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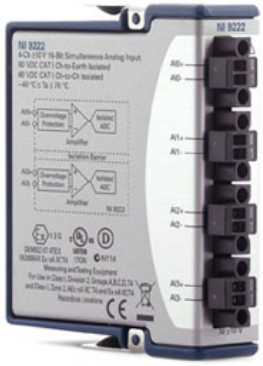
Detailed Specifications

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

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4-Channel, 1 MS/s/ch C Series Analog Input Modules

NI 9222, NI 9223





- 16-bit, 1 MS/s per channel (NI 9223)
- 16-bit, 500 kS/s per channel (NI 9222)
- 60 VDC, channel-to-channel isolation
- ±10 V range
- Backshells available for added strain relief
- Screw-terminal connectivity included in kit

Overview

The NI 9222 and NI 9223 C Series modules are high-speed, simultaneous modules for use in any NI CompactDAQ or CompactRIO chassis. With a sample rate of up to 1 MS/s and simultaneous analog-to-digital converters (ADCs), these modules are well-suited for applications such as ballistics, impact, and blast wave testing.

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Comparison Tables

Module	Range	Resolution	Simultaneous	Sample Rate	Isolation
NI 9223	±10 V	16-Bit	Yes	1 MS/s/ch	60 VDC, Ch-Ch
NI 9222	±10 V	16-Bit	Yes	500 kS/s/ch	60 VDC, Ch-Ch
NI 9215	±10 V	16-Bit	Yes	100 kS/s/ch	250 Vrms Ch-Earth (60 V for BNC)
NI 9239	±10 V	24-Bit	Yes	50 kS/s/ch	250 Vrms, Ch-Ch
NI 9229	±60 V	24-Bit	Yes	50 kS/s/ch	250 Vrms, Ch-Ch
NI 9225	300 Vrms	24-Bit	Yes	50 kS/s/ch	600 Vrms, Ch-Ch
NI 9227	5 A	24-Bit	Yes	50 kS/s/ch	250 Vrms, Ch-Ch
NI 9219	±60 V, ±15 V, ±4 V, ±1 V, ±125 mV	24-Bit	Yes	100 S/s/ch	250 VAC, Ch-Ch

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Application and Technology

Safety and Accuracy with Channel-to-Channel Isolation

Isolation is needed for safe operation around high voltages. With channel-to-channel isolation, your entire system, including the device under test, is protected from harmful voltage spikes up to the isolation rating. In addition to safety, isolation eliminates measurement errors caused by ground loops because the front end of the module is floating.

Synchronous Measurements with Multiple ADCs

The NI 9222 and NI 9223 use four 16-bit analog-to-digital converters (ADCs) for true simultaneous sampling at up to 1 MS/s per channel. You can synchronize all analog input modules installed in the same chassis to share the same start clock and/or sample clocks. This technology enables higher-channel-count, simultaneous test systems.

NI Signal Streaming Technology

A patented method for transferring data over PC buses, NI Signal Streaming technology is one of the core technologies that bring high-speed streaming data to NI C Series hardware. Though NI Signal Streaming optimizes bandwidth, ultimate throughput differs between systems. Internal benchmarks show a USB chassis can stream up to 16 NI 9223 channels and an Ethernet chassis can stream up to six NI 9223 channels without encountering a buffer overflow. For NI CompactRIO hardware, the number of supported channels depends on system architecture and use of the field-programmable gate array (FPGA).

Connectivity Accessories

NI 9222/23 modules use four of the 2-position screw-terminal connectors. These modules include all four connectors, and you can order more as replacements or for easy test equipment changes among devices under test. Those connectors are listed as model NI 9976.

NI 9971 - strain-relief backshells for signal wire security and high-voltage protection (qty 4)

NI 9976 - extra connectors for 2-position connector modules (qty 10)



Figure 1. High-Voltage Backshells (sold separately in quantities of four as NI 9971)

C Series Chassis

NI CompactDAQ Platform

NI CompactDAQ delivers the simplicity of USB to sensor and electrical measurements on the benchtop, in the field, and on the production line. By combining the ease of use and low cost of a data logger with the performance and flexibility of modular instrumentation, NI CompactDAQ offers fast, accurate measurements in a small, simple, and affordable system. Flexible software options make it easy to use NI CompactDAQ to log data for simple experiments or to develop a fully automated test or control system. The modular design can measure up to 256 channels of electrical, physical, mechanical, or acoustical signals in a single system. In addition, per-channel ADCs and individually isolated modules ensure fast, accurate, and safe measurements.



NI CompactRIO Platform

When used with the small, rugged CompactRIO embedded control and data acquisition system, C Series analog input modules connect directly to reconfigurable I/O (RIO) FPGA hardware to create high-performance embedded systems. The reconfigurable FPGA hardware within CompactRIO provides a variety of options for custom timing, triggering, synchronization, filtering, signal processing, and high-speed decision making for all C Series analog input modules. For instance, with CompactRIO, you can implement custom triggering for any analog sensor type on a per-channel basis using the flexibility and performance of the FPGA and the numerous arithmetic and comparison function blocks built into the NI LabVIEW FPGA Module.



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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.

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Detailed Specifications

The following specifications are typical for the range –40 to 70 °C unless otherwise noted. All voltages are relative to the AI– signal on each channel unless otherwise noted. The specifications are the same for the NI 9222 and the NI 9223 unless otherwise noted.

Input Characteristics

Number of channels	4 analog input channels
ADC resolution	16 bits
Type of ADC	Successive approximation register (SAR)

Input voltage ranges [1]

Measurement Voltage, AI+ to AI–		
Minimum [2]	Typical	Maximum
±10.5 V	±10.6 V	±10.7 V

Overvoltage protection	±30 V

Maximum Sampling Rate

Module	CompactDAQ	RIO	
	NI-DAQmx	FPGA User-Controlled I/O Sampling [3]	FPGA I/O Nodes
NI 9222	500 kS/s	500 kS/s	300 kS/s
NI 9223	1 MS/s	1 MS/s	350 kS/s

Accuracy

Measurement Conditions	Percent of Reading (Gain Error)	Percentage of Range [4] (Off-set Error)
Calibrated, max (–40 to 70 °C)	±0.20%	±0.10%
Calibrated, typ (23 °C, ±5 °C)	±0.02%	±0.01%
Uncalibrated, max (–40 to 70 °C)	±0.40%	±0.40%
Uncalibrated, typ (23 °C, ±5 °C)	±0.20%	±0.10%

Stability	
Gain drift	6 ppm/°C
Offset drift	29 µV/°C
CMRR (f_{in} = 60 Hz)	100 dB
–3 dB bandwidth	
NI 9222	>500 kHz
NI 9223	>1 MHz
Input impedance	>1 GΩ
Noise	0.75 LSB_{rms}
Total Harmonic Distortion (THD) (20 V_{pp} at 10 kHz)	–85 dB
Crosstalk (20 V_{pp} at 1 kHz)	–100 dB
MTBF	Contact NI for Bellcore MTBF or MIL-HDBK-217F specifications.

Power Requirements

Power consumption from chassis	

Active mode	1 W max
Sleep mode	5 mW max
Thermal dissipation (at 70 °C)	
Active mode	1.3 W max
Sleep mode	430 mW max

Physical Characteristics

If you need to clean the module, wipe it with a dry towel.

Note For two-dimensional drawings and three-dimensional models of the C Series module and connectors, visit ni.com/dimensions and search by module number.

Screw-terminal wiring	12 to 24 AWG copper conductor wire with 10 mm (0.39 in.) of insulation stripped from the end
Torque for screw terminals	0.5 to 0.6 N · m (4.4 to 5.3 lb · in.)
Ferrules	0.25 mm^2 to 2.5 mm^2
Weight	138 g (4.9 oz)

Safety

Safety Voltages

Connect only voltages that are within the following limits.

Isolation	
Channel-to-channel	
Continuous	60 VDC, Measurement Category I
Withstand	1000 V_{rms}, verified by a 5 s dielectric withstand test
Channel-to-earth ground	
Continuous	60 VDC, Measurement Category I
Withstand	1000 V_{rms}, verified by a 5 s dielectric withstand test
Division 2 and Zone 2 hazardous locations applications	
(Channel-to-channel and channel-to-earth ground)	60 VDC, Measurement Category I

Measurement Category I is for measurements performed on circuits not directly connected to the electrical distribution system referred to as *MAINS* voltage. MAINS is a hazardous live electrical supply system that powers equipment. This category is for measurements of voltages from specially protected secondary circuits. Such voltage measurements include signal levels, special equipment, limited-energy parts of equipment, circuits powered by regulated low-voltage sources, and electronics.

Caution Do *not* connect the NI 9222/9223 to signals or use for measurements within Measurement Categories II, III, or IV.

Hazardous Locations

U.S. (UL)	Class I, Division 2, Groups A, B, C, D, T4; Class I, Zone 2, AEx nA IIC T4
Canada (C-UL)	Class I, Division 2, Groups A, B, C, D, T4; Class I, Zone 2, Ex nA IIC T4
Europe (DEMKO)	Ex nA IIC T4

Safety Standards

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.

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; Industrial 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 EMC declarations and certifications, refer to the *Online Product Certification* section.

Caution When operating this product, use shielded cables and accessories.

CE Compliance CE

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 module number or product line, and click the appropriate link in the Certification column.

Shock and Vibration

To meet these specifications, you must panel mount the system and either affix ferrules to the ends of the terminal wires or use the NI 9971 backshell kit to protect the connections.

Operating vibration	
Random (IEC 60068-2-64)	5 g_{rms}, 10 to 500 Hz
Sinusoidal (IEC 60068-2-6)	5 g, 10 to 500 Hz
Operating shock (IEC 60068-2-27)	30 g, 11 ms half sine, 50 g, 3 ms half sine, 18 shocks at 6 orientations

Environmental

National Instruments C Series modules are intended for indoor use only but may be used outdoors if installed in a suitable enclosure. Refer to the manual for the chassis you are using for more information about meeting these specifications.

Operating temperature (IEC 60068-2-1, IEC 60068-2-2)	–40 to 70 °C
Storage temperature (IEC 60068-2-1, IEC 60068-2-2)	–40 to 85 °C
Ingress protection	IP 40
Operating humidity (IEC 60068-2-56)	10 to 90% RH, noncondensing
Storage humidity (IEC 60068-2-56)	5 to 95% RH, noncondensing
Maximum altitude	2,000 m
Pollution Degree	2

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.)

Calibration

You can obtain the calibration certificate and information about calibration services for the NI 9222/9223 at ni.com/calibration.

Calibration interval	1 year

[1] Refer to the *Safety Guidelines* section in the *NI 9222/9223 Operating Instructions and Specifications* manual for more information about safe operating voltages.

[2] The *minimum measurement voltage range* is the largest voltage the NI 9222/9223 is guaranteed to accurately measure.

[3] FPGA User-Controlled I/O Sampling provides low level access to sample acquisition and transfer, and higher sample rates. Visit ni.com/info and enter *samplerate* for information about FPGA User-Controlled I/O Sampling for the NI 9222/9223.

[4] Range equals 10.6 V

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