2010

Low Noise 7½-Digit Autoranging Multimeter

The 7½-digit Model 2010 Low Noise Multimeter combines high resolution with the high speed and accuracy needed for production applications such as testing precision sensors, transducers, A/D and D/A converters, regulators, references, connectors, switches, and relays. It is based on the same high speed, low noise A/D converter technology as the Models 2000, 2001, and 2002.

- **7½-digit resolution**
- **100nV rms noise floor**
- **7ppm DCV repeatability**
- **Built-in 10-channel scanner mainframe**
- **Dry circuit and low power measurement mode**
- **15 measurement functions including support for RTD and thermocouple temperature measurements**
- **Built-in ratio measurement function**

Ordering Information

2010 **Autoranging DMM**

Accessories Supplied

Model 1751 Safety Test Leads, User Manual, Service Manual

High Measurement Flexibility

The 2010 has 15 built-in measurement functions, including DCV, ACV, DCI, ACI, 2WΩ, 4WΩ, dry circuit resistance, temperature (with either thermocouples or RTDs), frequency, period, ratio, continuity measurement, and diode testing. This multi-functional design minimizes added equipment costs.

Creating a self-contained multipoint measurement solution is as simple as plugging a 2000-SCAN or 2001-TCSCAN scanner card into the option slot in the 2010's back panel. This "plug-in" approach eliminates the need for a separate scanner and significantly reduces programming and setup time in applications involving a limited number of test points. For larger applications, the 2010 is compatible with Keithley's Series 7000 switch matrices and cards.

Unique Resistance Measurement Functions

Characterizing the resistance, linearity, or isolation of contacts, connectors, switches, or relays completely and efficiently demands an uncommon combination of ohms measurement capabilities. The 2010 offers:

- ***A low-power ohms measurement mode.*** Low-level resistance measurements can be made with source current as low as 100μA, an order of magnitude lower than is possible with other DMMs, so device self-heating is minimized. Among other benefits, this low-power measurement capability makes the 2010 suitable for end-of-life contact testing per ASTM B539-90.
- ***A dry circuit test function.*** When measuring contact and connector resistances, it is important to control the test voltage carefully in order to avoid puncturing any oxides or films that may have formed. A built-in clamp limits the open circuit test voltage to 20mV to ensure dry circuit conditions.
- ***An offset compensated ohms function.*** This function eliminates thermal effects that can create errors in low-level resistance measurements in system environments.
- ***An extended ohms measurement capability.*** The 2010 provides a 10Ω range for more precise measurements of low resistances.

Optional Multiplexer Cards

Creating a self-contained multipoint measurement solution is as simple as plugging a scanner card into the option slot on the 2010's back panel. This approach eliminates the complexities of triggering, timing, and processing issues and helps reduce test time significantly. For applications involving more than 10 measurement points, the 2010 is compatible with Keithley's Series 7000 switch matrices and cards.

Model 2000-SCAN Scanner Card

- Ten analog input channels (2-pole)
- Configurable as 4-pole, 5-channel

ACCESSORIES AVAILABLE

TEST LEADS	
5804/5	4-Wire/Kelvin Test Lead Sets
SWITCH/SCANNER CARDS	
2000-SCAN	10-channel Scanner
2001-TCSCAN	9-channel Thermocouple Scanner
CABLES/ADAPTERS	
7007-1	Shielded IEEE-488 Cable, 1m (3.3 ft)
7007-2	Shielded IEEE-488 Cable, 2m (6.6 ft)
7009-5	RS-232 Cable
RACK MOUNT KITS	
4288-1	Single Fixed Rack Mount Kit
4288-2	Dual Fixed Rack Mount Kit
GPIB INTERFACES	
KPCI-488LPA	IEEE-488 Interface/Controller for the PCI Bus
KUSB-488A	IEEE-488 USB-to-GPIB Interface Adapter

SERVICES AVAILABLE

2000-SCAN-3Y-EW	1-year factory warranty extended to 3 years from date of shipment
2001-TCSCAN-3Y-EW	1-year factory warranty extended to 3 years from date of shipment
2010-3Y-EW	1-year factory warranty extended to 3 years from date of shipment
C/2000-3Y-ISO	3 (ISO-17025 accredited) calibrations within 3 years of purchase for Model 2000-SCAN*
C/2001-3Y-ISO	3 (ISO-17025 accredited) calibrations within 3 years of purchase for Model 2001-TCSCAN*
C/2010-3Y-ISO	3 (ISO-17025 accredited) calibrations within 3 years of purchase for Model 2010*

*Not available in all countries

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KEITHLEY

A GREATER MEASURE OF CONFIDENCE

2010

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DC VOLTAGE

Range	Resolution	Accuracy 23°C ± 5°C ±(ppm of rdg. + ppm of range) 90 Day	1 Year	Input Resistance
100.00000 mV	10 nV	25 + 9	37 + 9	> 10 GΩ
1.0000000 V	100 nV	18 + 2	25 + 2	> 10 GΩ
10.000000 V	1 μV	18 + 4	24 + 4	> 10 GΩ
100.00000 V	10 μV	25 + 5	35 + 5	10 MΩ ±1%
1000.0000 V	10 μV	31 + 6	41 + 6	10 MΩ ±1%

RESISTANCE

Range	Resolution	Accuracy 23°C ± 5°C ±(ppm of rdg. + ppm of range) 90 Day	1 Year	Test Current
10.000000 Ω	1 μΩ	40 + 9	60 + 9	10 mA
100.00000 Ω	10 μΩ	36 + 9	52 + 9	1 mA
1.0000000 kΩ	100 μΩ	33 + 2	50 + 2	1 mA
10.000000 kΩ	1 mΩ	32 + 2	50 + 2	100 μA
100.00000 kΩ	10 mΩ	40 + 2	70 + 2	10 μA
1.0000000 MΩ	100 mΩ	50 + 4	70 + 4	10 μA
10.000000 MΩ	1 Ω	200 + 4	400 + 4	640 nA
100.00000 MΩ	10 Ω	1500 + 4	1500 + 4	640 nA

DC CURRENT

Range	Resolution	Accuracy 23°C ± 5°C ±(ppm of rdg. + ppm of range) 90 Day	1 Year	Burden Voltage
10.000000 mA	1 nA	300 + 40	500 + 40	< 0.15 V
100.00000 mA	10 nA	300 + 40	500 + 40	< 0.18 V
1.0000000 A	100 nA	500 + 40	800 + 40	< 0.35 V
3.000000 A	1 μA	1200 + 15	1200 + 15	< 1 V

CONTINUITY 2W

Range	Resolution	Accuracy 23°C ± 5°C ±(ppm of rdg. + ppm of range) 90 Day	1 Year	Test Current
1 kΩ	100 mΩ	100 + 100	120 + 100	1 mA

DIODE TEST

Range	Resolution	Accuracy 23°C ± 5°C ±(ppm of rdg. + ppm of range) 90 Day	1 Year	Test Current
10.000000 V	1 μV	30 + 7	40 + 7	1 mA
4.400000 V	1 μV	30 + 7	40 + 7	100 μA
10.000000 V	1 μV	30 + 7	40 + 7	10 μA

DC OPERATING CHARACTERISTICS

Function	Digits	Readings/s		PLCs
DCV (all ranges), DCI (all ranges), and Ohms (<10M range)	7½	4	(3)	5
	6½	30	(27)	1
	6½	50	(44)	1
	5½	260	(220)	0.1
	5½	490	(440)	0.1
	5½	1000	(1000)	0.04
	4½	2000	(1800)	0.01

SPEED AND NOISE REJECTION

Rate	Digits	RMS Noise 100mV Range	RMS Noise 10V Range	NMRR	CMRR
5 PLC	7½	110 nV	1.2 μV	60 dB	140 dB
1 PLC	6½	125 nV	1.4 μV	60 dB	140 dB
0.1 PLC	5½	1.6 μV	11.5 μV	—	80 dB
0.01 PLC	4½	2.9 μV	139 μV	—	80 dB

TRUE RMS AC VOLTAGE AND CURRENT CHARACTERISTICS

Range	Resolution	Frequency Range	Accuracy (1 Year) 23°C ±5°C ±(% of reading + % of range)
100 mV to 750 V	0.1 μV to 1 mV	3 Hz–10 Hz	0.35 + 0.03
		10 Hz–20 kHz	0.06 + 0.03
		20 kHz–50 kHz	0.12 + 0.05
		50 kHz–100 kHz	0.60 + 0.08
		100 kHz–300 kHz	4 + 0.5

AC OPERATING CHARACTERISTICS

Function	Digits	Readings/s	Rate	Bandwidth
ACV (all ranges), and ACI (all ranges)	6½	2s/reading	SLOW	3 Hz–300 kHz
	6½	1.4	MED	30 Hz–300 kHz
	6½	4.8	MED	30 Hz–300 kHz
	6½	2.2	FAST	300 Hz–300 kHz
	6½	35	FAST	300 Hz–300 kHz

FREQUENCY AND PERIOD CHARACTERISTICS

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	0.3	0.01

TEMPERATURE CHARACTERISTICS

Thermocouple

Type	Range	Resolution	Accuracy[1] 90 Day/1 Year (23°C ± 5°C) Relative to Reference Junction	USING 2001-TCSCAN[2]
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
N	–200 to + 1300°C	0.001°C	±0.5°C	±0.70°C
T	–200 to + 400°C	0.001°C	±0.5°C	±0.68°C

4-WIRE RTD

Range	Resolution	Accuracy[3] 90 Day/1 Year (23°C ± 5°C)	Accuracy[3] 2 Years (23°C ± 5°C)
–100° to +100°C	0.001°C	±0.08°C	±0.12°C
–200° to +630°C	0.001°C	±0.14°C	±0.18°C

TEMPERATURE NOTES

1. For temperatures <–100°C, add ±0.1°C and >900°C add ±0.3°C.
2. Specifications apply to channels 2–6. Add 0.06°C/channel from channel 6.
3. Excluding probe errors.

GENERAL

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

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

POWER CONSUMPTION: 22VA.

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

STORAGE ENVIRONMENT: –40°C to 70°C.

SAFETY: Designed to IEC-1010-1.

EMC: Complies with European Union Directive 89/336/EEC (CE marking requirements), FCC part 15 class B, CTSPR 11, IEC 801-2, IEC 801-3, IEC 801-4.

VIBRATION: MIL-T-28800E Type III, Class 5.

WARMUP: 2 hours to rated accuracy.

DIMENSIONS:

Rack Mounting: 89mm high × 213mm wide × 370mm deep (3½ in × 8⅜ in × 14⅝ in).

Bench Configuration (with handle and feet): 104mm high × 238mm wide × 370mm deep (4⅛ in × 9⅜ in × 14⅝ in).

SHIPPING WEIGHT: 5kg (11 lbs).

VOLT HERTZ PRODUCT: ≤8 × 10⁷ V·Hz.