

2010

Low Noise Autoranging Multimeter 7½-Digit



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. Based on the same high speed, low noise A/D converter technology as the Models 2000, 2001, and 2002, the 2010 is the latest addition to Keithley's Series 2000 line of high performance Digital Multimeters.

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.

- 7½-digit resolution
- 100nV rms noise floor
- 7ppm basic DCV accuracy
- 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

This product is available with an Extended Warranty.

Accessories Supplied

Model 1751 Safety Test Leads, User Manual, Service Manual

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 7000 Series 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.
- Offset compensated ohms. 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 20 measurement points, the 2010 is compatible with Keithley's 7000 Series 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

5804/5/6 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

OTHER

KPCI-488 IEEE-488 Interface/Controller for the PCI Bus

KPC-488.2AT IEEE-488 Interface Card for IBM PC/AT (full slot)

1.888.KEITHLEY (U.S. only)

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A GREATER MEASURE OF CONFIDENCE

DMM optimized for resistance measurement applications

DIGITAL MULTIMETERS

2010

Low Noise Autoranging Multimeter

7½-Digit

Model 2010 Specifications

DIGITAL MULTIMETERS

DC VOLTAGE

| RANGE | RESOLUTION | ACCURACY 23°C ± 5°C ±(ppm of rdg. + ppm of range) | | INPUT RESISTANCE |
|--------------|------------|--|--------|------------------|
| | | 90 DAY | 1 YEAR | |
| 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) | | TEST CURRENT |
|--------------|------------|--|----------|--------------|
| | | 90 DAY | 1 YEAR | |
| 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) | | BURDEN VOLTAGE |
|--------------|------------|--|-----------|----------------|
| | | 90 DAY | 1 YEAR | |
| 10.000000 mA | 10 nA | 300 + 40 | 500 + 40 | < 0.15 V |
| 100.00000 mA | 100 nA | 300 + 40 | 500 + 40 | < 0.18 V |
| 1.0000000 A | 1 μA | 500 + 40 | 800 + 40 | < 0.35 V |
| 3.000000 A | 10 μA | 1200 + 15 | 1200 + 15 | < 1 V |

CONTINUITY 2W

| RANGE | RESOLUTION | ACCURACY 23°C ± 5°C ±(ppm of rdg. + ppm of range) | | TEST CURRENT |
|-------|------------|--|-----------|--------------|
| | | 90 DAY | 1 YEAR | |
| 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) | | TEST CURRENT |
|-------------|------------|--|--------|--------------|
| | | 90 DAY | 1 YEAR | |
| 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), | 7½ | 4 (3) | 5 |
| DCI (all ranges), and | 6½ | 30 (27) | 1 |
| Ohms (<10M range) | 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 | 6½ | 2s/reading | SLOW | 3 Hz–300 kHz |
| ACI (all ranges) | 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 | 3 Hz | 333 ms | 1 s | 0.3 | 0.01 |
| to 750 V | to 500 kHz | to 2 μs | | | |

TEMPERATURE CHARACTERISTICS

| TYPE | RANGE | RESOLUTION | 90 DAY/1 YEAR (23°C ± 5°C) | |
|------|------------------|------------|---|-----------------------------------|
| | | | ACCURACY Relative to Reference Junction | USING 2001-TCSCAN ⁵ |
| 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 |

GENERAL SPECIFICATIONS

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.

WARRANTY: 3 years.

SAFETY: Designed to IEC-1010-1.

EMC: Complies with European Union Directive 89/336/EEC (CE marking requirements), FCC part 15 class B, CTS/SPR 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 × 14⅞ in).

Bench Configuration (with handle and feet): 104mm high × 238mm wide × 370mm deep (4⅞ in × 9⅜ in × 14⅞ in).

SHIPPING WEIGHT: 5kg (11 lbs).

VOLT HERTZ PRODUCT: ≤8 × 10⁷V·Hz.

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