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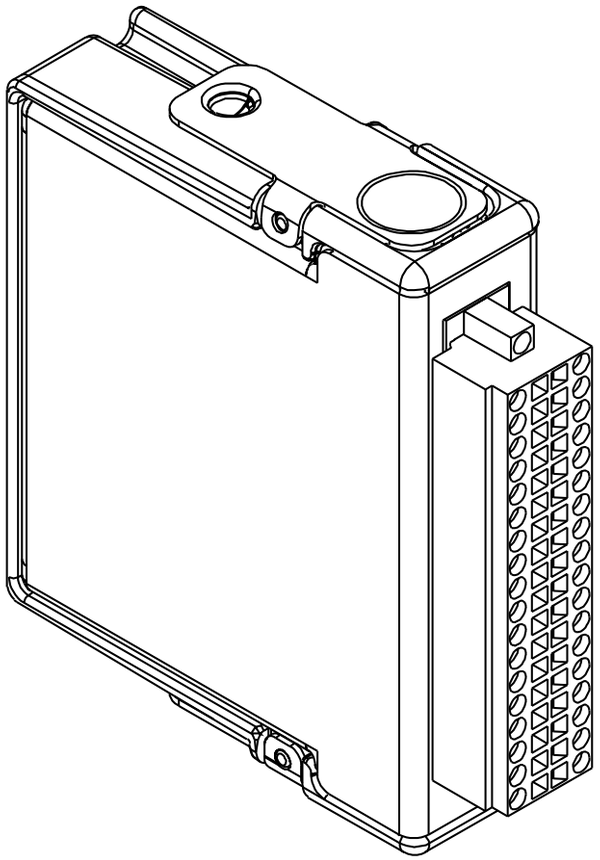
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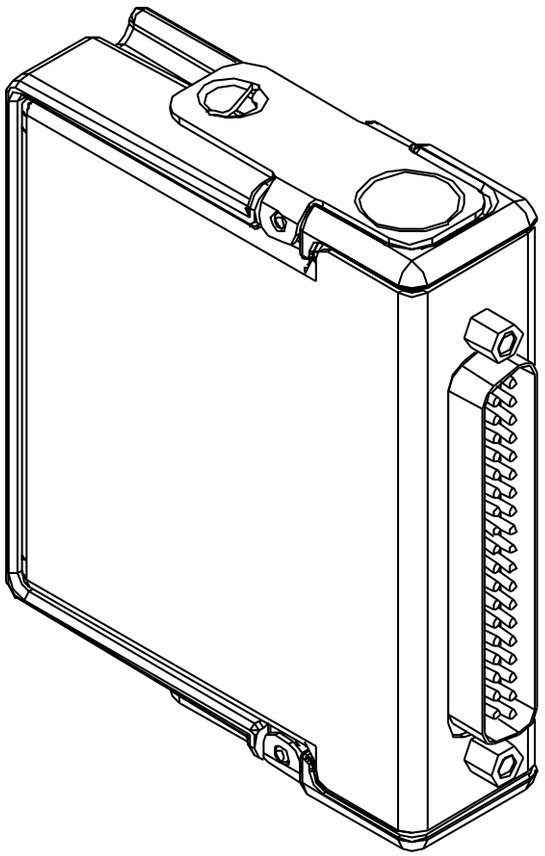
Find the *National Instruments sbRIO-9205* at our website: *Click HERE*

GETTING STARTED GUIDE

NI 9205

16 AI Differential/32 AI Single-Ended, ±200 mV to ±10 V, 16 Bit, 250 kS/s Aggregate





NATIONAL INSTRUMENTS™

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This document explains how to connect to the NI 9205.



Note Before you begin, complete the software and hardware installation procedures in your chassis documentation.



Note The guidelines in this document are specific to the NI 9205. The other components in the system might not meet the same safety ratings. Refer to the documentation for each component in the system to determine the safety and EMC ratings for the entire system.

Safety Guidelines

Operate the NI 9205 only as described in this document.



Caution Do not operate the NI 9205 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.

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Hazardous Voltage This icon denotes a warning advising you to take precautions to avoid electrical shock with the NI 9205 with spring terminal .

Safety Voltages

Connect only voltages that are within the following limits:

Maximum voltage[1]	
Channel-to-COM	±30 VDC

NI 9205 with Spring Terminal Isolation Voltages

Channel-to-channel	None
Channel-to-earth ground[2]	
Continuous	250 Vrms, Measurement Category II
Withstand	2,300 Vrms, verified by a 5 s dielectric withstand test

1 The maximum voltage that can be applied or output between AI and COM without creating a safety hazard.

2 This specification is valid only up to 2,000 m.

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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 9205 to signals or use for measurements within Measurement Categories III or IV.

NI 9205 with DSUB Isolation Voltages

Channel-to-channel	None
Channel-to-earth ground	
Continuous	60 VDC, Measurement Category I
Withstand	
up to 2,000 m	1,000 Vrms, verified by a 5 s dielectric withstand test
up to 5,000 m	500 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 9205 to signals or use for measurements within Measurement Categories II, III, or IV.

Safety Guidelines for Hazardous Voltages

You can connect hazardous voltages only to the NI 9205 with spring terminal . Do not connect hazardous voltages to the NI 9205 with DSUB.

If hazardous voltages are connected to the device, take the following precautions. A hazardous voltage is a voltage greater than 42.4 Vpk voltage or 60 VDC to earth ground.

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Caution Ensure that hazardous voltage wiring is performed only by qualified personnel adhering to local electrical standards.

Caution Do not mix hazardous voltage circuits and human-accessible circuits on the same module.

Caution Ensure that devices and circuits connected to the module are properly insulated from human contact.

Caution When module terminals are hazardous voltage LIVE (>42.4 Vpk/60 VDC), you must ensure that devices and circuits connected to the module are properly insulated from human contact. You must use the NI 9940 connector backshell kit to ensure that the terminals are not accessible.

Note You can use the NI 9940 only with the NI 9205 with spring terminal.

Safety Guidelines for Hazardous Locations

The NI 9205 is suitable for use in Class I, Division 2, Groups A, B, C, D, T4 hazardous locations; Class I, Zone 2, AEx nA IIC T4 and Ex nA IIC T4 hazardous locations; and nonhazardous

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locations only. Follow these guidelines if you are installing the NI 9205 in a potentially explosive environment. Not following these guidelines may result in serious injury or death.



Caution Do not disconnect I/O-side wires or connectors unless power has been switched off or the area is known to be nonhazardous.



Caution Do not remove modules unless power has been switched off or the area is known to be nonhazardous.



Caution Substitution of components may impair suitability for Class I, Division 2.



Caution For Division 2 and Zone 2 applications, install the system in an enclosure rated to at least IP54 as defined by IEC/EN 60079-15.



Caution For Division 2 and Zone 2 applications, connected signals must be within the following limits.

Capacitance	0.2 µF maximum

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Special Conditions for Hazardous Locations Use in Europe and Internationally

The NI 9205 has been evaluated as Ex nA IIC T4 Gc equipment under DEMKO Certificate No. 03 ATEX 0324020X and is IECEx UL 14.0089X certified. Each NI 9205 is marked Ex II 3G and is suitable for use in Zone 2 hazardous locations, in ambient temperatures of -40 °C ≤ Ta ≤ 70 °C. If you are using the NI 9205 in Gas Group IIC hazardous locations, you must use the device in an NI chassis that has been evaluated as Ex nC IIC T4, Ex IIC T4, Ex nA IIC T4, or Ex nL IIC T4 equipment.

Caution You must make sure that transient disturbances do not exceed 140% of the rated voltage.

Caution The system shall only be used in an area of not more than Pollution Degree 2, as defined in IEC 60664-1.

Caution The system shall be mounted in an ATEX/IECEx-certified enclosure with a minimum ingress protection rating of at least IP54 as defined in IEC/EN 60079-15.

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Caution The enclosure must have a door or cover accessible only by the use of a tool.

Electromagnetic Compatibility Guidelines

This product was tested and complies with the regulatory requirements and limits for electromagnetic compatibility (EMC) stated in the product specifications. These requirements and limits provide reasonable protection against harmful interference when the product is operated in the intended operational electromagnetic environment.

This product is intended for use in industrial locations. However, harmful interference may occur in some installations, when the product is connected to a peripheral device or test object, or if the product is used in residential or commercial areas. To minimize interference with radio and television reception and prevent unacceptable performance degradation, install and use this product in strict accordance with the instructions in the product documentation.

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Furthermore, any changes or modifications to the product not expressly approved by National Instruments could void your authority to operate it under your local regulatory rules.

Special Conditions for Marine Applications

Some products are Lloyd's Register (LR) Type Approved for marine (shipboard) applications. To verify Lloyd's Register certification for a product, visit *ni.com/certification* and search for the LR certificate, or look for the Lloyd's Register mark on the product.



Caution In order to meet the EMC requirements for marine applications, install the product in a shielded enclosure with shielded and/or filtered power and input/output ports. In addition, take precautions when designing, selecting, and installing measurement probes and cables to ensure that the desired EMC performance is attained.

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Preparing the Environment

Ensure that the environment in which you are using the NI 9205 meets the following specifications.

Operating temperature (IEC 60068-2-1, IEC 60068-2-2)	-40 °C to 70 °C
Operating humidity (IEC 60068-2-78)	10% RH to 90% RH, noncondensing
Pollution Degree	2
Maximum altitude	
NI 9205 with spring terminal	2,000 m
NI 9205 with DSUB	5,000 m

Indoor use only.



Note Refer to the device datasheet on *ni.com/manuals* for complete specifications.

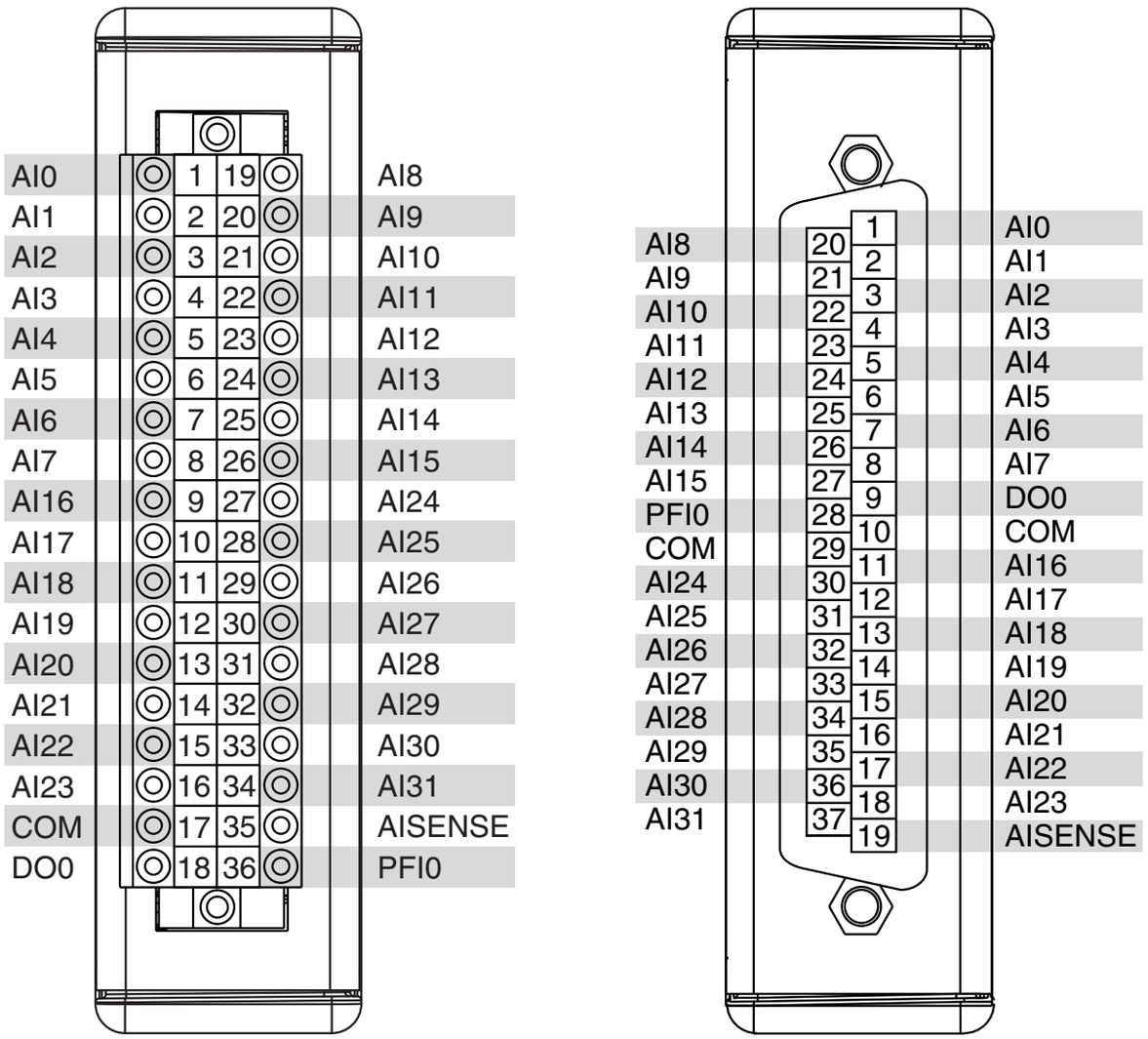
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Connecting the NI 9205

The NI 9205 provides connections for 32 single-ended channels or 16 differential channels.

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Figure 1. NI 9205 Pinout



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NI 9205 Signal Descriptions

Table 1. NI 9205 Signal Descriptions

Signal Name	Description
AI	Analog input channel
AISENSE	Reference for each AI channel for NRSE measurements
COM	Internally connected to the isolated ground reference
DO	Digital output channel[3]
PFI	Programmable function interface signal that functions as a digital input

Signals

You can connect single-ended or differential signals to the NI 9205. Use a differential measurement configuration to attain more accurate measurements and less noise. The following table

[3] The digital output channel is supported only in CompactRIO systems.

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shows the signal pairs that are valid for differential connection configurations with the NI 9205.

Table 2. Differential Pairs

Channel	AI +	AI-
0	AI0	AI8
1	AI1	AI9
2	AI2	AI10
3	AI3	AI11
4	AI4	AI12
5	AI5	AI13
6	AI6	AI14
7	AI7	AI15
16	AI16	AI24
17	AI17	AI25

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Table 2. Differential Pairs (Continued)

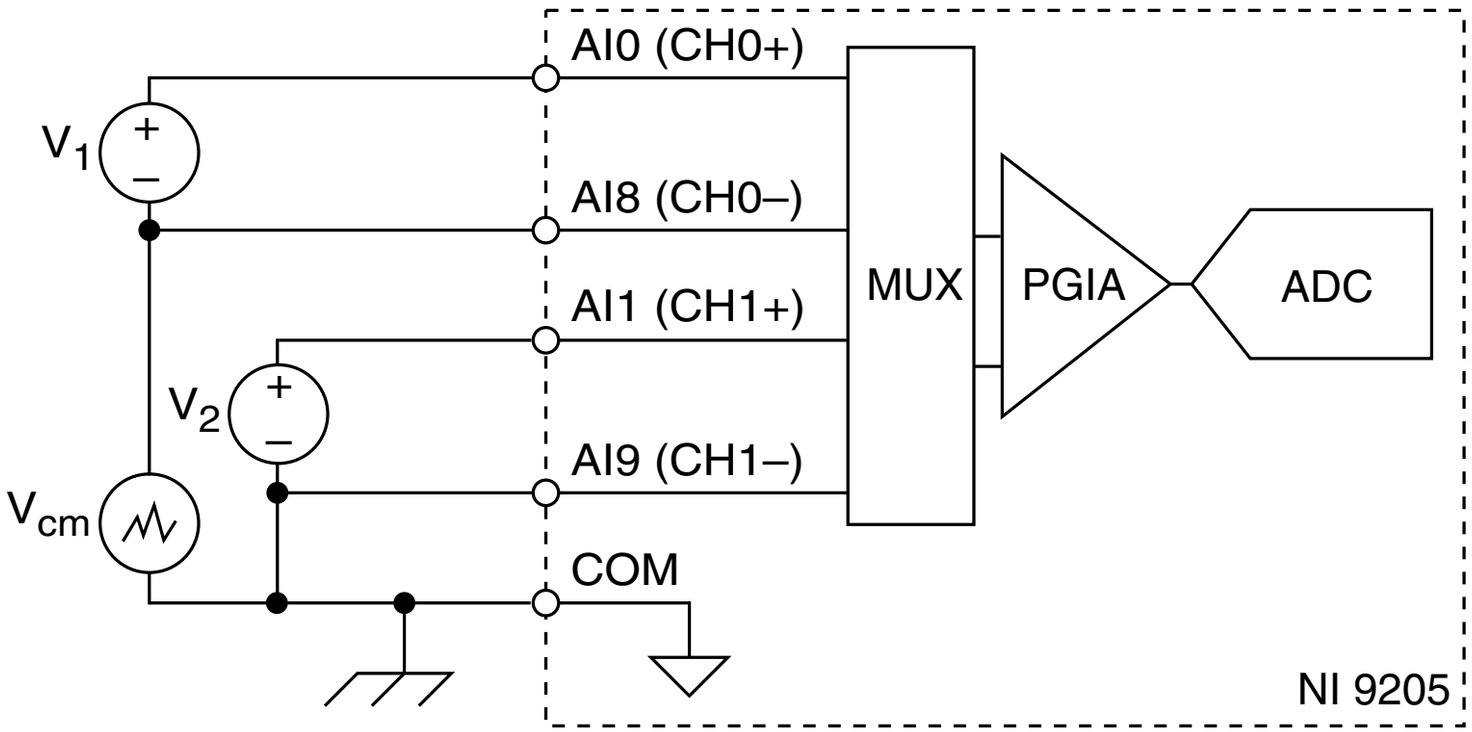
Channel	AI +	AI-
18	AI18	AI26
19	AI19	AI27
20	AI20	AI28
21	AI21	AI29
22	AI22	AI30
23	AI23	AI31

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Connecting Grounded Differential Signals

You can connect grounded differential signals to the NI 9205.

Figure 2. Connecting Grounded Differential Signals to the NI 9205



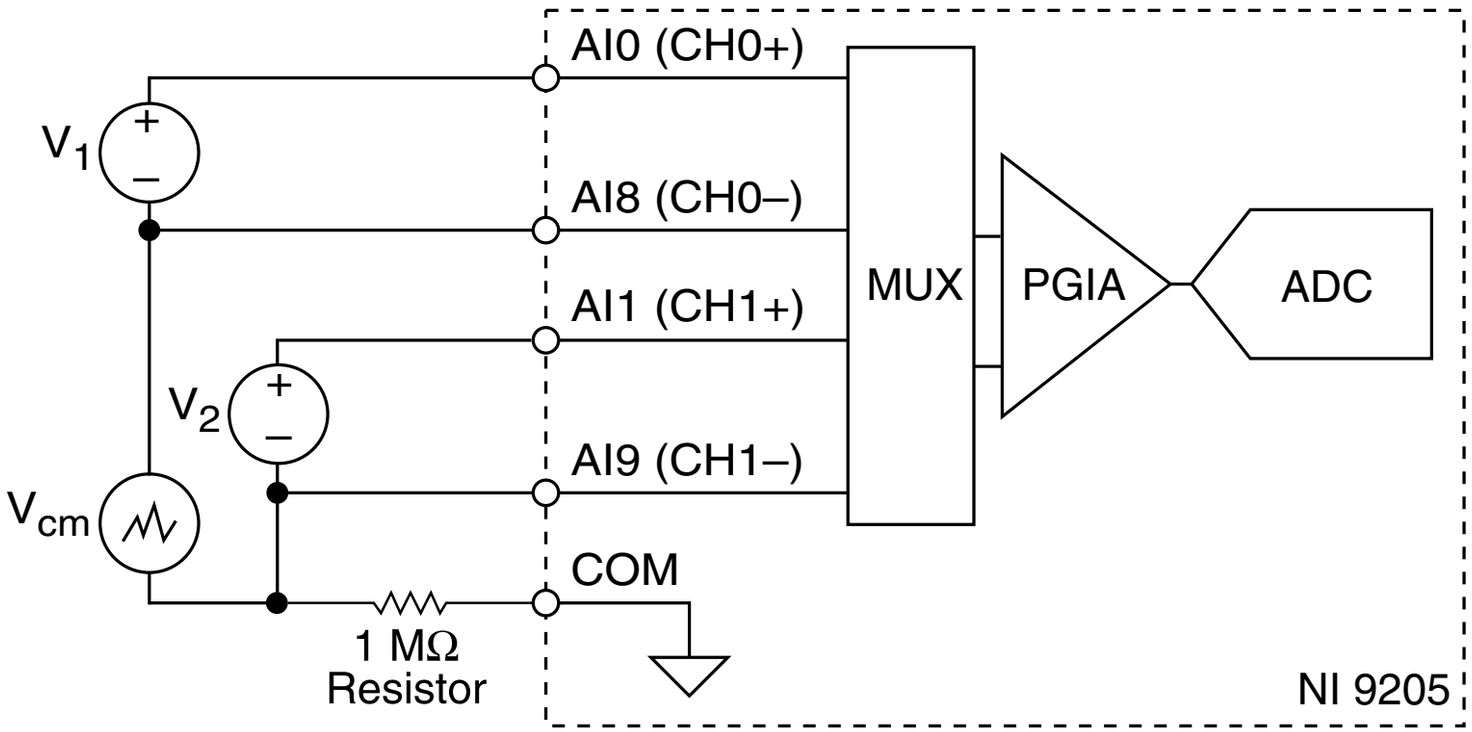
In a differential configuration, the NI 9205 rejects the common-mode noise voltage, V_{cm}, during the measurement of V_1. To connect grounded differential signals to the NI 9205, you must also connect the signal reference to COM.

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Connecting Floating Differential Signals

You can connect floating differential signals to the NI 9205.

Figure 3. Connecting Floating Differential Signals to the NI 9205



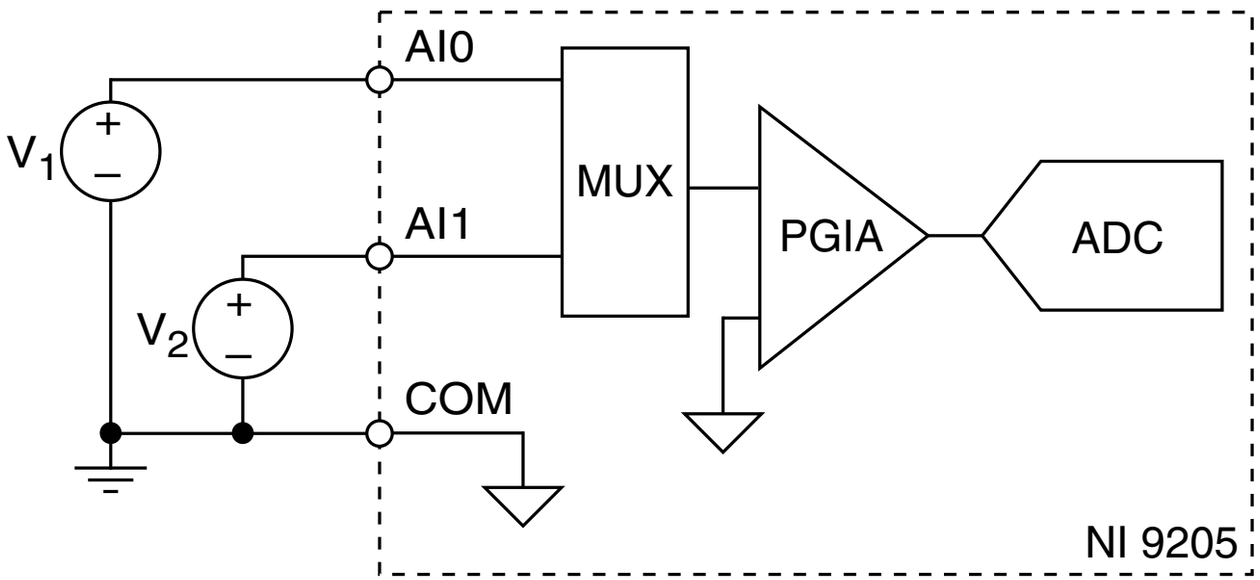
To connect floating differential signals to the NI 9205, you must connect the negative signal to COM through a 1 MΩ resistor to keep the voltage within the maximum working voltage. If the voltage source is outside the maximum working voltage, the NI 9205 does not read data accurately.

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Connecting RSE Voltage Signals

You can connect referenced single-ended (RSE) signals to the NI 9205.

Figure 4. Connecting RSE Voltage Signals



In an RSE configuration, the NI 9205 measures each channel with respect to COM. To connect RSE signals to the NI 9205, you must connect the voltage ground signal to COM to keep the maximum working voltage in the specified range.

Note If you leave COM unconnected, the signals float outside the working input range of the NI 9205. This

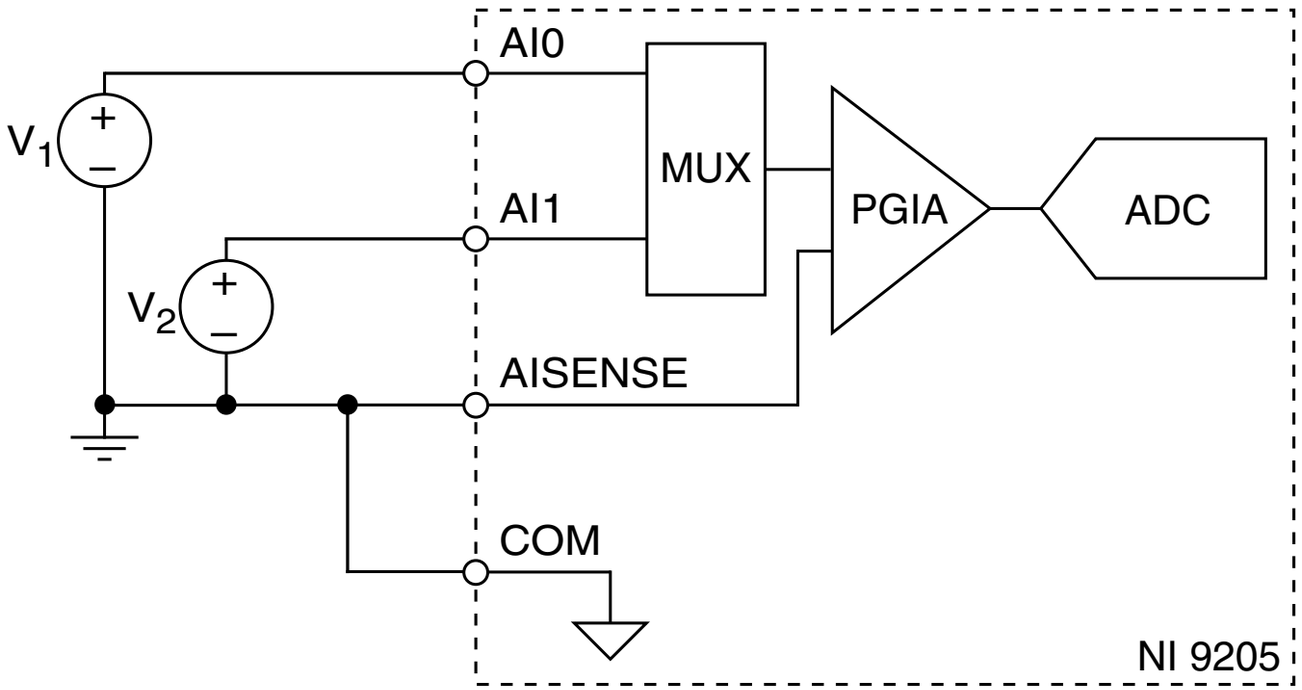
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may result in unreliable measurements because there is no way to ensure that the input signal is within 10 V of COM.

Connecting NRSE Voltage Signals

You can connect non-referenced single-ended (NRSE) signals to the NI 9205.

Figure 5. Connecting an RSE Voltage Signal to the NI 9205



In an NRSE configuration, the NI 9205 measures each channel with respect to AISENSE. An NRSE configuration provides remote sense for the negative input of the PGIA that is shared by

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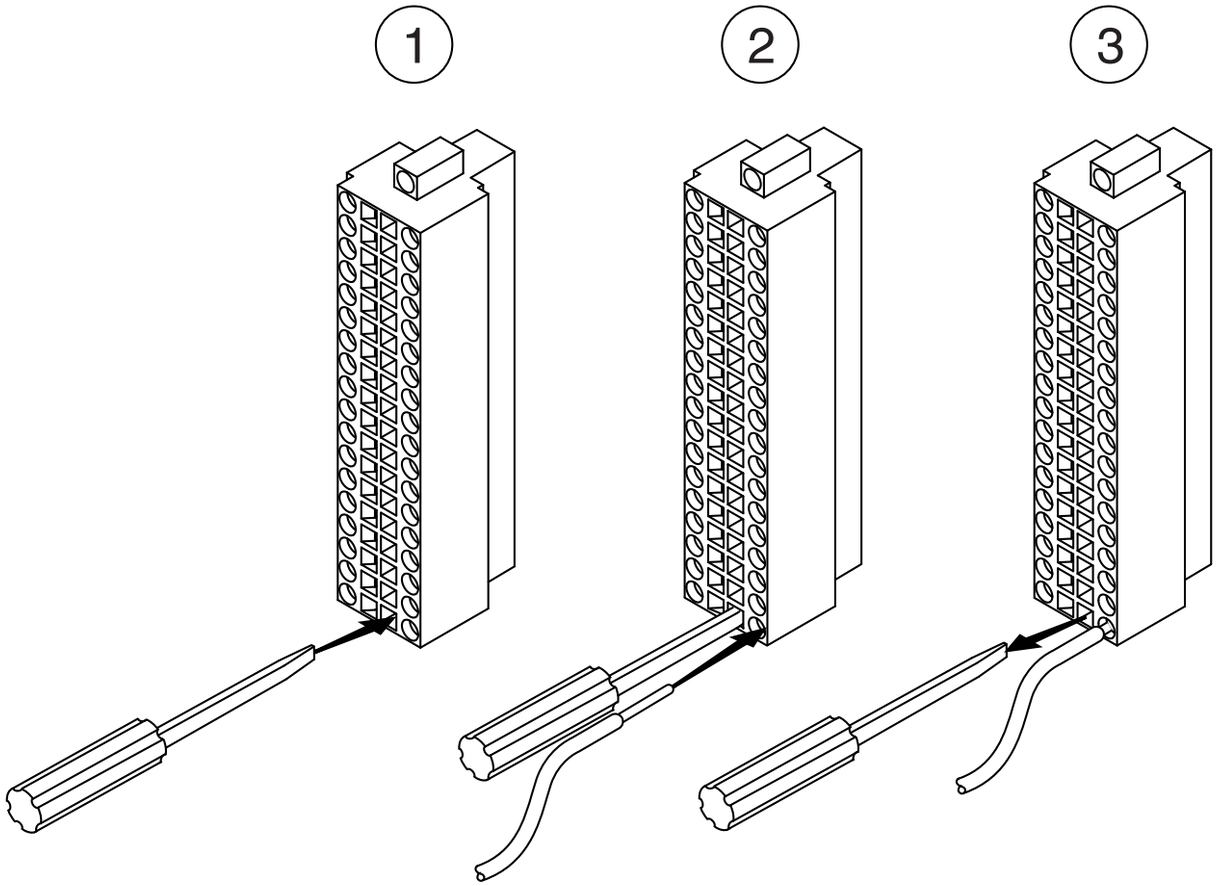
all channels and also provides improved noise rejection compared to an RSE connection.

Connecting Wires to a Spring-Terminal Connector

Complete the following steps to connect wires to the spring-terminal connector using the flathead screwdriver that is included with your C Series module or a flathead screwdriver with a blade smaller than 2.3 mm x 1.0 mm (0.09 in. x 0.04 in.).

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Figure 6. Connecting Wires to a Spring-Terminal Connector



1. Insert the screwdriver into a spring clamp activation slot to open the corresponding connector terminal.
2. Press a wire into the open connector terminal.
3. Remove the screwdriver from the activation slot to clamp the wire into place.

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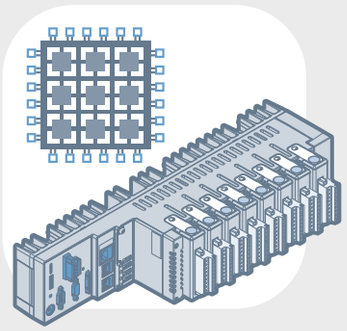
High-Vibration Application Connections

If your application is subject to high vibration, NI recommends that you use the NI 9940 backshell kit to protect connections to the NI 9205 with spring terminal.

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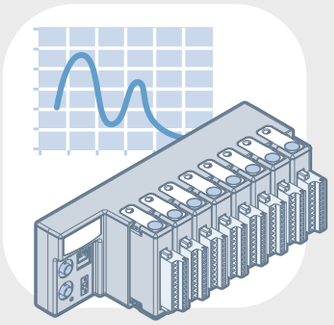
Where to Go Next

CompactRIO



- *NI 9205 Datasheet*
- *NI-RIO Help*
- *LabVIEW FPGA Help*

NI CompactDAQ



- *NI 9205 Datasheet*
- *NI-DAQmx Help*
- *LabVIEW Help*

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