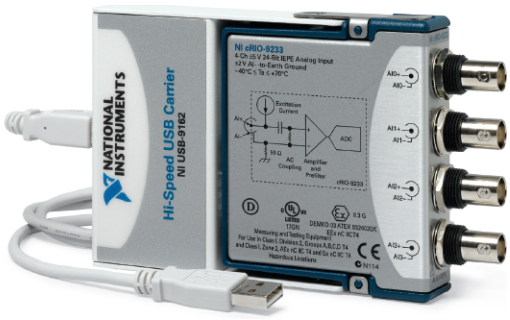
USB Dynamic Signal Acquisition

NI USB-9233

- 24-bit resolution
- 102 dB dynamic range
- 50 kS/s max rate per channel
- 4 simultaneous analog inputs
- ±5 V input range
- AC coupled with IEPE power
- Hi-Speed USB 2.0

Recommended Software

- LabVIEW
- LabVIEW Sound and Vibration Toolkit
- LabVIEW Order Analysis Toolkit
- LabWindows/CVI
- Measurement Studio
- DAQmx



Overview

The National Instruments USB-9233 is a four-channel dynamic signal acquisition module for making high-accuracy measurements from IEPE sensors. The NI USB-9233 delivers 102 dB of dynamic range and incorporates IEPE signal conditioning for accelerometers and microphones. The four USB-9233 input channels simultaneously acquire at rates from 2 to 50 kHz. In addition, the module includes built-in antialiasing filters that automatically adjust to your sampling rate.

Hardware

Data rates on the four simultaneous input channels of the USB-9233 range from 2 to 50 kHz. Each signal is AC coupled, buffered, analog prefiltered, and sampled by a 24-bit delta-sigma analog-to-digital converter (ADC) that performs digital filtering with a cutoff frequency that automatically adjusts to your data rate. The USB-9233 module features a voltage range of ±5 V and a dynamic range of over 100 dB. Communication to the USB-9233 is Hi-Speed USB 2.0, guaranteeing data throughput.

The USB-9233 is a nonisolated module that provides ±30 V of overvoltage protection (with respect to chassis ground) for IEPE sensor connections. IEPE excitation and AC coupling are not software-selectable and are always enabled.

The USB-9233 uses a method of A/D conversion known as delta-sigma modulation. If the data rate is 25 kS/s, each ADC actually samples its input signal at 3.2 MS/s (128 times the data rate) and produces samples that are applied to a digital filter. This filter then expands the data to 24 bits, rejects signal components greater than 12.5 kHz (the Nyquist frequency), and then digitally resamples the data at the chosen data rate of 25 kS/s. This combination of analog and digital filtering provides an accurate representation of desirable signals while rejecting out-of-band signals. The built-in filters automatically adjust themselves to discriminate between signals based on the frequency range, or bandwidth, of the signal.

Software

The USB-9233 uses NI-DAQmx as the hardware and OS interface, so you can build automated test systems or integrate the USB-9233 with other hardware, including National Instruments multifunction DAQ products and CAN devices, through NI-DAQmx function calls for NI LabVIEW, LabWindows/CVI, and Measurement Studio.

Other useful NI-DAQ driver software features include:

- Automatic Code Generation – DAQ Assistant is an interactive guide that steps you through configuring, testing, and programming measurement tasks and automatically generates the necessary code for LabVIEW, LabWindows/CVI, or Measurement Studio.
- Test Panels – With NI-DAQ, you can test all of your device functionality before you begin application development.
- LabVIEW Integration – All NI-DAQ functions use the waveform data type, which carries acquired data and timing information directly into more than 400 LabVIEW built-in analysis routines for display of results in engineering units on a graph.

Analysis Software

Because of its bandwidth, the USB-9233 is well-suited for applications in noise and vibration analysis. These applications are specifically addressed in the LabVIEW Sound and Vibration and LabVIEW Order Analysis toolkits. By using these toolkits in conjunction with a USB-9233 module, you can produce power spectra, frequency responses, fractional-octave analysis, sound-level measurements, order spectra, order maps, order extraction, and sensor calibration. The USB-9233 is ideal for a wide variety of mobile/portable applications such as industrial machine condition monitoring and in-vehicle noise, vibration, and harshness testing

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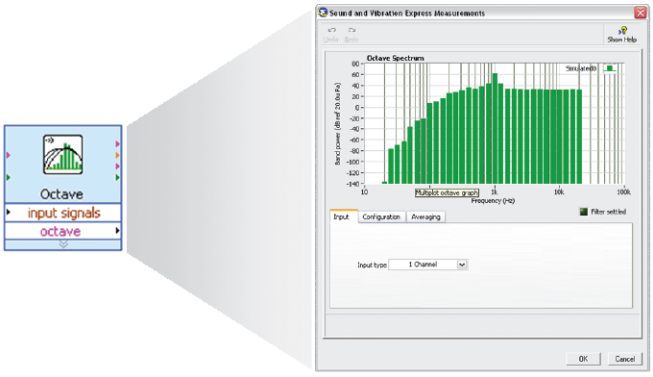
Analysis Capabilities.

- Power spectra
- Zoom FFTs
- Fractional-octave analysis
- Vibration level measurements
- Order spectra
- Order spectra
- Transient analysis

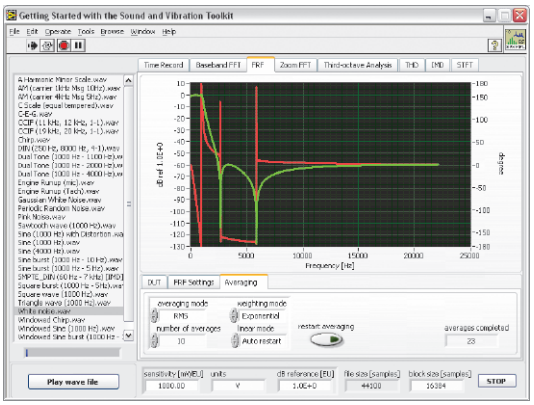
LabVIEW Sound and Vibration Toolkit

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 A-, B-, and C-Weighting
- Vibration Level with Single and Double Integration
- Sound Level with A-, B-, and C-Weighting
- Power Spectrum
- Zoom Power Spectrum
- Peak Search
- Power in Band
- Frequency Response
- Limit Testing
- Filtering

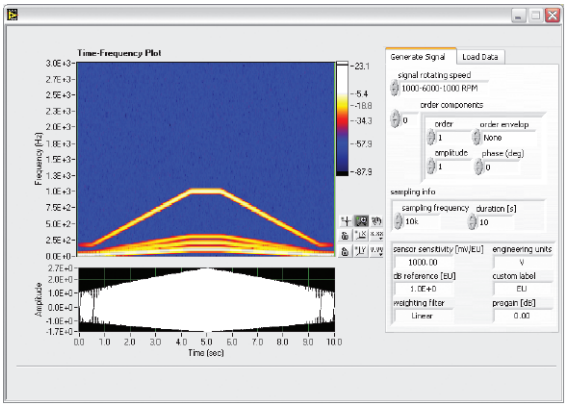


In addition, the LabVIEW Sound and Vibration Toolkit includes functionality for audio measurements, such as distortion, gain linearity, and crosstalk, with over 50 ready to run examples.



LabVIEW Order Analysis Toolkit

With the LabVIEW Order Analysis Toolkit, you can build custom applications with order analysis capabilities such as order tracking, order extraction, and tachometer signal processing. The toolkit has both Gabor Order Tracking, a patented algorithm based on the concept of joint time-frequency analysis (JTFA), and resampling techniques for online processing capability. Order analysis is a tool for examining dynamic signals generated by mechanical systems that include rotating or reciprocating components that works even when the signal source undergoes rotational speed variations or frequency/Doppler shifts.



Additional Dynamic Signal Acquisition Devices

There are numerous system requirements to consider when selecting data acquisition hardware for measuring or generating sound and vibration signals. From IEPE signal conditioning for accelerometers and microphones to high dynamic range (up to 118 dB) and multichannel synchronization (up to 5000 channels), National Instruments offers a range of hardware products for your application.

Product	Bus	Input Resolution (bits)	Dynamic Range (dB)	Sampling Rate per Channel	Analog Inputs	Input Range	Gain Settings	TEDS Support	Analog Outputs
High Performance									
NI 4461	PXI, PCI	24	118	204.8 kS/s	2	± 42V to 316 mV	-20 to 30 dB in 10 dB increments	Yes	2
NI 4462	PXI, PCI	24	118	204.8 kS/s	4	± 42V to 316 mV	-20 to 30 dB in 10 dB increments	Yes	0
High Density									
NI 4472	PXI, PCI	24	110	102.4 kS/s	8	± 10V	N/A	No	0

Ordering Information

NI USB-9233 779365-01

NI USB-9233 with Sound and Vibration Toolkit 779366-01

BUY NOW!

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

Specifications

The following specifications are typical for the range 0 to 60 °C unless otherwise noted.

Input Characteristics

Number of channels ..... 4 analog input channels
ADC resolution ..... 24 bits
Type of ADC ..... Delta-sigma (with analog prefiltering)

Data rate (fs)
- Minimum ..... 2 kS/s
- Maximum ..... 50 kS/s

Master timebase (internal)
- Frequency ..... 12.8 MHz
- Accuracy ..... ±100 ppm max

Input coupling ..... AC
AC cutoff frequency
- -3 dB ..... 0.5 Hz typ
- -0.1 dB ..... 4.2 Hz max

AC voltage full-scale range
- Typical ..... 5.4 V_{peak}
- Minimum ..... 5 V_{peak}
- Maximum ..... 5.8 V_{peak}

Common-mode voltage
- (AI- to earth ground) ..... ±2 V

IEPE excitation current
- Minimum ..... 2.0 mA
- Typical ..... 2.2 mA

IEPE compliance voltage ..... 19 V max

Overvoltage protection (with respect to chassis ground)
- For an IEPE sensor connected to AI+ and AI- ..... ±30 V
- For a low-impedance source connected to AI+ and AI- ..... -6 to 30 V

Input delay (in seconds)
- ≤ 25 kS/s ..... 12.8 / fs
- > 25 kS/s ..... 9.8 / fs

Accuracy (0 to 60 °C)

Error	Accuracy
Calibrated max	±0.3 dB
Calibrated typ	±0.1 dB
Uncalibrated max	±0.6 dB

Accuracy drift
- Typical ..... 0.001 dB/°C
- Maximum ..... 0.0045 dB/°C

Channel-to-channel matching
- Gain
  - Maximum ..... 0.27 dB
  - Typical ..... 0.07 dB
- Phase (*fin* in kHz) ..... *fin* · 0.077° + 0.067°

Dynamic characteristics

fs	Passband Freq	Passband Flatness (pk-to-pk max)	Passband Freq	Passband Phase Nonlinearity
≤25 kS/s	0.45 · *fs*	0.05 dB	0.45 · *fs*	±3.4°
>25 kS/s	0.42 · *fs*	0.05 dB	0.41 · *fs*	±1.3°

fs	Stopband Freq	Stopband Attenuation	Oversample Rate	Alias-Free Bandwidth
≤25 kS/s	0.58 · *fs*	95 dB	128 · *fs*	0.42 · *fs*
>25 kS/s	0.68 · *fs*	92 dB	64 · *fs*	0.32 · *fs*

Crosstalk
- Paired channels (0 and 1, 2 and 3) ..... -100 dB at 1 kHz
- Nonpaired channels ..... -110 dB at 1 kHz

Common-mode rejection ratio (CMRR)
- Minimum ..... 54 dB, *fin* ≤ 1 kHz
- Typical ..... 80 dB, *fin* ≤ 1 kHz
- Spurious-free dynamic range (SFDR) ..... 120 dB (*fin* = 1 kHz, -60 dB FS)

Idle channel noise and noise density

Idle Channel	50 kS/s	25 kS/s	2 kS/s
Noise	95 dB FS	98 dB FS	102 dB FS
Noise density	400 nV/√Hz	400 nV/√Hz	900 nV/√Hz

Input impedance
- Differential (AC) ..... >300 kΩ
- AI– (shield) to chassis ground ..... 50 Ω

Distortion
- Harmonic (THD)

	1 kHz, -40 to 70 °C	10 kHz, 25 to 70 °C	10 kHz, -40 to 25 °C
-1 dB FS	-90 dB	-80 dB	
-20 dB FS	-95 dB	-90 dB	-80 dB

- Intermodulation (full-scale input)
  - DIN 250 Hz/8 kHz 4:1 amplitude ratio ..... -80 dB
  - CCIF 11 kHz/12 kHz 1:1 amplitude ratio ..... -93 dB

NI Services and Support



NI has the services and support to meet your needs around the globe and through the application life cycle – from planning and development through deployment and ongoing maintenance. We offer services and service levels to meet customer requirements in research, design, validation, and manufacturing. Visit **ni.com/services**.

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We also offer service programs that provide automatic upgrades to your application development environment and higher levels of technical support. Visit **ni.com/ssp**.

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**.

Repair and Extended Warranty

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