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Find the *National Instruments PCI-4461* at our website: *Click HERE*

24-Bit, 204.8 kS/s Dynamic Signal Acquisition and Generation

NI 4461, NI 4462

- 2 or 4 simultaneously sampled analog inputs
- 2 simultaneously updated analog outputs (NI 4461 only)
- 118 dB dynamic range, 24-bit resolution
- 204.8 kS/s maximum sampling rate
- 92 kHz alias-free bandwidth
- Input range from ±316 mV to 42.4 V
- 6 gain settings
- AC/DC coupling
- Antialiasing and anti-imaging protection
- IEPE conditioning – software-configurable
- Multimodule synchronization

Operating Systems

- Windows 2000/NT/XP

Recommended Software

- LabVIEW
- LabVIEW Real-Time Module
- LabVIEW Sound and Vibration Toolkit
- LabVIEW Order Analysis Toolkit
- LabWindows/CVI
- Measurement Studio

Measurement Services Software (included)

- NI-DAQmx

Calibration Certificate Available



Product	Bus	Analog Inputs	Input Resolution	Sampling Rate	Input Range	Input Configuration	Analog Outputs	Output Resolution	Update Rate	Output Range	Triggering
NI 4461	PXI, PCI	2	24 bits	204.8 kS/s	±316 mV to 42.4 V	Differential/pseudodifferential	2	24 bits	204.8 kS/s	±100 mV to 10 V	Analog/digital
NI 4462	PXI, PCI	4	24 bits	204.8 kS/s	±316 mV to 42.4 V	Differential/pseudodifferential	0	–	–	–	Analog/digital

Table 1. NI 446x Channel, Speed, and Resolution Specifications

Overview

The National Instruments 4461 and 4462 are high-accuracy data acquisition devices specifically designed for sound and vibration applications. The devices include the hardware and software needed to make precision measurements with microphones, accelerometers, and other transducers that have very large dynamic ranges. Common applications for the NI 446x include audio test, automotive test, noise, vibration, and harshness (NVH) analysis, and machine condition monitoring (MCM).

The NI 446x devices offer a complete range of functionality for sound and vibration monitoring and analysis applications. With either two inputs and two outputs, or four inputs, they are ideal for applications where simultaneous generation and acquisition of noise, vibration, and acoustic signals are required. You can synchronize the acquisition clock of your NI 446x with other instruments in your system for mixed-signal applications. Both analog and digital triggering are available on an NI 446x.

Hardware

Applications

- Audio Test
- Noise, Vibration, and Harshness Test
- Machine Condition Monitoring
- Sound Power
- Structural Vibration
- Pass-by Noise

Analog Inputs

The analog input channels of NI 446x devices have 24-bit resolution ADCs that are simultaneously sampled at software-programmable rates for standard audio applications, such as 44.1 kS/s (the standard rate used in CD players), 48.0 kS/s (the rate used in digital audio tape (DAT) recorders and other digital audio equipment), 96.0 kS/s, and 192 kS/s. An NI 446x is well-suited for audio, sound, and vibration analysis applications.

The analog inputs offer programmable AC/DC coupling. A programmable gain amplifier stage on the inputs gives gain selection from -20 to +30 dB in 10 dB steps. Furthermore, to provide you with the quietest and highest-quality analog measurements, the input stage accepts differential or single-ended signal connections.

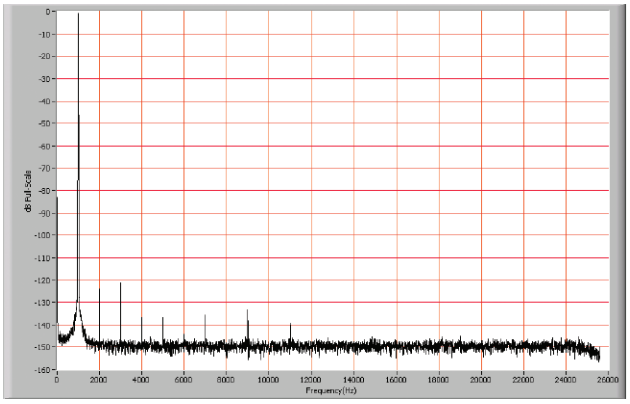


Figure 1. These 24-bit delta-sigma converters deliver outstanding dynamic range.

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With 118 dB dynamic range and low noise and distortion, NI 446x devices can make very accurate frequency-domain measurements. They have excellent amplitude flatness of ±0.1 dB within the frequency range of DC to 92 kHz, and have a typical THD of -107 dB.

Antialiasing

The analog inputs have both analog and digital filters implemented in hardware to prevent aliasing. Input signals are first passed through a fixed analog filter to remove any signals with frequency components beyond the range of the ADCs. Then digital antialiasing filters automatically adjust their cutoff frequency to remove any frequency components above half the programmed sampling rate.

Analog Outputs

NI 4461 devices have two channels of 24-bit resolution, high-fidelity analog output. A common application of the analog output is to stimulate a system under test while measuring the frequency response with the analog inputs. The output conversions occur simultaneously at software-programmable rates up to 204.8 kS/s. The analog output circuitry uses 8-times oversampling interpolators with 64-times oversampling delta-sigma modulators to offer exceptional spectral purity. Software-programmable attenuation of 0, 20, or 40 dB is available on the output channels. NI 4461 devices have excellent amplitude flatness of ±0.1 dB within DC to 92 kHz, and a THD of -95 dB at 1 kHz. You can simultaneously acquire data on the input channels while updating the output channels.

Anti-Imaging

NI 4461 output channels have both analog and digital anti-imaging filters. These filters remove the unwanted out-of-band components generated when an analog signal is produced from digital data. The digital filters limit the bandwidth of the output signal to half the original conversion rate, thereby rejecting images caused by the 8-times oversampling process. The signals generated by the analog output circuitry are low-distortion, low-noise, flat-frequency analog signals.

Multimodule Synchronization

For applications requiring more channels, you can synchronize the operation of two or more NI 446x devices with less than 0.1 deg phase mismatch. Synchronization is achieved by sharing a digital trigger and clock between multiple modules. The NI-DAQmx driver software automatically handles the synchronization of multiple devices in a single task.

Triggering

NI 446x devices offer both analog and digital triggering for signal acquisition. The source of the trigger can come from any analog input channel, the external digital trigger input, the PXI trigger bus (PXI devices), or the RTSI bus (PCI devices). The external digital trigger is 5 V TTL/CMOS-compatible and is activated by a choice of rising or falling edge. Triggering is needed in applications that acquire transient signals. When performing structural analysis by striking a metal beam with a hammer, for instance, you measure transient vibrations with accelerometers with acquisition triggered by the hammer impact.

Calibration

National Instruments calibrates the offset voltage and gain accuracy of the analog inputs and outputs. An onboard precision voltage reference ensures that the gain and offset remain stable and accurate. NIST-traceable and ISO 9002-certified calibration certificates are available on request.

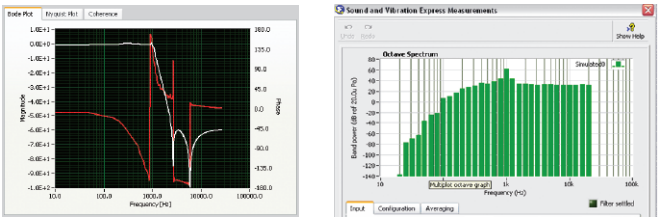


Figure 2. With application software such as NI LabVIEW, you can conduct frequency-response, swept-sine, and other common audio measurements.

Software

NI Measurement Services Software

NI 446x devices use NI measurement services software, based on the NI-DAQmx driver, as the hardware and OS interface. You can build automated test systems or integrate an NI 446x with other hardware, including modular instruments and multifunction data acquisition (DAQ) products, through NI-DAQmx function calls. NI measurement services software also includes DAQ Assistant, an interactive guide that steps you through configuring, testing, and programming measurement tasks and generates the necessary code automatically for National Instruments LabVIEW, LabWindows/CVI, or Measurement Studio.

Analysis Software

LabVIEW Sound and Vibration Toolkit

NI 446x devices are well-suited for audio, acoustic, and vibration analysis applications. The LabVIEW Sound and Vibration Toolkit incorporates Express technology to make it easier for you to perform sound and vibration measurement and analysis. The toolkit includes LabVIEW Express VIs for:

- Fractional-octave analysis with weighting
- Integrated vibration level
- Weighted sound level
- Zoom power spectrum
- Peak search
- Power in band

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- Power spectrum analysis
- Frequency response
- Limit testing

In addition, the LabVIEW Sound and Vibration Toolkit includes numerous VIs for audio measurements such as gain, phase, distortion, and swept-sine analysis. Swept-sine is a powerful analysis technique to measure frequency response. The toolkit also includes simple modular examples of all of these measurements, so you can quickly combine analog output, analog input, and data analysis to build a customized application. In addition, the existing signal generation is extended to include the tools and examples needed to provide the excitation required by most audio, noise, and vibration measurements. For example, a library of 33 waveforms is included in this toolkit to get you up and running fast.

This toolkit also optimizes LabVIEW to perform noise and vibration measurements. For example, all frequency measurements can perform zoom FFT analysis to offer improved resolution in the frequency range of interest. With the built-in fractional-octave analysis, you can perform measurements with any number of bands at any sampling frequency. NI 446x dynamic signal acquisition devices, combined with this toolkit, offer compliance with several standards for sound level measurements and octave analysis:

- IEC 61260 : 1995, class 1
- IEC 61672 : 2002, class 1
- ANSI S1.11 – 2004, class 1
- ANSI S1.4 – 1983
- ANSI S1.42 – 1986

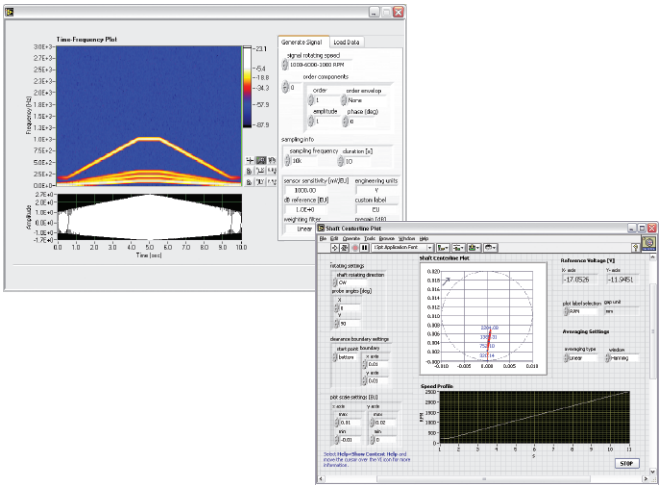
LabVIEW Order Analysis Toolkit

Order analysis is a tool for examining dynamic signals generated by mechanical systems that include rotating or reciprocating components. With order analysis you can dissect sound, vibration, and other dynamic signals into components that relate to physical elements of mechanical systems.

The LabVIEW Order Analysis Toolkit is ideal for machine monitoring, machine health, and machine efficiency applications. You can use the toolkit to perform the most common analyses required by MCM applications, including order tracking, slow-roll compensation, and vibration integration. With this toolkit, you can develop your application faster by using built-in examples for order spectra, tachometer processing, and waterfall plots.

You can also apply order analysis to dynamic signals generated by mechanical systems that include rotating or reciprocating components, such as turbines, compressors, pumps, and engines. It is common to use order analysis in applications such as machine condition monitoring and noise, vibration, and harshness (NVH) testing. With the added capability for online processing, you can easily create flexible applications for condition-based monitoring and predictive maintenance.

The National Instruments 446x dynamic signal acquisition devices are ideal for acquiring sound and vibration signals to analyze with this toolkit.



Ordering Information

PCI

NI PCI-4461	779307-01
NI PCI-4461 with Sound and Vibration Toolkit	779308-01
NI PCI-4462	779309-01
NI PCI-4462 with Sound and Vibration Toolkit	779310-01

PXI

NI PXI-4461	778442-01
NI PXI-4461 with Sound and Vibration Toolkit	779039-01
NI PXI-4462	779131-01
NI PXI-4462 with Sound and Vibration Toolkit	779132-01

Includes NI-DAQmx driver software.

BUY NOW!

For complete product specifications, pricing, and accessory information, call (800) 813 3693 (U.S.) or go to **ni.com/soundandvibration**.

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Specifications

Typical for 25 °C unless otherwise noted.

Analog Input

Number of simultaneously sampled input channels
- NI 4461 2
- NI 4462 4

Input configuration ..... Differential or pseudodifferential (50 Ω between negative input and chassis ground), each channel independently software-selectable

Input coupling ..... AC or DC, each channel independently software-selectable

A/D converter (ADC) resolution ..... 24 bits

ADC type ..... Delta-sigma

Sample rates (f_s), samples per second (S/s) ..... 1 kS/s to 204.8 kS/s in 181.9 µS/s increments, maximum

Input Signal Ranges

Gain	
Log (dB)	**Full-Scale Range (Peak)**
-20	±42.4 V
-10	±31.6 V
0	±10.0 V
+10	±3.16 V
+20	±1.00 V
+30	±0.316 V

Amplifier Characteristics

Input Impedance	Differential Configuration	Pseudodifferential Configuration
Between positive input and chassis ground	1 MΩ ll 217 pF	1 MΩ ll 217 pF
Between negative input and chassis ground	1 MΩ ll 229 pF	50 Ω

Input coupling ..... AC or DC, software-selectable

Common-mode rejection ratio (CMRR) ..... 80 dB with 0 dB gain; up to 105 dB for higher gain

Dynamic Characteristics

Specification	Low-Frequency Alias Rejection Disabled
Alias-free bandwidth (BW), (passband)	DC to 0.4535 f_s
Alias rejection, minimum	120 dBc

AC coupling
- -3 dB cutoff frequency ..... 3.4 Hz
- -0.1 dB cutoff frequency ..... 22.6 Hz

AI flatness ..... ±0.08 dB, gain ≥0 dB, 20 Hz to 92.2 kHz

AI dynamic range ..... 118 dBFS, 0 dB gain, 51.2 kS/s

THD, balanced source ..... -107 dBc up to 20 kHz, -104 dBc up to 92.2 kHz

Crosstalk (channel separation) ..... -138 dB at 1 kHz

AI interchannel gain mismatch ..... 0.003 dB up to 92.2 kHz

Integrated Electronic Piezoelectric (IEPE)
- Current ..... 0, 4, or 10 mA, each channel independently software-selectable
- Compliance ..... 24 V min

Channel input impedance with IEPE enabled ..... 1 MΩ ll 240 pF, pseudodifferential

Current noise ..... <300 pA/$\sqrt{\text{Hz}}$

Transducer Electronic Data Sheet (TEDS) Compatibility

The PCI-4461, PCI-4462, and PXI-4462 inputs work with transducer electronic data sheet (TEDS) sensors according to the IEEE 1451 Standard. For more information about TEDS, go to **ni.com/info** and enter **rdteds**.

Analog Output (NI 4461)

Output Characteristics

Number of output channels ..... 2, simultaneously sampled

Output configuration ..... Differential or pseudodifferential (50 Ω to chassis ground on shield), each channel independently software-selectable

DAC resolution ..... 24 bits

DAC type ..... Delta-sigma

Update rates (f_s) ..... 1 kS/s to 204.8 kS/s in 181.9 µS/s increments, maximum

Attenuation (dB)	Full-Scale Range (V_{pk})[1]
40	±0.1
20	±1.0
0	±10.0

[1]Each output channel range is independently software-selectable.

Output Signal Range

Voltage Output

Short circuit protection ..... Indefinite protection between positive and negative

Minimum working load ..... 600 Ω

Dynamic Characteristics

Image rejection ..... 75 dB min < 768 kHz, 66 dB min > 768 kHz

AO Flatness
- 20 Hz to 20 kHz ..... ±0.008 dB max
- 20 Hz to 92.1 kHz ..... ±0.1 dB max

AO dynamic range ..... 113 dBFS, 0 dB attenuation, 102.5 kS/s (30 kHz bandwidth)

AO THD ..... -97 dBc up to 20 kHz

AO interchannel gain mismatch ..... 0.03 dB, 20 Hz to 92.1 kHz

Internal Frequency Timebase Characteristics

Accuracy ..... ±20 ppm, over operating temperature range

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Triggers

Analog Trigger

Source	AI0, AI1
Level	±full-scale
Slope	Positive or negative (software-selectable)
Resolution	24 bits
Hysteresis	Programmable

Digital Trigger

Compatibility	5 V TTL
Polarity	Rising or falling edge
Pulse width	10 ns minimum
Source	SMB (PFI0), PXI trigger bus, RTSI bus

Certifications and Compliances

CE Mark Compliance CE

For a complete listing of all NI 446x specifications, please visit **ni.com/soundandvibration**.

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Hardware Services

NI Factory Installation Services

NI Factory Installation Services (FIS) is the fastest and easiest way to use your PXI or PXI/SCXI combination systems right out of the box. Trained NI technicians install the software and hardware and configure the system to your specifications. NI extends the standard warranty by one year on hardware components (controllers, chassis, modules) purchased with FIS. To use FIS, simply configure your system online with **ni.com/pxiadvisor**.

Calibration Services

NI recognizes the need to maintain properly calibrated devices for high-accuracy measurements. We provide manual calibration procedures, services to recalibrate your products, and automated calibration software specifically designed for use by metrology laboratories. Visit **ni.com/calibration**.

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351332A-01 2006-6904-301-101-D

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