ARTISAN®
TECHNOLOGY GROUP

Your **definitive** source for quality pre-owned equipment.

Artisan Technology Group
(217) 352-9330 | sales@artisantg.com | artisantg.com

Full-service, independent repair center
with experienced engineers and technicians on staff.

We buy your excess, underutilized, and idle equipment
along with credit for buybacks and trade-ins.

Custom engineering
so your equipment works exactly as you specify.

- Critical and expedited services
- In stock / Ready-to-ship
- Leasing / Rentals / Demos
- ITAR-certified secure asset solutions

Expert team | Trust guarantee | 100% satisfaction

All trademarks, brand names, and brands appearing herein are the property of their respective owners.

Find the *National Instruments PCI-4451* at our website: *Click HERE*

Dynamic Signal Acquisition and Generation

NI PCI-4451, NI PCI-4452

- 2 or 4 analog inputs
- 90 dB dynamic range, 16-bit resolution
- 5.0 to 204.8 kS/s sampling rates
- Overload detection
- AC/DC coupling
- Multiple-board synchronization
- 2 analog outputs (PCI-4451 only)
- 8 5V TTL/CMOS digital lines

Operating Systems
- Windows 2000/NT/XP/Me/9x
- Mac OS 9

Recommended Software
- LabVIEW
- LabVIEW Sound and Vibration Analysis Toolset
- LabVIEW Order Analysis Toolset
- Signal Processing Toolset
- LabWindows/CVI
- Measurement Studio for Visual Basic

Other Compatible Software
- Visual Basic
- C/C++

Driver Software (included)
- NI-DAQ

Calibration Certificate Included



Overview

The National Instruments PCI-4451 and PCI-4552 are specifically designed for sound and vibration applications. These boards include the hardware and software needed to make precision measurements of the signals associated with accelerometers, microphones, and other transducers that have very large dynamic range. These signals are common in applications such as automotive NVH analysis, machine condition monitoring, and audio test systems.

The NI PCI-445x boards offer a complete range of functionality for sound and vibration monitoring and analysis applications. The PCI-4451 has two inputs and two outputs and is ideal for applications where simultaneous generation and acquisition of noise, vibration and acoustic signals is required. The four-input PCI-4452 is ideal for applications that involve high input channel counts. The acquisition clocks of the PCI-445x boards can be synchronized with other instruments in your computer using the RTSI bus. Both analog and digital triggering are available on the PCI-4451 and the PCI-4452.

INFO CODES

For more information, or to order products online visit *ni.com/info* and enter:

ni4451
ni4452

BUY ONLINE!

Hardware

Analog Inputs

The analog inputs of the PCI-445x boards have 16-bit resolution ADCs that are simultaneously sampled at software-programmable rates. The hardware can digitize standard digital audio frequencies such as 44.1 kS/s (the standard rate used in CD players), 32.0 kS/s, and 48.0 kS/s (the rate used in digital audio tape (DAT) recorders and other digital audio equipment. These boards are well suited for audio, sound, and vibration analysis applications.

The analog inputs have AC/DC coupling. A programmable gain amplifier stage on the inputs gives programmatic gain select from -20 to +60 dB in 10 dB steps. Furthermore, to provide you with the quietest and highest quality analog measurements, the input stage has been designed to accept differential or single-ended signal connections.

The 90 dB dynamic range of PCI-445x boards contributes to low noise and distortion effects and makes possible high-accuracy measurements. The boards have excellent amplitude flatness of ±0.1 dB within the frequency range DC to 95 kHz, and have a maximum THD specification of -90 dB at 1 kHz and a worst-case THD of -80 dB at higher frequencies.

Antialiasing

The analog inputs have both analog and digital filters implemented in hardware to prevent aliasing. Input signals are first passed through fixed analog filters to remove any signals with frequency

Product	Analog Inputs	Input Resolution	Sampling Rate	Input Range	Analog Outputs	Input Configuration	Output Resolution	Update Rate	Output Range	Digital I/O	Triggering
PCI-4551	2	16 bits	204.8 kS/s	±10 mV to ±42.4 V	2	Differential/single ended	16 bits	51.2 kS/s	±10 0 mV to ±10 V	8	Analog/Digital
PCI-4552	4	16 bits	204.8 kS/s	±10 mV to ±42.4 V	–	Differential/single ended	–	–	–	8	Analog/Digital

Table 1. PCI-445x Channel, Speed, and Resolution Specifications

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Dynamic Signal Acquisition and Generation

Applications
Noise and vibration diagnostics
Audio test and measurement
Machine condition monitoring
Sound power
Telecommunications testing
Structural vibration
Pass-by noise

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

The PCI-4451 has two channels of 16-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 from 1.25 to 51.2 kS/s in increments of 47.684 µS/s. The analog output circuitry uses eight-times oversampling interpolators with 64-times oversampling delta-sigma modulators to generate high-quality signals. Software-programmable attenuation of 0, -20, or -40 dB is available on the output channels. The PCI-4451 has excellent amplitude flatness of ±0.2 dB within DC to 23 kHz, and a THD of -90 dB at 1 kHz. You can simultaneously acquire data on the input channels while updating the output channels

Anti-Imaging

The PCI-4451 output channels have both analog and digital anti-imaging filters. These filters remove the unwanted high-frequency signals generated when an analog signal is generated 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.

Multiboard Synchronization

For applications requiring more than four channels, the operation of two or more PCI-445x boards can be synchronized. Using the RTSI bus, you can send and receive timing signals between PCI-445x boards or between a PCI-445x board and DAQ vision and motion boards. Synchronization is achieved by sharing a digital trigger and the clock from one board to another.

Triggering

The PCI-445x boards have several trigger modes for acquiring signals. Pretrigger mode digitizes signals before and after a trigger condition occurs. Posttrigger mode digitizes signals after a trigger condition occurs. Delay trigger mode begins the signal capture after a programmable delay from the trigger. The source of the trigger can come from any analog input channel, the external digital trigger input, the RTSI bus, or the software. The external digital trigger is 5V 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, transient vibrations are measured with accelerometers whose acquisition is triggered by the hammer impact.

Calibration

The offset voltage and gain accuracy of the analog inputs and outputs are calibrated by National Instruments. An onboard precision voltage reference ensures that the input gain is stable and accurate. The boards are shipped with NIST-traceable and ISO-9002-certified calibration certificates.

Software

The PCI-445x boards use the NI-DAQ driver as the hardware and operating system interface. You can build automated test systems or integrate the PCI-4451 and PCI-4452 boards with other hardware, including computer-based instruments and multifunction DAQ products, through NI-DAQ function calls for LabVIEW, LabWindows/CVI, and Measurement Studio for Visual Basic.

The PCI-445x boards are well suited for applications in audio, sound, and vibration analysis. These applications are specifically addressed in the Sound and Vibration Toolset and the Order Analysis Toolset for LabVIEW. Using these toolsets in conjunction with a PCI-445x board, you can obtain power spectra, frequency responses, fractional-octave analysis, sound level measurements, transient analysis, and sensor calibrations. A typical setup for noise measurement applications would include the PCI-4451 and accessories, LabVIEW, and the Sound and Vibration Toolset.

Ordering Information

PCI-4451 777534-01
PCI-4452.....778317-01
Includes PCI-445x board, NI-DAQ, and calibration certificate.

For information on extended warranty and value added services, see page 20.

Example Configurations

See page 422 for accessory and cable options.

Device	Accessory	Cable
PCI-4451	BNC-2140 (777597-01) SCB-68 (776844-01)	Analog: SHC68-C68-A1 (184747-01) Digital: SHC50-68 (184748-01)
PCI-4452	BNC-2140 (777597-01) SCB-68 (776844-01)	Analog: SHC68-C68-A1 (184747-01) Digital: SCH50-68 (184748-01)

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Dynamic Signal Acquisition and Generation

Specifications

Analog Input

Channel Characteristics

Product	Number of Channels	Input Configuration
PCI-4451	2	Simultaneously sampled balanced differential
PCI-4452	4	

Resolution ..... 16 bits
Type of ADC ..... Delta-sigma, 128-times oversampling

Sampling Rates ..... 5 to 204.8 kS/s in increments of 190.735 µS/s
Frequency accuracy ..... ±25 ppm

Input Signal Ranges (software-selectable)

Gain		Full-Scale Range (Peak)
Linear	Log (dB)	
0.1	-20	±42.4 V
0.316	-10	±31.6 V
1	0	±10 V
3.16	+10	±3.16 V
10	+20	±1.00 V
31.6	+30	±0.316 V
100	+40	±0.100 V
316	+50	±0.0316 V
1000	+60	±0.0100 V

FIFO buffer size ..... 512 samples
Data transfers ..... DMA

Transfer Characteristics

INL relative accuracy ..... ±2 LSB
DNL ..... ±0.5 LSB typical, ±1 LSB maximum, no missing codes

Offset (residual DC)

Gain	Max Offset
-20 dB	±30 mV
-10 dB	±10 mV
0 dB	±3 mV
+10 dB	±1 mV
+20 dB	±300 µV
+30, +40, +50, +60 dB	±100 µV

Gain (amplitude accuracy) ..... ±0.1 dB, f_{in} = 1 kHz

Amplifier Characteristics

Input Impedance ..... 1 MΩ in parallel with 50 pF (+ and - each to AIGND)

Flatness (relative to 1 kHz)

Gain	Flatness
0, +10, +20, +30, +40 dB	±0.1 dB, 0 to 95 kHz, 204.8 kS/s, DC coupling
-20, -10, +50, +60 dB	±1 dB, 0 to 95 kHz, ±0.1 dB, 0 to 20 kHz, 204.8 kS/s, DC coupling

-3 dB bandwidth ..... 0.493 f_s
Input coupling ..... AC or DC, software selectable
AC -3 dB cutoff frequency ..... 3.4 Hz

Common-Mode Range

Gain	Range
≥ 0 dB	Both + and - should remain within ±12 V of AIGND
< 0 dB	Both + and – should remain within ±42.4 V of AIGND

Overvoltage protection ..... ±42.4 V, powered on or off
Inputs protected ACH0, ACH1, ACH2, ACH3

Common-Mode Rejection Ratio (f_{in} < 1 kHz)

Gain	CMRR
≥0 dB	90 dB
<0 dB	60 dB

Input noise spectral density ..... 8 nV/ $\sqrt{Hz}$ (achievable only at Gain = +50 or +60 dB
Idle channel noise ..... -90 dBFS

Dynamic Characteristics

Alias-free bandwidth ..... DC to 0.464 f_s
Alias rejection ..... 80 dB, 0.536 f_s < f_{in} < 63.464 f_s
Spurious-free dynamic range ..... 90 dB
THD ..... -80 dB; -90 dB for f_{in} < 20 kHz or signal < 1 V_{rms}
IMD ..... -100 dB (CCIF 14 kHz + 15 kHz)
Crosstalk (channel separation) ..... -100 dB, DC to 100 kHz

Phase Linearity and Interchannel Phase

Gain	Phase Linearity
≥0 dB	±1 deg
<0 dB	±2 deg

Interchannel gain mismatch ..... ±0.1 dB, for any gain (same configuration for all input channels)
Signal delay ..... 42 sample periods, any sample rate (time from when signal enters analog input to when digital data is available)

Onboard Calibration Reference

DC level ..... 5.000 V ±2.5 mV
Temperature coefficient ..... ±5 ppm/°C maximum
Long-term stability ..... ±15 ppm/$\sqrt{1{,}000}$ h

Analog Output (PCI-4451 only)

Channel Characteristics

Number of channels ..... 2 simultaneously updated
Output configuration ..... Balanced differential
Resolution ..... 16 bits
Type of DAC ..... Delta-sigma, 64-times oversampling
Sample rates ..... 1.25 to 51.2 kS/s in increments of 47.684 µS/s
Frequency accuracy ..... ±25 ppm

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Dynamic Signal Acquisition and Generation

Specifications (continued)

Output Signal Ranges (software selectable)

Gain		Full-Scale Range
Linear	Log (dB)	(Peak)
1	0 dB	±10.0 V
10	20 dB	±1.00 V
100	40 dB	±0.100 V

FIFO buffer size ..... 512 samples
Data transfers ..... DMA

Transfer Characteristics

Offset (residual DC) ..... ±5 mV maximum, any gain
Gain (amplitude accuracy) ..... ±0.1 dB, f_{out} = 1 kHz

Voltage Output Characteristics

Output impedance ..... 22 Ω between + and - of DACxOUT, 4.55 kΩ to AOGND
Flatness (relative to 1 kHz) ..... ±0.2 dB, 0 to 23 kHz, 51.2 kS/s
-3 dB bandwidth ..... 0.492 f_s
Output coupling ..... DC

Short-circuit protection ..... Yes (+ and – may be shorted together indefinitely)
Outputs protected ..... ±DAC0OUT, ±DAC1OUT
Idle channel noise ..... -91 dBFS , DC to 23 kHz measurement bandwidth

Dynamic Characteristics

Image-free bandwidth ..... DC to 0.450 f_s
Image rejection ..... 90 dB, 0.550 f_s < f_{out} < 63.450 f_s
Spurious-free dynamic range ..... 90 dB, DC to 100 kHz measurement bandwidth

THD ..... -80 dB; -90 dB for f_{out} < 5 kHz or signal < 1 V_{rms}
IMD ..... -90 dB (CCIF 14 kHz + 15 kHz)
Crosstalk (channel separation) ..... -80 dB, DC to 23 kHz measurement bandwidth
Phase linearity ..... ±1 degree
Interchannel phase ..... ±1 degree (same configuration both output channels)
Interchannel gain mismatch ..... ±0.1 dB (same configuration both output channels)
Signal delay ..... 34.6 ±0.5 sample periods, any sample rate (time from when digital data is expressed to when analog signal appears at output terminals)

Digital I/O

Number of channels ..... 8 input/output
Compatibility ..... 5 V TTL/CMOS
Digital logic levels
  Power-on state ..... Input (high-impedance)
  Data transfers ..... Programmed I/O

Timing I/O

Number of channels ..... 2 up/down counter/timers, 1 frequency scaler

Triggers

Analog Trigger

Source
  PCI-4451 ..... ACH<0..1>
  PCI-4452 ..... ACH<0..3>
Level ..... ± Full-scale
Slope ..... Positive or negative (software selectable)
Resolution ..... 16 bits
Hysteresis ..... Programmable
Digital Trigger
Compatibility ..... 5 V TTL/CMOS
Response ..... Rising or falling edge
Pulse width ..... 10 ns minimum

Bus Interface

Type ..... PCI master/slave

Power Requirements

	+ 5 VDC	+12 VDC	-12 VDC
PCI-4451	1.7 A, idle 2.0 A, active	100 mA typical*	40 mA typical
PCI-4452	2.2 A, idle 2.5 A, active	150 mA typical*	–

Available power (analog I/O connector) ..... 4.65 to 5.25 VDC at 1.0 A
Available power (digital I/O connector) ..... 4.65 to 5.25 VDC at 1.0 A

Physical

Dimensions (not including connectors) ..... 10.65 by 31.19 by 1.84 cm (4.19 by 12.28 by 0.73 in.)
Analog I/O connector ..... 68-pin VHDCI female type
Digital I/O connector ..... 50-pin VHDCI female type

Environment

Operating temperature ..... 0 to 40 °C
Storage temperature range ..... -25 to 85 °C
Relative humidity ..... 10 to 95%, no condensation

Calibration

Calibration interval ..... 1 year

Certifications and Compliances CE

Calibration interval ..... 1 year

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Artisan Technology Group is an independent supplier of quality pre-owned equipment

Gold-standard solutions

Extend the life of your critical industrial, commercial, and military systems with our superior service and support.

We buy equipment

Planning to upgrade your current equipment? Have surplus equipment taking up shelf space? We'll give it a new home.

Learn more!

Visit us at **artisantg.com** for more info on price quotes, drivers, technical specifications, manuals, and documentation.

Artisan Scientific Corporation dba Artisan Technology Group is not an affiliate, representative, or authorized distributor for any manufacturer listed herein.

We're here to make your life easier. How can we help you today?

(217) 352-9330 | sales@artisantg.com | artisantg.com

ARTISAN® TECHNOLOGY GROUP