

# Model 2000 6<sup>1</sup>/<sub>2</sub>-Digit Multimeter

## DC CHARACTERISTICS

CONDITIONS: MED (1 PLC)<sup>1</sup> 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 <sup>14</sup> 23°C ± 1°	90 DAY 23°C ± 5°	1 YEAR 23°C ± 5°	TEMPERATURE COEFFICIENT
								0°–18°C & 28°–50°C
<b>Voltage</b>	100.0000 mV	0.1 μV	> 10 GΩ	> 10 GΩ	30 + 30	40 + 35	50 + 35	2 + 6
	1.000000 V	1.0 μV	> 10 GΩ	> 10 GΩ	15 + 6	25 + 7	30 + 7	2 + 1
	10.00000 V	10 μV	> 10 GΩ	> 10 GΩ	15 + 4	20 + 5	30 + 5	2 + 1
	100.0000 V	100 μV	10 MΩ ±1%	10 MΩ ±1%	15 + 6	30 + 6	45 + 6	5 + 1
	1000.000 V <sup>9</sup>	1 mV	10 MΩ ±1%	10 MΩ ±1%	20 + 6	35 + 6	45 + 6	5 + 1
<b>Resistance<sup>15</sup></b>	100.0000 Ω	100 μΩ	1 mA	1 mA	30 + 30	80 + 40	100 + 40	8 + 6
	1.000000 kΩ	1 mΩ	1 mA	1 mA	20 + 6	80 + 10	100 + 10	8 + 1
	10.00000 kΩ	10 mΩ	100 μA	100 μA	20 + 6	80 + 10	100 + 10	8 + 1
	100.0000 kΩ	100 mΩ	10 μA	10 μA	20 + 6	80 + 10	100 + 10	8 + 1
	1.000000 MΩ <sup>16</sup>	1 Ω	10 μA	10 μA	20 + 6	80 + 10	100 + 10	8 + 1
	10.00000 MΩ <sup>11,16</sup>	10 Ω	700 nA // 10MΩ	700 nA // 10MΩ	150 + 6	200 + 10	400 + 10	95 + 1
	100.0000 MΩ <sup>11,16</sup>	100 Ω	700 nA // 10MΩ	700 nA // 10MΩ	800 + 30	1500 + 30	1500 + 30	900 + 1
<b>Current</b>	10.00000 mA	10 nA	< 0.15 V	< 0.15 V	60 + 30	300 + 80	500 + 80	50 + 5
	100.0000 mA	100 nA	< 0.03 V	< 0.03 V	100 + 300	300 + 800	500 + 800	50 + 50
	1.000000 A	1 μA	< 0.3 V	< 0.3 V	200 + 30	500 + 80	800 + 80	50 + 5
	3.00000 A	10 μA	< 1 V	< 1 V	1000 + 15	1200 + 40	1200 + 40	50 + 5
<b>Continuity 2W</b>	1 kΩ	100 mΩ	1 mA	1 mA	40 + 100	100 + 100	120 + 100	8 + 1
<b>Diode Test</b>	3.00000 V	10 μV	1 mA	1 mA	20 + 6	30 + 7	40 + 7	8 + 1
	10.00000 V	10 μV	100 μA	100 μA	20 + 6	30 + 7	40 + 7	8 + 1
	10.00000 V	10 μV	10 μA	10 μA	20 + 6	30 + 7	40 + 7	8 + 1

## DC OPERATING CHARACTERISTICS<sup>2</sup>

FUNCTION	DIGITS	READINGS/s	PLCS <sup>8</sup>
DCV (all ranges),	6.5 <sup>3,4</sup>	5	10
DCI (all ranges), and	6.5 <sup>3,7</sup>	30	1
Ohms (<10M range)	6.5 <sup>3,5</sup>	50	1
	5.5 <sup>3,5</sup>	270	0.1
	5.5 <sup>5</sup>	500	0.1
	5.5 <sup>5</sup>	1000	0.04
	4.5 <sup>5</sup>	2000	0.01

## DC SYSTEM SPEEDS<sup>2,6</sup>

RANGE CHANGE<sup>3</sup>: 50/s.

FUNCTION CHANGE<sup>3</sup>: 45/s.

AUTORANGE TIME<sup>3,10</sup>: <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: ±(1ppm of reading + 2ppm 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 <sup>12</sup>	CMRR <sup>13</sup>
10 PLC	5	6.5	< 1.5 μV	60 dB	140 dB
1 PLC	50	6.5	< 4 μV	60 dB	140 dB
0.1 PLC	500	5.5	< 22 μV	—	80 dB
0.01 PLC	2000	4.5	< 150 μV	—	80 dB

## DC Notes

- Add the following to "ppm of range" uncertainty: 1V and 100V, 2ppm; 100mV, 15ppm; 100Ω, 15ppm; 1K-1MΩ, 2ppm; 10mA and 1A, 10ppm; 100mA, 40ppm.
- Speeds are for 60Hz operation using factory default operating conditions (\*RST). Autorange off, Display off, Trigger delay = 0.
- Speeds include measurement and binary data transfer out the GPIB.
- Auto zero off.
- Sample count = 1024, auto zero off.
- Auto zero off, NPLC = 0.01.
- Ohms = 24 readings/second.
- 1 PLC = 16.67ms @ 60Hz, 20ms @ 50Hz/400Hz. The frequency is automatically determined at power up.
- For signal levels >500V, add 0.02ppm/V uncertainty for the portion exceeding 500V.
- Add 120ms for ohms.
- Must have 10% matching of lead resistance in Input HI and LO.
- For line frequency ±0.1%.
- For 1kΩ unbalance in LO lead.
- Relative to calibration accuracy.
- Specifications are for 4-wire ohms. For 2-wire ohms, add 1Ω additional uncertainty.
- 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 <sup>1</sup>: ±(% of reading + % of range), 23°C ±5 °C

VOLTAGE RANGE	RESOLUTION	CALIBRATION CYCLE	3 Hz–10 Hz <sup>10</sup>	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/<sup>o</sup>C<sup>8</sup>

0.035 + 0.003	0.005 + 0.003	0.006 + 0.005	0.01 + 0.006	0.03 + 0.01
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CURRENT RANGE	RESOLUTION	CALIBRATION CYCLE	3 Hz–10 Hz	10 Hz–3 kHz	3 kHz–5 kHz
1.000000 A	1 μA	90 Day/1 Year	0.30 + 0.04	0.10 + 0.04	0.14 + 0.04
3.00000 <sup>9</sup> A	10 μA	90 Day/1 Year	0.35 + 0.06	0.15 + 0.06	0.18 + 0.06

TEMPERATURE COEFFICIENT/<sup>o</sup>C<sup>8</sup>

0.035 + 0.006	0.015 + 0.006	0.015 + 0.006
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### HIGH CREST FACTOR ADDITIONAL ERROR ±(% of reading)<sup>7</sup>

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

### AC OPERATING CHARACTERISTICS<sup>2</sup>

FUNCTION	DIGITS	READINGS/s	RATE	BANDWIDTH
ACV (all ranges), and	6.5 <sup>3</sup>	2s/reading	SLOW	3 Hz–300 kHz
ACI (all ranges)	6.5 <sup>3</sup>	1.4	MED	30 Hz–300 kHz
	6.5 <sup>4</sup>	4.8	MED	30 Hz–300 kHz
	6.5 <sup>3</sup>	2.2	FAST	300 Hz–300 kHz
	6.5 <sup>4</sup>	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<sup>2,5</sup>

FUNCTION/RANGE CHANGE<sup>6</sup>: 4/s.

AUTORANGE TIME: <3s.

ASCII READINGS TO RS-232 (19.2k BAUD)<sup>4</sup>: 50/s.

MAX. INTERNAL TRIGGER RATE<sup>4</sup>: 300/s.

MAX. EXTERNAL TRIGGER RATE<sup>4</sup>: 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: ≤8 x 10<sup>7</sup> V·Hz.

OVERRANGE: 120% of range except on 750V and 3A ranges.

### AC Notes

<sup>1</sup> Specifications are for SLOW rate and sinewave inputs >5% of range.

<sup>2</sup> 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.

<sup>3</sup> 0.01% of step settling error. Trigger delay = 400ms.

<sup>4</sup> Trigger delay = 0.

<sup>5</sup> DETector: BANDwidth 300, NPLC = 0.01.

<sup>6</sup> Maximum useful limit with trigger delay = 175ms.

<sup>7</sup> Applies to non-sinewaves >5Hz and <500Hz. (Guaranteed by design for Crest Factors >4.3)

<sup>8</sup> Applies to 0°–18°C and 28°–50°C.

<sup>9</sup> For signal levels > 2.2A, add additional 0.4% to “of reading” uncertainty.

<sup>10</sup> Typical uncertainties. Typical represents two sigma or 95% of manufactured units measure < 0.35% of reading and three sigma or 99.7% < 1.06% of reading.

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## FREQUENCY AND PERIOD CHARACTERISTICS<sup>1,2</sup>

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

- Specifications are for square wave inputs only. Input signal must be >10% of ACV range. If input is <20mV on the 100mV range then frequency must be >10Hz.
- 20% overrange on all ranges except 750V range.

## TEMPERATURE CHARACTERISTICS

TYPE	RANGE	RESOLUTION	Relative to Reference Junction	Using <sup>5</sup> 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

- For temperatures <-100°C, add ±0.1°C and >900°C add ±0.3°C.
- Temperature can be displayed in °C, K or °F.
- Accuracy based on ITS-90.
- Exclusive of thermocouple error.
- Specifications apply to channels 2-6. Add 0.06°C/channel from channel 6.

## INTERNAL SCANNER SPEED<sup>4</sup>

### MAXIMUM INTERNAL SCANNER RATES

RANGE: Channels/s<sup>1</sup>

TRIGGER DELAY = 0

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

TRIGGER DELAY = AUTO

DCV <sup>2</sup>	ACV <sup>2,3</sup>	2-WIRE OHMS <sup>2</sup>	4-WIRE OHMS <sup>2</sup>	TEMPERATURE <sup>2</sup>
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

- Speeds are for 60Hz operation using factory default operating conditions (\*RST). Auto Zero off, Auto Range off, Display off, sample count = 1024.
- NPLC = 0.01.
- DETECTOR: BANDwidth 300.
- 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.

**LINE FREQUENCY:** 50Hz to 60Hz and 400Hz, 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. Altitude up to 2000 meters.

**STORAGE ENVIRONMENT:** -40°C to 70°C.

**WARRANTY:** 1 year.

**EMC:** Conforms to European Union EMC Directive.

**SAFETY:** Conforms to European Union Low Voltage Directive.

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

**WARMUP:** 1 hour to rated accuracy.

**DIMENSIONS: Rack Mounting:** 89mm high x 213mm wide x 370mm deep (3.5 in. x 8.38 in. x 14.56 in.).

**Bench Configuration (with handle and feet):** 104mm high x 238mm wide x 370mm deep (4.13 in. x 9.38 in. x 14.56 in.).

**NET WEIGHT:** 2.9kg (6.3 lbs).

**SHIPPING WEIGHT:** 5kg (11 lbs).

**VOLT HERTZ PRODUCT:** ≤8 x 10<sup>7</sup>V-Hz.

Specifications are subject to change without notice.

