

General Standards Corporation
High Performance Bus Interface Solutions

PCIe-24DSI12WRCIEPE

24-Bit, 12-Channel, 105KSPS Transducer Input Module

*With 12 Wide-Range Delta-Sigma Input Channels
and IEPE Current Excitation*

Features Include:

- 12 wide-range 24-Bit unbalanced differential simultaneously-sampled analog inputs.
- Supports IEPE (Integral Electronic Piezoelectric) transducers.
- Software-controlled Constant Current IEPE excitation with +24 V compliance, Factory-configurable from 1-8 mA.
- Precision DC and low-noise dynamic performance.
- Software-selectable analog input ranges of ± 10 mV, ± 100 mV, ± 1 V, ± 10 V with DC coupling, and ± 10 V with AC coupling.
- Input sample rates to 105 Kilosamples per second per channel.
- Delta-Sigma input conversion minimizes or eliminates the need for antialias filtering.
- MMCX coaxial connectors for 12 IEPE or voltage input channels.
- Coaxial interface for external clock and sync I/O.
- 105dB dynamic range with no postfiltering.
- Supports multiboard synchronization.
- Software-selectable AC or DC input coupling.
- AC low-frequency cutoff factory-configurable from 0.5-4 Hz.
- 256 K-sample analog input FIFO buffer.
- Continuous and Triggered-Burst sampling modes.
- On-demand internal offset and gain autocalibration of all analog inputs.
- Call for availability in alternate form factors, including PCI and cPCI, as well as 8-channel versions for PC104-Plus, PCIe104-Plus and PMC form factors.

Applications:

- | | | |
|------------------------|-----------------------|---------------------|
| ✓ Accelerometer Arrays | ✓ Voltage Acquisition | ✓ IEPE Conditioning |
| ✓ Transducer Inputs | ✓ Acoustic Analysis | ✓ Sonar Receivers |

PRELIMINARY

REV: 030416

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Overview:

The 12-channel PCIe-24DSI12WRCIEPE analog input module provides high-density 24-bit IEPE analog input resources on a standard PCI Express module. Optimized for flexibility and performance, the board is ideal for a wide variety of applications, ranging from IEPE transducer inputs and precision voltage measurements, to the analysis of complex acoustic signals and waveforms.

Functional Description:

Each of twelve analog input channels contains a lowpass image filter, and a delta-sigma A/D converter that provides inherent antialias suppression and sharp cutoff lowpass filtering. The inputs can be software-configured as either AC-coupled IEPE inputs with excitation current applied, or as high-impedance DC-coupled inputs with or without excitation current.

An internal voltage reference can be applied through all channels to support self-test operations and autocalibration. Gain and offset trimming is performed by applying correction values that are determined during on-demand autocalibration. A linear-phase digital antialiasing filter rejects out-of-band signals, and a lowpass analog filter rejects those interference signals that fall within the harmonic images of the digital filter.

ADC clocking is obtained either from an external hardware source, or internally from an internal sample-rate generator. The internal generator is adjustable over a 2:1 frequency range, and is divided down within the local controller to provide individual channel sample rates from 0.4 KSPS to 105 KSPS in the high-speed clocking mode, or from 0.2 KSPS to 52 KSPS in high-resolution and low-power modes. Conversion data from all active channels is transferred to the PCI Express bus through a 256 K-sample data buffer that is supported by two DMA channels. Multiple boards can be synchronized to perform simultaneous sampling with external sync and clock connections.

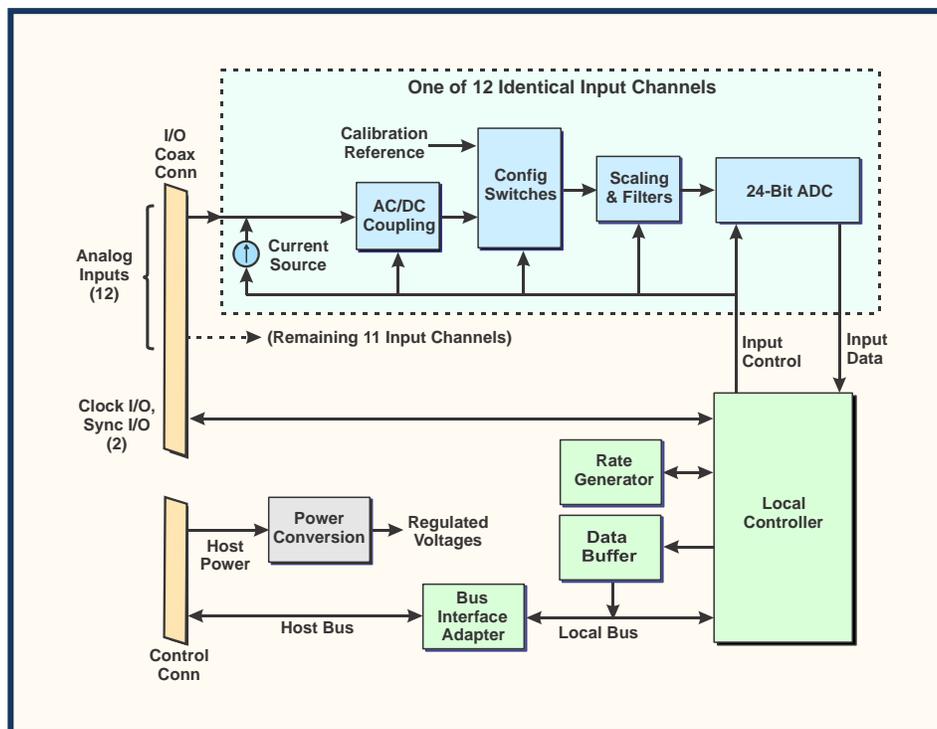


Figure 1. PCIe-24DSI12WRCIEPE; Functional Organization

This product is functionally compatible with the PCI Express Specification revision 1.0a. System input/output connections are made at the front panel through 14 coaxial connectors; 12 for the analog inputs and two for external clock and sync I/O. Power requirements consist of +3.3 VDC and +12 VDC, in compliance with the PCI Express specification, and operation over the specified temperature range is achieved with conventional air cooling.

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FUNCTIONAL SPECIFICATIONS

Typical at +25 °C, with specified operating conditions.

Input Characteristics:

Configuration:	12 coaxial channels; Unbalanced differential IEPE inputs with a high-impedance signal center conductor, and the shield grounded through 50 Ohms. 8 and 4-channel configurations also are available.
Voltage Range:	Software Configurable as ± 10 V, ± 1 V, ± 100 mV or ± 10 mV with DC coupling, or ± 10 V with AC coupling. AC or DC coupling is software-selectable..
Input Impedance:	Signal Input (Center conductor): 1.0 Megohm, in parallel with 40 pF. Shield: 50 Ohms in parallel with 0.1 μ F.
Excitation Source:	Software-enabled current source: Standard 4.0 mA \pm 2.5%. Options available from 1 to 8 mA. Minimum dynamic impedance: 350 Kohms. Compliance: -5 V to +24 V. Maximum current noise: 1 nArms, 10 Hz to 50 kHz.
Common Mode Rejection:	Shield: 80 dB to 15 kHz on ± 10 V range; 95 dB on lower ranges.
Common Mode Range:	± 2 Volts, limited by maximum shield voltage.
Overvoltage Protection:	Signal inputs: AC coupling: ± 36 -Volt transients with power applied; ± 40 Volts with power removed. DC coupling: ± 15 V. Shield inputs are protected to ± 3 Volts.

Transfer Characteristics:

Conversion Architecture:	24-Bit Delta-Sigma.															
Sample Rate:	0.4-105 kilosamples per second per channel in high-speed mode, 0.2-52 kilosamples per second in high-resolution and low-power modes.															
Oversampling Factor:	x128 in high-resolution mode: x64 in high-speed and low-power modes.															
DC Accuracy: (Mean composite error after autocalibration)	<table><thead><tr><th>Input Range</th><th>Midrange (Zero) Accuracy</th><th>Gain Accuracy</th></tr></thead><tbody><tr><td>± 10 V</td><td>± 1.0 mv</td><td>± 6.0 mv</td></tr><tr><td>± 1 V</td><td>± 0.3 mv</td><td>± 1.0 mv</td></tr><tr><td>± 100 mV</td><td>± 0.08 mv</td><td>± 0.20 mv</td></tr><tr><td>± 10 mV</td><td>± 0.02 mv</td><td>± 0.05 mv</td></tr></tbody></table>	Input Range	Midrange (Zero) Accuracy	Gain Accuracy	± 10 V	± 1.0 mv	± 6.0 mv	± 1 V	± 0.3 mv	± 1.0 mv	± 100 mV	± 0.08 mv	± 0.20 mv	± 10 mV	± 0.02 mv	± 0.05 mv
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-3 dB Bandwidth	DC-Coupled: DC to 49 percent of the selected sample rate. AC-Coupled: Upper cutoff frequency to 49 percent of the selected sample rate. Standard AC low-end cutoff frequency = 2 Hz. Options available from 0.5-4 Hz.															
Passband Ripple:	± 0.02 dB maximum.															
Stopband threshold:	55 percent of the selected sample rate.															
Stopband Attenuation:	98 dB.															
Integral Nonlinearity (INL)	0.001 percent of fullscale range.															
No Missing Codes	24 Bits.															
Dynamic Range:	103 dB; typical in high-resolution mode, 100 dB in all other modes.															
SINAD:	± 10 V Range: 100dB to 20 kHz; 85 dB typical to 50 kHz. ± 10 mV Range: 80dB to 1 kHz; 60 dB typical to 5 kHz.															
Interchannel Crosstalk:	-96 dB typical to 40 kHz															
Phase Skew:	Less than 100 ns (0.1-Degree for Fsig = 5 kHz), with Fsig/Fsamp <0.35; channel-channel (board-board for multiboard configurations), excluding noise, with high-frequency image filter.															
Antialias Filtering:	Each ADC provides linear-phase digital lowpass filtering as indicated for "passband" and "stopband". In addition to the digital filter, a 2 nd -order Butterworth lowpass analog image filter in each channel provides a -3 dB cutoff frequency of approximately 150kHz to suppress images from the digital filter. Optional alternative image filter frequencies are available.															

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Operating Modes and Controls:

Organization:	All input channels operate at the same sample rate, controlled by division of an internal or external rate generator frequency.
Sampling Clock I/O:	The sampling clock can be derived either from an internal rate generator, or from a TTL external hardware input. Multiple boards can be locked to a common clock by multidropping ('star' configuration) the output clock from an external source to the input clock of the next board in the chain.
Internal Rate Generator:	An internal PLL rate generator provide sample rates from 0.2 KSPS to 105 KSPS. The frequency of the generator is controlled by the ratio of two 10-Bit integers, and setting accuracy is 25 PPM.
Synchronization:	'Star-configuration' hardware sync inputs can be used to synchronize sampling among multiple boards.
Burst Timing:	Triggered burst sampling can be initiated either internally from an internal rate generator, or externally using the Sync input.
Data Format:	Software-selectable as either offset binary or two's complement. Width of the data field is selectable as 16, 18, 20 or 24 bits.
Channel Tags:	A 4-bit channel tag is appended to each input data value.
Buffer Access:	The input buffer FIFO is accessed through either of two DMA channels, with both block-mode and demand-mode transfers supported.
Auxiliary External Sync I/O:	A 6-pin connector on the back of the module provides clock and sync I/O capability within the enclosure.

PCIe Compatibility:

Conforms to PCI Express Specification revision 1.0a.
DMA transfers as bus master with two DMA channels.

Power Requirements:

+3.3VDC \pm 0.2 VDC from the PCIe bus, 0.9 Amps typical, 1.0 Amps maximum.
+12VDC \pm 0.4 VDC from the PCIe bus, 0.5 Amps typical, 0.6 Amps maximum.
Total power consumption: 9.4 Watts typical, 11 Watts maximum.

Physical Dimensions::

Height: 110.1 mm (4.37 in)
Width: 18.7 mm (0,74 in) not including bracket..21.6 mm (0.85 in) with Bracket.
Depth: 174.63 mm (6.60 in)

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Environmental Specifications:

Ambient Temperature Range:	
Standard Temperature:	Operating: 0 to +70 Degrees Celsius * Storage: -40 to +85 Degrees Celsius
Extended Temperature:	Operating: -40 to +80 Degrees Celsius * Storage: -40 to +85 Degrees Celsius * Air temperature at board surface.
Relative Humidity:	0 to 95%, non-condensing
Altitude:	Operation to 10,000 ft.
Cooling:	Conventional air cooling; 150 LFPM

Ordering Information:

Specify the basic product model number followed by an option suffix "-A-B-C-D-E", as indicated below. For example, model number **PCIe-24DSI12WRCIEPE-12-150K-2HZ-4MA-0** describes a PCI Express module with 12 input channels, standard 150 kHz image filter frequency, 2 Hz AC cutoff frequency, 4 mA excitation current, and no custom features. For industrial (extended) temperature operation, add "-I" at the end of the model number.

Optional Parameter	Value	Specify Option As:
Number of Input Channels	4 Channels	A = 4
	8 Channels	A = 8
	12 Channels	A = 12
Image Filter -3dB Frequency ^{1,2}	150kHz is standard	B = 150K
	Custom Frequency ³	B = xK ("x" = frequency in kHz)
AC Coupling Cutoff Frequency ²	2 Hz is standard; 0.5, 1, 2 or 4 Hz options available. ³	C = xHZ ("x" = Frequency in Hz)
Excitation Current	4 mA is standard; 1, 2, 4 or 8 mA options available. ³	D = xMA ("x" = Current in mA)
Custom Features	'No custom features' is standard	E = 0

¹ "x" indicates filter frequency in kilohertz; 1kHz-300kHz.

² ±15% frequency accuracy.

³ Contact Sales for availability of custom values.

SYSTEM I/O CONNECTIONS

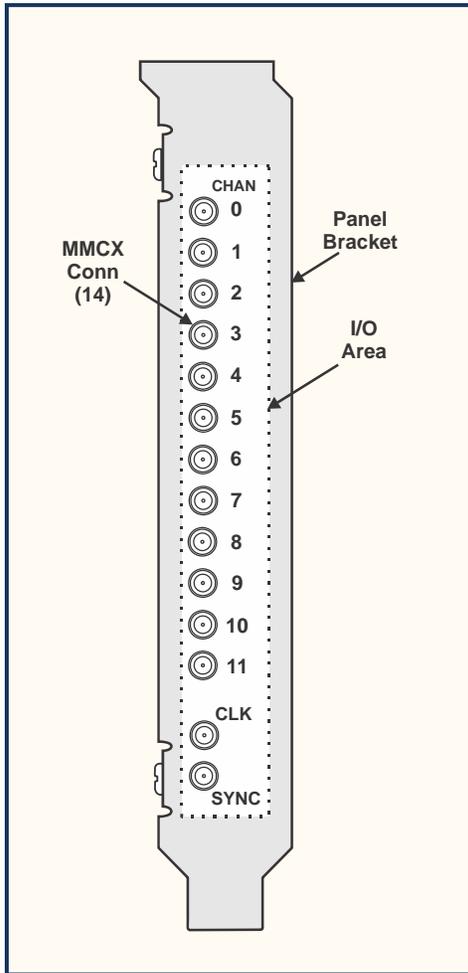


Figure 2. System I/O Panel Bracket

System I/O Panel Mating Connectors:

Standard MMCX Coaxial cable plug:

Examples: (Straight cable plug, crimp or solder):

Emerson 135-3402-001 (RG-178).

Emerson 135-3403-001 (RG-316),
(O.D. can exceed 0.16 in; 4mm)

Table 2. Internal Aux Sync I/O Connector

PIN	SIGNAL
1	DIGITAL RTN
2	AUX CLOCK
3	DIGITAL RTN
4	AUX SYNC
5	DIGITAL RTN
6	Reserved. Ground or leave disconnected.

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