

DATASHEET



NI 9220

16 AI, ± 10 V, 16 Bit, 100 kS/s/ch Simultaneous



- DSUB or spring-terminal connectivity
- 250 Vrms, CAT II, channel-to-earth isolation (spring terminal); 60 VDC, CAT I, channel-to-earth isolation (DSUB)
- -40 °C to 70 °C operating, 5 g vibration, 50 g shock

The NI 9220 is an analog input module for CompactDAQ and CompactRIO systems. Each channel provides a ± 10 V measurement range at a 16-bit resolution. The NI 9220 outputs 3.2 MB/s of data at the maximum sampling rate. There are two connector options for the NI 9220—a 36-position spring-terminal connector and a 37-position DSUB connector.

 <p>Kit Contents</p>	<ul style="list-style-type: none">• NI 9220• NI 9220 Getting Started Guide• Flathead Screwdriver (Spring Terminal)
 <p>Accessories</p>	<ul style="list-style-type: none">• NI 9940 Backshell Connector Kit (Spring Terminal)• NI 9923 Screw-Terminal Block (DSUB)

C SERIES ANALOG INPUT MODULE COMPARISON						
Product Name	Signal Levels	Channels	Sample Rate	Simultaneous	Resolution	Connectivity
NI 9201	±10 V	8 Single-Ended	500 kS/s	No	12-Bit	Screw-Terminal, Spring-Terminal, DSUB
NI 9205	±200 mV, ±1 V, ±5 V, ±10 V	32 Single-Ended, 16 differential	250 kS/s	No	16-Bit	Spring-Terminal, DSUB
NI 9206	±200 mV, ±1 V, ±5 V, ±10 V	32 Single-Ended, 16 Differential	250 kS/s	No	16-Bit	Spring-Terminal
NI 9207	±10 V	8 Differential	500 S/s	No	24-Bit	DSUB
NI 9209	±10 V	32 Single-Ended, 16 Differential	500 S/s	No	24-Bit	DSUB
NI 9215	±10 V	4 Differential	100 kS/s/ch	Yes	16-Bit	Screw-Terminal, Spring-Terminal, BNC
NI 9220	±10 V	16 Differential	100 kS/s/ch	Yes	16-Bit	Spring-Terminal, DSUB
NI 9221	±60 V	8 Single-Ended	800 kS/s	No	12-Bit	Screw-Terminal, Spring-Terminal, DSUB
NI 9222	±10 V	4 Differential	500 kS/s/ch	Yes	16-Bit	Screw-Terminal, BNC
NI 9223	±10 V	4 Differential	1 MS/s/ch	Yes	16-Bit	Screw-Terminal, BNC

NI C Series Overview



NI provides more than 100 C Series modules for measurement, control, and communication applications. C Series modules can connect to any sensor or bus and allow for high-accuracy measurements that meet the demands of advanced data acquisition and control applications.

- Measurement-specific signal conditioning that connects to an array of sensors and signals
- Isolation options such as bank-to-bank, channel-to-channel, and channel-to-earth ground
- -40 °C to 70 °C temperature range to meet a variety of application and environmental needs
- Hot-swappable

The majority of C Series modules are supported in both CompactRIO and CompactDAQ platforms and you can move modules from one platform to the other with no modification.

CompactRIO



CompactRIO combines an open-embedded architecture with small size, extreme ruggedness, and C Series modules in a platform powered by the NI LabVIEW reconfigurable I/O (RIO) architecture. Each system contains an FPGA for custom timing, triggering, and processing with a wide array of available modular I/O to meet any embedded application requirement.

CompactDAQ

CompactDAQ is a portable, rugged data acquisition platform that integrates connectivity, data acquisition, and signal conditioning into modular I/O for directly interfacing to any sensor or signal. Using CompactDAQ with LabVIEW, you can easily customize how you acquire, analyze, visualize, and manage your measurement data.



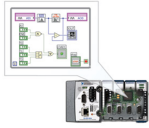
Software

LabVIEW Professional Development System for Windows



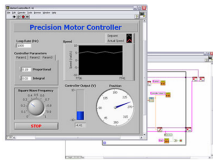
- Use advanced software tools for large project development
- Generate code automatically using DAQ Assistant and Instrument I/O Assistant
- Use advanced measurement analysis and digital signal processing
- Take advantage of open connectivity with DLLs, ActiveX, and .NET objects
- Build DLLs, executables, and MSI installers

NI LabVIEW FPGA Module



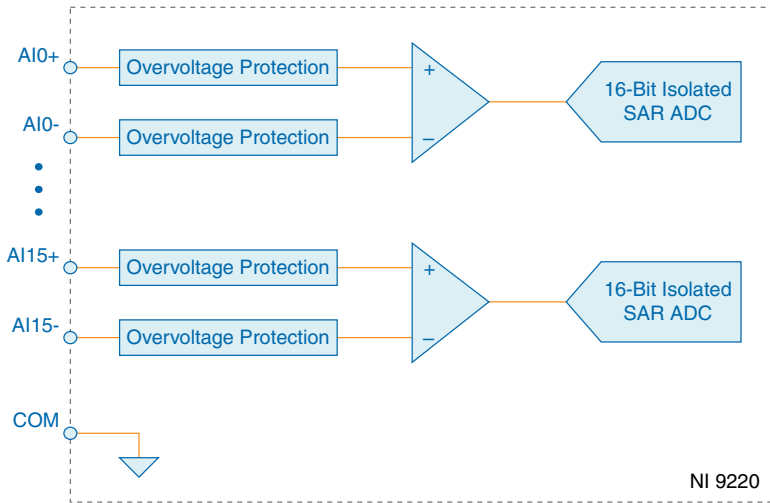
- Design FPGA applications for NI RIO hardware
- Program with the same graphical environment used for desktop and real-time applications
- Execute control algorithms with loop rates up to 300 MHz
- Implement custom timing and triggering logic, digital protocols, and DSP algorithms
- Incorporate existing HDL code and third-party IP including Xilinx IP generator functions
- Purchase as part of the LabVIEW Embedded Control and Monitoring Suite

NI LabVIEW Real-Time Module



- Design deterministic real-time applications with LabVIEW graphical programming
- Download to dedicated NI or third-party hardware for reliable execution and a wide selection of I/O
- Take advantage of built-in PID control, signal processing, and analysis functions
- Automatically take advantage of multicore CPUs or set processor affinity manually
- Take advantage of real-time OS, development and debugging support, and board support
- Purchase individually or as part of a LabVIEW suite

NI 9220 Circuitry



- Input signals on each channel are buffered, conditioned, and then sampled by an ADC.
- Each AI channel provides an independent signal path and ADC, enabling you to sample all channels simultaneously.

NI 9220 Specifications

The following specifications are typical for the range -40 °C to 70 °C unless otherwise noted. All voltages are relative to the AI- signal on each channel unless otherwise noted.



Caution Do not operate the NI 9220 in a manner not specified in this document. Product misuse can result in a hazard. You can compromise the safety protection built into the product if the product is damaged in any way. If the product is damaged, return it to NI for repair.



Caution The input terminals of this device are not protected from electromagnetic interference. As a result, this device may experience reduced measurement accuracy or other temporary performance degradation when connected cables are routed in an environment with radiated or conducted radio frequency electromagnetic interference. To limit radiated emissions and to ensure that this device functions within specifications in its operational electromagnetic environment, take precautions when designing, selecting, and installing measurement probes and cables.

Input Characteristics

Number of channels	16 analog input channels
ADC resolution	16 bits
Type of ADC	Successive approximation register (SAR)
Input voltage ranges	
Measurement Voltage (AI+ to AI-)	
Minimum ¹	±10.4 V
Typical	±10.5 V
Maximum	±10.6 V
Maximum voltage (Signal + Common Mode)	Each channel must remain within ±10.4 V of common
Overvoltage protection	±30 V
Conversion time	10 μs minimum
Sample rate	100 kS/s maximum

Table 1. Accuracy

Measurement Conditions		Percent of Reading (Gain Error)	Percent of Range ² (Offset Error)
Calibrated	Maximum (-40 °C to 70 °C)	0.142%	±0.070%
	Typical (23 °C ±5 °C)	0.010%	±0.001%
Uncalibrated ³	Maximum (-40 °C to 70 °C)	0.350%	±0.360%
	Typical (23 °C ±5 °C)	0.060%	±0.070%

Stability

Gain drift	5 ppm/°C
Offset drift	29 μV/°C
CMRR ($f_{in} = 60$ Hz)	70 dB
-3 dB bandwidth	>100 kHz
Input impedance	>1 GΩ

¹ The minimum measurement voltage range is the largest voltage the NI 9220 is guaranteed to accurately measure.

² Range equals ±10.5 V.

³ Uncalibrated accuracy refers to the accuracy achieved when acquiring in raw or unscaled modes where the calibration constants stored in the module are not applied to the data.

Input noise	0.85 LSB _{rms}
Crosstalk	-90 dB
Settling time (to 2 LSBs)	
10 V step	19 μs
20 V step	26 μs
No missing codes	15 bits
MTBF	1,522,250 at 25 °C; Bellcore Issue 6, Method 1, Case 3, Limited Part Stress Method

Power Requirements

Power consumption from chassis (full-scale input, 100 kS/s)	
Active mode	1 W maximum
Sleep mode	4 mW maximum
Thermal dissipation (at 70 °C)	
Active mode	1.250 W maximum
Sleep mode	510 mW maximum

Physical Characteristics

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



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

Spring-terminal wiring	
Gauge	0.08 mm ² to 1.0 mm ² (28 AWG to 18 AWG) copper conductor wire
Wire strip length	7 mm (0.28 in.) of insulation stripped from the end
Temperature rating	90 °C minimum
Wires per spring terminal	One wire per spring terminal
Connector securement	
Securement type	Screw flanges provided
Torque for screw flanges	0.2 N · m (1.80 lb · in.)
Weight	
NI 9220 with Spring Terminal	143 g (5.0 oz)
NI 9220 with DSUB	147 g (5.2 oz)

NI 9220 with Spring Terminal Safety Voltages

Connect only voltages that are within the following limits.

Channel-to-COM	±30 V maximum
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Isolation

Channel-to-COM	None
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Channel-to-earth ground

Continuous	250 Vrms, Measurement Category II
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Withstand	3,000 Vrms, verified by a 5 s dielectric withstand test
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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 connect the NI 9220 with spring terminal to signals or use for measurements within Measurement Categories III or IV.

NI 9220 with DSUB Safety Voltages

Connect only voltages that are within the following limits.

Channel-to-COM	±30 V maximum
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Isolation

Channel-to-COM	None
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Channel-to-earth ground

Continuous	60 VDC, Measurement Category I
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Withstand	1,000 Vrms, verified by a 5 s dielectric withstand test
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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 9220 with DSUB 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 (ATEX) and International (IECEX)	Ex nA IIC T4 Gc

Safety and Hazardous Locations 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 61010-1
- EN 60079-0:2012, EN 60079-15:2010
- IEC 60079-0: Ed 6, IEC 60079-15; Ed 4
- UL 60079-0; Ed 5, UL 60079-15; Ed 3
- CSA 60079-0:2011, CSA 60079-15:2012



Note For UL and other safety certifications, refer to the product label or the [Online Product Certification](#) section.

NI 9220 with Spring Terminal Electromagnetic Compatibility

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

- EN 61326-2-1 (IEC 61326-2-1): 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 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, refer to the [Online Product Certification](#) section.

NI 9220 with DSUB Electromagnetic Compatibility

This device 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 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, refer to the [Online Product Certification](#) 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)
- 94/9/EC; Potentially Explosive Atmospheres (ATEX)

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.

Shock and Vibration

To meet these specifications, you must panel mount the system.

Operating vibration

Random (IEC 60068-2-64)	5 g _{rms} , 10 Hz to 500 Hz
Sinusoidal (IEC 60068-2-6)	5 g, 10 Hz 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

Refer to the manual for the chassis you are using for more information about meeting these specifications.

Operating temperature

-40 °C to 70 °C

(IEC 60068-2-1, IEC 60068-2-2)

Storage temperature

-40 °C to 85 °C

(IEC 60068-2-1, IEC 60068-2-2)

Ingress protection

IP40

Operating humidity (IEC 60068-2-78)

10% RH to 90% RH, noncondensing

Storage humidity (IEC 60068-2-78)

5% RH to 95% RH, noncondensing

Pollution Degree

2

Maximum altitude

2,000 m

Indoor use only.

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 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.

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 9220 at ni.com/calibration.

Calibration interval	1 year
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373920A-02 Feb16