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Find the *National Instruments PXI-8840 / PXI-8840 RT* at our website: *Click HERE*

USER MANUAL

NI PXI-8840

This document provides reference information for PXI and the NI PXI-8840 embedded controller.

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Related Documentation

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

- IEEE Standard 488.1-2003, *IEEE Standard for Higher Performance Protocol for the Standard Digital Interface for Programmable Instrumentation*
- *PICMG 2.0 R3.0 CompactPCI Specification*, PCI Industrial Computers Manufacturers Group
- *PCI Local Bus Specification, Revision 2.3*, PCI Special Interest Group
- *PXI Hardware Specification, Revision 2.2*, PXI Systems Alliance
- *PXI Software Specification*, Revision 2.1, PXI Systems Alliance
- *Serialized IRQ Support for PCI Systems Specification*, Compaq Computer et al.
- *ExpressCard Standard*, PCMCIA
- *Universal Serial Bus (USB) Specification*, Revision 2.0
- *Universal Serial Bus (USB) Specification*, Revision 3.0

PXI Features

Benefits of PXI

The PXI (PCI eXtensions for Instrumentation) industry standard, an open specification governed by the PXI Systems Alliance (PXISA), defines a compact modular PC platform for test, measurement, and control systems. Because PXI leverages the PCI bus, PXI users receive all the benefits of PCI within an architecture that supports mechanical, electrical, and software features tailored to industrial instrumentation, data acquisition, industrial automation, and control applications.

Well-suited for industrial applications, PXI leverages from the CompactPCI specification, which defines a rugged form factor for PCI that offers superior mechanical integrity and easy installation and removal of hardware components. PXI products offer higher and more carefully defined levels of environmental performance required by the vibration, shock, temperature, and humidity extremes of industrial environments. PXI adds mandatory environmental testing and active cooling to the CompactPCI mechanical specification to ease system integration and ensure multivendor interoperability.

Additionally, PXI meets the more specific needs of instrumentation users by adding an integrated trigger bus and reference clock for multiple-board synchronization, a star trigger bus for very precise timing, and local buses for side-band communication between adjacent peripherals.

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NI PXI-8840

Description

The NI PXI-8840 PXI/CompactPCI embedded computer is a high-performance PXI/CompactPCI-compatible system controller. The NI PXI-8840 controller integrates standard I/O features in a single unit by using state-of-the-art packaging. Combining an NI PXI-8840 embedded controller with a PXI-compatible chassis, such as the NI PXI-1042, results in a fully PC-compatible computer in a compact, rugged package.

The NI PXI-8840 has an Intel® Core™ i5 4400E processor (2.7 GHz dual core processor), all the standard I/O, and a 320 GB (or larger) hard drive. It also has a PCI-based GPIB controller and an ExpressCard/34 expansion slot.

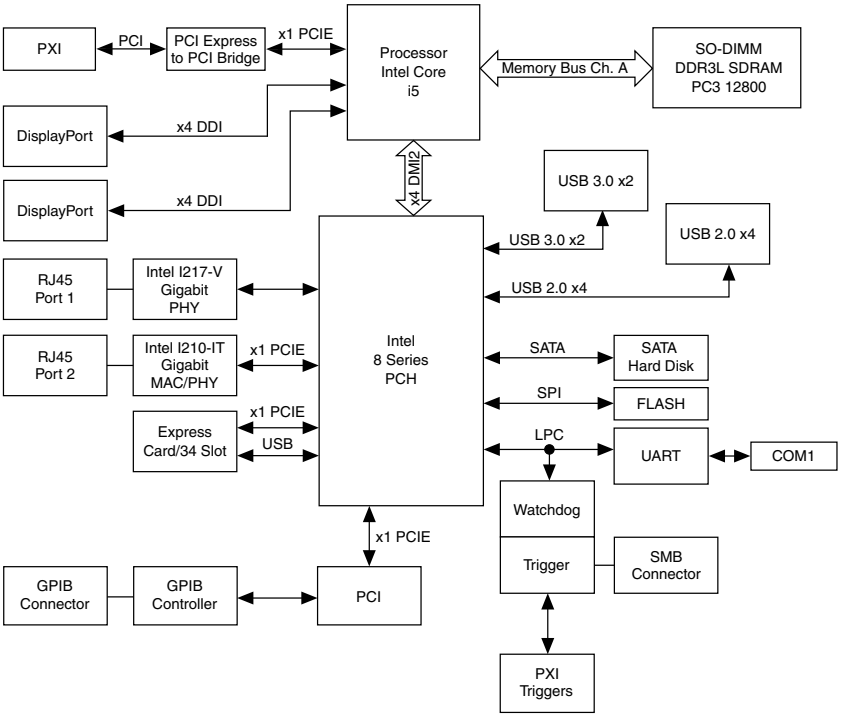
The standard I/O on each module includes two DisplayPort video, one RS-232 serial port, four Hi-Speed USB ports, two SuperSpeed USB ports, two Gigabit Ethernet, a reset button, and a PXI trigger.

Functional Overview

The NI PXI-8840 is a modular PC in a PXI 3U-size form factor. The following figure is a functional block diagram of the NI PXI-8840. Following the diagram is a description of each logic block shown.

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Figure 1. NI PXI-8840 Block Diagram



The NI PXI-8840 consists of the following logic blocks on two circuit card assemblies (CCAs):

- The *processor* is an Intel® Core™ i5 4400E processor (3 MB Cache, 2.7 GHz). The processor connects to the SO-DIMM block through the DDR3L interface supporting up to 1600 MHz SO-DIMMs, 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 NI PXI-8840, and the PCI Express interface to the PXI backplane through a PCI Express to PCI bridge.
- The *Platform Controller Hub* (PCH) provides the USB, PCI Express x1, and LPC interfaces that connect to the peripherals on the NI PXI-8840.
- The *DisplayPort* block consists of two DisplayPort connectors.
- The *USB* block consists of four Hi-Speed USB 2.0 connectors and two SuperSpeed USB 3.0 connectors.
- The *GPIB* block contains the GPIB interface.

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- The *ExpressCard/34* slot accommodates an ExpressCard/34 module.
- The *Ethernet Port 1* block consists of an Intel® I217-V Gigabit Ethernet Connection.
- The *Ethernet Port 2* block consists of an Intel® I210-IT Gigabit Ethernet Connection.
- The *UART* block connects to one serial port.
- 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 Connectors* connect the NI PXI-8840 to the PXI/CompactPCI backplane.

National Instruments Software

National Instruments has developed several software tools you can use with the NI PXI-8840.

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-

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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 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 NI PXI-8840 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 NI PXI-8840 controller features.

Most users do not need to use the BIOS setup program, as the NI PXI-8840 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.

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Accessing BIOS Setup Utility

Complete the following steps to start the BIOS setup program.

1. Power on or reboot your NI PXI-8840 controller.
2. When the message **`Press <DEL> to enter setup`** appears, press the <Delete> key. The setup program loads after a short delay.

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 NI PXI-8840 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 NI PXI-8840 controller, the processor speed, and the maximum number of processor cores.
- **Total Memory**—This value indicates the system RAM size the BIOS detects.

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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.

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.
- **ExpressCard Configuration**—Use this setting to access the **ExpressCard Configuration** submenu. Refer to the *ExpressCard 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 most compatible and optimal configuration possible.

- **SATA Controller**—This setting specifies whether or not 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, such as Windows 2000, do not

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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.

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** and **All**. The default value is **All**.
- **Turbo Boost**—This setting enables or disables Intel Turbo Boost technology. The default value is **Enabled**. Enabling Turbo Boost allows CPU cores to run at higher than their base frequency for short durations, while other cores are idle. Enabling Turbo Boost also can increase application jitter, so be careful when enabling this setting on a Real Time system. To achieve maximum possible Turbo Boost frequencies, also enable the C-States setting. When the BIOS is configured to boot LabVIEW Real-Time, Turbo Boost is disabled automatically. To manually enable Turbo Boost performance when in LabVIEW Real-Time mode, refer to the *LabVIEW RT Configuration Overrides Submenu*.
- **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

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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**.

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.

- **OS Soft Off Support**—This setting enables or disables the operating system's ability to put the system into soft off state. Disabling this option allows Windows 7 to show the shutdown screen. The default is **Enabled**.

ExpressCard Configuration Submenu

Use this submenu to apply alternate settings to the ExpressCard configuration. These settings determine how much memory space, I/O space, and PCI bus numbers are pre-allocated for the ExpressCard port, allowing non-PCI Express-aware operating systems to support hot-plugging ExpressCard devices. Normally, you do not need to modify these settings, as the factory default settings provide the most compatible and optimal configuration possible.

- **ExpressCard Resources**—This setting enables or disables the setting of the **Reserved Buses**, **Reserved Memory**, and **Reserved I/O** settings. The default value for this setting is **Enabled**. If this setting is disabled, the bus, memory, and I/O options disappear from this submenu. Disabling this setting effectively sets **Reserved Buses** to **0**, **Reserved Memory** to **0M**, and **Reserved I/O** to **0K**.
- **Reserved Buses**—This setting determines the number of PCI buses the BIOS reserves for ExpressCard PCI-PCI bridges that may be hot-plugged in the ExpressCard slot. The default value for this setting is **8** PCI buses.
- **Reserved Memory**—This setting determines the amount of memory space, in bytes, that the BIOS reserves for PCI-PCI bridges that may be hot-plugged in the ExpressCard slot. The default value for this setting is **64M** bytes of memory.
- **Reserved I/O**—This setting determines the amount of I/O space, in bytes, that the BIOS reserves for PCI-PCI bridges that may be hot-plugged in the ExpressCard slot. The default value for this setting is **4K** bytes of I/O space.

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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 most compatible and optimal configuration possible.

- **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 or not 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. This option can be used 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 is unable to 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**.

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.

- **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.

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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 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

Complete the following steps to start the BIOS Diagnostic Utility.

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 is tested first upon entry into the BIOS Diagnostic Utilities. A quick test is performed initially, and a more comprehensive test is performed afterwards. The user 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, the user is presented with the testing results. If both tests have succeeded or been skipped, **Press any key to continue** is displayed. To continue with testing, the user must press a key on the keyboard.

Note If either hard drive test fails, the controller is not permitted to boot, and the user is instructed to turn off the controller and replace the hard drive.

Memory Diagnostic Utility

The memory diagnostic utility is started immediately after the user presses a key to exit the hard drive diagnostic utility. The user 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, the user is presented with the testing result. If the memory test was successful or skipped, **Press any key to continue** is displayed. To continue to boot the controller, the user must press a key on the keyboard.

Note If the memory test fails, the controller is not permitted to boot, and the user is instructed to turn off the controller and replace the memory.

System CMOS

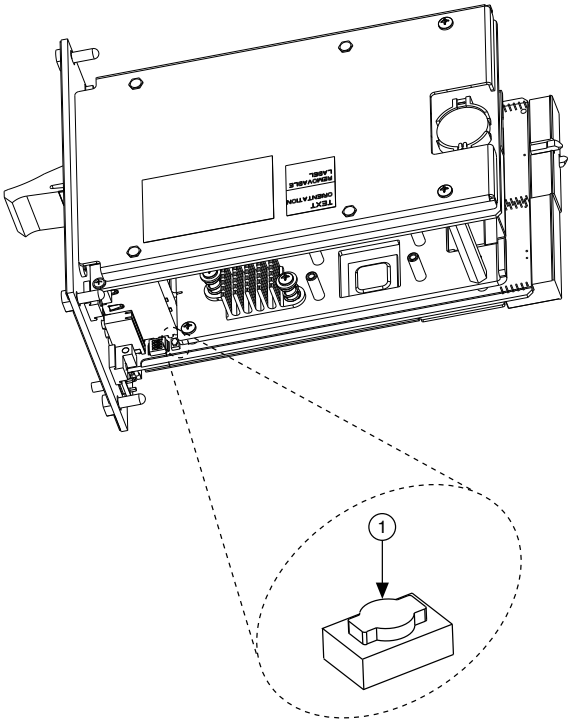
The NI PXI-8840 contains memory backed up by a battery to store BIOS configuration information.

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

ExpressCard

This section provides information on the installation and removal of ExpressCard™ modules.

Installing an ExpressCard

You can install an ExpressCard module while the NI PXI-8840 is running. The NI PXI-8840 automatically detects the card. ExpressCards are generally marked with a symbol or a label to indicate which end to insert into the slot. The cards are keyed to prevent incorrect insertion.

To install an ExpressCard, complete the following steps.

1. Hold the card so the top side is facing left.
2. Insert the card until it is completely seated in its connector. The connector has an automatic eject mechanism. If you insert the card and it is ejected, re-insert the card until it is seated.

If you encounter too much resistance, do not force the card. Check the card orientation and try again.

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The NI PXI-8840 automatically recognizes the ExpressCard and loads the appropriate driver(s). Third-party cards may require that you install additional drivers. Contact your ExpressCard vendor for more information.

Removing an ExpressCard

To remove an ExpressCard, complete the following steps.

1. Push in the module and then release to eject the card.
2. Slide the card out of the slot.

Caution To avoid data loss and other potential issues, stop communication with your ExpressCard device before removing it from the NI PXI-8840. In Windows, use the Safely Remove Hardware tool to stop the ExpressCard safely.

Boot Options

The NI PXI-8840 can boot from the following devices:

- The internal Serial ATA hard drive
- An external SCSI hard drive or SCSI CD/DVD-ROM if a 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 NI PXI-8840 BIOS configures the USB devices so that they work in a DOS environment.

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

NI PXI-8840 controllers 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 NI

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PXI-8840 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 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 NI PXI-8840 by upgrading the SO-DIMM.

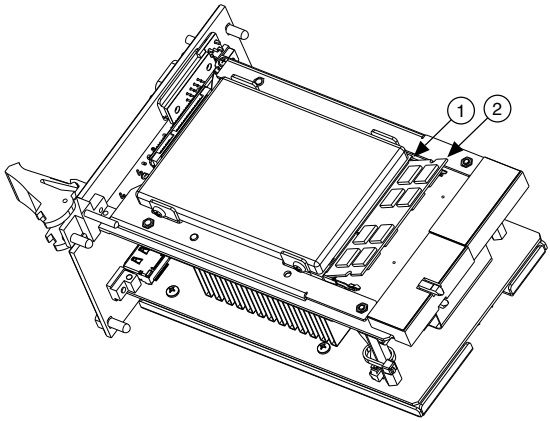
National Instruments offers the following SO-DIMMs for use with the NI PXI-8840 controller.

- 1600 MHz DDR3L PC3-12800 4 GB, 512 MB × 64, 1.18 in. max (NI part number 782341-4096)
- 1600 MHz DDR3L PC3-12800 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 NI PXI-8840 controller. We recommend you purchase your DDR3L SO-DIMM modules from National Instruments. Other off-the-shelf DDR3L SO-DIMM modules are not guaranteed to work properly.

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Figure 3. Installing a DDR3L SO-DIMM in an NI PXI-8840 Controller



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

Installing an OS

NI PXI-8840 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 NI PXI-8840 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`.

Specifications

This section lists the electrical, mechanical, and environmental specifications of the NI PXI-8840 embedded controller.

Caution Specifications are subject to change without notice.

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Features

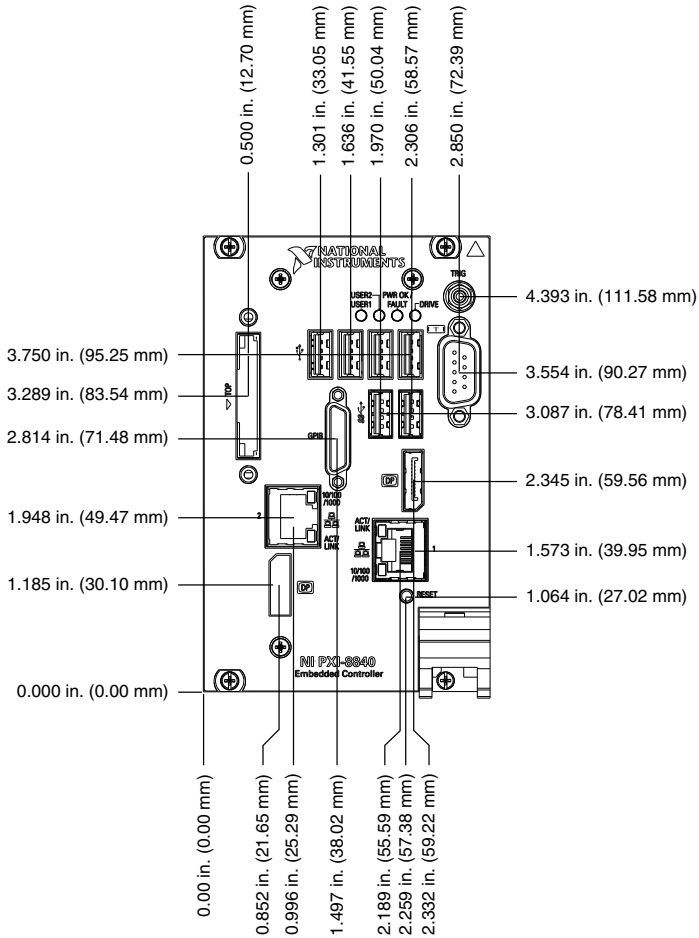
NI PXI-8840	
CPU	Intel® Core™ i5 4400E (2.70 GHz dual core processor)
On-die L2 cache	3 MB
Single-Channel 1600 MHz DDR3L RAM, PC3 12800	4 GB standard, 8 GB maximum
Hard Drive	320 GB Serial ATA, minimum*
Ethernet	Two 10/100/1000 BaseT ports
GPIB (IEEE 488 Controller)	Yes
Serial Port (RS-232)	Yes (1)
Parallel Port	No
Hi-Speed USB (2.0) Ports	Yes (4)
SuperSpeed USB (3.0) Ports	Yes (2)
ExpressCard/34 Slot	Yes
Display Interface	Two DisplayPort 1.2 ports
PS/2 Keyboard/Mouse Connector	No
PXI Trigger Bus Input/Output	Yes
Installed Operating System	Windows 7 Professional
* Extended-temperature 24/7 option provides 80 GB minimum SATA solid-state drive.	

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Front Panel Dimensions

The following figure shows the front panel layout and dimensions of the NI PXI-8840. Dimensions are in inches (millimeters).

Figure 4. NI PXI-8840 Front Panel Layout and Dimensions



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Electrical

Note Does not include any attached USB devices or ExpressCard.

Voltage (V)	Current (Amps) Typical	Current (Amps) Maximum
+3.3 V	1.12 A	1.84 A
+5 V (+5 V_{DC} and +5 V_{IO})	8.92 A	14.97 A
+12 V	0.18 A	0.27 A
-12 V	0.00 A	0.00 A

Physical

Board dimensions.....Four-wide 3U PXI module

Slot requirements.....One system slot plus three controller expansion slots

Compatibility.....Fully compatible with *PXI Specification*

Weight.....1.26 kg (2.77 lb) typical

Environmental

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

Pollution Degree.....2

Indoor use only.

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Operating Environment

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

Ambient temperature range[1, 2]

- Base.....5 °C to 50 °C[3] (Tested in accordance with IEC-60068-2-1 and IEC-60068-2-2.)
- 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.)

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 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.)

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1 For chassis that are not available in the online catalog at ni.com, contact National Instruments for supported operating temperatures.

2 Processor should not throttle CPU frequency under reasonable, worst case processor work loads in high operating temperatures.

3 5 °C to 40 °C for the NI PXI-1000B DC.

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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
- AS/NZS CISPR 11: Group 1, 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 generates 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.

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CE Compliance CE

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

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

Online Product Certification

To obtain product certifications and the 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 Electrical and Electronic Equipment, visit *ni.com/environment/weee*.

Battery Replacement and Disposal

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）

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`.)

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I/O Information

DisplayPort

The following figure shows the location and pinouts for the DisplayPort connectors on the NI PXI-8840. The following table lists and describes the DisplayPort connector signals.

Figure 5. DisplayPort Connector Location and Pinout

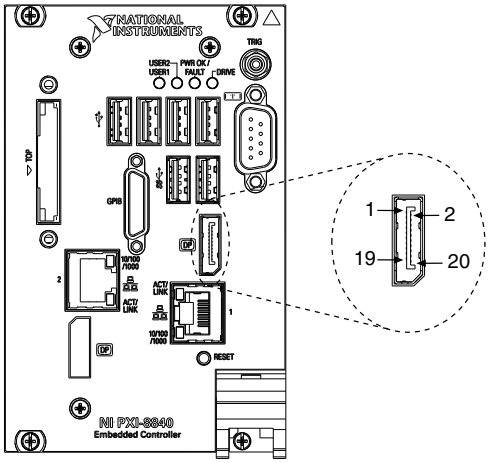


Table 1. DisplayPort Connector Signals

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)

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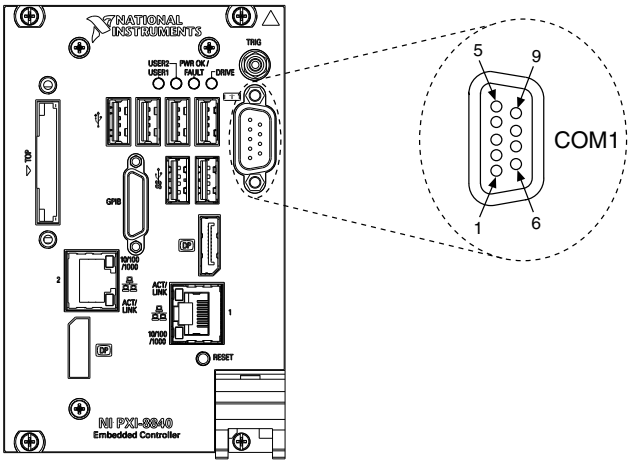
Table 1. DisplayPort Connector Signals (Continued)

Pin	Signal Name
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 NI PXI-8840. The following table lists and describes the COM1 connector signal.

Figure 6. COM1 Connector Location and Pinout



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Table 2. COM1 Connector Signals

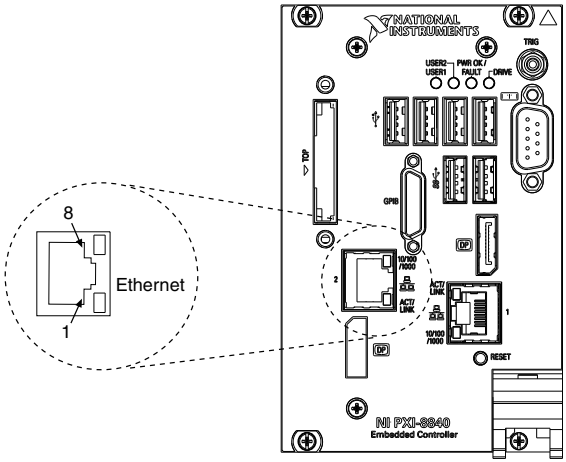
Pin	Signal Name	Signal Description
1	DCD#	Data Carrier Detect
2	RXD#	Receive Data
3	TXD#	Transmit Data
4	DTR#	Data Terminal Ready
5	GND	Ground
6	DSR#	Data Set Ready
7	RTS#	Ready to Send
8	CTS#	Clear to Send
9	RI#	Ring Indicator
Note: The pound symbol (#) indicates an active low signal.		

Ethernet

The following figure shows the location and pinouts for the dual stacked Ethernet connector on the NI PXI-8840. The following table lists and describes the Ethernet connector signals.

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

Figure 7. Ethernet Connector Location and Pinout



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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.

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

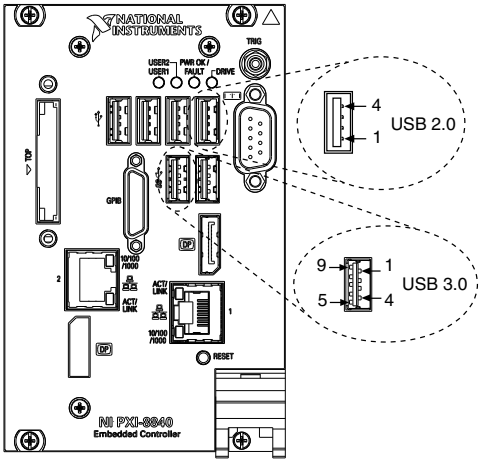
LED	Color	LED State	Condition
Top	Green	Off	LAN link is not established.
		On (steady state)	LAN link is established.
		On (brighter and pulsing)	The controller is communicating with another computer on the LAN.
Bottom	Unlit	Off	10 Mbit/sec data rate is selected.
	Green	On	100 Mbit/sec data rate is selected.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

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Universal Serial Bus

The following figure shows the location and pinouts for the Universal Serial Bus (USB) connector on the NI PXI-8840. Each controller has four 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.

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 +

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Table 6. USB 3.0 Connector Signals (Continued)

Pin	Signal Name	Signal Description
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+

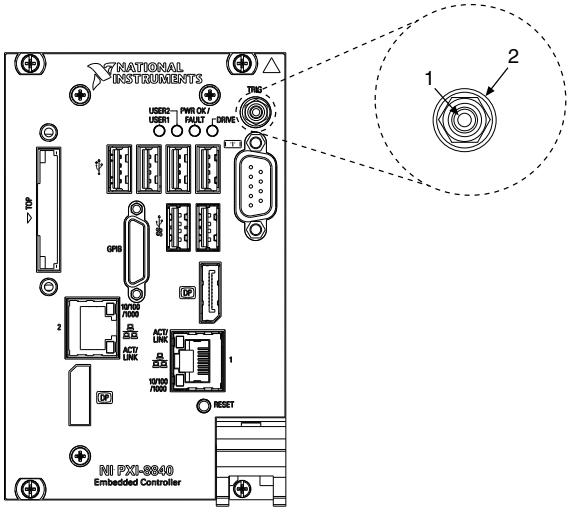
Trigger

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 NI PXI-8840. The following table lists and describes the trigger connector signals.

Refer to *PXI Trigger Connectivity* in the *NI PXI-8840 Getting Started Guide* for more information about the SMB trigger.

Figure 9. 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

GPIB (IEEE 488.2)

The following figure shows the location and pinouts for the GPIB connector on the NI PXI-8840. The following table lists and describes the GPIB connector signals.

National Instruments provides a GPIB mating connector, part number 183285-0R2.

Figure 10. GPIB Connector Location and Pinout

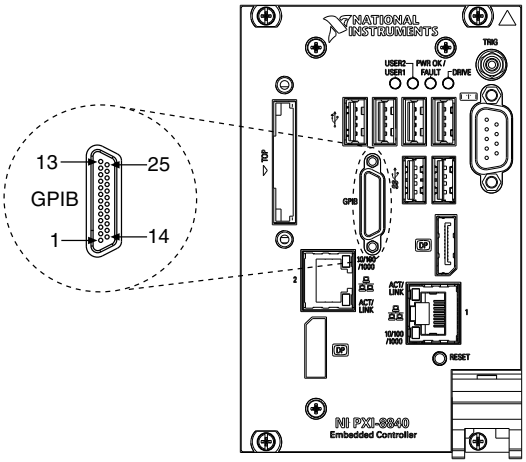


Table 8. GPIB Connector Signals

Pin	Signal Name	Signal Description
1	DIO1#	Data Bit 1
2	DIO2#	Data Bit 2
3	DIO3#	Data Bit 3
4	DIO4#	Data Bit 4
5	EOI#	End or Identify
6	DAV#	Data Valid

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Table 8. GPIB Connector Signals (Continued)

Pin	Signal Name	Signal Description
7	NRFD#	Not Ready for Data
8	NDAC#	Not Data Accepted
9	IFC#	Interface Clear
10	SRQ#	Service Request
11	ATN#	Attention
12	SHIELD	Chassis ground
13	DIO5#	Data Bit 5
14	DIO6#	Data Bit 6
15	DIO7#	Data Bit 7
16	DIO8#	Data Bit 8
17	REN#	Remote Enable
18-25	GND	Logic Ground
Note: The pound symbol (#) indicates an active low signal.		

ExpressCard/34 Slot

The NI PXI-8840 controller is equipped with an ExpressCard/34 slot on the front panel, providing I/O expansion and options for removable storage, Ethernet, and a variety of other I/O.

The following figure shows the location and pinouts for the ExpressCard/34 slot on the NI PXI-8840. The following table lists and describes the ExpressCard connector signals.

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Figure 11. ExpressCard/34 Slot Location and Pinout

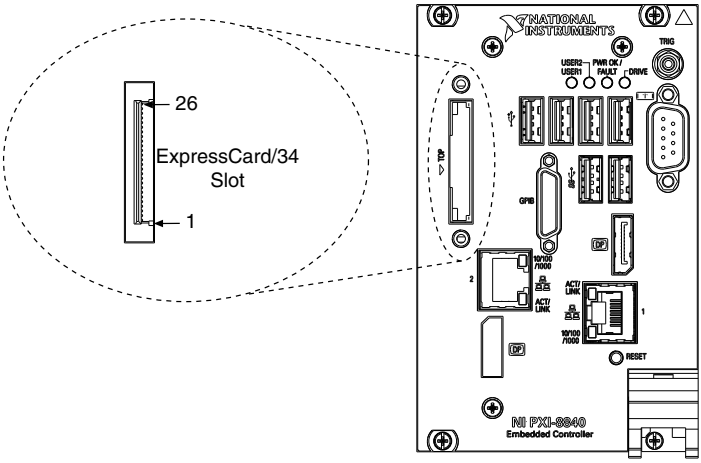


Table 9. ExpressCard Connector Signals

Pin	Signal Name	Signal Description
1	GND	Ground
2	USBD–	USB Data –
3	USBD+	USB Data +
4	CPUSB#	USB Presence
5	RESERVED	Reserved by spec for future use
6	RESERVED	Reserved by spec for future use
7	SMBCLK	SMBus Clock
8	SMBDATA	SMBus Data
9	+1.5V	Power
10	+1.5V	Power
11	WAKE#	PE Wake
12	+3.3VAUX	Power
13	PERST#	PE Reset
14	+3.3V	Power

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Table 9. ExpressCard Connector Signals (Continued)

Pin	Signal Name	Signal Description
15	+3.3V	Power
16	CLKREQ#	Clock Request
17	CPPE#	PE Presence
18	REFCLK–	Reference Clock –
19	REFCLK+	Reference Clock +
20	GND	Ground
21	PERn0	PE Data Receive -
22	PERp0	PE Data Receive +
23	GND	Ground
24	PETn0	PE Data Transmit -
25	PETp0	PE Data Transmit +
26	GND	Ground
Note: The pound symbol (#) indicates an active low signal.		

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