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Find the *National Instruments PXI-4060* at our website: *Click HERE*

5½ Digit Multimeters

NI 4050, NI 4060

- 5½-digits
- 5 measurement modes
- ±300 VDC/V_{rms} maximum
- 200 M maximum (2 and 4-wire)
- 60 readings/s maximum

Models
- NI PCMCIA-4050
- NI PCI-4060
- NI PXI-4060

Operating Systems
- Windows 2000/NT/XP

Recommended Software
- LabVIEW
- LabWindows/CVI
- Measurement Studio

Other Compatible Software
- Visual Basic
- C/C++

Driver Software (included)
- NI-DMM

Calibration Certificate Included

See page 21.



Overview

The NI 4050 and NI 4060 devices are full-featured digital multimeters (DMMs). They measure accurate 5½-digit DC voltage and current, True-rms AC voltage and current, and resistance measurements. The NI PCMCIA-4050, with its size, weight, and low-power consumption, is ideal for portable measurements and data logging with handheld and notebook computers. NI 4060 DMMs are perfectly suited for use in automated production test, portable field test, and benchtop electronic test. Using NI 4060 DMMs with National Instruments switching modules, such as PXI-2501, PXI-2503, SCXI-1127, SCXI-1128, or SCXI-1129, you can measure thousands of channels, consisting of voltages, thermocouples, RTDs, thermistors, and current loops, and keep a firm control on the cost of your system.

Hardware

Reading Rates

NI 4050 and NI 4060 DMMs offer multiple reading rates determined by your resolution, function, range selections, and powerline rejection. The maximum reading rate is 60 reading/s, once the initial setup time affecting the first reading is passed. Please contact your National Instruments local sales representative for more information regarding measurement performance in your specific application.

Measuring Voltages

The NI 4050 and NI 4060 DMMs have five input ranges available for measuring DC voltages – 20 mV, 200 mV, 2 V, 25 V, and 250 V. Five input ranges are available for measuring AC voltages – 20 mV_{rms}, 200 mV_{rms}, 2 V_{rms}, 25 V_{rms}, and 250 V_{rms}. The NI 4060 DMMs measure AC voltages to the specified accuracy as long as the voltage is within 10 percent of the selected input range. In AC voltage ranges, the NI 4050 and NI 4060 DMMs measure the AC-coupled True-rms value of a signal.

Measuring Resistance

The NI 4050 and NI 4060 DMMs have five basic input ranges for both 2 and 4-wire (NI 4060 only) resistance measurements, and an extended range for 2-wire measurements. The basic ranges are 200 , 2 k , 20 k , 200 k , and 2 M . With extended range, measurements up to 200 M are possible. The NI 4050 and NI 4060 DMMs use a common technique to measure resistance. The method involves sending a current through the test resistor and measuring the voltage drop across the resistor. In the extended ohms range, a 1 M resistor is added in parallel with the test resistor.

Measuring Current

For the PCMCIA-4050, use the optional CSM current-shunt accessories to measure both AC and DC current. The CSM accessories include a precision resistor that converts the current through the shunt into a voltage measurable by the PCMCIA-4050. For measuring currents up to 200 mA or 10 A, use the CSM-200mA or the CSM-10A, respectively.

The NI 4060 DMMs have built-in current measurement capability. Two input ranges exist for DC and True-rms AC current measurements – 20 mA and 200 mA. For measuring currents between 200 mA and 10 A, use the CSM-10A accessory.

Diode Testing

The NI 4050 and NI 4060 DMMs measure the forward drop (up to 2 V) across a diode. The diode is biased with 100 µA current, and the resulting voltage drop is measured. Diode measurements are made with a fixed range of 2 V.

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5½ Digit Multimeters

Calibration

The NI 4050 and NI 4060 DMMs are shipped with a calibration certificate stating that the instrument was calibrated to NIST-traceable standards to the levels detailed in the specifications. These DMMs can be returned to National Instruments or a qualified metrology lab for calibration.

Cables and Probes

The NI 4060 DMMs have built-in shrouded banana jacks to prevent exposure to potentially hazardous voltages on the test probes. The DMM kits include the P-1 Probe Set – two 1 m test leads (red and black) with test probes.

The P-2 Probe Set, sold separately, includes two 1 m test leads (red and black) with shrouded banana plugs on one end and a variety of optional terminals on the other – two alligator clips (red and black) with boots, two spring hooks (red and black), and two spade connectors (red and black).

The banana-plug-to-bare-wire kit is a pair of banana-to-bare wire plugs (one red, one black) that permits you to connect your DMM to screw terminals for channel expansion using matrices or scanners. To connect your NI 4060 to SCXI scanners and matrices, special cable kits are available (SCXI-1357 and SCXI-1358). Refer to page 498 for more information on switch cabling.

The probe sets meet IEC 1010 safety requirements and permit direct probing of circuits and cables.

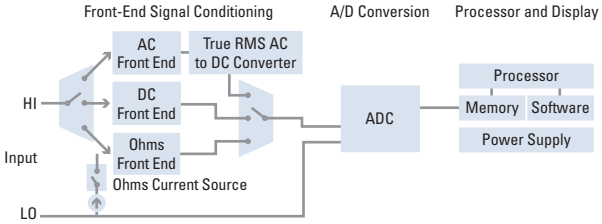


Figure 1. Fundamental DMM Architecture

Triggering for Switches (NI 4060 only)

The NI 4060 DMMs work with external multiplexer/matrix switches. In particular, the NI 4060 devices have been designed to integrate seamlessly with National Instruments switch offerings for SCXI and PXI. Two signals, Voltmeter Complete Trigger Output and Trigger Input, control the switches. Access to the signals is through two BNC connectors on the auxiliary trigger cable. On PXI, you can access the triggers through the PXI trigger bus.

Software

All National Instruments DMMs are shipped with NI-DMM driver software. NI-DMM is an IVI-compliant driver that provides access to the complete functionality of the DMM through an easy-to-use application programming interface. NI-DMM also includes the DMM Soft Front Panel (SFP). The DMM SFP is an interactive executable that provides an easy way to test input signals or debug your system. NI-DMM is optimized for use with NI LabVIEW, LabWindows/CVI, and Measurement Studio, as well as Microsoft Visual Basic and C/C++.

Ordering Information

NI PCMCIA-4050 777186-01
Includes the PCMCIA-4050 card, P4-BJ2 cable, P-1 probe set, NI-DMM, the DMM Soft Front Panel, and carrying case.
NI PCI-4060 777559-01
NI PXI-4060 777554-01
Includes the NI 4060 hardware, P-1 probe set, NI-DMM, and the DMM Soft Front Panel.

For information on extended warranty and value added services, see page 20.

Cables and Accessories

Standard probe, P-1 probe set 761000-01
Additional probe, P-2 probe set 184698-01
Banana plug to bare wire, P-3 probe set
1 m, red and black (2 wires) 185692-01
Auxiliary trigger cable for use with external multiplexers 0.5 m.....184931-0R5
10 A current shunt, CSM-10A.....777488-02
Visit ni.com for a more complete list of cables and accessories.

BUY ONLINE!

Visit ni.com/products and enter pxi4060, pci4060, or pcmcia4050.

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5½ Digit Multimeters

Specifications – NI 4060

Specifications are guaranteed between 15 and 35 °C unless otherwise noted.

DC Voltage (Accuracy % of Reading ± µV)

Range	24 Hour (25 °C ± 1 °C)	90 Day (25 °C ± 10 °C)	1 Year (25 °C ± 10 °C)	Temperature Coefficient (% of Reading/°C + µV/°C)
250 V[1]	0.0032% + 1.25 mV	0.021% + 1.25 mV	0.024% + 1.25 mV	0.0017% + 480 µV
25 V	0.0032% + 1 mV	0.021% + 1 mV	0.024% + 1 mV	0.0017% + 480 µV
2 V	0.0029% + 10 µV	0.014% + 10 µV	0.017% + 10 µV	0.0009% + 5 µV
200 mV	0.0029% + 6 µV	0.014% + 6 µV	0.017% + 6 µV	0.0009% + 1 µV
20 mV	0.0029% + 6 µV	0.014% + 6 µV	0.017% + 6 µV	0.0009% + 1 µV

[1]Overrange capabilities to 300 V

Accuracy numbers are for 5½ digits with autozero on and include the effects of full-scale and zero-scale errors, temperature variation, linearity, and noise.

Noise Rejection

NMRR ..... 80 dB (10 Hz filter setting, 50/60 Hz powerline frequency ±1%)
DC ECMRR ..... 140 dB (with a 1 kΩ imbalance in HI lead)
AC ECMR (50/60 Hz) ..... 150 dB (with a 1 kΩ imbalance in HI lead)

Input Characteristics

Input bias current ..... 1 nA maximum
Input resistance ..... >1 GΩ (2 V, 200 mV, 20 mV ranges); 1 MΩ (250 V, 25 V)

DC Current (Accuracy % of Reading ± µA)

Range	24 Hour (25 °C ± 1 °C)	90 Day (25 °C ± 10 °C)	1 Year (25 °C ± 10 °C)	Temperature Coefficient (% of Reading/°C + µV/°C)
20 mA[2]	0.015% + 10 µA	0.039% + 10 µA	0.042% + 10 µA	0.0035%/°C + 1 µA/°C
200 mA[2]	0.015% + 10 µA	0.039% + 10 µA	0.042% + 10 µA	0.0035%/°C + 1 µA/°C
10 A[2]	0.11% + 1 mA	0.035% + 2 mA	0.035% + 2 mA	0.007%/°C + 0.1 mA/°C

[2]Requires 10 A shunt, CSM-10A

Accuracy numbers are for 5½ digits with autozero on and include the effects of full-scale and zero-scale errors, temperature variation, linearity, and noise.

Input Characteristics

Input protection ..... Fuse F1 500 mA/250 V fast-fusing
Shunt resistor ..... 1 Ω
Burden voltage ..... <400 mV at 200 mA DC

AC Voltage (Accuracy % of Reading ± mV)

Range	24 Hour (25 °C ± 1 °C)	90 Day (25 °C ± 10 °C)	1 Year (25 °C ± 10 °C)	Temperature Coefficient (% of Reading/°C + µV/°C)
250 V[3]	0.6% + 250 mV	0.62% + 680 mV	0.62% + 680 mV	0.007% + 20 mV
25 V	0.16% + 30 mV	0.18% + 210 mV	0.18% + 210 mV	0.007% + 20 mV
2 V	0.28% + 3 mV	0.30% + 21 mV	0.30% + 21 mV	0.019% + 2 mV
200 mV	0.16% + 0.22 mV	0.18% + 1.20 mV	0.18% + 1.20 mV	0.007% + 0.110 mV
20 mV	0.28% + 100 µV	0.30% + 170 µV	0.30% + 170 µV	0.019% + 12 µV

[3]Overrange capabilities to 300 V

Accuracy numbers are for 5½ digits and include the effects of full-scale and zero-scale errors, temperature variation, linearity, and noise. Applies for sine waves ≥ 10% of input range. Accuracy may be affected by source impedance, cable capacitances, dielectric absorption, or slew rate.

Noise Rejection

AC CMRR (50/60 Hz) ..... >80 dB (with a 1 kΩ imbalance in HI lead)

Input Characteristics

Input resistance ..... 1 MΩ
Bandwidth ..... 20 Hz - 25 kHz

Additional AC Errors

Frequency-dependent errors

Input Frequency	Additional Error (% of reading)
20 Hz - 50 Hz	2.5%
50 Hz - 100 Hz	0%
100 Hz - 20 kHz	1%
20 Hz - 25 kHz	2.5%

AC Current (Accuracy % of Reading ± mA)

Range	24 Hour (25 °C ± 1 °C)	90 Day (25 °C ± 10 °C)	1 Year (25 °C ± 10 °C)	Temperature Coefficient (% of Reading/°C + µV/°C)
20 mA[4]	0.30% + 100 µA	0.32% + 170 µA	0.32% + 170 µA	0.022% + 12 µA
200 mA[4]	0.18% + 0.22 mA	0.20% + 1.2 mA	0.20% + 1.2 mA	0.009% + 0.110 mA
10 A[4]	0.3% + 22 mA	0.32% + 120 mA	0.32% + 120 mA	0.026% + 11 mA

[4]Requires 10 A shunt, CSM-10A

Accuracy numbers are for 5½ digits and include the effects of full-scale and zero-scale errors, temperature variation, linearity, and noise.

Input Characteristics

Input protection ..... Fuse F1 500 mA/250 V fast-fusing
Shunt resistor ..... 1 Ω
Burden voltage ..... < 400 mV at 200 mA AC

Resistance (Accuracy % of Reading ± Ω)

Range	24 Hour (25 °C ± 1 °C)	90 Day (25 °C ± 10 °C)	1 Year (25 °C ± 10 °C)	Temperature Coefficient (% of Reading/°C + µV/°C)
Extended resistance (> 2 MΩ)	0.1% + 6 kΩ	0.1% + 60 kΩ	0.1% + 60 kΩ	0.0072% + 6 kΩ
2 MΩ[5]	0.012% + 9 Ω	0.077% + 27 Ω	0.080% + 27 Ω	0.0072% + 2 Ω
200 kΩ	0.012% + 5 Ω	0.077% + 22 Ω	0.080% + 22 Ω	0.0072% + 2 Ω
20 kΩ	0.006% + 0.09 Ω	0.024% + 0.3 Ω	0.027% + 0.3 Ω	0.0020% + 0.02 Ω
2 kΩ	0.006% + 0.05 Ω	0.024% + 0.2 Ω	0.027% + 0.2 Ω	0.0020% + 0.02 Ω
200 Ω	0.006% + 0.05 Ω	0.024% + 0.2 Ω	0.027% + 0.2 Ω	0.0020% + 0.02 Ω

[5]With autozero on, or while scanning, and when large resistance with capacitive loads is measured, additional delay time is required. Accuracy numbers are for 4-wire resistance mode, 5½ digits with autozero on and include the effects of full-scale and zero-scale errors, temperature variation, linearity, and noise.

Measurement modes
Resistance ..... 2 or 4-wire
Extended ohms ..... 2-wire only
Maximum lead resistance ..... 10 Ω (200 Ω range), 1 kΩ (all other ranges)
Additional error for 2-wire resistance ..... 0.6 Ω

Diode Testing (Accuracy % of Reading ± µV)

Range	24 Hour (25 °C ± 1 °C)	90 Day (25 °C ± 10 °C)	1 Year (25 °C ± 10 °C)	Temperature Coefficient (% of Reading/°C + µV/°C)
2 V	0.006% + 7 µV	0.024% + 22 µV	0.027% + 22 µV	0.0020% + 2 µV

Accuracy numbers are for 5½ digits with autozero on and include the effects of full and zero-scale errors, temperature variation, linearity, and noise.

Test current ..... 100 µA

General Specifications

Settling time ..... Affected by source impedance and input signal changes.
Warm-up time ..... 30 minutes for measurements accurate within specifications.
Altitude ..... Up to 2,000 m; at higher altitudes the installation category must be derated.
Working voltage ..... 300 V maximum between either input terminal and earth ground

Power Requirement

+5 VDC ..... 250 mA in operational mode

Physical

Dimensions
PCI ..... 10.8 by 17.5 cm (4.25 by 6.9 in.)
PXI ..... 10 by 16 cm (3.9 by 6.33 in.)

Environment

Operating temperature ..... 0 to 55 °C
Storage temperature ..... -20 to 70 °C
Relative humidity ..... 10 to 90%, noncondensing

Certifications and Compliances

CE Mark Compliance CE

The product meets applicable EU directives for CE Mark compliance as follows:
Safety compliance IEC1010-1 Certified, Designed for UL 3111
Low-Voltage Directive EN 61010-1, Installation Category II, Pollution Degree 2, Double Insulated, Indoor use.

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