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PXI Express™

PXIe-1086 User Manual

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This hardware has been tested and found to comply with the applicable regulatory requirements and limits for electromagnetic compatibility (EMC) as indicated in the hardware's Declaration of Conformity (DoC)[1]. These requirements and limits are designed to provide reasonable protection against harmful interference when the hardware is operated in the intended electromagnetic environment. In special cases, for example when either highly sensitive or noisy hardware is being used in close proximity, additional mitigation measures may have to be employed to minimize the potential for electromagnetic interference.

While this hardware is compliant with the applicable regulatory EMC requirements, there is no guarantee that interference will not occur in a particular installation. To minimize the potential for the hardware to cause interference to radio and television reception or to experience unacceptable performance degradation, install and use this hardware in strict accordance with the instructions in the hardware documentation and the DoC[1].

If this hardware does cause interference with licensed radio communications services or other nearby electronics, which can be determined by turning the hardware off and on, you are encouraged to try to correct the interference by one or more of the following measures:

- Reorient the antenna of the receiver (the device suffering interference).
- Relocate the transmitter (the device generating interference) with respect to the receiver.
- Plug the transmitter into a different outlet so that the transmitter and the receiver are on different branch circuits.

Some hardware may require the use of a metal, shielded enclosure (windowless version) to meet the EMC requirements for special EMC environments such as, for marine use or in heavy industrial areas. Refer to the hardware's user documentation and the DoC[1] for product installation requirements.

When the hardware is connected to a test object or to test leads, the system may become more sensitive to disturbances or may cause interference in the local electromagnetic environment.

Operation of this hardware in a residential area is likely to cause harmful interference. Users are required to correct the interference at their own expense or cease operation of the hardware.

Changes or modifications not expressly approved by National Instruments could void the user's right to operate the hardware under the local regulatory rules.

[1] The Declaration of Conformity (DoC) contains important EMC compliance information and instructions for the user or installer. To obtain the DoC for this product, visit `ni.com/certification`, search by model number or product line, and click the appropriate link in the Certification column.

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About This Manual

The *NI PXIe-1086 User Manual* describes the features of the NI PXIe-1086 chassis and contains information about configuring the chassis, installing the modules, and operating the 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 2.0, PXI Systems Alliance

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1 Getting Started

This chapter describes the key features of the PXIe-1086 chassis and lists the kit contents and optional equipment you can order from National Instruments.

Unpacking

Carefully inspect the shipping container and the chassis for damage. Check for visible damage to the metal work. Check to make sure all handles, hardware, and switches are undamaged. Inspect the inner chassis for any possible damage, debris, or detached components. If damage appears to have been caused during shipment, file a claim with the carrier. Retain the packing material for possible inspection and/or reshipment.

What You Need to Get Started

The PXIe-1086 chassis kit contains the following items:

- ☐ PXIe-1086 chassis
- ☐ Filler panels
- ☐ *PXIe-1086 Getting Started Guide*
- ☐ Software media with *PXI Platform Services 14.0* or later
- ☐ *Read Me First: Safety and Electromagnetic Compatibility*
- ☐ Chassis number labels
- ☐ Inhibit fault cable connector

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Note An AC power cable is also required, but not included in the PXIe-1086 chassis kit. Refer to Table 1-1 for more information about AC power cables.

Table 1-1. AC Power Cables

Power Cable	Reference Standards
Standard 120 V (USA)	ANSI C73.11/NEMA 5-15-P/IEC83
Switzerland 220 V	SEV
Australia 240 V	AS C112
Universal Euro 230 V	CEE (7), II, IV, VII IEC83
United Kingdom 230 V	BS 1363/IEC83

If you are missing any of the items listed in Table 1-1, or if you have the incorrect AC power cable, contact National Instruments.

Key Features

The PXIe-1086 chassis combines a high-performance 18-slot PXI Express backplane with a high-output power supply and a structural design that has been optimized for maximum usability in a wide range of applications. The chassis' modular design ensures a high level of maintainability, resulting in a very low mean time to repair (MTTR). The chassis also features redundant power supplies and fans designed to maximize system availability. The PXIe-1086 chassis fully complies with the *PXI-5 PXI Express Hardware Specification*, offering advanced timing and synchronization features.

The key features of the PXIe-1086 chassis include the following:

High Performance for Instrumentation Requirements

- Up to 4 GB/s (single direction) per PXI Express slot dedicated bandwidth (Gen-2 x8 PCI Express)
- 38.25 W per slot cooling meets increased PXI Express cooling requirements
- Low-jitter internal 10 MHz reference clock for PXI slots with ± 25 ppm stability
- Low-jitter internal 100 MHz reference clock for PXI Express slots with ± 25 ppm stability
- Variable speed fan controller optimizes cooling and acoustic emissions
- Remote power-inhibit control
- Complies with PXI and CompactPCI Specifications

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High Reliability

- 0 to 50 °C operating temperature range
- Power supply, temperature, and fan monitoring
- Ethernet interface for remote monitoring

High Availability

- Dual redundant, hot-swappable power supplies
- Redundant, hot-swappable chassis fans

Multi-Chassis Support

- PXI Express System Timing Slot for tight synchronization across chassis
- Front CLK10 I/O connectors
- Switchless CLK10 routing

Optional Features

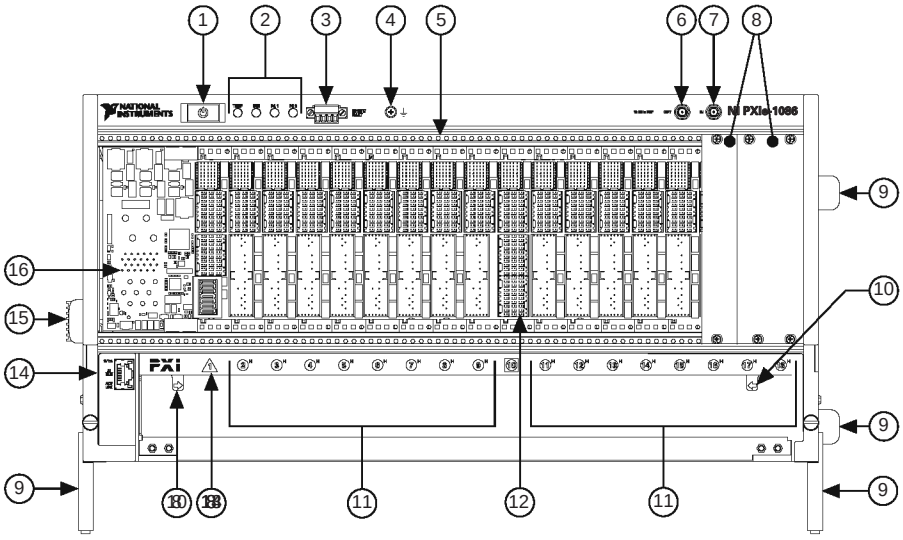
- Front and rear rack-mount kits
- Replacement power supply
- EMC filler panels
- Slot blockers for improved cooling performance
- Factory installation services
- Replacement fan modules

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Chassis Description

Figures 1-1 and 1-2 show the key features of the PXIe-1086 chassis front and back panels. Figure 1-1 shows the front view of the PXIe-1086. Figure 1-2 shows the rear view of the PXIe-1086.

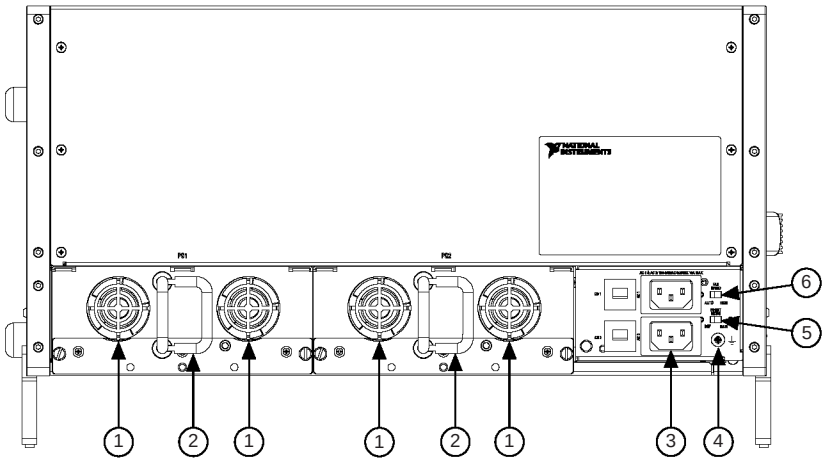
Figure 1-1. Front View of the PXIe-1086 Chassis (with Optional Filler Panels)



1	Power Inhibit Switch	9	Removable Feet
2	Status LEDs	10	Fan Door Latch
3	Inhibit/Fault Connector	11	PXI Express Hybrid Peripheral Slots (16x)
4	Ground Terminal	12	PXI Express PXI Express System Timing Slot
5	Backplane Connectors	13	PXI Express System Controller Slot
6	Clk10 Output	14	Ethernet Port
7	Clk10 Input	15	Chassis Carry Handle
8	PXI Filler Panels (Optional)	16	System Controller Expansion Slots

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Figure 1-2. Rear View of the PXIe-1086 Chassis



1	Power Supply Cooling Fan	3	Chassis Power Connectors	5	Inhibit Mode Selector Switch
2	Power Supply Handle	4	Protective Conductor Terminal (PE)	6	Fan Speed Selector Switch

Optional Equipment

Contact National Instruments to order the following options for the PXIe-1086 chassis.

EMC Filler Panels

Optional EMC filler panel kits are available from National Instruments.

Power Supply Filler Panels

Optional power supply filler panels are available from National Instruments. Use a power supply filler panel if you operate the PXIe-1086 chassis with a single power supply.

Rack Mount Kit

There are two optional kits for mounting the PXIe-1086 chassis into a rack. The first option is a pair of mounting brackets for use on the front of the chassis. The second option is a rear rack mount kit. The rear rack mount kit differs from the front kit to allow for easier installation into the rack. For more information, refer to Figure A-3, *NI Chassis Rack Mount Kit Components*.

Slot Blockers

Optional Slot Blocker kits are available from National Instruments. Slot Blockers improve cooling in a chassis by re-routing airflow from empty slots to slots containing PXI modules.

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Replacement Power Supply

Replacement power supply kits are available from National Instruments.

Replacement Fan Modules

Replacement fan modules are available from National Instruments.

PXIe-1086 Chassis Backplane Overview

This section provides an overview of the backplane features for the PXIe-1086 chassis.

Interoperability with CompactPCI

The design of the PXIe-1086 provides you the flexibility to use the following devices in a single PXI Express chassis:

- PXI Express compatible products
- CompactPCI Express compatible 2-Link system controller products
- CompactPCI Express compatible Type-2 peripheral products
- PXI peripheral products modified to fit in a hybrid slot
- Standard CompactPCI peripheral products modified to fit in a hybrid slot

System Controller Slot

The system controller slot is Slot 1 of the chassis and is a 2-Link configuration system slot as defined by the CompactPCI Express and PXI Express specifications. It has three expansion slots for system controller modules that are wider than one slot. These slots allow the system controller to expand to the left to prevent it from using peripheral slots.

The backplane connects the system slot to two PCI Express switches using a Gen-2 x8 and a Gen-2 x16 PCI Express link. These switches distribute PCI Express connections to the peripheral slots and to two PCI Express-to-PCI bridges to provide PCI buses to the hybrid peripheral slots. Refer to Figure 1-3.

System slot link 1 is a Gen-2 x8 PCI Express link to PCI Express switch 1, providing a nominal bandwidth of 4 GB/s (single direction) between the system controller and PCI Express switch 1. PXI Express peripheral slots 2-10 are connected to PCI Express switch 1 with Gen-2 x8 PCI Express links and are downstream of system slot link 1. PCI Express-to-PCI bridge 1 is connected to PCI Express switch 1 and provides a 32-bit, 33 MHz PCI bus for hybrid peripheral slots 2-9. PCI Express switch 1 also is connected to PCI Express switch 2 with a Gen-2 x8 PCI Express link for advanced backplane configurations.

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System slot link 2 is a Gen-2 x16 PCI Express link to PCI Express switch 2, providing a nominal bandwidth of 8 GB/s (single direction) between the system controller slot and PCI Express switch 2. PXI Express peripheral slots 11-18 are connected to PCI Express switch 2 with Gen-2 x8 PCI Express links and are downstream of system slot link 2. PCI Express-to-PCI bridge 2 is connected to PCI Express switch 2 and provides a 32-bit, 33 MHz PCI bus for hybrid peripheral slots 11-18. PCI Express switch 2 also is connected to PCI Express switch 1 with a Gen-2 x8 PCI Express link for advanced backplane configurations.

The system controller slot also has connectivity to some PXI features such as: PXI_CLK10, PXI Star, PXI Trigger Bus and PXI Local Bus 6.

By default, the system controller will control the power supply with the PS_ON# signals. A logic low on this line will turn the power supply on.

Note The Inhibit Mode switch on the rear of the chassis must be in the **Default** position for the system controller to have control of the power supply. Refer to the *Inhibit Mode Switch* section of Chapter 2, *Installation and Configuration*, for details about the Inhibit Mode switch.

Hybrid Peripheral Slots

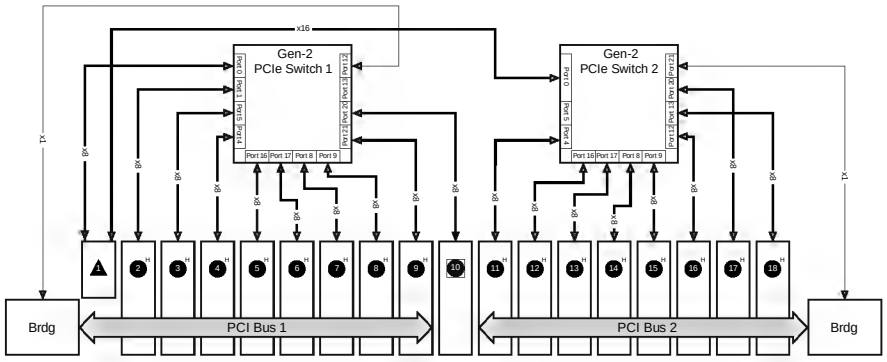
The chassis provides 16 hybrid peripheral slots as defined by the *PXI-5 PXI Express Hardware Specification*: slots 2 to 9 and slots 11 to 18. A hybrid peripheral slot can accept the following peripheral modules:

- A PXI Express peripheral with x8, x4, or x1 PCI Express link through a switch to the system slot. Each PXI Express peripheral slot can link up to a Gen-2 x8 PCI Express, providing a maximum nominal single-direction bandwidth of 4 GB/s.
- A CompactPCI Express Type-2 Peripheral with x8, x4, or x1 PCI Express link through a switch to the system slot.
- A hybrid-compatible PXI Peripheral module that has been modified by replacing the J2 connector with an XJ4 connector installed in the upper eight rows of J2. Refer to the *PXI Express Specification* for details. The PXI Peripheral communicates through the backplane's 32-bit PCI bus.
- A CompactPCI 32-bit peripheral on the backplane's 32-bit PCI bus.

The hybrid peripheral slots provide full PXI Express functionality and 32-bit PXI functionality except for PXI Local Bus. The hybrid peripheral slot only connects to PXI Local Bus 6 left and right.

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Figure 1-3. PXIe-1086 PCI Express Backplane Diagram



System Timing Slot

The System Timing Slot is slot 10. The system timing slot will accept the following peripheral modules:

- A PXI Express System Timing Module with x8, x4, or x1 PCI Express link to the system slot through a PCI Express switch. Each PXI Express peripheral slot can link up to a Gen-2 x8 PCI Express, providing a maximum nominal single-direction bandwidth of 4 GB/s.
- A PXI Express Peripheral with x8, x4, or x1 PCI Express link to the system slot through a PCI Express switch.
- A CompactPCI Express Type-2 Peripheral with x8, x4, or x1 PCI Express link to the system slot through a PCI Express switch.

The system timing slot has 3 dedicated differential pairs (PXIe_DSTAR) connected from the TP1 and TP2 connectors to the XP3 connector for each PXI Express hybrid peripheral slot, as well as routed back to the XP3 connector of the system timing slot as shown in Figure 1-4. The PXIe_DSTAR pairs can be used for high-speed triggering, synchronization and clocking. Refer to the *PXI Express Specification* for details.

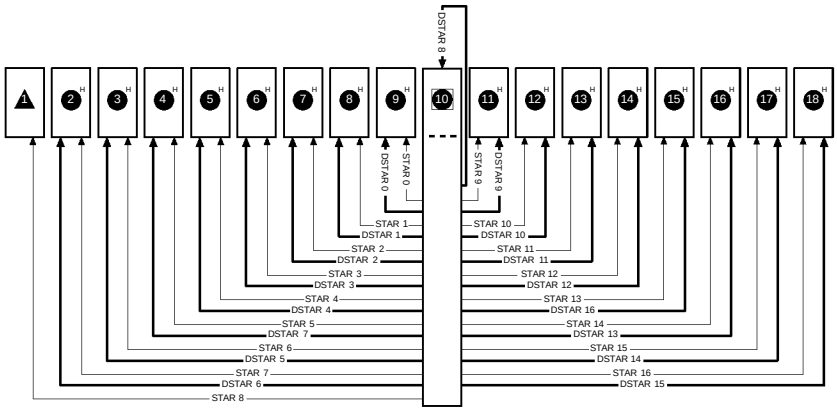
The system timing slot also has a single-ended (PXI Star) trigger connected to every slot. Refer to Figure 1-4 for details.

The system timing slot has a pin (PXI_CLK10_IN) through which a system timing module may source a 10 MHz clock to which the backplane will phase-lock. Refer to the *System Reference Clock* section for details.

The system timing slot has a pin (PXIe_SYNC_CTRL) through which a system timing module can control the PXIe_SYNC100 timing. Refer to the *PXI Express Specification* and the *PXIe_SYNC_CTRL* section of this chapter for details.

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Figure 1-4. PXI Express Star Connectivity Diagram



PXI Local Bus

The PXI backplane local bus is a daisy-chained bus that connects each peripheral slot with adjacent peripheral slots to the left and right, as shown in Figure 1-5.

The backplane routes PXI Local Bus 6 between all slots. The left local bus 6 from slot 1 is not routed anywhere and the right local bus signals from slot 18 are not routed anywhere.

Local bus signals may range from high-speed TTL signals to analog signals as high as 42 V.

Initialization software uses the configuration information specific to each adjacent peripheral module to evaluate local bus compatibility.

PXI Trigger Bus

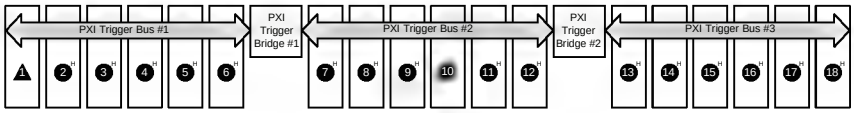
All slots on the same PXI bus segment share eight PXI trigger lines. You can use these trigger lines in a variety of ways. For example, you can use triggers to synchronize the operation of several different PXI peripheral modules. In other applications, one module located in the system timing slot can control carefully timed sequences of operations performed on other modules in the system. Modules can pass triggers to one another, allowing precisely timed responses to asynchronous external events the system is monitoring or controlling.

The PXI trigger lines from adjacent PXI trigger bus segments can be routed in either direction across the PXI trigger bridges through buffers. This allows you to send trigger signals to, and receive trigger signals from, every slot in the chassis. Static trigger routing (user-specified line and directional assignments) can be configured through Measurement & Automation Explorer (MAX). Dynamic routing of triggers (automatic line assignments) is supported through certain National Instruments drivers like NI-DAQmx.

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Note Although any trigger line may be routed in either direction, it cannot be routed in more than one direction at a time.

Figure 1-5. PXI Trigger Bus Connectivity Diagram



System Reference Clock

The PXIe-1086 chassis supplies PXI_CLK10, PXIe_CLK100, and PXIe_SYNC100 independently driven to each peripheral slot.

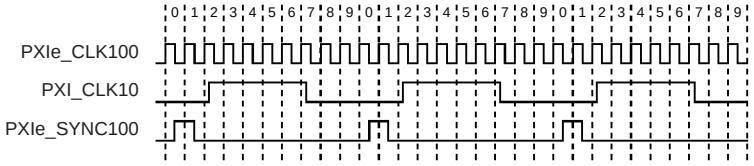
An independent buffer (having a source impedance matched to the backplane and a skew of less than 1 ns between slots) drives PXI_CLK10 to each slot. You can use this common reference clock signal to synchronize multiple modules in a measurement or control system.

An independent buffer drives PXIe_CLK100 to each peripheral slot. These clocks are matched in skew to less than 100 ps. The differential pair must be terminated on the peripheral with LVPECL termination for the buffer to drive PXIe_CLK100 so that when there is no peripheral or a peripheral that does not connect to PXIe_CLK100, there is no clock being driven on the pair to that slot.

An independent buffer drives PXIe_SYNC100 to each peripheral slot. The differential pair must be terminated on the peripheral with LVPECL termination for the buffer to drive PXIe_SYNC100 so that when there is no peripheral or a peripheral that does not connect to PXIe_SYNC100, there is no SYNC100 signal being driven on the pair to that slot.

PXI_CLK10, PXIe_CLK100 and PXIe_SYNC100 have the default timing relationship described in Figure 1-6.

Figure 1-6. System Reference Clock Default Behavior



To synchronize the system to an external clock, you can drive PXI_CLK10 from an external source through the PXI_CLK10_IN pin on the System Timing Slot. Refer to Table B-8, *XP4 Connector Pinout for the System Timing Slot*, for the pinout. When a 10MHz clock is detected on this pin, the backplane automatically phase-locks the PXI_CLK10, PXIe_CLK100, and PXIe_SYNC100 signals to this external clock and distributes these signals to the slots. Refer to Appendix A, *Specifications*, for the specification information for an external clock provided on the PXI_CLK10_IN pin of the system timing slot.

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You also can drive a 10 MHz clock on the 10 MHz REF IN connector on the front panel of the chassis. When a 10 MHz clock is detected on this connector, the backplane automatically phase-locks the PXI_CLK10, PXIe_CLK100, and PXIe_SYNC100 signals to this external clock and distributes these signals to the slots. Refer to Appendix A, *Specifications*, for the specification information for an external clock provided on the 10 MHz REF IN connector on the front panel of the chassis.

If the 10 MHz clock is present on both the PXI_CLK10_IN pin of the System Timing Slot and the 10 MHz REF IN connector on the front of the chassis, the signal on the System Timing Slot is selected. Refer to Table 1-2 which explains how the 10 MHz clocks are selected by the backplane.

Table 1-2. Backplane External Clock Input Truth Table

System Timing Slot PXI_CLK10_IN	Front Chassis Panel 10 MHz REF IN	Backplane PXI_CLK10, PXIe_CLK100 and PXIe_SYNC100
No clock present	No clock present	Backplane generates its own clocks
No clock present	10 MHz clock present	PXI_CLK10, PXIe_CLK100 and PXIe_SYNC100 all phase-locked to Front Chassis Panel—10 MHz REF IN
10 MHz clock present	No clock present	PXI_CLK10, PXIe_CLK100 and PXIe_SYNC100 all phase-locked to System Timing Slot— PXI_CLK10_IN
10 MHz clock present	10 MHz clock present	PXI_CLK10, PXIe_CLK100 and PXIe_SYNC100 all phase-locked to System Timing Slot—PXI_CLK10_IN

A copy of the backplane's PXI_CLK10 is exported to the 10 MHz REF OUT connector on the front panel of the chassis. This clock is driven by an independent buffer. Refer to Appendix A, *Specifications*, for the specification information for the 10 MHz REF OUT signal on the front panel of the chassis.

PXIe_SYNC_CTRL

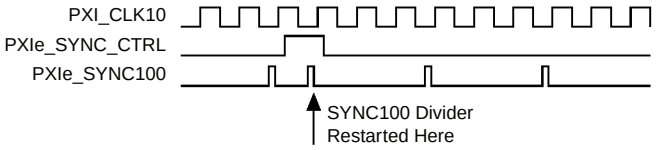
PXIe_SYNC100 is by default a 10 ns pulse synchronous to PXI_CLK10. The frequency of PXIe_SYNC100 is 10/*n* MHz, where *n* is a positive integer. The default for *n* is 1, giving PXIe_SYNC100 a 100 ns period. However, the backplane allows *n* to be programmed to other integers. For instance, setting *n* = 3 gives a PXIe_SYNC100 with a 300 ns period while still maintaining its phase relationship to PXI_CLK10. The value for *n* may be set to any positive integer from 1 to 255.

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The system timing slot has a control pin for PXIe_SYNC100 called PXIe_SYNC_CTRL for use when $n > 1$. Refer to Table B-7, *XP3 Connector Pinout for the System Timing Slot*, for system timing slot pinout. Refer to Appendix A, *Specifications*, for the PXIe_SYNC_CTRL input specifications.

By default, a high-level detected by the backplane on the PXIe_SYNC_CTRL pin causes a synchronous restart for the PXIe_SYNC100 signal. On the next PXI_CLK10 edge the PXIe_SYNC100 signal will restart. This will allow several chassis to have their PXIe_SYNC100 in phase with each other. Refer to Figure 1-7 for timing details with this method.

Figure 1-7. PXIe_SYNC100 at 3.33 MHz Using PXIe_SYNC_CTRL as Restart



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2 Installation and Configuration

This chapter describes how to prepare and operate the PXIe-1086 chassis.

Before connecting the chassis to a power source, read this chapter and the *Read Me First: Safety and Electromagnetic Compatibility* document included with your kit.

Safety Information

Caution Before undertaking any troubleshooting, maintenance, or exploratory procedure, carefully read the following caution notices. Protection equipment may be impaired if equipment is not used in the manner specified.

This equipment contains voltage hazardous to human life and safety, and is capable of inflicting personal injury.

- **Chassis Grounding**—The chassis requires a connection from the premise wire safety ground to the protective conductor terminal on the rear of the chassis. The earth safety ground must be connected during use of this equipment to minimize shock hazards. Refer to the *Connecting Safety Ground* and *Connecting to Power Source* sections for instructions on connecting safety ground.
- **Live Circuits**—Operating personnel and service personnel *must* not remove protective covers when operating or servicing the chassis. Adjustments and service to internal components must be undertaken by qualified service technicians. During service of this product, the mains connector to the premise wiring must be disconnected. Dangerous voltages may be present under certain conditions; use extreme caution.
- **Explosive Atmosphere**—Do *not* operate the chassis in conditions where flammable gases are present. Under such conditions, this equipment is unsafe and may ignite the gases or gas fumes.
- **Part Replacement**—Only service this equipment with parts that are exact replacements, both electrically and mechanically. Contact National Instruments for replacement part information. Installation of parts with those that are not direct replacements may cause harm to personnel operating the chassis. Furthermore, damage or fire may occur if replacement parts are unsuitable.
- **Modification**—Do *not* modify any part of the chassis from its original condition. Unsuitable modifications may result in safety hazards.
- **Location**—The chassis is for use in stationary (non-moveable), restricted access locations such as a desk or bench, or for installation in a rack only. Installation and maintenance are to be performed by skilled/trained service persons.

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Chassis Cooling Considerations

The PXIe-1086 chassis is designed to operate on a bench or in an instrument rack. The chassis must be oriented horizontally with the primary exhaust vent at top. Vertical orientation with the chassis handle up is not a supported configuration. Regardless of the configuration, you must provide the cooling clearances as outlined in the following sections.

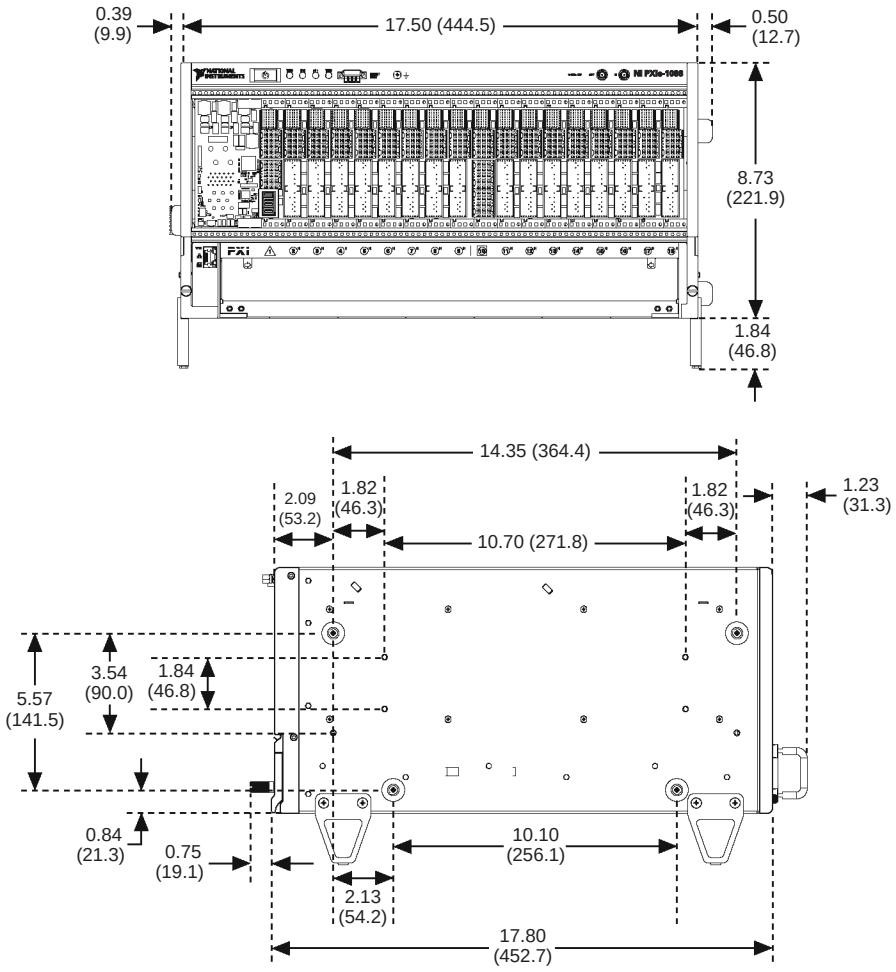
Providing Adequate Clearance

The primary cooling exhaust vent for the PXIe-1086 is on the top of the chassis. The primary intake vent is on the bottom of the chassis. The secondary intake vents are located along on the rear of the chassis. Adequate clearance between the chassis and surrounding equipment or blockages must be maintained to ensure proper cooling of the chassis power supply as well as the modules plugged into the chassis. These clearances are outlined in Figure 2-1. The vent locations for the PXIe-1086 chassis are shown in Figure 2-2. Failure to provide these clearances may result in thermal-related failures in the chassis or modules.

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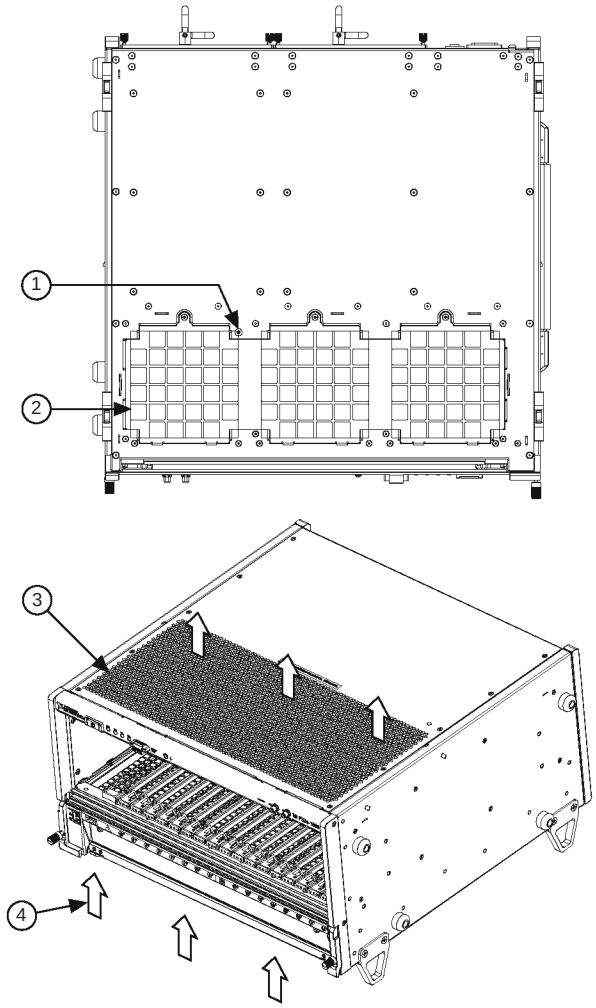
Figure 2-1. PXIe-1086 Cooling Clearances

Dimensions are in inches (millimeters)



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Figure 2-2. PXIe-1086 Vents



1	Ambient Temperature Sensor	3	Air Exhaust Vent
2	Primary Air Intake Vents	4	Airflow

Chassis Ambient Temperature Definition

The chassis fan control system uses the intake air temperature as the input for controlling fan speeds when in Auto Fan Speed mode. Because of this, the chassis ambient temperature is defined as the temperature of the air just outside of the fan intake vents on the bottom of the chassis. Note that this temperature may be higher than ambient room temperature depending on the surrounding equipment and/or blockages present. It is the user's responsibility to ensure

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that this ambient temperature does not exceed the rated ambient temperature as stated in Appendix A, *Specifications*. If the temperature exceeds the stated spec, the front-panel temperature LED blinks red, as discussed in the *Chassis LED Indicators* section of this chapter.

Setting Fan Speed

The fan-speed selector switch is on the rear panel of the PXIe-1086 chassis. Refer to Figure 1-2, *Rear View of the PXIe-1086 Chassis*, to locate the fan-speed selector switch. Select **High** for maximum cooling performance or **Auto** for improved acoustic performance. When set to **Auto**, the fan speed is determined by the chassis intake air temperature.

Installing Filler Panels

To maintain proper module cooling performance, install filler panels (provided with the chassis) in unused or empty slots. Secure with the captive mounting screws provided.

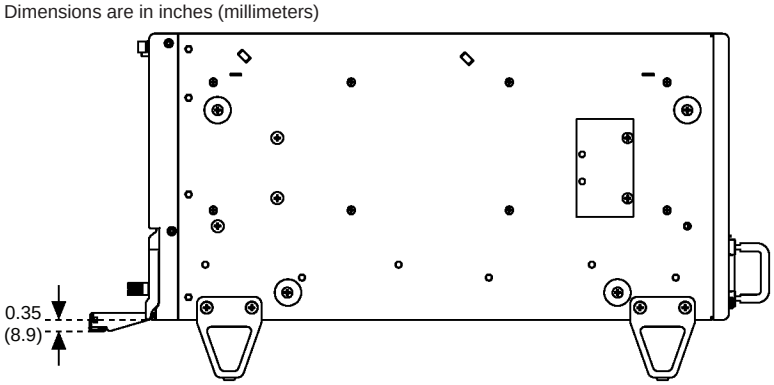
Installing Slot Blockers

The cooling performance of the chassis can be improved by installing optional Slot Blockers. Refer to `ni.com` for more details.

Fan Access Door Clearance

When installing the PXIe-1086 chassis, you also must provide the proper clearance for the fan access door to open fully, as shown in Figure 2-3.

Figure 2-3. Fan Access Door Clearance



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Rack Mounting

Rack mount applications require the optional rack mount kits available from National Instruments. Refer to the instructions supplied with the rack mount kits to install your PXIe-1086 chassis in an instrument rack. Refer to Figure A-3, *NI Chassis Rack Mount Kit Components*.

Note You may want to remove the feet and handle from the PXIe-1086 chassis when rack mounting. To do so, remove the screws holding the feet and handle in place.

Connecting Safety Ground

Caution The PXIe-1086 chassis are designed with three-position NEMA 5-15 style plugs for the U.S. that connect the ground line to the chassis ground. To minimize shock hazard, make sure the electrical power outlet you use to power the chassis has an appropriate earth safety ground.

Additionally, you must connect the premise safety ground to the chassis grounding screw located on the rear panel. Refer to Figure 1-2, *Rear View of the PXIe-1086 Chassis*, to locate the protective conductor terminal. To connect the safety ground, complete the following steps:

1. Connect a 16 AWG (1.3 mm) wire to the protective conductor terminal using a grounding lug. The wire must have green insulation with a yellow stripe or must be noninsulated (bare). The lug must be sized for the M4 x 6 screw.
2. Attach the opposite end of the wire to permanent earth ground using toothed washers or a toothed lug.

Connecting to Power Source

Cautions Do *not* install modules prior to performing the following power-on test.

To completely remove power, you *must* disconnect the AC power cable(s).

Attach input power through the rear AC inlets using the appropriate AC power cable supplied. Refer to Figure 1-2, *Rear View of the PXIe-1086 Chassis*, to locate the AC inlets.

The Inhibit Mode switch allows you to power on the chassis or place it in standby mode. Set the Inhibit Mode switch on the back of the chassis to the **Manual** position. Observe that all fans become operational and all front panel LEDs are a steady green. Switching the Inhibit Mode switch to the **Default** position allows the system controller to control the power supply.

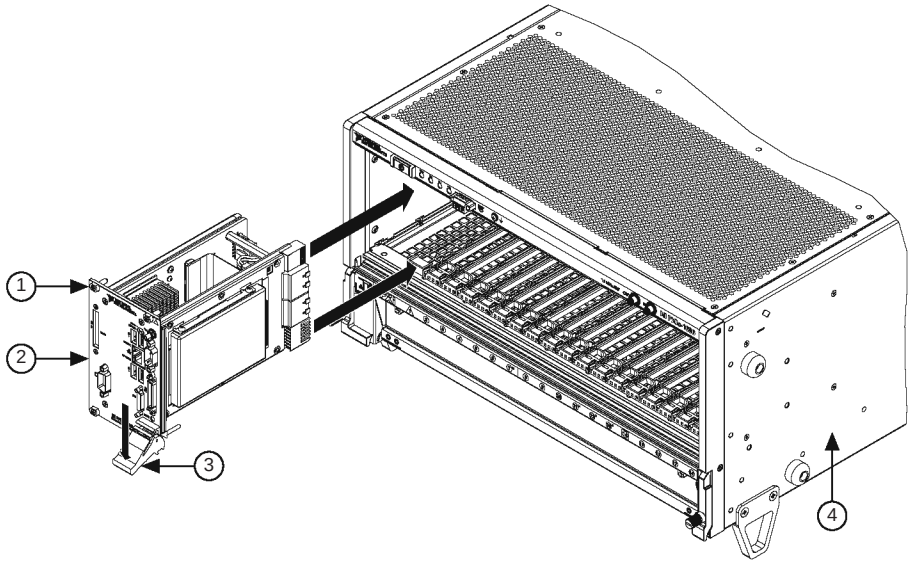
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Installing a PXI Express System Controller

This section contains general installation instructions for installing a PXI Express system controller in a PXIe-1086 chassis. Refer to your PXI Express system controller user manual for specific instructions and warnings. To install a system controller, complete the following steps:

1. Ensure that the chassis is properly grounded to protect it from electrical damage while you install the system controller.
2. Install the system controller into the system controller slot (slot 1, indicated by the red card guides) by first placing the system controller PCB into the front of the card guides (top and bottom). Slide the system controller to the rear of the chassis, making sure that the injector/ejector handle is pushed down as shown in Figure 2-4.

Figure 2-4. Installing a PXI Express System Controller



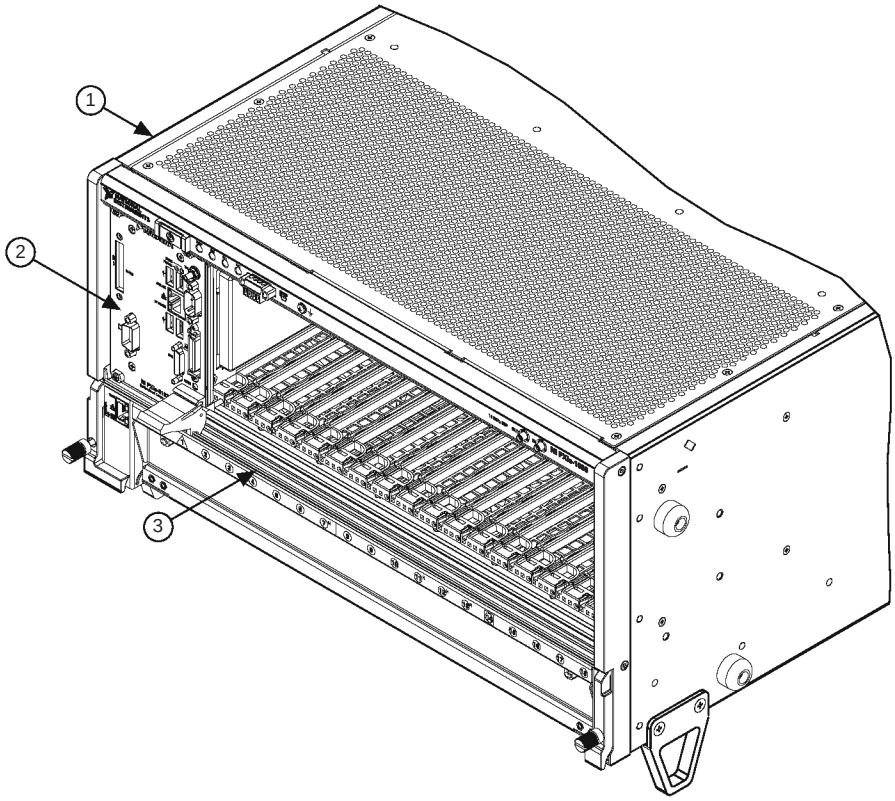
1	System Controller Front Panel Mounting Screws (4x)	3	Injector/Ejector Handle
2	NI PXI Express System Controller	4	PXIe-1086 Chassis

3. When you begin to feel resistance, pull up on the injector/ejector handle to seat the system controller fully into the chassis frame. Secure the system controller front panel to the chassis using the system controller front-panel mounting screws.
4. Connect the keyboard, mouse, and monitor to the appropriate connectors. Connect devices to ports as required by your system configuration.
5. Power on the chassis. Verify that the system controller boots. If the system controller does not boot, refer to your system controller user manual.

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Figure 2-5 shows a PXI Express system controller installed in the system controller slot of a PXIe-1086 chassis. You can place CompactPCI, CompactPCI Express, PXI, or PXI Express modules in other slots depending on the slot type.

Figure 2-5. NI PXI Express System Controller Installed in an PXIe-1086 Chassis



1	PXIe-1086 Chassis	2	NI PXI Express System Controller	3	Injector/Ejector Rail

Installing Peripheral Modules

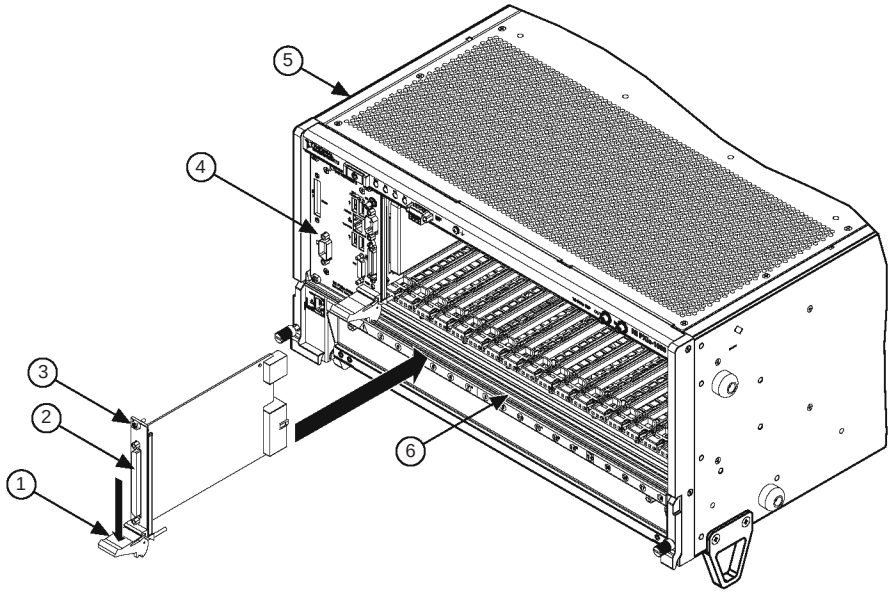
Caution The PXIe-1086 chassis has been designed to accept a variety of peripheral module types in different slots. To prevent damage to the chassis, ensure that the peripheral module is being installed into a slot designed to accept it. Refer to Chapter 1, *Getting Started*, for a description of the various slot types.

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This section contains general installation instructions for installing a peripheral module in a PXIe-1086 chassis. Refer to your peripheral module user manual for specific instructions and warnings. To install a module, complete the following steps:

1. Ensure that the chassis is properly grounded to protect it from electrical damage while you install the module.
2. Ensure that the chassis is powered off.
3. Install a module into a chassis slot by first placing the module card PCB into the front of the card guides (top and bottom), as shown in Figure 2-6. Slide the module to the rear of the chassis, making sure that the injector/ejector handle is pushed down as shown in Figure 2-6.
4. When you begin to feel resistance, push up on the injector/ejector handle to fully seat the module into the chassis frame. Secure the module front panel to the chassis using the module front-panel mounting screws.

Figure 2-6. Installing PXI, PXI Express, or CompactPCI Peripheral Modules



1	Injector/Ejector Handle	4	PXI Express System Controller
2	PXI Peripheral Module	5	PXIe-1086 Chassis
3	Peripheral Module Front Panel Mounting Screws (2x)	6	Injector/Ejector Rail

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Remote System Monitoring

The PXIe-1086 chassis provides an Ethernet port on the front panel of the chassis. You can use this Ethernet port to monitor the chassis operating parameters remotely over a network. Refer to Figure 1-1, *Front View of the PXIe-1086 Chassis (with Optional Filler Panels)*, to locate the Ethernet connector.

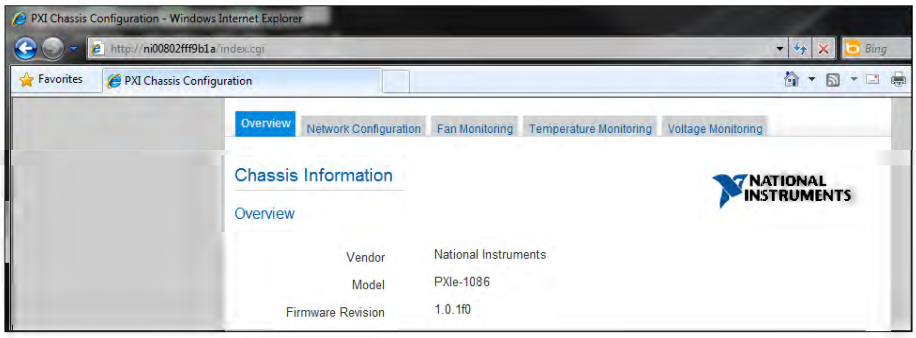
The Ethernet port on the chassis supports communication speeds of 10 Mbps and 100 Mbps. Contact your network administrator to determine whether your network supports DHCP. If your network uses DHCP, the network configuration is performed automatically.

To use the remote monitoring interface, connect one end of an Ethernet cable to your PXIe-1086 chassis. Connect the other end of the cable to your Ethernet network.

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

Through the remote monitoring Ethernet interface of the chassis, you can access a web page with information about the current chassis operating parameters. You can access this page in most browsers. Enter the IP address or hostname currently assigned to the chassis into the browser's address bar. Figure 2-7 shows an example of the web page.

Figure 2-7. Chassis Configuration Web Page



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The Ethernet connector has two LEDs that indicate the current status of the Ethernet link. Table 2-1 describes the behavior of these LEDs.

Table 2-1. Ethernet LED Behavior

LED	State	Description
ACT/Link	Off	Link is not established.
	Steady green	Link is established.
	Blinking green	Chassis is communicating with another device on the network.
10/100	Off	10 Mbps data rate is selected.
	Steady green	100 Mbps data rate is selected

Default Configuration Settings

The chassis ships from the factory with the following default configuration settings:

- DHCP with Auto IP fallback
- Default hostname as printed on the product label

Chassis LED Indicators

The PXIe-1086 chassis has four main LEDs on the front panel next to the Power Inhibit switch. Refer to Figure 1-1, *Front View of the PXIe-1086 Chassis (with Optional Filler Panels)*, to locate these LEDs.

You can use the four main LEDs to determine the chassis operating status quickly. Table 2-2 describes the behavior of these LEDs.

Table 2-2. Main Chassis LED Behavior

LED	State	Description
Temperature Status	Off	Chassis is powered off.
	Steady green	Air intake temperature is within chassis operating range.
	Blinking red	Air intake temperature is outside of chassis operating range.
	Steady red	Air intake or exhaust temperature has reached critical limits.

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Table 2-2. Main Chassis LED Behavior (Continued)

LED	State	Description
Fan Status	Off	Chassis is powered off.
	Steady green	All chassis fans are enabled and operating normally.
	Blinking red	One or more chassis fans have failed, but chassis can continue to operate.
	Steady red	One or more chassis fans have failed, and chassis must shut itself down.
Power Supply 1 Status	Off	Power supply is not installed or is in standby.
	Steady green	Power supply is active, and all voltages are within normal operating ranges.
	Blinking red	Power supply is active, and at least one voltage is out of range.
	Steady red	Power supply has failed.
Power Supply 2 Status	Off	Power supply is not installed or is in standby.
	Steady green	Power supply is active, and all voltages are within normal operating ranges.
	Blinking red	Power supply is active, and at least one voltage is out of range.
	Steady red	Power supply has failed.

Each chassis fan assembly has an LED that shows the current health of that fan. Table 2-3 describes the chassis fan LED behavior.

Table 2-3. Chassis Fan LED Behavior

LED	State	Description
Individual Fan Status	Off	Fan is not enabled.
	Steady green	Fan is operating normally.
	Steady red	Fan has failed.

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Each power supply also has an LED that shows the power supply's current health. Table 2-4 describes the power supply LED behaviors.

Table 2-4. Power Supply LED Behavior

LEDs	State	Description
Individual Power Supply Status	Off	Power supply is in standby.
	Steady green	Power supply is operating normally.
	Steady red	Power supply has failed.

Remote Inhibit and Fault Monitoring

The PXIe-1086 chassis supports remote inhibit and fault monitoring through a 4-pin terminal block on the chassis front panel. Refer to Figure 1-1, *Front View of the PXIe-1086 Chassis (with Optional Filler Panels)*, to locate this terminal block. Table 2-5 shows the terminal block pinout.

Table 2-5. Remote Inhibit and Fault Connector Pinout

Pin	Signal
1	Remote Inhibit (active low)
2	Ground
3	Remote Fault (active high)
4	Ground

When the chassis Inhibit Mode switch is in the Manual position, you can use the Remote Inhibit signal to control the chassis power supplies. Refer to *Inhibit Mode Switch* for more details.

The Remote Fault signal is an output signal that is asserted high when any chassis fault is detected. You can use this signal to monitor the overall chassis health.

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Inhibit Mode Switch

On the rear panel of the chassis there is an Inhibit Mode switch. Refer to Figure 1-2, *Rear View of the PXIe-1086 Chassis*, for the location.

The Inhibit Mode switch should be in the **Default** position when normal power inhibit switch functionality is desired. If the user needs to power on a chassis without a system controller installed the switch should be in the **Manual** position.

When the Inhibit Mode switch is set to the **Manual** position, the power supplies are enabled, and you can use the Inhibit signal (active low) on pin 1 of the Remote Inhibit and Fault connector to power off the chassis. To power off the chassis remotely, connect the Inhibit pin (pin 1) to a Logic Ground pin (pin 2). As long as this connection exists, the chassis will remain off (standby); when you remove this connection, the chassis turns on.

Note For the Remote Inhibit signal to control the On/Off (standby) state of the chassis, the Inhibit Mode switch must be in the **Manual** position.

PXI_CLK10 Connectors

There are two SMA connectors on the front of the PXIe-1086 chassis for PXI_CLK10. The connectors are labeled IN and OUT. You can use them for supplying the backplane with PXI_CLK10 or routing the backplane's PXI_CLK10 to another chassis. Refer to the *System Reference Clock* section of Chapter 1, *Getting Started*, for details about these signals.

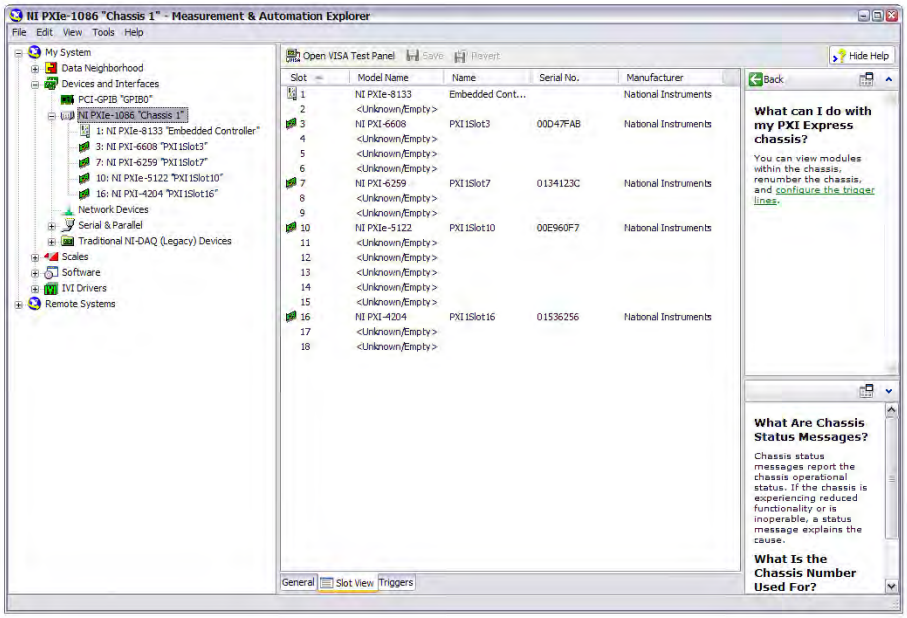
PXI Express System Configuration with MAX

The PXI Platform Services software included with your chassis automatically identifies your PXI Express system components to generate a `pxiesys.ini` file. You can configure your entire PXI system and identify PXI-1 chassis through Measurement & Automation Explorer (MAX), included with your system controller. MAX creates the `pxiesys.ini` and `pxisys.ini` file, which define your PXI system parameters. MAX also provides an interface to route and reserve triggers so dynamic routing, through drivers such as DAQmx, avoids double-driving and potentially damaging trigger lines. For more information about routing and reserving PXI triggers, refer to KnowledgeBase **3TJDOND8** at `ni.com/support`.

The configuration steps for single or multiple-chassis systems are the same.

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Figure 2-8. Multichassis Configuration in MAX



PXI-1 System Configuration

1. Launch MAX.
2. In the **Configuration** tree, click the **Devices and Interfaces** branch to expand it.
3. If the PXI system controller has not yet been configured, it is labeled **PXI System (Unidentified)**. Right-click this entry to display the pop-up menu, then select the appropriate system controller model from the **Identify As** submenu.
4. Click the PXI system controller. The chassis (or multiple chassis, in a multichassis configuration) is listed below it. Identify each chassis by right-clicking its entry, then selecting the appropriate chassis model through the **Identify As** submenu. Further expanding the **PXI System** branch shows all devices in the system that can be recognized by NI-VISA. When your system controller and all your chassis are identified, the required `pxisys.ini` file is complete.

The PXI specification allows for many combinations of PXI chassis and system modules. To assist system integrators, the manufacturers of PXI chassis and system modules must document the capabilities of their products. PXI Express devices must provide a driver and `.ini` file for identification. These files are provided as part of the PXI Platform Services software included with your system controller. The minimum documentation requirements for PXI-1 are contained in `.ini` files, which consist of ASCII text. System integrators, configuration utilities, and device drivers can use these `.ini` files.

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The capability documentation for a PXI-1 chassis is contained in a `chassis.ini` file provided by the chassis manufacturer. The information in this file is combined with information about the system controller to create a single PXI-1 system initialization file called `pxisys.ini` (PXI System Initialization). The NI system controller uses MAX to generate the `pxisys.ini` file from the `chassis.ini` file.

Device drivers and other utility software read the `pxiesys.ini` and `pxisys.ini` file to obtain system information. For detailed information about initialization files, refer to the PXI specification at `www.pxisa.org`.

Trigger Configuration in MAX

Each chassis has one or more trigger buses, each with eight lines numbered 0 through 7 that can be reserved and routed statically or dynamically. Static reservation *pre-allocates* a trigger line to prevent its configuration by a user program. Dynamic reservation/routing/deallocation is *on the fly* within a user program based upon National Instruments APIs such as NI-DAQmx. Static reservation of trigger lines can be implemented by the user in MAX through the **Triggers** tab. Reserved trigger lines will not be used by PXI modules dynamically configured by programs such as NI-DAQmx. This prevents the instruments from double-driving the trigger lines, possibly damaging devices in the chassis. In the default configuration, trigger lines on each bus are independent. For example, if trigger line 3 is asserted on trigger bus 0, by default it will not be automatically asserted on any other trigger bus.

Complete the following steps to reserve these trigger lines in MAX.

1. In the Configuration tree, click on the PXI chassis branch you want to configure.
2. Then, in the right-hand pane, toward the bottom, click on the **Triggers** tab.
3. Select which trigger lines you would like to statically reserve.
4. Click the **Apply** button.

PXI Trigger Bus Routing

The PXIe-1086 chassis can route triggers from one bus to others within the same chassis using the **Trigger Routing** tab in MAX, as shown in Figure 2-8.

Note Selecting any non-disabled routing automatically reserves the line in all trigger buses being routed to. If you are using NI-DAQmx, it will reserve and route trigger lines for you, so you won't have to route trigger lines manually.

Complete the following steps to configure trigger routings in MAX.

1. In the **Configuration** tree, select the chassis in which you want to route trigger lines.
2. In the right-hand pane, select the **Trigger Routing** tab near the bottom.
3. For each trigger line, select **Route Right**, **Route Outward From Middle**, or **Route Left** to route triggers on that line in the described direction, or select **Disabled** for the default behavior with no manual routing.
4. Click the **Apply** button.

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Using System Configuration and Initialization Files

The PXI Express specification allows many combinations of PXI Express chassis and system modules. To assist system integrators, the manufacturers of PXI Express chassis and system modules must document the capabilities of their products. The minimum documentation requirements are contained in `.ini` files, which consist of ASCII text. System integrators, configuration utilities, and device drivers can use these `.ini` files.

The capability documentation for the PXIe-1086 chassis is contained in the `chassis.ini` file on the software media that comes with the chassis. The information in this file is combined with information about the system controller to create a single system initialization file called `pxisys.ini` (PXI System Initialization). The system controller manufacturer either provides a `pxisys.ini` file for the particular chassis model that contains the system controller or provides a utility that can read an arbitrary `chassis.ini` file and generate the corresponding `pxisys.ini` file. System controllers from NI provide the `pxisys.ini` file for the PXIe-1086 chassis, so you should not need to use the `chassis.ini` file. Refer to the documentation provided with the system controller or to `ni.com/support` for more information on `pxisys.ini` and `chassis.ini` files.

Device drivers and other utility software read the `pxisys.ini` file to obtain system information. The device drivers should have no need to directly read the `chassis.ini` file. For detailed information regarding initialization files, refer to the PXI Express specification at `www.pxisa.org`.

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3 Maintenance

This chapter describes basic maintenance procedures you can perform on the PXIe-1086 chassis.

Caution Disconnect the power cable prior to servicing a PXIe-1086 chassis.

Service Interval

Clean dust from the chassis exterior (and interior) as needed, based on the operating environment. Periodic cleaning increases reliability.

Preparation

The information in this section is designed for use by qualified service personnel. Read the *Read Me First: Safety and Electromagnetic Compatibility* document included with your kit before attempting any procedures in this chapter.

Caution Many components within the chassis are susceptible to static discharge damage. Service the chassis only in a static-free environment. Observe standard handling precautions for static-sensitive devices while servicing the chassis. *Always* wear a grounded wrist strap or equivalent while servicing the chassis.

Cleaning

Cleaning procedures consist of exterior and interior cleaning of the chassis. Refer to your module user documentation for information on cleaning the individual CompactPCI or PXI Express modules.

Caution *Always* disconnect all power cables before cleaning or servicing the chassis.

Interior Cleaning

Use a dry, low-velocity stream of air to clean the interior of the chassis. Use a soft-bristle brush for cleaning around components.

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Exterior Cleaning

Clean the exterior surfaces of the chassis with a dry lint-free cloth or a soft-bristle brush. If any dirt remains, wipe with a cloth moistened in a mild soap solution. Remove any soap residue by wiping with a cloth moistened with clear water. Do not use abrasive compounds on any part of the chassis.

Caution Avoid getting moisture inside the chassis during exterior cleaning, especially through the top vents. Use just enough moisture to dampen the cloth.

Caution Do *not* wash the front- or rear-panel connectors or switches. Cover these components while cleaning the chassis.

Caution Do *not* use harsh chemical cleaning agents; they may damage the chassis. Avoid chemicals that contain benzene, toluene, xylene, acetone, or similar solvents.

Replacing a Modular Power Supply

This section describes how to remove and install a modular power supply for the PXIe-1086 chassis.

Caution Do not use a power supply from another chassis. Doing so may damage your chassis and the power supply. You *must* ensure the chassis is properly grounded after any maintenance. Refer to Chapter 2, *Connecting Safety Ground* and *Connecting to Power Source*, for instructions on connecting safety ground.

Removal

The PXIe-1086 power supply (part number 782106-01) is a replacement part for the PXIe-1086 chassis. Before attempting to replace a power supply, verify that there is adequate clearance behind the chassis.

The power supplies for this chassis are redundant and hot swappable. If both power supplies are installed and functional, you can remove either without disconnecting main AC power from the system. If both power supplies are installed, and one has failed, you can remove the failed supply without disconnecting main AC power from the system.

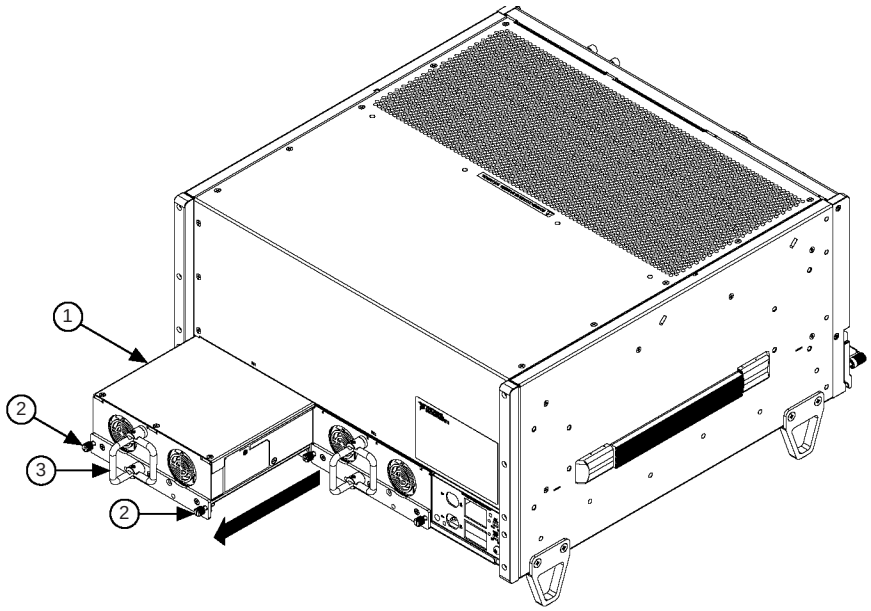
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Complete the following steps to remove a power supply from the rear of the chassis, as shown in Figure 3-1:

Caution Before handling the power supply, allow the fan to stop spinning.

1. Disengage the two screws on the rear of the power supply with a flat-blade screwdriver.
2. Extend the collapsible handle and pull the power supply out of the chassis.

Figure 3-1. Removing Power Supply from PXIe-1086 Chassis

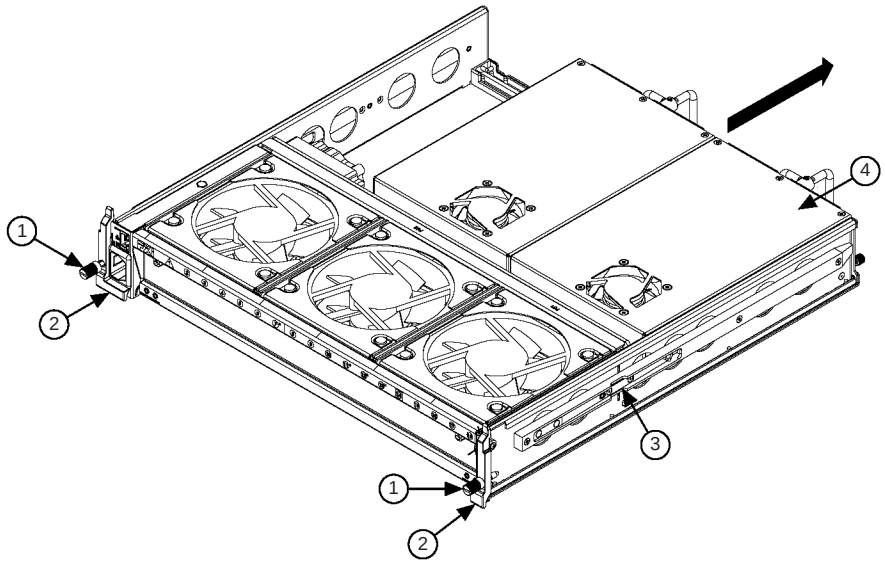


1	Power Supply	2	Captive Screw	3	Collapsible Handle

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If access to the rear of the chassis is not available, you still can remove the power supplies by removing the entire power drawer from the chassis. The power drawer is shown in Figure 3-2.

Figure 3-2. PXIe-1086 Power Drawer



1	Captive Screw	2	Power Drawer Lever	3	Side Latch	4	Power Supply

Note If you are using the PXIe-1086 and NI SC Express modules with front mounting terminal blocks together, you must remove the SC Express module front mount terminal blocks to access the power drawer. Refer to your module documentation for more information about removing the terminal blocks.

Complete the following steps to remove the power drawer:

1. Loosen the drawer lever captive screws with a flat-blade screwdriver until the threads disengage from the chassis frame.
2. Rotate the drawer levers to eject the drawer from the chassis frame.
3. Pull the drawer about halfway out until the side latches engage.
4. Press in the side latches on both sides to release the drawer and continue to pull out the drawer.

Caution Before handling the power supply, allow the fan to stop spinning.

5. Place the drawer on a table surface to remove the power supply.

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6. Disengage the two screws on the rear of the power supply with a flat-blade screwdriver. (Refer to Figure 3-1.)
7. Extend the collapsible handle and pull the power supply out of the chassis. (Refer to Figure 3-1.)

Installation

Ensure there is no visible damage to the new power supply before installing it. Verify that there is no foreign material inside the connector on the new power supply.

The power supplies for this chassis are redundant and hot swappable. If one power supply already is installed and functional, you can install the second power supply without first disconnecting main AC power from the system. If no power supplies are installed or functional in the system, you must remove main power from the system by disconnecting the power cable from the AC power connector on the chassis front panel.

Complete the following steps to install a power supply from the rear of the chassis:

1. Slide the power supply into an empty slot with the connector facing toward the chassis until it engages.
2. Fold down the collapsible handle on the power supply.
3. Tighten the two captive screws on the rear of the power supply to 11.5 lb · in. torque with a flat-blade screwdriver.

If access to the rear of the chassis is not available, you still can install power supplies by removing the entire power drawer from the chassis. The power drawer is shown in Figure 3-2.

Note If you are using the PXIe-1086 and NI SC Express modules with front mounting terminal blocks together, you must remove the SC Express module front mount terminal blocks to access the power drawer. Refer to your module documentation for more information about removing the terminal blocks.

Complete the following steps to remove the power drawer:

1. Loosen the drawer lever captive screws with a flat-blade screwdriver until the threads disengage from the chassis frame.
2. Rotate the drawer levers to eject the drawer from the chassis frame.
3. Pull the drawer about halfway out until the side latches engage.
4. Press in the side latches on both sides to release the drawer and continue to pull out the drawer.

Caution Before handling the power supply, allow the fan to stop spinning.

5. Place the drawer on a table surface to install the power supply.
6. Slide the power supply into an empty slot with the connector facing toward inside of drawer until it engages.

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7. Fold down the collapsible handle on the power supply.
8. Tighten the two captive screws on the rear of the power supply to 11.5 lb · in. torque with a flat-blade screwdriver.
9. Reinstall the power drawer. When reinstalling the drawer, tighten the drawer lever captive screws to 11.5 lb · in. torque.

Replacing a Modular Fan Assembly

This section describes how to remove and install a modular fan assembly for the PXIe-1086 chassis.

Caution Do not use a fan assembly from another chassis. Doing so may damage your chassis and the fan assembly.

Removal

The PXIe-1086 fan assembly (part number 782107-01) is a replacement part for the PXIe-1086 chassis. Before attempting to replace a fan assembly, verify that there is adequate clearance in front of the chassis.

The fans for this chassis are redundant and hot swappable. You can remove the fans with main AC power connected to the system.

Caution Use care when selecting which fans to remove, as an undesired system shut down can occur. Do not remove both fans from the same column, as this triggers a system shutdown.

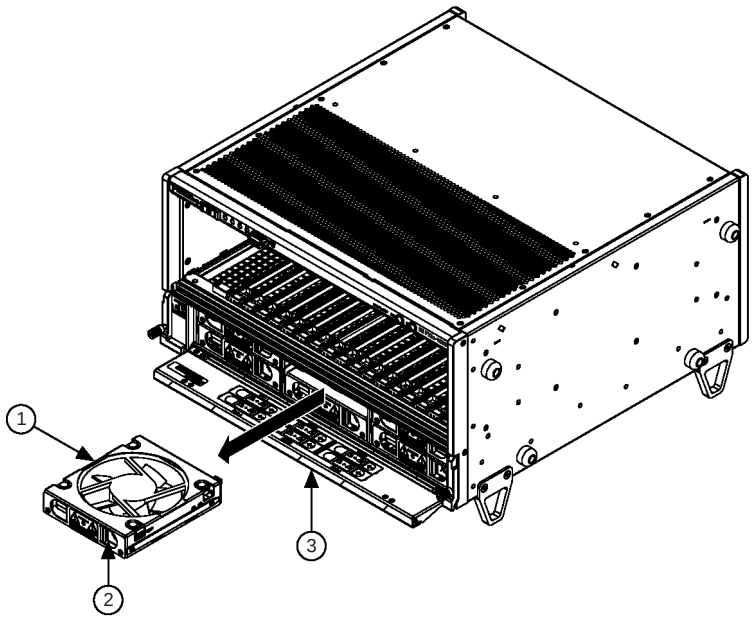
Caution Likewise, do not remove the working fan from the same column as a failed fan, as this also triggers a chassis shutdown.

Caution If all fans are installed and operating normally, you can remove any fan without causing the system to shut down.

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Figure 3-3 shows the PXIe-1086 chassis with a fan assembly removed.

Figure 3-3. PXIe-1086 Chassis with Fan Assembly Removed



1	Modular Fan Assembly	2	Fan Latch	3	Fan Door

Complete the following steps to remove a fan assembly:

1. Open the fan door by sliding the door latches inward and rotating the door down.
2. Locate the fan to be removed. A red LED indicates a failed fan.

Caution If the fan is still spinning, allow the fan to stop before handling. (The fan will not stop as long as it is in the airflow path.)

3. Slide the fan latch until it disengages and allows removal by pulling the fan module forward.

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