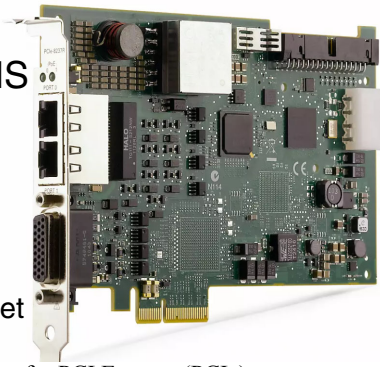


USER GUIDE AND SPECIFICATIONS

NI PCIe-8237R

GigE Vision Interface Device with Reconfigurable I/O and Power over Ethernet



The NI PCIe-8237R (NI 8237R) is a GigE Vision interface device for PCI Express (PCIe). The NI 8237R supports Power over Ethernet (PoE) and has a user-reconfigurable FPGA. This document describes how to install and configure the necessary hardware and software to use the NI 8237R.



Note You must install all required software before installing the hardware.

To access NI 8237R documentation after installation, navigate to **Start»All Programs»National Instruments»Vision»Documentation**.

The most recent versions of product documentation are available at ni.com/manuals. Visit ni.com/updates for the latest version of NI 8237R software.

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Required Components

The following items are necessary to set up and use the NI 8237R:

- ☐ NI 8237R image acquisition device
- ☐ GigE Vision camera
- ☐ Shielded Ethernet cable
- ☐ Computer running Microsoft Windows 7 (32-bit or 64-bit versions)/Vista (32-bit or 64-bit versions)/XP (32-bit) with at least one available x4 or larger PCIe slot.
- ☐ The following software packages:
 - LabVIEW 2011 or later
 - NI-IMAQ I/O 2.6.1 or later driver software, included with NI Vision Acquisition Software February 2013
 - NI-IMAQdx 4.1 or later driver software, included with NI Vision Acquisition Software February 2013

Optional Components

- ☐ Available 4-pin ATX peripheral power connector on computer's power supply for PoE
- ☐ The following software packages:
 - LabVIEW FPGA Module 2011 or later
 - NI Vision Development Module
 - NI Vision Builder for Automated Inspection 2012 SP1 or later

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.

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.

This is a pollution degree 2 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.

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.

This product is intended for use in industrial locations. There is no guarantee that harmful interference will not occur in a particular installation, when the product is connected to a test object, or if the product is used in residential areas. 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.

Furthermore, any changes or modifications to the product not expressly approved by National Instruments could void your authority to operate it under your local regulatory rules.



Caution To ensure the specified EMC performance, operate this product only with shielded cables and accessories.



Caution To ensure the specified EMC performance, product installation requires either special considerations or user-installed, add-on devices. See the product installation instructions for further information.

Cable Requirements for EMC Compliance

Select and install cables for the NI 8237R in accordance with the following requirements:

- Operate this device only with shielded cables.
- Install the snap-on ferrite (National Instruments part number 711849-01) included with your device on the isolated I/O power supply cable (V_{ISO} , C_{ISO}), as close as possible to the connection with the NI 8237R. Follow the procedure indicated in the section [Wiring an Isolated Output](#).

Installing the Software

Before installing the NI 8237R, you must install the application software and device drivers. Install the software in the following order:

1. **LabVIEW**—Refer to the *LabVIEW Release Notes* for installation instructions for LabVIEW and system requirements for the LabVIEW software. Refer to the *LabVIEW Upgrade Notes* for additional information about upgrading to the most recent version of LabVIEW.

After installation, documentation for LabVIEW is available by selecting **Start» All Programs»National Instruments»LabVIEW»LabVIEW Manuals**.

2. **NI-IMAQ I/O**—Refer to the *NI Vision Acquisition Software Release Notes* on the NI Vision Acquisition Software installation media for system requirements and installation instructions for the NI-IMAQ I/O driver.
After installation, documentation for the NI-IMAQ I/O driver software is available by selecting **Start»All Programs»National Instruments»Vision»Documentation»NI-IMAQ IO**.
3. **NI-IMAQdx**—Refer to the *NI Vision Acquisition Software Release Notes* on the NI Vision Acquisition Software installation media for system requirements and installation instructions for the NI-IMAQdx driver.
After installation, documentation for the NI-IMAQdx driver software is available by selecting **Start»All Programs»National Instruments»Vision»Documentation»NI-IMAQdx**.
4. **(Optional) LabVIEW FPGA Module**—Refer to the *LabVIEW FPGA Module Release and Upgrade Notes* for installation instructions and information about getting started with the LabVIEW FPGA Module.
After installation, documentation for the LabVIEW FPGA Module is available by selecting **Start»All Programs»National Instruments»LabVIEW»LabVIEW Manuals**.
5. **(Optional) NI Vision Development Module**—Refer to the *NI Vision Development Module Readme* on the NI Vision Development Module installation media for system requirements and installation instructions.
After installation, documentation for the NI Vision Development Module is available by selecting **Start»All Programs»National Instruments»Vision»Documentation»NI Vision**.

Installing the Hardware

This section describes how to unpack and install the device. You must install the software before installing the hardware.



Caution Electrostatic Discharge (ESD) can damage this product. To prevent damage, use industry-standard ESD prevention measures during installation, maintenance, and operation.

Unpacking

The device 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:

1. Ground yourself using a grounding strap or by touching a grounded object, such as the computer chassis.
2. 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.

3. 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 device in the antistatic package when not in use.

Installing

The following are general instructions for installation. Refer to the documentation provided by your computer manufacturer for specific instructions and warnings.

1. Power off and unplug the computer.



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

2. Remove the computer cover to expose the expansion slots.



Caution Installing a PCIe device into 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 device.

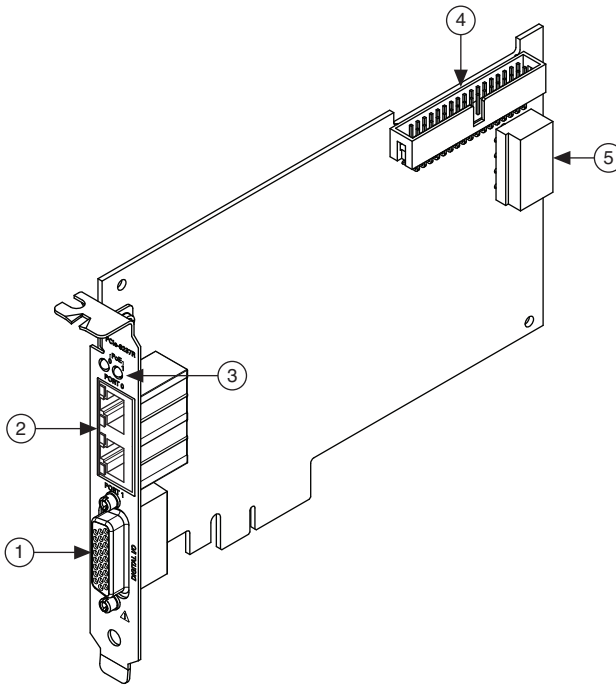
3. Touch a metal part of the computer to discharge any static electricity that might be on your clothes or body. Static electricity can damage the device.
4. Choose an unused x4 or larger PCIe slot, and remove the corresponding expansion slot cover on the back panel of the computer.
5. Remove the device from the antistatic package and gently rock the device into the PCIe slot. The connection may be tight, but do *not* force the device into place.



Note Check that the bracket of your device aligns with the hole in the back panel rail of the computer chassis.

6. Secure the device mounting bracket to the back panel rail of the computer.
7. (Optional) Connect an available 4-pin peripheral ATX power connector from the computer's power supply to the PoE power input on the device. This step is required to enable PoE. Refer to Figure 1 for the location of the power connection.
8. Replace the computer cover.
9. Connect an Ethernet cable to a GigE Vision camera, then connect the camera to the NI 8237R front panel. Refer to Figure 1 for the location of the Ethernet ports.
10. Plug in and power on the computer.

Figure 1. NI 8237R Connections and Indicators



- | | |
|---------------------------------------|--------------------------|
| 1 26-Pin Digital I/O D-SUB Connection | 4 34-Pin RTSI Connection |
| 2 Gigabit Ethernet Ports | 5 PoE Power Connection |
| 3 PoE Indicator LEDs | |



Note The first time you start the development computer after installing the hardware, allow several seconds for the drivers to load.

The NI 8237R is now installed and the camera is now connected.

Confirming the Device is Recognized

To confirm that the device is properly installed and the hardware is recognized, complete the following steps:

1. Select **Start»All Programs»National Instruments»Measurement & Automation Explorer** to open Measurement & Automation Explorer (MAX).
2. Expand **Devices and Interfaces**.
3. Verify that the device appears under **Devices and Interfaces»PCIe-8237R**.

Configuring the Device in MAX

After you have installed the device and powered on the computer, the computer will recognize the device and assign resources to it. Use MAX to configure the device for acquisition. For additional information about configuring your device, refer to the *Measurement & Automation Explorer Help for NI-IMAQdx* by opening MAX and selecting **Help»Help Topics»NI Vision»NI-IMAQdx**.

Connections

The following sections describe connections available on the NI 8237R. Refer for Figure 1 for the location of connectors and indicators on the device.

Digital I/O

The Digital I/O port on the NI 8237R offers 8 opto-isolated inputs, 8 opto-isolated outputs with external power supply input, 2 differential inputs (RS-422) which can be used with a quadrature encoder, and 2 bidirectional TTL lines. The Digital I/O port can be connected to any appropriate shielded device or connector block using a shielded cable. Refer to Table 1 for pin locations and functions.

Table 1. Pin Location and Definition on the NI 8237R Digital I/O

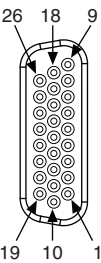
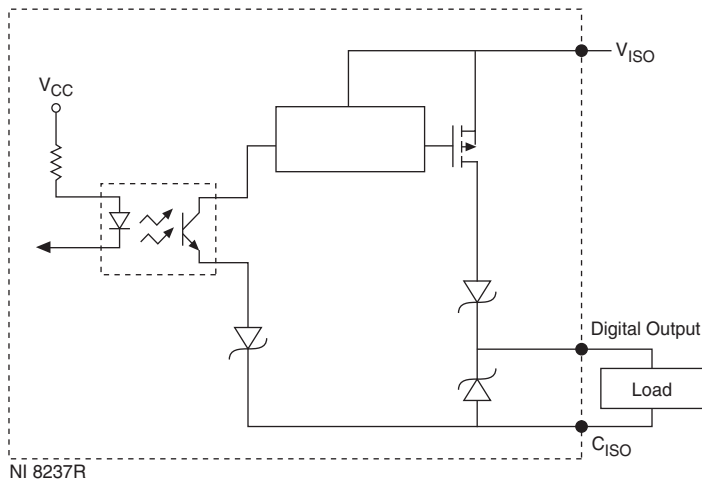
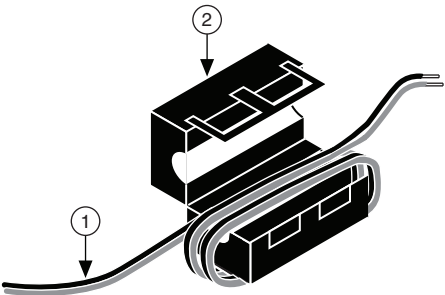
Pin Location	Pin Number	Signal	Description
	1	Iso Out 0	General purpose isolated output
	2	Iso Out 1	General purpose isolated output
	3	Iso Out 2	General purpose isolated output
	4	Iso In 0	General purpose isolated input
	5	Iso In 1	General purpose isolated input
	6	Iso In 2	General purpose isolated input
	7	TTL 0	Bidirectional TTL input/output
	8	GND	Digital ground reference for TTL and differential inputs
	9	TTL 1	Bidirectional TTL input/output
	10	Iso Out 3	General purpose isolated output
	11	C _{ISO}	Common ground reference for isolated inputs and outputs
	12	Iso Out 4	General purpose isolated output
	13	V _{ISO}	External power supply for the isolated outputs
	14	Iso In 3	General purpose isolated input
	15	C _{ISO}	Common ground reference for isolated inputs and outputs
	16	Iso In 4	General purpose isolated input
	17	Diff In 0+	RS-422 differential input 0 (positive side), or quadrature encoder phase A+
	18	Diff In 0-	RS-422 differential input 0 (negative side), or quadrature encoder phase A-
	19	Iso Out 5	General purpose isolated output
	20	Iso Out 6	General purpose isolated output
	21	Iso Out 7	General purpose isolated output
	22	Iso In 5	General purpose isolated input
	23	Iso In 6	General purpose isolated input
	24	Iso In 7	General purpose isolated input
	25	Diff In 1+	RS-422 differential input 1 (positive side), or quadrature encoder phase B+
	26	Diff In 1-	RS-422 differential input 1 (negative side), or quadrature encoder phase B-

Figure 3. Example of Connecting an Isolated Output to an External Load



When wiring an external power supply between the V_{ISO} and C_{ISO} pins of the Digital I/O connector in order to utilize the opto-isolated outputs, install the snap-on ferrite bead (National Instruments part number 711849-01) included with your device onto the external power supply wiring. The ferrite should be placed as close as possible to the power input of the shielded device or connector block connected to the Digital I/O port. Follow the procedure indicated in Figure 4 and Figure 5 to install the ferrite, making sure the cable wraps around the ferrite twice.

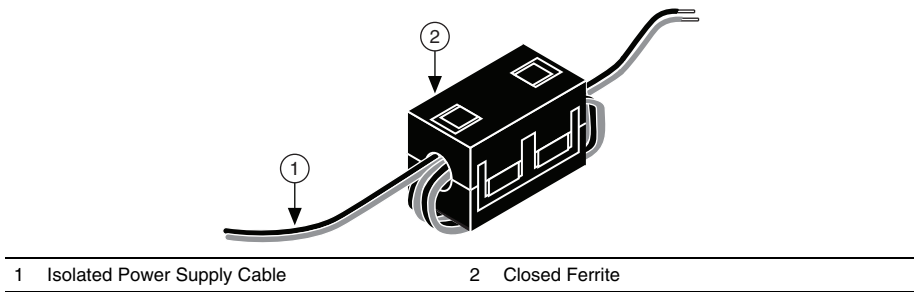
Figure 4. Installing a Ferrite on the Isolated Power Supply Cable



1 Isolated Power Supply Cable

2 Open Ferrite

Figure 5. Closed Ferrite on the Isolated Power Supply Cable



Connecting to a Differential Input

The NI 8237R accepts differential (RS-422) line driver inputs. Shielded cables are recommended for all applications. Unshielded cables are more susceptible to noise and can corrupt signals. Figure 6 shows the differential input/quadrature encoder input circuit. Figure 7 and Figure 8 show differential and single-ended line driver connections.

Figure 6. NI 8237R Quadrature Encoder/RS-422 Input Circuit

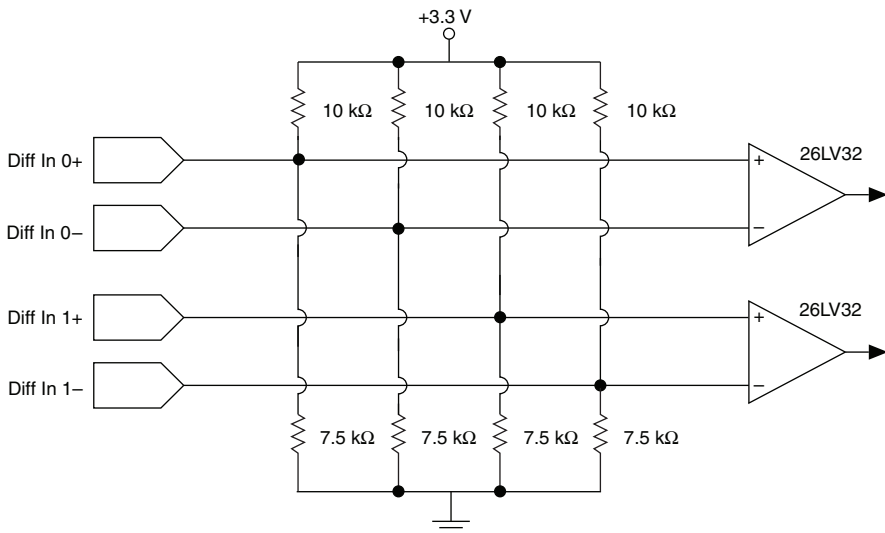


Figure 7. Example of Connecting Differential Line Drivers

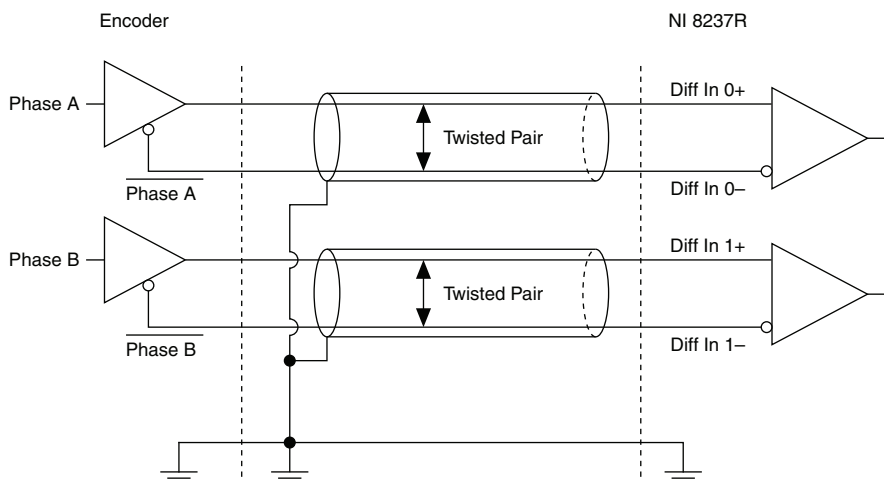
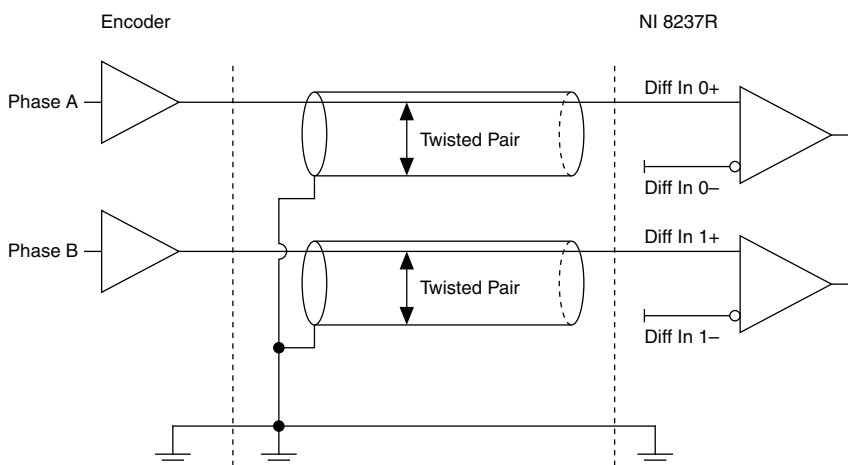


Figure 8. Example of Connecting Single-Ended Line Drivers



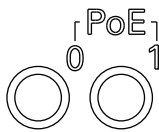
RTSI

The NI 8237R uses the Real-Time System Integration (RTSI) bus to synchronize multiple devices, such as data acquisition and motion control devices. The RTSI bus uses the National Instrument RTSI bus interface and ribbon cable to route additional timing and trigger signals between the NI 8237R and up to four National Instruments DAQ, Motion Control, or Vision devices. The RTSI bus also can synchronize multiple image acquisition devices to perform simultaneous captures.

Ethernet

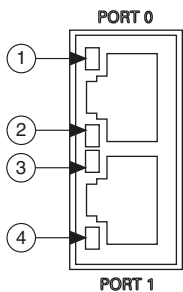
The NI 8237R provides two standard Gigabit Ethernet ports (Port 0 and Port 1) to acquire images from GigE Vision cameras. The NI 8237R can power PoE-capable cameras when connected to the power supply of the computer. When the NI 8237R is providing PoE, the LED that corresponds to the port will be lit. Figure 9 depicts the PoE LEDs on the NI 8237R.

Figure 9. PoE LEDs on the NI 8237R



Each Ethernet port on the NI 8237R has two Ethernet LEDs that indicate the connectivity status of the port. See Figure 10 for the location of these LEDs.

Figure 10. Ethernet LEDs on the NI 8237R



1	Port 0 Activity/Link LED	3	Port 1 Activity/Link LED
2	Port 0 Speed LED	4	Port 1 Speed LED

Refer to Table 2 for information on what the status of an Ethernet LED indicates.

Table 2. Ethernet LED Status Definitions on the NI 8237R

LED	Status	Definition
Activity/Link	Unlit	No link has been established
	Solid	A link has been negotiated
	Blinking	Activity on the link
Speed	Unlit	No link, or 10Mbps link
	Green	100 Mbps link
	Amber	1,000 Mbps link

Reconfigurable I/O

The NI 8237R has a user-reconfigurable FPGA that allows the I/O to be configured for a particular application. Different configurations are referred to as hardware personalities, and are defined by bitfiles. The NI 8237R can use a default hardware personality accessible through the Vision RIO palette in LabVIEW, installed with NI Vision Acquisition Software February 2013.



Note LabVIEW FPGA Module is required to customize the FPGA personality.

Where Do I Go From Here?

The following documents and resources contain information you may find helpful as you use the NI 8237R in an application.

- *National Instruments Example Finder*—LabVIEW contains an extensive library of VIs and example programs for use with FPGA targets. To access the NI Example Finder, open LabVIEW and select **Help»Find Examples**. Find help related to reconfigurable I/O on the NI 8237R by searching NI Example Finder for *Vision RIO*.
- LabVIEW FPGA documentation:
 - *FPGA Module* book in the *LabVIEW Help*—Select **Help»LabVIEW Help** in LabVIEW to view the *LabVIEW Help*. Browse the **FPGA Module** book in the **Contents** tab for information about using the FPGA Module to create VIs that run on FPGA targets.
 - *LabVIEW FPGA Module Release Notes and Upgrade Notes*—Contains information about installing the LabVIEW FPGA Module, describes new features, and provides upgrade information. To access this document, refer to ni.com/manuals. You can also view the LabVIEW Manuals directory that contains this document by selecting **Start»All Programs»National Instruments»LabVIEW»LabVIEW Manuals**.
 - *NI Vision-RIO VI Reference*—Select **Help»NI Vision-RIO VI Reference Help** in LabVIEW to view the Vision-RIO VI Reference for information about customizing the FPGA hardware personality.
- *LabVIEW FPGA IPNet*—Offers resources for browsing, understanding, and downloading LabVIEW FPGA functions or IP (intellectual property). Use this resource to acquire IP that you need for your application, download examples to help learn programming techniques, and explore the depth of IP offered by the LabVIEW FPGA platform. To access the LabVIEW FPGA IPNet, visit ni.com/ipnet.
- *NI Vision Builder for Automated Inspection Tutorial*—Refer to the *NI Vision Builder for Automated Inspection Tutorial* for information about basic vision techniques using Vision Builder AI. If Vision Builder AI is installed, access the tutorial by selecting **Start»All Programs»National Instruments»Vision Builder AI»Documentation**.

Specifications

The following specifications apply to the NI 8237R image acquisition device. These specifications are typical at 25 °C, unless otherwise stated.

TTL Inputs/Outputs

Number of channels	2
Type.....	Bidirectional
Input voltage range	0 V to 5 V
Output voltage range.....	0 V to 5 V
Maximum pulse rate	2 MHz
Minimum pulse detected.....	500 ns
Power-on state.....	Input (high-impedance), 10 kΩ pull-up to 5 V
Logic levels	
Input low voltage	0.59 V maximum
Input high voltage	2.57 V minimum
Output low voltage.....	0.38 V at 1.5 mA maximum
Output high voltage	4.12 V at 1.5 mA minimum

Differential Inputs

Number of channels	2
Type.....	RS-422 differential input or single-ended input
Maximum pulse rate	5 MHz, differential
Differential input threshold	±200 mV
Voltage range	0 V to 5.5 V
Single-ended logic levels	TTL compatible
Input low voltage	0.8 V
Input high voltage	2.0 V

Optically Isolated Inputs

Type.....	Current sinking
Number of channels	8
Input voltage range	0 V to 30 V
Input OFF voltage.....	0 V to 2 V
Input ON voltage	3.3 V to 30 V
Turn-on current	5.1 mA
Maximum pulse rate	100 kHz

Minimum pulse detected	10 μ s
Reverse polarity protection.....	Yes, -30 V

Optically Isolated Output

Type	Current sourcing
Number of channels.....	8
Supply voltage Range (V_{ISO}).....	5 V to 30 V
Maximum output voltage drop	1.31 V at 100 mA, V_{ISO} = 24 V
Maximum output current	
5 V on V_{ISO}	35 mA, maximum
24 V on V_{ISO}	80 mA, maximum
30 V on V_{ISO}	80 mA, maximum
Maximum current limit.....	345 mA



Note Isolated outputs have a current limit which will turn off the outputs in case the limit is exceeded. The circuit resets when the output is turned off.

Maximum pulse rate	2.5 kHz (100 k Ω , 300 pF load) 22 kHz (10 k Ω , 300 pF load)
Minimum pulse generated	400 μ s
Reverse polarity protection.....	Yes

RTSI

Number of channels.....	8
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Gigabit Ethernet Interface

Standard	IEEE 802.3 10BASE-T, 100BASE-TX, 1000BASE-T
Number of ports.....	2
Interface	RJ45
Speed	10, 100, 1000 Mbps

Power over Ethernet

Standard	IEEE 802.3af compatible
Supported power classes.....	0, 1, 2, and 3
Power output.....	15.4 W per port
Isolation	IEEE 802.3af compliant, Environment A

PCI Express Interface

PCI Express compliance	1.1
Native link width	x4
Up-plugging link width availability	x8, x16

Power Requirements

+12 V ATX peripheral (PoE inputs)	6.3 A peak, 4.1 A continuous
+12 V PCIe	0.92 A
+3.3 V PCIe	0.74 A

Physical Characteristics

Dimensions	11.1 cm × 16.8 cm (4.4 in. ×6.6 in.)
Weight	174 g (6.14 oz)

Environment

The NI 8237R is intended for indoor use only.	
Operating temperature	0 °C to 55 °C
Storage temperature	-20 °C to 70 °C
Relative humidity	5% to 90%, noncondensing
Pollution Degree	2



Caution Do *not* use the NI 8237R for connection to signals within Measurement Categories II, III, or IV.

Measurement Category	I
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Safety

This product 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, CSA 61010-1



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

Electromagnetic Compatibility

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

- EN 61326-1 (IEC 61326-1): Class A emissions; Basic immunity
- EN 55011 (CISPR 11): Group 1, Class A emissions
- EN 55022 (CISPR 22): Class A emissions
- EN 55024 (CISPR 24): Immunity
- AS/NZS CISPR 11: Group 1, Class A emissions
- AS/NZS CISPR 22: Class A emissions
- FCC 47 CFR Part 15B: Class A emissions
- ICES-001: Class A emissions



Note In the United States (per FCC 47 CFR), Class A equipment is intended for use in commercial, light-industrial, and heavy-industrial locations. In Europe, Canada, Australia and New Zealand (per CISPR 11) Class A equipment is intended for use only in heavy-industrial locations.



Note Group 1 equipment (per CISPR 11) is any industrial, scientific, or medical equipment that does not intentionally generate radio frequency energy for the treatment of material or inspection/analysis purposes.



Note For EMC declarations and certifications, and additional information, refer to the OnlineProduct Certification section

CE Compliance

This product meets the essential requirements of applicable European Directives, as amended for CE marking, as follows:

- 2004/108/EC; Electromagnetic Compatibility Directive
- 73/23/EEC; Low-Voltage Directive (safety)
- 89/336/EEC; Electromagnetic Compatibility Directive (EMC)



Note 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, 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 *Minimize Our Environmental Impact* 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）



中国客户 National Instruments 符合中国电子信息产品中限制使用某些有害物质指令 (RoHS)。关于 National Instruments 中国 RoHS 合规性信息，请登录 ni.com/environment/rohs_china。(For information about China RoHS compliance, go to ni.com/environment/rohs_china.)

Where to Go for Support

The National Instruments Web site is your complete resource for technical support. At ni.com/support you have access to everything from troubleshooting and application development self-help resources to email and phone assistance from NI Application Engineers.

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 electromagnetic 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.

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