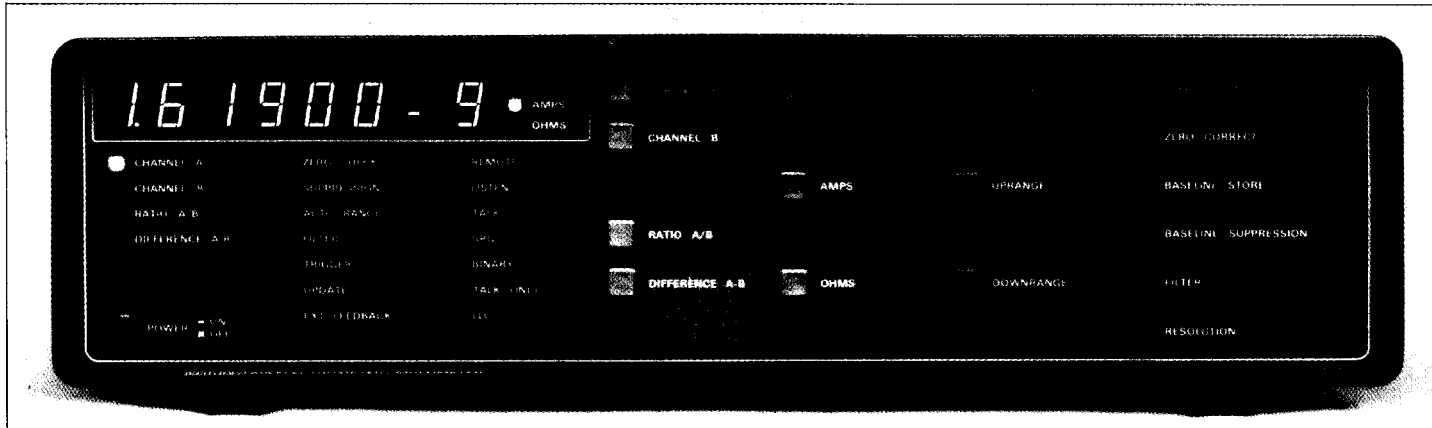


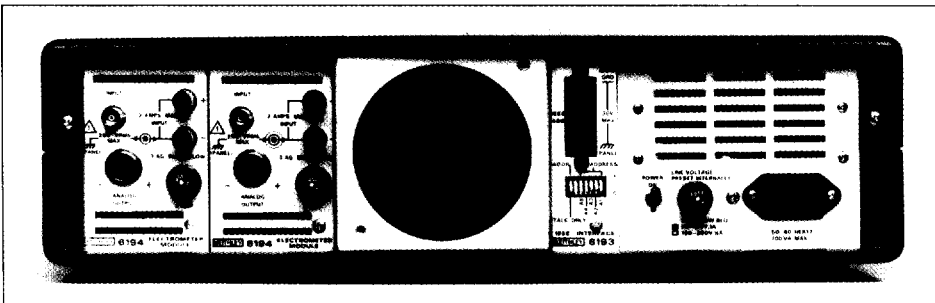


# 619/Electrometer

## Dual Channel



- Current measurement from 10fA to 2A dc
- Voltage measurement from 1μV to 200V dc with 20TΩ input resistance
- Resistance measurements from 10mΩ to 2TΩ
- Optional dual channels and IEEE-488 interface



Rear panel of Model 619 Electrometer/ Multimeter shows optional second channel (Model 6194) and IEEE-488 Interface (Model 6193) installed.

The 619 provides researchers, semiconductor designers, and component evaluators with two independent, separately programmable 5½-digit measurement channels, each with 1μV dc, 10fA dc, and 10mΩ sensitivities.

**System Compatibility.** Keithley designed the 619 to be a convenient and easily reconfigurable programmable instrument:

- Dual channels allow measurements at each node of a device without using switching systems that degrade the signal.
- EXTERNAL TRIGGER initiates a measurement. An ELECTROMETER COMPLETE signal is issued at the end of the measurement.
- Data Store capability allows storage of up to 50 readings.

**Guarding and Fast Sensitive Measurements.** The 619 uses feedback circuitry pioneered by Keithley for low current measurements. In the AMPS mode, the HI input is held within 1mV of circuit LO on the 2nA through 20mA ranges. This provides a convenient GUARD point (circuit LO) and minimizes the charge stored in connecting cables, permitting fast measurements in an automatic system.

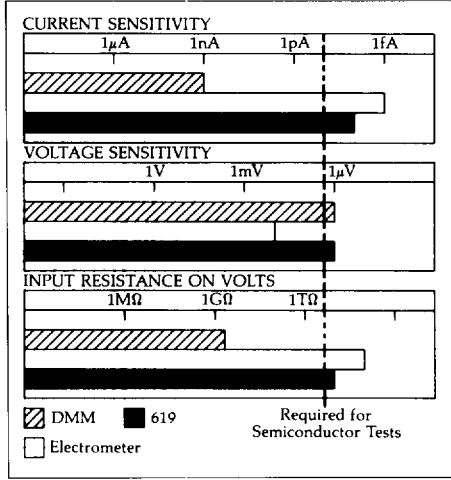
**Ratio, Difference.** Computes the ratio (A/B) or difference (A-B) of the readings from each channel.

**External Feedback.** An EXTERNAL FEEDBACK range may be selected to permit measurements of charge, logarithmic currents, or other special current-to-voltage relationships, depending on the device installed as the feedback element.

**Baseline Store, Baseline Suppress.** Touching BASELINE STORE will save the displayed reading in the memory. The BASELINE SUPPRESS button will then modify all future readings (on any range within that function) by subtracting the stored value.

**Filter.** Selection activates a low-pass filter for additional line frequency or noise rejection on a selected channel.

**Digital Self Test.** Digital Self Test on power up checks the RAM, ROM, circuit board configuration, and optoisolators.



Full range bipolar current gain characteristics and leakage measurements are facilitated by fA sensitivity.

1μV dc resolution allows lower level current forcing which minimizes self heating in van der Pauw measurements.

High input impedance enables measurements of gate voltages on MOSFETs.

# Electrometer/619

Dual Channel

## DC VOLTS

RANGE	MAXIMUM READING	ACCURACY (1 Year)* 23° ±5°C ±(%rdg + counts)	TEMPERATURE COEFFICIENT 0°-18°C & 28°-50°C ±(%rdg + counts)/°C
200 mV	199.999 × 10 <sup>-3</sup>	0.01 + 25	0.002 + 30
2 V	1.99999	0.01 + 10	0.002 + 3
20 V	19.9999	0.02 + 10	0.002 + 0.3
200 V	199.999	0.02 + 10	0.002 + 0.3

INPUT CAPACITANCE: ≤20pF.

INPUT RESISTANCE: ≥20TΩ.

NMRR: >55dB (>80dB with FILTER).

CMRR: >100dB (>125dB with FILTER).

ANALOG SETTTLING TIME (to 0.1% of final value, unfiltered): <5ms.

## DC AMPS

RANGE	MAXIMUM READING	ACCURACY (1 Year) 23° ±5°C ±(%rdg + counts)	TEMPERATURE COEFFICIENT 0°-18°C & 28°-50°C ±(%rdg + counts)/°C	INVERTING FULL SCALE ANALOG OUTPUT
2 nA	1.99999 × 10 <sup>-9</sup>	0.35 + 65	0.02 + 30	0.2 V
20 nA	19.9999 × 10 <sup>-9</sup>	0.35 + 35	0.02 + 3	2.0 V
200 nA	199.999 × 10 <sup>-9</sup>	0.15 + 25	0.01 + 30	0.2 V
2 μA	1.99999 × 10 <sup>-6</sup>	0.15 + 10	0.01 + 3	2.0 V
20 μA	19.9999 × 10 <sup>-6</sup>	0.15 + 25	0.01 + 30	0.2 V
200 μA	199.999 × 10 <sup>-6</sup>	0.15 + 10	0.01 + 3	2.0 V
2 mA	1.99999 × 10 <sup>-3</sup>	0.15 + 25	0.01 + 30	0.2 V
20 mA	19.9999 × 10 <sup>-3</sup>	0.15 + 10	0.01 + 3	2.0 V
2 A	1.99999	0.15 + 25	0.01 + 20	None

INPUT VOLTAGE DROP: <1mV at full scale except <0.6V on 2A range.

ANALOG SETTTLING TIME (to 0.1% of final value, unfiltered): 2nA through 2μA ranges: 50ms. 20μA through 2A ranges: 5ms.

NMRR: 2nA through 2μA ranges: 70dB. 20μA through 2A ranges: 55dB.

## OHMS

RANGE	MAXIMUM READING	ACCURACY (1 Year) 23° ±5°C ±(%rdg + counts)	TEMPERATURE COEFFICIENT 0°-18°C & 28°-50°C ±(%rdg + counts)/°C	MAXIMUM OPEN CIRCUIT VOLTAGE
2 kΩ	1.99999 × 10 <sup>3</sup>	0.2 + 25	0.01 + 30	5V
20 kΩ	19.9999 × 10 <sup>3</sup>	0.2 + 10	0.01 + 3	5V
200 kΩ	199.999 × 10 <sup>3</sup>	0.15 + 25	0.01 + 30	5V
2 MΩ	1.99999 × 10 <sup>6</sup>	0.15 + 10	0.01 + 3	5V
20 MΩ	19.9999 × 10 <sup>6</sup>	0.35 + 25	0.02 + 30	5V
200 MΩ	199.999 × 10 <sup>6</sup>	0.35 + 10	0.02 + 3	5V
2 GΩ	1.99999 × 10 <sup>9</sup>	0.35 + 10	0.02 + 0.3	300V
20 GΩ	19.9999 × 10 <sup>9</sup>	1 + 10	0.15 + 3	300V
200 GΩ	199.999 × 10 <sup>9</sup>	4 + 10	0.5 + 0.3	300V
2 TΩ	1.99999 × 10 <sup>12</sup>	10 + 25	0.5 + 0.3	300V

OHMS CURRENT SOURCES: 2kΩ, 20kΩ: 100μA.  
200kΩ, 2MΩ: 1μA.  
20MΩ, 2GΩ: 10nA.  
20GΩ through 2TΩ: 100pA.

ANALOG OUTPUT: Analog output voltage level is the product of the ohms current source and the resistance being measured.

### ANALOG SETTTLING TIMES:

To 0.1% of final value, unfiltered, with <100pF input capacitance: 2kΩ through 2MΩ: 5ms.  
20MΩ: 20ms.  
200MΩ: 200ms.

To 10% of final value, unfiltered, using 6191 Guarded Input Adapter with <1pF unguarded input capacitance: 2GΩ: 150ms.  
20GΩ: 1.5s.  
200GΩ: 15s.  
2TΩ: 150s.

## IEEE-488 BUS IMPLEMENTATION (Option 6193):

MULTILINE COMMANDS: DCL, LLO, SDC, GET.

UNILINE COMMANDS: IFC, REN, EOI, SRQ, ATN. Compatible with IEEE-488-1978 standard.

PROGRAMMABLE PARAMETERS: Front Panel Controls: Function, Range, Filter, Zero Check, Zero Correct, Baseline Store, Baseline Suppress. Internal Parameters: SRQ Response, Trigger Modes, Binary or ASCII Data Formats, number of readings to be stored, Data Terminators, Reading Rates, Integration Period.

ADDRESS MODES: TALK ONLY and ADDRESSABLE.

## GENERAL

DISPLAY: Numeric; 0.56 in. LED digits, 4½-digit mantissa @ 6.2 rdg./s (5½ digits @ 2.4 rdg/s in high resolution mode), 2-digit exponent; decimal point, signed exponent and mantissa.

OVERRANGE INDICATION: Display reads OFLO.

MAXIMUM ALLOWABLE INPUT: 250V rms, dc to 60Hz sine wave.

INTERNAL CURRENT (18°-28°C): <0.4pA.

EXTERNAL TRIGGER: TTL compatible EXTERNAL TRIGGER and ELECTROMETER COMPLETE.

INPUT CONNECTORS (6194 Electrometer rear panel): 2A range: 5-way binding posts. All other functions and ranges via Teflon insulated triaxial connector.

OUTPUT CONNECTORS: Analog: Amphenol Series 80 (microphone), 6194 Electrometer rear panel. IEEE: Amphenol or Cinch Series 57, 6193 IEEE Interface rear panel. BNC (chassis isolated) connections for EXTERNAL TRIGGER and ELECTROMETER COMPLETE.

### READING RATES:

Programmed Reading Rate	Number Of Integrations Averaged	Time Per Integration (ms)	Trigger To First Byte* (ms)	Readings Per Second
S0	1	4.1	32 (18 binary)	40
S1	1	16.67**	35	21
S2	2	16.67**	80	10
S3	4	16.67**	168	5.4
S4	1	100.1	120	4.7
S5	2	100.1	328	2.4
S6	4	100.1	742	1.2
S7	8	100.1	1680	0.6
S8	16	100.1	3360	0.3
S9	32	100.1	6720	0.15

\*Typical. Add an additional 42ms for first conversion on a new channel, 26ms for first conversion on a new range or function.

\*\*20 @ 50Hz.

### MAXIMUM ALLOWABLE COMMON MODE VOLTAGES:

Input LO (Ch.A) to line ground: 250V rms, dc to 60Hz sine wave.

Input LO (Ch.B) to line ground: 250V rms, dc to 60Hz sine wave.

Input LO (Ch.A) to Input LO (Ch.B): 250V rms, dc to 60Hz sine wave.

WARMUP: 1 hour to rated accuracy.

POWER: 90-110, 105-125, 180-220, or 210-250V, (internal switch selected), 50 or 60Hz, 75W max., 100VA max. (internally fan cooled).

ENVIRONMENTAL LIMITS: Operating: 0°-50°C, up to 35°C at 70% non-condensing R.H. Storage: -20° to 70°C.

DIMENSIONS, WEIGHT: 432mm wide × 127mm high × 406mm deep (17 in. × 5 in. × 16 in.), stackable enclosure. Net weight 9.8kg (22 lbs.) with Channel B Electrometer module and IEEE-488 Interface module.

ACCESSORIES SUPPLIED: One Model 6194 Electrometer Module, one Model 6011 Input Cable, analog output connectors.

ACCESSORIES AVAILABLE: See Selector Guide on page 49.