

# Getting Started with the NI PCIe-1429

The NI PCIe-1429 is a highly flexible PCI Express (PCIe) image acquisition device that supports Base, Medium, and Full configuration Camera Link-compatible cameras. The following sections describe how to get started using the NI 1429.

## Installing the NI 1429

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The following section contains a list of necessary and optional items for acquiring images with the NI 1429. This section also explains how to unpack, configure, and install the NI 1429.

### What You Need to Get Started

You need the following items to set up and use the NI 1429:

- Getting Started with IMAQ* CD Insert
- NI-IMAQ for Windows 2000/NT/XP and documentation



**Note** PDFs of the NI-IMAQ for Windows 2000/NT/XP documentation are installed on your computer at <NI-IMAQ>\Docs.

- PCIe computer with at least one x4 PCIe slot running Windows 2000/NT/XP



**Note** For some computers, a PCIe slot larger than x4 may be used. Refer to the [Installation](#) section for more information.

- Camera Link-compatible camera
- MDR 26-pin Camera Link cables:
  - One cable for Base configuration cameras
  - Two cables of the same length for Medium or Full configuration cameras

- ❑ Optional software packages and documentation:
  - IMAQ Vision for LabVIEW, LabWindows™/CVI™, or Measurement Studio (Visual Basic)
  - Vision Builder for Automated Inspection
  - LabVIEW
  - LabWindows/CVI
  - Measurement Studio

## Optional Equipment

National Instruments offers a variety of products for use with the NI 1429, including the following:

- IMAQ-1000 expansion device for enhanced input/output (I/O) capabilities
- 50-pin ribbon cable, used to connect the NI 1429 to the IMAQ-1000 device
- ATX power extension cable for the IMAQ-1000
- SMB to BNC cable, used for front panel trigger I/O
- RTSI bus cable, used to connect the NI 1429 to other IMAQ, Motion Control, or DAQ devices
- Other National Instruments IMAQ, Motion Control, or DAQ devices for enhanced triggering, timing, or I/O

For more specific information about these products, refer to the National Instruments catalog, visit [ni.com](http://ni.com), or call the National Instruments office nearest you.

## Safety Information



**Caution** The following paragraphs contain important safety information you *must* follow when installing and operating the device.

Do *not* operate the device in a manner not specified in the documentation. Misuse of the device may result in a hazard and may compromise the safety protection built into the device. If the device is damaged, turn it off and do *not* use it until service-trained personnel can check its safety. If necessary, return the device to National Instruments for repair.

Keep away from live circuits. Do *not* remove equipment covers or shields unless you are trained to do so. If signal wires are connected to the device, hazardous voltages can exist even when the equipment is turned off. To avoid a shock hazard, do *not* perform procedures involving cover or shield

removal unless you are qualified to do so. Disconnect all field power prior to removing covers or shields.

If the device is rated for use with hazardous voltages ( $>30 V_{\text{rms}}$ ,  $42.4 V_{\text{pk}}$ , or  $60 V_{\text{dc}}$ ), it may require a safety earth-ground connection wire. Refer to the device specifications for maximum voltage ratings.

Because of the danger of introducing additional hazards, do *not* install unauthorized parts or modify the device. Use the device only with the chassis, modules, accessories, and cables specified in the installation instructions. All covers and filler panels *must* be installed while operating the device.

Do *not* operate the device in an explosive atmosphere or where flammable gases or fumes may be present. Operate the device only at or below the pollution degree stated in the specifications. Pollution consists of any foreign matter—solid, liquid, or gas—that may reduce dielectric strength or surface resistivity. The following is a description of pollution degrees.

- Pollution Degree 1—No pollution or only dry, nonconductive pollution occurs. The pollution has no effect.
- Pollution Degree 2—Normally only nonconductive pollution occurs. Occasionally, nonconductive pollution becomes conductive because of condensation.
- Pollution Degree 3—Conductive pollution or dry, nonconductive pollution occurs. Nonconductive pollution becomes conductive because of condensation.

Clean the device and accessories by brushing off light dust with a soft, nonmetallic brush. Remove other contaminants with a stiff, nonmetallic brush. The unit *must* be completely dry and free from contaminants before returning it to service.

You *must* insulate signal connections for the maximum voltage for which the device is rated. Do *not* exceed the maximum ratings for the device. Remove power from signal lines before connection to or disconnection from the device.



**Caution** National Instruments measurement products may be classified as either Installation Category I or II. Operate products at or below the Installation Category level specified in the hardware specifications.

**Installation Category**<sup>1</sup>: Measurement circuits are subjected to working voltages<sup>2</sup> and transient stresses (overvoltage) from the circuit to which they

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<sup>1</sup> Installation Categories as defined in electrical safety standard IEC 61010-1.

<sup>2</sup> Working voltage is the highest rms value of an AC or DC voltage that can occur across any particular insulation.

are connected during measurement or test. Installation Category establishes standardized impulse withstand voltage levels that commonly occur in electrical distribution systems. The following is a description of Installation (Measurement<sup>1</sup>) Categories:

- Installation Category I is for measurements performed on circuits *not* directly connected to the electrical distribution system referred to as MAINS<sup>2</sup> voltage. This category is for measurements of voltages from specially protected secondary circuits. Such voltage measurements include signal levels, special equipment, limited-energy parts of equipment, circuits powered by regulated low-voltage sources, and electronics.
- Installation Category II is for measurements performed on circuits directly connected to the electrical distribution system. This category refers to local-level electrical distribution, such as that provided by a standard wall outlet (e.g., 115 V for U.S. or 230 V for Europe). Examples of Installation Category II are measurements performed on household appliances, portable tools, and similar products.
- Installation Category III is for measurements performed in the building installation at the distribution level. This category refers to measurements on hard-wired equipment such as equipment in fixed installations, distribution boards, and circuit breakers. Other examples are wiring, including cables, bus-bars, junction boxes, switches, socket-outlets in the fixed installation, and stationary motors with permanent connections to fixed installations.
- Installation Category IV is for measurements performed at the primary electrical supply installation (<1,000 V). Examples include electricity meters and measurements on primary overcurrent protection devices and on ripple control units.

## Unpacking

The NI 1429 ships in an antistatic package to prevent electrostatic discharge from damaging device components. To avoid such damage in handling the device, take the following precautions:

- Ground yourself via a grounding strap or by holding a grounded object, such as the computer chassis.
- Touch the antistatic package to a metal part of the computer chassis before removing the device from the package.



**Caution** *Never* touch the exposed pins of connectors.

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<sup>1</sup> Installation Category is also referred to as Measurement Category.

<sup>2</sup> MAINS is defined as the (hazardous live) electrical supply system to which equipment is designed to be connected for the purpose of powering the equipment. Suitably rated measuring circuits may be connected to the MAINS for measuring purposes.

Remove the device from the package and inspect it for loose components or any other signs of damage. Notify National Instruments if the device appears damaged in any way. Do *not* install a damaged device in the computer.

Store the NI 1429 in the antistatic package when not in use.

## Installation

The following instructions are for general installation. Refer to the documentation provided by your computer manufacturer for specific instructions and warnings. Refer to the [Specifications](#) section for a list of the typical power requirements for the device.

1. Install the NI-IMAQ driver software version 3.1 or later before installing the NI 1429 device.



**Note** For information about how to install NI-IMAQ, refer to the *Getting Started with IMAQ* CD Insert.

2. Power off and unplug the computer.



**Caution** To protect yourself and the computer from electrical hazards, the computer *must* remain unplugged until the installation is complete.

3. Remove the computer cover to expose access to the expansion slots.
4. Choose an unused x4 or larger PCIe slot, and remove the corresponding expansion slot cover on the back panel of the computer.

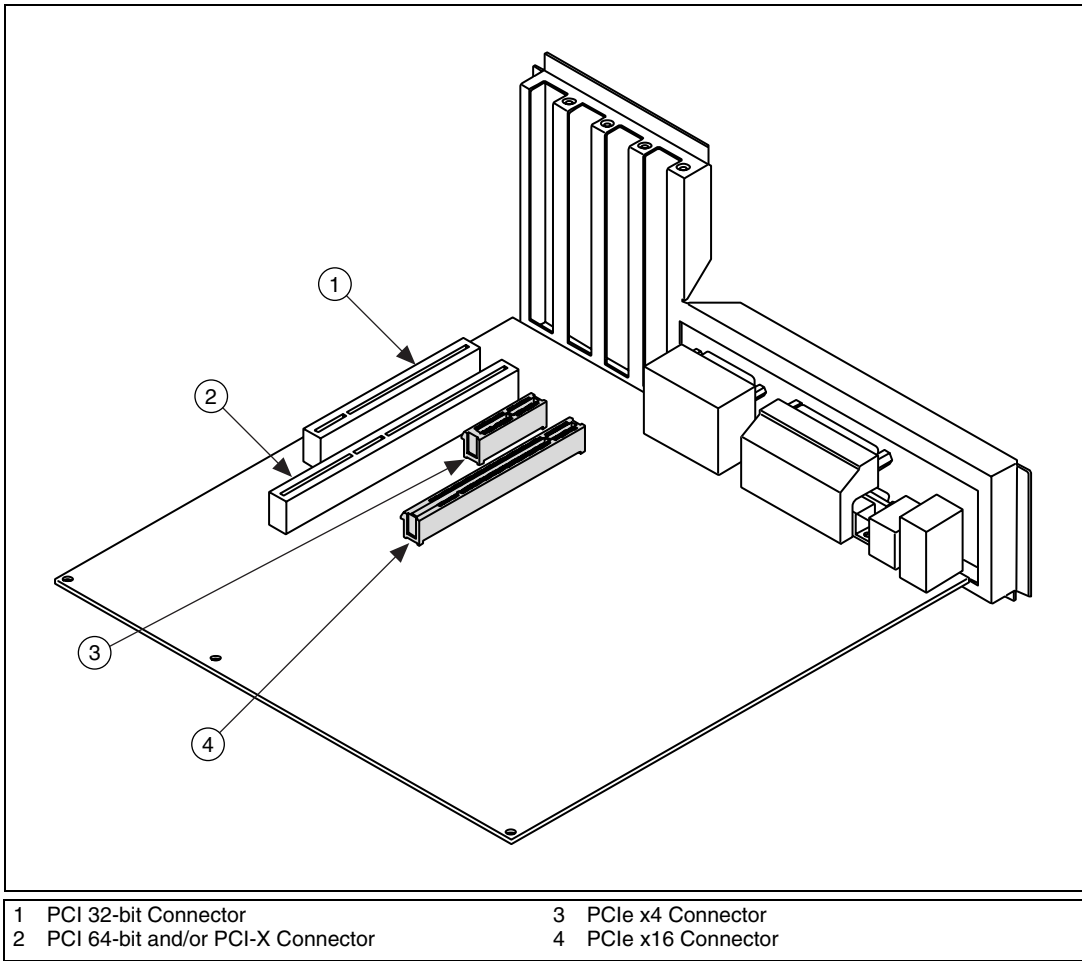


**Note** The NI 1429 device is intended for a x4 PCIe slot. It will not fit properly into a x1 PCIe slot. The NI 1429 will fit into, and can be used in, a x8 or x16 PCIe slot. Using a smaller width device in a larger width slot is called up-plugging. When up-plugging, some computers only support plug-in devices at the x1 data rate. If you plan to use the NI 1429 in an up-plugging configuration, with a camera that produces data faster than 200 MB/s, verify with your computer manufacturer that your computer will support a x4 plug-in device at a x4 data rate in the PC expansion slot you plan to use.

Refer to Figure 1 for a diagram that can help you identify different types of expansion slots in your computer.



**Caution** Installing a PCIe device into a PCI, PCI-X, AGP, or any non-PCIe slot can damage both the computer motherboard and the device. If you are unsure of the difference between connector types, do not install the device. Refer to the documentation provided by your computer manufacturer to determine the correct slot in which to install the NI 1429 device.



**Figure 1.** PC Expansion Slots

5. Touch a metal part on the computer case to discharge any static electricity that might be on your clothes or body before handling the NI 1429. Static electricity can damage the device.
6. Remove the NI 1429 from the antistatic package and gently rock the NI 1429 into the slot. The connection may be tight, but do *not* force the device into place.



**Note** Check that the bracket of the NI 1429 lines up with the hole in the back panel rail of the computer chassis.

7. Unless your computer secures expansion devices in a different manner, screw the mounting bracket of the device to the back panel rail of the computer.



**Note** If you will be using the IMAQ-1000 device, refer to the *IMAQ-1000 User Guide* for installation instructions.

8. Replace the cover.
9. Plug in and power on the computer.

Your NI 1429 is now installed.

## Configuring the NI 1429

After you have installed the NI 1429 and powered on your computer, Windows will recognize the device and assign resources to it. Use Measurement & Automation Explorer (MAX), the National Instruments configuration utility, to configure the NI 1429 for acquisition.



**Note** Ensure that you installed NI-IMAQ 3.1 or later before configuring the NI 1429 in MAX.

## Interfacing with the NI 1429

The Camera Link standard defines physical connections between image acquisition devices and Camera Link cameras, and it allows for flexibility of image format and data transfer protocols. The camera manufacturer defines image parameters, such as image resolution and the number of bits per pixel, and camera control parameters, such as frame-on-demand and exposure control signals.

These variable parameters are defined on a per-camera basis in a camera file (`<camera_model>.icd`) supplied by National Instruments. NI-IMAQ uses the information in this camera file to program the NI 1429 to acquire images from a specific camera. Without this camera file, the driver does not have the information necessary to configure the NI 1429 to recognize the image format of the particular camera you are using.

MAX provides a simple interface for associating a camera file with the NI 1429. Use the following guidelines to access the camera file in MAX:

1. Launch MAX.
2. Expand the **Devices and Interfaces** branch of the configuration tree.
3. Expand the **NI-IMAQ Devices** branch.
4. Expand the **NI PCIe-1429** branch.
5. Right-click **Channel 0** and select **Camera**.
6. Select your camera from the menu. If your camera is not in the menu, verify that the appropriate camera file is installed in the `Program Files\National Instruments\NI-IMAQ\Data` directory.

Many camera files are installed when you install NI-IMAQ, and many more are available for download from the National Instruments Camera Advisor at [ni.com/camera](http://ni.com/camera). You can also create your own camera files using the NI Camera File Generator. This utility can be downloaded from [ni.com/vision](http://ni.com/vision). When installing new camera files, save them to the Data folder located at Program Files\National Instruments\NI-IMAQ\Data.



**Note** If you lose communication with the camera during an acquisition for any reason, such as unplugging a cable or powering off your camera, you must restart the acquisition to allow the device to relock the incoming timing signals.



**Note** The NI 1429 device is equipped with a temperature monitor. The device will stop acquiring images if it reaches its maximum allowable temperature. An error will occur reporting that the maximum temperature has been reached.

Contact National Instruments technical support to request camera files not available in the Camera Advisor.

## Specifications

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These specifications are typical at 25 °C, unless otherwise stated.

### External Connections

Number of external trigger I/O lines .....1

External trigger lines

Voltage range.....0 to 5 V (TTL)

$V_{IH}$  min.....2.0 V

$V_{IL}$  max .....0.8 V

$V_{OH}$  min.....2.4 V at 8 mA source

$V_{OL}$  max .....0.55 V at 8 mA sink

Polarity .....Programmable, active-high  
or active-low

Power-on state .....Input (high-impedance)  
22.1 k $\Omega$  pull-down to ground

Camera interface.....Camera Link 1.1

## Clocks

Pixel clock frequency range ..... 20 to 85 MHz<sup>1</sup>



**Note** The Camera Link specification requires cameras to transmit at a minimum of 20 MHz.

## PCI Express Interface

Native link width..... x4

Up-plugging link width availability ..... x8, x16



**Note** Some system devices limit data transfer rates for plug-in devices in an up-plugging configuration. Refer to the documentation provided by your computer manufacturer to determine if your computer will support a x4 plug-in device at a x4 data rate in a larger slot.

## Serial Interface

Baud rates supported ..... 300, 600, 1200, 1800, 2000, 2400,  
3600, 4800, 7200, or 9600 bps;  
19.2, 38.4, or 56 kbps

## Power Requirements

Voltage ..... +12 V (1.25 A)<sup>2</sup>

## Physical

Dimensions..... 10.7 cm × 17.5 cm  
(4.2 in. × 6.9 in.)

Weight..... 205 g (7.23 oz)

## Environment

The NI PCIe-1429 device is intended for indoor use only.

Operating temperature..... 0 to 40 °C<sup>3</sup>

Storage temperature ..... -20 to 70 °C

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<sup>1</sup> This value corresponds to the serialized Camera Link cable transmission rate of 140 to 595 MHz.

<sup>2</sup> If you are using special firmware add-ons, this value is subject to change. Consult your firmware upgrade documentation for specific requirements.

<sup>3</sup> This temperature value was determined through testing the device in a Dell Precision 470 workstation with two adjacent plug-in devices each dissipating 11.6 W.

Relative humidity .....5 to 90%, noncondensing

Pollution Degree .....2

Approved at altitudes up to 2,000 m.

## Safety

The NI PCIe-1429 is designed to meet 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
- CAN/CSA-C22.2 No. 61010-1



**Note** For UL and other safety considerations, refer to the product label, or visit [ni.com/certification](http://ni.com/certification), search by model number or product line, and click the appropriate link in the Certification column.

## Electromagnetic Compatibility

Emissions .....EN 55011 Class A at 10 m  
FCC Part 15A above 1 GHz

Immunity .....EN 61326:1997 + A2:2001,  
Table 1

CE, C-Tick, and FCC Part 15 (Class A) Compliant



**Note** For EMC compliance, operate this device with shielded cabling. In addition, all covers and filler panels *must* be installed. Refer to the Declaration of Conformity (DoC) for this product for any additional regulatory compliance information. To obtain the DoC for this product, visit [ni.com/certification](http://ni.com/certification), search by model number or product line, and click the appropriate link in the Certification column.



**Note** The NI PCIe-1429 may experience temporary data interrupt if exposed to electrostatic discharge (ESD).

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