Detailed Specifications

For user manuals and dimensional drawings, visit the product page resources tab on ni.com.

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NI PXIe-4330

Data Acquisition with Integrated Signal Conditioning for Bridge-Based Measurements

- 8 simultaneously sampled analog input channels
- 25 kS/s/ch sampling rate; 24-bit ADC per channel; antialias filtering
- 0.02% of reading typical accuracy
- Software-selectable excitation voltage per channel (0.625 V to 10 V)

- Bult-in programmable quarter-, half-, and full-bridge completion per channel
- Software-selectable shunt calibration options per channel
- Multidevice triggering and synchronization via PXI Express
- Supported by NI-DAQmx driver software

Overview

The NI PXIe-4330 simultaneous bridge input module provides data acquisition with integrated signal conditioning for measuring bridge-based sensors, such as strain gages, load cells, and pressure transducers. It features eight channels with 24-bit analog-to-digital converters (ADCs) per channel and 25 kS/s sampling rate for simultaneous high-speed measurements. To remove noise, each module offers antialiasing and digital filters per channel. Each channel also features an independent programmable 0.625 to 10 V excitation voltage. Additionally, the NI PXIe-4330 provides remote sensing, internal bridge completion, and shunt calibration options per channel. The NI PXIe-4330 is intended to be used with the NI TB-4330 front-mounting terminal block for screw terminal connectivity.

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Comparison Tables

| Module	Channels	Max Sample Rate (kS/s/ch)	Resolution (bits)	Bridge Type
NI PXIe-4330	8	25	24	1/4, 1/2, Full
NI PXIe-4331	8	102.4	24	1/4, 1/2, Full

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Application and Technology

Integrated Signal Conditioning

By combining signal conditioning and analog-to-digital converters (ADCs) on the same device, the NI PXIe-4330 bridge input module delivers a smaller footprint and higher measurement performance. Integrated signal conditioning also provides simplified cable management and calibration due to fewer components, which drastically reduces the installation and maintenance cost of a high-channel-count measurement system.

Ratiometric Bridge-Based Measurements

Many sensors including strain-gages, load cells, pressure sensors, and torque sensors are based on the concept of a Wheatstone bridge. The output of a Wheatstone bridge is measured between the middle nodes of the two voltage dividers. The output voltage of the bridge scales with the excitation voltage. However, the ratio of the bridge output (VCH) and the excitation voltage (VEX) remains fixed over variations in excitation voltage, and it is this unitless ratio (VCH/VEX) that is of interest. To accurately measure the ratiometric output of a bridge based sensor both the bridge output voltage (VCH) and the excitation voltage must be known.

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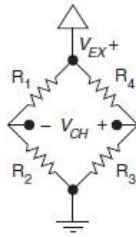
The NI PXIe-4330 bridge input module uses circuitry that continuously measures the excitation voltage and applies it as a reference to its analog-to-digital converter (ADC). In this way, variations in the excitation voltage are compensated for, and the module returns data as a ratio of the bridge output voltage and the excitation voltage. This approach removes the measurement's dependence on the stability and accuracy of the excitation voltage. Due to the ratiometric design, measurements with the PXIe-4330 bridge input module will be less susceptible to temperature drift and other variations in the excitation voltage.

PXI Express Dedicated Data Throughput

The SC Express modules are built on the x1 PXI Express bus with dedicated bandwidth per device up to 250 MB/s. Because of the added bandwidth provided by PXI Express, SC Express modules offer simultaneous sampling options using the same channel counts and connectivity as multiplexed devices. Unlike multiplexed devices that reduce sampling rates, you can use simultaneous sampling devices to maintain sampling rates as you expand the number of channels.

PXI Platform Advanced Timing and Synchronization

PXI Express provides advanced timing and synchronization features, including a 100 MHz differential system clock, differential signaling, and differential star triggers. By using differential clocking and synchronization, PXI Express systems benefit from increased noise immunity for instrumentation clocks and the ability to transmit at higher-frequency rates. The SC Express family leverages PXI Express to deliver tight synchronization between modules in one chassis or multiple chassis.

Wide Variety of I/O on the PXI Platform

When combined with more than 1500 I/O types in the PXI platform, this module offers the flexibility needed to develop a measurement system that meets your application needs. PXI modules are compatible with the CompactPCI and CompactPCI Express industrial computer standards and offer additional features such as environmental specifications, standardized software, and built-in timing and synchronization.

Connectivity

The NI PXIe-4330 is designed to be used with the NI TB-4330 front-mounting terminal block. The SC Express terminal blocks are hot-swappable and automatically recognized in software. This makes troubleshooting easier because you can connect and remove terminal blocks without powering down the PXI measurement system. Each terminal block also includes alignment fins that guide the connector onto the PXI Express module without bent pins.

Software Recommendations

LabVIEW Professional Development System for Windows
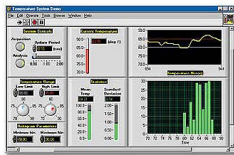
- Advanced software tools for large project development
- Automatic code generation using DAQ Assistant and Instrument I/O Assistant
- Tight integration with a wide range of hardware
- Advanced measurement analysis and digital signal processing
- Open connectivity with DLLs, ActiveX, and .NET objects
- Capability to build DLLs, executables, and MSI installers

Support and Services

System Assurance Programs

NI system assurance programs are designed to make it even easier for you to own an NI system. These programs include configuration and deployment services for your NI PXI, CompactRIO, or Compact FieldPoint system. The NI Basic System Assurance Program provides a simple integration test and ensures that your system is delivered completely assembled in one box. When you configure your system with the NI Standard System Assurance Program, you can select from available NI system driver sets and application

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development environments to create customized, reorderable software configurations. Your system arrives fully assembled and tested in one box with your software preinstalled. When you order your system with the standard program, you also receive system-specific documentation including a bill of materials, an integration test report, a recommended maintenance plan, and frequently asked question documents. Finally, the standard program reduces the total cost of owning an NI system by providing three years of warranty coverage and calibration service. Use the online product advisors at ni.com/advisor to find a system assurance program to meet your needs.

Calibration

NI measurement hardware is calibrated to ensure measurement accuracy and verify that the device meets its published specifications. To ensure the ongoing accuracy of your measurement hardware, NI offers basic or detailed recalibration service that provides ongoing ISO 9001 audit compliance and confidence in your measurements. To learn more about NI calibration services or to locate a qualified service center near you, contact your local sales office or visit ni.com/calibration.

Technical Support

Get answers to your technical questions using the following National Instruments resources.

- **Support** - Visit ni.com/support to access the NI KnowledgeBase, example programs, and tutorials or to contact our applications engineers who are located in NI sales offices around the world and speak the local language.
- **Discussion Forums** - Visit forums.ni.com for a diverse set of discussion boards on topics you care about.
- **Online Community** - Visit community.ni.com to find, contribute, or collaborate on customer-contributed technical content with users like you.

Repair

While you may never need your hardware repaired, NI understands that unexpected events may lead to necessary repairs. NI offers repair services performed by highly trained technicians who quickly return your device with the guarantee that it will perform to factory specifications. For more information, visit ni.com/repair.

Training and Certifications

The NI training and certification program delivers the fastest, most certain route to increased proficiency and productivity using NI software and hardware. Training builds the skills to more efficiently develop robust, maintainable applications, while certification validates your knowledge and ability.

- **Classroom training in cities worldwide** - the most comprehensive hands-on training taught by engineers.
- **On-site training at your facility** - an excellent option to train multiple employees at the same time.
- **Online instructor-led training** - lower-cost, remote training if classroom or on-site courses are not possible.
- **Course kits** - lowest-cost, self-paced training that you can use as reference guides.
- **Training memberships** and training credits - to buy now and schedule training later.

Visit ni.com/training for more information.

Extended Warranty

NI offers options for extending the standard product warranty to meet the life-cycle requirements of your project. In addition, because NI understands that your requirements may change, the extended warranty is flexible in length and easily renewed. For more information, visit ni.com/warranty.

OEM

NI offers design-in consulting and product integration assistance if you need NI products for OEM applications. For information about special pricing and services for OEM customers, visit ni.com/oem.

Alliance

Our Professional Services Team is comprised of NI applications engineers, NI Consulting Services, and a worldwide National Instruments Alliance Partner program of more than 700 independent consultants and integrators. Services range from start-up assistance to turnkey system integration. Visit ni.com/alliance.

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Detailed Specifications

This document lists specifications for the NI PXIe-4330 module. These specifications are typical for the range of 0 °C to 55 °C unless otherwise stated. The system must be allowed to warm up for 15 minutes to achieve the rated accuracy. All specifications are subject to change without notice. Visit ni.com/manuals for the most current specifications and product documentation.

⚠️ **Caution** The inputs of this sensitive test and measurement product are not protected from electromagnetic interference for functional reasons. As a result, this product may experience reduced measurement accuracy or other temporary performance degradation when cables are attached in an environment with electromagnetic interference present. Refer to the Declaration of Conformity (DoC) for this product for details of the standards applied to assess electromagnetic compatibility performance. To obtain the DoC, visit ni.com/certification, search by model number or product line, and click the appropriate link in the Certification column.

📝 **Note** Keep the filler panels on all unused slots in your chassis to maintain forced air cooling.

Input Characteristics	
Number of channels	8 analog input channels
ADC resolution	24 bits
Type of ADC	Delta-Sigma (with analog prefiltering)
Sampling mode	Simultaneous

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Input Ranges	
$V_{ex} \leq 2.5$ V	±100 mV/V
$V_{ex} \geq 2.75$ V	±25 mV/V
Common-mode voltage input range (V_{cm})	±2V
FIFO buffer size	1,022 samples
Data transfers	Direct memory access (DMA), Programmed I/O
Sample rates (f_s)	1 to 100 S/s in 1 S/s increments, 100 to 25.6 kS/s in 100 S/s increments

Fault protection (powered On or Off)	
Signal	**Level**
AI ±<0..7>, RS ±<0..7>, T ±<0..7>	±30 V to GND
EX ±<0..7>	Short-circuit protected
QTR/SC <0..7>	None
RSVD	±24 V to GND

Bridge Completion

Modes	Full, half, and quarter
Selection	Software selectable, per channel
Half-bridge completion	
Tolerance	±500 µV/V max
Stability	2.5 µV/V per °C max
Quarter-bridge completion	
Values	120 Ω, 350 Ω, 1 kΩ
Tolerance	0.1% max
Stability	10 ppm/°C max

Excitation Characteristics

Selection	Software selectable, per channel
Excitation type	Constant differential voltage (balanced)
Values (V_{ex})	0.625 V, 1 V, 1.5 V, 2 V, 2.5 V, 2.75 V, 3.3 V, 5 V, 7.5 V, 10 V
Tolerance	±0.5% ±83 mV max
Minimum current	29 mA

Maximum voltage excitation settings versus bridge configurations		
Bridge Resistance (individual element)	**Bridge Configuration**	**V_{ex} (max)**
120 Ω	Full	3.3 V
	Half and Quarter	5 V
350 Ω	Full	10 V
	Half and Quarter	10 V
1 kΩ	Full	10 V
	Half and Quarter	10 V

Excitation noise	250 µV$_{rms}$ (bandwidth = 50 kHz)
Short-circuit protection	EX to GND and between terminals

Shunt Calibration

Selection	Software selectable, per channel
Location	Internal across quarter-bridge completion, External referenced to negative excitation
Values	33.333 kΩ, 50 kΩ, 100 kΩ
Tolerance	0.1% max
Stability	10 ppm/°C max

Accuracy [1]

Accuracy table				
Measurement Conditions*	Range: ±25 mV/V		Range: ±100 mV/V	
	Gain Error (% of Reading)	Offset Error (µV/V)	Gain Error (% of Reading)	Offset Error (µV/V)
typ (23 °C ±5 °C)	0.02%	19 µV/V$_{ex}$	0.02%	30 µV/V$_{ex}$
max (23 °C ±5 °C)	0.05%	108 µV/V$_{ex}$	0.05%	168 µV/V$_{ex}$
max (0 °C to 55 °C)	0.1%	198 µV/V$_{ex}$	0.1%	258 µV/V$_{ex}$
* Before offset null or shunt calibration, −0.1 V ≤ V$_{cm}$ ≤ 0.1 V				

Gain stability	12 ppm/°C max
Offset stability	4.5 µV/V$_{ex}$ per °C max
CMRR (DC to 1 kHz)	85 dB
Spurious free dynamic range (SFDR)	
1 kHz, −60 dB FS	100 dB
Total harmonic distortion (THD)	
1 kHz, −1 dB FS	−88 dB
Crosstalk (f_{in} = 10 kHz, not including cable effects)	−100 dB

Input noise	
Excitation Voltage	Total (µV/V$_{rms}$), f_s = 25.6 kS/s, 350 Ω Full Bridge
0.625 V	2.97
1 V	1.84
1.5 V	1.23
2 V	0.92
2.5 V	0.74
2.75 V	0.67
3.3 V	0.56
5 V	0.37
7.5 V	0.25
10 V	0.18

Channel-to-channel matching		
Input Signal Frequency (f_{in})	Gain (max)	Phase (max)
0 to 10 kHz	0.12%	(0.032°/kHz) · f_{in}

Phase linearity (f_{in} = 0 to 10 kHz)	±0.05° max

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Digital filter group delay [2]	
Sample Rate (f_s)	Filter Delay (Samples)
12.9 kS/s ≤ f_s ≤ 25.6 kS/s	36
6.5 kS/s ≤ f_s ≤ 12.8 kS/s	34
3.3 kS/s ≤ f_s ≤ 6.4 kS/s	33
26 S/s ≤ f_s ≤ 3.2 kS/s	32
13 S/s ≤ f_s ≤ 25 S/s	17
9 S/s ≤ f_s ≤ 12 S/s	11
7 S/s, 8 S/s	9
6 S/s	7
4 S/s, 5 S/s	6
3 S/s	5
2 S/s	3
1 S/s	2

Analog input delay	1.1 µs

Bandwidth and Alias Rejection

Passband	
Frequency (for 26 S/s ≤ f_s ≤ 25.6 kS/s)	$0.40 \cdot f_s$
Flatness	0.05 dB max
Stopband	
Frequency	$0.55 \cdot f_s$
Rejection	100 dB
Alias-free bandwidth	$0.45 \cdot f_s$
Minimum frequency for ADC alias hole	1.6384 MHz
Rejection at alias hole	53 dB

Transducer Electronic Data Sheet (TEDS) Support

Number of channels	8

Internal Frequency Timebase Characteristics

Frequency	100 MHz
Accuracy	±50 ppm

Synchronization

Reference clock source	Onboard 100 MHz clock, Backplane PXIe_CLK100

Triggers

Analog trigger	
Source	AI <0..7>
Purpose	Reference trigger only
Level	Full scale (depending on input range), programmable
Mode	Rising-edge, Rising-edge with hysteresis, Falling-edge, Falling-edge with hysteresis, Entering Window, Leaving Window
Resolution	24-bits

Digital trigger	
Source	PXI_TRIG<0..7>, PXI_STAR, PXIe_DSTAR<A..B>
Purpose	Start or reference trigger
Polarity	Software-selectable
Debounce filter settings	Disable, 90 ns, 5.12 μs, 2.56 ms, custom interval
Output timing signals	
Sources	Sample Clock, Start Trigger Out, Reference Trigger Out
Destinations	PXI_TRIG<0..7>, PXIe_DSTAR C
Polarity	Software-selectable

Output Timing Signals

Sources	Sample Clock, Start Trigger Out, Reference Trigger Out
Destinations	PXI_TRIG<0..7>, PXIe_DSTAR C
Polarity	Software-selectable

Bus Interface

Form factor	x1 PXI Express peripheral module, Specification rev 1.0 compliant
Slot compatibility	x1 and x4 PXI Express or PXI Express hybrid slots
DMA channels	1, analog input

Calibration

You can obtain the calibration certificate and information about calibration services for the NI PXIe-4330 at ni.com/calibration.

Recommended warm-up time	15 minutes
Calibration interval	1 year

Power Requirements

+12 V	1.3 A
+3.3 V	1.1 A

Physical Requirements

Dimensions	Standard 3U PXIe, 16 × 10 cm (6.3 × 3.9 in.)
Weight	152 g (5.3 oz)
I/O connector	96-pin male DIN 41612/IEC 60603-2 connector.

Environmental Specifications

Maximum altitude	2,000 m (800 mbar), (at 25 °C ambient temperature)
Pollution Degree	2
Indoor use only	

Operating Environment

Ambient temperature range	0 to 55 °C (Tested in accordance with IEC-60068-2-1 and IEC-60068-2-2. Meets MIL-PRF-28800F Class 3 low temperature limit and MIL-PRF-28800F Class 2 high temperature limit.)
Relative humidity range	10% to 90%, noncondensing (Tested in accordance with IEC-60068-2-56.)

Storage Environment

Ambient temperature range	–40 to 71°C (Tested in accordance with IEC-60068-2-1 and IEC-60068-2-2. Meets MIL-PRF-28800F Class 3 limits.)
Relative humidity range	5% to 95%, noncondensing (Tested in accordance with IEC-60068-2-56.)

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Shock and Vibration	
Operating shock	30 g peak, half-sine, 11 ms pulse (Tested in accordance with IEC-60068-2-27. Meets MIL-PRF-28800F Class 2 limits.)
Random vibration	
Operating	5 to 500 Hz, 0.3 g_{rms}
Non-operating	5 to 500 Hz, 2.4 g_{rms} (Tested in accordance with IEC-60068-2-64. Nonoperating test profile exceeds the requirements of MIL-PRF-28800F, Class 3.)

Safety

This product is designed to meet the requirements of the following standards of safety for electrical equipment for measurement, control, and laboratory use:

- IEC 61010-1, EN 61010-1
- UL 61010-1, CSA 61010-1

Note For UL and other safety certifications, refer to the product label or the *Online Product Certification* section.

Measurement Category	I

Caution Do *not* use for measurements within Measurement Categories II, III, or IV.

Electromagnetic Compatibility

This product meets the requirements of the following EMC standards for electrical equipment for measurement, control, and laboratory use:

- EN 61326-2-1 (IEC 61326-2-1): Class A emissions; Basic immunity
- EN 55011 (CISPR 11): Group 1, Class A emissions
- AS/NZS CISPR 11: Group 1, Class A emissions
- FCC 47 CFR Part 15B: Class A emissions
- ICES-001: Class A emissions

Note For the standards applied to assess the EMC of this product, refer to the *Online Product Certification* section.

Note For EMC compliance, operate this device with shielded cables and accessories.

CE Compliance $C \epsilon$

This product meets the essential requirements of applicable European Directives, as amended for CE marking, as follows:

- 2006/95/EC; Low-Voltage Directive (safety)
- 2004/108/EC; Electromagnetic Compatibility Directive (EMC)

Online Product Certification

To obtain product certifications and the DoC for this product, visit ni.com/certification, search by model number or product line, and click the appropriate link in the Certification column.

Environmental Management

NI is committed to designing and manufacturing products in an environmentally responsible manner. NI recognizes that eliminating certain hazardous substances from our products is beneficial not only to the environment but also to NI customers.

For additional environmental information, refer to the *NI and the Environment* Web page at ni.com/environment. This page contains the environmental regulations and directives with which NI complies, as well as other environmental information not included in this document.

Waste Electrical and Electronic Equipment (WEEE)

EU Customers At the end of the product life cycle, all products *must* be sent to a WEEE recycling center. For more information about WEEE recycling centers, National Instruments WEEE initiatives, and compliance with WEEE Directive 2002/96/EC on Waste Electrical and Electronic Equipment, visit ni.com/environment/weee.htm.

电子信息产品污染控制管理办法 （中国 **RoHS**）

中国客户 National Instruments 符合中国电子信息产品中限制使用某些有害物质指令 (RoHS)。
关于 National Instruments 中国 RoHS 合规性信息，请登录 ni.com/environment/rohs_china。
(For information about China RoHS compliance, go to ni.com/environment/rohs_china.)

[1] Accuracies listed are warranted for the conditions described in the table above and for up to one year from the module external calibration.

[2] Digital Filter Group Delay defines the maximum amount of time required after the digitization of a sample begins until the sample is available to be read. The Sample Clock generated by this device for exporting across the NI PXIe backplane is not affected by the Digital Filter Group Delay.

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