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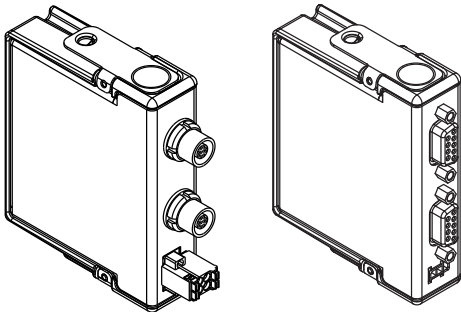
 **CLICK HERE**

NI-9218

GETTING STARTED GUIDE

NI 9218

2 AI, 51.2 kS/s/ch Simultaneous, Universal
Measurements



This document explains how to connect to the NI 9218. In this document, the NI 9218 with LEMO and the NI 9218 with DSUB are referred to inclusively as the NI 9218.



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 9218. 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 9218 only as described in this document.



Caution Do not operate the NI 9218 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.

NI 9218 with LEMO Safety Voltages

Connect only voltages that are within the following limits:

Maximum voltage, ± 30 V
from any pin to any pin
on a single connector¹

Isolation

Channel-to-channel, channel-to-V_{sup}, channel-to-earth,
V_{sup}-to-earth (up to 5,000 m)²

Continuous	60 VDC, Measurement Category I
------------	--------------------------------

Withstand	1,000 Vrms, verified by a 5 s dielectric withstand test
-----------	---

¹ The maximum voltage between pin 2 and pin 3 on a single connector is -20 V to +30 V.

² Must use crimp contact LEMO plug (784162-01) to maintain these ratings. Ratings are invalidated if solder version is used.



Caution Any excitation output voltage to earth ground must remain below 60 VDC for each channel. To determine excitation output voltage to earth ground for a channel, add the maximum excitation voltage to the maximum potential on pin 3. The maximum excitation voltages are 2 V +3% and 3.3 V +3% for the bridge excitations, 12 V +5% for the +12 V excitation, and 22 V for the IEPE excitation.

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 9218 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.

NI 9218 with DSUB Safety Voltages

Connect only voltages that are within the following limits:

Maximum voltage, ± 30 V
from any pin to any pin
on a single connector³

Isolation

Channel-to-channel, channel-to-Vsup inputs (up to 5,000 m)	
Continuous	60 VDC, Measurement Category I
Withstand	1,000 Vrms, verified by a 5 s dielectric withstand test

³ The maximum voltage between pin 2 and pin 3 on a single connector is -20 V to +30 V.

Channel-to-earth ground (up to 3,000 m)

Continuous	60 VDC, Measurement Category I
------------	--------------------------------

Withstand	1,000 Vrms, verified by a 5 s dielectric withstand test
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Channel-to-earth ground (up to 5,000 m)

Continuous	60 VDC, Measurement Category I
------------	--------------------------------

Withstand	860 Vrms
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Vsup inputs-to-earth ground (up to 5,000 m)

Continuous	60 VDC, Measurement Category I
------------	--------------------------------

Withstand	1,000 Vrms, verified by a 5 s dielectric withstand test
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Caution Any excitation output voltage to earth ground must remain below 60 VDC for each channel. To determine excitation output voltage to earth ground for a channel, add the maximum excitation voltage to the maximum potential on pin 3. The maximum excitation

voltages are 2 V +3% and 3.3 V +3% for the bridge excitations, 12 V +5% for the +12 V excitation, and 22 V for the IEPE excitation.

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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.

Safety Guidelines for Hazardous Locations

The NI 9218 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 9218 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 9218 has been evaluated as Ex nA IIC T4 Gc equipment under DEMKO Certificate No. 12 ATEX 1202658X and is IECEx UL 14.0089X certified. Each NI 9218 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 9218 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.



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.

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 connected to the CH 0 and CH 1 ports. Do not use unshielded cables or accessories unless they are installed in a shielded enclosure with properly designed and shielded input/output ports and connected to the product using a shielded cable. If unshielded cables or accessories are not properly installed and shielded, the EMC specifications for the product are no longer guaranteed.

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.

Preparing the Environment

Ensure that the environment in which you are using the NI 9218 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	5,000 m
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Indoor use only.



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

NI 9218 Pinout

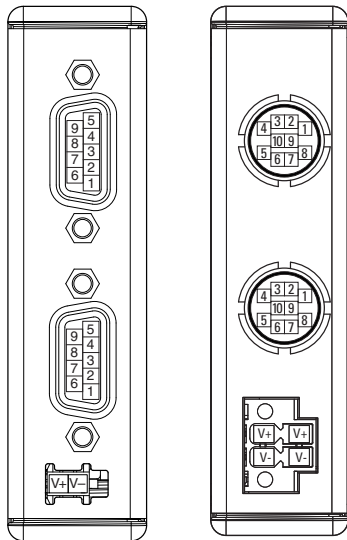


Table 1. Signals by Measurement Type

Mode	Pin									
	1	2	3	4	5	6	7	8	9	10 ⁴
±16 V	EX+	—	AI-, EX-	—	—	AI+	—	—	—	—
±65 mV	EX+ ⁵	—	EX- ⁵	—	—	AI+	AI- ⁶	—	—	—
Full-Bridge	EX+ ⁵	—	EX- ⁵	RS+	RS-	AI+	AI-	SC	SC	—
IEPE	—	AI+	AI-	—	—	—	—	—	—	—
TEDS	—	T+ ⁷	T-	—	—	—	—	—	—	T+ ⁸

⁴ NI 9218 with LEMO only.

⁵ Optional sensor excitation.

⁶ Tie to pin 3.

⁷ TEDS Class 1 data connection.

⁸ TEDS Class 2 data connection.

Table 2. Signal Descriptions

Signal	Description
AI+	Positive analog input signal connection
AI-	Negative analog input signal connection
EX+	Positive sensor excitation connection
EX-	Negative sensor excitation connection
RS+	Positive remote sensing connection
RS-	Negative remote sensing connection
SC	Shunt calibration connection
T+	TEDS data connection
T-	TEDS return connection

Measurement Types

The NI 9218 provides built-in support for the following measurement types.

- ± 16 V
- ± 65 mV
- Full-Bridge
- IEPE

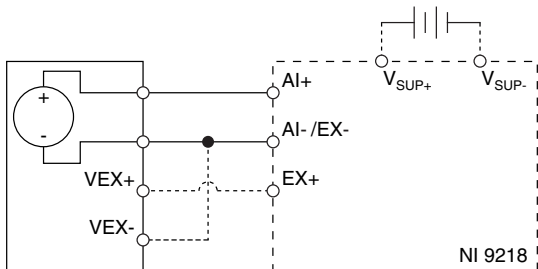


Tip NI recommends using the NI 9982 screw-terminal adapter when using built-in measurement types on the NI 9218.

The NI 9218 provides additional support for the following measurement types when using a measurement-specific adapter.

- ± 20 mA, requires the NI 9983
- ± 60 V, requires the NI 9987
- Half-Bridge, requires the NI 9986
- Quarter-Bridge, requires the NI 9984 ($120\ \Omega$) or NI 9985 ($350\ \Omega$)

± 16 V Connections

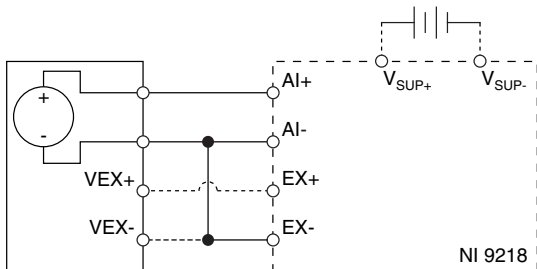


The NI 9218 provides optional 12 V sensor excitation. To use the 12 V excitation, connect a 9 VDC to 30 VDC power supply to Vsup, connect the excitation terminals on your sensor to EX+/EX-, and enable 12 V excitation in your software.

Related Information

[NI 9982 \$\pm 16\$ V Connection Pinout](#) on page 35

± 65 mV Connections



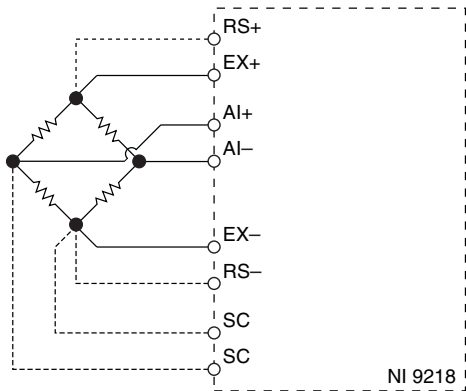
- You must connect AI- to EX- on the NI 9218.
- The NI 9218 provides optional 12 V sensor excitation. To use the 12 V excitation, connect a 9 VDC to 30 VDC power supply to V_{sup}, connect the excitation terminals on your

sensor to EX+/EX-, and enable 12 V excitation in your software.

Related Information

[*NI 9982 \$\pm 65\$ mV Connection Pinout*](#) on page 36

Full-Bridge Connections



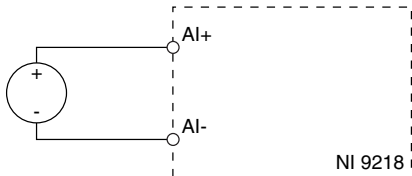
- The NI 9218 provides 2 V excitation to loads $\geq 120\ \Omega$ or 3.3 V excitation to loads $\geq 350\ \Omega$.
- The NI 9218 provides optional connections for remote sensing (RS) and shunt calibration (SC). Remote sensing

corrects for errors in excitation leads and shunt calibration
corrects for errors caused by resistance within one leg of the bridge.

Related Information

[NI 9982 Full-Bridge Connection Pinout](#) on page 37

IEPE Connections

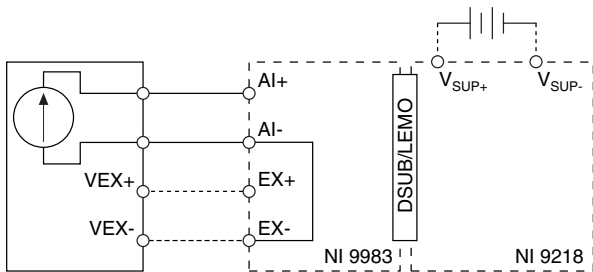


- The NI 9218 provides an excitation current for each channel that powers IEPE sensors.
- AI+ provides DC excitation and AI- provides the excitation return path.

Related Information

NI 9982 IEPE Connection Pinout on page 38

± 20 mA Connections

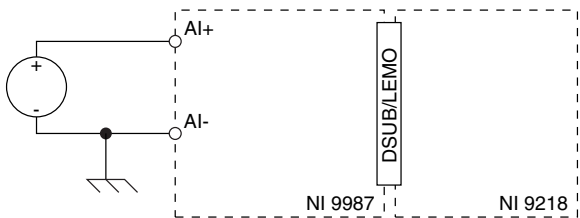


- Connecting ± 20 mA signals requires the NI 9983.
- The NI 9218 provides optional 12 V sensor excitation. To use the 12 V excitation, connect a 9 VDC to 30 VDC power supply to Vsup, connect the excitation terminals on your sensor to EX+/EX-, and enable 12 V excitation in your software.

Related Information

[NI 9983 Pinout](#) on page 39

± 60 V Connections

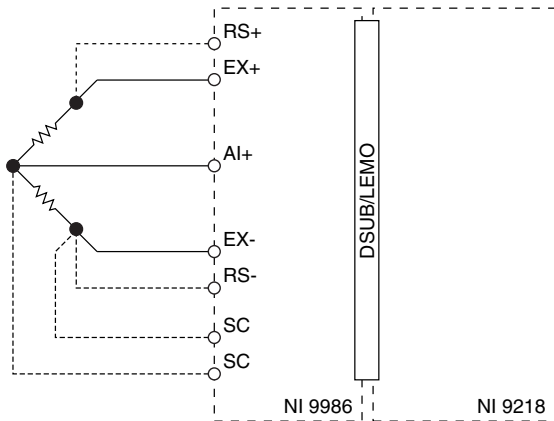


Connecting ± 60 V signals requires the NI 9987.

Related Information

[*NI 9987 Pinout*](#) on page 42

Half-Bridge Connections

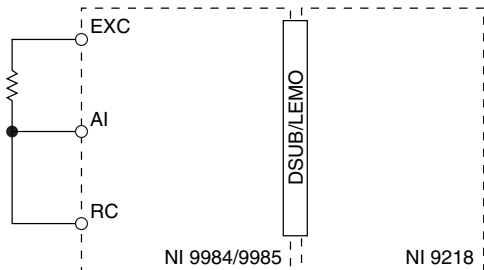


- Connecting half bridges requires the NI 9986.
- The NI 9218 provides 2 V excitation to half bridges of $\geq 240\ \Omega$ total or 3.3 V excitation to half bridges of $\geq 700\ \Omega$ total.
- The NI 9218 provides optional connections for remote sensing (RS) and shunt calibration (SC). Remote sensing corrects for errors in excitation leads and shunt calibration corrects for errors caused by resistance within one leg of the bridge.

Related Information

NI 9986 Pinout on page 41

Quarter-Bridge Connections



- Connecting 120 Ω quarter bridges requires the NI 9984.
- Connecting 350 Ω quarter bridges requires the NI 9985.



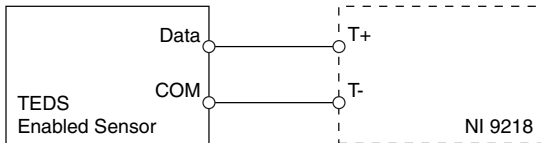
Tip NI recommends 2 V excitation when using a NI 9984 with 120 Ω quarter bridges and 3.3 V

excitation when using the NI 9985 with 350 Ω quarter bridges.

Related Information

[NI 9984/9985 Pinout](#) on page 40

TEDS Connections



For more information about TEDS, visit ni.com/info and enter the Info Code `rdteds`.

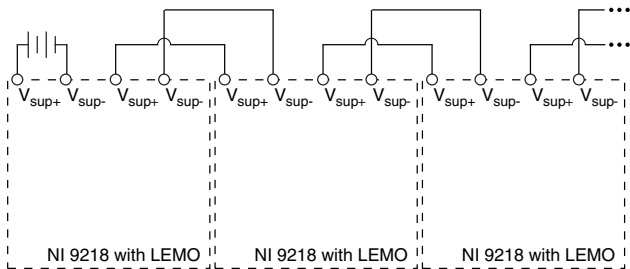
TEDS Support

TEDS Class 1 sensors provide an interface for transferring information from sensors. The NI 9218 with LEMO, NI 9218

with DSUB, NI 9982L, NI 9982D, NI 9982F support TEDS Class 1 sensors.

TEDS Class 2 sensors provide an interface for transferring information from TEDS enabled sensors. The NI 9218 with LEMO, NI 9982L, NI 9983L, NI 9984L, NI 9985L, and NI 9986L support TEDS Class 2 sensors.

Vsup Daisy Chain Topology



The NI 9218 with LEMO provides four pins on the Vsup connector for daisy chaining.

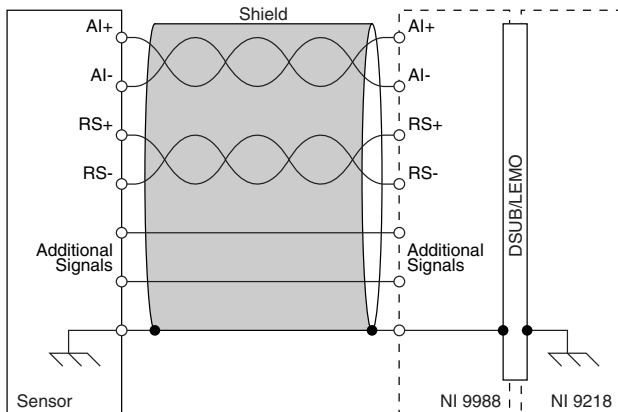
NI 9218 Connection Guidelines

Make sure that devices you connect to the NI 9218 are compatible with the module specifications.

Custom Cabling Guidelines

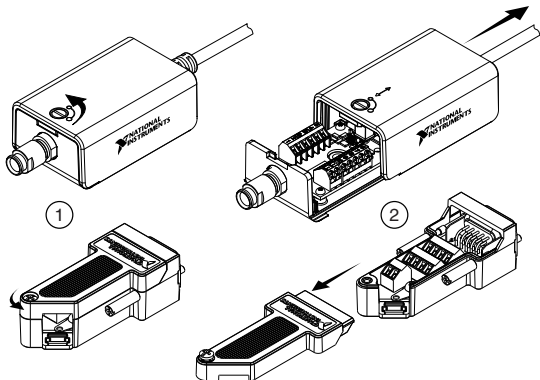
Observe the following guidelines when using the NI 9988 solder cup connector adapter or the LEMO crimp connector (784162-01) to create custom cables.

- Use a shielded cable for all signals.
- Connect the cable shield to earth ground.
- Use twisted-pair wiring for the AI+/AI- and RS+/RS- signals to achieve specified EMC performance.



Opening a Measurement Adapter

What to Do



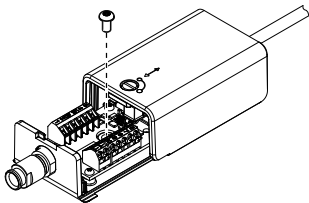
1. Unlock the measurement adapter housing/cover.
2. Slide the measurement adapter housing/cover to access the screw terminals.

Mounting the NI 998xD/998xL

What to Use

- NI 998xD or NI 998xL Measurement Adapter
- M4 or Number 8 Screw
- Screwdriver

What to Do



Mount the measurement adapter to a flat surface using the mounting hole on the measurement adapter and the screw.

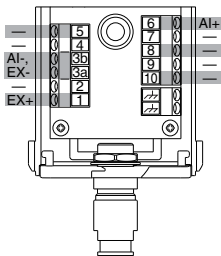
Measurement Adapter Grounding

The ground terminals on a measurement adapter are connected to chassis ground when the measurement adapter is connected to the NI 9218 and the NI 9218 is installed in a chassis.

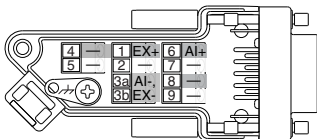
Measurement Adapter Pinouts

The following sections include pinouts for the NI 9218 measurement adapters.

NI 9982 ± 16 V Connection Pinout



NI 9982D/9982L



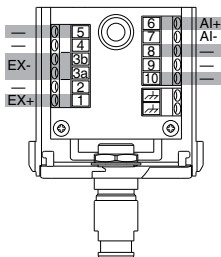
NI 9982F

Pins 3a and 3b are tied together on the NI 9982.

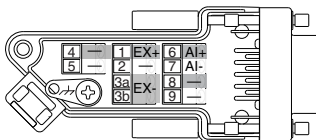
Related Information

[±16 V Connections](#) on page 17

NI 9982 ±65 mV Connection Pinout



NI 9982D/9982L



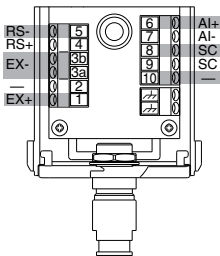
NI 9982F

Pins 3a and 3b are tied together on the NI 9982.

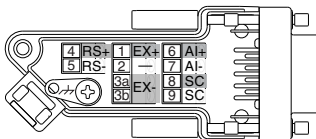
Related Information

[±65 mV Connections](#) on page 18

NI 9982 Full-Bridge Connection Pinout



NI 9982D/9982L



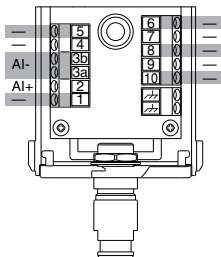
NI 9982F

Pins 3a and 3b are tied together on the NI 9982.

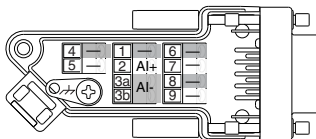
Related Information

[Full-Bridge Connections](#) on page 20

NI 9982 IEPE Connection Pinout



NI 9982D/9982L



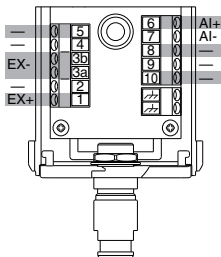
NI 9982F

Pins 3a and 3b are tied together on the NI 9982.

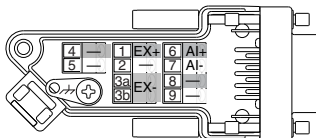
Related Information

[IEPE Connections](#) on page 21

NI 9983 Pinout



NI 9983D/9983L



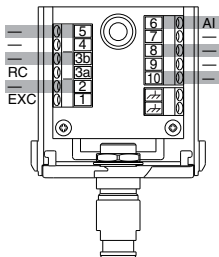
NI 9983F

Pins 3a and 3b are tied together on the NI 9983.

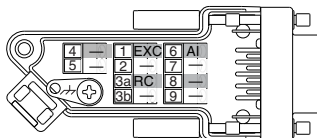
Related Information

[±20 mA Connections](#) on page 22

NI 9984/9985 Pinout



NI 9984D/9984L/9985D/9985L

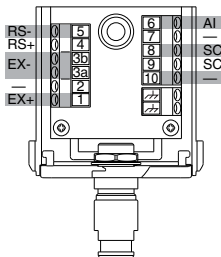


NI 9984F/9985F

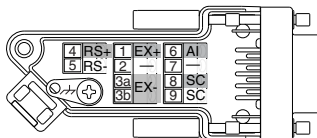
Related Information

[Quarter-Bridge Connections](#) on page 27

NI 9986 Pinout



NI 9986D/9986L



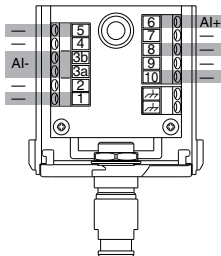
NI 9986F

Pins 3a and 3b are tied together on the NI 9986.

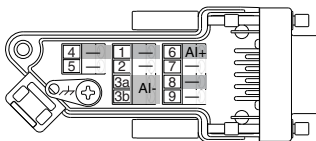
Related Information

[Half-Bridge Connections](#) on page 25

NI 9987 Pinout



NI 9987D/9987L



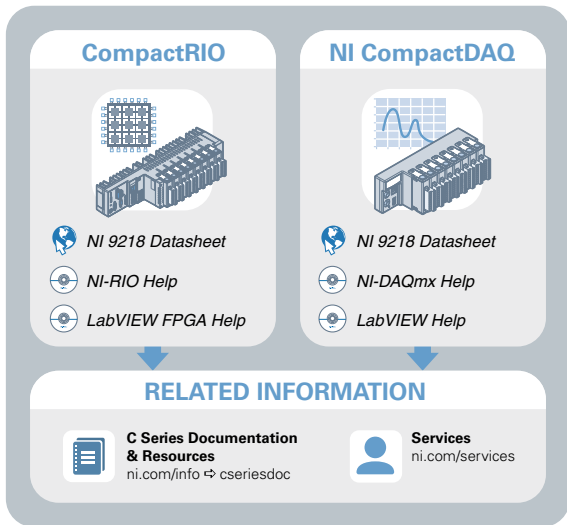
NI 9987F

Pins 3a and 3b are tied together on the NI 9987.

Related Information

[±60 V Connections](#) on page 23

Where to Go Next



Located at ni.com/manuals



Installs with the software

Worldwide Support and Services

The NI website 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.

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