PXIe-4468

User Manual

Provided by:

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Welcome to the PXIe-4468 User Manual

The PXIe-4468 User Manual provides detailed descriptions of product functionality and step-by-step processes for use.

Looking for something else?

For information not found in the User Manual for your product, like specifications or API reference, browse Related Information.

Related information:

- PXIe-4468 Specifications
- PXIe-4468 Calibration Procedure
- NI-DAQmx Help
- NI-DAQmx C Reference
- NI-DAQmx Python Reference
- NI-DAQmx and LabVIEW Compatibility
- LabVIEW User Manual
- Software and Driver Downloads
- Release Notes
- License Setup and Activation
- Dimensional Drawings
- Product Certifications
- Letter of Volatility
- Discussion Forums
- NI Learning Center

PXIe-4468 Overview

The PXIe-4468 is a sound and vibration module designed for making precision measurements with microphones, accelerometers, and other transducers that feature large dynamic ranges. Use the PXIe-4468 for sound and vibration applications such as audio test; automotive noise, vibration, and harshness (NVH); and machine condition monitoring.

> **Note** In this document, the PXIe-4468 with Mini-XLR and PXIe-4468 with BNC are referred to inclusively as the PXIe-4468. The information in this document applies to all versions of the PXIe-4468 unless otherwise specified.

Device Capabilities

The PXIe-4468 is a sound and vibration module that has the following features and capabilities.

- Pure Tone generator
- 2 differential analog input channels and 2 analog output channels
- 24-bit resolution
- 250 kS/s maximum sample rate
- AC/DC input coupling
- .8 Hz highpass filter cutoff frequency
- 6 gain settings
- Mini-XLR front connections
- 121 dB DSA dynamic range

Driver Support

NI recommends that you use the newest version of the driver for your module.

Table 1. Earliest Driver Version Support

Driver Name	Earliest Supported Version
NI-DAQmx	22.8

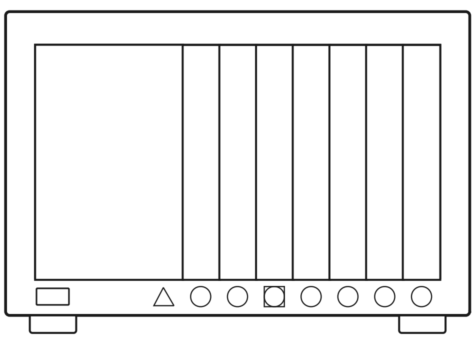
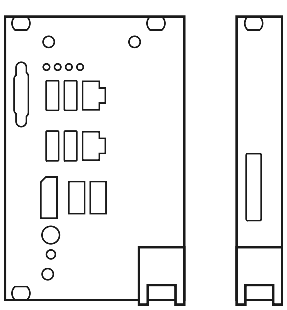
Components of a PXIe-4468 System

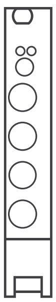
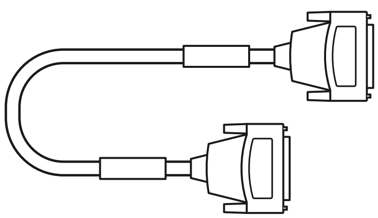
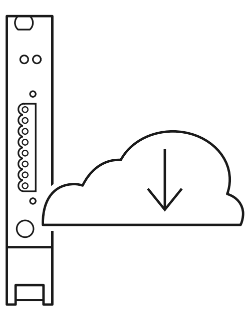
The PXIe-4468 is designed for use in a system that includes other hardware components, drivers, and software.

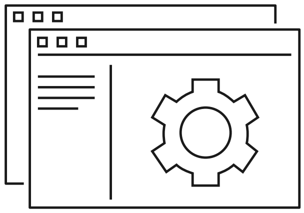
> **Notice** A system and the surrounding environment must meet the requirements defined in the ***PXIe-4468 Specifications***.

The following list defines the minimum required hardware and software for a system that includes a PXIe-4468.

Table 2. System Components

Component	Description and Recommendations
PXI Chassis 	A PXI chassis houses the PXIe-4468 and supplies power, communication, and timing for PXIe-4468 functions.
PXI Controller or PXI Remote Control Module 	You can install a PXI controller or a PXI remote control (MXI) module depending on your system requirements. These components, installed in the same PXI chassis as the PXIe-4468, interface with the instrument using NI device drivers.

Component	Description and Recommendations
Sound and Vibration Module 	Your sound and vibration module.
Cables and Accessories 	Cables and accessories allow connectivity to/from your instrument for measurements. Refer to ***Cables and Accessories*** for recommended cables and accessories and guidance.
NI-DAQmx Driver 	Instrument driver software that provides functions to interact with the PXIe-4468 and execute measurements using the PXIe-4468. **Note** NI recommends to always use the most current version of NI-DAQmx with the PXIe-4468. You can find the NI-DAQmx driver requirements in the ***NI-DAQmx Readme***.
NI Applications	NI-DAQmx offers driver support for the following applications: • LabVIEW • LabWindows/CVI

Component	Description and Recommendations
	• NI-DAQmx Measurement Studio Integration (Measurement Studio 2019) • SignalExpress • ANSI C • .NET • Python

Cables and Accessories

NI recommends using the following cables and accessories with your module.

Table 3. Cables and Accessories

Accessory Description	Notes	Part Number
1-Pin BNC (Male or Female) to 1-Pin SMB Female, 50 Ω Coaxial Cable	For both connector variants	189425-0R6
10-32 Male to 1-Pin BNC Male, Low-Noise Coaxial Cable	For both connector variants	780966-01
Mini XLR Female Microphone Cable	• For the PXIe-4468 with Mini-XLR • 0.46 M length	140151-0R46
1-Pin BNC Male to 1-Pin BNC Male Coaxial Cable	For the PXIe-4468 with BNC	779697-02
PXI Slot Blockers	Set of 5	199198-01

Programming Options

You can use the NI-DAQmx Driver to program your instrument in the supported ADE of your choice

- **NI-DAQmx**—Use NI-DAQmx to communicate with and control your sound and vibration instrument.

- LabVIEW
- LabVIEW Real-Time Module
- LabWindows/CVI
- LabWindows/CVI Real-Time Module
- NI-DAQmx Measurement Studio Integration (Measurement Studio 2019)
- SignalExpress

PXIe-4468 Front Panel

Figure 1. PXIe-4468 with Mini-XLR Front Panel

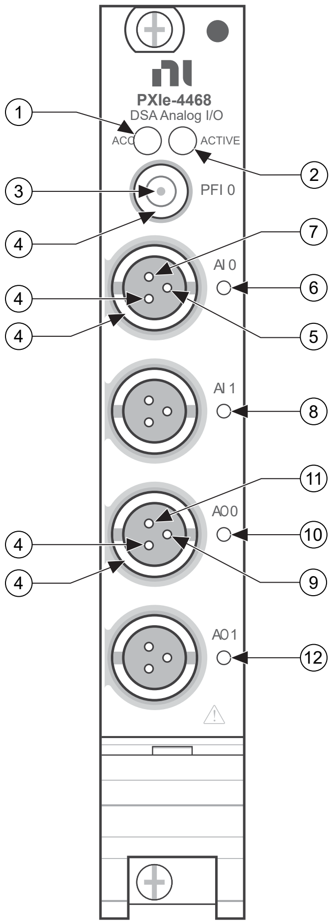
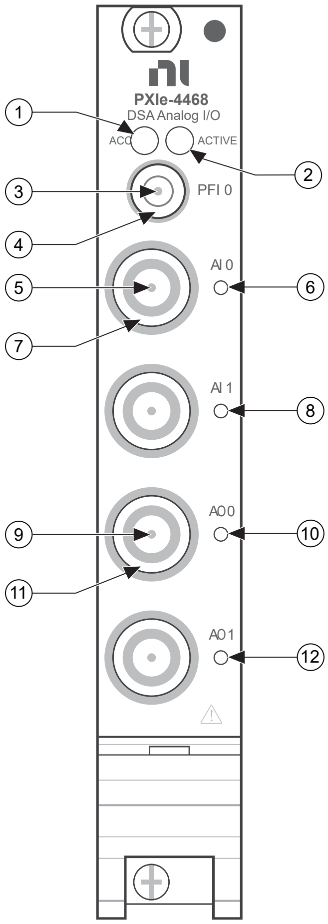


Figure 2. PXIe-4468 with BNC Front Panel



1. Access LED
2. Active LED
3. PFI
4. GND
5. AI+
6. AI 0 LED
7. AI-
8. AI 1 LED
9. AO+
10. AO 0 LED
11. AO-
12. AO 1 LED

Table 4. Signal Descriptions

Signal Name	Signal Description
PFI	Programmable Function Interface (PFI) line
AI+	Positive analog input signal
AI-	Negative analog input signal
AO+	Positive analog output signal
AO-	Negative analog output signal
GND	Chassis ground

PXIe-4468 LED Indicators

The PXIe-4468 features an ACC (Access), Active, AI 0, AI 1, AO 0, and AO 1 LED.

ACC (Access) LED

The Access LED, located on the module front panel, indicates the basic hardware status of the PXIe-4468.

The following table lists the Access LED states.

Table 5. Access LED Indicator Status

Status Indicator	Device State
(Off)	The PXIe-4468 is not yet functional, or has detected a problem with a PXI power rail.
Green	The PXIe-4468 is ready to be programmed.
Amber	The PXIe-4468 is being accessed. The Access LED flashes amber for 75 ms when the PXIe-4468 is accessed.

Why Is the Access LED Off When the Chassis Is On?

The LEDs may not light until the module has been configured in MAX. Before proceeding, verify that the PXIe-4468 appears in MAX.

If the Access LED fails to light after you power on the chassis, a problem may exist with the chassis power rails, a hardware module, or the LED.

Notice Apply external signals only while the PXIe-4468 is powered on. Applying external signals while the module is powered off may cause damage.

1. Disconnect any signals from the module front panels.

2. Power off the chassis.
3. Remove the module from the chassis and inspect it for damage. Do not reinstall a damaged module.
4. Install the module in a different chassis slot from which you removed it.
5. Power on the chassis.

> **Note** If you are using a PC with a device for PXI remote control system, power on the chassis before powering on the computer.

6. Verify that the module appears in MAX.
7. Reset the module in MAX and perform a self-test.

Active LED

The Active LED, located on the module front panel, indicates the module operation state.

The following table lists the Active LED states.

Table 6. Active LED Indicator Status

Status Indicator	Device State
(Off)	The PXIe-4468 is not acquiring or preparing to acquire data.
Amber	The PXIe-4468 is waiting for a trigger event to start an acquisition.
Green	An acquisition has been triggered, and the PXIe-4468 is currently acquiring data.
Alternating Amber/Green	The PXIe-4468 is changing reference clock timebase.
Red	An error has been detected by hardware. Use NI-DAQmx software to determine the cause and/or clear the error by resetting the module.

AI 0 and AI 1 LEDs

The AI 0 and AI 1 LEDs, located on the module front panel, indicate the signal status of the analog input channels.

The following table lists the AI 0 and AI 1 LED states.

Table 7. AI 0 and AI 1 LED Status Indicator

Status Indicator	Device State
Alternating Amber/Green	The reference clock source is changing to onboard or PXIeClk100.
Amber	The channel is waiting for a trigger to start acquiring.
Green	The channel is actively acquiring a signal.
Red	An error has been detected on the channel or board. Refer to the ***Why is the AI 0, AI 1, AO 0, or AO 1 LED Red?*** section below for more information.

AO 0 and AO 1 LEDs

The AO 0 and AO 1 LEDs, located on the module front panel, indicate the signal status of the analog output channels.

The following table lists the AO 0 and AO 1 LED states.

Table 8. AO 0 and AO 1 LED Status Indicator

Status Indicator	Device State
Alternating Amber/Green	The reference clock source is changing to onboard or PXIeClk100.
Amber	The channel is waiting for a trigger to start generating.
Green	The channel is actively generating a signal.
Red	An error has been detected on the channel or board. Refer to the ***Why is the AI 0, AI 1, AO 0, or AO 1 LED Red?*** section below for more information.

Why is the AI 0, AI 1, AO 0, or AO 1 LED Red?

A red AI 0, AI 1, AO 0, and AO 1 LED indicates that an error has been detected on the channel or board.

Possible errors include the following:

- The board is overheated.
- The power supply is not at the proper voltage.
- A clocking error occurred (PLL fell out of lock or PXIeClk100 was not present when using the external timebase).
- An external overvoltage or overcurrent was detected.
- An overload was detected.
- A streaming underflow was detected on the channel.
- Internal hardware failed (either due to software or hardware failure).

An external overvoltage, overcurrent, or overload error can be read through NI-DAQmx property nodes.

PXIe-4468 Installation and Configuration

Complete the following steps to install the PXIe-4468 into a chassis and prepare it for use.

1. Unpacking the Kit
2. Installing the Software
3. Installing the PXIe-4468 into a Chassis

Unpacking the Kit

> **Notice** To prevent electrostatic discharge (ESD) from damaging the device, ground yourself using a grounding strap or by holding a grounded object, such as your computer chassis.

1. Touch the antistatic package to a metal part of the computer chassis.
2. Remove the device from the package and inspect the device for loose components or any other sign of damage.

   > **Notice** Never touch the exposed pins of connectors.

   > **Note** Do not install a device if it appears damaged in any way.

3. Unpack any other items and documentation from the kit.

> **Note** Store the device in the antistatic package when the device is not in use.

Kit Contents

The following items are necessary to set up and use the PXIe-4468.

- PXIe-4468 module

- Documentation

Installing the Software

You must be an Administrator to install NI software on your computer.

1. Install an ADE, such as LabVIEW or LabWindows™/CVI™.
2. Download the driver software installer from ni.com/downloads.
   NI Package Manager downloads with the driver software to handle the installation. Refer to the NI Package Manager Manual for more information about installing, removing, and upgrading NI software using NI Package Manager.
3. Follow the instructions in the installation prompts.

   > **Note** Windows users may see access and security messages during installation. Accept the prompts to complete the installation.

4. When the installer completes, select **Restart** in the dialog box that prompts you to restart, shut down, or restart later.

Installing the PXIe-4468 into a Chassis

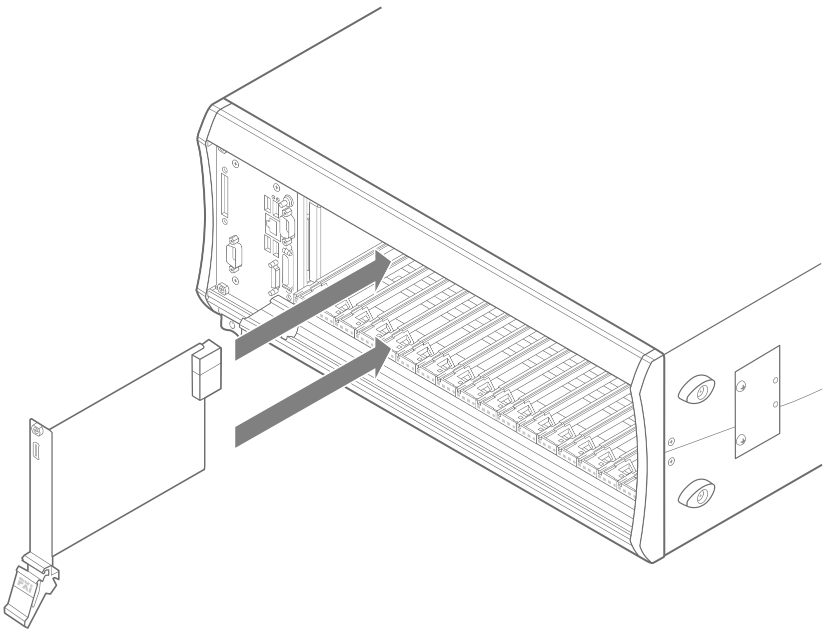
> **Notice** To prevent damage to the PXIe-4468 caused by ESD or contamination, handle the module using the edges or the metal bracket.

1. Ensure the AC power source is connected to the chassis before installing the module.
   The AC power cord grounds the chassis and protects it from electrical damage while you install the module.
2. Power off the chassis.
3. Inspect the slot pins on the chassis backplane for any bends or damage prior to installation. Do not install a module if the backplane is damaged.
4. Position the chassis so that inlet and outlet vents are not obstructed.
   For more information about optimal chassis positioning, refer to the chassis documentation.
5. Remove the black plastic covers from all the captive screws on the module front

panel.

6. Identify a supported slot in the chassis. The PXIe-4468 module can be placed in PXI Express hybrid peripheral slots (●H), PXI Express system timing slots (●), or PXI Express peripheral slots (●).
7. Touch any metal part of the chassis to discharge static electricity.
8. Ensure that the ejector handle is in the downward (unlatched) position.

Figure 3. Module Installation



9. Place the module edges into the module guides at the top and bottom of the chassis. Slide the module into the slot until it is fully inserted.
10. Latch the module in place by pulling up on the ejector handle.
11. Secure the module front panel to the chassis using the front-panel mounting screws.

> **Note** Tightening the top and bottom mounting screws increases mechanical stability and also electrically connects the front panel to the chassis, which can improve the signal quality and electromagnetic performance.

12. Cover all empty slots using either filler panels (standard or EMC) or slot blockers with filler panels, depending on your application.

> **Note** For more information about installing slot blockers and filler panels, go to ni.com/r/pxiblocker.

13. Power on the chassis.

Connecting Signals to the PXIe-4468

Refer to the following topics for guidance about PXIe-4468 signal connections.

Analog Input Connections

The following figure shows the PXIe-4468 analog input circuitry block diagram. Depending on the connector type, connect the signals as shown in the inset.

Figure 4. PXIe-4468 Analog Input Block Diagram

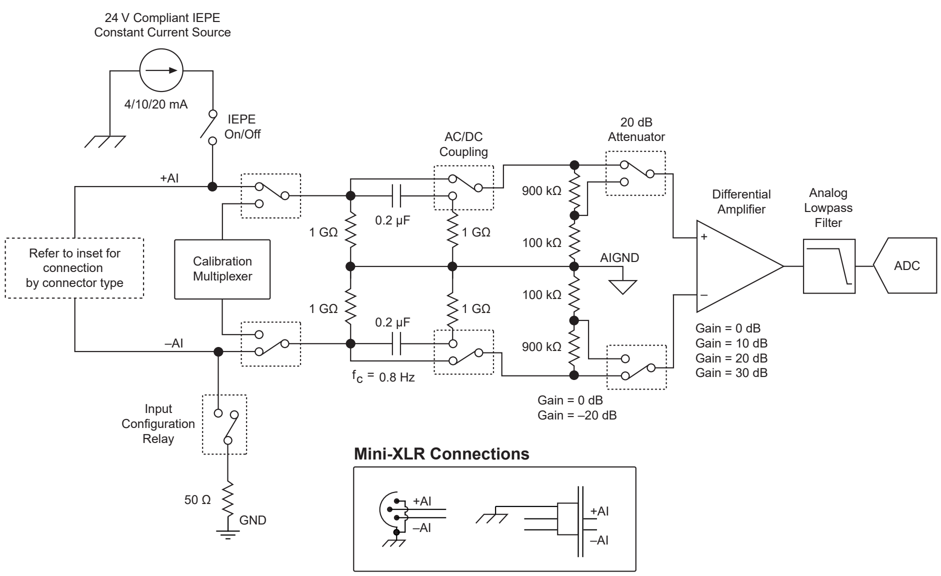


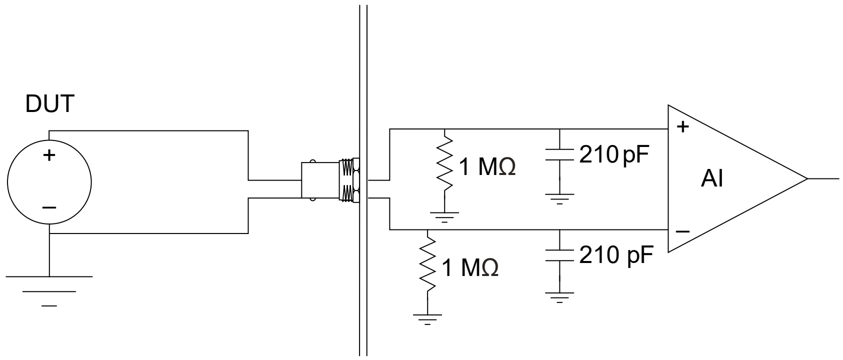
Table 9. Input Configuration Relay

Analog Input Channel Configuration	Input Configuration Relay
Differential	OFF
Pseudodifferential	ON

Connecting Analog Input in Differential Mode

The following figure shows the PXIe-4468 input connection with the terminal configuration in differential mode.

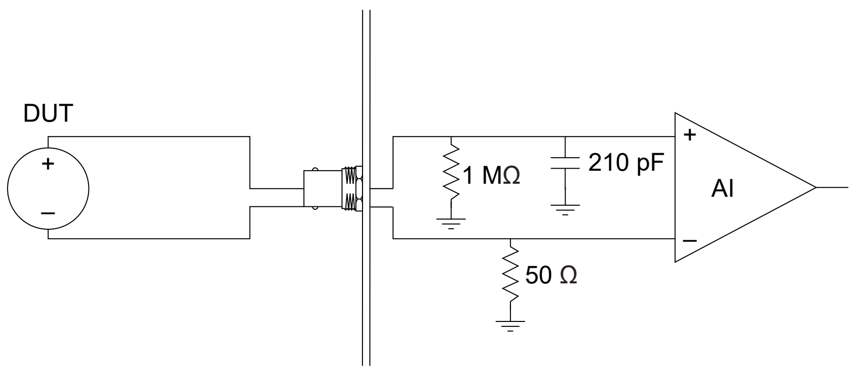
Figure 5. PXIe-4468 Input Connection in Differential Mode



Connecting Analog Input in Pseudodifferential Mode

The following figure shows an PXIe-4468 input connection with the terminal configuration in pseudodifferential mode.

Figure 6. PXIe-4468 Input Connection in Pseudodifferential Mode



Analog Output Connections

The following figure shows the PXIe-4468 analog output circuitry block diagram. Depending on the connector type, connect the signals as shown in the inset.

Figure 7. PXIe-4468 Analog Output Block Diagram

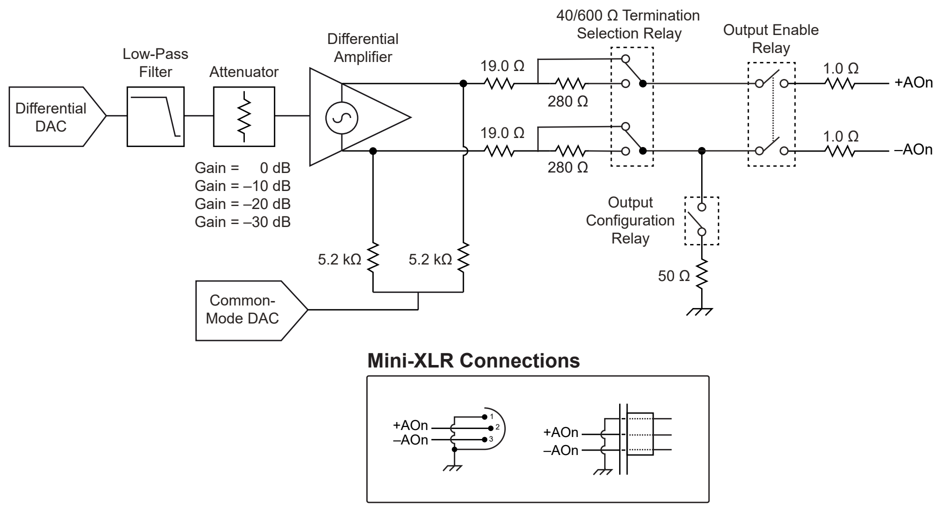


Table 10. Output Configuration Relay

Analog Output Channel Configuration	Output Configuration Relay
Differential	OFF
Pseudodifferential	ON

The PXIe-4468 output stage is a differential amplifier. The output stage can be configured to pseudodifferential mode in software, where the AO- terminal is internally connected to chassis ground through a 50 Ω resistor. This connection introduces a gain difference in the output stage of -22.0 mdB, for which the software corrects automatically. Refer to the ***NI-DAQmx Help*** for more information about terminal configuration.

The PXIe-4468 output stage can also be configured to pseudodifferential mode by making an external connection between AOn+ or AOn- to chassis ground. This connection introduces a gain change in the output stage of -22.0 mdB, for which the software does not correct.

For most applications, configuring the PXIe-4468 output stage in differential mode will yield the best performance. For improved common-mode noise rejection, it is highly recommended to make a connection between the chassis ground of the PXIe-4468 and the input device ground. This connection is critical when the input device is isolated; if this connection is not available, it may be better to configure the PXIe-4468 output stage in pseudodifferential mode.

The following figure show the recommended output connection.

Figure 8. PXIe-4468 Mini-XLR Recommended Output Connection

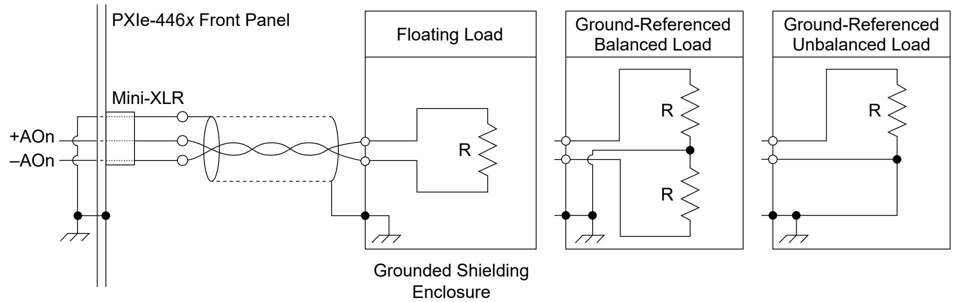
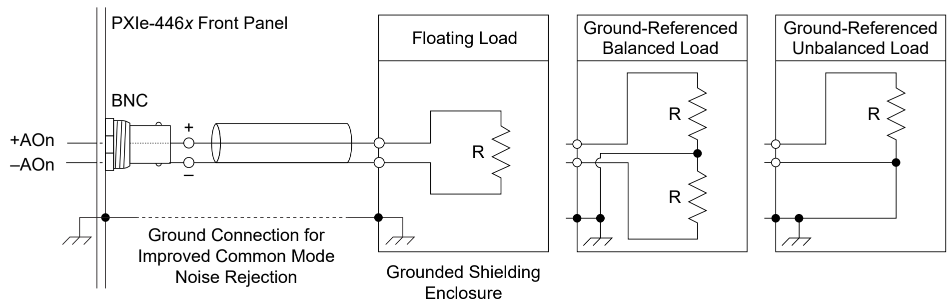


Figure 9. PXIe-4468 BNC Recommended Output Connection



Example Programs

NI-DAQmx includes several example applications that demonstrate the functionality of your device and can serve as interactive tools, programming models, and building blocks for your own applications.

Installed Example Locations

The installation location for NI-DAQmx example programs differs by programming language and development environment. Refer to the following table for information about example program installation locations.

Table 11. Installed NI-DAQmx Example Locations

Option		Installed Example Location
LabVIEW or LabWindows/CVI		**Help » Find Examples**
SignalExpress		`Program Files\National Instruments\SignalExpress\Examples`
ANSI C		`\Users\Public\Public Documents\National Instruments\NI-DAQ\Examples\DAQmx ANSI C`
.NET	4.0	`\Users\Public\Public Documents\National Instruments\NI-DAQ\Examples\DotNET 4.0`
	4.5	`\Users\Public\Public Documents\National Instruments\NI-DAQ\Examples\DotNET 4.5`

Dynamic Signal Acquisition Concepts

Nyquist Frequency and Nyquist Bandwidth

Any sampling system, such as an ADC, is limited in the bandwidth of the signals it can measure. Specifically, a sampling rate of f_S can represent only signals with frequencies lower than $f_S/2$. This maximum frequency is known as the Nyquist frequency. The bandwidth from 0 Hz to the Nyquist frequency is the Nyquist bandwidth.

Noise

Notice Electromagnetic interference can adversely affect the measurement accuracy of the DSA products described in this document. The inputs and outputs of these products are not connected to chassis ground for functional reasons. Therefore, the outer conductor of any connected coaxial cable is not connected to chassis ground and the outer conductor will not act as a shield for unwanted noise. The shield can act as an antenna to transmit noise into the environment or receive noise from the environment that could affect measurement accuracy. To ensure proper shielding effectiveness of connected coaxial cables, the outer conductor must be directly connected to chassis or earth ground at the load end of the cable. In addition, snap-on ferrite beads or other remedial measures may be required to prevent unwanted emissions or immunity. Refer to the ***PXIe-4468 Specifications*** for more information about EMC performance.

DSA devices typically have a dynamic range of more than 110 dB. Several factors can degrade the noise performance of input channels, such as noise picked up from nearby electronic devices. DSA devices work best when kept as far away as possible from other plug-in devices, power supplies, disk drives, and computer monitors. Cabling is also critical. Use well-shielded coaxial or floating cables for all connections. Route the cables away from sources of interference such as computer monitors, switching power supplies, and fluorescent lights. Physical motion or deformation can induce noise on sensitive analog cables. Use a transducer with a low output impedance to minimize system susceptibility to external noise sources and crosstalk.

You can reduce the effects of noise on your measurements by carefully choosing the sample rate to maximize the effectiveness of the anti-alias filtering. Computer monitor noise, for example, typically occurs at frequencies between 15 kHz and 65 kHz. If the signal of interest is restricted to below 10 kHz, for example, the anti-alias filters reject the monitor noise outside the frequency band of interest, and a sampling rate of at least 21.6 kS/s guarantees that any signal components in the 10 kHz bandwidth of interest are acquired without aliasing and without being attenuated by the digital filter.

When possible, use the differential configuration to minimize the effect of any noise produced by ground currents in the chassis and common-mode noise. If you have particularly noisy AC power, consider external filtering, such as a line conditioner or an uninterruptible power supply.

Analog Input

Analog Input Channel Configurations

You can configure the analog input channels of the PXIe-4468 in differential mode or pseudodifferential mode. You can configure the channels independently.

The term ***pseudodifferential*** refers to the 50 Ω resistance between the AI- terminal and chassis ground.

If the signal source is floating, use the pseudodifferential configuration. The pseudodifferential configuration provides a ground reference between the floating source and the DSA device by connecting a 50 Ω resistor (depending on the DSA device) from the negative input to ground. Without this, the floating source can drift outside of the common-mode range of the DSA device being used.

If the signal source is grounded or ground referenced, both the pseudodifferential and differential input configurations are acceptable. However, the differential input configuration is preferred, since using the pseudodifferential input configuration on a grounded signal source creates more than one ground-reference point. This condition may allow ground loop currents, which can introduce errors or noise into the measurement. The 50 Ω resistor between the negative input and ground is usually sufficient to reduce these errors to negligible levels, but results can vary depending on your system setup.

Configure the channels based on the signal source reference or DUT configuration. Refer to the following table to determine how to configure the channel.

Table 12. Source Reference and Channel Configuration

Source Reference	Channel Configuration
Floating	Pseudodifferential
Grounded	Differential or pseudodifferential

Input Coupling

The PXIe-4468 supports AC and DC coupling. Use the AI.Coupling property to configure the device or module for either AC or DC coupling.

- Select DC-coupling if the signal source has only small amounts of offset voltage or if the DC content of the acquired signal is important. When you select DC coupling, any DC offset present in the source signal is passed to the ADC.
- Select AC coupling if the signal source has a significant amount of unwanted offset so it can take full advantage of the input dynamic range. Selecting AC coupling enables a highpass resistor-capacitor (RC) filter into the signal conditioning path.
    - The filter time constant is 200 ms. The highpass RC filter settles to 2% accuracy in 1 s in response to a step input. It takes 3.128 s to settle to 24-bit accuracy in response to a step input. The settling time is somewhat dependent on the DUT impedance as well.

> **Note** NI-DAQmx does not compensate for the settling time introduced by the RC filter when switching from DC to AC coupling. To compensate for the filter settling time, you can discard the samples taken during the settling time or force a delay before you restart the measurement. You must force the delay after the AI task is committed, but before the task starts.

Using AC coupling results in an attenuation of the low-frequency response of the AI circuitry. Refer to the specifications for your product for information about the cut-off frequency.

Sensors and Transducers

A sensor or transducer is a device that outputs an electrical signal in response to a measured physical phenomenon such as pressure or temperature. The most common sensors for use with DSA devices include microphones for measuring sound pressure and accelerometers for measuring linear acceleration or vibration.

TEDS (Transducer Electronic Data Sheet)

The PXIe-4468 supports modes for Class I TEDS sensors without any additional hardware.

TEDS-capable sensors carry a built-in, self-identification EEPROM that stores a table of parameters and sensor information. TEDS sensors have two modes of operation: an analog mode that allows the sensors to operate as transducers measuring physical phenomena, and a digital mode that allows you to write and read information to and from the TEDS.

TEDS contains information about the sensor such as calibration, sensitivity, and manufacturer information. This information is accessible in Measurement & Automation Explorer (MAX), VIs in LabVIEW, or by calling the equivalent function calls in a text-based ADE.

Refer to the following help files and pages for more information about TEDS:

- ***Measurement & Automation Explorer Help for NI-DAQmx***—Contains information about configuring and testing data acquisition (DAQ) devices, RT Series DAQ devices, TEDS carriers, and RTSI cables using MAX for NI-DAQmx, and special considerations for operating systems. Select **Help » Help Topics » NI-DAQmx » MAX Help for NI-DAQmx** in MAX.
- ***NI-DAQmx Help***—Contains general information about measurement concepts, key NI-DAQmx concepts, and common applications that are applicable to all programming environments. Select **Start » National Instruments » NI-DAQmx » NI-DAQmx Help**.
- ***LabVIEW Help***—Contains information about LabVIEW programming concepts, step-by-step instructions for using LabVIEW, and reference information about LabVIEW VIs, functions, palettes, menus, and tools.
- ***IEEE 1451.4 Sensor Templates Overview***—Describes the structure and contents of the IEEE 1451.4 TEDS, including the Basic TEDS and each of the different sensor template contents.

Related information:

- IEEE 1451.4 TEDS Sensor Templates Overview

IEPE

The PXIe-4468 supports 4 mA, 10 mA, and 20 mA IEPE current settings.

If you attach an IEPE accelerometer or microphone that requires excitation to an AI channel of the DSA device, you must enable the IEPE excitation circuitry for that channel to generate the required excitation current. You can independently configure IEPE signal conditioning on a per channel basis on all DSA devices.

A DC voltage offset is generated equal to the product of the excitation current and sensor impedance when IEPE signal conditioning is enabled. To remove the unwanted offset, enable AC coupling. DC coupling can be used with IEPE excitation enabled without a loss of signal integrity only if the offset plus the peak of the AC signal of interest does not exceed the voltage range of the channel.

> **Note** You must set the inputs to pseudodifferential mode when IEPE is activated.

Overload Detection

When the signal voltage exceeds the input range, distortion caused by a clipped or overranged waveform can occur. The PXIe-4468 includes overload detection in both the analog domain (predigitization) and digital domain (postdigitization).

Use the OverloadedChansExist and OverloadedChans properties to access the overload detection feature.

An analog overrange can occur independently from a digital overrange, and vice versa. For example, an IEPE accelerometer might have a resonant frequency that, when stimulated, can produce an overrange in the analog signal. However, because the ADC delta-sigma technology uses very sharp anti-aliasing filters, the overrange is not passed into the digitized signal.

Conversely, a sharp transient on the analog side might not overrange, but the step response of the delta-sigma anti-aliasing filters might produce clipping in the digital data. The PXIe-4468 analog overload detection circuitry detects a clipped or overloaded condition. You can programmatically poll the overload detection circuitry on a per channel basis to monitor for an overload condition. If an overload is detected, consider any data acquired at that time corrupt.

DSA devices perform digital overload detection as a percentage of the range. The overload detection occurs before the device applies gain and offset corrections. Detecting the overload before the gain and offset corrections catches an overflow condition in the delta-sigma modulator or ADC filter.

For instance, on the PXIe-4468, the analog overload point for the 0 dB gain range is approximately 10.7 8 pk. This is the voltage at which the front-end circuitry begins showing signs of saturation.

Caution Overload detection is not supported for the ±42.4 V pk input range setting. This setting attenuates the signal by a factor of 10. This attenuation factor implies that the ADC reaches the analog saturation point at 115 V pk. This level is greater than what the ±42.4 V pk range can safely support. You risk damaging the input circuitry when measuring voltages capable of producing an overload condition when you use the ±42.4 V pk range (–20 dB gain) setting.

ADC

The PXIe-4468 analog-to-digital converters (ADCs) use the Delta-Sigma modulation conversion method. This approach involves oversampling the input signal and then decimating and filtering the resulting data to achieve the desired sample rate.

Analog Input Filter Delay

The filter delay is the time required for data to propagate through a converter. All DSA device channels have filter delays due to the presence of filter circuitry on both input and output channels. The digital filter delay is compensated to 0 ns by default. You can adjust the filter delay in NI-DAQmx.

Analog Output

Analog Output Channel Configurations

You can configure the analog output channels of the PXIe-4468 in differential mode or pseudodifferential mode. You can configure the channels independently.

The term ***pseudodifferential*** refers to the 50 Ω resistance between the AO- terminal and chassis ground.

If the DUT inputs are floating, use either the pseudodifferential or differential configuration.

If the DUT inputs are grounded or ground referenced, use the differential configuration. Using the pseudodifferential output configuration on a grounded DUT creates more than one ground-reference point. This condition may allow ground loop currents which can introduce errors or noise into the measurement. The 50 Ω resistor between the negative input and ground is usually sufficient to reduce these errors to negligible levels, but results can vary depending on your system setup.

Configure the channels based on the signal source reference or DUT configuration. Refer to the following table to determine how to configure the channel.

Table 13. DUT Input Reference and Channel Configuration

DUT Input Reference	Channel Configuration
Floating	Differential or pseudodifferential
Grounded	Pseudodifferential

The PXIe-4468 is automatically configured for differential mode when powered on or powered off. This configuration protects the 50 Ω resistor on the negative pin.

Output Distortion

You can minimize output distortion by connecting the outputs to external devices with a high input impedance.

Each output channel is rated to drive a minimum load of 600 Ω. However, you can achieve optimal performance with larger load resistances such as 10 kΩ or 100 kΩ. Refer to the ***PXIe-4468 Specifications*** for more information.

Output Impedance

The differential output impedance between positive and negative signal legs is approximately 40 Ω. For high impedance, it is greater than 1 MΩ.

DAC

The delta-sigma DAC on the PXIe-4468 functions in a way analogous to a delta-sigma ADC. The digital data first passes through a digital interpolation filter, then to the DAC resampling filter, and finally to the delta-sigma modulator.

In the DAC, the delta-sigma modulator converts high-resolution digital data to high-rate, 1-bit digital data. As in the ADC, the modulator frequency shapes the quantization noise so that almost all of the quantization noise energy is above the Nyquist frequency.

The digital 1-bit data is then passed to an inherently linear 1-bit DAC. The output of the DAC includes quantization noise at higher frequencies, and some images still remain near multiples of eight times the effective sample rate.

Analog Output Filter Delay

Output filter delay—the time required for digital data to propagate through the DAC and interpolation digital filters—varies depending on the update rate for DACs. This delay is an important factor for stimulus-response measurements, control applications, or any application where loop time is critical. You often might want to maximize the sample rate to minimize the time required for a specific number of update clock cycles to elapse, since it varies with frequency.

Refer to the ***PXIe-4468 Specifications*** for more information on the AO filter delay.

Pure Tone Generator

The Pure Tone Generator produces sine waves with exceptionally low distortion, previously only achievable by larger, boxed instruments and enables the testing of demanding parameters like data converter linearity and amplifier distortion.

You can use it to test demanding parameters like data converter linearity and amplifier distortion. The PXIe-4468 offers support for bench-quality signal-chain distortion analysis in a single-slot PXI Express form factor.

Many signal generators use widely available digital-to-analog converters (DACs) to create waveforms, but the noise and distortion performance of these types of generators is limited by the performance of commercially available parts. The NI Pure Tone sine wave generator uses novel digital signal processing (DSP) techniques to enable distortion performance far beyond the capabilities of conventional DACs to produce previously unachievable residual total harmonic distortion (THD) and total harmonic distortion plus noise (THD+N).

Refer to ***How To Generate Pure Tone Using The NI PXIe-4467/4468*** for more information on generating a Pure Tone using the PXIe-4468.

Related information:

- How To Generate Pure Tone Using The NI PXIe-4467/4468

FIFO and PCI Data Transfer

DSA device and module input channels share a FIFO buffer, and the output channels share a separate FIFO buffer. Refer to the ***PXIe-4468 Specifications*** for information on the buffer size.

The DSA devices and modules have a flexible data transfer request condition. You can program the device to request DMA transfers according to a programmable FIFO condition.

Timing Engines

The PXIe-4468 provide four timing engines, two for analog input and two for analog output. Multiple timing engines allow those devices to run up to two analog input and two analog output tasks simultaneously, each using independent timing and triggering configurations.

By default, NI-DAQmx automatically selects an available timing engine when reserving the task. Use the DAQmx Timing attribute/property SampTimingEngine to specify the timing engine to use or to determine which timing engine NI-DAQmx automatically selected.

Note You must reserve the task before querying the timing engine unless you explicitly specified the timing engine.

The SampTimingEngine attribute/property is an integer value corresponding to one of the four analog input timing or analog output engines available on the device:

SampTimingEngine Value	Timing Engine Used
0	te0
1	te1
2	te2
3	te3

The Sample Clock and Sample Clock Timebase, as well as the Start and Reference triggers, exist on each timing engine. Therefore, the names of the output terminals for those signals include the associated timing engine. If NI-DAQmx automatically selects the timing engine for a task, the timing engine, thus the output terminals for those signals, are undefined until you reserve the task. To reference one of those terminals, such as to share a Start Trigger across multiple tasks, use the Terminal attribute/property associated with each signal to determine the terminal name.

Note You must reserve the task before querying the terminal name unless you explicitly specify the timing engine.

Cleaning the PXIe-4468

Clean the hardware with a soft, nonmetallic brush. Make sure that the hardware is completely dry and free from contaminants before returning it to service.