

## SPECIFICATIONS

# PXIe-4322

## 16-Bit, 8-Channel, 250 kS/s Ch-Ch Isolated PXI Analog Output Module

This document lists specifications for the PXIe-4322 16-Bit, 8-Channel, 250 kS/s Ch-Ch Isolated PXI Analog Output 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](http://ni.com/manuals) for the most current specifications and product documentation.



**Note** To maintain forced-air cooling for PXI/PXI Express devices, make sure the PXI/PCI chassis fan speed is set to HIGH, the foam fan filters are removed if present, and the empty slots contain slot blockers and filler panels. For more information about cooling, refer to the *Maintain Forced-Air Cooling Note to Users*.

## Analog Characteristics

Number of channels	8 analog output channels
DAC resolution	16 bits
Type of DAC	R-2R
Monotonicity	16 bits
DNL	±1 LSB max
INL (best fit)	±4 LSBs max
Power-on output state <sup>1</sup>	
Voltage mode	0 V
Current mode	0 mA



**Note** You can program the power-on output states. Refer to your software documentation for information about programming the power-on output states using NI-DAQmx with LabVIEW or other National Instruments application development environments (ADEs).

<sup>1</sup> When the output stage powers on, a current glitch occurs for 1 ms peaking at 5  $\mu$ A. When the output stage powers off, a current glitch occurs for 3 ms peaking at 5  $\mu$ A.

Power-off output state	High impedance
Protection	
Overvoltage	±120 VDC
Short circuit	Indefinitely
Update rate	
Maximum	250 kS/s per channel
Minimum	No minimum
Timing accuracy	50 ppm of sample rate
Timing resolution	10 ns
Data transfers	DMA (scatter-gather), programmed I/O
Output FIFO size	8,191 samples shared among channels used

#### AO waveform modes

- Nonperiodic waveform
- Periodic waveform regeneration mode from onboard FIFO
- Periodic waveform regeneration from host buffer including dynamic update

## Voltage Mode

Output voltage range <sup>2</sup>	
Nominal	±16 V
Minimum	±16.57 V
Typical	±16.70 V
Maximum	±16.83 V
Current drive	±20 mA per channel max
Output impedance	25 mΩ
Noise (rms)	
10 Hz to 1 kHz bandwidth	30 μV <sub>rms</sub>
10 Hz to 300 kHz bandwidth	250 μV <sub>rms</sub>
10 Hz to 20 MHz bandwidth	500 μV <sub>rms</sub>
Slew rate	±10 V/μs

<sup>2</sup> Refer to the *Increasing Output Voltage Range in Voltage Mode* section in the *NI PXIe-4322 User Manual* for information about how to increase the nominal output voltage range by connecting multiple voltage channels in series.

## Crosstalk

Channel-to-channel @ 10 kHz	-100 dB
Common-mode voltage @ 60 Hz	-120 dB

## Settling time

1000 pF load, to 1 LSB	
20 V step	20 $\mu$ s
1 V step	12 $\mu$ s
0.1 V step	10 $\mu$ s
500 $\Omega$    100 pF, to 1 LSB	
20 V step	20 $\mu$ s
Capacitive drive	4500 pF

## Accuracy<sup>3</sup>

Measurement Conditions	Percent of Output (Gain Error)	Percent of Range* (Offset Error)
Calibrated, max (0 °C to 55 °C)	0.076%	0.018%
Calibrated, max (0 °C to 40 °C)	0.054%	0.014%
Calibrated, max (23 °C $\pm$ 5 °C)	0.014%	0.007%
Calibrated, typ (23 °C $\pm$ 5 °C)	0.010%	0.003%
* Range equals 16 V.		

## Stability

Gain drift	7 ppm/°C
Offset drift	25 $\mu$ V/°C

## Absolute Voltage Output Accuracy Equation

$$\text{AbsoluteVoltageAccuracy} = \text{Output} * (\text{GainError}) + \text{Range} * (\text{OffsetError})$$

## Absolute Voltage Output Accuracy Example

For a 10 V voltage output, the absolute output accuracy for an external temperature range of 18 °C to 28 °C is as follows:

$$\text{GainError} = 0.014\%$$

<sup>3</sup> Accuracies listed are warranted for the conditions described in the table for up to one year from the module external calibration.

$$\text{OffsetError} = 0.007\%$$

$$\text{AbsoluteAccuracy} = 10 \text{ V} * (\text{GainError}) + 16 \text{ V} * (\text{OffsetError}) = 2.52 \text{ mV}$$

## Current Mode

---

### Output current range<sup>4</sup>

Nominal	±20 mA
Minimum	±20.6 mA
Typical	±20.9 mA
Maximum	±21.1 mA
Compliance voltage	±16 V per channel max
Output impedance	100 MΩ
Noise (rms)	
10 Hz to 1 kHz bandwidth	50 nA
10 Hz to 300 kHz bandwidth	600 nA
Slew rate	±20 mA/μs
Crosstalk	
Channel-to-channel @ 1 kHz	-100 dB
Common-mode voltage @ 60 Hz	50 nA/V
Settling time	
100 Ω load	
Full-scale step to 2 LSB	20 μs
800 Ω load	
Full-scale step to 2 LSB	25 μs
2 mA step to 1 LSB	15 μs
Inductive drive	10 μH

---

<sup>4</sup> Refer to the *Increasing Output Current Range in Current Mode* section of the *NI PXIe-4322 User Manual* for information about how to increase the nominal output current range by connecting current channels in parallel.

## Accuracy<sup>5</sup>

Measurement Conditions	Percent of Output (Gain Error)	Percent of Range* (Offset Error)
Calibrated, max (0 °C to 55 °C)	0.12%	0.05%
Calibrated, max (0 °C to 40 °C)	0.09%	0.035%
Calibrated, max (23 °C ±5 °C)	0.033%	0.019%
Calibrated, typ (23 °C ±5 °C)	0.028%	0.004%
* Range equals 20 mA.		

## Stability

Gain drift ±15 ppm/°C

Offset drift ±75 nA/°C

## Absolute Current Output Accuracy Equation

$$\text{AbsoluteCurrentAccuracy} = \text{Output} * (\text{GainError}) + \text{Range} * (\text{OffsetError})$$

## Absolute Current Output Accuracy Example

For a 10 mA current output, the absolute output accuracy for an external temperature range of 18 °C to 28 °C is as follows:

$$\text{GainError} = 0.033\%$$

$$\text{OffsetError} = 0.019\%$$

$$\text{AbsoluteAccuracy} = 10 \text{ mA} * (\text{GainError}) + 20 \text{ mA} * (\text{OffsetError}) = 7.1 \mu\text{A}$$

## Synchronization

Reference clock source PXIe\_DSTAR<A.. B>, PXI\_STAR, PXIe\_Clk100, PXI\_TRIG<0..7>

<sup>5</sup> Accuracies listed are warranted for the conditions described in the table for up to one year from the module external calibration.

# Digital Triggers

Source	PXI_TRIG<0..7>, PXI_STAR, PXIe_DSTAR<A..B> PFI<0..1>
Purpose	Start Trigger, Pause Trigger
Polarity	Software-selectable
Debounce filter settings	Disable, 90 ns, 5.12 $\mu$ s, 2.56 ms, custom interval

# Clocking

Source	Onboard Clock, PXI_TRIG<0..7>, PXI_STAR, PXIe_DSTAR<A..B>, 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 $\mu$ s, 2.56 ms, custom interval

## 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>	✓	✓	—



**Note** NI does not recommend locking to non-selected frequencies.

# Output Timing Signals

---

Source	Start Trigger, Pause Trigger, Sample Clock, various derived timebases and clocks
Destination	PXI_TRIG<0..7> PXIe_DSTARC
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

---

PXIe-4322 modules may be installed in PXI Express slots or PXI Express hybrid slots.

## Calibration

---

Recommended warm-up time	15 minutes
Calibration interval	1 year

---

## Power Requirements

---

+3.3 V	800 mA
+12 V	700 mA

---

## Physical Requirements

---

Dimensions	Standard 3U PXIe, 16 cm × 10 cm (6.3 in × 3.9 in)
Weight	161 g (5.7 oz)
I/O connector	96-pin male DIN 41612/IEC 60603-2 connector

---



**Note** 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.

# 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 °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 <sub>rms</sub>
-----------	--------------------------------------

---

Non-operating	5 Hz to 500 Hz, 2.4 g <sub>rms</sub> (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 two terminals of an isolated channel	$\pm 120$ VDC
Isolation	
Channel to channel	
Continuous	300 V <sub>rms</sub> , Measurement Category II (Basic)
Withstand	1,500 V <sub>rms</sub> , verified by a 5 s dielectric withstand test
Channel to earth ground	
Continuous	300 V <sub>rms</sub> , Measurement Category II
Withstand	2,300 V <sub>rms</sub> , verified by a 5 s dielectric withstand test

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, 115 V for U.S. or 230 V for Europe.



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



**Attention** Ne pas utiliser pour effectuer des mesures dans les catégories de mesure III ou IV.



**Caution** The protection provided by the PXIe-4322 can be impaired if it is used in a manner not described in this document.



**Attention** La protection fournie par le PXIe-4322 peut être altérée s'il est utilisé d'une autre façon que celle décrite dans ce document.



**Caution** When hazardous voltages ( $> 30 V_{rms}/42.4 V_{pk}/60$  VDC) are present on any terminal, safety low-voltage ( $\leq 30 V_{rms}/42.4 V_{pk}/60$  VDC) cannot be connected to any other terminal.



**Attention** En présence de tensions dangereuses ( $> 30 V_{eff}/42,4 V_{pic}/60$  VCC) sur l'une des bornes, une basse tension de sécurité ( $\leq 30 V_{eff}/42,4 V_{pic}/60$  VCC) ne peut être raccordée à aucune autre borne.



**Caution** Do not supply hazardous voltages ( $> 30 V_{rms}/42.4 V_{pk}/60$  VDC) to the terminal block without the terminal block being connected to the PXIe-4322.



**Attention** Ne pas appliquer de tensions dangereuses ( $> 30 V_{eff}/42,4 V_{pic}/60$  VCC) au bornier sans que ce dernier ne soit connecté au PXIe-4322.

# Safety Compliance Standards

---

This product is designed to meet the requirements of the following electrical equipment safety standards 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 [Product Certifications and Declarations](#) section.

# 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 [Product Certifications and Declarations](#) section.

# CE Compliance

---

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)

# Product Certifications and Declarations

---

Refer to the product Declaration of Conformity (DoC) for additional regulatory compliance information. To obtain product certifications and the DoC for NI products, visit [ni.com/product-certifications](https://ni.com/product-certifications), search by model number, and click the appropriate link.

## 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 *Commitment to the Environment* web page at [ni.com/environment](https://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 NI products must be disposed of according to local laws and regulations. For more information about how to recycle NI products in your region, visit [ni.com/environment/weee](https://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](https://ni.com/environment/rohs_china)。(For information about China RoHS compliance, go to [ni.com/environment/rohs\\_china](https://ni.com/environment/rohs_china).)

## Worldwide Support and Services

---

The NI website is your complete resource for technical support. At [ni.com/support](https://ni.com/support), you have access to everything from troubleshooting and application development self-help resources to email and phone assistance from NI Application Engineers.

Visit [ni.com/services](https://ni.com/services) for information about the services NI offers.

Visit [ni.com/register](https://ni.com/register) to register your NI product. Product registration facilitates technical support and ensures that you receive important information updates from NI.

NI corporate headquarters is located at 11500 North Mopac Expressway, Austin, Texas, 78759-3504. NI also has offices located around the world. For support in the United States, create your service request at [ni.com/support](https://ni.com/support) or dial 1 866 ASK MYNI (275 6964). For

support outside the United States, visit the *Worldwide Offices* section of [ni.com/niglobal](http://ni.com/niglobal) to access the branch office websites, which provide up-to-date contact information.

Information is subject to change without notice. Refer to the *NI Trademarks and Logo Guidelines* at [ni.com/trademarks](http://ni.com/trademarks) for information on NI trademarks. Other product and company names mentioned herein are trademarks or trade names of their respective companies. For patents covering NI products/technology, refer to the appropriate location: **Help»Patents** in your software, the `patents.txt` file on your media, or the *National Instruments Patent Notice* at [ni.com/patents](http://ni.com/patents). You can find information about end-user license agreements (EULAs) and third-party legal notices in the `readme` file for your NI product. Refer to the *Export Compliance Information* at [ni.com/legal/export-compliance](http://ni.com/legal/export-compliance) for the NI global trade compliance policy and how to obtain relevant HTS codes, ECCNs, and other import/export data. NI MAKES NO EXPRESS OR IMPLIED WARRANTIES AS TO THE ACCURACY OF THE INFORMATION CONTAINED HEREIN AND SHALL NOT BE LIABLE FOR ANY ERRORS. U.S. Government Customers: The data contained in this manual was developed at private expense and is subject to the applicable limited rights and restricted data rights as set forth in FAR 52.227-14, DFAR 252.227-7014, and DFAR 252.227-7015.

© 2013—2019 National Instruments. All rights reserved.

375956C-01 May 23, 2019