

181/Nanovoltmeter

Bench/Systems

- 10nV sensitivity
- 10nV/°C stability (typical)
- μ P controlled
- 5½—6½-digit resolution
- Fully programmable
- Standard IEEE-488 interface
- Pushbutton zero



10nV sensitivity. The 181 was designed to provide useable 10nV sensitivity. A proprietary JFET input amplifier provides the ultra-low noise and high linearity required for this application.

The 181 should not be confused with μ P DMMs that average microvolt readings, then display "nanovolts". The 181 is optimized for nanovolt measurements.

Stability. The 181's zero stability is typically 10nV/°C for ambient temperature rates of change of less than 2°C/hr. **Rapid response with low noise.** Nanovoltmeter users have always requested an instrument with conflicting design parameters: fast response to a step input and low noise response to a DC or slowly varying input. The μ P has allowed Keithley to offer a discontinuous digital filter, acting on the rate of input change, to provide both fast response and low noise performance.

When a large input change is sensed with damping "out", the μ P switches off its 3-pole digital filter to allow a fast reading update which will be within 25 digits of final value. The filter is then switched on for low noise settling to the final value.

For a slowly varying signal, damping "in" is optimum. This allows the instrument to track the signal in a continuous manner by keeping its 3-pole digital filter "in" at all times.

Other Features.

- The readout can be expanded from 5½-digit to 6½-digit resolution by depressing the HI RES pushbutton. 6½ digits are always available on the IEEE-488 bus.
- All front panel controls are programmable.
- Front panel annunciator lamps continuously update instrument status. This is particularly helpful in systems applications.
- The isolated analog output is provided. This output can be set to represent either the three least significant decades or the three most significant decades of the displayed reading.
- The mV Input connector is manufactured with special Low Thermal EMF materials to minimize zero shifts and offsets.
- The Zero control also serves as a baseline suppression, since all readings displayed are the difference between the stored baseline and the actual voltage.



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DC VOLTS

RANGE	5½-DIGIT RESOLUTION	ACCURACY ±(%rdg + digits)		TEMPERATURE COEFFICIENT ±(%rdg + digits)/°C 0°-18°C & 28°-35°C	INPUT RESISTANCE	MAXIMUM ALLOWABLE INPUT	NMRR (LINE FREQUENCY)
		24 HR., 22°-24°C	1 YR., 18°-28°C				
2mV	10 nV	0.006% + 5 d*	0.015% + 5d*	0.002 % + 3 d	> 1 GΩ	120V**	> 90dB
20mV	100 nV	0.006% + 2 d*	0.015% + 2d*	0.002 % + 0.5d	> 1 GΩ	120V**	> 80dB
200mV	1 µV	0.006% + 2 d	0.015% + 2d	0.002 % + 0.2d	> 1 GΩ	120V**	> 80dB
2 V	10 µV	0.004% + 1.5d	0.007% + 2d	0.0007% + 0.2d	> 1 GΩ	1000V	> 60dB
20 V	100 µV	0.004% + 1.5d	0.01 % + 2d	0.0008% + 0.2d	10MΩ	1000V	> 60dB
200 V	1mV	0.004% + 1.5d	0.01 % + 2d	0.0008% + 0.2d	10MΩ	1000V	> 60dB
1000 V	10mV	0.005% + 1.5d	0.01 % + 2d	0.0012% + 0.2d	10MΩ	1000V	> 60dB

CMRR: 160dB on mV ranges, 140dB on V ranges; at DC and line frequency (50 or 60Hz).

*When properly zeroed.

**10 seconds maximum; 35V rms continuous.

IEEE-488 BUS IMPLEMENTATION:

Multiline Commands: DCL, LLO, SDC, GET.
Uniline Commands: IFC, REN, EO, SRQ, ATN.

PROGRAMMABLE PARAMETERS:

Front Panel Controls: Range, Filter, Zero, Damping, Hi Resolution.
Internal Parameters: SRQ Response, Trigger Modes, Data Terminators

ADDRESS MODES: Talk-Only and Addressable.

TRIGGER MODES:

One Shot: Updates output buffer once at first valid conversion after trigger on TALK and/or GET.
Continuous: Updates output buffer at all valid conversions after trigger.

GENERAL

NOISE: Less than 30nV p-p on lowest range with Filter on.

INPUT CAPACITANCE: 5000pF on mV ranges.

SETTLING TIME: 0.5 sec. to within 25 digits of final reading with Filter on, Damping off.

FILTER: 3-pole digital; RC = .5, 1 or 2 seconds depending on range.

CONVERSION SPEED: 4 readings/second.

DISPLAY: Seven 13mm (0.5 in.) LED digits with appropriate decimal point and polarity.

OVERLOAD INDICATION: Display indicates polarity and OFLO.

ANALOG OUTPUT:

Accuracy: ±(.15% of displayed reading + 1mV).

Time Constant: 400ms.

Level: ±2V full scale on all ranges; X1 or X1000 gain.

ISOLATION: Input LO to output LO or power line ground: 1400V peak, 5 × 10¹⁴Ω/Hz, greater than 10¹⁴Ω paralleled by 1500pF.

WARMUP: 1 hour to rated accuracy when properly zeroed.

ENVIRONMENTAL LIMITS:

Operating: 0°C to 35°C, 0% to 80% relative humidity.

Storage: -25°C to 65°C.

POWER: 105-125V or 210-250V (internal switch selected), 50-60Hz, 30V•A maximum.

INPUT CONNECTORS: Special low thermal for 200mV and lower ranges.

Binding posts for 2V to 1000V ranges.

DIMENSIONS, WEIGHT: 127mm high × 216mm wide × 359mm deep (5" × 8½" × 14¼"). Net weight 3.85kg (8½ lbs.).