

DATA SHEET



EMX-1434

"SMART" PXI EXPRESS 4-CHANNEL 204.8 KSA/S
ARBITRARY WAVEFORM GENERATOR

APPLICATIONS

Modal / GVT (Ground Vehicle Testing)
Acoustics
Shock / Vibration
Rotational Machinery
Electronic Test



www.vtiinstruments.com

FEATURES

Analog Performance

- 4-channel, 204.8 k Sa/s sample rate per channel
- Dual integrated tach input channels
- Synchronized DSA source
- Rotational measurement capability
- 4 channel DIO
- Advanced system-on-a-chip filtering and analysis
- Precision multi-channel synchronization
- End-to-end internal source self-calibration

System Level Functionality

- FPGA-based Synthetic Instrument Customization
- Corporate Wide Cloud Data Management / Access
- Comprehensive Runtime Health Monitoring
- Run-time Self-calibration / Embedded NIST Calibration
- Precision Distributed Measurement Synchronization
- Data Streaming at Full Acquisition Rates on all Channels across PXI Express backplane

Software

- X-Modal III
- EXLab
- SO Analyzer
- Open Source Drivers

Specifications contained within this document are subject to change without notice

OVERVIEW

High Performance Architecture

The EMX-1434 is an arbitrary source/tach high performance modular PXIe board which has four channels arbitrary sources and two channels tachometer inputs. It is uniquely designed for sound/vibration and DSA applications and can be easily synchronized with digitized data giving the capability to combine the required source and signal analysis into one single chassis to maximize flexibility. It supports various output modes such as Sine, Burst Sine, Chirp, Burst-random and continuous random. It also provides two 64-bit tachometer/counter input channels each of which has a 16k-word FIFO. The module functions as a high-performance arbitrary waveform generator that is also ideal for electronic test applications requiring standard function generator capability, or the need to generate custom-defined waveforms.

With its capability of providing stimulus to a shaker, loudspeaker and other electrical devices, it can be paired with the EMX-4250, EMX-4350, EMX-4380 and EMX-6010 products forming the basis for a versatile dynamic signal analysis system. With the most advanced PXIe and LXI architecture, it can stream numerous waveforms from the host computer to the module, with that ability to synchronize multiple channels in a distributed architecture through the use of IEEE-1588 precision time protocol.

Analog Performance

Analog Performance

Built-in Sine and Noise Waveforms

Sine waveform is one of the most common test waveforms. The EXM-1434 provides four independent channels of sine wave capability, each with its own frequency, phase, and amplitude. Sine waves can be generated in continuous and burst modes with frequencies from less than 1Hz to 93 kHz.

The EMX-1434's noise capabilities are specifically designed to provide periodic and pseudo random waveforms in either continuous or burst mode. Additionally, the EMX-1434 can band-translate the noise to have a non-zero start frequency. This allows the user to pinpoint the noise stimulus to frequencies of interest, avoiding troublesome resonances or frequencies that might damage the device under test.

Arbitrary Waveform

The EMX-1434 can generate arbitrary waveforms to provide simulate virtually any stimulus pattern with a bandwidth up to 80 kHz. Arbitrary waveforms can be downloaded from the host computer and then output a repeating loop. Or the host can continuously download new segments of a waveform to be concatenated with previous segments, allowing continuous, glitch-free playback of any length waveform.

24-bit Resolution for dynamic range

The EMX-1434 has a 24-bit DAC per channel and a very high -115dB spurious free dynamic range. The 24-bit DAC ensures superior accuracy and allows the EMX-1434 to output high-fidelity waveforms. The -115dB SFDR maximizes the dynamic performance of the EMX-1434 and is useful for applications where there is a need for smooth output levels over a wide amplitude range.

Analog Performance

Built-in Tachometer inputs for Rotating Machinery/Order Analysis Tests

The EMX-1434 has integrated dual tachometer inputs with signal conditioning for a wide range of Tach input signals. These inputs allow tight integration of tachometer information from rotating machinery with acquired data from a digitizer card. This provides the information the floating point processor needs to do RPM triggering of order analysis measurements. Data accuracy can be increased by the fact that the measurement data can be re-sampled and synchronized based on the edge of the tachometer. With the build-in tachometer feature, the EMX-1434 works best with the EMX series DSA products, EMX-4250, EMX-4350, EMX-4380 and EMX-6010 in stimulus and response applications such as rotating machinery and order analysis tests.

System-on-a-chip FPGA Customization

The EMX-1434 incorporates advanced user programmable FPGAs and a modular system-on-a-chip (SoC) implementation. With this SoC feature, the user is able to use MATLAB and Simulink, with access to hundreds of standard filters and analysis algorithms, to customize the FPGA and implement custom algorithms to output any waveforms.

This SoC feature is host-independent, providing real-time computation and analysis onboard the instrument. While using the EMX-1434 with the EMX series digitizer instruments in a closed-loop control system, this feature maximizes the stability by minimizing the loop time. The SoC feature also allows real-time data processing for incoming tachometer data.

Channel independence and pairing

The EMX-1434 four output channels are grouped in pairs. Both channels of a pair must output the same type of waveform - sine, random or arbitrary. But each pair of channels is completely independent from the other pair. For example, one channel pair can output two uncorrelated random noise signals while the other channel pair and produce two independent sine waves.

Graceful Shutdown/Safety Feature

Since arbitrary sources can drive very expensive devices under test, it is important to provide an orderly shutdown in case of emergency. In addition to programmable ramp-up and ramp-down rates, the arbitrary source has a smooth ramp-down from AC power failure, or in response to its emergency shutdown input. Furthermore, the EMX-1434 supports < 4 ms fast shutdown for failure conditions and < 5 sec slow shutdown which would be typically used for shaker applications.

Analog Performance

Built-in self calibration

Measurement accuracy is maximized utilizing a unique approach for run-time self-calibration eliminating the need to disconnect transducers or field connections. Complete end-to-end self-calibration is performed using a precise onboard voltage reference source permitting execution at test time, at current temperature. This approach not only delivers the most accurate measurements possible, but also validates the instrumentation signal path prior to test.

Complete embedded NIST traceable calibration eliminates the need to remove the instrument from service, resulting in maximum test equipment utilization, reduced need for spares, and reduced down time. The embedded web interface provides a fool-proof, easy to use interface to permit complete traceable calibration, in place, without removing the instrument from service.

System-level Functionality

FPGA-based synthetic instrument customization extends traditional hardware performance by combining nearly unlimited user-defined computational, processing, and control possibilities to deliver unmatched measurement performance and flexibility.

- Maximizes hardware performance and measurement flexibility
- Supports custom intellectual property algorithm implementation
- Closed loop multi-module control and data transfer optimization
- Simultaneous parallel channel data decimation and manipulation
- User-defined filters, data manipulation, and analysis on-board the instrument

Industry standard MATLAB® and Simulink® design tools simplify implementation, maximize re-usability, and provide access to hundreds of standard filters and analysis algorithms.

System-level Functionality

Corporate wide cloud data management delivers advanced data access, security and storage services throughout the organization, accessible from web browsers and other applications, on desktop and mobile devices.

- Simplified, next generation user data services
- Corporate wide data access and security
- Dynamically scalable data management services
- Accessible on a wide range of traditional and mobile devices
- Eliminates need for knowledge of the physical location or configuration of the system

Comprehensive runtime health monitoring (BIST: Built-in Self-test) provides test system confidence and peace of mind by ensuring that the complete instrumentation measurement path is functional and delivering the most accurate results possible.

- Ensures runtime instrument performance and accuracy
- Performed without disconnecting external transducer cabling
- Delivers exceptional run-time convenience and measurement confidence
- Instrument performance is verified utilizing precision internal voltage references

Precision distributed measurement synchronization ensures that all test data is time correlated whether the instrumentation is centrally located in the laboratory or distributed around a test article.

- Enables widely distributed system level performance
- Utilizes embedded IEEE 1588 precision time protocol
- Precise synchronization across multiple instrumentation modules and chassis
- Synchronization achieved over-the-wire (Ethernet), with complete user transparency

Software

Software

Open-source SDRL X-Modal III experimental modal analysis software features intuitive task oriented user interfaces, extensive modal parameter estimation algorithms, parallel display capabilities, flexible data management, and unparalleled channel expandability.

- MATLAB®-based open-source programming environment
- Multiple live parameter estimation windows displayed in parallel
- Task oriented, easy-to-use user interface always "one-click" away
- Simplified "cut & paste" data management and unit's unification tool

EXLab is an easy to use, turn-key, data acquisition solution featuring intelligent configuration capabilities, automatic device discovery, extensive time and frequency domain data visualization, and post-acquisition display and analysis tools.

- Intuitive setup and control
- Remote client monitor and control
- Advanced filtering, analysis, and modeling
- Waterfall, video, images, scatter, 3D model and SRS diagrams

Open Source industry standard, drivers and programming interfaces provide the flexibility and freedom of choice to select the application programming environment best suited for the application and specific development requirements.

- Support for all major programming environments
- Software interoperability, maintainability, and reusability
- Common development environment and interface across all instrumentation types

General Specifications

SOURCE

OUTPUT MODES

Sine, burst sine, pseudo random noise, and band translation. Arbitrary waveform with loop or continuous output and burst

DIGITAL-TO-ANALOG CONVERTER

Independent 24-bit per channel

OVERVOLTAGE PROTECTION

±40 V peak

DYNAMIC RANGE

115 dB, 0-51.2 k Hz spurious free

THD

-98 dB, to 20 kHz

CROSS CHANNEL PHASE MATCH

±0.01° per 1 kHz

CROSS CHANNEL AMP MATCH

±0.01 dB 10Hz to 20 kHz

SAMPLING RATE

204.8 kSa/s

FLATNESS

±0.01 dB to 35 kHz

±0.06 dB 35 kHz to 93 kHz

PHASE LINEARITY

±0.005° DC to 10kHz

±0.02° 10 kHz to 30 kHz

±0.5° 30 kHz to 93 kHz

CROSSTALK

-100 dB to 10 kHz

-95 dB 10 kHz to 93 kHz

MAXIMUM AMPLITUDE

±10 V

OUTPUT IMPEDANCE

<0.5 Ω

MAXIMUM OUTPUT CURRENT

±25 mA

MAXIMUM CAPACITIVE LOAD

Aberrations begin at 20nF

Overshoot and ringing but no oscillation at 1μF

RESIDUAL DC OFFSET

<±1mV

AMPLITUDE CONTROL

AMPLITUDE RANGE

-20 dB to 0 dB in 1dB steps

AMPLITUDE SCALE FACTOR

0 to 1

AMPLITUDE RAMP-DOWN TIME

4 ms

SINE OUTPUT MODE

SHUTDOWN

yes

SINE FREQUENCY

0.01 Hz to 93 kHz

FREQUENCY RESOLUTION

71 uHz

AMPLITUDE ACCURACY

±0.05 dB

GENERATED FREQUENCY ACCURACY

Clock source dependent; internal clock 50ppm.

NOISE OUTPUT MODE

FREQUENCY SPANS

80 KHz or 51.2 KHz Full Span – with/without Decimated by 5 and/or Decimated by 2 with maximum of 16 times

PASSBAND FLATNESS

< 1.2dBpp

CREST FACTOR

4:1 (Typical)

PERCENT IN-BAND ENERGY

> 90% (Typical)

MINIMUM SPAN

Full Span / (5*2¹⁶)

CENTER FREQUENCY RESOLUTION

71 uHz

FREQUENCY AND BAND TRANSLATION	MIN SPAN	MAX SPAN	MAX CENTER FREQUENCY
FS = 204.8 KHZ	0.244140625 Hz	80 KHz	80 KHz
FS = 131.072 KHZ	0.15625 Hz	51.2 KHz	51.2 KHz

General Specifications

ARBITRARY OUTPUT MODE

MAXIMUM SIGNAL BANDWIDTH

BUFFER SIZE

CONTINUOUS ARB DATA RATE

80 KHz or 51.2KHz

64K Samples x 2 Buffers

User must supply data @ rate = $F/(5^m) \cdot (2^n)$

Where $F_s = 204.8\text{KHz}$ or 131.072KHz

$m = 0$ or 1

$n = 0, 1, 2 \dots 16$

CONSTANT LEVEL OUTPUT

OUTPUT LEVEL AT 1KHZ

RESIDUAL DC OFFSET

$\pm 10\text{V}$ peak

$< \pm 1\text{mV}$

SUMMER INPUT

MAXIMUM INPUT

GAIN, SUMMER INPUT TO SIGNAL OUTPUT

INPUT IMPEDANCE

FLATNESS

$\pm 10\text{V}$ peak

1

2 k Ω

± 0.01 dB to 35 kHz

± 0.06 dB 35 kHz to 93 kHz

TACHOMETER

INPUTS

FREQUENCY INPUT RANGE

RANGES

INPUT TYPE

INPUT COUPLING

MINIMUM PULSE WIDTH

THRESHOLD

HYSTERESIS

2

1 MHz

± 25 V

± 250 V

Differential

DC, AC 0.6 Hz

600 nS

Programmable $\pm 95\%$ of range

Programmable $\pm 1\%$ of range

DIGITAL I/O

CHANNELS

VIN HIGH

VIN LOW

VOUT HIGH

VOUT LOW

OVERVOLTAGE PROTECTION

MAX SLEW RATE

SHUTDOWN INPUT

4

3.5 V min

1.5V max

4.9 V – $I_{out} \cdot 100 \Omega$

+0.1 V + $I_{out} \cdot 100 \Omega$

± 15 V peak

50 V/ μ s

A normally open contact between GND (SMB shell) and a 38 k Ω resistor pulled up to +5 V (SMB center).

Note: that this is not a safety rated shutdown and that if a safety rated shutdown is required then the user is responsible for such, not VTI Instruments.

Mechanical Specifications

IEEE 1588 CLOCK SPECIFICATIONS

CLOCK OSCILLATOR ACCURACY
SYNCHRONIZATION ACCURACY
TIMESTAMP ACCURACY
RESOLUTION

±50 ppm
Reports "synchronized" when $< \pm 100$ ns of the 1588 master clock
As good as time synchronization down to 50 ns
25 ns

IEEE 1588-BASED TRIGGER TIMING

ALARM

TRIGGER TIME ACCURACY
TIME TO TRIGGER DELAY

As good as time synchronization down to 50 ns
50 ns

RECEIVE LAN [0-7] EVENT

TRIGGER TIME ACCURACY
TIME TO TRIGGER DELAY

As good as time synchronization down to 50 ns

Future timestamp
Past/zero timestamp

50 ns typical
1 ms maximum

HARDWARE TRIGGER TIMING

DIO BUS

TIME TO TRIGGER DELAY

57 ns typical

Environmental Specifications

TEMPERATURE

OPERATING

0 °C to +50 °C

STORAGE

-40 °C to +70 °C

RELATIVE HUMIDITY

5% – 95% (non-condensing)

ALTITUDE

3000 m

SHOCK AND VIBRATION

Conforms to MIL-PRF-28800F

RANDOM VIBRATION

10 Min per Axis, MIL-PRF-28800F Class 3

SINUSOIDAL

5 to 55hz Resonance Search per MIL-PRF-28800F Class 3, each Axis

SHOCK

30g/Axis, 11ms half Sine pulse per MIL-PRF-28800F Class 3

Notes:

- 1) All specifications are typical unless otherwise stated as a minimum or maximum.
- 2) All specifications subject to change without notice.
- 3) All specifications assume within 24 hours and 5°C of self-calibration temperature unless otherwise specified.

Ordering Information

EMX-1434 4-Channel, 204.8 kSa/s Smart Arbitrary Waveform Source

SOFTWARE

X-MODAL III Modal Analysis Software

SO ANALYZER Acoustics/Impact/Rotational/Shock Software

EXLAB* General Purpose DAQ Software

*Multiple configurations available

RELATED PRODUCTS

EMX-4350 4-Channel, 625k Sa/s Smart Dynamic Signal Analyzer

EMX-4250 16-Channel, 204.8k Sa/s Smart Dynamic Signal Analyzer

EMX-4251 8-Channel, 204.8k Sa/s DSA Digitizer

EMX-4008 8-Channel, BNC adapter

EMX-4016 16-Channel, BNC adapter