PXI

NI PXI-8250 User Manual

National Instruments System Monitor Hardware

July 2008
372605A-01

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Contents

About This Manual

The *NI PXI-8250 User Manual* describes the features of the NI PXI-8250, and contains information about configuring and operating the hardware.

Conventions

The following conventions are used in this manual:

» The **»** symbol leads you through nested menu items and dialog box options to a final action. The sequence **File»Page Setup»Options** directs you to pull down the **File** menu, select the **Page Setup** item, and select **Options** from the last dialog box.

This icon denotes a note, which alerts you to important information.

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

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

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

`monospace` Text in this font denotes text or characters that you should enter from the keyboard, sections of code, programming examples, and syntax examples. This font is also used for the proper names of disk drives, paths, directories, programs, subprograms, subroutines, device names, functions, operations, variables, filenames, and extensions.

NI PXI-1042/1042Q NI PXI-1042/1042Q indicates that either an NI PXI-1042 or NI PXI-1042Q chassis may be used. When the NI PXI-1042Q chassis is referred to alone in the text, then the text is not relevant to the NI PXI-1042 chassis.

Related Documentation

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

- IEEE 1101.1-1991, *IEEE Standard for Mechanical Core Specifications for Microcomputers Using IEC 603-2 Connectors*
- IEEE 1101.10, *IEEE Standard for Additional Mechanical Specifications for Microcomputers Using IEEE 1101.1 Equipment Practice*
- *PICMG EXP.0 R1.0 CompactPCI Express Specification*, PCI Industrial Computers Manufacturers Group
- *PCI Express Base Specification*, Revision 1.1, PCI Special Interest Group
- *PXI-5 PXI Express Hardware Specification*, Revision 1.0, PXI Systems Alliance
- *NI System Monitor 1.1 Help*

1

Getting Started

This chapter includes information about the features of the NI PXI-8250 and information about operating the hardware.

About the NI PXI-8250 Module

The NI PXI-8250 module monitors the status parameters of a chassis and displays the status information with front panel LEDs and an alert relay.

Features

NI PXI-8250 can be used with an NI PXI-1042, NI PXI-1042Q, or NI PXI-1045 chassis to detect and report chassis voltage rail problems, out-of-range chassis intake temperature, or chassis power shuttle fan failure. The NI PXI-8250 monitors the status of these parameters and reports the status through a set of LEDs on the front panel of the module. The NI PXI-8250 also includes a relay that toggles when any of the parameters fall outside of specification during chassis operation. These features can be used to monitor the state of the chassis and easily identify system failure.

The NI PXI-8250 comes with *NI System Monitor* software that includes the driver for the module and an application programming interface (API) that allows programmatic access to the information reported by the module. Although the driver allows for proper detection of the hardware, it is not required for the normal operation of the six system status LEDs, the alert relay, or the power outputs of the NI PXI-8250.

There is also a set of six user LEDs on the front panel of the NI PXI-8250 designed for custom alert configurations. This feature is not available with *NI System Monitor 1.1*, and may be added in future releases of *NI System Monitor.* Refer to the *NI System Monitor Help* for more information.

What You Need to Get Started

To set up and use the NI PXI-8250 module, you must have the following items:

- ❑ An NI PXI-8250 System Monitor module
- ❑ An NI PXI-1042, NI PXI-1042Q, or NI PXI-1045 chassis
- ❑ This manual
- ❑ Optional: The *NI System Monitor 1.1* driver software and documentation

Software Programming Choices

The *NI System Monitor* software includes a simple but powerful high-level application programming interface (API) that makes creating custom applications for the NI PXI-8250 easy. Refer to the *NI System Monitor 1.1 Help* for information on the API.

Safety Information

Caution The following paragraphs contain important safety information you must follow when installing and operating the NI PXI-8250, and all devices connecting to the NI PXI-8250.

Do not operate the device in a manner not specified in this document. Misuse of the device can result in a hazard. You can compromise the safety protection built into the device if the device is damaged in any way. If the device is damaged, return it to National Instruments (NI) for repair.

Do not substitute parts or modify the device except as described in this document. Use the device only with the chassis, specified in the installation instructions. You must have all covers and filler panels installed during operation of the device.

Do not operate the device in an explosive atmosphere or where there may be flammable gases or fumes. If you must operate the device in such an environment, it must be in a suitably rated enclosure.

If you need to clean the device, use a soft, nonmetallic brush. Make sure that the device is completely dry and free from contaminants before returning it to service.

Operate the device only at or below Pollution Degree 2. Pollution is foreign matter in a solid, liquid, or gaseous state that can reduce dielectric strength or surface resistivity. The following is a description of pollution degrees:

- Pollution Degree 1 means no pollution or only dry, nonconductive pollution occurs. The pollution has no influence.
- Pollution Degree 2 means that only nonconductive pollution occurs in most cases. Occasionally, however, a temporary conductivity caused by condensation must be expected.
- Pollution Degree 3 means that conductive pollution occurs, or dry, nonconductive pollution occurs that becomes conductive due to condensation.

Note The NI PXI-8250 is intended for indoor use only.

You must insulate signal connections for the maximum voltage for which the device is rated. Do not exceed the maximum ratings for the device. Do not install wiring while the device is live with electrical signals. Do not remove or add connector blocks when power is connected to the system. Remove power from signal lines before connecting them to or disconnecting them from the device.

Operate the device at or below the *installation category*[1] marked on the hardware label. Measurement circuits are subjected to *working voltages*[2] and transient stresses (overvoltage) from the circuit to which they are connected during measurement or test. Installation categories establish standard impulse withstand voltage levels that commonly occur in electrical distribution systems. The following is a description of installation categories:

- Installation Category I is for measurements performed on circuits not directly connected to the electrical distribution system referred to as *MAINS*[3] voltage. This category is for measurements of voltages from specially protected secondary circuits. Such voltage measurements include signal levels, special equipment, limited-energy parts of

[1] Installation categories, also referred to as measurement categories, are defined in electrical safety standard IEC 61010-1.

[2] Working voltage is the highest rms value of an AC or DC voltage that can occur across any particular insulation.

[3] MAINS is defined as a hazardous live electrical supply system that powers equipment. Suitably rated measuring circuits may be connected to the MAINS for measuring purposes.

equipment, circuits powered by regulated low-voltage sources, and electronics.

- Installation Category II is for measurements performed on circuits directly connected to the electrical distribution system. This category refers to local-level electrical distribution, such as that provided by a standard wall outlet (for example, 115 AC voltage for U.S. or 230 AC voltage for Europe). Examples of Installation Category II are measurements performed on household appliances, portable tools, and similar devices/modules.
- Installation Category III is for measurements performed in the building installation at the distribution level. This category refers to measurements on hard-wired equipment such as equipment in fixed installations, distribution boards, and circuit breakers. Other examples are wiring, including cables, bus bars, junction boxes, switches, socket outlets in the fixed installation, and stationary motors with permanent connections to fixed installations.
- Installation Category IV is for measurements performed at the primary electrical supply installation (<1,000 V). Examples include electricity meters and measurements on primary overcurrent protection devices and on ripple control units.

2

Configuration and Installation

This chapter describes how to configure and install the NI PXI-8250.

Software Installation

Before installing the NI PXI-8250, install the *NI System Monitor* driver software. Refer to the *NI System Monitor 1.1 Help* for specific installation instructions.

Notes It is necessary to install the *NI System Monitor* driver software before attempting to use the NI PXI-8250, or the system will not recognize the NI PXI-8250 and you will be unable to configure or use the device.

The NI PXI-8250 will not be visible in Measurement & Automation Explorer (MAX) even after proper installation. You can see the module in Windows Device Manager once the installation process is complete and Device Manager has been refreshed.

When adding or removing an NI PXI-8250 module from a Windows XP/2000/NT system, you must be logged on with administrator-level permission. The NI PXI-8250 will not be viewable in Measurement & Automation Explorer (MAX) at any time.

Hardware Installation

The following instructions are for general module installation in the specified chassis. Consult the PXI chassis user manual for a given chassis for chassis-specific instructions and warnings related to installation or module configuration.

Cautions The NI PXI-8250 module may sustain damage or inflict damage on adjacent modules if improperly installed.

Proper slot selection is required for the operation of this module. If the module is installed in any other slot, the module will not operate and could potentially cause other adjacent modules to not operate. Appendix A, *Specifications*, lists the typical power required for the NI PXI-8250 module.

The NI PXI-8250 is a sensitive electronic device shipped in an antistatic bag. Open only at an approved workstation and observe precautions for handling electrostatic-sensitive devices.

Note Install the NI PXI-8250 in only the right-most slot of an NI PXI-1042/1042Q or NI PXI-1045. As such, the NI PXI-8250 should only be installed in slot 8 of an NI PXI-1042/1042Q chassis or slot 18 of an NI PXI-1045 chassis.

Complete the following steps to install the NI PXI-8250 module.

1. Power off and unplug the chassis.

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

2. Locate the rightmost (last numbered) slot of the NI PXI-1042/1042Q or NI PXI-1045 chassis and ensure it is unused. If occupied, relocate the module or remove the filler panel. Refer to Figure 2-1 for the location of this slot on the NI PXI-1042/1042Q chassis, and Figure 2-2 for the location of this slot on the NI PXI-1045 chassis.

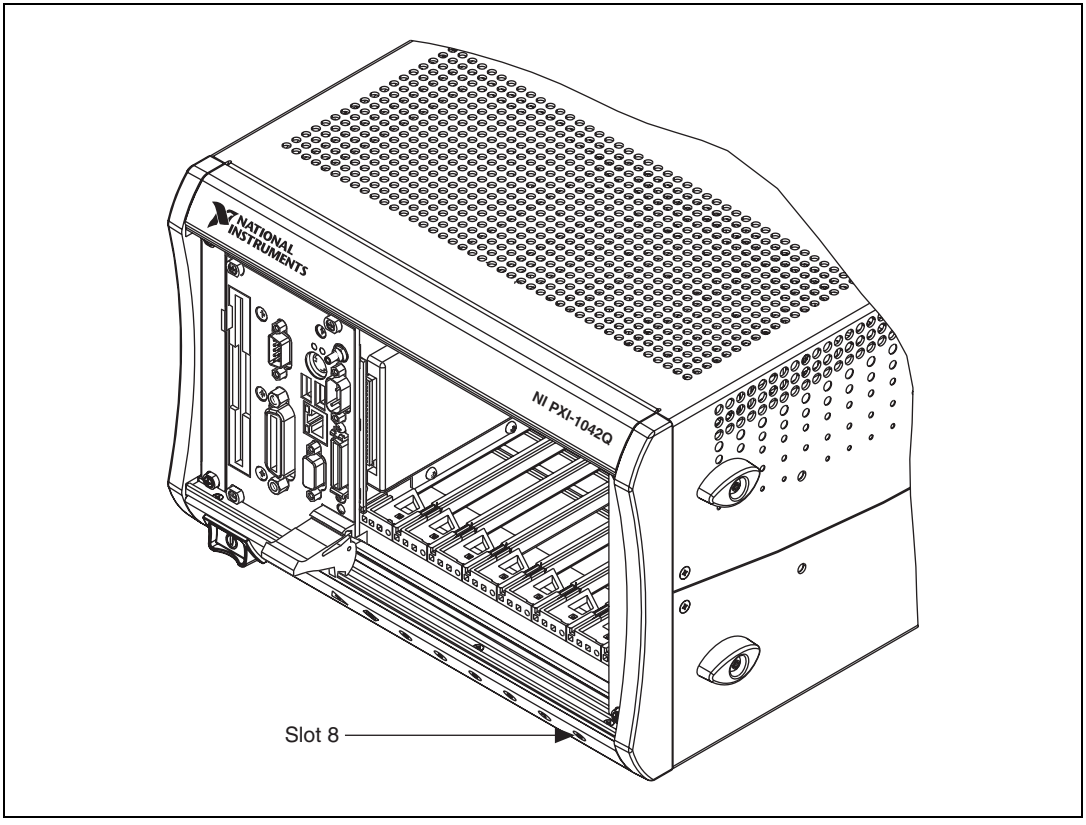


Figure 2-1. Location of NI PXI-1042Q Slot for NI PXI-8250 Support

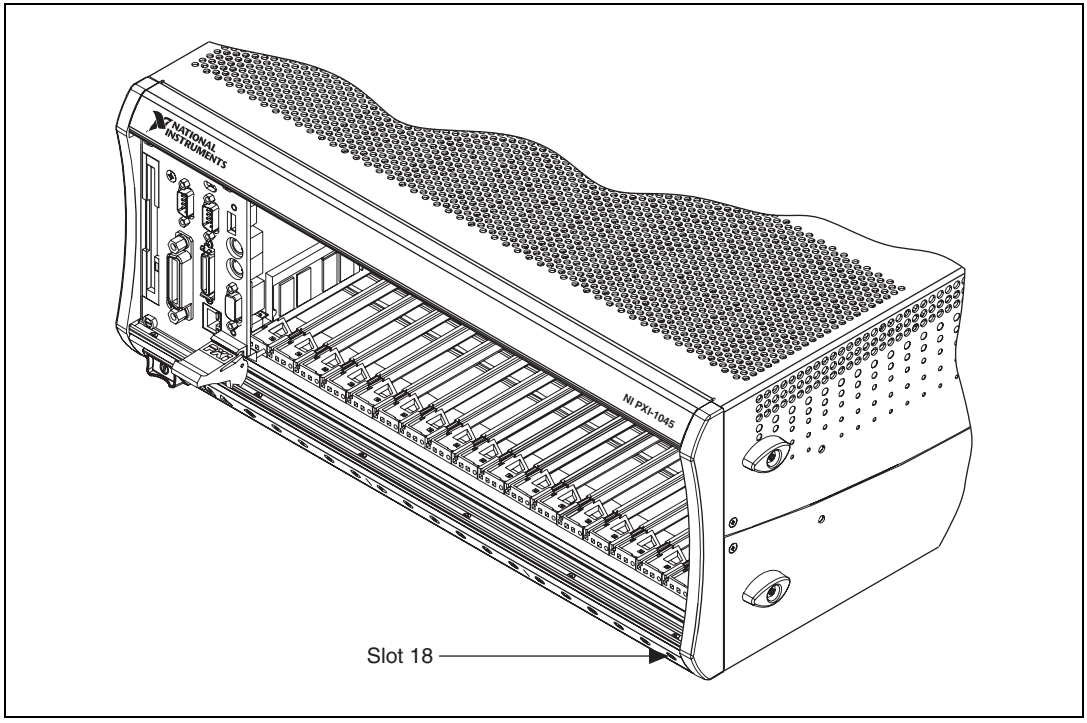


Figure 2-2. Location of NI PXI-1045 Slot for NI PXI-8250 Support

3. Touch a metal part on the chassis to discharge any static electricity that might be on your clothes or body. Static electricity can damage the hardware.
4. Insert the NI PXI-8250 module into the rightmost slot of an NI PXI-1042/1042Q or NI PXI-1045. The correct position is slot 8 for the NI PXI-1042/1042Q and slot 18 for the NI PXI-1045, as shown in Figure 2-1 and Figure 2-2, respectively. Use the injector/ejector handle to fully inject the device into place.
5. Screw the front panel of the NI PXI-8250 to the front panel mounting rails of the chassis.
6. Install a system controller or verify that a system controller has been installed in the controller slot.
7. Plug in and power on the chassis.
8. Plug in and power on the host computer if using a remote controller in the chassis.

9. Allow the operating system to properly detect and identify the NI PXI-8250 module.
10. Launch Windows Device Manager and refresh the view.

The NI PXI-8250 module should be visible in Windows Device Manager.

NI PXI-8250 Configuration

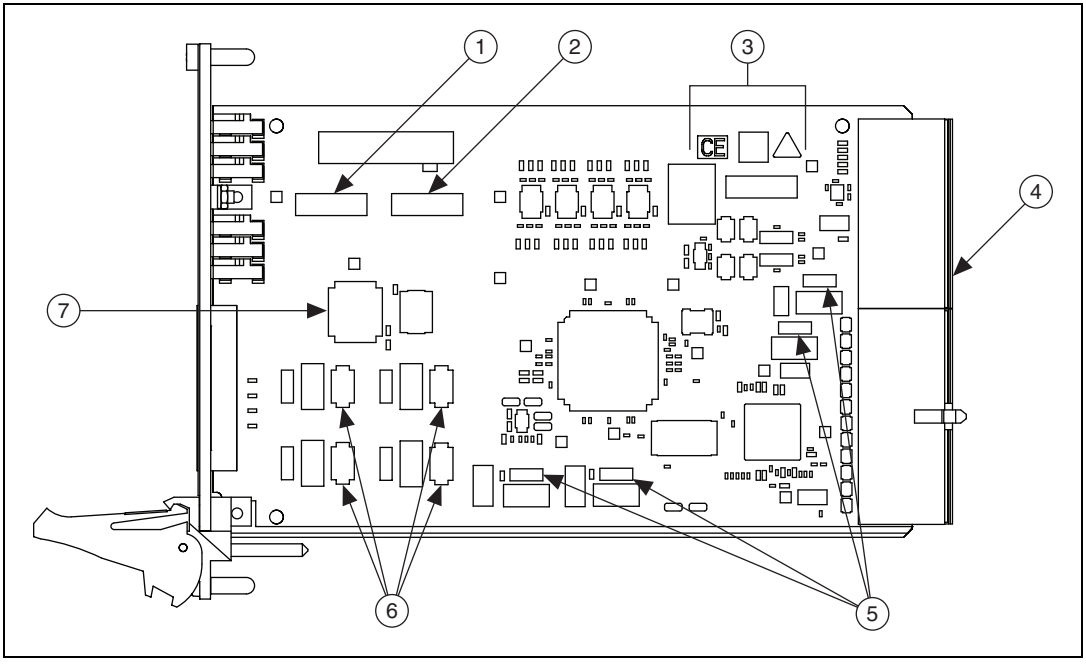
The NI PXI-8250 module is fully compatible with the industry standard *PXI Specification, Revision 2.2*, and the *PCI Local Bus Specification, Revision 3.0*, respectively. This compatibility allows the PXI system to automatically perform all bus-related configuration and requires no user interaction. Since the NI PXI-8250 does not require configuration, it will not show up in MAX.

3

Hardware Overview

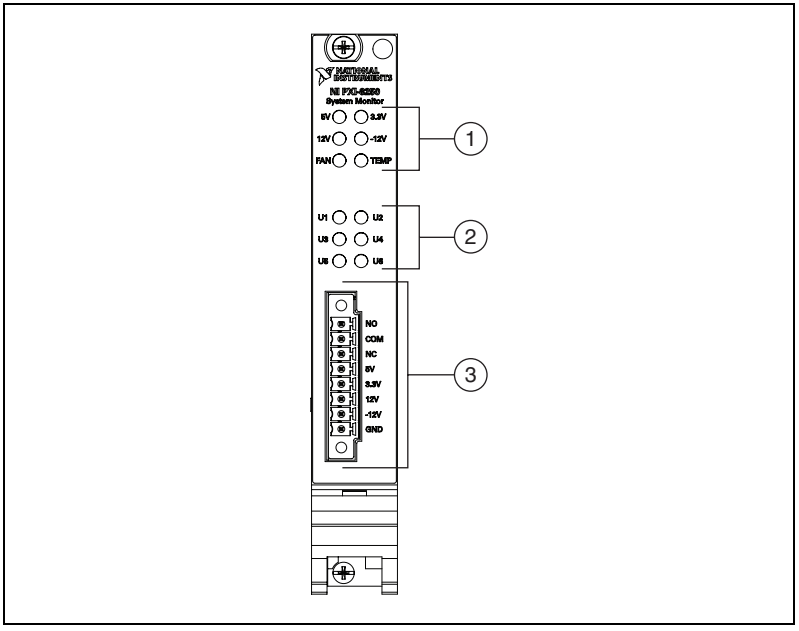
This chapter presents an overview of the NI PXI-8250 functionality.

Figure 3-1, Figure 3-2, and Figure 3-3 show the locations of key features for the NI PXI-8250 module.



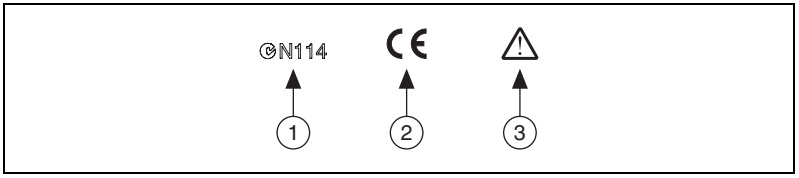
1	Assembly Part Number Label	5	One-Blow Fuses
2	Serial Number Label	6	Self-Resetting Fuses
3	Safety Symbols (Refer to Figure 3-3 for details)	7	Relay
4	PXI/CompactPCI Connectors		

Figure 3-1. NI PXI-8250 Parts Locator Diagram



1	System Status LEDs	3	Front Panel Connector (Relay/Power Outputs)
2	User LEDs		

Figure 3-2. NI PXI-8250 Front Panel Diagram



1	Identification Number Used in Australia
2	Symbol Indicating FFC Compliance
3	Symbol to Alert User to Read the Manual

Figure 3-3. Symbols on the Back of the NI PXI-8250

System Monitoring Architecture

With the NI PXI-8250, you can simultaneously monitor intake temperature, fan speeds, and power supply levels of your NI PXI chassis. This information allows the user to achieve a higher level of system performance reliability. Once the first set of data is processed, these status parameters will also light up the top six LEDs on the front panel. The LEDs light either as green if the status parameter is in range, or red if the parameter is out of range. Refer to the *Front Panel LEDs* section for more information on the LEDs.

A custom FPGA on the NI PXI-8250 communicates with the power supply module of the chassis for status information. Upon boot-up, the NI PXI-8250 waits 7 seconds for the chassis sensors to acquire their first value. Once the wait period is over, the NI PXI-8250 begins acquisition of the first full set of data from the chassis. The status information is then obtained every 5 seconds automatically in hardware until the controller is rebooted or shutdown.

Voltage Rail Level Monitoring

The NI PXI-8250 module monitors the +5 V, +3.3 V, +12 V, and –12 V rails delivered by the power supply shuttle within an accuracy of ±100 mV. The data from the +5 V and +3.3 V rails have two significant figures, while the data from the +12 V and –12 V rails have one significant figure.

Each power rail has its own status LED on the front panel to reflect the current status of the rail. If the voltage rail is within ±5% of the common chassis specification, then the LED will light green. Otherwise, the LED will light red.

The voltage rail level monitoring feature of the NI PXI-8250 reports when a voltage rail goes out of spec. This information is useful in ensuring proper operating conditions for each PXI module.

Temperature Monitoring

The NI PXI-8250 provides monitoring of the single intake thermistor located in the power supply shuttle of the PXI chassis. The reading from the thermistor (0–50 °C) is compared to the operating range of the chassis. If the reading is in range, the TEMP LED will light green. Otherwise, it will light red. All temperature measurements are reported in Celsius and are accurate to within 1 °C of the actual intake temperature.

Fan Monitoring

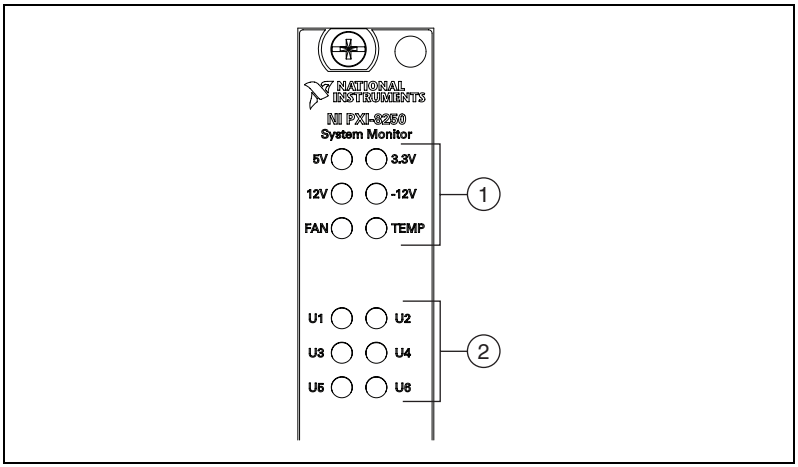
The NI PXI-8250 module allows the user to monitor the revolutions per minute (RPM) of all rear-facing fans of a PXI chassis (two fans in an NI PXI-1042/1042Q and three fans in an NI PXI-1045), accurate to ±50 RPM. The fan data from the chassis is interpreted by the NI PXI-8250 and the FAN front panel LED reflects the status of all of the fans collectively together. Hence, if one or more of the fans becomes non-operational (status below 1500 RPM) the LED will turn red to indicate a fan error. Otherwise, the fan LED will light green if all of the fans are operating within normal tolerances.

Additional Monitoring Features

In addition to the system status monitoring features, the NI PXI-8250 module includes an alert relay and fused power outputs. These features are useful for user-defined monitoring applications. Refer to the *Front Panel Connector* section for more information on the fused power outputs.

Front Panel LEDs

The NI PXI-8250 has 12 front panel LEDs, including 6 system status LEDs and 6 user-configured LEDs, as shown in Figure 3-4. Upon boot, all 12 LEDs will flash orange while it is being configured. The module then turns the LEDs off for 7 seconds until the first valid sample set is acquired.



1 System Status LEDs (x6) 2 User LEDs (x6)

Figure 3-4. NI PXI-8250 Front Panel LED Diagram

System Status LEDs

There are 6 system status LEDs to report the status of the +5 V, +3.3 V, +12 V, and –12 V power rails, the intake temperature of the chassis, and the overall status of the power shuttle fans of the chassis. These LEDs only light up either red or green depending on whether the status information shows the parameters in the specified range. The criteria for the system status LEDs to light green is provided in Table 3-1. The acceptable range for voltage rail data is ±5%, 0–50 °C for the intake temperature reading, and 1500+ RPM for fan speed. Any data acquired outside of these ranges will be reflected as a red-lit LED.

Table 3-1. System Status LED Green State Criteria

Parameter	Criteria for Green LED status
+5 V rail	±5% from nominal
+3.3 V rail	±5% from nominal
+12 V rail	±5% from nominal
–12 V rail	±5% from nominal
Fans	>1500 RPM for all fans
Temperature	0–50 °C

User LEDs

The 6 user LEDs are driven by implementing them in software. Refer to the *NI System Monitor 1.1 Help* for more information on developing applications for the NI PXI-8250.

Front Panel Connector

The NI PXI-8250 has one 8-pin connector on the lower section of the front panel. The 8-pin connector provides the three connections for the relay, as well as five connections for the fused power outputs. The three relay pins included normally closed (NC), normally open (NO), and common (COM) ports to the electromechanical relay. The five power output connections include fused pins to +5V, +3.3V, +12V, –12V, and ground.

Caution Power off all devices before connecting or disconnecting the NI PXI-8250 plug. Failure to do so may damage the module.

Figure 3-5 shows the layout of this connector.

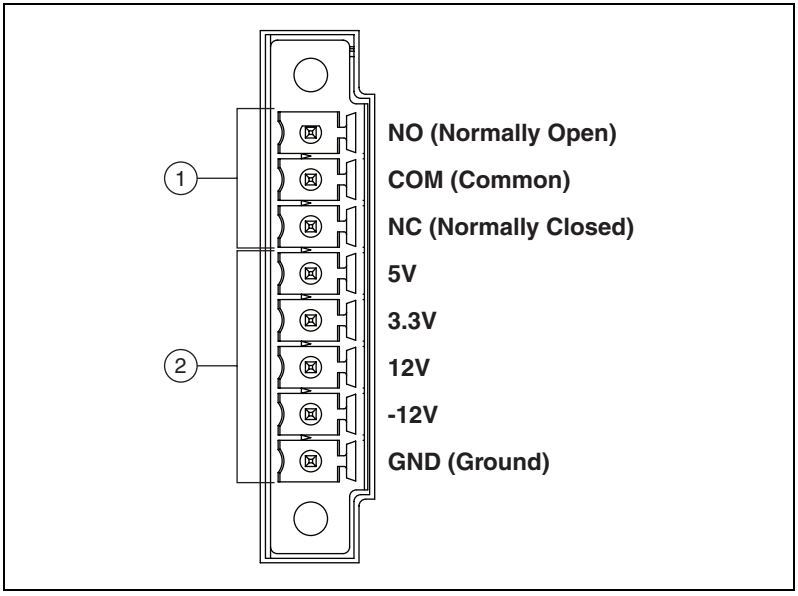


Figure 3-5. NI PXI-8250 Front Panel Connector Pinout Diagram

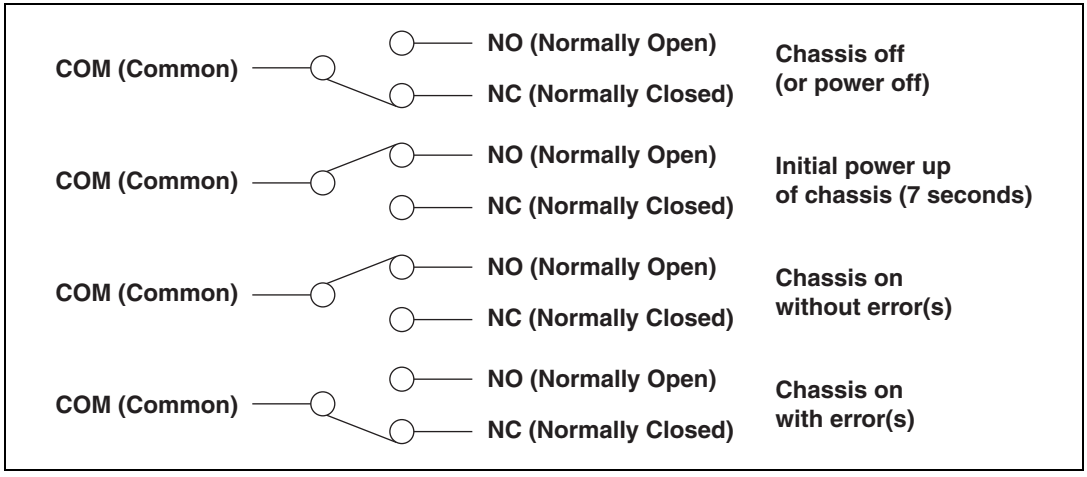


Figure 3-6. NI PXI-8250 Relay Operation Diagram

Alert Relay Pins

The NI PXI-8250 has an electromechanical non-latching relay with three ports: normally open (NO), normally closed (NC), and common (COM). The top three pins of the front panel connector are connected to a relay as indicated in Figure 3-5. This relay is useful for a creating a custom external warning indicator circuit, such as a factory warning light or speaker.

During normal operation without any system status errors, the relay will have COM connected to NO (and not NC). Once a system status error has occurred (for instance. if the voltage rail level is out of range), the relay will flip to connect COM to NC, rather than NO. Refer to Figure 3-6 for other relay status information.

Notes For a use case where a warning light or speaker should be active (connected) to show an error, connect from the COM to the NC port.

For a use case where a warning light or speaker should be active (connected) to show proper, in-spec operation, connect from the COM to the NO port.

The relay alerts an error by connecting COM to NC when the chassis is powered off or loses power. The relay on the NI PXI-8250 is rated to 30 V and 1 A switching/carry current. Any connections to the relay on the NI PXI-8250 must have a wire length less than 20 meters.

Power Output Pins

The lower 5 pins of the 8-pin front panel connector are general purpose power outputs connected to each voltage rail of the power supply. Refer to Figure 3-5 for the location of the power output pins. The +5 V, +3.3 V, +12 V, and –12 V rails are all available from these connector pins along with a ground connection at the bottom. These pins draw power from the chassis power supply and are protected from current over-draw with self-resetting fuses. Table 3-2 lists the maximum power output ratings for each voltage rail.

Table 3-2. Fused Power Output Ratings

Voltage Rail	Maximum Allowed Current Draw
+5.0 V	0.75 A
+3.3 V	0.75 A
+12.0 V	0.25 A
–12.0 V	0.25 A

The NI PXI-8250 has self-resetting fuses rated at 1 A/125 V on the front end and one-blow fuses rated at 4 A/125 V on the back end of the card to protect the card from excessive current draw. Refer to Figure 3-1 for the locations of these fuses.

When current is exceeded on any of the rails (the current limits are provided in Table 3-2), the self-resetting fuses will open the circuit. These fuses are designed to reset themselves and do not need to be repaired.

As a fail-safe, one blow fuses have also been added to ensure that excessive current is stopped if a self-resetting fuse fails to operate properly. In the event that any of the one-blow fuses blow, the board must be returned for repair.

A

Specifications

This appendix lists the hardware and software performance specifications for the PXI-8250. Hardware specifications are typical at 25 °C, unless otherwise stated.

Caution Specifications are subject to change without notice.

Maximum Power Requirements

Without power outputs

+5 V (±5%) ..... 0.10 A
+3.3 V (±5%) ..... 0.50 A
+12 V (±5%) ..... 0 A
–12 V (±5%) ..... 0 A
Power consumption..... 2.15 W

With power outputs

+5 V (±5%) ..... 0.85 A
+3.3 V (±5%) ..... 1.25 A
+12 V (±5%) ..... 0.25 A
–12 V (±5%) ..... 0.25 A
Power consumption..... 14.38 W

Maximum Current for Fused Power Output

+5V rail ..... 0.75 A

+3.3V rail ..... 0.75 A

+12V rail ..... 0.25 A

–12V rail ..... 0.25 A

Monitoring Alert Limits (Green Status LEDs)

Voltage rail level .....±5% (from nominal)

Intake temperature .....0–50 °C

Fan speed .....1,500 RPM or more for all fans in a chassis

Monitoring Accuracy

Voltage rail level readings .....±100 mV

Intake temperature readings.....±1 °C

Fan speed readings.....±50 RPM

Alert Relay Specification

Max current (switching/carry) .....1 A

Max voltage .....30 V

Max power.....30 W

Max cable length .....20 m

Connectors

Front panel connector .....8-pin 3.5 mm pitch, screw-flange connector

Physical

Front panel dimensions.....3U × 4 HP

Overall dimensions .....13.34 × 2.03 cm (5.25 × 0.8 in.)

Weight .....150 g (5.29 oz)

Environment

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

Pollution Degree 2

Indoor use only.

Operating Environment

Ambient temperature range..... 0 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 to 70 °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 to 500 Hz, 0.3 g_{rms}

Non-operating ..... 5 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 meets the requirements of the following standards of safety for electrical equipment for measurement, control, and laboratory use:

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

Note For UL and other safety 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 (IEC 61326): 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 For the standards applied to assess the EMC of this product, refer to the *Online Product Certification* section.

Note For EMC compliance, operate this product according to the documentation.

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

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 *NI and the Environment* 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 life cycle, all products *must* be sent to a WEEE recycling center. For more information about WEEE recycling centers and National Instruments WEEE initiatives, visit `ni.com/environment/weee`.

电子信息产品污染控制管理办法 （中国 RoHS）

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

B

Technical Support and Professional Services

Visit the following sections of the award-winning National Instruments Web site at ni.com for technical support and professional services:

- **Support**—Technical support resources at ni.com/support include the following:
  - **Self-Help Technical Resources**—For answers and solutions, visit ni.com/support for software drivers and updates, a searchable KnowledgeBase, product manuals, step-by-step troubleshooting wizards, thousands of example programs, tutorials, application notes, instrument drivers, and so on. Registered users also receive access to the NI Discussion Forums at ni.com/forums. NI Applications Engineers make sure every question submitted online receives an answer.
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    For information about other technical support options in your area, visit ni.com/services, or contact your local office at ni.com/contact.
- **Training and Certification**—Visit ni.com/training for self-paced training, eLearning virtual classrooms, interactive CDs, and Certification program information. You also can register for instructor-led, hands-on courses at locations around the world.
- **System Integration**—If you have time constraints, limited in-house technical resources, or other project challenges, National Instruments Alliance Partner members can help. To learn more, call your local NI office or visit ni.com/alliance.

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

If you searched `ni.com` and could not find the answers you need, contact your local office or NI corporate headquarters. Phone numbers for our worldwide offices are listed at the front of this manual. You also can visit the Worldwide Offices section of `ni.com/niglobal` to access the branch office Web sites, which provide up-to-date contact information, support phone numbers, email addresses, and current events.

Glossary

Symbol	Prefix	Value
p	pico	10^{-12}
n	nano	10^{-9}
µ	micro	10^{-6}
m	milli	10^{-3}
k	kilo	10^{3}
M	mega	10^{6}
G	giga	10^{9}
T	tera	10^{12}

Numbers/Symbols

°	degrees
/	per
%	percent
±	plus or minus
+5 V	+5 VDC source signal
+3.3 V	+3.3 VDC source signal
+12 V	+12 VDC source signal
–12 V	–12 VDC source signal

A

A	amperes
AC	alternating current

API	application programming interface

B

backplane	An assembly, typically a printed circuit board, with connectors and signal paths that bus the connector pins.

C

C	Celsius
CFR	Code of Federal Regulations
cm	Centimeters
COM	A common terminal of the relay that either connects to NO or NC. *See also* NO or NC.
CompactPCI	An adaptation of the Peripheral Component Interconnect (PCI) Specification 2.1 or later for industrial and/or embedded applications requiring a more robust mechanical form factor than desktop PCI. It uses industry standard mechanical components and high-performance connector technologies to provide an optimized system intended for rugged applications. It is electrically compatible with the PCI Specification, which enables low-cost PCI components to be utilized in a mechanical form factor suited for rugged environments.
CSA	Canadian Standards Association

D

DC	direct current
DoC	Declaration of Conformity
driver	Software that communicates commands to control a specific board.

E

electromechanical relay	Electromechanical relay made of a coil, an armature mechanism, and electrical contacts. When the coil is energized, the induced magnetic field moves the armature that opens or closes the contacts.
EMC	Electromagnetic Compatibility

F

FCC	Federal Communications Commission
filler panel	A blank module front panel used to fill empty slots in the chassis.
FPGA	Field Programmable Gate Array
fuse	A circuit protection device that prevents overcurrent draw. *See also* self-resetting fuse.

G

g	(1) grams; (2) a measure of acceleration equal to 9.8 m/s^2
g_{RMS}	A measure of random vibration; the root mean square of acceleration levels in a random vibration test profile.

H

Hz	Hertz; cycles per second

I

IEC	International Electrotechnical Commission—An organization that sets international electrical and electronics standards.
IEEE	Institute of Electrical and Electronics Engineers
in.	inches

L

LED	Light-Emitting Diode

M

m	meters
MAX	Measurement & Automation Explorer—A controlled, centralized configuration environment that allows you to configure all of your NI devices.
ms	milliseconds

N

NI	National Instruments
NO	The normally-open terminal of a relay that connects to the common (COM) terminal only when the relay coil is energized.
NC	The normally-closed terminal of a relay that connects to the common (COM) terminal only when the relay coil is de-energized.

O

oz	ounces

P

PCI	Peripheral Component Interconnect—A high-performance expansion bus architecture originally developed by Intel to replace ISA and EISA. It offers a theoretical maximum transfer rate of 132 MB/s.
PXI	PCI eXtensions for Instrumentation

R

RMS	Root Mean Square
RPM	revolutions per minute—units for velocity

S

s	seconds
self-resetting fuse	A fuse that acts as an open circuit only when current is overdrawn. Once the overdraw ends the fuse returns to normal closed circuit operation.
system controller	A module configured for installation in slot 1 of a PXI chassis. This device is unique in the PXI system in that it performs the system controller functions, including clock sourcing and arbitration for data transfers across the backplane. Installing such a device into any other slot can damage the device, the PXI backplane, or both.

U

UL	Underwriter's Laboratories

V

V	volts

W

W	watts

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