

## KEITHLEY

## 2010

The Keithley 2010 is a high-precision, 7.5-digit low-noise benchtop digital multimeter designed for high-speed, high-accuracy production testing. Known for its exceptionally low 100 nV noise floor and high DCV basic accuracy of 7 ppm, the 2010 combines resolution and throughput, supporting speeds up to 2000 readings per second.

## SPECIFICATIONS

## General

|                           |                                                            |
|---------------------------|------------------------------------------------------------|
| Interfaces                | GPIB (IEEE-488.2), RS-232                                  |
| Display                   | 12-character vacuum fluorescent display (VFD)              |
| Storage Temperature Range | -40 °C to 70 °C                                            |
| Operating Humidity Range  | Up to 80% RH at 35 °C (non-condensing)                     |
| Safety Compliance         | Conforms to European Union Directive 73/23/EEC, EN61010-1  |
| EMC Compliance            | Conforms to European Union Directive 89/336/EEC, EN61326-1 |
| Warm-up Time              | 2 hours                                                    |

## Physical

|                       |                                                                                       |
|-----------------------|---------------------------------------------------------------------------------------|
| Power Supply          | 100 V / 120 V / 220 V / 240 V $\pm 10\%$ , 45 Hz to 66 Hz and 360 Hz to 440 Hz, 22 VA |
| Operating Temperature | 0°C to 50°C °C                                                                        |
| Dimensions (W×H×D)    | 213 mm × 89 mm × 370 mm mm                                                            |
| Weight                | 4.2 kg kg                                                                             |

## DC Voltage

|                            |                                                                                      |
|----------------------------|--------------------------------------------------------------------------------------|
| Basic DC Voltage Accuracy  | 7 ppm                                                                                |
| DC Voltage Linearity       | 1 ppm of reading + 1 ppm of range                                                    |
| DC Voltage Noise Floor     | 100 nV RMS                                                                           |
| DC Voltage Ranges          | 100 mV, 1 V, 10 V, 100 V, 1000 V                                                     |
| DC Voltage Resolution      | 10 nV to 100 $\mu$ V                                                                 |
| DC Voltage Input Impedance | >10 G $\Omega$ (100mV, 1V, 10V ranges); 10 M $\Omega$ $\pm 1\%$ (100V, 1000V ranges) |
| Maximum DC Input Voltage   | 1000 V peak                                                                          |

## AC Voltage

|                            |                                                |
|----------------------------|------------------------------------------------|
| AC Voltage Ranges          | 100 mV, 1 V, 10 V, 100 V, 750 V                |
| AC Voltage Resolution      | 100 nV to 1 mV                                 |
| AC Voltage Frequency Range | 3 Hz to 300 kHz                                |
| AC Voltage Input Impedance | 1 M $\Omega$ $\pm$ 2% in parallel with <100 pF |
| Maximum AC Input Voltage   | 750 V RMS, 1000 V peak                         |
| Maximum Volt-Hertz Product | 8 $\times$ 10 <sup>7</sup> V·Hz                |

## DC Current

|                                |                                                                                   |
|--------------------------------|-----------------------------------------------------------------------------------|
| DC Current Ranges              | 10 mA, 100 mA, 1 A, 3 A                                                           |
| DC Current Resolution          | 1 nA to 1 $\mu$ A                                                                 |
| DC Current Burden Voltage      | <0.15 V (10mA range), <0.25 V (100mA range), <0.5 V (1A range), <1.2 V (3A range) |
| DC Current Overload Protection | 3 A, 250 V fuse (user accessible)                                                 |

## AC Current

|                                |                                   |
|--------------------------------|-----------------------------------|
| AC Current Ranges              | 1 A, 3 A                          |
| AC Current Resolution          | 1 $\mu$ A to 10 $\mu$ A           |
| AC Current Frequency Range     | 3 Hz to 5 kHz                     |
| AC Current Overload Protection | 3 A, 250 V fuse (user accessible) |

## Resistance

|                            |                                                                                                                            |
|----------------------------|----------------------------------------------------------------------------------------------------------------------------|
| Resistance Ranges          | 10 $\Omega$ , 100 $\Omega$ , 1 k $\Omega$ , 10 k $\Omega$ , 100 k $\Omega$ , 1 M $\Omega$ , 10 M $\Omega$ , 100 M $\Omega$ |
| Resistance Resolution      | 1 $\mu\Omega$ to 10 $\Omega$                                                                                               |
| Measurement Configurations | 2-wire and 4-wire                                                                                                          |
| Offset Compensation        | Selectable on 10 $\Omega$ , 100 $\Omega$ , 1 k $\Omega$ , 10 k $\Omega$ ranges                                             |
| Dry Circuit Mode Ranges    | 10 $\Omega$ , 100 $\Omega$ , 1 k $\Omega$                                                                                  |
| Dry Circuit Clamp Voltage  | 20 mV                                                                                                                      |

## Temperature

|                                    |                                               |
|------------------------------------|-----------------------------------------------|
| RTD Types Supported                | PT100, D100, F100, PT385, PT3916              |
| Thermistor Ranges Supported        | 2.2 k $\Omega$ , 5 k $\Omega$ , 10 k $\Omega$ |
| Thermocouple Types Supported       | None (only RTDs and Thermistors supported)    |
| Temperature Measurement Resolution | 0.001 $^{\circ}$ C                            |

## Frequency & Period

|                              |                         |
|------------------------------|-------------------------|
| Frequency Measurement Range  | 3 Hz to 300 kHz         |
| Period Measurement Range     | 333 ms to 3.3 $\mu$ s   |
| Frequency Input Signal Level | 100 mV RMS to 750 V RMS |

## A/D Converter & Rates

|                                    |                                 |
|------------------------------------|---------------------------------|
| A/D Converter Resolution           | 7.5 digits                      |
| Maximum Reading Rate               | 2000 readings/s (at 4.5 digits) |
| Reading Rate at 6.5 Digits         | 50 readings/s (at 1 NPLC)       |
| Reading Rate at 7.5 Digits         | 3.2 readings/s (at 10 NPLC)     |
| Normal Mode Rejection Ratio (NMRR) | >60 dB at 50 Hz/60 Hz           |
| Common Mode Rejection Ratio (CMRR) | >140 dB at DC, 50 Hz/60 Hz      |

## Triggering & Buffer

|                      |                                                                      |
|----------------------|----------------------------------------------------------------------|
| Internal Buffer Size | 275 readings                                                         |
| Math Functions       | mX+b, Percent, Min/Max, Limits, Ratio, Delta, Null, dB, dBm          |
| Trigger Delay Range  | 0 to 99 hours (in 1 ms steps)                                        |
| Trigger Sources      | Manual, External Trigger (TTL), Bus (GPIB, RS-232), Immediate, Timer |

## Connectivity & Expansion

|                    |                                                                               |
|--------------------|-------------------------------------------------------------------------------|
| Digital I/O Port   | 1 input, 4 outputs (open collector)                                           |
| Scanner Card Slots | 1 slot (supports 10-channel scanner cards)                                    |
| Command Languages  | SCPI (Standard Commands for Programmable Instruments), Keithley 197 emulation |

## Resistance & Semiconductor Measurements

|                                   |                                                                                                                            |
|-----------------------------------|----------------------------------------------------------------------------------------------------------------------------|
| Diode Test Currents               | 10 $\mu$ A, 100 $\mu$ A, 1 mA                                                                                              |
| Diode Test Voltage Compliance     | 10 V                                                                                                                       |
| Continuity Beeper Threshold Range | 1 $\Omega$ to 1000 $\Omega$                                                                                                |
| Maximum 4-Wire Lead Resistance    | 10% of range per lead (10 $\Omega$ and 100 $\Omega$ ranges), 1 k $\Omega$ per lead (1 k $\Omega$ to 100 k $\Omega$ ranges) |

## AC Measurements

|                 |                   |
|-----------------|-------------------|
| AC Crest Factor | 5:1 at full scale |
|-----------------|-------------------|

## DC Measurements

|                    |                  |
|--------------------|------------------|
| Input Bias Current | < 30 pA at 23 °C |
|--------------------|------------------|

## Safety & Isolation

|                             |            |
|-----------------------------|------------|
| Maximum Common Mode Voltage | 500 V peak |
|-----------------------------|------------|

## Power Supply

|                   |                                                             |
|-------------------|-------------------------------------------------------------|
| Power Consumption | 22 VA typical                                               |
| Line Frequency    | 45 Hz to 66 Hz, and 360 Hz to 440 Hz (automatically sensed) |

## Environmental

|                            |                  |
|----------------------------|------------------|
| Maximum Operating Altitude | 2000 m (6562 ft) |
|----------------------------|------------------|

**Expansion**

|                          |                                            |
|--------------------------|--------------------------------------------|
| Compatible Scanner Cards | Keithley 2000-SCAN, 2001-SCAN, 2001-TCSCAN |
|--------------------------|--------------------------------------------|

**System & Architecture**

|                            |                         |
|----------------------------|-------------------------|
| A/D Converter Architecture | Multi-slope integrating |
|----------------------------|-------------------------|

**Performance**

|                                             |             |
|---------------------------------------------|-------------|
| Reading Rate at 4.5 Digits                  | 2000 rdgs/s |
| Reading Rate at 5.5 Digits                  | 1000 rdgs/s |
| RTD Temperature Measurement Accuracy        | ±0.06 °C    |
| Thermistor Temperature Measurement Accuracy | ±0.08 °C    |

**System & Programming**

|                        |                 |
|------------------------|-----------------|
| Emulation Languages    | Keithley 197    |
| Trigger Link Connector | 8-pin micro-DIN |

**TECHNOLOGY**

7.5-digit low-noise multimeter

**APPLICATIONS**

Production testing of sensors, transducers, converters, connectors, switches, and relays

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