

177/Digital Multimeter

4½-Digit with 1μV/1mΩ/1nA Sensitivity

- Analog and BCD or IEEE-488 outputs
- TRMS AC
- 1μV, 1mΩ, 1nA sensitivity



Keithley's Model 177 Microvolt DMM features extended capabilities for the most sensitive bench measurements. The Model 177's 1μV sensitivity lets you measure a multitude of low-level DC signals, including transducer outputs at practical limits of detectability. And its 4½-digit precision lets you resolve these even in the presence of large steady-state signals.

Analog output

The Model 177 has a rear panel output where 1V DC corresponds to 10,000 counts. The Model 177 serves as an amplifier (for microvolt signals), an attenuator (for kilovolt signals), or as a converter to DCV (for AC, current and resistance signals).

1mΩ

The Model 177's 1mΩ resolution and 4½-digit accuracy bring economy and ease to low-resistance measurement tasks. Measurements are simple with the 2-terminal input and front-panel control for lead resistance compensation.

1nA

The Model 177's 1nA DC resolution is a decade greater sensitivity than found in most DMMs.

TRMS AC

The Model 177's TRMS response lets you measure real-life waveforms. Specified accuracy is retained for sinusoids, distorted sinusoids and non-sinusoid waveforms alike. Crest factor is 3:1 at full scale (19999 counts), increasing downscale. Frequency response spans the standard audio range from 45Hz to 20kHz.

Diode test

Check semiconductor junctions using the 2kΩ range where the applied current is 1mA ± 1% and the forward voltage drop is displayed dir-

ectly (to 1.9999 volts). Reverse bias registers as overrange (5 volts open circuit).

Battery option

The Model 1788 Battery Pack is for those who need isolation from line, whether for field use or for minimum coupling in critical measurements. This rechargeable lead-acid pack can be purchased with the Model 177 or later for simple field installation.

IEEE-488 Interface

The 177 is part of Keithley's 488 Line of low-cost interfaceable DMMs. A single plug-in PC board can be installed when ordered or easily field-installed later to enable communication of measured data to monitoring devices such as desk-top computers or printers at affordable prices.

System flexibility.

The Model 1793 IEEE-488 Interface offers all the operational output variations you'll require. For example, in the ADDRESSABLE trigger mode, the controller initiates the measurement and receives the output reading 400ms later. In the ADDRESSABLE non-trigger mode, the instrument will output the reading immediately. Either mode may be commanded under software control using separate addresses.

In the TALK ONLY mode, the instrument will output readings to a printer at a selectable rate from 2.5 readings per second to one reading per hour. No controller is required in this mode. The Model 1793 is field installable and supplied with a new top cover for the instrument. When ordering Model 177 with 1793 option installed, specify Model 177/1793.

Digital Multimeter/177

4¹/₂-Digit with 1 μ V/1m Ω /1nA Sensitivity

DC VOLTS

RANGE	RESOLUTION	ACCURACY (1 YEAR) 18°-28°C		MAXIMUM ALLOWABLE INPUT
		±(% rdg + digits)		
20mV*	1 μ V	0.4 % + 2		1200V momentary
200mV*	10 μ V	0.4 % + 1		1200V momentary
2 V	100 μ V	0.3 % + 1		1200V momentary
20 V	1mV	0.3 % + 1		1200V
200 V	10mV	0.3 % + 1		1200V
1200 V	100mV	0.35 % + 1		1200V

*Front panel zero

TEMPERATURE COEFFICIENT (0°-18°C & 28°-55°C): $\pm(0.005\% + 0.1 \text{ digit})/^\circ\text{C}$ except $\pm(0.005\% + 0.6 \text{ digit})/^\circ\text{C}$ on 20mV range.

INPUT RESISTANCE: 10M Ω \pm 0.5%.

NMRR: Greater than 80dB on 20mV range at 50Hz and 60Hz; greater than 60dB on all other ranges.

CMRR (1k Ω unbalance): Greater than 120dB at DC, 50Hz and 60Hz.

DC & TRMS AC AMPS

RANGE	RESOLUTION	ACCURACY (1 YEAR) 18°-28°C		MAXIMUM VOLTAGE BURDEN
		DC*	AC 45Hz-10kHz (above 2000 counts)	
20 μ A	1nA	0.2% + 2	—	0.02V
200 μ A	10nA	0.2% + 1	0.8% + 15	0.2 V
2mA	100nA	0.2% + 1	0.8% + 15	0.2 V
20mA	1 μ A	0.2% + 1	0.8% + 15	0.2 V
200mA	10 μ A	0.2% + 1	0.8% + 15	0.25V
2000mA	100 μ A	0.2% + 1	0.8% + 15	0.6 V

*Front panel zero

MAXIMUM INPUT: 2A, 250V DC or rms (fuse protected).

TEMPERATURE COEFFICIENT (0°-18°C & 28°-55°C): DC: $\pm(0.01\% + 0.2 \text{ digit})/^\circ\text{C}$ except $\pm(0.01\% + 0.6 \text{ digit})/^\circ\text{C}$ on 20 μ A range. AC: $\pm(0.07\% + 2 \text{ digits})/^\circ\text{C}$.

CREST FACTOR: 3.

GENERAL

DISPLAY: Five 0.5" LED digits, appropriate decimal position and polarity indication.

CONVERSION PERIOD: 400ms

OVERRANGE INDICATION: Display blinks all zeros above 19999 counts.

MAXIMUM COMMON MODE VOLTAGE: 1400V peak.

ANALOG OUTPUT:

Output Voltage: 1V = 10,000 counts.

Output Resistance: 5000 Ω .

CONNECTORS: Input: Binding posts. Output: Banana jacks.

ENVIRONMENT: Operating: 0°C to 55°C, 0 to 80% relative humidity up to 40°C. Storage: -25° to 65°C.

POWER: 105-125V or 210-250V (switch selected), 90-110V available. 50-60Hz, 8W. Optional 6-hour battery pack, Model 1788.

DIMENSIONS, WEIGHT: 85mm high \times 235mm wide \times 275mm deep (3¹/₂" \times 9¹/₄" \times 10³/₄"). Net weight, 1.7kg (4 lbs.).

ACCESSORY SUPPLIED: Instruction manual.

TRMS AC VOLTS

RANGE	RESOLUTION	ACCURACY (1 YEAR) (above 2000 counts) 18°-28°C; 100Hz-10kHz	
		±(% rdg + digits)	
200mV	10 μ V	0.5% + 15	
2 V	100 μ V	0.5% + 15	
20 V	1mV	0.5% + 15	
200 V	10mV	0.5% + 15	
1000 V	100mV	0.5% + 15	

EXTENDED FREQUENCY ACCURACY (45Hz-20kHz): $\pm(0.7\% + 15d)$.
TEMPERATURE COEFFICIENT (0°-18°C & 28°-55°C, 45Hz-20kHz): $\pm(0.05\% + 2 \text{ digits})/^\circ\text{C}$.

RESPONSE: True root mean square.

CREST FACTOR: 3.

INPUT IMPEDANCE: 1M Ω \pm 1% shunted by less than 75pF.

MAXIMUM ALLOWABLE INPUT: 1000V rms, 1400V peak, 10⁷V \cdot Hz.

CMRR (1k Ω unbalance): 60dB at DC, 50Hz and 60Hz.

OHMS

RANGE	RESOLUTION	ACCURACY (1 YR.) 18°-28°C		TEMPERATURE COEFFICIENT 0°-18°C & 28°-55°C ±(% rdg + digits)/°C	NOMINAL APPLIED CURRENT
		±(% rdg + digits)			
20 Ω *	1m Ω	0.05% + 3		0.004% + 0.6	1 mA
200 Ω *	10m Ω	0.05% + 2		0.004% + 0.2	1 mA
2 k Ω	100m Ω	0.04% + 1		0.004% + 0.2	1 mA
20 k Ω	1 Ω	0.04% + 1		0.004% + 0.2	100 μ A
200 k Ω	10 Ω	0.04% + 1		0.004% + 0.2	10 μ A
2000 k Ω	100 Ω	0.04% + 1		0.005% + 0.2	1 μ A
20M Ω	1 k Ω	0.10% + 1		0.02 % + 0.2	0.1 μ A

*Front panel zero

MAXIMUM ALLOWABLE INPUT: 350V peak.

OPEN-CIRCUIT VOLTAGE: 5V.

ACCESSORIES AVAILABLE:

- Model 1010: Single Rack Mounting Kit
- Model 1017: Dual Rack Mounting Kit
- Model 1301: Temperature Probe
- Model 1600A: High Voltage Probe (40kV)
- Model 1641: Kelvin Test Leads
- Model 1651: 50-Ampere Current Shunt
- Model 1681: Clip-On Test Lead Set
- Model 1682A: RF Probe
- Model 1683: Universal Test Lead Kit
- Model 1684: Hard Shell Carrying Case
- Model 1685: Clamp-On AC Probe
- Model 1691: General Purpose Test Lead Set
- Model 1779: Spare Parts Kit
- Model 1788: Rechargeable Battery Pack
- Model 1792: Isolated BCD Output
- Model 1793: Isolated IEEE-488 Output

DMM Accessories/Selector Guide

	128	130	131	132C 132F	135A	169	177	179A	191	192	195
Rack Mount Kits											
Single						1010	1010	1010	1010		
Dual						1017	1017	1017	1017		
Universal Fixed										1019A	1019A
Universal Slide										1019S	1019S
Probes											
Temperature	1301	1301	1301	8712 ²	1301	1301	1301	1301	1301	1301	1301
High Voltage	1600A	1600A	1600A	1600A	1600A	1600A	1600A	1600A	1600A	1600A	1600A
RF	1682A	1682A	1682A	1682A	1682A	1682A	1682A	1682A	1682A	1682A	1682A
Current	1685	1685	1685	1685	1685	1685	1685	1685	1685	1685	1685
Carrying Case											
Soft, with Stand	1304	1304	1304	1304	1304						
Deluxe, Heavy Duty	1306	1306	1306	1306	1306	1684	1684	1684	1684		
Holster	8700	8700	8700	8700	8700						
Spare Parts Kit		1309	1309		1359	1699	1779	1919			
Maintenance Kit									1913		
Test Leads											
Kelvin									1641	1641	1641
Clip On	1681	1681	1681	1681	1681	1681	1681	1681	1681	1681	1681
Universal	1683	1683	1683	1683	1683	1683	1683	1683	1683	1683	1683
General Purpose	1691 ¹	1691	1691 ¹	1691	1691	1691					
Current Options											
Shunt (50A)	1651	1651	1651	1651	1651	1651	1651	1651			1651
TRMS AC				Std.			Std.	Std.	1920	1920	1950
Averaging AC	Std.	Std.	Std.		Std.	Std.			1910	1910	
Output Options											
BCD							1792	1792			
IEEE-488							1793	1793		1923A	Std.
Cables											
BCD							1796	1796			
IEEE-488							7008	7008		7008	7008
Power Options											
Line						1766	Std.	Std.	Std.	Std.	Std.
Battery	Std.	Std.	Std.	Std.	Std.	Std.	1788	1788			
Rear Inputs										1924	Std.

¹Supplied accessory.

²Model 871 Thermometer probes may also be used (see page 41).