

NI 4051 Specifications

Portable 5½-Digit Multimeter

This document lists the specifications of the NI 4051. These specifications are guaranteed between 15 °C and 35 °C unless otherwise specified.

Electromagnetic Compatibility Guidelines

This product was tested and complies with the regulatory requirements and limits for electromagnetic compatibility (EMC) as stated in the product specifications. These requirements and limits are designed to provide reasonable protection against harmful interference when the product is operated in its intended operational electromagnetic environment. There is no guarantee that interference will not occur in a particular installation. To minimize the potential for the product to cause interference to radio and television reception or to experience unacceptable performance degradation, install and use this product in strict accordance with the instructions in the product documentation.



The following statements contain important information needed before installing and using this product:



Caution This product is intended for use in industrial locations. As a result, this product may cause interference if used in residential areas. Such use must be avoided unless the user takes special measures to reduce electromagnetic emissions to prevent interference to the reception of radio and television broadcasts.



Caution This product may become more sensitive to electromagnetic disturbances in the operational environment when test leads are attached or when connected to a test object.



Caution Emissions that exceed the regulatory requirements may occur when this product is connected to a test object.



Caution Changes or modifications not expressly approved by National Instruments could void the user's authority to operate the hardware under the local regulatory rules.

Installing the Software

Before installing the NI 4051, complete the following steps to install the software:

1. (Optional) Install an application development environment (ADE), such as LabVIEW or LabWindows™/CVI™, if you are developing an application for the NI 4051.
2. Install the latest service packs for your operating system.
3. Download and open NI-DMM from ni.com/updates.
4. Follow the instructions in the installation prompts.

(Windows Vista) Users may see access and security messages during installation. Accept the prompts to complete the installation.

5. When the installer completes, a dialog box appears and asks if you want to restart, shut down, or restart later. Select **Restart**.

Installing the NI 4051

To install the NI 4051, insert the NI 4051 into an available PCMCIA slot as shown in Figure 1.

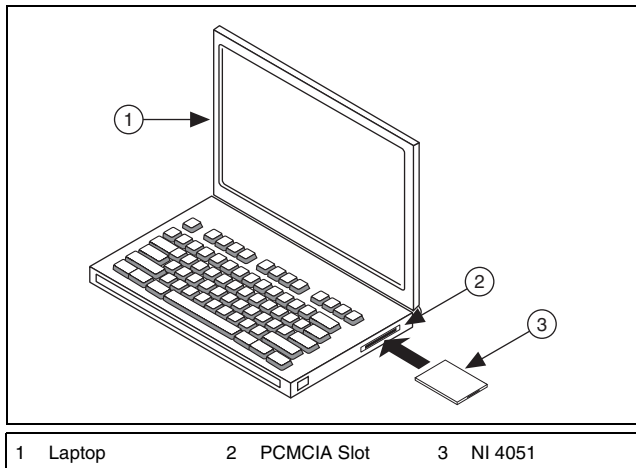


Figure 1. PCMCIA Installation

Using the NI 4051

The following sections explain how to configure and test the NI 4051 in MAX as well as how to connect signals to the NI 4051.

Configuring the NI 4051

To configure and test the NI 4051 in MAX, complete the following steps:

6. Launch MAX (**Start»All Programs»National Instruments»Measurement & Automation**). MAX automatically detects the NI 4051.
7. Expand **Devices and Interfaces**.



Note Windows Vista does not support Traditional NI-DAQ (Legacy) for the NI 4051. Refer to the *Supported Hardware* section of the *NI-DMM Readme* file at **Start»All Programs»National Instruments»NI-DMM»Documentation** to determine which operating systems are compatible with the NI 4051.

8. Verify that the NI 4051 appears in the Traditional NI-DAQ (Legacy) folder in **Devices and Interfaces**.



Note If the NI 4051 is not listed, press <F5> to refresh **Devices and Interfaces**. If the NI 4051 is still not listed, repeat the steps in the *Installing the NI 4051* section. If the DMM still does not appear, visit NI Technical Support at ni.com/support. For more information about using MAX, refer to the available help files within MAX.

9. Record the device number or device name assigned to the NI 4051. You need this when programming the NI 4051.

Select the NI 4051 to see its properties in the configuration view. The device number appears in the Values column. When developing your application, the resource name for the NI 4051 is DAQ : : n , where n is the device number MAX assigned to the NI 4051.

10. Perform a self-test on the NI 4051 to verify installation.

Right-click the NI 4051, select **Properties**, and click **Test Resources**.

A dialog box appears and indicates whether the NI 4051 passed the test.



Note If the NI 4051 does not pass the test, repeat the steps in the *Installing the NI 4051* section. If the NI 4051 still does not pass the test, visit NI Technical Support at ni.com/support.

11. Complete the following steps to run the functional test panels and to use the NI 4051.
 - Right-click the NI 4051 and click **Test Panels**.
 - Refer to the *Connecting Signals* section to connect a signal to the NI 4051.
 - Click **Close** to close the test panels for the NI 4051.

Connecting Signals

The following sections explain how to connect signals to the NI 4051 for common measurements.



Caution Always refer to this specifications document *before* connecting signals. Failure to observe the specified maximum signal ratings can cause shock, a fire hazard, or damage to the devices connected to the NI 4051. NI is *not* liable for any damage or injuries resulting from incorrect signal connections.

The P4-BJ2 accessory cable connects the NI 4051 to the P-1 test probes, or other types of test probes equipped with shrouded banana plugs. Both the P4-BJ2 accessory cable and the P-1 test probes are sold separately.



Note The accessory cable connector is polarized and cannot be plugged in incorrectly.

Refer to Figure 2 to connect the accessory cable to the NI 4051.

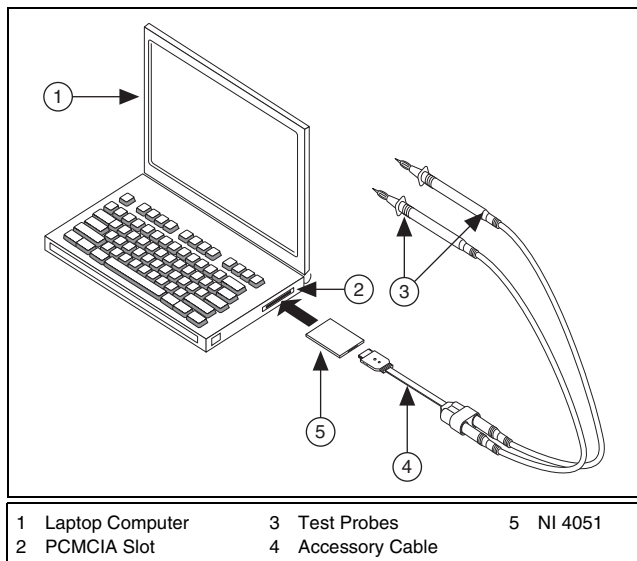


Figure 2. Connecting Cables and Probes to the NI 4051

DC and AC Voltage

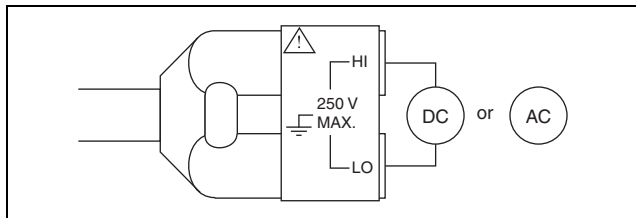


Figure 3. NI 4051 Signal Connections for Voltage Measurements

2-Wire Resistance

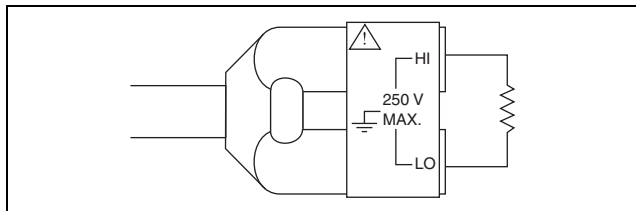


Figure 4. NI 4051 Signal Connections for 2-Wire Resistance Measurements

Voltage Drop Across a Diode

The NI 4051 can excite a device under test and read the resulting voltage drop, which is useful for testing diodes.

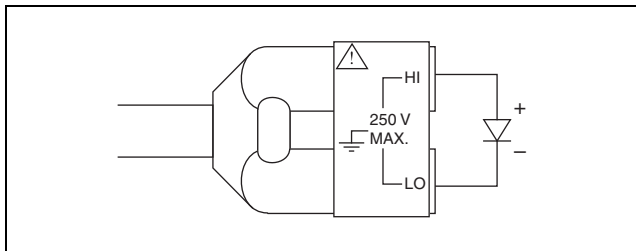


Figure 5. NI 4051 Signal Connections for Diode Measurements

DC Voltage

Accuracy $\pm$ (% of Reading + Offset)

Range	24 Hour (25 °C $\pm$ 1 °C)	90 Day (25 °C $\pm$ 10 °C)	1 Year (25 °C $\pm$ 10 °C) *	Tempco (% of Reading / °C $\pm$ μ V / °C)
20 mV	0.0029% $\pm$ 27 μ V	0.014% $\pm$ 250 μ V	0.017% $\pm$ 250 μ V	0.0009% $\pm$ 25 μ V
200 mV	0.0029% $\pm$ 27 μ V	0.014% $\pm$ 250 μ V	0.017% $\pm$ 250 μ V	0.0009% $\pm$ 25 μ V
2 V	0.0029% $\pm$ 37 μ V	0.014% $\pm$ 260 μ V	0.017% $\pm$ 260 μ V	0.0009% $\pm$ 25 μ V
25 V	0.08% $\pm$ 5 mV	0.25% $\pm$ 20 mV	0.25% $\pm$ 10 mV	0.015% $\pm$ 2400 μ V
250 V	0.08% $\pm$ 5 mV	0.25% $\pm$ 20 mV	0.25% $\pm$ 10 mV	0.015% $\pm$ 2400 μ V

* (25 °C $\pm$ 5 °C) for 250 V and 25 V ranges only.

Note: Accuracy numbers are for 5 1/2 digits and include the effects of full-scale and zero-scale errors, temperature variation, linearity, and noise.

Noise Rejection

NMRR (10 Hz reading rate,

50/60 Hz powerline

frequency $\pm 1\%$) 100 dB

DC ECMRR..... 140 dB (with a 1 k Ω
imbalance in LO lead)

AC ECMR (RDC to 60 Hz) 150 dB (with a 1 k Ω
imbalance in LO lead)

Input Characteristics

Input bias current 1 nA max

Input resistance >1 G Ω (2 V, 200 mV, 20 mV
ranges);
100 M Ω (250 V, 25 V)

DC Current with NI CSM-200mA or NI CSM-10A Current Shunt

DC current measurements require the use of an external current shunt.

Accuracy $\pm$ (% of Reading + Offset)

Shunt	Recommended NI 4051 DCV Range	Equivalent Current Range	1 Year (25 °C $\pm$ 10 °C)	Tempco / °C
NI CSM- 200mA	20 mV	20 mA	0.15% + 250 μ A	0.035% + 25 μ A
NI CSM- 200mA	200 mV	200 mA	0.15% + 250 μ A	0.035% + 25 μ A
NI CSM- 10A	200 mV	10 A*	0.5% + 26 mA	0.007% + 2.5 mA
* The current through the shunt must not exceed 10 A even when half of the voltage range is used. Note: Accuracy numbers require a null offset.				

Input Characteristics

Using NI CSM-200mA shunt

Input protection	Fuse F 500 mA 250 V Fast-Acting
Shunt resistor	1 Ω
Burden voltage	<400 mV at 200 mA

Using NI CSM-10A shunt

Input protection	Fuse F 12.5 A 250 V Fast-Acting
Shunt resistor	10 m Ω
Burden voltage	<400 mV at 10 A

AC Voltage

Accuracy $\pm$ (% of Reading + Offset)

Range	24 Hour (25 °C $\pm$ 1 °C)	90 Day (25 °C $\pm$ 10 °C)	1 Year (25 °C $\pm$ 10 °C)	Tempco / °C
20 mV	0.4% + 100 μ V	0.42% + 170 μ V	0.42% + 170 μ V	0.019% + 12 μ V
200 mV	0.3% + 0.22 mV	0.32% + 1.20 mV	0.32% + 1.20 mV	0.007% + 0.11 mV
2 V	0.4% + 3 mV	0.42% + 21 mV	0.42% + 21 mV	0.019% + 2 mV
25 V	0.3% + 30 mV	0.32% + 210 mV	0.32% + 210 mV	0.007% + 20 mV
250 V	0.6% + 500 mV	0.62% + 680 mV	0.62% + 680 mV	0.007% + 20 mV
Note: Accuracy numbers are valid for sine waves $\geq 10\%$ of the input range and may be affected by source impedance, cable capacitances dielectric absorption, or slew rate.				

Noise Rejection

AC CMRR (DC to 60 Hz) >80 dB (with a 1 k Ω imbalance in LO lead)

Input Characteristics

Input resistance 100 M Ω all ranges

Bandwidth..... 20 Hz to 1 kHz

Additional AC Errors

Frequency-dependent errors

Input Frequency	Additional Error (% of Reading)
20 Hz to 50 Hz	2.5%
50 Hz to 100 Hz	1%
100 Hz to 1 kHz	0%

AC Current with NI CSM-200mA or NI CSM-10A Current Shunt

AC current measurements require the use of an external current shunt.

Accuracy $\pm$ (% of reading + Offset)

Shunt	Recommended NI 4051 ACV Range	Equivalent Current Range	1 Year (25 °C $\pm$ 10 °C)	Tempco / °C
NI CSM-200mA	20 mV	20 mA	0.43% + 170 μ A	0.019% + 0.012 mA
NI CSM-200mA	200 mV	200 mA	0.47% + 1.2 mA	0.007% + 0.11 mA
NI CSM-10A	200 mV	10 A *	0.60% + 120 mA	0.026% + 11 mA

* The current through the shunt must not exceed 10 A, even when half of the voltage range is used.

Note: Accuracy numbers require a null offset. Refer to the [Additional AC Errors](#) section for frequency-dependent errors.

Input Characteristics

Using NI CSM-200mA shunt

Input protection	Fuse F 500 mA 250 V Fast-Acting
Shunt resistor	1 Ω
Burden voltage	<400 mV at 200 mA

Using NI CSM-10A shunt

Input protection	Fuse F 12.5 A 250 V Fast-Acting
Shunt resistor	10 m Ω
Burden voltage	<400 mV at 10 A

Resistance

Accuracy $\pm$ (% of Reading + Offset)

Range	24 Hour (25 °C $\pm$ 1 °C)	90 Day (25 °C $\pm$ 10 °C)	1 Year (25 °C $\pm$ 10 °C)	Tempco / °C
200 Ω	0.006% + 0.4 Ω	0.024% + 4 Ω	0.027% + 4 Ω	0.0020% + 0.40 Ω
2 k Ω	0.006% + 0.4 Ω	0.024% + 4 Ω	0.027% + 4 Ω	0.0020% + 0.40 Ω
20 k Ω	0.006% + 0.5 Ω	0.024% + 4 Ω	0.027% + 4 Ω	0.0020% + 0.40 Ω
200 k Ω	0.012% + 37 Ω	0.077% + 350 Ω	0.080% + 350 Ω	0.0072% + 35 Ω
2 M Ω	0.012% + 55 Ω	0.077% + 370 Ω	0.080% + 370 Ω	0.0072% + 35 Ω
Extended resistance (>2 M Ω)	0.1% + 6 k Ω	0.1% + 60 k Ω	0.1% + 60 k Ω	0.0072% + 6 k Ω

Measurement mode..... 2-wire resistance

Test current 100 μA for 200 Ω , 2 $\text{k}\Omega$,
 20 $\text{k}\Omega$ ranges;
 1 μA for 2 $\text{M}\Omega$ and 200 $\text{k}\Omega$
 ranges;
 1 μA and 100 $\text{M}\Omega$ in parallel
 for extended resistance
 measurements

Diode Testing

Accuracy $\pm$ (% of Reading + Offset)

Range	24 Hour (25 °C $\pm$ 1 °C)	90 Day (25 °C $\pm$ 10 °C)	1 Year (25 °C $\pm$ 10 °C)	Tempco / °C
2 V	0.006% + 60 μV	0.024% + 400 μV	0.027% + 400 μV	0.002% + 40 μV

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
Bus type	PCMCIA, slave
Altitude	Up to 2,000 m
Working voltage	250 V maximum between either input terminal and earth ground
Power requirement	+5 VDC, 45 mA in operational mode
Operating temperature	0 °C to 55 °C
Storage temperature	-20 °C to 70 °C
Relative humidity	10% to 90% noncondensing
Measurement category	II
Pollution Degree	2
Indoor use only.	

Physical

Dimensions 8.6×5.4 cm
(3.4×2.1 in.)
(Type II PC card)

Weight 31 g (1.1 oz)



Note The P4-BJ2 cable connects the NI 4051 to the test probes.

P4-BJ2 cable

Length 0.3 m

End that connects
to the NI 4051 3.7×2.3 cm
(1.5×0.9 in.)



Note If you need to clean the module, wipe it with a dry towel.

Compliance and Certifications

Safety

This product meets the requirements of the following standards of safety for electrical equipment for measurement, control, and laboratory use:

- IEC 61010-1, EN 61010-1
- UL 61010-1, CSA 61010-1



Note Operate the NI 4051 only as described in these operating instructions.



Note For UL and other safety certifications, refer to the product label or the [*Online Product Certification*](#) section.

Electromagnetic Compatibility

This product meets the requirements of the following EMC standards for electrical equipment for measurement, control, and laboratory use:

- EN 61326-2-1 (IEC 61326-2-1): Class A emissions; Basic immunity
- EN 55011 (CISPR 11): Group 1, Class A emissions
- AS/NZS CISPR 11: Group 1, Class A emissions
- FCC 47 CFR Part 15B: Class A emissions
- ICES-001: Class A emissions



Note For EMC declarations and certifications, refer to the [Online Product Certification](#) section.

CE Compliance

This product meets the essential requirements of applicable European Directives as follows:

- 2006/95/EC; Low-Voltage Directive (safety)
- 2004/108/EC; Electromagnetic Compatibility Directive (EMC)

Online Product Certification

To obtain product certifications and the Declaration of Conformity (DoC) for this product, visit ni.com/certification, search by model number or product line, and click the appropriate link in the Certification column.

Environmental Management

NI is committed to designing and manufacturing products in an environmentally responsible manner. NI recognizes that eliminating certain hazardous substances from our products is beneficial to the environment and to NI customers.

For additional environmental information, refer to the *NI and the Environment* Web page at ni.com/environment. This page contains the environmental regulations and directives with which NI complies, as well as other environmental information not included in this document.

Waste Electrical and Electronic Equipment (WEEE)



EU Customers At the end of the product life cycle, all products *must* be sent to a WEEE recycling center. For more information about WEEE recycling centers, National Instruments WEEE initiatives, and compliance with WEEE Directive 2002/96/EC on Waste and Electronic Equipment, visit ni.com/environment/weee.

电子信息产品污染控制管理办法（中国 RoHS）



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