plugged into a current terminal.

⚠ Caution

Placing the probes across (in parallel with) a powered circuit when a lead is plugged into a current terminal can damage the circuit you are testing and blow the Meter's fuse. This can happen because the resistance through the Meter's current terminals is very low, so the Meter acts like a short circuit.

Low Pass Filter (87)

The 87 is equipped with an ac low pass filter. When measuring ac voltage or ac frequency, press ⬭ to activate the low pass filter mode (LO). The Meter continues measuring in the chosen ac mode, but now the signal diverts through a filter that blocks unwanted voltages above 1 kHz, refer to Figure 2. The lower frequency voltages pass with reduced accuracy to the measurement below 1 kHz. The low pass filter can improve measurement performance on composite sine waves that are typically generated by inverters and variable frequency motor drives.

⚠⚠Warning

To avoid possible electric shock or personal injury, do not use the Low Pass Filter option to verify the presence of hazardous voltages. Voltages greater than what is indicated may be present. First, make a voltage measurement without the filter to detect the possible presence of hazardous voltage. Then select the filter function.

Note

In Low Pass Mode, the Meter goes to manual mode. Select ranges by pressing the RANGE button. Autoranging is not available in Low Pass Mode.

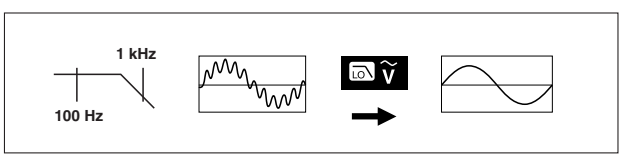


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Figure 2. Low Pass Filter

Bar Graph

The analog bar graph functions like the needle on an analog meter, but without the overshoot. The bar graph updates 40 times per second. Because the graph responds 10 times faster than the digital display, it is useful for making peak and null adjustments and observing rapidly changing inputs. The graph is not shown for capacitance, frequency counter functions, temperature, or peak min max.

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

In the 60 V range, for example, 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.

The bar graph also has a zoom function, as described under “Zoom Mode” in the Users Manual located on the 80 Series V User Manuals CD.

Table 6. MIN MAX Functions

Button	MIN MAX Function
MIN MAX	Enter MIN MAX recording mode. The Meter is locked in the range displayed before you entered MIN MAX mode. (Select the desired measurement function and range before entering MIN MAX.) The Meter beeps each time a new minimum or maximum value is recorded.
MIN MAX (while in MIN MAX mode)	Step through maximum (MAX), minimum (MIN), and average (AVG) and present values.
))))) PEAK MIN MAX	Model 87 only: Select 100 ms or 250 µs response time. (The 250 µs response time is indicated by PEAK on the display.) Stored values are erased. The present and AVG (average) values are not available when 250 µs is selected.
AutoHOLD	Stop recording without erasing stored values. Press again to resume recording.
MIN MAX (hold for 1 second)	Exit MIN MAX mode. Stored values are erased. The Meter stays in the selected range.

AutoHOLD Mode

⚠⚠Warning

To avoid electrical shock or personal injury, do not use AutoHOLD mode to determine that circuits are without power. The AutoHOLD mode will not capture unstable or noisy readings.

The AutoHOLD mode captures the present reading on the display. When a new, stable reading is detected, the Meter beeps and displays the new reading. To enter or exit AutoHOLD mode, press (AutoHOLD).

Relative Mode

Selecting relative mode ((REL Δ)) causes the Meter to zero the display and store the present reading as the reference for subsequent measurements. The Meter is locked into the range selected when you pressed (REL Δ). Press (REL Δ) again to exit this mode.

In relative mode, the reading shown is always the difference between the present reading and the stored reference value. For example, if the stored reference value is 15.00 V and the present reading is 14.10 V, the display shows -0.90 V.

Maintenance

⚠⚠Warning

To avoid electrical shock or personal injury, repairs or servicing not covered in this manual should be performed only by qualified personnel as described in the *80 Series V Service Information*.

General Maintenance

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

Fuse Test

If a test lead is plugged into the **mA/µA** or **A** terminal and the rotary switch is turned to a non-current function, the Meter chirps and flashes "LEAd" if the fuse associated with that current terminal is good. If the Meter does not chirp or flash "LEAd", the fuse is bad and must be replaced.

⚠⚠Warning

To avoid electrical shock or personal injury, remove the test leads and any input signals before replacing the battery or fuses. To prevent damage or injury, install ONLY specified replacement fuses with the amperage, voltage, and speed ratings shown in Replacement Parts in the Users Manual located on the *80 Series V User Manual CD*.

Specifications

Maximum Voltage between any Terminal and Earth Ground: 1000 V rms

⚠ **Fuse Protection for mA or µA inputs:** 44/100 A, 1000 V FAST Fuse

⚠ **Fuse Protection for A input:** 11 A, 1000 V FAST Fuse

Display: Digital: 6000 counts updates 4/sec; (Model 87 also has 19,999 counts in high-resolution mode).
Analog Bargraph: 33 segments, updates 40/sec. Frequency: 19,999 counts, updates 3/sec at > 10 Hz

Temperature: Operating: -20 °C to +55 °C; Storage: -40 °C to +60 °C

Altitude: Operating: 2000 m; Storage: 10,000 m

Temperature Coefficient: 0.05 x (specified accuracy)/ °C (< 18 °C or > 28 °C)

Electromagnetic Compatibility: In an RF field of 3 V/m total accuracy = specified accuracy + 20 counts
Except: 600 µA dc range total accuracy=specified accuracy + 60 counts.
Temperature not specified.

Relative Humidity: 0 % to 90 % (0 °C to 35 °C); 0 % to 70 % (35 °C to 55 °C)

Battery Type: 9 V zinc, NEDA 1604 or 6F22 or 006P

Battery Life: 400 hrs typical with alkaline (with backlight off)

Vibration: Per MIL-PRF-28800 for a Class 2 instrument
Shock: 1 Meter drop per IEC 61010-1:2001

Size (HxWxL): 1.25 in x 3.41 in x 7.35 in (3.1 cm x 8.6 cm x 18.6 cm)

Size with Holster and Flex-Stand: 2.06 in x 3.86 in x 7.93 in (5.2 cm x 9.8 cm x 20.1 cm)

Weight: 12.5 oz (355 g)

Weight with Holster and Flex-Stand: 22.0 oz (624 g)

Safety: Complies with ANSI/ISA S82.01-2004, CSA 22.2 No. 1010.1:2004 to 1000 V Overvoltage Category III, IEC 664 to 600 V Overvoltage Category IV. UL listed to UL61010-1. Licensed by TÜV to EN61010-1.

IP Rating: 30

Detailed Specifications

For all detailed specifications:

Accuracy is given as ±([% of reading] + [number of least significant digits]) at 18° C to 28° C, with relative humidity up to 90 %, for a period of one year after calibration.

For Model 87 in the 4 ½-digit mode, multiply the number of least significant digits (counts) by 10. AC conversions are ac-coupled and valid from 3 % to 100 % of range. Model 87 is true rms responding. AC crest factor can be up to 3 at full scale, 6 at half scale. For non-sinusoidal wave forms add -(2 % Rdg + 2 % full scale) typical, for a crest factor up to 3.

Table 7. Model 87 AC Voltage Function Specifications

Function	Range	Resolution	Accuracy					
			45 – 65 Hz	30 – 200 Hz	200 – 440 Hz	440 Hz - 1 kHz	1 - 5 kHz	5 - 20 kHz[1]
$\tilde{V}$ [2,4]	600.0 mV	0.1 mV	± (0.7 % + 4)	± (1.0 % + 4)			± (2.0 % + 4)	± (2.0 % + 20)
	6.000 V	0.001 V	± (0.7 % + 2)					
	60.00 V	0.01 V						
	600.0 V	0.1 V					± (2.0 % + 4) [3]	unspecified
	1000 V	1 V					unspecified	unspecified
	Low pass filter		Same as 45 - 65 Hz	± (1.0 % + 4)	+1 % + 4 -6 % - 4[5]	unspecified	unspecified	unspecified

[1] Below 10 % of range, add 12 counts.

[2] The Meter is a true rms responding meter. When the input leads are shorted together in the ac functions, the Meter may display a residual reading between 1 and 30 counts. A 30 count residual reading will cause only a 2-digit change for readings over 3 % of range. Using REL to offset this reading may produce a much larger constant error in later measurements.

[3] Frequency range: 1 kHz to 2.5 kHz.

[4] A residual reading of up to 13 digits with leads shorted, will not affect stated accuracy above 3 % of range.

[5] Specification increases from -1% at 200 Hz to -6% at 440 Hz when filter is in use.

Table 8. Model 83 AC Voltage Function Specifications

Function	Range	Resolution	Accuracy		
			50 Hz - 60 Hz	**30 Hz - 1 kHz**	**1 kHz - 5 kHz**
$\tilde{V}$[1]	600.0 mV	0.1 mV	± (0.5 % + 4)	± (1.0 % + 4)	± (2.0 % + 4)
	6.000 V	0.001 V	± (0.5 % + 2)	± (1.0 % + 4)	± (2.0 % + 4)
	60.00 V	0.01 V	± (0.5 % + 2)	± (1.0 % + 4)	± (2.0 % + 4)
	600.0 V	0.1 V	± (0.5 % + 2)	± (1.0 % + 4)	± (2.0 % + 4)[2]
	1000 V	1 V	± (0.5 % + 2)	± (1.0 % + 4)	unspecified

1. Below a reading of 200 counts, add 10 counts.
2. Frequency range: 1 kHz to 2.5 kHz.

Table 9. DC Voltage, Resistance, and Conductance Function Specifications

Function	Range	Resolution	Accuracy	
			Model 83	Model 87
$\overline{\overline{V}}$	6.000 V	0.001 V	± (0.1 % + 1)	± (0.05 % + 1)
	60.00 V	0.01 V	± (0.1 % + 1)	± (0.05 % + 1)
	600.0 V	0.1 V	± (0.1 % + 1)	± (0.05 % + 1)
	1000 V	1 V	± (0.1 % + 1)	± (0.05 % + 1)
$\overline{\overline{mV}}$	600.0 mV	0.1 mV	± (0.3 % + 1)	± (0.1 % + 1)
Ω	600.0 Ω	0.1 Ω	± (0.4 % + 2)[1]	± (0.2 % + 2)[1]
	6.000 kΩ	0.001 kΩ	± (0.4 % + 1)	± (0.2 % + 1)
	60.00 kΩ	0.01 kΩ	± (0.4 % + 1)	± (0.2 % + 1)
	600.0 kΩ	0.1 kΩ	± (0.7 % + 1)	± (0.6 % + 1)
	6.000 MΩ	0.001 MΩ	± (0.7 % + 1)	± (0.6 % + 1)
	50.00 MΩ	0.01 MΩ	± (1.0 % + 3)[2]	± (1.0 % + 3)[2]
nS	60.00 nS	0.01 nS	± (1.0 % + 10)[1]	± (1.0 % + 10)[1]

1. When using the REL Δ function to compensate for offsets.
2. Add 0.5 % of reading when measuring above 30 MΩ in the 50 MΩ range, and 20 counts below 33 nS in the 60 nS range.

Table 10. Temperature Specifications (87 Only)

Temperature	Resolution	Accuracy[1,2]
-200 °C to +1090 °C	0.1 °C	1 % + 10
-328 °F to +1994 °F	0.1 °F	1 % + 18

1. Does not include error of the thermocouple probe.
2. Accuracy specification assumes ambient temperature stable to ± 1 °C. For ambient temperature changes of ± 5 °C, rated accuracy applies after 1 hour.

Table 11. Current Function Specifications

Function	Range	Resolution	Accuracy		Burden Voltage (typical)
			Model 83[1]	Model 87[2, 3]	
mA	60.00 mA	0.01 mA	± (1.2 % + 2)[5]	± (1.0 % + 2)	1.8 mV/mA
A~	400.0 mA[6]	0.1 mA	± (1.2 % + 2)[5]	± (1.0 % + 2)	1.8 mV/mA
(45 Hz to 2 kHz)	6.000 A	0.001 A	± (1.2 % + 2)[5]	± (1.0 % + 2)	0.03 V/A
	10.00 A[4]	0.01 A	± (1.2 % + 2)[5]	± (1.0 % + 2)	0.03 V/A
mA	60.00 mA	0.01 mA	± (0.4 % + 4)	± (0.2 % + 4)	1.8 mV/mA
A⎓	400.0 mA[6]	0.1 mA	± (0.4 % + 2)	± (0.2 % + 2)	1.8 mV/mA
	6.000 A	0.001 A	± (0.4 % + 4)	± (0.2 % + 4)	0.03 V/A
	10.00 A[4]	0.01 A	± (0.4 % + 2)	± (0.2 % + 2)	0.03 V/A
µA ~	600.0 µA	0.1 µA	± (1.2 % + 2)[5]	± (1.0 % + 2)	100 µV/µA
(45 Hz to 2 kHz)	6000 µA	1 µA	± (1.2 % + 2)[5]	± (1.0 % + 2)	100 µV/µA
µA⎓	600.0 µA	0.1 µA	± (0.4 % + 4)	± (0.2 % + 4)	100 µV/µA
	6000 µA	1 µA	± (0.4 % + 2)	± (0.2 % + 2)	100 µV/µA

1. AC conversion for Model 83 is ac coupled and calibrated to the rms value of a sine wave input.
2. AC conversions for Model 87 are ac coupled, true rms responding, and valid from 3 % to 100 % of range, except 400 mA range (5 % to 100 % of range) and 10 A range (15 % to 100 % or range).
3. Model 87 is a true rms responding meter. When the input leads are shorted together in the ac functions, the Meter may display a residual reading between 1 and 30 counts. A 30 count residual reading will cause only a 2 digit change for readings over 3 % of range. Using REL to offset this reading may produce a much larger constant error in later measurements
4. ⚠ 10 A continuous up to 35 °C; < 20 minutes on, 5 minutes off at 35 °C to 55 °C. 20 A for 30 seconds maximum; > 10 A unspecified.
5. Below a reading of 200 counts, add 10 counts.
6. 400 mA continuous; 600 mA for 18 hrs maximum.

Table 12. Capacitance and Diode Function Specifications

Function	Range	Resolution	Accuracy
⊣⊢	10.00 nF	0.01 nF	± (1 % + 2)[1]
	100.0 nF	0. 1 nF	± (1 % + 2)[1]
	1.000 µF	0.001 µF	± (1 % + 2)
	10.00 µF	0.01 µF	± (1 % + 2)
	100.0 µF	0.1 µF	± (1 % + 2)
	9999 µF	1 µF	± (1 % + 2)
⊣▶⊢	3.000 V	0.001 V	± (2 % + 1)

1. With a film capacitor or better, using Relative mode to zero residual.

Table 13. Frequency Counter Specifications

Function	Range	Resolution	Accuracy
Frequency	199.99	0.01 Hz	± (0.005 % + 1)
(0.5 Hz to 200 kHz, pulse	1999.9	0.1 Hz	± (0.005 % + 1)
width > 2 µs)	19.999 kHz	0.001 kHz	± (0.005 % + 1)
	199.99 kHz	0.01 kHz	± (0.005 % + 1)
	> 200 kHz	0.1 kHz	unspecified

Table 14. Frequency Counter Sensitivity and Trigger Levels

Input Range[1]	Minimum Sensitivity (RMS Sine wave)		Approximate Trigger Level (DC Voltage Function)
	5 Hz - 20 kHz	0.5 Hz - 200 kHz	
600 mV dc	70 mV (to 400 Hz)	70 mV (to 400 Hz)	40 mV
600 mV ac	150 mV	150 mV	—
6 V	0.3 V	0.7 V	1.7 V
60 V	3 V	7 V (≤140 kHz)	4 V
600 V	30 V	70 V (≤14.0 kHz)	40 V
1000 V	100 V	200 V (≤1.4 kHz)	100 V
Duty Cycle Range	**Accuracy**		
0.0 to 99.9 %	Within ± (0.2% per kHz + 0.1 %) for rise times < 1 µs.		

1. Maximum input for specified accuracy = 10X Range or 1000 V.

Table 15. Electrical Characteristics of the Terminals

Function	Overload Protection[1]	Input Impedance (nominal)	Common Mode Rejection Ratio (1 kΩ unbalance)		Normal Mode Rejection					
$\overline{\overline{V}}$	1000 V rms	10 MΩ < 100 pF	> 120 dB at dc, 50 Hz or 60 Hz		> 60 dB at 50 Hz or 60 Hz					
$\overline{\overline{mV}}$	1000 V rms	10 MΩ < 100 pF	> 120 dB at dc, 50 Hz or 60 Hz		> 60 dB at 50 Hz or 60 Hz					
$\tilde{V}$	1000 V rms	10 MΩ < 100 pF (ac-coupled)	> 60 dB, dc to 60 Hz							
		Open Circuit Test Voltage	**Full Scale Voltage**		**Typical Short Circuit Current**					
			To 6.0 MΩ	**50 MΩ or 60 nS**	**600 Ω**	**6 k**	**60 k**	**600 k**	**6 M**	**50 M**
Ω	1000 V rms	< 7.9 V dc	< 4.1 V dc	< 4.5 V dc	1 mA	100 µA	10 µA	1µA	1 µA	0.5 µA
⊣▶⊢	1000 V rms	< 7.9 V dc	3.000 V dc		1.0 mA typical					

1. 10^6 V Hz max

Table 16. MIN MAX Recording Specifications

Model	Nominal Response	Accuracy
83	100 ms to 80 %	Specified accuracy ± 12 counts for changes > 200 ms in duration (± 40 counts in ac with beeper on)
87	100 ms to 80 % (dc functions) 120 ms to 80 % (ac functions) 250 µs (peak) (Model 87 only)[1]	Specified accuracy ± 12 counts for changes > 200 ms in duration Specified accuracy ± 40 counts for changes > 350 ms and inputs > 25 % of range Specified accuracy ± 100 counts for changes > 250 µs in duration (add ± 100 counts for readings over 6000 counts) (add ± 100 counts for readings in Low Pass mode)

1. For repetitive peaks: 1 ms for single events.