

Specifications

System DMM/196

PART NUMBER
196-SPEC

DC VOLTS (6 1/2 Digits)

RANGE	RESOLUTION	INPUT RESISTANCE	ACCURACY ¹ ± (%rdg + counts)			TEMPERATURE COEFFICIENT ± (%rdg + counts)/°C 0°-18° & 28°-50°C
			24 Hr., ² 23° ± 1°C	90 Days, 18°-28°C	1 Year, 18°-28°C	
300 mV	100 nV	>1 GΩ	0.0020 + 20 ³	0.005 + 20 ³	0.008 + 20 ³	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

¹For 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.

²Relative to calibration standards.

³When 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 ¹ ± (%rdg + counts)				
		20Hz-50Hz ²	50Hz-200Hz ²	200Hz-10kHz ²	10kHz-20kHz ²	20kHz-100kHz ²
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

¹For 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.

²For sinewave inputs > 2,000 counts.

³For 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, 10⁷ 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 1 Year, 18°-28°C		RESOLUTION
	20Hz-20kHz	20kHz-100kHz	
-34 to +49 dB (20mV to 300V)	0.2	0.4	0.01 dB
-54 to -34 dB (2mV to 20mV)	1.1	3 ¹	0.01 dB

¹Typical.

OHMS (6 1/2 Digits)

RANGE	RESOLUTION	NOMINAL I-SHORT	ACCURACY ¹ ± (%rdg + counts)			TEMPERATURE COEFFICIENT ± (%rdg + counts)/°C 0°-18° & 28°-50°C
			24 Hr., ² 23° ± 1°C	90 Days, 18°-28°C	1 Year, 18°-28°C	
300 Ω ³	100 μΩ	1.7 mA	0.0025 + 20 ³	0.008 + 20 ³	0.010 + 20 ³	0.001 + 7
3 kΩ ³	1 mΩ	1.7 mA	0.0025 + 20	0.005 + 20	0.007 + 20	0.001 + 1
30 kΩ ³	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 ⁴	1 kΩ	0.5 μA	2.0 + 5	2.0 + 5	2.0 + 5	0.30 + 1

¹For 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.

²4-wire accuracy, 3000-30kΩ ranges.

³When properly zeroed.

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

⁵Relative to calibration standards.

CONFIGURATION: Automatic 2- or 4-wire. Offset compensation available on 3000-30kΩ 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 3000-30kΩ ranges, at 23°C ± 1°C.

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LTR	REVISIONS	APP.	DATE	DRN.	DATE

KEITHLEY Keithley Instruments Inc.
Cleveland, Ohio 44139

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PART NUMBER
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BRUNING 40-21 62198

Specifications

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DC AMPS (5 1/2 Digits)

RANGE	RESOLUTION	ACCURACY ¹		MAXIMUM VOLTAGE BURDEN
		± (%rdg + counts) 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

¹4 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 ¹		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

¹ 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 (20µA to 3A)	0.2	0.01 dB
-54 to -34 dB (2µA to 20µA)	0.9	0.01 dB

MAXIMUM READING RATES¹

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 ²		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 ²		9 (7.5)		0.3 (0.25)		0.3 (0.25)

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

¹Reading 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.

²Internal 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	7.9.86		7.8.90
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				APP. M/S	DATE 7-18-86

KEITHLEY Keithley Instruments Inc.
Cleveland, Ohio 44139

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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. 5×10^6 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 Ω and 300M Ω 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 Ω 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.

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4	ECO# 1156	NK	7-8-86	CHKD.	DATE
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