NI-9221 Specifications

Contents

NI-9221 Datasheet

- DSUB, screw terminal, or spring terminal connectivity
- 250 V RMS, CAT II, channel-to-earth isolation (screw and spring terminal); 60 V DC, CAT I, channel-to-earth isolation (DSUB)
- -40 °C to 70 °C operating range, 5 g vibration, 50 g shock

The NI-9221 is an analog input module for CompactDAQ and CompactRIO systems. The NI-9221 provides eight channels of ±60 V input with 800 kS/s sample rate.

	Kit Contents	• NI 9221 • NI 9221 Getting Started Guide
	Accessories	• NI 9927 Backshell Connector Kit (Screw Terminal) • NI 9981 Backshell Connector Kit (Spring Terminal) • NI 9924 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, ±20 mA	8 Differential, 8 Current	500 S/s	No	24-Bit	Spring-Terminal, DSUB
NI 9209	±10 V	32 Single-Ended, 16 Differential	500 S/s	No	24-Bit	Spring-Terminal, 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
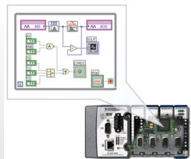
- Design FPGA applications for NI RIO hardware
- Program with the same graphical environment used for desktop and real-time applications
- Execute control algorithms with loop rates up to 300 MHz
- Implement custom timing and triggering logic, digital protocols, and DSP algorithms
- Incorporate existing 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
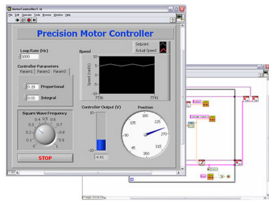
- Design deterministic real-time applications with LabVIEW graphical programming
- Download to dedicated NI or third-party hardware for reliable execution and a wide selection of I/O
- Take advantage of built-in PID control, signal processing, and analysis functions
- Automatically take advantage of 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-9221 Block Diagram
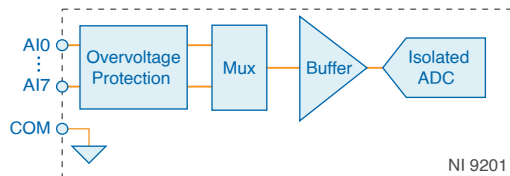
Input signals are scanned, buffered, conditioned, and then sampled by a single ADC.

NI-9221 Specifications

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

> ⚠️ **Caution** Do not operate the NI-9221 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** Le NI-9221 ne doit en aucun cas être utilisé d'une autre façon que celle spécifiée dans ce document. Une mauvaise utilisation du produit peut s'avérer dangereuse. Si le produit est endommagé de quelque manière que ce soit, la sécurité intégrée dans le produit risque d'en être compromise. Si le produit est endommagé, le renvoyer à NI pour réparation.

Input Characteristics

Number of channels	8
ADC resolution	12 bits
Type of ADC	Successive approximation register (SAR)
Maximum Sample Rate (Aggregate)	
R Series Expansion Chassis	475 kS/s
All Other Chassis	800 kS/s
Input range	±60 V

Measurement voltage, channel-to-COM (V)	
Minimum	±61.4
Typical	±62.50
Maximum	±63.8
Overvoltage protection, channel-to-COM	±100 V

Table 1. NI-9221 Accuracy (Excludes Noise)

Measurement Conditions		Percent of Reading (Gain Error)	Percent of Range (Offset Error)
Calibrated	Typical (25 °C, ±5 °C)	±0.04%	±0.07%
	Maximum (-40 °C to 70 °C)	±0.25%	±0.25%
Uncalibrated	Typical (25 °C, ±5 °C)	±0.26%	±0.43%
	Maximum (-40 °C to 70 °C)	±0.67%	±1.06%
Stability			
Gain drift		±34 ppm/°C	
Offset drift		±580 µV/°C	
Input bandwidth (-3 dB)		950 kHz min	
Input impedance			
Resistance		1 MΩ	
Capacitance		5 pF	
Input noise, code-centered			
RMS		0.7 LSBrms	

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	1.25 µs
MTBF	1,092,512 hours at 25 °C; Bellcore Issue 2, Method 1, Case 3, Limited Part Stress Method

Power Requirements

Power consumption from chassis	
Active mode	1 W maximum
Sleep mode	1 mW maximum
Thermal dissipation (at 70 °C)	
Active mode	1 W maximum
Sleep mode	32 mW maximum

Physical Characteristics

Spring-terminal wiring	

Gauge	0.2 mm to 2.5 mm (30 AWG to 12 AWG) copper conductor wire
Wire strip length	10 mm (0.39 in.) of insulation stripped from the end
Temperature rating	90 °C, minimum
Wires per spring terminal	One wire per spring terminal; two wires per spring terminal using a 2-wire ferrule
Connector securement	
Securement type	Screw flanges provided
Torque for screw flanges	0.2 N · m (1.80 lb · in.)
Weight	
NI-9221 with screw terminal	165 g (5.8 oz)
NI-9221 with spring terminal	152 g (5.4 oz)
NI-9221 with DSUB	142 g (5.0 oz)

NI-9221 with Screw Terminal and NI-9221 with Spring Terminal Safety Voltages

Connect only voltages that are within the following limits.

Channel-to-COM	±60 V DC maximum
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

NI-9221 with DSUB Safety Voltages

Connect only voltages that are within the following limits.

Channel-to-COM	±60 V DC maximum
Channel-to-channel	None
Channel-to-earth	
Continuous	60 V DC, Measurement Category I
Withstand	1,000 V RMS, verified by a 5 s dielectric withstand test

Hazardous Locations

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

Electromagnetic Compatibility

- EN 61326 (IEC 61326): Class A emissions; Industrial immunity

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

CE Compliance $C \epsilon$

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)

Product Certifications and Declarations

Refer to the product Declaration of Conformity (DoC) for additional regulatory compliance information. To obtain product certifications and the DoC for NI products, visit ni.com/product-certifications, search by model number, and click the appropriate link.

Shock and Vibration

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

Operating vibration	
Random	5 g RMS, 10 Hz to 500 Hz
Sinusoidal	5 g, 10 Hz to 500 Hz
Operating shock	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 (IEC 60068-2-1, IEC 60068-2-2)	-40 °C to 70 °C
Storage temperature (IEC 60068-2-1, IEC 60068-2-2)	-40 °C to 85 °C
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 **Engineering a Healthy Planet** 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.

EU and UK Customers

- ⊠ **Waste Electrical and Electronic Equipment (WEEE)**—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 RoHS— NI 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 NI 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-9221 at ni.com/calibration.

Calibration interval	1 year