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Find the *National Instruments PXIe-8821* at our website: *Click HERE*

USER MANUAL

PXIe-8821

This document provides reference information for PXI Express and the PXIe-8821 embedded controller.

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Related Documentation

The following documents contain information you may find helpful as you read this manual:

- *PICMG EXP.0 R2.0 CompactPCI Express Specification*, PCI Industrial Computers Manufacturers Group
- IEEE Standard P1284.1-1997 *(C/MM) Standard for Information Technology for Transport Independent Printer/System Interface*
- *PCI Express Base Specification*, PCI Special Interest Group
- *PXI-5 PXI Express Hardware Specification*, PXI Systems Alliance
- *PXI-6 PXI Express Software Specification*, PXI Systems Alliance
- *Serialized IRQ Support for PCI Systems Specification*, Compaq Computer et al.
- *ExpressCard Standard*, PCMCIA

PXI Express Features

Benefits of PXI Express

The PXI (PCI eXtensions for Instrumentation) industry standard, an open specification governed by the PXI Systems Alliance (PXISA), has quickly gained adoption and grown in prevalence in test, measurement, and control systems since its release in 1998. One of the key elements driving the rapid adoption of PXI is its use of PCI in the communication backplane. As the commercial PC industry has improved the available bus bandwidth by evolving PCI to PCI Express, PXI is now able to meet even more application needs by integrating PCI Express into the PXI standard. By taking advantage of PCI Express technology in the backplane, PXI Express increases the available PXI bandwidth from up to 132 MB/s to up to 8 GB/s for a more than 60x improvement in bandwidth.

PXI Express maximizes both hardware and software compatibility with PXI modules. PXI Express hybrid slots deliver both PCI and PCI Express signaling to accept devices that use PXI communication and triggering or the newer PXI Express standard. Software compatibility is maintained because PCI Express uses the same OS and driver model as PCI, resulting in complete software compatibility among PCI-based systems, for example PXI, and PCI Express-based systems such as PXI Express.

PXI Express, like PXI, leverages from the CompactPCI specification to define a rugged, modular form factor that offers superior mechanical integrity and easy installation and removal of hardware components. PXI Express products offer higher and more carefully defined levels of environmental performance required by the shock, vibration, temperature, and humidity extremes of industrial environments. Mandatory environmental testing and active cooling is added to the CompactPCI mechanical specification to ease system integration and ensure multivendor interoperability.

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The demanding timing and synchronization requirements of instrumentation systems are met by the integrated features of PXI Express. Not only are the trigger bus, 10 MHz system reference clock, and star trigger bus available in PXI retained by PXI Express, but new timing and synchronization features that include a 100 MHz differential system reference clock for the synchronization of multiple modules and three differential star trigger buses for the distribution of precise clock and trigger signals have been added. Differential timing and synchronization signals provide PXI Express systems with increased noise immunity and the ability to transmit clock signals at higher frequencies.

PXIe-8821

Description

The PXIe-8821 PXI Express/CompactPCI Express embedded controller is a high-performance PXI Express/CompactPCI Express-compatible system controller. The PXIe-8821 controller integrates standard I/O features in a single unit by using state-of-the-art packaging. Combining a PXIe-8821 embedded controller with a PXI Express-compatible chassis, such as the PXIe-1085, results in a fully PC-compatible computer in a compact, rugged package.

The PXIe-8821 has an Intel® Core™ i3 4110E processor (2.6 GHz dual-core processor), all the standard I/O, and a 320 GB (or larger) hard drive.

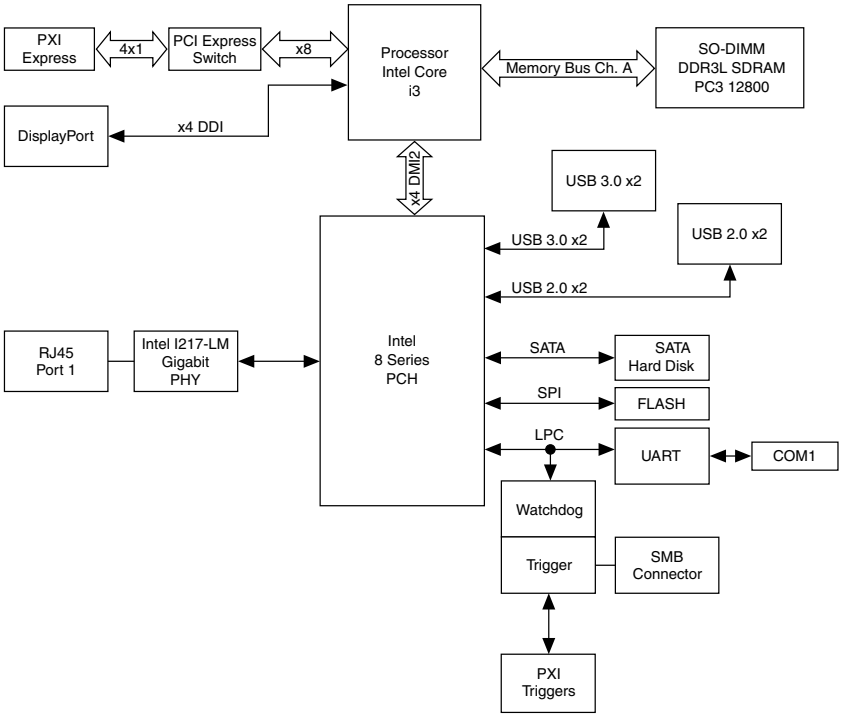
The standard I/O on each module includes one DisplayPort video, one RS-232 serial port, two Hi-Speed USB ports, two SuperSpeed USB ports, one Gigabit Ethernet, a reset button, and a PXI trigger.

Functional Overview

The PXIe-8821 is a modular PC in a PXI Express 3U-size form factor. The following figure is a functional block diagram of the PXIe-8821. Following the diagram is a description of each logic block shown.

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Figure 1. PXIe-8821 Block Diagram



The PXIe-8821 consists of the following logic blocks on one circuit card assembly (CCA):

- The *processor* is an Intel® Core™ i3 4110E processor (3 MB Cache, 2.6 GHz). The processor connects to the SO-DIMM block through the DDR3L interface supporting up to 1600 MHz SO-DIMMs and the PCH through a x4 DMI2 (Direct Media Interface) interface supporting up to 5 GT/s per lane.
- The *SO-DIMM block* consists of one 64-bit DDR3L SDRAM socket that can hold up to 8 GB of memory.
- The processor provides the DisplayPort interface that connects to display peripherals on the PXIe-8821, and the PCI Express interface to the PXI Express backplane through a PCI Express switch.
- The *Platform Controller Hub* (PCH) provides the USB, PCI Express x1, and LPC interfaces that connect to the peripherals on the PXIe-8821.
- The *DisplayPort* block consists of one DisplayPort connector.
- The *USB* block consists of two Hi-Speed USB 2.0 connectors and two SuperSpeed USB 3.0 connectors.
- The *Ethernet Port 1* block consists of an Intel® I217-LM Gigabit Ethernet Connection.
- The *UART* block connects to one serial port.

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- The *SMB* Front Panel Trigger provides a routable connection of the PXI triggers to/from the SMB on the front panel.
- The *Watchdog* block consists of a watchdog timer that can reset the controller or generate triggers.
- The *PXI Express Connectors* connect the PXIe-8821 to the PXI Express/CompactPCI Express backplane.

National Instruments Software

National Instruments has developed several software tools you can use with the PXIe-8821.

National Instruments hardware and software work together to help you make the most of your PXI system. The LabVIEW, Measurement Studio, and LabWindows™/CVI™ application development environments combine with leading hardware drivers such as NI-DAQmx to provide exceptional control of NI hardware. Instrument drivers are available at `ni.com/idnet` to simplify communication with instruments over a variety of buses.

LabVIEW is a powerful and easy-to-use graphical programming environment you can use to acquire data from thousands of different instruments including USB, IEEE 488.2, VXI, serial, PLCs, and plug-in boards. LabVIEW helps you convert acquired data into meaningful results using powerful data analysis routines. Add-on tools provide additional specialized functionality. For more information, visit `ni.com/labview` and `ni.com/toolkits`.

If you prefer to use Microsoft's Visual Basic, Visual C++, and Visual Studio .NET for the core of your application, Measurement Studio adds tools for Measurement and Automation to each language. For more information, visit `ni.com/mstudio`.

LabWindows/CVI is an interactive ANSI C programming environment designed for building virtual instrument applications. LabWindows/CVI delivers a drag-and-drop editor for building user interfaces, a complete ANSI C environment for building your test program logic, and a collection of automated code generation tools, as well as utilities for building automated test systems, monitoring applications, or laboratory experiments. For more information, visit `ni.com/lwcvi`.

NI-DAQmx provides an extensive library of functions that you can call from your application development environment or interactive environment such as NI Signal Express. These functions provide an intuitive API for National Instruments multifunction DAQ products. Features available include analog input (A/D conversion), buffered data acquisition (high-speed A/D conversion), analog output (D/A conversion), waveform generation, digital I/O, counter/timer operations, SCXI signal conditioning, RTSI or PXI synchronization, self-calibration, messaging, and acquiring data to extended memory. For more information, visit `ni.com/daq`.

National Instruments modular instruments use specialized drivers suited to each product's specialization. Express VIs provide customized, interactive programming of instruments in a

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single interface, and soft front panels provide an interface for testing the functionality of each instrument with no programming required. NI Switches, DMMs, High-Speed DIO, High-Speed Digitizers, and Sources each have customized drivers for high-end modular instrumentation systems. RF applications leverage two drivers, NI-RFSG and NI-RFSA, and Dynamic Signal Acquisition is available through NI-DAQmx. For more information, visit `ni.com/modularinstruments`.

You can expand the timing and triggering functionality of your PXI system with PXI Timing and Synchronization products. These products provide precision clock sources, custom routing of triggers for multi-chassis synchronization, clock sharing, and more and are programmed with NI-Sync. For more information, visit `ni.com/pxi`.

NI-VISA is the National Instruments implementation of the VISA specification. VISA is a uniform API for communicating and controlling USB, Serial, GPIB, PXI, VXI, and various other types of instruments. This API aids in the creation of portable applications and instrument drivers. For information about writing your own PXI instrument driver with NI-VISA, refer to the *NI-VISA Getting Started Manual* and the `readme.txt` file in the NI-VISA directory. For more information, visit `ni.com/visa`.

With LabVIEW for Linux and support for more than two hundred devices on Linux with the NI-DAQmx driver, you can now create virtual instruments based on the Linux OS. Instrument control in Linux has been improved by the NI-VISA driver for Linux, and NI modular instruments are partially supported. For more information, visit `ni.com/linux`.

Configuration

BIOS Setup Utility

You can change the PXIe-8821 configuration settings in the BIOS setup program. The BIOS is the low-level interface between the hardware and operating system software that configures and tests your hardware when you boot the system. The BIOS setup program includes menus for configuring settings and enabling PXIe-8821 controller features.

Most users do not need to use the BIOS setup program, as the PXIe-8821 controller ships with default settings that work well for most configurations.

Caution Changing BIOS settings may lead to incorrect controller behavior and possibly an unbootable controller. If this happens, follow the instructions for restoring default settings in the *System CMOS* section. In general, do *not* change a setting unless you are absolutely certain what it does.

Accessing BIOS Setup Utility

1. Power on or restart your PXIe-8821 controller.
2. When the message **`Press <DEL> to enter setup`** appears, press the <Delete> key. The setup program loads after a short delay.

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The **Main** menu is displayed when you first enter the BIOS setup program.

Use the following keys to navigate through the BIOS setup program:

- **Left Arrow, Right Arrow**—Use these keys to move between the different setup menus. If you are in a submenu, these keys have no effect, and you must press <Esc> to leave the submenu first. (To use the arrows on the numeric keypad, you must turn off Num Lock.)
- **Up Arrow, Down Arrow**—Use these keys to move between the options within a setup menu. (To use the arrows on the numeric keypad, you must turn off Num Lock.)
- **<Enter>**—Use this key either to enter a submenu or display all available settings for a highlighted configuration option.
- **<Esc>**—Use this key to return to the parent menu of a submenu. At the top-level menus, this key serves as a shortcut to the **Exit** menu.
- **<+> and <–>**—Use these keys to cycle between all available settings for a selected configuration option.
- **<Tab>**—Use this key to select time and date fields.
- **<F9>**—Use this key to load the optimal default values for BIOS configuration settings. The optimal default values are the same as the shipping configuration default values.

Main Setup Menu

The most commonly accessed and modified BIOS settings are in the **Main** setup menu. The **Main** setup menu reports the following configuration information:

- **BIOS Version and Build Date**—These values indicate the version of the PXIe-8821 controller BIOS and the date on which the BIOS was built.
- **Embedded Firmware Version**—This value helps identify the built-in hardware capabilities.
- **Processor Type, Base Processor Frequency, and Active Processor Cores**—These values indicate the type of processor used in the PXIe-8821 controller, the processor speed, and the maximum number of processor cores.
- **Total Memory**—This value indicates the system RAM size the BIOS detects.
- **PXIe Chassis Information**—These values indicate the overall chassis link configuration, the link width of each link, and the link speed of each link.

The **Main** setup menu also includes the following settings:

- **System Date**—This setting controls the date, which is stored in a battery-backed real-time clock. Most operating systems also include a way to change this setting. Use <+> and <-> in conjunction with <Enter> and <Tab> to change these values.
- **System Time**—This setting controls the time of day, which is stored in a battery-backed real-time clock. Most operating systems include a way to change this setting. Use <+> and <-> in conjunction with <Enter> and <Tab> to change these values.

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Advanced Setup Menu

This menu contains BIOS settings that normally do not require modification. If you have specific problems such as unbootable disks or resource conflicts, you may need to examine these settings.

Caution Changing settings in this menu may result in an unstable or unbootable controller. If this happens, follow the procedures outlined in the *System CMOS* section to restore BIOS settings to their factory defaults.

The **Advanced** setup menu includes the following settings and submenus:

- **SATA Configuration**—Use this setting to access the **SATA Configuration** submenu. Refer to the *SATA Configuration Submenu* section for more information.
- **CPU Configuration**—Use this setting to access the **CPU Configuration** submenu. Refer to the *CPU Configuration Submenu* section for more information.
- **Video Configuration**—Use this setting to access the **Video Configuration** submenu. Refer to the *Video Configuration* Submenu section for more information.
- **Power/Wake Configuration**—Use this setting to access the **Power/Wake Configuration** submenu. Refer to the *Power/Wake Configuration Submenu* section for more information.
- **PCI Configuration**—Use this setting to access the **PCI Configuration** submenu. Refer to the *PCI Configuration Submenu* section for more information.
- **AMT Configuration**—Use this setting to access the **AMT Configuration** submenu. Refer to the *AMT Configuration Submenu* section for more information.
- **USB Configuration**—Use this setting to access the **USB Configuration** submenu. Refer to the *USB Configuration Submenu* section for more information.
- **Serial Port Configuration**—Use this setting to access the **Serial Port Configuration** submenu. Refer to the *Serial Port Configuration Submenu* section for more information.

SATA Configuration Submenu

Use this submenu to apply alternate settings to the hard disk drive (HDD) interfaces. Normally, you do not need to modify these settings, as the factory default settings provide the best possible configuration.

- **SATA Controller**—This setting specifies whether the onboard SATA controller is enabled or disabled. The default value is **Enabled.**
  - **SATA Mode Selection**—This setting determines whether AHCI mode is enabled or disabled for the SATA port. Some operating systems do not support AHCI mode. You can use this setting to disable AHCI mode and enable IDE mode so that non-compatible OSes function correctly. The default value is **AHCI**.
- **Internal Drive (SATA)**—This item displays the onboard SATA drive detected in the system.
- **Removable Hard Drive**—This item displays the removable hard drive, if installed.

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CPU Configuration Submenu

Use this submenu to apply alternate settings to the CPU. Normally, you do not need to modify these settings, as the factory default settings provide the most compatible and optimal configuration possible.

- **Hyper Threading**—This setting enables or disables Intel Hyper-Threading technology. The default value is **Enabled**. Enabling Hyper-Threading increases performance for some applications by adding virtual CPU cores. Hyper-Threading can increase application jitter, so be careful when enabling this setting on a Real Time system. When the BIOS is configured to boot LabVIEW Real-Time, Hyper-Threading is disabled automatically. To manually enable Hyper-Threading performance when in LabVIEW Real-Time mode, refer to the *LabVIEW RT Configuration Overrides Submenu*.
- **Enabled CPU Cores**—This setting selects the number of active CPU cores for the processor. Valid values are **1, 2, 3** and **All**. The default value is **All**.
- **C-States**—This setting enables or disables CPU power management. The default value is **Enabled**. Enabling C-States allows the processor to put idle CPU cores to sleep, allowing active cores to run at higher than base frequencies when Turbo Boost is enabled. Enabling C-States can increase application jitter, so be careful when enabling this setting on a Real Time system. When the BIOS is configured to boot LabVIEW Real-Time, C-States are disabled automatically. To manually enable C-States when in LabVIEW Real-Time mode, refer to the *LabVIEW RT Configuration Overrides Submenu*.
- **Hardware Prefetcher**—This setting enables or disables CPU cache hardware prefetching. The default value is **Disabled** when booting LabVIEW Real-Time and **Enabled** when booting other OSs. Enabling hardware prefetching can increase system performance for some applications, but can cause control algorithms to behave less deterministically.
- **Adjacent Cache Line Prefetch**—This setting enables or disables prefetching of adjacent cache lines from memory to the CPU cache. The default value is **Disabled** when booting LabVIEW Real-Time and **Enabled** when booting other OSs. Enabling adjacent cache line prefetching can increase system performance for some applications, but can cause control algorithms to behave less deterministically.

Video Configuration Submenu

Use this submenu to apply alternate settings to the video configuration. Normally, you do not need to modify these settings, as the factory default settings provide the most compatible and optimal configuration possible.

- **Primary Display**—This setting specifies which video adapter the BIOS should use as the primary adapter if more than one is present. To use an external video adapter as the primary graphics adapter, choose **Add-in Board Video**. The default value is **Onboard Video**.

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Power/Wake Configuration Submenu

Use this submenu to apply alternate configurations to the power and wake features of the chipset and controller. Normally, you do not need to modify these settings, as the factory default settings provide the most compatible and optimal configuration possible.

- **Restore After Power Loss**—This setting specifies the power state that the controller should return to after AC power is lost. Valid values are **Stay Off** and **Turn On**. The default is **Stay Off**. When set to **Stay Off**, the controller returns to the soft off power state after AC power is restored. When set to **Turn On**, the controller powers on when AC power is restored.
- **Power Button Off Behavior**—This setting specifies how the PXI Express power button should behave. Valid options are **Normal** and **Disabled**. The default value is **Normal**. When set to **Normal**, the OS controls the power button. When set to **Disabled**, pressing the power button has no effect. The **Disabled** option should be used only in conjunction with the PXI Express chassis' inhibit mode switch.
- **PXIe Backplane WAKE#**—This setting enables or disables a PXI Express peripheral module's ability to wake a soft off system. The default value is **Disabled**.
- **SMBus ALERT#**—This setting enables or disables a System Management device's ability to wake a soft off system by asserting the ALERT# signal. The default value is **Disabled**.

PCI Configuration Submenu

Use this submenu to apply alternate settings to PCI devices. Normally, you do not need to modify these settings, as the factory default settings provide the most compatible and optimal configuration possible.

- **PCIe Max Payload Size**—This setting determines the maximum payload size of PCI Express devices. Valid options are **Auto** and **128 Bytes**. The default value is **Auto**, which allows the BIOS to choose an optimal value based on which devices are present.

AMT Configuration Submenu

Use this submenu to apply alternate settings for Intel Advanced Management Technology (AMT) and its Management Engine. Normally, you do not need to modify these settings, as the factory default settings prove the most compatible and optimal configuration possible.

- **Management Engine Setup Prompt**—This setting enables or disables the Intel AMT Management Engine setup prompt on the BIOS POST screen. When this setting is set to **Enabled**, you can press <Ctrl-P> at the BIOS POST screen to configure the Management Engine. The default value is **Disabled**.
- **Unconfigure Management Engine**—This setting allows you to reset the Management Engine to factory settings on the next boot. This option reverts to its default value after the Management Engine is reset. The default value is **Disabled**.
- **USB-Based Configuration**—This setting enables or disables automatic configuration of the Management Engine based on Management Engine configuration files that may be present on USB devices plugged into the controller. The default value is **Disabled**.

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USB Configuration Submenu

Use this submenu to apply alternate configurations to the USB ports. Normally, you do not need to modify these settings, as the factory default settings provide the best possible configuration.

- **USB Devices**—This item lists the total number of devices detected in the system, categorized by device type.
- **Legacy USB Support**—This setting specifies whether legacy USB support is enabled. Legacy USB support refers to the ability to use a USB keyboard and mouse during system boot or in a legacy operating system such as DOS. The default value is **Enabled**. This option is disabled automatically when booting LabVIEW Real-Time to reduce application jitter.
- **Overcurrent Reporting—**This setting allows the BIOS to notify the operating system of any USB ports that source too much current. The default value for this setting is **Disabled**.
- **Transfer Timeout**—This setting specifies the timeout value for Control, Bulk, and Interrupt USB transfers. The default value for this setting is 20 seconds.
- **Device Reset Timeout**—This setting specifies the number of seconds the Power-On Self Test waits for a USB mass storage device to start. The default is 20 seconds.
- **Device Power-Up Delay**—This setting specifies the maximum time a device takes before it properly reports itself to the host controller. When set to **Auto**, a root port is granted 100 ms, and for a hub port, the delay value is taken from the hub descriptor. When set to **Manual**, you can set the delay manually. The default value for this setting is **Auto**.
- **Device Power-Up Delay in Seconds**—This setting specifies the number of seconds the Power-On Self Test waits for a USB device or hub to power on. This setting is visible only if **Device Power-Up Delay** is set to **Manual**. The default is 5 seconds.

In addition, the following option is available for each detected device if a USB mass storage device is present:

- **Emulation Type**—This setting specifies how the BIOS presents the USB mass storage device to the system. You can use this option to present a USB mass storage device as a floppy, Zip, hard disk, or CD-ROM drive. The default is **Auto**, which allows the BIOS to treat small USB flash disk drives as floppy drives and larger USB flash disk drives as hard disk drives.

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Serial Port Configuration Submenu

Use this submenu to apply alternate configurations to the serial port. Normally, you do not need to modify these settings, as the factory default settings provide the most compatible and optimal configuration possible.

- **Serial Port Configuration**—Use this setting to access the **Serial Port Configuration** submenu. The submenu includes the following items:
  - **Base Address**—This item displays the current base address for the onboard serial port.
  - **Interrupt Request (IRQ)**—This item displays the interrupt request (IRQ) for the onboard serial port.

LabVIEW RT Setup Menu

Use this menu to configure boot options for LabVIEW RT if it is installed on the controller. If you are not using LabVIEW RT, you should leave these settings at default.

Note The settings below override the behavior of the switches shown in the figure in the *LabVIEW RT Configuration Switches* section. To use the settings from the switches, select **Use Switch Setting** for each option.

- **Boot Configuration**—This setting selects whether the controller should boot LabVIEW RT, LabVIEW RT Safe Mode, or an installed OS such as Windows 7. The default is **Use Switch Setting**.
- **Reset IP Address**—If the controller is deployed to a different subnet from which it was originally configured, or if the current IP address is invalid, use this switch to reset the IP address and other TCP/IP settings to their factory defaults during LabVIEW RT startup. The default is **Use Switch Setting**.

Note By default, the target automatically attempts to connect to the network using DHCP. If the target cannot initiate a DHCP connection, the target connects to the network with a link-local IP address of `169.254.x.x`.

- **Disable Startup VI**—If the controller becomes inaccessible because of a startup VI, this switch can prevent VIs from automatically running at startup. The default is **Use Switch Setting**.
- **LabVIEW RT Configuration Overrides**—Use this setting to access the LabVIEW RT Configuration Overrides submenu. Refer to the *LabVIEW RT Configuration Overrides Submenu* section for more information.

Current Hardware Switch Settings

This submenu displays the current values of the LabVIEW RT configuration switches, indicating Boot Configuration, Reset IP Address, and Disable Startup VI switch status.

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LabVIEW RT Configuration Overrides Submenu

To minimize jitter when booting into LabVIEW Real-Time mode, the following features are automatically disabled. You can enable these features manually. Refer to the *CPU Configuration Submenu* section for specific details on what each feature enables.

- **CPU Hyper Threading**—The default is **Use RT Default**.
- **CPU C-States**—The default is **Use RT Default**.

Boot Setup Menu

Use this menu to configure settings related to the boot process and boot device priority.

- **Boot Settings Configuration**—Use this setting to access the **Boot Settings Configuration** submenu. Refer to the *Boot Settings Configuration Submenu* section for more information.
- **PXI Drive Boot**—This setting specifies whether boot support is enabled for legacy mass storage devices, such as SCSI drives. When enabled, legacy mass storage controllers with boot support are displayed in the **Boot Option Priorities** menu. The default value is **Enabled**.
- **PXE Network Boot**—This setting specifies whether the PXE network boot agent is enabled. When enabled, the Intel Boot Agent is displayed in the **Boot Option Priorities** menu, allowing you to boot from a PXE server on the local subnet. Note that the Intel Boot Agent device names are preceded by **IBA GE Slot** in the **Boot Option Priorities** menu. You must restart the system for this setting to take effect. The default value is **Disabled**.
- **Boot Option Priorities**—These settings specify the order in which the BIOS checks for bootable devices, including the local hard disk drive, removable devices such as USB flash disk drives or USB CD-ROM drives, or the PXE network boot agent. The BIOS first attempts to boot from the device associated with **1st Boot Device**, followed by **2nd Boot Device**, and **3rd Boot Device**. If multiple boot devices are not present, the BIOS setup utility does not display all these configuration options. To select a boot device, press <Enter> on the desired configuration option and select a boot device from the resulting menu. You also can disable certain boot devices by selecting **Disabled**.

Note Only one device of a given type is shown in this list. If more than one device of the same type exists, use the *Device BBS Priorities* submenus to re-order the priority of devices of the same type.

The following submenus are displayed if one or more bootable devices of the corresponding type is present:

- **Hard Drive BBS Priorities**—Use this setting to access the **Hard Drive BBS Priorities** submenu to re-order or disable bootable hard drive devices. Refer to the *Hard Drive BBS Priorities Submenu* section for more information.
- **CD/DVD ROM Drive BBS Priorities**—Use this setting to access the **CD/DVD ROM Drive BBS Priorities** submenu to re-order or disable bootable CD/DVD ROM drive

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devices. Refer to the *CD/DVD ROM Drive BBS Priorities Submenu* section for more information.

- **Floppy Drive BBS Priorities**—Use this setting to access the **Floppy Drive BBS Priorities** submenu to re-order or disable bootable floppy drive devices. Refer to the *Floppy Drive BBS Priorities Submenu* section for more information.
- **Network Device BBS Priorities**—Use this setting to access the **Network Device BBS Priorities** submenu to re-order or disable bootable network devices. Refer to the *Network Device BBS Priorities Submenu* section for more information.

Boot Settings Configuration Submenu

Use this submenu to apply alternate configurations to boot settings. Normally, you do not need to modify these settings, as the factory default settings provide the most compatible and optimal configuration.

- **Setup Prompt Timeout**—This setting specifies the number of seconds the system waits for a BIOS Setup menu keypress (the <Delete> key). The default value is **2**.
- **Bootup NumLock State**—This setting specifies the power-on state of the keyboard NumLock setting. The default value is **On**.

Hard Drive BBS Priorities Submenu

- **Boot Option #1, Boot Option #2, Boot Option #3**—These settings specify the boot priority of hard drive devices. The highest priority device is displayed on the main **Boot Option Priorities** list. Optionally, each device can also be **Disabled** if the device should never be used as a boot device.

CD/DVD ROM Drive BBS Priorities Submenu

- **Boot Option #1, Boot Option #2, Boot Option #3**—These settings specify the boot priority of CD/DVD ROM drive devices. The highest priority device is displayed on the main **Boot Option Priorities** list. Optionally, each device can also be **Disabled** if the device should never be used as a boot device.

Floppy Drive BBS Priorities Submenu

- **Boot Option #1, Boot Option #2, Boot Option #3**—These settings specify the boot priority of floppy drive devices. The highest priority device is displayed on the main **Boot Option Priorities** list. Optionally, each device can also be **Disabled** if the device should never be used as a boot device.

Network Device BBS Priorities Submenu

- **Boot Option #1, Boot Option #2, Boot Option #3**—These settings specify the boot priority of network devices. The highest priority device is displayed on the main **Boot Option Priorities** list. Optionally, each device can also be **Disabled** if the device should never be used as a boot device.

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Security Menu

Use this menu to enable BIOS security options.

- **Administrator Password**—This setting specifies a password that must be entered to access the BIOS Setup Utility. If only the Administrator's password is set, this setting limits access to only the BIOS setup program and is asked for only when entering the BIOS setup program. By default, no password is specified.
- **User Password**—This setting specifies a password that must be entered to access the BIOS Setup Utility or boot the system. If only the user's password is set, this is a power on password and must be entered to boot or enter the BIOS setup program. In the BIOS setup program, the user has Administrator rights. By default, no password is specified.

Save & Exit Menu

The **Save & Exit** setup menu includes all available options for exiting, saving, and loading the BIOS default configuration. As an alternative to this screen, press <F9> to load optimal BIOS default settings and <F10> to save changes and exit setup.

The **Save & Exit** setup menu includes the following settings:

- **Save Changes and Reset**—Any changes made to BIOS settings are stored in NVRAM. The setup program then exits and reboots the controller. You also can use the <F10> key to select this option.
- **Discard Changes and Reset**—Any changes made to BIOS settings during this session of the BIOS setup program are discarded. The setup program then exits and reboots the controller. You also can use the <Esc> key to select this option.
- **Save Changes**—Changes made to BIOS settings during this session are committed to NVRAM. The setup program remains active, allowing further changes.
- **Discard Changes**—Any changes made to BIOS settings during this session of the BIOS setup program are discarded. The BIOS setup continues to be active.
- **Restore Factory Defaults**—This option restores all BIOS settings to the factory default. This option is useful if the controller exhibits unpredictable behavior due to an incorrect or inappropriate BIOS setting. Notice that any nondefault settings such as boot order, passwords, and so on also are restored to their factory defaults. You also can use the <F9> key to select this option.
- **Save As User Defaults**—This option saves a copy of the current BIOS settings as the User Defaults. This option is useful for preserving custom BIOS setup configurations.
- **Restore User Defaults**—This option restores all BIOS settings to the user defaults. This option is useful for restoring previously preserved custom BIOS setup configurations.
- **Boot Override**—This option lists all possible bootable devices and allows the user to override the **Boot Option Priorities** list for the current boot. If no changes have been made to the BIOS setup options, the system continues booting to the selected device without first rebooting. If BIOS setup options have been changed and saved, a reboot is required and the boot override selection is not valid.

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BIOS Diagnostic Utilities

You can test the hard drive and memory of your controller with the included BIOS diagnostic utilities.

Accessing BIOS Diagnostic Utilities

1. Power on or reboot your controller.
2. When the message **<F2> to run diagnostics** appears, press the <F2> key. The first diagnostic utility loads after a short delay.

Hard Drive Diagnostic Utility

The hard drive diagnostic utility tests the hard drive first upon entry into the BIOS Diagnostic Utilities. The utility initially performs a quick test, and a more comprehensive test afterwards. You may abort and skip any test by pressing the <Esc> key at any time during that test. After both tests have finished or been skipped, you see the testing results. If both tests have succeeded or been skipped, the utility displays **Press any key to continue**. To continue with testing, press any key on the keyboard.

Note If either hard drive test fails, the controller cannot boot, and the utility instructs you to turn off the controller and replace the hard drive.

Memory Diagnostic Utility

The memory diagnostic utility starts immediately after you press a key to exit the hard drive diagnostic utility. You may abort and skip the memory test by pressing the <Esc> key at any time during this test. After the memory utility has finished or been skipped, you see the testing result. If the memory test was successful or skipped, the utility displays **Press any key to continue**. To continue to boot the controller, press any key on the keyboard.

Note If the memory test fails, the controller cannot boot, and the utility instructs you to turn off the controller and replace the memory.

System CMOS

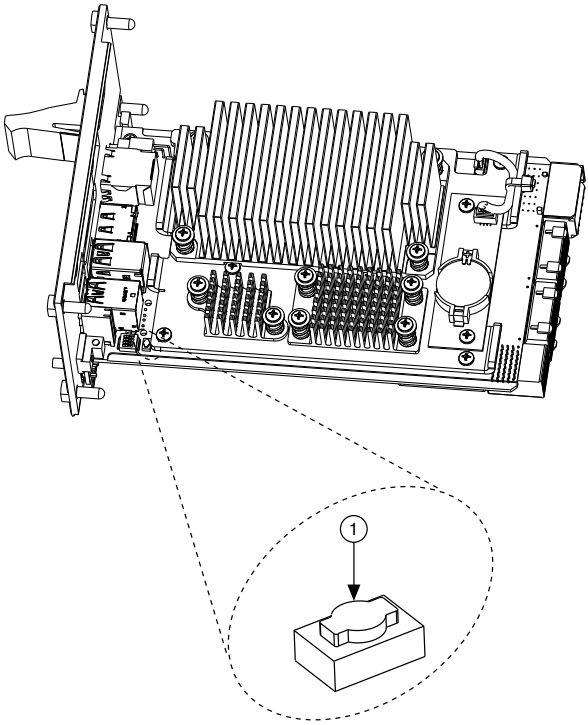
The PXIe-8821 contains memory backed up by a battery to store BIOS configuration information.

Complete the following steps to clear the CMOS contents:

1. Power off the chassis.
2. Remove the controller from the chassis.
3. Press the push-button switch, as shown in the following figure.
4. Wait 10 seconds.
5. Reinstall the controller in the chassis.

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Figure 2. Clearing the CMOS Contents



1. Push-Button Switch SW1

Boot Options

The PXIe-8821 can boot from the following devices:

- The internal Serial ATA hard drive
- An external SCSI hard drive or SCSI CD/DVD-ROM if an SCSI adapter, such as the PXI-8214, is used.
- A network PXE server on the same subnet.
- An external USB mass storage device such as a USB hard drive, USB CD/DVD-ROM, or USB flash drive.
- An external USB floppy drive.
- Most PCI or PCI Express-based devices that provide an Option ROM.

Note There are some limitations when booting from a USB device. You can install Windows 7 and later from a USB CD/DVD-ROM, but not earlier versions of Windows. The PXIe-8821 BIOS configures the USB devices so that they work in a DOS environment.

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There are two ways to configure the controller to boot from these devices:

- Enter the BIOS setup by rebooting the controller and pressing <Delete> during the memory tests. Select the **Boot** menu. You will see a list of all bootable devices, ordered by device type. You can set the boot order by altering the **1st Boot Device**, **2nd Boot Device**, and **3rd Boot Device** settings.
- To boot from a different device without permanently changing the boot order, press <F10> during POST. After the BIOS completes the POST and just before the controller boots the OS, the **Boot** menu is displayed. You can select the device type you want to boot from.

Hard Drive Recovery

PXIe-8821 controllers preinstalled with Windows include two methods of restoring the original factory condition of your hard drive. Hard drive-based recovery stores a factory backup on a separate portion of your hard drive, allowing you to restore your controller without additional media. The PXIe-8821 controller also ships with an OS Recovery DVD that allows you to reinstall your operating system onto your hard drive through an external USB CD/DVD-ROM. For more information about these tools, refer to KnowledgeBase 2ZKC02OK, *Hard Drive Recovery and OS Installation for PXI and VXI Controllers*, at `ni.com/support`.

Note The hard drive recovery hot key is <F4>. To access the hard drive-based recovery tool, press and hold <F4> when video first appears during the boot process.

If you need to recover your factory-installed operating system from a DVD, you can use the included OS re-installation DVD with an external USB CD/DVD-ROM drive. Boot the PXI Express controller using the OS re-installation DVD to recover the OS. You also may need to reinstall other software after using the DVD to recover the OS.

Note Recovering the OS erases the contents of your hard disk. Back up any files you want to keep.

Upgrade Information

You can change the amount of installed RAM on the PXIe-8821 by upgrading the SO-DIMM.

National Instruments offers the following SO-DIMMs for use with the PXIe-8821 controller.

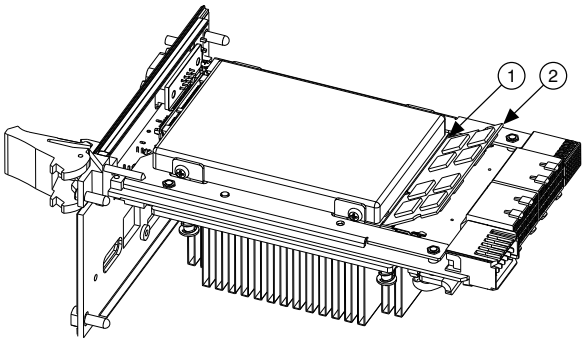
- 1600 MHz DDR3L PC3-12800 2 GB, 256 MB x 64, 1.18 in. max (NI part number 785347-01)
- 1866 MHz DDR3L PC3-14900 4 GB, 512 MB × 64, 1.18 in. max (NI part number 785346-01)
- 1866 MHz DDR3L PC3-14900 8 GB, 1024 MB × 64, 1.18 in. max (NI part number 783001-8192)

Note National Instruments has tested and verified that the DDR3L SO-DIMMs we sell work with the PXIe-8821 controller. We recommend you purchase your DDR3L

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SO-DIMM modules from National Instruments. Other off-the-shelf DDR3L SO-DIMM modules are not guaranteed to work properly.

Figure 3. Installing a DDR3L SO-DIMM in a PXIe-8821 Controller



1. DDR3L SO-DIMM Socket
2. DDR3L SO-DIMM Module

Installing an OS

PXIe-8821 controllers may include a preinstalled OS. In some cases, you may want to install a different OS. When doing so, consider the following guidelines.

Installing from a USB CD/DVD-ROM

The PXIe-8821 supports the installation of Windows 7 from a USB CD/DVD-ROM. As an alternative to a USB CD/DVD-ROM drive, you can use an external SCSI CD/DVD-ROM with a PXI-SCSI adapter.

Note For additional assistance with installing or changing an operating system, refer to KnowledgeBase 2ZKC02OK, *Hard Drive Recovery and OS Installation for PXI and VXI Controllers*, at `ni.com/support`.

PXIe-8821 Specifications

Note Specifications are subject to change without notice.

Caution Using the PXIe-8821 controller in a manner not described in this user manual can impair the protection the controller provides.

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Features

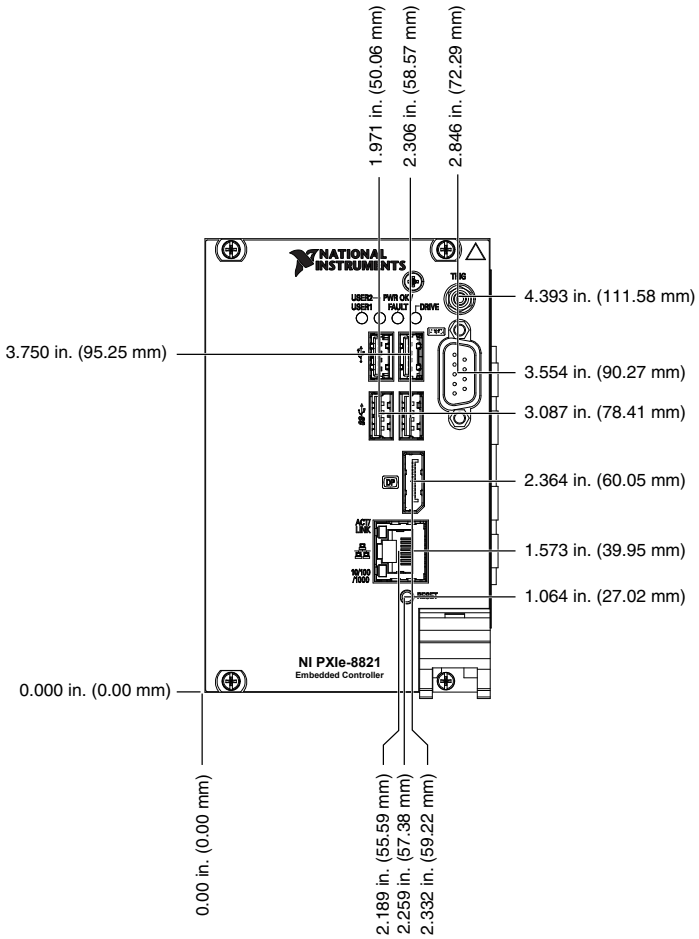
PXIe-8821	
CPU	Intel® Core™ i3 4110E (2.6 GHz dual-core processor)
On-die last level cache	3 MB
Single-Channel 1600 MHz DDR3L RAM, PC3 12800	2 GB standard, 8 GB maximum
Hard Drive	320 GB Serial ATA, minimum*
Ethernet	One 10/100/1000 BaseT port
PXI Express 4 Link Configuration	x1, x1, x1, x1
PXI Express 2 Link Configuration	x1, x1
GPIB (IEEE 488 Controller)	No
Serial Port (RS-232)	Yes (1)
Parallel Port	No
Hi-Speed USB (2.0) Ports	Yes (2)
SuperSpeed USB (3.0) Ports	Yes (2)
ExpressCard/34 Slot	No
PS/2 Keyboard/Mouse Connector	No
PXI Trigger Bus Input/Output	Yes
Installed Operating System	Windows 7 Professional for Embedded Systems
* Extended-temperature 24/7 option provides 80 GB minimum SATA solid-state drive.	

Front Panel Dimensions

The following figure shows the front panel layout and dimensions of the PXIe-8821. Dimensions are in inches (millimeters).

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Figure 4. PXIe-8821 Front Panel Layout and Dimensions



Electrical

Note Does not include any attached USB devices.

Voltage (V)	Current (Amps) Typical	Current (Amps) Maximum
+3.3 V	1.09 A	1.77 A
+5 V	0.93 A	2.15 A
+12 V	2.86 A	4.82 A

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Voltage (V)	Current (Amps) Typical	Current (Amps) Maximum
-12 V	0 A	0 A
+5 V_{Aux}	0.19 A	0.46 A

Physical

Board dimensions	Four-wide 3U PXI Express module
Slot requirements	One system slot plus three controller expansion slots
Compatibility	Fully compatible with *PXI Express Specification* 1.0
Weight	0.98 kg (2.16 lb) typical

Environmental

Maximum altitude	2,000 m (800 mbar) (at 25 °C ambient)
Pollution Degree	2

Indoor use only.

Operating Environment

Caution The operating temperature must not be exceeded, even when used in a chassis with a higher temperature range.

Ambient temperature range	5 °C to 50 °C (Tested in accordance with IEC-60068-2-1 and IEC-60068-2-2. Meets MIL-PRF-28800F Class 3 high temperature limit.)
Extended temperature option	0 °C to 55 °C (Tested in accordance with IEC-60068-2-1 and IEC-60068-2-2. Meets MIL-PRF-28800F Class 3 low temperature limit and MIL-PRF-28800F Class 2 high temperature limit.)
Relative humidity range	10% to 90%, noncondensing (Tested in accordance with IEC-60068-2-56.)

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Storage Environment

Ambient temperature range	-40 °C to 65 °C (Tested in accordance with IEC 60068-2-1 and IEC 60068-2-2. Meets MIL-PRF-28800F Class 3 low temperature limit.)
Extended Temperature Option	-40 °C to 71 °C (Tested in accordance with IEC 60068-2-1 and IEC 60068-2-2. Meets MIL-PRF-28800F Class 3 limits.)
Relative humidity range	5% to 95%, noncondensing (Tested in accordance with IEC 60068-2-56.)

Shock and Vibration

Operating shock	30 g peak, half-sine, 11 ms pulse (Tested in accordance with IEC 60068-2-27. Meets MIL-PRF-28800F Class 2 limits.)
Random vibration	
Operating	5 Hz to 500 Hz, 0.3 g_{rms} (with solid-state hard drive)
Nonoperating	5 Hz to 500 Hz, 2.4 g_{rms} (Tested in accordance with IEC 60068-2-64. Nonoperating test profile exceeds the requirements of MIL-PRF-28800F, Class 3.)

Safety

This product is designed to meet the requirements of the following standards of safety for information technology equipment:

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

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 61326-1 (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

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- 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 *Online Product Certification* section.

CE Compliance CE

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

- 2014/35/EU; Low-Voltage Directive (safety)
- 2014/30/EU; Electromagnetic Compatibility Directive (EMC)

Online Product Certification

Refer to the product Declaration of Conformity (DoC) for additional regulatory compliance information. To obtain product certifications and 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 NI products must be disposed of according to local laws and regulations. For more information about how to recycle NI products in your region, visit *ni.com/environment/weee*.

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Battery Replacement and Disposal

Battery Directive This device contains a long-life coin cell battery. If you need to replace it, use the Return Material Authorization (RMA) process or contact an authorized National Instruments service representative. For more information about compliance with the EU Battery Directive 2006/66/EC about Batteries and Accumulators and Waste Batteries and Accumulators, visit *ni.com/environment/batterydirective*.

电子信息产品污染控制管理办法（中国 RoHS）

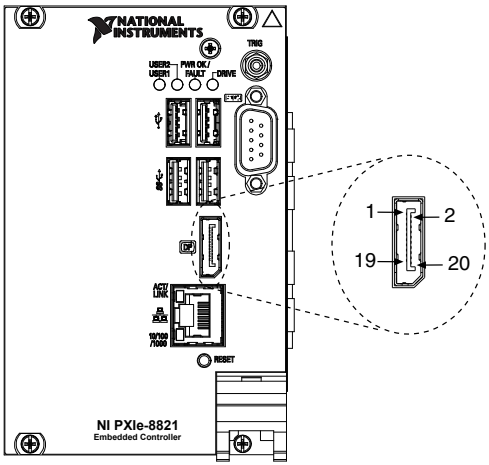
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I/O Information

DisplayPort

The following figure shows the location and pinouts for the DisplayPort connectors on the PXIe-8821. The following table lists and describes the DisplayPort connector signals.

Figure 5. DisplayPort Connector Location and Pinout



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Table 1. DisplayPort Connector Signals

Pin	Signal Name
1	ML_Lane0(p)
2	GND
3	ML_Lane0(n)
4	ML_Lane1(p)
5	GND
6	ML_Lane1(n)
7	ML_Lane2(p)
8	GND
9	ML_Lane2(n)
10	ML_Lane3(p)
11	GND
12	ML_Lane3(n)
13	CONFIG1
14	CONFIG2
15	AUX CH (p)
16	GND
17	AUX CH (n)
18	Hot Plug Detect
19	Return
20	DP_PWR

COM1

The following figure shows the location and pinouts for the COM1 connector on the PXIe-8821. The following table lists and describes the COM1 connector signal.

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Figure 6. COM1 Connector Location and Pinout

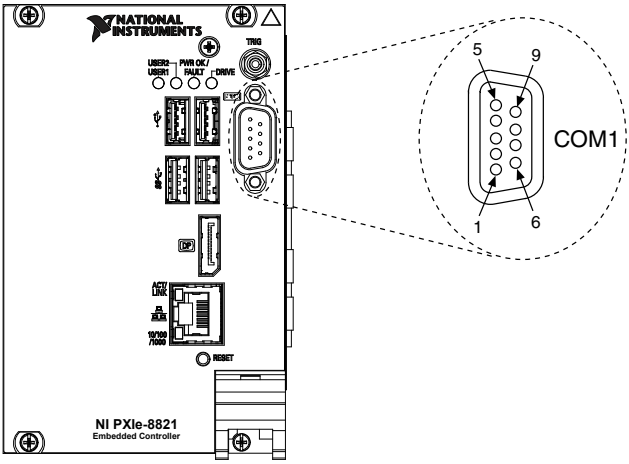


Table 2. COM1 Connector Signals

Pin	Signal Name	Signal Description
1	DCD#	Data Carrier Detect
2	RXD#	Receive Data
3	TXD#	Transmit Data
4	DTR#	Data Terminal Ready
5	GND	Ground
6	DSR#	Data Set Ready
7	RTS#	Ready to Send
8	CTS#	Clear to Send
9	RI#	Ring Indicator
Note: The pound symbol (#) indicates an active low signal.		

Ethernet

The following figure shows the location and pinouts for the dual stacked Ethernet connector on the PXIe-8821. The following table lists and describes the Ethernet connector signals.

Note Only Ethernet Port 1 supports the Wake On LAN feature.

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Figure 7. Ethernet Connector Location and Pinout

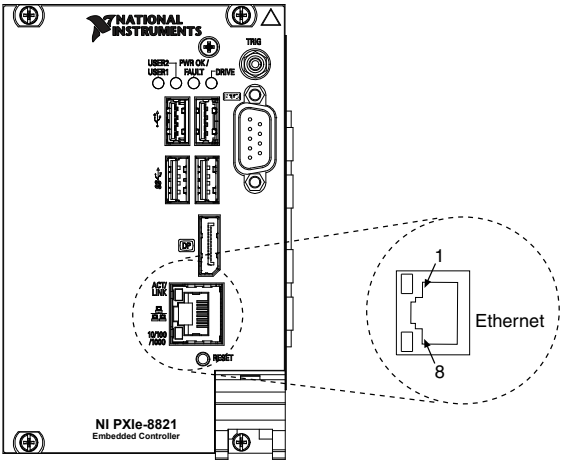


Table 3. Ethernet Connector Signals

Pin	Fast Ethernet	Gigabit Ethernet
1	TX+	TX_A+
2	TX-	TX_A-
3	RX+	RX_B+
4	NC	TX_C+
5	NC	TX_C-
6	RX-	RX_B-
7	NC	RX_D+
8	NC	RX_D-

Note The Ethernet controller can perform an automatic crossover, thus eliminating the need for crossover cables.

The following table lists and describes the 10/100/1000 LAN connector LED states.

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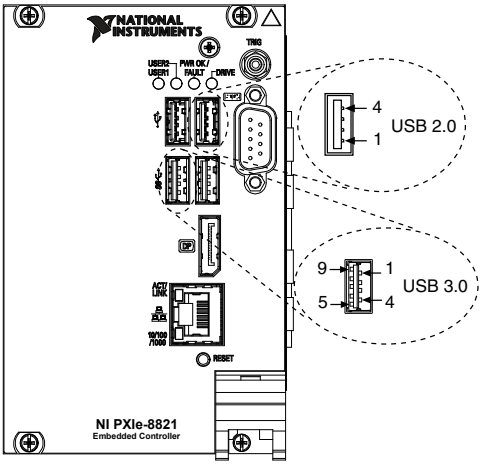
Table 4. 10/100/1000 LAN Connector LED States

LED	Color	LED State	Condition
Top	Green	Off	LAN link is not established.
		On (steady state)	LAN link is established.
		On (brighter and pulsing)	The controller is communicating with another computer on the LAN.
Bottom	Unlit	Off	10 Mbit/sec data rate is selected.
	Green	On	100 Mbit/sec data rate is selected.
	Amber	On	1000 Mbit/sec data rate is selected.

Universal Serial Bus

The following figure shows the location and pinouts for the Universal Serial Bus (USB) connector on the PXIe-8821. Each controller has two USB 2.0 ports and two USB 3.0 ports on the front panel.

Figure 8. USB Connector Location and Pinout



The following table lists and describes the USB 2.0 connector signals.

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Table 5. USB 2.0 Connector Signals

Pin	Signal Name	Signal Description
1	VCC	Cable Power (+5 V)
2	-Data	USB Data -
3	+Data	USB Data +
4	GND	Ground

The following table lists and describes the USB 3.0 connector signals.

Table 6. USB 3.0 Connector Signals

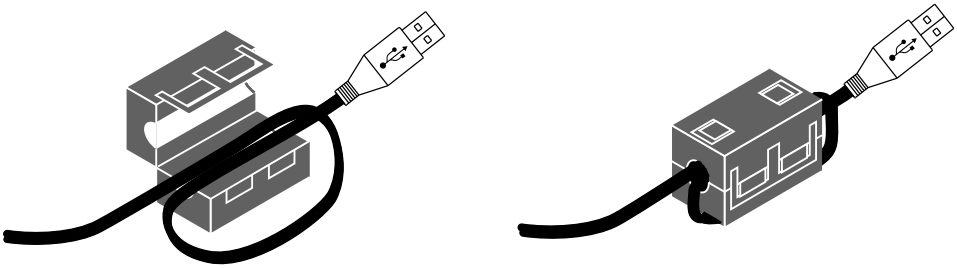
Pin	Signal Name	Signal Description
1	VCC	Cable Power (+5 V)
2	-Data	USB Data -
3	+Data	USB Data +
4	GND	Ground
5	StdA_SSRX–	USB Data Receive-
6	StdA_SSRX+	USB Data Receive+
7	GND_DRAIN	Ground
8	StdA_SSTX–	USB Data Transmit-
9	StdA_SSTX+	USB Data Transmit+

Caution Install a noise-suppression ferrite (included in your shipping kit) around all attached external USB 2.0 cables to ensure that your device meets all EMC standards applicable to your country. Install the ferrite so that each USB cable loops through the ferrite as shown in the following figure. The ferrite should be installed so that it is approximately 50-75 mm (2-3 in.) from the end of the cable that plugs

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into the controller. The ferrite should accommodate from 2-4 USB 2.0 cables depending on cable diameter.

Figure 9. Installing a Ferrite on a Single USB 2.0 Cable



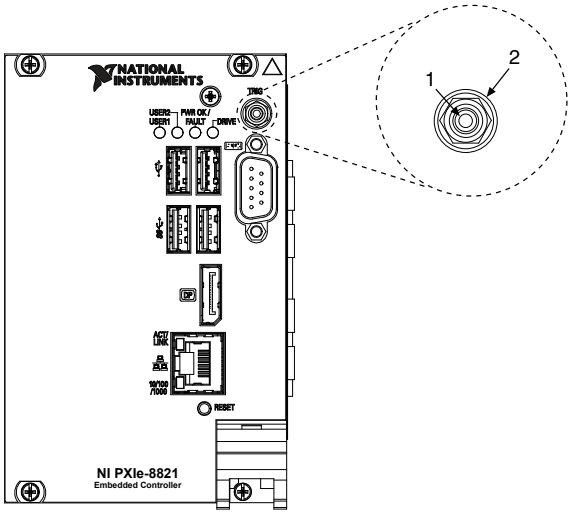
Trigger

The TRIG connector is the software-controlled trigger connection for routing PXI triggers to or from the backplane trigger bus.

The following figure shows the TRIG connector location on the PXIe-8821. The following table lists and describes the trigger connector signals.

Refer to *PXI Trigger Connectivity* in the *PXIe-8821 Getting Started Guide* for more information about the SMB trigger.

Figure 10. TRIG Connector Location and Pinout



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Table 7. TRIG Connector Signals

Pin	Signal Name	Signal Description
1	TRIG	Trigger
2 (Shield)	GND	Ground

Worldwide Support and Services

The NI website 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.

Visit *ni.com/services* for NI Factory Installation Services, repairs, extended warranty, and other services.

Visit *ni.com/register* to register your NI product. Product registration facilitates technical support and ensures that you receive important information updates from NI.

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