SPECIFICATIONS

# NI PXIe-4322

Français Deutsch 日本語 한국어 简体中文

ni.com/manuals

This document lists specifications for the NI PXIe-4322 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** Keep the filler panels on all unused slots in your chassis to maintain forced air cooling.

## 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[1]

- 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).

Power-off output state ..... High impedance

[1] When the output stage powers on, a current glitch occurs for 1 ms peaking at 5 µA. When the output stage powers off, a current glitch occurs for 3 ms peaking at 5 µA.

NATIONAL INSTRUMENTS

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[1]

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 $\mu V_{rms}$

10 Hz to 300 kHz bandwidth .....250 $\mu V_{rms}$

10 Hz to 20 MHz bandwidth .....500 $\mu V_{rms}$

Slew rate .....±10 V/µs

Crosstalk

Channel-to-channel @ 10 kHz.....-100 dB

Common-mode voltage @ 60 Hz .....-120 dB

[1] 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.

Settling time

1000 pF load, to 1 LSB

20 V step ..... 20 µs

1 V step ..... 12 µs

0.1 V step ..... 10 µs

500 Ω||100 pF, to 1 LSB

20 V step ..... 20 µs

Capacitive drive ..... 4500 pF

## Accuracy[1]

| 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 ±5 °C) | 0.014% | 0.007% |
| Calibrated, typ (23 °C ±5 °C) | 0.010% | 0.003% |
| * Range equals 16 V. | | |

## Stability

Gain drift ..... 7 ppm/°C

Offset drift ..... 25 µV/°C

## Absolute Voltage Output Accuracy Equation

$$AbsoluteVoltageAccuracy = Output * (GainError) + Range * (OffsetError)$$

## 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:

$$GainError = 0.014\%$$

$$OffsetError = 0.007\%$$

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

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

# Current Mode

Output current range[1]

- 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

[1] 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[1]

| 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

*AbsoluteCurrentAccuracy = Output * (GainError) + Range * (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:

*GainError* = 0.033%

*OffsetError* = 0.019%

*AbsoluteAccuracy* = 10 mA * (*GainError*) + 20 mA* (*OffsetError*) = 7.1 µA

# Synchronization

Reference clock source..... PXIe_DSTAR<A.. B>, PXI_STAR, PXIe_Clk100, PXI_TRIG<0..7>

# Digital Triggers

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

Purpose ..... Start Trigger, Pause Trigger

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

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>, 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

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** National Instruments 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 output

NI 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 × 10 cm (6.3 × 3.9 in.)

Weight ..... 161 g (5.7 oz)

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

**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.

# 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 $g_{rms}$
- 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 two terminals of an isolated channel ..... ±120 VDC

Isolation

- Channel to channel
  - Continuous ..... 300 $V_{rms}$, Measurement Category II (Basic)
  - Withstand ..... 1,500 $V_{rms}$, verified by 5 s dielectric withstand test

Channel to earth ground

Continuous ..... 300 $V_{rms}$, Measurement Category II

Withstand ..... 3,000 $V_{rms}$,
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.

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

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

**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 NI PXIe-4322.

# Safety

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 61010-1

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

# CE Compliance CE

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

- 2006/95/EC; Low-Voltage Directive (safety)
- 2004/108/EC; 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`.)

# Where to Go for Support

The National Instruments Web site is your complete resource for technical support. At `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.

National Instruments corporate headquarters is located at 11500 North Mopac Expressway, Austin, Texas, 78759-3504. National Instruments also has offices located around the world to help address your support needs. For telephone support in the United States, create your service request at `ni.com/support` and follow the calling instructions or dial 512 795 8248. For telephone support outside the United States, visit the Worldwide Offices section of `ni.com/niglobal` to access the branch office Web sites, which provide up-to-date contact information, support phone numbers, email addresses, and current events.

375956B-01 May13