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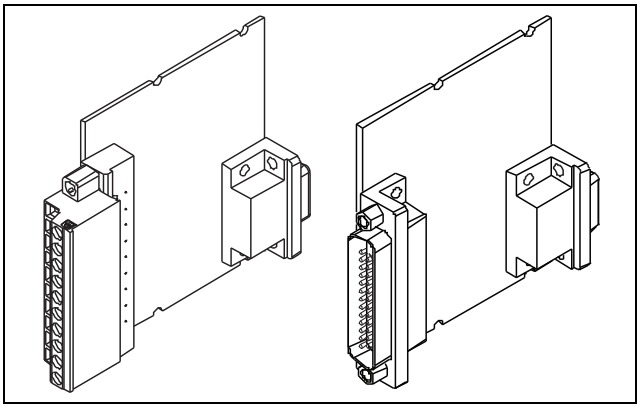
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Find the *National Instruments sbRIO-9221* at our website: *Click HERE*

OPERATING INSTRUCTIONS AND SPECIFICATIONS

NI 9201E/9221E

8-Channel, 12-Bit Analog Input Modules



NATIONAL INSTRUMENTS

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This document describes how to use the National Instruments 9201E and National Instruments 9221E and includes dimensions, terminal assignments, and specifications for the NI 9201E/9221E. In this document, the NI 9201E/9221E with screw terminal and NI 9201E/9221E with DSUB are referred to inclusively as the NI 9201E/9221E. Visit `ni.com/info` and enter `rdsoftwareversion` to determine which software you need for the modules you are using. For information about installing, configuring, and programming the system, refer to the system documentation. Visit `ni.com/info` and enter `cseriesdoc` for information about C Series documentation.

Caution National Instruments makes no electromagnetic compatibility (EMC) or CE marking compliance claims for the NI 9201E/9221E. The end-product supplier is responsible for conformity to any and all compliance requirements.

Caution The NI 9201E/9221E must be installed inside a suitable enclosure prior to use. Hazardous voltages may be present.

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NI 9201E/9221E Dimensions

The following figure shows the dimensions of the NI 9201E/9221E.

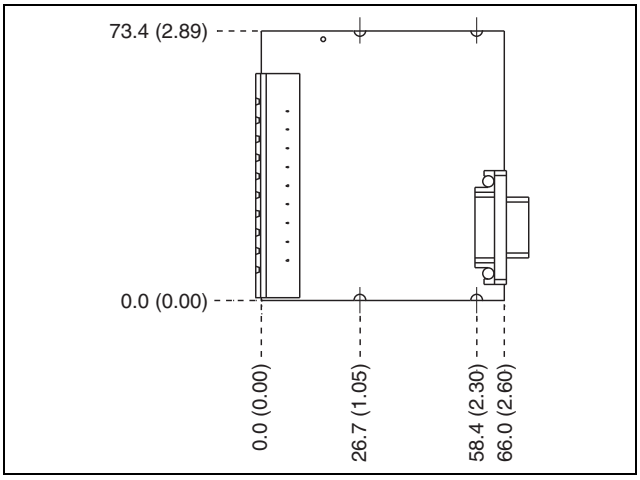


Figure 1. NI 9201E/9221E Dimensions in Millimeters (Inches)

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Connecting the NI 9201E/9221E

The NI 9201E/9221E provides connections for eight analog input channels.

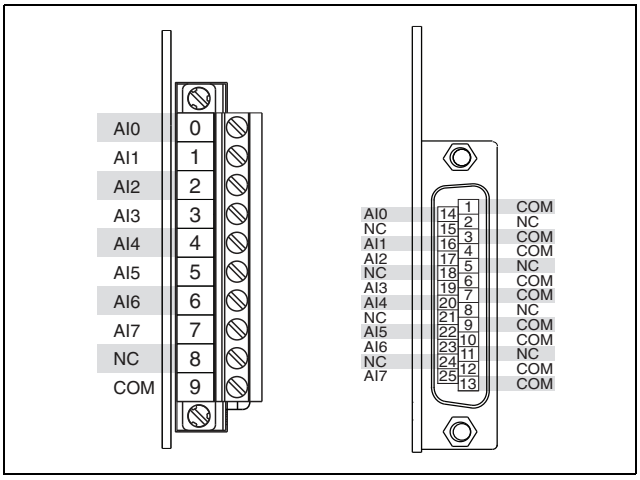


Figure 2. NI 9201E/9221E Terminal and Pin Assignments

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The NI 9201E/9221E with screw terminal has a 10-terminal, detachable screw-terminal connector. The NI 9201E/9221E with DSUB has a 25-pin DSUB connector. Each channel has an AI terminal or pin to which you can connect a voltage signal. COM, the common terminal or pin, is internally connected to the isolated ground reference of the module.

The NI 9201E/9221E channels are isolated from other modules in the system. The module protects each channel from overvoltages. Refer to the *Specifications* section for more information about overvoltage protection. The input signals are scanned, buffered, conditioned, and then sampled by a single 12-bit ADC. Refer to Figure 3 for an illustration of the input circuitry on the NI 9201E/9221E.

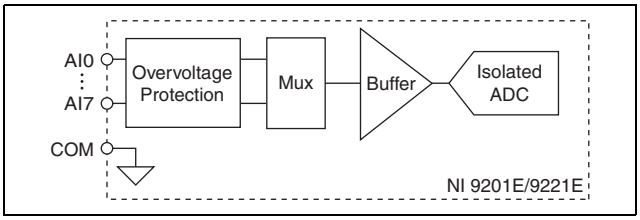


Figure 3. Input Circuitry on the NI 9201E/9221E

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You can connect single-ended voltage signals to the NI 9201E/9221E. Connect the positive lead of the voltage signal to AI. Connect the ground signal to COM. Refer to Figure 4 for an illustration of connecting a single-ended voltage signal to the NI 9201E/9221E.

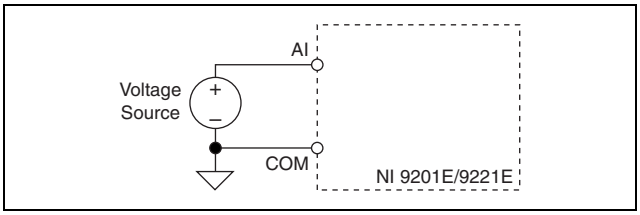


Figure 4. Connecting a Single-Ended Voltage Signal to the NI 9201E/9221E

Note You must use 2-wire ferrules to create a secure connection when connecting more than one wire to a single terminal on the NI 9201E/9221E with screw terminal.

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Sleep Mode

This module supports a low-power sleep mode. Support for sleep mode at the system level depends on the chassis that the module is plugged into. Refer to the chassis manual for information about support for sleep mode. If the chassis supports sleep mode, refer to the software help for information about enabling sleep mode. Visit `ni.com/info` and enter `cseriesdoc` for information about C Series documentation.

Typically, when a system is in sleep mode, you cannot communicate with the modules. In sleep mode, the system consumes minimal power and may dissipate less heat than it does in normal mode. Refer to the *Specifications* section for more information about power consumption and thermal dissipation.

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Specifications

The following specifications are typical for the range –40 to 85 °C internal to any enclosures unless otherwise noted. All voltages are relative to COM unless otherwise noted. The specifications are the same for the NI 9201E and the NI 9221E 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 9201E, single channel	475 kS/s	800 kS/s
NI 9201E, scanning	475 kS/s	500 kS/s
NI 9221E	475 kS/s	800 kS/s

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Input range

NI 9201E ..... ±10 V

NI 9221E ..... ±60 V

Operating voltage ranges

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 9201E	±10.3	±10.53	±10.8	250 V_{rms}	±60 VDC
NI 9221E	±61.4	±62.50	±63.8		

Overvoltage protection
(channel-to-COM) ..... ±100 V

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NI 9201E accuracy (excludes noise)

Measurement Conditions	Percent of Reading (Gain Error)	Percent of Range* (Offset Error)
Calibrated typ (25 °C, ±5 °C)	±0.04%	±0.07%
Calibrated max (–40 to 85 °C)	±0.25%	±0.25%
Uncalibrated typ (25 °C, ±5 °C)	±0.26%	±0.46%
Uncalibrated max (–40 to 85 °C)	±0.67%	±1.25%
* Range equals 10.53 V		

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NI 9221E accuracy (excludes noise)

Measurement Conditions	Percent of Reading (Gain Error)	Percent of Range* (Offset Error)
Calibrated typ (25 °C, ±5 °C)	±0.04%	±0.07%
Calibrated max (–40 to 85 °C)	±0.25%	±0.25%
Uncalibrated typ (25 °C, ±5 °C)	±0.26%	±0.43%
Uncalibrated max (–40 to 85 °C)	±0.67%	±1.06%
* Range equals 62.50 V		

Stability

Gain drift ..... ±34 ppm/°C

Offset drift

NI 9201E..... ±100 µV/°C

NI 9221E..... ±580 µV/°C

Input bandwidth (–3 dB)

NI 9201E ..... 690 kHz min

NI 9221E ..... 950 kHz min

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Input impedance

- Resistance ..... 1 MΩ
- 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 9201E ..... 2 µs
- NI 9221E ..... 1.25 µs

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

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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 85 °C)

Active mode ..... 1 mW max

Sleep mode ..... 32 mW max

Physical Characteristics

Use a dry, low-velocity stream of air to clean the module. If needed, use a soft-bristle brush for cleaning around components.

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.

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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 9201E/9221E with screw terminal ..... 64 g (2.2 oz)

NI 9201E/9221E with DSUB ..... 44 g (1.6 oz)

Safety

Safety Voltages

Connect only voltages that are within the following limits.

Channel-to-COM ..... ±60 VDC max

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NI 9201E/9221E with Screw Terminal Isolation Voltages

Channel-to-channel ..... None

Channel-to-earth ground

Continuous ..... 250 V_{rms}, Measurement Category II, (Double insulation)

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 9201E/9221E with screw terminal to signals or use for measurements within Measurement Categories III or IV.

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NI 9201E/9221E with DSUB Isolation Voltages

Channel-to-channel ..... None

Channel-to-earth ground

Continuous ..... 60 VDC, Measurement Category I, (Double insulation)

Withstand ..... 1,000 V_{rms}, verified by a 5 s dielectric withstand test

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 9201E/9221E with DSUB to signals or use for measurements within Measurement Categories II, III, or IV.

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Safety Standards

This product meets the requirements of the following standards of safety for electrical equipment for measurement, control, and laboratory use when installed in a suitable enclosure:

- 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.

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.

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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 85 °C

Storage temperature
(IEC 60068-2-1, IEC 60068-2-2) ..... –40 to 85 °C

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

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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 to the environment and 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 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`.

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Calibration

You can obtain the calibration certificate and information about calibration services for the NI 9201E/9221E at ni.com/calibration.

Calibration interval ..... 1 year

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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, contact your local branch office:

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