

# Specifications

# System DMM/196

PART NUMBER  
196-SPEC

## DC VOLTS (6 1/2 Digits)

| RANGE  | RESOLUTION | INPUT RESISTANCE | ACCURACY <sup>1</sup><br>± (%rdg + counts) |                         |                         | TEMPERATURE COEFFICIENT<br>± (%rdg + counts)/°C<br>0°-18° & 28°-50°C |
|--------|------------|------------------|--|-------------------------|-------------------------|--|
|        |            |                  | 24 Hr., <sup>2</sup><br>23° ± 1°C          | 90 Days,<br>18°-28°C    | 1 Year,<br>18°-28°C     |  |
| 300 mV | 100 nV     | >1 GΩ            | 0.0020 + 20 <sup>3</sup>                   | 0.005 + 20 <sup>3</sup> | 0.008 + 20 <sup>3</sup> | 0.0006 + 10  |
| 3 V    | 1 μV       | >1 GΩ            | 0.0013 + 10                                | 0.003 + 20              | 0.0036 + 20             | 0.0004 + 1   |
| 30 V   | 10 μV      | 11 MΩ            | 0.0015 + 10                                | 0.006 + 20              | 0.008 + 30              | 0.0013 + 3   |
| 300 V  | 100 μV     | 10.1 MΩ          | 0.003 + 10                                 | 0.009 + 20              | 0.009 + 30              | 0.0013 + 1   |

<sup>1</sup>For 5 1/2-digit accuracy, divide count error by 10. For 4 1/2-digit accuracy, count error is 5 (except 15 on 300mV range). For 3 1/2-digit accuracy, count error is 5.

<sup>2</sup>Relative to calibration standards.

<sup>3</sup>When properly zeroed.

**ANALOG SETTling TIME:** < 1ms (< 2ms on 300mV range), to 0.01% of step change.

**CMRR:** > 120dB at dc, 50Hz or 60Hz (± 0.05%) with 1kΩ in either lead.

**NMR:** > 60dB at 50Hz or 60Hz (± 0.05%).

**LINEARITY:** Linearity is defined as the maximum deviation from a straight line between the readings at zero and full range: 10ppm of range for 3V-300V ranges; 15ppm of range for 300mV range; at 23°C ± 1°C.

**MAXIMUM ALLOWABLE INPUT:** 300V rms, 425V peak, whichever is less.

## TRMS AC VOLTS (5 1/2 Digits)

| RANGE  | RESOLUTION | ACCURACY <sup>1</sup><br>± (%rdg + counts) |                         |                          |                          |                           |
|--------|------------|--|-------------------------|--------------------------|--------------------------|---------------------------|
|        |            | 20Hz-50Hz <sup>2</sup>                     | 50Hz-200Hz <sup>2</sup> | 200Hz-10kHz <sup>2</sup> | 10kHz-20kHz <sup>2</sup> | 20kHz-100kHz <sup>2</sup> |
| 300 mV | 1 μV       | 2 + 100                                    | 0.3 + 100               | 0.15 + 100               | 0.4 + 200                | 2.0 + 300                 |
| 3 V    | 10 μV      | 2 + 100                                    | 0.3 + 100               | 0.15 + 100               | 0.3 + 200                | 1.5 + 300                 |
| 30 V   | 100 μV     | 2 + 100                                    | 0.3 + 100               | 0.15 + 100               | 0.4 + 200                | 1.5 + 300                 |
| 300 V  | 1 mV       | 2 + 100                                    | 0.3 + 100               | 0.15 + 100               | 0.4 + 200                | 1.5 + 300                 |

<sup>1</sup>For 4 1/2-digit accuracy, divide count error by 10. For 3 1/2-digit accuracy, count error is 5. In 3 1/2- and 4 1/2-digit modes, specifications apply for inputs > 200Hz.

<sup>2</sup>For sinewave inputs > 2,000 counts.

<sup>3</sup>For sinewave inputs > 20,000 counts.

**RESPONSE:** True root mean square, ac coupled.

**CREST FACTOR (ratio of peak to rms):** Up to 3:1 allowable.

**NONSINUSOIDAL INPUTS:** For fundamental frequencies < 1kHz, crest factor < 3, add 0.25% of reading to specified accuracy for 300mV and 3V ranges; add 0.6% of reading to specified accuracy for 30V and 300V ranges.

**INPUT IMPEDANCE:** 1MΩ shunted by < 120pF.

**3dB BANDWIDTH:** 300kHz typical.

**MAXIMUM ALLOWABLE INPUT:** 300V rms, 425V peak, 10<sup>7</sup> V·Hz, whichever is less.

**SETTLING TIME:** 1 second to within 0.1% of change in reading.

**TEMPERATURE COEFFICIENT (0°-18°C & 28°-50°C):**

< ±(0.1 × applicable accuracy specification)/°C below 20kHz, ±(0.2x) for 20kHz to 100kHz.

**CMRR:** > 60dB at 50Hz or 60Hz (± 0.05%) with 1kΩ in either lead.

| INPUT                           | ACCURACY ± dB<br>1 Year, 18°-28°C |                | RESOLUTION |
|---------------------------------|-----------------------------------|----------------|------------|
|                                 | 20Hz-20kHz                        | 20kHz-100kHz   |            |
| -34 to +49 dB<br>(20mV to 300V) | 0.2                               | 0.4            | 0.01 dB    |
| -54 to -34 dB<br>(2mV to 20mV)  | 1.1                               | 3 <sup>1</sup> | 0.01 dB    |

<sup>1</sup>Typical.

## OHMS (6 1/2 Digits)

| RANGE               | RESOLUTION | NOMINAL I-SHORT | ACCURACY <sup>1</sup><br>± (%rdg + counts) |                         |                         | TEMPERATURE COEFFICIENT<br>± (%rdg + counts)/°C<br>0°-18° & 28°-50°C |
|---------------------|------------|-----------------|--|-------------------------|-------------------------|--|
|                     |            |                 | 24 Hr., <sup>2</sup><br>23° ± 1°C          | 90 Days,<br>18°-28°C    | 1 Year,<br>18°-28°C     |  |
| 300 Ω <sup>3</sup>  | 100 μΩ     | 1.7 mA          | 0.0025 + 20 <sup>3</sup>                   | 0.008 + 20 <sup>3</sup> | 0.010 + 20 <sup>3</sup> | 0.001 + 7  |
| 3 kΩ <sup>3</sup>   | 1 mΩ       | 1.7 mA          | 0.0025 + 20                                | 0.005 + 20              | 0.007 + 20              | 0.001 + 1  |
| 30 kΩ <sup>3</sup>  | 10 mΩ      | 160 μA          | 0.0025 + 20                                | 0.005 + 20              | 0.007 + 20              | 0.001 + 1  |
| 300 kΩ              | 100 mΩ     | 50 μA           | 0.006 + 20                                 | 0.020 + 20              | 0.021 + 20              | 0.004 + 1  |
| 3 MΩ                | 1 Ω        | 5 μA            | 0.007 + 20                                 | 0.020 + 20              | 0.021 + 20              | 0.004 + 1  |
| 30 MΩ               | 10 Ω       | 0.5 μA          | 0.06 + 50                                  | 0.1 + 50                | 0.1 + 50                | 0.030 + 1  |
| 300 MΩ <sup>4</sup> | 1 kΩ       | 0.5 μA          | 2.0 + 5                                    | 2.0 + 5                 | 2.0 + 5                 | 0.30 + 1   |

<sup>1</sup>For 5 1/2-digit accuracy, divide count error by 10. For 4 1/2-digit accuracy, count error is 5 (except 15 on 300Ω range). For 3 1/2-digit accuracy, count error is 5.

<sup>2</sup>4-wire accuracy, 300Ω-30kΩ ranges.

<sup>3</sup>When properly zeroed.

<sup>4</sup>Resolution on 300MΩ range is limited to 5 1/2 digits.

<sup>5</sup>Relative to calibration standards.

**CONFIGURATION:** Automatic 2- or 4-wire. Offset compensation available on 300Ω-30kΩ ranges, requires proper zeroing. Allowable compensation of ± 10mV on 300Ω range and ± 100mV on 3kΩ and 30kΩ ranges.

**MAX. ALLOWABLE INPUT:** 300V rms, 425V peak, whichever is less.

**OPEN CIRCUIT VOLTAGE:** 5.5V maximum.

**LINEARITY:** Linearity is defined as the maximum deviation from a straight line between the readings at zero and full range: 20ppm of range for 300Ω-30kΩ ranges, at 23°C ± 1°C.

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**KEITHLEY** Keithley Instruments Inc.  
Cleveland, Ohio 44139

SPECIFICATIONS

PART NUMBER  
196-SPEC

BRUNING 40-21 62198

# Specifications

# System DMM/196

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196-SPEC.

### DC AMPS (5 1/2 Digits)

| RANGE  | RESOLUTION | ACCURACY <sup>1</sup>                 |  | MAXIMUM VOLTAGE BURDEN |
|--------|------------|---------------------------------------|--|------------------------|
|        |            | ± (%rdg + counts)<br>1 Year, 18°-28°C |  |                        |
| 300 µA | 1 nA       | 0.09 + 20                             |  | 0.4 V                  |
| 3 mA   | 10 nA      | 0.05 + 10                             |  | 0.4 V                  |
| 30 mA  | 100 nA     | 0.05 + 10                             |  | 0.4 V                  |
| 300 mA | 1 µA       | 0.05 + 10                             |  | 0.5 V                  |
| 3 A    | 10 µA      | 0.09 + 10                             |  | 2 V                    |

<sup>1</sup>4 1/2-digit count error is 20. 3 1/2-digit count error is 5.  
**MAXIMUM ALLOWABLE INPUT:** 3A, 250V.  
**OVERLOAD PROTECTION:** 3A fuse (250V), accessible from rear panel.  
**TEMPERATURE COEFFICIENT** (0°-18°C & 28°-50°C):  
 < ±(0.1 × applicable accuracy specification)/°C.

### TRMS AC AMPS (5 1/2 Digits)

| RANGE  | RESOLUTION | ACCURACY <sup>1</sup> |            | MAXIMUM VOLTAGE BURDEN |
|--------|------------|-----------------------|------------|------------------------|
|        |            | 20Hz-45Hz             | 45Hz-10kHz |                        |
| 300 µA | 1 nA       | 2 + 100               | 0.9 + 100  | 0.4V                   |
| 3 mA   | 10 nA      | 2 + 100               | 0.6 + 100  | 0.4V                   |
| 30 mA  | 100 nA     | 2 + 100               | 0.6 + 100  | 0.4V                   |
| 300 mA | 1 µA       | 2 + 100               | 0.6 + 100  | 0.5V                   |
| 3 A    | 10 µA      | 2 + 100               | 0.6 + 100  | 2 V                    |

<sup>1</sup> For sine wave inputs >2000 counts. For 4 1/2-digit accuracy, divide count error by 10. For 3 1/2-digit accuracy, count error is 5. In 3 1/2- and 4 1/2-digit modes, specifications apply for sine wave inputs >200Hz.  
**RESPONSE:** True root mean square, ac coupled.  
**CREST FACTOR** (ratio of peak to rms): Up to 3:1 allowable at 1/2 full scale.  
**NONSINUSOIDAL INPUTS:** Specified accuracy for fundamental frequencies <1kHz, crest factor <3.  
**SETTLING TIME:** 1 second to within 0.1% of change in reading.  
**MAXIMUM ALLOWABLE INPUT:** 3A, 250V.  
**OVERLOAD PROTECTION:** 3A fuse (250V) accessible from rear panel.  
**TEMPERATURE COEFFICIENT** (0°-18°C & 28°-50°C):  
 < ±(0.1 × applicable accuracy specification)/°C.

| INPUT                          | ACCURACY ± dB |            |
|--------------------------------|---------------|------------|
|                                | 20Hz-10kHz    | RESOLUTION |
| -34 to +69 dB<br>(20µA to 3A)  | 0.2           | 0.01 dB    |
| -54 to -34 dB<br>(2µA to 20µA) | 0.9           | 0.01 dB    |

### MAXIMUM READING RATES<sup>1</sup> DCV, DCA, ACV, ACA READINGS/SECOND

| RESOLUTION               | Continuous into Internal Buffer |         | External Trigger into Internal Buffer |            | Triggered via IEEE-488 Bus |            |
|--------------------------|---------------------------------|---------|---------------------------------------|------------|----------------------------|------------|
|                          | MUX:                            |         | MUX:                                  |            | MUX:                       |            |
|                          | Off                             | On      | Off                                   | On         | Off                        | On         |
| 3 1/2-Digit              | 1000                            | 1000    | 237                                   | 80         | 112                        | 58         |
| 4 1/2-Digit              | 333                             | 333     | 145                                   | 63         | 91                         | 49         |
| 5 1/2-Digit              | 35 (29)                         | 9 (7.5) | 40 (33)                               | 9 (7.5)    | 35 (29)                    | 9 (7.5)    |
| 6 1/2-Digit <sup>2</sup> |                                 | 9 (7.5) |                                       | 0.3 (0.25) |                            | 0.3 (0.25) |

### OHMS READINGS/SECOND

| RESOLUTION               | Continuous into Internal Buffer |           | External Trigger into Internal Buffer |            | Triggered via IEEE-488 Bus |            |
|--------------------------|---------------------------------|-----------|---------------------------------------|------------|----------------------------|------------|
|                          | MUX:                            |           | MUX:                                  |            | MUX:                       |            |
|                          | Off                             | On        | Off                                   | On         | Off                        | On         |
| 3 1/2-Digit              | 53                              | 25        | 57                                    | 25         | 37                         | 23         |
| 4 1/2-Digit              | 43                              | 20        | 47                                    | 21         | 30                         | 19         |
| 5 1/2-Digit              | 16 (13)                         | 9.5 (7.5) | 18 (15)                               | 9.5 (7.5)  | 15 (12.5)                  | 9.5 (7.5)  |
| 6 1/2-Digit <sup>2</sup> |                                 | 9 (7.5)   |                                       | 0.3 (0.25) |                            | 0.3 (0.25) |

**Offset Compensated Ohms:** Rates are 0.5 × normal mux on ohms rates.

<sup>1</sup>Reading rates are for on-range on-scale readings with internal filter off, for 3V, 3kΩ, and 3mA ranges. 6 1/2- and 5 1/2-digit rates are for 60Hz operation. Values in parentheses are for 50Hz operation.  
<sup>2</sup>Internal filter on.

### IEEE-488 BUS IMPLEMENTATION

**MULTILINE COMMANDS:** DCL, LLO, SDC, GET, GTL, UNT, UNL, SPE, SPD.  
**UNILINE COMMANDS:** IFC, REN, EOI, SRQ, ATN.  
**INTERFACE FUNCTIONS:** SH1, AH1, T6, TE0, L4, LE0, SR1, RL1, PPO, DC1, DT1, C0, E1.  
**PROGRAMMABLE PARAMETERS:** Range, Function, Zero, Integration Period, Filter, EOI, Trigger, Terminator, Delay, 500-Reading Storage, Calibration, Display, Multiplex, Status, Service Request, Self Test, Output Format, TRANSLATOR.

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|     | A. FIC-1.5162 | M/S  | 7-18-86 |      | 7-8-86 |
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**GENERAL**

**RANGING:** Manual or autoranging.  
**MAXIMUM READING:** 3029999 counts in 6½-digit mode.  
**ZERO:** Control subtracts on-scale value from subsequent readings or allows value to be programmed.  
**CONNECTORS:** Analog: Switch selectable front or rear, safety jacks. Digital: TRIGGER input and VOLTMETER COMPLETE output on rear panel, BNCs.  
**WARMUP:** 2 hours to rated accuracy.  
**DISPLAY:** 10, 0.5-in. alphanumeric LED digits with decimal point and polarity. Function and IEEE-488 bus status also indicated.  
**ISOLATION:** Input Lo to IEEE Lo or power line ground: 500V peak.  $5 \times 10^6$  max. V·Hz product.  $> 10^9 \Omega$  paralleled by 400pF.  
**DATA MEMORY:** 1 to 500 locations, programmable. Measurement intervals selectable from 1ms to 999999ms or triggered.  
**BENCH READING RATE:** 5 readings/second (2/second on 30M $\Omega$  and 300M $\Omega$  ranges).  
**FILTER:** Weighted average (exponential). Programmable weighting, 1 to 1/99.  
**OPERATING ENVIRONMENT:** 0°-50°C, 0%-90% relative humidity up to 35°C; linearly derate 3% RH/°C, 35°C-50°C (0%-60% RH up to 28°C on 300M $\Omega$  range).

**STORAGE ENVIRONMENT:** -25° to +65°C.  
**POWER:** 105-125V or 210-250V, rear panel switch selected, 50Hz or 60Hz, 30VA max. 90-110V and 180-220V versions available upon request.  
**DIMENSIONS, WEIGHT:** 127mm high x 216mm wide x 359mm deep (5 in. x 8½ in. x 14¼ in.). Net weight 3.7kg (8 lbs.).  
**ACCESSORIES AVAILABLE:**  
 Model 1019A-1: 5¼-in. Single Fixed Rack Mounting Kit  
 Model 1019A-2: 5¼-in. Dual Fixed Rack Mounting Kit  
 Model 1019S-1: 5¼-in. Single Slide Rack Mounting Kit  
 Model 1019S-2: 5¼-in. Dual Slide Rack Mounting Kit  
 Model 1651: 50-Ampere Shunt  
 Model 1681: Clip-On Test Lead Set  
 Model 1682A: RF Probe  
 Model 1685: Clamp-On Current Probe  
 Model 1751: General Purpose Test Leads  
 Model 1754: Universal Test Lead Kit  
 Model 5806: Kelvin Clip Leads  
 Model 7007-1: Shielded IEEE-488 Cable, 1m  
 Model 7007-2: Shielded IEEE-488 Cable, 2m  
 Model 7008-3: IEEE-488 Cable, 3 ft. (0.9m)  
 Model 7008-6: IEEE-488 Cable, 6 ft. (1.8m)

Prices and specifications subject to change without notice.

BRUNING 40-21 62198

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