2000 6½-Digit Multimeter

DC CHARACTERISTICS

CONDITIONS: MED (1 PLC)[1] or SLOW (10 PLC) or MED (1 PLC) with filter of 10

ACCURACY: ±(ppm of reading + ppm of range) (ppm = parts per million) (e.g., 10ppm = 0.001%)

FUNCTION	RANGE	RESOLUTION	TEST CURRENT OR BURDEN VOLTAGE (±5%)	INPUT RESISTANCE	24 HOUR[14] 23°C ± 1°	90 DAY 23°C ± 5°	1 YEAR 23°C ± 5°	TEMPERATURE COEFFICIENT 0°–18°C & 28°–50°C
Voltage	100.0000 mV	0.1 µV		> 10 GΩ	30 + 30	40 + 35	50 + 35	2 + 6
	1.000000 V	1.0 µV		> 10 GΩ	15 + 6	25 + 7	30 + 7	2 + 1
	10.00000 V	10 µV		> 10 GΩ	15 + 4	20 + 5	30 + 5	2 + 1
	100.0000 V	100 µV		10 MΩ ±1%	15 + 6	30 + 6	45 + 6	5 + 1
	1000.000 V[9]	1 mV		10 MΩ ±1%	20 + 6	35 + 6	45 + 6	5 + 1
Resistance[15]	100.0000 Ω	100 µΩ	1 mA		30 + 30	80 + 40	100 + 40	8 + 6
	1.000000 kΩ	1mΩ	1 mA		20 + 6	80 + 10	100 + 10	8 + 1
	10.00000 kΩ	10mΩ	100 µA		20 + 6	80 + 10	100 + 10	8 + 1
	100.0000 kΩ	100mΩ	10 µA		20 + 6	80 + 10	100 + 10	8 + 1
	1.000000 MΩ[16]	1 Ω	10 µA		20 + 6	80 + 10	100 + 10	8 + 1
	10.00000 MΩ[11, 16]	10 Ω	700 nA // 10MΩ		150 + 6	200 + 10	400 + 10	70 + 1
	100.0000 MΩ[11, 16]	100 Ω	700 nA // 10MΩ		800 + 30	1500 + 30	1500 + 30	385 + 1
Current	10.00000 mA	10 nA	< 0.15 V		60 + 30	300 + 80	500 + 80	50 + 5
	100.0000 mA	100 nA	< 0.03 V		100 + 300	300 + 800	500 + 800	50 + 50
	1.000000 A	1 µA	< 0.3 V		200 + 30	500 + 80	800 + 80	50 + 5
	3.00000 A	10 µA	< 1 V		1000 + 15	1200 + 40	1200 + 40	50 + 5
Continuity 2W	1 kΩ	100mΩ	1 mA		40 + 100	100 + 100	120 + 100	8 + 1
Diode Test	3.00000 V	10 µV	1 mA		20 + 6	30 + 7	40 + 7	8 + 1
	10.00000 V	10 µV	100 µA		20 + 6	30 + 7	40 + 7	8 + 1
	10.00000 V	10 µV	10 µA		20 + 6	30 + 7	40 + 7	8 + 1

DC OPERATING CHARACTERISTICS[2]

FUNCTION	DIGITS	READINGS/s	PLCs[8]
DCV (all ranges),	6½[3, 4]	5	10
DCI (all ranges), and	6½[3, 7]	30	1
Ohms (<10M range)	6½[3, 5]	50	1
	5½[3, 5]	270	0.1
	5½[5]	500	0.1
	5½[5]	1000	0.04
	4½[5]	2000	0.01

DC SYSTEM SPEEDS[2, 6]

RANGE CHANGE[3]: 50/s.
FUNCTION CHANGE[3]: 45/s.
AUTORANGE TIME[3, 10]: <30 ms.
ASCII READINGS TO RS-232 (19.2K BAUD): 55/s.
MAX. INTERNAL TRIGGER RATE: 2000/s.
MAX. EXTERNAL TRIGGER RATE: 500/s.

DC GENERAL

LINEARITY OF 10VDC RANGE: ±(2ppm of reading + 1ppm of range).
DCV, Ω, TEMPERATURE, CONTINUITY, DIODE TEST INPUT PROTECTION: 1000V, all ranges.
MAXIMUM 4WΩ LEAD RESISTANCE: 10% of range per lead for 100Ω and 1kΩ ranges; 1kΩ per lead for all other ranges.
DC CURRENT INPUT PROTECTION: 3A, 250V fuse.
SHUNT RESISTOR: 0.1Ω for 3A, 1A and 100mA ranges. 10Ω for 10mA range.
CONTINUITY THRESHOLD: Adjustable 1Ω to 1000Ω.
AUTOZERO OFF ERROR: Add ±(2ppm of range error + 5µV) for <10 minutes and ±1°C change.
OVERRANGE: 120% of range except on 1000V, 3A and Diode.

SPEED AND NOISE REJECTION

RATE	READINGS/S	DIGITS	RMS NOISE 10V RANGE	NMRR[12]	CMRR[13]
10 PLC	5	6½	< 1.5 µV	60 dB	140 dB
1 PLC	50	6½	< 4 µV	60 dB	140 dB
0.1 PLC	500	5½	< 22 µV	—	80 dB
0.01 PLC	2000	4½	< 150 µV	—	80 dB

DC Notes

[1] Add the following to "ppm of range" uncertainty:1V and 100V, 2ppm; 100mV, 15ppm; 100Ω, 15ppm; <1MΩ, 2ppm; 10mA and 1A, 10ppm; 100mA, 40ppm.

[2] Speeds are for 60 Hz operation using factory default operating conditions (*RST). Autorange off, Display off, Trigger delay = 0.

[3] Speeds include measurement and binary data transfer out the GPIB.

[4] Auto zero off.

[5] Sample count = 1024, auto zero off.

[6] Auto zero off, NPLC = 0.01.

[7] Ohms = 24 readings/second.

[8] 1 PLC = 16.67ms @ 60Hz, 20ms @ 50Hz/400Hz. The frequency is automatically determined at power up.

[9] For signal levels >500V, add 0.02ppm/V uncertainty for the portion exceeding 500V.

[10] Add 120ms for ohms.

[11] Must have 10% matching of lead resistance in Input HI and LO.

[12] For line frequency ±0.1%.

[13] For 1kΩ unbalance in LO lead.

[14] Relative to calibration accuracy.

[15] Specifications are for 4-wire ohms. For 2-wire ohms, add 1Ω additional uncertainty.

[16] For rear inputs, add the following to Temperature Coefficient "ppm of reading" uncertainty: 10MΩ 70ppm, 100MΩ 385ppm. Operating environment specified for 0° to 50°C and 50% RH at 35°C.

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TRUE RMS AC VOLTAGE AND CURRENT CHARACTERISTICS

ACCURACY [1]: ±(% of reading + % of range), 23°C ±5 °C

VOLTAGE RANGE	RESOLUTION	CALIBRATION CYCLE	3 Hz–10 Hz	10 Hz–20 kHz	20 kHz–50 kHz	50 kHz–100 kHz	100 kHz–300 kHz
100.0000 mV	0.1 µV						
1.000000 V	1.0 µV	90 Days	0.35 + 0.03	0.05 + 0.03	0.11 + 0.05	0.60 + 0.08	4 + 0.5
10.00000 V	10 µV						
100.0000 V	100 µV	1 Year	0.35 + 0.03	0.06 + 0.03	0.12 + 0.05	0.60 + 0.08	4 + 0.5
750.000 V	1 mV						
		TEMPERATURE COEFFICIENT/°C [8]	0.035 + 0.003	0.005 + 0.003	0.006 + 0.005	0.01 + 0.006	0.03 + 0.01

CURRENT RANGE	RESOLUTION	CALIBRATION CYCLE	3 Hz–10 Hz	10 Hz–5 kHz
1.000000 A	1 µA	90 Day/1 Year	0.30 + 0.04	0.10 + 0.04
3.00000[9] A	10 µA	90 Day/1 Year	0.35 + 0.06	0.15 + 0.06
		TEMPERATURE COEFFICIENT/°C [8]	0.035 + 0.006	0.015 + 0.006

HIGH CREST FACTOR ADDITIONAL ERROR ±(% of reading) [7]

CREST FACTOR:	1–2	2–3	3–4	4–5
ADDITIONAL ERROR:	0.05	0.15	0.30	0.40

AC OPERATING CHARACTERISTICS [2]

FUNCTION	DIGITS	READINGS/s	RATE	BANDWIDTH
ACV (all ranges), and	6½ [3]	2s/reading	SLOW	3 Hz–300 kHz
ACI (all ranges)	6½ [3]	1.4	MED	30 Hz–300 kHz
	6½ [4]	4.8	MED	30 Hz–300 kHz
	6½ [3]	2.2	FAST	300 Hz–300 kHz
	6½ [4]	35	FAST	300 Hz–300 kHz

ADDITIONAL LOW FREQUENCY ERRORS ±(% of reading)

	SLOW	MED	FAST
20Hz – 30Hz	0	0.3	—
30Hz – 50Hz	0	0	—
50Hz – 100Hz	0	0	1.0
100Hz – 200Hz	0	0	0.18
200Hz – 300Hz	0	0	0.10
> 300Hz	0	0	0

AC SYSTEM SPEEDS [2, 5]

FUNCTION/RANGE CHANGE [6]: 4/s.
AUTORANGE TIME: <3 s.
ASCII READINGS TO RS-232 (19.2k BAUD) [4]: 50/s.
MAX. INTERNAL TRIGGER RATE [4]: 300/s.
MAX. EXTERNAL TRIGGER RATE [4]: 300/s.

AC GENERAL

INPUT IMPEDANCE: 1MΩ ±2% paralleled by <100pF.
ACV INPUT PROTECTION: 1000Vp.
MAXIMUM DCV: 400V on any ACV range.
ACI INPUT PROTECTION: 3A, 250V fuse.
BURDEN VOLTAGE: 1A Range: <0.3V rms. 3A Range: <1V rms.
SHUNT RESISTOR: 0.1Ω on all ACI ranges.
AC CMRR: >70dB with 1kΩ in LO lead.
MAXIMUM CREST FACTOR: 5 at full scale.
VOLT HERTZ PRODUCT: $\leq 8 \times 10^7$ V·Hz.
OVERRANGE: 120% of range except on 750V and 3A ranges.

AC Notes

1. Specifications are for SLOW rate and sinewave inputs >5% of range.
2. Speeds are for 60 Hz operation using factory default operating conditions (*RST). Auto zero off, Auto range off, Display off, includes measurement and binary data transfer out the GPIB.
3. 0.01% of step settling error. Trigger delay = 400ms.
4. Trigger delay = 0.
5. DETector:BANDwidth 300, NPLC = 0.01.
6. Maximum useful limit with trigger delay = 175ms.
7. Applies to non-sinewaves >5Hz and <500Hz. (Guaranteed by design for Crest Factors >4.3)
8. Applies to 0°–18°C and 28°–50°C.
9. For signal levels > 2.2A, add additional 0.4% to "of reading" uncertainty.

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FREQUENCY AND PERIOD CHARACTERISTICS [1,2]

ACV RANGE	FREQUENCY RANGE	PERIOD RANGE	GATE TIME	RESOLUTION ±(ppm of reading)	ACCURACY 90 DAY/1 YEAR ±(% of reading)
100 mV to 750 V	3 Hz to 500 kHz	333 ms to 2 µs	1 s (SLOW)	0.3	0.01

Frequency Notes

[1] Specifications are for squarewave inputs >10% of ACV range, except 100mV range. On 100mV range frequency must be >10Hz if voltage is <20mV.

[2] 20% overrange on all ranges except 750V range.

TEMPERATURE CHARACTERISTICS

THERMOCOUPLE [2,3,4]

TYPE	RANGE	RESOLUTION	90 DAY/1 YEAR (23°C ± 5°C) ACCURACY [1] Relative to Reference Junction	Using [5] 2001-TCSCAN
J	–200 to + 760°C	0.001°C	±0.5°C	±0.65°C
K	–200 to + 1372°C	0.001°C	±0.5°C	±0.70°C
T	–200 to + 400°C	0.001°C	±0.5°C	±0.68°C

Temperature Notes

[1] For temperatures <–100°C, add ±0.1°C and >900°C add ±0.3°C.

[2] Temperature can be displayed in °C, K or °F.

[3] Accuracy based on ITS-90.

[4] Exclusive of thermocouple error.

[5] Specifications apply to channels 2-6. Add 0.06°C/channel from channel 6.

INTERNAL SCANNER SPEED[4]

MAXIMUM INTERNAL SCANNER RATES

RANGE: Channels/s[1]

TRIGGER DELAY = 0

DCV [2]	ACV [2,3]	2-WIRE OHMS [2]	4-WIRE OHMS [2]	TEMPERATURE [2]
All : 110	All : 100	All : 105	<10MΩ : 33	All : 60

TRIGGER DELAY = AUTO

DCV [2]	ACV [2,3]	2-WIRE OHMS [2]	4-WIRE OHMS [2]	TEMPERATURE [2]
0.1 V : 105	All : 1.8	100 Ω : 85	100 Ω : 29	All : 60
1 V : 105		1 kΩ : 85	1 kΩ : 29	
10 V : 105		10 kΩ : 42	10 kΩ : 22	
100 V : 70		100 kΩ : 28	100 kΩ : 18	
1000 V : 70		1 MΩ : 8	1 MΩ : 7	
		10 MΩ : 5	10 MΩ : 5	
		100 MΩ : 3	100 MΩ : 3	

Internal Scanner Speed Notes

[1] Speeds are for 60Hz operation using factory default operating conditions (*RST). Auto Zero off, Auto Range off, Display off, sample count = 1024.

[2] NPLC = 0.01.

[3] DETector:BANDwidth 300.

[4] 10-channel card specification. See individual card specifications for options other than 10-channel card.

TRIGGERING AND MEMORY

READING HOLD SENSITIVITY: 0.01%, 0.1%, 1%, or 10% of reading.

TRIGGER DELAY: 0 to 99 hrs (1ms step size).

EXTERNAL TRIGGER LATENCY: 200µs + <300µs jitter with autozero off, trigger delay = 0.

MEMORY: 1024 readings.

MATH FUNCTIONS

Rel, Min/Max/Average/StdDev (of stored reading), dB, dBm, Limit Test, %, and mX+b with user defined units displayed.

dBm REFERENCE RESISTANCES: 1 to 9999Ω in 1Ω increments.

STANDARD PROGRAMMING LANGUAGES

SCPI (Standard Commands for Programmable Instruments)

Keithley 196/199

Fluke 8840A. Fluke 8842A

REMOTE INTERFACE

GPIB (IEEE-488.1, IEEE-488.2) and RS-232C.

GENERAL

POWER SUPPLY: 100V / 120V / 220V / 240V ±10%.

LINE FREQUENCY: 45Hz to 66Hz and 360Hz to 440Hz, automatically sensed at power-up.

POWER CONSUMPTION: 22 VA.

OPERATING ENVIRONMENT: Specified for 0°C to 50°C. Specified to 80% R.H. at 35°C.

STORAGE ENVIRONMENT: –40°C to 70°C.

WARRANTY: 3 years.

EMC: Complies with European Union Directive 89/336/EEC, EN61326-1.

SAFETY: Conforms to European Union Directive 73/23/EEC EN61010-1, CAT II.

VIBRATION: MIL-PRF-28800F Class 3 Random.

WARMUP: 1 hour to rated accuracy.

DIMENSIONS: Rack Mounting: 89mm high × 213mm wide × 370mm deep (3½ in × 8⅜ in × 14⁹⁄₁₆ in).

Bench Configuration (with handle and feet): 104mm high × 238mm wide × 370mm deep (4⅛ in × 9⅜ in × 14⁹⁄₁₆ in).

NET WEIGHT: 2.9kg (6.3 lbs).

SHIPPING WEIGHT: 5kg (11 lbs).

VOLT HERTZ PRODUCT: ≤8×10^7V·Hz.

Specifications are subject to change without notice.