

Keysight Technologies

M9181A PXI Digital Multimeter

6½ Digit, Basic Features

Data Sheet



OVERVIEW

Product Description

The Keysight Technologies, Inc. M9181A PXI digital multimeter provides the most popular measurement functions, including DCV, ACV, DCI, ACI, 2- and 4-wire resistance at 6½ digits of resolution. The M9181A delivers trustworthy measurements at an affordable price.



Applications

- Aerospace and defense
- Automotive electronics test
- Industrial electronics test

Features

- 6½ digit resolution
- Up to 150 readings per second at 4½ digits
- Basic 1 year DCV accuracy of 90 ppm
- DCV, ACV, DCI, ACI, 2- and 4-wire resistance
- Floating isolation (CAT II) to 240 V (floating measurement to 240 V maximum)
- Software drivers to support most common programming environments
- PXI form factor
- Chassis connector compatibility: PXI-1 (J-1 only)

Customer values

- The most common DMM measurements
- Measurements you can trust
- Low cost solution
- Application development in the environment of your choice reduces development time
- Customer supportable calibration procedures and calibration services available from Keysight

PXI-DMM M918xA Feature Summary

All three products are 6½ digit PXI DMMs that take DCV, ACV, DCI, ACI, 2- and 4-wire resistance measurements.

| DMM | Description | DC basic 1 year accuracy | Maximum reading rate at 4½ digits | Other measurements | Triggering | DC source |
|--------|------------------------------|--------------------------|-----------------------------------|--|--|------------------------------|
| M9181A | Basic features PXI DMM | 90 ppm | 150 rdgs/sec | None | Immediate | n/a |
| M9182A | High performance PXI DMM | 40 ppm | 4,500 rdgs/sec | Temperature, capacitance, frequency, period | Immediate, analog threshold, PXI trigger bus | n/a |
| M9183A | Enhanced performance PXI DMM | 40 ppm | 15,000 rdgs/sec | Offset compensated resistance, temperature, capacitance, frequency, period, pulse width, duty cycle, totalizer/event counter | Immediate, analog threshold, PXI trigger bus | ± 10 V ±(1.2 µA to 12 mA) |

EASY SETUP ... TEST ... AND MAINTENANCE

Hardware platform

Compliance

The M9181A 6½ digit, DMM is PXI compliant, using either cPCI (J1) or PXI-1 (J1). The M9181A uses fast data interfaces and can be integrated with other test and automation modules in a PXI, Compact PCI, or Hybrid chassis. The PXI format offers high performance in a small, rugged package. It is ideal for many automated test systems. A wide array of complementary PXI products are currently available. Keysight products include switches, multiplexers, digitizers, waveform generators and local oscillators.

Software platform

IO Libraries

Keysight IO Libraries Suite offers fast and easy instrument connections. IO Libraries Suite 16.1 adds support for PXI, helping you display all of the modules in your system and view information about installed software. In addition, IO Libraries Suite 16.1 and newer versions allow you to more easily find the right driver and start module soft front panels directly with Keysight Connection Expert.

National Instruments IO libraries are also supported and may be used along with Keysight IO libraries.

Drivers

Keysight's digital multimeters include software drivers for WindowsXP, Windows Vista and Windows 7. These drivers work in the most popular test and measurement development environments, including LabVIEW, Visual Studio (C, C++, C#, Visual Basic), and MATLAB.

Easy software integration

Application code examples that demonstrate DMM setup and basic functionality are included for LabVIEW, Visual Basic and C/C++, C#, and MATLAB. These application code examples help you integrate the DMM module into your measurement system.

Soft front panel

The soft front panel provides easy to use instrument control. Its graphical user interface guides developers through module setup so users can quickly configure the DMM.

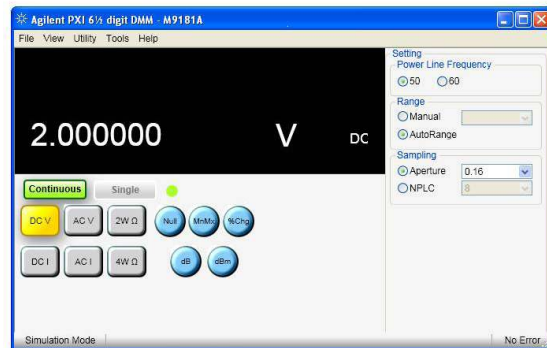


Figure 1. M9181A soft front panel

One notable feature of the soft front panel is the Driver Call Log, which allows the user to see the driver calls for each button pushed. The user can incorporate the driver calls into the application program – enabling fast and easy program development.

Calibration

Each M9181A is factory calibrated and shipped with an ISO-9002, NIST-traceable calibration certificate.

Calibration is required once per year. A calibration procedure allows you to do in-rack calibration using standard calibration sources. Alternatively, Keysight and third party calibration labs offer calibration services for the M9181A DMM.

TECHNICAL SPECIFICATIONS AND CHARACTERISTICS

| M9181A: Accuracy specifications \pm (% of reading + % of range) ^{1,2,3} | | | |
|--|---------------------|---|----------------------------|
| Function | Range | Frequency, test current or burden voltage | 1 year 23 °C \pm 5 °C |
| DC voltage | 200.0000 mV | | 0.0100 + 0.0018 |
| | 2.000000 V | | 0.0090 + 0.0005 |
| | 20.00000 V | | 0.0120 + 0.0015 |
| | 200.0000 V | | 0.0100 + 0.0005 |
| True RMS, AC voltage ^{4,5} | 200.0000 mV | 10 Hz - 20 Hz | 3.60 + 0.35 |
| | | 20 Hz - 47 Hz | 0.50 + 0.35 |
| | | 47 Hz - 10 kHz | 0.16 + 0.35 |
| | | 10 kHz - 50 kHz | 0.40 + 0.35 |
| | | 50 kHz - 100 kHz | 2.20 + 0.50 |
| | 2.000000 V | 10 Hz - 20 Hz | 3.50 + 0.13 |
| | | 20 Hz - 47 Hz | 0.50 + 0.09 |
| | | 47 Hz - 10 kHz | 0.08 + 0.06 |
| | | 10 kHz - 50 kHz | 0.40 + 0.13 |
| | | 50 kHz - 100 kHz | 2.20 + 0.25 |
| | 20.00000 V | 10 Hz - 20 Hz | 4.50 + 0.18 |
| | | 20 Hz - 47 Hz | 0.65 + 0.15 |
| | | 47 Hz - 10 kHz | 0.09 + 0.12 |
| | | 10 kHz - 50 kHz | 0.30 + 0.18 |
| | | 50 kHz - 100 kHz | 1.70 + 0.25 |
| | 200.0000 V | 10 Hz - 20 Hz | 3.30 + 0.20 |
| | | 20 Hz - 47 Hz | 0.70 + 0.18 |
| | | 47 Hz - 10 kHz | 0.08 + 0.13 |
| | | 10 kHz - 50 kHz | 0.55 + 0.18 |
| | | 50 kHz - 100 kHz | 1.80 + 0.25 |
| Resistance ⁶ | 200.0000 Ω | 1 mA | 0.013 + 0.003 |
| | 2.000000 k Ω | 1 mA | 0.012 + 0.002 |
| | 20.00000 k Ω | 100 μ A | 0.012 + 0.002 |
| | 200.0000 k Ω | 10 μ A | 0.020 + 0.003 |
| | 2.000000 M Ω | 1 μ A | 0.060 + 0.004 |
| | 20.00000 M Ω | 100 nA | 0.200 + 0.003 |
| DC Current ⁷ | 2.000000 mA | < 25 mV | 0.050 + 0.050 |
| | 20.00000 mA | < 250 mV | 0.050 + 0.005 |
| | 200.0000 mA | < 55 mV | 0.050 + 0.040 |
| | 2.000000 A | < 520 mV | 0.200 + 0.005 |

- Specifications are for 1 hour warm up, within 1 hour self-cal, aperture \geq 0.5 sec; null measurement for DCV, Ω , DCI.
- For temperatures outside the range of 23 °C \pm 5 °C, but within 0 to 50 °C, add 0.1 \times accuracy specification per °C.
- 20% overrange on all ranges.
- Minimum input specified: 20 mV or 5% of range, whichever is larger.
- Signal is limited to 8×10^6 volt Hz product. For example, at 100 kHz, the highest input is 80 V.
- Specifications are for 4-wire resistance measurements, for 2-wire, add 1 m Ω .
- For 2 mA and 200 mA DCI ranges, resolution is limited to 5½ digits.

Definitions for specifications

Specification (spec): Represents warranted performance of a calibrated instrument that has been stored for a minimum of two hours within the operating temperature range of 0 to 50 °C, unless otherwise stated and after a one hour warm-up period. The specifications include measurement uncertainty. Data represented in this document are specifications unless otherwise noted.

Typical (typ): Represents characteristic performance, which 80% of the instruments manufactured will meet. This data is not warranted, does not include measurement uncertainty and is valid only at room temperature (approximately 25 °C).

Nominal (nom): The expected mean or average performance, or an attribute whose performance is by design, such as the 50 Ω connector. This data is not warranted and is measured at room temperature (approximately 25 °C).

Measured (meas): An attribute measured during the design phase for purposes of communicating expected performance, such as amplitude drift vs. time. This data is not warranted and is measured at room temperature (approximately 25 °C).

TECHNICAL SPECIFICATIONS AND CHARACTERISTICS continued

M9181A: Accuracy specifications \pm (% of reading + % of range)^{1,2,3}

| Function | Range | Frequency, test current or burden voltage | 1 year 23 °C \pm 5 °C |
|-----------------------------------|----------------|---|----------------------------|
| True RMS, AC current ⁴ | 2.000000 mA | 10 Hz - 20 Hz | 2.90 + 0.20 |
| | | 20 Hz - 47 Hz | 1.00 + 0.20 |
| | | 47 Hz - 1 kHz | 0.12 + 0.20 |
| | | 1 kHz - 10 kHz | 0.22 + 0.20 |
| | 20.000000 mA | 10 Hz - 20 Hz | 2.80 + 0.15 |
| | | 20 Hz - 47 Hz | 1.00 + 0.15 |
| | | 47 Hz - 1 kHz | 0.16 + 0.15 |
| | | 1 kHz - 10 kHz | 0.40 + 0.20 |
| | 200.000000 mA | 10 Hz - 20 Hz | 2.80 + 0.20 |
| | | 20 Hz - 47 Hz | 1.00 + 0.20 |
| | | 47 Hz - 1 kHz | 0.20 + 0.11 |
| | | 1 kHz - 10 kHz | 0.40 + 0.20 |
| 2.000000 A | 10 Hz - 20 Hz | 2.70 + 0.25 | |
| | 20 Hz - 47 Hz | 0.90 + 0.30 | |
| | 47 Hz - 1 kHz | 0.35 + 0.20 | |
| | 1 kHz - 10 kHz | 0.50 + 0.25 | |

- Specifications are for 1 hour warm up, within 1 hour self-cal, aperture \geq 0.5 sec; null measurement for DCV, Ω , DCI.
- For temperatures outside the range of 23 °C \pm 5 °C, but within 0 to 50 °C, add 0.1 \times accuracy specification per °C.
- 20% overrange on all ranges.
- Minimum input specified: 0.2 mA or 5% of range, whichever is greater.

MEASUREMENT CHARACTERISTICS

Environmental and physical characteristics

| | | |
|-------------------|--|--|
| Temperature range | Operating -10° to 55 °C Non-operating -40 ° to +85 °C | |
| Relative humidity | Operating to 80% at 40 °C Storage to 95% at 40 °C | |
| Connectors | V HI, 2-wire Ω IN V LO, 2-wire Ω IN I HI, 4-wire Ω IN I LO, 4-wire Ω IN | Sheathed banana jack Sheathed banana jack Sheathed banana jack Sheathed banana jack |
| Safety | Complies with IEC 61010-1, CAT II 240 V, Pollution degree 2 | |
| EMC | Complies with EN61326-1 Industrial Environment | |
| Warm-up time | 1 hour | |

Physical characteristics

| | |
|------------|-----------------------------------|
| Dimensions | 3U/1-slot PXI/CompactPCI standard |
| Weight | 0.5 kg (1 lb.) |

Power dissipation

| | |
|--------|-------------|
| +5 V | Total power |
| 300 mA | 1.5 W max |

MEASUREMENT CHARACTERISTICS continued

| DC voltage | |
|------------------------------|--|
| Measurement method | Delta-Sigma A/D conversion |
| Input resistance | 200 mV, 2.0 V ranges: >10 G Ω with typical leakage of < 50 pA; 20 V, 200 V ranges: 10.0 M Ω |
| Input isolation | 240 V from earth ground |
| Input overvoltage protection | 300 VDC on voltage inputs |
| DCV noise rejection | Normal mode rejection at 50, 60, or 400 Hz \pm 0.5%; > 90 dB (apertures \geq 0.160 s); CMRR (1 k Ω lead imbalance) \geq 100 dB |

| True RMS AC voltage | |
|------------------------------|--|
| Measurement method | AC coupled (10 Hz to 100 kHz) true RMS — measures the AC component only Analog RMS DC converter |
| Crest factor | Maximum crest factor of 4 at full scale, 7 at 10% of range |
| Input impedance | 1 M Ω , in parallel with capacitance of less than 300 pF |
| Settling time | < 0.5 sec to within 0.1% of final value |
| Peak input | 8 x 10 ⁶ volt Hz product (example: 80 V @ 100 kHz) |
| Input overvoltage protection | 250 VAC on voltage inputs |
| ACV noise rejection | Common mode rejection at 50 Hz or 60 Hz; 1 k Ω imbalance in either lead > 60 dB |

| Resistance | |
|----------------------------------|--|
| Measurement method | Selectable 2-wire or 4-wire. Current source referenced to LO output |
| Maximum test voltage | 240 mV for 200 Ω ranges; 2.4 V for 20 k Ω to 20 M Ω ranges |
| Maximum lead resistance (4-wire) | 50 k Ω for 200 k Ω , 2.0 M Ω and 20 M Ω ranges; 5 k Ω for 20 k Ω range 500 Ω for 200 Ω and 2 k Ω ranges; 50 Ω for 20 Ω range |
| Input protection | 300 V on all ranges |

| DC current | |
|------------------|---|
| Shunt resistance | 10 Ω for 2 mA and 20 mA, 0.1 Ω for 200 mA and 2 A |
| Input protection | Protected with 2.5 A, 250 V fast blow fuse |

| True RMS AC current | |
|---------------------|--|
| Measurement method | AC coupled true RMS measurement (measures the AC component only). Analog RMS DC converter |
| Shunt resistance | 10 Ω for 2 mA and 20 mA, 0.1 Ω for 200 mA and 2 A |
| Input protection | Protected with 2.5 A, 250 V fast blow fuse |

| Sensitivity (typ) | | |
|-------------------|------------------|-----------------|
| Function | Lowest range | Sensitivity |
| DCV | 200.0000 mV | 100 nV |
| ACV | 200.0000 mV | 100 nV |
| Resistance | 20.0000 Ω | 100 $\mu\Omega$ |
| DCI | 2.000000 mA | 10 nA |
| ACI | 2.000000 mA | 1 nA |

| Resolution vs. aperture and reading rate for DCV, DCI, Ω | | |
|---|-----------------------------|---------------------|
| Measurement aperture | Maximum readings per second | Resolution |
| 1.28 s | 0.8 | 6½ digits (21 bits) |
| 160 ms | 6 | 6 digits (20 bits) |
| 20 ms | 45 | 5½ digits (18 bits) |
| 10 ms | 85 | 5 digits (17 bits) |
| 5 ms | 150 | 4½ digits (16 bits) |

CONFIGURATION AND ORDERING INFORMATION

Hardware¹

| Model | Description |
|--------------------|---|
| M9181A | PXI 6½ digit multimeter, basic features |
| DMM units include: | Getting started guide, software drivers, user and service documentation (on CD ROM), Keysight I/O libraries |

1. The M9181A is intended for use in a PXI chassis.

Software

| Model | Description |
|------------------------------------|---|
| Supported operating systems | Microsoft Windows XP (32-bit), Microsoft Windows Vista (32/64-bit), Microsoft Windows 7 (32/64-bit) |
| Standard compliant drivers | IVI-C, IVI-COM, LabVIEW |
| Supported application environments | Visual Studio (VB.NET, C#, C/C++), LabVIEW, MATLAB |
| Keysight IO Libraries | Includes: VISA Libraries, Keysight Connection Expert, IO Monitor |

Warranty and Calibration

| Advantage Services: Calibration and Warranty | |
|--|--|
| Keysight Advantage Services is committed to your success throughout your equipment's lifetime. | |
| Calibration | |
| R-50C-011-3 | Yearly calibration, for 3 years |
| R-50C-011-5 | Yearly calibration, for 5 years |
| Warranty | |
| Standard warranty is 3 year | |
| R-51B-001-3C | 1 year return-to-Keysight warranty extended to 3 years |
| R-51B-001-5C | 1 year return-to-Keysight warranty extended to 5 years |

Accessories

| Model | Description |
|--------|---------------|
| 34138A | Test lead set |

Related products

| Model | Description |
|--------|--|
| M9018A | 18-slot PXIe chassis |
| M9021A | PXIe system interface |
| M9101A | PXI high-density multiplexer, 64 channels, reed relays |
| M9103A | PXI high-density multiplexer, 99 channels, armature relays |
| M9120A | PXI high-density matrix switch, 4x32, armature relays |
| M9121A | PXI high-density matrix switch, 4x64, reed relays |
| M9182A | PXI multimeter, 6 ½ digit, high performance |
| M9183A | PXI multimeter, 6 ½ digit, enhanced performance |

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PCI eXtensions for Instrumentation (PXI) modular instrumentation delivers a rugged, PC-based high-performance measurement and automation system.



Three-Year Warranty

www.keysight.com/find/ThreeYearWarranty

Keysight's commitment to superior product quality and lower total cost of ownership. The only test and measurement company with three-year warranty standard on all instruments, worldwide.



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Up to five years of protection and no budgetary surprises to ensure your instruments are operating to specification so you can rely on accurate measurements.

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