

GETTING STARTED GUIDE

NI Digital Multimeters

**For the NI PCMCIA-4050, NI PXI/PCI-4060,
NI PXI/PCI-4070, and NI PXI-4072**

This document explains how to install, configure, test, and set up an NI PCMCIA-4050, NI PXI/PCI-4060, NI PXI/PCI-4070, or NI PXI-4072 National Instruments digital multimeter (DMM) for common measurements. For more information on the DMM, such as features and programming, refer to the *NI Digital Multimeters Help* file at **Start»Programs»National Instruments»NI-DMM»Documentation»NI Digital Multimeters Help**.

Detailed specifications about the DMM are available in the specifications document included with the DMM.

For the most current versions of specifications and other documentation, visit ni.com/manuals.



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Conventions

The following conventions are used in this manual:

- » The » symbol leads you through nested menu items and dialog box options to a final action. The sequence **File»Page Setup»Options** directs you to pull down the **File** menu, select the **Page Setup** item, and select **Options** from the last dialog box.
- ◆ The ◆ symbol indicates that the following text applies only to a specific product.
-  This icon denotes a tip, which alerts you to advisory information.
-  This icon denotes a note, which alerts you to important information.



This icon denotes a caution, which advises you of precautions to take to avoid injury, data loss, or a system crash. When this symbol is marked on a product, refer to the *Read Me First: Safety and Radio-Frequency Interference* document included with the device for precautions to take.

bold

Bold text denotes items that you must select or click in the software, such as menu items and dialog box options. Bold text also denotes parameter names.

DMM

Digital multimeter—refers to the NI PCMCIA-4050, NI PXI-4060, NI PCI-4060, NI PXI-4070, NI PCI-4070, or NI PXI-4072.

italic

Italic text denotes variables, emphasis, a cross reference, hardware labels, or an introduction to a key concept. This font also denotes text that is a placeholder for a word or value that you must supply.

monospace

Text in this font denotes text or characters that you should enter from the keyboard and programming examples. This font is also used for the proper names of disk drives, paths, directories, programs, and filenames.

*monospace
italic*

Italic text in this font denotes text that is a placeholder for a word or value that you must supply.

NI 4050

Refers to the NI PCMCIA-4050.

NI 4060

Refers to the NI PXI/PCI-4060.

NI 4070

Refers to the NI PXI/PCI-4070.

NI 4072

Refers to the NI PXI-4072.

1. Verifying the System Requirements

This section specifies the minimum system requirements and recommended system for NI-DMM 2.3 and later.

Minimum System Requirements

- Processor: Pentium 200 MHz or equivalent
- RAM: 64 MB
- PXI chassis and controller, desktop computer, or laptop with a PCMCIA slot
- 1/8 in. flathead screwdriver
- Number 1 Phillips screwdriver

Recommended System

- Processor: Pentium III/Celeron 600 MHz or equivalent
- RAM: 256 MB
- One of the following operating systems:
 - Windows 2000
 - Windows NT 4.0 service pack 6
 - Windows XP
- One of the following Application Development Environments (ADEs) and associated documentation:
 - NI LabVIEW 7.0 or later
 - NI LabWindows™/CVI™ 6.0 or later
 - Microsoft Visual C++ 6.0 or later
 - Microsoft Visual Basic 6.0



Note Waveform acquisition performance at full rate (1.8 MS/s) on the NI 4070/4072 depends highly on system-specific factors such as CPU speed, memory architecture, and system chipset characteristics. Simultaneous acquisitions on multiple NI 4070/4072 devices or acquisitions of longer durations may require a faster processor or more memory. Other applications running at the same time may also affect performance.

2. Unpacking

The DMM ships in an antistatic package to prevent electrostatic discharge (ESD). ESD can damage several components on the DMM.



Caution *Never touch the exposed pins of connectors.*

To avoid damage in handling the DMM, take the following precautions:

- Ground yourself using a grounding strap or by touching a grounded object.
- Touch the antistatic package to a metal part of the computer chassis before removing the DMM from the package.

Remove the DMM from the package and inspect it for loose components or any sign of damage. Notify NI if the DMM appears damaged in any way. Do *not* install a damaged DMM into the computer or chassis.

Store the DMM in the antistatic envelope when not in use.

3. Verifying the Kit Contents

To set up and use the DMM, you need the following items:

- DVD-sized case, which includes the following items:
 - NI-DMM driver software CD, which includes the *NI Digital Multimeters Help*



Note The NI PCI-4070 requires NI-DMM 2.2 or later. The NI 4072 requires NI-DMM 2.3 or later.

- *NI Digital Multimeters Getting Started Guide*
- *NI-DMM Instrument Driver Quick Reference Guide*
- NI 4050, NI 4060, or NI 4070/4072
- Test probes
- Specifications document included with the DMM
- Read Me First: Safety and Radio-Frequency Interference*

4. Installing the Software

Complete the following steps to install the software before installing the DMM.

1. Install an application development environment (ADE) such as NI LabVIEW, NI LabWindows/CVI, Microsoft Visual C++, or Microsoft Visual Basic.
2. Install the NI-DMM instrument driver software according to the instructions on the CD included with the DMM.

5. Installing the Hardware



Cautions You *must* power off the PC or PXI chassis before installing the DMM hardware.

To prevent damage to the DMM due to ESD or contamination, handle the device using the edges or the metal bracket.



Notes Install the NI-DMM software before installing the hardware.

Refer to [Appendix B: Chassis Recommendations](#) for more information about installing the DMM hardware in a PC or PXI chassis.

Installing the PXI DMM

To install the PXI DMM, refer to Figure 1 and complete the following steps:

1. Power off the PXI chassis.
2. Slide the PXI DMM into an available slot until the ejector handle locks in the up position.
3. Secure the PXI DMM with the screw provided.
4. Power on the PXI chassis.

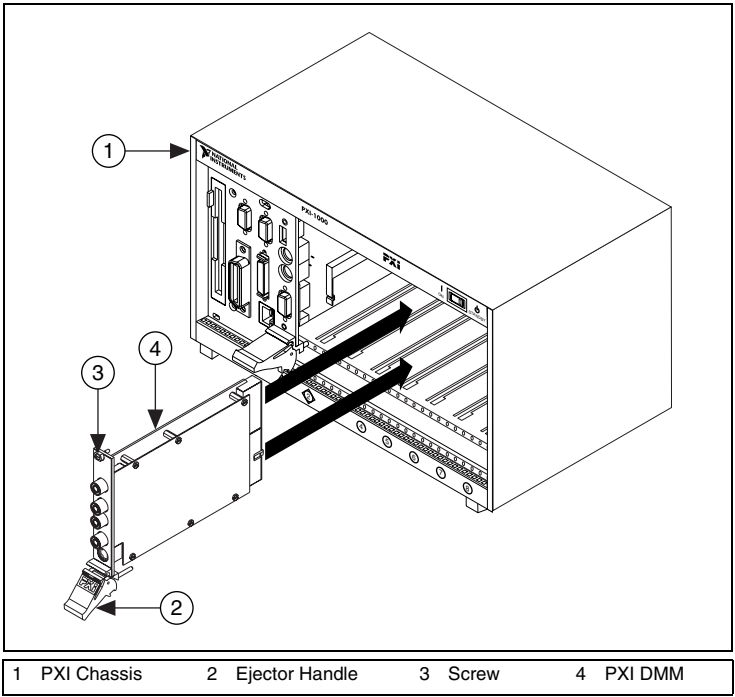


Figure 1. PXI Installation

Installing the PCI DMM

To install the PCI DMM, refer to Figure 2 and complete the following steps:

1. Power off the PC and remove the cover.
2. Insert the PCI DMM into an open PCI slot.
3. Secure the PCI DMM with the screw provided.
4. Replace the PC cover.
5. Power on the computer.

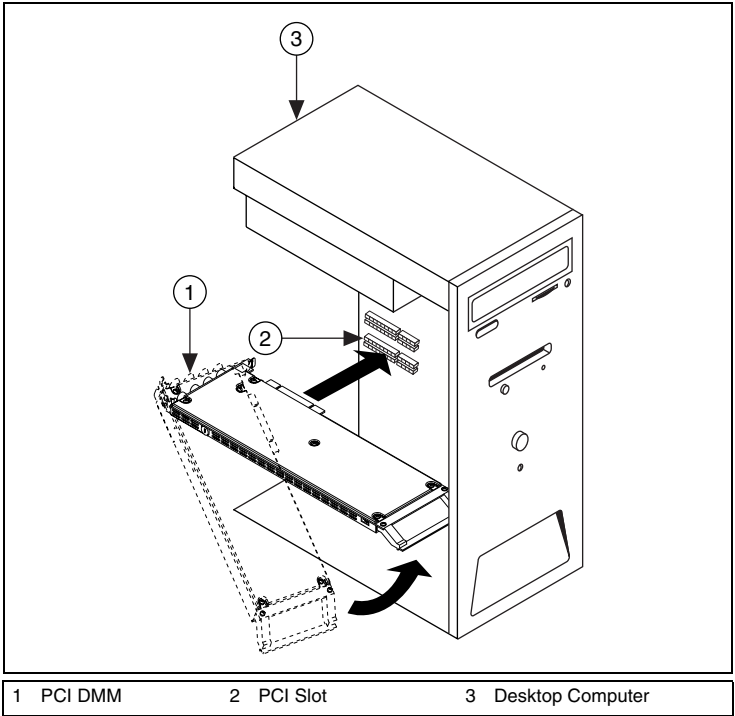


Figure 2. PCI Installation

Installing the PCMCIA DMM

To install the PCMCIA DMM, insert the PCMCIA DMM into an open PCMCIA slot as shown in Figure 3.

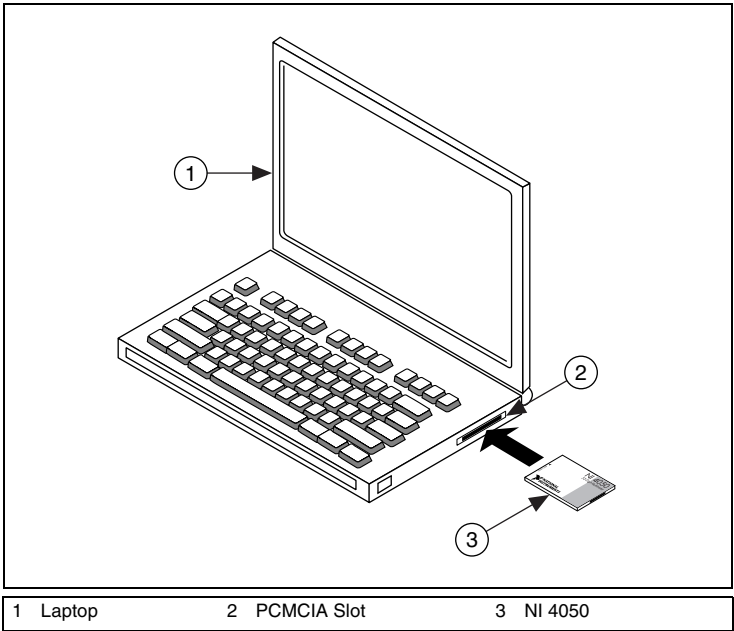


Figure 3. PCMCIA Installation

6. Configuring and Testing in MAX

To configure and test the DMM in Measurement & Automation Explorer (MAX), complete the following steps:

1. Launch MAX (**Start»Programs»National Instruments»Measurement & Automation**). MAX detects the DMM you installed.
2. Expand **Devices and Interfaces**.

If you are using a DMM with the LabVIEW Real-Time Module, expand **Remote Systems**. Find your target device IP address or name, expand it, and then expand **Devices and Interfaces**.

3. Check that your DMM appears under Devices and Interfaces.

The DMMs appear in the Traditional NI-DAQ and NI-DAQmx folders in Devices and Interfaces, as follows.

Device	Folder Name
NI 4050 NI 4060	Traditional NI-DAQ
NI PXI-4070	Traditional NI-DAQ/NI-DAQmx
NI PCI-4070 NI 4072	NI-DAQmx



Note If the DMM is not listed, press <F5> to refresh the list. If MAX does not recognize the DMM, refer to ni.com/support/install for troubleshooting information.

When the NI PXI-4070, which is supported by both Traditional NI-DAQ and NI-DAQmx, is present with both versions of NI-DAQ, the NI PXI-4070 is listed with a different name under the Traditional NI-DAQ and NI-DAQmx folders in Devices and Interfaces.

Only NI-DAQmx devices are listed under **Remote Systems»Devices and Interfaces**.

- Under the folder where your DMM appears, right-click your DMM.
 - To test the DMM, perform one of the following steps.
 - If the DMM is under Traditional NI-DAQ, select **Properties** and then click **Test Resources** in the Properties window.
 - If the device is under NI-DAQmx, select **Self-Test**. If you need help during the self-test, open the *Measurement & Automation Explorer Help for NI-DAQmx* by selecting **Help»Help Topics**. When the self-test finishes, a message indicates a successful verification or the occurrence of an error. If an error occurs, refer to ni.com/support for troubleshooting information.



Note If the DMM does not pass the test, power off the PC, remove the DMM, and repeat the appropriate hardware installation procedure. If the DMM still does not pass the test, refer to ni.com/support.

- (NI-DAQmx Devices Only) To perform self-calibration, select **Self-Calibrate**. The DMM must warm up for at least 60 minutes before self-calibrating.

- ◆ Steps 5 and 6 apply to the NI 4050/4060 only.
- 5. Right-click the NI 4050/4060, and click **Test Panels** to run the functional test panels and to use the DMM. Refer to the 7. *Connecting Signals* section to connect a signal to the DMM.



Note The **Run Test Panels** option currently is *not* available for the NI 4070/4072. Run the DMM Soft Front Panel (SFP) to run functional tests of the NI 4070/4072. You can launch the DMM SFP from **Start»Programs»National Instruments»NI-DMM»NI-DMM Soft Front Panel**.

- 6. Click **Close** to close the test panels for the NI 4050/4060.

7. Connecting Signals

The following sections explain how to connect signals to the DMM front panel connectors for common measurements. To learn more about these measurements, refer to the *NI Digital Multimeters Help* at **Start»Programs»National Instruments»NI-DMM»Documentation»NI Digital Multimeters Help**.



Caution Always refer to the specifications document included with the DMM *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 DMM. NI is *not* liable for any damage or injuries resulting from incorrect signal connections.

DC and AC Voltage

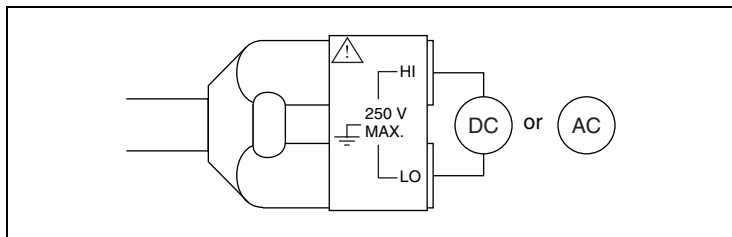


Figure 4. NI 4050 Signal Connections for Voltage Measurements

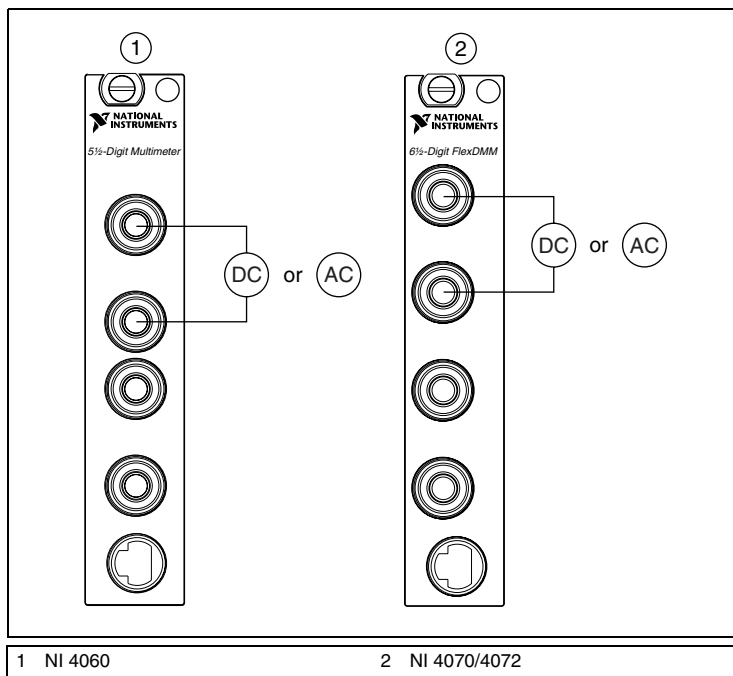


Figure 5. NI 4060 and NI 4070/4072 Signal Connections for Voltage Measurements

DC and AC Current

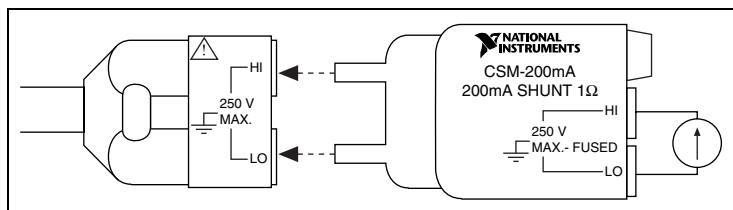


Figure 6. NI 4050 Signal Connections for Current Measurements



Note To measure current, the NI 4050 requires the NI CSM-200mA current shunt module (shown in Figure 6), which is available from NI.

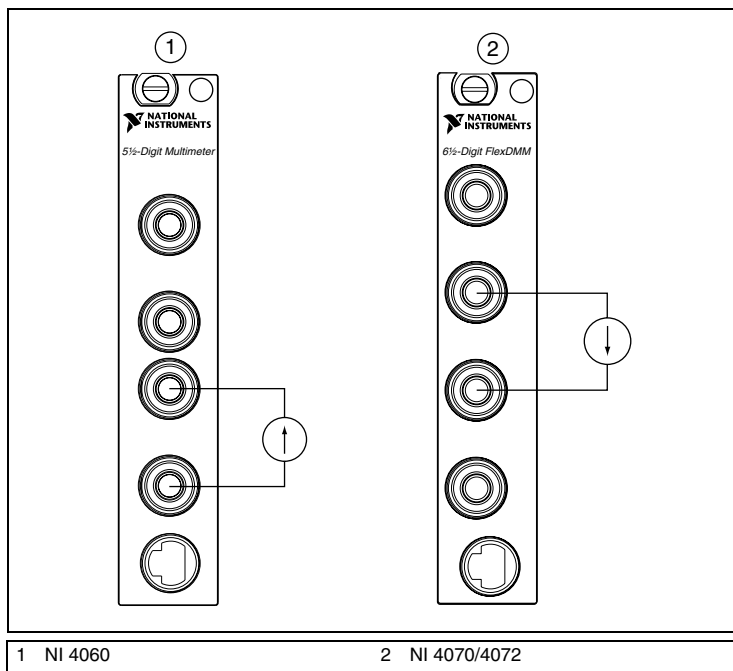


Figure 7. NI 4060 and NI 4070/4072 Signal Connections for Current Measurements



Tip To measure current beyond the specifications of the NI 4060 and NI 4070/4072, a 10 A current shunt module, the NI CSM-10A, is available from NI. Refer to the *NI CSM-10A/200mA Installation Guide* at ni.com/manuals for more information. Refer to ni.com/instruments for purchasing information.

2-Wire Resistance

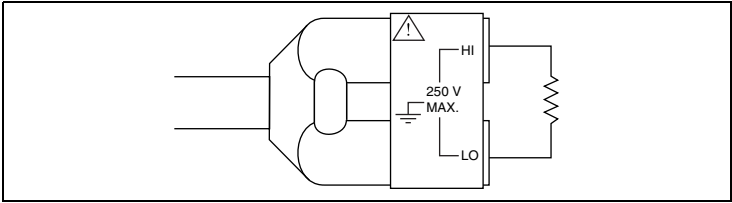
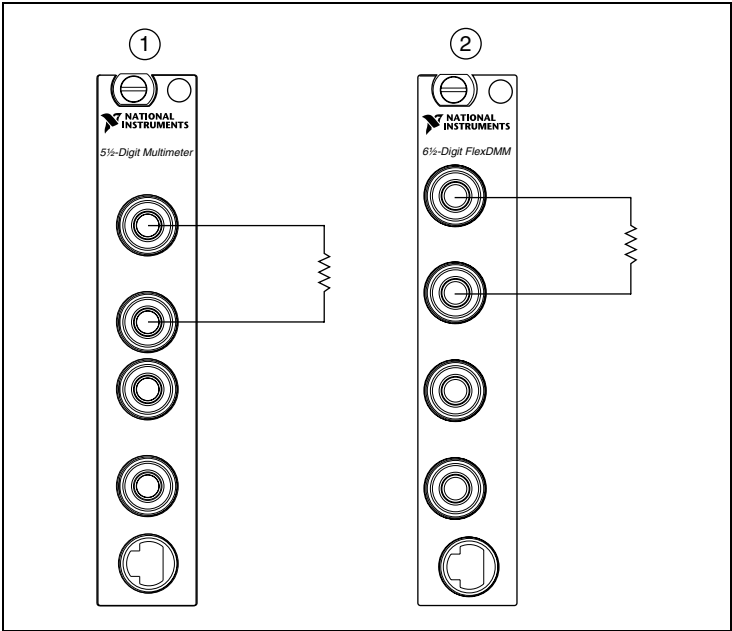


Figure 8. NI 4050 Signal Connections for 2-Wire Resistance Measurements



1 NI 4060

2 NI 4070/4072

Figure 9. NI 4060, NI 4070/4072 Signal Connections for 2-Wire Resistance Measurements

4-Wire Resistance

4-wire resistance measurements use both pairs of terminals, which allows you to measure low resistances accurately by eliminating the effects of lead resistance.



Note The NI 4050 does not support 4-wire resistance measurements.

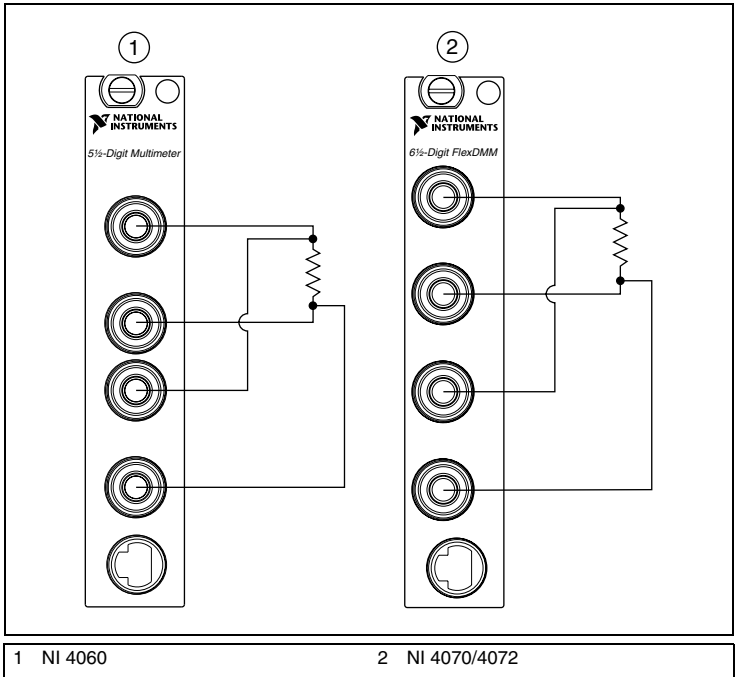


Figure 10. NI 4060 and NI 4070/4072 Signal Connections for 4-Wire Resistance Measurements

Voltage Drop Across a Diode

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

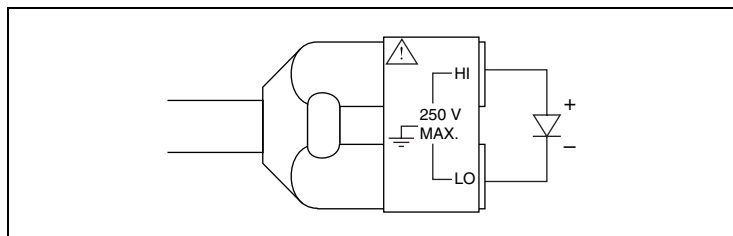
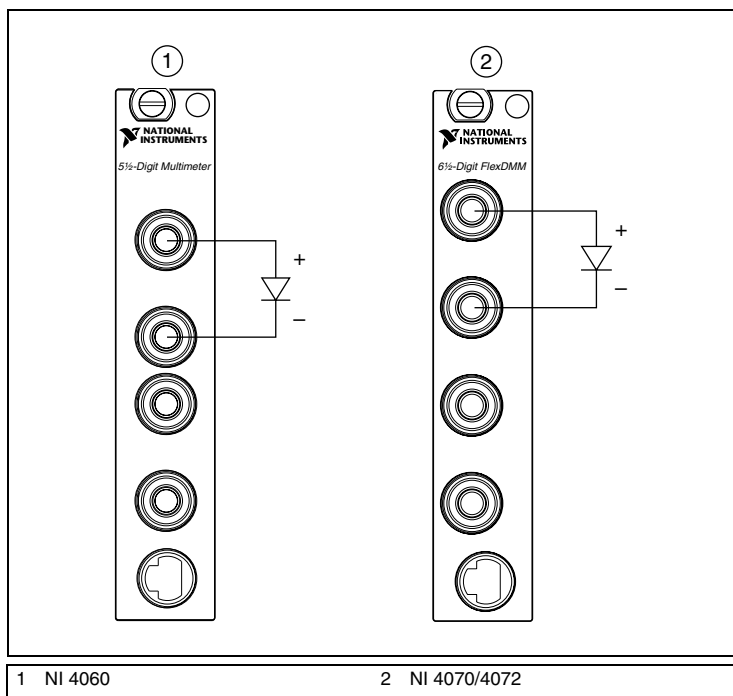


Figure 11. NI 4050 Signal Connections for Diode Measurements



1 NI 4060

2 NI 4070/4072

Figure 12. NI 4060 and NI 4070/4072 Signal Connections for Diode Measurements

Using Cables and Probes

The DMM kit contains a pair of test probes with safety banana jacks. These probes meet international safety requirements, including UL 3111 and IEC 1010-1, for the full range of applications supported by the DMM.



Caution Before using any probes or accessories not supplied by NI, ensure that they meet applicable safety requirements for the signal levels you may encounter.

Connect the test probes to the DMM front panel connectors using safety banana jacks. The shrouds around the banana jacks prevent you from contacting potentially hazardous voltages connected to the test probes. You also can connect the cable to standard, unshrouded banana jack probes or accessories. Use unshrouded probes or accessories only when the voltages are less than $30 V_{\text{rms}}$ and $42 V_{\text{pk}}$, or 60 VDC.



Cautions NI 4050 users—To prevent possible safety hazards, the maximum voltage between either of the inputs and the ground of the computer should never exceed ± 250 VDC or $250 V_{\text{rms}}$.

NI 4060 users—To prevent possible safety hazards, the maximum voltage between either of the inputs and the ground of the computer should never exceed ± 300 VDC or $300 V_{\text{rms}}$. The maximum current that the NI 4060 can measure between the current inputs is ± 200 mA DC or $200 \text{ mA}_{\text{rms}}$.

NI 4070 and NI 4072 users—To prevent possible safety hazards, the maximum voltage between either of the inputs and the ground of the computer should never exceed ± 300 VDC or $300 V_{\text{rms}}$. The maximum current that the NI 4070 or NI 4072 can measure between the current inputs is ± 1 A DC or 1 A_{rms} .

8. Programming the DMM

You can acquire data with the DMM by using the DMM SFP or the NI-DMM instrument driver in your application, and you can run the NI-DMM examples to demonstrate the functionality of the DMMs.

DMM Soft Front Panel

The DMM SFP is a software representation of a traditional benchtop DMM. Use the DMM SFP to test the basic functionality of the DMM and become familiar with its operation.

You can launch the DMM SFP from **Start»Programs»National Instruments»NI-DMM»NI-DMM Soft Front Panel**.

NI-DMM Instrument Driver

NI-DMM features a set of operations and attributes that exercise all the functionality of the DMM, including configuration, control, and other module-specific functions. NI-DMM controls all NI digital multimeters.

Refer to the *Programming* section of the *NI Digital Multimeters Help* at **Start»Programs»National Instruments»NI-DMM»Documentation»NI Digital Multimeters Help** for information on using NI-DMM in your applications.

NI-DMM Examples

The NI-DMM examples are instructional tools that demonstrate some of the functionality of the DMMs that you can use or integrate into your systems. NI-DMM includes examples covering single point measurements, multipoint measurements, triggering, waveform acquisitions (NI 4070/4072 only), and performance (NI 4070/4072 only).

The following table shows the location of the NI-DMM examples for all supported ADEs.

ADE	Location
LabVIEW	<LabVIEW>\examples\instr\niDMM
CVI	<CVI>\samples\niDMM
C/C++ ^{1,2}	<Measurement Studio>\VC\Examples\niDMM
VB ^{1,2}	<Measurement Studio>\VB\Samples\niDMM

¹ Not all examples are available for Visual C/C++ and Visual Basic.
² Any C and VB examples installed by a previous version of NI-DMM are copied to `VXIpnp\WinNT\NIDMM\Examplesxx`, where `xx` is the previous version number of NI-DMM. Delete this directory if you do not need the old examples.



Tip For best accuracy, NI 4070/4072 users should run the Self-Cal example after their device has been installed and has warmed up.

Refer to the *NI-DMM Programming Examples* section of the *NI Digital Multimeters Help* at **Start»Programs»National Instruments»NI-DMM»Documentation»NI Digital Multimeters Help** for a complete example list. Refer to ni.com/zone for examples that use National Instruments DMMs with National Instruments switch modules.

Appendix A: Front Panels

This appendix shows the front panels for National Instruments DMMs.

PXI/PCI

The PXI and PCI front panels contain five connectors—four shrouded banana jacks and one 9-pin connector. Figure 13 shows the front panels for the NI 4060 and the NI 4070/4072.

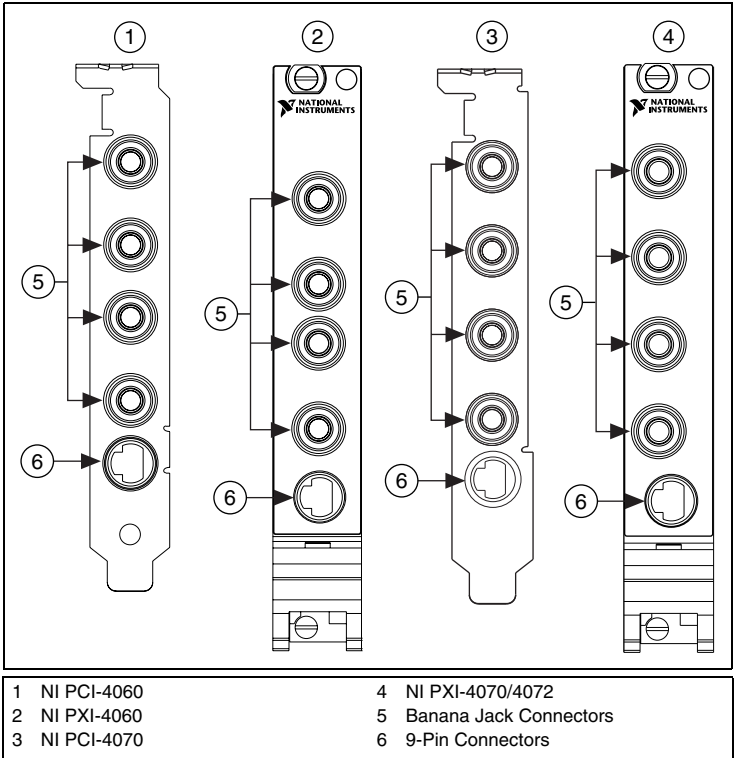


Figure 13. Connections on the PXI and PCI Devices

The four banana jacks are high-voltage, safety signal connectors. The 9-pin connector labeled *AUX I/O* is a digital signal connector, which carries TTL-level triggering signals for use with external scanning equipment.

Refer to the *NI Digital Multimeters Help*, located at **Start»Programs»National Instruments»NI-DMM»Documentation»NI Digital Multimeters Help**, for information about scanning.

PCMCIA



Caution To measure current with the NI PCMCIA-4050, you *must* use a current shunt. Refer to the *DC and AC Current* section for more information.

An accessory cable connects the NI PCMCIA-4050 to a pair of test probes equipped with shrouded banana jacks. Both the accessory cable and the test probes ship with the NI PCMCIA-4050.

Refer to Figure 14 to connect the accessory cable to the NI PCMCIA-4050. The accessory cable connector is polarized so that it cannot be plugged in incorrectly.

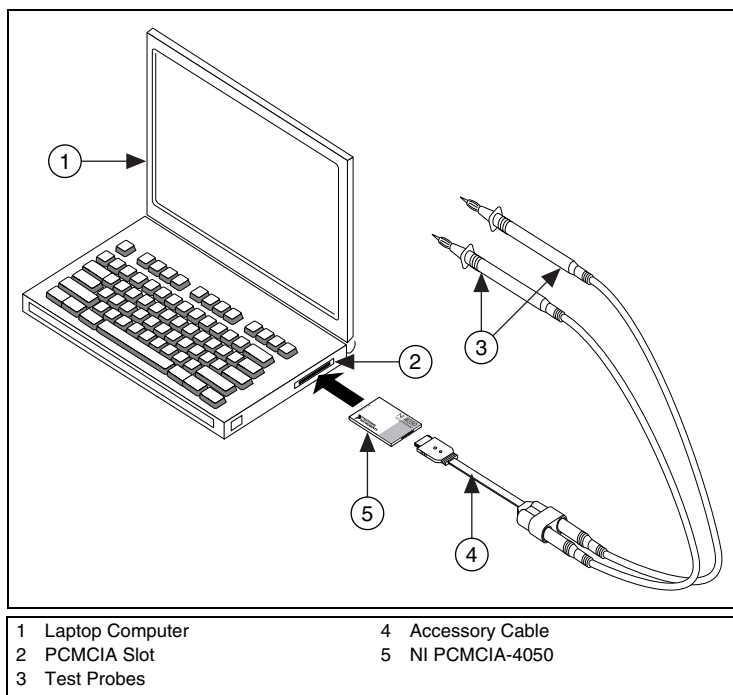


Figure 14. Connecting Cables and Probes to the NI PCMCIA-4050

Appendix B: Chassis Recommendations

This appendix specifies the recommended chassis components and conditions for a system that includes National Instruments DMMs.

PXI Chassis Recommendations

The NI PXI-4060, NI PXI-4070, and NI PXI-4072 are designed to operate in any PXI-compliant chassis. Normal operating conditions for these DMMs include the following:

- All PXI filler panels must be installed in empty slots.
- The PXI chassis fans that provide forced air must remain unobstructed to allow for proper cooling of the PXI chassis, devices, and controller.
- Routine maintenance of the chassis cooling fan filters must be performed to assure continuous cooling effectiveness.

Temperature rise on a module within a chassis can vary with slot position. You can keep this variation to a minimum by taking the precautions previously listed.

PCI Chassis Recommendations

The NI PCI-4060 and NI PCI-4070 are designed to operate in any ATX-compliant industrial or personal computer. Normal operating conditions for these DMMs include the following:

- All covers for the industrial chassis or personal computer must be installed.
- All PCI filler panels must be installed to close off unused PCI slots.



Caution For optimal electromagnetic compatibility (EMC) performance and input protection, you *must* install the front panel screw.

- The PCI front panel bracket on the NI PCI-4060 and NI PCI-4070 must have a firm, direct, metal-to-metal mounting connection to ensure proper grounding. Some computer manufacturers use a securing lever made of plastic; such a lever is unacceptable for safety reasons and must be removed. Also, the PCI devices must be screwed down. If the chassis does not meet these requirements, you must use a different computer chassis.

The cooling capability of most industrial and personal computers is less effective than the cooling capability in a PXI chassis. The NI PCI-4060 dissipates low enough power that additional cooling is not needed in most computers. The NI PCI-4070 dissipates higher power, and NI strongly

recommends that NI PCI-4070 users implement the following precautions to maximize the cooling capability of the computer:

- Install an additional 80 mm, 32 cubic ft/min (CFM) fan that forces air towards the NI PCI-4060 or NI PCI-4070. Most computer chassis contain one or two mounting locations for this type of fan. These fans are inexpensive and readily available at most computer supply stores.



Note If the hard drive mounts vertically in front of the fan mounting location(s) in the computer chassis, you must move the hard drive to a horizontal 3.5 in. drive bay or to another suitable location that does not obstruct the fan mounting location(s).

- Add additional fans, such as PCI fan cards and chassis fans, to increase the air circulation inside the computer.

Appendix C: Fuse Replacement

This appendix explains how to replace the fuse in the NI 4060 and NI 4070/4072.



Note The NI 4050 does not have a user-replacable fuse.

Replace the fuse with one of the fuse types listed in Table 1. To replace the fuse in the NI CSM-10A or NI CSM-200mA shunt modules, refer to the *NI CSM-10A/200mA Installation Guide* at ni.com/manuals.



Caution For continued protection against fire, replace the fuse only with fuses of the same type and rating. Refer to Table 1 for fuse types.

Table 1. Appropriate Fuses for the NI 4060 and NI 4070/4072

DMM	Fuse Rating	Fuse Type	Manufacturer
NI 4060	500 mA/250 V	Fast acting	Schurter
	500 mA/250 V	Fast acting	Littelfuse
NI 4070 and NI 4072	1.25 A/250 V	Fast acting	Littelfuse

NI 4060

To replace the fuse, complete the following steps:

- ◆ NI PXI-4060
- 1. Remove all front panel connections from the NI PXI-4060.
- 2. Power down the chassis and remove the device.
- 3. Hold the device at the angle shown in Figure 15, and locate the fuse holder.

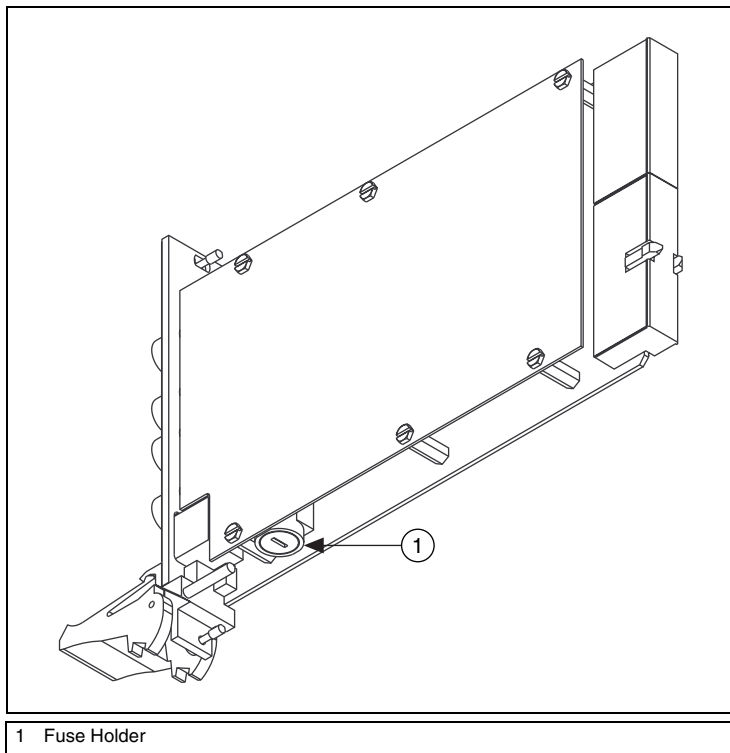


Figure 15. Removing the Fuse from the NI PXI-4060

- 4. Insert a screwdriver into the slot on the fuse holder.
- 5. Turn counterclockwise.
- 6. Pull out the holder and remove the 5×20 mm glass fuse.
- 7. Visually verify that the fuse is blown.

8. Insert a new fuse into the holder and slide the holder back into place.
9. Turn the fuse holder clockwise until it snaps shut.

◆ NI PCI-4060

1. Remove all front panel connections from the NI PCI-4060.
2. Power off the computer and remove the device.
3. Remove the four screws that secure the top and bottom insulators onto the device, as shown in Figure 16.

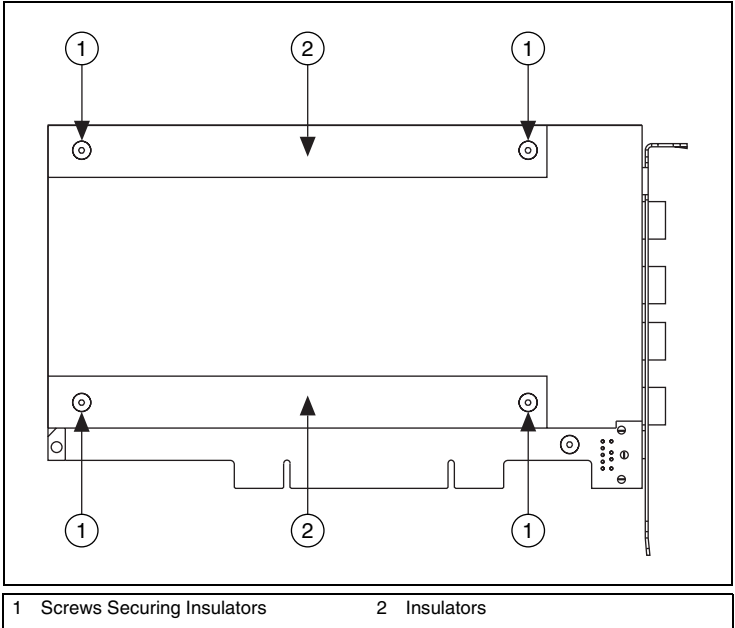


Figure 16. Removing the Insulators from the NI PCI-4060

4. Remove the bottom and top insulators.
5. Locate the 5 × 20 mm glass fuse shown in Figure 17.

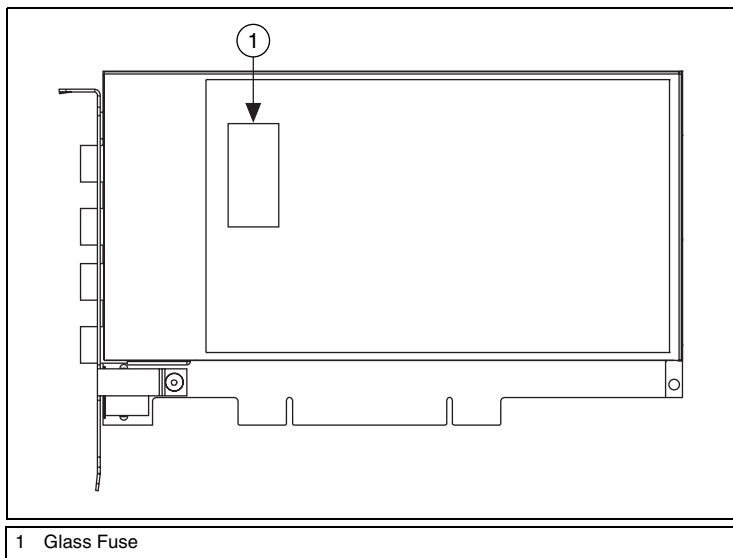


Figure 17. Removing the Fuse from the NI PCI-4060

6. Visually verify that the fuse is blown and remove it.
7. Press the new fuse into the silver holding fixture until you hear a snap.



Caution Do *not* operate the NI PCI-4060 without both insulators replaced and secured.

8. Reattach the top and bottom insulators in the opposite order that you removed them.

NI 4070/4072

◆ NI PXI-4070 and NI PXI-4072

To replace the fuse, complete the following steps:

1. Remove all front panel connections from the NI PXI-4070 or NI PXI-4072.
2. Power off the chassis and remove the NI PXI-4070 or NI PXI-4072.
3. Locate the fuse hole shown in Figure 18.

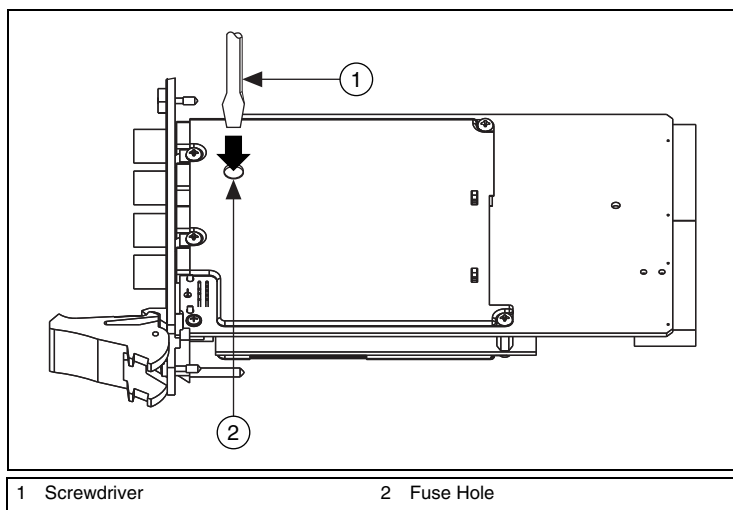


Figure 18. Removing the Fuse from the NI PXI-4070 and NI PXI-4072

4. Insert a screwdriver into the hole.
5. Gently press the fuse with the screwdriver until one of the fuse clamps releases.



Caution Do not cover the fuse slot on the opposite side of the NI PXI-4070 or NI PXI-4072 with your hand, as doing so may cause injury.

6. Locate the fuse slot shown in Figure 19.

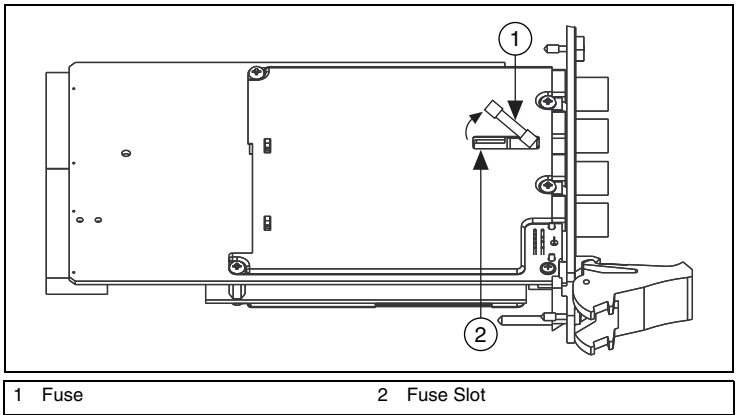


Figure 19. Removing the Fuse from the NI PXI-4070 or NI PXI-4072

7. Pry the fuse loose from the slot.
8. Visually verify that the fuse is blown.
9. Insert a new fuse into the fuse slot, as shown in Figure 20.

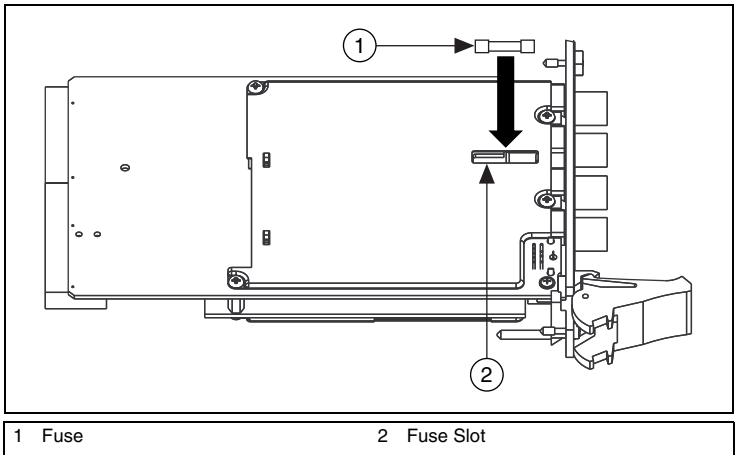
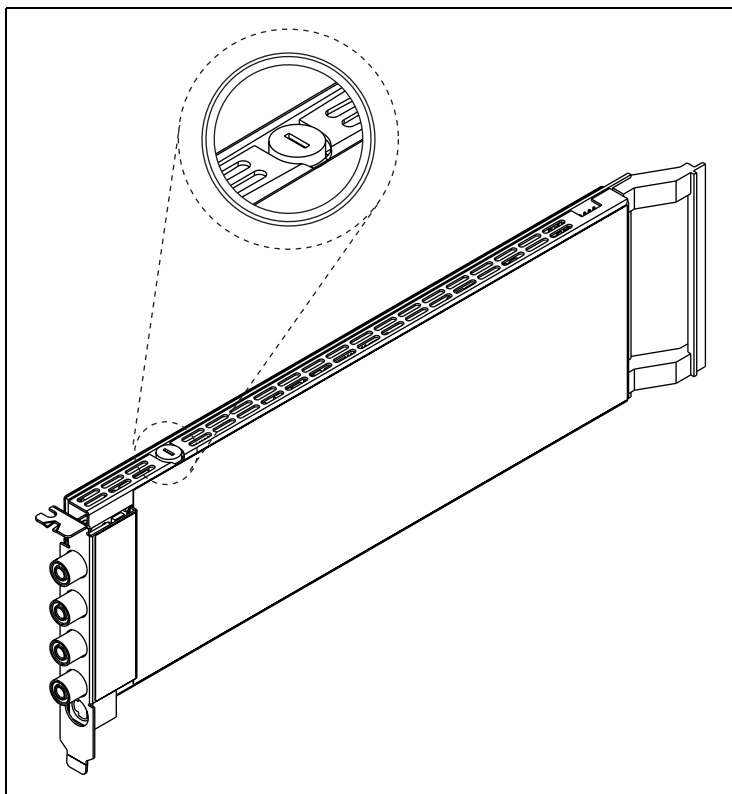


Figure 20. Replacing the Blown Fuse in the NI PXI-4070 or NI PXI-4072

10. Gently press the fuse with the screwdriver until both fuse clamps snap the fuse into place.

◆ NI PCI-4070

1. Remove all front panel connections from the NI PCI-4070.
2. Power down the chassis and remove the device.
3. Hold the NI PCI-4070 at the angle shown in Figure 21, and locate the fuse holder.
4. Insert a screwdriver into the slot on the fuse holder.
5. Turn counterclockwise.
6. Pull out the fuse holder and remove the 5×20 mm fuse.
7. Visually verify that the fuse is blown.
8. Insert a new fuse into the holder and slide the holder back into place.
9. Turn the fuse holder clockwise until it snaps shut.



1 Fuse Holder

Figure 21. Removing the Fuse from the NI PCI-4070

Appendix D: Technical Support Resources

NI Web Support

National Instruments Web support is your first step for help in solving installation, configuration, and application problems and questions. Online problem-solving and diagnostic resources include frequently asked questions, knowledge bases, product-specific troubleshooting wizards, manuals, drivers, software updates, and more. Web support is available through the Technical Support section of ni.com.

A Declaration of Conformity (DoC) is our claim of compliance with the Council of the European Communities using the manufacturer's declaration of conformity. This system affords the user protection for electronic compatibility (EMC) and product safety. You can obtain the DoC for your product by visiting ni.com/certification. If your product supports calibration, you can obtain the calibration certificate for your product at ni.com/calibration.

Worldwide Support

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Finland 385 0 9 725 725 11, France 33 0 1 48 14 24 24,
Germany 49 0 89 741 31 30, India 91 80 51190000, Israel 972 0 3 6393737,
Italy 39 02 413091, Japan 81 3 5472 2970, Korea 82 02 3451 3400,
Malaysia 603 9131 0918, Mexico 01 800 010 0793,
Netherlands 31 0 348 433 466, New Zealand 0800 553 322,
Norway 47 0 66 90 76 60, Poland 48 22 3390150,
Portugal 351 210 311 210, Russia 7 095 783 68 51,
Singapore 65 6226 5886, Slovenia 386 3 425 4200,
South Africa 27 0 11 805 8197, Spain 34 91 640 0085,
Sweden 46 0 8 587 895 00, Switzerland 41 56 200 51 51,
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