Building Forward Together | ADLINK

Dependable, Application-Ready Solutions

Audio and Vibration Testing Solutions

24-bit Dynamic Signal Acquisition Modules



www.adlinktech.com

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Complete DSA Solutions for Audio and Vibration Testing Applications

Dynamic signal analyzers provide highly accurate measurement and analysis, and are widely used in audio testing, acoustic measurement, environmental noise testing, vibration analysis, NVH measurement, machine condition monitoring, and rotating machinery evaluation. ADLINK's dynamic signal analyzer series features 24-bit analog-to-digital converters (ADCs) with sampling rates up to 432 kS/s for PXI, PCI, and USB platforms for flexible yet accurate measurement supporting high performance and cost-effectiveness in a wide variety of testing applications.

As a leading provider of trusted PXI platform and data acquisition products in Asia, ADLINK leverages extensive field experience to provide leading cost-effective solutions for sound and vibration measurement and analysis.







Audio Loopback Test

Vibration Test



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Contents

Overview

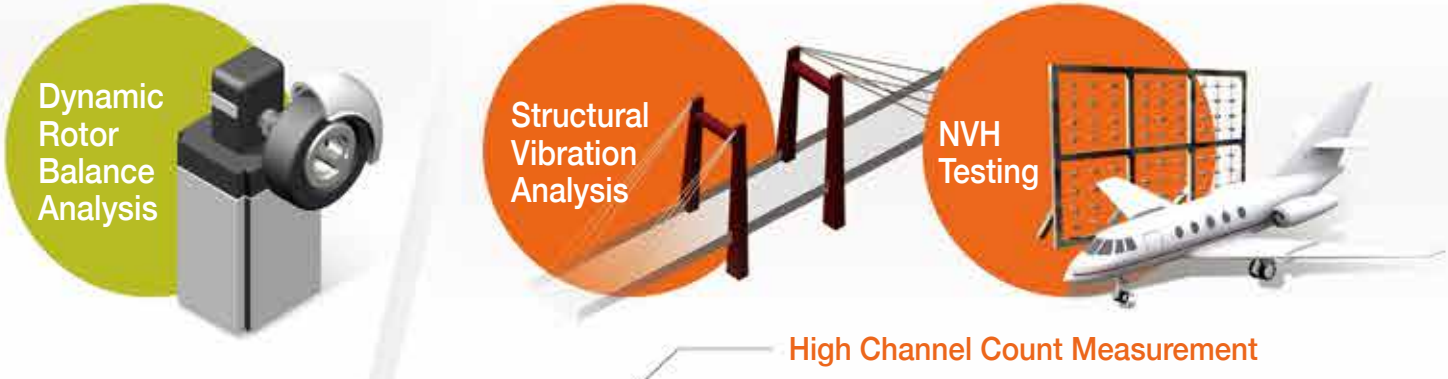
Complete DSA Solutions for Audio and Vibration Testing Applications ---- 1
Application-oriented Dynamic Signal Acquisition Modules for New Generation Audio and Vibration Measurement ---- 3

Applications

Mobile Phone Audio Loop Testing ---- 5
HiFi Mobile Phone Audio Testing ---- 7
Car Navigation Audio Testing ---- 9
Portable USB DSA for Dynamic Rotor Balance Analysis ---- 11

Selection Guide

13



High Channel Count Measurement



- **Complete sound and vibration systems for PXI, PCI, and USB**
- **High sampling rate, low-distortion, high-dynamic performance**
- **Automated testing reducing total cost of ownership**

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Application-oriented Dynamic Signal Acquisition Modules for New Generation Audio and Vibration Measurement

Based on various bus standards, ADLINK's Dynamic Signal Acquisition (DSA) modules are specifically designed for audio, noise, and vibration measurement applications. Featuring up to 432 kS/s sampling rates, 24-bit resolution, and IEPE signal conditioning, the series delivers highly accurate signal acquisition and easy connection to microphone or acceleration sensor for component testing. ADLINK further provides a wealth of industrial-grade computer and PXI platforms enabling customers to choose the products most suitable to their own audio and vibration applications, speeding system development.

Features

- **Complete sound and vibration systems in PXI, PCI, and USB**
- **24-bit ADCs and DACs with up to 118 dB dynamic range**
- **Up to 432 kS/s AI and up to 192 kS/s AO**
- **AC/DC coupling, IEPE conditioning, anti-aliasing filters, and auto calibration**
- **Flexible multi-module synchronization**





24-Bit High Resolution



Excitation Power


Auto Calibration



Software Support

Superior Performance for a Variety of Audio Testing Needs

With the evolution of electronic multimedia devices, manufacturers must take advantage of not only electro-acoustic technology and system design expertise, but also complete audio testing systems to ensure product quality. ADLINK's dynamic signal acquisition modules with high 24-bit resolution and sampling rates can acquire detailed measurement distinguishing subtle audio changes, while managing heavy bass, stereo, HiFi and other high-end signals (noise Level < 3μVrms and THD+N <100dB). In addition, the modules are suitable for mechanical equipment monitoring applications in harsh environments, with high precision and dynamic measurement performance enabling accurate monitoring and measurement of activity such as, for example, power plant turbines to detect operational anomalies.

Dynamic Performance Comparison (DSA vs. Sound Card)

	Flatness	Ground Noise	Dynamic Range	THD	Crosstalk	Performance
Sound Card	±0.3	-70 to -85	70 to 85	-65 to -85	-70 to -85	Low
High-end Sound Card	±0.04 to ±0.08	-85 to -95	85 to 95	-85 to -95	-85 to -95	Medium
ADLINK PCI-9527	±0.03	-117	100	-100	-100	High

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Easy Sensor Connection Reduces Wiring Time

By integrating pre-conditioning circuit design and providing built-in independent excitation current source (2 to 4mA) for all input/output channels, ADLINK dynamic signal acquisition products can directly connect and drive integrated electronic piezoelectric (IEPE) sensors through the front panel, with no need for extra signal conditioning equipment and power cabling, speeding measurement tasks and reducing overall system costs.



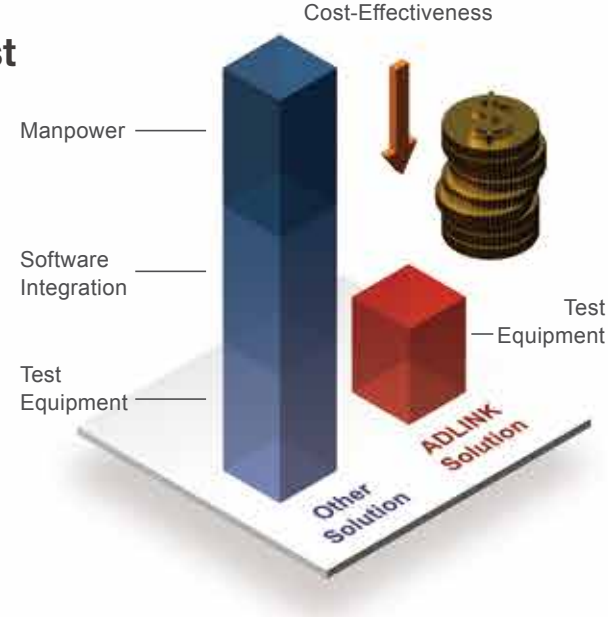
Software Support Simplifies Program Development

ADLINK's dynamic signal acquisition series offers rich SDKs such as LabVIEW™, MATLAB® and other third-party software tools to assist users in quickly designing their programs and applications, shrinking the verification cycle and accelerating time to market. ADLINK's proprietary audio analysis software (Audio Analyzer) helps speedily complete audio testing of headphone jacks, microphones, speakers and other electro-acoustic components with no need for programming.



Automated Testing Reduces Total Cost of Ownership

Benefiting from ADLINK's high-performance dynamic signal acquisition modules, users can build an automated audio and vibration test system and save the cost of purchasing expensive equipment while meeting the demand for high-specification mobile phone testing. Software support aids in the upgrading of detection tasks automated testing without the need for self-developing testing programs. Complete hardware and software solutions improve testing quality and reduce testing time and cost.





Audio Loop Back Testing

As smart phones and tablets continue to gain popularity, multimedia content is becoming more important to consumers all the time. To provide superior multimedia experience, device innovation is not limited to improvement of display quality and size, but also audio quality. As a result, integration of more and better quality electro-acoustic components (i.e. stereophonic loudspeaker and noise-canceling microphone) is a priority in product development. With audio quality recognized as an important factor in gaining market share, manufacturers must maximize the effectiveness of their audio testing systems to ensure product quality.

Application Requirements

In mobile phone manufacturing complete audio testing is required for production lines, to quickly check audio interfaces including 3.5mm earphone circuit, speaker, and microphone, to identify defective products before shipment. Previously, manufacturers have used an external audio analyzer which is bulky, expensive, and difficult offers little support for testing program development due to a lack of easy to use SDKs. The system adds time to production by minimal integration with other programs and difficulty in meeting test automation requirements.

Alternatively, a sound card can be used in testing, although only for lower audio distortion/noise specifications. The solution can only, however, detect basic audio function, with no simultaneous recording and broadcast functions, affecting consistency and stability of test results and showing relatively high false rates. The lower audio distortion/noise specifications are unable to accurately generate a frequency response curve and distinguish the audio quality differences (good or bad) according to the actual audio performance of mobile phone.

- **Ease system integration and shorten testing cycle while improving testing efficiency**
- **Maximize accuracy and consistency of test results**
- **Quick testing system building and auto-execute test items**
- **Meet automated production line requirements**

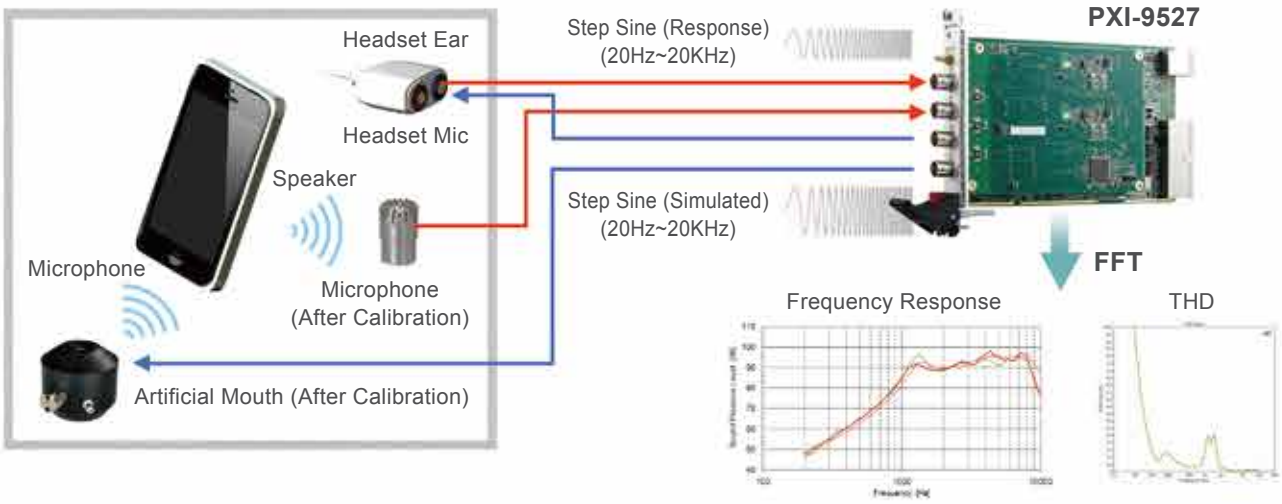
Audio Loop Back Testing Items:

- **Loop frequency/distortion response test from headset MIC to earphone left/right channel**
- **Loop frequency/distortion response test from headset MIC to speaker**
- **Loop frequency/distortion response test from built-in microphone to earphone left/right channel**

Audio Testing Solution Comparison

	Advantages	Disadvantages
Audio Analyzer	Sound analysis system based on industry references Complete analysis software Support digital audio testing	Bulky and occupy space Expensive and unsuitable for the production line applications Time-consuming and longer maintenance and verification cycle time
Sound Card	Low Price	Poor accuracy and design quality are prone to high false detection rate and maintenance rate Obtaining imprecise testing results through Lower distortion and noise specifications is unable to meet high-end audio product testing needs The different time differences lead to inconsistent and unstable test results when triggering analog inputs and analog outputs simultaneously
ADLINK Solution	PC-based architecture to easily integrate with other test functions and quickly complete automated testing system in production lines High 24-bit resolution, low distortion and low noise specifications offer more precise measurements to meet high-end audio product testing standards Complete sound vibration testing applications through integrating with IEPE to directly connect microphone or acceleration sensor Synchronous trigger of AI and AO to enhance stability and consistency of audio loop back testing Significantly reduce testing costs but better test performance/quality	The lack of complete analysis software, particularly as compared to traditional audio analyzer No digital audio testing support

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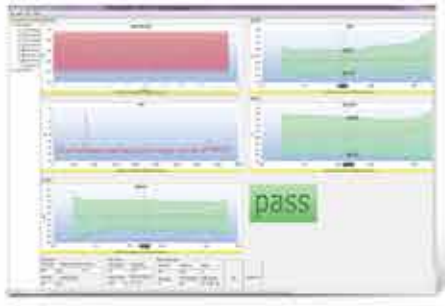


ADLINK Solution

ADLINK's PXI-9527, a 24-bit high dynamic signal acquisition card provides an excellent solution for audio loop testing of smart phones. As shown, the DUT audio input/output connects to the PXI-9527 via analog input/output channels, forming the testing loop. Via the mobile phone control program, the PXI-9527 analog output channel generates a swept sine wave from 20Hz to 20KHz, varying with mobile phones type, after which the signals are transmitted back to the PXI-9527's analog input channel, embodying test results of frequency response and distortion response after Fast Fourier Transform (FFT) processing, determining the DUT's audio quality. The PXI-9527 provides two analog input channels and two analog output channels capable of simultaneously detecting 3.5mm earphone audio circuit, speaker and microphone to fully satisfy multiple electro-acoustic device testing requirements. Expandability allows users to easily and quickly reconfigure test settings, such that if the number of electro-acoustic components to be tested changes, simply adding a switch or installing another PXI-9527 handles the variation, with no need to redesign the entire test system. The PXI-9527 also provides IEPE current output on each analog input channel, so no external power supply is required to power the microphone sensor, thereby simplifying system structure.

Benefits

ADLINK's mobile phone audio testing solution provides more efficient implementation of audio testing systems and significantly reducing overall testing costs. The single-card solution providing complete signal output and collection rather than unidirectional and single-tone tests (only recording or broadcasting), significantly shortens the test cycle. With 24-bit precision, low distortion and low noise specifications, the PCI/PXI-9527 can stably and synchronously acquire AI and AO signals to ensure the accuracy and consistency of measurement results. Support for C/C++, .NET, LabVIEW, and diverse SDKs allows quick development of customized audio testing systems and flexible integration of other testing items. ADLINK also provides ready-to-use audio testing software enabling effortless testing system customization, reducing software development and system integration time and costs.



Audio Analyzer
Ready-to-Use Audio Testing Software

Recommended Products



PCI/PXI-9527
24-Bit High-Resolution Dynamic Signal Acquisition and Generation Module

HiFi Mobile Phone Audio Testing

Mobile phones featuring High Fidelity (HiFi) technology experienced significant growth in 2014 and have driven increases in new product development, with manufacturers replacing conventional codec chips with advanced 192KHz/24-bit DAC and op-amp chips. Through audio, op-amp and other chips, sound quality of mobile phones can compare to 4X CD quality. HiFi technology will continue to be widely applied in mobile phones. As audio performance and quality are enhanced, challenges grow in audio testing. Upgraded function tests are required and can be realized by replacing low-end sound cards with more high-end audio test hardware.

Application Requirements

Currently, commercially available sound cards (THD+N: -80 to -90dB, Noise level: 20 to 50μVrms) are unable to satisfy the demands of HiFi measurement, such that manufacturers are required to access suitable 24-bit high precision, low distortion and low noise audio acquisition cards for production line testing with requirements are as follows:

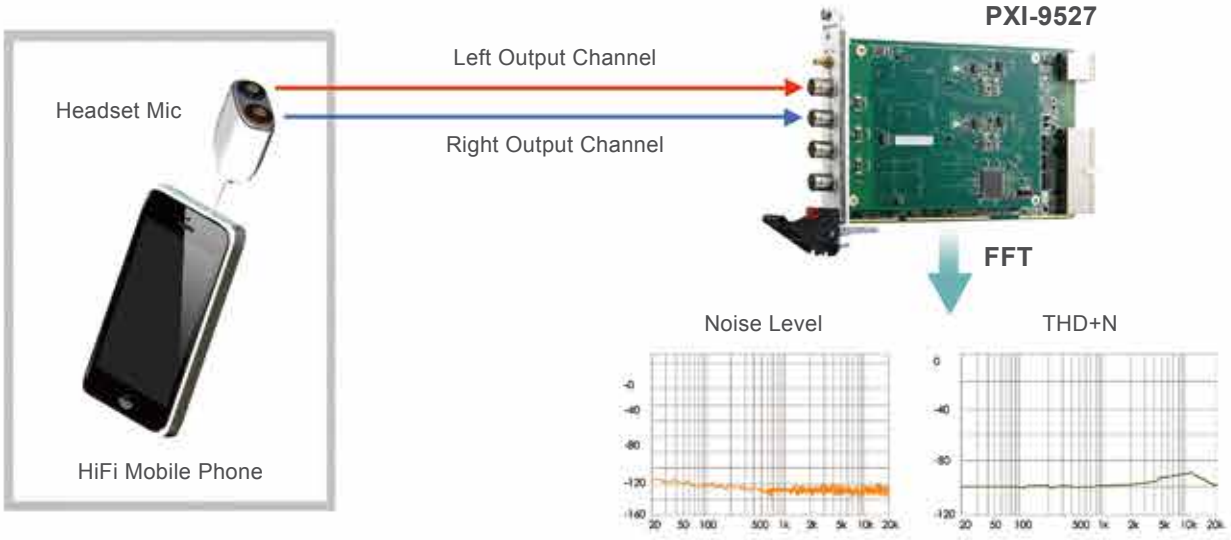
- **Noise level referred to input < 3μVrms**
- **THD+N (20Hz – 20KHz) referred to input < -95dB**

HiFi Mobile Phone Testing Items:

- **Noise level testing: Acquisition of earphone output noise signals to verify compliance with specification, with standard values varying according to mobile phone model, normally 3 to 5μVrms.**
- **THD+N testing: Acquisition of earphone output single-tone signals at different frequencies (20Hz to 20KHz) to verify compliance of THD+N with specification, with standard values will varying according to mobile phone model, normally -90dB to -100dB.**

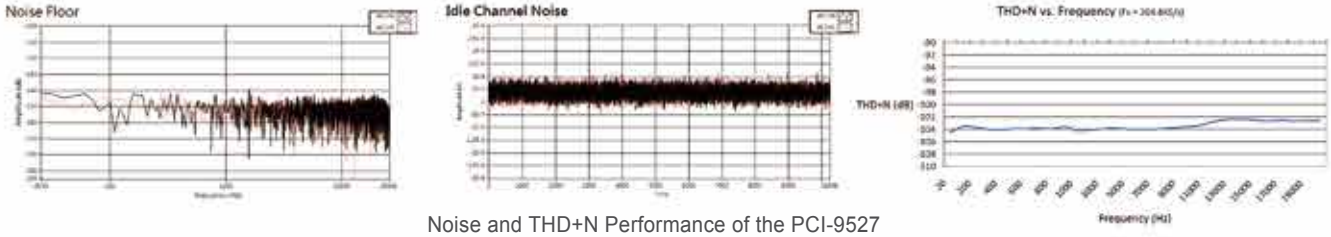


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ADLINK Solution

For HiFi mobile phone audio quality testing, ADLINK provides the PCI-9527, connecting the phone's left and right sound tracks through its two analog input channels. After input measurement range is set at ± 0.316V, the PCI-9527 measures earphone output and compares the acquired values with original design specs, to evaluate DUT noise level. Further adjusted is input measurement according to the mobile phone's THD+N testing requirement, and earphone output single-tone signals are then tested at different frequencies (20Hz to 20KHz) using FFT to obtain THD+N measured values. Finally, DUT is tested for compliance with HiFi design standards.



Noise and THD+N Performance of the PCI-9527

Benefits

The PCI-9527 provides 24-bit high precision and ultra-low distortion, accepting input signals as low as 3μVrms and input THD+N (1KHz) to more than 100dB. Compared with standard sound cards often limited to measuring THD in -80dB or -90dB ranges, the PCI-9527 thoroughly fulfils key indicators in HiFi-enabled mobile phone testing, making it a clear market leader.

Recommended Products



PCI/PXI-9527

24-Bit High-Resolution Dynamic Signal Acquisition and Generation Module



Car Navigation Audio Testing

To secure a position in the in-vehicle infotainment and navigation market, manufacturers are required to provide superior audio and video capabilities, while optimizing audio reproduction quality. What is required is a cost-efficient audio testing solution.

Application Requirements

In-vehicle infotainment and navigation device manufacturers require audio testing systems that can quickly measure four audio output channels (including multiple speakers in various vehicle locations), analyzing audio quality and identifying device defects. Previously, manufacturers have largely relied on manual testing requiring extended testing times, utilizing expensive testing instrumentation, often with fewer output channels (usually only two), which further extends the duration of testing events. Lower testing costs and quicker processing turnaround are, accordingly, beneficial, with specific requirements including:

- **Quick testing system setup providing a variety of automatic testing programs on production lines**
- **Increased bandwidth to shorten testing cycles and improve test efficiency**
- **Reduced cost of testing equipment**

Car Navigation Audio Testing Items:

- **Audio Output Level**
- **Crosstalk: <60 dB (1KHz)**
- **Frequency Responses: ±3dB (20Hz to 20KHz)**
- **Signal-to-Noise Ratio (SNR): 70dB (1KHz)**
- **Total Harmonic Distortion + Noise (THD+N): -60dB (1KHz)**
- **Dynamic Range: 70dB (1KHz)**



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ADLINK Solution

ADLINK's PCIe-9529 24-bit high-precision signal acquisition module with dynamic range up to 110dB and eight input channels easily meets multi-channel vehicle navigation testing requirements, measuring Signal-to-Noise Ratio (SNR), THD+N, channel crosstalk, volume, primary frequency, and items. Eight 24-bit sampling analog input channels mean the PCIe-9529 can simultaneously measure two 4-channel devices, and included LabVIEW drivers allow quick development of in-house testing programs. As shown, PCIe-9529's eight analog input channels connect to two DUT soundtracks, after which FFT is used to obtain testing values including SNR, THD+N, dynamic range, and others, to effectively and quickly determine whether the DUT conforms to specific requirements.

Benefits

Users can benefit greatly from ADLINK's PCIe-9529 multi-channel signal acquisition module, with shorter testing, improved efficiency, and significant time and manpower reduction, all with no requirement for expensive audio analyzers, thus significantly reducing overall costs of testing. With eight 24-bit sampling analog input channels, the PCIe-9529 can test two 4-channel devices simultaneously, shortening test cycles and enhancing efficiency. The SDKs support C/C++, .NET and LabVIEW, allowing quick development of required audio testing systems for automated production line testing, reducing time, effort, and cost.

Recommended Products



PCIe/PXIe-9529

8-CH 24-Bit High-Resolution Dynamic Signal Acquisition Module

Machine Vibration Analysis

Industrial machinery is subject to nearly constant shock and vibration, creating fatigue and wear on materials and components. Imprecision and eventually system failure can result. Forecasting potential problems to implement preventive measures and maintenance or equipment replacement is critical to sustain performance and avoid downtime and costly damage. Machines or tools using a rotary axis, for example, frequently exhibit vibration and noise from unbalanced rotation. This imbalance reduces the life of shaft bearings, so a dynamic balance process is employed, using accelerometer and tachometer readings to calculate and adjust mass and deviation angle. Temperature and voltage readings can also be used to diagnose machine health.

Conventionally, data acquisition modules collect data from sensors on individual machines. Based on the data, portable vibration detectors check for potential problem machines one by one, a time-consuming and labor-intensive practice, with unavoidable errors and slow reaction times.

Dynamic Rotor Balance Analysis

For rotary machines, unbalanced rotation can easily generate unacceptable vibration and noise, while reducing the lifetime of shaft bearings.
The imbalance can be caused by effective displacement of the mass centre line from the actual axis of the mechanism. Especially in tooling machines, vibration caused by the imbalance can seriously affect machining precision. To avoid such vibration and noise, the imbalance is reduced using a procedure known as dynamic balance, in which an accelerometer and tachometer measure vibration frequency and rotary speed to enable calculation of the unbalanced mass and deviation angle. A DSA (dynamic signal acquisition) module with high resolution and wide dynamic range is implemented to receive output from the accelerometer and tachometer.

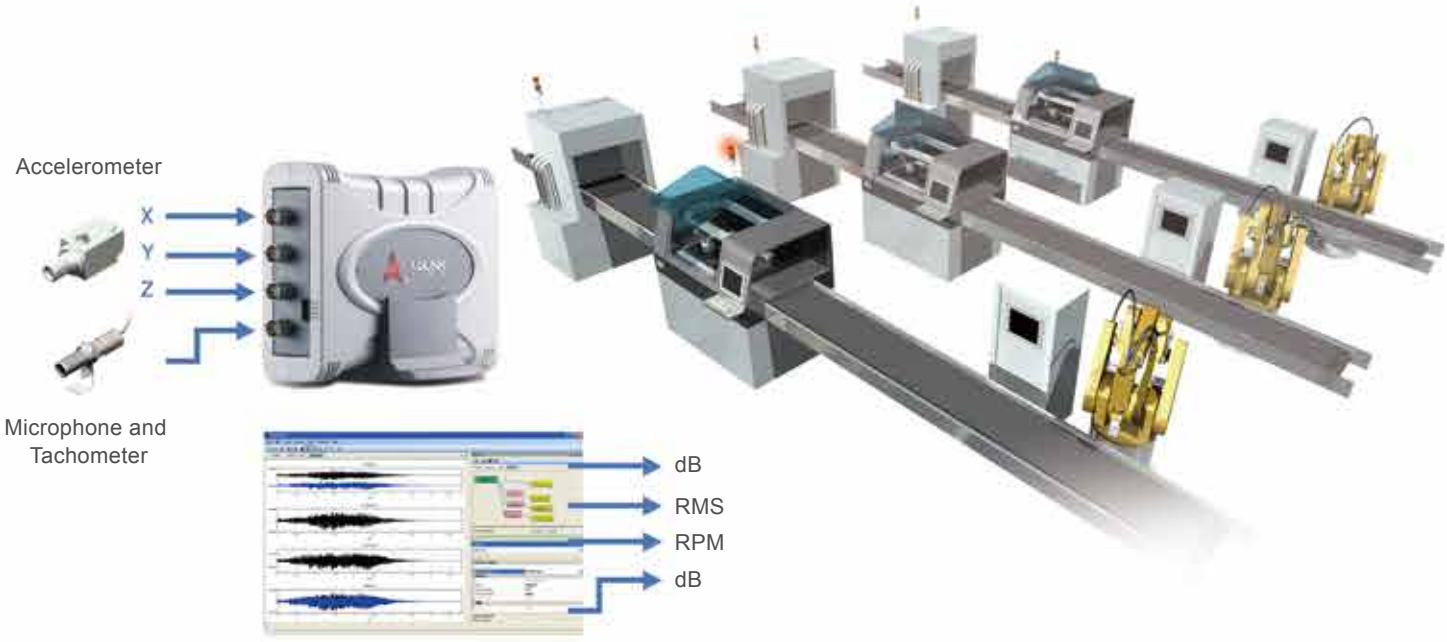


USB-2405 USB 2.0 DSA Module

Predictive Diagnosis of Mechanical Faults

Performance of regular maintenance which periodically replaces aging or worn parts and consumables is the most common method to keep machinery working properly. In fact, however, differences in usage can lead to early damage of the components or speed depletion of consumptive materials, producing noise and vibration and reducing machine accuracy causing breakdown, or even industrial accidents. Abnormalities can be identified in advance by predictive diagnosis. In rotation machinery, for example, various rotating components exhibit characteristic frequencies that can be measured by accelerometer and spectral analysis. After long-term operation, mechanical parts, experiencing mild to severe wear and tear and mechanical aging will gradually produce vibration, with corresponding frequency values reflecting the change. Frequency comparison and analysis can identify components likely to fail, with preventive maintenance or replacement indicated accordingly.

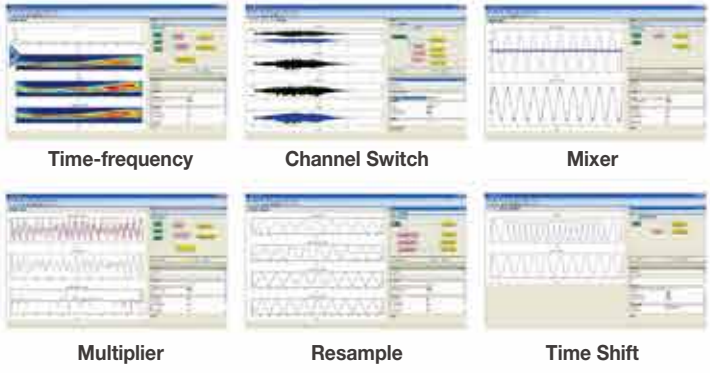
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ADLINK Solution

The USB-2405 24-bit USB DSA, features 4 simultaneously sampling input channels accepting both accelerometer and tachometer data. Each channel provides up to 2mA excitation current to IEPE or ICP® sensors. With the library of the included Visual Signal DAQ Express utility, vibration frequency and rotary speed can be calculated precisely with no programming requirement, for further dynamic balance analysis. The ADLINK USB-2405, with included Visual Signal DAQ Express, includes powerful vibration analysis functions found in known sound and vibration analysis software:

- **Viewer (channel, X-Y plot, time-frequency)**
- **Conversion (channel switch, time shift, resample, data selection,..)**
- **Filter(FIR/median/notch/moving average)**
- **Mathematics (RMS, sound pressure level, diff, mixer,...)**
- **Transform (FFT, IFFT)**
- **Time-Frequency Analysis (Short-term FFT)**



Benefits

Visual Signal DAQ Express's visualization user interface allows acquisition and analysis of noise and vibration signals with no programming requirement, significantly reducing new project development time.

The ADLINK USB-2405 provides analysis functions similar to known sound and vibration analysis software, which can conserve development resources.

Recommended Products



USB-2405

4-CH 24-Bit 128kS/s Dynamic Signal Acquisition USB 2.0 Module

Dynamic Signal Acquisition Products for Diverse Platforms - Selection Guide

PXI and PXI Express Platform

PXI's open hardware platform is specifically created for testing, measurement and control function, and supports the industry's highest bandwidth and lowest latency. ADLINK offers over 100 different PXI bus products for automation testing and measurement applications, including 3U/6U and 6-/19-slot host chassis, desktop or portable integrated chassis, and a variety of PXI instruments and modules, enabling easy integration of required test and measurement functions.



PCI and PCI Express Platform

PCI/PCI Express is the most popular PC-based platform in the current industrial control field, and has the advantages of competitive price and diverse hardware choices. ADLINK offers a range of industrial computer systems, including rack-mount or wall-mount host chassis, and fanless embedded computers for high-performance embedded applications. These industry-leading products provide high-performance computing, high-speed scalable PCI/PCIe slots, and compact size to meet a variety of application needs.



USB Data Acquisition Platform

With the high-speed USB standard and latest semiconductor technology, ADLINK provides flexible, modular, and easy-to-use USB dynamic signal acquisition platforms, ideal for portable testing and control applications.



Dynamic Signal Analyzers Selection Guide

Form Factor	Model Name	Analog Input				Analog Output			Digital IO
		Analog Input Channels	Max. Sampling Rates (S/s)	AD Resolution (bits)	FIFO Size (sample)	Voltage Output Channels	Update Rate (S/s)	Update Rate (S/s)	Digital IO
PCI	PCI-9524	4+4 (4-ch load cell inputs & 4-ch general purpose AD)	Up to 30 kS/s	24	256 k	2	5 K	16	8 DI , 8 DO (Isolated)
	PCI-9527	2	432 kS/s		2048		216 kS/S	24	-
PCIe	PCIe-9529	8	192 kS/s				-	-	-
PXI	PXI-9527	2	432 kS/s				216 kS/S	24	-
PXIe	PXIe-9529	8	192 kS/s			-	-	-	-
USB	USB-2405	4	128 kS/s			-	-	-	2 DIO

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PCI/PXI-9527

24-Bit High-Resolution Dynamic Signal Acquisition and Generation Module



- PXI specifications Rev. 2.2 compliant (PXI-9527)
- 24-bit Sigma-Delta ADC and DAC
- 2CH simultaneous sampling analog input & 2CH simultaneous updated analog output
- 432 kS/s maximum sampling rate with software programmable rate
- Programmable input range: ±40 V, ±10 V, ±3.16 V, ±1 V, ±0.316 V
- Programmable output range: ±10 V, ±1 V, ±0.1 V
- AC or DC input coupling, software selectable
- Trigger I/O connector for external digital trigger signal
- Supports IEPE output on each analog input, software-configurable
- Supported OS: Windows 7/8 x64/x86, Linux
- SDK Compatibility: LabVIEW, MATLAB, C/C++, Visual Basic, Visual Studio.NET
- Software utility: Audio Analyzer

PCIe/PXIe-9529

8-CH 24-Bit High-Resolution Dynamic Signal Acquisition Module



- 24-Bit Sigma-Delta ADC
- 8 simultaneous analog inputs
- 192 kS/s maximum sampling rate
- ±1V, and 10V input ranges
- 110 dB dynamic range
- Antialiasing filters
- AC (0.5Hz), or DC coupling, software selectable
- IEPE - 4mA, software configurable
- Supported OS: Windows 7/8 x64/x86, Linux
- SDK Compatibility: LabVIEW, MATLAB, C/C++, Visual Basic, Visual Studio.NET

USB-2405

4-CH 24-Bit 128kS/s Dynamic Signal Acquisition USB 2.0 Module



- Hi-Speed USB 2.0, and USB bus power
- 24-bit Sigma-Delta ADC with built-in anti-aliasing filter
- 4CH simultaneous sampling analog input, up to 128kS/s
- AC or DC input coupling, software selectable
- Analog or digital triggering
- Supports 2mA excitation output on each analog input channel for IEPE sensor measurement
- Full auto-calibration
- Supporting Time-Frequency analysis software -Visual Signal
- Supported Operating System: Windows 7/8 x64/x86, Linux, and MAC
- SDK Compatibility: LabVIEW, MATLAB, C/C++, Visual Basic, Visual Studio. NET

WORLDWIDE OFFICES

ADLINK Technology, Inc.

9F, No.166 Jian Yi Road, Zhonghe District
New Taipei City 235, Taiwan
新北市中和區建一路166號9樓
Tel: +886-2-8226-5877
Fax: +886-2-8226-5717
Email: service@adlinktech.com

Ampro ADLINK Technology, Inc.

5215 Hellyer Avenue, #110 San Jose, CA 95138, USA
Tel: +1-408-360-0200
Toll Free: +1-800-966-5200 (USA only)
Fax: +1-408-360-0222
Email: info@adlinktech.com

ADLINK Technology Singapore Pte. Ltd.

84 Genting Lane #07-02A, Cityneon Design Centre,
Singapore 349584
Tel: +65-6844-2261
Fax: +65-6844-2263
Email: singapore@adlinktech.com

ADLINK Technology Singapore Pte Ltd. (Indian Liaison Office)

#50-56, First Floor, Spearhead Towers
Margosa Main Road (between 16th/17th Cross)
Malleswaram, Bangalore - 560 055, India
Tel: +91-80-65605817, +91-80-42246107
Fax: +91-80-23464606
Email: india@adlinktech.com

ADLINK Technology Japan Corporation

〒101-0045 東京都千代田区神田鍛冶町3-7-4
神田374ビル4F
KANDA374 Bldg. 4F, 3-7-4 Kanda Kajicho,
Chiyoda-ku, Tokyo 101-0045, Japan
Tel: +81-3-4455-3722
Fax: +81-3-5209-6013
Email: japan@adlinktech.com

ADLINK Technology, Inc. (Korean Liaison Office)

경기도 성남시 분당구 수내로46번길4 경동빌딩 2층
(수내동 4-4번지) (우) 463-825
2F, Kyungdong B/D, 4 Sunae-ro 46beon-gil, Bundang-gu,
Seongnam-si, Gyeonggi-do, Korea, 463-825
Toll Free: +82-80-800-0585
Tel: +82-31-786-0585
Fax: +82-31-786-0583
Email: korea@adlinktech.com

PENTA ADLINK Technology GmbH

Ulrichsbergerstrasse 17
94469 Deggendorf, Germany
Tel: +49 (0) 991 290 94 – 10
Fax: +49 (0) 991 290 94 - 29
Email: emea@adlinktech.com

ADLINK Technology (China) Co., Ltd.

上海市浦东新区张江高科技园区芳春路300号 (201203)
300 Fang Chun Rd., Zhangjiang Hi-Tech Park
Pudong New Area, Shanghai, 201203 China
Tel: +86-21-5132-8988
Fax: +86-21-5192-3588
Email: market@adlinktech.com

ADLINK Technology Beijing

北京市海淀区上地东路1号盈创动力大厦E座801室(100085)
Rm. 801, Power Creative E, No. 1 Shang Di East Rd.
Beijing, 100085 China
Tel: +86-10-5885-8666
Fax: +86-10-5885-8626
Email: market@adlinktech.com

ADLINK Technology Shenzhen

深圳市南山区科技园南区高新南七道数字技术园
A1栋2楼C区 (518057)
2F, C Block, Bldg. A1, Cyber-Tech Zone, Gao Xin Ave. Sec. 7
High-Tech Industrial Park S., Shenzhen, 518054 China
Tel: +86-755-2643-4858
Fax: +86-755-2664-6353
Email: market@adlinktech.com

LiPPERT ADLINK Technology GmbH

Hans-Thoma-Strasse 11, D-68163 Mannheim, Germany
Tel: +49 621 43214-0
Fax: +49 621 43214-30
Email: emea@adlinktech.com

ADLINK Technology, Inc. (French Liaison Office)

6 allée de Londres, Immeuble Ceylan 91940 Les Ulis, France
Tel: +33 (0) 1 60 12 35 66
Fax: +33 (0) 1 60 12 35 66
Email: france@adlinktech.com

ADLINK Technology, Inc. (Israel Liaison Office)

27 Maskit St., Corex Building PO Box 12777
Herzliya 4673300, Israel
Tel: +972-54-632-5251
Fax: +972-77-208-0230
Email: israel@adlinktech.com

ADLINK Technology, Inc. (UK Liaison Office)

Tel: +44 774 010 59 65
Email: UK@adlinktech.com

50-40306-1000

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