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Find the *National Instruments USB-4431* at our website: ***Click HERE***

Sound and Vibration Data Acquisition

NI USB-4431 *NEW!*

- One 24-bit analog output
- Four 24-bit simultaneous analog inputs
- ±3.5 V output range
- ±10 V input range
- 100 dB dynamic range
- Antialiasing filters
- TEDS read/write
- Software-selectable AC/DC coupling (0.1 Hz HPF)

Recommended Software

- Sound and Vibration Measurement Suite
- Sound and Vibration Toolkit
- LabVIEW

Analysis Capabilities

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



>> For complete specifications, see the *NI USB-443x Specifications* manual at **ni.com/manuals**.

Overview

The NI USB-4431 is a five-channel dynamic signal acquisition module for making high-accuracy measurements from IEPE sensors. The USB-4431 delivers 100 dB of dynamic range and incorporates software-selectable IEPE (2.1 mA constant current) signal conditioning for accelerometers and microphones. The module consists of four analog input channels for reading from IEPE sensors with a single analog output. The four analog input channels simultaneously acquire at rates from 2 to 102.4 kS/s. In addition, each channel includes built-in antialiasing filters that automatically adjust to your sampling rate. The USB-4431 is ideal for a wide variety of portable test applications such as frequency response audio tests or suspension shaker tests.

Hardware

Each simultaneous signal is 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-4431 features a voltage range of ±10 V and a dynamic range of 100 dB. In addition, the module can read and write to transducer electronic data sheet (TEDS) Class 1 smart sensors. The USB-4431 has ±60 V of overvoltage protection and three software-selectable modes of measurement operation: IEPE-on with AC coupling, IEPE-off with AC coupling, and IEPE-off with DC coupling.

The module uses a method of analog-to-digital conversion known as delta-sigma modulation. If, for example, the data rate is 25 kS/s, then 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 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 antialiasing filters automatically adjust themselves to discriminate between signals based on the frequency range, or bandwidth, of the signal.

The USB-4431 offers analog output using a delta-sigma modulation digital-to-analog converter (DAC). The overclocking and filtering is done in the digital domain. The now-filtered signal is then output using a DAC. The DAC in the USB-4431 combines high image rejection performance with good flatness in the passband. The analog output also has the flexibility to generate a variety of signals from a DC voltage, to 43.5 kHz sine waves, to arbitrary waveforms.

Analysis Software

The USB-4431 is well-suited for noise and vibration analysis applications. The NI Sound and Vibration Measurement Suite, which specifically addresses these applications, has two components: the NI Sound and Vibration Assistant and LabVIEW analysis VIs (functions) for power spectra, frequency response (FRF), fractional octave analysis, sound-level measurements, order spectra, order maps, order extraction, sensor calibration, human vibration filters, torsional vibration, and sound quality.

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NI Sound and Vibration Assistant

The Sound and Vibration Assistant is interactive software designed to simplify the process of acquiring and analyzing noise and vibration signals by offering:

- A drag-and-drop, interactive analysis and acquisition environment
- Rapid measurement configuration
- Extended functionality through LabVIEW

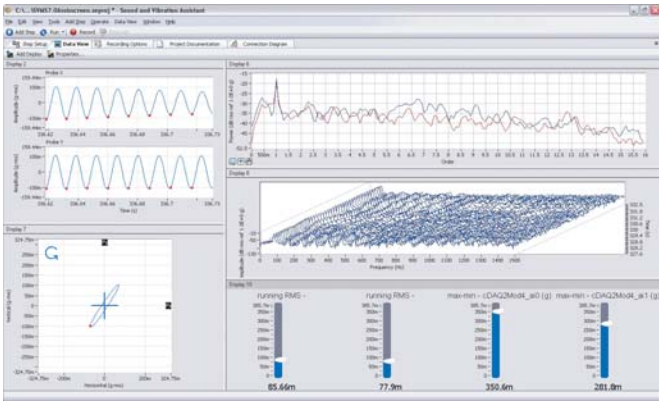


Figure 1. Characterize vibration orders and orbit position with drag-and-drop analysis blocks.

Interactive Analysis Environment

The Sound and Vibration Assistant introduces an innovative approach to configuring your measurements using intuitive drag-and-drop steps. Combining the functionality of traditional noise and vibration analysis software with the flexibility to customize and automate routines, the Sound and Vibration Assistant can help you streamline your application.

Rapid Measurement Configuration

You can immediately use the many built-in steps in the Sound and Vibration Assistant. Instantly configure a measurement and analysis application with:

- Hardware I/O – generation and acquisition of signals from a variety of devices, including data acquisition devices and modular instruments
- Signal processing – filtering, windowing, and averaging
- Time-domain analysis – sound- and vibration-level measurements
- ANSI and IEC fractional-octave analysis
- Frequency-domain analysis – power spectrum, frequency response, power-in-band, peak search, and distortion
- Order analysis – tachometer processing, order power spectrum, order tracking, and order extraction
- ***NEW!*** Bode and polar, orbit and timebase, and shaft centerline plot steps
- ***NEW!*** Sound quality – sharpness, loudness, and roughness measurements
- Report generation – ability to drag and drop signals to Microsoft Excel or export data to Microsoft Word or UFF58 files

Extended Functionality through LabVIEW

Reuse your measurement applications developed with the Sound and Vibration Assistant in LabVIEW by converting projects into LabVIEW block diagrams. With the LabVIEW full-featured graphical programming environment, you can further automate your application or customize your analysis.

Sound and Vibration Analysis VIs for LabVIEW

With the sound and vibration analysis VIs in LabVIEW, you can develop a variety of custom audio, acoustic, and vibration applications. Functionality includes:

- Full, 1/3, 1/6, 1/12, and 1/24 octave analysis with linear A-, B-, or C-weighting
- Vibration level with single or double integration
- Sound level with linear A-, B-, or C-weighting
- Baseband, zoom, and subset power spectrum
- Peak search
- Power-in-band
- Frequency response (FRF)
- Filtering
- Swept sine
- Distortion analysis (THD, THD+N, IMD)
- Noise measurements (SNR)
- Human vibration weighting filters
- Torsional vibration
- Sound quality analysis
- Tachometer signal processing
- Order tracking
- Order spectrum
- Order extraction
- New order plots (Bode and polar, shaft centerline, and orbit and timebase)
- Spectral map
- Waterfall display for power, octave, and order spectra

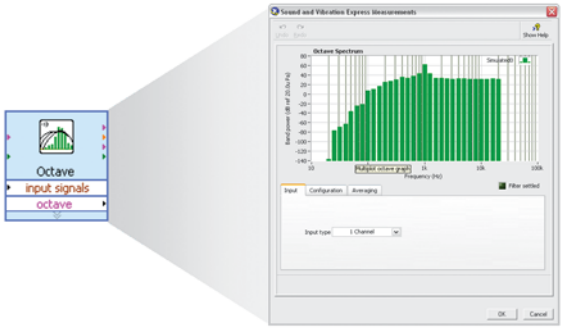


Figure 2. Easy-to-Configure Octave Analysis Splash Screen

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- Data presentation in cascade, shaft centerline, orbit, Bode, or polar plot format
- Shock response spectrum
- File input and output to UFF58

Recommended Hardware

The Sound and Vibration Measurement Suite includes more than 50 examples that work with both dynamic signal acquisition (DSA) and multifunction data acquisition devices. For sound and vibration data acquisition, National Instruments recommends DSA devices. With 24-bit ADCs and DACs and integrated antialiasing filters, DSA devices are ideal for acoustic, noise, and vibration measurements.

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 13,000 channels), National Instruments offers a wide range of hardware products for your applications.

Product	Bus	Input Resolution (bits)	Dynamic Range (dB)	Sampling Rate per Channel (kS/s)	Analog Inputs	Input Range	Gain Settings	Coupling	TEDS Support	Analog Outputs
High Performance										
NI 4461	PXI, PCI	24	118	204.8	2	±42 V to 316 mV	-20 to 30 dB in 10 dB increments	AC/DC	✔	2
NI 4462	PXI, PCI	24	118	204.8	4	±42 V to 316 mV	-20 to 30 dB in 10 dB increments	AC/DC	✔	–
High Density										
NI 4495	PXI	24	114	204.8	16	±10 to 1 V	0 and 20 dB	DC	–	–
NI 4496	PXI, PXI Express	24	114	204.8	16	±10 to 1 V	0 and 20 dB	AC	✔	–
NI 4498	PXI, PXI Express	24	114	204.8	16	±10 V to 316 mV	0 to 30 dB in 10 dB increments	AC	✔	–
Low Cost										
NI 4472	PXI, PCI	24	110	102.4	8	±10 V	N/A	AC/DC	–	–
NI 4474	PCI	24	110	102.4	4	±10 V	N/A	AC/DC	–	–
Portable/Compact										
NI 9233	USB	24	102	50	4	±5 V	N/A	AC	✔	–
NI 9234	USB, Wi-Fi	24	102	51.2	4	±5 V	N/A	AC/DC	✔	–
NI 4432	USB	24	101	102.4	5	±40 V	N/A	AC/DC	✔	–
NI 4431	USB	24	100	102.4	4	±10 V	N/A	AC/DC	✔	1

Table 2. NI Dynamic Signal Acquisition Hardware

Ordering Information

NI USB-4431 780164-01
NI USB-4431 with Sound and Vibration Measurement Suite 780165-01
NI USB-4432 780421-01
NI USB-4432 with Sound and Vibration Measurement Suite 780422-01

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

Analog Input

Input channels	
NI USB-4431	4
NI USB-4432	5
Input connector	1 BNC per channel
ADC resolution	24 bits
ADC type	Delta-sigma
Sampling mode	Simultaneous
Sample rates (f_s)	1 kS/s to 102.4 kS/s in 349.2 µS/s increments
Sample rate accuracy	±100 ppm max
Input range	
NI USB-4431	±10 V_{pk}
NI USB-4432	±40 V_{pk}
Input protection	±60 V max

AI Distortion and Noise

Input Signal Frequency (f_{in})	THD	THD+N
20 Hz to 20 kHz	-99 dB typ	-90 dB typ
	-93 dB max	-84 dB max
20 Hz to 46.4 kHz	-93 dB typ	-86 dB typ
	-87 dB max	-80 dB max

Analog Output

Output channels	1
AO signal connection	BNC
AO frequency range	DC to 43.5 kHz
AO frequency accuracy	±100 ppm max
DAC resolution	24 bits
DAC type	Delta-sigma
Output signal range	±3.5 V_{pk}
Output coupling	DC
Short circuit protection	Indefinite
Minimum working load	1 kΩ
Output impedance	50 Ω

AO Distortion

Update Rate (kS/s)	THD (1 kHz)	THD (20 Hz to 20 kHz)
51.2	-100 dB typ	-89 dB max
80	-97 dB typ	-86 dB max
96	-95 dB typ	-85 dB max

Safety and Compliance

Safety

This product is designed to meet the requirements of the following standards of safety for electrical equipment for measurement, control, and laboratory use:

- IEC 61010-1, EN 61010-1
- UL 61010-1, CSA 61010-1

Note: For UL and other safety certifications, refer to the product label or visit **ni.com/certification**, search by model number or product line, and click the appropriate link in the Certification column.

Electromagnetic Compatibility

This product meets the requirements of the following EMC standards for electrical equipment for measurement, control, and laboratory use:

- EN 61326 (IEC 61326): Class A emissions; Basic immunity
- EN 55011 (CISPR 11): Group 1, Class A emissions
- AS/NZS CISPR 11: Group 1, Class A emissions
- FCC 47 CFR Part 15B: Class A emissions
- ICES-001: Class A emissions

Note: For EMC compliance, operate this product according to the documentation.

CE Compliance

This product meets the essential requirements of applicable European Directives, as amended for CE marking, as follows:

- 2006/95/EC; Low-Voltage Directive (safety)
- 2004/108/EC; Electromagnetic Compatibility Directive (EMC)

Note: Refer to the Declaration of Conformity (DoC) for this product for any additional regulatory compliance information. 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.

Waste Electrical and Electronic Equipment (WEEE)

EU Customers: At the end of their life cycle, all products must be sent to a WEEE recycling center. For more information about WEEE recycling centers and National Instruments WEEE initiatives, visit **ni.com/environment/weee.htm**.

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Training and Certification

NI training is the fastest, most certain route to productivity with our products. NI training can shorten your learning curve, save development time, and reduce maintenance costs over the application life cycle. We schedule instructor-led courses in cities worldwide, or we can hold a course at your facility. We also offer a professional certification program that identifies individuals who have high levels of skill and knowledge on using NI products. Visit **ni.com/training**.

Professional Services

Our NI Professional Services team is composed of NI applications and systems engineers and a worldwide National Instruments Alliance Partner program of more than 600 independent consultants and integrators. Services range from start-up assistance to turnkey system integration. Visit **ni.com/alliance**.

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OEM Support

We offer design-in consulting and product integration assistance if you want to use our products for OEM applications. For information about special pricing and services for OEM customers, visit **ni.com/oem**.

Local Sales and Technical Support

In offices worldwide, our staff is local to the country, giving you access to engineers who speak your language. NI delivers industry-leading technical support through online knowledge bases, our applications engineers, and access to 14,000 measurement and automation professionals within NI Developer Exchange forums. Find immediate answers to your questions at **ni.com/support**.

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

System Assurance Programs

NI system assurance programs are designed to make it even easier for you to own an NI system. These programs include configuration and deployment services for your NI PXI, CompactRIO, or Compact FieldPoint system. The NI Basic System Assurance Program provides a simple integration test and ensures that your system is delivered completely assembled in one box. When you configure your system with the NI Standard System Assurance Program, you can select from available NI system driver sets and application development environments to create customized, reorderable software configurations. Your system arrives fully assembled and tested in one box with your software preinstalled. When you order your system with the standard program, you also receive system-specific documentation including a bill of materials, an integration test report, a recommended maintenance plan, and frequently asked question documents. Finally, the standard program reduces the total cost of owning an NI system by providing three years of warranty coverage and calibration service. Use the online product advisors at **ni.com/advisor** to find a system assurance program to meet your needs.

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

NI provides complete repair services for our products. Express repair and advance replacement services are also available. We offer extended warranties to help you meet project life-cycle requirements. Visit **ni.com/services**.

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