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NI 9201

±10 V, Analog Input, 500 kS/s, 8 Ch Module



- 8 single-ended channels, 500 kS/s sample rate
- ±10 V measurement range, 12-bit resolution
- 250 Vrms channel-earth, CAT II (screw terminal), or 60 VDC channel-earth, CAT I (D-SUB) isolation
- 10-position screw-terminal or 25-pin D-SUB connectors available
- -40 °C to 70 °C operating, 5 g vibration, 50 g shock

Overview

The NI 9201 is a C Series module for 8-channel analog input at a maximum aggregate rate of 500 kS/s. It offers an effective combination of channel count and speed at a low price for an economical multifunction system.

As with most C Series modules, the NI 9201 is protected from harmful voltage spikes of up to 2,300 Vrms. This means that no harmful voltage within the isolation rating can harm other modules in the system, the chassis, or any connected computer equipment. In addition to the absolute protection from the isolation, the module provides up to 100 V of overvoltage protection for errant signal connection or unexpected outputs to the individual channels.

You can choose from two connector options for the NI 9201: a 10-position screw-terminal connector for direct connectivity and a 25-position D-SUB connector. The industry-standard 25-position D-SUB connector provides low-cost cabling to a wide variety of accessories from NI or other vendors. Several vendors also offer custom D-SUB cable fabrication services, and can provide cables with a pinout that matches your exact application needs.

Recommended Accessories

- NI 9927 strain relief and operator protection (for screw-terminal variant)
- NI 9924 front-mount 25-pin D-SUB to screw-terminal connector (for D-SUB variant)

Optional Accessories

- NI 9936 extra screw-terminal block (for screw-terminal variant)
- NI 9980 spring-terminal block (for screw-terminal variant)

Note: The NI 9980 is not compatible with the NI 9927 and must be used with low- or non-hazardous voltages or installed in a properly rated enclosure.

Box Contents

- 1 NI 9201 C Series module
- 1 NI 9201 Operating Instructions and Specifications manual
- 1 NI 9936 10-position screw-terminal connector (for screw-terminal variant) network conditions (This is 50 channels from NI 9220 modules running at 100 kS/s per channel.)

NI CompactRIO Streaming Performance

The NI cRIO-9082 system and MXI-Express reconfigurable I/O (RIO) expansion chassis have the largest throughput available and are the recommended solutions for high-speed streaming to disk applications within the CompactRIO family. All CompactRIO chassis have a built-in FPGA that is programmable with NI LabVIEW and can be used to process or filter data before it is transferred to the host controller. Note that communication with the host controller is not a requirement for high-speed control systems because the control logic can often be fully implemented in the FPGA using LabVIEW.

-An NI cRIO-9081/9082 can stream to disk a full chassis of NI 9220 modules running at the maximum 100 kS/s per channel rate.

-MXI-Express expansion chassis have a throughput of approximately 200 MB/s, so 1,000 channels of NI 9220 data can stream over a single connection. This connection can be a daisy chain of multiple chassis that is connected to an NI cRIO-9082 or a PXI Express chassis for maximum streaming performance.

-The NI cRIO-9022 embedded real-time controller can stream a little more than 6 MB/s to disk. For direct streaming applications, this chassis can store approximately 30 NI 9220 channels running at the maximum sample rate.

Comparison Tables

Product Name	Signal Ranges	Channels	Sample Rate	Simultaneous	Resolution	Isolation	Connectivity
NI 9201	±10 V	8 single-ended	500 kS/s	No	12-Bit	250 Vrms Ch-Earth (Screw Terminal), 60 VDC Ch-Earth (D-SUB)	Screw Terminal, 25-Pin D-SUB
NI 9205	±200 mV, ±1 V, ±5 V, ±10 V	32 single-ended, 16 differential	250 kS/s	No	16-Bit	250 Vrms Ch-Earth (Spring Terminal), 60 VDC Ch-Earth (D-SUB)	Spring Terminal, 37-Pin D-SUB
NI 9206	±200 mV, ±1 V, ±5 V, ±10 V	33 single-ended, 16 differential	250 kS/s	No	16-Bit	600 VDC Ch-Earth	Spring Terminal
NI 9215	±10 V	4 differential	100 kS/s/ch	Yes	16-Bit	250 Vrms Ch-Earth (Screw Terminal), 60 VDC Ch-Earth (BNC)	Screw Terminal, BNC
NI 9220	±10 V	16 differential	100 kS/s/ch	Yes	16-Bit	250 Vrms Ch-Earth (Spring Terminal), 60 VDC Ch-Earth (D-SUB)	Spring Terminal, 37-Pin D-SUB
NI 9221	±60 V	8 single-ended	800 kS/s	No	12-Bit	250 Vrms Ch-Earth (Screw Terminal), 60 VDC Ch-Earth (D-SUB)	Screw-Terminal, 25-Pin D-SUB
NI 9222	±10 V	4 differential	500 kS/s/ch	Yes	16-Bit	60 VDC Ch-Ch	Screw Terminal
NI 9223	±10 V	4 differential	1 MS/s/ch	Yes	16-Bit	60 VDC Ch-Ch	Screw Terminal
NI 9229	±60 V	4 differential	50 kS/s/ch	Yes	24-Bit	250 Vrms Ch-Ch (Screw Terminal), 60 VDC Ch-Ch (BNC)	Screw Terminal, BNC
NI 9239	±10 V	4 differential	50 kS/s/ch	Yes	24-Bit	250 Vrms Ch-Ch (Screw Terminal), 60 VDC Ch-Ch (BNC)	Screw Terminal, BNC

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Application and Technology

NI C Series Overview



NI C Series modules are engineered to provide high-accuracy measurements to meet the demands of advanced DAQ and control applications. Each module contains measurement-specific signal conditioning to connect to an array of sensors and signals, bank and channel-to-channel isolation options, and support for wide temperature ranges to meet a variety of application and environmental needs all in a single rugged package. You can choose from more than 100 C Series modules for measurement, control, and communication to connect your applications to any sensor on any bus.

Most C Series I/O modules work with the NI CompactDAQ and NI CompactRIO platforms. The modules are identical, and you can move them from one platform to the other with no modification.

NI CompactRIO Platform



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

[Configure Your Complete NI CompactRIO System](#)

NI CompactDAQ Platform



NI CompactDAQ is a portable, rugged data acquisition platform that integrates connectivity and signal conditioning into modular I/O to directly interface with any sensor or signal. Using NI CompactDAQ with LabVIEW, you can easily customize how you acquire, analyze, present, and manage your measurement data. From research to development to validation, NI provides programmable software, high-accuracy measurements, and local technical support to help ensure you meet your exact measurement application requirements.

[Configure Your Complete NI CompactDAQ System](#)

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Ordering Information

For a complete list of accessories, visit the product page on ni.com.

Products	Part Number	Recommended Accessories	Part Number
NI 9201			
NI 9201 with Screw Terminals Requires: 1 Connectivity Accessories ;	779013-01	Connectivity Accessories: screwTerminal - NI 9927 Strain relief, operator protection (qty 1)	782715-01

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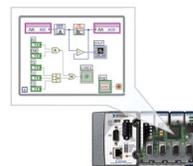
Software Recommendations

LabVIEW Professional Development System for Windows



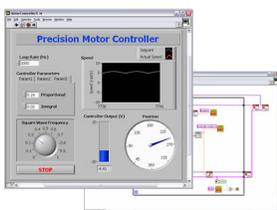
- Fully integrated graphical system design software
- Support for a wide range of measurement hardware, I/O, and buses
- Custom, event-driven user interfaces for measurement and control
- Extensive signal processing, analysis, and math functionality
- Advanced compiler to ensure high-performance execution and code optimization
- Professional software development with code quality review, unit testing, and executable creation

LabVIEW FPGA Module



- Design FPGA applications for NI reconfigurable I/O (RIO) hardware targets
- 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 CORE Generator functions
- Included in the LabVIEW Embedded Control and Monitoring Suite

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
- Includes real-time OS, development and debugging support, and board support

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.

Detailed Specifications

The following specifications are typical for the range -40 to 70 °C unless otherwise noted. All voltages are relative to COM unless otherwise noted. The specifications are the same for the NI 9201 and the NI 9221 unless otherwise noted.

Input Characteristics

Number of channels

8 analog input channels

ADC resolution

12 bits

Type of ADC

Successive approximation register (SAR)

Sample rate (aggregate)		
Module	Maximum Sample Rate (R Series Expansion Chassis)	Maximum Sample Rate (All Other Chassis)
NI 9201, single channel	475 kS/s	800 kS/s
NI 9201, scanning	475 kS/s	500 kS/s
NI 9221	475 kS/s	800 kS/s

Input range

NI 9201

 ± 10 V

NI 9221

 ± 60 V

Operating voltage ranges ¹					
Module	Measurement Voltage, Channel-to-COM			Maximum Voltage, Channel-to-Earth Ground or COM-to-Earth Ground	
	Min (V)	Typ (V)	Max (V)	Screw Terminal	DSUB
NI 9201	± 10.3	± 10.53	± 10.8	250 V _{rms}	± 60 VDC
NI 9221	± 61.4	± 62.50	± 63.8		

Overvoltage protection (channel-to-COM)

 ± 100 V

NI 9201 accuracy (excludes noise)		
Measurement Conditions	Percent of Reading (Gain Error)	Percent of Range* (Offset Error)
Calibrated typ (25 °C, ± 5 °C)	$\pm 0.04\%$	$\pm 0.07\%$
Calibrated max (-40 to 70 °C)	$\pm 0.25\%$	$\pm 0.25\%$
Uncalibrated typ (25 °C, ± 5 °C)	$\pm 0.26\%$	$\pm 0.46\%$
Uncalibrated max (-40 to 70 °C)	$\pm 0.67\%$	$\pm 1.25\%$
* Range equals 10.53 V		

NI 9221 accuracy (excludes noise)		
Measurement Conditions	Percent of Reading (Gain Error)	Percent of Range* (Offset Error)
Calibrated typ (25 °C, ± 5 °C)	$\pm 0.04\%$	$\pm 0.07\%$
Calibrated max (-40 to 70 °C)	$\pm 0.25\%$	$\pm 0.25\%$
Uncalibrated typ (25 °C, ± 5 °C)	$\pm 0.26\%$	$\pm 0.43\%$
Uncalibrated max (-40 to 70 °C)	$\pm 0.67\%$	$\pm 1.06\%$
* Range equals 62.50 V		

Stability

Gain drift

 ± 34 ppm/°C

Offset drift

NI 9201

 ± 100 μ V/°C

NI 9221

 ± 580 μ V/°C

Input bandwidth (-3 dB)

NI 9201

690 kHz min

NI 9221

950 kHz min

Input impedance

Resistance	1 M Ω
Capacitance	5 pF
Input noise (code-centered)	
RMS	0.7 LSB _{rms}
Peak-to-peak	5 LSB
No missing codes	12 bits
DNL	-0.9 to 1.5 LSB
INL	± 1.5 LSB
Crosstalk (at 10 kHz)	-75 dB
Settling time (to 1 LSB)	
NI 9201	2 μ s
NI 9221	1.25 μ s
MTBF	1,092,512 hours at 25 °C; Bellcore Issue 2, Method 1, Case 3, Limited Part Stress Method



Note Contact NI for Bellcore MTBF specifications at other temperatures or for MIL-HDBK-217F specifications.

Power Requirements

Power consumption from chassis

Active mode	1 W max
Sleep mode	1 mW max

Thermal dissipation (at 70 °C)

Active mode	1 W max
Sleep mode	32 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	
NI 9201/9221 with screw terminal	150 g (5.3 oz)
NI 9201/9221 with DSUB	145 g (5.1 oz)

Safety

Safety Voltages

Connect only voltages that are within the following limits.

Channel-to-COM	± 60 VDC max
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NI 9201/9221 with Screw Terminal Isolation Voltages

Channel-to-channel	None
Channel-to-earth ground	
Continuous	250 V _{rms} , Measurement Category II
Withstand	2,300 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* connect the NI 9201/9221 with screw terminal to signals or use for measurements within Measurement Categories III or IV.

NI 9201/9221 with DSUB Isolation Voltages

Channel-to-channel	None
Channel-to-earth ground	
Continuous	60 VDC, Measurement Category I

Withstand	1,000 V _{rms} , 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 9201/9221 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 nC IIC T4
Canada (C-UL)	Class I, Division 2, Groups A, B, C, D, T4; Class I, Zone 2, Ex nC IIC T4
Europe (DEMKO)	EEx nC 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 (IEC 61326): 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 the standards applied to assess the EMC of this product, refer to the *Online Product Certification* section.

 **Note** For EMC compliance, operate this device with double-shielded cables.

CE Compliance

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)

 **Note** For the standards applied to assess the EMC of this product, refer to the *Online Product Certification* section.

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 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. If you are using the NI 9201/9221 with screw terminal, you also must either affix ferrules to the ends of the terminal wires or use the NI 9932 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

National Instruments 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 their life cycle, all products *must* be sent to a WEEE recycling center. For more information about WEEE recycling centers and National Instruments WEEE initiatives, 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

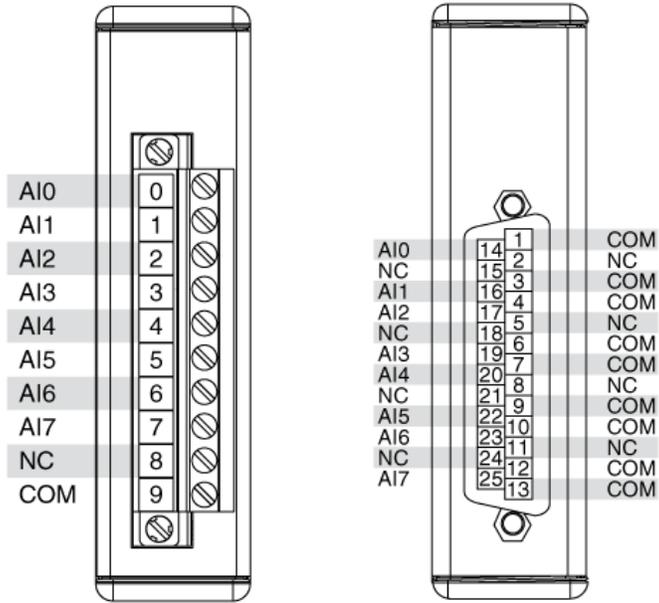
You can obtain the calibration certificate for this device at ni.com/calibration.

Calibration interval 1 year

¹ Refer to the *Safety Guidelines* section in the *NI 9201/9221 Operating Instructions and Specifications* for more information about safe operating voltages.

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Pinouts/Front Panel Connections



NI 9201/9221 Terminal and Pin Assignments

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