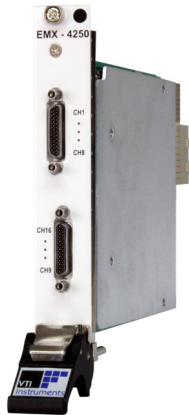


## DATA SHEET



# EMX-4250/4251

"SMART" HIGH DENSITY DYNAMIC  
SIGNAL ANALYZERS

## APPLICATIONS

Modal Analysis  
Ground Vehicle Testing (GVT)  
Acoustic Analysis  
Order Analysis  
Vibration Control / Analysis  
High Speed Data Acquisition



[www.vtiinstruments.com](http://www.vtiinstruments.com)

## FEATURES

### 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

### Analog Performance

- 204.8 k Samples / Second / Channel Data Rates
- 16-Channel/8-Channel 24-Bit ADC's
- Software selectable for Single Ended or Differential Inputs
- -105 dB Spurious Free Dynamic Range
- Cross Channel Phase Matching <0.01°
- Auto-ranging  $\pm 100$  mV to  $\pm 10$  V Inputs

### Software

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

RELIABLE DATA FIRST TIME EVERY TIME

## Analog Performance

The EMX-4250 and EMX-4251 Smart Dynamic Signal Analyzer incorporate best-in-class analog design methodology to deliver industry leading measurement accuracy. These instruments are ideal for a wide range of applications including noise vibration, and harshness (NVH), machine condition monitoring, rotational analysis, acoustic test, modal test, as well as general purpose high speed digitization and signal analysis.

**204.8 k samples / second /channel data rates** extend the operational capabilities of DSA analyzers to new levels by ensuring sampling and bandwidth performance is capable of accurately capturing all critical frequency domain information, while delivering the flexibility needed for general purpose applications.

- Exceptional anti-alias signal rejection
- Flexible analog and user defined digital filter combinations
- Ideal for DSA and general purpose, high speed parallel acquisition

Aggressive anti-aliasing filter performance (user selectable / definable analog and digital filter combinations) eliminates power spectrum of unwanted signals that contribute to measurement errors delivering confidence.

Differential inputs deliver superior common mode performance far beyond levels capable with other implementation approaches. While the latest 24-bit ADC technology delivers exceptional signal resolution, especially when combined with multiple input ranges.

- Highest quality low noise, low distortion ADC's
- Best-in-class noise immunity
- Exclusive balanced AC coupling implementation

**Wide -105 dB spurious free dynamic range (SFDR)**, a key measure of the superior measurement fidelity provided by this instrument, ensures that the strength ratio of the fundamental signal of interest signal is exceptional.

- Ensures unwanted signal artifacts are greatly attenuated
- Essential performance metric for accurate frequency domain measurements
- Essential for frequency domain performance where distortion typically increases with frequency

## Analog Performance

"Intelligent" Signal Conditioning delivers exceptional measurement flexibility with multiple options to support a wide range of transducers and signal types including IEPE and charge transducers.

- Built-in IEPE support for IEPE transducers directly from the EMX-4250/4251
- High performance "intelligent" signal conditioning provides unmatched signal conditioning flexibility
- Intelligent signal conditioning delivers standalone signal conditioning with buffered analog outputs
- LXI Ethernet control of intelligent signal conditioning for stand-alone operation

Cross channel phase matching  $<0.01^\circ$  delivers the uncompromised phase response required for accurate single and cross channel measurements common in most DSA applications.

- Exceptional cross channel phase matching  $<0.01^\circ$
- Deterministic channel-to-channel, card-to-card, and chassis-to-chassis phase response
- Ensures phase accuracy of all channels relative to the tachometer, trigger and other channels

Auto-ranging  $\pm 100$  mV to  $\pm 10$  V inputs maximize signal resolution by automatically selecting the correct input range for the signal. Software selectable, this function can be used during setup and configuration to identify the most appropriate gain level.

- (7) Different gain ranges
- 10 V input range for high level signals and transducers
- Lowest distortion signal conditioning for maximum signal integrity

## 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** provides test system confidence and peace of mind by ensuring that the complete instrumentation measurement path is functional and performing 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

**Runtime self-calibration** ensures that instruments deliver the most accurate results possible by compensating for ambient temperature fluctuations, without the need to disconnect field wiring.

- Maximizes measurement accuracy
- Performed across the entire measurement path
- Precision internal voltage sources validate and adjust coefficients
- Eliminating inaccuracies generated by internal circuitry temperature gradients

**Embedded NIST traceable calibration** eliminates lengthy test system down-time, simplifies calibration processes, and reduces spare equipment requirements.

- Maximizes facility up-time and utilization
- Completely automated embedded process
- Supports multiple portable calibration standards
- Performed in-place without removing instrumentation

**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

NUMBER OF CHANNELS	16
EMX-4250	8
EMX-4251	
INPUT CONNECTOR	25-pin Micro D
AMPLITUDE RESOLUTION	24 bits
INPUT COUPLING	AC or DC
INPUT TYPE	IEPE (psuedo-differential), volts (differential or psuedo-differential)
FREQUENCY SAMPLING RATE	User programmable 204.8 kHz or 131072 Hz with Decimate by 5 and by 2 <sup>n</sup> . Lowest Sample rate = 2 Hz
FREQUENCY BANDWIDTH	Maximum 92.2 kHz
SPURIOUS FREE DYNAMIC RANGE	-105 dBfs typical, 10V range, 1 kHz test frequency
THD	< -98 dB typical, 20 Hz to 20 kHz
NOISE	20 nV/ sqrt (Hz) typical, 100 Hz, 0.1V Range
ALIASED RESPONSES	< -90 dB (typical)
ANTI-ALIAS FILTER	3-Pole linear phase -3.0 dB at 500 kHz
DIGITAL ANTI-ALIASING FILTER	Programmable
CROSSTALK	-100 dBfs typical at 1kHz
DC OFFSET	< 1 mV DC coupling, < 5 mV AC coupling
AC COUPLING 3 DB CORNER FREQ	0.37Hz Typical for Ranges=0.1V, 0.2V, 0.5V; 0.25Hz Typical for Ranges=1V, 2V, 5V, 10V
RANGES (V PK)	0.1V, 0.2V, 0.5V, 1 V, 2 V, 5 V, 10 V Add 10% to include over-range capability
INPUT IMPEDANCE	Single Ended 2 M $\Omega$ Differential 4 M $\Omega$ Either side-to-chassis 2 M $\Omega$ , 35 pF nominal
COMMON MODE REJECTION RATIO	-80dB typical at 1kHz
OVER-VOLTAGE PROTECTION	$\pm$ 30 V pk
IEPE EXCITATION CURRENT	4.5mA or 10mA Nominal, programmable
IEPE COMPLIANCE	IEPE compliance voltage (>21 V)
OPEN/SHORT IEPE TRANSDUCER DETECTION	Green/Red LED located on Breakout Box for fault indication
TEDS	IEEE 1451.4
AMPLITUDE ACCURACY AT 1 KHZ	$\pm$ 0.03dB
AMPLITUDE MATCH	0.01 dB Typical
AMPLITUDE FLATNESS	+0.01 dB to 46 kHz
CHANNEL-TO-CHANNEL PHASE MATCH	Applies to any EMX-4250/4251 module in the same mainframe $\pm$ 0.01° at 1 kHz
PHASE LINEARITY	$\pm$ 0.05° up to 90 kHz+0.01 dB (full-scale signal)
PHASE ACCURACY (RELATIVE TO TACH)	<0.1° at 1 kHz (typical phase accuracy to EMX-1434)
TRIGGER MODES	Input (level / edge), external (through octopus cable or breakout box), PXIe, LXI, software, timer, source, RPM
EMBEDDED HEALTH MONITORING	Internal temperature, open/short IEPE transducer detection
BUILT-IN SELF-TEST (BIST)	Yes
EMBEDDED SELF-CALIBRATION	Yes
EMBEDDED NIST TRACEABLE CALIBRATION	Yes
AUTOMATIC ADC OVER RANGE/OVER	
FLOW DETECTION	Yes
FPGA CUSTOMIZATION	Mathworks (MATLAB and Simulink) development environment
ONBOARD MEMORY	128 Gb

## Mechanical Specifications

### IEEE 1588 CLOCK SPECIFICATIONS

CLOCK OSCILLATOR ACCURACY	±50 ppm
SYNCHRONIZATION ACCURACY	Reports "synchronized" when < ±100 ns of the 1588 master clock
TIMESTAMP ACCURACY	As good as time synchronization down to 50 ns
RESOLUTION	25 ns

### IEEE 1588-BASED TRIGGER TIMING

ALARM	
TRIGGER TIME ACCURACY	As good as time synchronization down to 50 ns
TIME TO TRIGGER DELAY	50 ns

RECEIVE LAN [0-7] EVENT	
TRIGGER TIME ACCURACY	As good as time synchronization down to 50 ns
TIME TO TRIGGER DELAY	

FUTURE TIMESTAMP	50 ns typical
PAST/ZERO TIMESTAMP	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-2880F Class 3
SINUSOIDAL	5 to 55hz Resonance Search per MIL-PRF-2880F Class 3, each Axis
SHOCK	30g/Axis, 11mS half Sine pulse per MIL-PRF-2880F Class 3

#### Notes:

- 1) All specifications are typical unless otherwise stated as a minimum or maximum.
- 2) For current detailed specification please refer to the on-line manual at [www.vtiinstruments.com](http://www.vtiinstruments.com).
- 3) All specifications subject to change without notice.
- 4) All specifications assume within 24 hours and 5°C of self-calibration temperature unless otherwise specified.

## Ordering Information

EMX-4250	16-Channel, 204.8 kSa/s "Smart" DSA Digitizer
EMX -4251	8-Channel, 204.8 kSa/s "Smart" DSA Digitizer
EMX-4008	8-Channel, BNC adapter
EMX-4016	16-Channel, BNC adapter

### SOFTWARE

X-MODAL III	General Purpose DAQ Software
EXLAB*	Modal Analysis Software

\*Multiple configurations available

### RELATED PRODUCT

EMX-1434	4-Channel, 192k Sa/s Arbitrary Waveform Source
EMX-4350	4-Channel, 400k Sa/s DSA Digitizer