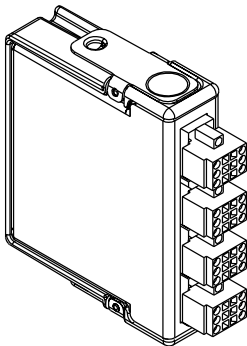


## GETTING STARTED GUIDE

# NI 9219

4 AI, 100 S/s/ch Simultaneous, Universal  
Measurements



This document explains how to connect to the NI 9219.



**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 9219. 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

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Operate the NI 9219 only as described in this document.



**Caution** Do not operate the NI 9219 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.



**Hazardous Voltage** This icon denotes a warning advising you to take precautions to avoid electrical shock.

## Safety Guidelines for Hazardous Voltages

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.



**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 9972 connector backshell kit to ensure that the terminals are not accessible.

## Safety Voltages

Connect only voltages that are within the following limits.

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### Channel-to-channel

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Continuous	250 VAC, Measurement Category II
------------	----------------------------------

Withstand	1,390 VAC, verified by a 5 s dielectric withstand test
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---

### Channel-to-earth ground

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Continuous	250 VAC, Measurement Category II
------------	----------------------------------

Withstand	2,300 VAC, verified by a 5 s dielectric withstand test
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---

### Zone 2 hazardous locations applications in Europe

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Channel-to-channel and channel-to-earth ground	60 VDC, Measurement Category I
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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** If using in Division 2 or Zone 2 hazardous locations applications, do not connect the NI 9219 to signals or use for measurements within Measurement Categories II, III, or IV.



**Note** Measurement Categories CAT I and CAT O are equivalent. These test and measurement circuits are not intended for direct connection to the MAINS building installations of Measurement Categories CAT II, CAT III, or CAT IV.

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 9219 to signals or use for measurements within Measurement Categories III or IV.

## Safety Guidelines for Hazardous Locations

The NI 9219 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 locations only. Follow these guidelines if you are installing the NI 9219 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.

## Special Conditions for Hazardous Locations Use in Europe and Internationally

The NI 9219 has been evaluated as Ex nA IIC T4 Gc equipment under DEMKO Certificate No. 07 ATEX 0626664X and is IECEx UL 14.0089X certified. Each NI 9219 is marked  II 3G and is suitable for use in Zone 2 hazardous locations, in ambient temperatures of  $-40\text{ }^{\circ}\text{C} \leq T_a \leq 70\text{ }^{\circ}\text{C}$ . If you are using the NI 9219 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/EN 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.



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

## Electromagnetic Compatibility Guidelines

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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.



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.



**Caution** To ensure the specified EMC performance, operate this product only with shielded cables and accessories.

## 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](https://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.

## Preparing the Environment

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Ensure that the environment in which you are using the NI 9219 meets the following specifications.

Operating temperature (IEC 60068-2-1, IEC 60068-2-2)	-40 °C to 70 °C
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Operating humidity (IEC 60068-2-78)	10% RH to 90% RH, noncondensing
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Pollution Degree	2
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Maximum altitude	2,000 m
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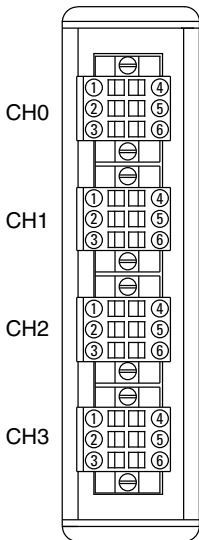
Indoor use only.



**Note** Refer to the device datasheet on [ni.com/manuals](https://ni.com/manuals) for complete specifications.

# NI 9219 Pinout

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**Table 1.** Signals by Mode

Mode	Pin					
	1	2	3	4	5	6
Voltage	T+	T-	—	HI	LO	—
Current	T+	T-	HI	—	LO	—
4-Wire Resistance	T+	T-	EX+	HI	EX-	LO
2-Wire Resistance	T+	T-	HI	—	LO	—
Thermocouple	T+	T-	—	HI	LO	—
4-Wire RTD	T+	T-	EX+	HI	EX-	LO
3-Wire RTD	T+	T-	EX+	—	EX-	LO
Quarter-Bridge	T+	T-	HI	—	LO	—
Half-Bridge	T+	T-	EX+	HI	EX-	—
Full-Bridge	T+	T-	EX+	HI	EX-	LO

**Table 1.** Signals by Mode (Continued)

Mode	Pin					
	1	2	3	4	5	6
DI	T+	T-	—	HI	LO	—
Open Contact	T+	T-	HI	—	LO	—

**Table 2.** Signal Descriptions

Signal	Description
EX+	Positive sensor excitation connection
EX-	Negative sensor excitation connection
HI	Positive input signal connection
LO	Negative input signal connection
T+	TEDS data connection
T-	TEDS COM connection

# Measurement Types

---

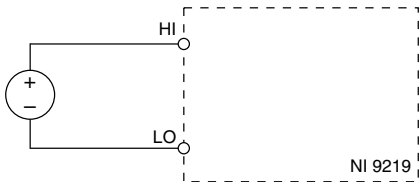
The NI 9219 provides modes for the following measurement types.

- Voltage
- Current
- 4-Wire Resistance
- 2-Wire Resistance
- Thermocouple
- 4-Wire RTD
- 3-Wire RTD
- Quarter-Bridge
- Half-Bridge
- Full-Bridge
- Digital In<sup>1</sup>
- Open Contact<sup>1</sup>

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<sup>1</sup> Only supported in CompactRIO systems.

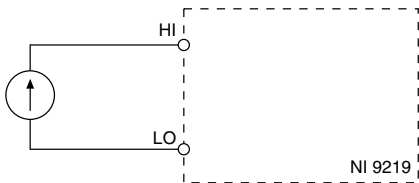
## Voltage Connections



### Related Information

*Voltage Pinout* on page 30

## Current Connections

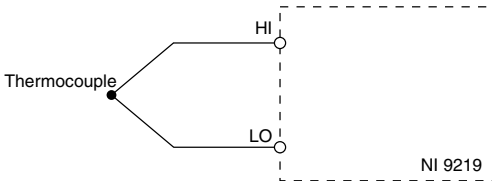


### Related Information

[Current Pinout](#) on page 30



## Thermocouple Connections



Changes in the ambient air temperature near the front connector or a thermocouple wire conducting heat directly to terminal junctions can cause thermal gradients. Observe the following guidelines to minimize thermal gradients and improve the system accuracy.

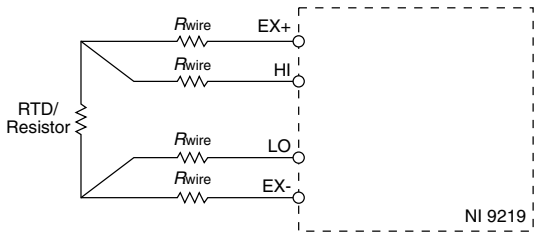
- Use small-gauge thermocouple wire. Smaller wire transfers less heat to or from the terminal junction.
- Avoid running thermocouple wires near hot or cold objects.
- Minimize adjacent heat sources and air flow across the terminals.
- Keep the ambient temperature as stable as possible.

- Make sure the NI 9219 terminals are facing forward or upward.
- Keep the NI 9219 in a stable and consistent orientation.
- Allow the thermal gradients to settle after a change in system power or in ambient temperature. A change in system power can happen when the system powers on, the system comes out of sleep mode, or you insert/remove modules.

## Related Information

[Thermocouple Pinout](#) on page 31

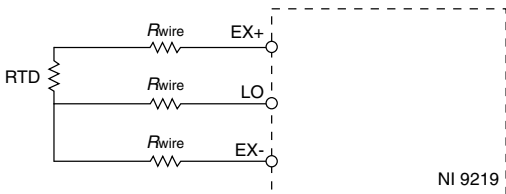
## 4-Wire Resistance and 4-Wire RTD Connections



### Related Information

[4-Wire Resistance and 4-Wire RTD Pinout](#) on page 31

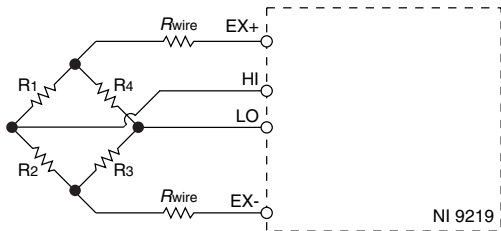
## 3-Wire RTD Connections



### Related Information

[3-Wire RTD Pinout](#) on page 32

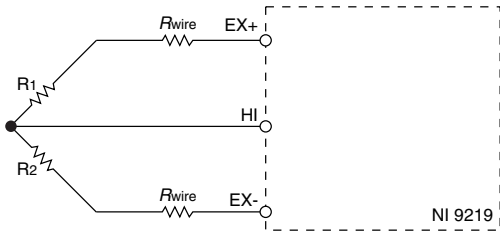
## Full-Bridge Connections



### Related Information

[Full-Bridge Pinout](#) on page 32

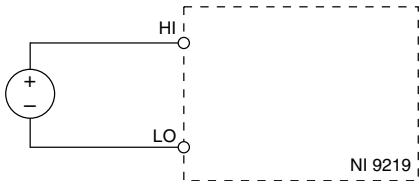
# Half-Bridge Connections



## Related Information

[Half-Bridge Pinout](#) on page 33

## Digital In Connections



The digital in measurement type is only supported in CompactRIO systems.

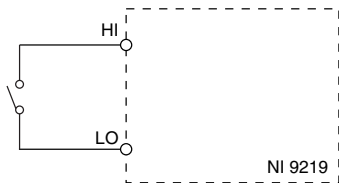


**Tip** Visit [ni.com/info](http://ni.com/info) and enter the Info Code 9219cdaq for information about implementing the digital in measurement type in CompactDAQ systems.

### Related Information

[Digital In Pinout](#) on page 33

## Open Contact Connections



The open contact measurement type is only supported in CompactRIO systems.



**Tip** Visit [ni.com/info](http://ni.com/info) and enter the Info Code 9219cdaq for information about implementing the open contact measurement type in CompactDAQ systems.

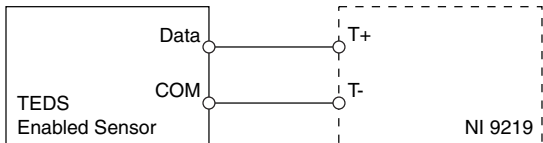
### Related Information

[Open Contact Pinout](#) on page 34



## TEDS Connections

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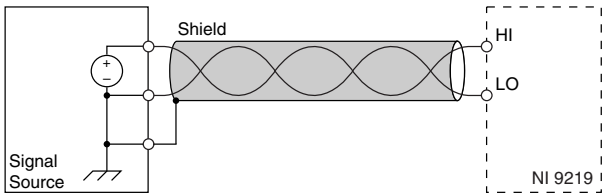
For more information about TEDS, visit [ni.com/info](http://ni.com/info) and enter the Info Code `rdteds`.

## NI 9219 Connection Guidelines

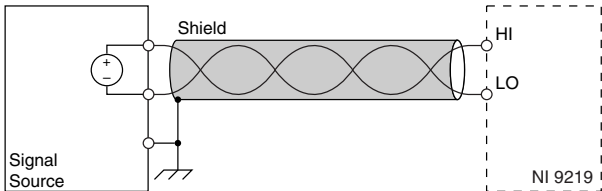
---

- Make sure that devices you connect to the NI 9219 are compatible with the module specifications.
- Use shielded cables and twisted pair wiring for the best signal quality.
- NI recommends using the NI 9972 backshell for all connections to the NI 9219.

- You can connect ground-referenced signal sources to the NI 9219. The following figure illustrates a grounded connection for a voltage source.



- You can connect floating signal sources to the NI 9219. Ensure that the voltages on the HI and LO connections are within the channel-to-earth working voltage range. The following figure illustrates a floating connection for a voltage source.



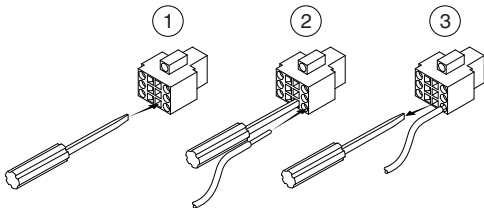
## Connecting to a Spring-Terminal Connector

### What to Use

- NI 9219 spring-terminal connector
- 0.08 mm<sup>2</sup> to 1.0 mm<sup>2</sup> (28 AWG to 18 AWG) copper conductor wire with 7 mm (0.28 in.) of insulation stripped from the end
- Flathead screwdriver with a 2.3 mm x 1.0 mm (0.09 in. x 0.04 in.) blade, included with the NI 9219

### What to Do

Complete the following steps to connect wires to the 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.

## High-Vibration Application Connections

If your application is subject to high vibration, NI recommends that you use the NI 9972 backshell kit to protect connections to the NI 9219.

## Excitation Protection

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The NI 9219 protects the excitation circuit from overcurrent and overvoltage fault conditions. The NI 9219 automatically disables the circuit in the event of a fault condition. Whenever possible, channels automatically recover after the fault is removed.



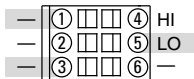
**Note** Refer to the device datasheet on [ni.com/manuals](https://ni.com/manuals) for more information about excitation protection.

## Measurement Type Pinout

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The following sections include pinouts for the NI 9219 measurement types.

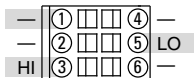
## Voltage Pinout



### Related Information

[Voltage Connections](#) on page 15

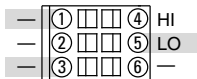
## Current Pinout



### Related Information

[Current Connections](#) on page 16

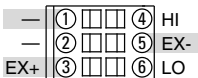
## Thermocouple Pinout



### Related Information

[Thermocouple Connections](#) on page 17

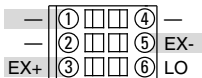
## 4-Wire Resistance and 4-Wire RTD Pinout



### Related Information

[4-Wire Resistance and 4-Wire RTD Connections](#) on page 19

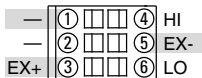
## 3-Wire RTD Pinout



### Related Information

[3-Wire RTD Connections](#) on page 20

## Full-Bridge Pinout

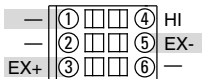


### Related Information

[Full-Bridge Connections](#) on page 21



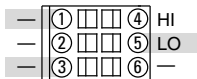
## Half-Bridge Pinout



### Related Information

[Half-Bridge Connections](#) on page 22

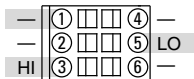
## Digital In Pinout



### Related Information

[Digital In Connections](#) on page 23

## Open Contact Pinout



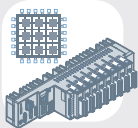
### Related Information

[Open Contact Connections](#) on page 24

# Where to Go Next

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## CompactRIO



*NI 9219 Datasheet*



*NI-RIO Help*



*LabVIEW FPGA Help*

## NI CompactDAQ



*NI 9219 Datasheet*



*NI-DAQmx Help*



*LabVIEW Help*

## RELATED INFORMATION



### C Series Documentation & Resources

[ni.com/info/cseriesdoc](http://ni.com/info/cseriesdoc)



### Services

[ni.com/services](http://ni.com/services)



Located at [ni.com/manuals](http://ni.com/manuals)



Installs with the software

## Worldwide Support and Services

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The NI website is your complete resource for technical support. At [ni.com/support](https://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.

Visit [ni.com/services](https://ni.com/services) for NI Factory Installation Services, repairs, extended warranty, and other services.

Visit [ni.com/register](https://ni.com/register) to register your NI product. Product registration facilitates technical support and ensures that you receive important information updates from NI.

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