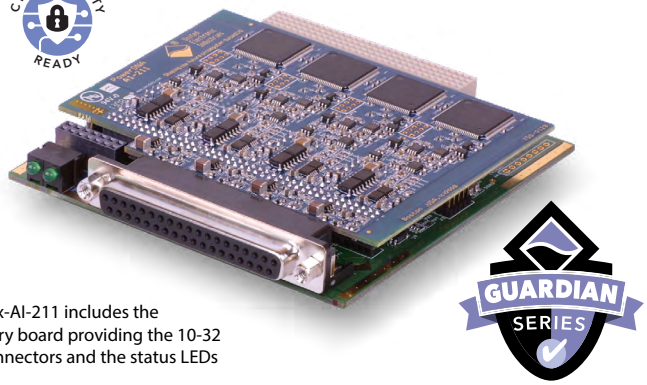
DNA/DNR-AI-211

4-channel IEPE / ICP® Vibration Sensor Interface

- DNA-AI-211 for Cube chassis
- DNR-AI-211 for RACKtangle™ chassis
- 4 Independent 24-bit input channels
- 125 KSPS maximum sample rate (each channel)
- Digital anti-aliasing filter provides 100 dB attenuation
- 350 VDC channel to channel isolation
- 0 to 8 mA excitation, software selectable
- Status LEDs indicate open or shorted sensors
- Standard 10-32 UNF coaxial connections



The DNx-AI-211 includes the accessory board providing the 10-32 UNF connectors and the status LEDs

General Description

The DNA-AI-211 and DNR-AI-211 are high performance, four channel vibration measurement boards for use with UEI's popular Cube and RACKtangle I/O chassis respectively. The board allows direct connection to industry standard 2-wire vibration sensors (e.g. ICP and IEPE). This A/D per channel provided allows all four channels to be sampled simultaneously, allowing vibration data on different channels to be easily correlated in the time domain. The board will sample all four channels up to their maximum 125 kSPS (maximum board throughput of 500 kSPS). Using the Cube/RACKtangles' trigger/sync interface, channels on multiple boards and even in multiple chassis are easily configured to sample simultaneously.

BENEFITS OF UEI'S GUARDIAN SERIES

✓	OVER VOLTAGE PROTECTION
✓	SHORT DETECTION
✓	OPEN INPUT DETECTION

UEI's Guardian series boards include a sophisticated, reliable on-board monitoring system, allowing quick and easy system testing, sensor diagnostics monitoring and fault detection for rapid resolution in field or lab.

Learn more about UEI's Guardian series

The DNx-AI-211 provides exceptional accuracy with signal to noise ratios (SNR) ranging from 110 dB at 1 kSPS to 97 dB at 125 kSPS. The 24-bit converters also provide the dynamic range required to monitor everything from the smallest signals up to a full scale shock on a single input range. However, for extremely low level signals, the AI-211 input amplifier offers 4 different input ranges from +25/-15 VDC to ±2.5 VDC.

Anti-aliasing filtering is provided by a combination of conventional analog and a digital filter inherent in the A/D converter. The allows a combination of low passband ripple (±0.005 dB), steep falloff and low stop band floor (-100 dB) unattainable with simple analog filtering. The digital nature of the filter ensures each filter induces identical phase shift so no filter induced inter-channel phase jitter will impact or corrupt subsequent analysis.

Each of the four input channels is fully electrically isolated from each other, as well as the cube in general. The isolation ensures that input noise is minimized as noise picked up by other channels has no impact on the measurement. The isolation also

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Technical Specifications:

Channel Configurations	
Configuration	4, two wire ICP/IEPE or Voltage inputs
Sampling	Simultaneous (if sampled at identical frequencies)
Isolation	350 VDC (channel-to-channel and channel-to-chassis)
Input Specifications	
Resolution	24-bits
Signal to Noise Ratio	109 dB at 5 kHz, 106 dB at 10 kHz, 100 dB at 50 kHz
Total Harmonic Distortion	-108 dB typical (at 1 kHz)
Sample Rate	1 SPS to 125 kSPS (500 kSPS per board)
Input Coupling	DC or AC (.1 Hz, 1.0 Hz or 10 Hz HP filter)
Input Ranges	+25 to -13, ±12.5, ±5.0, ±2.5 Volt
Input Impedance	10 MΩ, minimum, 40 pF max
Offset Error	< 0.1 mV (5 µV per °C)
Gain Error	0.1% typical, <0.5% (5 ppm per °C)
Integral Nonlinearity (INL)	15 ppm, maximum
Anti-Aliasing Filtering (including both analog & filter in the A/D intself)	
Filter Cutoff Frequency	0.49 times A/D sample frequency (3 db point)
Passband Ripple	±0.005 dB max
Stop Band Attenuation	-100 dB
Stop Band Frequency	0.547 times sample frequency
Bias Current Specifications	
Output Current Range	0.0 to 8 mA ± 1% (software selectable)
Short Circuit Protection	Continuous short will not cause damage
Maximum Output Voltage	25 VDC minimum
Dynamic Output Impedance	500 kΩ minimum
Open/Short Detection	Automatic alarms for both high and low current at user selectable trigger points
Open/Short Annunciators	LEDs adjacent to the 10-32 UNF connectors
General Specifications	
Connections (1 per channel)	Standard 10-32 UNF coaxial connectors
ESD protection	15 kV
Operating temperature	tested -40 °C to +85 °C
Vibration *IEC 60068-2-6* *IEC 60068-2-64*	5 g, 10-500 Hz, sinusoidal 5 g (rms), 10–500 Hz, broad-band random
Shock *IEC 60068-2-27*	100 g, 3 ms half sine, 18 shocks @ 6 orientations 30 g, 11 ms half sine, 18 shocks @ 6 orientations
Humidity	0 to 95%, non-condensing
Altitude	120,000 ft
Power consumption	6.75 W, maximum (Cubes should include DNA-FAN option if multiple AI-211s are installed)
MTBF	250,000 hours

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protects the cube and the reliability of measurements on other channels in the event that a sensor input is shorted externally or if a sensor fails in a way that could impact other measurements through a ground path.

The bias drive current is user selectable from 0 mA to 8 mA. The bias output is also monitored by on board A/D converters, allowing your application to easily determine if a particular sensor is shorted, opened or is otherwise behaving abnormally. Annunciator LEDs mounted adjacent to each channel's I/O connector also illuminate when the measured bias current is outside of the acceptable range. The current output may also be disabled allowing the input to perform standard voltage measurements.

All connections are provided through standard 10-32 UNF coaxial connectors. Like all Cube I/O boards, the DNA-AI-211 offers operation in harsh environments and has been tested to 5 g vibration, 50 g shock, -40 to +85 °C temperatures and altitudes up to 70,000 feet.

A Brief Introduction to Piezoelectric vibration sensing

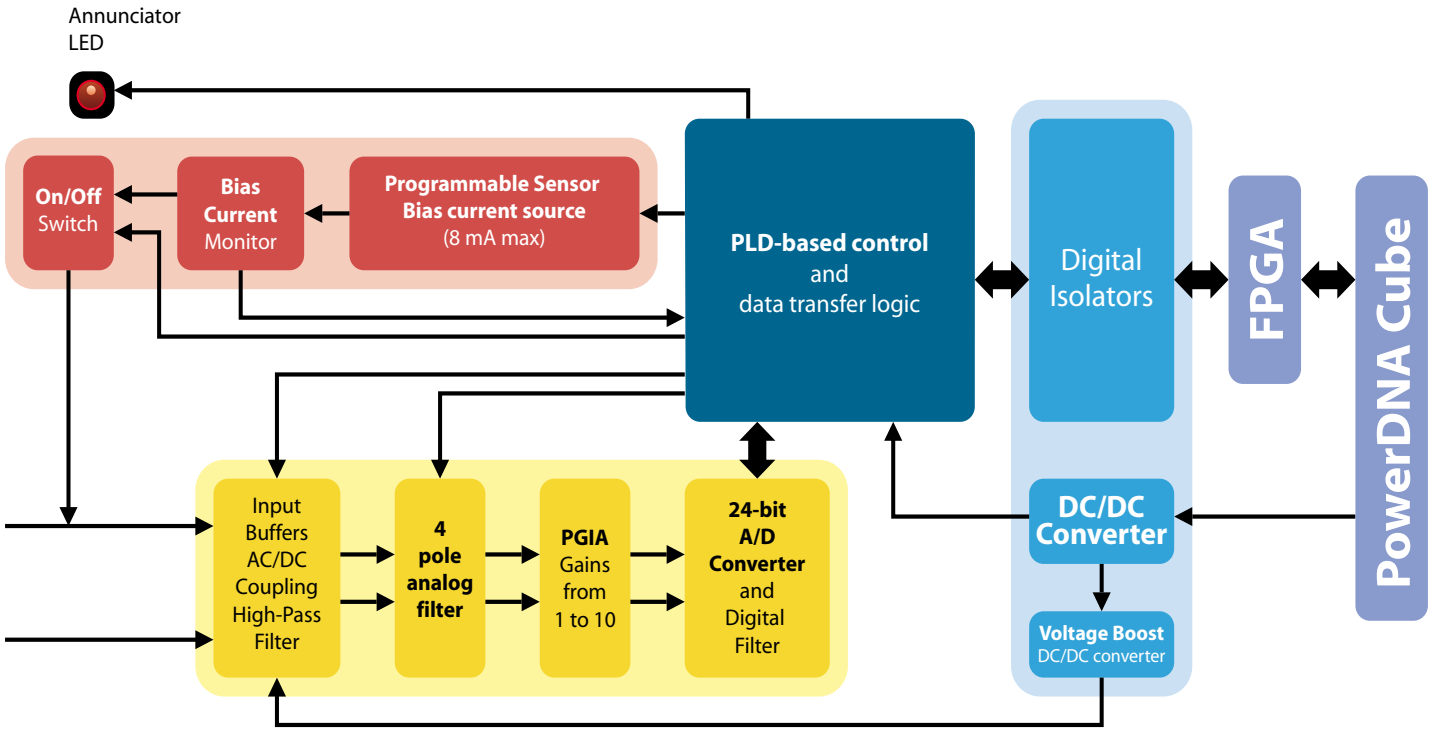
When a piezoelectric crystal is deformed, a small EMF is generated. Measurement of this voltage will determine the extent of the deformation. Sensor manufacturers use different size/shape crystals to provide a wide range of sensors with different scale factors and frequency response.

The most basic sensors just bring the raw voltage generated by the crystal deformation. This is a very small output with very high source. impedance. To monitor this type of sensor, you need a charge amplifier between the sensor and the DAQ board.

ICP/IEPE is the most common type of piezoelectric sensor. ICP/IEPE sensors build the charge amplifier into the sensor itself, which is powered by the current excitation provided by the AI-211. The ICP/IEPE devices have the large advantage that you don't need an intermediate charge amplifier. You simply plug the sensor into the DNx-AI-211. If you want to learn more about the technology, simply Google ICP and/or IEPE.

Many ICP/IEPE sensors have a very wide output dynamic range, well wider than the standard 16-bit resolution available on some boards will support. Prior to the advent of 24-bit converters, automatic gain control (AGC) systems were typically built into the front end of the DAQ board to match the output dynamic range. However these systems were expensive and always induced some sort of error (timing and/or voltage) when switching ranges. For this reason, UEI utilizes 24-bit converters on the DNx-AI-211.

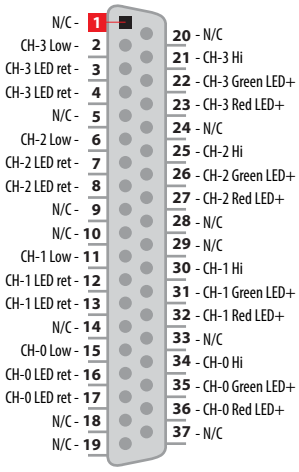
Block Diagram



Each Channel (4 channels per board)

Pinout Diagram: (DNx-AI-211 connector)

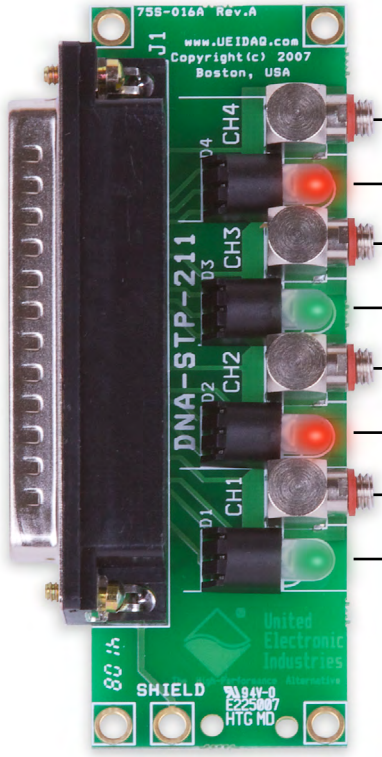
I/O Connector is a 37-pin "D" socket connector



Note: An LED+ pin brought high turns on the LED. For example, if Pin 35 is high, the channel 0 Green LED will be on (OK). If Pin 36 is brought high, the Channel 0 Red LED will be on. (If both are high on the same channel, the LED will be orange. However, this is not a valid state on the DNx-AI-211. The valid states are green, solid red, flashing red.)

Pinout Diagram: Using DNA-STP-211 breakout board (included).

(I/O Connectors are female 10-32 UNF coaxial connectors)



LED Indications

Green - OK
Solid Red - Open Sensor
Flashing Red - Shorted Sensor
Off - Bias current turned off

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Ordering Guide

Part Number	Description
DNx-AI-211	High Peformance 4-Channel, 2-Wire Vibration Measurement Board (Use DNA- prefix for Cube chassis and DNR- for RACKTangle chassis)
DNA-CBL-BNC	10-32 UNF Coaxial to Standard Full-Size BNC Cable/Adaptor (2 foot long)

Extended Warranty	Option to purchase UEI's extended 5 year warranty is available