2110 5½–Digit Dual–Display Digital Multimeter

Datasheet

The 2110 5½-Digit Dual-Display Digital Multimeter combines a compelling price with a comprehensive set of capabilities, superior measurement accuracy, and high speed for a broad range of applications. It features 15 measurement functions and 7 math functions and has dual-line display capability, which allows it to display two different measurements concurrently. The 2110 is an unbeatable value for production, R&D, and test engineers, scientists, and students making a wide variety of measurements in portable, bench, and system applications.

Key Features

- High accuracy, high speed for general purpose measurements
- 15 measurement functions, including capacitance and thermocouple measurements
- Dual-line display allows concurrent measurements
- TMC-compliant USB 2.0 interface for use with SCPI test commands
- Includes PC software utilities for graphing and data sharing in both Microsoft® Word and Excel
- Rugged construction for durability in bench/portable applications
- Includes all accessories, such as start-up software, USB cable, power cable, and safety test leads
- CE compliant and c UL us listed
- Three year warranty

High Accuracy, Abundant Capabilities, Low Cost

The 2110 provides precision and a rich set of capabilities at a value price. It has 0.012% one-year basic DC voltage accuracy and 0.020% one-year basic resistance accuracy up to the 100 kΩ range.

The 2110 provides a wide number of measurement ranges and functions:

- DC voltage: 0.1 V, 1 V, 10 V, 100 V, and 1000 V
- AC voltage: 0.1 V, 1 V, 10 V, 100 V, and 750 V
- DC current: 10 A, 100 A, 1 A, 3 A, and 10 A
- AC current: 1 A, 3 A, and 10 A
- Two- and four-wire resistance: 100 Ω, 1 kΩ, 10 kΩ, 100 kΩ, 1 MΩ, 10 MΩ, and 100 MΩ
- Frequency: From 10 Hz to 300 kHz
- Capacitance measurement: 1 nF, 10 nF, 100 nF, 1µF, 10 µF, 100 µF
- Thermocouple measurement: J-, R-, S-, T-, E-, N-, B-, C-, and K-type thermocouples
- Temperature (RTD and NTC Thermistor) measurements
- Diode measurement
- Continuity test
- Programmable A-D converter and filter settings for signal to noise optimization. Additionally, seven mathematical operations can be performed on measurement readings: percentage, average, min/max, NULL, limits, mX+b, dB, and dBm testing.

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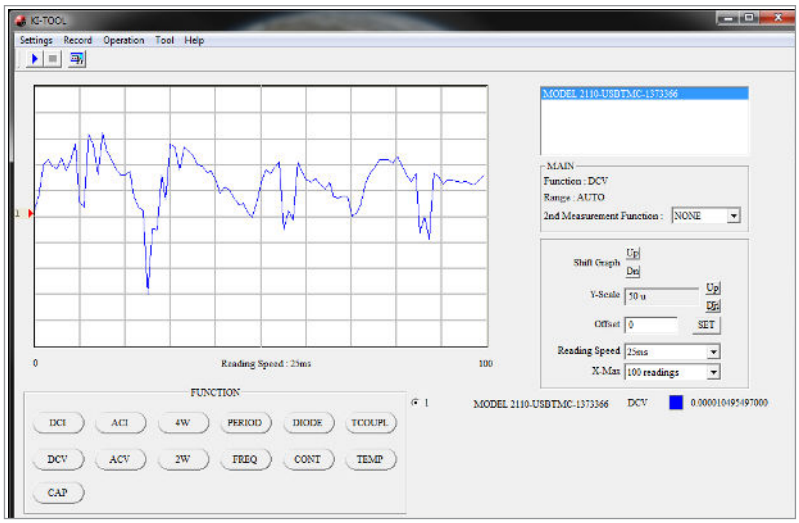
Speed

At 5½ digits, the 2110 delivers up to 200 readings/s via the USB remote interface. At the fast 4½-digit setting, it reads up to 50,000 readings/s and up to 30,000 readings/s into the buffer, making it ideal for production and monitoring applications in which speed is critical.

Simplicity

The 2110 is operational and intuitive to use right out of the box. The functions on the front panel are user friendly and easy to read. Its KI-Tool and KI-Link software allow users to quickly control the instrument over USB, record measurements, and display time-series plots of the data. Its LabView® and IVI drivers give more-advanced customers even more control over the instrument. The TMC-compliant USB remote interface allows easy re-use of existing SCPI programs.



KI-Tool simplifies basic measurement applications through every setup and graphical data representation.

Applications

Built for Production Testing

The 2110 Digital Multimeter is ideal for applications in manual, semi-automatic, and automatic testing of low-cost electronic devices, circuits, modules, electrical components, and semiconductor components. Key features include:

- Speed: up to 50,000 readings per second
- Control: USB interface, accepting SCPI (IEEE-488.2) commands
- External BNC trigger lines
- NIST traceability (with included calibration certificate)

Built for General Purpose Uses

The 2110 Digital Multimeter is also ideal for bench uses such as research, development, service, calibration, and teaching. Bench-oriented features include:

- Accuracy: 0.012% basic DCV accuracy
- Easy-to-operate panel
- Easy waveform plotting and data collection with KI-Tool and KI-Link
- Store up to 2000 readings

Startup Software, PC Utilities Included

The KI-Tool application provides charting and graphing capabilities without programming to simplify setup, checkout, and basic measurement applications requiring graphical data representation. Scale, offset, and level can be adjusted to fine-tune images for visual evaluation of signal and noise elements over time. It also includes tabular data and SCPI command prompt windows for maximum flexibility. Data sets can also be saved to disk files.

The Microsoft Excel Add-In utility is also included and provides quick data import into a standard Microsoft Excel spreadsheet, including selectable graphing, instrument settings, and number of data points collected. Data can then be analyzed through standard or optional Microsoft Excel functions, including graphical, statistical, and trend charting. A version supporting Microsoft Word is also included for direct data import into reports.

LabView, IVI-C, and IVI-COM drivers are also supplied to allow for increased flexibility in integrating the 2110 into new and existing systems and test routines.

All accessories, such as start-up software, USB cable, power cable, and safety test leads, are included with the 2110.

2110 rear panel.

DC Characteristics

DC Voltage

Range	Resolution	Input Resistance	Accuracy[1] ±(% of reading + % of range) 1 Year, 23° ±5 °C	Temperature Coefficient 0°–18 °C & 28°–40 °C
100.000 mV	1 µV	10 MΩ	0.012 + 0.004	0.001 + 0.0005
1.00000 V	10 µV		0.012 + 0.001	0.0009 + 0.0005
10.0000 V	0.1 mV		0.012 + 0.002	0.0012 + 0.0005
100.000 V	1 mV		0.012 + 0.002	0.0012 + 0.0005
1000.00 V	10 mV		0.02 + 0.003	0.002 + 0.0015

DCI (DC Current)

Range	Resolution	Shunt Resistance	Accuracy[1] ±(% of reading + % of range) 1 Year, 23° ±5 °C	Temperature Coefficient 0°–18 °C & 28°–40 °C
10.0000 mA	0.1 µA	5.1 Ω	0.05 + 0.020	0.005 + 0.002
100.000 mA	1 µA	5.1 Ω	0.05 + 0.010	0.005 + 0.001
1.00000 A	10 µA	0.1 Ω	0.150 + 0.020	0.008 + 0.001
3.0000 A	100 µA	0.1 Ω	0.200 + 0.030	0.008 + 0.001
10.0000 A	100 µA	5 mΩ	0.250 + 0.050	0.008 + 0.001

Resistance[2]

Range	Resolution	Test Current	Accuracy[1] ±(% of reading + % of range) 1 Year, 23° ±5 °C	Temperature Coefficient 0°–18 °C & 28°–40 °C
100.000 Ω	1 mΩ	1 mA	0.020 + 0.020	0.003 + 0.0005
1.00000 kΩ	10 mΩ	1 mA	0.020 + 0.003	0.003 + 0.0005
10.0000 kΩ	100 mΩ	100 µA	0.020 + 0.002	0.003 + 0.0005
100.000 kΩ	1 Ω	10 µA	0.020 + 0.002	0.003 + 0.0005
1.00000 MΩ	10 Ω	1 µA	0.030 + 0.004	0.005 + 0.0005
10.0000 MΩ	100 Ω	0.1 µA	0.200 + 0.004	0.05 + 0.0005
100.000 MΩ	1 kΩ	0.1 µA	2.000 + 0.005	0.5 + 0.0005

Diode Test

Range	Resolution	Test Current	Accuracy[1] ±(% of reading + % of range) 1 Year, 23° ±5 °C	Temperature Coefficient 0°–18 °C & 28°–40 °C
1.0000 V	10 µV	1 mA	0.020 + 0.030	0.002 + 0.0005

Continuity

Range	Resolution	Test Current	Accuracy[1] ±(% of reading + % of range) 1 Year, 23° ±5 °C	Temperature Coefficient 0°–18 °C & 28°–40 °C
1000 Ω	10 mΩ	1 mA	0.020 + 0.020	0.002 + 0.0005

1. Specifications valid after two hour warm-up.
   a. ADC set for continuous trigger operation.
   b. Input bias current <30 pA at 25 °C.
   c. Measurement rate set to 10 PLC.
2. Specifications for 4W ohms mode. For 2W ohms, use zero null or subtract lead resistance from displayed reading.
   a. Maximum lead resistance 10% of range per lead for 100 Ω and 1 kΩ ranges; add 1 kΩ per lead for all other ranges.

Measurement Noise Rejection DC (60 Hz/50 Hz) at 5.5 Digits

CMRR	120 dB for 1 kΩ unbalance in LO lead.
NMRR	60 dB for line frequency ±0.1%.

Temperature (Thermocouple) Characteristics

Thermocouple Type	Range	Accuracy[1] ± °C 1 Year, exclusive of lead accuracy
B	600 to 1800 °C	1.5
C	0 to 2300 °C	1.5
E	–250 to 1000 °C	1.5
J	–200 to 1200 °C	1.0
K	–200 to 1350 °C	1.0
N	–200 to 1300 °C	1.0
R	0 to 1750 °C	1.5
S	0 to 1750 °C	1.5
T	–250 to 400 °C	1.5

1. Specifications valid after two hour warm-up;
   a. ADC set for continuous trigger operation.

RTD and NTC Thermistor Measurements

Accuracy ±0.8 ˚C, 1 year, exclusive of lead accuracy. PT100, D100, F100, PT385, PT3916, SPRTD (R-Zero, A4, B4, Ax, Bx, Cx, and Dx), NTCT (A, B, and C), and user-definable RTD.

Capacitance Characteristics

Range	Test Current	Accuracy[1] ±(% of reading + % of range) 1 Year, 23° ±5 °C
1.000 nF	10 µA	2.0 + 0.80
10.00 nF	10 µA	1.0 + 0.50
100.0 nF	100 µA	1.0 + 0.50
1.000 µF	100 µA	1.0 + 0.50
10.00 µF	100 µA	1.0 + 0.50
100.0 µF	1 mA	1.0 + 0.50

1. Specifications valid after two hour warm-up.
   a. ADC set for continuous trigger operation.
   b. Null enabled.

AC Characteristics

Frequency and Period

Range	Frequency (Hz)	Accuracy[1] ±(% of reading + % of range) 1 Year, 23° ±5 °C	Temperature Coefficient 0°–18 °C & 28°–40 °C
100.000 mV to 750.000 V[2]	10–40	0.03	0.002
	40–300 k	0.02	0.002

ACV (AC TRMS Voltage)

Range	Resolution	Frequency	Accuracy[1] ±(% of reading + % of range) 1 Year, 23° ±5°C	Temperature Coefficient 0°–18°C & 28°–40°C
100.000 mV to 750.000 V[2]	1 µV to 10 mV	10 Hz–20 kHz	0.12 + 0.05	0.01 + 0.01
		20 kHz–50 kHz	0.25 + 0.05	0.02 + 0.02
		50 kHz–100 kHz	0.65 + 0.08	0.04 + 0.02
		100 kHz–300 kHz	5.00 + 0.50	0.2 + 0.02

ACI (AC TRMS Current)

Range	Resolution	Frequency	Accuracy[1] ±(% of reading + % of range) 1 Year, 23° ±5 °C	Temperature Coefficient 0°–18 °C & 28°–40 °C
1.0000 A to 3.00000 A	10 µA to 100 µA	10 Hz–900 Hz	0.30 + 0.06	0.02 + 0.01
		900 Hz–5 kHz	1.50 + 0.15	0.02 + 0.01
10.0000 A	100 µA	10 Hz–900 Hz	0.50 + 0.12	0.02 + 0.01
		900 Hz–5 kHz	2.50 + 0.20	0.02 + 0.01

1. Specifications valid after two hour warm-up.
   a. Slow AC filter (3 Hz bandwidth).
   b. Pure sine wave input greater than 5% of range.
2. 750 VAC range is limited to 100 kHz.

General Specifications

Input Bias Current	<30 pA at 25 °C.
Input Protection	1000 V all ranges (2 W input).
AC CMRR	70 dB (for 1 kΩ unbalance LO lead).
Power Supply	100 V / 120 V / 220 V / 240 V.
Power Line Frequency	50/60 Hz auto detected.
Power Consumption	25 VA max.
Digital I/O interface	USB-compatible Type B connection.
Environment	For indoor use only.
Operating Temperature	0° to 40 °C.
Operating Humidity	Maximum relative humidity 80% for temperature up to 31 °C.
Storage Temperature	–40° to 70 °C.
Operating Altitude	Up to 2000 m above sea level.
Bench Dimensions (with handles and bumpers)	107 mm high × 252.8 mm wide × 305 mm deep (3.49 in. × 9.95 in. × 12.00 in.).
Weight	2.23 kg (4.92 lbs.).
Safety	Conforms to European Union Low Voltage Directive, EN61010-1. Measurement Cat 1 1000V and CAT II 600V.
EMC	Conforms to European Union Directive 89/336/EEC, EN61326-1.
Warranty	Three years.

Ordering Information

2110-100	5½-digit USB Digital Multimeter (100 V)
2110-120	5½-digit USB Digital Multimeter (120 V)
2110-220	5½-digit USB Digital Multimeter (220 V)
2110-240	5½-digit USB Digital Multimeter (240 V)

Supplied Accessories

Reference Manual on CD, Specifications, LabVIEW® Driver, Keithley I/O Layer, USB Cable, Power Cable, Safety Test Leads, KI-Tool, and KI-Link Add-in (both Microsoft Word and Excel versions), Calibration Certificate

Available Accessories

4299-3	Single Rack Mount Kit
4299-7	Fixed Rack Mount Kit
5805	Kelvin Probes, 0.9m (3ft)
5805-12	Kelvin Probes, 3.6m (12ft)
5808	Low Cost, Single Pin, Kelvin Probes
6517-TP	Thermocouple Bead Probe (K-Type)

Available Services

C/2110-3Y-DATA	3 (Z-540-1 compliant) calibrations within 3 years of purchase for 2110
C/2110-5Y-DATA	5 (Z-540-1 compliant) calibrations within 5 years of purchase for 2110
C/2110-3Y-ISO	3 (ISO-17025 accredited) calibrations within 3 years of purchase for 2110
C/2110-5Y-ISO	5 (ISO-17025 accredited) calibrations within 5 years of purchase for 2110

Warranty Information

Warranty Summary	This section summarizes the warranties of the 2110. For complete warranty information, refer to the Tektronix warranty page at www.tek.com/service/warranties/warranty-2. Any portion of the product that is not manufactured by Keithley is not covered by this warranty and Keithley will have no duty to enforce any other manufacturer's warranties.
Hardware Warranty	Keithley Instruments, Inc. warrants the Keithley manufactured portion of the hardware for a period of one year from defects in materials or workmanship; provided that such defect has not been caused by use of the Keithley hardware which is not in accordance with the hardware instructions. The warranty does not apply upon any modification of Keithley hardware made by the customer or operation of the hardware outside the environmental specifications.
Software Warranty	Keithley warrants for the Keithley produced portion of the software or firmware will conform in all material respects with the published specifications for a period of ninety (90) days; provided the software is used on the product for which it is intended in accordance with the software instructions. Keithley does not warrant that operation of the software will be uninterrupted or error-free, or that the software will be adequate for the customer's intended application. The warranty does not apply upon any modification of the software made by the customer.

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