

6½ Digit PXI Digital Multimeters

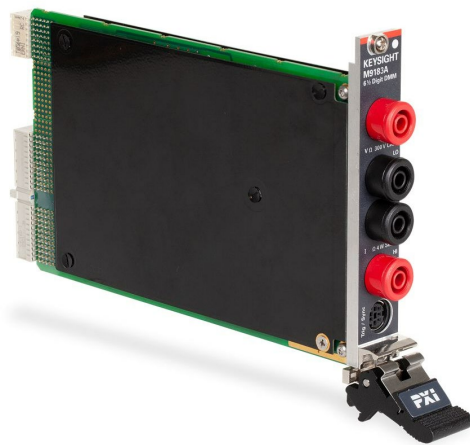
(M9181A, M9182A, M9183A)

Overview

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 an affordable price. Keysight's M9182A and M9183A 6½ digit high performance PXI digital multimeters (DMMs) offer fast throughput, flexible measurements, and trustworthy results. The M9182A provides ten built-in measurement types with all the accuracy and stability you would expect from 6½ digit DMM. The M9183A provides the same capabilities as the M9182A, with market-leading measurement speed of up to 15,000 readings per second, additional ranges, and a DC source.

Key Features

- 6½ digit resolution
- High throughput: up to 15,000 rdgs/sec, 66 µs single reading interval
- DCV basic one year accuracy: up to 40 ppm
- DCV, ACV, DCI, ACI, 2- and 4-wire resistance measurements
- Various DMM measurement types and DC source function on higher-end models



Industries and Applications

- Aerospace and defense
- Automotive electronics test
- Industrial electronics test
- Medical device test
- Semiconductor and component test

Customer Values

- M9181A provides a low cost solution with the most common DMM measurements
- Measurements you can trust
- Higher test throughput due to the lowest latency
- Application development in the environment of your choice reduces development time
- Customer supportable calibration procedures as well as 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 | DCV basic 1 year accuracy | Maximum reading rate at 4½ digits | Other measurements | Triggering | DC source | Floating isolation | Connector compatibility |
|--------|------------------------------|---------------------------|--|--|--|----------------------------|--------------------|------------------------------------|
| M9181A | Basic features PXI DMM | 90 ppm | 150 rdgs/sec, 6.7 ms single reading interval time | None | Immediate | n/a | CAT II 240 V | PXI-1 (J-1 only) |
| M9182A | High performance PXI DMM | 40 ppm | 4,500 rdgs/sec, 222 µs single reading interval time | Temperature, capacitance, frequency, period | Immediate, analog threshold, PXI trigger bus, external | n/a | CAT II 250 V | PXI-1 (J-1 only), PXIe hybrid slot |
| M9183A | Enhanced performance PXI DMM | 40 ppm | 15,000 rdgs/ sec, 66 µs single reading interval time | Temperature, capacitance, frequency, period, offset compensated Ω, pulse width, duty cycle, totalizer/ event counter | Immediate, analog threshold, PXI trigger bus, external | ± 10 V ± (1.2 µA to 12 mA) | CAT II 250 V | PXI-1 (J-1 only), PXIe hybrid slot |

Easy Setup... Test... and Maintenance

Hardware Platform

Compliance

The M9181A, M9182A and M9183A 6½ digit DMMs are PXI compliant, using either a cPCI (J1) or PXI-1 (J1) slot. Additionally, the M9182A and M9183A are also compatible with the PXIe Hybrid slot. Designed to benefit from fast data interfaces, these PXI DMMs 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 an ideal deployment platform for many automated test systems. A wide array of complementary PXI products is currently available. Products from Keysight include switches, multiplexers, digitizers, waveform generators, and local oscillators.

Software Platform

IO Libraries Suite

Keysight IO Libraries Suite offers fast and easy instrument connections. IO Libraries Suite 16.1 supports PXI, helping you display all of the modules in your system, view information about installed software and allows 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 come complete with software drivers for Windows Vista, and Windows 7 (32 and 64 bit). These software drivers work in the most popular test and measurement development environments including LabVIEW, Visual Studio (C, C++, C#, Visual Basic), MATLAB and VEE.

Easy Software Integration

Application code examples are included for LabVIEW, Visual Basic, C/C++, C#, and MATLAB – demonstrating DMM set up and basic functionality. These application code examples can be used to help you integrate the DMM module into your measurement system.

Soft Front Panel

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

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 then incorporate the driver calls into their application program – enabling fast and easy program development.

Calibration

Each M9181A, M9182A and M9183A DMM is factory calibrated and shipped with an ISO-9002, NIST-traceable calibration certificate.

Calibration is required once per year. A documented calibration process allows you to do in-rack calibration using standard calibration sources. Alternatively, Keysight and 3rd party calibration labs offer calibration services for the PXI DMMs.

M9181A Technical Specifications and Characteristics

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

| | | | |
|-----------------------------------|---------------|---|--|
| True RMS, AC current ⁸ | 2.000000 mA | 10 Hz - 20 Hz 20 Hz - 47 Hz 47 Hz - 1 kHz 1 kHz - 10 kHz | 2.90 + 0.20 1.00 + 0.20 0.12 + 0.20 0.22 + 0.20 |
| | 20.000000 mA | 10 Hz - 20 Hz 20 Hz - 47 Hz 47 Hz - 1 kHz 1 kHz - 10 kHz | 2.80 + 0.15 1.00 + 0.15 0.16 + 0.15 0.40 + 0.20 |
| | 200.000000 mA | 10 Hz - 20 Hz 20 Hz - 47 Hz 47 Hz - 1 kHz 1 kHz - 10 kHz | 2.80 + 0.20 1.00 + 0.20 0.20 + 0.11 0.40 + 0.20 |
| | 2.000000 A | 10 Hz - 20 Hz 20 Hz - 47 Hz 47 Hz - 1 kHz 1 kHz - 10 kHz | 2.70 + 0.25 0.90 + 0.30 0.35 + 0.20 0.50 + 0.25 |

| Function | Lowest Range | Sensitivity |
|---------------------------------|--------------|-------------|
| M9181A Sensitivity (typ) | | |
| DCV | 200.0000 mV | 100 nV |
| ACV | 200.0000 mV | 100 nV |
| Resistance | 20.0000 Ω | 100 μΩ |
| DCI | 2.000000 mA | 10 nA |
| ACI | 2.000000 mA | 1 nA |

1. Specifications are for 1 hour warm up, within 1 hour self-cal, aperture ≥ 0.5 sec; null measurement for DCV, Ω, DCI.
2. For temperatures outside the range of 23 °C ± 5 °C, but within 0 to 50 °C, add 0.1 × accuracy specification per °C.
3. 20% overrange on all ranges.
4. Minimum input specified: 20 mV or 5% of range, whichever is larger.
5. Signal is limited to 8x10⁶ volt Hz product. For example, at 100 kHz, the highest input is 80 V.
6. Specifications are for 4-wire resistance measurements, for 2-wire, add 1 mΩ.
7. For 2 mA and 200 mA DCI ranges, resolution is limited to 5½ digits.
8. Minimum input specified: 0.2 mA or 5% of range, whichever is greater.

M9182A / M9183A Technical Specifications and Characteristics

| Function | Range ³ | Frequency | 24 hour 23 °C ± 1 °C | 90 day 23 °C ± 5 °C | 1 year 23 °C ± 5 °C |
|--|----------------------------|------------------|-------------------------|------------------------|------------------------|
| M9182A and M9183A: Accuracy specifications ±(% of reading + % of range)^{1,2} | | | | | |
| DC voltage ¹⁵ | 200.0000 mV | | 0.0030 + 0.0005 | 0.0040 + 0.0008 | 0.0050 + 0.0010 |
| | 2.000000 V | | 0.0020 + 0.0002 | 0.0030 + 0.0002 | 0.0040 + 0.0003 |
| | 20.00000 V | | 0.0040 + 0.0006 | 0.0050 + 0.0007 | 0.0070 + 0.0008 |
| | 200.0000 V | | 0.0030 + 0.0002 | 0.0040 + 0.0002 | 0.0050 + 0.0003 |
| | 300.0000 V | | 0.0130 + 0.0002 | 0.0230 + 0.0003 | 0.0250 + 0.0003 |
| True RMS, AC voltage ^{4,5} (Fast RMS off) | 200.0000 mV ⁶ | 10 Hz - 20 Hz | 3.00 + 0.18 | 3.10 + 0.19 | 3.20 + 0.22 |
| | | 20 Hz - 47 Hz | 0.37 + 0.08 | 0.38 + 0.09 | 0.40 + 0.10 |
| | | 47 Hz - 10 kHz | 0.13 + 0.05 | 0.14 + 0.06 | 0.15 + 0.06 |
| | | 10 kHz - 50 kHz | 0.25 + 0.08 | 0.26 + 0.10 | 0.27 + 0.12 |
| | | 50 kHz - 100 kHz | 1.90 + 0.18 | 1.95 + 0.19 | 2.00 + 0.20 |
| | 2.000000 V | 10 Hz - 20 Hz | 3.00 + 0.10 | 3.10 + 0.11 | 3.20 + 0.13 |
| | | 20 Hz - 47 Hz | 0.37 + 0.07 | 0.38 + 0.08 | 0.40 + 0.09 |
| | | 47 Hz - 10 kHz | 0.05 + 0.05 | 0.06 + 0.06 | 0.07 + 0.06 |
| | | 10 kHz - 50 kHz | 0.32 + 0.06 | 0.33 + 0.07 | 0.35 + 0.08 |
| | | 50 kHz - 100 kHz | 1.90 + 0.08 | 2.00 + 0.09 | 2.10 + 0.10 |
| | 20.00000 V | 10 Hz - 20 Hz | 3.00 + 0.07 | 3.10 + 0.08 | 3.30 + 0.10 |
| | | 20 Hz - 47 Hz | 0.37 + 0.06 | 0.38 + 0.07 | 0.40 + 0.08 |
| | | 47 Hz - 10 kHz | 0.06 + 0.05 | 0.07 + 0.06 | 0.07 + 0.07 |
| | | 10 kHz - 50 kHz | 0.18 + 0.09 | 0.20 + 0.11 | 0.22 + 0.13 |
| | | 50 kHz - 100 kHz | 1.30 + 0.15 | 1.40 + 0.18 | 1.50 + 0.20 |
| | 200.0000 V & 300.0000 V | 10 Hz - 20 Hz | 3.00 + 0.07 | 3.10 + 0.08 | 3.30 + 0.08 |
| | | 20 Hz - 47 Hz | 0.43 + 0.06 | 0.44 + 0.07 | 0.45 + 0.08 |
| | | 47 Hz - 10 kHz | 0.07 + 0.05 | 0.08 + 0.07 | 0.09 + 0.08 |
| | | 10 kHz - 50 kHz | 0.28 + 0.07 | 0.30 + 0.08 | 0.32 + 0.10 |
| | | 50 kHz - 100 kHz | 1.30 + 0.09 | 1.60 + 0.12 | 2.40 + 0.13 |

M9182A / M9183A Technical Specifications and Characteristics (continued)

| Function | Range ³ | Frequency or Test Current | 24 hour 23 °C ± 1 °C | 90 day 23 °C ± 5 °C | 1 year 23 °C ± 5 °C |
|--|--|---------------------------|-------------------------|------------------------|------------------------|
| M9182A and M9183A: Accuracy specifications ±(% of reading + % of range)^{1,2} | | | | | |
| True RMS, AC voltage ^{4,5} (Fast RMS on) | 200.0000 mV ⁶ | 350 Hz - 800 Hz | 0.60 + 0.08 | 0.65 + 0.09 | 0.70 + 0.10 |
| | | 800 Hz - 10 kHz | 0.13 + 0.05 | 0.14 + 0.06 | 0.15 + 0.06 |
| | | 10 kHz - 50 kHz | 0.55 + 0.08 | 0.60 + 0.10 | 0.63 + 0.12 |
| | | 50 kHz - 100 kHz | 5.30 + 0.18 | 5.40 + 0.19 | 5.60 + 0.20 |
| | 2.000000 V | 350 Hz - 800 Hz | 0.93 + 0.07 | 0.96 + 0.08 | 1.00 + 0.09 |
| | | 800 Hz - 10 kHz | 0.07 + 0.05 | 0.08 + 0.06 | 0.08 + 0.06 |
| | | 10 kHz - 50 kHz | 0.62 + 0.06 | 0.65 + 0.07 | 0.70 + 0.08 |
| | | 50 kHz - 100 kHz | 5.10 + 0.08 | 5.20 + 0.09 | 5.30 + 0.10 |
| | 20.00000 V | 350 Hz - 800 Hz | 0.93 + 0.06 | 0.96 + 0.07 | 1.00 + 0.08 |
| | | 800 Hz - 10 kHz | 0.07 + 0.05 | 0.07 + 0.06 | 0.07 + 0.07 |
| | | 10 kHz - 50 kHz | 0.31 + 0.09 | 0.33 + 0.11 | 0.35 + 0.13 |
| | | 50 kHz - 100 kHz | 2.00 + 0.15 | 2.20 + 0.18 | 2.40 + 0.20 |
| 200.0000 V & 300.0000 V | 350 Hz - 800 Hz | 1.00 + 0.06 | 1.10 + 0.07 | 1.10 + 0.08 | |
| | 800 Hz - 10 kHz | 0.07 + 0.05 | 0.07 + 0.07 | 0.08 + 0.08 | |
| | 10 kHz - 50 kHz | 0.34 + 0.07 | 0.45 + 0.08 | 0.50 + 0.10 | |
| | 50 kHz - 100 kHz | 2.50 + 0.09 | 2.80 + 0.12 | 3.20 + 0.13 | |
| Resistance ^{7,15} | 20.00000 Ω (M9183A only) 200.0000 Ω 2.000000 kΩ 20.00000 kΩ 200.0000 kΩ 2.000000 MΩ 20.00000 MΩ 200.0000 MΩ (M9183A , 2-wire only) | 10 mA | 0.004 + 0.004 | 0.009 + 0.004 | 0.014 + 0.005 |
| | | 1 mA | 0.004 + 0.002 | 0.010 + 0.002 | 0.013 + 0.003 |
| | | 1 mA | 0.003 + 0.002 | 0.008 + 0.002 | 0.012 + 0.002 |
| | | 100 μA | 0.003 + 0.002 | 0.008 + 0.002 | 0.012 + 0.002 |
| | | 10 μA | 0.006 + 0.002 | 0.010 + 0.002 | 0.016 + 0.003 |
| | | 1 μA | 0.018 + 0.002 | 0.030 + 0.003 | 0.040 + 0.004 |
| | | 100 nA | 0.120 + 0.002 | 0.130 + 0.003 | 0.200 + 0.003 |
| | | 4 nA | 0.800 + 0.013 | 1.000 + 0.015 | 1.300 + 0.025 |
| | | | | | |

M9182A / M9183A Technical Specifications and Characteristics (continued)

| Function | Range ³ | Frequency or Burden Voltage | 24 hour 23 °C ± 1 °C | 90 day 23 °C ± 5 °C | 1 year 23 °C ± 5 °C |
|--|------------------------------|-----------------------------|-------------------------|------------------------|------------------------|
| M9182A and M9183A: Accuracy specifications ±(% of reading + % of range)^{1,2} | | | | | |
| DC Current ¹⁵ | 200.0000 nA (M9183A only) | < 100 μV | 0.130 + 0.020 | 0.160 + 0.023 | 0.170 + 0.030 |
| | 2.000000 μA (M9183A only) | < 100 μV | 0.050 + 0.004 | 0.080 + 0.003 | 0.210 + 0.008 |
| | 20.00000 μA (M9183A only) | < 100 μV | 0.050 + 0.002 | 0.080 + 0.003 | 0.130 + 0.004 |
| | 200.0000 μA (M9183A only) | < 2.5 mV | 0.052 + 0.100 | 0.070 + 0.150 | 0.100 + 0.200 |
| | 2.000000 mA | < 25 mV | 0.020 + 0.015 | 0.030 + 0.020 | 0.040 + 0.028 |
| | 20.00000 mA | < 250 mV | 0.020 + 0.002 | 0.035 + 0.003 | 0.045 + 0.003 |
| | 200.0000 mA | < 55 mV | 0.020 + 0.025 | 0.030 + 0.030 | 0.040 + 0.040 |
| | 2.000000 A | < 520 mV | 0.100 + 0.003 | 0.150 + 0.004 | 0.200 + 0.005 |
| True RMS, AC current ⁸ | 2.000000 mA ⁹ | 10 Hz - 20 Hz | 2.70 + 0.20 | 2.90 + 0.20 | 2.90 + 0.20 |
| | | 20 Hz - 47 Hz | 0.90 + 0.20 | 0.90 + 0.20 | 1.00 + 0.20 |
| | | 47 Hz - 1 kHz | 0.04 + 0.08 | 0.08 + 0.15 | 0.12 + 0.20 |
| | | 1 kHz - 10 kHz | 0.12 + 0.20 | 0.14 + 0.20 | 0.22 + 0.20 |
| | 20.00000 mA | 10 Hz - 20 Hz | 1.80 + 0.15 | 2.60 + 0.15 | 2.80 + 0.15 |
| | | 20 Hz - 47 Hz | 0.60 + 0.15 | 0.90 + 0.15 | 1.00 + 0.15 |
| | | 47 Hz - 1 kHz | 0.07 + 0.05 | 0.15 + 0.10 | 0.16 + 0.15 |
| | | 1 kHz - 10 kHz | 0.21 + 0.15 | 0.30 + 0.20 | 0.40 + 0.20 |
| | 200.0000 mA | 10 Hz - 20 Hz | 1.80 + 0.20 | 2.70 + 0.20 | 2.80 + 0.20 |
| | | 20 Hz - 47 Hz | 0.60 + 0.20 | 0.90 + 0.20 | 1.00 + 0.20 |
| | | 47 Hz - 1 kHz | 0.15 + 0.08 | 0.17 + 0.09 | 0.20 + 0.11 |
| | | 1 kHz - 10 kHz | 0.30 + 0.15 | 0.35 + 0.18 | 0.40 + 0.20 |
| 2.000000 A | 10 Hz - 20 Hz | 1.80 + 0.20 | 2.50 + 0.23 | 2.70 + 0.25 | |
| | 20 Hz - 47 Hz | 0.66 + 0.30 | 0.80 + 0.30 | 0.90 + 0.30 | |
| | 47 Hz - 1 kHz | 0.30 + 0.19 | 0.33 + 0.19 | 0.35 + 0.20 | |
| | 1 kHz - 10 kHz | 0.40 + 0.20 | 0.45 + 0.23 | 0.50 + 0.25 | |
| Frequency or Period ^{10, 14} | 200 mV to 300 V | 1Hz - 20 Hz | 0.08 + 0.01 | 0.08 + 0.01 | 0.08 + 0.01 |
| | | 20 Hz - 130 Hz | 0.03 + 0.01 | 0.03 + 0.01 | 0.03 + 0.01 |
| | | 130 Hz - 640 Hz | 0.03 + 0.01 | 0.03 + 0.01 | 0.03 + 0.01 |
| | | 640 Hz - 2.5 kHz | 0.03 + 0.01 | 0.03 + 0.01 | 0.03 + 0.01 |
| | | 2.5 kHz - 40 kHz | 0.03 + 0.01 | 0.03 + 0.01 | 0.03 + 0.01 |
| | | 40 kHz - 200 kHz | 0.05 + 0.01 | 0.05 + 0.01 | 0.05 + 0.01 |
| | | 200 kHz - 300 kHz | 0.07 + 0.01 | 0.07 + 0.01 | 0.07 + 0.01 |

M9182A / M9183A Technical Specifications and Characteristics (continued)

| Function | Range | Full scale reading or resolution | 24 hour 23 °C ± 1 °C | 90 day 23 °C ± 5 °C | 1 year 23 °C ± 5 °C |
|--|-----------------|----------------------------------|-------------------------|------------------------|------------------------|
| M9182A and M9183A: Accuracy specifications ±(% of reading + % of range)^{1,2} | | | | | |
| Single shot duty cycle ¹¹ [M9183A only] | 2 - 100 Hz | 0.02 % | 0.03 ± 0.03 | 0.03 ± 0.03 | 0.03 ± 0.03 |
| | 100 Hz - 1 kHz | 0.20 % | 0.03 ± 0.30 | 0.03 ± 0.30 | 0.03 ± 0.30 |
| | 1 - 10 kHz | 2.00 % | 0.03 ± 3.00 | 0.03 ± 3.00 | 0.03 ± 3.00 |
| Single shot pulse width ^{12, 14} [M9183A only] | 14 µs - 62.5 ms | 1 µs | .01 ± 4 µs | .01 ± 4 µs | .01 ± 4 µs |
| Capacitance ¹³ [M9183A and M9182A] | 1000.0 pF | 1199.9 pF | 1.00 + 0.10 | 1.00 + 0.10 | 1.00 + 0.10 |
| | 10.000 nF | 11.999 nF | 1.20 + 0.05 | 1.20 + 0.05 | 1.20 + 0.05 |
| | 100.00 nF | 119.99 nF | 1.00 + 0.10 | 1.00 + 0.10 | 1.00 + 0.10 |
| | 1.0000 µF | 1.1999 µF | 1.00 + 0.10 | 1.00 + 0.10 | 1.00 + 0.10 |
| | 10.000 µF | 11.999 µF | 1.00 + 0.10 | 1.00 + 0.10 | 1.00 + 0.10 |
| | 100.00 µF | 119.99 µF | 1.00 + 0.10 | 1.00 + 0.10 | 1.00 + 0.10 |
| | 1.0000 mF | 1.1999 mF | 1.20 + 0.10 | 1.20 + 0.10 | 1.20 + 0.10 |
| | 10.000 mF | 11.999 mF | 2.00 + 0.10 | 2.00 + 0.10 | 2.00 + 0.10 |

1. Specifications are for 1 hour warm up, within 1 hour self-cal, aperture ≥ 0.5 sec. Slow AC filter for AC measurements only.
2. For temperatures outside the range of 23 °C ± 5 °C, but within 0 °C to 50 °C, add 0.1 × accuracy specification per °C.
3. 20% over range on all ranges except 300 V range, maximum measurable input is 250V.
4. Minimum input specified: 5 mV or 1% of range, whichever is larger.
5. Signal is limited to 8×10⁶ Volt Hz product. For example, at 32 kHz, the highest input is 250 V.
6. For inputs from 5 mV to 15 mV, add 100 µV to the specification.
7. Specifications are for 4-wire resistance measurements, for 2-wire, add 1 mΩ additional error to the specification; for offset compensated ohms (M9183A only), add 0.02% of range.
8. Minimum input specified: 60 µA or 1.5% of range, whichever is larger; for inputs < 5% of full scale, add 0.02% of range.
9. For inputs from 60 to 120 µA, add 10 µA to the specification; for inputs < 5% of full scale, add 0.1% of range.
10. Minimum amplitude greater of 100 mV, or 5 % of range for 1 Hz to 2.5 kHz, or 25 % of range for 2.5 kHz to 200 kHz, or 40% of range for 200 kHz to 300 kHz.
11. Specifications are % of reading (0.03) ± adder.
12. Specifications are % of reading + time.
13. Specifications apply to input signals ≥ 5% of range.
14. Maximum wait time for duty cycle and period is 5 seconds.
15. DCV, DCI & Resistance specifications only valid with the math NULL feature enabled.

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).

Note: All graphs contain measured data from several units at room temperature unless otherwise noted.

M9182A / M9183A Technical Specifications and Characteristics (continued)

| Function | Lowest Range | Sensitivity |
|--|-------------------|-----------------|
| M9182A and M9183A Sensitivity (nom) | | |
| DCV | 200.0000 mV | 0.1 μ V |
| ACV | 200.0000 mV | 0.1 μ V |
| Resistance (M9183A) | 20.00000 Ω | 10 $\mu\Omega$ |
| Resistance (M9182A) | 200.0000 Ω | 100 $\mu\Omega$ |
| DCI (M9183A) | 200.0000 nA | 0.1 pA |
| DCI (M9182A) | 2.000000 mA | 10 nA |
| ACI | 2.000000 mA | 1 nA |
| Capacitance | 1000.0 pF | 0.1 pF |

| Temperature Function | Type | R ₀ (Ω) | Sensitivity | Range/max temperature | 1 year 23 °C \pm 5 °C |
|--|----------------|-----------------------------|-------------|-----------------------|--|
| M9182A and M9183A temperature accuracy (spec)¹ | | | | | |
| RTD temperature measurement ^{2,3} | pt385 | 100 Ω , 200 Ω | 0.01 °C | -150 to 650 °C | \pm 0.06 °C |
| | | 500 Ω , 1 k Ω | 0.01 °C | -150 to 650 °C | \pm 0.03 °C |
| | Cu (Copper) | Less than 12 Ω | 0.01 °C | -100 to 200 °C | \pm 0.18 °C at \leq 20 °C \pm 0.05 °C otherwise |
| | | Higher than 90 Ω | 0.01 °C | -100 to 200 °C | \pm 0.10 °C at \leq 20 °C \pm 0.05 °C otherwise |
| Thermocouple temperature measurement ^{4,5} | B | NA | 0.01 °C | 2200 °C | \pm 0.38 °C |
| | E | NA | 0.01 °C | 1200 °C | \pm 0.035 °C |
| | J | NA | 0.01 °C | 2000 °C | \pm 0.06 °C |
| | K | NA | 0.01 °C | 3000 °C | \pm 0.07 °C |
| | N | NA | 0.01 °C | 3000 °C | \pm 0.10 °C |

| | | | | | |
|-------------------------|---------|----|---------|---------------|-----------|
| | R | NA | 0.01 °C | 2700 °C | ± 0.25 °C |
| | S | NA | 0.01 °C | 3500 °C | ± 0.35 °C |
| | T | NA | 0.01 °C | 550 °C | ± 0.06 °C |
| Thermistor ³ | 2.25 kΩ | NA | 0.01 °C | -80 to 150 °C | ± 0.1 °C |
| | 5 kΩ | NA | 0.01 °C | -80 to 150 °C | ± 0.1 °C |
| | 10 kΩ | NA | 0.01 °C | -80 to 150 °C | ± 0.1 °C |

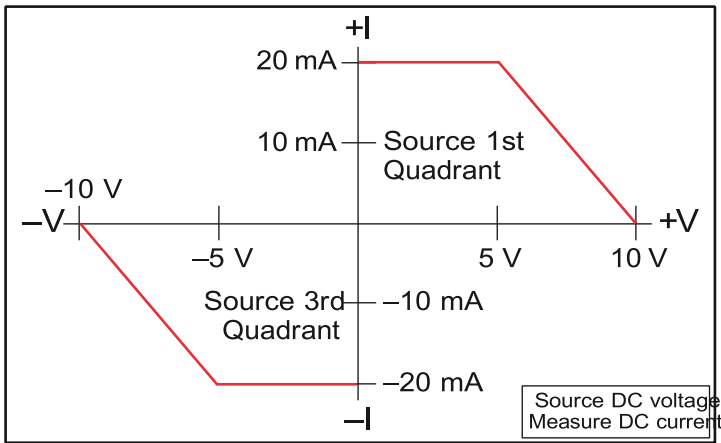
1. Specifications are for one hour warm up, within one hour self-cal, aperture ≥ 0.5 sec.
2. 4-wire RTD measurement, R0 variable 1 Ω to 7 k Ω.
3. For total measurement accuracy, add temperature probe error.
4. For total measurement accuracy, add thermocouple error and cold junction compensation.
5. DMM linearization temperature range may be greater than that of the thermocouple device.

Source-Measure [(spec) unless otherwise stated]

| Parameter | Closed Loop | Open Loop |
|---|------------------|--------------|
| M9183A source DC voltage, measure DC voltage | | |
| DC voltage source (output) range | +10 to -10 V | +10 to -10 V |
| DC source sink current at 5 V output | 5 mA | 5 mA |
| DAC resolution (nom) | 18 bits /12 bits | 12 bits |
| DC voltage source accuracy 1 Year, 23°± 5° C | 0.015% ± 0.0004 | 1.00% ± 0.04 |
| Settling time (typ) | 100 ms/1 ms | 1 ms |
| Source resistance (nom) | 200 ohms | 200 ohms |

| M9183A source DC voltage, measure DC voltage | |
|---|----------------------|
| DC voltage source (output) range | -10.000 to +10.000 V |
| DC current measurement range | 0 to ± 20 mA |

| | |
|--|---------------|
| Voltage resolution (nom) | 5 mV |
| Voltage source accuracy 1 Year, (23 °C ± 5 °C) ^{1,2,3,4} | 2.0% ± 0.4% |
| Settling time (typ) | 100 ms |
| DC current measurement accuracy | 0.1% + 0.005% |



| Current output | Compliance voltage | Minimum level | Source accuracy 1 year, (23 °C ± 5 °C) ^{1,2,3} |
|---|--------------------|---------------------|--|
| M9183A source DC current, measure DC voltage | | | |
| DC voltage measurement range | | 0 to ± 2.0 V | |
| < 1.25 µA | 4.2 V | 10 nA | 1% + 1% |
| < 12.5 µA | 4.2 V | 50 nA | 1% + 1% |
| < 125 µA | 4.2 V | 100 nA | 1% + 0.5% |
| < 1.25 mA | 4.2 V | 1 µA | 1% + 0.5% |
| < 12.5 mA | 1.2 V | 10 µA | 1% + 0.5% |

1. Specifications are for one hour warm up, within one hour self-cal, slow AC filter.
2. For temperatures outside the range of 23 °C ± 5 °C, but within 0 °C to 50 °C, add 0.1 × accuracy specification per °C.
3. Repetitive reading at an aperture of 133 ms or higher.
4. If DCV source > 6 V, then add current * 4 ohms; if DCV source > 8 V, then add current * 30 ohms.

Triggering Characteristics

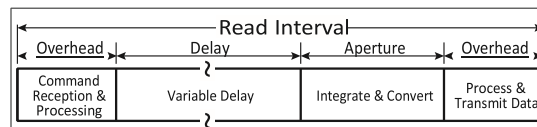
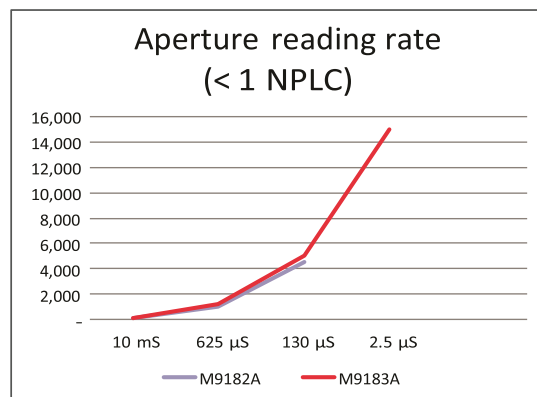
The M9182A and M9183A have advanced triggering capabilities that exceed those found on other digital multimeters. Advanced triggering enables you to obtain the signal you need and accurately measure it, in a variety of applications.

| External hardware trigger | | |
|---|---|---|
| Trigger input voltage level range (at DIN 7 connector) | +3 to +15 V activates the trigger | |
| Minimum trigger pulse width | Aperture + 50 μ s | |
| Trigger input impedance | 3 k Ω | |
| Edge | Selectable positive or negative edge | |
| PXI bus trigger inputs | | |
| Trigger input voltage level range (via PXI backplane) | CMOS level (see PXI standard) | |
| Minimum trigger pulse width | Aperture + 50 μ s | |
| Edge | Selectable positive or negative edge | |
| Trigger features | | |
| Trigger sources | Immediate, PXI trigger, external DIN connector, analog threshold trigger source | |
| Trigger delay [Auto delay (default delay) ensures 1st reading accuracy in most configurations] | Measurement delay | 50 μ s to 15 s |
| | Resolution | 1 μ s to 65 ms and 16 μ s above 65ms |
| Reading storage | Circular buffer - 80 readings | |
| Multi Sample Mode (DCV and DCI functions only) | Aperture range | 2.5 μ s to 160 ms (M9183A) |
| | | 130 μ s to 160 ms (M9182A) |
| | Maximum read interval range | 1 sec for apertures \geq 625 μ s, else 65 ms |
| | Reading per trigger | Up to 80 readings (maximum of 78 pre-triggers or a maximum of 80 post triggers) |
| Trigger sources | PXI trigger, external DIN connector, and analog threshold (accuracy within 5% of range) | |

Measurement Characteristics

| Measurement aperture | Maximum readings per second | Resolution |
|---|-----------------------------------|---------------------|
| M9181A Resolution vs. Aperture and Reading Rate for DCV, DCI, Ω | | |
| 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) |
| M9182A / M9183A Resolution vs. Aperture and Reading Rate for DCV, DCI, Ω | | |
| 10 ms | 98 | 6½ digits (22 bits) |
| 625 µs | 1,200 | 5½ digits (18 bits) |
| 130 µs | 4,500 | 4½ digits (14 bits) |
| 2.5 µs | 15,000 (M9183A only) ¹ | 4½ digits (14 bits) |

1. 15,000 readings/second represent a typical maximum with a measurement aperture of 2.5 µs. Results will vary, depending on what PC hardware, PXI hardware, and driver are used.



Time frame of a single measurement

Minimum read interval = 66 µs (M9183A)
 Minimum read interval = 222 µs (M9182A)

Measurement Characteristics (continued)

Transaction Speed

Transactional I/O speed is a single reading measurement. This is important when you are taking many single measurements with the DMM. The M9183A delivers the highest transactional measurement speed in its class. These fast readings, up to 15,000 readings per second with a read interval rate of 66 μ s, provides the lowest latency, translating into higher test-system throughput and lower cost of test per unit tested. Variable delay can be programmed to allow fully settled readings in most configurations.

System Reading and Throughput Rates (M9182A/3A)

| Switching ranges within a function | Aperture (A) | Range change time (ms) |
|--|----------------|--------------------------|
| DCV | $A \leq 20$ ms | $(A \times 0.2) + 15$ |
| | $A > 20$ ms | $A + 15.6$ |
| Resistance (2-wire or 4-wire) | $A < 33$ ms | $(A \times 0.05) + 15.5$ |
| | $A \geq 33$ ms | $A + 13$ |
| DCI (200 mA or 2 A to any other range) | $A \leq 40$ ms | 4.2 |
| | $A > 40$ ms | 15.7 |
| DCI (all other ranges) | All apertures | 1 |
| Capacitance | All apertures | 12 |

| Switch between functions | Aperture (A) | Function change time (ms) |
|--------------------------|-----------------------------------|---------------------------|
| DCV | $A < 16$ ms | 15.6 |
| | $A \geq 16$ ms | $A + 25$ |
| Resistance to DCI | $A < 16.66$ ms | 7.8 |
| | $16.66 \text{ ms} \leq A < 40$ ms | $A \times 0.65$ |
| | $40 \text{ ms} < A < 66.66$ ms | 7.8 |
| | $A \geq 66.66$ ms | $(A \times 0.51) + 45$ |
| DCV to capacitance | $A < 33.33$ ms | 23.4 |
| | $A \geq 33.33$ ms | $(A \times 0.65) + 50$ |

| | | |
|---------------------------|---|---------------------|
| Resistance to capacitance | $A \leq 33.33 \text{ ms}$ | 23.4 |
| | $33.33 \text{ ms} < A < 80 \text{ ms}$ | $(A \times 2) + 35$ |
| | $80 \text{ ms} \leq A < 160 \text{ ms}$ | 23.4 |
| | $A \geq 160 \text{ ms}$ | 160 |

| DC Voltage | |
|------------------------------|---|
| Measurement method | Delta-sigma A/D conversion |
| Input resistance | 200 mV, 2.0 V ranges: $>10 \text{ G}\Omega$ with typical leakage of $< 50 \text{ pA}$; |
| | M9181A: 20 V, 200 V ranges: $10.0 \text{ M}\Omega$ |
| | M9182A/3A: 20 V, 200 V, 300 V ranges: $10.0 \text{ M}\Omega$ |
| Input isolation | M9181A: 240 V from Earth ground |
| | M9182A/3A: 250 V from Earth ground |
| Input overvoltage protection | M9181A: 240 VDC on voltage inputs |
| | M9182A/3A: 250 VDC all ranges |
| DCV noise rejection | M9181A: Normal mode rejection at 50, 60, or 400 Hz $\pm 0.5\%$; $> 90 \text{ dB}$ (apertures $\geq 0.160 \text{ s}$); CMRR (1 k Ω lead imbalance) $\geq 100 \text{ dB}$ |
| | M9182A/3A: Normal mode rejection at 50, 60, or 400 Hz $\pm 0.5\%$; $> 95 \text{ dB}$ (apertures $\geq 0.160 \text{ s}$); CMRR (1 k Ω lead imbalance) $\geq 120 \text{ dB}$ |
| True RMS AC Voltage | |
| Measurement method | M9181A: AC coupled (10 Hz to 100 kHz) true RMS — measures the AC component only. Analog RMS DC converter. |
| | M9182A/3A: AC coupled (10 Hz to 100 kHz) true RMS — measures the AC component of an input waveform that consists of AC and DC components. |
| Crest factor | Maximum crest factor of 4 at full scale, 7 at 10% of range |
| Input impedance | 1 M Ω , in parallel with $< 300 \text{ pF}$ |
| Settling time | $< 0.5 \text{ sec}$ to within 0.1% of final value Fast RMS (M9182A/3A): $< 0.05 \text{ sec}$ to within 0.1% of final value |

| | |
|-----------------------------------|--|
| Peak input | 8 x 10 ⁶ V Hz product (example: 250 V @ 32 kHz) |
| Input overvoltage protection | M9181A: 240 VAC on voltage inputs |
| | M9182A/3A: 250 VAC all ranges |
| 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 |
| Offset compensation (M9183A only) | All ranges, use with apertures > 5 ms Voffset + (I*R) < 2.2 V for ranges \geq 2 k Ω Voffset + (I*R) < 0.22 V for ranges < 2 k Ω |
| Maximum test voltage | M9181A: 240 mV for 200 Ω ranges; 2.4 V for 20 k Ω to 20 M Ω ranges |
| | M9182A/3A: 240 mV for 20 Ω and 200 Ω ranges; 2.4 V for 20 k Ω to 20 M Ω ranges |
| | M9183A only: 1.0 V for 200 M Ω range |
| 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 | M9181A: 240 V on all ranges M9182A/3A: 250 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; Virtual zero shunt for 200 μ A, 20 μ A, 2 μ A, and 200 nA range (M9183A only) |
| 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 |

| Frequency and period (M9182A and M9183A) | |
|---|--|
| Measurement method | Direct (conventional) counting |
| Input impedance | 1 M Ω with < 300 pF |
| Sensitivity (130 Hz) | .001 Hz |
| Totalizer (M9183A only) | |
| Active edge polarity | Positive or negative transition |
| Maximum count | 10,000,000,000 |
| Allowed rate | 1 to 30,000 events per second |
| Threshold | Set threshold DAC |
| Accuracy | ± 2 counts |
| Capacitance (M9182A and M9183A) | |
| Measurement method | Differential charge balance: variable currents used to stimulate dV/dt response. |
| Connection type | 2-wire |

| 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 Full accuracy to 40% RH for 41 °C to 55 °C (non-condensing) | | | | | | | | | | | | | | |
| Max operative altitude | 2000m (10,000 feet) | | | | | | | | | | | | | | |
| Connectors | <table border="0"> <tr> <td>V HI*, 2-wire Ω IN, DCV OUT</td> <td>Sheathed banana jack</td> </tr> <tr> <td>V LO*, 2-wire Ω IN, DCV OUT</td> <td>Sheathed banana jack</td> </tr> <tr> <td>I HI*, 4-wire Ω IN</td> <td>Sheathed banana jack</td> </tr> <tr> <td>I LO*, 4-wire Ω IN</td> <td>Sheathed banana jack</td> </tr> <tr> <td>Sync OUT**</td> <td>DIN 7, pin 2</td> </tr> <tr> <td>External Trigger IN**</td> <td>DIN 7, pin 7</td> </tr> <tr> <td>Trigger and Sync common**</td> <td>DIN 7, pin 4</td> </tr> </table> | V HI*, 2-wire Ω IN, DCV OUT | Sheathed banana jack | V LO*, 2-wire Ω IN, DCV OUT | Sheathed banana jack | I HI*, 4-wire Ω IN | Sheathed banana jack | I LO*, 4-wire Ω IN | Sheathed banana jack | Sync OUT** | DIN 7, pin 2 | External Trigger IN** | DIN 7, pin 7 | Trigger and Sync common** | DIN 7, pin 4 |
| V HI*, 2-wire Ω IN, DCV OUT | Sheathed banana jack | | | | | | | | | | | | | | |
| V LO*, 2-wire Ω IN, DCV OUT | Sheathed banana jack | | | | | | | | | | | | | | |
| I HI*, 4-wire Ω IN | Sheathed banana jack | | | | | | | | | | | | | | |
| I LO*, 4-wire Ω IN | Sheathed banana jack | | | | | | | | | | | | | | |
| Sync OUT** | DIN 7, pin 2 | | | | | | | | | | | | | | |
| External Trigger IN** | DIN 7, pin 7 | | | | | | | | | | | | | | |
| Trigger and Sync common** | DIN 7, pin 4 | | | | | | | | | | | | | | |
| Safety & EMC | Refer to Declaration of Conformity for the latest revisions of regulatory compliance at: www.keysight.com/go/conformity | | | | | | | | | | | | | | |
| Warm-up time | 1 hour | | | | | | | | | | | | | | |

* Do not connect the V HI and V LO or I HI and I LO connectors to anything when the measurement function does not utilize those connectors.

** M9182A & M9183A only

| Physical characteristics | |
|--------------------------|------------------------------------|
| Dimensions | 3U/1-slot PXI/Compact PCI standard |
| Weight | 0.5 kg (1 lb.) |
| Power dissipation | |
| +5 V | Total power |
| 300 mA | 1.5 W max |

Configuration

| Model | Description |
|--|---|
| Hardware | |
| M9181A | PXI 6½ digit multimeter, basic features |
| M9182A | PXI 6½ digit multimeter, high performance |
| M9183A | PXI 6½ digit multimeter, enhanced performance |
| Software | |
| 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 Development Environments (ADE) | Visual Studio (VB.NET, C#, C/C++), LabVIEW, MATLAB, VEE |
| Keysight IO Libraries | Includes: VISA Libraries, Keysight Connection Expert, IO Monitor |
| Accessories | |
| 34138A | Test lead set |

Related Products

| Model | Description |
|--------|--|
| M9018A | 18-slot PXIe chassis |
| M9021A | PCIe cable interface to an external system controller |
| M9036A | Embedded controller |
| 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 |

Visit www.keysight.com/find/pxi-dmm to find out more.

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