SPECIFICATIONS

PXIe-4310

8-channel, 16-bit, 400 kS/s/ch, Ch-Ch Isolated Analog Input Module

This document lists specifications for the PXIe-4310 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.

Note   To maintain forced air cooling in the PXI Express system, refer to the *Maintain Forced-Air Cooling Note to Users*.

Caution   Maximum voltage for all analog inputs is ±11 V for all ranges.

Terminology

Maximum and *minimum* specifications characterize the warranted performance of the instrument within the recommended calibration interval and under the stated operating conditions. These specifications are subject to production verification or guaranteed by design.

Typical specifications are specifications met by the majority of the instruments within the recommended calibration interval and under the stated operating conditions, based on measurements taken during production verification and/or engineering development. The performance of the instrument is not warranted.

Supplemental specifications describe the basic function and attributes of the instrument established by design and are not subject to production verification. They provide information that is relevant for the adequate use of the instrument that is not included in the previous definitions.

All performance specifications are *typical* unless otherwise noted. These specifications are valid within the full operating temperature range.

Safety Guidelines for Hazardous Voltages

If hazardous voltages are connected to the module, take the following precautions. A hazardous voltage is a voltage greater than 42.4 V_{pk} or 60 VDC to earth ground.

⚠️ **Caution** Ensure that hazardous voltage wiring is performed only by qualified personnel adhering to local electrical standards.

⚠️ **Caution** You must install mating connectors according to local safety codes and standards and according to the specifications provided by the manufacturer. You are responsible for verifying the safety compliance of third-party connectors and their usage according to the relevant standard(s), including UL and CSA in North America and IEC and VDE in Europe.

⚠️ **Caution** Make sure that devices and circuits connected to the module are properly insulated from human contact.

⚠️ **Caution** When module terminals are hazardous voltage LIVE (>42.4 V_{pk} /60 VDC), you must ensure that devices and circuits connected to the module are properly insulated from human contact.

⚠️ **Caution** Do not mix hazardous voltage circuits and human-accessible circuits on the same module.

Analog Input

Number of channels ....8 differential

ADC resolution ....16 bits

DNL ....No missing codes guaranteed

INL ....Refer to the *AI Absolute Accuracy* section.

Sampling rate

    Maximum ....400 kS/s per channel

    Minimum ....No minimum

    Timing accuracy ....50 ppm of sample rate

    Timing resolution ....10 ns

Input coupling ....DC

PXIe-4310 or TB-4310 (10V)

    Voltage measurement range
    (software-selectable per channel) ....±10 V, ±5 V, ±2 V, ±1 V

Maximum working voltage (signal + common mode)

Maximum Working Voltage (Signal + Common Mode)	
Range	Working Voltage
10 V	±11 V
5 V	±10.5 V
2 V	±9 V
1 V	±8.5 V

CMRR (to 60 Hz) .... 130 dB

Bandwidth (small signal, -3 dB) .... 950 kHz

Filtering

Lowpass (software-selectable
per channel) .... 10 kHz, 100 kHz, disable

Cut-off frequency tolerance .... ±5%

Filter type .... 2nd order Butterworth

Input impedance

Device on[1]

AI+ to AI COM .... >1 GΩ in parallel with 50 pF

AI- to AI COM .... >1 GΩ in parallel with 50 pF

Device off

AI+ to AI COM .... 5 kΩ

AI- to AI COM .... 5 kΩ

Input bias current .... ±100 pA

Input FIFO size .... 8,190 samples shared among channels used

Data transfers .... DMA (scatter-gather), programmed I/O

Fault protection (powered on)

Between AI+ and AI- .... ±60 V

Between any AI and COM .... ±60 V

Between PFI or RSVD lines and COM .... ±24 V

Input current during fault conditions .... ±0.5 mA max/AI pin

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[1] The impedance given is for the PXIe-4310 module only. Refer to the *PXIe-4310 and TB-4310 (10V)/TB-4310 (600V) Getting Started Guide and Terminal Block Specifications* for terminal block impedance information.

AI Absolute Accuracy

INL error ....51 ppm of range

Nominal Range		Residual Gain Error (ppm of Reading)	Residual Offset (ppm of Range)	Offset Tempco (ppm of Range/°C)	Random Noise σ (µV$_{rms}$)	Absolute Accuracy at Full Scale (µV)
Positive Full Scale	Negative Full Scale					
10	-10	110	16	9	171	2495
5	-5	111	21	9	91	1278
2	-2	114	42	10	49	561
1	-1	120	75	13	38	323

Note   Accuracies listed are valid for up to two years from the module external calibration.

Stability

Reference tempco ....5 ppm/°C

Gain drift...13 ppm/°C

AI Absolute Accuracy Equation

*AbsoluteAccuracy = Reading * (GainError) + Range * (OffsetError) + NoiseUncertainty*

*GainError = ResidualAIGainError + GainTempco * (TempChangeFromLastInternalCal) + ReferenceTempco * (TempChangeFromLastExternalCal)*

*OffsetError = ResidualAIOffsetError + OffsetTempco * (TempChangeFromLastInternalCal) + INL_Error*

$$NoiseUncertainty = \frac{RandomNoise * 3}{\sqrt{10000}}$$

For a coverage factor of 3 sigma and averaging 10000 points.

AI Absolute Accuracy Example

Absolute accuracy at full scale on the analog input channels is determined using the following assumptions:

- *TempChangeFromLastExternalCal* = 10 °C
- *TempChangeFromLastInternalCal* = 1 °C
- *number_of_readings* = 10000
- *CoverageFactor* = 3 σ

For example, on the 10 V range, the absolute accuracy at full scale is as follows:

GainError = 110 ppm + 13 ppm * 1 °C + 5 ppm * 10 °C = 173 ppm of reading

OffsetError = 16 ppm + 9 ppm * 1 °C + 51 ppm = 76 ppm of range

$$NoiseUncertainty = \frac{171\,\mu V * 3}{\sqrt{10000}} = 5.13\ \mu V$$

AbsoluteAccuracy = 10 V * (*GainError*) + 10 V * (*OffsetError*) + *NoiseUncertainty* = 2495 μV

Digital PFI Input

Electrical Characteristics

Level	Min	Max
Input high voltage (VIH)	2.09 V	5.5 V
Input low voltage (VIL)	0 V	0.90 V
Hysteresis	0.60 V	0.87 V

Triggers

Analog trigger

Source	AI<0..7>
Purpose	Reference Trigger
Level	Full Scale (depending on AI Range), Programmable
Resolution	16-bit
Mode	Rising-edge, Rising-edge with Hysteresis, Falling-edge, Falling-edge with Hysteresis, Entering Window, Leaving Window

Digital trigger

    Source ....PXI_TRIG<0..7>, PXI_STAR, PXIe_DSTAR<A..B> PFI<0..1>

    Purpose..Start Trigger, Reference Trigger, Pause Trigger

    Polarity..Software-selectable

    Debounce filter settings ....Disable, 90 ns, 5.12 μs, 2.56 ms, custom interval

Clocking

Source ....Onboard Clock, PXI_TRIG<0..7>, PXI_STAR, PXIe_DSTAR<A..B>, PFI<0..1>, PXIe_Clk100 (RefClk Only)

Destination ....Sample Clock, Sample Clock Timebase, Reference Clock

Polarity..Software-selectable (except Reference Clock)

Debounce filter settings
(Sample clock only)...Disable, 90 ns, 5.12 μs, 2.56 ms, custom interval

Table 1. Reference Clock Locking Frequencies

Reference Signal	Locking Input Frequency (MHz)		
	10	20	100
PXIe_DSTAR<A..B>	✔	✔	✔
PXI_STAR	✔	✔	—
PXIe_Clk100	—	—	✔
PXI_TRIG<0..7>	✔	✔	—
PFI<0..1>	✔	✔	—

Note National Instruments does not recommend using any combination of locking input frequency and reference signal other than those checked as supported in Table 1.

Output Timing Signals

Source .... Start Trigger, Reference Trigger,
Pause Trigger,
PFI<0..1>,
Sample Clock,
Various derived timebases and clocks

Destination.. 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 .... 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
PXIe-4310 at `ni.com/calibration`.

Recommended warm-up time........................... 15 minutes

Calibration interval .... 2 years

Power Requirements

+3.3 V .... 2.9 W
+12 V .... 7.1 W

Physical Requirements

Dimensions .... Standard 3U PXIe,
16 cm by 10 cm
(6.3 in. by 3.9 in.)

Weight.. 170 g (6.0 oz)

⚠ **Caution**   Clean the hardware with a soft, nonmetallic brush. Make sure that the
hardware is completely dry and free from contaminants before returning it to service.

I/O connector .... 96-pin male DIN 41612/IEC 60603-2 connector.

Environmental

Maximum altitude...2,000 m (800 mbar),
at 25 °C ambient temperature

Pollution Degree 2

Indoor use only

Operating Environment

Ambient temperature range ....0 °C 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 °C 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.)

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 Hz to 500 Hz, 0.3 g_{rms}

    Non-operating ....5 Hz 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 Voltage

Connect only voltages that are within the following limits:

Between any AI+ and AI-.........................±11 V

Between any AI terminal and COM ....±11 V

Isolation

Channel to channel

Continuous[1] ....600 VDC/V_{pk}, Measurement Category O;
300 V_{rms}, Measurement Category II

Rated transient overvoltage ....2,500 V_{pk}

Channel to earth ground

Continuous.......................................600 VDC/V_{pk}, Measurement Category O;
300 V_{rms}, Measurement Category II

Rated transient overvoltage ....2,500 V_{pk}

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

⚠ **Caution** The protection provided by the PXIe-4310 can be impaired if it is used in a manner not described in this document.

Safety Standards

This product meets 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 C22.2 No. 61010-1

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

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[1] Measurement Categories CAT I and CAT O are equivalent. These test and measurement circuits are not intended for direct connection to the MAINS building installations of Measurement Categories CAT II, CAT III, or CAT IV. MAINS is a hazardous live electrical supply system that powers equipment. Measurement Category O is for measurements of voltages from specially protected secondary circuits, such as signal levels, special equipment, limited-energy parts of equipment, circuits powered by regulated low-voltage sources, and electronics.

Measurement Category II is for measurements performed on circuits directly connected to the electrical distribution system. This category refers to local-level electrical distribution, such as that provided by a standard wall outlet, for example, 120 V for U.S. or 240 V for Europe.

Electromagnetic Compatibility

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

- EN 61326-1 (IEC 61326-1): Class A emissions; Basic immunity
- EN 55011 (CISPR 11): Group 1, Class A emissions
- EN 55022 (CISPR 22): Class A emissions
- EN 55024 (CISPR 24): Immunity
- AS/NZS CISPR 11: Group 1, Class A emissions
- AS/NZS CISPR 22: Class A emissions
- FCC 47 CFR Part 15B: Class A emissions
- ICES-001: Class A emissions

Note In the United States (per FCC 47 CFR), Class A equipment is intended for use in commercial, light-industrial, and heavy-industrial locations. In Europe, Canada, Australia and New Zealand (per CISPR 11) Class A equipment is intended for use only in heavy-industrial locations.

Note Group 1 equipment (per CISPR 11) is any industrial, scientific, or medical equipment that does not intentionally generate radio frequency energy for the treatment of material or inspection/analysis purposes.

Note For EMC declarations and certifications, and additional information, refer to the *Online Product Certification* section.

CE Compliance $C \in$

This product meets the essential requirements of applicable European Directives as follows:

- 2014/35/EU; Low-Voltage Directive (safety)
- 2014/30/EU; Electromagnetic Compatibility Directive (EMC)

Online Product Certification

Refer to the product Declaration of Conformity (DoC) for additional regulatory compliance information. 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 to the environment and to NI customers.

For additional environmental information, refer to the *Minimize Our Environmental Impact* 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 and Electronic Equipment, visit `ni.com/environment/weee`.

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`.)

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