

Keithley Instruments, Inc.
 28775 Aurora Road
 Cleveland, Ohio 44139
 1-888-KEITHLEY
 www.keithley.com

Electrometer / High Resistance Meter Specifications**VOLTS**

Range	5½-Digit resolution	Accuracy (1 Year) ¹ 18°C-28°C ±(%rdg+counts)	Temperature coefficient 0°C-18°C & 28°C-50°C ±(%rdg+counts)/ °C
2V	10µV	0.025+4	0.003+2
20V	100µV	0.025+3	0.002+1
200V	1mV	0.06+3	0.002+1

NMRR: 2V and 20V range > 60dB, 200V range > 55dB. 50Hz or 60Hz²

CMRR: >120dB at DC, 50Hz or 60Hz.

Input Impedance: >200TΩ in parallel with 20pF, < 2pF guarded (1MΩ with zero check on).

Small signal bandwidth at preamp output: Typically 100kHz (-3dB).

AMPS

Range	5½-Digit resolution	Accuracy (1 Year) ¹ 18°C-28°C ±(%rdg+counts)	Temperature coefficient 0°C-18°C & 28°C-50°C ±(%rdg+counts)/ °C
20pA	100aA ³	1+30	0.1+5
200pA	1fA ³	1+5	0.1+1
2nA	10fA	0.2+30	0.1+2
20nA	100fA	0.2+5	0.03+1
200nA	1pA	0.2+5	0.03+1
2µA	10pA	0.1+10	0.005+2
20µA	100pA	0.1+5	0.005+1
200µA	1nA	0.1+5	0.005+1
2mA	10nA	0.1+10	0.008+2
20mA	100nA	0.1+5	0.008+1

¹ When properly zeroed, 5½-digit, 1 PLC (power line cycle), median filter on, digital filter = 10 readings.

² Line sync on

³ aA =10E-18A, fA=10E-15A.

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Input bias current: <3fA at T_{cal}. Temperature coefficient = 0.5fA/°C, 20pA range

Input bias current noise: <750aA p-p (capped input), 0.1Hz to 10Hz bandwidth, damping on. Digital filter = 40 readings, 20pA range

Input voltage burden at T_{cal} ±1°C: <20µV on 20pA, 2nA, 20nA, 2µA, 20µA ranges. <100µV on 200pA, 200nA, 200µA ranges. <2mV on 2mA range. <5mV on 20mA range.

Temperature coefficient of input voltage burden: <10µV/°C on pA, nA, µA ranges.

Preamp settling time (to 10% of final value) typical: 0.5sec (damping off) 2.0 sec (damping on) on pA ranges. 15msec on nA ranges damping off, 1msec on µA ranges damping off. 500usec on mA ranges damping off.

NMRR: >60dB on all ranges at 50Hz or 60Hz.²

COULOMBS

Range	5½-Digit resolution	Accuracy (1 Year) ^{4, 5} 18°C-28°C ±(%rdg+counts)	Temperature coefficient 0°C-18°C & 28°C-50°C ±(%rdg+counts)/ °C
2nC	10fC	0.4+5	0.04+3
20nC	100fC	0.4+5	0.04+1
200nC	1pC	0.4+5	0.04+1
2µC	10pC	0.4+5	0.04+1

Input bias current: <4fA at T_{CAL}. Temperature coefficient = 0.5fA/°C, 2nC range

⁴ Specifications apply immediately after charge acquisition. Add

$$\left(4fA + \frac{|Q_{AV}|}{RC}\right)T_A$$

where T_A = period of time in seconds between the coulombs zero and measurement, Q_{AV} = average charge measured over T_A, and RC = 300,000 typical.

⁵ When properly zeroed, 5½-digit, 1 PLC (power line cycle), median filter on, digital filter = 10 readings.

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OHMS

Range	5½-Digit resolution	Accuracy ⁶ (10-100% Range) 18°C-28°C (1 Year) ±(%rdg+counts)	Temperature coefficient (10-100% Range) 0°C-18°C & 28°C-50°C ±(%rdg+counts)/ °C	Auto V source	Amps range
2MΩ	10Ω	0.125+1	0.01+1	40V	200μA
20MΩ	100Ω	0.125+1	0.01+1	40V	20μA
200MΩ	1kΩ	0.15+1	0.015+1	40V	2μA
2GΩ	10kΩ	0.225+1	0.035+1	40V	200nA
20GΩ	100kΩ	0.225+1	0.035+1	40V	20nA
200GΩ	1MΩ	0.35+1	0.110+1	40V	2nA
2TΩ	10MΩ	0.35+1	0.110+1	400V	2nA
20TΩ	100MΩ	1.025+1	0.105+1	400V	200pA
200TΩ	1GΩ	1.15+1	0.125+1	400V	20pA

Preamp settling time: Add voltage source settling time to preamp settling time in Amps specification. Ranges over 20Gohm require additional settling based on the characteristics of the load.

OHMS (Alternating Polarity Method)

The alternating polarity sequence compensates for the background (offset) currents of the material or device under test. Maximum tolerable offset up to full scale of the current range used.

Using Keithley 8002A or 8009 fixture

Repeatability: $\Delta I_{BG} \times R / V_{ALT} + 0.1\%$ (1 σ) (instrument temperature constant $\pm 1^\circ\text{C}$).

Accuracy: $(V_{SRC}Err + I_{MEAS}Err \times R) / V_{ALT}$

ΔI_{BG} is a measured, typical background current noise from the sample and fixture.

V_{ALT} is the alternating polarity voltage used.

$V_{SRC}Err$ is the accuracy (in volts) of the voltage source using V_{ALT} as the setting.

$I_{MEAS}Err$ is the accuracy (in amps) of the ammeter using V_{ALT} / R as the rdg.

⁶ Specifications are for auto V-source ohms, when properly zeroed, 5½ -digit, 1 PLC, median filter on, digital filter = 10 readings. If user selectable voltage is required, use manual mode. Manual mode displays resistance (up to $10^{18}\Omega$) calculated from measured current. Accuracy is equal to the accuracy of the V-source plus the accuracy of the selected Amps range.

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Range	5½-Digit resolution	Accuracy (1 Year) 18°C-28°C ±(%setting+offset)	Temperature coefficient 0°C-18°C & 28°C-50°C ±(%setting+offset)/ °C
100V	5mV	0.15+10mV	0.005+1mV
1000V	50mV	0.15+100mV	0.005+10mV

Maximum output current:

100V Range: ±10mA, hardware short circuit protection at <14.0mA

1000V Range: ±1mA, hardware short circuit protection at <1.4mA

Settling time:

100V Range: <8ms to rated accuracy

1000V Range: <50ms to rated accuracy

Noise (typical): 10Hz-20Mhz

100V Range: < 2.6mVrms

1000V Range: < 2.9mVrms

TEMPERATURE (thermocouple)

Thermocouple type	Range	Accuracy (1 Year) ⁷ 18°C-28°C, ±(%rdg+°C)
K	-25°C to 150°C	±(0.3%+1.5°C)

HUMIDITY

Range	Accuracy (1 Year) ⁸ 18°C-28°C, ±(%rdg+%RH)
0-100%	±(0.3%+0.5)

IEEE-488 BUS IMPLEMENTATION

Implementation: SCPI (IEEE-488.2, SCPI-1999.0)

Trigger to reading done: 150ms typical, with external trigger.

RS-232 implementation: Supports: SCPI 1991.0. Baud Rates: 300, 600, 1200, 2400, 4800, 9600, 19.2k, 38.4k, 57.6k, and 115.2k.

Flow control: none, Xon/Xoff.

Connector: DB-9 TXD/RXD/GND.

⁷ Excluding probe errors, T_{CAL} ± 5°C, 1 PLC integration time.

⁸ Humidity probe accuracy must be added. This is ±3% RH, for Model 6517RH, up to 65°C probe environment, not to exceed 85°C.

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GENERAL

DISPLAY: 6½-digit vacuum fluorescent multilines.

OVERRANGE INDICATION: Display reads "OVERFLOW." For readings >105% of range, the display reads "OUT OF LIMIT" for excessive overrange conditions.

RANGING: Automatic or manual.

CONVERSION TIME: Selectable 0.01 PLC to 10 PLC.

PROGRAMS: Provide front panel access to IEEE address, choice of engineering units or scientific notation.

MAXIMUM INPUT: 250V peak, DC to 60Hz sine wave; 10sec per minute maximum on mA ranges.

MAXIMUM COMMON MODE VOLTAGE (DC to 60Hz sine wave): Electrometer, 500V peak; V Source, 750V peak.

ISOLATION (Meter COMMON to chassis): > 10¹⁰Ω, < 500pF

INPUT CONNECTOR: Three lug triaxial on rear panel.

2V ANALOG OUTPUT: 2V for full range input. Non-inverting in volts mode, inverting when measuring amps, ohms or coulombs. Output impedance 10kΩ nominal.

PREAMP OUTPUT: Provides a guard output for Volts measurements. Can be used as an inverting output or with external feedback in Amps and Coulombs modes.

EXTERNAL TRIGGER: TTL compatible External Trigger and Electrometer Complete.

GUARD: Switchable voltage guard available.

DIGITAL I/O AND TRIGGER LINE: Available, see manual for usage.

EMC: Conforms to European Union Directive 89/336/EEC, EN 61326-1.

SAFETY: Conforms to European Union Directive 73/23/EEC, EN 61010-1.

TEST SEQUENCES: Device-Characterization (Diode, Capacitor, Cable, Resistor), Resistivity, Surface-Insulation-Resistance, Sweep.

READING STORAGE: 50,000.

READING RATE:

To internal buffer	425	readings/second ⁹
To IEEE-488 bus	400	readings/second ^{9,10}
Bus transfer	3300	readings/second ¹⁰

DIGITAL FILTER: Median and averaging.

ENVIRONMENT: Operating: 0°–50°C; relative humidity 70% non-condensing, up to 35°C. Storage: –25° to +65°C. For indoor use only.

ALTITUDE: Maximum 2000 meters above sea level per EN61010-1.

WARM-UP: 1 hour to rated accuracy (see manual for recommended procedure).

POWER: User selectable 100, 120, 220, 240VAC, 50/60Hz, 100VA Max.

PHYSICAL:

Case Dimensions: 90mm x 214mm x 369mm (3 ½ in X 8 ½ in X 14 ½ in)

Working Dimensions: From front of case to rear including power cord and IEEE-488 connector: 15.5 inches.

Net Weight: 5.4 kg (11.8 lbs).

Shipping Weight: 6.9 kg (15.1 lbs).

⁹ 0.01 PLC, digital filters off, front panel off, temperature + RH off, line sync off

¹⁰ Binary transfer mode.