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NI PXIe-4322

8-Channel Isolated Analog Output



- 8-channel isolated analog voltage and current output
- +/-16 V at 20 mA per channel in voltage mode, +/-20 mA in current mode; stack channels for up to +/-128 V or +/-160 mA per module
- 300 V CAT II channel-to-channel isolation
- 16-bit resolution, 250 kS/s per channel update rate
- Voltage and current modes software selectable per channel
- NI-DAQmx driver software and NI LabVIEW SignalExpress LE interactive data-logging software

Overview

The NI PXIe-4322 isolated analog output module features integrated signal conditioning with 16-bit digital-to-analog converters (DACs) to provide accurate, simultaneous dynamic voltage and current outputs. Each channel on the NI PXIe-4322 features a 16-bit DAC and can output +/-16 V at 20 mA in voltage mode or +/-20 mA in current mode at rates of up to 250 kS/s per channel. The module also features 300 Vrms CAT II channel-to-channel isolation and 300 Vrms CAT II channel-to-earth isolation. With the isolation on this module, you can stack voltage channels to up to 128 V per module or up to 300 V by using an external offset. In current mode, the module operates in all four quadrants, so you can both sink and source current. Furthermore, you can connect channels in series to achieve higher current outputs. The NI TB-4322 is a front-mount, screw-terminal block for use with the NI PXIe-4322. The NI PXIe-4322 is easily programmed with the NI-DAQmx driver, and supports multidevice tasks and hardware-timed single-point operations. As part of the PXI platform, the SC Express modules tightly synchronize with more than 1,500 PXI I/O instruments, such as NI X Series DAQ modules and dynamic signal acquisition modules.

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Application and Technology

Integrated Signal Conditioning

By combining signal conditioning and digital-to-analog converters (DACs) on the same device, the NI PXIe-4322 isolated analog output 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.

PXI Express Dedicated Data Throughput

NI 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 and update 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. SC Express modules take advantage of 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 the more than 1,500 I/O types in the PXI platform, this module offers the flexibility 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-4322 is designed to be used with the NI TB-4322 front-mount terminal block. The TB-4322 provides screw-terminal connectivity, so you can easily rewire and stack channels in series or parallel to increase current or voltage outputs. 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 to minimize the risk of bent pins.

Taking Advantage of the Isolation on the NI PXIe-4322

By stacking the channels in series in voltage mode, you can achieve up to +/-128 V per module. Figure 1 shows two stacked channels to achieve +/-32 V. Likewise, you can connect channels in parallel in current mode to achieve higher current outputs. Figure 2 shows this configuration.

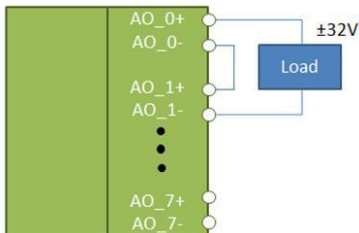


Figure 1: Stacking channels in voltage mode

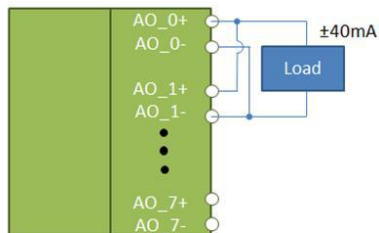



Figure 2: Stacking channels in current mode

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.

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	
<ul style="list-style-type: none"> • 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 μV _{rms}
10 Hz to 300 kHz bandwidth.....	250 μV _{rms}
10 Hz to 20 MHz bandwidth.....	500 μV _{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

Accuracy¹

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

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

Absolute Voltage Output Accuracy Example

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

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

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

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

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 range¹

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

Accuracy¹

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 the 10 mA current output, the absolute output accuracy at 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>

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 μs, 2.56 ms,
custom interval

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

Cloning

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 μ 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 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 ($\leq 30 V_{rms}/42.4 V_{pk}/60 VDC$) 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

Vertrieb durch



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Gold
Alliance
Partner

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

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.

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 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.